



# SES Water Drought Plan 2019



<b>NON-TECHNICAL SUMMARY .....</b>	<b>2</b>
<b>1. INTRODUCTION.....</b>	<b>4</b>
1.1. Overview of process .....	4
1.3. Baseline water resources situation.....	5
1.4. Levels of service .....	7
1.5. Pre-draft and draft consultation details .....	8
1.6. Links with Water Resources Management Plan .....	8
<b>2. DROUGHT TRIGGERS AND MANAGEMENT ACTIONS.....</b>	<b>9</b>
2.1. Data sources and arrangements .....	9
2.2. Drought triggers .....	10
2.3. Forecasting .....	13
2.4. Demand-side actions .....	14
2.5. Supply-side actions and triggers .....	19
2.6. Drought permits .....	23
2.7. Sequencing of drought management actions .....	28
2.8. Summary timeline of drought management actions .....	43
2.9. Compensation .....	44
2.10. Identifying the end of a drought .....	45
<b>3. ENVIRONMENTAL ASSESSMENT .....</b>	<b>46</b>
3.1. Scoping .....	46
3.2. Environmental impacts (including Water Framework Directive).....	46
3.3. Mitigation measures.....	47
3.4. Environmental data provision and monitoring plan .....	48
3.5. Post drought actions.....	48
<b>4. MANAGEMENT AND COMMUNICATIONS STRATEGY .....</b>	<b>49</b>
4.1. Management structure .....	49
4.2. Communications plan .....	49
4.3. Lessons learned from previous droughts .....	52
4.4. Post drought actions.....	53
<b>5. DROUGHT SCENARIOS .....</b>	<b>53</b>
5.1. Drought Scenarios and worked examples.....	53
5.2. Seasonal peaks scenario .....	54
5.3. Single season drought scenario: 2005/06 (surface water) .....	54
5.4. Two dry winter drought scenario: 2004/05 and 2005/06 (groundwater sources) .....	58
5.5. 1 in 200 year Groundwater drought scenario .....	64
5.6. Summary of drought scenarios.....	66
<b>6. GLOSSARY OF DROUGHT PLAN TERMINOLOGY.....</b>	<b>67</b>
<b>APPENDIX A: DROUGHT OPTIONS TABLES .....</b>	<b>70</b>
<b>APPENDIX B: REVIEW OF BOUGH BEECH OPERATING CURVES AND TRIGGER LEVELS .....</b>	<b>84</b>
<b>APPENDIX C: COMMUNICATIONS PLAN .....</b>	<b>86</b>
<b>APPENDIX D: RIVER EDEN DROUGHT PERMIT ENVIRONMENTAL ASSESSMENT REPORT .....</b>	<b>90</b>
<b>APPENDIX E: GROUNDWATER ABSTRACTIONS DROUGHT PERMITS ENVIRONMENTAL ASSESSMENT REPORT .....</b>	<b>91</b>

**TABLE OF FIGURES**

Figure 2.1: Well House Inn Drought Trigger Curves .....	11
Figure 2.2: Bough Beech Reservoir Drought Trigger Curves .....	12
Figure 2.3: SES Water groundwater and surface water drought permits .....	24
Figure 5.1: Monthly rainfall totals (January 2000-May 2011) and long-term average (1990-May 2011) rainfall at Bough Beech reservoir .....	55
Figure 5.2: Well House Inn: 2003-2007 mean monthly groundwater levels compared to long-term monthly minima, means and maxima (Oct 1942 – Dec 2010).....	55
Figure 5.3: River Eden flows at Chiddingstone (April 1996-March 2011) .....	56
Figure 5.4: Bough Beech storage levels and corresponding drought triggers and action zones (April 2003-March 2007) .....	58
Figure 5.5: Well House Inn Historic Levels and revised Drought Triggers and Action Zones from January 2003 to December 2007 .....	63
Figure 5.6: Groundwater Levels - 1 in 200 Year Scenario.....	65
Figure 5.7: Bough Beech Levels - 1 in 200 Year Scenario.....	66

**TABLE OF TABLES**

Table 1.1: Drought Scenarios .....	9
Table 2.1: Summary of estimated savings from demand restrictions .....	19
Table 2.2: Summary of supply-side outputs.....	23
Table 2.3: Summary of key licence conditions for the River Eden abstraction .....	25
Table 2.4: Inclusions and exemptions from Phase 1 temporary use restrictions.....	32
Table 2.5: Inclusions and exemptions from Phase 2 temporary use restrictions.....	34
Table 2.6: Inclusions and exemptions from Phase 3 temporary use restrictions.....	38
Table 2.7: Inclusions and exemptions associated with a Drought Order to restrict non- essential uses of water .....	40
Table 2.8: Approximate timescales required for drought management measures.....	44
Table 4.1: Potential Audiences .....	52
Table 5.1: Actions taken by SESW during the 2004-2006 two dry winter drought.....	61

## Non-Technical Summary

This document is a revision of the Drought Plan published in March 2013. This plan is consistent with our next Water Resources Management Plan due to be published in 2019.

This Drought Plan sets out the operational actions we will consider taking in response to drought events of different severities, guided by the position at any time of reservoir and groundwater levels in relation to specified triggers. The aim of the plan is to minimise environmental impacts, but where potential impacts are identified, it presents a balance of measures that may include restrictions on customers' use of water. The plan includes an assessment of the environmental impacts that may result from the implementation of drought permits on the River Eden and at three groundwater sources: Hackbridge/Goatbridge, the Woodmansterne Group and the Kenley Group, and the mitigation measures that we could take.

All droughts vary in terms of their duration and impact on the availability of water resources. This variation is caused by a number of factors, in particular the complex interactions between climatic variables, customer demand and surface and/or groundwater levels during the period leading up to a drought. All water companies must manage the impact of droughts to ensure that essential supplies of water to customers are maintained. Since it is an operational plan, we consider it important to demonstrate the robustness of Plan against real drought scenarios, particularly those we have experienced in the recent past when operational conditions were similar to the current situation.

Multi season droughts (comprising two or more dry winters) have a large effect on groundwater resources, and as we rely on groundwater for approximately 85% of our supply, such droughts present the greatest potential threat to our overall resources.

In 2004-06, a severe two dry winter drought affected South East England during which it was necessary to implement a number of drought management actions; with groundwater sources in some cases reaching their lowest recorded water levels. In 2006, we were the only water company to take the step of introducing both hosepipe and non-essential use restrictions. These demand restrictions were in addition to leakage reductions and implementing drought permits to abstract water from the River Eden outside our licensed winter period, with no significant adverse environmental impacts identified. During this drought, we communicated extensively with customers and other stakeholders, highlighting important information about water use and the water resources situation at the time. This suite of demand and supply side measures collectively contributed to the avoidance of the need to introduce emergency drought orders.

More recently, another two dry winters have been experienced across our supply area. Following our Drought Plan, we implemented Phases 1 and 2 of its temporary use restrictions in April 2012. This was supported by extensive customer communication activities and liaison with regulators and other water companies in South East England, to facilitate a co-ordinated approach across the region particularly in respect of the implementation of temporary restrictions on water use. We were granted a drought permit to abstract water from the River Eden in May 2012. During this permit, we carried out an extensive monitoring regime to support future understanding of the potential

impacts of this drought permit. Lessons learnt and feedback from customers and stakeholders during these drought events were incorporated into the 2013 Drought Plan.

In 2010, a change in legislation led to an expansion of the scope of the temporary water use restrictions water companies are able to apply without approval from the Secretary of State. Measures to restrict demand are taken seriously by the Company, we recognise the potential impacts on our customers; however, demand restrictions have been proven an effective means of conserving water supplies and avoiding more serious restrictions. Hosepipe bans have been estimated to save up 4% of average and 6% of peak demand. Building on experience and consideration of the benefits and impacts of restricting certain uses, we propose a phased approach, prioritising water saving measures subject to the severity of the drought conditions being experienced, the impact on customers, particularly small businesses, and reflecting regional drought impact and coordination of measures being implemented by water companies in South East England.

In this revision of the plan, a larger suite of drought permit options is identified as being available. We have assessed the mitigation measures needed before and during a drought permit so that we minimise and monitor impacts on the environment. This means we are now more resilient to drought events more severe than that experienced in 2004-06. The plan has also been tested to a severe drought scenario, determined to be a frequency of once in every 200 years. This was found to be very challenging to manage with more reliance being placed on groundwater storage. We will seek to increase resilience to these severe droughts through our WRMP19 and subsequent plans.

We are continuing to address metering, water efficiency and leakage, with an increase in demand management planned for the 2020-2025 period. We also operate a fully pressure managed network, which would allow phased pressure reduction measures to be implemented if a drought event were sufficiently serious to require it.

The risk of drought continues to be serious and proactive measures, such as those taken in the 2004-06 and 2011/12 droughts ensured that supplies were maintained. We are committed to continual improvement of our Drought Plan to enable effective management any droughts in our supply area.

## 1. Introduction

This document is a revision of our previous Drought Plan, published in March 2013. It sets out the how we will determine when a drought is triggered, how it will respond operationally, as well as the measures taken to mitigate the effects and monitor the impact of those actions, both during their implementation and afterwards.

The Drought Plan is linked to the Water Resource Management Plan (WRMP) in that both plans have the objective of maintaining a secure and sustainable supply of water to customers. The overall aim is to avoid or minimise the impact of a drought on both its customers and the environment. In this revision of the Drought Plan, the company has considered a wider range of drought scenarios, including those that are at the extreme end of the spectrum. This is aligned with the approach being taken with the next WRMP, with the revised draft for the 2019 plan re-submitted to Defra in April 2019.

This Plan takes into account the guidance documentation issued by the Environment Agency (EA) and Defra, recently enacted legislation, and the experiences and lessons learnt by the Company and those shared across the Water Industry when managing droughts. This includes the 2011/12 drought that resulted in the use of temporary use restrictions and a drought permit to abstract from the River Eden. No further droughts have occurred since this period.

The plan was updated in April 2019 following a request for further information relating to the monitoring, mitigation and compensation measures associated with drought permits. The revisions to the plan are largely based on the outputs of a series of workshops held with the Environment Agency and Natural England.

### 1.1. Overview of process

Water companies in England and Wales are required to prepare and maintain drought plans under Sections 39B and 39C of the Water Industry Act 1991, amended by the Water Act 2003, and clarified in the Drought Plan Direction 2011, amended in 2016. Water companies must prepare and submit an updated draft Plan to the Secretary of State no later than 4 years and 3 months after publication of their previous final Plan (s4(b)(ii) of the Drought Plan Direction 2016).

This plan is compliant with the following document published by Defra and the EA:

- How to write and publish a drought plan – July 2015

The following guidance documents issued from the EA have been considered within this plan:

- Environmental assessment in Water Company Drought Plans – May 2016
- Drought Plan and WRMP links – November 2016
- Drought Plan guideline extra information (drought permit and order application ready) – November 2016
- Drought options – November 2016
- Exceptional shortage of rain (position statement) – January 2017

## 1.2. Water company specific information

### Sources

We rely on groundwater for approximately 85% of our supply from sources located within the North Downs Unconfined Chalk, the North Downs Confined Chalk, the Mole Valley Chalk and the Lower Greensand aquifer resource units within our supply area.

We have a single surface water source, Bough Beech reservoir, which provides approximately 15% of our supplies. It is a pumped storage reservoir, which abstracts water from the River Eden during the winter period, normally September to April. The licence permits abstraction from the river subject to certain conditions, including the maintenance of a Minimum Residual Flow (MRF) of 22 Ml/d downstream of the abstraction.

Winter rainfall (defined as October to March) is of greatest importance as this normally recharges the aquifers from which we draw our supplies. Summer rainfall events (defined as April to September) are of limited benefit to groundwater reserves apart from reducing the demands placed on them due to reduced outdoor use and garden watering during these periods. Unless sustained over a long period of time, summer rainfall is evaporated, transpired by plants or absorbed in the soil and rock pore spaces above the water table and it therefore does not recharge the aquifers.

Critical drought issues are associated with multi-season droughts rather than a single dry season. A dry summer serves to increase demand, a condition that is considered in detail as part of the WRMP. Multi-season droughts have the potential to restrict the overall resource balance and this issue is reviewed within this Plan.

### Demand

In previous plans, we have divided our network into two Water Resource Zones (WRZs), Sutton WRZ and East Surrey WRZ. In preparation for this Plan, and the draft WRMP19, we have completed a WRZ integrity assessment. Based on the level of network connectivity between our Water Treatment Works (WTW), we consider it appropriate to merge the two zones into one covering the whole Company area. Support for this approach has been given by the Environment Agency. This aligns with the focus we have placed on supplying customers from more than one WTW in order to enhance resilience to drought and also other events including water quality outages, flooding and bursts on strategic trunk mains.

We supply water to approximately 707,000 consumers in 289,000 properties. The majority of demand, which was an average of 165 Ml/d in 2017/18, is from domestic households. Due to various factors, this leads to a high peak effect, with domestic demand increasing significantly during dry summer periods. Approximately 54% of household properties and 87% of non-household properties within our supply area are metered. We are continuing to address increased metering, demand management and leakage, with significant additional investment planned in these areas from 2020.

## 1.3. Baseline water resources situation

Our current WRMP was approved by the EA and the Secretary of State for publication in June 2014 (WRMP14). We are in the process of updating this plan (WRMP19), a revised draft of which was submitted to the Secretary of State in April 2019 following public consultation in 2018. The WRMP comprises an assessment of the supply-

demand balance given current stated levels of service (which relate to the frequency of implementation of demand restrictions), together with a review of the options available to manage the supply-demand balance, given environmental and other constraints and projected impacts of climate change.

WRMP14 defined the work to be carried out during the five year period commencing April 2015 (known in the water industry as the AMP6 period) and beyond to 2039/40, setting out a plan of how to meet the forecast demand for water for this period. The WRMP14 proposes a twin-track of demand and supply side measures to manage the supply-demand balance. WRMP19 will propose work to be done during the five-year period commencing April 2020 (AMP7) but it is significantly more long-term, setting out a plan through to 2080.

Our demand management programme as set out in WRMP14 for the AMP6 period included installing a further 32,000 meters to previously unmeasured household customers, a decrease in leakage of 500,000 litres a day, and a reduction in per capita consumption to 157 litres per person per day. In our Draft WRMP19, we propose to continue with an ambitious programme on demand management, with options to reduce leakage, increase water efficiency programmes and the inclusion of a compulsory metering programme, in particular in the first 10 years of the plan. Inclusion of these measures is subject to customer support. When appropriate, additional effort will be made to influence customers' behaviour by encouraging them to use water wisely during dry periods when resources are challenged.

On the supply-side, since the 2013 Drought Plan the peak capacity of Bough Beech WTW has been increased by 7 Ml/d to 52 Ml/d. We will continue to actively manage its surface water and groundwater sources to minimise the risk of supply failure, as well as increase our resilience to outage and flooding. We propose to continue with our network integration so that all properties can be supplied by more than one water treatment works as part of our Business Plan for 2020-2025. We have also explored options for potential bulk supplies with neighbouring companies through the Water Resources in the South East process.

In WRMP14, two key design demand scenarios were considered, namely:

- Dry year average - representing the average year-round demand in a dry year
- Dry year critical period - representing the peak period demand in a dry year, usually experienced during summer

These demand scenarios are based on an analysis of historic weather conditions (temperature and rainfall, including recent drought events experienced in our supply area) and responses to these droughts in terms of increases/decreases in demand (distribution input, incorporating customer demand and leakage). This information has been used to inform the definition of a dry year and the critical period for use in the WRMP19.

In the WRMP, these demands are balanced against groundwater and surface water yields that would be available under a range of drought conditions. These are called deployable outputs. As such, in our WRMP we already plan to be able to balance supply and demand during a drought of such magnitude. However, in any particular drought event, the actual supply-demand balance may not be exactly as that forecast in the WRMP and the extent of the drought will not be known until it is over. In these instances,



we will consider implementing one or more drought management measures (including demand restrictions). These will reflect our levels of service (described more fully in section 2.4 below). The purpose of this Drought Plan is to mitigate risk of supply-demand imbalance under more extreme but plausible droughts, to accommodate variations from the design conditions used in the WRMP, and to outline the actions we would take in such circumstances.

We have a number of options to maintain the supply demand balance during a drought, which include:

- To appeal to customers to reduce demand
- To introduce restrictions on demand to household and non-household customers (Temporary Use Bans and Non-Essential Use Bans)
- To implement both long and short-term measures to increase available supplies (including Drought Permits)
- To utilise a bulk supply from a neighbouring water company

These will be discussed in further detail in Section 3 of the Plan.

#### 1.4. Levels of service

Demand restrictions are one of the mechanisms water companies can use to help manage the severity of a drought event. These restrictions can take different forms, and their implementation will depend on the particular drought event. Companies plan to be able to manage supply and demand only having recourse to demand restrictions according to a certain return period. These return periods are termed ‘Levels of Service’ and are effectively a standard of service we aim to provide to our customers. Our levels of service are that sufficient resources will be available so that:

- We will prohibit the use of hosepipes and unattended watering devices (Temporary Use Bans or TUBs) no more than once every 10 years on average – i.e. there is a 10% risk of a TUB being required in any year.
- We will implement an ordinary drought order to restrict the non-essential use of water no more than once every 20 years on average, i.e. there is a 5% risk of an ordinary drought order being required in any year.
- We will require Emergency drought order measures (e.g. rota cuts, use of standpipes and phased pressure management) only in extreme droughts beyond a 1 in 200-year frequency or emergency situations, i.e. there is a 0.5% risk of an emergency drought order being required in any year.

Demand restrictions are implemented on a precautionary basis as a management response in preparation for a developing drought of unknown severity and therefore their frequency will not necessarily reflect the magnitude of the ultimate drought event. It is important to recognise that the level of service return period is not equivalent to the drought severity return period. Having said this, demand restrictions would not generally be expected during drought events with a return period of 1 in 10 years or less, but this depends on how the drought is defined.

As detailed in Section 3, trigger curves related to groundwater and reservoir levels are used to inform when it may be appropriate to implement demand restrictions. With a changing climate, the frequency and magnitude of droughts will change and therefore

the trigger curves that currently define levels of service may be breached more frequently in the future and will therefore need to be reviewed in order to maintain our stated levels of service.

### **1.5. Pre-draft and draft consultation details**

For this Drought Plan, we have carried out pre-consultation with the Environment Agency (EA) since early in 2016. This has been in the form of quarterly review meetings and, in relation to the draft Drought Plan, specific discussions particularly in reference to the drought scenarios, since the guidance has significantly changed since the 2013 Plan was submitted. The Agency requested further information on the selection of droughts and whether using one WRZ would have an impact on the drought plan.

During the consultation process for the 2013 Drought Plan, representations were received from nine organisations, with emphasis on environmental monitoring, testing against more severe drought scenarios (i.e. a third dry winter) and the potential impacts of temporary restrictions on water use. These representations were addressed in the final version of that plan. However, for this plan, the scenarios used now include an extreme drought of 1 in 200 years, instead of a third dry winter.

The Environmental Assessment Reports (EARs) within this plan includes outcomes from the National Environment Programme (NEP) schemes (specifically the scheme relating to the Carshalton Branch of the River Wandle) and the EA's London Basin Groundwater model.

We published our draft Drought Plan for public consultation in October 2017, with an eight-week consultation period. We received feedback from six organisations. Our Statement of Response to this feedback was submitted to Defra in February 2018. We made amendments to the draft plan where we considered appropriate to address the representations received.

Further revisions have been made to this plan to reflect the request from Defra for additional information regarding drought permits. To ensure the revised plan met the requirements of the stakeholders involved in the drought permitting process and potential impacts on the wider environment, we carried out a series of workshops with both the Environment Agency and Natural England between December 2018 and January 2019.

### **1.6. Links with Water Resources Management Plan**

Baseline supply availability within the WRMP is based on fixed value deployable outputs for a range of drought conditions, without the inclusion of contributions from drought measures. We have not deemed it necessary to include any drought measures within the WRMP options appraisal to enhance resilience in terms of the system-demand balance.

It should be noted that actual operational source outputs of groundwater sources will vary with prevailing groundwater levels. It is therefore not possible to accurately calculate the impact of demand restrictions upon water availability because the operational source output reduces as the drought. Deployable output values are based on annual groundwater level minima. Drought trigger curves are based upon level of service return periods for Bough Beech reservoir and stochastically generated groundwater level minima. Temporary use restrictions cannot be directly related to

drought severity as the need for restrictions will depend on the season and other factors.

The Drought Plan and WRMP include drought scenarios that go beyond the historical record, by looking at droughts of differing characteristics in terms of duration and intensity. This required the use of stochastic weather data to generate the probability of drought that could reasonably occur over the planning period. This is summarised in Table 1.1.

**Table 1.1: Drought Scenarios**

Drought Scenarios	Example Drought Description	Example Drought Severity	Duration	Plan in which scenario is used	
				WRMP	Drought Plan
Historic Droughts	2004/5 or 2012	Worst on record	Short	Yes	Yes
	2004/6 or extended 2012	Plausible - approx. 1 in 100 years	Medium	Yes	Yes
Additional Drought Scenarios	Stochastic 1 in 200 years	Severe Drought	Long	Yes	Yes

## 2. Drought triggers and management actions

The actions to be taken can be divided into those related to decreasing demand, including household and non-household use, leakage and operational use, and those that increase supplies. In addition, there are operational changes that can be implemented which can re-distribute resources in order to balance out areas where supplies are at a higher risk. The investment in resilience we have undertaken during the current and previous AMP period improves the transfer of water across our area of supply.

We are mindful of the need to balance measures between those that impact on consumers and those which may impact negatively on the environment. Discussion of the sequencing of restrictions is outlined in Section 2.7. Appendix A contains Drought Options Tables summarising information on each drought management action in the format required by the EA Drought Plan Guideline, such as the triggers, potential increases in supply or reductions in demand and the environmental impact of the options.

### 2.1. Data sources and arrangements

We continually monitor and record groundwater levels, surface water levels and rainfall within our supply area. Consequently, the risk of drought and its impact on both water resources and our customers can be effectively assessed and that appropriate drought measures can be implemented in good time to maintain supplies and meet our Levels of Service.

We monitor water levels at Bough Beech reservoir, whilst groundwater levels are monitored at a number of observation boreholes (OBHs), including at Well House Inn and the Rose & Crown and also Chipstead and Riverhead. Chipstead and Riverhead OBHs are maintained by the Environment Agency with whom we have an arrangement to receive this data regularly.

Daily rainfall data is collected from 10 sites across the supply area, including at Bough Beech WTW, Cheam WTW and the Redhill Head Office. For drought prediction purposes, we have an arrangement with the EA for the provision of areal rainfall and potential evapotranspiration (PET) data for use with groundwater and surface water models.

## 2.2. Drought triggers

In order to manage day-to-day water supply for the WRZ from groundwater and surface water sources, we regularly monitor water levels in the following two locations:

- Well House Inn OBH;
- Bough Beech Reservoir.

The water level at Well House Inn OBH, located in the North Downs Chalk, provides a groundwater level considered representative of our groundwater sources (both Chalk and Lower Greensand). The water level at Bough Beech Reservoir, our only surface water source, is used to calculate how full the reservoir is. Other OBH are used to provide supplementary information, although the data is not collected as regularly.

At each of the two locations, trigger levels have been identified that when breached help us to identify actions that need to be taken to ensure it can maintain its stated levels of service (Section 2.4). The triggers also assist us to identify when it is in a drought and when a drought is over. Trigger levels from groundwater and surface water sources are considered in combination.

The drought trigger levels are intended to support our management decisions as part of a framework for drought management. It is important to note that the trigger levels act as guidance to required action but should be seen within the context of the time of year, water level trends, and a range of other factors.

