Draft Drought Plan

2022-2027

Published for consultation 2021

WONDERFUL ON TAP

SEVERN TRENT

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Summary

This is a draft version of Severn Trent Water's statutory drought plan. This drought plan will cover the period 2022-27. We produce drought plans to explain how we will manage both supplies and demand for water during a drought in our region. Our plan aims to balance the interests of customers, the environment and the wider economy. The plan helps us and our stakeholders to make the right decisions at the right time and shows how we will provide a continuous supply of water to our customers during a drought.

For the purposes of this plan we define a drought as a period when there is significantly less water available than normal[1] for a period of three months or more. Whether the effects of any particular drought are focused primarily on the environment, on public water supply or on other water users in the wider economy will depend on the individual characteristics of each drought. All droughts differ in severity, extent and duration. Droughts are naturally occurring events and we cannot plan to prevent them from happening. Instead, we plan to minimise the impacts of droughts when they do occur.

Our plan considers a wide range of drought scenarios. Our approach considers not only the worst droughts in the 1920 to 2014 record but also late 19th Century droughts, drought response surfaces and drought scenarios generated using statistical techniques.

The levels of service that our customers can expect as a response to drought are:

- We will restrict our customers' use of water, on average, no more than three times every 100 years. This applies to both temporary use bans and non-essential use bans. A temporary use ban applies to household customers and is similar to what we used to call a hosepipe ban. A non-essential use ban applies to non-household customers, for example commercial car washing or window cleaning businesses
- We consider that rota cuts / standpipes for our customers are unacceptable. As we would only need to consider using emergency measures in an extremely severe drought we do not have a planned frequency for them

There are a number of indicators that a drought period is developing, for example reservoir storage and rainfall data. We monitor these indicators to identify whether the region is experiencing or likely to experience drought conditions. 85% of our region is managed by predominately using reservoir drought trigger levels.

During times of drought we may utilise demand side actions and/or supply side actions. Actions that could reduce customer demand or leakage are our 'demand side actions'. We consider that demand side actions can be applied anywhere in our supply region. However, we will select the appropriate combination of options and target them depending on the extent to which different parts of our region are affected by drought. Actions that could increase our supply of water are our 'supply side actions'. We can implement most of these actions without any special permissions but there are some options that would require either Government or Environment Agency approval.

Our plan also describes how we may choose to apply for drought permits and drought orders. These allow us to abstract and / or discharge water in different ways to what we do in non-drought conditions. We have 6 locations

[1] We consider that there is less water available than 'normal' when any of our drought triggers, such as reservoir storage, are in trigger zone C or below – we explain our drought triggers, drought trigger zones and associated actions further in section 2.

where we may choose to implement a drought permit or drought order if needed, including a new site at our Dove reservoirs.

Communication is a key part of our plan. We have set out how our communications plan will operate at different stages before, during and after a drought. Effective agile communications can help to reduce demand in a drought, for example, by raising customer awareness of the limited availability of water resources.

We have planned our system so that it can withstand any drought that is as severe as those we have seen over the last 95 years and up to a 1 in 200-year event. We have also tested our investment proposals against a range of plausible future droughts not seen in the historic record that have quantified probabilities for drought severity and duration. We are confident that our plans represent a good balance between cost, environment, and resilience to severe droughts. Our stochastic drought modelling indicates that we are resilient to a 1 in 200-year drought without the need for emergency drought orders. We are assessing our resilience to a 1 in 500-year drought in preparation for our 2024 Water Resource Management Plan.

Reports to accompany this draft plan

To accompany this draft drought plan we have produced several other reports which provide further information on how we will supply our customers in a drought whilst protecting the environment. The following reports can be found on our website:

- Non-technical summary
- Strategic Environmental Assessment (SEA) of the drought plan

In addition, the following reports are available on request:

- Habitats Regulations Assessment (HRA) of the drought plan
- Water Framework Directive (WFD) assessment

Section 1 Introduction

1.1 About Severn Trent

Our purpose is to take care of one of life's essentials, delivering an outstanding customer experience, best value service and environmental leadership. We are one of the largest water companies in the country and provide high quality drinking water and sewerage services (taking wastewater away) in the Midlands. For further information on our business, please visit www.stwater.co.uk.

1.2 What is a drought?

Droughts are naturally occurring events. There is no single definition of drought, but all droughts involve an extended period of lower than average rainfall. Whether the impact of any particular drought falls on the environment, on public water supply or on other water users in the wider economy will depend on the individual characteristics of each drought. All droughts differ in severity, extent, and duration. The effect of droughts will also be different depending on whether the majority of the water sources affected are rivers, reservoirs or groundwater.

For the purposes of this drought plan, we are referring to an event that lasts a minimum of two or three months. This means that a few days or weeks of particularly hot and / or dry weather do not constitute a drought. Periods of this sort will class as heatwaves if there are prolonged periods of higher than average temperatures. Heatwaves can cause water companies short term issues by drawing down levels in treated water reservoirs. However, events like this are too short term to fall within the scope of this plan.

We expect climate change to lead to more extreme climatic events in the future – these will include severe droughts as well as severe flooding events. Extreme droughts are low likelihood, but high consequence, events.

1.3 What is a Drought Plan?

Droughts are naturally occurring events and we plan to minimise the impacts that they might have. We produce a drought plan to explain how we will manage both supplies and demand for water during a drought in our region. Our plan aims to balance the interests of customers, the environment and the wider economy. The plan helps us and our stakeholders to make the right decisions at the right time and shows how we will provide a continuous supply of drinking water to our customers during a drought.

Under Sections 39B and 39C of the Water Industry Act 1991, as amended by the Water Act 2003 and in accordance with the Drought Plan Regulations 2005 and the Drought Plan Direction 2020, we are legally required to prepare and maintain a drought plan. This drought plan sets out how Severn Trent Water will "continue, during a period of drought, to discharge its duties to supply adequate quantities of wholesome water, with as little recourse as reasonably possible to drought orders or drought permits." This definition is consistent with the Water Industry Act 1991.

We are also required to consult with the public on the content of the plan, assess the representations we receive and prepare our statement of response within 15 weeks of the draft plan publication date.

We have based the structure of this plan on the recommended structure provided in Appendix I: Advice on the structure and format of your plan in the EA guidance 'Water company drought plan guidelines' dated December 2020.

1.3.1 Consistency with the EA and NRW drought plans

When preparing our draft drought plan we have considered and referred to the 2017 Drought Response Framework produced by the Environment Agency (EA). We have also referred to the EA area and/or NRW (Natural Resources Wales) drought plans as appropriate and where they are available. We can confirm that there is consistency between the EA/NRW drought plans that we have reviewed and our own plans.

1.4 Overview of process

Appendix C of the EA guidance note 'Water company drought plan guidelines' dated December 2020 provides a useful overview of the Drought plan process. We have reproduced it in Figure 1 below.

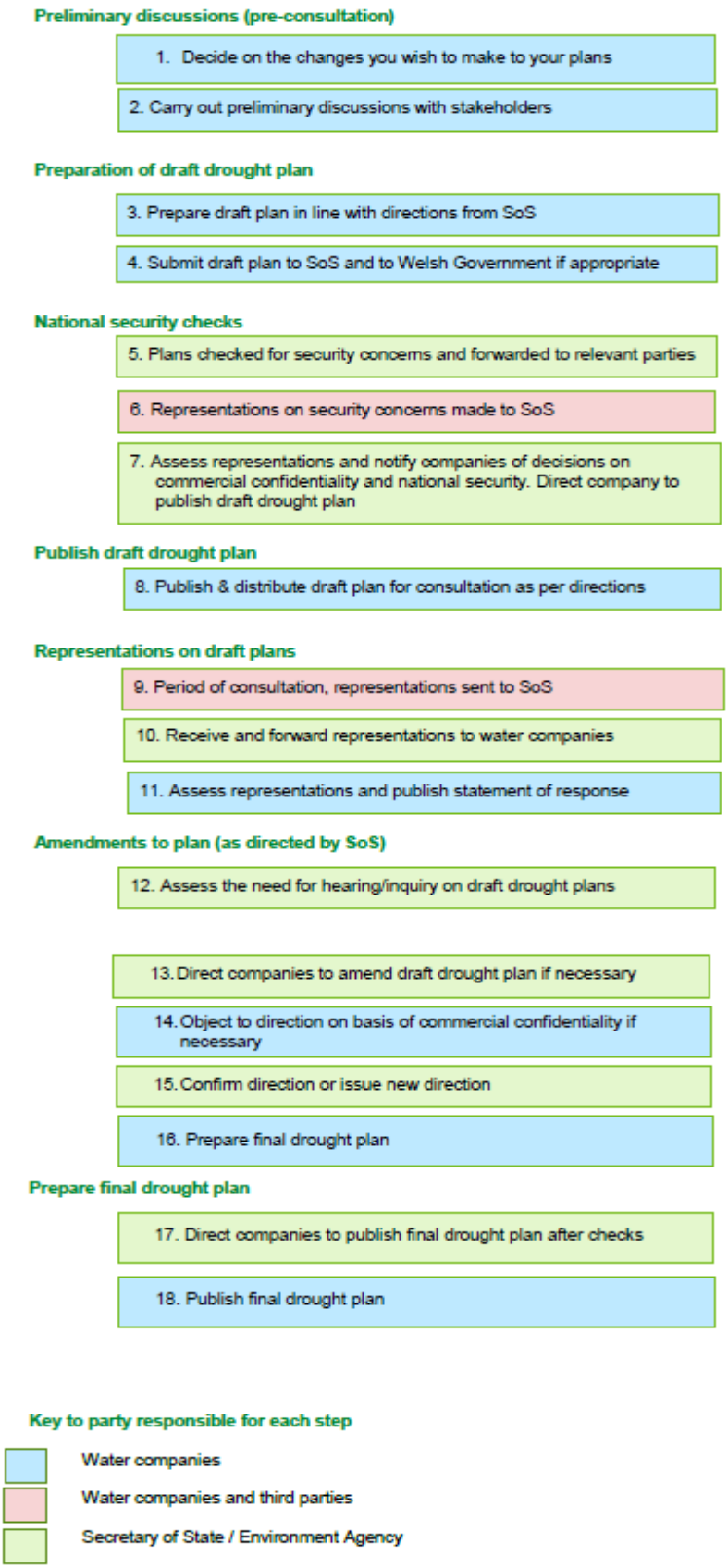


Figure 1 Process flow diagram from EA guidance

1.5 Severn Trent & Hafren Dyfrdwy

In February 2017, Dee Valley Water became part of the Severn Trent group. In May 2018, Ofwat approval was received to align the boundaries of Severn Trent Water and Dee Valley Water to the national boundaries of England and Wales (Figure 2) . In line with this approval, we launched the new name, Hafren Dyfrdwy on 1st July 2018. Both Severn Trent and Hafren Dyfrdwy customers can expect their respective drought plans to provide information on how water supplies and demand are managed during a drought in their region. We will continue to work closely with the Environment Agency and Natural Resources Wales to ensure consistency between plans for our customers. We published the Hafren Dyfrdwy Drought Plan in 2020. It can be found here: https://www.hdcymru.co.uk/about-us/plan-and-strategy/water-resource-planning/drought-plan/

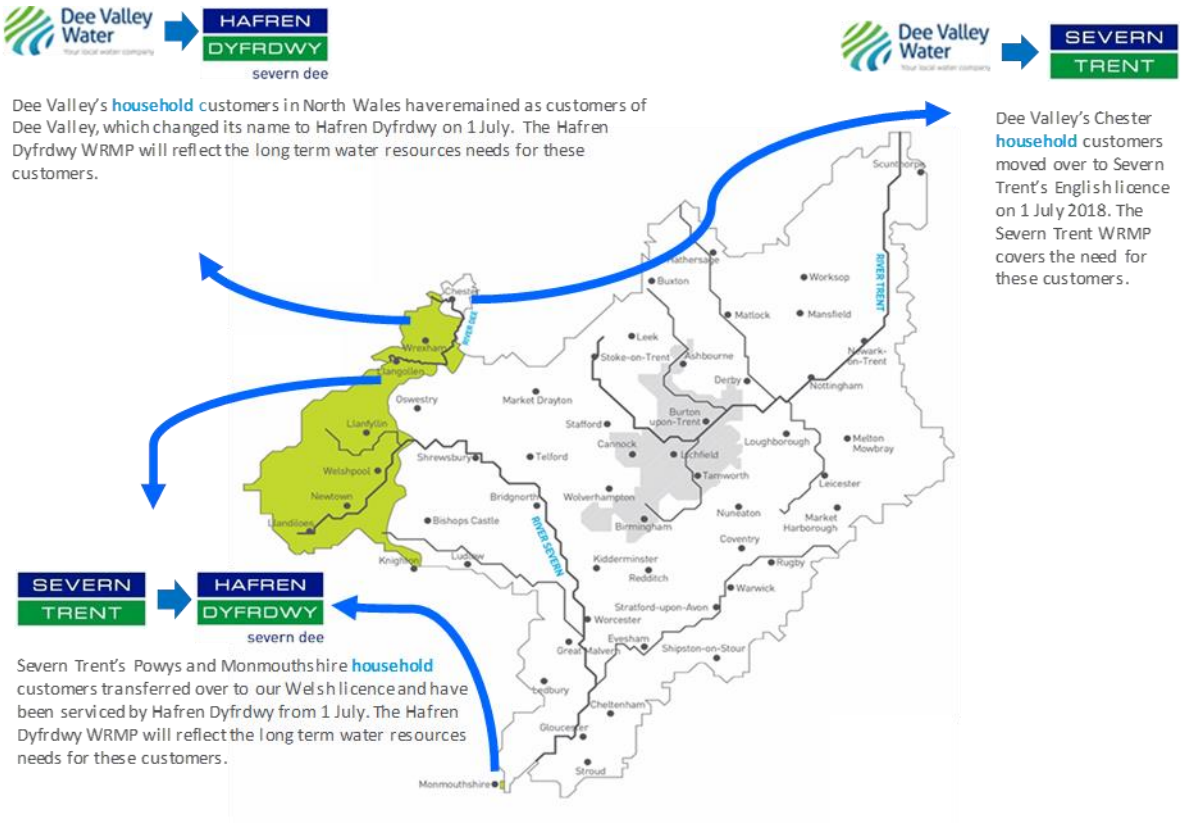


Figure 2 Map illustrating company changes between Severn Trent & Hafren Dyfrdwy

1.6 Baseline water resources situation, levels of service and customer views

We have described our baseline water resources situation in our 2019 Water Resources Management Plan (WRMP19), and in the annual review information that we provide to the EA and Defra. As a company we produce other plans that overlap to some extent with drought management. For example, we produce water resource management plans (WRMPs) and business plans. We have included a table in Appendix G that describes why we produce these other plans and summarises what they contain. As stated in that table, this drought plan is not an investment plan. Any assessment of, or proposal for, investment for drought resilience is in our business plan or WRMP.

Figure 3 shows the WRZs within our Severn Trent region following the creation of Hafren Dyfrdwy. These 15 zones vary widely in scale, from the Strategic Grid zone which supplies the majority of our customers, to the small zones of Mardy and Bishops Castle which supply much smaller populated areas. These zones have very different water resources challenges, with some requiring significant investment in the long term to ensure secure supplies, while others require minimal investment to maintain the current assets and infrastructure.

We have checked that the new WRZs of Chester and Shelton comply with the requirements of the Environment Agency document entitled '*Water resource zone integrity - Supporting document for the Water Resource Management Plan Guidelines*' dated July 2016. All other WRZs were checked as part of our previous WRMP, no changes have been made to any other water resource zones. We outlined and agreed the approach that we took to our WRZ boundaries with the Environment Agency in autumn 2018.

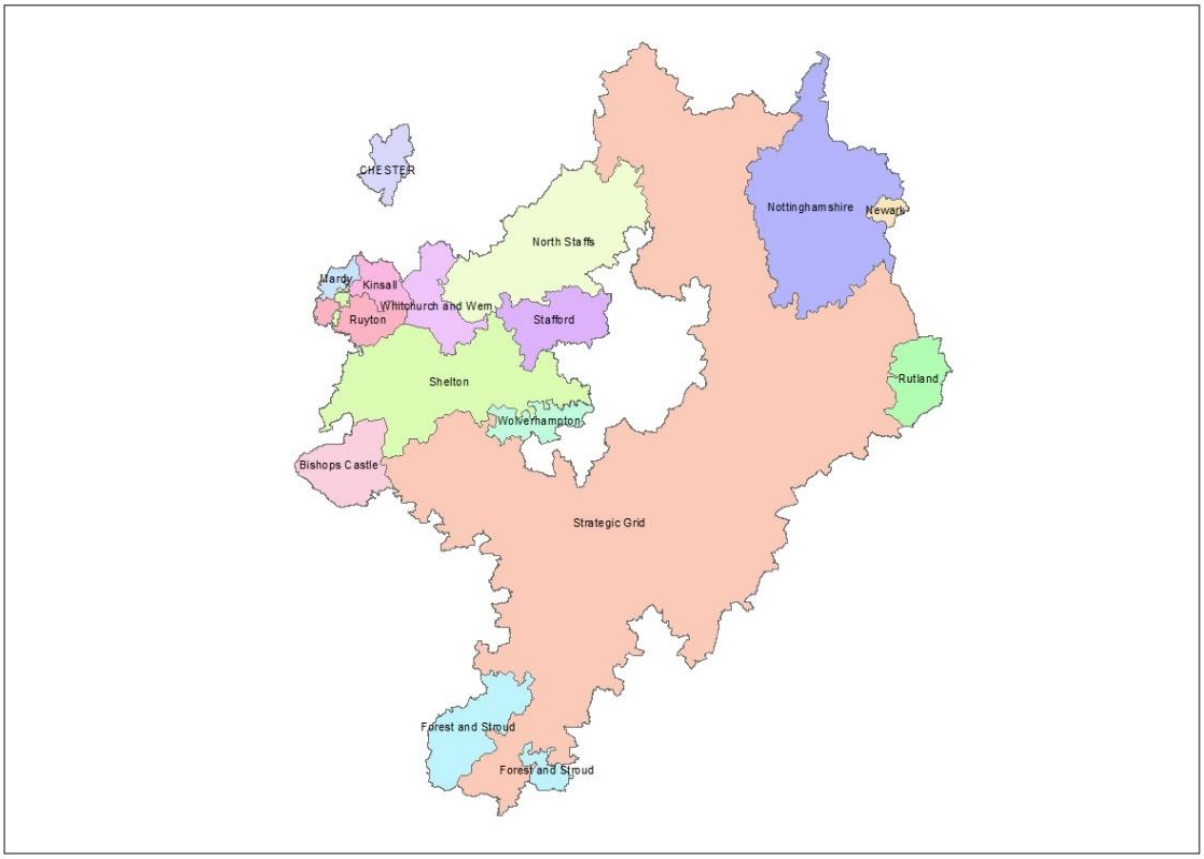


Figure 3 Severn Trent Water Resource Zones

1.6.1 Levels of service

Our stated levels of service set out the standard of service that our customers (household and non-household) can expect. Section 5.1.3 also sets out how we can help those in the region on private supplies. The levels of service stated for this drought plan are consistent with those recognised by Ofwat at the Price Review of 2019 (PR19). These levels of service that our customers can expect as a response to drought are:

- We will restrict our customers' use of water, on average, no more than three times every 100 years. This applies to both temporary use bans (TUBs – level 2 restrictions) and non-essential use bans (NEUBs – level 3 restrictions). We explain these in section 3.1.5.
- We consider that rota cuts / standpipes for our customers are unacceptable. Note that rota cuts and standpipes are often referred to as 'level 4 restrictions' or emergency drought (order) measures. As

we would only need to consider using such measures in an extremely severe drought we do not have a planned frequency for them.

These stated levels of service are consistent with those we have quoted in previous Severn Trent publications, such as our 2014-19 drought plan and are consistent with the WRMP19 that we published on our website in 2018/2019. We are reviewing this information in WRMP24 due to the new requirement to plan to 1 in 500 year drought events and our new stochastic modelling methodology. We set out the sensitivity of our system (in terms of deployable output) to different levels of service in our WRMP. Table 1 shows the modelled frequency* of customer restrictions:

Table 1 Modelled frequency of restrictions on customers' use

	Our levels of service	Length of record (years)	Company states LoS frequency
Level 2: Temporary Water Use Ban (TUB)	3 (1976 and 1984: Elan Valley Group, 1934: Tittesworth)	95	Not more than 3 in 100
Level 3: Non-Essential Use Ban (NEUB)	1 (1984 for Elan Valley)	95	Not more than 3 in 100
Level 4: Rota cuts/ standpipes	0	95	Not acceptable / no planned frequency

** The 1995-96 drought does not trigger restrictions in our modelled scenarios and therefore does not appear in this table. We have shown the modelled results for this drought in section 2.5.*

Our company wide levels of service (Table 2) are based on water resources modelling that we have carried out using flow series which extend from 1920 to 2019. This annual average risk value has been calculated based on the frequency of Temporary Use Bans (TUBs) and Non-Essential Use Bans (NEUBs) water use restriction that we used in our calculation of deployable output in our Aquator water resources model. We have provided more detail on how we use this flow record in section 2. This drought plan makes no explicit allowance for the impacts of future climate change. This is consistent with our 2014-19 drought plan. However, we are carrying out a further rigorous assessment of climate change for our WRMP24.

Table 2 Company Level of Service and Annual Average Risk of Drought Restrictions for each AMP from 2020 to 2045

Drought restriction	Our levels of service	2020-25	2025-30	2030-35	2035-40	2040-45
Temporary Water Use Ban	3 in 100 years (3% annual risk)	3%	3%	3%	3%	3%
Ordinary Drought Orders (Non-Essential Use Restrictions)	3 in 100 years (3% annual risk)	3%	3%	3%	3%	3%
Emergency Drought Orders	We consider these unacceptable	<0.2%	<0.2%	<0.2%	<0.2%	<0.2%

1.6.2 Customer and stakeholder views

We sought the views of our customers and stakeholders on drought resilience through our PR19 business planning process and through research conducted following the hot weather and high demand during the initial Covid-19 lockdown in 2020. A few examples that informed our PR19 plan are described below.

Willingness to Pay (WTP) work. This is similar to the work we carried out for WRMP14. The WTP research we carried out prior to PR19 showed that our customers were willing to pay £3.8m to half the risk of standpipes. This may sound like a large amount of money, but it was actually smaller than the WTP values for some of the other improvements we asked customers about.

Immersive research. We carried out research like this for PR19 as it has many advantages over the other approaches as it means we can 'immerse' selected customers in more detail so that they are properly informed before we ask them for their views on these (often technical and complex) issues. This work also allows customers to better consider competing priorities.

Overall, customer awareness of drought and the water resources supply / demand challenge is very low. According to our customer tracker, only 7% of customers think that we won't have enough water in 10 years' time and 10% in 20 years' time. By inference, severe drought is therefore not something that customers anticipate will affect the UK.

As drought is not something most customers consciously consider, we used deliberative research to discuss and understand our customer's informed views (in line with our strategic research framework). We used a drought 'story board' to help customers imagine the development of a drought situation over time, with progressively more serious customer impact as outlined in Figure 4.

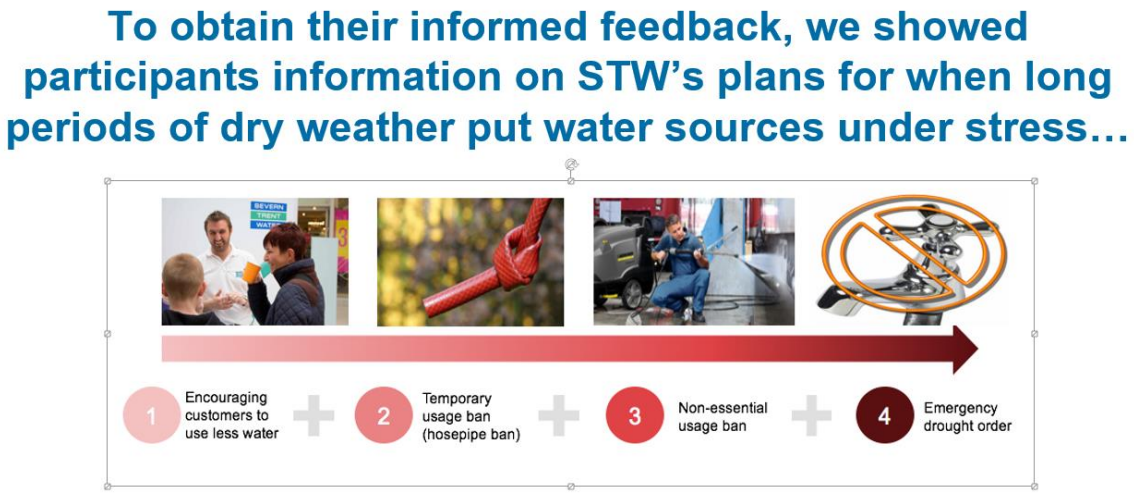


Figure 4 Material used for PR19 immersive customer views' research

In summary the customers we engaged generally felt that:

- Drought is not an issue they anticipate will affect the UK
- Due to the perceived minimal impact of temporary use ban (TUB) restrictions, the expected frequency is mostly seen as acceptable
- They do not see non-essential use bans (NEUBs) as having direct impact on them, but worry about the impact on businesses
- Level 4 is seen as extreme, although probably proportionate and very unlikely to occur (we described the frequency of this as 'never / once every 200 years)'.

We think that this useful and in-depth customer insight work has shown that the current levels of service we provide and those that we plan for in our drought plan and WRMP are in line with customer views and expectations. Customers expect us to be prepared to address any long-term challenges which may affect water supply, such as climate change or population growth. Customers also expect us to meet our statutory

obligations, including those related to restoring unsustainable abstraction and ensuring no environmental deterioration. Further information on our PR19 customer research can be found here: https://www.stwater.co.uk/content/dam/stw/about_us/pr19-documents/sve_appendix_a1_engaging_customers.pdf

As suggested in the 2017 Water Resources Planning Guidelines (WRPGs), we considered using the UKWIR (United Kingdom Water Industry Research) risk-based planning report directly in our customer research in relation to drought resilience. We did not think that this work was suitable for the WTP phase of our work, but we have adapted elements of it to assist with our immersive research. We are aware that there are challenges involved in helping customers to better understand the likelihood of extreme drought events.

In addition to this customer engagement work we have shared our extreme drought scenario work, described in section 2, with our Water Forum. Our Water Forum includes experts in this field. We have also presented our drought resilience work at WRMP external stakeholder forum meetings. For example, we held one of these multi stakeholder WRMP19 events in Coventry on 6 October 2017. We provide more details on the extensive stakeholder engagement we have carried out in our 2019 WRMP.

One of the organisations represented at our stakeholder events, and that responded to our pre-consultation, is the Consumer Council for Water (CCWater). CCWater is a statutory consumer body for the water industry in England and Wales. In addition to gathering views from CCWater, we have sought customers' views on the priority that they place on never having level 4 restrictions such as standpipes/ rota cuts. We have done this in different phases. We carried out some work of this sort in preparation for our WRMP14 but we adapted our approach in the research we did to support our PR19 plans. For example, our PR19 WTP work focused on emergency drought measures such as rota cuts and standpipes whereas the PR14 work asked about restrictions on hosepipe use. We expected customers to have stronger views on rota cuts and standpipes than they did on 'hosepipe ban' frequency. We also carried out research at the request of CCWater following the hot weather high demand in the initial Covid-19 lockdown between March – June 2020 (see section 5.2.3). We believe that using research we conduct for our Water Resource Management Plan and our Business Plan which link well with our Drought Plan, as well as other customer research on hot weather/high demand we are able to effectively ensure our customer's views on drought are taken into account in our Drought Plan.

1.7 Alignment with Water Resource Management Plan and Regional Plans

In developing this draft drought plan we have ensured we are consistent with our draft WRMP24 where possible, however the alignment with WRMP is complex as the WRMP24 timeline is different to that of this drought plan and we are earlier in the process in terms of developing our WRMP24. To this effect, there are elements of this plan that are aligned with WRMP24 as the analysis has already been carried out, but other elements that are based on WRMP19. The assumptions and data used are consistent and aligned with our draft WRMP24 for the new drought trigger curves which have been developed utilising a longer data set. These are included in this draft drought plan. However, this draft drought plan utilises our drought vulnerability analysis based on the outputs of our WRMP19 which has assessed our drought vulnerability to droughts of various return periods, types and severities.

Severn Trent's geographical position means that we interface with each of the new regional water resources groups. As a company we are situated mainly within Water Resources West (WRW) where we have 12 WRZs, while we have three WRZs within Water Resources East (WRE). Through engagement with the relevant regional groups, and by contributing to the Regional Coordination Group (RCG), we have ensured that our drought plan aligns with the other water companies within WRW and is consistent with the approach being taken by the other regional groups. All WRW water company members, including Severn Trent, propose to adopt a consistent form

of notice for Temporary Use Bans; to use regionally consistent data and assumptions for their drought plan where appropriate; and to align our drought communications where appropriate. Full information on this alignment that Severn Trent have agreed to can be found in Appendix H.

1.8 Pre-draft and draft consultation details

We sent a pre consultation email on 23rd July 2020 to interested parties, neighbouring water companies and statutory consultees. These organisations included:

- CCWater (Consumer Council for Water)
- CRT (Canals and River Trust)
- Defra
- Environment Agency
- Environmental charities
- Local authorities
- Natural England
- Non household water retailers
- NRW (Natural Resources Wales)
- Ofwat
- Regional water resource groups

We requested early views on the issues these organisations want us to address in our plan. We asked for these responses no later than the 14th August 2020. We have accounted for these responses, produced this draft drought plan and submitted it to the Secretary of State in March 2021. Once we receive permission, we will publish the draft plan for public consultation.

Section 2.4. of the Environment Agency's water company drought plan guidelines state that we should make paper copies of our draft plan available for inspection at our offices during the consultation on the draft Drought Plan. However, in light of Covid-19 to help maintain social distancing, in the first instance we will make hard copies available for posting on request. In the event a member of the public wishes to inspect a non-redacted version of the draft plan or its associated appendices, which is not suitable to be posted, then we will make provision to allow access to our Head Office in Coventry following Covid-19 rules.

We will be running our public consultation on this drought plan (subject to receiving the approval to commence the consultation) for eight weeks after receiving approval to commence the consultation. All consultation responses should also be sent to the Secretary of State at Water.resources@defra.gov.uk or Defra, Water Company Drought Plan, 3rd Floor, 2 Marsham Street, London, SW1P 4DF. We will produce our statement of response (SoR) within seven weeks of the public consultation ending. This will then meet the requirement for companies to publish their SoR within 15 weeks of publishing our draft plan for consultation. This SoR will show how we have responded to the comments we have received. For example, we may also produce a revised draft drought plan which highlights the sections we have amended as a result of the public consultation. In addition, there may also be comments which we discuss in the SoR but which do not require specific changes to the Drought Plan text. We intend to publish our final drought plan, subject to approval, at the end of 2021 / early 2022.

Section 2 Drought triggers

2.1 Historic droughts and other drought scenarios

When preparing this plan we have considered a wide range of drought scenarios. For example, all of our WRMP19 modelling, which uses our historic record, includes flows across our region from 1920 to 2014. Companywide the 1975-76 drought is the most extreme in our hydrological and hydrogeological record. This is the drought that we have based much of our current plans on. However, we have also looked at what the impacts might be if we were to experience a more severe drought than the 1975-76 drought and the other drought events present in our baseline modelling period e.g. 1933-35, 1995-96.

If we experience a drought more extreme than the droughts we currently plan for it could lead to emergency measures such as standpipes in the street or rota cuts for our customers. As we said in section 1.6.1, we do not plan for level 4 restrictions such as rota cuts or standpipes. In an extremely severe drought we would consider using them, and from WRMP24 onwards we will have a planned level of service for these types of drought.

Please see Appendix D for the technical detail around how we investigated our water resource system to cope with a variety of droughts.

2.1.1 Chester WRZ and Drought Resilience

Now that the Chester WRZ has been incorporated into the wider Severn Trent plan, we have carried out the modelling necessary to understand the level of service for the Chester WRZ during a 1 in 200 year drought scenario.

The only sources in the Chester WRZ are the River Dee and the Mickle Trafford borehole. The borehole is resilient to drought and the River Dee abstraction is protected from Dee General Direction (DGD) cut-backs by augmentation from the Pen Y Cae Lower reservoir in Hafren Dyfrdwy's Wrexham WRZ. Stochastic modelling of the Natural Resources Wales (NRW) River Dee model has shown that flow levels in the River Dee have high resilience to droughts and abstractions from the River Dee are not affected by severe and extreme droughts. This indicates that the Chester WRZ deployable output and levels of service during severe and extreme droughts will only be determined by the resilience and capability of Pen Y Cae Lower reservoir to augment the River Dee as per the DGD rules.

To assess this, testing was undertaken by running the stochastic data that has been prepared for deployable output modelling (i.e. 8,700 years) through the Wrexham water resources model, with the Wrexham zonal demand set at a level above forecast demand plus target headroom for that zone.

In our modelled scenarios, augmentation from Pen Y Cae Lower reservoir was fully maintained throughout all plausible severe and extreme droughts in the stochastic data. Therefore, the Chester WRZ was found to be resilient to plausible severe and extreme droughts, and the deployable output at all return periods is consistent with the historic, asset capacity / licence-based deployable output of 29.3 Ml/d. Therefore we can conclude that the 1 in 200 year deployable output for Chester is 29.3Ml/d and the Level of Service remains consistent with the baseline level of service. These results are available in table 10 of our final WRMP19.

We have not quantified a risk of level 4 emergency drought orders as we do not feel these are acceptable to include in our 'business as usual' planning, and therefore they would only be used as part of our Emergency Plan. However, we have calculated the likelihood of this level of restriction and our drought resilience analysis demonstrates that we are able to meet Defra's reference level of service (a 1 in 200-year drought) without the use of emergency drought orders, as shown in Table 3.

