WATER RESOURCES ACT 1991

APPLICATION FOR A DROUGHT PERMIT

DOCUMENT 3 - STATEMENT OF REASONS

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Executive Summary

This Statement of Reasons (SOR) is provided to support the application by Thames Water (TWUL) for a drought permit at the Farmoor river abstraction on the River Thames following an exceptional shortage of rainfall in the SWOX (Swindon and Oxfordshire) Water Resource Zone (WRZ).

An exceptional shortage of rainfall (ESoR) occurred between November 2021 and August 2022 (see Section 5):

- the Standard Precipitation Index is classified as extremely dry, and is the fourth lowest out of the 131 other 10-month periods ending in August in the historical record.
- rainfall ranking shows that the 10-month period leading up to August 2022 was the fourth driest such period on record, with the only other drier periods being the significant historical droughts of 1976, 1921 and 1934.
- the 10-month rainfall accumulation ending August 2022 is classified as exceptionally low, being only 62% of the long-term average (LTA 1891-2021).
- return period analysis estimates the return period of the current drought as 1 in 36 years.

River levels in the Thames are exceptionally low (Section 5.5.2) meaning that Farmoor abstraction is constrained by licence conditions, resulting in low storage at Farmoor reservoir for the time of year (Section 5.5.3) and further drawdown is predicted at 60% or lower rainfall LTA. Low aquifer levels are affecting the ability of the groundwater sources to provide alternative supplies (Section 5.5.1).

Declining Farmoor storage threatens a serious deficiency of supply for a significant proportion of the population in the SWOX WRZ - ~458,000 customers (Section 5.6).

TWUL have followed the Drought Plan 2022 in managing this event (Section 6). The actions taken include an investment of £1.1 million in media and water efficiency campaigning between May and August 2022. A Temporary Use Ban (TUB) was introduced on 24th August across the whole TWUL region, following similar bans made by Southern Water and South East Water. There has been a clear reduction in demand from peaks in July and August to September (Section 6.5.4).

TWUL has also focussed on internal actions that could increase supply. This has included focussing resources on reducing outage (Section 6.6.5). Outage events over the last 10 months (i.e. from the start of the Exceptional Shortage of Rainfall event) have had a smaller impact on the supply demand balance than the allowance stated in the Annual Review 2020 (17.14 Ml/d) and referenced in the Drought Plan, or than the planning allowance from WRMP19 (17.50 Ml/d). Outage decreased from November 2021 and had an impact of 1.7 Ml/d in the period April to August 2022 (15.8 Ml/d lower than the WRMP19 allowance).

Whilst TWUL has made efforts to find and fix leaks throughout this drought, unfortunately leakage performance has deteriorated from November 2021 (59.72 Ml/d) to September 2022 when the rate was 71.85 Ml/d (Section 6.5.3) (15.21 Ml/d above target). This is in part due to exceptionally high demand and changing ground conditions caused by the hot and dry weather, but is also due

to poor contractor performance. TWUL has put in place a recovery plan, and is recruiting in-house repair teams, in order to improve performance over the coming months. This has started to have an impact on leakage levels which have dropped from a peak in August. Whilst it is accepted leakage performance is not as good as it should be, the reduced outage levels mean that the supply demand balance for the WRZ has not reduced once both outage and leakage are accounted for.

This drought permit application is the first such application in the current drought and allows for increasing abstraction from the Thames at Farmoor by 30 Ml/d (Section 1.3). This permit was selected as the first to be applied for as it provides relatively high water resources benefits and has a significant impact on reducing the threat of a serious deficiency in supplies, by maintaining Farmoor reservoir storage. It is desirable that approval is gained as rapidly as possible to maximise the benefits of the permit before river flows and Farmoor storage potentially recede further. If this permit is not granted the likelihood of Farmoor reservoir failing causing a serious deficiency of supply would increase.

1. Introduction

1.1. Purpose of Statement of Reasons (SOR)

Thames Water Utilities Limited (TWUL) is a water and sewerage undertaker appointed by the Secretary of State. It provides water supplies (approximately 2,600 million litres per day) to 9 million customers across London and the Thames Valley in an area shown in Figure 1.

TWUL is making an application to the Environment Agency (EA) for a Drought Permit under Section 79a of the Water Resources Act 1991 (WRA). This Statement of Reasons is a document required by Defra as part of that application. It includes the information set out in the joint guidance produced by Defra and the Environment Agency dated March 2021.

Before granting this application, the EA must be satisfied that a serious deficiency of supplies exists or is threatened and that the reason for the deficiency is an exceptional shortage of rain. This is the statutory test set out in Section 73 WRA. The purpose of this document is to explain how those criteria have been met within the context of requiring further drought management measures in accordance with TWUL's Drought Plan[1].

[1] TWUL Final Drought Plan 2022, August 2022

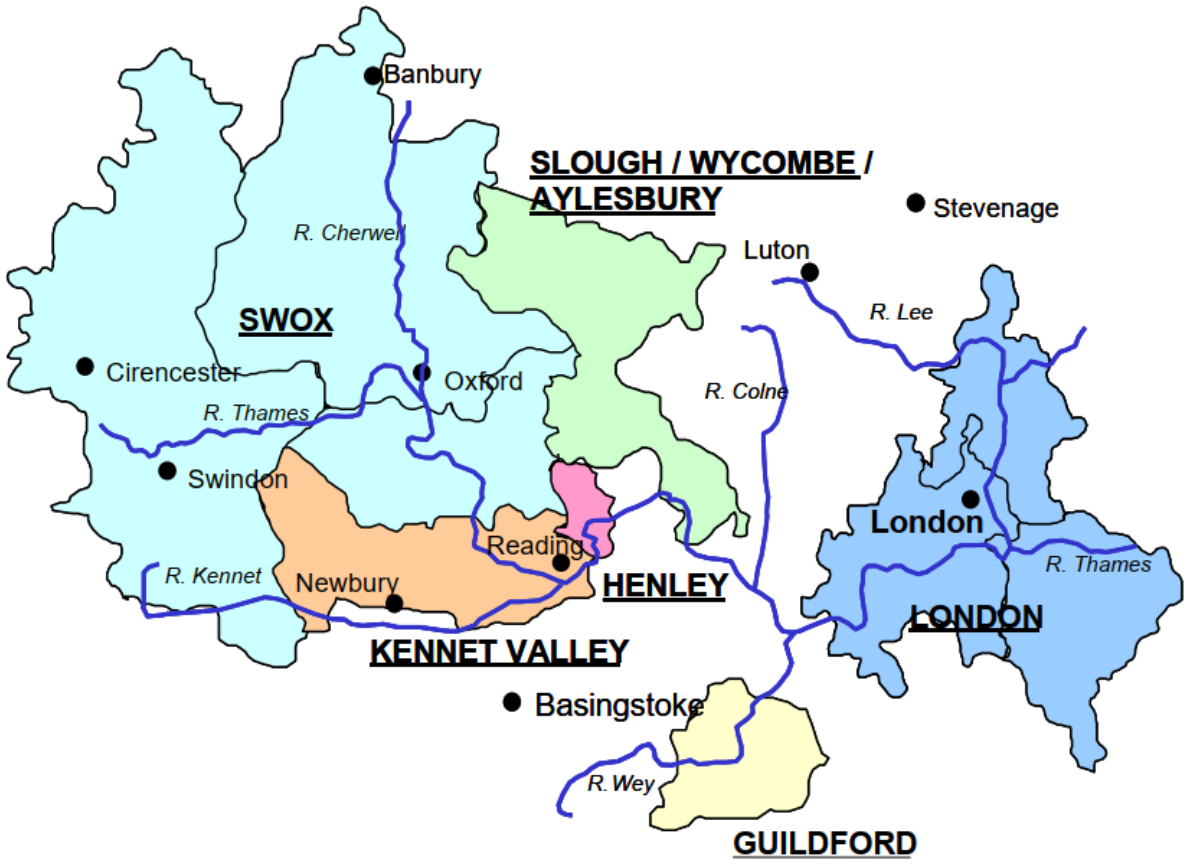


Figure 1 - TWUL's supply area

1.2. Background to drought event

The summer of 2022 has seen an intense heatwave in the UK[2], with July temperatures exceeding 40°C and southern England experiencing the driest July on record.

In the SWOX Water Resource Zone (WRZ), between November 2021 and August 2022 there has been an exceptional shortage of rainfall. Rainfall ranking shows that this period was the fourth driest 10-month period to August on record, with the only other drier periods being the significant historical droughts of 1976, 1921 and 1934.

In their Thames Area Water Situation Report for August, the EA reported that "River flows at 80% of indicator sites were below normal or lower, and over half were exceptionally low."

[2] https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2022/driest-july-in-england-since-1935#:~:text=Drought%20Group%20met.-,Extreme%20heat,%C2%B0C%20at%20Coningsby%2C%20Lincolnshire.

TWUL brought in a Temporary Use Ban on 24th August, following similar demand restrictions by Southern Water in Hampshire and on the Isle of Wight commencing 5th August, and by South East Water in Kent and Sussex which commenced on the 12th August.

1.3. Drought measure sought

Under the provision of section 79a of the Water Resources Act 1991, the purpose of the Drought Permit sought is to authorise, but not require, TWUL to abstract (or increase abstraction) from the following source: River Thames at Farmoor.

The variation to the abstraction licence is specified in Table 1.

Table 1 - Licence variation sought

Measure (site name)	Licence No.	Variation Sought
Farmoor	28/39/16/0078	Normal conditions apply other than: At any time when naturalised flow at Farmoor flow gauging station, downstream of the abstraction, is greater than 346.3 Ml/d, abstraction shall not exceed 300 Ml/d or 12.5 Ml/hour. Under these circumstances, there would be a residual flow of at least 46.3 Ml/d downstream of the abstraction. At any time when naturalised flow at Farmoor flow gauging station, downstream of the abstraction, is between 136.4 Ml/d and 346.4 Ml/d, abstraction shall not result in the residual flow being reduced below 46.4 Ml/d. Abstractions of at least 90 Ml/d would hence be possible. At any time when naturalised flow at Farmoor flow gauging station, downstream of the abstraction, is less than 136.4 Ml/d, abstraction shall not exceed 90 Ml/d or 3.75 Ml/hour.

Subsequent to this application, TWUL intend to provide further application(s) for drought permits at SWOX sources such as Meysey Hampton, Baunton, Ogbourne, Axford, Childrey Warren and Latton.

1.3.1. Need for measure

In the unlikely event of the need to introduce Level 4 emergency restrictions, before applying for an Emergency Drought Order, the Secretary of State would expect TWUL to have taken all necessary actions in respect of:

- conservation and augmentation of water resources
- demand management
- publicity.

Such actions would certainly include the present application for a Drought Permit in which the measure is expected to augment much depleted water resources by up to 30Ml/d, a substantial addition to supply capability in the SWOX WRZ.

1.4. Implementation policy and trigger for Drought Permit application

It follows from above that the drought permit would be implemented if, and only if, TWUL considers there to be a reasonable risk of Level 4 restrictions being needed. As given in TWUL's Drought Plan, implementation policy for introducing drought permit measures in SWOX is based on the naturalised flow in the River Thames at Farmoor[3]:

- Trigger for determining the submission date for NEUB (Non-Essential Use Ban) and drought permit applications is set at 200 Ml/d flow in the River Thames (5-day running mean) under Drought Event Level (DEL) 3 or DEL4 drought event scenarios.

- Trigger for predicting the implementation of NEUB and drought permit options is set at 100 Ml/d (5-day running mean) under DEL3 or DEL4. The latest point of implementing drought permit options will be either by river flow actually receding down to the 100 Ml/d level, or reservoir storage drawing down to 70% in June and July and to 60% in August and September, whichever is the earliest. If NEUB is not already in place company-wide through the London protocol, the above criteria will also be used as the basis for implementing the NEUB.

Note that the 200 Ml/d trigger has been chosen on the basis that it represents the threshold flow at which the maximum licensed abstraction is approximately equal to demand on the Farmoor system; up to this point Farmoor reservoir will be close to full capacity. With further decline in flow, reservoir storage will start to drawdown relatively rapidly with respect to London reservoir storage drawdown.

The 100 Ml/d trigger represents the point of significant risk of Farmoor reservoir storage falling to 70% in June and July and 60% in August and September. As all droughts are different, the correspondence of this trigger with the measures being triggered by the London protocol, which will override demand measures in SWOX, will depend on the way the specific drought has developed. Note that a base flow at Farmoor of 200 Ml/d can sometimes be reached towards the end of the summer/autumn recession under normal water situation conditions (best defined by groundwater levels), typically in September or early October. Therefore, a DEL3 or DEL4 criterion is added to the triggers as set out above.

[3] Drought Plan Appendix P

A naturalised 5-day mean flow at Farmoor which remained consistently below 200Ml/d was reached on 28/7/22 (Section 5.5.2), and a DEL3 drought event scenario was activated on 25/8/22 (more details are provided in Section 6). Therefore, the trigger point for application of drought permits was crossed on 25/8/22.

1.5. Overview of approach

To systematically set out the reasons for requiring the drought permit and in so doing also the criteria to be satisfied, the SOR is structured as noted below:

A) To demonstrate by a series of analytical steps that an exceptional shortage of rain has occurred [Section 5.4].

B) To demonstrate the impact on water resources from the shortage of rain described in A [Section 5.5].

C) To describe the threat to water supply resulting from the stress to water resources as set out in B [Section 5.6].

D) In response to the threat and in accordance with the Drought Plan, to describe the actions taken and measures implemented or planned [Section 6].

E) Environmental Assessment Report (EAR), the purpose of which is to consider the potential impacts to the environment compared to the benefits to supply from additional abstraction and its contribution to lessen the likelihood of incurring very much higher socio-economic costs with Level 4 Emergency Drought Order restrictions should drought conditions continue to become even more severe [Section 7].

Section 2 defines the criteria which need to be satisfied for the drought permit application and which sections of the SOR deal with each criterion.

Sections 3 and 4 give background to the TWUL water supply area and water resources strategy.

2. Criteria to be satisfied

2.1. Principal guidance document

The principal document which sets out the guidelines for drawing up drought permit and drought order applications is: *Drought permits and drought orders. March 2021. www.defra.gov.uk.* This document will be referred to herein as the *Defra guidelines.*

2.2. Criteria

The Defra guidelines (Section 1.1.2) specifies the following main legislative criteria for application of a drought permit:

The Environment Agency must be satisfied that the following conditions have been met before a permit is granted:

- a serious deficiency of supplies of water in any area exists or is threatened

and that

- the reason for the deficiency is an exceptional shortage of rain[4].

In relation to the Statement of Reasons, the Defra guidelines (Section 1.3) state:

You must present a statement setting out the reasons why a drought permit or order is needed with your application. Your statement should:

- explain that a drought order or permit is required due to an exceptional shortage of rain and the lack of rainfall is, or has, the potential to threaten water supplies
- include details of the demand management actions you have undertaken in line with your drought plan such as implementing Temporary Use Bans (TUBS) (where appropriate), enhanced leakage activities and appropriate outage control
- provide detail of other supply options you have considered (such as alternative supplies).

In relation to the application for a drought permit, the Defra guidelines (Section 2.4.2) state:

Your explanation of why you need the permit must set out:

- Evidence of an exceptional shortage of rain
- Evidence that a serious deficiency of supplies exists or is threatened
- The effects of the current water shortage and how you are making full use of available (licensed) sources of water in your water resource zone and if not, why (e.g. abstraction identified as unsustainable and could cause environmental damage)
- How many people are affected by the shortage
- Daily demand on the affected water supply

[4] Section 79A(1) of the Water Resources Act 1991 (WRA 1991) as amended by the Environment Act 1995.

- Alternatives to drought permits that you've considered and why you've rejected them
- What could happen if you do not get a drought permit
- What you've done so far to reduce demand and conserve supplies
- What you've done to comply with any relevant water resource management arrangements
- Any operational changes you could make to avoid future drought-related problems

2.3. Criteria reference in SOR

Table 2 provides the section reference to where the above criteria are considered in the SOR.

Table 2 - Criteria section reference

Defra guidelines section	Criteria	Description	SOR Section/Comments
1.3	explain that a drought order or permit is required due to an exceptional shortage of rain and the lack of rainfall is, or has, the potential to threaten water supplies	Application of methodology to quantify *exceptional shortage of rain*.	5.4
		Application of methodology to quantify impact of exceptional shortage of rain on water resources.	5.5
		Assessment of threat to supplies.	5.6
	include details of the demand management actions you have undertaken in line with your drought plan such as implementing Temporary Use Bans (TUBS) (where appropriate), enhanced leakage activities and appropriate outage control	Application of Drought Management Methodology	6.2
		Demand-side measures	6.5
	provide detail of other supply options you have considered (such as alternative supplies)	Supply-side measures	6.6
2.4.2	Evidence of an exceptional shortage of rain	Monthly rainfall figures to show how exceptional event is.	5.4

Defra guidelines section	Criteria	Description	SOR Section/Comments
	Evidence that a serious deficiency of supplies exists or is threatened	Assessment of threat to supplies.	5.6
	How many people are affected by the shortage	Population affected.	4.4
	Daily demand on the affected water supply	Daily water demand and how it is met.	4.6 and 4.7
	What you've done so far to reduce demand and conserve supplies	Steps taken to reduce demand and the effect they have had.	6.5
	What you've done to comply with any relevant water resource management arrangements	Evidence that the water company has operated in accordance with any water resource management arrangements relating to the application.	1.4 and 6
	Any operational changes you could make to avoid future drought-related problems	Any changes to operational practices or policies that will help avoid or reduce the likelihood of future drought related problems.	6.7

Defra guidelines section	Criteria	Description	SOR Section/Comments
	The effects of the current water shortage and how you are making full use of available (licensed) sources of water in your water resource zone and if not, why (e.g. abstraction identified as unsustainable and could cause environmental damage)	How full use is being made of available (licensed) sources.	6.6.1.1
	Alternatives to drought permits that you've considered and why you've rejected them	Other options considered and reasons for rejection.	6.6.1
	What could happen if you do not get a drought permit	The consequences if the Drought Permit is not granted.	5.6

3. TWUL's water supply area - background

3.1. The Thames catchment - basics

3.1.1. Geology

As can be seen in Figure 2, the Thames catchment has approximately a 60/40 split between clay and outcrop aquifer. The SWOX and London WRZs are also shown in the figure.

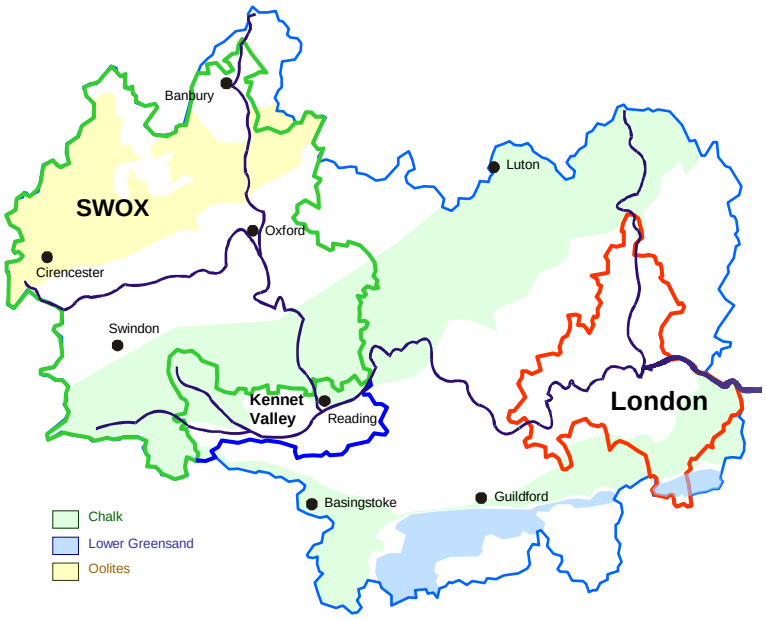


Figure 2 - Thames catchment geology with aquifer and clay outcrops (white areas) and SWOX WRZ

3.1.2. Surface water (sub-catchments)

In terms of surface water flow, the Thames catchment has 23 sub-catchments (Figure 3) of which Cherwell, East and West Cotswolds, Upper Thames, Ock, Thame, Berkshire Downs and Chilterns West are relevant in assessing the water resources situation in the SWOX WRZ.

Figure 3 - Thames sub-catchments

3.1.3. Rainfall

Average annual rainfall over the Thames catchment is around 700 mm[5], distributed fairly evenly through the year but with a tendency towards an autumn maximum. The western part of the Thames catchment will receive a somewhat higher annual average.

On average 65-70% of the rainfall is lost to evaporation, concentrated mainly in the summer. This imposes a marked seasonality on the Thames flow regime and aquifer recharge patterns.

3.2. Water supply and importance of groundwater

During the summer, when evapotranspiration losses are high and dry soil conditions greatly restrict surface runoff, most of the river flow derives from the outflow (baseflow) from the extensive aquifer outcrops within the Thames catchment.

Some 80% of TWUL's water supply is derived from surface water abstraction (largely from the upper and lower Thames) and the remainder is derived from groundwater abstraction. However, as for most of southeast England, during periods of prolonged low rainfall leading to a serious drought, water supply is largely sustained by groundwater abstraction and baseflow within rivers.

[5] 'Marsh,T.J. and Hannaford, J. (Eds) 2008. UK Hydrometric Register. Hydrological Data UK series. Centre for Ecology and Hydrology, Wallingford

For SWOX WRZ it is the baseflow from the Cotswold Oolites that provides the water resource during drought for Farmoor reservoir.

The major aquifer systems that contribute to the baseflow in the River Thames are:

- Great and Inferior Oolites of the Cotswolds.
- Chalk of the Marlborough Downs.
- Chalk of the West Berkshire Downs.
- Chalk of the Chilterns.
- Lower Greensand of the Guildford area.
- Chalk of the Hampshire Downs.
- Chalk of the North Downs.
- Thames River Terrace Gravel Deposits.

4. Water resources strategy

This sub-section covers general aspects of water resources planning relevant to drought management.