### Well House Inn OBH

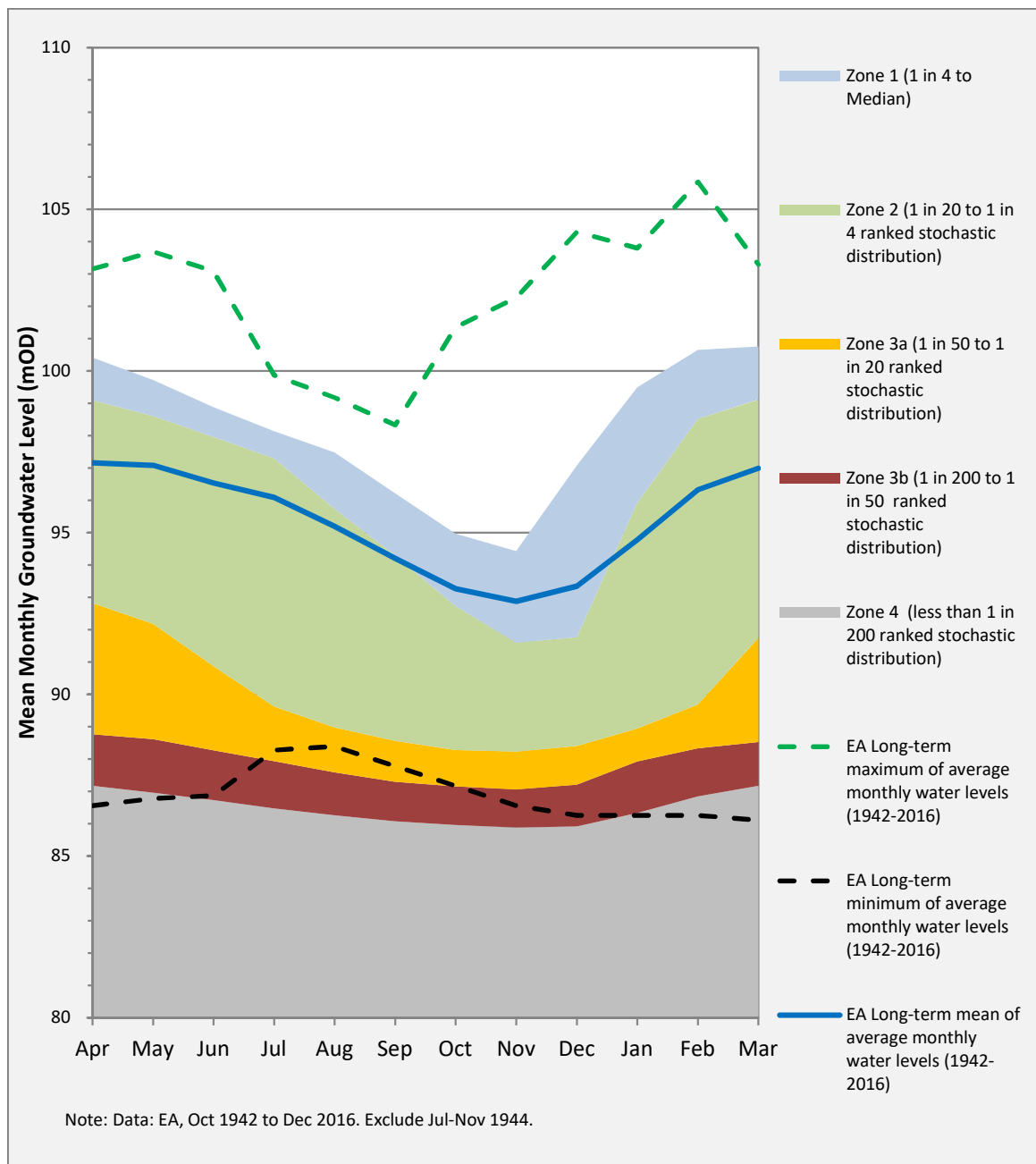
Our groundwater sources are located in both the Chalk and the Lower Greensand. The Well House Inn OBH is located in the Chalk. In WRMP19, we have assessed the use of an alternative borehole (Riverhead) to represent the Lower Greensand.

There are two observations boreholes which could be used to represent the water resources in the Chalk, Well House Inn and Chipstead. To date Well House Inn OBH has been used because it has a longer record, despite its atypical behaviour as water levels decline. This issue has largely been overcome by developing a lumped parameter model in which there are changes in storage characteristics based upon the actual groundwater level. However, the Chipstead OBH record could be hindcast to produce a long-term record and used in the future to develop an alternative a lumped model well. For this plan Well House Inn is considered representative of both aquifers.

The charts of trigger levels have been produced by plotting the maximum or minimum of the average monthly levels (see Figure 2.1).

The method for creating trigger levels in the Drought Plan 2013 used an assumption of normally distributed data from Well House Inn. Within this plan, a revised method for trigger levels has been employed which uses the stochastically generated data set for 15,000 years (75 years with 200 scenarios). The output from the lumped parameter model has been ranked and levels equivalent to the 200, 50, 20, 4 and 2-year return periods are presented as potential trigger levels. This has added another zone (Zone 4 with a less than 1 in 200 return period).

**Figure 2.1: Well House Inn Drought Trigger Curves**

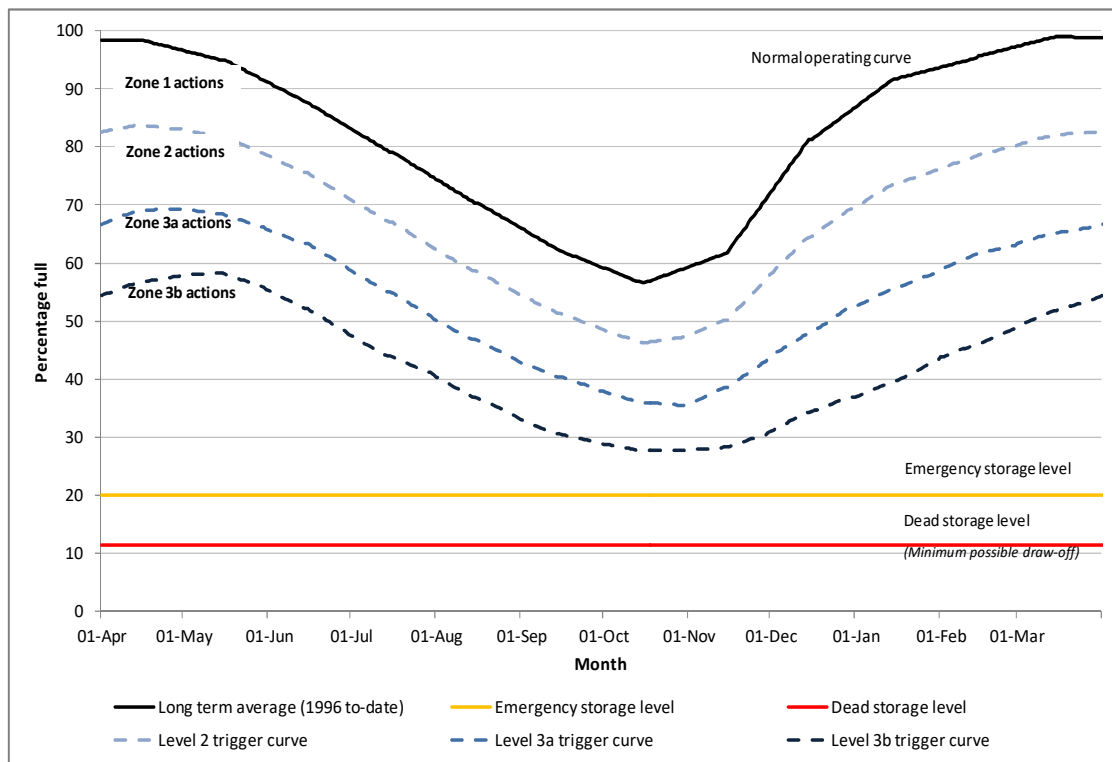


### Bough Beech Reservoir

Bough Beech is our only surface water resource. We have an agreement with Thames Water for a bulk supply at Merton Pumping Station of up to 13.6 MI/d although in recent years the quantity available for transfer has been limited to approximately 7.5 MI/d. However, Thames Water has confirmed that this bulk supply cannot be guaranteed during a drought year and hence we do not include an allowance for bulk supplies from neighbouring companies in its baseline water resource estimates.

The operating curves for Bough Beech reservoir as shown in Figure 2.2 are used as a second set of trigger levels for the implementation of drought management measures across our area. These surface water trigger levels are used in combination with the groundwater trigger levels from Well House Inn OBH.

**Figure 2.2: Bough Beech Reservoir Drought Trigger Curves**



The normal operating curve shown above is based on average observed storage levels at Bough Beech reservoir between 1996 and 2010. The shape of the drought trigger curves was derived from this average observed normal operating curve. The period between 1996 and 2010 contained both wet and dry years and is therefore considered representative of the average behaviour of the reservoir. A review of the average observed normal operating curve was undertaken for this Drought Plan using data up to 2016, and concluded that there was no change.

The level of the trigger curves was derived in conjunction with our Aquator model of the Bough Beech reservoir system. The software Aquator is used to model the performance of the Bough Beech reservoir system for use in water resources planning, particularly the WRMP. The Level 3a and 3b trigger curves shown in Figure 5.3 are incorporated in this model to allow an estimation the number of potential breaches that

may occur over a long period. Level 3a and 3b trigger curves were set to meet our Levels of Service, consistent with a frequency of trigger curve breaches that may result in instigation of temporary use restrictions no more than once in every 10 years on average (Level 3a), and non-essential use restrictions no more than once in every 20 years on average (Level 3b). In this way, this Plan is consistent with the latest update of our WRMP.

The observed reservoir level record (from 1996) is not long enough to ensure trigger curves are set at the appropriate level. Therefore, reservoir levels were simulated in Aquator based on a modelled River Eden flow series, which was in turn developed from historic rainfall and potential evapotranspiration (PET) records. The trigger curves shown in **Figure 2.2** were developed for the previous drought plan using 108 years of data. To ensure that the trigger levels were still appropriate for use in this Drought Plan, reservoir levels were simulated for an extended period of 99 years of daily flow data (1918 to 2016). This confirmed that the triggers were set to ensure we continue to meet our Levels of Service.

In 2011/12, we completed the first upgrade of the Bough Beech WTW, which enabled the treatment of up to 45 MI/d of water abstracted from Bough Beech to be put into supply at peak periods. This is an increase from the previous peak capacity of 36 MI/d. In 2012/13, the capacity of the WTW was increased again as a result of Phase 2 of the works at Bough Beech.

Since August 2012, the peak capacity of Bough Beech WTW of 52 MI/d enables abstraction and treatment of greater volumes of water from Bough Beech, with the potential to drawdown water in the reservoir at a faster rate than previously. A review of the storage levels between 2013 and 2016 was undertaken to ensure that there was no change in the storage levels post-upgrade compared to pre-upgrade storage levels. The review concluded that there was no significant change to the peak draw down rate following completion of the works and it was therefore appropriate to continue using the existing operating curves and trigger levels. This review is detailed further in Appendix B. Should the treatment works have any further increase in capacity in the future this will be reviewed.

It is recommended that the operating curve and trigger levels are reviewed following any further significant changes to the WTW capacity, connectivity of Bough Beech reservoir within the distribution network or capacity of Bough Beech reservoir, all of which have the potential to affect the Deployable Output of Bough Beech reservoir.

### **2.3. Forecasting**

Managing water resources continually requires consideration of existing supplies along with future climate and its potential impacts on groundwater and surface water supplied. For the majority of time, when winter rainfall has been sufficient to replenish groundwater levels and Bough Beech Reservoir is full, no formal assessment is required. However, if there has been insufficient rainfall over the winter recharge period, groundwater levels are below average or there has been insufficient flow in the River Eden to fill Bough Beech reservoir, a more detailed analysis of potential scenarios and impacts is required.

In early 2017, following several months of below average rainfall over the winter of 2016/17, such an assessment of water resources for the remaining winter and spring was required to help anticipate any impacts on operations in 2017. Three scenarios were selected where rainfall between February and May 2017 was 100%, 80% and 60% of long-term average. Time series of rainfall and PET were run through groundwater and surface water models to identify the impact on groundwater deployable outputs and reservoir levels. The outputs indicated that groundwater levels were at risk of breaching trigger levels 3a and even possibly 3b at Well House Inn OBH but that surface water levels in Bough Beech reservoir were predicted not to breach either trigger level 3a or 3b. This exercise gave us advanced notice of possible issues with groundwater resources in 2017.

We have repeated these forecasts or 'prospects' reports as requested by the Environment Agency to inform the National Drought Group, so that any co-ordinated action necessary can be planned and implemented.

#### **2.4. Demand-side actions**

The demand-side measures taken will depend on the timing and severity of a drought. Since 2010, the legislation governing the powers available to water companies to impose water use restrictions to manage demand has been amended.

The following demand management measures are discussed in this section:

- Customer awareness
- Leakage management & Operational Usage
- Temporary water use restrictions on households (Temporary Use Bans)
- Restrictions on uses of water through an Ordinary Drought Order (Non-Essential Use Bans)
- Emergency Drought Orders including phased pressure reduction, rota cuts and standpipes

In line with recommendations made in the EA Drought Plan Guideline and UKWIR Code of Practice, we engaged in discussions with other water companies in South East England regarding the potential for taking a joined-up approach to drought management. The potential benefits of this are recognised, particularly in terms of consistency of messages to customers regarding the need for water conservation and introduction of a new scope of demand restrictions. While it has been recognised that it is not feasible to implement identical drought plans due to the different circumstances of individual companies, whenever practical we will align its approach to that of neighbouring water companies. This includes enforcement of the Temporary Use Bans and Non-Essential Use Bans.

##### **Customer awareness**

Communicating clearly with customers is one of the most important parts of the drought management process. We recognise that to achieve the required savings during a drought period it is essential that we gain the full co-operation and engagement of our customers, both household and non-household. Measures to manage demand would be combined with a proactive media communications campaign to improve customer



awareness of the situation and the details of the actions being taken. We would work with regional and national groups to co-ordinate messaging.

We will utilise different channels of communication including the website, social media, leaflets with bills, electronic newsletters and printed magazines, as well as media publicity on a regional level including radio and television and working with third parties. This will build on our existing water efficiency and consumer education campaigns such as the schools education programme, home water efficiency check visits, behavioural change campaigns, water use calculator and free water-saving packs.

Information needs to be accurate, up to date, transparent, clear and consistent. Communication methods will be designed to encourage water saving behaviour and communicate the need for, likely duration and frequency of demand management measures, as well as the terms of any concessions. Where possible, communications will be designed so that it is relevant and understandable to different groups of consumers. We will seek assistance from our Customer Scrutiny Panel and stakeholders including environmental groups and those representing vulnerable groups to identify the best way to get the information to consumers.

An awareness raising programme normally suppresses peak demand, particularly indiscriminate garden watering. Average demand is unlikely to be significantly affected.

In the event of a drought which is triggered in the winter period, whether single-season or multiple-seasons, communications will be focussed on reducing leakage, through the promotion of campaigns such as *Wrap Up For Winter*.

For non-households, communications will be directed to the Retailers operating in our area of supply with the intention that they make their customers aware of the need to be more water efficient. Specific messages will be directed to different sectors, with support sought from the relevant organisations. For example, we will communicate with the National Farmers Union to discuss measures that could be taken in agricultural properties. Similarly, the Horticultural Trades Association partnered with the water industry to produce an online Water Conservation Certificate which is targeted at landscapers and those that maintain parklands and sports grounds. It is therefore a key organisation that we will liaise with during a drought.

### **Leakage management, Pressure Control and Operational Usage**

Our record on leakage is one of the best in the industry and we have consistently met Ofwat performance targets. This has been achieved this by the implementation of a comprehensive, telemetry linked District Metering system reaching approximately 97% of properties, optimised pressure management throughout the network, the use of a data analysis system to provide 'real time' estimation of leakage, and the implementation of an industry leading performance-based leakage detection contract.

Our current target (for 2019/20) is 24.0 MI/d. Due to our effective and proactive approach to leakage management, it is not expected that leakage can be reduced significantly during drought periods. Leakage is however an important issue to customers and proactive reduction of leakage reinforces the message that water needs to be conserved, particularly during periods of drought when wetland and river ecosystems are likely to be under stress.

The options available to reduce demand from leakage and operational usage are:

- Increase resources on leakage detection
- Reduce leak repair 'run times' on company apparatus
- Increased focus on leak repairs of customers' supply pipes
- Increase awareness of the need for customers to repair leaks on internal plumbing systems
- Additional pressure management within District Metered Areas, to reduce leakage and customer consumption
- Restrict mains flushing activities to essential operations only (for example as part of the commissioning of a new water main)
- Restrict service reservoir cleaning operations to essential operations only (for example due to a sample failure)

During the drought year of 2006, we implemented increased active leakage control. Higher than normal numbers of leak detection staff were employed and the response time for repairing visible leaks was improved. We estimate that this initiative resulted in a temporary reduction in total leakage of around 0.3 MI/d and a record low end of year leakage figure of 24.01 MI/d. Our leakage reduction strategy will continue to be reviewed in the event of the Zone 1 trigger levels being activated, in order to assess the need for any further leakage reduction measures.

During 2016-2018 we carried out a programme of installing critical pressure point (CPP) loggers at the extremities of each District Meter area. The pressure at the inlet to a District Meter area can then be controlled based on the data from these CPP loggers. This optimises pressure control so that service levels are met but leakage and usage is minimised. During a drought period the scope for additional controls can be investigated.

Estimated savings from and the scheduling of leakage, pressure management and operational usage restrictions is detailed in

Table 2.1 and Section 2.1.7 respectively.

### **Temporary use bans**

The Flood and Water Management Act 2010 amended the Water Industry Act 1991 to update the legislation on temporary use bans (TUBs). Supporting information, definitions and exemptions for each water use activity covered by the legislation are detailed by The Water Use (Temporary Bans) Order 2010.

These restrictions cover the outdoor use of water for household purposes. There are 11 categories of use, which we have divided into those implemented in Phase 1 and those in Phases 2 & 3.

#### **Phase 1:**

- Watering a garden using a hosepipe

#### **Phase 2 & 3:**

- Cleaning a private motor-vehicle using a hosepipe
- Watering plants on domestic or other non-commercial premises using a hosepipe
- Cleaning a private leisure boat using a hosepipe

- Filling or maintaining a domestic swimming or paddling pool
- Drawing water, using a hosepipe, for domestic recreational use
- Filling or maintaining a domestic pond using a hosepipe
- Filling or maintaining an ornamental fountain
- Cleaning walls, or windows, of domestic premises using a hosepipe
- Cleaning paths or patios using a hosepipe
- Cleaning other artificial outdoor surfaces using a hosepipe

Further details on the exemptions and differentiation of Phase 2 and 3 restrictions, and how their implementation is related to the Drought Triggers, is given in Section 0. It should be noted that there may be circumstances where we may need to implement one or more of these phases concurrently.

We recognise from its experiences throughout the 2004-06 and the 2011/12 droughts the value of publicity around demand restrictions as a communication tool to convey to consumers the need for reduced water usage.

### **Savings from Temporary Use Bans**

Company specific data regarding water savings achieved by sprinkler and fuller hosepipe bans was recorded during the implementation of demand restrictions between 1996 and 2007. It was found that sprinkler bans produced savings at both average and peak demand when accompanied by an intensive media campaign. A saving of up to 1.5% at average and 3.5% at peak, i.e. June to September inclusive, could be expected, based upon the difference between actual demand and that expected based on the climatic conditions experienced in 2005/06.

However, as stated in UKWIR (2007a), “the magnitude of reduction in any year depends on the demand that would have been expected in that year had restrictions and other measures not been imposed”. Therefore, the savings in any particular drought may not align exactly with those estimated in this Drought Plan, being dependent on temperatures experienced in the drought year and also factors such as the degree of preceding media attention at a local, regional or national scale, outside our own communications strategy.

The activity banned was primarily associated with garden watering by domestic customers. As customer garden watering is recognised as one of the key drivers of a summer increase in demand, restricting this activity is generally considered an appropriate step to take when resources may be insufficient to meet the projected summer peak.

It was found that the introduction of full hosepipe bans provided a further suppression of demand, and a saving of up to 4% at average and up to 6% at peak could be expected, inclusive of savings from sprinkler bans. These estimated savings are summarised in

#### **Table 2.1**

#### **Table 2.1: Summary of estimated savings from demand restrictions**

While these figures may not be directly comparable to the activities defined by the current legislation, they offer an indicative measure of the effectiveness of certain

restrictions and are taken into account in considering the appropriate phasing of activities. This is discussed in more detail in Section 0.

No additional data on the effect of restrictions could be determined from the drought in 2011/12 since heavy rainfall occurred within days after the introduction of the hosepipe ban in April 2012, with the ban lifted in July 2012.

### **Drought Orders (Non-Essential Use Bans)**

The activities defined under The Water Use (Temporary Bans) Order 2010 as Drought Orders are intended not to overlap with the activities covered by TUBs, and are generally worded to apply to non-domestic purposes. There are 10 categories of use:

- Watering outdoor plants on commercial premises
- Filling or maintaining a non-domestic swimming or paddling pool
- Filling or maintaining a pond
- Operating a mechanical vehicle-washer
- Cleaning any vehicle, boat, aircraft or railway rolling stock
- Cleaning non-domestic premises
- Cleaning a window of a non-domestic building
- Cleaning industrial plant
- Suppressing dust
- Operating cisterns

Non-Essential Use Bans (NEUBs) have the potential to impact on businesses, particularly those relating to window cleaning and vehicle cleaning. Therefore, the Company would only apply for a drought order to restriction non-essential uses of water after implementation of the full suite of temporary water use restrictions (TUBs). A NEUB will be considered when the resource situation is such that we are uncertain of achieving the normal deployable output (DO) of our sources.

We will implement any restrictions in a flexible, proportional and transparent manner that considers all affected users. Partial exemptions may be granted from this ban in an attempt to save water while minimising the economic and social impact. Further detail on the sequencing and communication of NEUBs is given in Section 0.

### **Savings from Non-essential Use Bans**

It is estimated that an additional demand saving of approximately 8.5% could be expected as a result of a full NEUB being implemented (UKWIR, 2007a), over and above savings achieved by the temporary water use restrictions. This information was calculated as part of the UKWIR (2007a) study that modelled the effects of demand restrictions during droughts: SES Water specific data from the 2003-06 drought quoted in this study suggested that a saving of between 10 and 17% at average and 20% at peak could be expected in the past with the non-essential use ban, inclusive of hosepipe bans.

These estimated savings are summarised in

**Table 2.1** but as discussed earlier, should be taken as estimates only due to likely variance in temperatures and therefore antecedent levels of demand.

### **Summary of Demand-Side Savings**

The savings and area of implementation of the demand-side measures detailed in Sections 2.4.1 to 2.4.6 are given in Table 2.1. Note that the cumulative savings are calculated from the savings of each measure added to those previously implemented. Further details are given in Appendix A.

**Table 2.1: Summary of estimated savings from demand restrictions**

Restriction	Annual Average Saving	Peak Period Saving	Cumulative Annual Average Saving	Cumulative Peak Period Saving
Customer Awareness	0.2%	0.4%	0.2%	0.4%
Leakage Control	0.2%	0.2%	0.4%	0.6%
Pressure Management	0.1%	0.2%	0.5%	0.8%
Operational Usage Restrictions	0.01%	0.01%	0.51%	0.81%
Temporary Use Ban: Phase 1	1.5%	3.5%	2.01%	4.31%
Temporary Use Ban: Phase 2 & 3	2.5%	2.5%	4.51%	6.81%
Non-Essential Use Ban	8.5%	13.5%	13.01%	20.31%

## 2.5. Supply-side actions and triggers

During a drought we have a number of supply side options that can be taken to maintain the supply-demand balance. These are:

- Lowering of pumps and purchase of borehole licences to increase available supplies
- Utilise a bulk supply from a neighbouring water company
- Preferential use of peak resources that are more resilient to drought (e.g. Hackbridge/Goatbridge and Clifton's Lane)
- Use of existing transfers available within our supply network
- Conjunctive use of resources by transferring water from Bough Beech reservoir to augment groundwater
- A drought permit on the River Eden to supplement the abstraction used to refill Bough Beech reservoir
- Drought permits for additional abstraction from Hackbridge/Goatbridge, Woodmansterne and Kenley Groups

The potential benefits of each of the above measures are considered below. Appendix A contains Drought Options Tables summarising information on each drought management action in the format required by the Environment Agency in its guidance, “How to write and publish a drought plan” published July 2015 and updated April 2017, which can be found at:

<https://www.gov.uk/government/collections/how-to-write-and-publish-a-drought-plan>.

This information includes the triggers, potential increases in supply or reductions in demand and environmental impact of the options.

### **Lowering of pumps and purchase of borehole licences**

Although the average deployable output of some of our individual sources is constrained by pump capacity or pump intake level, the average deployable output of most of the groups is constrained by the annual average group licence. Therefore there is little scope to increase output from these sources within the licensed quantities. Lowering pumps at existing sources is estimated to provide around 3 MI/d of additional average deployable output during an extended drought, while increasing pump capacity is estimated to provide around 5 MI/d.

The difference between peak deployable outputs and peak daily licence suggests that there may be some potential to increase peak output over the short term during droughts (i.e. peak deployable output) by lowering pumps and increasing pump capacity at some sources to allow them to pump closer to the peak daily licence. However, in many cases the potential gains of doing this are limited by hydrogeological constraints (e.g. major flow horizons below which yields rapidly drop) and even where they are not, the group annual licence often tends to limit what gains could be achieved within the daily licence. Taking hydrogeological constraints into account, lowering pumps at existing sources is estimated to provide around 2 MI/d of additional peak deployable output during an extended drought, while increasing pump capacity is estimated to provide around 17 MI/d.