Table 3 Chester WRZ Annual Average Risk of Drought Restrictions per AMP from 2020 to 2045

Drought restriction	DGD Stage	Our levels of service	2020-25	2025-30	2030-35	2035-40	2040-45
Temporary Water Use Ban	Stage 2 / 3	1 in 40 (2.5% annual risk)	2.5%	2.5%	2.5%	2.5%	2.5%
Ordinary Drought Orders (Non-Essential Use Restrictions)	Stage 3	We do not plan for NEUB	0.47%	0.47%	0.47%	0.47%	0.47%
Emergency Drought Orders	N/A	We consider these unacceptable	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%

For information on our drought triggers and actions for Chester, please see appendix B.

2.1.2 Drought Resilience Statement

We have planned our system so that it can withstand any drought that is as severe as those we have seen over the last 95 years and up to a 1 in 200-year event. We have also tested our investment proposals against a range of plausible future droughts not seen in the historic record that have quantified probabilities for drought severity and duration. We are confident that our plans represent a good balance between cost, environment and resilience to severe droughts. Our stochastic drought modelling indicates that we are resilient to a 1 in 200-year drought without the need for level 4 emergency drought orders. As detailed in section 1.6.1 we are reviewing this information in WRMP24 due to the new requirement to plan to 1 in 500 year drought events.

2.2 Triggers, Data sources and arrangements

There are a number of indicators that a drought period is developing. The following indicators affect the hydrological conditions within our region:

- Rainfall deficits, particularly comparisons against long term averages (we discuss this further in section 3.3.3)
- Soil moisture deficit (SMD) - high soil moisture deficits occur when soils are dry. This indicates that drought conditions may be building and demand could increase
- Low river flows; however, our resource rivers are, with only one exception, supported by impounding or pumped fill reservoirs. It is because of this that our operations can generally survive a short sharp drought, such as the one in 2003, when river flows fell markedly
- Falling groundwater levels
- Falling reservoir storage

We are grateful to both the EA and NRW for providing us with some of the information listed above. For example, the EA provides us with regular flow data at many locations and NRW provides flows for sites such as the Wye at Redbrook. Should we wish to vary any of these arrangements then we will contact the relevant organisations. It is important to all parties that we continue to share the most accurate and up to date information that is available. This collaborative working helps us to make decisions with the best information possible.

We also use publicly available data such as that found in the Centre for Ecology and Hydrology (CEH) UK drought portal (see references for link). Figure 5 shows a map from this portal in which we have selected the June 2020 spatial data:

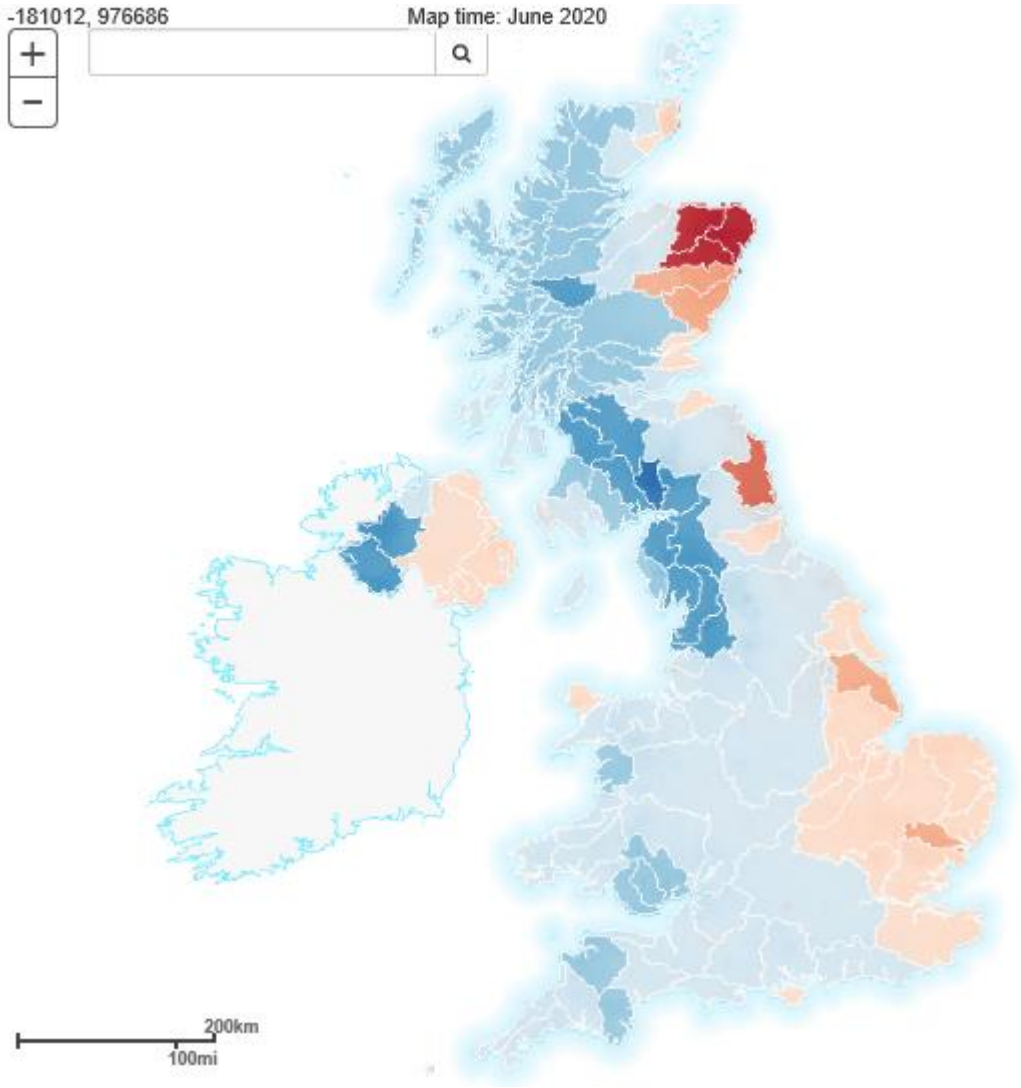


Figure 5 Drought portal information on CEH portal

As part of our normal operations we monitor the indicators listed above and we also monitor:

- Levels of customer demand
- Leakage, and
- The quantities of abstraction at surface and groundwater sources, for instance we monitor the amount of our annual licence that we have used.

2.2.1 Surface water triggers

We manage droughts by using reservoir drought triggers in the following three water resource zones (WRZs):

- Strategic Grid
- Nottinghamshire and

- North Staffordshire

Taken together, these three WRZs make up over 85% of the total population of our region. We have derived drought action triggers for the major reservoirs in our Strategic Grid and North Staffordshire WRZs. We also include the Nottinghamshire WRZ here as it receives a significant supply from the Strategic Grid. Therefore, the water resources position in the Nottinghamshire zone depends upon the resources position in the Strategic Grid. We describe the approach that we take in our other WRZs in section 2.2.2.

In the three WRZs listed above we regard the variation in reservoir storage as the fundamental, operational measure of any drought situation. We base our drought triggers on this (an example of these drought trigger zones can be seen later in this section and the complete set are presented in appendix B).

We use surface water sources as drought action triggers only when they are of strategic importance. We consider that our larger raw water reservoirs or reservoir groups are strategic whereas our smaller sources are not. For example, we own and operate numerous service reservoirs which store treated water and provide supply for localised areas. These assets are not strategic in nature and it is not appropriate for us to use them as drought triggers.

To take the appropriate drought management action at the correct time we monitor reservoir levels and quickly identify when any of these levels enter into the specified trigger zones. As a drought situation develops there is a risk that storage will fall through the predefined trigger zones. However, we are proactive and instigate several operational responses to try to head off any issues before storage falls too far. This is part of our BAU (Business as Usual) operations. Taking this action early does not guarantee that storage will recover but it puts us in the best possible position if the lack of rainfall were to continue. The responses we take when as a result of indicators crossing triggers are both supply-side and demand-side. This means that they either increase the amount of water that we have available or reduce the amount that we need to supply.

Water company members of Water Resources West have agreed to consistently adopt Level 1 to 4 definitions to categorise their drought actions. We will continue to use drought trigger zones internally to manage our operations and actions in a drought. However, for consistency with other WRW companies our drought plan details drought restriction levels and how they relate to our operational drought triggers. The Level definitions encompass more than one of our drought trigger zones in certain instances. Table 4 details our drought trigger zone definitions and how these relate to the Level 1 - 4 drought restrictions.

Table 4 Definitions of the drought trigger zones

Drought trigger zone	Drought restriction level	Comment
A	1	Above normal - storage is above average for the time of year
B		Normal - storage is in the average range for the time of year
C		Below normal - storage is below average for the time of year
D	2	Low storage – storage is low for the time of year
E	2/3	Notably low storage - storage is notably low for the time of year. If storage is in this zone for more than 7 days between April and October we expect to implement a TUB. On average, we would not expect more than 3 of these in 100 years. We may also need to implement drought permits in this zone.
F	3	Exceptionally low storage* - storage is exceptionally low for the time of year. In this zone we consider, and potentially implement, drought orders to restrict non-essential demand. If necessary, we would then consider the use all possible actions to avoid emergency drought orders.

Emergency storage	4	If storage ever reached this level we would refer to our emergency contingency plans rather than the drought plan

Figure 6 illustrates the operational measures we may take in North Staffordshire as Tittesworth reservoir storage reduces and passes through the trigger zones. We have provided a summary of all surface water data triggers and drought management actions in appendix B.

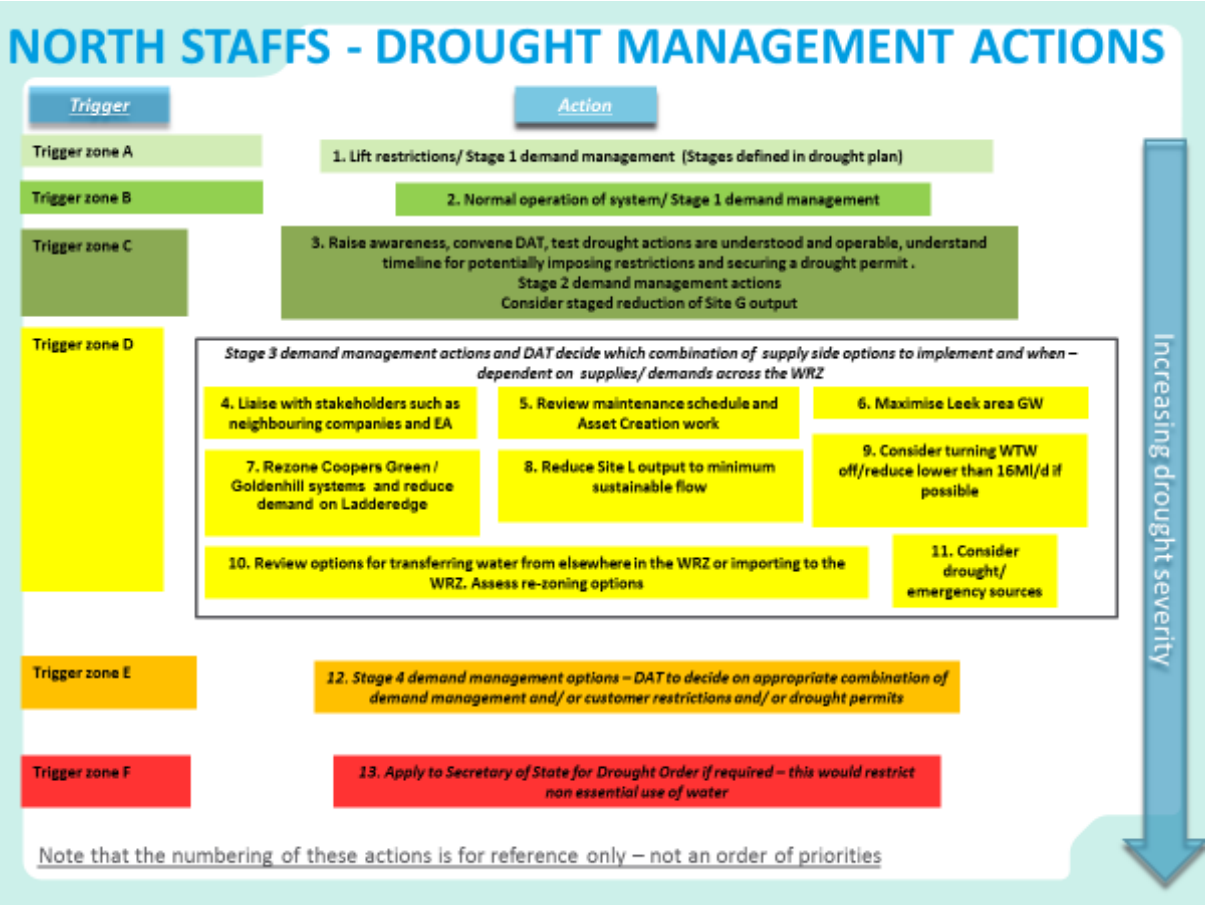


Figure 6 Decision flowchart showing drought management actions for North Staffordshire

Since we published our 2014 drought plan we have reviewed our reservoir drought trigger zones. Figure 7 shows the drought trigger zones for Tittesworth reservoir in North Staffordshire.

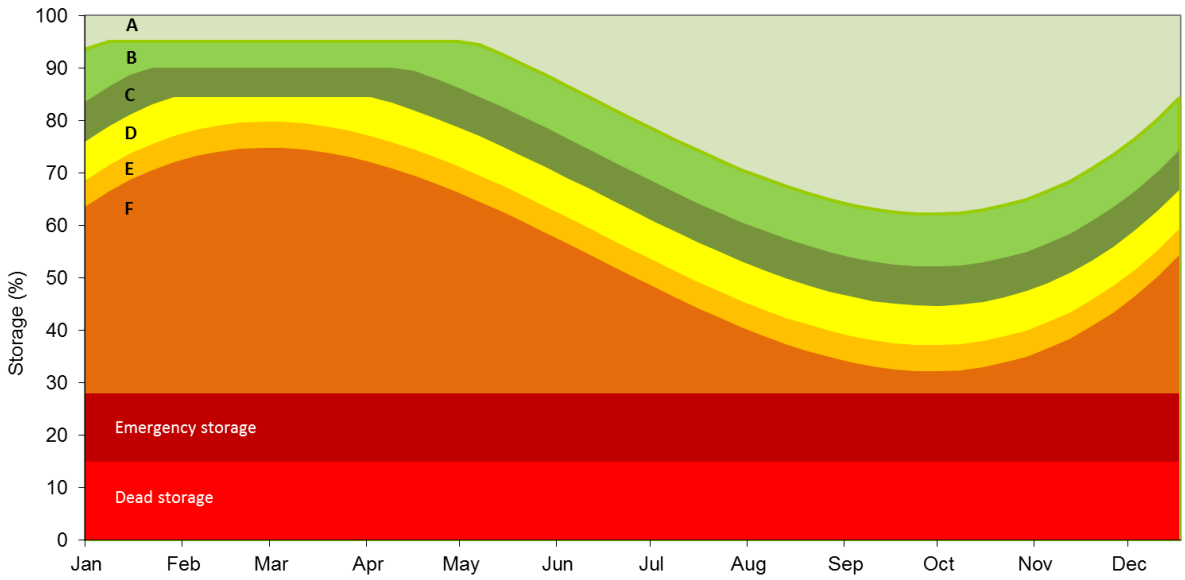


Figure 7 Graph showing drought trigger zones for North Staffordshire

The reason for drought trigger zones is to alert the business and our stakeholders when we expect to implement drought management options. In particular we use them to trigger potential implementation of restrictions e.g. temporary use bans (TUBs), drought permits and/ or drought orders. Since we produced our 2014-19 drought plan we have reviewed and updated the drought triggers that we use.

To review our reservoir drought triggers we used our Aquator water resource model. Updating our drought triggers is one of many improvements and updates that we have made to our water resources planning capability since PR19.

This company-wide Aquator model includes all five of the reservoirs or reservoir groups for which we produced revised trigger curves. These are:

- Carsington and Ogston
- Derwent Valley
- Elan Valley
- Tittesworth and
- Draycote

We have updated these curves for WRMP24 and these updated curves are used in this drought plan.

The process we followed had the following stages:

- Analysis of the Aquator modelled results for the 100 year run with no demand restrictions applied on customers. It was essential for this run not to have demand restrictions in as it would mean that the previous curves would have an effect on the generation of the new, improved curves
- Comparison and verification of the curves to take account of:
    - modelled crossing frequency of curves
    - target crossing frequency, which is based upon our stated levels of service,
    - overall system behaviour (in terms of percentiles) and

- historical records of drawdown

- Internal 'sense check' of the curves against operational experience and knowledge. We then used these finalised trigger curves to produce the trigger zones shown above and in appendix B.

We carried out a review to determine what levels we should use for the dead/ emergency storage in our (strategic) raw water reservoirs. The results of this review can be found in our WRMP19.

2.2.2.1 Triggers in water resource zones that do not have reservoir triggers

In the 11 WRZs that have no reservoir triggers we use a different approach (we do not include our Chester WRZ here – see section 2.2.2.3).

We have developed some high level 'triggers' for the Forest and Stroud WRZ and for the other 10 WRZs that do not have reservoir triggers. We have included these in Figure 8.

Figure 8 Illustrative triggers for WRZs without reservoir triggers performance

The 10 WRZs not yet mentioned are as follows:

- Bishops Castle
- Kinsall
- Mardy
- Newark

- Rutland
- Ruyton
- Stafford
- Shelton
- Whitchurch and Wem
- Wolverhampton

These 10 WRZs predominantly receive their supply from either groundwater, bulk imports, river abstractions or a combination of these sources. The only difference between these WRZs and the Forest and Stroud WRZ is that we do not expect to need a drought order to increase supply in any of these WRZs. Our approach to making drought management decisions at specified triggers in these 10 WRZs is shown in Figure 9.

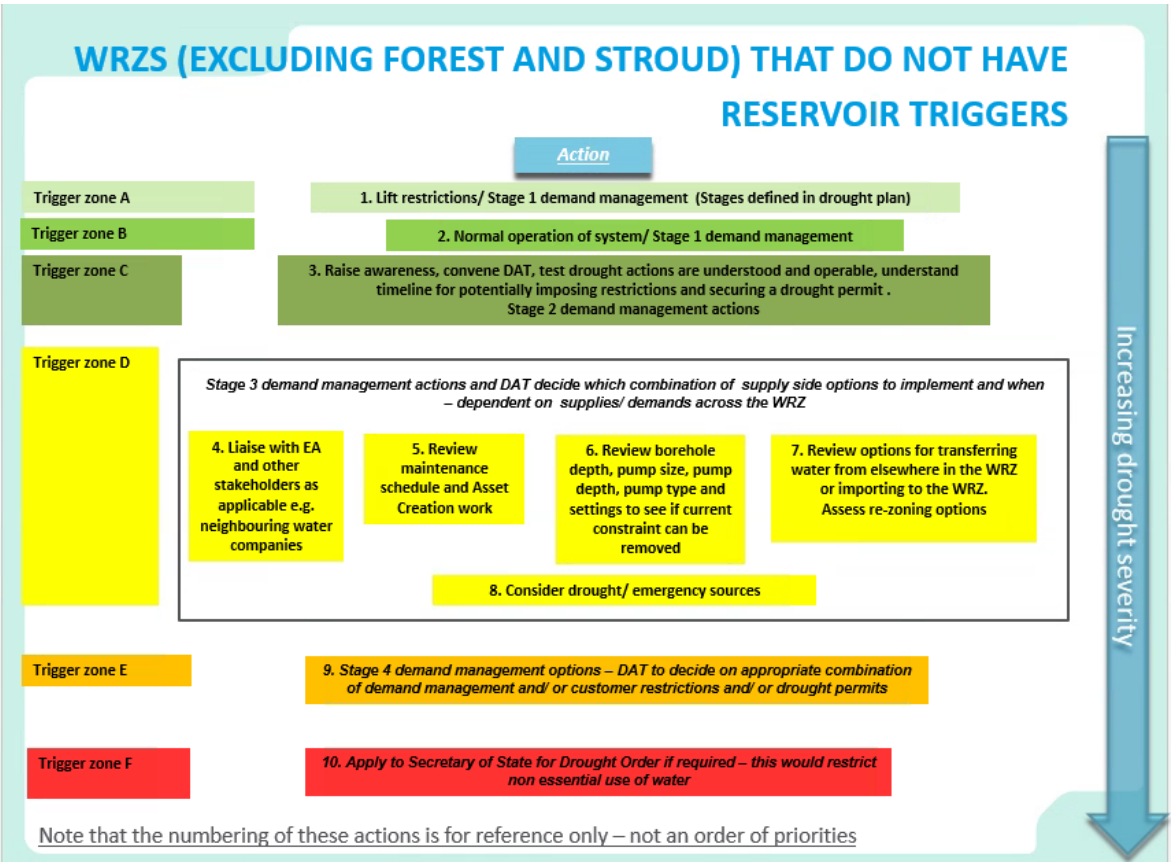


Figure 9 Decision flow chart showing drought management actions for our other water resource zones

We have included more detail for these drought management actions in the completed tables in appendix B.

2.2.2.2 Forest and Stroud zone

This zone does not rely directly on reservoir storage and it receives raw water from our River Wye abstraction at Wyelands and from groundwater sources. Although we usually refer to this river abstraction as Wyelands some documents refer to it as the Lydbrook abstraction. Both names refer to the same abstraction. During wet or average conditions we abstract up to 55 Ml/d at this site but our maximum abstraction becomes restricted if storage in the Elan Valley reservoirs is low and the 'hands off flow' conditions in our licence are triggered by low flows at Redbrook gauging station.

Table 5 illustrates the licence conditions that govern this abstraction. The revised licence conditions applied from 1st April 2018 onwards and are being used in our WRMP24 modelling. We will update our Environmental Assessment Report with the new licence conditions when we next update it.

Table 5 Rules governing our River Wye abstraction

Redbrook GS flow (Ml/d)	Elan storage	Regulation release for Lydbrook (Ml/d)	Maximum Lydbrook abstraction (Ml/d)	Max transfer to Ross	Max transfer to STW
> 1,400	Independent of storage	Not required	55.0	9.1	45.9
1,209 – 1,400			45.5	9.1	36.4
< 1,209	Above Abs control Line	27.3	45.5	9.1	36.4
	Below Abs Control Line		39.8	9.1	30.7

The combined outputs of the groundwater sources in this WRZ are not sufficient to meet demand. If we forecast that there is a high drought risk to the groundwater sources in our Forest and Stroud WRZ, it becomes more important that our Wyelands abstraction is not limited.

This river abstraction is limited when river flows at the Redbrook gauging station are low. Our abstraction licence at Wyelands is also linked to the storage in the Elan Valley reservoirs. However, any decision our drought action team (DAT) makes for this WRZ will be triggered primarily by the river and groundwater levels. The storage in the Elan Valley reservoirs is only a secondary trigger.

The decision flow chart in Figure 10 shows our approach to making drought management decisions and the drought triggers that we use in our Forest and Stroud WRZ.

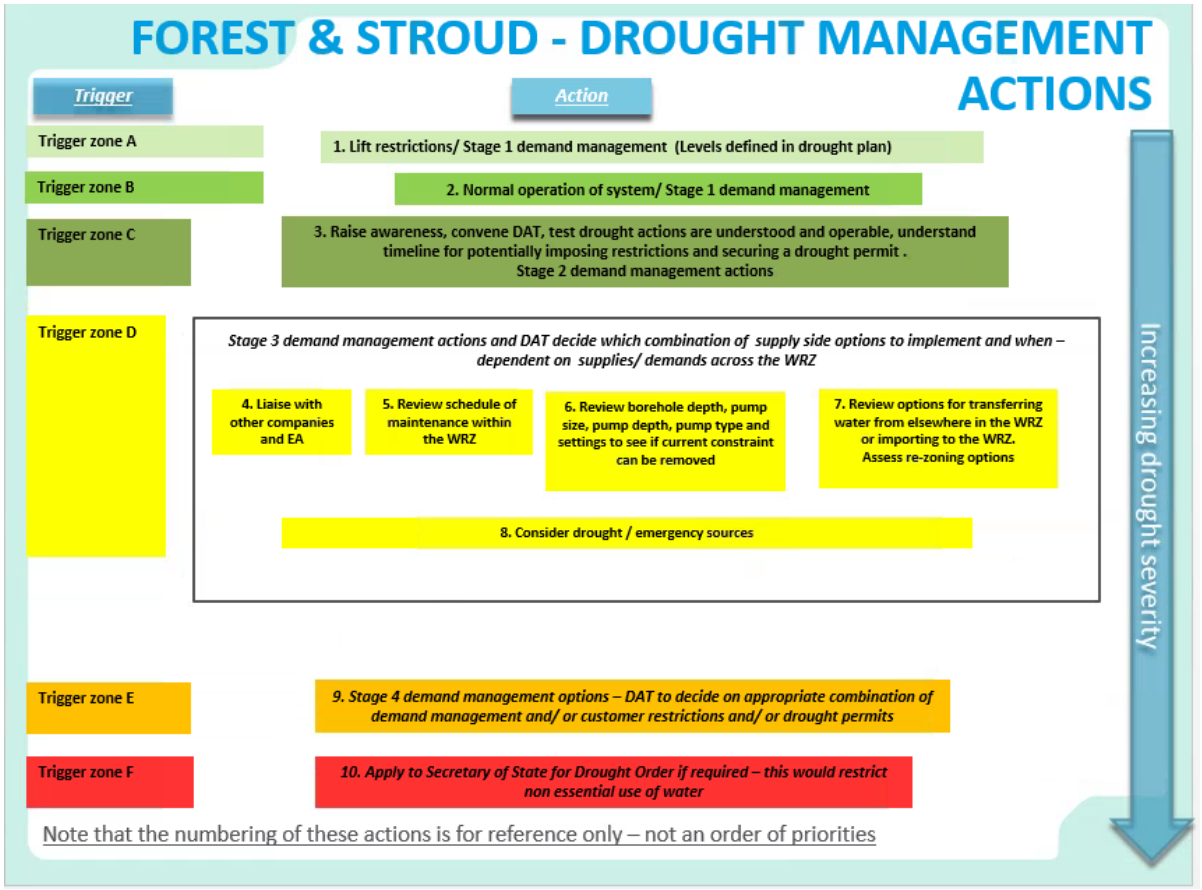


Figure 10 Decision flowchart showing drought management actions for the Forest and Stroud water resource zone

These drought management options include the Wyelands level 3 drought order, which we have described in more detail in section 3.3.4.7 of this plan. We have included more detail for these and all of our drought management actions in the completed tables in appendix B.

2.2.2.3 Chester WRZ triggers

As detailed in section 2.1.1, Chester WRZ has been incorporated into the wider Severn Trent area since the previous publication of our previousdrought plan. The drought triggers for the Chester WRZ are dictated by the Dee General Directions (DGD) which govern the Dee Storage system. The DGD specify the principles and detail under which the prescribed flows and abstractions must be reduced in a drought. As stocks decrease, trigger points are crossed which prompt drought management actions to be taken. The triggers we would follow and drought management actions that we would take in the Chester WRZ as governed by the DGD are detailed in Appendix B.

2.2.3 Groundwater triggers

Although, we track groundwater levels and consider them to be useful drought indicators, we do not currently have formal groundwater triggers in the way we do for reservoirs. Although, as shown in Figure 8 we have high level equivalents that serve a similar purpose. This is because individual groundwater sources have a very localised impact that are not entirely appropriate to use as strategic triggers. The way that groundwater sources

respond to droughts is very different to the way that surface water sources respond. So although we still account for drought risk in these sources, we currently manage the risk in a slightly different way.

The mechanism that we use to manage groundwater drought risk involves a combination of monitoring, and decision making. We consider the present and forecast conditions and how effective any action would be. The decision flow chart in section 2.2.2 illustrates this process. We would not expect a single low level to trigger significant drought management actions. Groundwater sources have a determined minimum reliable output and in most cases drought actions are dictated by an increase in local demand beyond this level or the deteriorating performance of other assets/storage. The process for monitoring groundwater and making decisions applies to all of our groundwater sources, including those in our 'groundwater-only' water resource zones.

We use a combination of telemetry and manual dips to monitor our groundwater sources. We also use external sources of information on groundwater levels to monitor approaching drought conditions. For example, we use information from CEH or the EA that show the groundwater picture for the Midlands region. We use data from regionally representative observation boreholes, such as Heathlanes, to support our drought indicator monitoring. When levels in observation boreholes start to cross into "below normal" conditions (as detailed in the Water Situation Report), we inform our Drought Action Team (DAT).

We have some flexibility in how we operate groundwater sources. Most of our pumps are 'fixed speed' which means that the instantaneous flow is constant but we can vary the number of hours in a day that we operate them for. If demand increases in a dry year or a drought year we would expect to run these pumps for longer to maintain levels in our service reservoirs. We also have some flexibility within WRZs or within individual groundwater sources there may be multiple boreholes from which we can pump water. We switch between these to meet demand and react to outages and other operational factors such as cost.

As a general rule our sandstone sources are more drought resilient than our limestone sources. For context, we abstract much more from sandstone than we do from limestone. When the drought risk is heightened, we present groundwater level information to our DAT on a map to show where the risks to supply from our groundwater sources are greatest. When our groundwater team notices any drought problems relating to our groundwater levels they raise these concerns at our DAT.

As part of our PR19 work we validated and updated all of our groundwater DOs and source performance diagrams (SPDs). The details of this can be found in J.

We are committed to furthering our knowledge with how our level sensitive groundwater sources are impacted in drought years, particularly in light of the uncertainty surrounding future climate change effects. For our groundwater / river zones such as Forest and Stroud zone and Wolverhampton we acknowledge that additional individual triggers are worth investigating and we are currently exploring options to conduct a pilot study to understand whether drought triggers on some of our level sensitive/spring sources would be appropriate.

The options that could be used to develop a system for monitoring groundwater levels to quantify triggers that could be used to inform drought management actions are based on a combination of the following factors:

- Demand on the groundwater source
- River flow
- Rainfall levels

The results of this pilot study should help our understanding of whether drought triggers are appropriate for certain sources and how we can develop these in conjunction with the EA.

2.3 Forecasting

As part of our business as usual (BAU) activity we produce forecasts of how we expect water resources to change in the month ahead. For example we do this for key reservoir sources such as the Derwent Valley reservoir group. We circulate these water availability information packs monthly and we share the raw water availability section of this with the EA. When we produce these information packs we use all of the latest hydrological and operational information we have as well as weather forecasts from sources such as the Met Office. In addition, we refer to the latest hydrological outlook (see reference to website in references section).

2.4 Links to actions/measures with timing information

We have described the actions we consider when resources fall into certain drought trigger zones in section 2.2 and section 3. We have included all of the reservoir drought trigger zones and the associated drought management actions in appendix B.

We do specify when we would take each drought management action in section 3.4.2 and appendix B. However, in order to retain flexibility, we allow our Drought Action Team to choose which action or combination of actions is most suitable when resources are in a specific drought zone. For the majority of drought actions we do not specify exactly how long they would take to implement as this may vary depending on factors like customer demands, outages and water availability in different locations. However, there are some drought management actions such as drought permits/ orders and customer restrictions where we have given estimates of lead in times and/ or implementation timings. Refer to sections 3.1 and 3.3 for this information.

2.5 Testing our drought triggers

Modelling various drought events including those on the observed record and synthetic droughts provides us with a number of scenarios to test our drought triggers and proposed actions (as described in section 2.1). The following three sub-sections present plots of modelled reservoir storage data with our drought trigger zones for reservoirs across our Strategic Grid and North Staffs WRZs using three different drought scenarios. Each drought event has unique characteristics which allow us to evaluate how our drought triggers and proposed actions perform under different scenarios. For this analysis we have selected an event from our baseline modelling period (1995/96), a historic drought (1887/88) and a stochastically generated 1 in 200-year 30 month drought.

2.5.1 Baseline Data

Figure 11 below presents the modelled storage of the Elan Valley, Derwent Valley, Carsington/Ogston and Tittesworth Reservoirs during the 1995/96 drought. These plots highlight the variation of drought impacts on our reservoirs with notable impacts on storage on the Elan Valley Reservoirs, Derwent Reservoirs and Tittesworth Reservoir. Storage in the Elan Valley Reservoirs enters drought trigger E for 15 days in December 1995. Proposed drought actions under trigger zone E include the implementation of a TUB (level 2 restriction) if reservoir storage enters trigger zone E for at least 7 days however, we limit the introduction of TUBs to the start of April to the end of October. In this scenario we would not impose a TUB on customers but would carry out other “stage 3” demand management actions as well as maintain our supply-side drought options which are associated with our drought trigger zone D (see section 3 for more detail).

Modelled storage in Tittesworth Reservoir drops throughout 1995 reaching a minimum storage of 39% (drought trigger E) in October 1995. Despite some storage recovery during the autumn/winter of 1995/96 drought trigger zone F is crossed in December 1995. At this stage drought measures in the North Staffordshire WRZ include applying for a drought order to introduce a non-essential use ban (NEUB – level 3 restriction) if appropriate. In

this scenario it is likely that we would not impose a NEUB due to the time of year that trigger F is crossed but we would continue to monitor the situation very closely and be prepared to submit a drought order application to the Secretary of State.

In the Derwent Valley Reservoirs modelled storage reaches a minimum of 31% and moves into drought trigger zone F from December 1995 to February 1996. Drought management actions under trigger zone F are the same as the detail above for Tittesworth. Note that the black lines (which represent modelled storages in the figure below) reflect the impact of the drought actions we have mentioned in this plan with the exception of the drought permits and the drought/ emergency sources.