4.1. Water resources zones

As explained in Section 3.5 of the Drought Plan, supply demand planning and thus drought management planning, starts at the Water Resources Zone (WRZ) level. A WRZ is defined in the Environment Agency's Water Resource Planning Guideline as an area of well-integrated water supply connectivity in which there is the same risk to security of supply. That is to say, any demand-side measures introduced by a water company would apply to all consumers within the WRZ in question.

For water resource planning purposes the TWUL supply area is divided into six independent WRZs reflecting the different characteristics of the supply areas and associated risks to meeting demand within the TWUL area.

The London WRZ is the largest of the six zones and covers the Greater London area. The next largest is the Swindon and Oxfordshire zone (SWOX). The water resources for both of these zones are largely based on abstraction of water from the River Thames, which is stored in large raw water reservoirs. The other zones within the Thames Valley are Kennet Valley (including Reading and Newbury), Henley, Slough/Wycombe/Aylesbury (SWA) and Guildford.

4.2. Levels of Service

The frequency of imposition of water use restrictions defines TWUL's Levels of Service customers receive. The lower the level of service, the more frequent is the imposition of restrictions to reduce demand. Conversely, the higher the level, the less frequently they are required.

A water company's conformance to its stated Levels of Service is a direct reflection of the combined effectiveness of its Water Resources Management Plan (WRMP) and Drought Plan. It is therefore important that the two sets of plans should be as far as possible consistent with each other.

Both the Drought Plan and WRMP are based on the following principles:

- The need to maintain security of supply for customers.
- The level of restrictions imposed on customers is commensurate with TWUL's Levels of Service (LoS).

The planned Levels of Service for water supply restrictions adopted by TWUL are set out below in Table 3.

Table 3 - Planned Levels of Service[6]

Restriction Level	Frequency of Occurrence	Water use restrictions
Level 1	1 year in 5 on average	Intensive media campaign
Level 2	1 year in 10 on average	Temporary Use Bans (TUBs) and Enhanced media campaign
Level 3	1 year in 20 on average	Non-Essential Use Bans (NEUBs) requiring the granting of a drought order and Drought Permits Note these would be applied in a staged manner
Level 4	Never (in reality this equates to ~ 1 year in 100 years on average)	If extreme measures (such as standpipes and rota cuts) were necessary, their implementation would require the granting of an Emergency Drought Order

[6] Extracted from Table 1 of the Drought Plan.

4.3. Supply-demand balance

For ensuring it has an adequate supply of water, a water company must plan for a dry year demand (Dry Year Distribution Input). This is the demand that would be expected during dry, hot conditions. In order to plan for this dry year demand it is necessary to understand the raw water availability during normal conditions and how this may be reduced during a range of different drought conditions. The amount of water resources available to maintain water supply during drought periods, with a given frequency of demand restrictions or supply interruptions, is termed water available for use which is defined as:

Water available for use = Deployable Output minus outages plus/minus bulk supply imports to/exports from WRZ

Deployable Output is defined as the output of a commissioned source or group of sources or of a bulk supply for a given level of service as constrained by:

- Environment
- Abstraction licence, if applicable
- Pumping plant and/or well/aquifer properties
- Raw water mains and/or aquifers
- Transfer and/or output main
- Treatment
- Water quality

Outages are temporary reductions in Deployable Output, which can be caused by factors such as mechanical failure or pollution events. During drought it is clearly important that outages are minimal.

Within a given WRZ, the difference between water available for use and the dry year demand plus an allowance for planning uncertainties (Target Headroom) is referred to as the supply demand balance. If dry year demand plus Target Headroom is equal to water available for use, then the WRZ in question is said to be in supply demand balance. Conversely, should the dry year demand plus Target Headroom exceed water available for use then the WRZ is said to have a supply demand deficit. The greater the deficit, the greater the risk that water use restrictions would need to be introduced more frequently than stated in TWUL's Levels of Service and ultimately the greater the risk to maintaining essential supplies.

4.4. SWOX WRZ population affected

It has been estimated that the supply to around 458,000 of TWUL's customers in the SWOX WRZ are at risk of a deficiency of supply if Farmoor Reservoir fails (see Section 5.6 for details).

4.5. Previous droughts (within last 5 years)

No drought measures (e.g. drought permits and TUBs) have been imposed in the last 5 years; the only measures have been campaigns to ask customers to reduce usage for water supply purposes rather than drought.

4.6. Daily demand on the affected supply

The average demand on Farmoor reservoir between 1 July 2022 and 13 September 2022 has been 162.9 Ml/d. This has reduced slightly in the early part of September, with the average between 1-13 September 2022 being 149.1 Ml/d.

4.7. Components of the SWOX WRZ water supply

SWOX WRZ's water supply is based on an integrated network of the Farmoor river /reservoir system (8 kilometres upstream of Oxford) and several groundwater sources, the principal one being Gatehampton. Due to the importance of the Farmoor resource system, which supplies around 42% of SWOX WRZ's demand (see Section 5.6), coupled with its relative vulnerability to drought, the performance of the Farmoor river/reservoir system is the primary factor in determining the threat to supplies in the SWOX WRZ.

4.8. Serious deficiency of supply - rationale

In order to demonstrate that a serious deficiency of supplies of water in the SWOX WRZ is threatened, the following rationale is applied:

i) Security of supply of the SWOX WRZ means in practice removing as far as possible the need for emergency drought measures, which would be required when Farmoor reservoir storage draws down to a level of 33%[7]. This means it is crucially important to maintain reservoir storage to as high a level as the flow in the River Thames will allow.

ii) As a drought worsens, the flow in the River Thames gradually reduces such that the quantity of river water available to transfer to Farmoor reservoir, and thereby maintain reservoir storage, also reduces. This renders SWOX's demand for water increasingly dependent upon the volume of water stored in Farmoor reservoir as river flows recede under worsening drought conditions.

iii) Flow in the River Thames is made up of surface runoff and baseflow, the latter being the outflow of groundwater emanating from the Great and Inferior Oolites of the Cotswolds, see Section 3. During prolonged dry periods, baseflow will be the

[7] As per Appendix P of the Drought Plan: The trigger for applying to Defra for an Emergency Drought Order would be after the implementation of NEUB measures and would be based on modelling of the likely decline in Farmoor storage taking into account the benefit derived from implementation of Drought Permit options. This assessment would use modelling as a guide to determine the potential time to reach the 33% and the application for an Emergency Drought Order would be based on the expected elapsed time to obtain an EDO. Assessment of conditions at the time of year would also be instrumental in the decision.

major component of river flow, that is to say, baseflow is the minimum flow during prolonged dry periods. Significant summer rainfall can help to provide additional peaks of river flow from which reservoir storage can benefit. However, being derived from fast-flowing surface run-off, these peaks tend to be short lived, generally rising and falling in less than one week.

iv) Winter rainfall (generally taken as October through to March) is effective rainfall insofar as the conditions of low evapo-transpiration enable a large proportion of rainfall to either run off into streams and rivers or recharge the underlying aquifers. Winter rainfall therefore provides the long-term stock of water resources in the form of higher groundwater levels and consequent higher baseflows into streams and rivers. Below normal winter rainfall means that baseflows, and hence the longer-term stock of water resources, will be below normal. By the end of winter groundwater levels will generally be at their highest and, as a consequence, so will baseflows. Thereafter into spring and summer groundwater levels will recede and reach their lowest point generally around mid-autumn before rising again with the onset of winter rainfall. Similarly, baseflows will follow the same cyclic pattern.

v) It follows from iv that the greater the cumulative shortfall of below average winter rainfall or effective rainfall, the potentially more serious will be the ensuing water resources situation.

vi) Even during exceptional low groundwater conditions at the end of a second successive dry winter recharge season (usually taken as March), SWOX WRZ's reservoir storage has historically been above 90%. However, because groundwater levels will be exceptionally low under these conditions, the ensuing summer's baseflows will be insufficient to maintain Farmoor reservoir storage which will tend to decline at an accelerating rate over the summer and autumn months, thereby posing an increasing threat to TWUL's ability to maintain essential supplies as reservoir stocks decline.

The above rationale has guided the arrangement in the Drought Plan for triggering the application and implementation of DD11 restrictions and drought permits, see Section 1.4.

4.9. Summary

The primary factor determining the threat to supplies in the SWOX WRZ is the level of reservoir storage. During prolonged dry periods, this is governed largely by the baseflow in the River Thames above Farmoor, which is dependent upon the status of groundwater levels in the Great and Inferior Oolites of the Cotswolds. This in turn is governed by the cumulative antecedent effective rainfall which typically recharges the major aquifers during the winter months. The potential severity of a drought is a function of the cumulative shortfall of effective rainfall at the end of the winter recharge season. Periods of significant summer rainfall can help to boost declining reservoir stocks.

5. Exceptional Shortage of Rainfall

The purpose of this section is to demonstrate that the SWOX WRZ has experienced an exceptional shortage of rainfall (ESoR) which, Sections 5.5 and 5.6 will show, could lead to a serious deficiency of supply.

EA guidance[8] on evidencing an exceptional shortage of rainfall sets out the requirements. Some of these are essential, whilst others are recommended or can provide supporting evidence – these are set out in Table 4 and Table 5.

It is necessary to define the period of analysis over which the ESoR has occurred and also the geographical extent, which are outlined in Sections 5.1 and 5.2 respectively. Further detail supporting these decisions is provided in the other parts of Sections .

The analysis of the rainfall data is provided in Section 5.4, and has largely been completed utilising the EA's analysis tools.

The water resources situation and the threat of a serious deficiency of supply are detailed in Sections 5.5 and 5.6.

[8] Hydrological guidance for the assessment of an Exceptional Shortage of Rain (ESoR) – Draft (EA, March 2021) and Appendix D in the Drought Permits and Drought Orders – Supplementary Guidance (EA, March 2021).

Table 4 - Decision making evidence for rainfall (Reproduced from Table 6 in the ESoR guidance)

Decision making evidence (rainfall)	Category	Section	Notes
SPI	Essential	5.4.1	
Rainfall ranking	Essential	5.4.2	
Rainfall probability bands	Essential	5.4.3	
Rainfall return period analysis	Recommended as supporting evidence	5.4.2	
Percent of long term average rainfall	Recommended as supporting evidence	5.4.4	
Temporal variability in rainfall	Supporting evidence	N/A	Not required
Spatial variability in rainfall	Supporting evidence	N/A	Not required
Long term weather forecast	Supporting evidence	N/A	Not required

Table 5 - Decision making evidence for non-rainfall variables (Reproduced from Table 7 in the ESoR guidance)

Decision making evidence (non-rainfall)	Category	Section	Notes
Soil Moisture Deficit	Supporting evidence	5.5.1.1	Not required
Temperature	Supporting evidence	N/A	Not required
Effective rainfall	Supporting evidence	N/A	Not required
River flow	Supporting evidence	5.5.2	
Reservoir storage	Supporting evidence	5.5.3	
Groundwater levels	Supporting evidence	5.5.1	

5.1. Period of analysis

The period of analysis to evidence the ESoR is from November 2021 to the end of August 2022 (10 months). Figure 4 shows the cumulative SWOX rainfall from June 2021 to August 2022, and the long-term average (LTA) rainfall (1961-1990). This shows that rainfall was around the long-term average until November 2021, and the shortage builds from this time until the most recent data point in August 2022. Additional evidence to support this period of analysis is presented in Sections 5.4.4 and 5.5.1.

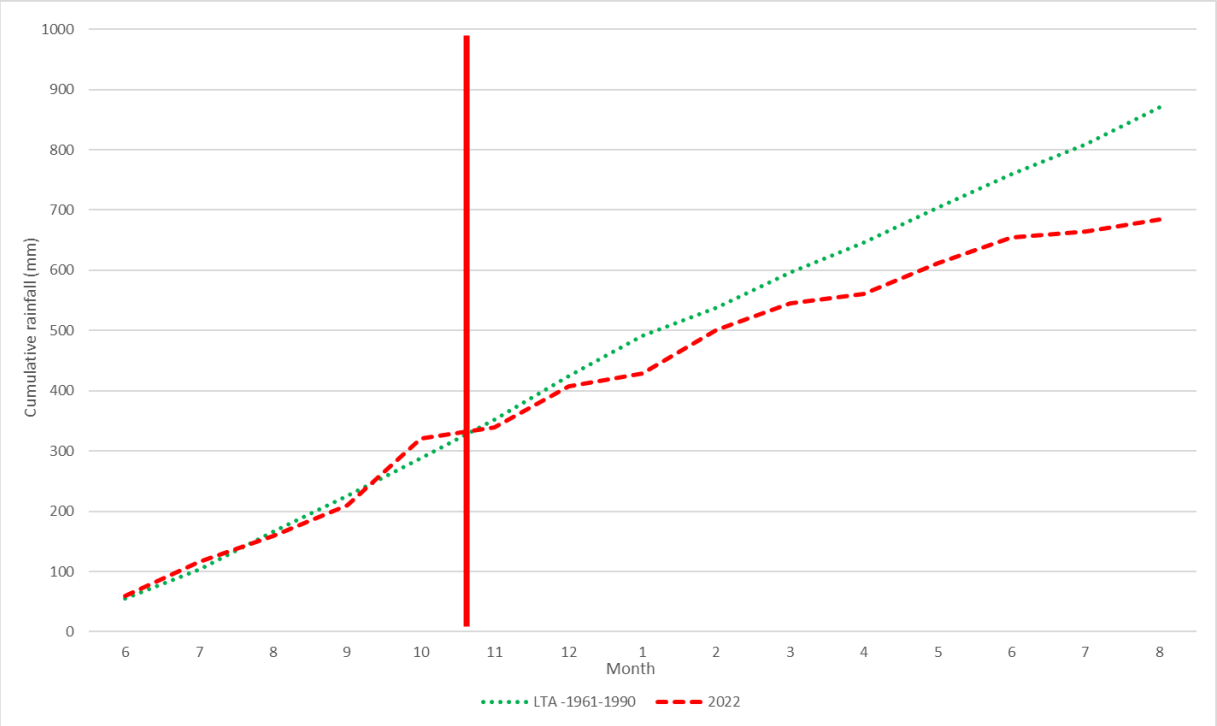


Figure 4 – SWOX cumulative monthly rainfall from June 2021 to August 2022, and long-term average with red vertical line indicating the beginning of the rainfall shortage from November

5.2. Geographical extent of analysis

The geographical extent selected incorporates the following hydrometric areas:

- Cherwell
- Cotswolds East
- Cotswolds West
- Upper Thames
- Ock
- Thame
- Berkshire Downs
- Chilterns West

These can be seen in Figure 5 below.

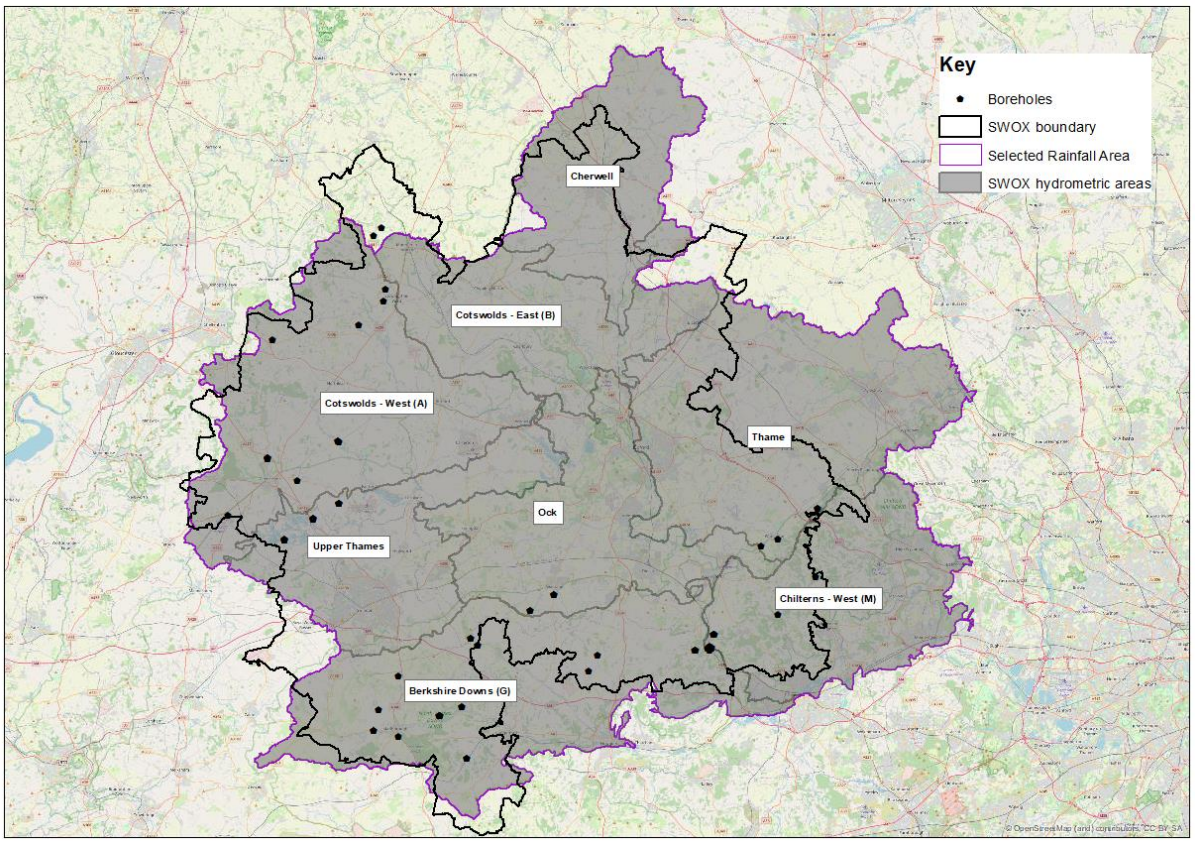


Figure 5 - Map showing Thames hydrometric areas covering the SWOX WRZ and the selected extent for the rainfall analysis.

Although the drought permit being applied for is for the Farmoor abstraction on the Thames, the shortage of rainfall in the entire WRZ is of relevance to this application. There are a number of groundwater sources in the WRZ. The groundwater levels in the observation boreholes, and sources (particularly the key sources of Baunton, Axford and Meysey Hampton), are low (see Section 5.5.1) due to the prolonged recession and lack of recharge to the aquifers caused by the sustained exceptional shortage of rainfall. A number of these sources are therefore constrained, meaning that the supply from Farmoor reservoir cannot be conserved and supported by additional groundwater abstraction.

If Farmoor storage cannot be maintained this could lead to a serious deficiency of supply in the SWOX WRZ (see Section 5.6).

For this reason the ESoR is being assessed for the area that incorporates all sources in the zone in this application.

5.3. Rainfall data

The rainfall data set used in this analysis is the HadUK areal rainfall for hydrological areas, and has been provided by the Environment Agency (EA) under licence, and updated monthly. HadUK data, produced by the Met Office, is a 1 km gridded product derived from the interpolation of

observed rainfall. The EA were provided with a shapefile comprising the areas listed in Section 5.2. The EA then produced a single time series of monthly rainfall for the selected area.

The record covers the period from 1891 to August 2022. In accordance with the guidance the entire record is used for the majority of the assessments described in this section. However, in calculating the percentage deviation from the long-term average rainfall the standard period of 1961 to 1990 was used (Section 5.4.4), which is also in accordance with the guidance.

5.4. Analysis

This section contains the analysis to show the exceptional shortage of rainfall in the selected area and over the chosen period.

5.4.1. Standard Precipitation Index

The Standard Precipitation Index (SPI) is a measure of deviation from average values of rainfall, normalised according to the natural variability. A value of less than -2 indicates extremely dry conditions. The EA's SPI tool has been used to calculate SPIs for the SWOX area, utilising all of the data from 1891 to August 2022. Table 6 provides the SPI values, and cumulative rainfall totals for period lengths between 1 and 12 months, ending in August 2022. This shows that the 10 month period selected for analysis has a value of -2.36 and is extremely dry. A number of the other periods also have values less than -2 including the 5, 6 and 8 month periods. The 11 and 12 month periods have values greater than -2 which indicates that there was more rainfall prior to November 2021, providing a further indication that the rainfall shortage started in November 2021.

Figure 6 is a plot of the 10 month SPIs ending August for all of the years in the record (1892 to 2022). This shows that the current drought is the fourth most severe in the historic record out of 131, when considering this SPI period. The only historical droughts that were more severe for a 10 month SPI are 1976, 1921 and 1934.

The SPI therefore indicates that there is clearly an exceptional shortage of rainfall.