We have previously undertaken a review of private companies and individuals that hold abstraction licences for purposes other than public water supply within its supply area with a view to identifying if there were opportunities for the potential transfer and sale of licensed volumes. There is limited potential to establish transfer of unused licensed quantities to augment public water supplies. It is recognised that to enable the use of these licences through trading, this would need to be discussed in detail with the Environment Agency and applications made, which would take some time.

### **Bulk supply from neighbouring water company**

We have an agreement with Thames Water for a bulk supply of up to 13.6 MI/d although in recent years the quantity available for transfer has been limited to approximately 7.5 MI/d. To date, Thames Water has indicated that whilst it may be able to provide a bulk supply in the short term, there are significant risks in relying on this being available throughout a drought period because of pressures on supplies within their own system. Any bulk supply received would be via our pumping station at Merton. However, it is clear that limited reliance should be placed on the availability of this supply during a drought period.

### **Use of peak resources**

We operate a number of relatively drought resilient ‘peak sources’ such as Hackbridge, Goatbridge and Clifton’s Lane that are primarily used to meet peak demands. These sources draw groundwater from the confined Chalk and Lower Greensand aquifers that take longer to respond to reduced recharge than the unconfined Chalk sources to the south. The two confined Chalk sources are also part of our artificial recharge scheme that pumps surplus winter recharge from the unconfined Chalk into the confined Chalk aquifer and allows abstraction at higher sustained rates in the summer to meet peak demands. In order to maximise the benefit of the artificial recharge scheme, we can recharge the maximum allowable volume of 730 MI between November and March and then abstract the annual licensed Hackbridge/Goatbridge volume of 3,920 MI at a continuous rate of 17.2 MI/d for 7.5 months between the two sources. We will carefully manage these sources when entering a drought period as initiated by the drought triggers.

### **Transfer of water from Bough Beech reservoir**

Due to the improved connectivity developed within our supply network over the last ten years, up to 18 MI/d of potable water can be transferred from Bough Beech WTW and Elmer WTW to the Burgh Heath, Margery and Nork zones via the Buckland Pumping Station (PS).

Further work has been carried in the current (AMP6) period to increase transfer capacity from Bough Beech WTW. This work includes mains reinforcements and upgrades to booster pumping stations in order to take full advantage of the uprating of Bough Beech WTW.

The overall scheme will provide the following benefits:

- Increased resilience to treatment works outages (by 2025 it will be possible to supply all customers from more than one WTW)
- Facilitates greater flexibility and conjunctive use of groundwater and surface water sources
- Improves peak deployable output across our area of supply

However, in a prolonged drought, the output from Bough Beech will have to be carefully managed, and there will still be a need for drought interventions such as drought permits.

### **Other internal conjunctive use/transfer schemes**

We have the capacity to transfer water within its boundaries using the Kenley to How Green and the Buckland transfer schemes. These internal transfers can be operated within existing licences and infrastructure capacities, and therefore would have no outside impact on customers or the environment.

### **Summary of supply-side outputs**

The deployable output associated with the supply-side options, as detailed in Sections 2.5.1 to 2.5.5 is given in

Table 2.2. Further details are provided in Appendix A.



**Table 2.2: Summary of supply-side outputs**

Supply-side option	Maximum resource option can provide (MI/d)
Lowering of pumps	3 (average), 5 (peak)
Increasing pump capacities	2 (average), 17 (peak)
Bulk supply from Thames Water	7.5
Use of peak resources	17.2
Transfer from Bough Beech Reservoir	18.0

## 2.6. Drought permits

Defra, the Welsh Assembly Government and the EA provide clarification and guidance on the distinctions between drought permits and drought orders (Defra, WAG and EA, 2011).

In summary, both a drought permit and an ordinary drought order would allow a water company to modify or suspend conditions on an abstraction licence held by the water company. A drought permit application is submitted to the Environment Agency under the WRA 1991 Section 79a (as amended by EA 1995), whereas an ordinary drought order is submitted to the Secretary of State under the WRA 1991 Section 74.

In the case of drought permits, the Environment Agency must be satisfied that a serious deficiency of supplies of water in any area exists or is threatened and the reason for the deficiency is an exceptional shortage of rain.

In the case of ordinary drought orders, the Secretary of State must be satisfied that either a serious deficiency of supplies of water in any area, exists or is threatened; or such a deficiency in the flow or level of water in any inland waterway to pose a serious threat to any flora or fauna which are dependent on those waters, exists or is threatened; and that the reason for the deficiency is an exceptional shortage of rain.

Exceptional shortage of rain will be demonstrated by comparing rainfall within the relevant catchment to the drought permit and comparing against the monthly long-term average. We have been monitoring rainfall at operational sites and our Head Office for the following periods:

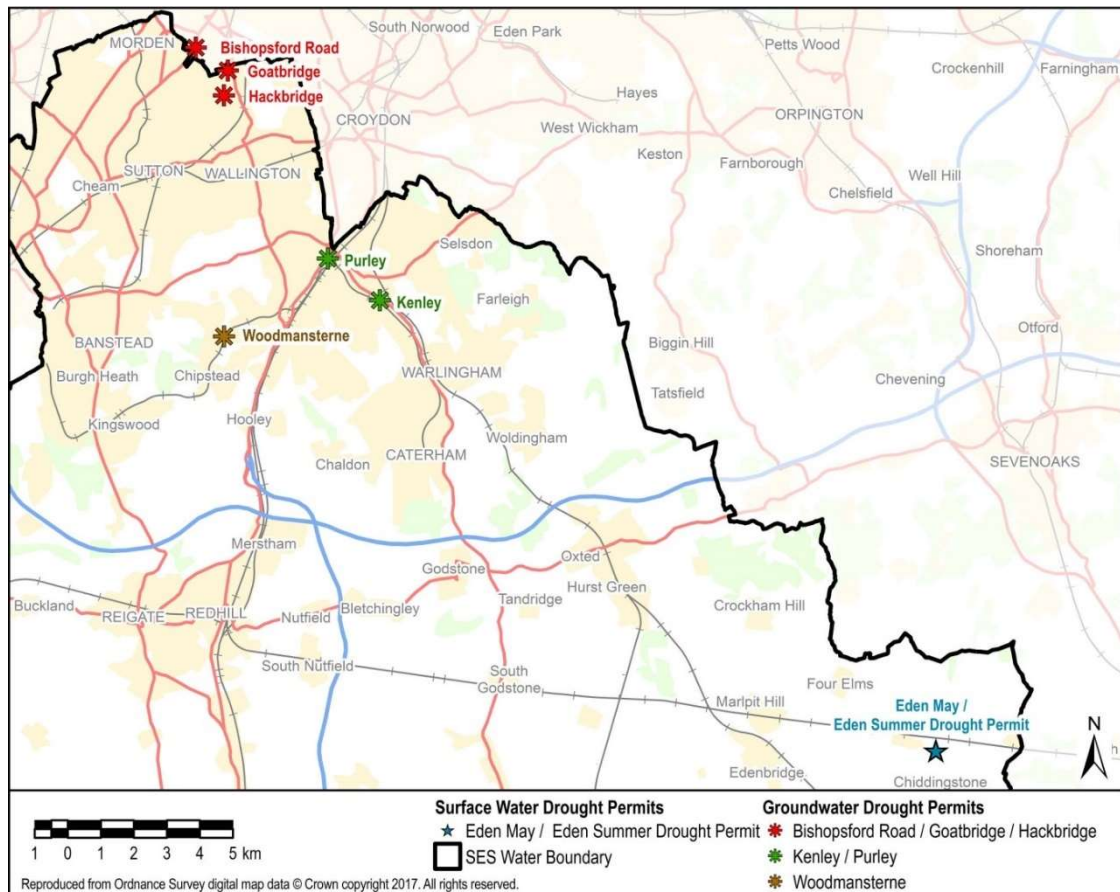
- Redhill Head Office, Kenley – 1910
- Westwood - 1932
- Elmer, Margery – 1935
- Godstone - 1950
- Dorking – 1960
- Bough Beech – 1965
- Cheam – 1966
- Nork – 1992

For example, for the River Eden drought permit, data from the rainfall gauge at Bough Beech can be used to assess the difference against long-term average.

In relation to drought permit applications, it would usually be more appropriate for the water company to apply for a drought order as an alternative option where a Habitats Directive site is impacted.

For the purposes of this Drought Plan, drought permits are deemed most appropriate for the schemes available. Drought permit options are presented in Figure 2.3 and discussed below.

**Figure 2.3: SES Water groundwater and surface water drought permits**



**2.6.1. River Eden drought permits**

Bough Beech reservoir is refilled primarily via an abstraction from the River Eden which normally operates during the winter. The 2004-06 and 2011/12 droughts highlighted the vulnerability of our groundwater sources. As our only surface water source, Bough Beech provides us with an important source of supply during some groundwater droughts, particularly as it is possible to distribute water from Bough Beech across our supply area.

In the past, we have applied for and been granted drought permits on the River Eden to support the abstraction that refills Bough Beech reservoir. Table 2.3 provides a summary of the current licence conditions (licence issued in April 2018) that govern the abstraction from the River Eden.

**Table 2.3: Summary of key licence conditions for the River Eden abstraction**

Abstraction from the River Eden	Quantity
Annual licensed quantity subject to the following restriction: Abstractions are not permitted from May to August inclusive;	29,000 MI
Daily maximum licensed quantity subject to the following restrictions: <ul style="list-style-type: none"> <li>• Abstractions are not permitted in September in any year when the flow as measured at Chiddingstone gauging station is at or below a local minimum residual flow (MRF) condition relating to the River Eden of 50 MI/d.</li> <li>• Abstractions are not permitted in October in any year when the flow as measured at Chiddingstone gauging station is at or below a local MRF condition relating to the River Eden of 25MI/d.</li> <li>• Abstractions are not permitted in the months of November to April in any year when the flow as measured at Chiddingstone gauging station* is at or below a local MRF condition relating to the River Eden of 22MI/d.</li> </ul> <p>*The 'Chiddingstone gauging station' is the gauge referred to in Section 12(2)(a) (1) of the East Surrey Water (Bough Beech Reservoir) Order 1965 (ref 12) (at Chiddingstone).</p>	272.76 MI/d

There are two types of potential drought permit relating to the River Eden abstraction that can be sought to maintain storage in Bough Beech reservoir, as follows:

- A drought permit to enable the winter abstraction from the River Eden to continue for an additional period of time; historically this has been into May, so this permit is often termed the May drought permit
- A drought permit to enable summer abstraction from the River Eden (after any May drought permit has ceased).

We recognise the importance of protecting the environment. It would therefore propose controls and mitigation measures if/when a drought permit for the River Eden is sought. We were granted drought permits to extend the winter abstraction period into May in 2005, 2006 and 2012.

Environmental Assessment Reports (EAR) were carried out in preparation for these drought permit applications and monitoring was undertaken during the operation of the drought permits. Environmental baseline data for the site is detailed in the EAR in Appendix D, which goes on to present an assessment which illustrates that the drought permits, with appropriate mitigation, will not have an adverse impact on the environment. This assessment is summarised in Section 3 **Error! Reference source not found.** The Environment Agency placed requirements on SES Water during the operation of the aforementioned drought permits, which we adhered to, as it recognises the importance of protecting the environment during a drought.

Bough Beech reservoir provides an important alternative supply. Thus, we may seek to implement the Eden May drought permit when water levels in Bough Beech have

breached the necessary trigger level, even if groundwater levels have not breached the same trigger level at Well House Inn (unless they are at normal levels) and without implementing demand restrictions across the water resource zone.

We consider that an application for a summer drought permit on the River Eden would only be considered in an extreme drought, after the introduction of a drought order to restrict the non-essential use of water and the granting of the River Eden drought permit for extension of the winter abstraction period into May.

### **2.6.2. Groundwater abstraction drought permit sites**

In our 2013 Drought Plan, the Hackbridge Group, the Kenley Group and the Woodmansterne Group of sources were identified as appropriate sources for drought permits due to the fact that they were considered as relatively resilient to drought and that the hydrogeological capability (i.e. the potential yield) of the sources is considered to significantly exceed the average annual licensed capacity. We propose that these sources remain as potential drought permit sites.

Priority abstraction licence groups identified as suitable for additional abstraction under drought permits are:

- Hackbridge / Goatbridge / Bishopsford Road (peak and average abstraction)
- Kenley / Purley (average abstraction only)
- Woodmansterne (peak and average abstraction)

In terms of sequencing of drought permits, we may apply for the Hackbridge group permit before or alongside applying for a drought permit to abstract water from the River Eden for an additional period of time. The remaining groundwater permits are likely to be considered after the River Eden, depending on the relative trigger levels of the sources. Further information on sequencing is given in Section 0.

Through drought permit applications, we would look to increase the peak and annual average licensed abstraction from the Hackbridge and Woodmansterne Group of sources. At the Kenley Group, we would look to increase only the annual average licensed abstraction. Further detail is provided below.

#### **Hackbridge/Goatbridge/Bishopsford Road**

##### ***Source characteristics***

The Hackbridge Group licence comprises three sources in the confined Chalk: Hackbridge (two operational boreholes), Goatbridge (one operational borehole) and Bishopsford Road.

The group's average deployable output (ADO) and peak deployable output (PDO) are currently constrained by the licensed abstraction rates at 8.47 MI/d and 17.2 MI/d respectively (the peak licence is actually 19 MI/d but 1.8 MI/d is 'allocated' in the DO calculation to the aggregated licence of Sunlight Laundry). The installed pump capacity is approximately 19 MI/d which allows pumping at the full peak licence rate if the Wandle Road Laundry is not abstracting.

We also operate a Carshalton Ponds/River Wandle augmentation scheme whereby the outflow from Carshalton Ponds has to be maintained at greater than 4.5 MI/d before abstraction can take place at Hackbridge and Goatbridge boreholes (and a number of the unconfined sources). This operates by drawing water from the River Wandle at

Goatbridge and pumping it back up to Carshalton Ponds, i.e. it re-circulates the flow in the upper stretches of the Carshalton Branch when the natural springflow into the Ponds is less than 4.5 MI/d. If the re-circulated flow drops below 4.5 MI/d as a result of losses (e.g. evaporation and leakage), then there is an available mechanism to top up the re-circulated water by pumping from the confined Chalk utilising the Goatbridge abstraction borehole that is normally used for the public water supply. The Wandle minimum flow requirement could be met by discharging from Goatbridge abstraction borehole into the river in less than one day. This backup mechanism is assumed to provide sufficient resource to keep the augmentation scheme viable (although this has not been required to date).

We also operate an artificial recharge scheme at the Hackbridge source which takes surplus winter licensed abstraction from the sources in the unconfined Chalk aquifer and recharges it to the confined Chalk aquifer to allow the licensed abstraction rates indicated above. The objective of this scheme is effectively to capture water that would have been naturally discharged as peaks in winter springflow to the River Wandle and inject it into the confined Chalk aquifer in order to be abstracted during subsequent peak summer demands.

In order to maximise the licensed abstraction from the Hackbridge group, we can recharge the maximum allowable 730 MI at a maximum rate of approximately 6.5 MI/d which takes approximately 112 days (1 November to 20 February). The current licence allows a maximum average abstraction of 19 MI/d over a 30-day period (including a 1.8 MI/d allowance for the Wandle Road Laundry abstraction licence) and therefore at the maximum abstraction rate (and assuming Wandle Road Laundry takes its full 1.8 MI/d) the annual licensed volume is abstracted in 206 days. The annual licence period begins on the 1 April and if daily abstractions were at their maximum of 19 MI/d, this would be used by the 23 October.

### ***Drought permit***

Subject to the drought circumstances, we will apply for a drought permit to either:

- Increase the annual licensed abstraction at Hackbridge / Goatbridge by 893 MI to allow continued abstraction at 19 MI/d for the remaining 8 days up until recharge commences again i.e. up until 31 October (Hence this drought permit will only be needed for a few days unless extended into the recharge period through to end of March); or to
- Increase the daily and 30-day licence to 20.8 MI/d (equal to the installed pump capacity of Hackbridge/Goatbridge plus the Wandle Road Laundry allocation of 1.8 MI/d) which will allow SESW to pump 19 MI/d within a period of 30 days irrespective of how much of its 1.8 MI/d allocation Wandle Road Laundry takes (this drought permit could be sought from 1 April).

Both the above drought permit options would be conditional on the continued operation of the Carshalton Ponds/River Wandle augmentation scheme; should this cease, for whatever reason, including mechanical failure, abstraction under the drought permit would stop. This would ensure that the outflow from Carshalton Ponds is maintained at greater than 4.5 MI/d while the drought permit abstraction is in operation.

The environmental impact of these temporary licence changes is summarised in Section 3.

## **The Woodmansterne Group**

### ***Source characteristics***

The Woodmansterne Group licence comprises four sources in the unconfined Chalk of the North Downs: Chipstead (one borehole), Outwood Lane (one borehole), Holly Lane (one borehole), and Woodmansterne (five boreholes). The Smitham licence is also aggregated with the Woodmansterne Group licence.

The group's annual licence (including Smitham) is 10,751 MI equating to 29.45 MI/d and its peak daily licence is 51.89 MI/d.

Having previously been constrained by a combination of pump capacity and potential yield, the group's Average Deployable Output (ADO) became licence constrained following the addition of Outwood Lane to the abstraction licence in June 2007. Consequently, any increase in ADO from this licence group will now need to come from a licence increase under a drought permit. All sources are pumped to Woodmansterne for treatment which has a capacity of 45 MI/d, following its recent upgrade which took place between 2016 and 2018.

### ***Drought permit***

The drought permit within this group is an increase in annual and peak licence at the Outwood Lane source in order to allow abstraction from this source at 8 MI/d (an increase of 4.98 MI/d on the current daily licence) for up to three months during the summer peak demand period. This equates to an increase in the annual licensed volume of 448MI. The environmental impact of such an increase is summarised in Section 3.

## **Kenley Group (Kenley and Purley sources)**

### ***Source characteristics***

The Kenley Group licence comprises two sources in the unconfined Chalk of the North Downs: Kenley (four operational boreholes) and Purley (three operational boreholes). The group's annual licence is 8318.35 MI, equating to 22.79 MI/d, and its peak daily licence is 44.39 MI/d.

### ***Drought permit***

The drought permit at this site is to increase the ADO by increasing the annual licence. The immediate opportunity (without infrastructure works of lowering pumps) is to increase the annual licence to allow pumping at the PDO of 24.9 MI/d for a six-month period, i.e. an increase of 2.1 MI/d equating to an annual volumetric increase of 382 MI. In the absence of infrastructure works to lower pumps, the majority of this increase (1.5 MI/d) will come from the Kenley source with the remainder (0.6 MI/d) from the Purley boreholes. The environmental impact of this increase in annual licensed volume is summarised in Section 3.

## **2.7. Sequencing of drought management actions**

Four different zones of actions are defined, dependent upon the severity of the drought. When water levels fall below one of the four trigger curves at Bough Beech reservoir and/or the Well House Inn OBH, some or all of the following actions will be considered. For supply-side actions, the measures considered or taken will depend on the source

group affected. Triggers and actions will be reviewed based on any experiences we gain through future drought events, and updated if required. It should be noted that customers are not entitled to compensation as a result of the implementation of any of the drought management actions detailed in this section.

A proportional, phased approach to demand-side restrictions is encouraged by the EA Drought Plan Guideline and UKWIR Code of Practice, and legislation explicitly allows for flexibility in the implementation of restrictions. Building on experience and consideration of the benefits and impacts of restricting certain uses, we propose a phased approach, based on priorities for water savings and the impact on customers and particularly small businesses.

Further details on the following drought management actions are given in Appendix A.

### **2.7.1. Zone 1 Actions**

#### ***Demand-side Actions***

- Increase customer awareness of resource situation. This is to be achieved by use of the some or all of the following: social media (Twitter, Facebook) newsletters, press releases to local media, liaison with community and stakeholder groups, awareness raising programmes on local radio and providing regular updates on key sections of our website
- Communication and consultation with the fire services and other essential services about possible forthcoming drought measures
- Consider increased leakage activity
- Restrict operational usage to essential operations only
- Keep the EA, Local Authorities, the Consumer Council for Water (Thames Region) and neighbouring water companies informed of the situation

#### ***Supply-side Actions***

- Make preparations to bring peak sources such as Hackbridge/Goatbridge and Clifton's Lane WTW online
- Make conjunctive use of resources, depending on the surface versus groundwater situation. During the winter, if there is a high confidence that Bough Beech reservoir will be filled, then this surface water can be transferred to the central and northern areas to supplement the groundwater. As the reservoir normally cannot be filled after 1 May it is unlikely that the water would be transferred from this point onwards. In addition, use of this transfer is usually only carried out when the reservoir is above its Zone 3a drought trigger curve.
- Transfer of supplies to the Northern area to supplement chalk borehole supplies, through the use of 'The Avenue' transfer (Kenley WTW to How Green service reservoir) and/or Buckland PS

### **2.7.2. Zone 2 Actions**

#### ***Demand-side Actions***

- Increase customer awareness of the resource situation and ask for support in reducing demand to avoid the need for restrictions. This is to build on the work undertaken in Zone 1 with further communications with the media (e.g. interviews), additional advertising such as on buses, and engagement with schools, Local

Authorities, Housing Associations and with retail sectors such as gardening centres.

- Focus on reducing run times for visible and reported leaks, and increase focus on customer-side leakage
- Evaluate districts where further pressure management is feasible
- Liaise with the EA as to actions being planned or taken. Keep others informed such as Ofwat, Water UK, CC Water, South East Rivers Trust, neighbouring water companies and customers with special water needs

#### ***Supply-side Actions***

- Bring peak sources, such as Hackbridge/Goatbridge and Clifton's Lane, into supply or increase their output, depending on abstraction in comparison to licenced quantities and the sources most at risk
- Increase the transfer of supplies via 'The Avenue (Kenley WTW to How Green service reservoir) and Buckland PS. The maximum transfer level is currently 36.5 Ml/d. The transfer is bi-directional so can be used to support the northern or central areas.
- Make further conjunctive use of resources, depending on the surface versus groundwater situation. During the winter, if there is a high confidence that Bough Beech reservoir will be filled, then this surface water can be transferred to the northern area to supplement groundwater sources. In all other conditions, use of this transfer is usually only carried out when the reservoir is above its Zone 3a drought trigger curve. As the reservoir normally cannot be filled after 1 May it is unlikely that the water would be transferred from this point onwards.
- Request information regarding the availability of a bulk supply from Thames Water at Merton PS, and make preparations for its use (pump tests and sampling)

### **2.7.3. Zone 3a Actions**

#### ***Demand-side Actions***

- Further increase customer awareness of the resource situation and step up appeals for restraint in water use in order to reduce demand. This will build on the existing communications programme and involve additional engagement with local media, increased coverage and urgency of messages in the local press and radio and use of social media, leaflets and posters to convey the water conservation message.
- Write to Retailers, large commercial customers, Local Authorities, housing associations, fire authorities, hospitals and schools to engage their support in reducing demand
- Continue to focus on reducing leakage through increased resources on detection and repairs
- Consider offering free repairs on leaks to fittings within household properties
- Implement pressure reduction in districts where this is considered feasible
- Give formal notification to the fire and other essential services 72 hours before the implementation of any temporary water use restrictions
- Implement Phase 1 of demand restrictions in part or all of our area of supply. These restrictions are set out in Table 2.4. Maintain communications programme to keep customers informed of the likely frequency and duration of temporary water use restrictions.



- If the situation is deteriorating, implement Phase 2 of demand restrictions in addition to Phase 1. This restricts all of the water uses listed in the temporary water use ban legislation, with specific exclusions under each category as set out in Table 2.5.

We will consider representations on Phase 1 or 2 temporary use restrictions through the sitting of a two-weekly panel to review representations, which will include the Senior Managers within Wholesale Services and Customer Services. This was implemented when we considered representations received on the 2006 non-essential use ban and the 2012 temporary use restrictions. We will also respond to any person who contacts us regarding temporary use restrictions.