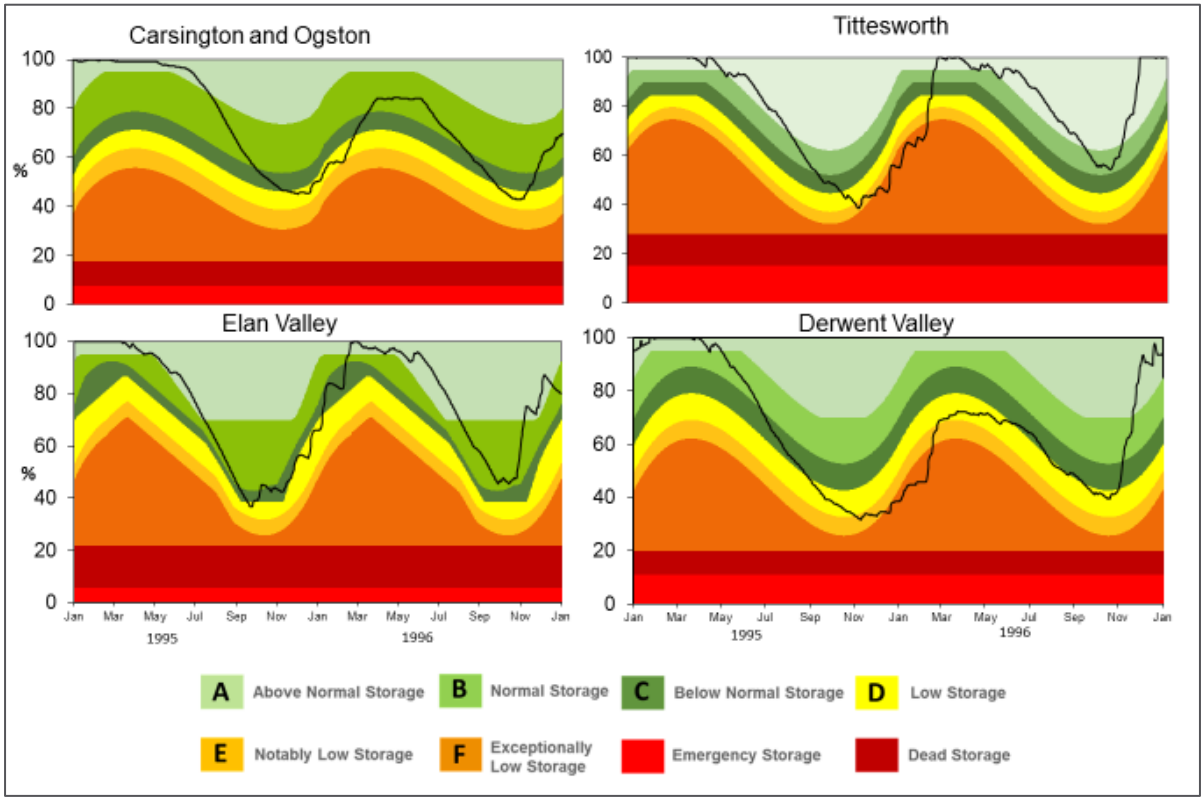


Figure 11 Modelled reservoir storage and drought triggers for the 1995/96 drought

2.5.2 Historic Drought

Figure 12 shows the modelled reservoir storage for four reservoirs during the 1887/89 drought. This scenario was selected because innovative research in collaboration with the University of Liverpool highlighted the severity of this drought event in the north of our region (see section 2.1 for more information). This is reflected in the modelled reservoir storage of both the Derwent Valley and Tittesworth Reservoirs. During this event Tittesworth reservoir modelled storage reaches drought trigger F in January 1888. As outlined in section 2.5.1 our drought actions under trigger F include the option to impose level 3 restriction NEUBs if appropriate. Again in this scenario it is likely that we do not impose a NEUB due to the timing of the reservoir storage entering trigger zone F but would have an application ready to submit in order to impose a NEUB if storage level throughout January continued to decrease.

In the Derwent Valley Reservoirs modelled storage remains in drought trigger zone B for much of 1887 and entering zone C for only a short period during that year. In this scenario there are no notable drought impacts on the storage levels in the Elan Valley and Carsington/ Ogston Reservoirs. This highlights how the spatial variation of droughts in our region can have different impacts on our supply system.

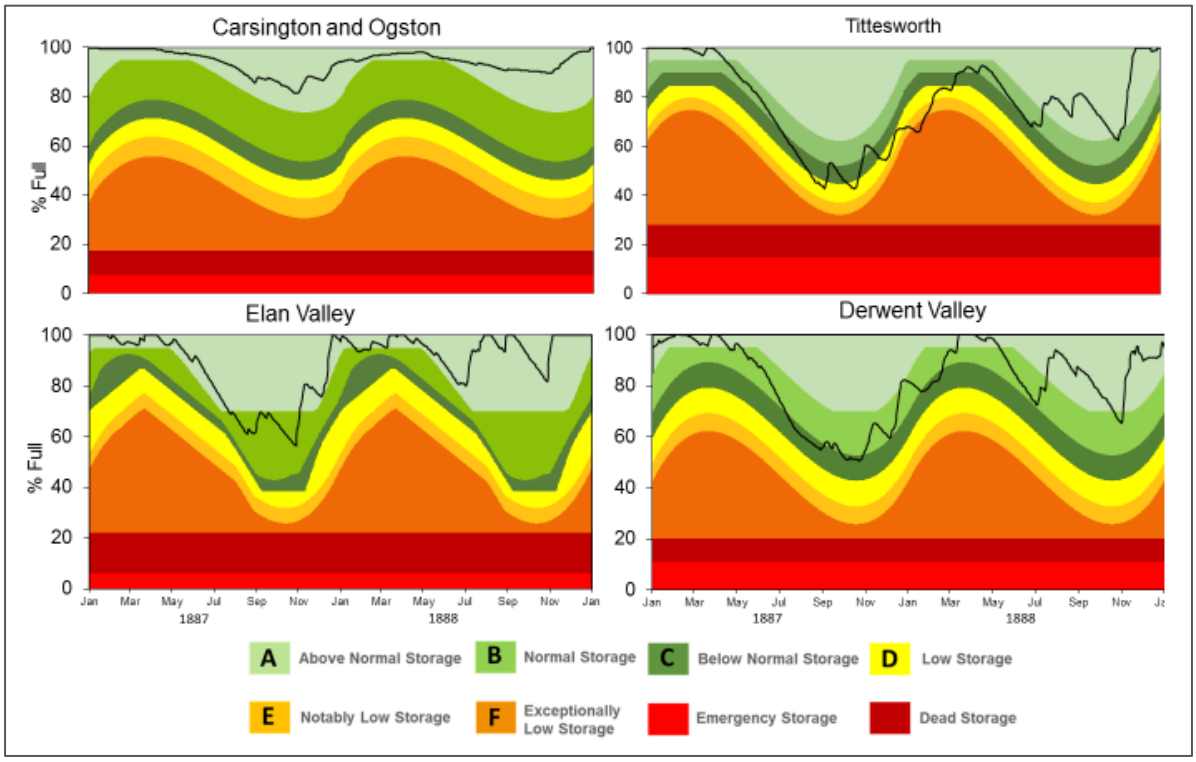


Figure 12 Modelled reservoir storage and drought triggers for the 1887/89 drought

2.5.3 Stochastic Drought

Figure 13 shows the modelled reservoir storage during a stochastically generated 1 in 200-year return period 30-month drought (see Appendix D for more information). In the Elan Valley Reservoirs modelled storage falls rapidly crossing into drought trigger zone D in July 1961. It does not reach drought trigger zone E. There are a variety of drought management actions associated with drought trigger zone D including a review of scheduled works maintenance and changing operations at site G and the Reservoirs at site U to support storage in the Elan Valley reservoir system (more information can be found in Appendix B). From August 1961 modelled storage in the Elan Valley Reservoirs moves into trigger zone B and remains there for most of the year.

In the Derwent Valley Reservoirs modelled storage falls throughout 1961 crossing into drought trigger zone C in July 1961. Storage remains in trigger zone C until the end of the year. Possible drought management actions associated with trigger zone C include a number of options to maintain reservoir storage and reduce treatment works output. Tittesworth Reservoir modelled storage also crosses and remains in drought trigger zone D for a substantial period from September 1961. In the North Staffordshire WRZ trigger zone D drought management actions include reducing output from Site L and reviewing water import options. Tittesworth Reservoir storage enters drought trigger zone E for a limited number of days in November 1961. This falls within the criteria for implementing a level 2 restriction TUB under the management action associated with drought trigger E. However, as this occurs outside of TUB implementation period (the start of April to the end of October) under this scenario we are unlikely to introduce a TUB but would implement other drought management actions linked to drought trigger D and discuss further actions that could be taken to minimise further reductions in reservoir storage.

Modelled reservoir storage in Carsington/ Ogston reaches its lowest level (50%) of the three scenarios presented in section 2.5. Modelled storage remains in drought trigger C for only a couple of weeks towards the end of the year. Under drought trigger C drought management actions include stage 2 demand management, the convening of DAT and a review of drought management actions.

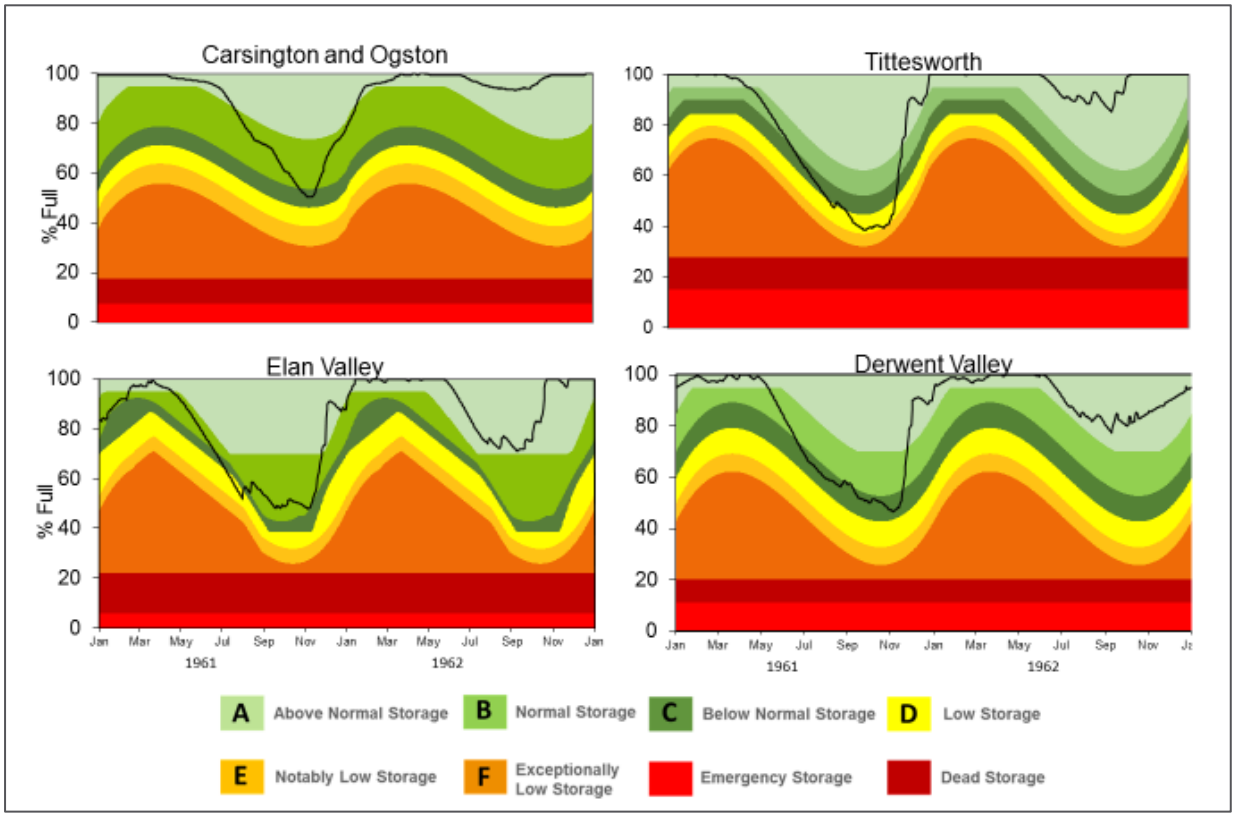


Figure 13 Modelled reservoir storage and drought triggers for a stochastic 1 in 200-year drought

Section 3 Drought actions

There are several actions we can take to manage the effects of a drought. We broadly split these into two groups: demand-side and supply-side. The supply-side actions increase the amount of water we have available during a drought. The demand-side actions are ones that reduce the demand from our customers for water during a drought. We would implement our demand saving actions first and prioritise the use of those supply actions where we have high confidence they are the least damaging options to the environment.

3.1 Demand-side actions

Our drought management action flow charts show how we would expect to phase in the different demand management options available to us. In addition, section 5 of this plan shows how decreasing reservoir storage triggers an escalation from 'Stage 1 demand management' to 'Stage 4 demand management'. Section 5 also provides detail on how we would increase our focus on demand management progressively in line with our communications strategy.

We consider that demand-side actions can be applied anywhere in our supply region. However, we will select the appropriate combination of options and target them depending on the extent to which different parts of our region are affected by drought. The following list shows some of the options available to us:

- Raise awareness within the company, convene DAT and alert works managers
- Liaise with the Environment Agency (EA) and other stakeholders about emerging drought and flexibility of available options
- Closely monitor demand, flows and abstraction/ releases
- Increase leakage detection
- Increase water conservation campaign (e.g. extra distribution of water saving devices, water audits for non-household customers).
- High profile promotion of meter option
- Media appeals for customer restraint

And, in the most severe drought conditions:

- Temporary water use bans (Level 2 restrictions), which are discussed in section 3.1.5 and, ultimately
- Restrictions on non-essential use through a drought order (Level 3 restrictions).

We consider that pressure optimisation and working with our customers to encourage the efficient use of water are routine activities that we carry out as part of our normal operation. This equates to 'Stage 1' demand management as defined in section 5. The water conservation campaign mentioned above is over and above our 'normal' water efficiency work. We provide details of our water efficiency and leakage activities in the following sections.

3.1.1 Promoting Water Efficiency

We promote water efficiency in various ways from offering free and subsidised products, top tips and information leaflets, home audits and working with schools though our education team. Information on these are available from our website: https://www.stwater.co.uk/wonderful-on-tap/save-water/love-your-water/.

We run proactive and extensive campaigns promoting water efficiency focussing on areas where we can achieve the most benefit for customers. This includes toilet flushing, gardening and, in 2018-19, frost protection. We also focus on education and had the aim to engage 700,000 customers between 2015 and 2020 to advise them on how they can reduce their water consumption and how to avoid blocking pipes. We use multiple

communication channels including literature, advertising, our website, face to face contact, telephone contact and social media. Our campaigns are a key component of the company's communications which aim to reduce long term demand by our customers. We will continue our extensive promotion of water efficiency.

3.1.1.1 AMP6

For AMP6 we set an ambitious target to deliver 25 Ml/d worth of water efficiency savings during the AMP which included 7Ml/d with our non-household customers. However, due to the introduction of retail competition for non-household customers in England we transferred activity from our non-household programme to the household programme. We are not currently delivering any non-household customer water efficiency activities within the Severn Trent region, as these activities sit with water retailers. In preparing our 2019 WRMP and PR19 business plan, we consulted with all retailers to gain an understanding of their water efficiency plans and assess the potential for future activity. We have also undertaken research to assess retailer appetite for partnership working on water efficiency activity. In line with the market code, we will liaise with retailers on drought issues to ensure their customers are informed.

We achieved 25.7 Ml/d of savings during AMP6 solely with our household customers (Figure 14).

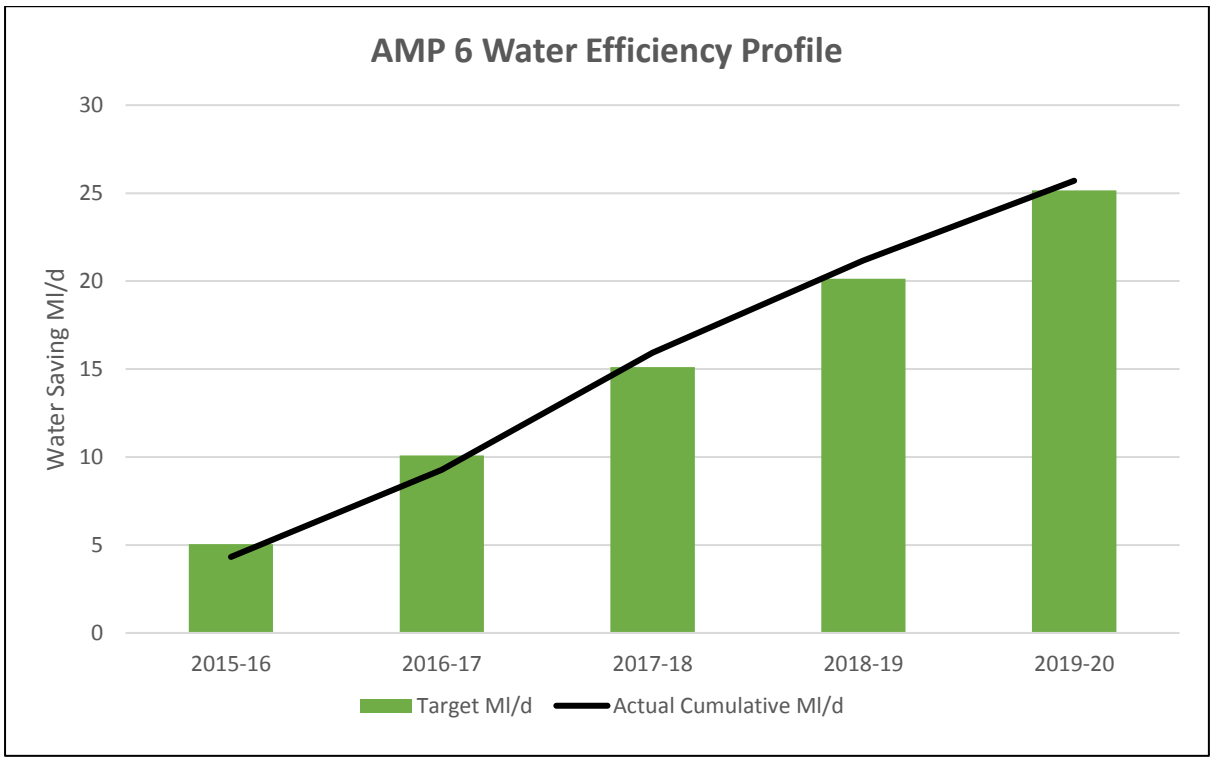


Figure 14 AMP6 water efficiency profile

Our activities included:

- Providing free water saving products to our customers.
- Subsidising higher value products to our customers (e.g. water butts and shower heads).
- Working with social housing providers to reduce water consumption in social housing properties by providing free water saving products to these organisations and water efficiency home water efficiency audits. In 2018-19 we trialled home water efficiency audits with social housing companies completing 5,000 audits. We will continue to offer these audits.

- Introducing a free home water efficiency audits which includes the free installation of free water saving products to our household customers which we intend to roll out across the company in future years. We have already completed audits in Rugby and Coventry and are currently offering these in Nottingham.
- Providing information to our customers on how to use less water. This includes a comprehensive self-audit calculator which offers tips on how to reduce consumption and recommends free water saving products to our customers. We are currently updating our calculator.
- Providing an educational programme to schools and adult groups which aims to deliver long-term behaviour change and a change in water using habits.
- We also continue to contribute to improving the evidence base by measuring the savings delivered by our home install programme.
- Incentivising developers to build properties to high water efficiency standards (the optional 110 l/p/d (litres per person per day) standard in part G of the building regulations) by offering refunds on infrastructure charges where developers build to the required standard. https://www.stwater.co.uk/building-and-developing/regulations-and-forms/application-forms-and-guidance/infrastructure-charges/

3.1.1.2 Trials & Campaigns

In 2017, we ran a specific media campaign to understand whether additional promotion can drive more customer interest in water saving and increase uptake and installation of water saving products. The success of this activity was used to update future communications strategies including 2018 and 2019 campaigns to further promote water efficiency and engage with our customers.

Our 2017 water efficiency campaign, shortlisted for a Utility Week Award, was our first targeted campaign based on analysis of billing information, behaviours and the demographics of our customer base. This included ACORN socio-economic profiling, third-party data on ordering behaviour from 'Save Water Save Money', and our own customer research to understand the messages that would resonate with customers. Nearly 2,000 customers (from a base of 264,000) ordered water efficiency products as a consequence – a take-up above industry norms.

In 2017 we worked with a social housing provider and a 3rd party on a trial of 1,000 social housing properties carrying out water efficiency audits and installing water savings products free of charge to the tenants. Partnering with the social housing organisation achieved a higher uptake than our standard household audit programme. We have now scaled up this programme. We aim to complete 5,000 audits each year in AMP7.

We have also continued our successful water efficiency audit and install programme – free of charge to customers – having completed over 30,000 audits to date.

In July 2018 we launched our second and biggest campaign of the year focused on water efficiency. The campaign was aimed at getting customers to re-appraise the value of water and the part it plays in their lives. We used a multi-channel approach that included TV, outdoor advertising, social media, digital and local radio weather sponsorship. The campaign created engagement with Severn Trent and the campaign message of 'use water wisely', and delivered water saving tips and access to free and discounted products.

3.1.1.3 AMP7 and Beyond

We are continuing with annual water efficiency campaigns to promote water efficiency to our customers as well as to continue the engagement with customers to value their water.

As part of our PR19 business plan submission, we reviewed the savings we assume from water efficiency activities and have improved their accuracy and, where possible, used measured savings. This review has led to a fall in savings assumed. On a like for like basis we intend to maintain a similar level of water efficiency activity in future in most areas of our water efficiency activity. However, we will increase the number of home water

efficiency audits we deliver each year in AMP7 and in time we will offer an audit to all of our customers. Please note that because of the Covid-19 pandemic our home water efficiency audits were put on hold.

Alongside the planned AMP7 activities we will continue to work with our innovation team to find new ways to help customer reduce their water use and deliver on our water efficiency targets and achieve our overall ambition to reduce per capita consumption (PCC).

We will also continue to actively promote customers to register as Priority Services Customers when distributing water efficiency communications. We also have ambitions to provide water efficiency audits to potentially vulnerable customers in social housing and offer free internal repairs on leaks. These ambitions are dependent on council and customer agreement.

In AMP7 we are continuing with our AMP6 activities (see section 3.1.1.1) but are increasing the number of home audits with the ambition of completing 35,000 audits per year (with the exception due to Covid-19) during AMP7 to deliver 1.05 Ml/d of demand reduction from this programme. To help achieve this demand reduction, which is shown in Figure 15 and make our programme more effective we will use our smart metering programme to pro-actively target customers with apparent high consumption and with a greater focus on identifying plumbing losses – in particular leaking toilets.

As detailed in our WRMP19, we also have a very ambitious metering plan. This is supported by our water efficiency programme that will deliver enablers to help consumers make a choice to use less water. We are also working closely with the wider industry, stakeholders and government on options to help drive down PCC including water labelling and improved buildings and fittings regulations. It is now recognised that driving down PCC is largely not within the control of water companies, and a multi stakeholder approach is required. We are actively working with the EA nationally on this challenge.

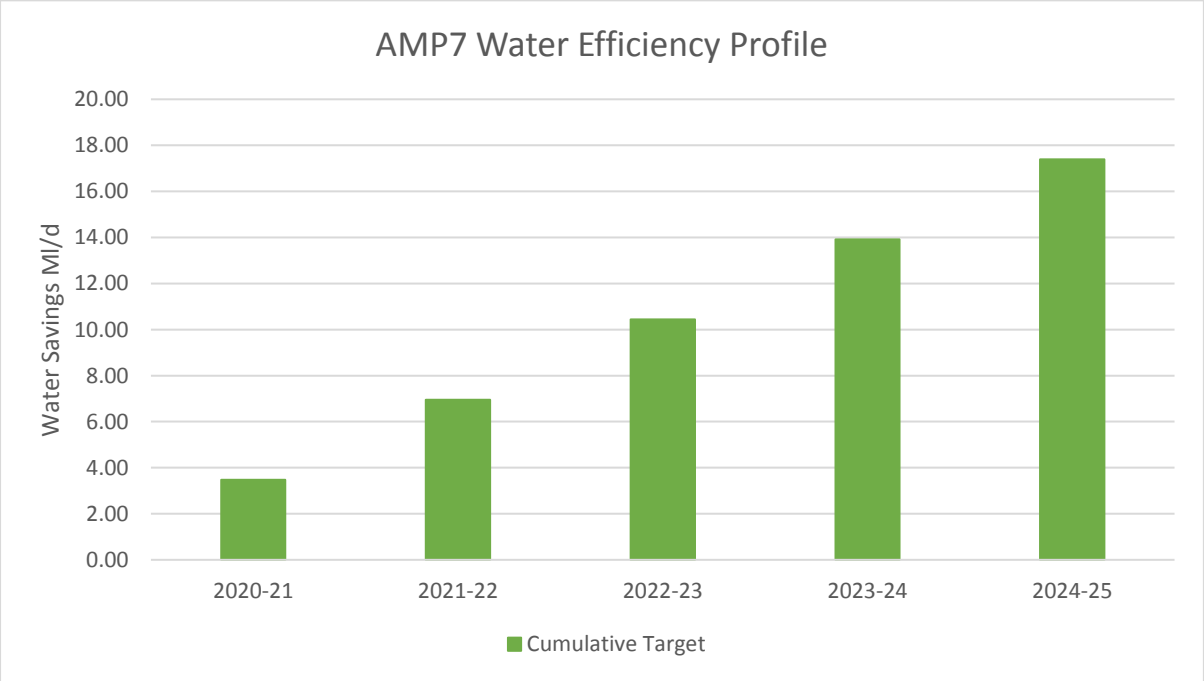


Figure 15 AMP7 water efficiency profile

3.1.2 Reducing Leakage on our network

Leakage currently makes up around 23% of the total water we put into supply. We have a strong track record of reducing leakage, and over the past 10 years this has helped us to meet the water needs of a growing population without having to increase the amount of water we abstract and put into supply.

3.1.2.1 AMP6 Performance

We outperformed the Severn Trent commitment on reducing leakage and delivered a 10% leakage reduction over AMP6. Figure 16 shows the record of total leakage in our region since 2003. The graph indicates that the overall trend is one of falling leakage.

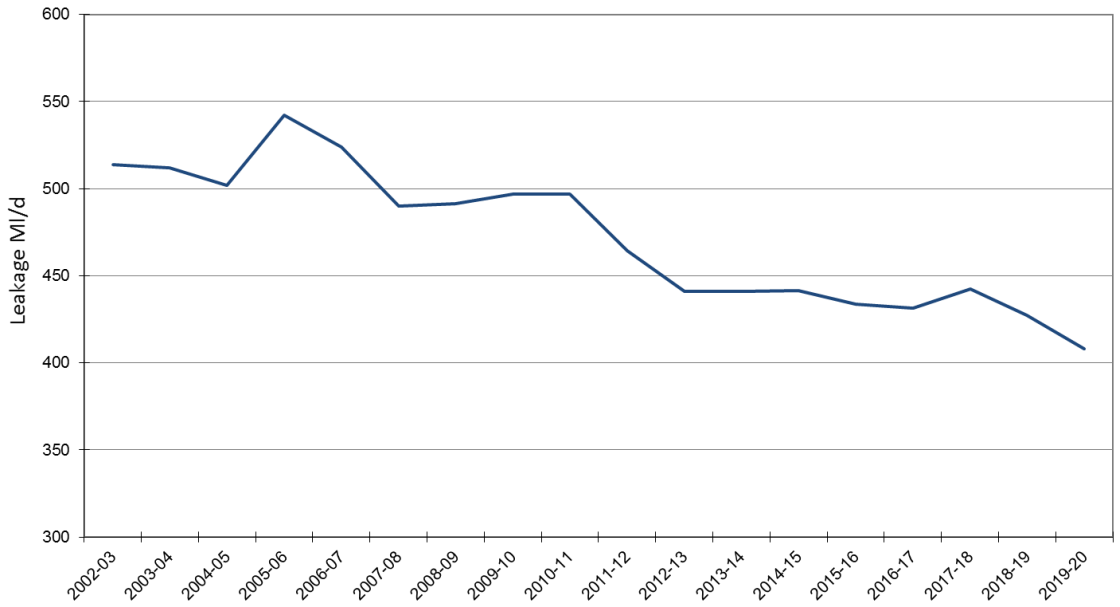


Figure 16 Company total leakage since 2003

3.1.2.2 Long Term leakage Targets

Our AMP7 leakage target is to reduce leakage by 62 Ml/d (15%) over five years between 2020 and 2025. This is also in line with our regulator expectations. The 15% target is the economic level of leakage reduction needed for AMP7 and contributes to our wider package of demand management and supply improvement investment proposals that we derived using our supply / demand investment modelling.

Every five years we update our long term economic level of leakage assessment as part of the WRMP process. Our traditional approach to setting leakage reduction targets in previous WRMPs has been led by an economic appraisal of the costs and benefits of reducing leakage in the context of the overall supply / demand needs. In zones where there is a forecast supply / demand deficit, then we have considered leakage reduction as part of the least-cost package of measures to resolve that deficit, along with water resources and other demand management measures.

We have changed our approach and targets in direct response to the outcomes of the draft WRMP consultation process, where customers and stakeholders challenged our long term leakage ambition and pressed us to continue with significant multi-AMP leakage reduction strategies. Separately, the National Infrastructure Commission (NIC) has set out a challenge that the industry should reduce leakage by 50% over the next 25 years.

Figure 17 sets top down AMP7, AMP8, AMP9, AMP10 and AMP11 reduction targets based on achieving the 50% leakage reduction challenge set by NIC that we have committed to.

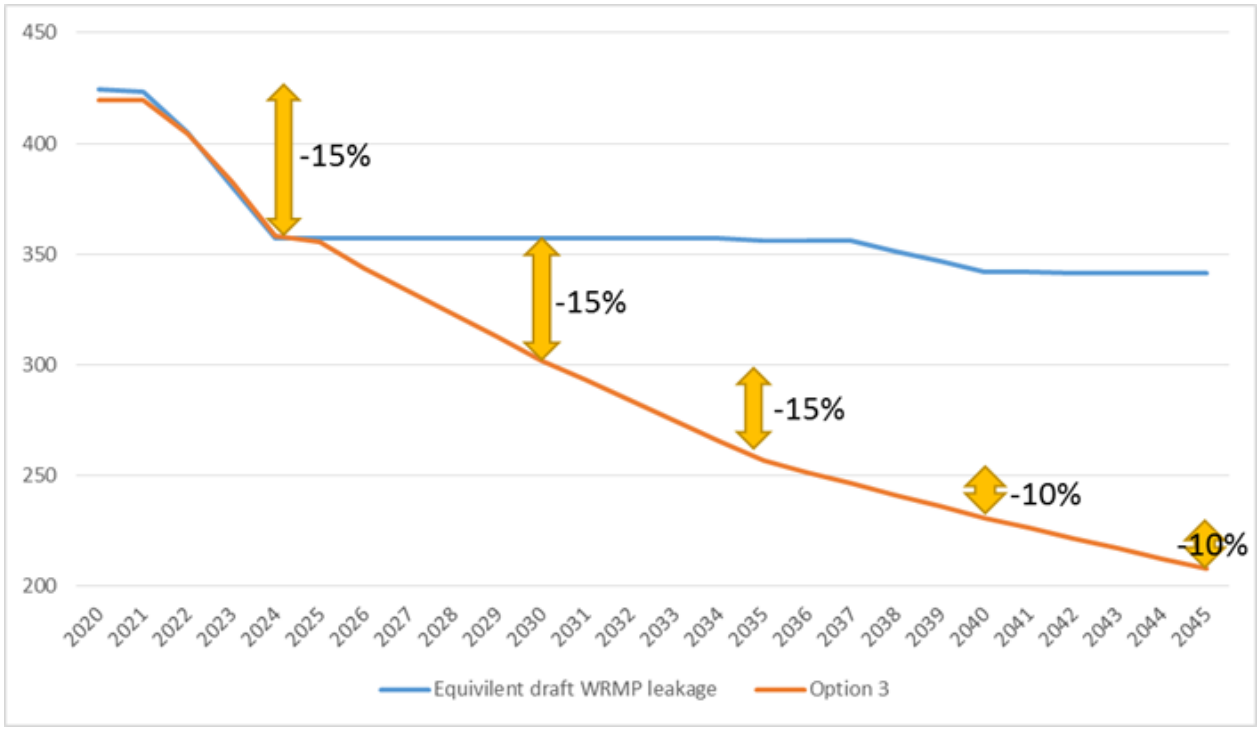


Figure 17 NIC long term leakage targets

3.1.2.3 Distribution Input

Distribution input is the amount of water we put into supply and we use this as a measure of the company wide demand for water. Figure 18 shows an overall decline in distribution input across our region since 1989. Increasing household demand has been more than offset by our water efficiency activities, our leakage reduction programme and declining demand from commercial customers. The decline in use by commercial customers is caused by a decline in the prominence of heavy industry.