Table 6 - SWOX SPI for month ending August 2022

Period (Months)	Rainfall total in period	SPI
1	20.1	-1.55
2	29.8	-2.67
3	72.5	-2.04
4	123.9	-1.87
5	138.9	-2.32
6	183.4	-2.15
7	255.5	-1.62
8	277	-2.10
9	344.7	-1.90
10	363	-2.36
11	474.4	-1.77
12	525.6	-1.74

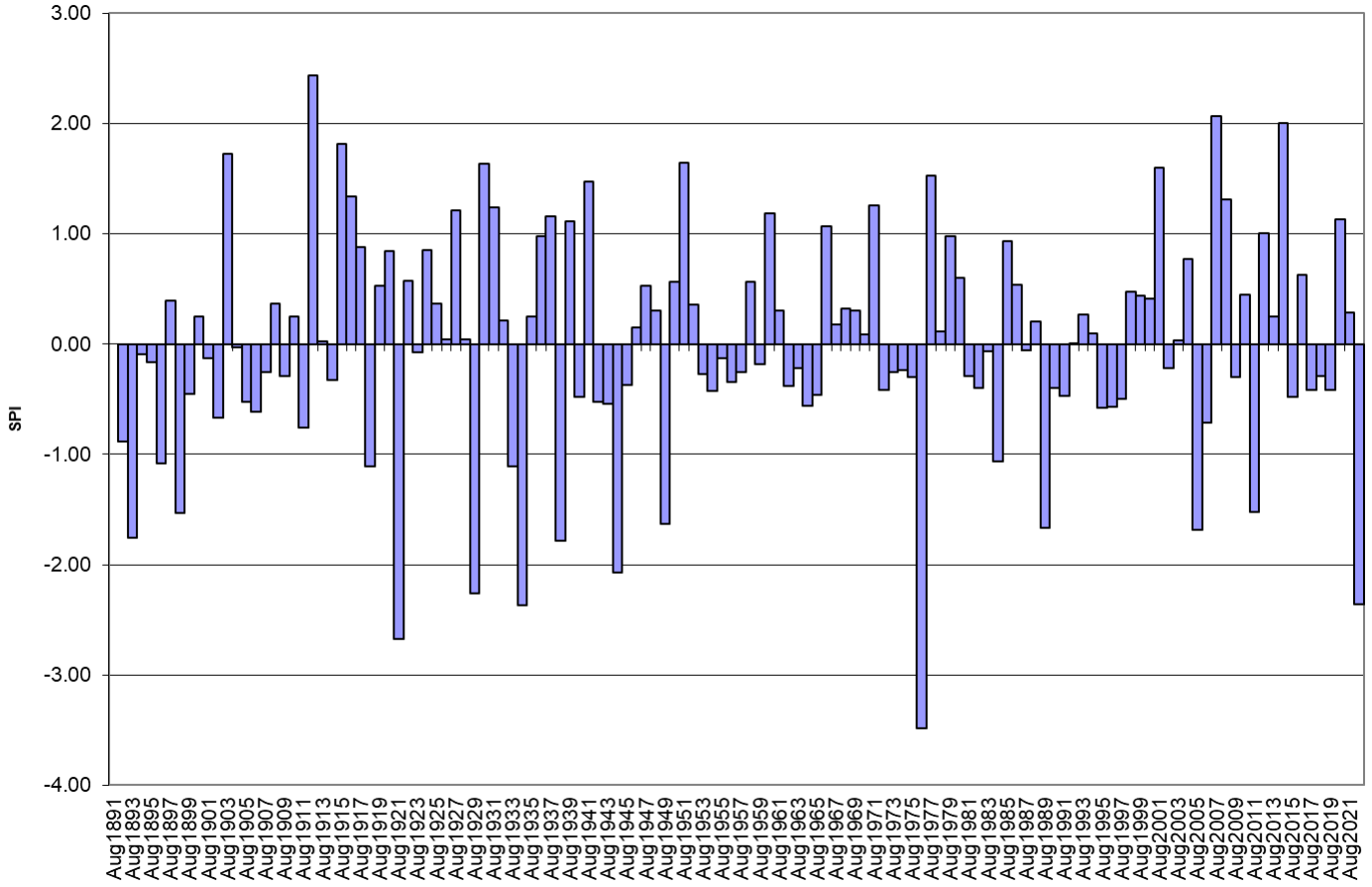


Figure 6 – Plot of SPIs for 10 month periods ending August from 1882 to 2022

5.4.2. Rainfall ranking and return period analysis

As described above, it was identified that the rainfall deficit for the current drought event began in November 2021. The entire historic record (1891-2022) was therefore analysed and the accumulated rainfall from November to the following August (10 month accumulations ending August) was calculated for each year in the record. When the rainfall totals were ranked the current drought was the fourth most severe from the last 131 years (which also supports the SPI analysis in Section 5.4.1). Using the recommended Type 1 EV distribution[9] the probability and return period for each of the events was calculated - the current drought had a return period of approximately 36 years (see Table 7).

[9] Described in the EA document "Categorising hydrological data by probability ranking" (EA, 2011), which states that the probability is calculated from P = (r-0.4)/(N + 0.2) where P is the probability of the event, r is the rank of the event in the population and N is the number of events (i.e. 131 events). The return period is then 1 divided by P.

Table 7 – Ranked 10 month ending August rainfall totals with return periods

Rank	Year	10 month rainfall total (mm)	Return Period
1	1976	281	219
2	1921	338	82
3	1934	362	50
4	2022	363	36
5	1929	371	29
6	1944	386	23
7	1938	411	20
8	1893	413	17
9	2005	419	15
10	1989	421	14

A plot of the cumulative rainfall totals for the rainfall from the 6 most severe events (based on 10 month accumulations ending in August) and for 2022 is shown in Figure 7.

The cumulative rainfall for this period in 2022 is 363 mm, which represents a cumulative deficit of 232 mm when compared to the 1891 to 2021 long-term average (595 mm).

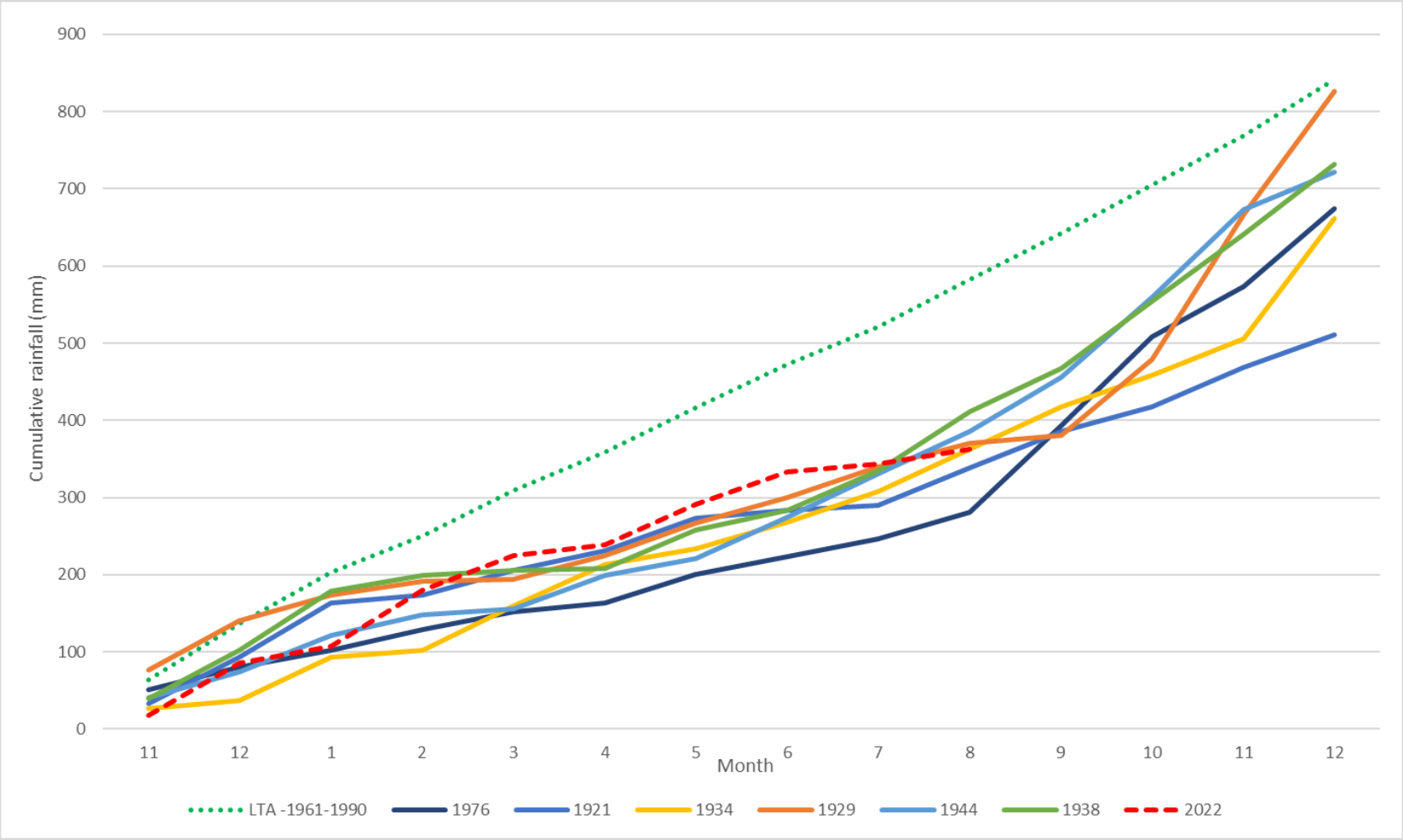


Figure 7 – SWOX cumulative rainfall for 6 most severe historical events (ranked on 10 month ending August accumulations) and 2022

5.4.3. Probability bands

The EA's *Monthly rainfall probability ranking macro* spreadsheet was used to analyse the rainfall data and to produce Figure 8. This shows the cumulative rainfall, and the probability banding for each month from September 2021 to August 2022, and for accumulations over different numbers of months from 1 to 12. The probability bands are reproduced from the EA's guidance note[10] in Table 8.

Figure 8 shows that a 10 month drought has developed from November 2021 to August 2022. The relevant banding for each of the months from the beginning of this drought (indicated by the black dashed box) is either notably low, or exceptionally low in the case of July and August.

It can also been seen that the 10 month accumulation to August represents only 62% of the long-term average (1891 – 2021) rainfall for this period.

This provides further evidence that there has been an exceptional shortage of rain.

Table 8 – Probability bandings

Category	Probability of value being surpassed by lower value P(X)	Probability of occurrence
Exceptionally high	>0.95	0.05 (5%)
Notably high	0.87 – 0.95	0.08 (8%)
Above normal	0.721 – 0.869	0.15 (15%)
Normal	0.28 – 0.72	0.44 (44%)
Below normal	0.131 – 0.279	0.15 (15%)
Notably low	0.05 – 0.13	0.08 (8%)
Exceptionally low	<0.05	0.05 (5%)

[10] Categorising hydrological data by probability ranking (EA, 2011)

Station:	SWOX											
Period (Months) of Cumulative Rainfall	Period Ending in Month											
	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22	Jul 22	Aug 22
1	51.2	111.4	18.3	67.7	21.5	72.1	44.5	15.0	51.4	42.7	9.7	20.1
	N	AN	EL	N	NL	AN	N	NL	N	N	EL	NL
	86%	179%	29%	93%	33%	151%	77%	30%	88%	77%	20%	33%
2	93.7	162.6	129.7	86.0	89.2	93.6	116.6	59.5	66.4	94.1	52.4	29.8
	N	N	N	NL	BN	N	N	BN	BN	N	NL	EL
	77%	133%	103%	63%	64%	82%	110%	55%	61%	83%	50%	27%
3	150.6	205.1	180.9	154.4	107.5	161.3	138.1	131.6	110.9	109.1	103.8	72.5
	N	N	N	N	EL	N	N	N	BN	NL	NL	EL
	88%	112%	97%	99%	53%	86%	80%	84%	67%	67%	64%	44%
4	210.1	262.0	223.4	248.6	218.9	179.6	205.8	153.1	183.0	153.6	118.8	123.9
	N	N	N	N	BN	NL	N	BN	N	BN	EL	EL
	93%	113%	90%	96%	83%	72%	84%	69%	86%	69%	56%	55%
5	314.3	321.5	280.3	291.1	270.1	291.0	224.1	220.8	204.5	225.7	163.3	138.9
	N	N	N	BN	BN	BN	NL	BN	BN	BN	NL	EL
	111%	112%	95%	91%	83%	93%	73%	75%	73%	84%	60%	51%
6	333.5	425.7	339.8	348.0	312.6	342.2	338.5	239.1	272.2	247.2	235.4	183.4
	N	AN	N	BN	BN	N	BN	NL	BN	BN	BN	EL
	100%	123%	97%	94%	81%	92%	91%	67%	77%	74%	74%	55%
7	365.1	444.9	444.0	407.5	369.5	384.7	386.7	350.5	290.5	314.9	256.9	255.5
	N	N	N	N	BN	BN	BN	BN	NL	BN	NL	EL
	93%	112%	108%	96%	85%	89%	90%	83%	70%	77%	67%	67%
8	414.9	476.5	463.2	511.7	429.0	441.6	429.2	401.7	401.9	333.2	324.6	277.0
	N	N	N	N	BN	BN	BN	BN	BN	NL	NL	EL
	94%	105%	101%	106%	87%	91%	87%	84%	84%	71%	71%	62%
9	512.4	526.3	494.8	530.9	533.2	501.1	486.1	444.2	453.1	414.6	342.9	344.7
	N	N	N	N	N	BN	BN	BN	BN	BN	EL	EL
	101%	105%	96%	100%	97%	93%	90%	82%	84%	83%	66%	66%
10	618.5	623.8	544.6	562.5	552.4	605.3	545.6	501.1	495.6	495.8	434.3	363.0
	N	N	N	N	BN	N	BN	BN	BN	BN	NL	EL
	107%	110%	96%	95%	92%	102%	92%	85%	83%	83%	78%	62%
11	671.0	729.9	642.1	612.3	584.0	624.5	649.8	560.6	552.5	538.3	505.5	414.4
	N	AN	N	N	BN	N	N	BN	BN	NL	NL	EL
	104%	114%	102%	96%	89%	97%	99%	87%	85%	82%	79%	74%
12	840.8	782.4	748.2	709.8	633.8	656.1	669.0	664.8	612.0	595.2	548.0	525.6
	AN	N	N	N	BN	BN	N	N	BN	NL	NL	EL
	119%	111%	106%	101%	90%	93%	95%	94%	87%	84%	78%	75%

Figure 8 – SWOX cumulative monthly rainfall probability bandings

5.4.4. Percent of long term average rainfall

The long-term average monthly rainfall values were calculated for SWOX from the rainfall data provided by the EA (as described in Section 5.3). The long-term averages were taken for the 1961-1990 standard period in accordance with the guidance. SWOX monthly rainfall totals are compared to the long-term average monthly values in Figure 9. This shows that prior to November 2021, while there were some months that had a shortage of rainfall, there were also some that had a surplus. From November 2021 to August 2022 there is only one month of above average rainfall (February 2022), while 5 of the 10 months have a deficit of 50% or more. This provides additional evidence for the selection of the November 2021 to August 2022 period of analysis, and for the ESoR.

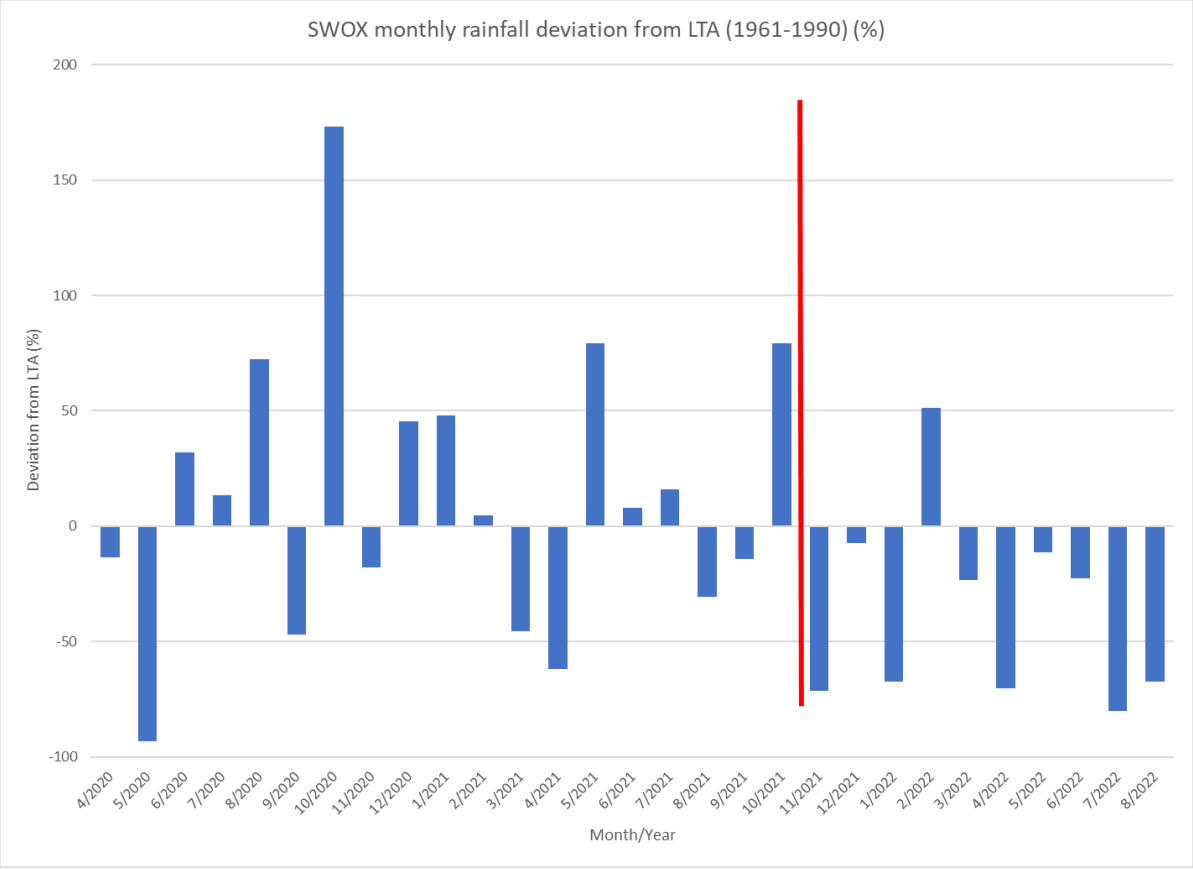


Figure 9 – SWOX monthly rainfall deviation from long term average from April 2020 to August 2022. Red line indicates the start of the period of analysis for the ESoR

5.5. Water Resources Situation

The purpose of this section is to demonstrate that due to the exceptional shortage of rain, as evidenced in Section 5.4, groundwater levels and river flows are substantially below their normal

levels for the time of year, which will provide evidence in support of the threat of a serious deficiency to water supply in Section 5.6.

5.5.1. Groundwater status

Figure 10, reproduced from the EA's August 2022 Thames Water Situation Report, shows the location of the regional observation boreholes. These are colour-coded to provide a guide as to the groundwater level status within the major aquifers across the Thames Area based upon the EA's probability bands for ranking flow, groundwater levels and rainfall (shown in the key, with probabilities given in Table 8). Those relevant to the SWOX WRZ are Ampney Crucis (notably low), Jackaments Bottom (exceptionally low), Rockley (notably low), Gibbet Cottages (below normal) and Stonor Park (below normal).

Figure 10 also shows the surface water monitoring points. Due to the lack of rainfall and hence surface runoff, river flows are at a comparable probability band to groundwater status, with the River Coln and the Thames at Farmoor being exceptionally low.

As noted in Section 5.2 low groundwater levels are constraining a number of groundwater source abstractions, including the key sources of Baunton, Axford and Meysey Hampton. This prevents groundwater sources being used to relieve demand on Farmoor preventing mitigation of the drawdown rate.

In addition the aquifers that provide baseflow to the Thames at Farmoor, which the levels of Ampney Crucis and Jackaments bottom represent, are notably and exceptionally low, respectively. This is the reason for exceptionally low flows in the Thames at Farmoor.

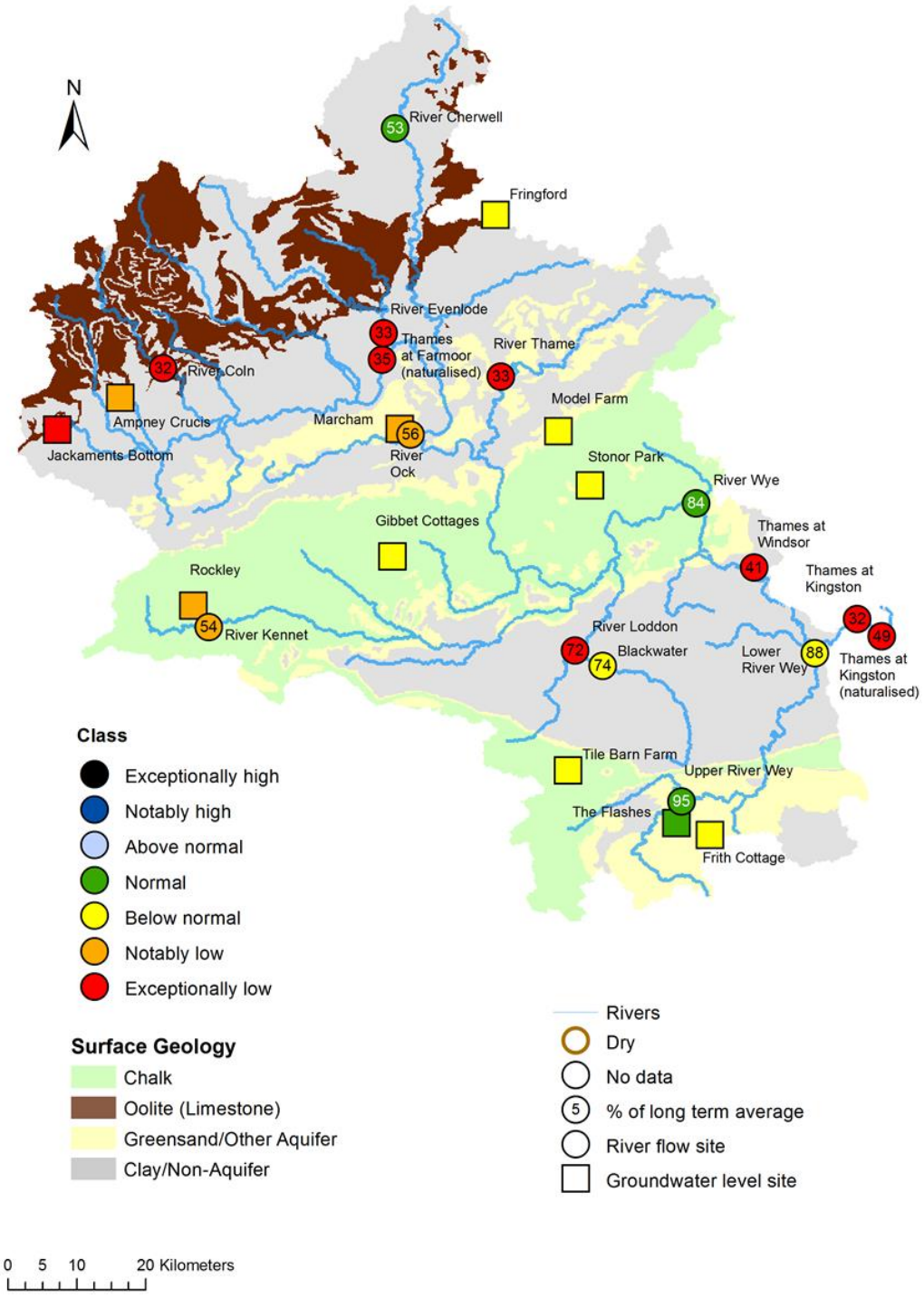


Figure 10 – Groundwater and surface water site status from the Thames Water Site Situation Report August 2022

5.5.1.1. Aquifer responses to ESoR

Figure 11 to Figure 15 show the groundwater levels from January 2021 to August 2022 in the observation boreholes in the major aquifers that are relevant to the SWOX sources. These respond differently to the exceptional shortage of rainfall due to their characteristics.