**Table 2.4: Inclusions and exemptions from Phase 1 temporary use restrictions**

Restricted uses of water	Exemptions from restrictions
<p>Watering a garden <u>using a sprinkler, unattended hosepipe or equivalent</u>, including the following definitions of “a garden” (The Water Use (Temporary Bans) order 2010, Clause 4(2)):</p> <p>a) a park;                      b) a lawn;                      c) a grass verge;                      d) an allotment garden, as defined by section 22(1) of the Allotments Act 1922(a);                      e) any area of an allotment used for non-commercial purposes;                      f) any other green space.</p>	<p>Watering a garden <u>using a sprinkler, unattended hosepipe or equivalent</u>, including the following definitions of “a garden” (The Water Use (Temporary Bans) order 2010, Clause 4(2)):</p> <p>a) gardens open to the public;                      b) an area of grass used for sport or recreation.</p>
	<p>Watering a garden <u>using a handheld hosepipe</u>, including the following definitions of “a garden” (The Water Use (Temporary Bans) order 2010, Clause 4(2)):</p> <p>a) a park;                      b) gardens open to the public;                      c) a lawn;                      d) a grass verge;                      e) an area of grass used for sport or recreation;                      f) an allotment garden, as defined by section 22(1) of the Allotments Act 1922(a);                      g) any area of an allotment used for non-commercial purposes;                      h) any other green space.</p>
	<p>Watering a garden using automatic irrigation systems, provided that they comply with all of the following conditions:</p> <ul style="list-style-type: none"> <li>– The water supply to which the device is connected must be one which is charged to the user by reference to volume by meter belonging to SES Water plc;</li> <li>– No part of the system may be handheld;</li> <li>– The system must incorporate a pressure reducing valve;</li> <li>– The system must incorporate a time clock control;</li> <li>– The system must deliver water by means of a drip or trickle system;</li> <li>– The system must not disperse water through the air by means of sprinkler, jet, mister or similar device;</li> <li>– The system must deliver water directly either on to the surface of the soil or under the surface of the soil; and</li> </ul>

Restricted uses of water	Exemptions from restrictions
	<ul style="list-style-type: none"> <li>- The system must not cause any surface water run-off.</li> </ul>
	<p>Newly laid turf for the first 28 days since being laid</p>
	<p>Any person who has dispensation as a result a need arising from disability, medical condition or similar, to use a hosepipe for the prohibited purposes or to fill or maintain a domestic swimming or paddling pool or ornamental fountain. This includes Blue Badge holders or customers who are registered on the SES Water Priority Services list due to a lack of mobility.</p>

**Table 2.5: Inclusions and exemptions from Phase 2 temporary use restrictions**

Included in restrictions	Exemptions from restrictions
<p>Watering a garden using a hosepipe, including using sprinklers, dripper hoses, automatic irrigation systems and similar devices, including the following definitions of “a garden” (The Water Use (Temporary Bans) order 2010, Clause 4(2)):</p> <ul style="list-style-type: none"> <li>a) a park;</li> <li>b) a lawn;</li> <li>c) a grass verge;</li> <li>d) an allotment garden, as defined by section 22(1) of the Allotments Act 1922(a);</li> <li>e) any area of an allotment used for non-commercial purposes;</li> <li>f) any other green space.</li> </ul>	<p>Watering a garden using a hosepipe, including using sprinklers, dripper hoses, automatic irrigation systems and similar devices, including the following definitions of “a garden” (The Water Use (Temporary Bans) order 2010, Clause 4(2)):</p> <ul style="list-style-type: none"> <li>a) gardens open to the public;</li> <li>b) an area of grass used for sport or recreation.</li> </ul> <p>Automatic irrigation systems, provided that they comply with all of the following conditions:</p> <ul style="list-style-type: none"> <li>– The water supply to which the device is connected must be one which is charged to the user by reference to volume by meter belonging to SES Water;</li> <li>– No part of the system may be handheld;</li> <li>– The system must incorporate a pressure reducing valve;</li> <li>– The system must incorporate a time clock control;</li> <li>– The system must deliver water by means of a drip or trickle system;</li> <li>– The system must not disperse water through the air by means of sprinkler, jet, mister or similar device;</li> <li>– The system must deliver water directly either on to the surface of the soil or under the surface of the soil; and</li> <li>– The system must not cause any surface water run-off.</li> </ul> <p>Any person who has dispensation as a result a need arising from disability, medical condition or similar, to use a hosepipe for the prohibited purposes or to fill or maintain a domestic swimming or paddling pool or ornamental fountain. This includes Blue Badge holders or customers who are registered on the SES Water Priority Services list due to a lack of mobility.</p>
<p>Cleaning a private motor-vehicle using a hosepipe</p>	<p>Users who clean private motor vehicles for remuneration in the course of a trade or business</p>

Included in restrictions	Exemptions from restrictions
	Any person who has dispensation as a result a need arising from disability, medical condition or similar, to use a hosepipe for the prohibited purposes. This includes Blue Badge holders or customers who are registered on the SES Water Priority Services list due to a lack of mobility.
Watering plants on domestic or other non-commercial premises using a hosepipe, where plants are in an outdoor pot or in the ground, under cover	Watering plants using a hosepipe that are: a) grown or kept for sale or commercial use, or b) part of a National Collection or temporary garden or flower display.
Cleaning a private leisure boat using a hosepipe	<p>Cleaning of vessels using a hosepipe that are: a) used in the course of a business; b) are used as a primary residence; or c) made available or accessible to the public.</p> <p>Cleaning of any area of a private leisure boat which, except for doors or windows, is enclosed by a roof and walls</p> <p>Using a hosepipe to clean a private leisure boat for health or safety reasons, to prevent the spread of non-native species, where fouling is increasing fuel consumption or engines designed to be cleaned with a hosepipe</p>
Filling or maintaining a domestic swimming or paddling pool or pond	<p>a) filling or maintaining a pool where necessary in the course of its construction b) filling or maintaining a pool using a hand-held container which is filled with water drawn directly from a tap c) filling or maintaining a pool that is designed, constructed or adapted for use in the course of a programme of medical treatment d) filling or maintaining a pool that is used for the purpose of decontaminating animals from infection or disease e) filling or maintaining a pool used in the course of a programme of veterinary treatment f) filling or maintaining a pool or pond in which fish or other aquatic animals are being reared or kept in captivity</p>

Included in restrictions	Exemptions from restrictions
Filling or maintaining an ornamental fountain	Filling or maintaining an ornamental fountain which is in or near a fish pond and whose purpose is to supply sufficient oxygen to the water in the pond in order to keep the fish healthy
Drawing water, using a hosepipe, for domestic recreational use	<i>No exemptions relevant to this category</i>
Cleaning walls, or windows, of domestic premises using a hosepipe	Users who clean walls or windows of domestic premises for remuneration in the course of a trade or business
	Any person who has dispensation as a result a need arising from disability, medical condition or similar, to use a hosepipe for the prohibited purposes. This includes Blue Badge holders or customers who are registered on the SES Water Priority Services list due to a lack of mobility.
Cleaning paths or patios using a hosepipe	Users who clean paths or patios for remuneration in the course of a trade or business
	Any person who has dispensation as a result a need arising from disability, medical condition or similar, to use a hosepipe for the prohibited purposes. This includes Blue Badge holders or customers who are registered on the SES Water Priority Services list due to a lack of mobility.

***Supply-side Actions***

- Consider implementation of bulk supply from Thames Water at Merton PS, if available. This involves assessing the risks on water quality, the presence of any Undertakings on the water supplies to be transferred, and the notifications required to be given to consumers.
- If the situation is deteriorating and the time of year is appropriate, commence preparation of a drought permit application to enable the winter abstraction from the River Eden to continue into May.

**2.7.4. Zone 3b Actions*****Demand-side Actions***

- Implement the **Phase 3** of demand restrictions, in addition to Phases 1 and 2, effectively removing the exemptions from Phase 2 that relate to certain categories of use by which users are remunerated in the course of a trade or business. This Phase represents the use of full powers under the temporary water use ban legislation. Inclusions and exemptions from Phase 3 are shown in Table 2.6.
- At the same time as implementing its Phase 3 demand restrictions, consider applying to the Secretary of State for a Drought Order to restrict non-essential uses of water. We propose to implement restrictions on the categories of use provided for in the Drought Direction 2011 in a single phase to keep the message simple for customers. The inclusions and exemptions associated with a Drought Order to restrict non-essential uses of water are set out in Table 2.7.

However, we may make use of the flexibility allowed for in the legislation to take a phased approach and offer exemptions. This will depend upon the circumstances of the drought, with the purpose of reducing the negative impact on commercial customers and to respond to representations received during the earlier stages/drought action zones.

We will consider representations on Phase 3 restrictions or a Drought Order through the sitting of a two-weekly panel to review representations, which will include the Senior Managers within Wholesale Services and Customer Services. We will also respond to any person who contacts us regarding the temporary use restrictions.

**Table 2.6: Inclusions and exemptions from Phase 3 temporary use restrictions**

Included in restrictions	Exemptions from restrictions
<p>Watering a garden <u>using a hosepipe</u>, including the following definitions of “a garden” (The Water Use (Temporary Bans) order 2010, Clause 4(2)):</p> <ul style="list-style-type: none"> <li>a) a park;</li> <li>b) gardens open to the public;</li> <li>c) a lawn;</li> <li>d) a grass verge;</li> <li>e) an area of grass used for sport or recreation;</li> <li>f) an allotment garden, as defined by section 22(1) of the Allotments Act 1922(a);</li> <li>g) any area of an allotment used for non-commercial purposes;</li> <li>h) any other green space.</li> </ul>	<p>Automatic irrigation systems, provided that they comply with all of the following conditions:</p> <ul style="list-style-type: none"> <li>– The water supply to which the device is connected must be one which is charged to the user by reference to volume by meter belonging to SES Water</li> <li>– No part of the system may be handheld</li> <li>– The system must incorporate a pressure reducing valve</li> <li>– The system must incorporate a time clock control</li> <li>– The system must deliver water by means of a drip or trickle system</li> <li>– The system must not disperse water through the air by means of sprinkler, jet, mister or similar device</li> <li>– The system must deliver water directly either on to the surface of the soil or under the surface of the soil</li> <li>– The system must not cause any surface water run-off</li> </ul> <p>Any person who has dispensation as a result a need arising from disability, medical condition or similar, to use a hosepipe for the prohibited purposes. This includes Blue Badge holders or customers who are registered on the SES Water Priority Services list due to a lack of mobility.</p> <p>Using a hosepipe to water an area of grass used for sport or recreation for health or safety reasons</p>
<p>Cleaning a private motor-vehicle using a hosepipe, including any commercial users of water under this category</p>	<p>Any person who has dispensation as a result a need arising from disability, medical condition or similar, to use a hosepipe for the prohibited purposes. This includes Blue Badge holders or customers who are registered on the SES Water Priority Services list due to a lack of mobility.</p>
<p>Watering plants on domestic or other non-commercial premises using a hosepipe</p>	<p>Any person who has dispensation as a result a need arising from disability, medical condition or similar, to use a hosepipe for the prohibited purposes. This includes Blue Badge holders or customers who are registered on the SES Water Priority Services list due to a lack of mobility.</p>



Included in restrictions	Exemptions from restrictions
Cleaning a private leisure boat using a hosepipe	<p>Using a hosepipe to clean a private leisure boat for health or safety reasons</p> <p>Any person who has dispensation as a result a need arising from disability, medical condition or similar, to use a hosepipe for the prohibited purposes. This includes Blue Badge holders or customers who are registered on the SES Water Priority Services list due to a lack of mobility.</p>
Filling or maintaining a domestic swimming or paddling pool	<i>No exemptions relevant to this category</i>
Drawing water, using a hosepipe, for domestic recreational use	<i>No exemptions relevant to this category</i>
Filling or maintaining a domestic pond using a hosepipe	Filling or maintaining a pond in which fish or other aquatic animals are being reared or kept in captivity
Filling or maintaining an ornamental fountain	Filling or maintaining an ornamental fountain which is in or near a fish pond and whose purpose is to supply sufficient oxygen to the water in the pond in order to keep the fish healthy
Cleaning walls, or windows, of domestic premises using a hosepipe, including any commercial users of water under this category	Cleaning walls or windows using a hosepipe for health or safety reasons
Cleaning paths or patios using a hosepipe	Cleaning paths or patios using a hosepipe for health or safety reasons
Cleaning other artificial outdoor surfaces using a hosepipe	Cleaning other artificial outdoor surfaces using a hosepipe for health or safety reasons

**Table 2.7: Inclusions and exemptions associated with a Drought Order to restrict non-essential uses of water**

Included in restrictions	Exemptions from restrictions
	<p>It is not the intention to revoke, during a Drought Order restricting non-essential uses of water, the following exemption, which applied through Phases 1-3 of the Company’s temporary use restrictions:</p> <p>Any person who has dispensation from SES Water as a result of demonstrating a need, arising from disability, medical condition or similar, to use a hosepipe for the prohibited purposes or to fill or maintain a domestic swimming or paddling pool or ornamental fountain.</p>
<p>Watering the following plants on commercial premises using a hosepipe:</p> <ul style="list-style-type: none"> <li>a) plants which are in a pot or other container that is outdoors or under cover;</li> <li>b) plants which are in the ground under cover.</li> </ul>	<p>Watering plants on commercial premises using a hosepipe that are:</p> <ul style="list-style-type: none"> <li>a) grown or kept for sale or commercial use; or</li> <li>b) part of a National Plant Collection or temporary garden or flower display.</li> </ul>
<p>Filling or maintaining a swimming or paddling pool other than a domestic swimming or paddling pool</p>	<p>Filling or maintaining a swimming or paddling pool other than a domestic swimming or paddling pool does not include:</p> <ul style="list-style-type: none"> <li>a) filling or maintaining a pool that is open to the public</li> <li>b) filling or maintaining a pool where necessary in the course of its construction</li> <li>c) filling or maintaining a pool using a hand-held container which is filled with water drawn directly from a tap</li> <li>d) filling or maintaining a pool that is designed, constructed or adapted for use in the course of a programme of medical treatment</li> <li>e) filling or maintaining a pool that is used for the purpose of decontaminating animals from infections or disease</li> <li>f) filling or maintaining a pool that is used in the course of a programme of veterinary treatment</li> <li>g) filling or maintaining a pool in which fish or other aquatic animals are being reared or kept in captivity</li> </ul>

Included in restrictions	Exemptions from restrictions
	h) filling or maintaining a pool that is for use by pupils of a school for school swimming lessons
Filling or maintaining: a) a non-domestic pond; or b) a domestic pond	This does not include: a) filling or maintaining a pond in which fish or other aquatic animals are being reared or kept in captivity; b) filling or maintaining a pond using a hand-held container which is filled with water drawn directly from a tap.
Operating a mechanical vehicle-washer, whether automatic or not	<i>No exemptions relevant to this category</i>
Cleaning any vehicle, boat, aircraft or railway rolling stock using a hosepipe	Cleaning any vehicle, boat, aircraft or railway rolling stock for health or safety reasons
Cleaning any of the following using a hosepipe: a) any exterior part of a non-domestic building other than a window b) a non-domestic wall.	The cleaning of any exterior part of a non-domestic building or a non-domestic wall for health or safety reasons
Cleaning a window of a non-domestic building using a hosepipe	Cleaning a window of a non-domestic building using a hosepipe for health or safety reasons or for the removal of graffiti
Cleaning industrial plant using a hosepipe	Cleaning industrial plant using a hosepipe for health or safety reasons
Suppressing dust using a hosepipe	Suppressing dust using a hosepipe for health or safety reasons
Operating a cistern in any building that is unoccupied and closed	<i>No exemptions relevant to this category</i>

### ***Supply-side Actions***

- If the situation is deteriorating and the time of year is appropriate, after we have published notification of our intention to implement Phase 3 demand restrictions, we will consider applying for a drought permit to enable the winter abstraction from the River Eden to continue into May;
- In an extreme event, after the application of a drought order to restrict non-essential uses of water, consider applying for one or more of the following drought permits, in the expected order shown below. It should be noted that the order of implementation of supply-side management options in any particular drought event will depend on a number of factors, including the time of year, the characteristics of the particular drought event, and whether our other sources are behaving as expected:
  - i) A drought permit for increased groundwater abstraction from the Woodmansterne Group
  - ii) A drought permit for increased groundwater abstraction from the Kenley Group
  - iii) A drought permit for increased groundwater abstraction from Hackbridge/ Goatbridge then
  - iv) A drought permit to enable summer abstraction from the River Eden

#### **2.7.5. Emergency Drought Order (Level 4)**

If the situation is irretrievable, consideration is to be given to applying to the Secretary of State for emergency drought orders. Emergency drought orders would be the final action in extreme droughts that would be taken by the Company under this Drought Plan. An extreme drought approximates to a 1 in 500-year drought scenario. Implementation of an emergency drought order requires application and approval from the Secretary of State and it is expected that this process may take approximately 4-5 months.

Pressure reduction would be introduced first, most likely using a phased approach. Further measures in the case of an exceptional drought not hitherto experienced would be the introduction of standpipes and/or rota cuts or other measures as appropriate. We would work closely with neighbouring water companies, local authorities, Retailers and other stakeholders in planning the implementation of such measures. We would also consider introducing per capita consumption target to encourage essential use only.

Drought actions beyond those outlined above relating to civil emergency are dealt with in our Emergency Plan. In such cases, we would work with other responsible emergency planning bodies, such as Local Authorities and Resilience Forums, to ensure security of supply in emergencies.

The monitoring programme outlined in Section 3 will be carried out if a drought permit or drought order is implemented to ensure continuous assessment of the current situation with regard to water resource availability and environmental impact.

## 2.8. Summary timeline of drought management actions

### Publication of notice and representations

#### *Temporary water use restrictions*

There are statutory requirements set out in the updated sets of legislation with which we will comply in terms of giving notice before implementing temporary water use. This involves the publication of formal notice in certain formats and allowing an appropriate period for representations to be submitted by customers and responded to by the Company where appropriate.

In addition, we may also use methods such as radio to communicate the notice more extensively to customers across the supply area. We will also take into account the numbers of customers affected and whether commercial customers are impacted by each phase of restrictions when deciding upon a proportionate period for representations. This will be balanced with the relative urgency of implementing restrictions.

In considering representations or objections from individual customers or interested groups, we will seek to take a fair and even-handed approach. We may decide to amend the concessions for restrictions or adapt its plan for implementation, and complaints will be dealt with in accordance with our complaints procedure.

- A lead-in time of one week is allowed in all cases to take into account the need to prepare and publish noticed in at least two local newspapers and our website.
- We consider that allowing two weeks for representations to be made and for these to be duly considered is an appropriate period for Phases 1 and 2 of the temporary water use restrictions.
- Phase 3 of the temporary water use restrictions has the potential to impact upon commercial customers, so we would allow an additional week to receive and respond to representations.

In revoking restrictions, including the partial lifting of restrictions, notice will be given in the same formats, but will take immediate effect on publication as representations do not need to be allowed for.

#### *Drought orders*

Drought orders must be prepared by the Company and submitted to the Secretary of State before they can be implemented, and may involve hearings or inquiries before they are approved. The application submitted must include evidence of the required advertisements in the media (local newspapers) and notice to the EA and local authorities affected. The application must also be publicly available and 7 days allowed for public representations to the Secretary of State.

Once the drought order has been approved, further time for providing notice of implementation in the required media formats must be allowed for before the restrictions are imposed. From our experience during the 2006 drought, the process from first advertising the intention to apply for a drought order to implementing that order took approximately six months, including a public hearing. Without a hearing, such as in 2012, it is estimated that it may take 2-3 months.

It should be noted that there may be circumstances where we may have to introduce more than one of the three phases of temporary water use bans simultaneously, and we will use the flexibility provided for in the legislation to respond proportionally to the drought conditions. This may affect the expected timeframes for implementation.

A programme indicating the approximate timescales between inception and implementation of drought management measures is provided in Table 2.8. These timescales are approximate because in some cases, the implementation time may become beyond our control such as in the case of a public hearing. In addition, it should be noted that as outlined above, we may progress one or more of these actions concurrently, in order to expedite management of the drought as may be required.

**Table 2.8: Approximate timescales required for drought management measures**

Drought management action	Estimated time required from inception to implementation
Customer awareness/media coverage	From 1 week
Conjunctive Use/Transfers	From 1 week
Water use temporary ban – Phase 1	3 weeks
Water use temporary ban – Phase 2	3 weeks
Water use temporary ban – Phase 3	4 weeks
Leakage reduction / pressure management / operational usage restrictions	2 weeks
Drought permits	4 months
Drought order demand restrictions	2-3 months; up to 6 months with an inquiry or hearing
Bulk Supply from Thames Water	If available, 2-3 months

## 2.9. Compensation

As required by the Drought Direction (2016) Section 3, we are required to state whether we will consider compensation as a result of the implementation of drought management measures. This includes both drought orders and permits.

The factors affecting this assessment are as follows:

- Impact on customers, organisations and businesses of Temporary Use Bans, including loss of revenue from landscape gardeners, garden centres and the horticultural sector
- Impact on customers, organisations and businesses of a Non-Essential Use Ban, including loss of revenue from window cleaners and car wash businesses. This would also include impacts on Retailers.
- Exemptions given to usage restrictions (as detailed in Tables 2.4 to 2.7) which are designed to reduce their impact on customers, in terms of taking account of vulnerabilities (such as being a Blue Badge Holder) and financial impact (such as allowing watering of turf for 28 days and the use of trickle irrigation systems).

- The impact of our drought permits on river flows that may affect fisheries and anglers. This is considered in Appendix D, section 6.3, with the impact assessed as being low and temporary in nature.
- The impact of our drought permits on other abstractors. This is considered in Appendix D, section 6.1, and Appendix E, section 6.11, with the impact assessed as negligible.
- The impact of our drought permits on recreation. This is considered to be negligible.

Taking into account these factors, it is concluded that compensation, either financial or otherwise, will not be considered in respect of the measures detailed in this plan.

## 2.10. Identifying the end of a drought

### *Triggers*

We will make a decision on ending the drought designation following analysis of multiple indicators.

Groundwater and surface water storage levels will be reviewed in the context of the time of year and degree to which they start to show a recovery. More specifically, the occurrence of sufficient winter recharge of its groundwater sources will be a key determinant. We can usually be confident that a drought will have ended when levels at one/both of its trigger sites rise above the relevant Zone 2 trigger curve and stay above it for a period. This will usually need to have been demonstrated before we will consider removing drought management actions and resuming normal operations. In this way, we intend to assess the resource situation as a whole and consideration will be given in particular to the potential recharge timescales relating to groundwater sources. We consider that this prudent approach will help ensure that demand restrictions are not lifted then reinstated in quick succession, as this would likely be unacceptable to customers, and may cause confusion.

In addition, we will consider using the EA's drought forecasts as a means of trying to ascertain the future outlook with respect to our resource situation.

### *Consultation and communication*

Consultation with EA and potentially neighbouring water companies at drought coordination meetings will be undertaken to confirm the wider water resources situation and outlook for the region before we declare to our customers that the drought is over. We propose that public announcements will be made jointly with the EA where appropriate.

On the demand side, legislation states that the lifting of any restrictions must be notified in two local newspapers and on our website. The change can then take immediate effect without need for consultation. The circumstances at the time will be assessed to determine whether a gradual withdrawal or one-step revocation of restrictions is most appropriate, taking into account the effect on customers. A wide press release would be sent to relevant parties to announce decisions and the media engaged. Customers will be thanked for their cooperation and understanding. Further detail is contained in the Communications Plan.

### **3. Environmental Assessment**

#### **3.1. Scoping**

Detailed environmental assessments are provided in the EARs and are given in Appendices D & E to this report. A summary of the findings is given here.

##### ***Surface Water***

The environmental assessment concluded that the effects of the surface water drought permits would be temporary and correspond with the period of implementation only. It is anticipated that only the reach of the River Eden between the Bough Beech abstraction and its confluence with the River Medway will be impacted. Low to moderate flows are expected to be reduced, but not below levels that typically occur between May and August due to a minimum residual flow (MRF) condition.

##### ***Groundwater***

The study has found that the groundwater source drought permits at each of the sites will not have a significant effect on the water regime, in that baseflow contributions to the Wandle will not be significantly affected by the drought permits. In turn, it was determined that there would be no changes to the hydrology, hydromorphology or water quality within the Wandle.

Since there was no significant effect on the water regime, any effect on environmental features was screened out (including no effects on nationally designated sites local to the abstractions). Our drought permits will not result in a notable increase to the effects associated with Thames Water's Waddon drought permit.

##### **Habitats Regulation Assessment**

A formal Habitats regulation assessment is required where the implications of any new plans or projects are capable of affecting the designated interest features of European Sites, including Sites of Conservation (SACs) and Special Protection Areas (SPAs); along with other protected sites created under the Ramsar convention.

Since there are no internationally designated sites identified as affected by either the groundwater or surface water drought permits, including an assessment for in combination effects with other abstractors, the need for a full Habitats Regulation Assessment is screened out. However, we recognise that there are a number of non-statutory designated sites within our supply area and some of these are potentially affected by our drought measures, including Local Wildlife Sites such as the River Eden, as detailed in Section 3.2.

#### **3.2. Environmental impacts (including Water Framework Directive)**

The Eden May and Eden summer drought permits were found to have a potentially minor and temporary impact on water quality. There is potential for elevated concentrations of SRP and algal blooms to be observed during the period of abstraction, both of which are linked to low flows. However, no impact on ammonia or dissolved oxygen is anticipated, and no changes were observed during the 2005/06 drought permit. Similarly, no impacts were identified in relation to geomorphology.



The drought permits were also found to have no/minor impact upon macroinvertebrates, macrophytes and diatoms and a potentially minor impact upon angling.