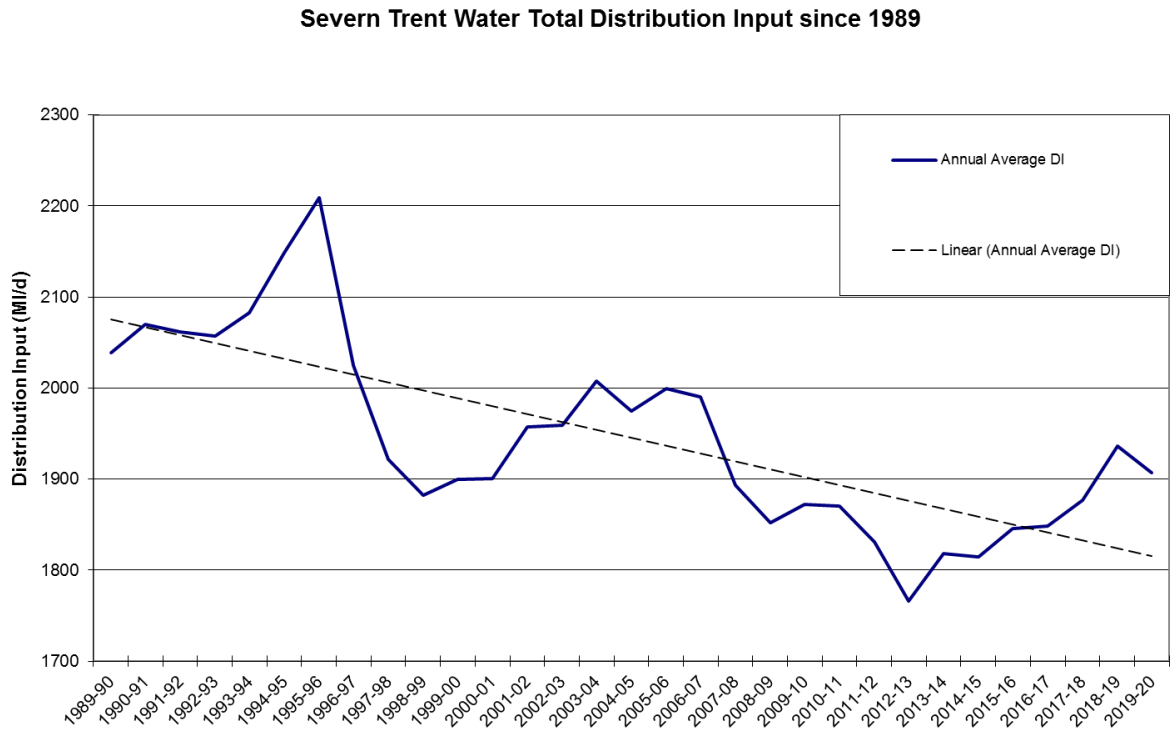


Figure 18 Severn Trent Water distribution input from 1989 to 2020

If our drought indicators are in trigger zone C we will place an extra emphasis on leakage. We refer to this again in the escalation of messages table in section 5.1.2. It is difficult to generalise about exactly how much further we could reduce leakage in a drought as it will depend on the severity or extent of the drought and our leakage performance as we enter the drought period. However, we will divert our staff from other tasks onto leakage work and we can also hire in external contractors if necessary.

3.1.3 Effects on Fire Service

There are a small number of actions we take that could affect fire hydrants. The most obvious of these is when we lower pressure during a drought to reduce leakage. In this reduced pressure scenario we will mitigate the potential problems for the fire service in the following ways:

- As happens during non-drought periods we will communicate with the fire service during incidents - this is usually via our 24hr call centre.
- If appropriate, we advise them of alternative locations to take a supply from that have higher pressure/ flow. For example, we may suggest that they connect to a larger main or bypass anything (PRV) that is creating a head loss.
- In addition, if needed, we will send a Severn Trent technician to the area to assist.
- In the future we intend to be more proactive so we will inform the fire service which areas we will lower pressure in before we do it.

3.1.4 Bulk imports and exports

We have common boundaries with seven other water companies and bulk supply agreements with six of these companies. Table 6 summarises the strategic bulk supply agreements that we hold with neighbouring water companies. We use a threshold of 1 Ml/d to determine whether an import or export classes as strategic, meaning that we do not consider transfers of less than this magnitude as being strategic. There are 3 new transfers since our last Drought Plan, due to change in company boundaries and inclusion of Hafren Drfrdwy.

Table 6 Bulk supplies with neighbouring water companies

Neighbouring company	Location	Basic details of transfer	How would this supply operate in a drought?
Anglian Water	Import from East Midlands into our Strategic Grid and Rutland WRZs	We import up to 18 Ml/d of treated water from Anglian Water	There are no drought conditions in this agreement but, if entered a drought, we would engage with Anglian Water and, if we are able to, we may reduce our import.
Dŵr Cymru Welsh Water (DCWW)	Export from our Forest and Stroud WRZ	We provide DCWW with up to 9 Ml/d of treated water. This volume is supported by regulation releases from the Elan Valley.	This is not usually variable in a drought due to licence conditions. However, in a drought we would communicate with all other water companies to help with message consistency and to see if we can assist each other
Dŵr Cymru Welsh Water (DCWW)	Import from the Elan Valley reservoirs	DCWW provide partially treated water to our Strategic Grid WRZ.	This import reduces when storage in the Elan Valley reservoirs crosses specified storage triggers.
South Staffordshire Water	Import of treated River Severn water to the Wolverhampton WRZ	We import up to a peak daily rate of 48 Ml/d.	The River Severn is a regulated river and the shared South Staffordshire asset abstraction can be limited by specific low flows and licence conditions and the terms of operating agreements.
United Utilities	Import to our Shelton WRZ	We have an agreement that states we can receive a supply of treated water from UU in case of an emergency failure of our ability to supply customers in this area.	The primary aim of this import is to provide resilience to other sources in this WRZ for a relatively short period of time. It is unlikely this would be able to be utilised in a drought scenario.
Yorkshire Water Services	Export from our Derwent Valley reservoirs	We export up to 68 Ml/d of untreated water to Yorkshire Water Services from our Derwent Valley reservoirs.	The quantity that we export (and the amount we treat ourselves) reduces as reservoir storage reduces.
Hafren Dyfrdwy	Import from HD's Wrexham WRZ	We import from Hafren Dyfrdwy (Wrexham) to our Chester WRZ*	The Chester WRZ, which was formerly part of Dee Valley Water has been transferred to Severn Trent which we now receive an import from.
Hafren Dyfrdwy	Export from our Chester WRZ	We export from our Chester WRZ to Hafren Drfrdwy's Saltney WRZ*	The Chester WRZ, which was formerly part of Dee Valley Water has been transferred to Severn Trent which we now export from.
Hafren Dyfrdwy	Export from our Shelton WRZ	We export from our Shelton WRZ to Hafren Drfrdwy's Llanfyllin WRZ*	Part of the existing Shelton WRZ now lies within the HD Llanfyllin WRZ and therefore a new bulk export from the Shelton zone has been created.

**Volume of transfer will be confirmed once full metering is in place.*

Under drought conditions, there are some transfers that can be varied in accordance to the agreement and offer a degree of flexibility if required. Where these are possible, they are illustrated as drought management actions in appendix B.

There are also limitations to our imports and exports under normal and drought conditions. For example, we are aware that transferring raw water from catchment to catchment could cause the spread of invasive non-native species (INNS). Any changes to these transfers are also restricted by the maximum capacity of the infrastructure, and none of our transfers are bi-directional so are limited to one direction.

3.1.4.1 Severn Trent's Derwent Valley agreement with Yorkshire Water

In 1989 Severn Trent Water and Yorkshire Water entered into an agreement with regards to the quantity of raw water each company is entitled to take from the Derwent Valley.

The quantity of water that can be taken by Severn Trent Water and Yorkshire Water is set through operating guidelines. In 'normal' conditions, Severn Trent are entitled to 75.9% of the annual licensed quantity from the reservoirs for us; Yorkshire Water are entitled to 24.1% of the annual quantity licenced for abstraction and it resets to zero at the start of each calendar year. As part of the operating guidelines there are five control lines (or 'states') which dictate the quantity of water both Severn Trent Water and Yorkshire Water are entitled to abstract at different times of the year depending on the quantity of water stored within the Derwent Valley reservoirs. The quantity of water permitted for abstraction by each company, including in a drought situation, based on the 5 states is shown in Table 7. The agreement does also allow either party to increase abstraction in agreement with the other at times of high demand, or when other resources are temporarily unavailable. We utilised this part of the agreement in 2018 & 2020 during hot weather events.

Table 7 Abstraction entitlements in each Derwent Valley reservoir state

State	Severn Trent entitlement (Ml/d)	Yorkshire Water entitlement (Ml/d)
1	185	68
2	175	50
3	155	45
4	135	40
5	115	35

Yorkshire Water have agreed with Severn Trent Water that they will endeavour to reduce their minimum transfer to 15Ml/d in the lowest band (i.e. below State 5). When in a drought situation Severn Trent Water and Yorkshire Water will consult on short term bulk transfers. The availability of any such transfers will be dependent on Severn Trent Water's own water situation.

Figure 19 below shows how the 'States' change over the course of the year.

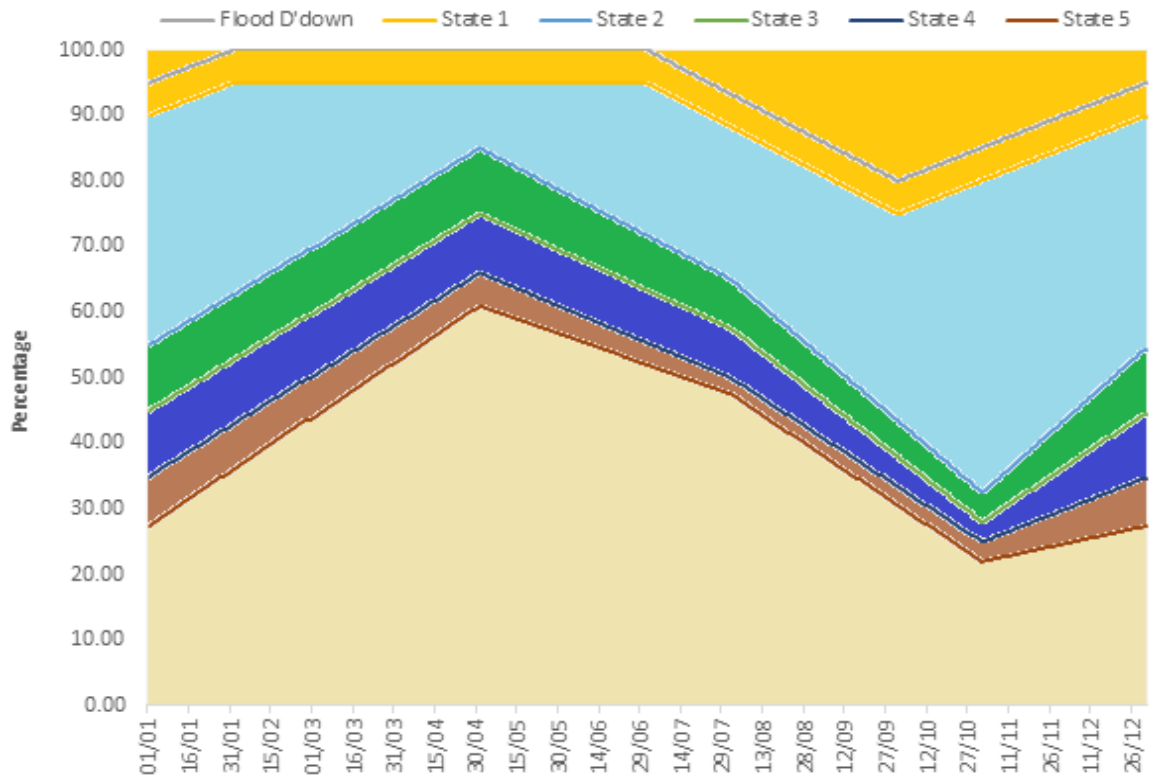


Figure 19 Derwent valley reservoir state curves

A minimum compensation flow of 54 Ml/d from Ladybower reservoir should be provided when the River Derwent flow at Derby is above 340 Ml/d.

If the reservoirs are in State 1 and the Yorkshire Water requirement is less than 68 Ml/d then up to 18 Ml/d can be added to the "Yorkshire Bank", provided that the bank does not hold more than 270 Ml.

When the reservoirs are in States 2 or 3 and there is sufficient water in the bank then Yorkshire Water can take up to 5 Ml/d on top of the entitlement, to be deducted from the bank.

3.1.5 Temporary water use restrictions

If extended drought conditions mean that reservoir storage or other drought indicators are in drought trigger zone E, we may need to temporarily restrict certain uses of water. Before making a decision to impose restrictions our DAT will review current resources and how the outlook is likely to change. For example, DAT will use the reservoir storage forecasts that we described in section 2.3.

Prior to the Water Use (Temporary Bans) Order 2010, water companies were only allowed to restrict the use of a hosepipe if it was to water a garden or wash a private car. Since 2010 water companies have had wider and more far reaching powers to restrict water use. It is worth clarifying that we refer to temporary use bans (TUBs) in this plan although we may use the phrase 'hosepipe ban' in other communications. We have changed our terminology to better reflect the current legislation. As well as being able to bring in level 2 restrictions e.g. TUBs if we need to we can also apply for a drought order to bring in a non-essential use ban (NEUB – level 3 restriction). For clarity, we define:

- A temporary use ban (TUB – level 2 restriction) as a way in which we can reduce customer demand for water during a drought by banning specified activities;
- A non-essential use ban (NEUB – level 3 restriction) as a more severe measure to reduce demand by banning even more specified activities, including commercial uses of water.

We would only consider imposing a level 2 temporary water use restriction between April and October because they would have little impact outside of that period. It is worth noting that, whilst level 3 restrictions such as drought orders/ NEUBs and drought permits require that we demonstrate exceptional shortage of rainfall, this is not true for TUBs. The legislation governing TUBs allows a water company to impose a TUB if "it is experiencing, or may experience, a shortage of water for distribution". A drought is one reason for such as shortage but it is not the only possible cause. We have listed the activities that we will restrict using a TUB or NEUB in the following sections of this plan.

3.1.5.1 Temporary use bans (TUBs)

Table 8 shows the 11 activities that the legislation now allows us to restrict under a temporary use ban (TUB – level 2 restriction). See Appendix E for the full detail regarding the statutory and discretionary exceptions relating to these activities.

Table 8 The activities we will restrict under a TUB and the exceptions we expect to make

Number	Activity restricted by TUBs
1	Watering a garden using a hosepipe
2	Cleaning a private motor-vehicle 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	leaning paths or patios using a hosepipe
11	Cleaning other artificial outdoor surfaces using a hosepipe

The exceptions listed in Appendix E are necessary for us to comply with legislative requirements (statutory exceptions), but others are at our discretion (discretionary exceptions). The discretionary exceptions that we have included in the table above includes all of the 'discretionary universal exceptions' and some of the 'suggested discretionary concessional exceptions' shown in table 3.2 of the 2013 UKWIR Code of practice and guidance on water use restrictions. What this means is that we have granted more exceptions than the minimum industry standard. We have done this to minimise the impacts of restrictions on specific groups such as customers on our 'vulnerable customers list'.

We contributed to the development of the 2013 UKWIR Code of practice and guidance on water use restrictions (CoP). The Water UK board signed off this CoP in July 2013. The 2013 CoP is an update to the 2009 version. The 2013 version includes learning from the drought which ended in 2012 during which seven companies in the South and East of England implemented restrictions. It is also consistent with the current legislation and regulatory policy. We support and follow the principles of the 2013 CoP which are to:

- Ensure a consistent and transparent approach
- Ensure that water use restrictions are proportionate

- Communicate clearly with customers and the wider public/ users
- Consider representations in a fair way

Following the 2013 Code of Practice also helps us to delay the economic impacts of restrictions on business customers for as long as we can. By following this CoP we will also 'phase' in restrictions on use in a way that is consistent with other companies in the UK.

In most drought scenarios we think that the clearest way to impose restrictions on customers is on a company wide basis. However, circumstances mean that if this is not in our customers' best interests, especially Priority Services Customers, we want to keep open the option of imposing restrictions at a WRZ level.

3.1.5.2 Non-essential use bans (NEUBs)

Table 9 shows the activities that the legislation now allows us to restrict under a Non-essential use ban (NEUB – level 3 restriction). See Appendix E for the details around the exceptions related to each activity.

Table 9 The activities we will restrict under a NEUB and the exceptions we expect to make

Number	Activity restricted by NEUBs
1	Watering outdoor plants on commercial premises
2	Filling or maintaining a non-domestic swimming or paddling pool or hot tub/jacuzzi
3	Filling or maintaining a pond
4	Operating a mechanical vehicle-washer
5	Cleaning any vehicle, boat, aircraft or railway rolling stock
6	Cleaning non-domestic premises
7	Cleaning a window of a non-domestic building
8	Cleaning industrial plant
9	Suppressing dust
10	Operating cisterns (in unoccupied buildings)

If we need to impose restrictions like TUBs or NEUBs, customers can contact us to ask for exemptions or for more information. After we receive these representations, we will consider these and whether it is appropriate for us to vary our policy to discretionary exceptions. If we impose restrictions and we become aware that some customers are not complying, we will try to work with them to understand why this is. If this does not work, then we will explore the enforcement options open to us. However, we expect that by demonstrating that we are reducing leakage and doing everything that we can, that the overwhelming majority of our customers will also 'do their bit'.

As we described in section 1.6 our stated levels of service are that we expect to impose restrictions no more than three times every 100 years. When talking to customers we do not distinguish between a TUB and a NEUB. However, as our decision flow charts show we would not impose a level 3 restriction i.e. a NEUB until drought trigger zone F. This means that we will not impose a NEUB unless we have already imposed a TUB. The table of modelled and stated frequency of TUBs and NEUBs we included in section 1.6 shows that there can be a difference between stated levels of service and the modelled.

Our baseline deployable output (DO) modelling for WRMP19 of the 95-year period from 1920 to 2014 shows that the two most critical droughts in our region in terms of causing level 2 & 3 restrictions (TUBs and NEUBs) are those that included the following years: 1976 and 1984. Our water resource modelling shows that these are the droughts when we would have needed to impose customer restrictions. Our modelling also shows that reservoirs such as the Derwent Valley reservoir group and Tittesworth reservoir cross the TUB and NEUB triggers, but they do so outside of 'summer' period in which we would impose restrictions. These 'winter' crossings at Tittesworth and Derwent occur in the 1933-34 and the 1995-96 droughts. Figure 20 shows Tittesworth Reservoir

storage in the 1995-96 drought. Our modelling has also demonstrated that in 1975-76 our storage at Elan Valley entered Zones E and F in summer (see Figure 21). The modelled TUB and NEUB frequency shown is consistent with the levels of service we state to customers as both are 3 in 100 or less.

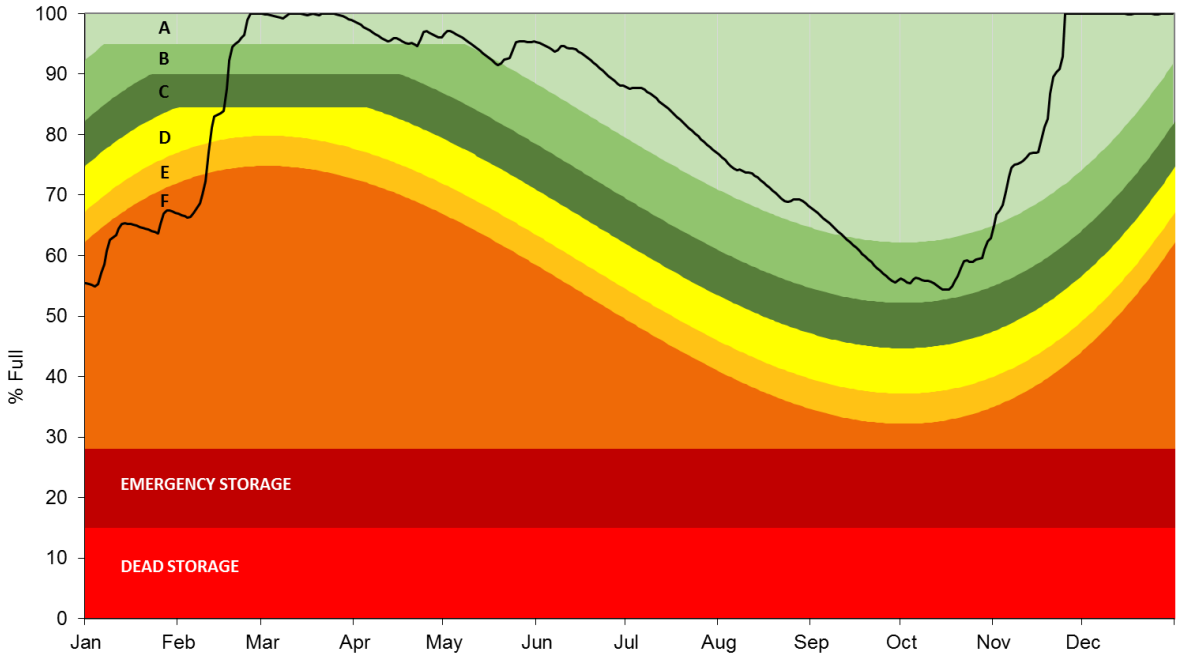


Figure 20 Tittesworth modelled storage entering drought trigger zones E and F in the 1995-96 'winter'

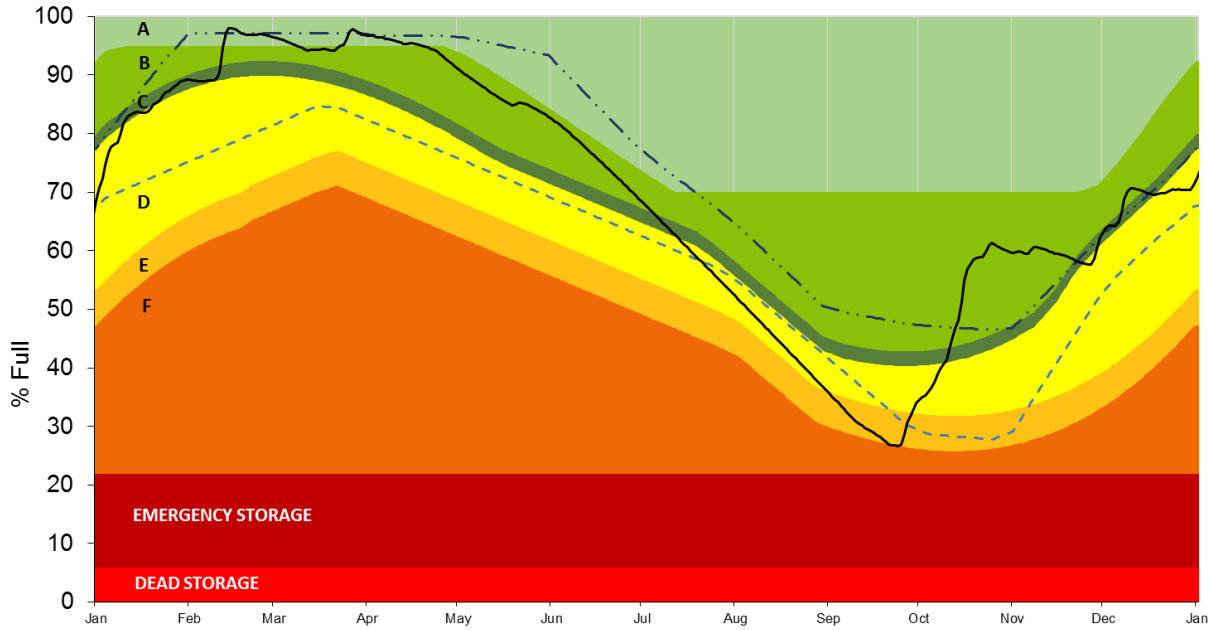


Figure 21 Elan Valley modelled storage entering drought trigger zones E and F in the 1975-76 'summer'

We have considered the results of UKWIR research as well as company specific factors when deciding what reduction in demand to expect as a result of temporary water use restrictions. The 2007 UKIWR report (Drought and demand: modelling the impact of restrictions on demand during drought) suggested that a full hosepipe

ban could reduce demand in the summer by between 5% and 9.5%. There is some uncertainty associated with these results and they were gained from companies in the South East of England, where average water consumption is significantly higher than in our region. We believe that a 5% demand saving is a reasonable assumption for demand savings across the Severn Trent region. This reduction in demand is consistent with our previous drought plan. It is also consistent with the Aquator modelling we carry out in support of our water resources management plan (WRMP).

We plan on the basis that we will not impose a level 2 restriction TUB if reservoir storage or other indicators have been in zone E for less than 7 days and that we would need a 'lead in' time of 14 days before we introduce restrictions on our domestic customers. This timescale allows sufficient, but not excessive, time for this engagement with our customers. We understand that there is no other formal process for objecting to restrictions imposed under a TUB, unless a customer requests a judicial review under the Human Rights Act. If any customers have any concerns about how and when we might restrict use we would welcome them to approach us at any time. We have given more detail on our communication plan and associated engagement in section 5.

3.1.5.3 Compensation arrangements for drought measures

Interruptions to water supply through a Drought Order

The compensation that we may make to household and non-household customers because of a Drought Order are defined by condition Q of our Instrument of Appointment. When a supply of water is interrupted or cut off due to a Drought Order, the affected customer(s) may be entitled to compensation payment or account credit. However, like all water companies if Ofwat determined all reasonable steps were taken to avoid the circumstances that gave rise to the Drought Order then Severn Trent would not be required to issue compensation.

If applicable, for household customers we would pay a sum of £10 multiplied by the number of days during which, or part of which, the supply of water to the premises is interrupted - up to the maximum average water charge for the previous year. For non-household customers we would pay/credit a sum of £50 multiplied by the number of days during which, or part of which, the supply of water to the premises is interrupted - up to the maximum amount of water charges for the previous charging year, or £500 if the customer is not liable (i.e. third party) to pay the charges.

Adverse impacts, damages and losses by drought management actions

Abstractors or occupiers/owners of land who suffer adverse impacts, damages and losses through Severn Trent's drought management actions from a drought permit or order are entitled to claim for compensation under the Water Resources Act (WRA) 1991. These rules are set out under Schedule 9 of the WRA, where abstractors must submit a claim within six months of the expiry date of the permit or order.

We would always follow the appropriate regulations and standards in relation to compensating customers or other organisations potentially affected by our actions. However, there may be times during a drought when we would like to go above and beyond these standards. We would make these decisions during a drought by considering the specific circumstances of each case. More information can be found using the link below.

https://www.legislation.gov.uk/ukpga/1991/57/schedule/9

Guaranteed Standards Scheme

Severn Trent follow the Guaranteed Standards Scheme (GSS) set out by Ofwat which determines whether we may be required to pay compensation to a household or business customer.

3.1.6 Level 4 Restrictions - Emergency drought orders/ emergency plans

We do not class droughts as emergencies unless there is a major environmental or other acute incident requiring activation of multi-agency major incident response arrangements or a serious threat of emergency drought orders.

Legally, emergency drought orders allow companies to "prohibit or limit the use of water for such purposes as (they) see fit" and to supply water by means of standpipes or water tanks. The timing of applications and the determination on these applications is the same as for ordinary drought orders. However, emergency drought orders are granted for a period of up to three months and may only be extended to last a maximum total of five months. Emergency drought orders are described in the water industry as 'level 4 restrictions'.

This drought plan covers the actions we might require up to the classification of an emergency. At this stage we will activate our emergency plans to deal with a loss of supply and maintaining essential water supplies. Due to their sensitivity our emergency plans are not publicly available, but they describe the measures we would consider during emergency scenarios. Scenarios of this type are outside the scope of a drought plan. However, it is vital to stress that the probability of a drought causing such plans to be implemented is extremely low.

3.2 Supply-side actions

This plan not only includes measures for reducing demand during droughts but also ways in which we can increase our supplies of water. Since we published our 2014-19 drought plan there are some supply-side actions which we know are no longer available. For example, in the North Staffs WRZ we had an option that involved recommissioning Meir but, due to water quality reasons, we have revoked this abstraction licence and we no longer own the site. As this is no longer a viable drought option we have removed it from our plan. There are also some options that we have included in this drought plan that we did not include in our 2014 plan.

3.2.1 Drought / Emergency Sources

As we are considering more extreme droughts in this plan to those we considered in our 2014 plan we think that it is essential to explore a wider range of potential drought sources. We currently consider the following to be drought sources that may provide a supply-side benefit in a drought (or another emergency that threatens our ability to supply piped water supplies to all of our customers):

- Blackbrook reservoir
- Linacre reservoir group
- Monksdale borehole
- Norton emergency borehole
- Witcombe reservoir
- Stanley Moor borehole

3.2.1.1 Deploying these sources

Some of the sources listed above could be deployed at short notice whereas others have a long lead in time and would require (temporary) infrastructure, environmental assessments, hydrological studies and water quality assessments. Table 10 shows how 'ready' each of these drought/ emergency sources is. In appendix F we also include some additional information relating to these sources.

Table 10 Potential requirements to deploy our drought/ emergency sources

Source	WRZ that would benefit	Estimated peak yield (Ml/d)	Estimated average yield (Ml/d)	What is needed to get it into supply	Comments / timescale
Norton borehole	Strategic Grid (West)	N/A	0.7	Standard internal processes for bringing into supply a source that has monthly water quality samples taken but is not normally used for public supply	Expect it would take around 3 – 6 months to bring into supply.
Blackbrook reservoir	Strategic Grid (East)	14.5	6	Need to test water quality of the reservoir and build infrastructure to either transfer to Site B or, less likely, install on-site treatment and construct infrastructure to get treated water into our grid.	Expect it would take in excess of 9-12 months to bring this into supply..
Linacre reservoir group	Strategic Grid (East)	9	6.8	Need to test water quality of the reservoir and build infrastructure for on-site treatment and construct infrastructure to get treated water into our grid.	Expect it would take in excess of 12 months to bring this into supply.
Monksdale borehole	Strategic Grid (East)	N/A	1.5	Need to test water quality of the raw water, build on-site treatment and construct infrastructure to get treated water into our grid.	Due to the long lead-in time to deploy (9-12 months), the modest yield available (on an annual average basis) and the lack of environmental data available we expect to need this source less frequently than we would use NEUBs.
Stanley Moor borehole	Strategic Grid (East)	N/A	0.5	As above.	As above.
Witcombe reservoir	Strategic Grid (South) – with possibility of supply to Forest & Stroud via	8.7	1.4	As above.	As above.

existing
transfers

It is important to note that the drought resilience we described in section 2.1.2 does not rely on our ability to use any of the sources listed in the table above. As a result, if we decide to use sources such as Linacre or Blackbrook as WRMP24 options we would still be resilient to a 1 in 200 year drought without the need for level 4 restrictions.

We note that there is a continuum between the sources that we use the most and those which we never use (see Figure 22). This means that although it is fairly straightforward to tell which sources are at either end of this spectrum it is less obvious what to call the sources that fall in between these two categories. For example, there are several groundwater sources that we use to support river flows during periods of low flows. We operate these sources too frequently to class them as 'drought sources', but not frequently enough for them to be classed as constant sources of supply.

The timescales and requirements of a drought management option are different to those of an emergency plan option. We discuss our emergency contingency planning process in section 3.1.6. Although our drought action flow diagrams (in Appendix B) state that we would "consider use of drought/ emergency sources" when we enter trigger zone D, the long lead in time means that we would be very unlikely to fully implement these actions until we had entered into drought trigger zone E/F. As described in section 1.6 we do not expect to enter into drought trigger zone F in the 95 year record that we model in Aquator. We discuss the WFD implications of using these sources in section 6.5 of this plan as well as in the separate WFD assessment that accompanies this plan.

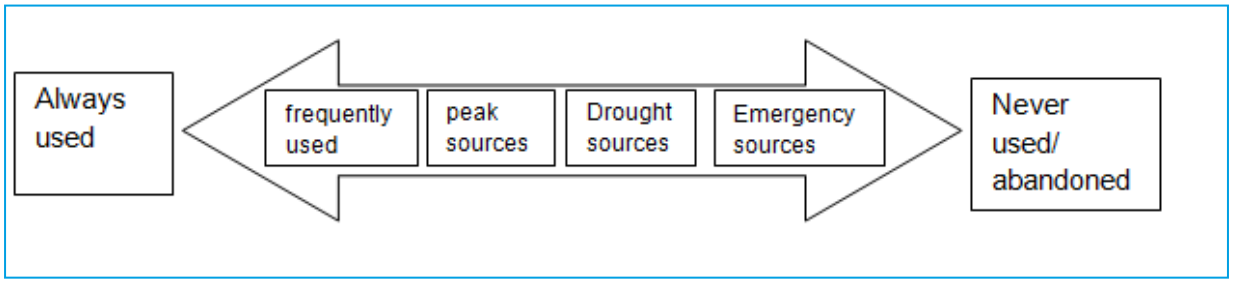


Figure 22 Frequency that we expect to use our various sources

We assess the feasibility and viability of all of our sources including drought and emergency sources. If we find that sources cannot be of value to us in the future, we have a site abandonment procedure that releases the source, and its abstraction licence, for alternative and more productive use.

3.3 Drought orders and permits

There are some plausible drought scenarios when we will need to apply to the Environment Agency for level 3 restrictions such as drought permits or to the Secretary of State for drought orders. We have prepared our drought plan so that we will need to implement these measures as infrequently as is reasonably possible. In this section when we talk about drought orders we refer to ordinary drought orders (level 3 restriction) and not emergency drought orders. We explained our approach to emergency drought orders in section 3.1.6.

The main differences between drought orders and drought permits are that:

1) Drought permits allow companies to take water from specified sources and vary or suspend abstraction licence conditions
2) Drought orders do this, but also allow companies to discharge water to specified places and to modify or suspend discharges or filtering/ treating of water
3) Drought permits are normally determined within 12 days of the application
4) Drought permits are determined by the EA
5) Drought orders are determined by the Secretary of State/ Welsh Ministers
6) Drought orders are normally determined within 28 days
7) Drought orders allow water companies to restrict non-essential uses of water for their domestic and commercial customers

Table 11 shows our modelled frequency of crossing through zones E & F, (triggering potential drought permits & drought orders, respectively) at our strategic reservoirs using our WRMP19 data.