Figure 11 and Figure 12 show Ampney Crucis and Jackaments Bottom respectively. These boreholes are in the Great Oolite and Inferior Oolites in the Cotswolds. These aquifers provide a large proportion of the baseflow to the Thames at Farmoor, and their levels are therefore indicative of the flows in the Thames. As noted in Section 5.5.1 they currently sit in the notably low and exceptionally low probability bandings.

The figures show that these Aquifers are more responsive to rainfall. Ampney Crucis level fluctuated between below Normal and Above Normal throughout winter 2021-22, and then receded from Normal to Notably Low between April and August 2022.

Jackaments Bottom has generally been Below Normal or lower from December 2021, although it did recover to Normal in April 2022. From April there was a rapid recession and it dropped to Exceptionally Low around June 2022, and has continued to recede.

Gibbett Cottages (Figure 13), Rockley (Figure 14) and Stonor Manor/Stonor Park (Figure 15) are sited in chalk aquifers of the Berkshire Downs, Marlborough Downs and Chilterns West respectively. These aquifers respond more slowly to rainfall than the sources in the Oolites, particularly Gibett Cottages and Stonor Manor; these two sources receded into the Below Normal band in February 2022. The effects of the ESoR can be seen here as the groundwater levels did not rebound significantly in the April to July 2022 period, when peak level is usually reached.

Rockley is slightly more responsive with the levels usually rebounding earlier in the year than Gibbett Cottages and Stonor Manor. The level rebounded to Normal in April - May 2022, but has since receded to Notably Low.

Given the ESoR since November 2021 (Section) it is likely that the levels in the chalk aquifers will continue to recede for some time even if there is significant rainfall as the soil moisture deficit is currently much higher than the long-term average for August (see Table 9).

The oolite aquifers may respond more quickly, but there is still a significant soil moisture deficit, and the onset of recharge will depend upon the amount of rainfall received over the coming months.

Table 9 – Soil moisture deficits for SWOX hydrometric areas (Reproduced from Thames Water Situation Report August 2022)

Area	SMD (mm)	
	End August	End August LTA
Cotswolds West	107	63
Cotswolds East	113	71
Berkshire Downs	145	102
Chilterns West	147	101
Upper Thames	149	100
Cherwell	129	89
Thame	146	101
Ock	155	106

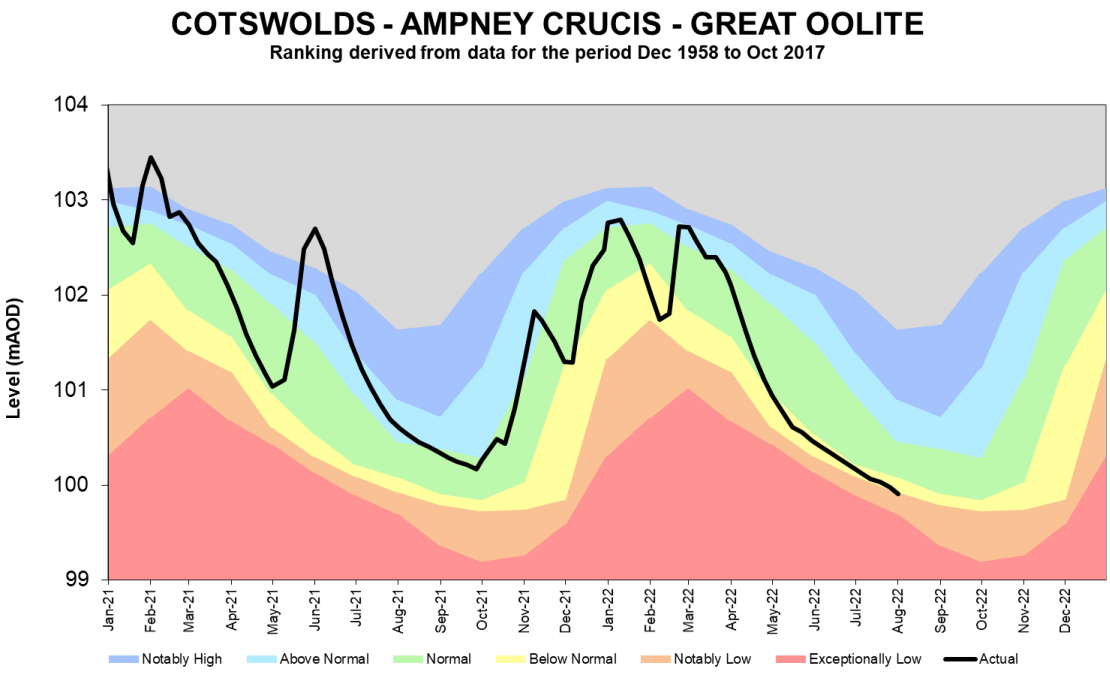


Figure 11 - Ampney Crucis groundwater levels from Jan 2021 to July 2022 with probability bandings

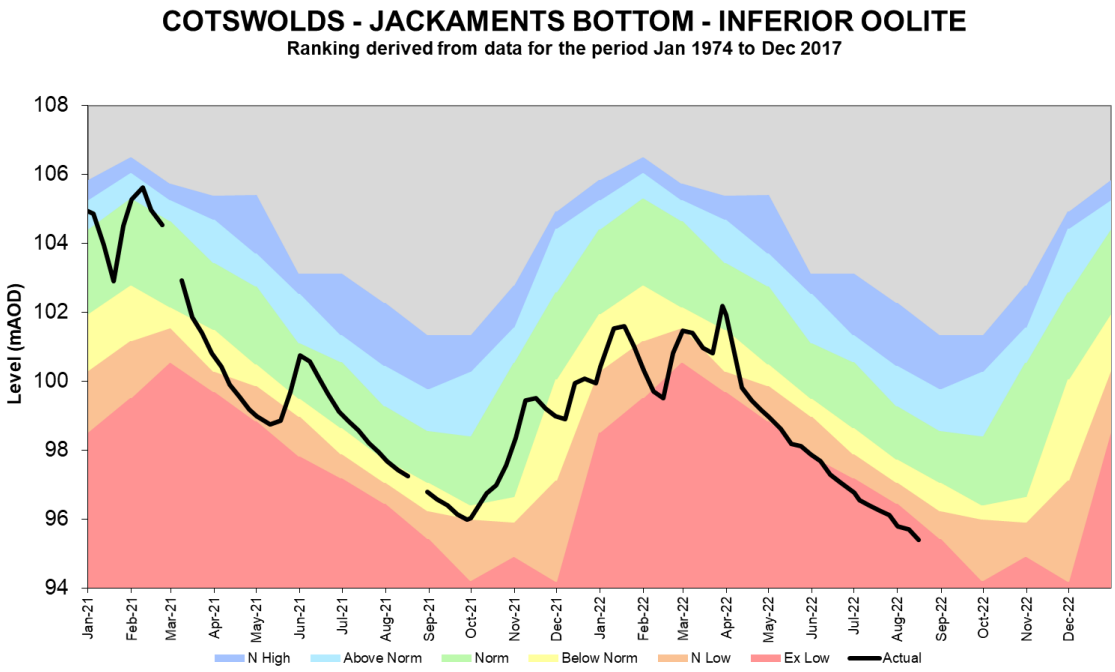


Figure 12 - Jackaments Bottom groundwater levels from Jan 2021 to July 2022 with probability bandings

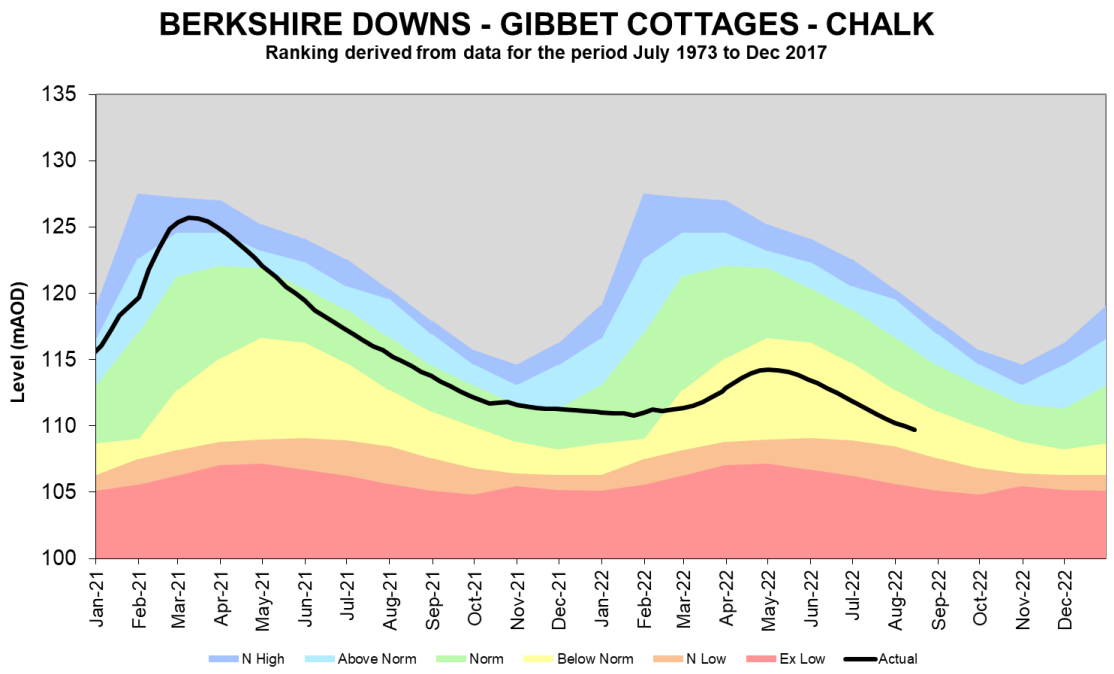


Figure 13 - Gibbett Cottages groundwater levels from Jan 2021 to July 2022 with probability bandings

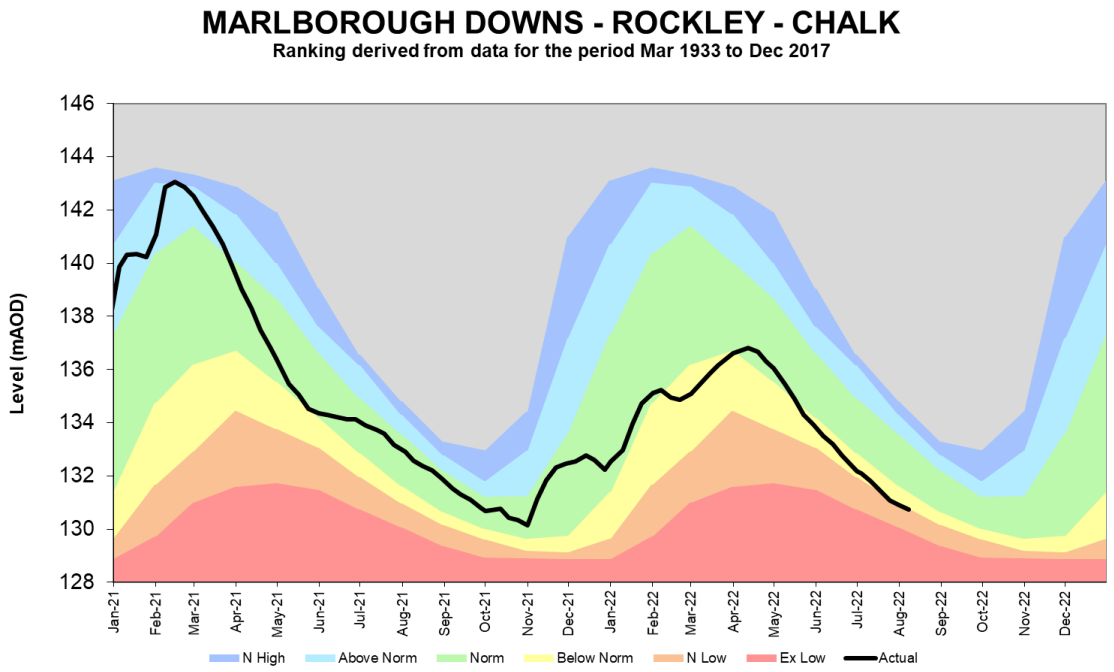


Figure 14 - Rockley groundwater levels from Jan 2021 to July 2022 with probability bandings

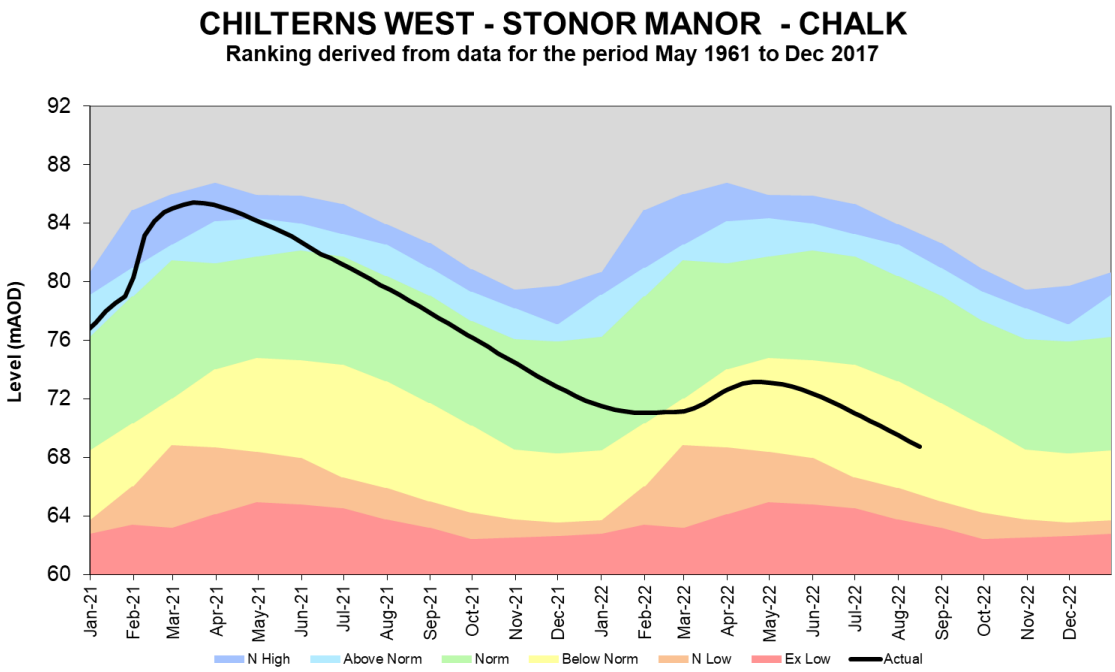


Figure 15 - Stonor Manor groundwater levels from Jan 2021 to July 2022 with probability bandings

5.5.1.2. Predicted groundwater levels

Thames Water have carried out modelling to predict groundwater levels in the Ampney Crucis and Rockley observation boreholes (Figure 16 and Figure 17 respectively). These predictions shows that even with 100% of LTA Ampney Crucis is unlikely to recover to Normal levels by March 2023, and in the 60% LTA rainfall scenario the level will reach Exceptionally Low in the late autumn/winter 2022.

Rockley is predicted to recover to Normal under the 100% or 120% LTA rainfall scenarios, to remain largely Below Normal under 80% LTA and to reach Exceptionally Low in early 2023 under the 60% scenario.

If there is a continued ESoR then the groundwater levels in the aquifers will continue to recede, as will Thames flows at Farmoor, which will increase the serious threat of a deficiency of supply.

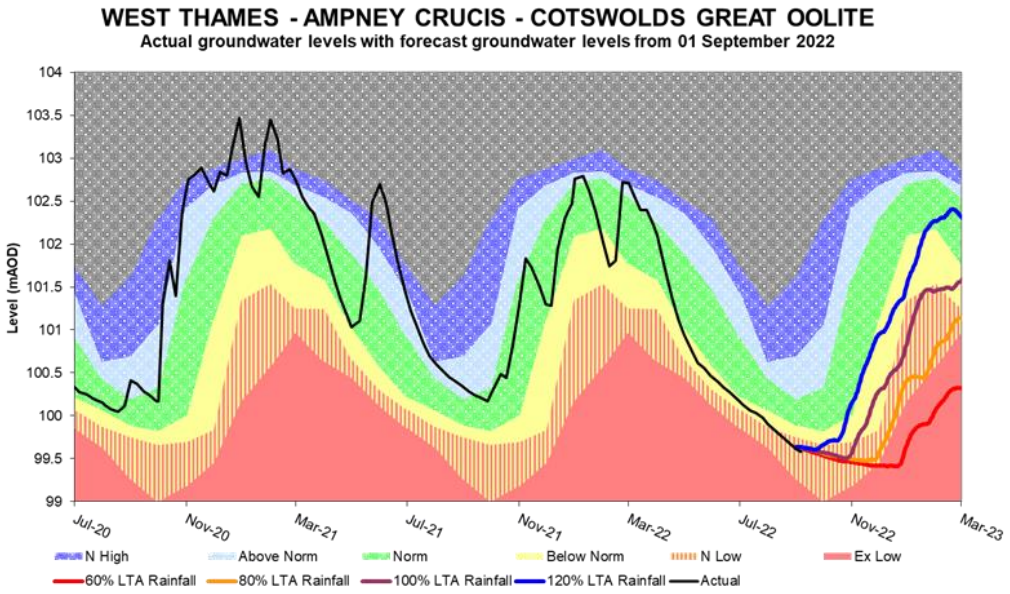


Figure 16 - Ampney Crucis predicted groundwater levels under 60, 80, 100 and 120% of LTA rainfall conditions

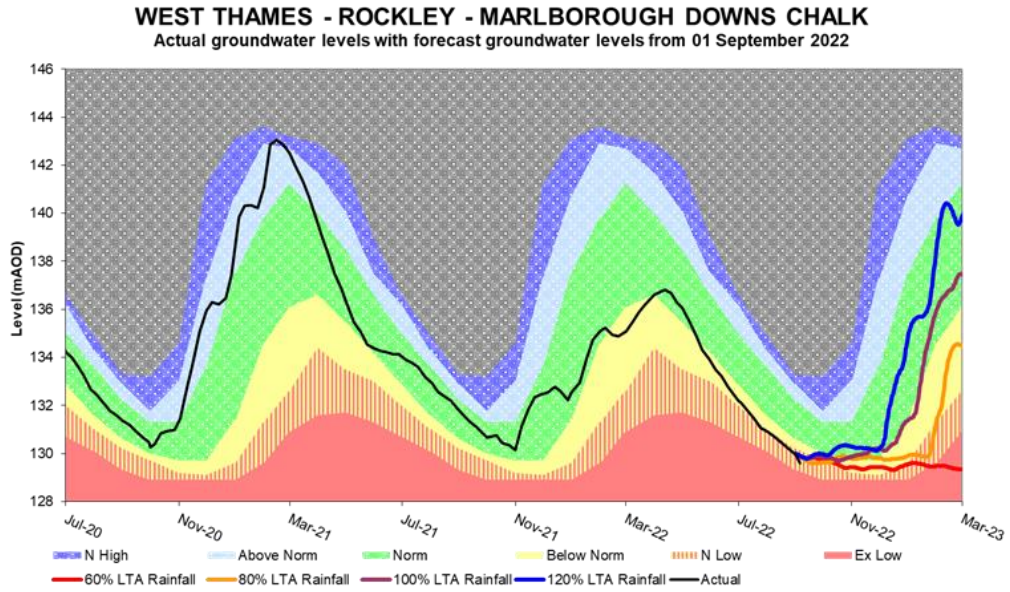


Figure 17 - Rockley predicted groundwater levels under 60, 80, 100 and 120% of LTA rainfall conditions

5.5.1.3. Groundwater level return periods

The most up to date data for August 2022 for the observation boreholes was used to estimate return periods for the groundwater levels. The longest records available were used to carry out these calculations. The periods of record for each observation borehole are given in Table 10. Where there are missing data for August in a year of the record then that year was not included in the analysis.

The probabilities of the groundwater levels being lower than the recorded level, and the associated return periods (calculated utilising the EA's methodology as outlined in Section 5.4.2 and footnote[9]) are given in Table 11.

Jackaments Bottom is at the second lowest level in the record, with a return period of 29.5 years, and Ampney Crucis is at the fourth lowest level in the record, with a return period of 16.4 years. The probability of Ampney Crucis level being lower is 6.1%, and is therefore approaching the boundary of the Exceptionally Low band (5%).

These groundwater data provide further evidence of the ESoR on the water resources situation in the SWOX WRZ.

Table 10 – Periods of record used for observation borehole return period analysis

Observation borehole	Start date	End date	Number of years in analysis
Ampney Crucis	05/12/1958	13/09/2022	59
Jackaments Bottom	13/01/1974	13/09/2022	47
Gibbett Cottages	26/07/1973	13/09/2022	48
Rockley	19/03/1933	13/09/2022	85
Stonor Manor	31/05/1961	13/09/2022	59

Table 11 – Ranks, probabilities and return periods for latest August groundwater levels

Observation borehole	Rank for August 2022 level	Probability of level being lower than August 2022	Return Period (years)
Ampney Crucis	4	6.1%	16.4
Jackaments Bottom	2	3.4%	29.5
Gibbett Cottages	7	13.7%	7.3
Rockley	7	7.7%	12.9
Stonor Manor	12	19.6%	5.1

5.5.2. River flow

As shown in Figure 10 flows in the Thames at Farmoor have been classified as exceptionally low.