Implementation of the drought permit may impact fish and therefore monitoring and other associated actions have been included to mitigate any potential impacts. However, an assessment of the 2005/06 drought permit found no impact on fish populations, with virtually no difference observed between drought and non-drought years. The monitoring and mitigation plan was reviewed and updated in consultation with the Environment Agency and Natural England during a series of workshops between December 2018 and January 2019.

The potential impact of the drought permit on invasive and non-native species (INNS) is considered to be low in relation to issues caused during natural periods of low flow. Therefore, no additional baseline monitoring is proposed specific to INNS.

### **Water Framework Directive**

Since the arrival of the WFD, the Environment Agency has been responsible for assessing the entire water environment. WFD monitoring, known as classification, is risk-based and focuses where there is likely to be a problem. It uses a principle of 'one out, all out' which means that the poorest individual result will define the overall assessment.

The drought permit is considered to have a negligible effect on macroinvertebrates and minor temporary effect on diatoms, macrophytes and fish. As such, the risk of WFD status deterioration or prevention of achievement of WFD potential for these is considered negligible.

### **3.3. Mitigation measures**

To help alleviate the impact of the drought permits identified in Section 3.2, several mitigation measures have been identified. These would be managed by SES Water, with the input sought from other organisations such as the Environment Agency, the local Rivers Trust and farmers. We have also identified long-term measures which could be completed as part of a catchment management approach aimed at enhancing habitats and water quality, which will reduce the impact of the drought permit but are not a requirement for their implementation.

#### **Fish**

Once a drought permit has been implemented, the following prioritised mitigation actions are proposed:

- Fishery welfare walkovers - a walkover of the reaches deemed to be at risk from the effects of low flows. To be undertaken by a fishery specialist to identify the need for any fish rescues.
- Fish Rescue & Relocation - If fish are unable to relocate themselves naturally and are deemed at risk of mortality, an appropriate fish removal methodology shall be performed by the Environment Agency fisheries team. Fish will then be relocated to the areas of the river identified in the fisheries habitat walkover assessment. Fish removal during drought periods is considered a last resort as increasing stress can lead to mortality.

- The drought permit has the potential to increase sedimentation of spawning grounds, however trout spawning occurs between October and April and therefore the impact is limited. A release of water from the compensation flow (located downstream of the Chiddingstone weir) to simulate a summer flushing event can be arranged if thought to be beneficial prior to the spawning season. A release from the compensation flow is tested as part of the dam risk assessment.
- Entrainment of eels and other fish species can be reduced by limiting pumping to daylight hours since they are more active at night. This is more significant in the period up to the end of July

Catchment management measures recommended:

- Fish Passage Alleviation/ Impoundment Removal – in order to limit the effects of the obstructions currently impacting upon the Eden.
- Establish desired target species for local anglers.

### **Macrophytes**

Macrophyte data suggest that the habitat is potentially at risk of becoming eutrophic with associated increased colonisation by filamentous algae.

- Efforts should be made to ensure that runoff to channels from surrounding agricultural land is minimised by preventing poaching by grazing animals and where appropriate, buffer zones are established.
- In addition, contaminants from road runoff should be diverted to attenuating ponds where possible to ensure that primary producers and the herbivores that graze them are not at risk from their toxicity. Algal proliferation occurs when residence time is sufficient to allow the accumulation of biomass that otherwise would be carried downstream.
- Ponding behind obstructions in the channel should be prevented, and the establishment of a low flow channel ensured wherever possible.

### **3.4. Environmental data provision and monitoring plan**

For the River Eden, two monitoring plans have been outlined, one prior to implementation of the drought plan (baseline) and one during implementation of the drought plan (drought).

Baseline monitoring can be used to gain an understanding of the natural variation in water quality, ecology, fisheries, geomorphology and biodiversity that occurs in the River Eden under a range of hydrological conditions. It will predominantly cover 'normal' (i.e. non-drought) conditions but it will also continue during a drought event. When, if a drought permit application is expected/required, it would be supplemented by additional drought monitoring.

Full details on the monitoring can be found in Appendix D, Section 10.2.

### **3.5. Post drought actions**

A review of key environmental data, notably data collected following the drought permit, would take place to investigate the impact on the environment of the drought measures taken (e.g. drought permits) and to be able to demonstrate that receptors have fully recovered.

The extent of the impact of the drought and the drought permit and the effectiveness of any mitigation measures should be reviewed, using information outlined in this EMP, and subsequently documented. Updates will be made, if and where appropriate, to the environmental assessment and EMP.

Results and lessons learned from the drought and implementation of the drought permit could inform subsequent resources decision making and planning.

## **4. Management and communications strategy**

### **4.1. Management structure**

We benefit from our relatively small size and by having a very clear straightforward management structure. All supply operations and drought management of water resources is undertaken by the Water Resources Manager, with overall responsibility for the Drought Plan implementation with the Wholesale Services Director.

Throughout a drought period the situation will be continually reviewed through the management and liaison process outlined below:

- A water resources group consisting of the Water Strategy Manager, Head of Production, Communications Manager, Water Quality Science Manager and the Wholesale Services Director will be set up.
- The Wholesale Services Director will report on drought management as an item in weekly senior management meetings, with escalating severity as appropriate as a drought progresses. This will continue for the period that our resources remain in a sensitive condition. Our Board will be kept fully informed of the situation via the production of Board papers. In this way, management of a drought will be embedded in the day-to-day management of our operations.
- The Water Resources Group will take into account any representations received from customers prior to and during implementation of drought restrictions.
- Monthly drought meetings / telecons organised by the Environment Agency with representatives from the regional water companies. There are three levels of meetings which are Senior (Managing Director level), Technical, and Communication (Public Relations). At the Senior meetings representatives are also present from Defra, Ofwat, CCW and Natural England.
- Regular updates will be provided to Water UK.

We are committed to effective monitoring and management of its resource base throughout periods of drought. We will continue to take a proactive approach in managing drought through implementation of its Drought Plan in order to conserve resources and minimise the risk of emergency measures.

### **4.2. Communications plan**

We have, as part of our public relations activities, an ongoing programme aimed at promoting the careful use of water and increasing customer awareness of the environmental and other benefits which accrue from this, particularly during drought periods. A Communication Plan has been developed to specifically address potentially

affected parties in the situation of a potential or actual drought. The complete plan can be viewed in Appendix C.

Responsibility for implementation of the Communication Plan lies with the Water Strategy Manager and the Communications Manager. A summary of potential audiences is given in **Table 4.1**.

The Communication Plan will be operated in a phased approach, with increasing communication being undertaken in line with the increasing severity of a drought situation. Three phases of communication action corresponding to the breaching of drought trigger levels are as follows:

### ***Zone 1 Communication***

- Ongoing promotion of water saving initiatives via social media, local media campaigns, newsletters and our website
- Encouraging local government authorities and commercial users to minimise water use, including engagement with Retailers
- Production of an update on the current situation for key local stakeholders including schools and hospitals

### ***Zone 2 Communication***

Continuation of Zone 1 Communication but addition of the following actions:

- Expansion of the media campaign to include the national media
- Informing large users of water and vulnerable customers of potential impacts of drought
- Presence at schools, garden centres and other events to promote awareness and water saving initiatives
- Increasing advertising, for example on buses, of the need to save water

### ***Zone 3a and Zone 3b Communication***

Building on Zone 2 Communication but to include the following actions, which become more important as drought severity increases:

- Writing to customers appealing for a reduction in water use.
- Activation of joint initiatives with the EA, English Nature, other local water companies and Water UK.
- Seek to increase and inject urgency into local press coverage.
- Ensure the Company's crisis media strategy is in place should it be needed.
- Inform the Fire Authorities and other local essential services at least 72 hours prior to the implementation of any demand restrictions.

### ***Post-Drought Communication***

- Consultation with the EA to reach a joint decision regarding the withdrawal of water restrictions.
- Make public announcements of the lifting of water restrictions through 'global' press releases and telephone calls.
- Thank customers for their co-operation and understanding.

We will continue to review and update the level of information provided to inform customers about the risk of drought and our plans to effectively manage drought to avoid emergency measures.

Table 4.1: Potential Audiences

Group	Organisation
<b>Domestic and commercial customers</b>	Private Consumer Council for Water Citizens Advice Bureau Housing Associations Retailers
<b>Regulators</b>	Environment Agency Ofwat Defra Drinking Water Inspectorate Natural England
<b>Environmental and other relevant interest organisations and groups</b>	Local wildlife groups and campaign groups Friends of the Earth South East Rivers Trust WWF RSPB CPRE Angling Trust Local fisheries bodies and groups Waterwise
<b>Government representatives and Local Authorities</b>	Councils MPs, AMs MEPs
<b>Representative bodies</b>	e.g. Confederation of British Industry, NFU, Chambers of Trade and Commerce, Countryside Landowners and Business Association, Horticultural Trade Association
<b>Community based institutions and organisations</b>	Parish Councils Town Councils Residents associations
<b>Public services</b>	Fire Service Health Authorities Police services
<b>Press and media</b>	Newspapers TV Radio Internet based
<b>Water companies</b>	All plus WRSE
<b>Sports and interest groups</b>	Angling clubs Canoe clubs Sailing clubs
<b>Waterways and navigation</b>	Canal & Rivers Trust Canal authorities

### 4.3. Lessons learned from previous droughts

Since there have not been any further droughts since the publication of the current plan in 2013, there are lessons learnt that are part of this revision of the plan. However, in late 2016 the zone 2 level at Bough Beech was triggered and a Water Resources Group was formed. As a result of the discussions held, additional detail on operational usage and communications has been added to this plan.

#### 4.4. Post drought actions

After the decision to end drought measures is taken, a review of the drought management procedure will be conducted. This will involve a review of the effectiveness and cost of all demand and supply drought management measures, together with the impact on customers. Disaggregating the impacts of any one measure on any reduction in demand observed is challenging due to the combination of drought communication measures to which customers are inherently exposed during a drought.

The drought management review will identify important lessons learnt from the process and use these to influence and improve future drought management procedures.

## 5. Drought scenarios

### 5.1. Drought Scenarios and worked examples

All droughts vary in terms of their duration and impact on the availability of water resources. All water companies operate different combinations of source types to supply their customers, and each will have varying response patterns to different drought events. In many cases this is due to differences in antecedent conditions, drought duration and demands placed upon the supply system during the drought. It is therefore essential that our Drought Plan is tested against a range of drought scenarios that could occur within our supply area based on actual historic and theoretical worst-case events, to ensure that the adopted measures are sufficiently robust to protect essential water supplies.

Our previous Drought Plan scenarios were based on historic groundwater and surface water levels and rainfall data. The scenarios selected were based on the drought events of 2004-06 and 1920-23. Consideration was given to updating the scenarios to include the 2012 drought, however, annual minima groundwater levels in both 2006 and 2012 were 86.66 maOD. In terms of data availability, it was concluded that the 2006 drought was the more appropriate for use in the WRMP therefore it has been used for the Drought Plan also. Each scenario is discussed as a worked example to illustrate the actions taken by the company as the drought progresses to balance demand and supply. We consider that the actual historic drought scenarios provide a robust basis for the development and testing of its Drought Plan and ensures that the Drought Plan reflects an up-to-date position with respect to operation of our sources and the nature of its customer base.

This Drought Plan also considers an additional severe and entirely theoretical drought scenario based on a stochastic time series with a return period of approximately 1 in 200 years. This severe drought is outside of the typical planning range of a water company but provides an opportunity to review how our drought actions would allow it to respond to such an event.

Further detail on the characteristics of such droughts and our actions to manage them is provided in the following sections.

## 5.2. Seasonal peaks scenario

Seasonal peaks are common and reflect increasing demand for water in the summer period. A significant proportion of the increase in domestic use can be attributed to garden watering. We have a history of managing these peaks effectively by developing 'peak' resources through long term operational investment plans.

We have successfully managed seasonal peaks in demand over recent years, including most recently in 2018. Phase 1 of works to upgrade the water treatment works at Bough Beech reservoir, allowing it to abstract from the reservoir, treat and distribute increasingly larger volumes of water to meet these peak demands, was completed in 2012. In 2018 we also increased the peak capacity at Woodmansterne WTW.

Alongside this, recent and proposed improvements to our transfer capability will further improve our ability to manage seasonal peak events.

## 5.3. Single season drought scenario: 2005/06 (surface water)

### **Antecedent hydrometric conditions for single and dual season drought scenarios**

This section outlines the hydrological conditions which preceded both the example single season drought event (2005/06) and the example two dry winter drought event (2004/05 and 2005/06) described in this section.

In its November 2006 'Drought Prospects' report, the Environment Agency reviewed the status of water resources. It clearly states the importance of winter rainfall for water resources. Figures presented in the report showed that less than 75% of average rainfall fell within our supply area between October 2004 and April 2006, which had a clear impact upon the operationally important winter recharge of groundwater and surface water sources. It also presented data showing that observation boreholes within our supply area were 'exceptionally low'.

Figure 5.1 to Figure 5.3 illustrate rainfall, groundwater levels and flow rates compared to long-term average trends observed within our supply area during this period. It can be seen that the majority of rainfall between 2004 and 2006 is below the long-term average. Rainfall that is able to recharge aquifers is known as 'effective rainfall'; that is, it does not run off or evaporate but percolates into the ground. Summer rainfall events are of limited benefit to groundwater reserves as much of the water evaporates or remains in the soil. However, it does help to restrict demand as garden watering reduces during these periods.

Groundwater levels are shown to have been well below the long-term averages at the Well House Inn OBH (Figure 5.3). The minimum groundwater level in 2006 of 86.66 maOD has been assigned a return period of approximately 1 in 35 years. Flows recorded at Chiddingstone were also visibly lower than the long-term average during the winters of 2004 to 2006 (Figure 5.4).



**Figure 5.1: Monthly rainfall totals (January 2000-May 2011) and long-term average (1990-May 2011) rainfall at Bough Beech reservoir**

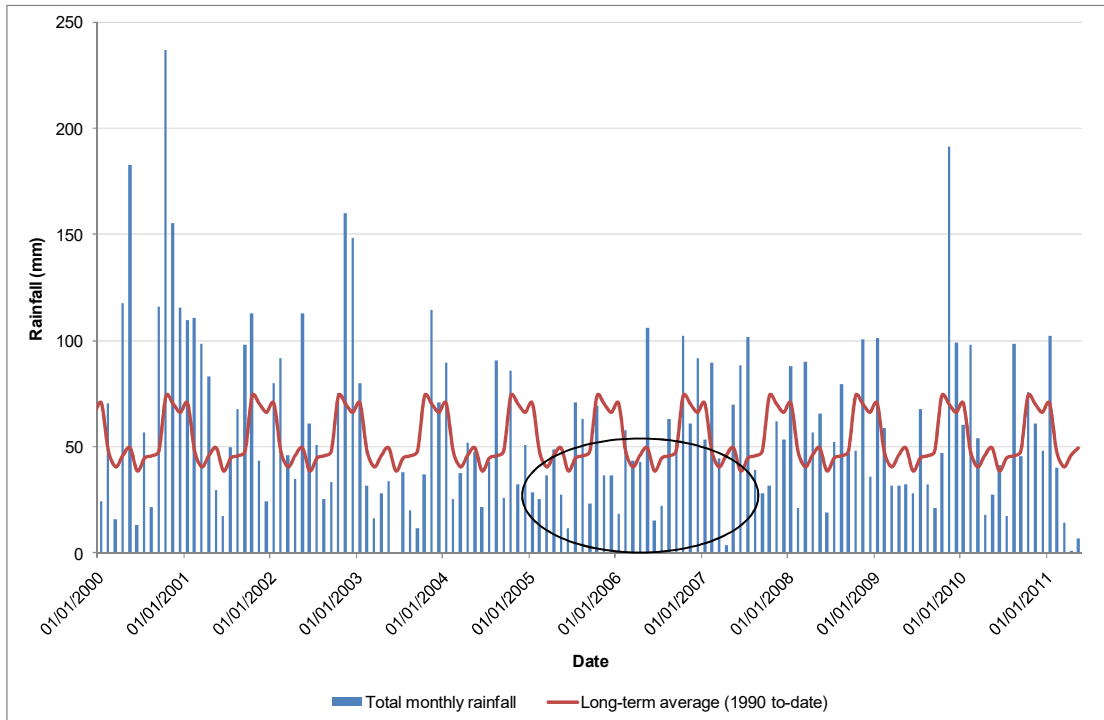


Figure reproduced from 2013 Drought Plan

**Figure 5.2: Well House Inn: 2003-2007 mean monthly groundwater levels compared to long-term monthly minima, means and maxima (Oct 1942 – Dec 2010)**

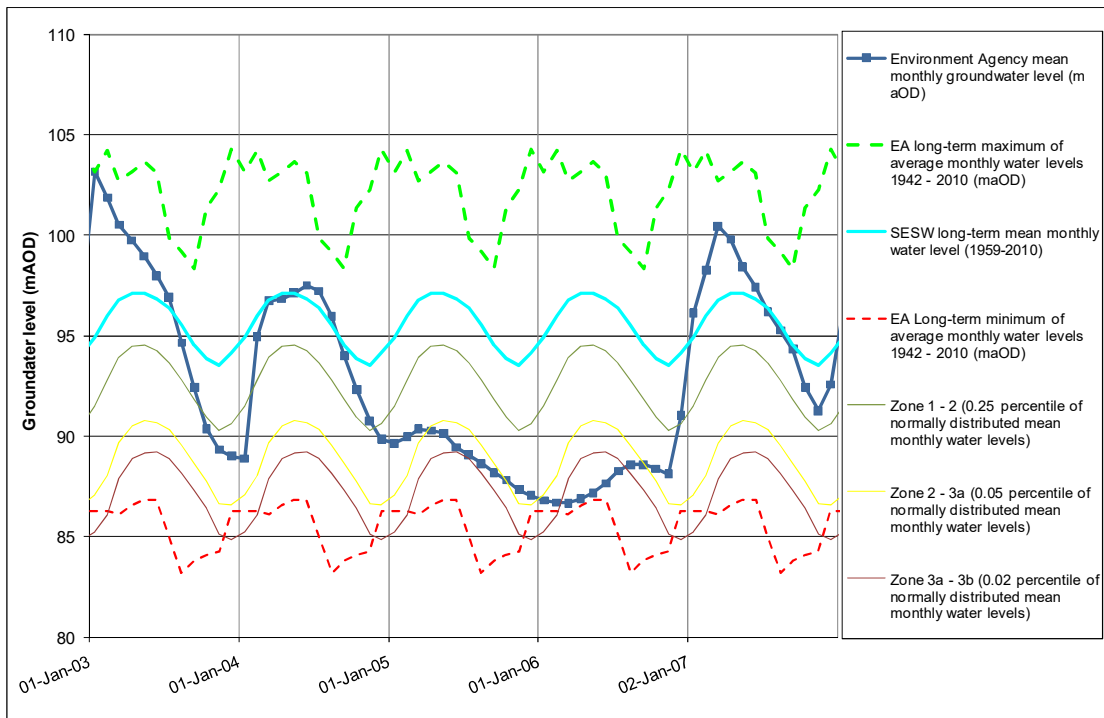


Figure reproduced from 2013 Drought Plan (Includes data from 1942 omitted from 2017 Drought Plan)

**Figure 5.3: River Eden flows at Chiddingstone (April 1996-March 2011)**

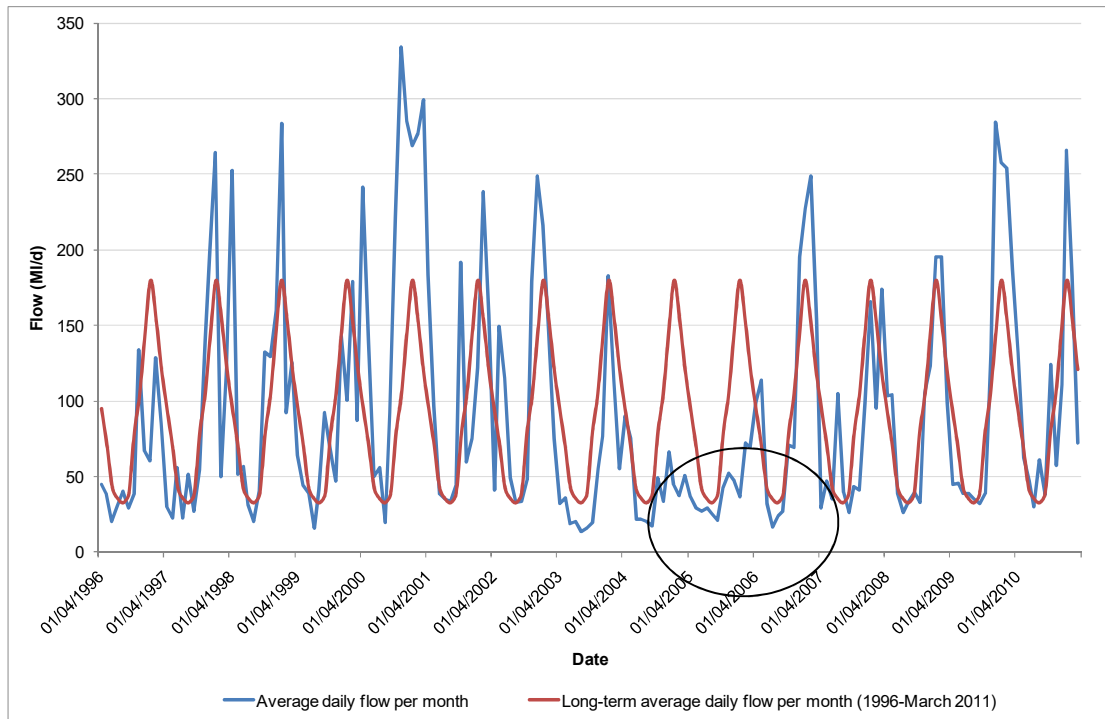


Figure reproduced from 2013 Drought Plan

**Characteristics of a single season drought scenario**

With the capacity increases at the Bough Beech and Woodmansterne water treatment works (WTW), and our proposals to increase both the WTW and trunk main capacity further, we are developing a robust response to peak period demands. It can be said therefore that we have the ability to deal with a single summer season drought (i.e. caused by peak demands).

The scenario demonstrated in this section, however, represents a single winter season drought. Such events have been found from past records to predominantly affect Bough Beech reservoir. Bough Beech is considered a single season reservoir, primarily due to the constraints on refilling the reservoir. A single dry winter, which reduces the water available to refill the reservoir, has the potential to significantly affect the reservoir. Groundwater levels are more resilient to single dry winters due to the way that storage within aquifers tends to buffer the effects of reduced recharge.

The refill of Bough Beech reservoir is predominantly via a pumped abstraction from the River Eden, along with rainfall onto the reservoir itself and other minor surface water runoff. The River Eden abstraction licence (as shown earlier in Table 2.3) stipulates that a Minimum Residual Flow (MRF) of 50 MI/d must be maintained in the River Eden at the abstraction location (Chiddingstone) in September, 25 MI/d in October and 22 MI/d for the remainder of the abstraction period (November to April inclusive). During a winter where there is low rainfall and consequently low river levels, there is the potential that Bough Beech may not be refilled sufficiently to meet demand the following year. Figure reproduced from 2013 Drought Plan (Includes data from 1942 omitted from 2017 Drought Plan)

5.4 illustrates the low river levels experienced during the winter of 2005/06 in relation to long-term average levels at Chiddingstone. Figure 5.10 shows the response of the reservoir itself to the low winter flow conditions experienced in 2005/06.

### **Management of a single season drought**

We manage Bough Beech reservoir using control curves, which are used to assess the most appropriate actions at different water storage levels. Figure 5.4 shows the frequency and timing of actual breaches of Bough Beech trigger levels and the corresponding drought management actions taken in accordance with the action zones set out in Section 2.

It is common for the Zone 2 and even Zone 3a trigger curves to be breached for a limited period of time (1-3 months) during the autumn period. This may be due to normal use of Bough Beech over the summer followed by limited refill in the early autumn. As introduced in Section 4 the timing of these trigger curve breaches meant that we are unlikely to impose demand restrictions on customers unless reservoir levels did not recover sufficiently during the winter.

Bough Beech storage levels were indeed slow to replenish during the winter of 2005 and the spring of 2006. We viewed these levels in conjunction with its groundwater trigger site, Well House Inn. We made the decision to impose drought management measures across its supply area in the form of firstly a sprinkler and unattended hosepipe ban (which would now comprise the first phase of the planned implementation of temporary use ban powers, as presented in Section 4), followed by a full hosepipe ban, then a non-essential use ban, to manage the combined shortfall.

In addition, to mitigate the effects of the low winter refill, we applied for and were granted a drought permit to extend the winter abstraction period into May 2006. This was instigated by the breach of the Zone 3a trigger curve in December 2005, as the dry winter progressed. Our records suggest that significant volumes of water were abstracted from the River Eden to refill Bough Beech reservoir during this drought permit.