Table 11 Modelled frequency of crossing zone E & F at strategic reservoirs

	Frequency of crossing zone E more than 7 days (drought permit action)	Frequency of crossing zone F more than 7 days (drought order action)
Elan	5 (3 winter: 1921, 1933-34, 1995-96; 2 summer: 1976, 1984)	1 (summer 1984)
Tittesworth	3 (2 winter: 1933-34, 1995-96; 1 summer: 1934)	2 (winter: 1934, 1996)
Derwent Valley	0	0
Carsington & Ogston	0	0
Draycote	0	0

As described in the following sections and Table 11, although we may cross into drought trigger zones E & F, this does not necessarily mean a drought permit or drought order will be appropriate. We may be able to source supply to customers from elsewhere in the WRZ/region, or our projections may indicate future storage recovery (e.g. increased precipitation and river flows) that would mean the permit/order would not be necessary by the time of implementation. This is why our modelled frequency in Table 11 is higher than historic drought permits/orders that have been put in place in dry years.

3.3.1 Demand side Drought Orders

The Secretary of State can grant a drought order if they are satisfied that either:

- a serious deficiency of water supplies exists or is threatened or
- there is a serious threat to any flora or fauna, and
- this has been caused by an exceptional shortage of rainfall

In our water resources modelling we assume that a restriction on these non-essential uses lowers summer customer demand by an extra 5%. This means that, in combination with the temporary use restrictions (level 2 restriction) applied to domestic customers, we model a 10% reduction in demand.

This value is consistent with the reduction in demand associated with a drought order shown in the 2007 UKWIR report Drought and demand: potential for improving the management of future droughts. The cumulative or in combination reduction in demand of 10% is towards the lower end of the range of values quoted in other industry publications. This is appropriate to our company specific circumstances as our customers use less water on average than the customers of most of the other water companies in England and Wales.

We assume 28 days as the time required for Defra to grant a drought order to restrict the use of commercial customers. However, it does not follow that there must be an equivalent volume of reservoir storage in zone F to supply 28 days of average or peak demand. This is because as reservoir storage falls through the zones above we will implement actions to reduce the demand on the reservoir or reservoir group. For example, during the low storage experienced at Draycote reservoir in 2011-12 we were able to reduce the net outflow from Draycote reservoir to zero.

In our modelling we assume that when reservoir storage enters drought trigger zone E (which is defined in section 2.2) for more than seven days, we will:

- reduce the modelled demand by 5%

We also assume that if storage enters drought trigger zone F our modelled demand will:

- reduce by 10%

These reductions only occur if the modelled storage enters these zones in the summer (April to October inclusive) months as during winter there would be no significant reduction in demand. The 180 day duration for demand reductions is consistent with that assumed for a hosepipe ban when we prepared our 2019 WRMP, our 2014 WRMP and our 2014 drought plan. These demand reductions apply for a period of 180 days, unless storage recovers sufficiently before this period has finished.

We do not have a curve in our model solely for when we implement drought orders. Despite this we can predict when they are likely to occur by looking at the time of year, the reservoir current storage and our projections for future reservoir storage. If we think that there is a reasonable chance that we would need a drought order or permit we would engage with the relevant stakeholders at an early stage. For example, during the drought that ended in 2012 we contacted the Midlands Region EA to agree what we would need to provide to support any drought permit application. Table 12 illustrates some indicative scenarios:

Table 12 Indicative drought permit application scenarios

Time of year	Current reservoir storage	Projected future reservoir storage	Is a winter or summer drought permit application likely
Winter / Spring / early summer – (November to July inclusive)	Zone E	Projections indicate that storage will remain in zone E or reduce further	Yes, although we would not apply for a summer drought permit unless we had imposed a TUB

Winter / Spring / early summer – (November to July inclusive)	Zone E	Projections will indicate that storage will increase to zone D or above within 28 days	No, this would be unnecessary
Late summer / autumn (August to October inclusive)	Zone E	Projections indicate that storage will remain in zone R or reduce further	Yes, but it is unlikely that our projections would indicate this as winter inflows are usually high
Late summer / autumn (August to October inclusive)	Zone E	Projections indicate that storage will increase to zone D or above within 28 days	No, this would be unnecessary

By allowing us to restrict the non-essential uses listed in section 3.1, drought orders provide us with powers to manage the demand of more of our non-household customers. We may also apply for a drought order rather than a drought permit in locations where we consider there needs to be a decision on the grounds of imperative reasons of over-riding public interest. Decisions of this type are taken by the Government rather than the EA.

Currently we think that there are three specific locations where we may apply for a drought order for this reason. These three locations are:

- The River Wye at Wyelands. The River Wye is a Special Area of Conservation (SAC) and therefore covered by the Habitats Directive. As discussed in section 3.3.4.7, our drought order here would request a temporary variation to the conditions of our existing abstraction licence. The triggers for this application are summarised in section 2.2.2.
- The River Severn at site G, if the EA has already applied for a drought order
- The River Churnet at Tittesworth if we have not applied for a discharge permit

We describe our approach to a potential drought permit and/or drought order on the River Churnet in section 3.3.4.5 of this plan.

3.3.2 Lead in times for drought permits and drought orders

The lead in time that we will require to prepare our drought permit or drought order applications will depend on how much information we have readily available at the time. We estimate that we will require at least seven days lead in time for us to finalise our application. However if we are considering applying for either a drought permit or drought order we will have already been collating the supporting information required. This means that some of this lead in time could occur whilst the drought indicators are still in trigger zone D. In section 6 we explain that we are routinely gathering the supporting environmental information that we need as part of a drought permit/ order application. Therefore, we are confident that we could quickly make an application if necessary.

In the event of applying for a drought permit or order the EA may request to see sensitive Severn Trent data, such as pre-published leakage data. We will be able to make data available for the EA on secure password protected spreadsheets or alternatively permit access to our offices to view data, as necessary.

3.3.3 Drought permits

Drought permits allow us to take water from specified sources and vary or suspend conditions in abstraction licences to enable us to continue providing water for public consumption. This is a supply-side drought

management option as it can increase the amount of water available to abstract. The EA will grant drought permits if it is satisfied that:

- a serious deficiency of supplies of water in any area exists or is threatened and
- the reason for this is an exceptional shortage of rainfall

Although companies need to demonstrate a "serious deficiency of supplies" and "exceptional shortage of rainfall" to obtain either a drought order or permit, there are no exact definitions of either term. This is because each drought and situation is different. To provide the industry with clarity the EA produced a guidance note entitled 'Exceptional shortage of rain: Principles for the assessment of drought orders and permits'. We have reproduced this note in appendix I. In summary, this note states that the EA will consider the following matters when assessing drought orders or permits:

- technical analysis methods
- period of analysis
- geographic extent of analysis
- other meteorological and hydrometric measures
- relationship to the serious deficiency question
- relationship to water company system
- other sources of information
- presentation

This guidance note helps to define what the EA would expect without being excessively prescriptive. For example it states that there should be no set definition of exceptional shortage of rain and it states that the technical methods "can include return period analysis". We believe that this note sets out a sensible and pragmatic approach. We also note that we routinely analyse and monitor some of the information mentioned in this note as part of our internal drought communications. It is important that we monitor localised as well as regional (rainfall) data. One way in which we can assess whether a rainfall deficit is exceptional is to refer to the CEH portal (see Figure 5).

A drought permit will normally be in force for a maximum period of six months, but those six months can start at any time of the year. Drought permits can be extended if necessary. However, it is an understanding between the EA and water companies that a drought permit, starting in summer, would be accompanied by a reduction in domestic customer demand through a temporary use ban (TUB). We describe the potential environmental impacts and the assessments we have carried out in section 6 of this plan.

3.3.4 Potential drought permit and order sites

In a drought we may have to apply for drought permits or drought orders at the following locations:

- Avon & Leam
- Derwent
- River Churnet
- Wyelands
- Site G
- River Dove

Figure 23 shows the geographical locations of these sites in relation to the location of sites of special scientific interest (SSSIs), special areas of conservation (SACs) and special protection areas (SPAs) that are in our region.

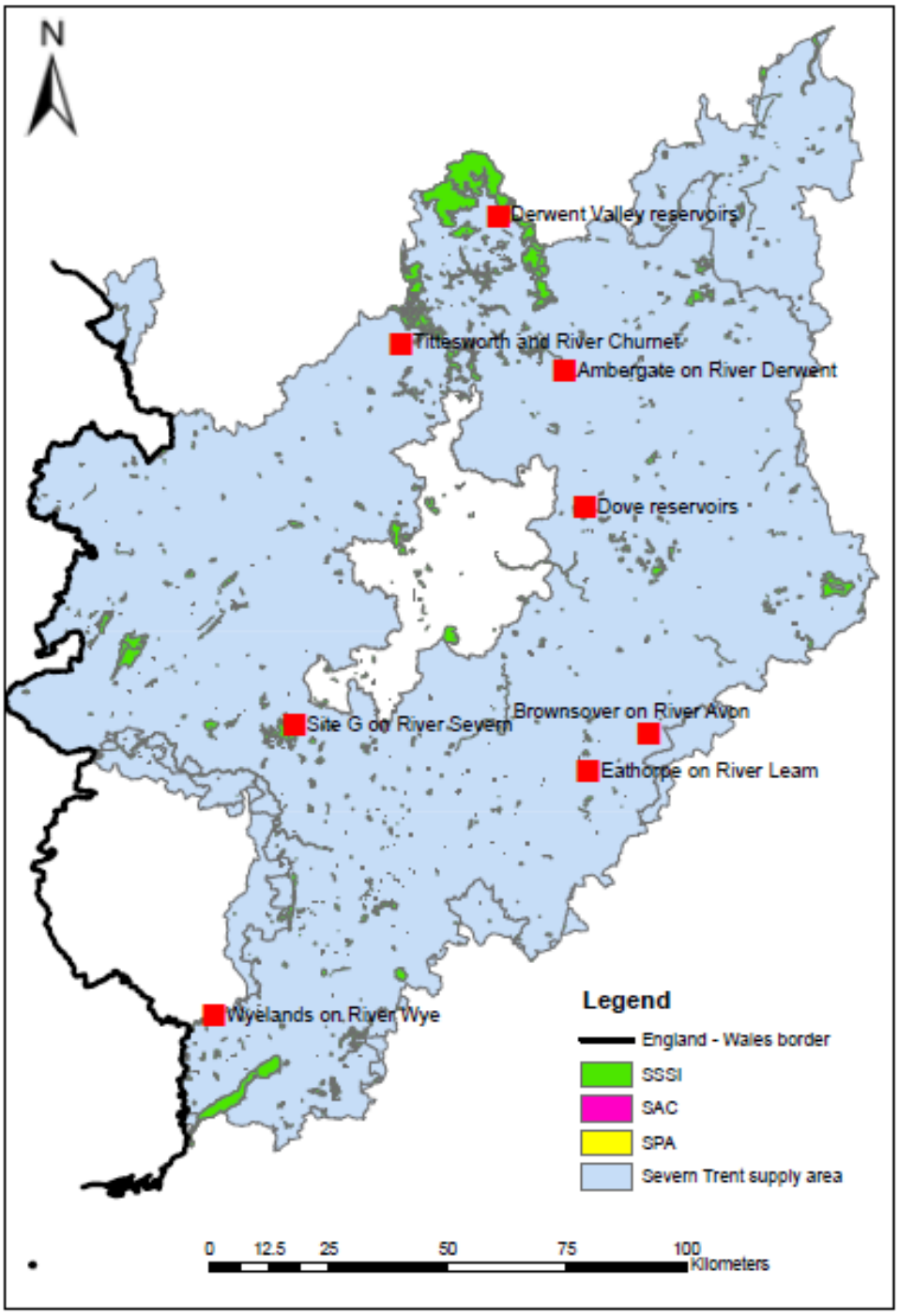


Figure 23 Location of potential drought permit and drought

These locations are unchanged from our previous drought plan apart from the addition of the Dove Reservoirs. Where the locations are unchanged, we have carried out extensive work on Environmental Assessments for the drought permits/ orders that and we have carried out the associated monitoring for several years in the catchments that include all of these sites.

However, we do not entirely rule out the need for drought permits/ orders that we do not currently list. The reason we cannot entirely rule this out is that in a drought more extreme than any we have previously experienced we do not know exactly how, where or when the effects will be most apparent. As a result, we want to keep these options open if very extreme or unexpected events or series of events occur.

3.3.4.1 River Leam and River Avon

In 'normal' conditions our abstraction licences mean that:

- We cannot abstract at Eathorpe between May and mid-September unless Draycote reservoir storage is below the summer abstraction thresholds.
- We have to operate so that, if the flow in the River Leam at Princes Drive Weir in Leamington drops beneath 18.2Ml/d, we only abstract at Willes Meadow the same amount of water that we released from Draycote reservoir the previous day.
- We cannot abstract from the River Avon if the flow at Stareton gauging station is equal to or below 45 Ml/d.

This drought permit will:

- Authorise abstraction at Eathorpe on the River Leam to Draycote Reservoir at any time of year when the lower storage condition at Draycote Reservoir would normally prohibit such abstraction
- Relax the flow condition in the River Leam at Princes Drive Weir in Leamington from 18.2 Ml/d to 12.2 Ml/d
- Reduce the hands-off flow in the River Avon at Stareton from 45 Ml/d to 35 Ml/d exclusively to allow us to transfer additional water from the River Avon at Brownsover into Draycote reservoir.

The full EAR (Environmental Assessment Report) can be requested from Severn Trent. A summary of the associated EAR is detailed here:

- The magnitude of DP effects was derived from water balance modelling work performed for both river catchments; hydrological and water resource analysis was therefore used to provide a time series of river flows (between June 1972 and January 2012 on the Leam and October 1962 and February 2012 on the Avon) for both a baseline condition and also for a number of drought permit scenario conditions.
- For most receptors, only negligible or minor negative impacts were predicted. The notable exceptions were in-river habitats at Offchurch on the River Leam, and some species and life history stages of fish on the River Leam, where potential moderate negative impacts were considered possible (although not necessarily probable), depending on the timing and duration of DP implementation.
- No in-combination impacts are predicted for the River Avon downstream of the Leam confluence, given the generally negligible/minor nature of the predicted impacts on the reaches upstream and the negligible nature of the predicted changes in flow in this reach.
- Additional monitoring and mitigation measures have been proposed to reduce all potential impacts to a minor negative level of significance, where possible.

3.3.4.2 Derwent Reservoirs

In 'normal' conditions our abstraction licences mean that we:

- Abstract approximately 75% of the annual licensed quantity from the reservoirs for our use.
- Approximately 25% is for Yorkshire Water's use.

- We should provide a minimum compensation flow of 54 Ml/d from Ladybower reservoir (when the River Derwent flow at Derby is above 340 Ml/d).
- We should provide an aggregate quantity of compensation water of 74Ml/d (or 92Ml/d when flow at Derby is <340Ml/d) from Ladybower Reservoir and the River Noe/Jaggers Clough to the River Derwent

This drought permit will:

- Reduce the aggregate quantity of compensation water from Ladybower Reservoir to the River Derwent and the River Noe/ Jaggers Clough flows from 74 Ml/d (or 92 Ml/d when flow at Derby is <340 Ml/d) to 51 Ml/d.
- Reduce compensation water from Ladybower Reservoir from 54 Ml/d to 34 Ml/d.

The full EAR (Environmental Assessment Report) can be requested from Severn Trent. A summary of the associated EAR is detailed here:

- The environmental impacts of drought permit operation and impacts on water users were investigated in a staged process. Likely changes to 'pathway variables' (flow, physical habitat and water quality) were predicted numerically and the potential effects on 'receptors' (ecology and water users) were assessed using expert judgement and with reference to effects during previous low flow periods.
- Predicted flow and habitat changes arising from Derwent Valley drought permit operation were greatest between Ladybower Reservoir and Rowsley but even there impacts on the environment and on other water users were considered likely to be minor. Further downstream, changes in flow were very modest relative to the large flow contribution from the River Wye
- However, because droughts are infrequent, predictions of drought response are inevitably a little uncertain. Therefore, an updated Environmental Monitoring Plan and potential mitigation measures have been set out in consultation with the Environment Agency
- Post-Drought Permit monitoring is required to assess recovery and the success of the mitigation measures, and to check that there are no long-term effects on any environmental features.

3.3.4.3 River Derwent at Ambergate

In 'normal' conditions our abstraction licences mean that we can:

- Abstract up to 62,100 Ml annually from the river at Ambergate
- We have included the daily maximum abstraction rate in Table 13.

This drought permit will:

Authorise the abstraction of up to 320 Ml/d at Ambergate when the flow in the River Derwent at Derby is not less than 500 Ml/d, rather than the present flow threshold of 680 Ml/d.

We have taken Table 13 from the River Derwent and Derwent Valley environmental report which we discuss in section 6.1.1. This table summarises the changes that these two drought permit applications would seek to make.

Table 13 Derwent and Derwent Valley drought permits

System	Mean daily flow controls at St. Mary's Bridge Derby (Ml/d)	Permissible Abstractions Ml/d	Total Upper Derwent compensatory flow requirement (Ml/d)

	Normal	Drought permit	Normal & drought permit	Yorkshire Bridge		Below Noe Confluence	
				Normal	Drought Permit	Normal	Drought Permit
Derwent Valley Reservoir System	≤340		245 (daily average value)	≥72	≥34	≥92	≥51
	>340	>340		≥54	≥34	≥74	≥51
Ambergate	>680	>500	320	n/a	n/a	n/a	n/a
	≤680	≤500	≤15	n/a	n/a	n/a	n/a
	≤340	≤340	0	n/a	n/a	n/a	n/a

The full EAR (Environmental Assessment Report) can be requested from Severn Trent. A summary of the associated EAR is detailed here:

- The environmental impacts of drought permit operation and impacts on water users were investigated in a staged process. Likely changes to 'pathway variables' (flow, physical habitat and water quality) were predicted numerically and the potential effects on 'receptors' (ecology and water users) were assessed using expert judgement and with reference to effects during previous low flow periods.
- Predicted flow change arising from the Ambergate drought permit would only affect the lower river, with the impacts on the environment and on other water users all found to be insignificant.
- However, because droughts are infrequent, predictions of drought response are inevitably a little uncertain. Therefore, an updated Environmental Monitoring Plan and potential mitigation measures have been set out in consultation with the Environment Agency
- Post-Drought Permit monitoring is required to assess recovery and the success of the mitigation measures, and to check that there are no long-term effects on any environmental features.

3.3.4.5 River Churnet

In 'normal' conditions, our abstraction licences mean that we must:

- Provide at least 14.8 Ml/d compensation flow from Tittesworth Reservoir (including Solomon's Hollow)
- Not abstract more than to 16,000 Ml annually from the reservoir.

In addition, we currently have an abstraction licence for Abbey Green borehole. If we are granted a drought order (or drought permit with a future successful discharge permit application under Environmental Permitting Regulations (EPR)) it will allow us to:

- Reduce the compensation flow at Tittesworth Reservoir (including Solomon's Hollow) from a minimum of 14.8 Ml/d to a minimum of 8 Ml/d

- Abstract up to 3.3 Ml/d from the Abbey Green borehole to discharge a compensation flow into the River Churnet 1.8 km downstream of Tittesworth reservoir
- No longer release a total minimum discharge of 19.32 Ml/d from a combination of Tittesworth Reservoir (including Solomon's Hollow) and Deep Hayes. It is worth noting that this clause is going to be removed from the licence in the future.

The environmental impacts of this drought order/permit are covered in the Churnet environmental report. We describe the purpose and content of our environmental reports in section 6.1.

Should we require this drought management option we would:

1) Apply to Defra for a drought order to reduce the compensation flow from Tittesworth, abstract from Abbey Green borehole for river augmentation purposes and discharge from Abbey Green borehole to the river (drought orders can contain provisions authorising discharges), or

2) Apply to the EA for a drought permit to reduce the compensation flow from Tittesworth and to abstract from Abbey Green borehole for river augmentation purposes. For this drought permit option to be a reality we would need to have applied to the EA for an Environmental Permitting Regulations (EPR) permit for the discharge from Abbey Green borehole to the river which we reserve the right to do on a permanent basis.

The full EAR (Environmental Assessment Report) can be requested from Severn Trent. A summary of the associated EAR is detailed here:

- The results of the hydrological and water quality modelling and analysis have been used to assess baseline data and predict potential impacts. For most receptors, only negligible or minor negative impacts were predicted. The notable exceptions were some species and life stages of fish, where potential moderate negative impacts were considered possible (although not necessarily probable), depending on the timing and duration of drought permit implementation and potential water quality effects.
- In general, the monitoring carried out during previous droughts shows that the river ecology recovers fairly rapidly after droughts.
- Additional monitoring and mitigation measures have been proposed to reduce all potential impacts to a minor negative level of significance, where possible

3.3.4.6 Site G

In 'normal' conditions the flow in the Severn at Bewdley is greater than 850 Ml/d and our abstraction licences mean that:

- We can abstract a daily maximum of 211 Ml/d at site G

However, we can also abstract an additional 20 Ml/d as we have transferred this from our shared South Staffordshire asset licence. So, in 'normal' conditions, the total daily maximum is 231 Ml/d but, we usually abstract less than this. The key constraint at site G during a drought is that our maximum daily abstraction reduces from 211 Ml/d down to 91 Ml/d during maximum regulation of the River Severn, and to a maximum of 9,100 Ml during the first 100 days of regulation (the figures are 111 Ml/d daily and 11,100 Ml with the 20 Ml/d currently transferred to site G from the shared South Staffordshire asset). Table 14 illustrates these restrictions upon our abstraction.

Table 14 Site G drought permit/ order

	River Severn Regulation State	Site G	Site G + 20 Ml/d from the shared South Staffordshire asset
Daily	Bewdley >850 Ml/d	211 Ml/d	231 Ml/d
Seasonal	First 100 days regulation (then pro-rata)	9,100 Ml	11,100 Ml
Daily	Maximum regulation	91 Ml/d	111 Ml/d
Annual	Maximum regulation	33,346 Ml/year	404,646 Ml/year

We expect to apply for this drought permit/ order if we have to reduce our abstraction at site G due to the maximum regulation condition in the abstraction licence. A reduction in abstraction at site G will have the greatest impact on our operation if there is the requirement to support the Elan Valley asset S flow to site U in Birmingham from the River Severn. This is most likely to occur if the Elan Valley Reservoirs storage is below the Elan Valley Licence Rule curve and flow to site U has been reduced so that we need River Severn support to supply the demand on site U.

The proposed drought permit/ order will suspend:

- The daily abstraction restriction under maximum regulation.
- The constraint limiting abstraction over the first 100 days of river regulation (special conditions 2b and 2c of the site G licence).
- The joint licence constraints at site G and the shared South Staffordshire asset, under maximum regulation. The daily maximum of 303 Ml/d (max regulation) will revert to 431 Ml/d, and the seasonal limits equivalent to 273 Ml/d (licence No 110 and 163) and 303 Ml/d (licence No.110, 163 and 584) will be removed.

If the period of the drought permit/ order extends beyond 100 days of river regulation we will review the situation with the EA in light of likely future demand on site G and current storage in site T and the Elan Valley reservoirs. We have described this as a drought permit/order as the fact that the R. Severn estuary is a HD site means that we may require a drought order, rather than a permit, even if the EA has not applied for a drought order itself. In the event that the EA has already applied for a drought order on the River Severn then we would need to apply for a drought order at site G. This drought order will:

- Reverse the 5% reduction on abstraction that would have been introduced by the EA's River Severn drought order
- Potentially make the other temporary changes that we would apply for in a drought permit application.

The full EAR (Environmental Assessment Report) can be requested from Severn Trent. A summary of the associated EAR is detailed here:

- The Environmental Assessment Report for the River Severn at Site G used a combination of measured and modelled flow, water quality and ecological data to analyse the response of the water environment to drought and low flows.
- In the event that a Drought Permit at Site G was implemented in advance of a River Severn Drought Order being implemented, it was determined there would be no effect of the Site G Drought Permit/Order acting alone on the riverine reaches, since any effects would be counterbalanced by additional regulation releases. There is a very small risk of reduced freshwater inflows to the Severn Estuary under such a scenario but any such effects would be expected to be of extremely short duration and very unlikely to occur.
- In the event that a Site G Drought Order were to be implemented after implementation of a River Severn Drought Order, the results indicate a low to negligible impact on river flow and riverine habitats; flows are reduced at times of drought but the baseline scenario also shows similar reductions indicating that the changes are due to the normal flow recession that would be expected during a dry period.
- Mitigation measures have been proposed to reduce the potential impacts to a minor negative level of significance. Post Drought Permit monitoring has been recommended to confirm that any impacts would be minor and of a temporary nature.

3.3.4.7 Wyelands

We described how we operate this source in both 'normal' and drought conditions in section 2.2.2.

We expect that this drought order will:

- Authorise the abstraction of up to 45.5 Ml/d at Wyelands when the flow in the River Wye at Redbrook is less than 1209 Ml/d and Elan Reservoirs storage is below the Elan Storage Licence Rule Curve.
- If DCWW is also experiencing severe drought conditions we may apply to increase our Wyelands abstraction to 48.5 Ml/d in order to transfer and extra 3 Ml/d to DCWW.

The full EAR (Environmental Assessment Report) can be requested from Severn Trent. A summary of the associated EAR is detailed here:

- The two most important reaches with respect to changes to flows are immediately downstream of the Wyelands abstraction (where flow changes arising from changes to the Wyelands abstraction are greatest in proportion to baseline flows) and Redbrook gauging station (which is the control for the abstraction). These reaches have been the primary focus of the hydrological assessment
- The magnitude of drought order effects was derived from water balance modelling work; hydrological and water resource analysis was therefore used to provide a time series of river flows for both a baseline condition and also for two drought order scenario conditions.
- In the event that a drought order at Wyelands was implemented without drought permit/order operation of DCWW sources, there would be no effects upstream of the Wyelands abstraction for most receptors (negligible impacts were predicted for fish, angling and protected rights upstream of Wyelands), and only negligible impacts were predicted for all receptors in reaches downstream of Wyelands.
- Given that neither a Wyelands-only nor an in combination drought order has been applied for previously, impacts could not be established from the historic record of biological monitoring. Rather, the modest effects on biological receptors are predicted from the generally small or localised effects on water quality and physical habitat. Nevertheless, there is inevitable uncertainty in such estimates and therefore, high risk receptors have been identified, and monitoring and mitigation measures proposed.

- Given the likely in-combination nature of impacts on the River Wye in the event of a drought of unprecedented severity, it is recommended that any such mitigation measures be undertaken jointly by all interested parties (EA, NE, NRW, DCWW).

3.3.4.8 Dove Drought Permit

In 'normal' conditions our abstraction licences for the Dove Reservoir system means that we can:

- Abstract a maximum volume of 296 Ml/d from the river Dove.
- Abstract a maximum aggregate volume of 73,200 Ml/yr from the reservoirs and river, to be transferred to the local water treatment works.
- The daily river abstraction has a prescribed residual flow of 159 Ml/d dependant on the flow at two upstream EA gauges.
- There is a second licence condition on the daily river abstraction that reduces the residual flow to 90 Ml/d to enable more abstraction under certain low reservoir storage conditions.
- We provide a compensation flow downstream of the reservoirs.

If we were granted a Drought Permit at this site, it would mean:

- The daily river abstraction would need to remain at or above the prescribed flow rate of 159 Ml. I.e. we would not abstract at the prescribed rate of 90 Ml even if combined reservoir storage reached the lower storage threshold, to protect the aquatic ecosystem from deterioration due to abstraction in drought conditions.
- Abstract a maximum aggregate volume of 77,200 Ml/yr from the reservoirs and river, to be transferred to the local water treatment works.
- We would not take the reservoir levels below historic lake levels.

The compensation flow downstream of the reservoirs will remain unchanged and because the reservoirs are pumped storage, and designed not to spill, there would be no change to the flow regime downstream of the reservoirs.

The drought permit assessment has focussed on the potential impacts of a change in reservoir drawdown and how that might affect the aquatic environment associated with the reservoirs.

The full EAR (Environmental Assessment Report) can be requested from Severn Trent. A summary of the associated EAR is detailed here:

- Using measured reservoir level data during a previous drought permit implementation to predict hydrological impacts in comparison to a modelled baseline scenario. The results of the hydrological analyses were used to assess baseline data and predict potential impacts for receptors including designated sites, protected and water-level sensitive species and recreational users.
- Predicted changes in water level and shoreline exposure during drought permit implementation in March 2019 were largely within the range of recent historical variation. For all receptors under the proposed Drought Permit, no impacts were predicted in comparison with the baseline
- There will be no impacts on the water bodies downstream of the reservoirs, nor on the River Dove.
- Routine operational monitoring will continue to be undertaken and will allow the effects of the proposed drought permit to be captured.

3.3.5 Management Structure / role and responsibilities

Water availability and our raw water position is tracked as business-as-usual (BAU) by our Water Availability Team (WAT). This monitoring ensures that we have early sight of any potential drought developing. As we move into a drought situation it is essential that we have a clear management chain and line of communication. This is necessary so we can make informed decisions quickly and effectively, and can agree and implement these actions. Overall control of our response to a drought is managed by our Drought Action Teams (DATs). We have four different levels of DAT:

- Operational bronze
- Operational silver
- Tactical DAT
- Strategic DAT

We judge which level of DAT we need to convene by monitoring levels of raw water against our drought triggers (described in section 2.2). If resources are in:

i. Trigger zones A or B and tracking normally we manage through our normal operating rhythm (within WAT)
ii. Trigger zones A or B but trending towards zone C, we will manage our system via operational bronze DAT (separately to WAT)
iii. Trigger zone C we will manage our system via operational silver DAT
iv. Trigger zone D we will manage our system via tactical DAT
v. Trigger zone E or below we will manage our system via strategic DAT

3.3.5.1 Operational bronze DAT

This team meets fortnightly separately to WAT if condition (ii) above applies. We have set out the composition of this DAT in Table 15.

Table 15 Bronze Drought Action Team (DAT)

DAT member	Role
Strategic Asset Management – Water Resources Lead (Chair)	Overall responsibility for managing the response to a drought whilst in trigger zone A or B
Principal Hydrologist	Provide technical advice on hydrology and licensing
Water Resources and Production Manager	Controls interventions on the grid and daily production requirements
Strategic Network Optimisation Advisors	Support water resources and production manager
Hydrology and Modelling Analysts	Provide technical advice on hydrology and modelling
(Principal/Senior) Hydrogeologist(s)	Provides technical advice on hydrogeology and groundwater assets

3.3.5.2 Operational silver DAT

Our Silver DAT is made up of the same members as our Water Availability Team (WAT), but when a drought is impending this team meets separately. We have set out the composition of this DAT in Table 16.

Table 16 Operational silver Drought Action Team (DAT)

DAT member	Role
Head of Network Control (Chair)	Overall responsibility for managing the response to a drought and network management
Head of Asset Strategy and Performance (Chair)	Responsibility for Asset Strategy & Planning and water resource management planning
Head of Asset Creation Non-Infra	Responsible for engineering projects on our non-infrastructure assets
Strategic Asset Management – Water Resources Lead	Lead on implementation of drought plan measures
Strategic Grid and Resilience Manager	Advice on grid resilience and capacity head of asset management
Area Production Operations Lead (for the areas affected)	Responsible for managing water production operations
Principal Hydrologist	Provide technical advice on hydrology and licensing
Hydrology and Modelling Analysts	Provide technical advice on hydrology and modelling
(Principal/Senior) Hydrogeologist(s)	Provides technical advice on hydrogeology and groundwater assets
Process Design Engineering Lead	Advice and sign off on water treatment processes
Network Control – water resources lead	Supports Head of Network Control
Water Resources and Production Manager	Controls interventions on the grid and daily production requirements
Operation Control Centre – Response Lead	Supports Head of Network Control
Head of Regulatory Performance and Assurance – if needed	Responsible for contact with EA and environmental permitting
Customer Strategy and Experience – if needed	Responsible for customer experience
External communications – if needed	Responsible for all external customer communications

3.3.5.3 Tactical DAT

The Water Availability Team expands to become the tactical DAT if any sites enter drought trigger zone D. We have set out the composition of this DAT in Table 17.

Table 17 Tactical Drought Action Team (DAT)

DAT member	Role
Head of Network Control (Chair)	Overall responsibility for managing the response to a drought and network management
Head of Asset Strategy and Performance (Chair)	Responsibility for Asset Strategy & Planning and water resource management planning
Head of Asset Creation Non-Infra	Responsible for engineering projects on our non-infrastructure assets
Strategic Asset Management – Water Resources Lead	Lead on implementation of drought plan measures
Strategic Grid and Resilience Manager	Advice on grid resilience and capacity head of asset management
Area Production Operations Lead (for the areas affected)	Responsible for managing water production operations
Principal Hydrologist	Provide technical advice on hydrology and licensing
Hydrology and Modelling Analysts	Provide technical advice on hydrology and modelling

(Principal/Senior) Hydrogeologist(s)	Provides technical advice on hydrogeology and groundwater assets
Process Design Engineering Lead	Advice and sign off on water treatment processes
Network Control – water resources lead	Supports Head of Network Control
Water Resources and Production Manager	Controls interventions on the grid and daily production requirements
Operation Control Centre – Response Lead	Supports Head of Network Control
Head of Regulatory Performance and Assurance – if needed	Responsible for contact with EA and environmental permitting
Customer Strategy and Experience – if needed	Responsible for customer experience
External communications – if needed	Responsible for all external customer communications
Security and Resilience Lead	Responsible for security, emergency plans, incident management, engaging with mutual aid and Local Resilience Forums
Legal Counsel (Legal) – if needed	Responsible for legal issues
Water Regulations and Public Health Lead – if needed	Responsible for water quality considerations

3.3.5.4 Strategic DAT

This is the highest level of DAT and it is chaired by the Production Director or an appropriate deputy. The silver, tactical and strategic DATs include senior managers who have expertise in water resources, water treatment, water quality and communications. These managers are supported by extensive technical expertise from within their departments. Strategic DAT includes all of the members of tactical DAT as well as the people listed in Table 18.