The flows have been analysed to put the current drought in context. The naturalised flow record for Farmoor only extends back to 1992 so there is a limited amount of data available for estimating return periods. Attempts were made to extend the flow series using the naturalised flow record for Eynsham gauging station, however the Eynsham record produced many annual minimum flows that were ranked amongst the most severe events in the 1950s to 1960s. As there were not numerous severe droughts in this period the veracity of the data at low flows was in doubt. Checks of the NRFA station data[11] found a comment that:

Rating reflects flow data fairly accurately, however flow through side weir is not gauged and should be measured. Weir is by-passed through this channel at fairly low stages.

The low flows from Eynsham were therefore not considered to be robust and the Farmoor record was not extended with the Eynsham data. Only the naturalised Farmoor record has been used for the analysis in this section.

Figure 18 shows the 5 day rolling average naturalised flows for the Thames at Farmoor for 2022 and the other 5 most severe historical events in the record (1992 to 2022). 2022 has the second lowest 5 day mean August flow (146.1 Ml/d), with only 1995 being lower (95.6 Ml/d).

The return period for the 2022 August flow was calculated utilising the EA's methodology (as outlined in Section 5.4.2 and footnote[9]) and was found to be 18.3 years.

As noted in Section 5.5.1 flows in the Thames at Farmoor are reliant upon baseflows from the Great and Inferior Oolite aquifers in the Cotswolds, for which the levels are currently Notably Low and Extremely Low. If the levels in these aquifers continue to recede it is likely that the flows in the Thames will also recede, and the minimum flow may not yet have been reached.

Figure 19 shows predicted flows at Farmoor under 25, 40, 60, 80 and 100% LTA rainfall, along with the 136.4 Ml/d flow constraint that would further curtail abstraction to Farmoor reservoir, potentially increasing the drawdown rate. Under 25% and 40% of LTA rainfall, flow is below this constraint for significant periods of the next 6 months. Even under 80% and 100% LTA flow is not predicted to be consistently above 377.3 Ml/d, which would allow the maximum licensed amount of 300 Ml/d to be abstracted, until December and January respectively.

[11] NRFA Station Peak Flow Data for 39008 - Thames at Eynsham (ceh.ac.uk)

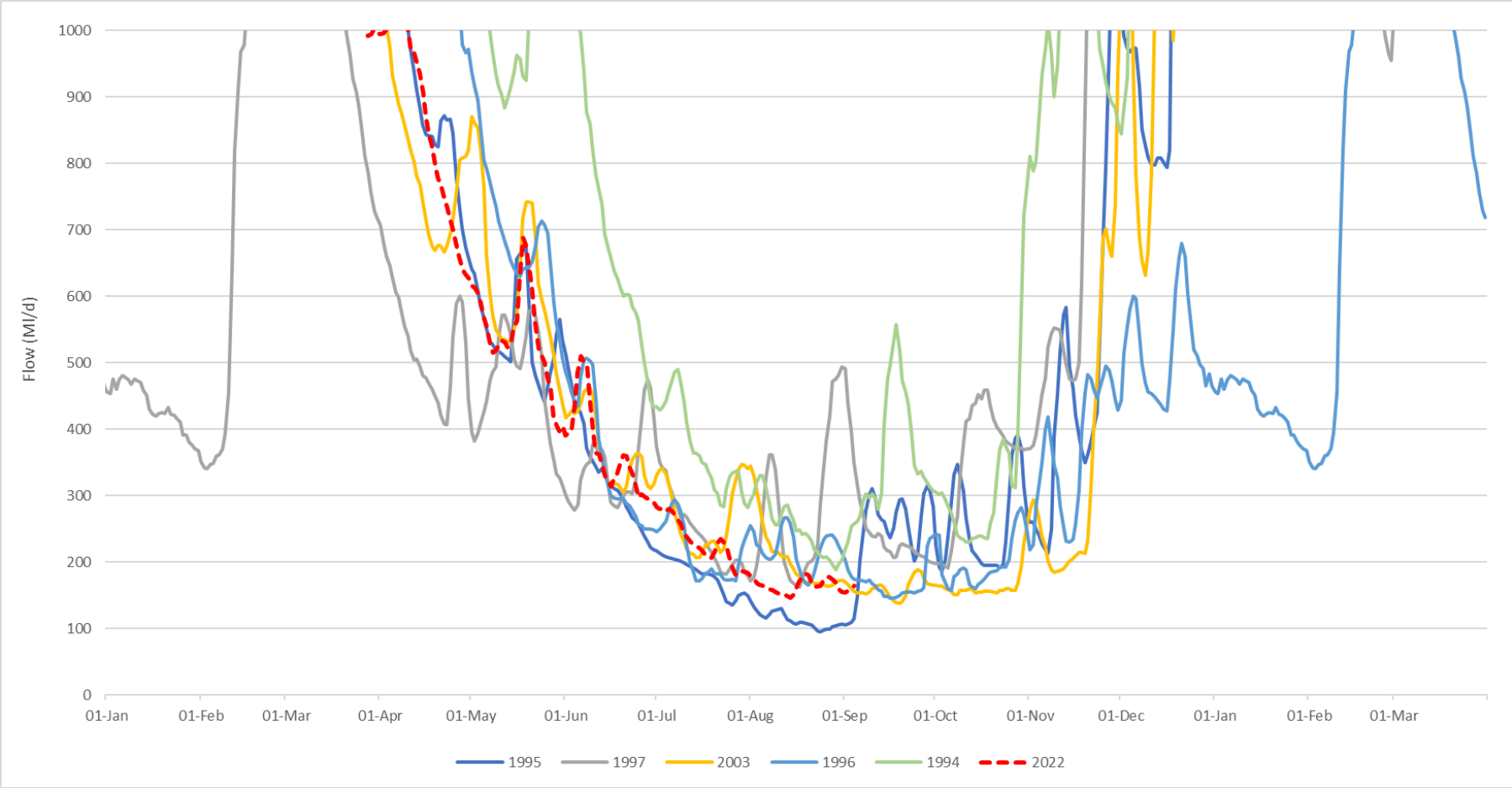


Figure 18 - 5 day rolling average naturalised flow at Farmoor for the 5 most severe historical events in the record, and 2022

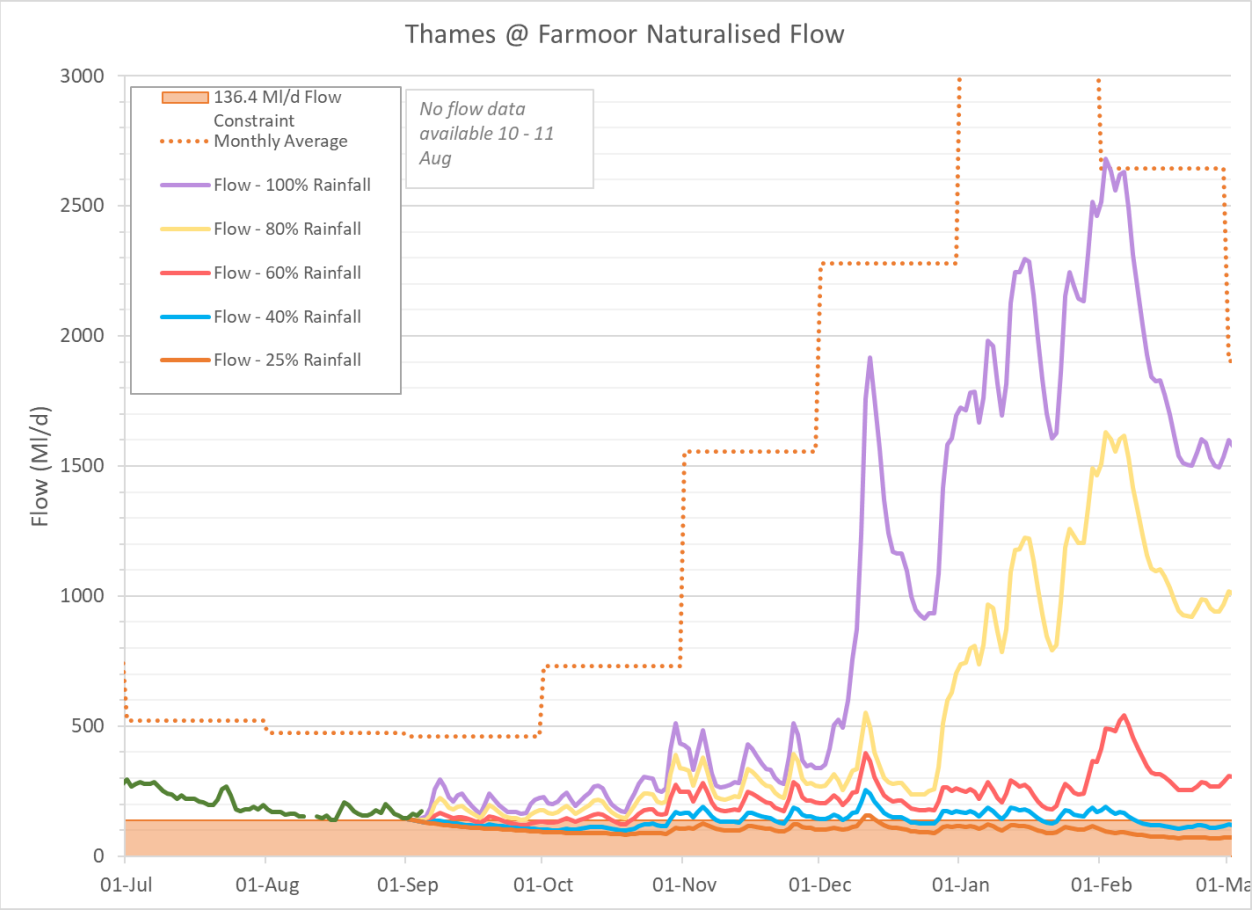


Figure 19 - Predicted naturalised flow at Farmoor with 25, 40, 60, 80 and 100% of LTA rainfall

5.5.3. Reservoir storage

Farmoor storage data is available from January 1994 to September 2022. Figure 20 shows storage in the two historical years with the lowest August storage (1995 and 2003) and 2022. 2022 was ranked second, based on storage on 31 August, after only 1995, giving a return period for this level of 18.3 years. Although it can be seen that the drawdown at the beginning of September 2003 was slightly quicker than in 2022.

The predicted storage has been modelled under 25 to 100% LTA rainfall scenarios from the position on 1 September 2022. This shows that with 50% LTA rainfall or less emergency storage would be reached between November 2022 and January 2023, triggering drought level 4 restrictions (i.e. emergency drought orders).

Even under the 60% LTA rainfall scenario Farmoor would not refill by March 2023, potentially causing issues in 2023 if there is a continuing or subsequent shortage of rainfall.

Please note that whilst there was a slight increase in storage in early September, after the start point of the modelling, the reservoir has drawn down again to a similar level. This indicates that the risk of failure is similar, but it would occur approximately a week later.

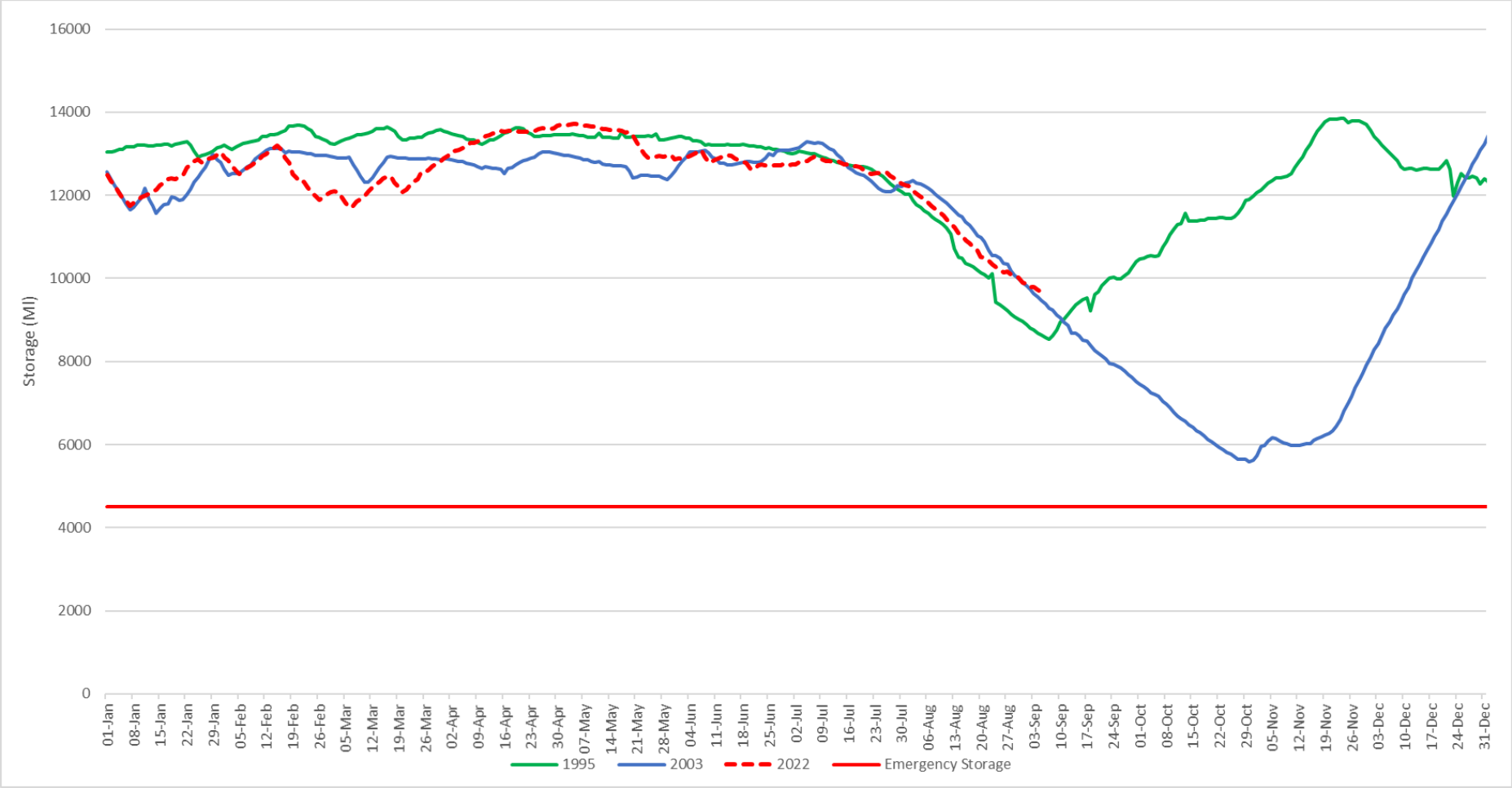


Figure 20 - Farmoor reservoir storage – comparison of two worst historic drought years with 2022 storage

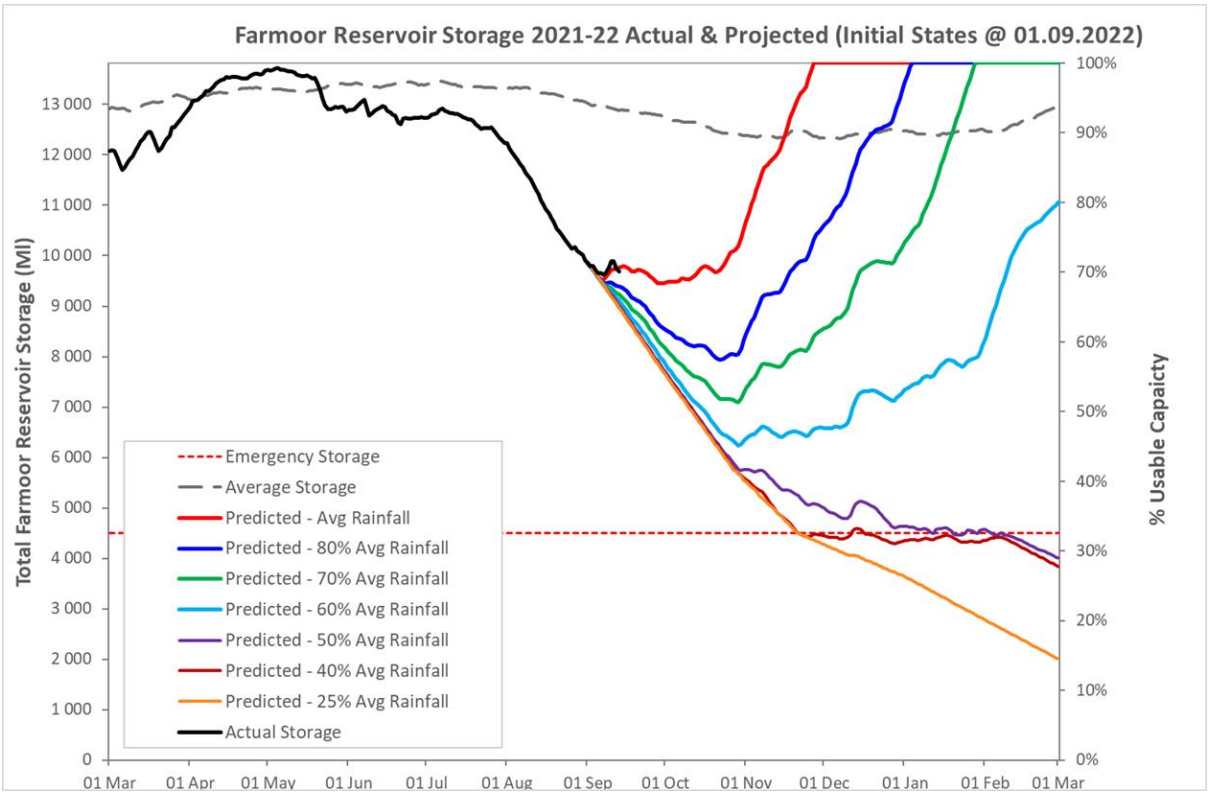


Figure 21 - Farmoor reservoir storage and predicted drawdown under 25 to 100% LTA rainfall scenarios

5.6. Threat of serious deficiency to water supply

The purpose of this section is to provide evidence that a serious deficiency of supplies exists or is threatened, as a result of the exceptional shortage of rainfall and the water resources situation evidenced in the preceding sub-sections of Section 5.

Farmoor reservoir is key to supplying a significant proportion of the population in the SWOX WRZ. The total population within the WRZ is calculated as 1,090,338. The dry year annual average (DYAA) deployable output calculated for WRMP19 was ~329 Ml/d, with the deployable output of Farmoor reservoir being calculated as ~139 Ml/d. Farmoor therefore represents approximately 42% of the supply in the WRZ. If supply from Farmoor reservoir was ceased due to the severity of the drawdown then the potential population at risk of deficiency of supply would be around 458,000 customers (0.42 x 1,090,338).

If Farmoor reaches emergency storage, level 4 restrictions would be applied for (i.e. emergency drought orders). Whilst Farmoor has not reached this level before, it is likely that they would be extreme challenges in treating and supplying sufficient quantities of water to meet WRZ demand.

Due to the exceptional shortage of rainfall described and the water resources situation, there is a realistic threat of supply from Farmoor reservoir failing causing a serious deficiency of supply. Granting of a drought permit would mitigate that risk, refusal would increase the risk.

5.7. Summary of ESoR

Between November 2021 and August 2022 there has been a significant shortage of rainfall in the area that covers the SWOX water supply sources. This has been shown by the SPI, which has a value of -2.36 (Section 5.4.1), which is classified as extremely dry. The SPI was the fourth lowest out of the 131 other 10 month periods ending in August in the historical record.

Rainfall ranking (Section 5.4.2) also showed that the 10 month period leading up to August 2022 was the fourth driest 10 month period to August on record, with the only other drier periods being the significant historical droughts of 1976, 1921 and 1934. The cumulative rainfall for this period was 363 mm, representing a deficit of 232 mm when compared to the 1891 to 2021 long-term average (595 mm).

Return period analysis, following the recommended methodology of the EA, estimates the return period of the current drought as 1 in 36 years (Section 5.4.2).

Probability bands have been calculated using the EA's *Monthly rainfall probability ranking* tool (Section 5.4.3) and the development of the current drought from November 2021 to August 2022 can clearly be seen (Figure 8). The 10 month accumulation ending August 2022 is classified as exceptionally low, with the accumulated rainfall being only 62% of the long-term (1891-2021) average for that period.

The deviation from the percentage long-term average rainfall was also plotted (Section 5.4.4 and Figure 9) which showed that since November 2021 there was only a single month with rainfall that was above the long term average. The remaining months were below average, some significantly so.

River levels in the Thames are exceptionally low meaning that Farmoor abstraction is constrained due to the conditions on flow in the licence. Storage in Farmoor reservoir is low for the time of year as demonstrated in Section 5.5.3, because sufficient water cannot be abstracted from the river to maintain storage.

The exceptional shortage of rainfall has impacted upon aquifer levels within the WRZ (Section 5.5.1). Jackaments Bottom was Exceptionally Low at the end of August with the second lowest August level in the record, this level having a return period of 29.5 years. Ampney Crucis is currently classified as Notably Low with the fourth lowest August level in the record, but the probability of the level being lower in August (6.1%) is approaching the Exceptionally Low banding (5%).

The groundwater sources from which supply could increase to mitigate the Farmoor drawdown rate are therefore largely hydrogeologically or licence constrained.

Predicted flows in the Thames (Section 5.5.2) show that if there is a continued shortage of rainfall it would mean constraints on the abstraction to Farmoor would remain in place, limiting abstraction to slow the drawdown or assist in refill. Under a continued shortage of rainfall Farmoor storage is likely to continue to decline (Section 5.5.3).

Declining Farmoor storage could lead to deficiency of supply for a significant proportion of the population in the SWOX WRZ (Section 5.6).

A drought permit is therefore necessary to allow abstraction from the Thames to increase protecting Farmoor storage.

All of the evidence presented in this section proves that there has been an exceptional shortage of rainfall in the area relevant to the sources in the SWOX WRZ that has impacted on the water resources situation and threatens a serious deficiency of supply.

5.8. Update on early September rainfall

In the first two weeks of September there has been some rainfall in the area of the SWOX WRZ. However, as there are high soil moisture deficits (Section 5.5.1.1 - Table 9) this rainfall is unlikely to have a significant impact on the situation described and the requirement for a drought permit.

The rainfall has caused slight increases in the Thames flows however, it has also been accompanied by subsequent elevations in the concentration of nitrates, which has meant that not all of these flows are available for abstraction.