The aquifers, particularly the chalk aquifer in the Northern area, began to show signs of recovery in December 2006, predominantly due to above average rainfall, and perhaps also due to the continuation of the hosepipe and sprinkler ban. This recovery, combined with the recovery of Bough Beech levels during late spring 2006, instigated the removal of the customer restrictions on 18 January 2007.

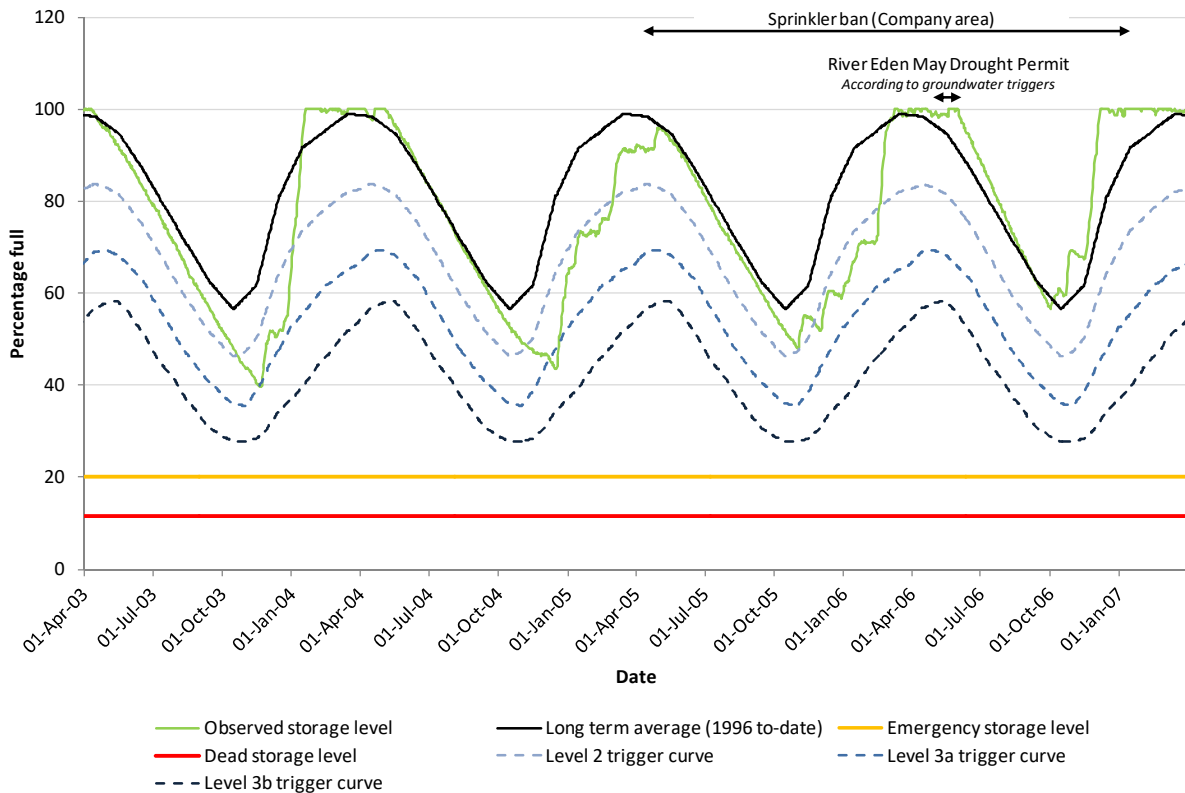
As discussed earlier, the intention of having surface water and groundwater trigger curves is to enable use of Bough Beech reservoir to augment the available resources within other water supply zones during times of potential shortage, and vice versa.

Transmission capacity exists to transfer some Bough Beech reservoir water into other supply areas. These transfers would only be made when the reservoir contains more water than is required to meet supply requirements within its own area. As a general rule, overdrawing of Bough Beech reservoir is considered whenever the groundwater levels fall below the normal operating curve for the Well House Inn OBH and the amount of transfer from Bough Beech should increase if the groundwater levels fall into Zones 3a or 3b. If groundwater levels are below the normal operating curve but are increasing,

consideration is given to stopping any further transfer from Bough Beech reservoir. In this way, information from the different drought trigger sites is combined.

The implementation of demand restrictions and the River Eden drought permit following the dry winter of 2005/06 appears from Figure 5.10 to have benefited storage levels in Bough Beech reservoir to the extent to which it was possible to utilise the stored water to meet demand through one of the worst groundwater droughts on record.

**Figure 5.4: Bough Beech storage levels and corresponding drought triggers and action zones (April 2003-March 2007)**



The hosepipe ban and non-essential use ban that were imposed throughout our supply area during 2006-07 were in response to trigger level breaches at Well House Inn OBH rather than at Bough Beech reservoir, as discussed in the following section.

**5.4. Two dry winter drought scenario: 2004/05 and 2005/06 (groundwater sources)**

**Characteristics of a two dry winter drought**

Two dry winter droughts have a large effect on groundwater resources, and, as we rely on groundwater for 85% of our supply, such droughts present the greatest potential threat to our overall resources. Recharge of our aquifers is dependent on adequate winter rainfall over a number of seasons. Consecutive dry winters are likely to lead to a situation where groundwater levels decline to extremely low levels and the groundwater resources available for abstraction are reduced towards the drought deployable outputs or less. It was recently stated that the majority of multi-season droughts in the last 100 years have lasted for two winters (Marsh, 2007).

Although the long-term minimum groundwater level in the available observed record at Well House Inn was recorded in 1944 following a single very dry winter (preceded and followed by very dry summers), our groundwater sources are generally resilient to single dry winters, but are significantly affected by multi season droughts comprising two or more dry winter periods, such as that experienced between 2004 and 2006. The hydrological conditions leading up to and during this two dry winter drought have been outlined in Section 2.73 above. During this period, water levels within a number of our groundwater sources fell to their lowest recorded levels. This period of severe drought is considered the worst on record and therefore the most appropriate period for testing the effectiveness of our Drought Plan with respect to groundwater levels.

### **Management of a two dry winter drought**

Drought management actions are initiated by a combination of drought control triggers derived from groundwater levels and from Bough Beech reservoir levels (see Section 4.1). In the context of groundwater, trigger levels are compared to prevailing levels in the Well House Inn observation borehole. As detailed in Section 2, the trigger curves for Well House Inn have been updated for this Drought Plan to incorporate recent data and reflect revised analysis of this groundwater level record.

The Well House Inn trigger curves, perhaps unsurprisingly given our reliance on groundwater sources, have been the predominant driver for demand restrictions being imposed across our supply area. These restrictions have been introduced when actual groundwater levels at Well House Inn OBH are approaching or have reached Zone 3a or 3b trigger levels, as outlined in Section 2.

The normal procedure has been a sprinkler/unattended hosepipe ban (Phase 1 of the temporary use ban powers) to be implemented first; then if levels do not see a significant improvement, this is followed by a full hosepipe ban (Phases 2 and 3 of the temporary use ban powers). The prolonged exceedance of the Zone 3a trigger level from April 2005 to August 2006 is an example of when the situation did not improve for an extended period and groundwater levels approached their all-time minimum. In fact, Zone 3b was breached in February 2006. As a result, we were the first to apply for and the only to implement a non-essential use ban throughout its supply area. This was in place from 27 May to 15 November 2006. Savings from the Temporary Use Bans and Non-Essential Use Bans are given in Sections 3.1.4 and 3.1.6. The sprinkler and hosepipe bans were removed in January 2007.

Table 5.1 summarises the actions taken to manage the 2004-06 two dry winter drought. The timing of sprinkler and unattended hosepipe, hosepipe and non-essential use restrictions are discussed, as well as the timing of drought permits and communication activities. We did not consider it necessary to activate all drought management options available during the 2004-06 two dry winter drought; if the drought had been more severe, we may have considered applying for one/more groundwater drought permit(s).

Encouraged by the Environment Agency in a letter accompanying the 2006 drought permit, we operate its sources conjunctively. As a result, drought actions are not always implemented when trigger levels are breached. An example is over the winter of 2003/04 when Well House Inn OBH levels dipped briefly into Zone 3a conditions and no restrictions were implemented. In addition, in late 1996, groundwater levels dipped below the Zone 3a curve but a sprinkler ban was not introduced until May 1997. This

illustrates the flexibility and pragmatism that we operate around our Drought Plan as it recognised that the introduction of a demand restriction that predominantly affects peak (summer) water use, i.e. Phases 1-3 of the temporary use restrictions, would not be effective during the winter. Following recovery of groundwater levels at the end of 1997, the sprinkler ban was removed in May 1998 and there was no need to impose a hosepipe ban.

### **Impact of revised trigger curves on management of the 2004-06 two dry winter drought**

As indicated above, a new set of trigger curves has been derived for this Drought Plan. These take account of updated groundwater modelling, which links trigger levels directly with a groundwater level return period, in turn assisting with meeting our levels of service. The impact that the revised trigger curves would have had during the 2004-06 two dry winter drought is illustrated in Figure 5.5 and described in the following paragraphs.

The commencement of a Company-wide sprinkler ban just preceded the time at which Well House Inn groundwater levels would have entered the new Zone 3a which is consistent with the drought actions proposed. Although the rate of groundwater level recession was slowed to bring groundwater levels above the Zone 3a curve for a short period at the end of 2005, there was no winter recharge and groundwater levels would have fallen back into Zone 3a at the start of 2006 and into Zone 3b in March 2006. The commencement of the Company-wide hosepipe ban and subsequent Company-wide non-essential use ban are still consistent with the position of Well House Inn groundwater levels in relation to the revised trigger curves.

It is important to note that whilst demand restrictions obviously reduce the demand component of the supply-demand balance, they do not result in an increase in the theoretical deployable output of groundwater sources due to the way in which the latter are calculated. In reality however, the reduction in abstraction resulting from demand restrictions will have the effect of reducing the rate of depletion of the groundwater resource available for abstraction that in turn delays the point at which low pumping water levels become a constraint on output.

Our phasing of its demand restrictions, as well as the related implementation times, is shown with reference to the revised Well House Inn trigger curves during the 2004-06 drought in Figure 5.5. These demand restrictions are shown only in terms of strict breaches of the trigger curves. In reality, we could consider applying for these restrictions prior to the actual breach occurring, particularly where, for example in the case of the drought order for non-essential use, the time from inception to implementation may inhibit potential achievable savings due to seasonality. In addition, it can be seen from comparing the duration of the new powers being in effect with the bans that were actually implemented, that in reality we will keep the demand restrictions in place until we were confident that the drought had ended.

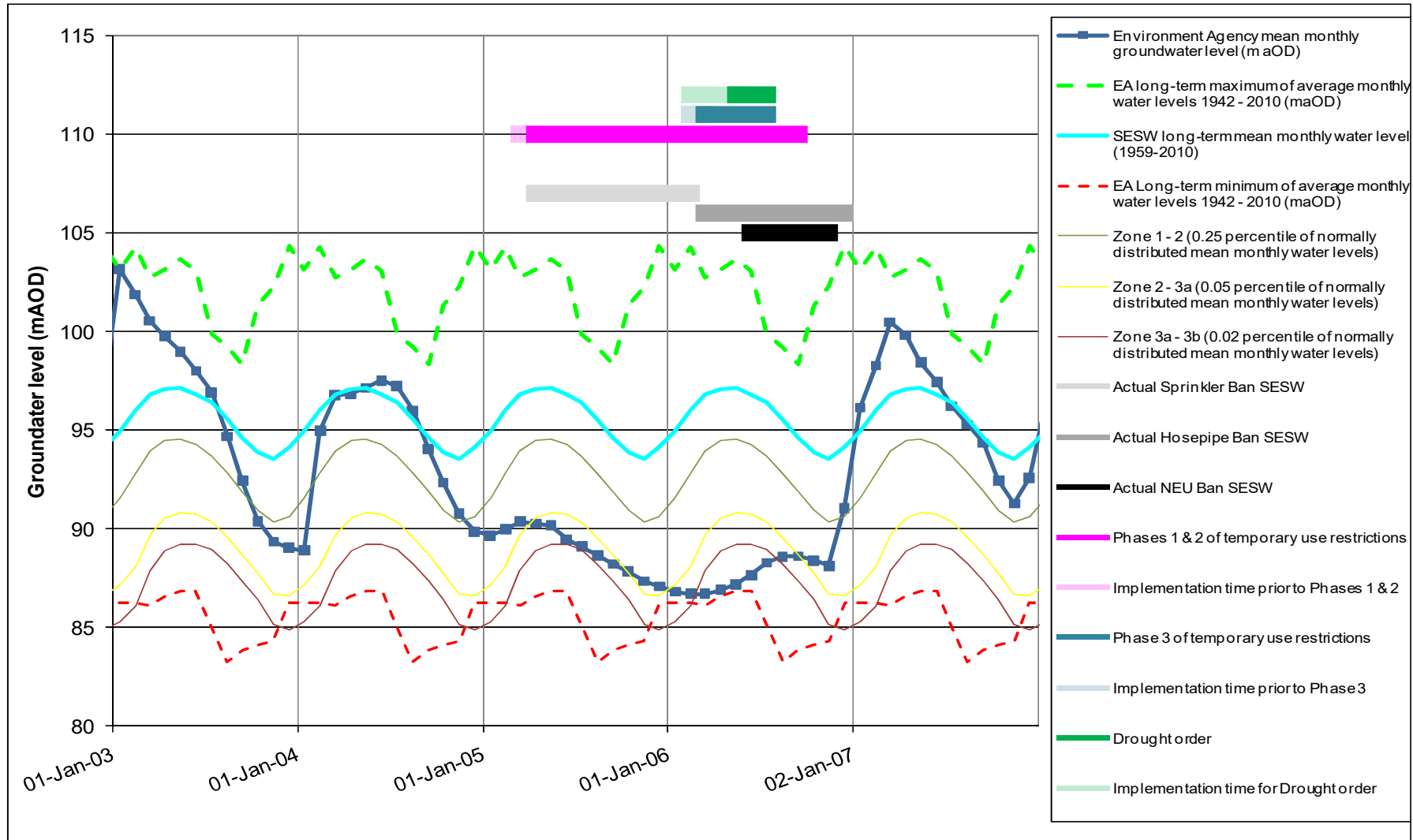
**Table 5.1: Actions taken by SESW during the 2004-2006 two dry winter drought**

Zone	Action	Description
Zone 2	Leakage reduction efforts	During 2006, we implemented increased active leakage control. Higher than normal numbers of leak detection staff were kept on and the response time for repairing visible leaks was improved. We estimate that this initiative resulted in a temporary reduction in total leakage of around 0.3 Ml/d.
Zones 1-3a	Further increase customer awareness	Customer awareness was maintained through ongoing media coverage of the drought and press releases. The 2006 issue of the Company magazine had a number of features concerning the drought. Letters were also sent to every customer advising of the drought and asking for their assistance in economising their use of water. Appropriate banners were attached to all our vehicles advising of the restrictions imposed at that time. A major press conference with national television was held at our head office on 26 May 2006 in advance of implementing restrictions to non-essential use.
	Utilise Bulk Supply from Thames Water	We sent a request for the bulk supply from Thames Water in January 2006. It was granted by Thames Water and taken from 3 April 2006 to 6 September 2006, resulting in up to an additional 5 Ml/d being available for use in the SESW supply area.
	Write to commercial customers to reduce demand	<p>In 2005 we wrote to the Chief Executive or senior responsible officer of approximately 500 organisations who are the highest water users supplied by the Company. The letter asked for a sustainable approach to the use of water in the context of the restriction on domestic properties already introduced.</p> <p>In 2006, as the drought progressed, we wrote to every commercial customer advising of the drought and asking that they make every effort to economise in their use of water. This was repeated on introduction of the NEU ban in May 2006.</p>
	Sprinkler and unattended hosepipe restriction	A ban on sprinklers and unattended hosepipes (now Phase 1 of temporary use restrictions) was introduced on 22nd April 2005 across the Company area. We were the first water company in the UK to apply this ban. It is estimated that this saved approximately 1.5% of expected average and 3.5% of expected peak demand in that year.

Zone	Action	Description
	Hosepipe restriction	We introduced a full hosepipe ban (now Phases 2 and 3 of temporary use restrictions) on 1st March 2006 across the area; this was lifted on 18th January 2007. Before this, the last full hosepipe ban was in the East Surrey WRZ from April 1992 until December 1992. It is estimated that this saved approximately 4% of expected average and 6% of expected peak demand in that year, including savings already accumulated from the sprinkler ban.
	Drought permits to abstract from the River Eden	We successfully applied for drought permits to abstract from the River Eden during May 2005 and May 2006 and to remove the then operational autumn flush licence condition during the autumn of 2006. This resulted in an additional 320 MI being abstracted in May 2005, 927 MI in May 2006 and 2,078 MI in the autumn of 2006 (N.B. this is no longer a drought permit option), subject to conditions agreed with the EA to protect the environment, to support refill of Bough Beech reservoir.
Zone 3b	Drought order to restrict non-essential use of water	<p>A drought order to restrict the non-essential use of water came into force across the area in May 2006. This allowed us to ban the use of hosepipes for a range of activities including the watering of sports grounds and golf courses as well as the restricting the operations of mechanical vehicle washers, the topping up of private swimming pools and the washing of road vehicles, railway stock and aircraft. However, in order to assist our customers as much as possible, while fully protecting the integrity of the water supply, we did not implement all of the restrictions permitted by the drought order. We granted allocations of water for some of the non-domestic uses described above, and made a free raw water supply available for tankering by customers from our abandoned Pains Hill source. In this way we consider that we implemented the drought order sensitively and progressively, as required by the Minister of State at Defra in the granting of the order. It is estimated that this saved approximately 10-17% of expected average and 20% of expected peak demand in that year, including savings already accumulated from the sprinkler and hosepipe bans. This drought order was lifted on 15th November 2006.</p> <p>Part of the decision-making process that led to removal of the drought order was that winter was approaching, and while we had previously largely had the support of our customers in the actions taken, there was a risk that moving into the winter period would reduce in customers' views the clear justification for the restriction; maintaining customer support for actions was a clear driver in this case.</p>



Figure 5.5: Well House Inn Historic Levels and revised Drought Triggers and Action Zones from January 2003 to December 2007



### 5.5.1 in 200 year Groundwater drought scenario

In line with current guidance, (Environment Agency, 2016) we have developed and worked through an extreme 1 in 200 year drought scenario. This scenario is entirely theoretical and exceeds any drought on record. It is important to highlight that statistically, a drought event on this scale is unlikely to occur. However, we recognise that testing our Drought Plan to highlight how it would respond to such an event is a useful exercise to undertake.

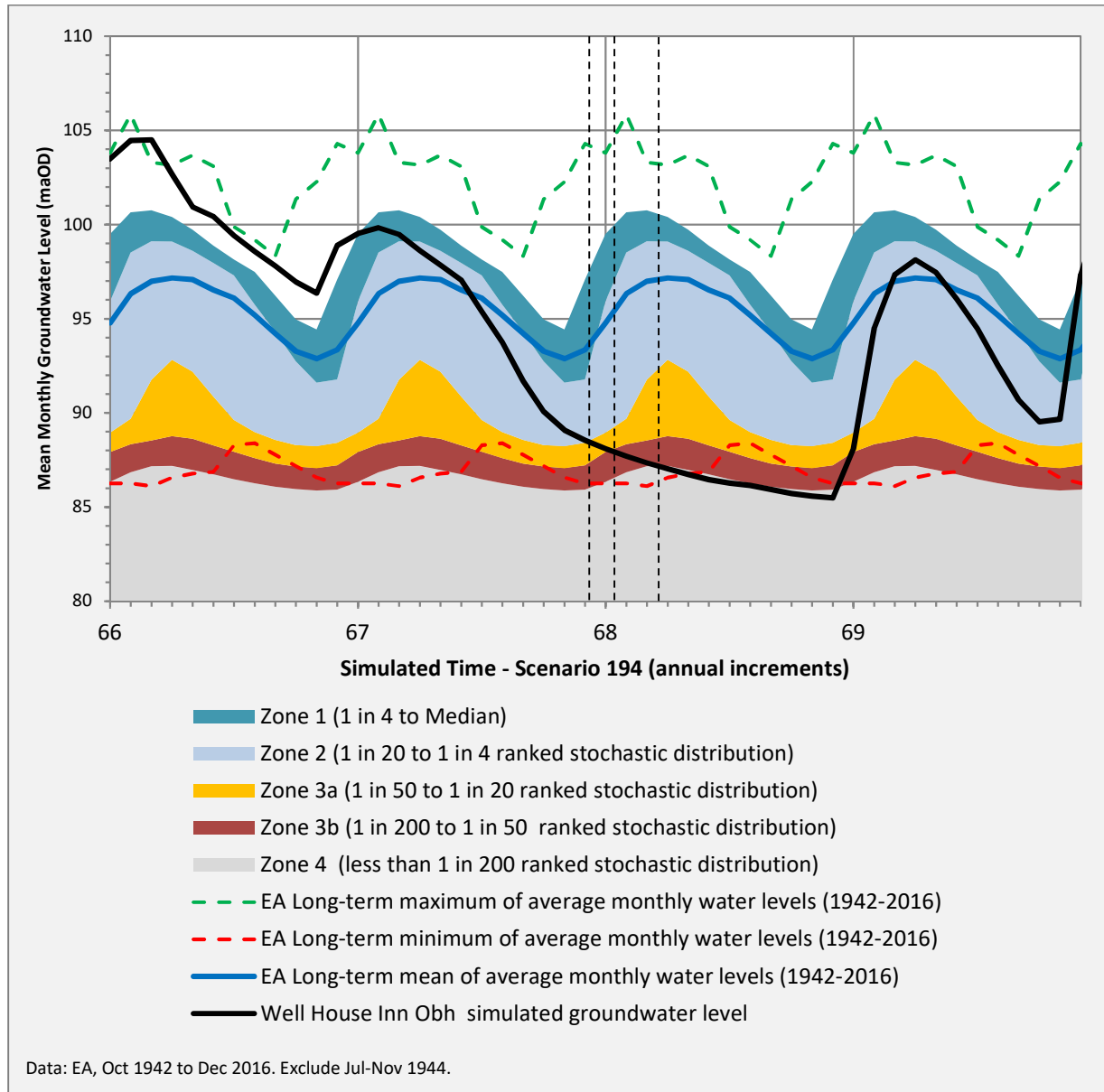
Existing rainfall, groundwater and surface water records are of insufficient length to robustly identify a 1 in 200-year event. Therefore, to obtain a time series of sufficient length, a stochastically generated rainfall and PET time series (WRSE, 2016) totalling 15,000 years was used. In order to identify the 1 in 200-year event from this stochastic rainfall and PET data, a groundwater model of Well House Inn was selected. As outlined previously, groundwater and surface water resources respond differently to the same climatic event. A groundwater model was preferentially selected over a surface water model to derive the 1 in 200-year drought due to the importance of groundwater supply.

The stochastic time series (200 sequences each of 75 years) were each run through a lumped parameter groundwater model of Well House Inn to obtain annual minima of groundwater level. These values were then ranked and assigned return periods, with the 1 in 200-year groundwater level being identified as 85.46 mAOD. A sequence selected to represent the 1 in 200-year groundwater level was then run through Catchmod to derive flow for the River Eden and the resulting flow input into Aquator to model the Bough Beech reservoir response.

The scenario generated is of one extremely dry winter (for groundwater recharge purposes considered as October to March) with approximately 28% of long-term average (LTA) rainfall followed by two winters of approximately long-term average rainfall.

As shown in Figure 5.6, groundwater levels dip below the trigger level into Zone 3a in December of the extremely dry winter (Scenario 194 Year 67) and fall through Zone 3a and Zone 3b by March of the following year (Year 68). Groundwater levels remain at, or close to, Zone 4 until recharge occurs in December of Year 68.