Table 18 Strategic Drought Action Team (DAT)

DAT member	Role
Production Director (Chair)	Overall responsibility for managing the response to a drought
Head of Customer Network Operations	Responsible for managing the distribution network in our region
Deputy Chief Engineer (represents Chief Engineer)	Responsible for engineering and providing a 2nd line assurance of DAT decisions
Deputy General Counsel (Legal)	Responsible for legal issues
Head of Finance and Performance Production	Responsible for financial and performance issues
Head of Customer Strategy and Experience	Responsible for customer experience
Head of Asset Creation Infrastructure	Responsible for engineering projects on our infrastructure asset
Head of Communications	Responsible for all communications

Our DATs allow us to monitor and evaluate the effectiveness of our drought management actions. It also provides the benefit that it is a forum for technical discussions as well as for understanding the implications to our communication activities. By ensuring consistent internal and external drought messages we are in a stronger position to join-up our communications with those of our relevant stakeholders.

3.3.5.5 Annual Review

This drought plan does not only apply during drought years. We have a regular 'raw water availability' agenda item at our Strategic Grid Steering Group. This helps to remind staff of the processes described in this plan, to assess the need for any further proactive mitigating actions and to ensure that our drought plan remains both current and achievable.

3.4 Drought plan action categorisation and trigger annotation

3.4.1 Action categorisation

Each of our drought plan actions have been categorised using level 1 to 4 definitions. Table 19 below shows the level at which we would consider initiating each of our drought plan demand and supply actions. We have only included actions up until level 3 (i.e. extreme drought management actions). Level 4 actions are included in our company emergency plans.

Table 19 Our drought plan actions categorised based on level definitions

Severity of the drought	Level	Severn Trent trigger zone	Demand side actions	Supply side actions
Drought Plan 	Level 1	A, B	Communications campaign. Liaise with the EA (ongoing throughout)	Liaise with the EA (ongoing throughout) Review maintenance schedule
		C	Increased leakage control	Drought actions with minor environmental impacts (optimising sources, outage). See section 2.2. and Appendix B
	Level 2	D	Continue with increased leakage control	Optimise supply network e.g rezones
		D	Temporary use bans Drought permit	Drought actions with minor environmental impacts (see section 2.2. and Appendix B)
	Level 3	E	Ordinary drought permits or orders Non-essential use bans	All supply side emergency sources (see section 3.2) Beechtree Lane abstraction licence Moderate environmental impact drought permit and ordinary drought orders

				(see section 3.3 and section 4)
		E	All possible actions to avoid emergency drought orders (see section 4) i.e. pressure management; tariff changes; removal of exemption under TUBs & NEUBs	All possible actions including major environmental impact drought permits and orders (see section 3.3 and section 4) i.e. tankering; trades/transfers; effluent re-use; network changes; fast track of WRMP schemes
Emergency Plan	Level 4	F	Emergency drought orders (such as standpipes)	Supply side actions included in our emergency contingency plans

3.4.2 Drought trigger annotation

Annotated drought trigger graphs have been created to provide clarity regarding the drought actions (both supply and demand) we would take at different stages of a drought as reservoir storage changes . The reservoir drawdown curves are based on our historical records.

Figure 24 shows our Derwent Valley reservoirs with the observed 1995 - 1996 drawdown and the demand-side and supply-side actions that we would now take in that scenario. It is worth noting that each drought situation will be different and so we will use the annotated graph as a guide but will endeavour to implement the right actions at the right time. We would liaise with the Environment Agency in each situation.

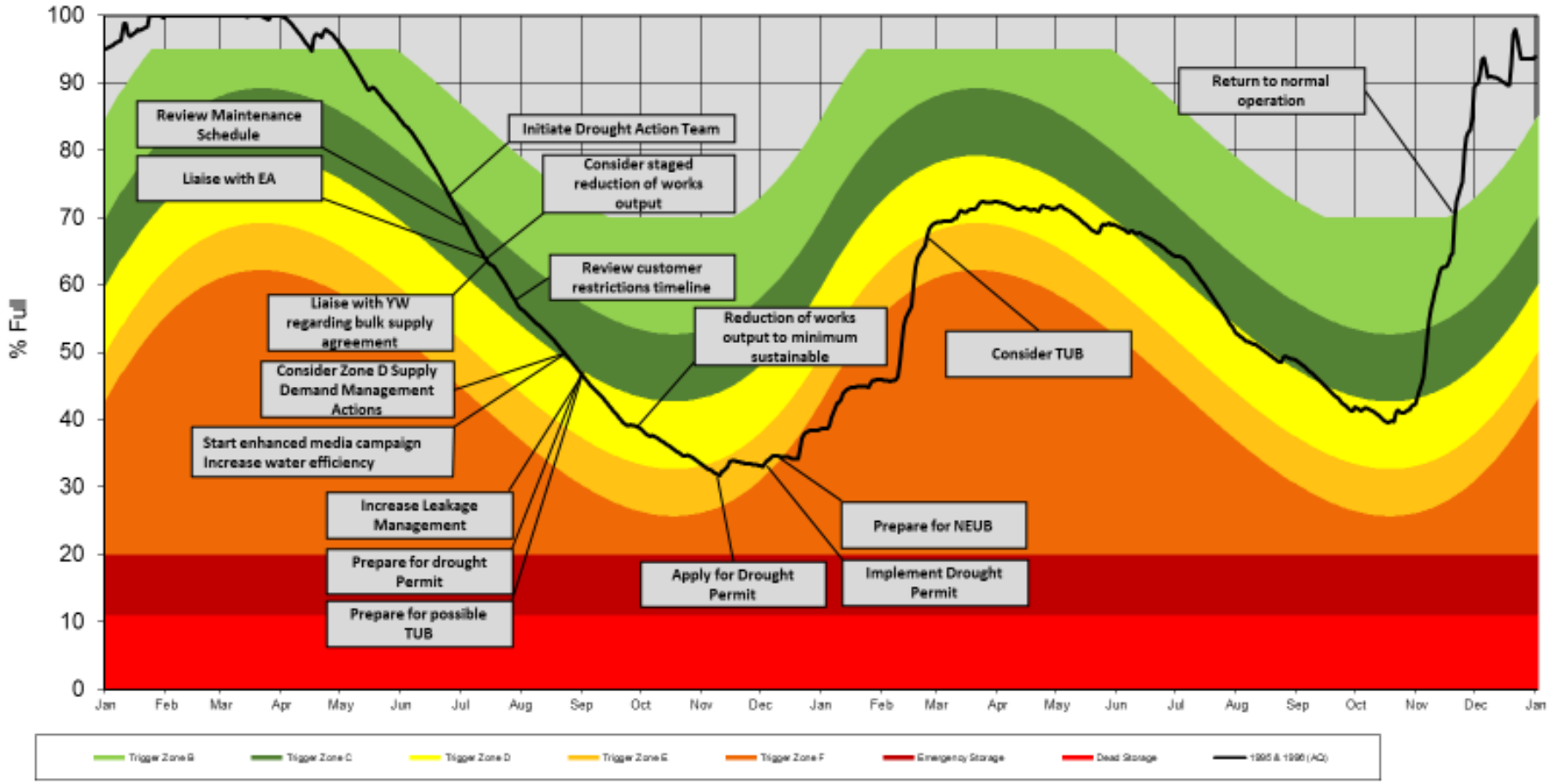


Figure 24 Derwent Valley reservoirs with the observed 1995 - 1996 drawdown and the annotated demand-side and supply-side actions

In appendix B we have included several other drought curves annotated with supply and demand actions in different droughts. The following reservoirs and the year(s) of the historic drawdown we have annotated are detailed below:

- Derwent Valley – 2018
- Elan Valley – 1975-76
- Tittesworth – 2010-11

As detailed in Section 3.3.5 our Drought Action Team (DAT) will manage a drought and the relevant actions to ensure we maintain supply to customers and these annotated graphs will form a key part of the decision-making process.

Section 4 Extreme Drought Measures

In the instance of an extreme drought, we have identified actions that we could implement to delay the need for level 4 severe drought restrictions. These are actions that we could take in the event of an extreme drought, after using non-essential use bans (i.e. level 3 drought restrictions) and before needing to apply for and implement level 4 emergency restrictions. We have identified actions that are/will:

- Practical to implement during an extreme drought
- Likely to be temporary
- Technically feasible
- Generally not result in permanent increases to deployable output

The extreme drought actions that we would look to implement are both supply and demand actions. Table 20 below details the type action (supply or demand), the water resources zones in which it would apply, a description of the action and the likely trigger for needing it, an indication of the likely benefit or saving, identification of significant barriers, and an indication of the timescale for implementation.

In the event of implementing one, or more, of our extreme drought actions we would endeavour to make sure that our demand actions are implemented before our more extreme supply side actions. We have identified a priority order for the actions however we would consider all of them as necessary and implement the measure(s) we believe to be the right one(s) for the circumstance.

Table 20 Extreme drought actions

Type of action	Water Resource Zone	Summary of action	Trigger for action to be used	Likely benefit / saving	Barriers	Environmental impacts	Timescales	Priority order
Demand	All zones as necessary	Increased media & comms	After implementing TUBs & NEUBs and if the raw water position fails to improve	2% demand reduction assumed	No significant barriers however we would need to be conscious of the level and regularity of our comms with customers as over-information can sometimes be viewed negatively	Will only lead to a positive environmental outcome	Ready to implement	1
Demand	All zones as necessary	Pressure management i.e. further reduce pressure while still maintaining essential services, night time reductions.	Once we increase our media & comms we will consider this as it should form part of additional ongoing coms	We assume limited savings	Customer communication to ensure awareness of this	Neutral to positive - reduced leakage through pressure management	Ready to implement	2
Demand	All zones as necessary	Reward scheme for using less water, incentive scheme e.g. bill rebate, postcode scale targets and reward for all if target met, or charitable giving if target met	Once we increase our media & comms we will consider this as it should form part of additional ongoing coms	We assume limited savings	Metering	Neutral to positive - would hope for reduced demand therefore less raw water required to be put into supply	Ready to implement	3
Demand	All zones as necessary	Removal of exemptions under TUBs and NEUBs	After implementing TUBs & NEUBs	We assume limited savings	Customer communication to ensure awareness	Neutral to positive - reduced usage by	Ready to implement once approval	4

		(as detailed in Tables 10 and 11 of this drought plan)	and if the raw water position fails to improve		of this. Potential representations.	removing exemptions	received and correct comms determined	
Supply	Strategic Grid	Use Beechtree Lane abstraction licence for drought purposes (with Environment Agency agreement)	After implementing TUBs & NEUBs and if the raw water position fails to improve	At least 10 Ml/d	DWI standards	Negligible - temporary use will not have WFD No Deterioration impacts	Ready to utilise as soon as barriers are overcome	5
Supply	Dependent on the Drought Order location	Drought Orders	As we continue to move through the drought trigger zones after a TUB/NEUB is in place	Dependent on the Drought Order	Environmental impacts. WFD objectives	Dependant on the location but consideration over any impact would be needed. However, mitigation measures have been proposed in Section 6 of this drought plan which could be used to mitigate against any impact	Minimum achievable timescale of 10 days (timescales rely on Environment Agency approval)	6
Supply	Dependent on the trade/transfer location	Trades/transfers	After implementing TUBs & NEUBs and if the raw water position fails to improve	Dependent on the trade/transfer	Donor areas also experiencing extreme drought conditions therefore limiting their ability to transfer raw (or treated) water	These would be seen in the donor location, however we believe they would be negligible if the donor has the capacity to trade surplus water	Ready to implement as soon as agreement between Severn Trent and donor reached	7

Supply	All zones as necessary	Tankering	After implementing TUBs & NEUBs and if the raw water position fails to improve		Logistics. Available water elsewhere within our supply area	Negligible – we would use water abstracted within our abstraction licence limits		8
Supply	Dependent on the location of the re-use scheme	Effluent re-use i.e. redirecting discharge (relocate to other watercourses).	After implementing TUBs & NEUBs and if the raw water position fails to improve	Dependent on the specific sewage treatment works discharge	Customer perception. Infrastructure constraints	Direct re-use would reduce the quantity of water discharged to watercourses thereby potentially reducing flow to a level which can cause environmental deterioration	Months	9
Supply	All zones as necessary	Network changes i.e. temporary pipelines, new supplies, speed up construction process e.g. overland pipes.	After implementing TUBs & NEUBs and if the raw water position fails to improve	Dependent on the changes implemented	Planning consents. Distances. Network constraints	Would need careful consideration if temporary pipelines are constructed for example. Dialogue with the relevant environmental bodies would be required	Month to year	10
Supply	Dependent on the WRMP scheme location	Fast track WRMP supply schemes	After implementing TUBs & NEUBs and if the raw water position fails to improve	Dependent on the WRMP scheme	Feasibility. Cost. Understand the environmental impacts fully	Potentially unknown if full assessment not undertaken. Would need careful	Months to years	11

			consideration and dialogue between Severn Trent and the relevant environmental bodies

Section 5 Customer communications

5.1 Communications plan

It is vital that we have a clear communications route to our customers and other stakeholders so that we communicate the correct messages at the correct time. This section of our plan sets out the communications plan that we would follow at different stages before, during and after a drought.

Effective communications can help to reduce demand in a drought, for example, by raising customer awareness of the limited availability of water resources. Conversely, poorly prepared messages can have a detrimental effect on the public response to appeals for restraint.

We use the DAT to prevent this from happening. For instance, the communications team attend DAT meetings and work with the DAT to provide clear briefings for internal communication, ensuring our employees communicate appropriate messages and advice to customers. External methods of communication available to us include social media, leafleting, mailed letters, radio and/or television, local and national press and by updating our website.

We work closely with the Environment Agency in all instances of drought and we will utilise joint communications, where necessary, to communicate with customers during all stages of a drought. This could be in the form of joint press briefings for example, but the format of any joint communications will be agreed during each event.

As detailed in Section 1.7 we have worked closely with other water companies who are also members of Water Resources West to agree to align our drought communications where appropriate.

5.1.1 Stakeholders

Table 21 provides a list of stakeholders that we expect to communicate with during a drought. In this list, we have included all of the groups mentioned in appendix I of the EA guidelines regardless of whether these are statutory or non-statutory consultees. Please refer to Table 22 for how we escalate our messages during a drought. Although we expect to contact most of the non-statutory groups in a drought there may be circumstances when we do not need to specifically contact every one of these groups. This list is not exhaustive and we may contact other bodies not included in this table.

We endeavour to ensure that the stakeholder information we have is up to date at the point that it is needed in a drought. We updated our stakeholder information following our draft drought plan pre-consultation email sent in July 2020. In each instance of consultation or in the event of a drought we will have the most up to date record of stakeholder information (based on previous correspondence) and we will investigate and confirm correct information in any instance where communication is undeliverable.

Table 21 Stakeholders that we expect to contact in a drought

Group	Stakeholder
Domestic and commercial customers	Private customers
	Non household retailers
	Consumer Council for Water
	Citizens Advice Bureau
Regulators	Drinking Water Inspectorate (DWI)
	Ofwat

	Defra
	Ministry for Housing, Communities and Local Government (MHCLG)
	Environment Agency
	Natural England
	Natural Resources Wales/ Cyfoeth Naturiol Cymru
Environmental and other relevant interest organisations and groups	Local wildlife groups and campaign groups
	Waterwise
	Local fisheries bodies and groups
	Angling Trust
	Campaign to Protect Rural England
	RSPB
	WWF
	Friends of the Earth
Local authorities and political representatives	Councils
	MPs
Representative bodies	Primarily Water UK but also others such as: Confederation of British Industry, NFU, Chambers of Trade and Commerce, Countryside Landowners and Business Association, Horticultural Trade Association
Energy companies	For example: RWE Generation UK, EON, SSE, Energy UK
Community based institutions and organisations	Parish Councils
	Town Councils
Water companies	For example, neighbouring water companies like Yorkshire Water, Anglian Water, South Staffordshire Water, DCWW, United Utilities, Thames Water
Public services	Fire service
	Health authorities
	Police services
	Local Resilience Forums (LRFs)
Press and media	Newspapers
	Television
	Radio
Sports and interest groups	Angling clubs
	Canoe / boating clubs
Waterways and navigations	Canal and River Trust
	Canal authorities
Other relevant water undertakers	New appointees and variations (NAVs)

In addition to the public consultation, we invited the following statutory stakeholders to comment on this draft drought plan:

- Environment Agency
- Natural Resources Wales/ Cyfoeth Naturiol Cymru
- Ofwat
- Secretary of State/Welsh Ministers
- Any licensed or appointed water supplier which supplies water in the Severn Trent region via our supply system.

Once Strategic DAT has recommended that we impose restrictions on our customers' water use we will send regular briefing statements to Defra, CCWater and Ofwat. If drinking water quality could be affected, we will contact the DWI. All such communications will be approved by Strategic DAT.

We will report on the situation regularly to Water UK particularly if other UK water utilities are suffering similar drought problems. It is important that Water UK co-ordinate any reporting of the national situation and present it in a consistent manner in the national news media. Regular conference calls will ensure this is handled consistently.

Similarly, we will involve other external bodies if supplies are under extreme risk. For example, if tankering to outlying areas becomes necessary, we may ask the police and county highways departments for advice. We will make contact with the Local Resilience Forums (LRFs) to ensure full public awareness of the situation.

5.1.2 Escalation of messages

Communications will:

- Show customers that their contribution to water efficiency is worthwhile
- Explain to customers in simple terms how they can save water
- Demonstrate to customers that we are doing our bit to manage water resources wisely

Table 22 Escalation of messages

Stage of communication	Trigger
Stage 1- first fall in resources • Ongoing water efficiency communications continue as per normal water efficiency campaign plan Includes standard marketing of • Save-a-flushes • Water butts and other products (e.g. shower heads, timers) • Guide to saving water (print and web) • Education activity • Opportunistic media and PR	Reservoir storage / other indicators moving towards Zone C
Stage 2 – projections show likelihood of continued fall in resources • Specific and targeted focus on promoting water efficiency through regional media, exploiting existing relationships • Social media campaigns, e.g. ask customers for their best water saving tips • Extra emphasis on leakage. We provided some illustrative information on the quantities of leakage reduction we could achieve in section 3.1. We will start this extra emphasis on leakage in stage 2 but will continue with this work in stage 3 and 4. • We will showcase our work in finding and fixing leaks, promotion of leakline, reporting leaks online and report a leak app. • Show good examples of our customers taking action to reduce consumption • Working with the gardening industry to promote saving water in the garden • Frost awareness PR • Work with WaterWise, Water UK and other water companies to ensure joined up and consistent messaging • Working closely with non-household retailers to understand their predicted water use profiles over the coming weeks	DAT convened/ indicators in zone C
Stage 3 – one to two weeks leading to proposed restrictions on use • Specific focus in the regional media on water usage and efficiency • Possible radio campaign showing what we do and what customers can do	DAT decision/ indicators in zone D or E

• This would include paid for elements of advertising, including features and promotions • Possible increased activities such as water efficiency product giveaways via radio and TV • Higher profile of water saving on the website, including front page banner • Increased use of social media including Facebook and Twitter campaigns • Press features on water resources activity, summarising how we plan for dry spells and how customers can help • Water efficiency adverts in newspapers • Formal media appeals to conserve water • Possible sponsorship of weather section in print, tv and radio media • Participate in any joint national media campaigns on water efficiency • One to one media briefings • Setting out what actions are likely to happen over the coming days/weeks so that nothing comes as a surprise to people • Close liaison with stakeholders and regulators to maintain "no surprises" • Close working with other water companies – consider joint statements and adverts • Asking large commercial customers if there is scope for them to reduce demand	
Stage 4 – restrictions imminent or in place • We plan to give a notice period (14 days) to customers before we put any restrictions in place • We will use at least two local newspapers as well as social media and our website to advertise restrictions. • We will give details of how customers can make representations • Daily updates on water resources levels to manage high volumes of reactive interest • Intense local broadcast activity – All traditional media (TV / radio / newspapers) as well as social media. This activity will reach far more people than those who see the adverts in the local newspapers and on our website • Advertising in the media in areas where there is a known supply/demand imbalance • Close contact with stakeholders on a regular basis • Withdrawal of softer messaging to avoid any confusion as hard messaging introduced.	DAT decision/ indicators in zone E or zone F
Stage 5 – removal of restrictions • Strong message in the media - thank you to our customers for their help at this time • Close liaison with stakeholders to ensure messaging is consistent	DAT decision/ indicators in zone A

When we communicate with customers during a drought or a period of extremely hot weather we are able to measure the number of people accessing information on our website, the number of tweets that people click to request further information and the number of water efficiency packs that we distribute. We also know how many people different newspapers or radio programmes reach and we record what communications activities we do and when. In addition to this we measure how demand changes across the company and over time.

However, there is not always an obvious correlation between the extent and type of communications work and the demand for water. This makes monitoring the effectiveness of our communications a challenging exercise. For example, in response to periods of hot weather we increase the amount of proactive media work that we did. In addition, we also devote additional resources to our leakage reduction work. We describe this in more detail in section 3.1.2.

Waterwise published a report in July 2013 on the 2010-12 drought (see appendix for full reference) and one conclusion of this was that "The impacts on the public of communications and promotion are difficult to measure but by most measures, there seems to have been a positive reaction both in terms of action and understanding". This supports our point that it is not easy to measure the effectiveness of this type of communications.

5.1.3 Private supplies

We have prepared this drought plan to show how we intend to provide our customers with water during drought. However, we are aware that some people in our region depend on 'private supplies'. For example, householders or businesses may have their own borehole. About 1% of the population of England and Wales use a private water supply.

If a drought adversely affects these people then we encourage them to contact their local authority first and then Severn Trent for advice. If this scenario arises we will consider how we can help without putting our own customers' supplies at risk. A person's Local Authority has the relevant duties and powers under the relevant legislation. Further information on this can be found in the following documents:

1. Legislation of private water supplies and drought, and Managing Insufficiency of Private Water Supplies. Drinking Water Inspectorate (DWI). https://www.dwi.gov.uk/private-water-supplies/regulations-guidance/guidance-documents/

2. Water Industry Act 1991, Chapter III, Section 80-84, UK Government. https://www.legislation.gov.uk/ukpga/1991/56/contents

The Local Authority responsible will consider whether the circumstances pose a danger to life or human health. In such a case we may be required to supply water by means other than in pipes, if practicable, and at reasonable cost for a specified period.

The needs of vulnerable people shall be taken into account. Water needs for vulnerable people should be agreed with the Local Authority, accounting for the water companies capabilities at the time, and provided accordingly.

It is expected that large domestic private water supplies (more than 10,000 litres a day) and commercial private water supplies (including farms) make their own arrangements for alternative supplies.

In the event of widespread requests for support, for say animal welfare, from individuals or from Local Authorities, we would expect directions from the relevant industry regulators or government departments. We may elect to support a request for alternative supplies as long as there is no adverse effect on its ability to provide mains or alternative supplies to our customers.

5.1.4 Support for Non-Household customers

In April 2017 the non-household water market was opened to competition, this means that business customers may now choose their water retailer. Severn Trent formed a Joint Venture with United Utilities called Water Plus. On the 1st of April 2018 Severn Trent transferred their business customers over to Water Plus. This means that business customers must now contact their retailer for any billing or metering issues, however they may still contact Severn Trent directly for network related issues.

In an incident which affects water supply, not limited to drought circumstances, our first priority is to look after our most vulnerable customers and priority sites (e.g. hospitals), and to provide alternative supply to these customers. Support for non-household customers through alternative supplies (tankers, bowsers and bottled water) depends on the nature of the incident and the resource capacity available (both human and physical). Where we do have capacity, any support we provide will be distributed in a fair and equitable way. We have developed a hierarchy of types of business customers (based on their nature) to prioritise the order in which we would offer support where available. We are currently reviewing this with respect to businesses which care for livestock (farms, vets, rescue centres etc.), however there is no guarantee that we will be able to provide alternative supplies during an incident. As a wholesaler we have no legal obligation to provide a certain amount of water to livestock in a certain amount of time, but we will provide support wherever possible.

Businesses must therefore look at what contingency they can put in place, many already have storage tanks and we know there are some who have private contracts for alternative supplies such as tankering etc. Some retailers are beginning to offer contingency supply support, however this is not a requirement on retailers and is therefore a business decision for them and any support is likely to come at a cost to the customer.

We support Defra's advice on their website that any person that is responsible for any animal welfare must have their own 24 hour contingency plan. Our rural business customers are able to contact us and we will offer advice when possible.

5.1.5 Targeted agile communications

With the onset of drought, and once we move into our silver operational DAT mode (details of this are found in section 3.3.5.2), our communications team are fully involved to ensure that we can communicate in an appropriate manner and at an appropriate time over the course of each individual drought. This includes targeted agile communications taking into consideration the different circumstances that arise in each drought, and during hot weather high demand.

As a drought progresses, we can utilise data and evidence to target our communications to areas and customers with particularly high demands. We can use the loggers on our network to determine areas of high consumption and we can also use these loggers to determine areas of low water pressure which can also be a sign of high water usage.

We can use this data to send direct text messages and/or emails to customers in certain geographical locations which ask them to try to reduce their water usage due to high demand in their area. This form of agile communications is generally beneficial for a short-term event where customers are at imminent risk of a supply interruption rather than for long term drought awareness. We can use targeted radio and television adverts, as well as social media and direct emails for longer term messaging about water usage in a drought. In some circumstances we will use these communication approaches across the entire Severn Trent region.

The impact of agile communications on demand is difficult to quantify as there can be multiple factors for a change in customer water use. As detailed in Section 5.1.2 "The impacts on the public of communications and promotion are difficult to measure but by most measures, there seems to have been a positive reaction both in terms of action and understanding". However, we did utilise direct text messaging during May/June 2020 when

a period of hot weather and high demand coincided with the first national Covid-19 lockdown. In the areas where we had low pressure and high demand, we trialled sending text messages to all customers within specific geographical areas where we had mobile telephone contact numbers. In the June hot weather peak we sent out 250,000 text messages. The overall reduction in demand was a success. We saw demand in these geographic locations after these targeted text messages decrease by between 2 – 4%.

The positive outcome of this use of agile communications is an approach that will be carried forward for future events, but it is worth highlighting that other factors may also be involved with this demand reduction such as antecedent weather conditions (i.e. a drop in temperature and increased rainfall). There is more to do internally to ensure that any savings from targeted text messages are monitored in real-time. For example it might indicate if we should bring level 2 restrictions e.g. TUBS on earlier than planned, however it is worth noting that the targeted text messaging is likely to be most beneficial during a hot weather high demand period as opposed to a sustained drought event. We are also looking at more sustained coms with our metered customers about saving money on their bills following a 12 month marketing trial with metered customers in selected District Metered Areas (DMAs) to provide them with advice and devices to save water in order to save money on their bills.

Section 5.2.3 also details additional information on the communications reach during the hot weather in the first Covid-19 lockdown in May/June 2020 and brings to life some of the other targeted agile communications that we used at that time, and will continue to utilise in future scenarios.

5.2 Lessons learned from previous droughts and events

5.2.1 1995

We have not had to restrict our customers' use of water since the 1995-96 drought. Therefore when we look to learn from our experiences of previous droughts, this is the drought we often refer back to. For example, when we analyse reservoir storage information we frequently show the actual drawdown records from 1995 and 1996 as these are useful comparators. As a result of this two year drought we restricted the use of all of our customers in 1995 and the use of approximately half of them in 1996.

As well as implementing this form of demand management we also sought to increase the supplies available to us. Although there have been several changes since 1996, for example legislation has changed, we think that we can still learn lessons from this unusually dry period when we have level 2 & 3 restrictions. In the 1995-96 drought we applied for a Drought Order relating to the refill of the Derwent Valley and Carsington reservoirs. In 1996 we applied for a drought permit for the Derwent catchment but we withdrew our application due to changed weather conditions. In the Churnet Valley we were granted a drought order from December 1995 to June 1996 to aid the winter refill of Tittesworth reservoir. We used Abbey Green borehole to compensate the River Churnet in a way similar to how we may do so if we needed a drought permit or order here in the future. However, we are aware that different legal and regulatory requirements exist now and we address these in the Churnet environmental report.

Since the 1995-96 drought we undertook a comprehensive review of the areas where providing a reliable supply was most difficult. Since then we have invested significantly to improve our infrastructure. As described in section 3.1 our investment and the commitment of our staff have reduced leakage to its lowest ever. Other examples of where we have invested in our network since 1996 include enhancements to the network by duplication or upsizing of mains and provision of new local booster pumps. We assigned the investment to where it would have the most impact in making our sources more robust in terms of treatment and deployability.

We continue to invest in the construction of permanent infrastructure. We target this investment in proportion to the risk of loss of supply during extreme events such as droughts. As we prepared our PR19 business plan submission we assessed what we need to invest to provide the optimal level of resilience for our customers. When we talk about resilience in this context we mean making our network better able to cope with the challenges posed by extreme events that are beyond the control of Severn Trent.

To help us manage our drought communications in the most effective way we collected local demand data at sub-daily time intervals during previous drought years. We have collected valuable information, some examples of which are shown below:

- In summer 1995, peak demands in local networks tended to occur at 9 o'clock in the evening, which we assume was associated with use of sprinklers and hose pipes for garden watering
- For small areas of mainly detached houses the ratio of peak flow to mean daily flow was over 7 to 1
- For small areas of terraced and semi-detached properties the ratio was 3.6 to 1
- For a mixed suburban area of properties, the ratio was 2.6 to 1
- Nationally, customer awareness campaigns during 2006 demonstrated the benefits of media awareness campaigns in reducing total demand, despite no restrictions on use in our region. One of the most effective ways of reducing peak demands is to reduce dependence upon the public water supply by gardeners. This can be achieved through encouraging alternative practices.

As described above we have learned lessons from managing previous droughts and used this knowledge to prepare this plan. We learned some specific and some general lessons from implementing various drought management actions since 2014. Table 23 summarises the lessons and provides references to the relevant part of this drought plan.

Table 23 Lessons learned since previous drought plan

Lessons learned since publication of our 2014-19 drought plan	Section of Drought Plan
We need updated environmental reports to accompany any drought permit / order application and we realise that the timescales for these are longer than we had estimated in 2014	Section 6
We have more 'drought / emergency / extreme sources and options' available now than we included in our 2014-19 drought plan	Sections 3 and 4
We have revised the drought actions from our 2014-19 drought plan and removed ones we know are no longer available to us	Reflected in flow charts and tables (section 2 and appendix B)
We have improved understanding of the EA's requirements for drought permit / order applications especially in relation to the associated environmental reports / monitoring requirements. For example, we know more about the water quality issues and what needs to be in place before we can use Abbey Green borehole to support flow in the River Churnet	Section 3 and 6

We remain committed to learn, review and improve our processes and will do so if / when we experience droughts in the future. For example, we note that in the 2015 EA 'National drought framework' the EA states that it will use the www.gov.uk website to publish drought maps. As described in the communication plan section we will work closely on communications with the EA and, where appropriate, we will direct queries to this source of information. Figure 25 illustrates how these might look:

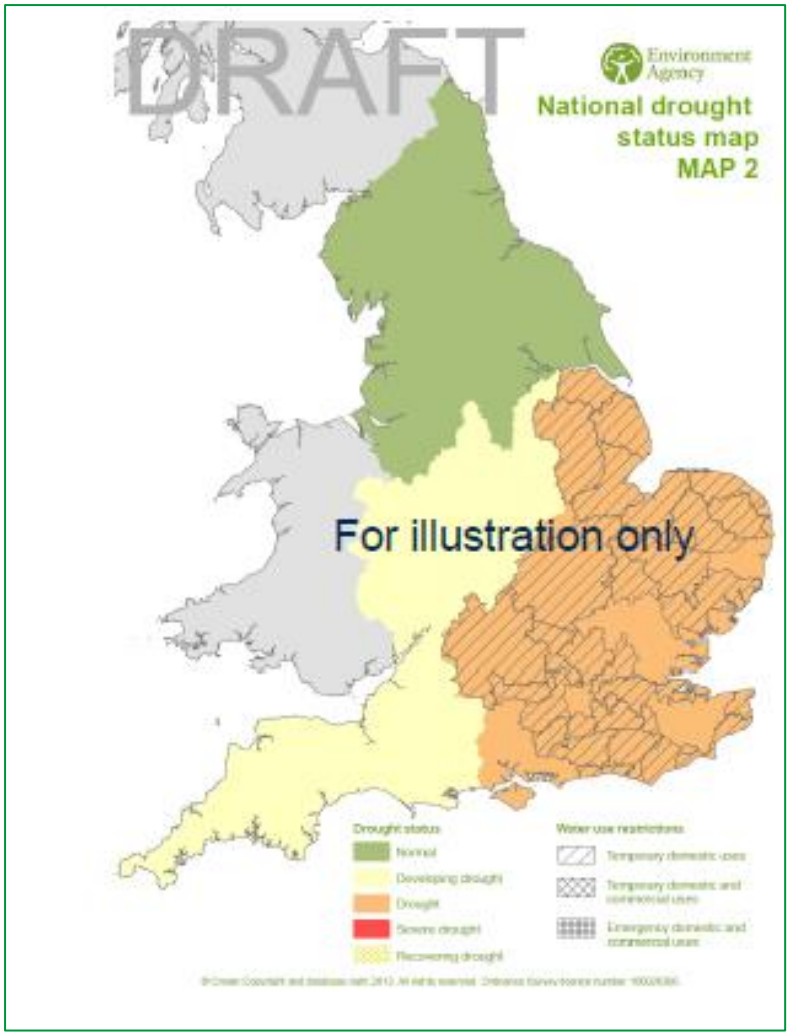


Figure 25 EA drought maps

5.2.2 2018

During the publication of our draft Drought Plan (2019-2024) we experienced a 'Hot/Dry weather event' in summer 2018 with some impacts lasting until spring 2019 due to an unusually dry Autumn/winter. We have committed to include our learnings from this event, to ensure our latest Drought Plan is the most up-to-date for our customers.