The developing rainfall situation will be monitored and if necessary this assessment will be updated.

6. Alignment with Drought Plan 2022

It is a statutory requirement (sections 39B and 39C Water Industries Act 1991 as introduced by the Water Act 2003) for water companies to prepare and maintain a drought plan. The current plan was approved by Defra in August 2022.

As given in Section 1 of the guidelines for producing drought plans by the Environment Agency (Water Company Drought Plan guideline v1.2, 2020), a drought plan has a threefold purpose as follows:

Your drought plan should show how you will provide a secure supply of water and protect the environment during dry weather and droughts. A drought plan is an operational plan that sets out what actions you will take before, during and after a drought. It also sets out how you will assess the effects, including the environmental impacts of your actions and what you will do to monitor and prevent or mitigate these effects.

It is necessary for TWUL to evidence that they have followed their drought plan when applying for a drought permit.

The purpose of this section is to evidence alignment with TWUL's drought plan, including how the Drought Management Methodology (DMM) has been applied to determine the drought state and the actions and measures already taken and proposed.

The DMM is designed to:

- provide triggers to guide the introduction of drought plan measures
- ensure that drought plan measures are proportionate to the drought risk being experienced
- provide sequencing which allows measures to be brought in with the appropriate lead in times and minimises the impacts on the environment from drought measures (e.g. the least damaging measures will be used first)
- to minimise as far as possible the risk of imposing Level 4 restrictions (i.e. emergency drought orders).

Whilst the drought plan sets out actions that should, or could, be taken in a drought, every drought situation is different and decisions may need to be taken that reflect the current operational context.

6.1. Methodology for determining the Drought Event Level

In accordance with the drought management methodology prescribed in TWUL's Drought Plan 2022 (Main Report Section 4 and Appendix P), assessments of the water situation and drought severity have been made systematically over the drought period.

For all the WRZs the risk to security of supply and the appropriate measures to be taken are determined by a consideration of both the prevailing and predicted water situation. In the case of the SWOX WRZ, the assessment is based on the hydrological and hydrogeological indicators discussed in Section 5.5, namely groundwater levels in the major Cotswold aquifers, flows in the River Thames at Farmoor and Farmoor reservoir storage. From an assessment of the prevailing

and predicted status of these indicators, combined risk factors (Rc) are assessed for prevailing and predicted status.

Based on the prevailing and predicted Rc values, an Overall Risk Indicator (ORI) has been developed to provide a balanced assessment of the known short-term ('prevailing') risks and potential worst-case ('predicted') risks. From this a Drought Event Level (DEL) is established using a predicted worst-case scenario of 60% LTA rainfall. The DEL level determines the level of governance and potential worst-case measures that should be implemented in accordance with TWUL's Levels of Service.

6.2. Current Drought Event Level

The latest assessment to give the current Drought Event Level of DEL3 is given in Appendix A.

Table 12 below shows the end of month assessment for July and August 2022 for SWOX and London WRZs. The increase from DEL2 to DEL3 took place on 25 August 2022 following a re-assessment of the drought event level in mid-August.

Table 12 - Overall Risk Indicator and Drought Event Level for July and August 2022

Date	SWOX ORI prevailing/predicted	London ORI prevailing/predicted	Drought event level
2nd August	1/3	2/2	DEL2
25th August	2/3	2/2	DEL3

6.3. Sequencing of measures

For any drought scenario the timing of introduction of the most severe measures that are required is assessed within the protocol. This enables determination of the timing and sequencing of the lesser and, by necessity, earlier measures. Thus a timeline can be used to hindcast from the point at which it is identified that the most severe predicted measure is required.

It is also necessary to implement water use restrictions in the sequence set out in TWUL's Levels of Service, as follows:

- Media campaign must precede a Temporary Use Ban.
- Temporary Use Ban must precede a NEUB.
- Temporary Use Ban must precede a drought permit.
- NEUB must precede an emergency drought order (EDO).

As shown in Table 13, it can be seen that the elapsed time by which a NEUB or drought permit could be put in place starting from a point when no preliminary measures had been introduced would be in the order of 15 weeks; for an EDO the equivalent elapsed time is likely to be 25 weeks.

Table 13 - Drought measures indicative timescale for SWOX WRZ

Measure	Triggers	Time to implement (weeks)			
Media campaign	DEL1 or higher	2			
Temporary Use Ban	DEL2 or higher		3		
NEUB/drought permit	Application to Defra/EA - 200Ml/d rule (Section 1.4)			10	
Emergency drought order (EDO)	Application to Defra - implementation of DD11				10
Cumulative Elapsed time		2	5	15	25

The elapsed times shown in Table 13 are used as a guide for planning the timing of the earliest introduction of measures when used in association with the worst-case scenarios described above which provide predictions of when certain risk levels will be reached.

6.4. Actions/measures taken to date

The principal demand and supply side measures thus far introduced or proposed are summarised in Table 14; full details of the demand side measures taken are given in Section 6.5, and supply side measures are detailed in 0.

Table 14 - Summary of measures introduced or proposed

Measures	Actions undertaken or proposed
Demand–side	
Enhanced media and water efficiency campaign	31st May 2022 – 31st August 2022
Temporary Use Ban	Formal notice given 17/8/2022. Introduction 24/8/22
Supply-side	
Application for Drought Permit	Application date 26/9/22
Expected implementation of Drought Permit	Expected date 14/10/22

6.5. Demand-side measures

In accordance with a prevailing Overall Risk Indicator of ORI 2 for SWOX WRZ, Table 15 below gives the range of demand–side measures TWUL has either put into effect or is considering.

Table 15 - Demand-side measures

Measure	Description of measure	Drought Event Risk Level	Level of Service	Summary of activities
Media /water efficiency campaign	Wide-scale media activity and advertising to encourage voluntary reduction in water usage	DEL1	Level 1	Preliminary media campaign commenced in May 2022 with the launch of the water efficiency (WEFF) website providing water saving tips, organic social media and hotspot paid media going live. Evidence of the communications plan implemented in 2022 is provided in Appendix B.
Enhanced Media /water efficiency campaign	Enhancement of above activity	DEL2	Level 2	Evidence of the enhanced communications plan implemented in 2022 is provided in Appendix B.
Leakage reduction	Increased leakage activity / network pressure management	DEL1/-DEL2	Not applicable	Information on leakage management provided in Section 6.5.3.
Temporary Use Ban	Company-wide 11 categories of use (largely domestic) banning the use of a hosepipe.	DEL2	Level 2	Public notification started around 8th August 2022, with formal notification on 17th August 2022. A TUB was implemented on 24th August 2022.

Measure	Description of measure	Drought Event Risk Level	Level of Service	Summary of activities
Drought Direction 2011 (DD11) measures (formerly non-essential use Ordinary Drought Order)	Application by TWUL to Defra to grant 10 categories of non-essential use affecting commercial businesses.	DEL3	Level 3	Application to be triggered by implementation of DD11 measures and risk of reaching Level 3 control curve on LTCD/Farmoor emergency storage. To be kept under consideration depending upon continuation of the ESoR and developing water resources situation.
Emergency Drought Order	Application by TWUL to Defra to prohibit or limit the use of water as TWUL thinks fit; to set up, and supply water by means of standpipes, rota cuts or water tanks.	DEL4	Level 4	Application to be triggered by implementation of DD11 measures and risk of reaching Level 4 control curve on LTCD/Farmoor emergency storage. To be kept under consideration depending upon continuation of the ESoR and developing water resources situation.

6.5.1. Media/Water efficiency activity

In addition to TWUL's ongoing water efficiency campaign activities, increased activity has been carried out due to the developing dry weather situation throughout 2022. These activities follow the strategy set out in TWUL's Drought Plan 2022 (Section 7 – Communications Strategy) and comply with the legislation and guidance. These activities incorporated the lessons learnt from Drought 2012.

The first stage of the water efficiency campaigning for this summer's drought ran from 31st May to the 31st August with formal notice of TUBs given on 17th August followed by an implementation date of 24th August 2022.

The media campaign resulted in 26,400 clicks to the TWUL water saving calculator. This has resulted in a 13% increase in the number of people making a deliberate effort to reduce water usage. Further information is being gathered about take up of water saving devices to assist in estimating savings in Ml/d.

Full details of the number of customers contacted and estimated reach of the media campaign are provided in Appendix B – Media/Water Efficiency Activity. A short summary of the campaign activities is given in Table 16 and Figure 22.

Figure 23 provides details of the stakeholder communications undertaken in advance of implementing a TUB on 24 August 2022.

This media campaign is remaining in place whilst a TUB is implemented (see Figure 24 and Figure 25 for next steps being undertaken in September and October).

Following this drought event we will review the campaign and how effective different actions have been to help us to learn lessons to apply in future droughts.

Table 16 – Summary of media/water efficiency activities

Date	Demand Management Activities
May/June 2022	Customer research and *Every Drop Counts* campaign to raise customer awareness – two press releases. 42 pieces of coverage across national, regional and trade media – in online and broadcast. £1.1 million invested in efficiency campaigning from May to September.
July 2022	*Every Drop Counts* campaign – 15 media interviews on radio and TV.
12-22/07/2022	6 emails sent to customers across the Thames region around water efficiency in the heatwave.
25/07/2022	Social media release of infographic about heatwave response.
05-06/08/2022	Email sent to all TWUL customers around hot weather and water efficiency.
08/08/2022	Pre-official announcement of TUB – TV and radio interviews. Announcement in national and regional newspapers (The Daily Mirror, The Sun and The Metro)
17/08/2022	Formal TUBs notice issued Official TUB announcement via TV and radio interviews. Social media release of infographic supporting TUB announcement. Texts to customers that a TUB to be introduced on 24 August
24/08/2022	Day of TUBs implementation – TV and radio interviews on key regional media. Total coverage on 24 August included 1312 media clippings for broadcast; online; print outlets. Texts to customers that a TUB starting that day.
26/08/2022	Formal exceptions notice issued

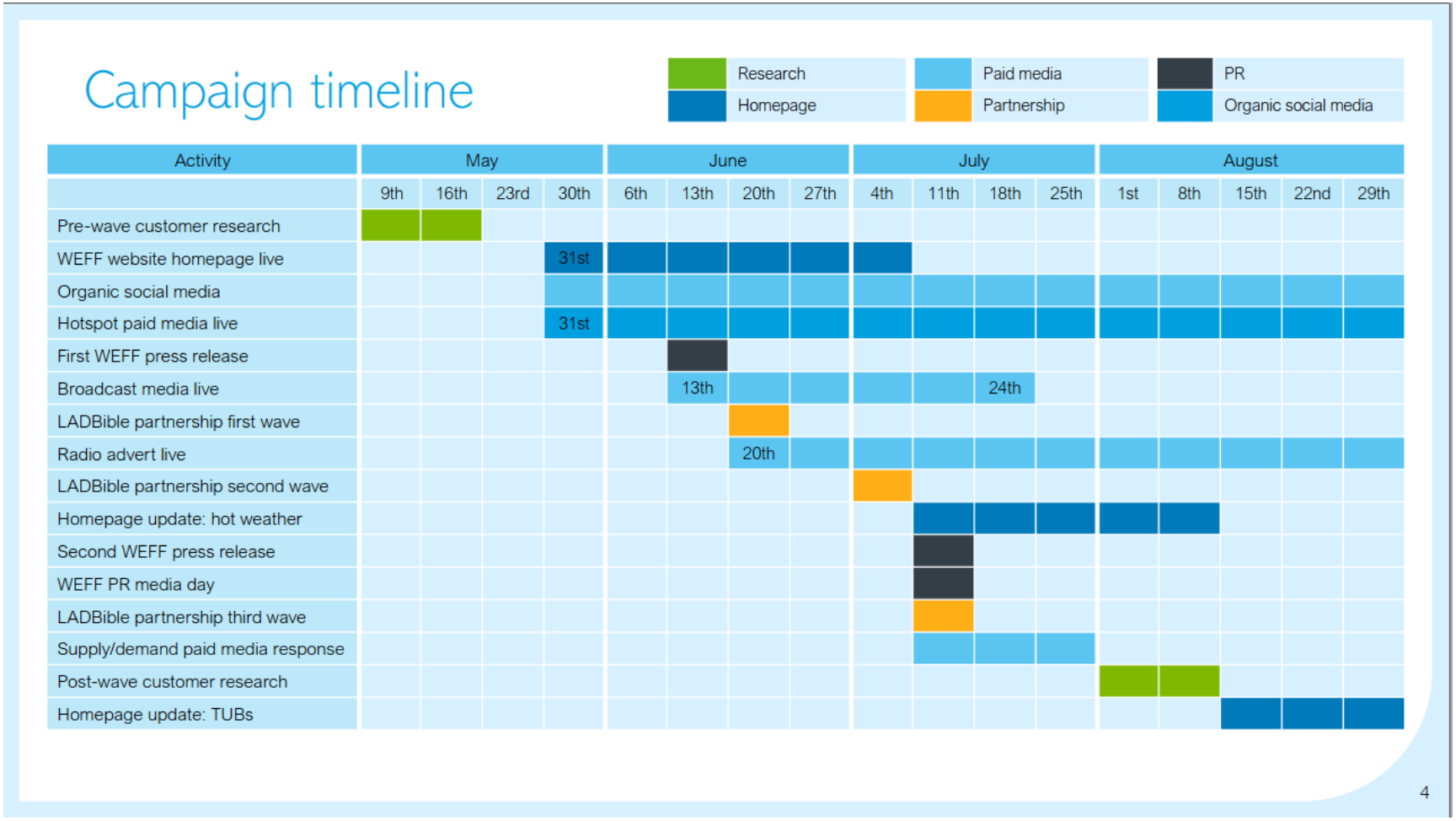
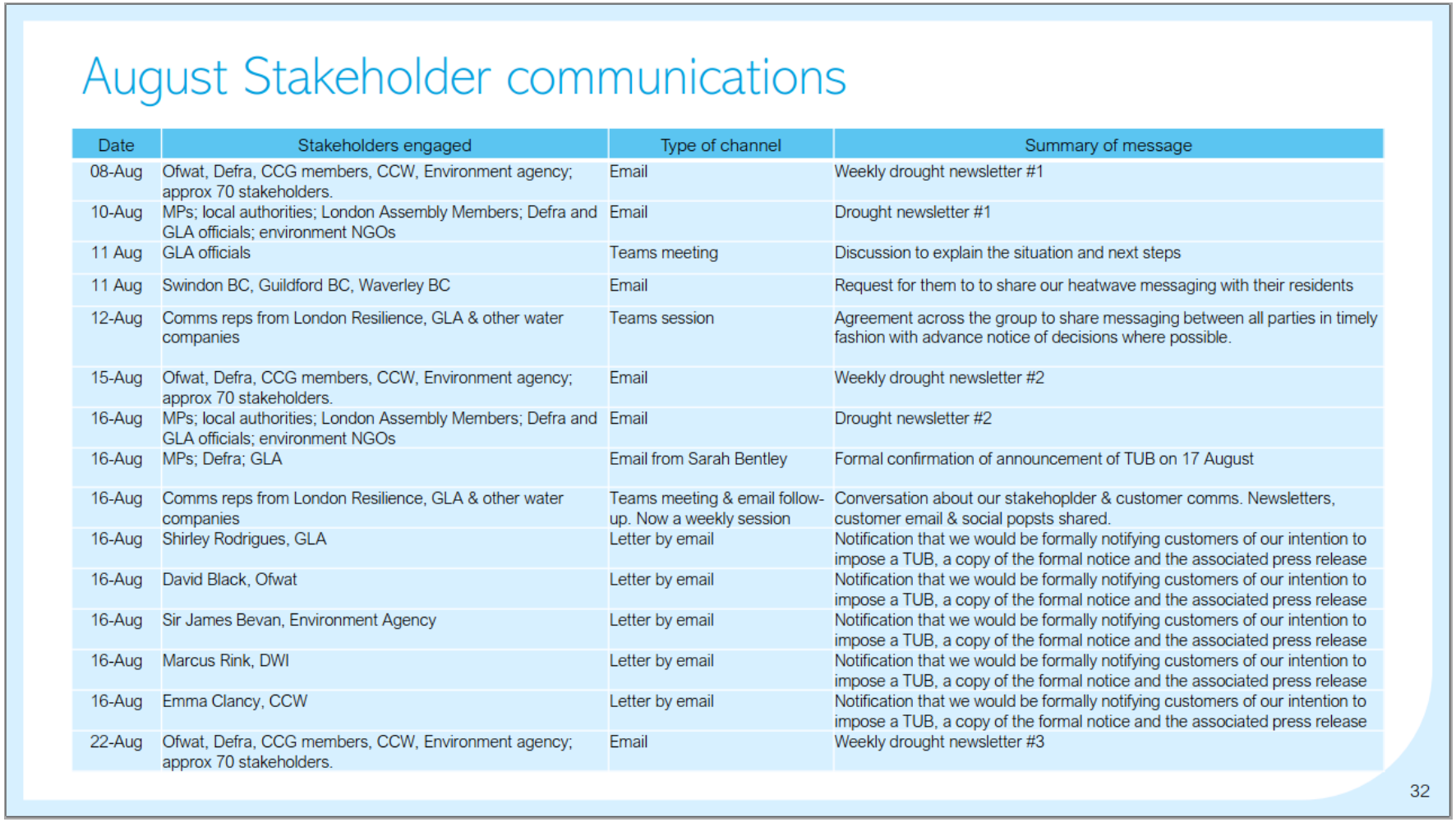


Figure 22 - Media/water efficiency campaign timeline



August Stakeholder communications

Date	Stakeholders engaged	Type of channel	Summary of message
08-Aug	Ofwat, Defra, CCG members, CCW, Environment agency; approx 70 stakeholders.	Email	Weekly drought newsletter #1
10-Aug	MPs; local authorities; London Assembly Members; Defra and GLA officials; environment NGOs	Email	Drought newsletter #1
11 Aug	GLA officials	Teams meeting	Discussion to explain the situation and next steps
11 Aug	Swindon BC, Guildford BC, Waverley BC	Email	Request for them to to share our heatwave messaging with their residents
12-Aug	Comms reps from London Resilience, GLA & other water companies	Teams session	Agreement across the group to share messaging between all parties in timely fashion with advance notice of decisions where possible.
15-Aug	Ofwat, Defra, CCG members, CCW, Environment agency; approx 70 stakeholders.	Email	Weekly drought newsletter #2
16-Aug	MPs; local authorities; London Assembly Members; Defra and GLA officials; environment NGOs	Email	Drought newsletter #2
16-Aug	MPs; Defra; GLA	Email from Sarah Bentley	Formal confirmation of announcement of TUB on 17 August
16-Aug	Comms reps from London Resilience, GLA & other water companies	Teams meeting & email follow-up. Now a weekly session	Conversation about our stakehoplder & customer comms. Newsletters, customer email & social popsts shared.
16-Aug	Shirley Rodrigues, GLA	Letter by email	Notification that we would be formally notifying customers of our intention to impose a TUB, a copy of the formal notice and the associated press release
16-Aug	David Black, Ofwat	Letter by email	Notification that we would be formally notifying customers of our intention to impose a TUB, a copy of the formal notice and the associated press release
16-Aug	Sir James Bevan, Environment Agency	Letter by email	Notification that we would be formally notifying customers of our intention to impose a TUB, a copy of the formal notice and the associated press release
16-Aug	Marcus Rink, DWI	Letter by email	Notification that we would be formally notifying customers of our intention to impose a TUB, a copy of the formal notice and the associated press release
16-Aug	Emma Clancy, CCW	Letter by email	Notification that we would be formally notifying customers of our intention to impose a TUB, a copy of the formal notice and the associated press release
22-Aug	Ofwat, Defra, CCG members, CCW, Environment agency; approx 70 stakeholders.	Email	Weekly drought newsletter #3

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Figure 23 – Stakeholder communications