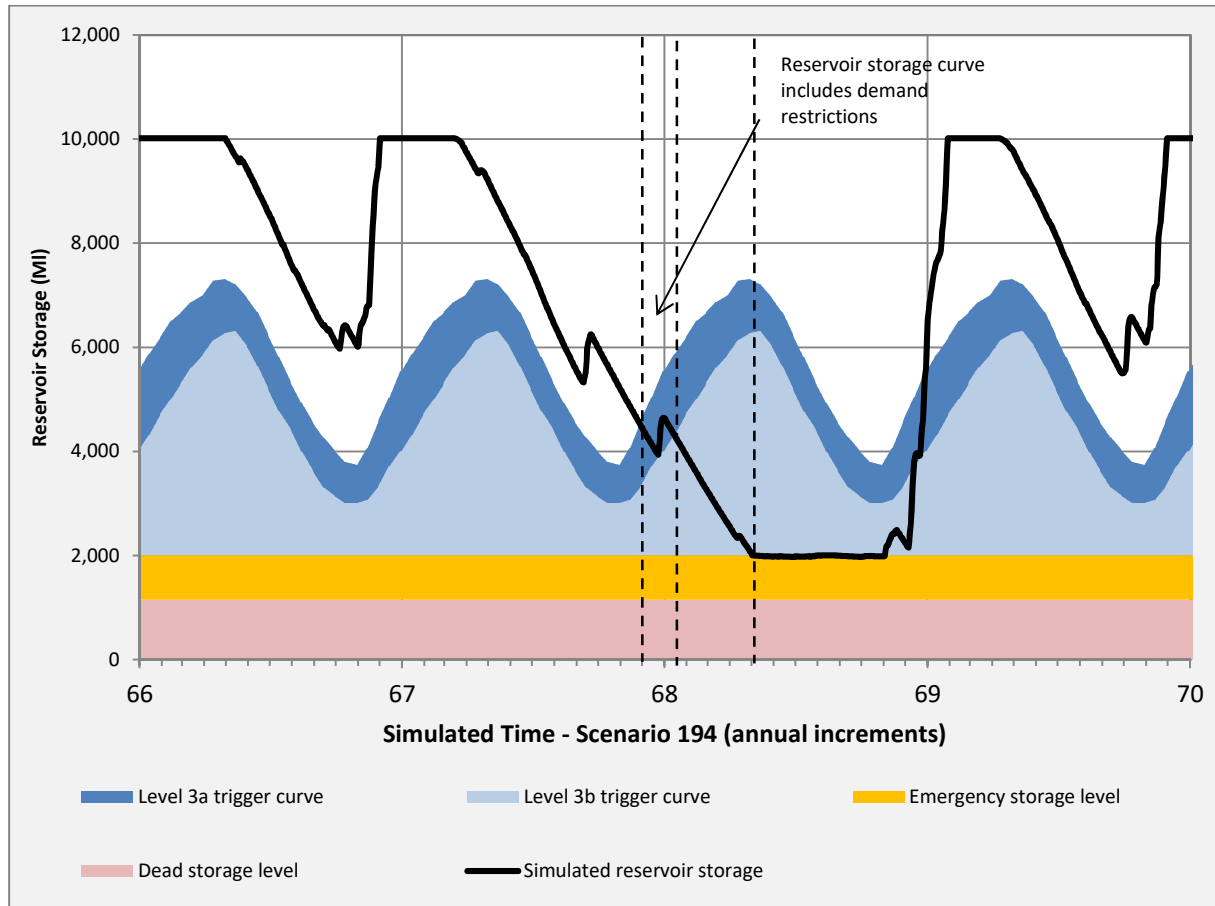
Figure 5.6: Groundwater Levels - 1 in 200 Year Scenario



Water levels in Bough Beech reservoir respond to the extreme dry winter by dropping below trigger level 3a in Scenario 194 in December of Year 67 (see Figure 5.7). This triggers demand restrictions that result in a temporary recovery of reservoir levels. Reservoir levels then continue to drop below trigger level 3a in January of Year 68 and then into emergency storage in May of Year 68. Reservoir levels stay in emergency storage for 181 days before recovering.

The reservoir simulation does not allow the drought permit to be taken into account in reservoir levels so it is possible that the time during which the reservoir level is below each trigger level or in emergency storage is reduced.

Figure 5.7: Bough Beech Levels - 1 in 200 Year Scenario



### 5.6. Summary of drought scenarios

The actions taken during the two dry winter groundwater drought of 2004-2006 and the single season Bough Beech reservoir drought of 2005-2006 were successful in enabling supplies to be maintained without recourse to the full suite of supply side drought management actions or emergency measures. Section 2.4 provides evidence for the demand-reducing effects of some of the demand related drought actions taken during this time. We are therefore confident that sufficiently flexible measures are in place to address a range of drought scenarios without the current small supply-demand deficit being considered a significant issue.

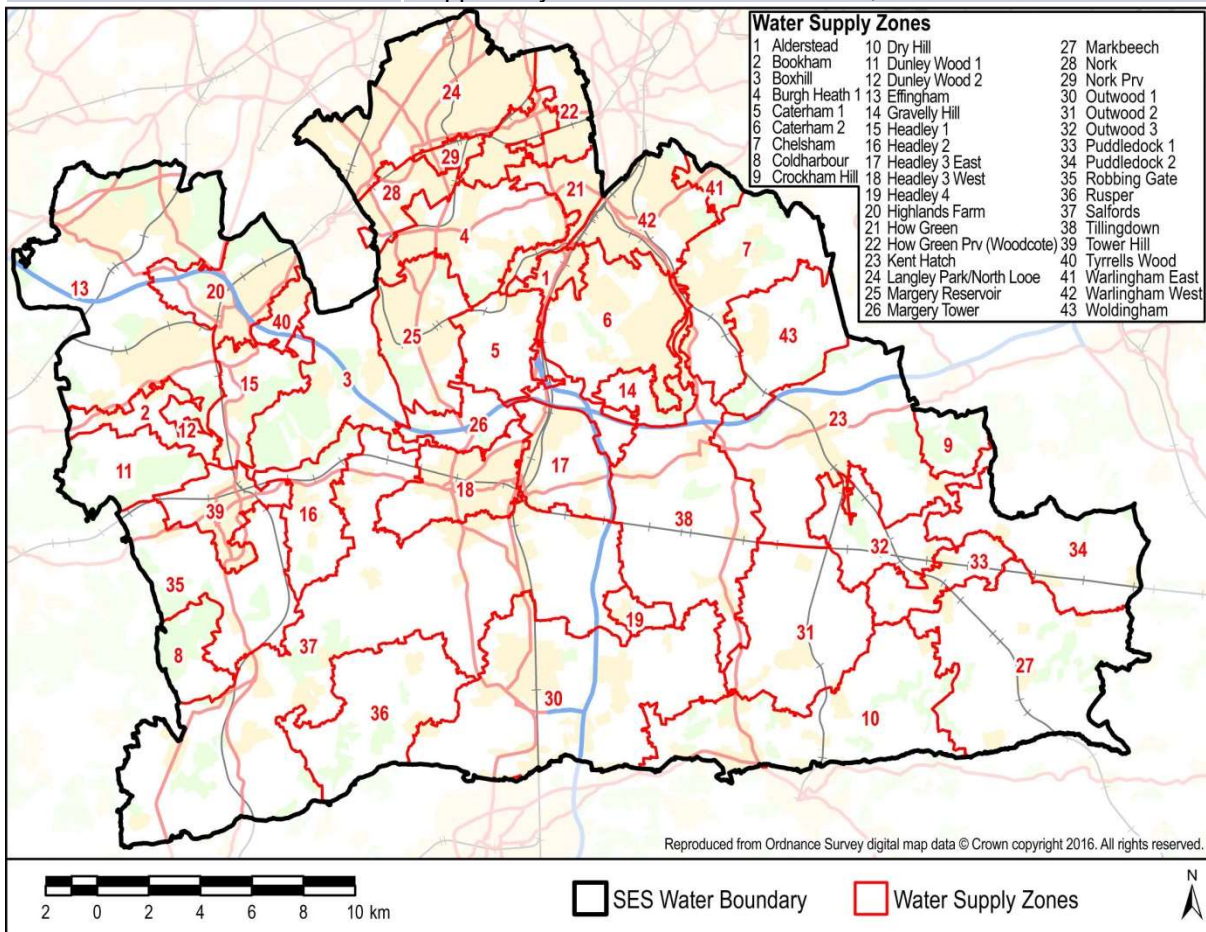
We are now more resilient to more severe drought events than that experienced in 2004-06, given the larger suite of drought permit options now identified as being available. However, the 1 in 200-year drought scenario would be challenging to manage with more reliance being placed on groundwater storage, although these would approach minimum levels at the end of the drought simulation similar to those experienced in the 2004-2006 drought. We would seek to increase resilience to these severe droughts through our WRMP19 and subsequent plans.

## 6. Glossary of drought plan terminology

Term	Explanation
<b>Abstraction</b>	The removal of water from any source, either permanently or temporarily.
<b>Abstraction licence</b>	The authorisation granted by the Environment Agency (England) or Natural Resources Wales (for sites in Wales) to allow the removal of water from a source.
<b>Baseline</b>	Information on the environment that details conditions prior to implementation of a drought action.
<b>Bulk transfers</b>	A legal agreement for exporting and importing water between a donor and recipient operator.
<b>Control curves</b>	A diagram or graph presenting drought triggers levels.
<b>Demand management</b>	The implementation of policies or measures which serve to manage control or influence the consumption or waste of water.
<b>Drought management zones</b>	The area (within a resource zone) that a particular drought management action will apply to as specified.
<b>Deployable output</b>	The output of a commissioned source or group of sources or of bulk supply as constrained by: <ul style="list-style-type: none"> <li>• environment</li> <li>• licence, if applicable</li> <li>• pumping plant and/or well or aquifer properties</li> <li>• raw water mains and/or aquifers</li> <li>• transfer and/or output main</li> <li>• treatment</li> <li>• water quality</li> </ul>
<b>Drought order</b>	An authorisation granted by the Secretary of State (England) or Welsh Ministers (Wales) under drought conditions which imposes restrictions upon the use of water and/or allows for abstraction/impoundment outside the schedule of existing licences on a temporary basis.
<b>Drought permit</b>	An authorisation granted by the Environment Agency (England) or Natural Resources Wales (for sites in Wales) under drought conditions which allows for abstraction/impoundment outside the schedule of existing licences on a temporary basis.
<b>Environmental assessment</b>	An assessment of environmental sensitivity and likely impacts from implementing drought management actions.
<b>Environmental monitoring plan</b>	The plan of how the company will address: <ul style="list-style-type: none"> <li>• gaps in the environmental assessment of the supply-side drought management action</li> <li>• baseline monitoring (including pre drought monitoring)</li> <li>• in- drought monitoring</li> <li>• post drought monitoring</li> </ul>

<b>Environmental report</b>	The report that accompanies an application for a drought order or drought permit. It should be based on the information from within the environmental assessment and updated with any additional information.
<b>Feature</b>	A way of describing an ecological, chemical, habitat or morphological element to be assessed. For example a species of plant or animal, habitat type or sub-habitat type.
<b>Government</b>	In this guideline Government refers to central Government (Defra) and the Welsh Government.
<b>Habitats Regulations</b>	The Conservation of Habitats and Species Regulations 2010. The domestic legislation which transposes the EU Habitats and Wild Birds Directives into UK law and replaces the Conservation (natural habitats &c) Regulations 1994.
<b>In-drought monitoring</b>	Monitoring that is undertaken during the implementation of a drought management action.
<b>Levels of service</b>	The standard of service that water company customers can expect to receive from their water company, commonly setting out the frequency of restrictions that a company expects to apply to its customers.
<b>NNR</b>	National Nature Reserve - designation to protect the most important areas of wildlife habitat and geological formations in Britain, and as places for scientific research.
<b>Ramsar site</b>	Internationally important wetland site.
<b>Resource zone</b>	The largest possible zone in which all resources, including external transfers, can be shared and hence the zone in which all customers experience the same risk of supply failure from a resource shortfall.
<b>SAC</b>	Special Area of Conservation - Designated under the European Habitats Directive (1991)
<b>SPA</b>	Special Protection Area - Classified under the European Birds Directive (1979)
<b>SSSI</b>	Site of Special Scientific Interest - A site given a statutory designation by English Nature or Natural Resources Wales because it is particularly important, on account of its nature conservation value.
<b>Strategic Environmental Assessment (SEA) Directive</b>	The Strategic Environmental Assessment Directive ensures significant environmental effects arising from proposed plans and programmes are identified, assessed, subjected to public participation, taken into account by decision-makers and monitored.
<b>Water resource management plan (WRMP)</b>	A water company long-term strategic plan for water supply and demand over 25 years.
<b>Resilience options</b>	Additional options to deal with plausible droughts worse than those in the recorded record. A case should be made for these in the drought plan but they should be included and funded through your next WRMP.
<b>Habitats regulation assessment (HRA)</b>	A HRA will identify whether or not your actions will have an adverse effect on a site's integrity. A HRA will identify whether or not your actions will have an adverse effect on a site's integrity.

<b>RBMPs</b>	River basin district (RBD) plans aim to protect and improve the water environment for the benefit of people and wildlife. The plans set out how organisations, stakeholders and communities will work together to achieve an improved water environment for each RBD.
<b>Civil emergency</b>	Civil emergency is defined in the water industry act section 208 (point 7). The Environment Agency or Natural Resources Wales is not responsible for emergency plans. You do not need to include what you would do to maintain supply during a civil emergency in your drought plan as this will be covered by your emergency plan.
<b>Designated sites of conservation importance</b>	Nature sites and areas of countryside can be ‘designated’, which means they have special status as protected areas because of their natural and cultural importance. You can search for designated sites here: <a href="https://www.gov.uk/check-your-business-protected-area">https://www.gov.uk/check-your-business-protected-area</a>
<b>Business plans</b>	The business plan sets out a water company’s business strategy and how they will provide value-for-money water and if applicable wastewater services to their customers.
<b>Water resource zones</b>	The largest possible zone in which all resources, including external transfers, can be shared and hence the zone in which all customers experience the same risk of supply
<b>Water Supply zone</b>	Area of the network. Supply zones are sub-divided into areas supplied by the same service reservoir, as shown below.



## Appendix A: Drought Options Tables

### *Demand-side drought management actions*

Option Name	Customer Awareness	Leakage Management
<b>Trigger(s)</b> <i>or preceding actions</i>	Zone 1 and beyond, therefore guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn	Consideration in Zone 1, with action proposed in Zone 2 and beyond, therefore guided by storage levels at Bough Beech reservoir, groundwater levels at Well House Inn, and following customer awareness campaign
<b>Demand saving</b> <i>MI/d unless stated</i>	0.2% - estimate based on savings from Water Efficiency Programmes	0.2% - Up to approximately 0.3MI/d, estimated based on the temporary reduction in total leakage achieved during 2006
<b>Demand saving</b> <i>% reduction on peak week demand</i>	0.4% - estimate as expected to be effective in reducing demand and having potentially wide and long-term behavioural change benefits	Not known
<b>Location</b> <i>Area affected or whole supply zone</i>	Company Area	Company Area
<b>Implementation timetable</b> <i>Preparation time, time of year effective, duration</i>	1 week preparation. Regularly implemented / updated throughout pre-drought, drought period and post-drought. Effects expected throughout year.	In parallel to anticipating and implementing demand restrictions and for their duration
<b>Permissions required and constraints</b> <i>Including details of liaison carried out with bodies responsible for giving any permits or approvals</i>	None	None
<b>Risks associated with option</b>	None	None



Option Name	Pressure Management and Operational Usage Restrictions	Temporary water use restrictions – Phase 1
<b>Trigger(s)</b> <i>or preceding actions</i>	Consideration and planning in Zone 1, implementation in Zone 2	Zone 3a – Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn Following customer awareness campaign
<b>Demand saving</b> <i>% reduction on annual average demand</i>	0.1% Pressure Management, 0.01% Operational Usage Restrictions	Up to approximately 1.5% of drought year demand
<b>Demand saving</b> <i>% reduction on peak period demand</i>	0.2% Pressure Management, 0.01% Operational Usage Restrictions	Up to approximately 3.5% of drought year demand
<b>Location</b> <i>Area affected or whole supply zone</i>	Targeted to District Metered Areas where further pressure management is feasible. All operational usage (reservoir cleaning, flushing) should be reviewed to determine if essential.	Company Area
<b>Implementation timetable</b> <i>Preparation time, time of year effective, duration</i>	2 weeks. Reservoir cleaning only takes place from October to April.	3 weeks to allow for advertising and representations. Most effective during summer months.
<b>Permissions required and constraints</b> <i>Including details of liaison carried out with bodies responsible for giving any permits or approvals</i>	None	None
<b>Risks associated with option</b>	Negative customer reaction to reduced pressure. Water quality considerations.	Negative customer reaction

Option Name	Temporary water use restrictions – Phase 2	Temporary water use restrictions – Phase 3
<b>Trigger(s)</b> <i>or preceding actions</i>	Zone 3a – Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn  Following customer awareness campaign and in addition to Phase 1 of restrictions	Zone 3b – Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn  Following customer awareness campaign and in addition to Phases 1 & 2 of restrictions
<b>Demand saving</b> <i>% reduction on annual average demand</i>	Up to approximately 4% of drought year demand, including savings already achieved in Phase 1	Not expected to be significant in addition to Phases 1 and 2 already in place
<b>Demand saving</b> <i>% reduction on peak period demand</i>	Up to approximately 6% of drought year demand, including savings already achieved in Phase 1	Not expected to be significant in addition to Phases 1 and 2 already in place
<b>Location</b> <i>Area affected or whole supply zone</i>	Company area	Company area
<b>Implementation timetable</b> <i>Preparation time, time of year effective, duration</i>	3 weeks to allow for advertising and representations	4 weeks to allow for advertising and representations
<b>Permissions required and constraints</b> <i>Including details of liaison carried out with bodies responsible for giving any permits or approvals</i>	None	None
<b>Risks associated with option</b>	Negative customer reaction	Negative commercial customer reaction

Option Name	Drought order	Emergency drought order – pressure reduction, rota cuts and/or standpipes
<b>Trigger(s)</b> <i>or preceding actions</i>	Zone 3b - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn  Following customer awareness campaign and full implementation of Phases 1, 2 & 3 of temporary water use restrictions, but applied for at the same time as Phase 3 of temporary water use restrictions	In emergency only, after all other drought management actions have been taken
<b>Demand saving</b> <i>MI/d unless stated</i>	Up to approximately 10-17% of drought year demand, including savings already achieved by temporary water use bans	Not known
<b>Demand saving</b> <i>% reduction on peak week demand</i>	Up to approximately 20% of drought year demand, including savings already achieved by temporary water use bans	Range but potentially large savings
<b>Location</b> <i>Area affected or whole supply zone</i>	Company area	Company area
<b>Implementation timetable</b> <i>Preparation time, time of year effective, duration</i>	Varies. Minimum 2-3 months with no obstacles; up to 6 months with inquiry.	Unknown as not implemented recently, but likely to be at least 5 months from inception to implementation. Likely to be undertaken in a phased approach, with 2 or 3 phases.
<b>Permissions required and constraints</b> <i>Including details of liaison carried out with bodies responsible for giving any permits or approvals</i>	Application needs to be submitted to and granted by the Secretary of State for Defra. Public hearing / inquiry may be required.	Application needs to be submitted to and granted by the Secretary of State for Defra
<b>Risks associated with option</b>	Application not approved. Negative customer reaction.	Application not approved and potential for widespread customer dissatisfaction

**Supply-side drought management actions**

	<b>Option Name</b>	<b>Zone One Utilisation of peak resources such as Hackbridge and Clifton's Lane</b>	<b>Zone Two Utilisation of peak resources such as Hackbridge and Clifton's Lane</b>
<b>Option Implementation Assessment</b>	<b>Trigger(s)</b> <i>or preceding actions</i>	Zone 1 - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn	Zone 2 - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn
	<b>Deployable output of action</b>	Range of potential outputs – max 17.2 MI/d	Range of potential outputs – max 17.2 MI/d
	<b>Location</b> <i>Area affected or whole supply zone</i>	Hackbridge / Goatbridge – Langley Park SZ Clifton's Lane WTW – Headley Supply Zone	Hackbridge / Goatbridge – Langley Park SZ Clifton's Lane WTW – Headley Supply Zone
	<b>Implementation timetable</b> <i>Preparation time, time of year effective, duration</i>	Hackbridge / Goatbridge – from 1 week Cliftons Lane – 6 weeks	Hackbridge / Goatbridge – from 1 week Cliftons Lane – 6 weeks
	<b>Permissions required and constraints</b> <i>Including details of liaison carried out with bodies responsible for giving any permits or approvals</i>	None required	None required
	<b>Risks associated with option</b>	None	None
<b>Environmental Assessment</b>	<b>Risk to the environment</b> <i>High, Medium, Low or Unknown</i>	Low	Low
	<b>Summary of likely environmental impacts</b> <i>Include details for features of moderate and major sensitivity and minor sensitivity features from designated sites</i>	None	None
	<b>Baseline information used</b>	n/a	n/a
	<b>Summary of additional baseline monitoring requirements</b>	None	None
	<b>Mitigation measures</b>	None required	None required
	<b>Impact on other activities</b> <i>e.g. fisheries, industry, etc.</i>	None	None

	Option Name	Zone 1 transfer of potable water from Kenley WTW to How Green service reservoir	Zone 2 transfer of potable water from Kenley WTW to How Green service reservoir
Option Implementation Assessment	<b>Trigger(s)</b> <i>or preceding actions</i>	Zone 1 - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn	Zone 2 - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn
	<b>Deployable output of action</b>	<7.5MI/d	<7.5MI/d
	<b>Location</b> <i>Area affected or whole supply zone</i>	Warlingham to How Green Supply Zones	Warlingham to How Green Supply Zones
	<b>Implementation timetable</b> <i>Preparation time, time of year effective, duration</i>	From 1 week	From 1 week
	<b>Permissions required and constraints</b> <i>Including details of liaison carried out with bodies responsible for giving any permits or approvals</i>	None required	None required
	<b>Risks associated with option</b>	Supplies are not guaranteed	Supplies are not guaranteed
Environmental Assessment	<b>Risk to the environment</b> <i>High, Medium, Low or Unknown</i>	None	None
	<b>Summary of likely environmental impacts</b> <i>Include details for features of moderate and major sensitivity and minor sensitivity features from designated sites</i>	None	None
	<b>Baseline information used</b>	n/a	n/a
	<b>Summary of additional baseline monitoring requirements</b>	None	None
	<b>Mitigation measures</b>	None required	None required
	<b>Impact on other activities</b> <i>e.g. fisheries, industry, etc.</i>	None	None

	Option Name	Zone One transfer of potable water using the Buckland transfer main	Zone Two transfer of potable water using the Buckland transfer main
Option Implementation Assessment	<b>Trigger(s)</b> <i>or preceding actions</i>	Zone 1 - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn	Zone 2 - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn
	<b>Deployable output of action</b>	Up to 10 Ml/d	Up to 10 Ml/d
	<b>Location</b> <i>Area affected or whole supply zone</i>	Headley to Burgh Heath and Margery Supply Zones	Headley to Burgh Heath and Margery Supply Zones
	<b>Implementation timetable</b> <i>Preparation time, time of year effective, duration</i>	From 1 week	From 1 week
	<b>Permissions required and constraints</b> <i>Including details of liaison carried out with bodies responsible for giving any permits or approvals</i>	None required	None required
	<b>Risks associated with option</b>	Supplies are not guaranteed	Supplies are not guaranteed
Environmental Assessment	<b>Risk to the environment</b> <i>High, Medium, Low or Unknown</i>	None	None
	<b>Summary of likely environmental impacts</b> <i>Include details for features of moderate and major sensitivity and minor sensitivity features from designated sites</i>	None	None
	<b>Baseline information used</b>	n/a	n/a
	<b>Summary of additional baseline monitoring requirements</b>	None	None
	<b>Mitigation measures</b>	None required	None required
	<b>Impact on other activities</b> <i>e.g. fisheries, industry, etc.</i>	None	None

	Option Name	Zone One conjunctive use of potable water from Bough Beech reservoir to augment groundwater in Chalk aquifers	Zone Two conjunctive use of potable water from Bough Beech reservoir to augment groundwater in Chalk aquifers
Option Implementation Assessment	<b>Trigger(s)</b> <i>or preceding actions</i>	Zone 1 - Guided by storage at Bough Beech reservoir and levels at Well House Inn	Zone 2 - Guided by storage at Bough Beech reservoir and levels at Well House Inn
	<b>Deployable output of action</b>	Up to 18Ml/d, the current capacity of the transfer main	Up to 18Ml/d, the current capacity of the transfer main
	<b>Location</b> <i>Area affected or whole supply zone</i>	Headley to Burgh Heath and Margery Supply Zones	Headley to Burgh Heath and Margery Supply Zones
	<b>Implementation timetable</b> <i>Preparation time, time of year effective, duration</i>	From 1 week	From 1 week
	<b>Permissions required and constraints</b> <i>Including details of liaison carried out with bodies responsible for giving any permits or approvals</i>	None	None
	<b>Risks associated with option</b>	Available supplies from Bough Beech are not guaranteed	Available supplies from Bough Beech are not guaranteed
Environmental Assessment	<b>Risk to the environment</b> <i>High, Medium, Low or Unknown</i>	None - would operate within existing Bough Beech licence	None - would operate within existing Bough Beech licence
	<b>Summary of likely environmental impacts</b> <i>Include details for features of moderate and major sensitivity and minor sensitivity features from designated sites</i>	None	None
	<b>Baseline information used</b>	n/a	n/a
	<b>Summary of additional baseline monitoring requirements</b>	None required	None required
	<b>Mitigation measures</b>	None required	None required
	<b>Impact on other activities</b> <i>e.g. fisheries, industry, etc.</i>	None	None