Conditions seen throughout 2018-2019:

The summer of 2018 saw below average rainfall across the United Kingdom. The Severn Trent region received below average rainfall in eight out of nine months from May to January 2019, with exceptionally low rainfall occurring in June (22% of long term average across the entire region). Exceptionally low rainfall continued into the winter, with January 2019 receiving just 46% of long term average rain. During the summer, customer demand increased due to the combination of very hot and very dry weather over a prolonged period. The total company demand in June/July 2018 was the highest recorded since the hot summer of 2006.

Our reservoirs were close to 100% full in April 2018, however the prolonged low rainfall coupled with high demand affected our reservoir storage, notably across our supplies in the East Midlands.

Our experience of managing our water supply system during the hot and dry weather conditions uncovered additional drought management options that were not previously included in the 2014-2019 plan, or our draft 2019-2024 plan. We held internal post-event reviews and a further session with the EA in spring 2019, as per our 'post-drought' process described in section 7. The following section will describe the actions undertaken in 2018 and Table 24 highlights the lessons learnt.

Table 24 Lessons learned since publication of our 2019-24 draft drought plan

Lessons learned since publication of our 2019-24 drought plan	Section of Drought Plan
A new drought permit site has been identified – Dove Reservoirs. During 2018/19 this was implemented to increase our annual aggregate abstraction licence so we could maintain security of supply. This location is now included and an EAR is being finalised.	Sections 3.3.4.8 and 6.1.2
Abstraction licence changes can help maximise water into supply by rebalancing across sources	Further explained below
The 2016 Derwent Valley drought trigger curves in the original draft 2019-24 drought plan were too precautionary	Further explained below
There are new drought management actions that were used throughout 2018 for our assets that have now been included. This included enhanced maintenance of structures, early clearance of hindrances to abstraction, and works capacity variation	Section 3
We will improve drought permit readiness e.g. updating our EARs so they are 'on the shelf' versions, learning from previous application, update stakeholders, include enhanced monitoring at Derwent Valley	Sections 3.3 and 6

5.2.2.1 Licence changes

As part of our Drought Management Actions, we utilised the transfer of abstraction licences between our assets to support continued supply to our customers. In 2018 Birmingham experienced particularly high levels of demand, and due to flow levels all abstractors along the River Severn were restricted by the Environment Agency through the River Severn Regulations.

A decision from our Drought Action Team initiated liaison with the Environment Agency to enable a short-term partial licence transfer from one of our WTWs to another further downstream on the River Severn. We worked efficiently with the EA, and the application was fast-tracked to ensure that the full benefit of the transfer was realised. It is our intention to review the application that was made to understand what the future implications might be after this draft drought plan is submitted, but before the final plan submission. However this is subject to other River Severn abstraction licence activities. It is also worth highlighting that we would not expect such a quick turnaround when it comes to licence changes in future droughts.

Another licence change was completed for our Derwent Valley reservoirs in Derbyshire, as explained in section 3.3.4.2, we export raw water from these reservoirs to Yorkshire Water. During the summer and autumn Derwent Valley storage levels impacted our ability to meet the required export, therefore we needed to use additional temporary pumps in addition to our permanent assets already in place. The licence change was to allow the additional abstraction location for the temporary pumps, this ensured we kept supply to Yorkshire Water who were also impacted by the hot/dry weather event.

5.2.2.2 Derwent Valley

Our Derwent Valley Reservoir drought curves have been updated for our draft WRMP24 baseline water resources modelling.

During the 2018 drought, because our 2018 drought plan was still only in its draft form, we continued to use the drought curves for the Derwent valley reservoirs from our 2014 drought plan. It can be seen from Figure 26 that had we used the updated drought curves, both a Temporary use ban and a summer drought permit, may have been triggered.

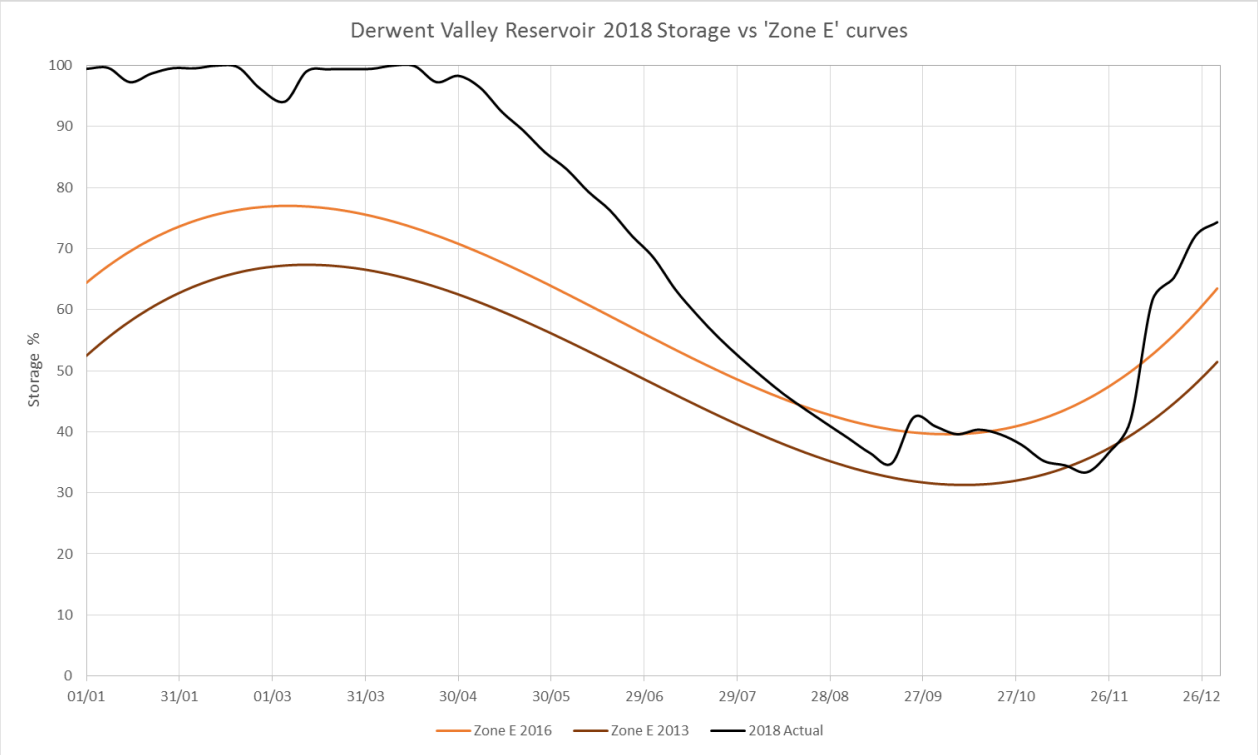


Figure 26 Graph showing Zone E 'TUB' curves for previous drought plan (2014) vs current draft drought plan (2016). 2018 actual storage is included

Following the experience gained during the 2018 drought, we decided that for the Derwent valley reservoirs the 2014 drought plan curves were more suitable triggers for TUBS and NEUBs, and that the 2016 curves may be too precautionary. As the 2016 curves were used for WRMP19, we also tested the effects of using the 2014 drought curves in our baseline WRMP19 model. This showed that the change between these curves does not affect our DO for the Strategic Grid water resources zone or the level of service within the zone, and therefore this change does not represent a material change to the WRMP.

For this draft drought plan and our 2022 draft WRMP, we have updated the flow series used in creating our drought curves, this includes the 2018 drought hydrological data. We have used this most up to date information available to review and updated the drought curves on all of our reservoirs, including Derwent. Again, this update does not affect our DO for the Strategic Grid WRZ or the level of service within the zone. Our updated curves are now actually similar to the original 2014 curves.

5.2.3 2020

During May/June 2020, the United Kingdom was in a national lockdown due to the Covid-19 pandemic. This in itself increased demand but was further exacerbated by the hot weather experienced at the time. This had an impact on some customers' supply. We have undertaken a review of the causes and impact of this event(s) and have externally reported on the recommendations from this review. These recommendations explain how the

supply challenges we faced have led us to reconsider a number of aspects of our operations to avoid repetition, particularly with regards to vulnerable customers and during a drought.

The recommendations from the review (Table 25) are categorised into three categories:

1) Continue current approach
2) Tweak current approach
3) New approach

Table 25 Recommendations from Covid-19 lockdown demand review

Continue current approach	Tweak current approach	New approach
1) Continue risk-based investments – the high-risk areas in 2018 were not at risk in 2020. 2) Undertake annual executive 'deep dive' of summer preparations in forecasting, supply, demand, customer and incident management. 3) Maintain approach of running incidents from the Head Office. Seeking to operate remotely (albeit in exceptional circumstances) added extra complexity. 4) Plan maintenance when higher probability demand will be low with regular reviews and options to re-instate production. 5) Maintain new approach of having customer team 'manage' pockets of customer contact, comparing notes with Network Control who might miss small pockets caused by airlocks and the like 6) Continue to broaden customer contact options (social media, self-help, bots, WhatsApp etc.) to enable call centre to focus on vulnerable customers at peak times 7) Continue to strength PSR register 8) Continue 'peace time' relationship building	1) Keep incident triggers under review in light of Covid-19 (or other exceptional circumstances). Peak demand is not following normal patterns. 2) Allocate and provide regular volunteer incident roles in advance – support volunteers need clarity and to be well-practiced. 3) Introduce spot checks for third party suppliers (e.g. bottled water) to ensure they can deliver against the SLAs. 4) Activate software to prevent contacts being delivered to customers outside the 0900 to 2100 window (except in exceptional circumstances). 5) Pro-actively brief MPs and councillors in high risk areas, asking for their help to spread key messages	1) Make ST demand forecasting 'open source' and readily available on our website, inviting scrutiny and challenges (and also encouraging water efficiency). 2) Undertake a review of demand management options – linked to WRMP24 demand actions

with LRFs and other key stakeholders as a priority – it pays exceptional dividends in incidents

During this period of increased demand, we increased our proactive communication with household customers. We trialled emails, social media, digital adverts, PR, and internal communications to highlight water efficiency and leakage. Over the course of 2020 we had more than three times the number of unique visitors to our 'free ways to save' website than in 2019. To give a specific example, on the 13th May 2020, we emailed 200,000 customers on a water meter aged 25-36. Over 97,000 customers opened the email (49% open rate) and over 24,000 clicked through to our website driving an increase in water saving device orders from 54 per day to over 5,000 in 24 hours. Up to May 2020 we had fulfilled 23,269 orders for free water saving products in the 5 months of 2020, compared to 29,470 orders for the whole of 2019. In May 2020 alone the number of unique visits to our 'save water' website pages increased by more than 1000% compared to May 2019. In terms of social media activity, the number of engagements across our platforms increased by 220%. We also featured in 25 articles: two television, 20 radio, and three paper/web reaching 1,983,617 people. We also used a combination of organic and paid social media posts to reach 130.4 million people in 2020 and have prompted over 102,500 engagements. We also ran text message alert trails, the details of this can be found in section 5.1.5. These types of targeted and increased communications campaigns are an approach that we will maintain into the future during instances of hot weather, high demand and drought. We do acknowledge that using information such as social media reach shows the impact of our comms campaigns but not necessarily a direct link to demand.

Section 6 Environmental Assessment

As mentioned in sections 3.3.1 and 3.3.3 there are some specific locations where we may apply for level 3 restrictions - either a drought permit or a drought order. Section 6.1 provides the details of the environment assessments that we would use in support of these applications. We also consider the environmental impacts of all the other drought measures included in this plan within the associated Strategic Environmental Assessment (SEA). This is an important step to ensure we comply with the Drought Plan Directions.

The Strategic Environmental Assessment Directive (2001/42/EC) requires a formal environmental assessment of certain categories of plans and programmes which are likely to have significant effects on the environment. Government has transposed the Directive into appropriate Regulations to apply to England and Wales. We are the responsible authority and have to judge whether our drought plans fall within the scope of the SEA Directive. We carried out an SEA for our 2014 Drought Plan and we have done so for this plan too. This SEA will report on the likely significant environmental effects of implementing this plan. We have produced this SEA and have published it alongside this draft drought plan.

We have also undertaken a Habitat Regulations Assessment (HRA) for this draft drought plan. This assesses the likely effects of the drought plan on European sites, alone or in combination with other plans. This HRA considers whether actions in a drought plan would adversely affect the integrity of any European sites. The consultation on the SEA and HRA is separate to the draft drought plan consultation although there is some cross over, for example, in terms of the sites affected. The HRA can be requested from us directly.

6.1 Environmental assessment reports (EARs)

The EA's 2020 Environmental assessment for water company drought planning supplementary guidance states that we must demonstrate that we have met our responsibility to monitor, assess and where possible mitigate for the environmental impact of all our supply side drought management actions.

One of our responses to this is to produce EARs to assess the possible environmental impacts of the potential drought permit / order sites we listed in sections 3.3.1 and 3.3.3. Figure 27 is taken from the EA's 2020 environmental assessment supplementary guidance and gives an overview of the environmental assessment process.

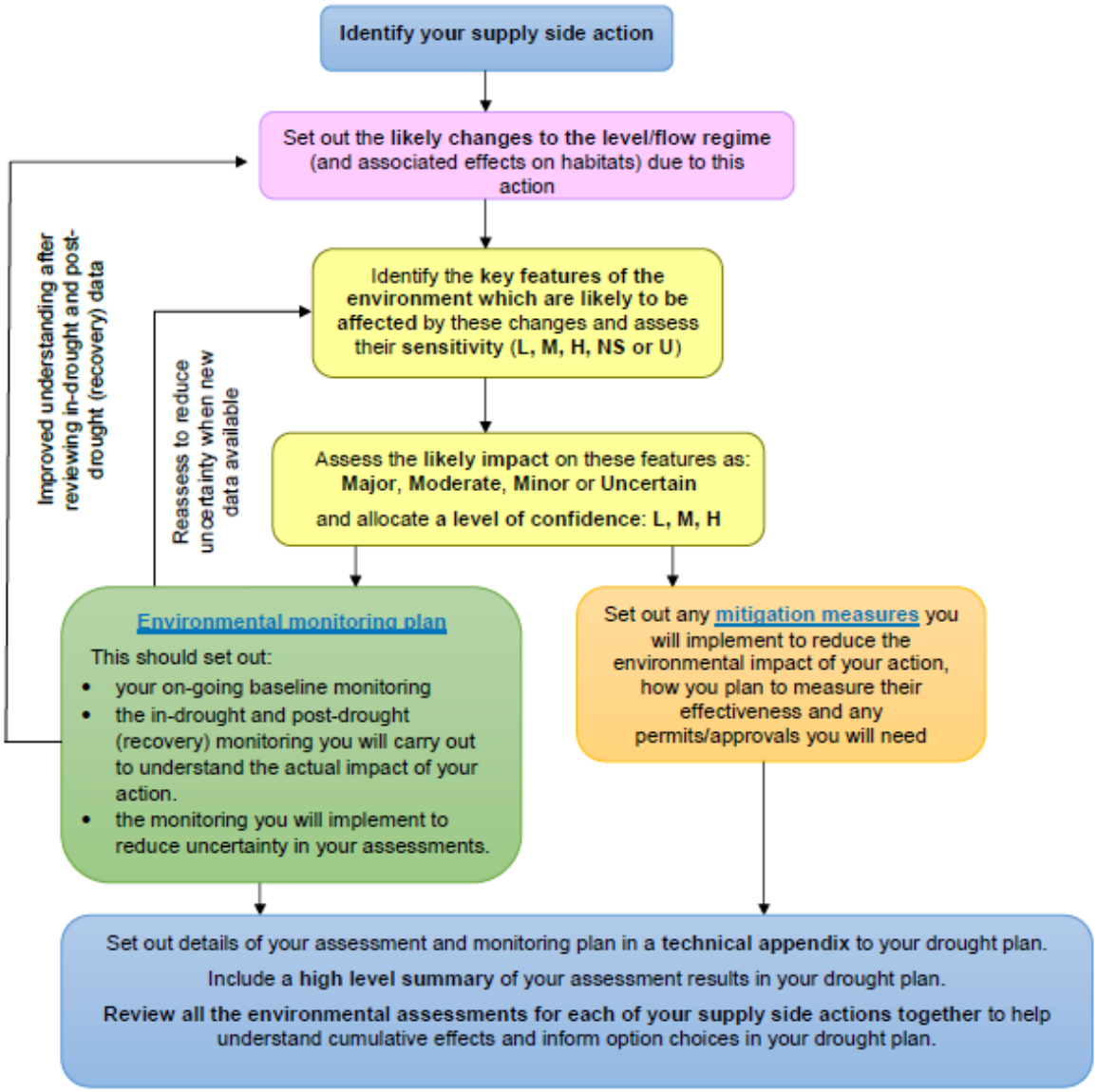


Figure 27 EA flow chart of the high level approach to develop our environmental assessments for our supply side drought management actions

In agreement with the Environment Agency we have prioritised the updates to our EARs. The intention is that we will have finalised versions, subject to regulator approval, of the following EARs when the final plan is published:

- River Churnet (pathways report)
- River Derwent and Derwent Reservoirs
- Dove

In agreement with the EA, there is best endeavours to have the Avon & Leam EAR updated by the time the final drought plan is published. Since we published our 2014 drought plan we have completed the EARs for our site G and Wyelands abstractions. The EAR for site G was finalised in February 2017 and the Wyelands EAR in September 2015. These two EARs are therefore lowest priority for updates and are not planned before the final drought plan is submitted.

During the process of producing the site G and Wyelands reports we learned that they are complex assessments and we should not underestimate the time that they take to produce. We concluded we needed a programme for updating these EARs that keeps them fit for purpose and as current as possible but ensures that we only make wholesale changes when significant changes occur either in the catchments themselves or within the applicable legislation/ regulations. We note that we carry out ongoing monitoring at each of the drought permit/ order sites and this will highlight to ourselves and the EA the occurrence of any 'step changes'.

The EA's 2020 document entitled 'drought permits and drought orders' sets the expectation for water companies to include details of all possible drought permit options in our drought plan and to be application ready as part of our drought plan development. Because we carry out ongoing monitoring at all of the drought permit/ order sites and due to the timescales involved in producing full updates of our EARs we consider that we are as application ready as is pragmatic.

One difference between the EARs we are updating and those we produced to accompany our 2014-19 drought plan is that the drought plan guidance asks us to focus more on droughts of a greater severity than those in our current record. We described in section 2.1 how we have modelled these more extreme drought to support this drought plan and our 2019 WRMP. We have used this modelling of more extreme drought scenarios to select an extreme drought for each of the catchments (Derwent, Churnet, Avon / Leam, Severn, Wye and Dove). As we have modelled the impact of the drought permits/ orders on flows in our historic record as well as in a severe drought event derived from our stochastic drought analysis; for each catchment we have covered a full range of plausible drought scenarios.

6.1.1 Environmental assessment reports (EARs) - River Derwent and Derwent reservoirs; River Churnet

We have described what these drought permit/ orders will do in section 3.3. We produce EARs to assess the possible environmental impacts of drought permit/ orders. We note that these EARs assess the incremental impact of the drought permit/ orders on the environment and not the impact of the drought itself. We expect to have completed these EARs in line with the publication date of this draft plan. We note that this timescale may vary depending upon how many reviews and revisions are required in order to produce reports that meet both our internal requirements and those of regulators such as the EA and Natural England. These EARs, or non-technical summaries of them, are available on request.

6.1.2 Environmental assessment report (EAR) - Dove

This is a new drought permit site following on from the hot/dry weather event of 2018/2019. We implemented a drought permit for less than one month until 31st March 2019 to increase the aggregate annual abstraction licences at this site. This was accompanied by an Environmental Statement as opposed to a full EAR. The report used measured reservoir level data to predict hydrological impacts under the baseline and proposed Drought Permit. The results of the hydrological analyses were used to assess baseline data and predict potential impacts for receptors. It is expected at time of publishing this draft plan an EAR for this site will be available for review.

6.1.3 Environmental assessment report (EAR) – River Leam & Avon

We expect to have completed the updated EAR for this site at the time of publishing the final drought plan. We have described what the drought permit will do in section 3.3. The EAR summary detailed in that section is as per the current EAR and will be updated as necessary.

6.1.4 Environmental assessment reports (EAR) – site G and Wyelands

We have described what these drought permit/ orders will do in section 3.3. We produce EARs to assess the possible environmental impacts of these drought permit/ order. We note that the EAR is to assess the incremental impact of the drought permit/ order on the environment and not the impact of the drought itself. We expect to not to have completed updated EARs by the time the final plan is published, as agreed with the EA. These EARs are available on request and the primary conclusions can be found in section 3.3.

The EAR for site G does note that although Severn Trent applied for a site G drought permit in September 1984 it was never used as site T and the Elan reservoirs started to refill.

6.2 Environmental considerations for supply actions without an EAR

An EAR is required, and has been or is the process of being updated and completed, for each of the sites where we may apply for a future drought permit or drought order. We are also required to carry out environmental assessments for our other supply actions (including our Beechtree Lane extreme supply action) detailed in section 2.2 and Appendix B. Our SEA, HRA and WFD assessments have assessed these actions, and we provide a high-level overview of the environmental assessment details within the tables in Appendix C. We have also considered our emergency sources detailed in section 3.2. For each of these sources we have also completed a high level table within Appendix C, but it is worth noting that the long lead in time for these sources means it is likely we will be able to agree with the EA the necessary environmental actions (i.e. monitoring; mitigation) to use the source. Our environmental data provision and monitoring plan is detailed in section 6.3, and our mitigation measures are detailed in section 6.4.

6.3 Environmental data provision and monitoring plan

As part of our drought management work we have collected, and continue to collect, environmental data at all of our potential drought permit/ order sites. For each site there is a Site Investigation Plan (SIP) which we share with the EA for comment. We share this to ensure we do not duplicate work between us. These agreed monitoring plans will allow us to assess the environmental impact of any changes to our normal operations that we make as a result of the drought. This phase of monitoring is often referred to as 'baseline' monitoring to distinguish it from 'in-drought' or 'post-drought' monitoring. Our environmental monitoring records:

- The feature(s) we monitor
- The location of survey sites
- The timing and frequency of monitoring
- Who undertakes the monitoring.

The SIP details sites to monitor for:

- Spot flow
- Permanent flow
- Macro invertebrates
- Fish
- The river habitat as part of a RHS (river habitats survey)
- The habitat during habitat walkovers and

- White clawed crayfish.

For each year monitored we have produced a stand-alone monitoring report, which we use to track whether significant changes (step changes) have occurred.

6.4 Mitigation measures, compensation requirements

As we described in section 3, we are investing significant resources every year to manage customer demands, promote water efficiency and reduce leakage. We have committed to devote even more resources to demand management during a drought. This work reduces the likelihood of needing drought permits or drought orders, or other supply-side actions. However, when we have exhausted all of the demand management options available, we will have to use supply-side measures like drought permits. However, we would not impose water use restrictions between November and March as we do not think they would be an effective way of reducing demand.

When we implement any drought management action we seek to avoid any adverse environmental damage. In addition to trying to prevent any environmental harm from occurring we have also considered numerous environmental mitigation measures. Some of these mitigation measures are generic and can apply to any location where we may apply for a drought permit/ order.

The following list shows generic mitigation measures that we will consider if we have to implement a drought permit or drought order:

- Fish rescue
- Aeration (for example, of discharges)
- Reduction of other abstractions, if possible
- Freshet releases (these are releases of water from reservoirs for environmental purposes)
- Other forms of flow augmentation (potentially from rarely used / emergency / resilience sources)
- Increase the frequency / coverage of monitoring – this constitutes 'in- drought' monitoring
- Ensure there is adequate 'post-drought monitoring'
- Habitat restoration.

The list above is neither exhaustive nor prescriptive. This means that we may not necessarily need all of these measures in every drought. It also means that if there are measures not listed here that will provide an environmental benefit then we may still implement them. We will decide on the precise combination of measures that is most appropriate to the circumstances of any given drought. We will discuss any necessary mitigation measures with the EA during the drought permit application process to determine the most appropriate monitoring and mitigation regime.

We have not included compensation in the list of mitigation measures above as we do not think that any of our proposed level 3 restrictions of drought permits / orders will cause adverse impacts that our mitigation does not address. However, we are open to discussions on this topic during or after a drought because every drought is different and we would want to account for the specific circumstances of each case.

The mitigation measures that we propose using are appropriate for the level of impact predicted and the importance of the receptor. We design our measures to minimise the impacts occurring as a result of maintained, or increased, abstraction during a drought. As a result we would expect the majority of them only to be in place for the duration of the drought permit/ order.

The mitigation measures we implement will mitigate the impacts of the drought permit or drought order and not the impacts of the drought itself.

We have also carried out more detailed site specific assessments of mitigation measures in each of the environmental assessment reports we described in section 3.3 and 6.1.

For example, section 5 of the environmental assessment report (EAR) for the Derwent describes mitigation. It illustrates how we plan to:

- Understand the baseline condition of the hydrology and ecology at the location
- Set appropriate monitoring and
- Mitigate against any adverse impacts if they occur.

In the Avon and Leam EAR we propose additional monitoring and mitigation measures to reduce all potential impacts to a minor negative level of significance, where possible. This EAR describes measures which include:

"A repeat habitat walkover survey and spot gauging will facilitate the identification of temporal minimum flow requirement thresholds for all species and life stages. This will facilitate assessment of the minimum flow required to protect fish populations during key periods of sensitivity, whilst still optimising the supply resource;

Temporary return to normal abstraction rates in the event of a pollution incident, evidence of ecological distress, or evidence of serious detrimental environmental consequences on downstream watercourses;

Funding of appropriate reasonable measures (e.g. habitat restoration) in the event of ecological damage occurring on watercourses affected by increased abstraction; and

Provision of appropriate assistance and / or funding of reasonable additional measures to protect habitats and sites or species of special ecological interest affected by the DP."

We also provide the detail of our mitigation measures in the other completed environmental assessment reports i.e. the River Severn and River Wye EARs.

In the unlikely event that we need to use any of the drought / emergency sources / extreme actions (apart from Norton) described in Table 10 and Table 20 the long lead in time will allow time to carry out a hydrological and environmental assessment. We will consider what, if any, mitigation is necessary as part of these environmental assessments in conjunction with the EA.

6.5 Consideration of Water Framework Directive (WFD) article 4.6

Article 4.6 of the WFD provides an exemption for temporary deterioration of water bodies caused by "exceptional" events with "natural causes". Extreme droughts could fall into these categories but as we cannot prevent droughts from occurring, this plan needs to consider whether any of the actions that we, Severn Trent Water, take could cause temporary deterioration. On this topic, the 2020 EA 'Environmental assessment for water company drought planning supplementary guidance', recommends that drought plans should:

- *"clearly identify all actions that could cause temporary deterioration using appropriate assessment methods*
- *clearly describe why the circumstances are exceptional using hydrological data and any other relevant indicators*
- *clearly justify why an action that causes temporary deterioration is preferable to the alternatives*
- *include details of planned mitigation to minimise the impacts of such actions before during and after*
- *set out what action you will take to restore the water body following the drought."*

We have addressed all of these points within:

- the relevant parts of section 3 of this drought plan
- the SEA, HRA and WFD assessments that accompany this plan (the SEA is published separately alongside this plan; the HRA and WFD assessments can be requested)
- the Environmental Assessment Reports (EARs) described in section 3.3 and 6.1

For ease of reference we have summarised how and where we have addressed these points in Table 26.

Table 26 How we have considered the actions in this plan against WFD deterioration

Action	Does this cause temporary WFD deterioration	Where do we provide more details?	Other comments
All actions from business as usual, standard demand management through TUBs and NEUBs, awareness raising and supply / transfer options covered in our Baseline DO modelling	No	The SEA / HRA discuss all of our drought options. There is also some information in section 3 and section 6 of this plan	These don't apply here because they are reasonably foreseeable
Drought permits (Dove, Avon & Leam and Derwent)	Unlikely	The primary source of information for these is the EAR reports (both the existing version and the ones we are currently preparing). The data sources above also apply. Mitigation is covered in section 6.4. of this plan	There is a low likelihood of needing these permits and we would not apply for them unless we had to
Supply-side drought orders (Site G, Wyelands and Churnet)	Potentially	The data sources above apply	There is an even lower likelihood that we would apply for these and they are very much last resort options. When we are in this territory we will have started or be about to consult our emergency plans
Drought / emergency sources, and other supply sources without an EAR	Potentially	Section 3.2.1 and 6.2	We have assessed the WFD impacts of a number of these following dialogue with the EA but as there is such a long lead in time before we may need to use them, we would have time to do undertake required environmental assessment/monitoring. If we need these options our emergency plans will be active

Section 7 End of Drought

We define the end of a drought as when our water resources availability has returned to 'normal'. Indicators of the end of a drought are that:

- There have been several months of average or above average rainfall (winter rainfall usually provides greater recharge).
- Reservoir storage has recovered, for example, storage in the majority of reservoirs is above the appropriate trigger curves (these curves are shown in sections 2 and Appendix B).
- River flows have returned to normal.
- Groundwater levels have returned to the normal range.

We will analyse these and other relevant indicators (such as those described in section 2) before we conclude that conditions have returned to 'normal'. Due to the long term impacts that droughts can have, for example on our groundwater sources, there may be a significant delay before we can say definitively that a drought is over. We will liaise with the EA, NRW and Water UK/other companies before we formally declare a return to 'normal' conditions. We will consult with other stakeholders if necessary before declaring a drought is over. This is part of the consistency in messaging that our communications plan discussed.

Once normal conditions have resumed and all restrictions lifted, our DAT will undertake a review of our drought management processes against those as outlined in this drought plan. There will be a post-drought review to learn lessons, review the ongoing effectiveness of our drought planning, communications, drought management and environmental management. If we have used customer restrictions, drought permits or drought orders we will review these in detail. The reviews will consider both operational performance as well as customer impact including implications for Priority Services Customers (see section 5.2.3). Should there be any information relevant to our WRMP work or to other areas of the company then we will pass this directly to those teams. Where necessary and requested to do so we will release results of any review as a 'lessons identified' report.

Following the drought that ended in 2012 we engaged with other companies and stakeholders. For example, we contributed to a Water UK drought resilience workshop on 23 July 2012 as well as the joint Water UK and EA workshop 'Drought resilience – Securing the future' on 16 August 2012. We have maintained links with the National Drought Group (NDG) ever since 2012. These links involve both drought communications as well as more technical hydrological and hydrogeological situation reports.

Within our customer communication section 5.1.2., we detail the end of drought communications messaging that we will undertake to ensure our customers are informed if, and when, restrictions that we have implemented are removed i.e. TUBs or NEUBs.

Section 8 Appendices

Appendix A Glossary

Acronym	Definition
AMP	Asset Management Period
AMP5	Asset Management Period 5 i.e. 2010 to 2015
AMP6	Asset Management Period 6 i.e. 2015 to 2020
AMP7	Asset Management Period 7 i.e. 2020 to 2025
AMP8	Asset Management Period 8 i.e. 2025 to 2030
AMP9	Asset Management Period 9 i.e. 2030 to 2035
AMP10	Asset Management Period 10 i.e. 2035 to 2040
AMP11	Asset Management Period 11 i.e. 2040 to 2045
BAU	Business as Usual
CCWater	Consumer Council for Water
CEH	Centre for Ecology and Hydrology
CoP	Code of Practice
CRT	Canal and River Trust
DAT	Drought Action Team
DCWW	Dŵr Cymru Welsh Water
Defra	Department for Environment, Food and Rural Affairs
DGD	Dee General Direction
DMA	District Metered Area
DO	Deployable Output
DP	Drought Permit
DWI	Drinking Water Inspectorate
dWRMP	draft Water Resource Management Plan
EA	Environment Agency
EAR	Environmental Assessment Report
fWRMP	final Water Resources Management Plan
GSS	Guaranteed Standards Scheme
H & S	Health and Safety
HD	Hafren Dyfrdwy
HRA	Habitats Regulation Assessment
INNS	Invasive non-native species
l/p/d	litres per person per day
LTA	Long term average
Ml	megalitre
Ml/d	mega litre per day
NDG	National Drought Group
NEUB	Non-essential use ban
NIC	National Infrastructure Commission
NRW	Natural Resources Wales
Ofwat	Water Services Regulation Authority
PCC	per capita consumption
PR19	price review 2019
R & D	Research and Development
RCG	Regional Coordination Group
RoC	Review of Consents
RSA	Restoring Sustainable Abstraction
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment

SIP	Site Investigation Plan
SMD	Soil moisture deficit
SoR	Statement of Response
SPA	Special Protection Area
SPD	Source Performance Diagram
SSSI	Site of Special Scientific Interest
SSW	South Staffordshire Water
TUB	Temporary Use Ban
UKWIR	United Kingdom Water Industry Research
UU	United Utilities
UWAG	Usk and Wye Abstraction Group
WAT	Water Availability Team
WFD	Water Framework Directive
WRA	Water Resources Act
WRE	Water Resources East
WRMP	Water resources management plan
WRMP14	Water resources management plan 2014
WRMP19	Water resources management plan 2019
WRMP24	Water resources management plan 2024
WRPG	Water resource planning guidelines
WRSE	Water Resources South East
WRW	Water Resources West
WRZ	Water resource zone
WTP	Willingness to Pay

Appendix B All drought triggers, associated drought actions and consideration of yield benefits

Section 2 of this plan shows the drought management actions and the triggers for North Staffordshire, Forest and Stroud, and for our groundwater only WRZs. For completeness we have listed these drought management actions again as well as providing the triggers and actions for all of the WRZs. Table 27 shows the companywide demand side actions that would be taken at different stages.