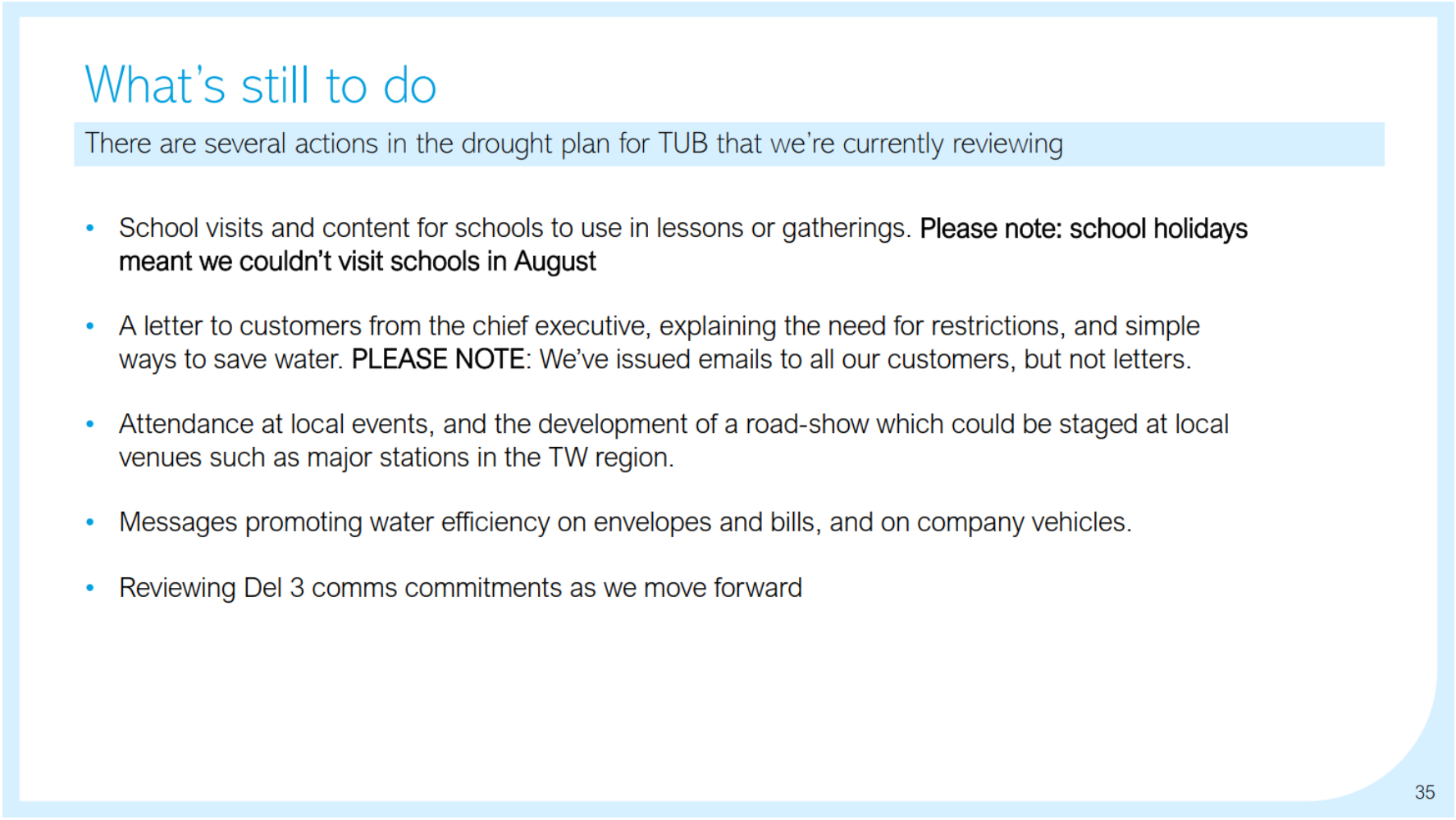

Figure 24 – Next steps for Sepetmber and October

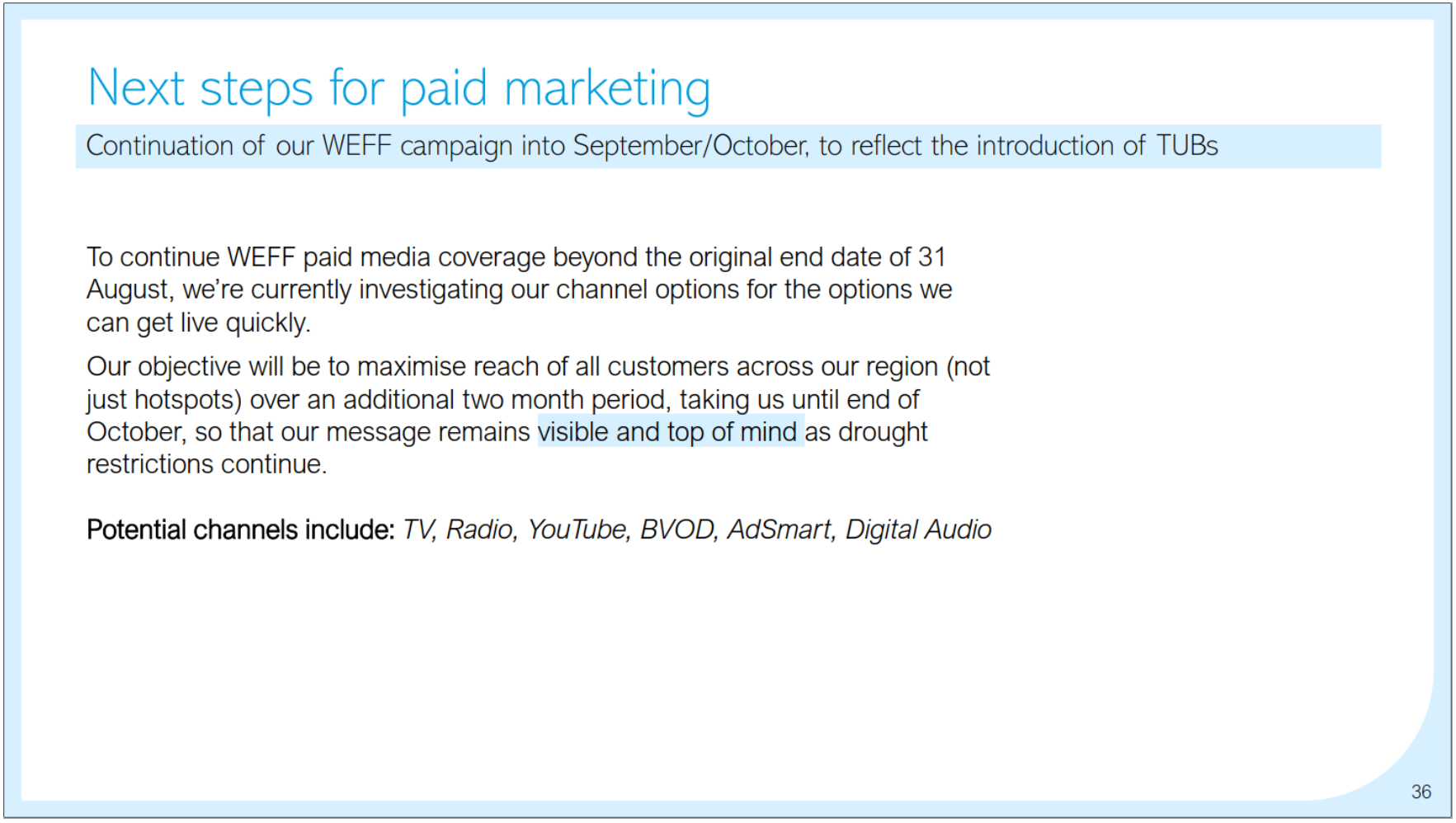

Figure 25 – Next steps – paid for marketing

6.5.2. Temporary Use Ban

In accordance with TWULs Drought Plan a Temporary Use Ban (TUB) was implemented on 24 August 2022. This was necessary because of the continued shortage of rainfall (Section 5) and the worsening water resources situation which had led to the drought event level being predicted to cross from DEL2 into DEL3 in late August (DEL3 was triggered on 25 August 2022 - see Section 6.2). In accordance with the guidance and legislation the required notice procedure was observed (Section 6.5.1).

A TUB will therefore have been in place for 33 days when this application is made (26 September 2022). This is considered to be sufficient time for the TUB to take effect. TUB restrictions will be kept in place until the threat of a serious deficiency of supply is averted, and storage in Farmoor reservoir has recovered.

The legal notice produced by TWUL and published on the website[12] has been reproduced in Appendix C – Thames Water TUB Legal Notice. This details the restrictions imposed, and the exceptions to these restrictions.

As noted in Section 1.2, Southern Water introduced a TUB in Hampshire and on the Isle of Wight commencing 5th August, and South East Water introduced a TUB in Kent and Sussex which commenced on 12th August. Efforts were made to align conditions and exceptions between the three companies to prevent customer uncertainty, as required by the guidance.

6.5.3. Leakage performance in SWOX WRZ

Leakage reduction remains a fundamental component of ongoing plans to manage the balance between supply and demand. In the last AMP period (2015/16 to 2019/20), leakage targets were met and exceeded and 20% reductions were set for the AMP period 2020/21 to 2024/2025. As stated in the Drought Plan, all activities that are part of the long-term leakage reduction programme will continue during a drought. Whilst not sustainable in the long term, further gains can be made by diverting resources to increasing find and fix rates during a drought period.

Leakage was forecast to be 56.64 Ml/d for 2022/23 in the WRMP19 DYAA final planning demand table however, the leakage rate on 9th September 2022 was 71.85 Ml/d (15.21 Ml/d above target). This is an increase on the rate from 26th November 2021 of 59.72 Ml/d. This increased leakage was addressed in TWUL's annual WRMP review for 2022[13] which calculated leakage as 70.44 Ml/d:

"Regretfully, leakage remains above forecast in the Thames Valley WRZs. In these zones the level of activity has fallen short of that needed to offset leakage recurrence. These areas are a complex mix of urban towns/cities surrounded by rural areas where customer demands fluctuate significantly in the summer. The Thames Valley region was most impacted by the resource and performance challenges faced during 2021/22, with repair performance in Thames Valley falling

[12] Legal notice of water restrictions | Help | Thames Water

[13] Thames Water WRMP AR22 (TWUL, June 2022)

26% short of our enhanced leakage plan. As part of our insourcing plan over the coming year, the repair teams in Thames Valley are planned to transition across first (during August 2022) to drive an improvement in performance as early as possible. These areas will need further focus in the coming year to restore leakage levels to those required."

The increased leakage is caused by a number of factors. Leakage values include any unaccounted for usage. Due to the exceptionally high demands experienced in 2022 this unaccounted for usage will also have increased.

The dry weather causes changing ground conditions that have provoked higher burst & leak frequency. In Swindon and Oxford, from the opening week of June to present day we have seen approximately a 20% increase in our leakage value, but this includes a 67% increase in visible leaks raised on our mains over last year's performance figures with the highest completed visible leakage mains repairs since 2018.

TWUL had a contractor partner tasked with finding and fixing leaks. Their performance was not up to the required standard and this has led to a change in the way TWUL are dealing with leakage. TWUL has been, and is still, recruiting in-house repair teams and is deploying them as part of a recovery plan to bring leakage rates down to the planned levels. This has been ongoing for two months and the leakage rate has started to drop from a peak in August. In addition studies are being undertaken to improve pressure management, where this has not already been optimised.

TWUL are working exceptionally hard to improve leakage performance and acknowledge that to date this has not been good enough. It is planned that leakage will be at the forecast rate by the end of the year. Over the next 6 months (the potential period of this drought permit) there will be a marked improvement in leakage rates.

6.5.4. Demand reduction

Demand varies widely between years and is difficult to forecast and analyse as it is dependent upon numerous factors. In 2022 there were record breaking temperatures in the UK with a heatwave occurring in mid-July. This led to the highest demands in the SWOX WRZ in the last 20 years being experienced from the 9th to 20th July, as shown in Figure 26[14]. This peak demand occurred just as flows in the Thames at Farmoor receded, reducing abstraction from the river and causing Farmoor storage to start to draw down.

During July there was an intensive media campaign around water efficiency (Section 6.5.1). During this campaign the demand fell below the 2021 demand values from 10th to 24th July. Demand increased again to a peak on Thursday 11th August, which was just after the initial pre-notification of TUBs in the media. Since that time there has been a trend of declining demand from around 337 Ml/d to 309 Ml/d on 17th August when the TUB was officially announced, and further to 299 Ml/d on 24 August when the TUB was implemented. It reached its lowest value of

[14] Please note that demand data was only available for Thames Valley, which included other water resource zones – SWA, GUI, HEN, KV. The SWOX data was calculated from the Thames Valley total based upon the ratio of the WRMP19 DYAA distribution input values from the planning tables.

283 Ml/d on 6th September, around 2 weeks after TUB implementation, and since that point it increased slightly to 284 Ml/d on 11th September.

The average demand data shows that the average reduction in demand between 11th August and 6th September is 2 Ml/d (284 Ml/d – 282 Ml/d), a reduction of just 0.7% (2/284). The equivalent reduction in 2022 would have been 2.4 Ml/d (0.007x337), however the actual reduction in this period was 54 Ml/d (337-283 Ml/d) or 16.0 %, which is much greater than the average reduction for this period.

It is extremely difficult to attribute the amount of the reduction in demand that is due to TUBs media campaigns or implementation, and how much is due to other factors (changes in weather, holidays etc.) without complex modelling that it is not possible to undertake within the timescales of this drought permit application, due to the urgent nature of the water resources situation. However, it is clear that there was a significant reduction in demand after the TUBs was announced and implemented, and these activities are therefore considered to have been effective.

Temperature data has been requested from the Environment Agency. Once this is received additional analysis of the changes in demand observed as the weather changed will be undertaken, to attempt to calculate proportions of demand reduction due to changes in weather and that due to the media campaign and TUB. This analysis will be included in subsequent drought permit submissions.

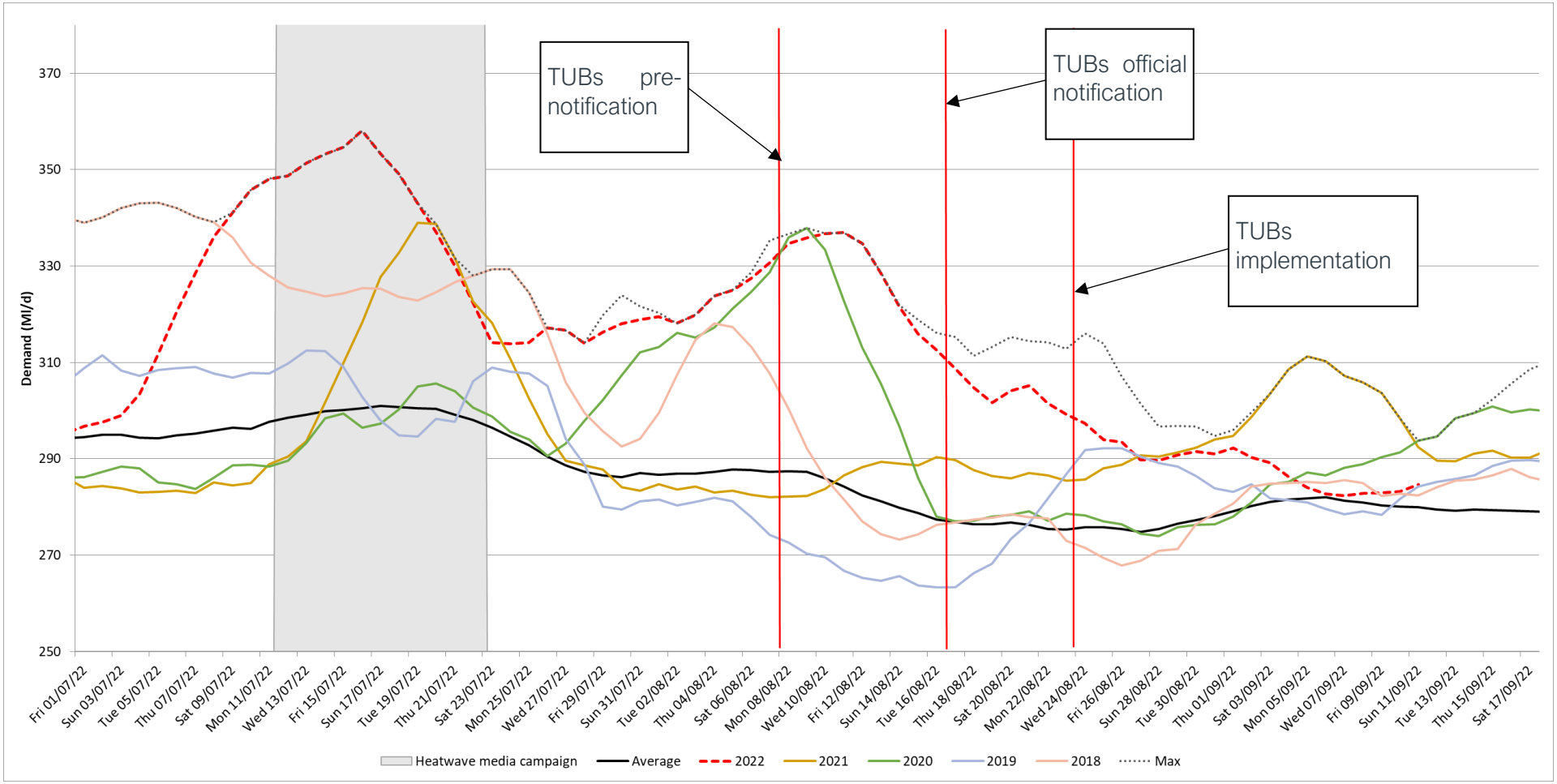

Figure 26 - SWOX demand in 2018-2022 and average (2003-2021), with grey band showing heatwwave media campaign, initial TUBs pre-notification, official TUBs notification and TUBs implementation are indicated by the red lines.

6.6. Supply-side

6.6.1. Alternatives to drought permits

As stated in the Drought Plan, supply-side options with the notable exception of drought permits and orders can be categorised into:

1. Optimisation of existing sources
2. Strategic schemes
3. Bulk supplies
4. Recommissioning of disused sources
5. In extremis options (only considered in events more extreme than Level 3)

With the exception of option 5, each supply-side measure is detailed further below.

6.6.1.1. Optimisation of existing sources

As stated in the Drought Plan, the assessment of water availability assumes that all existing sources are operating at their expected capacity, optimising the sources that are most drought resistant. In general, this means in London and SWOX WRZs, utilising groundwater sources in order to conserve reservoir storage noting that, with the network connectivity, not all sources can preserve storage at Farmoor.

Several years ago, supply capability was made more robust by upgrading the GATOX pipeline (Gatehampton to Oxford pipeline) which has improved the connectivity from TWUL's groundwater sources in the Goring Gap to the demand centres supplied by the Farmoor system.

However, the Goring area (Gatehampton and Cleeve) has recently been suffering from power failures and the subsequent borehole start-up process has been causing turbidity spikes that then lock out the borehole. As a result, the Gatehampton wellfield currently has 6 out of 8 boreholes in supply and the raw abstraction is about 10 Ml/d below peak DO, which means the GATOX pipeline is not currently running at maximum capacity. There is an expectation that all of boreholes will be available for supply by the end of September, and that the GATOX main will be maximised before the implementation of any drought permits, provided there are no more power outages.

Power loggers are being installed at Gatehampton and Cleeve to gather data on the outages, to assist with future proofing the supply. Longer term there are plans to install raw water run to waste facilities at Gatehampton and Cleeve that would help to mitigate this issue. Various design solutions are being explored, and whether it might be possible to install a smaller temporary solution at Gatehampton ahead of next Summer.

An allowance for outage due to mechanical failure and pollution events is allowed for in the Drought Plan which is stated as 17.14 Ml/d based on recent historical outages. Outages within SWOZ WRZ between November and December 2021 were averaging just over 7 Ml/d, reducing to just less than 4 Ml/d between January and March 2022 as detailed further in Section 6.6.5.

Additional information is being compiled about the sources within the WRZ that have been optimised/maximised throughout this event, and this will be included in subsequent drought permit applications.

6.6.1.2. Strategic Resources

Unlike the London WRZ, SWOX WRZ has no strategic drought water resource options built into its deployable output; the major supply-side augmentation comes mainly in the form of increased abstraction from existing sources introduced at the specified low flow trigger through the drought permit mechanism.

6.6.1.3. Bulk supplies

TWUL are currently using the import at Brimpsfield Valve from Birdlip Res (Severn Trent Water) to help meet demand in SWOX. The current strategy is to use the import every 48 hours.

The provision for a bulk supply to Severn Trent Water of 2.3 Ml/d exists from the North Cotswolds area, but this is emergency use only and has not been used for several years.

6.6.1.4. Import from SWA

There are 2 transfers from SWA into SWOX as follows:

a) Radnage to Bledlow: Transfers are usually <0.5 Ml/d. Peak transfers in summer 2022 have been 0.45 Ml/d, compared with 0.31 in 2021. The maximum transfer of last 8 years was 0.56 Ml/d in 2020.

b) Stokenchurch to Chinnor: Peak transfers have increased over the last 8 years from 0.8 Ml/d up to max of 2.86 Ml/d in 2021. In summer 2022, the peak transfer was 2.66 Ml/d.

In summary, these transfers are small and there has been little change in recent years.

6.6.1.5. Recommissioning disused sources

As stated in the Drought Plan, with only a few exceptions, all of our licensed sources are fully utilised. There is an ongoing review of source outage and availability to determine requirements to be undertaken work for drought readiness. There are no known disused sources identified that provide DO and could have been brought back online since the start of the ESoR event.

6.6.2. List of drought permit options and associated issues

Drought permit options form an important part of our plan for the SWOX WRZ.

The full list of SWOX options with their suggested order of priority is given in Table 17 below (extracted from Appendix C of the Drought Plan), with Farmoor the subject of this Drought Permit highlighted in bold type.

The Farmoor drought permit (which has Drought Plan Priority 1) involves making fuller use of the Farmoor system by increasing the availability of raw water for abstraction from the River Thames during periods of low flow and low storage levels at Farmoor reservoir, thereby providing an effective gain to water supply in the range of 10 to 30 Ml/d. Note that, RWE Generation UK is the major abstractor from the River Thames immediately downstream of Farmoor. TWUL have

contacted RWE Generation UK to inform them of the drought permit application and will continue to liaise with them well in advance of implementing the Farmoor drought permit option.