	Option Name	Request and, if available, implement bulk supply from Thames Water	River Eden drought permit: Extending winter abstraction period
Option Implementation Assessment	<b>Trigger(s)</b> <i>or preceding actions</i>	Zone 2/3 - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn	Zone 3a - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn
	<b>Deployable output of action</b>	Maximum of 13.6 Ml/d, however recent experience suggests that only 7.5 Ml/d may be available. Supply is not guaranteed	Will depend upon specific drought year flows in the River Eden, but potentially large additional volume to refill Bough Beech reservoir - use of this volume to meet demand will then be subject to the abstraction licence from Bough Beech reservoir and the capacity of the Bough Beech WTW to treat the water
	<b>Location</b> <i>Area affected or whole supply zone</i>	Langley Park Supply Zone	Headley to Burgh Heath and Margery Supply Zones
	<b>Implementation timetable</b> <i>Preparation time, time of year effective, duration</i>	Approximately 1-2 months	Approximately 4 months from inception to implementation; only available during May and potentially June
	<b>Permissions required and constraints</b> <i>Including details of liaison carried out with bodies responsible for giving any permits or approvals</i>	None, the resource is authorised under licence to Thames Water	Statement of Need and Environmental Report needs to be submitted to the EA. Approval of drought permit needs to be granted by the EA. If not approved, the Company will consider submitting a drought order application to the Secretary of State, Defra
	<b>Risks associated with option</b>	Availability related to supply/demand in Thames Water and their ability to supply. Is not a guaranteed source	Drought permit not granted



	Option Name	Request and, if available, implement bulk supply from Thames Water	River Eden drought permit: Extending winter abstraction period
Environmental Assessment	<b>Risk to the environment</b> <i>High, Medium, Low or Unknown</i>	None, treated water supply from the London Water Ring Main derived from licensed sources.	Low risk to invertebrates communities; low risk to fisheries
	<b>Summary of likely environmental impacts</b> <i>Include details for features of moderate and major sensitivity and minor sensitivity features from designated sites</i>	None	Limited impact: there are no designated conservation sites likely to be impacted by this drought permit; in addition the drought permit will likely be constrained by a Minimum Residual Flow condition, to be agreed with the EA, which will act to protect the environment from low flow impacts
	<b>Baseline information used</b>	n/a	Environmental report which accompanied 2005 and 2006 drought permit applications
	<b>Summary of additional baseline monitoring requirements</b>	None required	Monitoring of dissolved oxygen and temperature is proposed for duration of drought permit
	<b>Mitigation measures</b>	None required	As with the drought permits granted in 2005 and 2006, it is likely that a Minimum Residual Flow would be proposed, to be agreed with the EA; in addition, if critical deterioration in dissolved oxygen levels occurs (i.e. they reduce to 30% saturation) abstraction would be stopped immediately
	<b>Impact on other activities</b> <i>e.g. fisheries, industry, etc.</i>	None	None expected

	Option Name	River Eden drought permit: Summer abstraction	Hackbridge/Goatbridge drought permit
Option Implementation Assessment	<b>Trigger(s)</b> <i>or preceding actions</i>	Zone 3b - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn	Zone 3b - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn
	<b>Deployable output of action</b>	Will depend upon specific drought year summer flows in the River Eden - use of this volume to meet demand will then be subject to the abstraction licence from Bough Beech reservoir and the capacity of the Bough Beech WTW to treat the water	Up to 1.8MI/d
	<b>Location</b> <i>Area affected or whole supply zone</i>	Headley to Burgh Heath and Margery Supply Zones	Langley Park Supply Zone
	<b>Implementation timetable</b> <i>Preparation time, time of year effective, duration</i>	Approximately 4 months from inception to implementation; only available during the summer (June/July to August inclusive)	Approximately 4 months from inception to implementation
	<b>Permissions required and constraints</b> <i>Including details of liaison carried out with bodies responsible for giving any permits or approvals</i>	Statement of Need and Environmental Report needs to be submitted to the EA. Approval of drought permit needs to be granted by the EA. If not approved, the Company will consider submitting a drought order application to the Secretary of State, Defra	Statement of Need and Environmental Report needs to be submitted to the EA. Approval of drought permit needs to be granted by the EA. If not approved, the Company will consider submitting a drought order application to the Secretary of State, Defra
	<b>Risks associated with option</b>	Drought permit not granted	Yields are theoretical based upon deployable output assessment and have not been verified under drought conditions

	Option Name	River Eden drought permit: Summer abstraction	Hackbridge/Goatbridge drought permit
Environmental Assessment	<b>Risk to the environment</b> <i>High, Medium, Low or Unknown</i>	Uncertain, but based upon extended winter drought permit risks, low risk to invertebrates communities; low risk to fisheries	Reduced springflow to River Wandle
	<b>Summary of likely environmental impacts</b> <i>Include details for features of moderate and major sensitivity and minor sensitivity features from designated sites</i>	Limited impact: there are no designated conservation sites likely to be impacted by this drought permit; in addition the drought permit will likely be constrained by a Minimum Residual Flow condition, to be agreed with the EA, which will act to protect the environment from low flow impacts	Impacts are considered to be groundwater level/groundwater head reductions and although the magnitude of these is difficult to accurately assess using analytical methods, empirical data suggests that drawdowns are small due to the high transmissivity of the aquifer
	<b>Baseline information used</b>	Environmental report which accompanied 2005 and 2006 drought permit applications	Test pumping assessments
	<b>Summary of additional baseline monitoring requirements</b>	Monitoring of dissolved oxygen and temperature is proposed for duration of drought permit	Empirical observation has limited value due to high transmissivity of aquifer
	<b>Mitigation measures</b>	As with the drought permits granted in 2005 and 2006, it is likely that a Minimum Residual Flow would be proposed, to be agreed with the EA; in addition, if critical deterioration in dissolved oxygen levels occurs (i.e. they reduce to 30% saturation) abstraction would be stopped immediately	Continued augmentation of the River Wandle at Carshalton Ponds to maintain an MRF of 4.5Ml/d
	<b>Impact on other activities</b> <i>e.g. fisheries, industry, etc.</i>	None expected	Potential derogation on other abstractors

	Option Name	Woodmansterne Group drought permit	Kenley Group drought permit
Option Implementation Assessment	<b>Trigger(s)</b> <i>or preceding actions</i>	Zone 3b - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn	Zone 3b - Guided by storage levels at Bough Beech reservoir and groundwater levels at Well House Inn
	<b>Deployable output of action</b> <i>MI/d unless stated</i>	Up to 4.98 MI/d for a 3 month period	Up to 2.1 MI/d
	<b>Location</b> <i>Area affected or whole supply zone</i>	How Green, Burgh Heath and Nork Supply Zones	Warlingham & Caterham Supply Zones
	<b>Implementation timetable</b> <i>Preparation time, time of year effective, duration</i>	Approximately 4 months from inception to implementation	Approximately 4 months from inception to implementation
	<b>Permissions required and constraints</b> <i>Including details of liaison carried out with bodies responsible for giving any permits or approvals</i>	Statement of Need and Environmental Report needs to be submitted to the EA. Approval of drought permit needs to be granted by the EA. If not approved, the Company will consider submitting a drought order application to the Secretary of State, Defra	Statement of Need and Environmental Report needs to be submitted to the EA. Approval of drought permit needs to be granted by the EA. If not approved, the Company will consider submitting a drought order application to the Secretary of State, Defra
	<b>Risks associated with option</b>	Yields are theoretical based upon deployable output assessment and have not been verified under drought conditions	Yields are theoretical based upon deployable output assessment and have not been verified under drought conditions

	Option Name	Woodmansterne Group drought permit	Kenley Group drought permit
Environmental Assessment	<b>Risk to the environment</b> <i>High, Medium, Low or Unknown</i>	Reduced springflow to River Wandle	Reduced springflow to River Wandle
	<b>Summary of likely environmental impacts</b> <i>Include details for features of moderate and major sensitivity and minor sensitivity features from designated sites</i>	Impacts are considered to be groundwater level/groundwater head reductions and although the magnitude of these is difficult to accurately assess using analytical methods, empirical data suggests that drawdowns are small due to the high transmissivity of the aquifer	Impacts are considered to be groundwater level/groundwater head reductions and although the magnitude of these is difficult to accurately assess using analytical methods, empirical data suggests that drawdowns are small due to the high transmissivity of the aquifer
	<b>Baseline information used</b>	Test pumping assessments	Test pumping assessments
	<b>Summary of additional baseline monitoring requirements</b>	Empirical observation has limited value due to high transmissivity of aquifer	Empirical observation has limited value due to high transmissivity of aquifer
	<b>Mitigation measures</b>	Continued augmentation of the River Wandle at Carshalton Ponds to maintain an MRF of 4.5MI/d	Continued augmentation of the River Wandle at Carshalton Ponds to maintain an MRF of 4.5MI/d
	<b>Impact on other activities</b> <i>e.g. fisheries, industry, etc.</i>	Potential derogation on other abstractors	Potential derogation on other abstractors

## **Appendix B: Review of Bough Beech Operating Curves and trigger levels**

### **Introduction**

Level 3a and 3b trigger levels for Bough Beech reservoir assist the management of water resources during periods of drought within the Company-wide resource zone. Once a trigger level is breached it prompts us to review various actions in conjunction with other factors including groundwater levels and time of year.

### **Reviewing the shape of the operating curve**

The operating curve and trigger levels were last reviewed and updated in 2011 for the 2013 Drought Plan. In August 2012, the capacity of the Bough Beech water treatment works (WTW) was increased from 36 Ml/d to 52 Ml/d. This increase in capacity enables us to increase the rate of peak drawdown of the reservoir and thus has the potential to alter the shape of the normal operating curve, on which the drought management trigger levels are based. The aim of this review is to establish whether the normal operating curve has changed as a result of the increase in WTW capacity and therefore whether the trigger levels need to be revised.

Daily values of percentage full of Bough Beech reservoir were provided by SES Water between 1 January 1995 and 31 March 2017. These values were plotted for each calendar year. Each year in the post-upgrade period (1 January 2013 to 31 December 2016) fell within the bounds of the storage levels of the pre-upgrade period (1 January 1995 to 31 December 2011), with the exception of November 2016 to January 2017, when long-term below average rainfall reduced flows in the River Eden and in turn lead to lower storage levels (Figure B1). However, the important point to note is that the rate of draw down has not changed. Average storage levels for the two periods, pre- and post- upgrade were again compared and showed some variance, but not on the rate or level of reservoir drawdown (Figure B2).

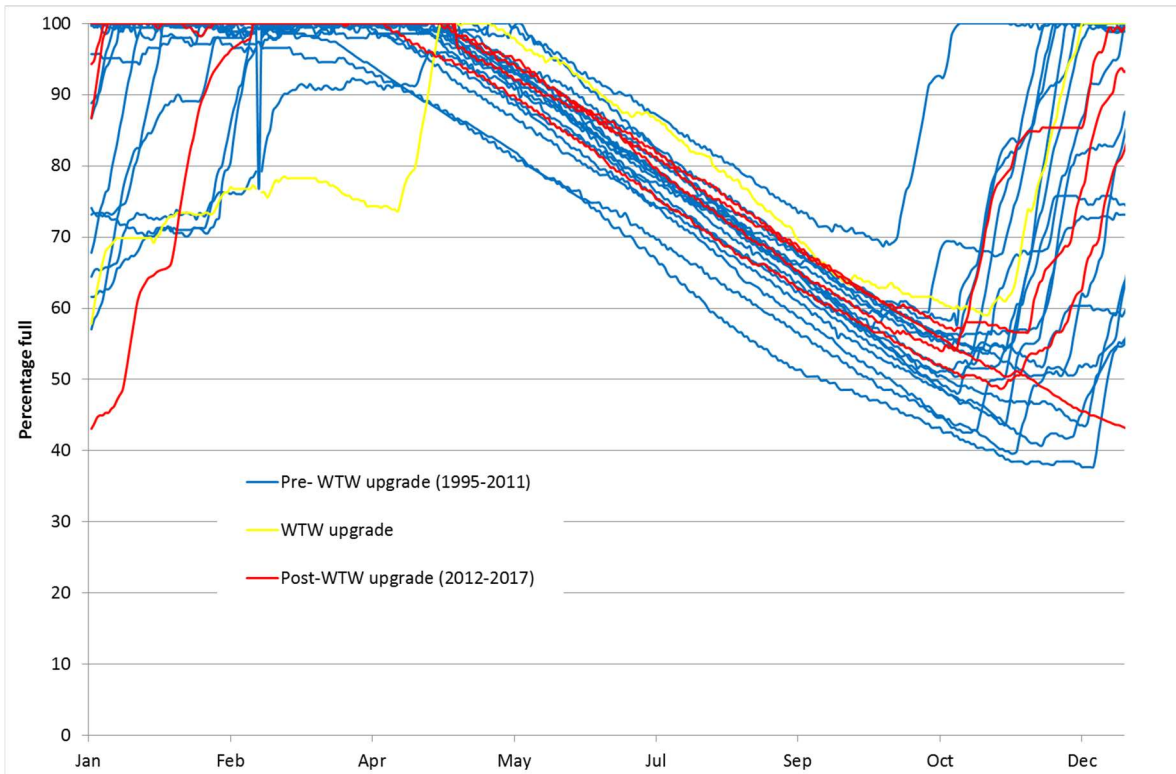
It is inevitable that there will be a bias towards climate and the below average rainfall in the shorter post-upgrade period of three years when compared to the longer pre-upgrade period of 16 years which in turn includes both periods of flood and drought. A reduction in long-term average rainfall has the potential to both increase demand and reduce the water available in the River Eden to abstract and fill the reservoir.

### **Conclusion**

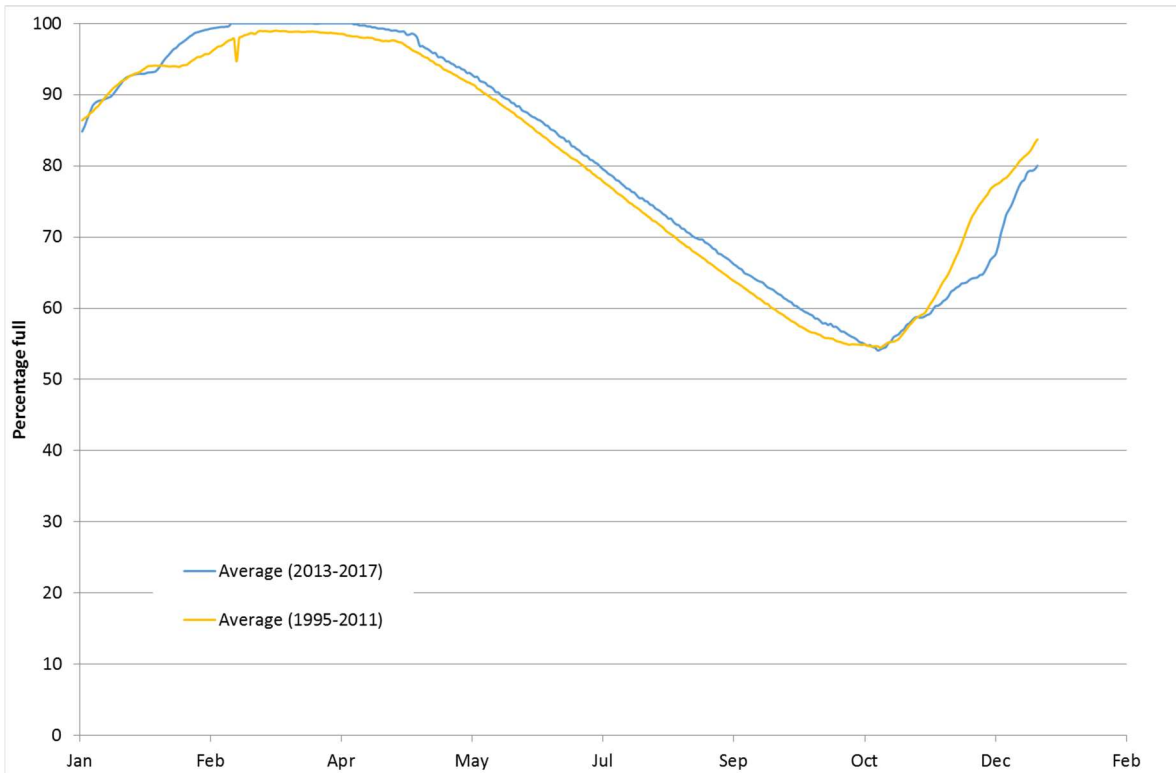
A review of both annual actual and long-term average storage levels for Bough Beech indicate that there is no significant change in the operation of Bough Beech following completion of the WTW upgrade and therefore a revision to the operating curve or trigger levels is not required.

It is recommended that the operating curve and trigger levels will be reviewed following any further significant changes to the WTW capacity, connectivity with Bough Beech reservoir or capacity of Bough Beech reservoir.

**Figure B.1 Annual storage levels for Bough Beech reservoir (January 1995 to March 2017)**



**Figure B.2 Annual average storage levels for Bough Beech reservoir, before (January 1995 to January 2011) and after (January 2013 to March 2017) upgrades to the water treatment works at Bough Beech.**



## Appendix C: Communications Plan

The Communication Plan detailed here is separated into the three main 'zones' or phases of drought management actions that are represented earlier in this Drought Plan. It is reiterated here that these zones relate to the groundwater and surface water triggers and associated drought management zones, as described in Section 2 of this Drought Plan.

### **Zone 1 Communication Plan**

Zone 1 communications utilise our ongoing public relations channels and build upon our ongoing demand management activities to keep customers aware of the resource situation and further encourage the careful use of water.

#### *Water efficiency programme*

As part of our performance commitment to reduce household consumption (Per Capita Consumption), we provide customers with information about how to use water wisely alongside a wide range of water efficiency initiatives. We adopt a balanced approach between behavioural change and device measures. We offer all our customers free packs that can help them save water and energy, and encourage consumers to use the water usage calculator on our website. If resources were to come under pressure, we would incorporate awareness-raising of the resource situation into our water efficiency activities.

#### *Customer Newsletter*

This is circulated to our customers annually and includes topical water-saving initiatives. This advice and appeals for greater restraint would be stepped-up in this publication and other leaflets if resources were to come under pressure.

#### *Social Media and the Company's website ([www.seswater.co.uk](http://www.seswater.co.uk))*

This website includes all drought related publicity made available to our customers and the public in both recent and ongoing media campaigns.

- The use of Facebook and Twitter to give messages on the resource situation and measures that can be taken
- The 'News' section of our website keeps customers abreast of water situation reports in our supply area relative to average conditions
- The 'Saving Water' section of our website, along with other avenues, is used to promote and distribute water efficiency information, such as the water use calculator, further increasing customer awareness in times of drought
- We also use our website to keep customers updated on the progress we are making to save water against our leakage reduction strategy, including against our sustainable economic level of leakage

#### *Press Releases*

Regular press releases, containing details on rainfall patterns, etc are sent to all of our local media emphasising the need to use water with care.

#### *Education programme*

Our well-established education programme incorporates water efficiency and using water wisely messages. These are delivered either during school visits to our educational centre, or



in schools as a Saving Water Talk and/or Saving Water Workshop. This would be stepped up with an emphasis on passing the message to parents.

#### *Local Radio*

We maintain close contact and a good working relationship with the local radio stations in our supply area and we would seek to get them to start talking about the need to conserve water.

#### *South East Communication Group*

As an active member of this group of communications representatives of all the SE water companies we would work together to deliver joint messages and actions.

#### *Local Authorities*

Local authorities will be contacted in order that they may fulfil their duties under the Local Government Act 2000, the Government's Climate Challenge programme and their commitments to environmental sustainability.

#### *Consumer Council for Water*

We will liaise with customer representatives, primarily the Consumer Council for Water (CCW) London and South East. In doing this we will help CCW achieve their aim to see a widespread safe, secure, reliable supply of water used wisely. Furthermore, this will allow customers to get (and be able to recognise that they are getting) high standards and good value for money in water services.

#### *Fire Authorities*

There will be ongoing correspondence with all of the company's Fire Authority customers to update them with the progression of our plans to implement drought measures. We will also advise of the foreseeable implications that those measures might have on the provision of adequate water supplies for operational firefighting. Opportunity for consultation will be provided at the initial planning stage of drought measures and thereafter.

#### *Other Essential Services*

We will ensure ongoing correspondence with providers of essential services such as hospitals and schools, advising them of our plans to implement drought measures and of any foreseeable implications these measures may have on their activities.

### **Zone 2 Communication Plan**

This builds on the work already undertaken in the Zone 1 category with the addition of the following:

- Production of a series of short articles for the local press which emphasise the need to save water and how this can be done.
- Speak to the producers of the local radio stations about running a regular 'slot' talking about the need to conserve water and how this can be done.
- Consider additional advertising in those areas under greatest stress. For example, advertisements on buses using the simple message "Every Drop Counts".
- Emphasise the water saving/conservation theme during school visits either by staff to schools or when school classes visit our treatment works, as well as through our schools retrofit water efficiency programme.

- Liaise with the Environment Agency and South East Communication Group re activating plans on collective action and messaging.
- Visit all gardening centres in the supply area to ask them to distribute low-water gardening leaflets.
- Try to get regional programmes of ITV and BBC1 to begin discussing and covering the issue.
- Vulnerable customers or those with special needs will be individually notified of any imminent restrictions on their water supply as a result of drought, providing they are registered with SESWs Priority Services Register. We will try to ensure that customers with mobility problems can easily get to a supply of water in the event of supply being cut off.
- Contact the few commercial customers that use large volumes of water and those for whom water is essential to their business purposes to advise them of imminent and current drought measures and advise them on how they may be able to decrease their water demand.
- Consider writing to all customers appealing for their co-operation in reducing water use, prior to the introduction of restrictions.
- Update the Company's crisis media strategy to ensure everything is in place should temporary water use restrictions have to be introduced.

### ***Zone 3 Communication Plan***

Build on the actions already taken for Zones 1 and 2 with the addition of the following Zone 3a and Zone 3b actions, which would be especially important during drought periods.

#### *Zone 3a Communication Plan*

- Produce a leaflet explaining why water conservation is vital.
- Activate joint initiatives with the Environment Agency, all the local water companies and Water UK. Consult with Natural England, Ofwat and CC Water.
- Seek to inject urgency into local press coverage.
- Try to increase coverage on local radio programmes.
- Try to get local television to begin running major stories on the worsening situation and potential danger.
- Consider putting signs on all our vehicle fleet stressing the need to conserve water.
- Hold meetings with the editors of all the local newspapers and producers of all the local radio stations to emphasise the seriousness of the situation and to seek their co-operation.
- If required, publicise notice to implement Phase 1 of temporary use restrictions on customers in 2 local newspapers and on our website. 2 weeks for representations will follow before implementation.
- If required, publicise notice to implement Phase 2 of temporary use restrictions on customers in 2 local newspapers and on our website. 2 weeks for representations will follow before implementation.

- Formal notification will be submitted in writing to Fire Authorities at least 72 hours prior to the implementation of any temporary water use restrictions.
- Formal notification will be provided in writing to providers of essential services such as hospitals and schools at least 72 hours prior to the implementation of any temporary water use restrictions.
- Following their implementation customers are informed of the likely frequency and duration of the temporary water use restrictions.

#### *Zone 3b Communication Plan*

- If required, publicise notice to implement Phase 3 of temporary use restrictions on customers in two local newspapers and on our website. Three weeks for representations will follow before implementation.
- Before applying for a Drought Order, the Company will contact the EA, Secretary of State (Defra) and Natural England. Upon submission of its application, we will formally publicise its intention to apply for a Drought Order to the EA and local authorities (except county councils). It will also notify its customers through notices in two local newspapers, on its website and in the London Gazette, as required (Defra, WAG and EA, 2011).
- Formal notification will be submitted in writing to Fire Authorities at least 72 hours prior to the implementation of a Drought Order.
- Formal notification will be provided in writing to providers of essential services such as hospitals and schools at least 72 hours prior to the implementation of a Drought Order.
- Following its implementation customers are informed of the likely frequency and duration of the Drought Order.

#### ***Post Drought Communication Plan***

A decision to withdraw water restrictions in a post drought situation will be taken in consultation with the Environment Agency. Public announcements will be made jointly where appropriate.

Announcements that restrictions are being eased or withdrawn will be made by sending out a 'global' press release to all the media announcing the move. Telephone calls will also be made to key media people, such as editors, producers, etc who have assisted with the drought media liaison process. Customers will be thanked for their co-operation and understanding.

## **Appendix D: River Eden Drought Permit Environmental Assessment Report**

**Appendix E: Groundwater Abstractions Drought Permits  
Environmental Assessment Report**