Table 17 - SWOX WRZ drought permit options

Source	Current licence limit (Ml/d)	Potential abstraction with Drought Permit (Ml/d)	Potential Gain (Mld)					Issues/ Risks	Priority
			Min est	Max est	1:100 DO	1:200 DO	1:500 DO		
River Thames @ Farmoor	59.1	59.1 + whatever flow is available	10	30	20	20	20	Oxford Watercourses. 30 Ml/d preferred. No Likely Significant Effects on the Oxford Meadows SAC. Navigation issues in extreme drought. Reductions in velocity and water quality. Short term effects with respect to Biodiversity, flora and fauna including moderate adverse effects regarding INNS, fish community and moderate risk of short term deterioration to the fish component of 2 WFD water bodies. Other abstractors. The DO assessment is provisional and will be updated when the SWOX model is updated.	1
Gatehampton	101.5	105	3.5	3.5	3.5	3.5	3.5	Suspension of flow constraint to allow an increase in abstraction of 3.5 Ml/d.	1
Oxford Canal	0	5 or 10	0	5 to 10	5	5	5	Canal and River Trust Agreement required.	1

Source	Current licence limit (Ml/d)	Potential abstraction with Drought Permit (Ml/d)	Potential Gain (Mld)					Issues/ Risks	Priority
			Min est	Max est	1:100 DO	1:200 DO	1:500 DO		
Meysey Hampton	0	Previous summer limit (Ml/d)	11.37	11.37	11.37	11.37	11.37	No likely significant effects on the North Meadow and Clattinger Farm SAC. Low flows and extension in recovery of flow in surface water (e.g. Ampney Brook). Water quality risk associated with St Peter STW. Potential Cumulative effects with other Cotswolds GW options.	2
Latton	15 ave (17 month)	20 ave	3	5	2.3	2.3	2.3	No Likely Significant Effects on the North Meadow and Clattinger Farm Special Area of Conservation. Groundwater level (Great Oolite) reduction and recovery affecting Ampney Brook. Water quality risk associated with St Peter STW. Other abstractors. Potential cumulative effects with other Cotswolds GW options (Baunton 1 and 2).	2
Baunton 1	0 (flow constraint)	6.3	0	6.3	6.3	6.3	6.3	No Likely Significant Effects on the North Meadow and Clattinger Farm Special Area of Conservation. Impact on the River Churn. Potential cumulative effects with other Cotswolds gw options (Latton and Baunton 2).	3
Bibury	6.819	11.819	0	5	5	5	5	Limited treatment capacity. Minor adverse effects on flows in the River Coln.	5

Source	Current licence limit (Ml/d)	Potential abstraction with Drought Permit (Ml/d)	Potential Gain (Mld)					Issues/ Risks	Priority
			Min est	Max est	1:100 DO	1:200 DO	1:500 DO		
Childrey Warren	0 (emergency licence)	4.546	4.546	4.546	3.33	2.99	2.62	Hydrological impact on the Letcombe Brook	5
Ogbourne	0	3.5	0	3.5	1.2	1.2	1.2	Moderate Hydrological impact on the River Og and minor on the River Kennet. Moderate risk to water quality.	7
Baunton 2	6.3 with DP	17	0	10.7	10.7	10.7	10.7	No Likely Significant Effects on the North Meadow and Clattinger Farm Special Area of Conservation. Low flows in River Churn and extended recovery with adverse effects on ecology. Potential cumulative effects with other Cotswolds gw options (Latton and Baunton 1).	8
Ogbourne emergency boreholes	0	4	0	4	4	4	4	Low yield in drought. Adverse hydrological effects on River Og. Potential for adverse effects on the River Kennet SSSI. Potential for cumulative effects with Axford drought permit.	9

Source	Current licence limit (Ml/d)	Potential abstraction with Drought Permit (Ml/d)	Potential Gain (Mld)					Issues/ Risks	Priority
			Min est	Max est	1:100 DO	1:200 DO	1:500 DO		
Axford 1	6	13.1, (unconstrained licence)	0	7.1	7.1	7.1	7.1	Moderate hydrological effects of drought permit on the River Kennet. Medium risk to water quality. Potential for cumulative effects with Ogbourne, Ogbourne emergency boreholes and Axford 2 drought permits.	10
Axford 2	13.1 (with DP)	20	0	6.9	6.9	6.9	6.9	Major Hydrological effects from the Drought Permit on the River Kennet. Medium risk to water quality. Potential for cumulative effects with Ogbourne, Ogbourne emergency boreholes and Axford 1 drought permits.	11

6.6.3. Order of priority

In general, the order of prioritising SWOX's drought permit options is based on the balance between gain to supply capability and the degree of environmental impact.

The Farmoor option is selected in this (the first) application for a drought permit as abstracting additional river water provides relatively high gain versus medium environmental risk. By including this drought permit in this application, it is anticipated that approval can be gained as rapidly as possible to maximise its benefit before river flows potentially recede further.

As noted above in Section 1.4, the rate of reservoir storage decline can be relatively rapid, consequently, TWUL intends to apply for further drought permits in further application(s) within a short timeframe following this application.

6.6.4. Drought permit options considered and rejected

As discussed in the previous sub-section, at this point in the drought event only the highest priority option (i.e. Farmoor) is being prepared for initial implementation, with further options selected for later implementation (potentially including Baunton 1&2 (noting that Baunton 2 will be submitted at a later date than Baunton 1), Meysey Hampton, Ogbourne, Axford 1&2, Childrey Warren and Latton). The remaining options are not currently being considered due to the issues/risks given in the above table.

Other Drought Plan Priority 1 options in the SWOX resource zone are:

- increased abstraction from Gatehampton (from 101.5 Ml/d to 105 Ml/d) under conditions when the flow constraints are in force. However, abstraction here is currently below 100 Ml/d owing to power failure/start-up/turbidity issues in some of the Gatehampton boreholes (as described in Section 6.6.1.1), so this drought permit is not currently relevant.

- abstraction from the Oxford Canal, however there is no treatment available at Grimsbury to take advantage of this abstraction, so this drought permit is not currently usable.

6.6.5. Outage

As stated in Section 6.6.1.1, it is prudent to make an allowance for outage during a drought event due to unexpected issues such as mechanical failure or water quality, particularly during drought conditions. The Annual Review 2020 reported an allowance for SWOX of 17.14 Ml/d which is also stated in the Drought Plan. The outage allowance calculated for WRMP19 was 17.50 Ml/d.

Demand varies across the year, with demands generally being lower in the winter and higher in the summer. Because of this expected variation TWUL do not plan outages for the summer unless they are necessary. Most outages are planned for the autumn and winter periods.

In addition to this the teams that manage outages have weekly and monthly meetings/forums to stay informed of potential issues, and were therefore aware from late 2021, and throughout 2022, that there had been a lack of rainfall. When forecasts were available they also became aware of the potential for hot weather. This factored into their planning and only essential work was carried

out as planned outage from early 2022. This approach led to there being very little outage during 2022 and below that allowed in the Drought Plan.

The Ml/d loss to supply for each period is calculated by summing the total number of Ml lost to supply and dividing by the number of days in the period. Details of the assets and the number of Ml lost to supply are given in Table 18. In summary:

- Between November 2021 and December 2021, 14 outages occurred in SWOX WRZ with the average impact from outage on the supply demand balance being 10.9 Ml/d. Of these outages 7 (50%) were resolved within 24 hours.
- Between January and March 2022, 10 outages occurred in the SWOX WRZ. The average impact from outage on the supply demand balance was 3.9 Ml/d. Of these outages 5 (50%) were resolved within 24 hours.
- Between April and September 2022, 14 outages occurred in the SWOX WRZ. The average impact from outage on the supply demand balance was 1.7 Ml/d. Of these outages 8 (57%) were resolved within 24 hours, showing an increase in the number fixed within 24 hours during the drought.

Table 18 – Table of outages

Asset	Number of outages (Loss of supply in Ml)		
	Nov 2021-Dec 2021	Jan 2022-Mar 2022	Apr 2022-Aug 2022
Farmoor WTW	6 (272.4 Ml)	1 (38.8 Ml)	2 (103.4 Ml)
Swinford WTW	2 (24.6 Ml)	3 (85.3 Ml)	4 (135.3 Ml)
Watlington WPS	2 (69.3 Ml)	4 (85.8 Ml)	8 (27.5 Ml)
Chinnor WPS	1 (202.4 Ml)	N/A	N/A
Manor Road WPS	2 (15.0 Ml)	N/A	N/A
Witheridge Hill WPS	1 (84.0 Ml)	1 (140 Ml)	N/A
Marlborough WPS	N/A	1 (3.2 Ml)	N/A
Total Ml lost to supply	667.7	353.1	266.2
Days in period	61	90	153
Ml/d lost to supply	10.9	3.9	1.7

Please note that outages at Farmoor and Swinford water treatment works would actually help to maintain Farmoor storage, rather than reducing it, and these outages therefore have no negative impact on the Farmoor reservoir drawdown.

As the outages have been managed to reduce their impact and have been brought below the planned level of outage, there is very little effect on the supply demand balance (SDB), and the only change is a slight improvement. For the year 2022-23 in the WRMP19 DYAA FP SDB planning table for SWOX there was a surplus of 20.96 Ml/d (see Figure 27 for SDB plot). This value would increase by the amount of the decrease in outage from the planned allowance of 17.5 Ml/d (i.e up to 15.8 Ml/d (17.5 – 1.7 = 15.8)). Between April and August 2022 this means that the supply demand balance surplus was ~36.8 Ml/d (21.0 + 15.8 = 36.8)

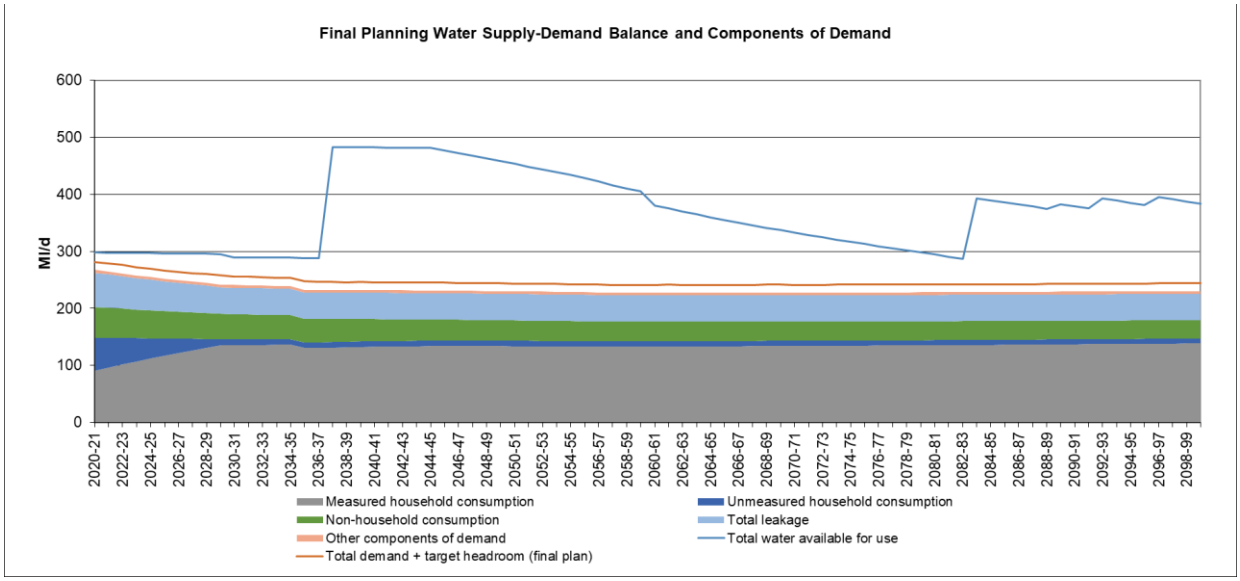

Figure 27 - SWOX DYAA final planning supply demand balance

6.7. Future operational changes

The effectiveness and uptake of all aspects of the water efficiency campaign will be reviewed following this year's drought and changes may be made to the structure of the campaign going forward to ensure it is as effective as possible.

Other options are stated as being under consideration in the Drought Plan including a permit to abstract from the Oxford Canal and an increase in abstraction at Bibury. These sources will continue to be reviewed as future options but could not be implemented in this drought event due to there being no treatment at Grimsbury to utilise water from Oxford Canal, nor any current treatment capacity at Bibury.

Further information is being gathered about the potential timescales for these options to be brought into supply and this will be included in any subsequent drought permit applications.

6.8. Summary

Every drought situation is different, and this year exceptionally low rainfall has occurred, alongside record breaking high temperatures, influencing surface water and groundwater conditions in addition to demand. As demonstrated in this Statement of Reason and summarised below, both supply-side and demand-side measures have been triggered as stated in the Drought Plan ahead of applying for this Drought Permit at Farmoor:

- Non-drought and hot weather response water-efficiency campaigning;
- Application of TUBs for demand management;
- Pro-active management of outage;
- Optimisation of relevant sources where feasible within the context of this drought situation; and
- Review of other options including imports, bulk supplies and recommissioning of disused sources. There are no higher priority drought permits or orders stated in the Drought Plan ahead of Farmoor.

Whilst leakage is currently 15.21 Ml/d above target for a number of reasons, TWUL have fortunately controlled outage which is 15.8 Ml/d below target. This means that the supply demand balance for the WRZ is not reduced once both changes are accounted for.

Measures will continue to be reviewed for the 6 months that this Drought Permit is in place.

7. Environmental Assessment Report

An Environmental Assessment Report (EAR) for this permit application has been prepared and is submitted with this permit application (Reference: Document 4 of the submission). Please refer to the EAR for full details.

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8. Appendix A - Formal Review of Drought Event Level (DEL) 08/09/2022

2022-09 Dry Weather Event Level

9. Appendix B – Media/Water Efficiency Activity

Water Efficiency activity.pdf

10. Appendix C – Thames Water TUB Legal Notice[15]

We originally published the legal notice below on 17 August 2022. Following feedback, we've revised exceptions 16 and 17 and added four new exceptions.

We've included these revisions, which we formally published on 26 August 2022, at the foot of this page.

10.1. Our legal notice

WATER INDUSTRY ACT 1991

TEMPORARY BAN ON WATER USE

Thames Water Utilities Limited

Thames Water Utilities Limited ('Thames Water') gives notice that, pursuant to powers contained in sections 76 and 76A–C of the Water Industry Act 1991 ('The Act'), the following uses of water supplied by Thames Water, including water supplied by Thames Water but billed by other companies, are prohibited.

This prohibition will start at 00:01 BST on Wednesday 24 August 2022 and will continue until further notice. The prohibition applies to the whole Thames Water supply area as illustrated in

[15] Copied from Legal notice of water restrictions | Help | Thames Water

the map below. Thank you for your support at this important time.

Further details concerning the prohibitions, current drought and water efficiency advice may be found on our help page.

10.1.1. Prohibited uses

The following uses are prohibited:

1. Watering a garden using a hosepipe;
2. Cleaning a private motor-vehicle (and trailers) using a hosepipe;
3. Watering plants on domestic or other non-commercial premises using a hosepipe;
4. Cleaning a private leisure boat using a hosepipe;
5. Filling or maintaining a domestic swimming or paddling pool*;
6. Drawing water, using a hosepipe, for domestic recreational use;
7. Filling or maintaining a domestic pond using a hosepipe;
8. Filling or maintaining an ornamental fountain*;
9. Cleaning walls or windows of domestic premises using a hosepipe;
10. Cleaning paths or patios using a hosepipe;
11. Cleaning other artificial outdoor surfaces using a hosepipe.

*Please note that prohibitions 5 and 8 apply to all means of filling, including fixed or permanent plumbing. In relation to all other prohibitions, customers can still undertake the above activities if they use mains water from a bucket or watering can or use water that is not sourced from the

mains such as grey water, rainwater from a water butt through a hosepipe, or private boreholes for example.

10.1.2. Exceptions to the prohibitions

The following uses are excepted from the prohibitions. Those who meet the requirements below can continue to use water without having to make representations to Thames Water to receive permission.

In using water, it is requested that everyone uses water wisely and adopts water efficient practices.

1. Health and Safety: Using a hosepipe to (a) water a garden, (b) to clean a private leisure boat, (c) clean the walls and windows of domestic premises, (d) to clean paths and patios or (e) to clean artificial outdoor surfaces, for health or safety reasons, where health or safety reasons includes removing or minimising any risk to human or animal health or safety and preventing or controlling the spread of causative agents of disease. Please note that for areas of grass used for sports or recreation, this exception only applies to the active playing strip and not the entire ground;
2. Using a hosepipe to water plants that are (a) grown or kept for sale or commercial use, or (b) that are part of a National Plant Collection or temporary garden or flower display;
3. Using a hosepipe to clean any area of a private leisure boat which, except for doors or windows, is enclosed by a roof and walls;
4. Filling or maintaining a pool where necessary in the course of its construction;
5. Filling or maintaining a pool using a hand-held container which is filled with water drawn directly from a tap;
6. Filling or maintaining a pool that is designed, constructed or adapted for use in the course of a programme of medical treatment;
7. Filling or maintaining a pool that is used for the purpose of decontaminating animals from infections or disease;
8. Filling or maintaining a pool used in the course of a programme of veterinary treatment;
9. Filling or maintaining a pool in which fish or other aquatic animals are being reared or kept in captivity;
10. Using a hosepipe to fill or maintain a domestic pond in which fish or other aquatic animals are being reared or kept in captivity;
11. 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;
12. People with severe mobility problems who hold a current Blue Badge as issued by their local authority will not be prohibited from using a hosepipe to: (a) water a garden attached to a domestic dwelling, (b) clean a private motor vehicle, (c) water plants on domestic or other non-commercial premises, (d) water allotments where the Blue Badge holder is the tenant, (e) fill or maintain a domestic pond, (f) clean walls or windows of domestic premises, (g) clean paths or patios; or (h) clean other artificial surfaces;
13. Using a hosepipe to clean: (a) a private motor vehicle, (b) a private leisure boat, (c) walls and windows of domestic premises, (d) paths or patios; or (e) other outdoor artificial surfaces, where this is done as a service to customers in the course of a business;
14. Watering a garden and watering plants on domestic or other non-commercial premises using an approved drip or trickle irrigation watering system, fitted with a pressure reducing

valve and a timer, that are not handheld, that place water drip by drip directly onto the soil surface or beneath the soil surface without any surface run off or dispersion of water through the air using a jet or mist;

15. Cleaning a private leisure boat using a hosepipe if the vessel is a primary residence, in cases where fouling is causing increased fuel consumption or where engines are designed to be cleaned with a hosepipe;
16. Using a hosepipe to water a garden or to water plants on domestic or other non-commercial premises where such watering is restricted to newly laid turf, newly sown lawns, newly planted trees, shrubs and plants where the laying, sowing or planting has been carried out as a service to customers in the course of a business. This exemption only applies for a period of 28 days from the day of planting, sowing or turf laying;
17. Customers on the Vulnerable Customers list who have mobility issues but are not in possession of a Blue Badge can use a hosepipe to: (a) water a garden, (b) clean a private motor vehicle, (c) water plants on domestic or other non-commercial premises, (d) fill or maintain a domestic pond, (e) clean walls or windows of domestic premises, (f) clean paths or patios or (g) clean other artificial outdoor surfaces;
18. Cleaning a private leisure boat using a hosepipe to prevent or control the spread of non-native and/or invasive species;
19. Filling or maintaining an ornamental fountain to operate water features with religious significance.

10.1.3. The following definitions apply:

"Using a hosepipe" in relation to a purpose listed in the prohibitions includes drawing relevant water supplied by Thames Water through a hosepipe from a container and applying it for the purpose; filling or partly filling a container with relevant water supplied by Thames Water by means of a hosepipe and applying it for the purpose;

“Garden” includes a park, gardens open to the public, a domestic garden, a lawn, a grass verge, an area of grass used for sport or recreation, an allotment garden, any area of an allotment garden used for non-commercial purposes and any other green space;

“Garden” does not include agricultural land, as defined in s.109(1) of the Agriculture Act 1947; other land used in the course of a business for the purpose of growing, for sale or commercial use, any crops, fruit, vegetables or other plants; land used for the purpose of a National Plant Collection; a temporary garden or flower display; or plants (including plant organs, seeds, crops and trees) which are in an outdoor pot or in the ground, under cover.

“Hosepipe” includes anything designed, adapted or used to serve the same purpose as a hosepipe. The prohibitions apply whether or not any device is attached to the hosepipe, such as a sprinkler, dripper hose, automatic irrigation systems or similar devices for example;

“Drawing water using a hosepipe for domestic recreational use” includes operating water slides and other recreational equipment. Thames Water considers the recreational use of hot tubs to fall within the definition of domestic recreational use, but will not consider hot tubs that are designed, constructed or adapted for use in the course of medical treatment to fall within the definition of domestic recreational use;

"Relevant water" does not include water supplied by Thames Water Utilities Limited before this prohibition takes effect;

"Private motor-vehicle" does not include (a) a public service vehicle, as defined in section 1 of the Public Passenger Vehicles Act 1981, and (ii) a goods vehicle, as defined in section 192 of the Road Traffic Act 1988.

Further definitions and details about the powers to prohibit water use can be found in The Water Industry Act 1991 and The Water Use (Temporary Bans) Order 2010 ('The Order').

10.1.4. Representations

Representations concerning any of the above prohibitions needed to have been made by 23 August 2022 to Thames Water by completing an online form, calling our drought helpline or writing to us.

If, as a result of any representation, Thames Water Utilities Limited decides to vary any terms of the prohibition, a further notice will be published. Subject to this, the prohibitions will have effect from 24 August 2022 and will remain in force until further notice.

10.1.5. Penalties

Any person who contravenes any of these prohibitions may be guilty of an offence, and liable, on summary conviction, to a fine not exceeding £1,000.

10.2. Additions to the legal notice

In response to feedback from customers, we've made the following additions - formally published on 26 August 2022 - to our original legal notice.

Thames Water Utilities Limited

Variation of Temporary Use Ban

Section 76 and 76A–76C of Water Industry Act 1991

The prohibition on the use of water supplied by Thames Water Utilities Limited ('Thames Water') for a number of specified purposes has been in force since 24 August 2022.

Full details of the prohibition can be found on our website

Following a review of the position, Thames Water has decided to vary the terms of Exception 16 and 17 to the prohibition as follows:

16. Using a hosepipe to water a garden or to water plants on domestic or other non-commercial premises where such watering is restricted to newly laid turf, newly sown lawns, newly planted

trees, shrubs and plants. This exemption only applies for a period of 28 days from the day of planting, sowing or turf laying.

17. Adding, for clarity, "(h) water allotments where the Vulnerable Customer is the tenant"

The following additional exceptions to the prohibition are now included:

20. Watering food crops on allotments
Allotment holders shall be able to water their food crops (but not other plants and flowers) with a hosepipe, where no other means of watering is reasonably possible.

21. Commercial viability of sports
Where watering is needed to maintain the commercial viability of sports pitches such as golf courses, bowling greens and croquet lawns, then areas essential for play may be watered with a hose/sprinkler. For golf, we consider the essential areas to be the tee and green, but not the fairway and approach. For bowling greens and croquet lawns, we consider the essential area to be the lawn area.

If other examples appear, we will clarify the position on our website.

22. Kew Gardens
The Royal Botanic Gardens, Kew will not be prohibited from irrigating using a hosepipe any plant collections where the irrigation is strictly necessary to support their scientific work in compliance with the functions contained in the National Heritage Act 1983.

23. Trees planted in the last three planting seasons
You may use a hosepipe to water trees planted in the last three planting seasons that cannot reasonably be hand-watered, or watered with non-potable water. This exception only extends to planting by a council, charitable/voluntary organisation, commercial organisation, local authority affiliated body such as a community tree nursery, or which require watering as part of a Forestry Commission grant agreement.

The above changes will come into force at 00:01 BST on 24 August 2022 and will remain in force until further notice.

10.2.1. Representations

Representations about the terms of this variation notice could be made by 08:00 on 27 August 2022. We have now removed our online form.

If, as a result of such representations, any further terms of the prohibition are varied, a further notice shall be published.