Table 27 Companywide – demand-side actions

Demand-side action to help maintain supply	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Brief description of action	'Normal' demand management activity	More focused/ targeted demand/ leakage management	1 or 2 weeks from restrictions on use	Restrictions imminent/ in place	Removal of restrictions
Trigger for this action (or the preceding action that leads to this action)	If moving towards trigger C	Indicators in zone C	Indicators in zone D or E	DAT decision/ Indicators in zone E or F	DAT decision/ Indicators returned to zone A/B
Yield/ DO of the action	None	Depends on extent and on customer behaviour. Estimated as between 0 and 2% demand reduction	The 0-2% range is our estimate for the impact of this activity in both stage 2 and stage 3.	Up to 5% demand reduction for a TUB and a further 5% reduction for NEUB	None
Location	Companywide or area/ zone affected by drought	Same as for stage 1	Same as for stage 1	Same as for stage 1	Same as for stage 1
Implementation timetable (time from trigger to implementation, time of year and duration)	None – this is BAU	<1 week	Indicators must be in zone E for > 1 week between April and mid-October before we consider imposing restrictions	Approximately 1 -2 weeks	<1 week
Any permissions we need or constraints that apply	None	None	None	None – internal DAT decision	None – internal DAT decision
Risks associated with this action eg effects on the environment, social and economic factors and	None	None	None	Refer to earlier sections describing TUBs and NEUBs and associated	None

uncertainties associated with timing, quantity, quality or cost	exemptions/ vulnerable customers

North Staffordshire

Our drought management actions and the triggers for North Staffordshire are shown in Figure 28, Figure 29 and Table 28.

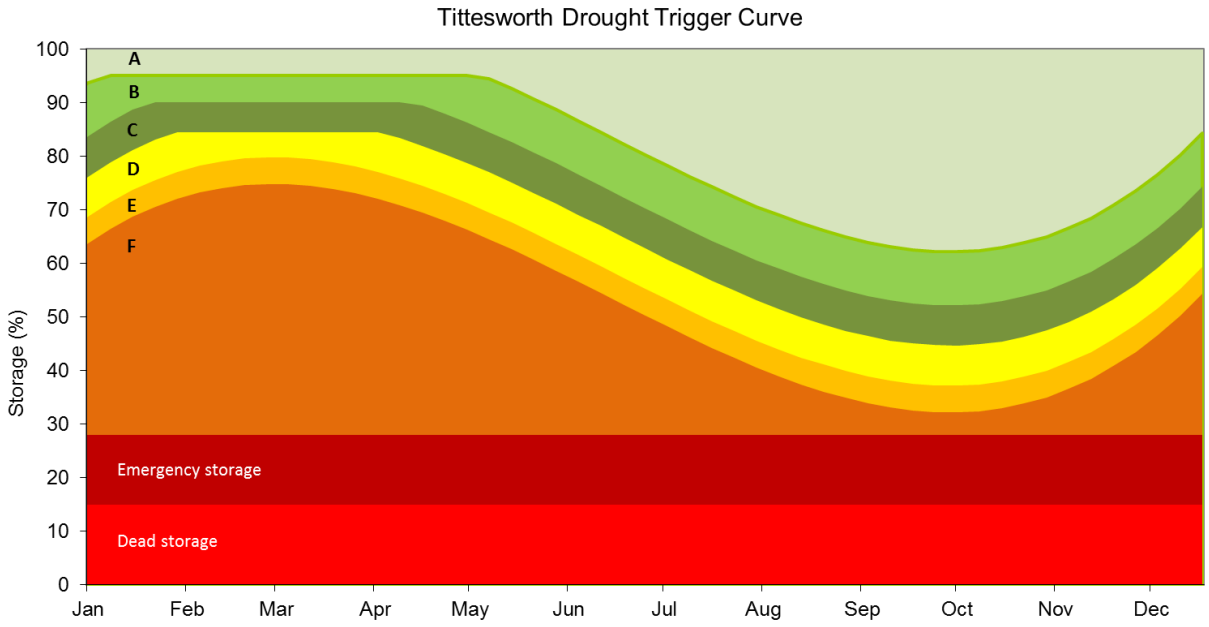


Figure 28 Tittesworth drought trigger curves

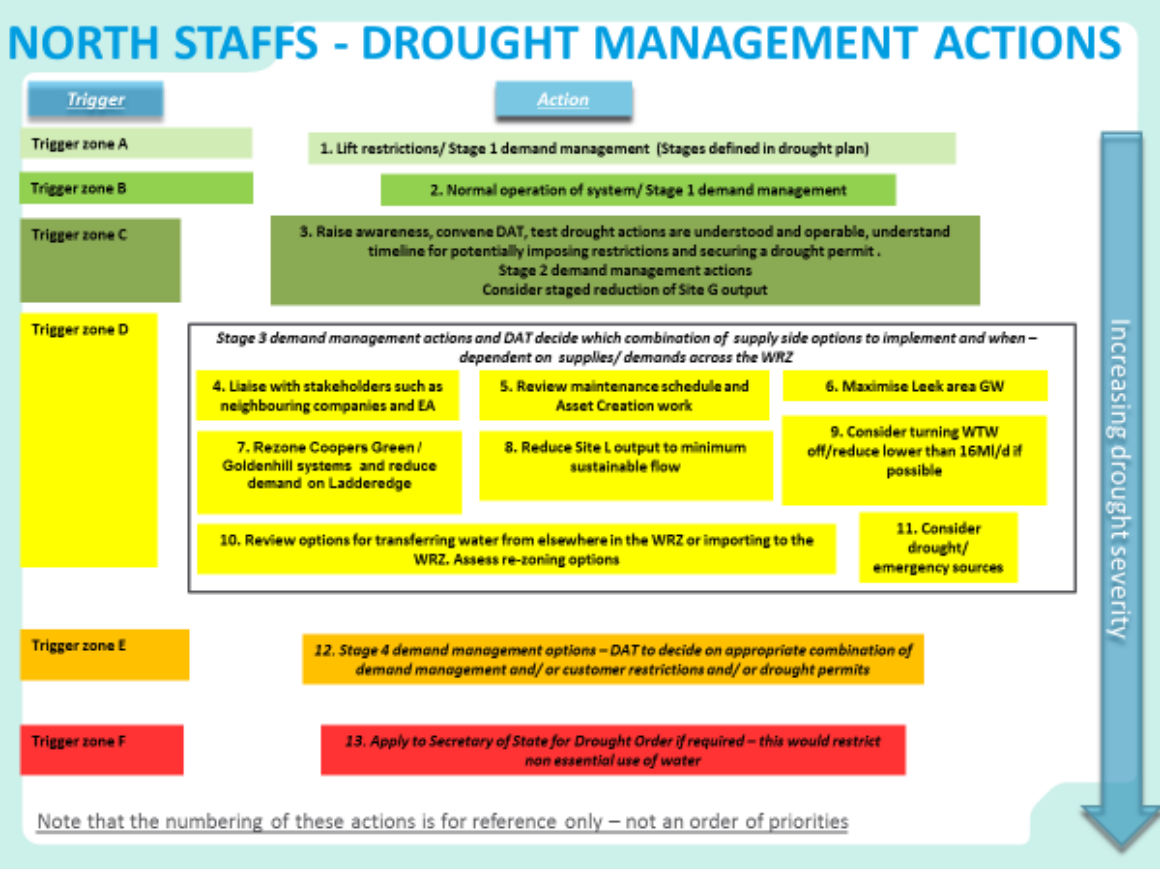


Figure 29 North Staffs drought management actions

Table 28 North Staffs drought management action impacts

Supply-side action to help maintain supply	Actions 1-5	Actions 6-9	Action 10	Action 11	Action 12	Action 13
Description of action	Essentially these are increasing our readiness	These are essentially maximising/ balancing existing sources	Transfers/ re zoning options	Drought/ emergency sources	Churnet drought permit	Churnet drought order – see section 3.3.4.5 for details
Trigger for this action (or the preceding action that leads to this action)	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram
Yield/ DO of the action	None	No extra DO because included in base modelling	No extra DO because included in base modelling	We have not identified any of these in this WRZ so n/a	No DO increase	DO increase 4 Ml/d (based on modelling carried out for WRMP19)
Location	N. Staffs WRZ	N. Staffs WRZ	N. Staffs WRZ and	As above	See Figure 23	See Figure 23

			nearby WRZs			
Implementation timetable (time from trigger to implementation, time of year and duration)	<1 week	<1 week	Depends on option chosen and if new infrastructure is needed	As above	One week to finalise application. EA decision expected within 12 days.	We assume 28 days required for Defra to decide on a drought order application
Any permissions we need or constraints that apply	None	Internal DAT decision	As above	As above	Internal DAT decision & EA permission	Internal DAT decision & Defra permission
Risks associated with this action e.g. effects on the environment, social and economic factors and uncertainties associated with timing, quantity, quality or cost	None	None	As above	As above	Refer to earlier sections describing effects of this drought permit.	Refer to earlier sections describing effects of this drought permit/ order.

In section in 3.4.2 we have annotated our Derwent Valley reservoir drought curve from 1995 - 1996 with our drought actions. For additional information we include the Tittesworth annotated drought trigger curve using the 2010 drawdown in Figure 30.

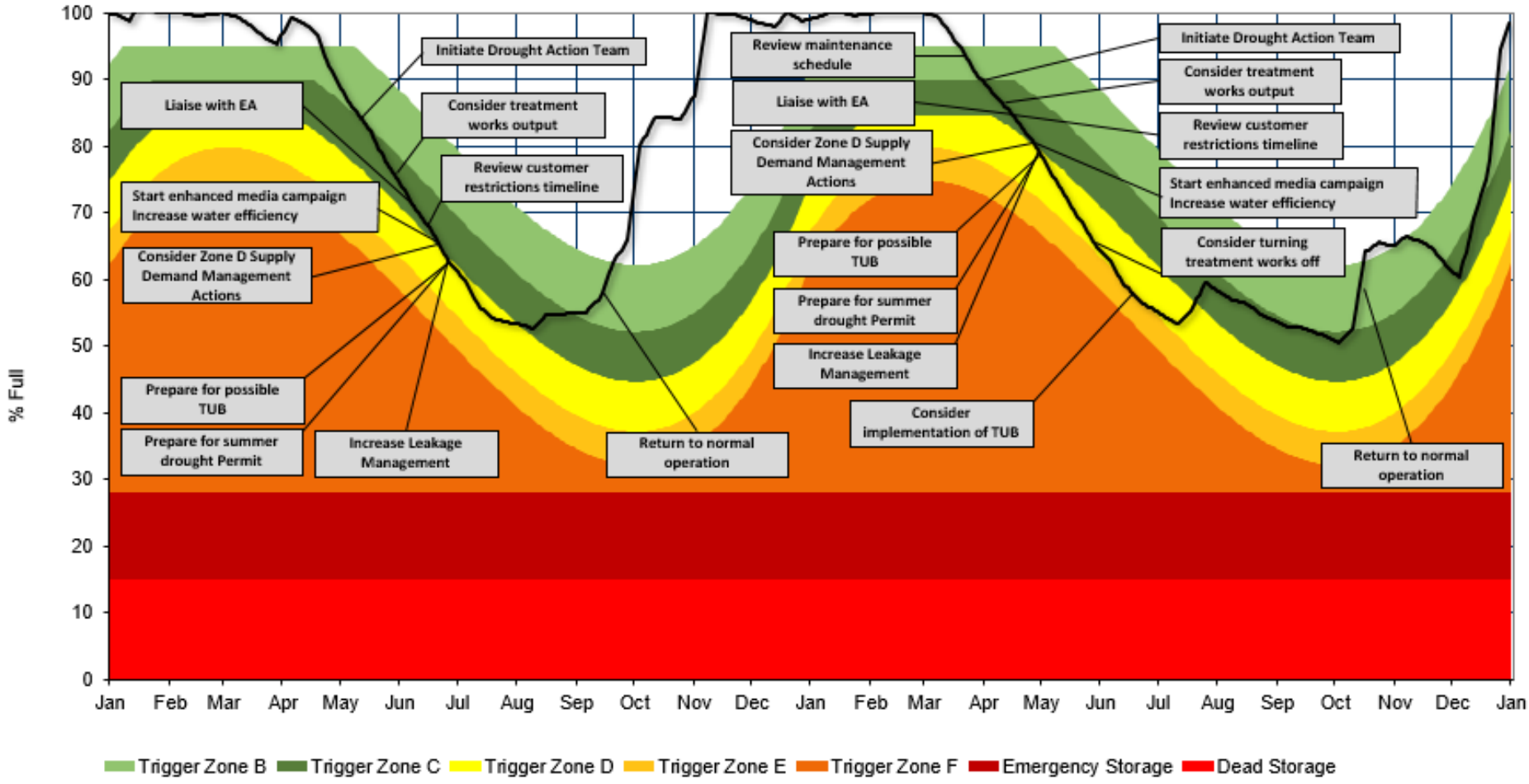


Figure 30 Tittesworth with the observed 2010 drawdown and the annotated demand-side and supply-side actions

Forest and Stroud

Our drought management actions and the triggers for Forest and Stroud are shown in Figure 31, Figure 32 and Table 29.

Figure 31 Triggers for zones without reservoir triggers

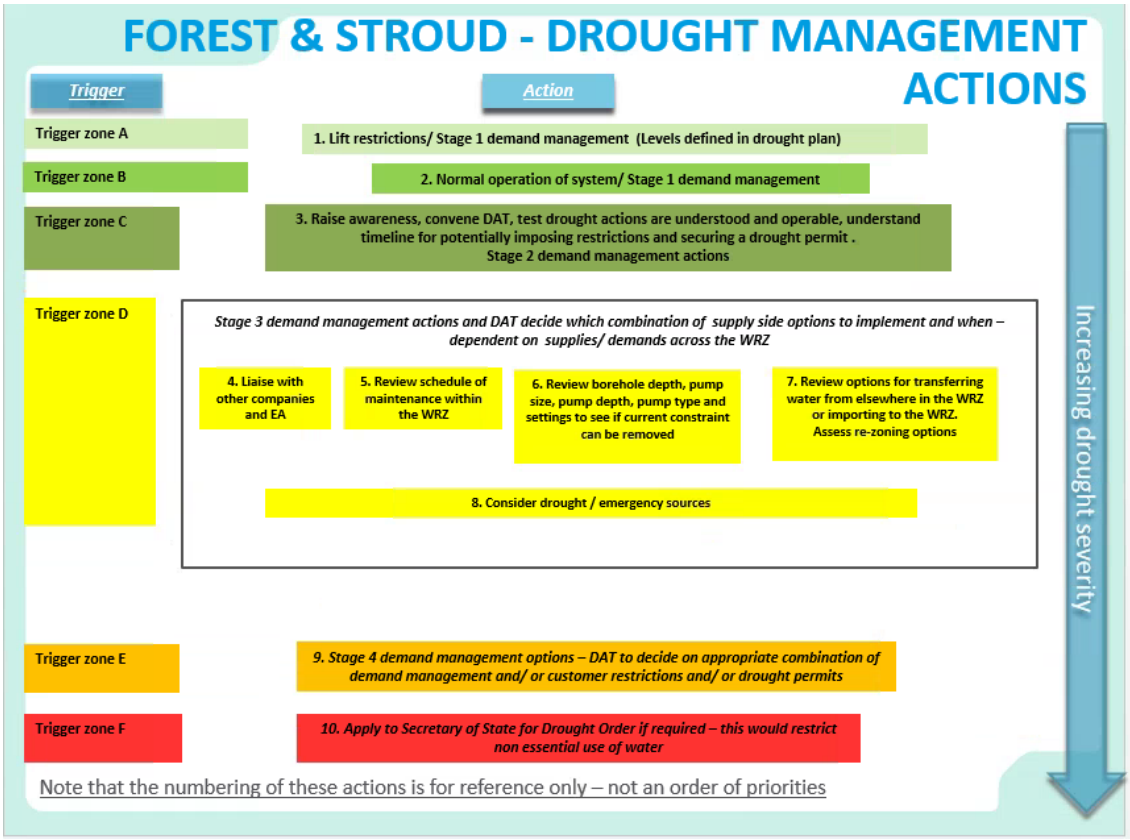


Figure 32 Forest and Stroud drought management actions

Table 29 Forest and Stroud drought management action impacts

Supply-side action to help maintain supply	Actions 1-6	Action 7	Action 8	Action 9	Action 10
Description of action	Essentially these are increasing our readiness	Transfers/ re zoning options	Drought/ emergency sources	We have not identified any of these in this WRZ so n/a	Wyelands drought order
Trigger for this action (or the preceding action that leads to this action)	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As above	As shown in flow diagram
Yield/ DO of the action	None	No DO increase because included in base DO	We have not identified any of these in this WRZ but refer to comment about Witcombe in Grid table	As above	No DO increase – as shown in table 10 of WRMP tables
Location	F&S WRZ	F&S WRZ and nearby WRZs	As above	As above	Wyelands/Site K – see Figure 23
Implementation timetable (time from trigger to	<1 week	<1 week	As above	As above	We assume 28 days required for Defra to decide

implementation, time of year and duration)					on a drought order application
Any permissions we need or constraints that apply	None	Internal DAT decision	As above	As above	Internal DAT decision & Defra permission
Risks associated with this action e.g. effects on the environment, social and economic factors and uncertainties associated with timing, quantity, quality or cost	None	None	As above	As above	Refer to earlier sections describing effects of this drought order.

WRZs (excluding Forest and Stroud) that do not have reservoir triggers

Our drought management actions and the triggers for all of WRZs (excluding Forest and Stroud) that do not have reservoir triggers are shown in Figure 33, Figure 34 and Table 30.

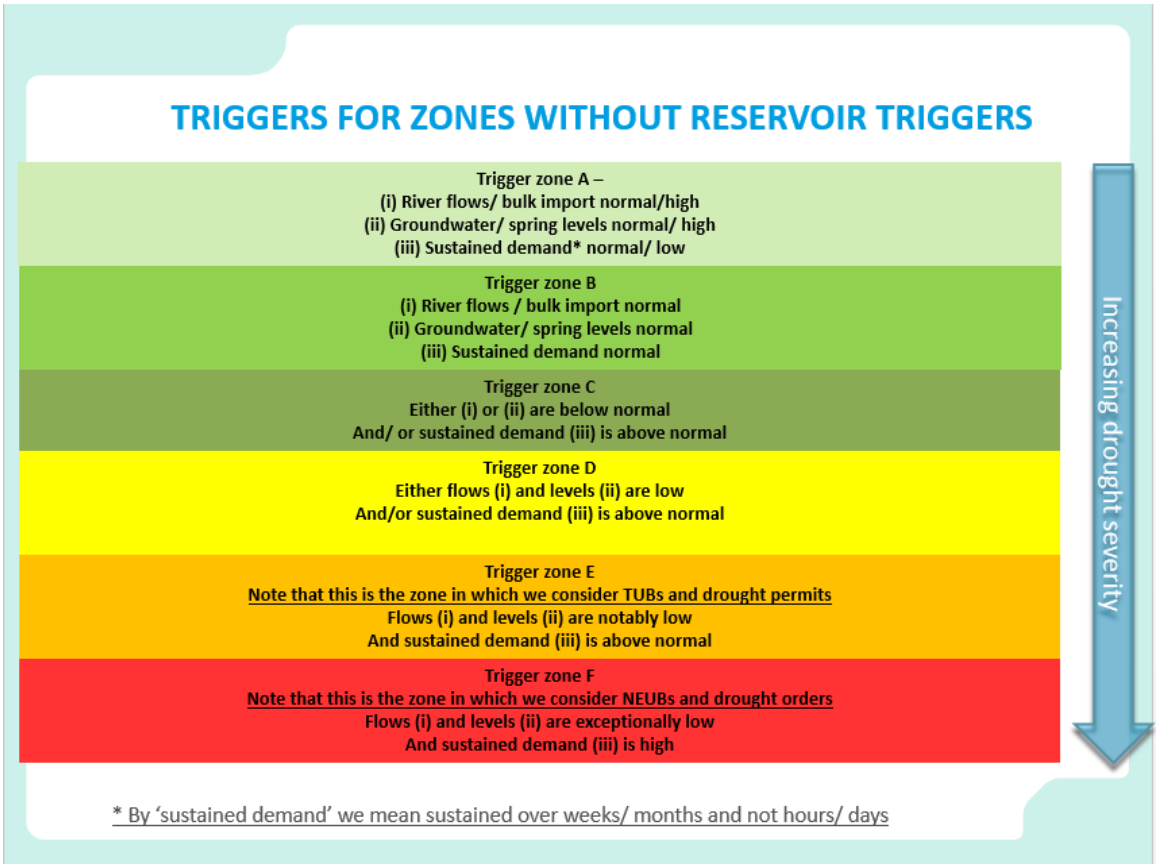


Figure 33 Triggers for zones without reservoir triggers

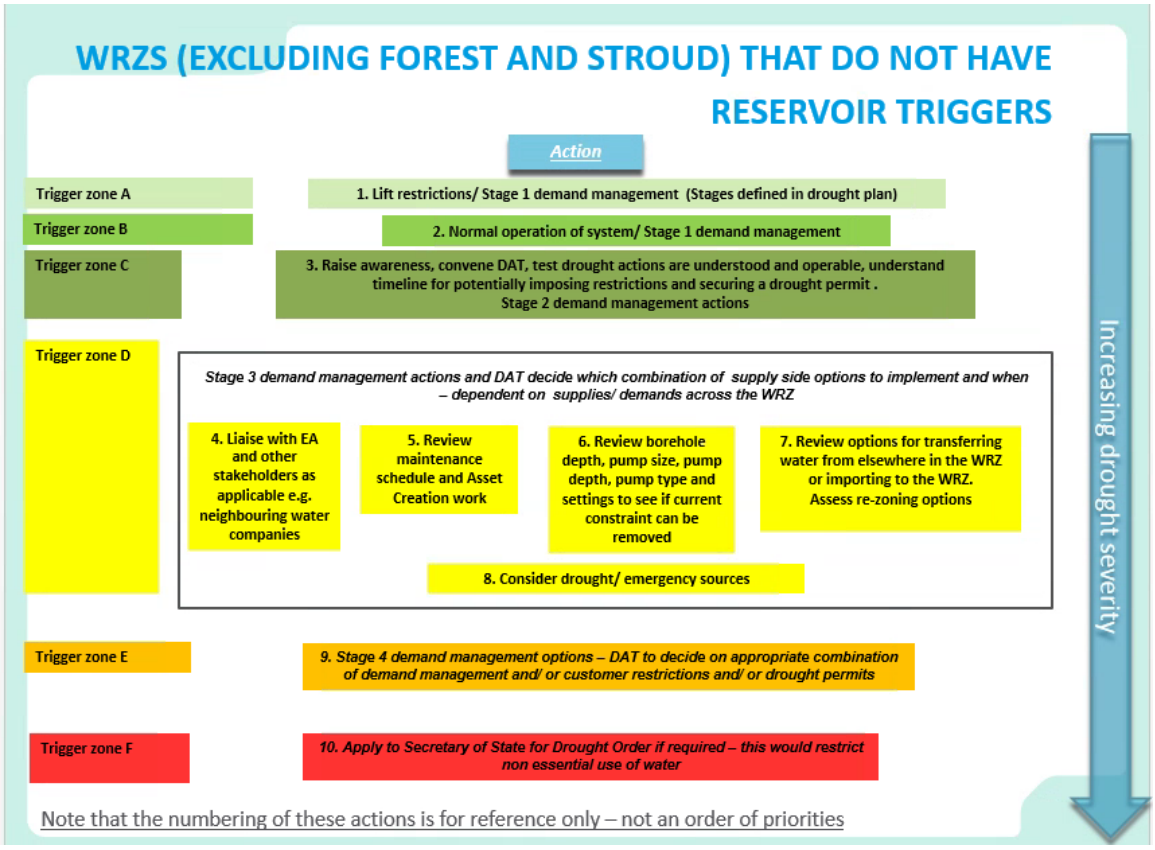


Figure 34 WRZs (excluding Forest and Stroud) that do not have reservoir triggers drought management actions

Table 30 Drought management action impacts for WRZs without reservoir triggers (excluding Forest & Stroud

Supply-side action to help maintain supply	Actions 1-5	Action 6	Action 7	Action 8	Action 9 & 10
Description of action	Essentially these are increasing our readiness	Review borehole constraints/ re zoning options	Transfers/ re zoning options	Drought/ emergency sources	We have not identified any drought orders/ permits in these WRZs so n/a
Trigger for this action (or the preceding action that leads to this action)	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As above
Yield/ DO of the action	None	Depends on option chosen	No extra DO because included in base modelling	None	As above
Location	WRZ in question	WRZ in question	WRZ in question	N/A	As above
Implementation timetable (time from trigger to implementation, time of year and duration)	<1 week	<1 week	<1 week	In excess of 12 months	As above

Any permissions we need or constraints that apply	None	Internal DAT decision	None	N/A	As above

Strategic Grid East

Our drought management actions and the triggers for the Strategic Grid East are shown in Figure 35, Figure 36, Figure 37 and Table 31.

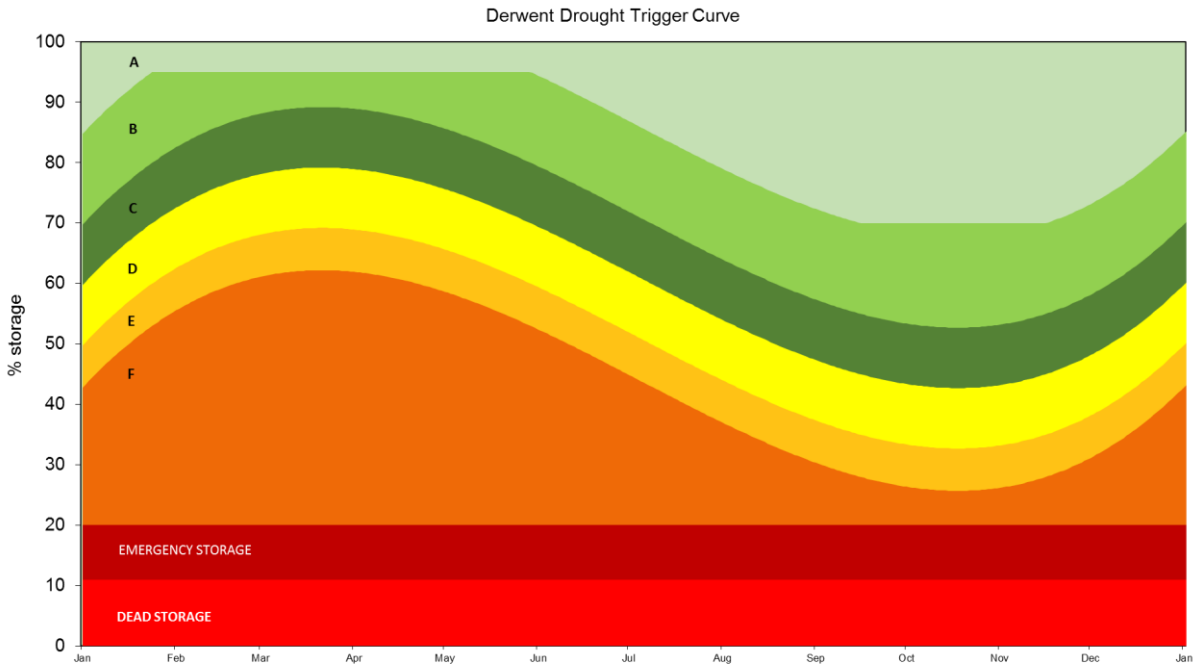


Figure 35 Derwent drought trigger curves

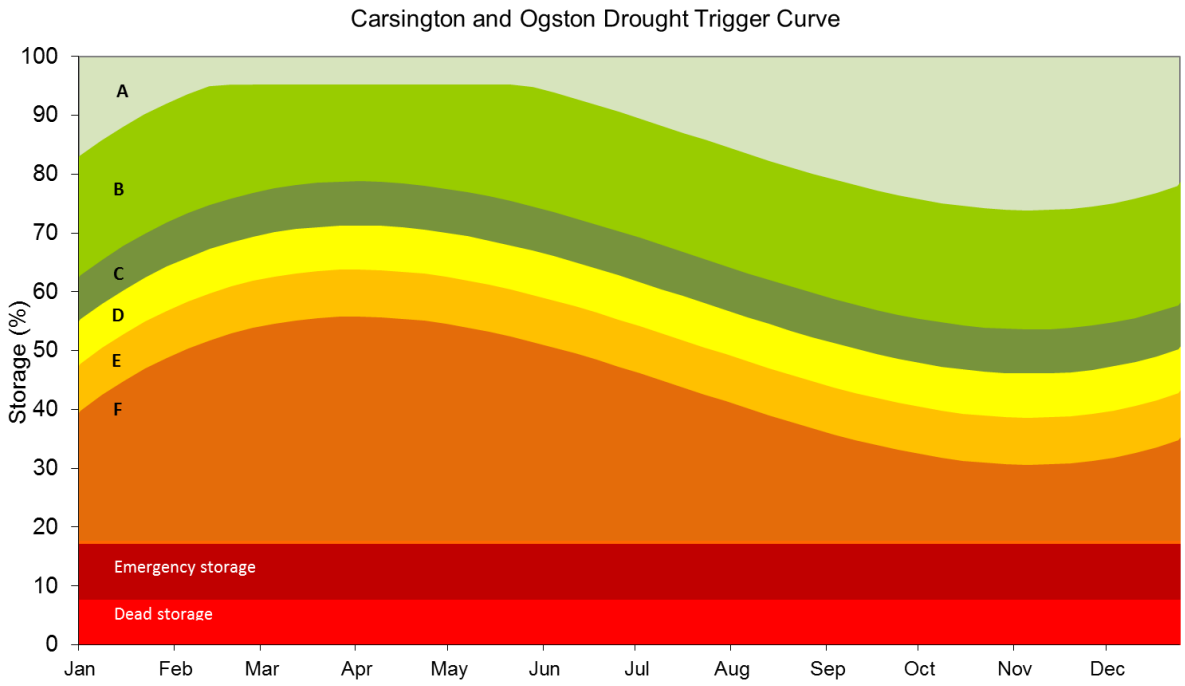


Figure 36 Carsington & Ogston drought trigger curves

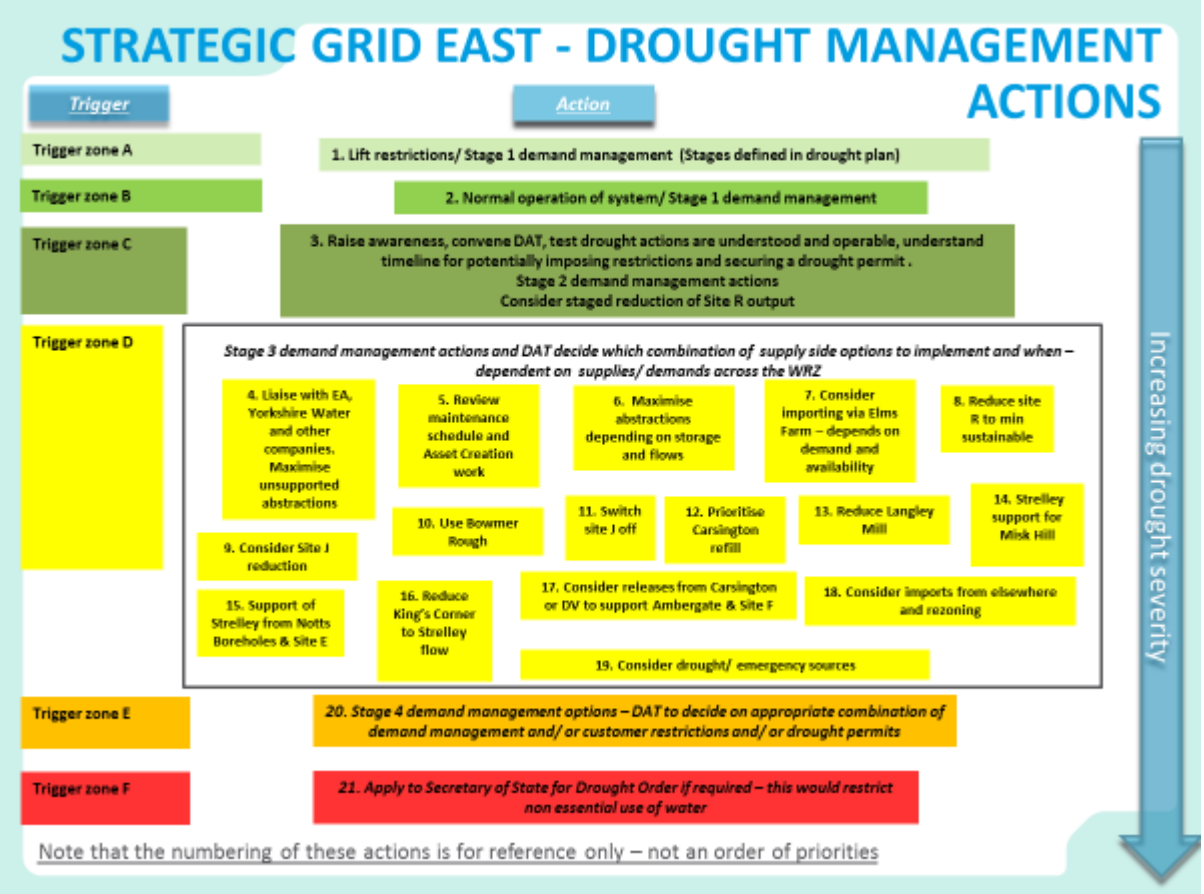


Figure 37 Strategic Grid East drought

Table 31 Strategic Grid East Drought management action impacts

Supply-side action to help maintain supply	Actions 1-5	Action 6-17	Action 18	Action 19	Action 20 & 21
Description of action	Essentially these are increasing our readiness	These are essentially maximising/ balancing existing sources	Transfers/ re zoning options	Drought/ emergency sources	Action 20 could involve the Derwent Valley and R. Derwent drought permits. There are no drought orders identified so action 21 is n/a
Trigger for this action (or the preceding action that leads to this action)	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram
Yield/ DO of the action	None	No extra DO because included in base modelling	No extra DO because included in base modelling	As shown in Table 10	No DO increase – as shown in table 10 of dWRMP tables
Location	Grid WRZ (East)	Grid WRZ (East)	WRZ(s) in question	As shown in Table 10Table 10	See Figure 23
Implementation timetable (time from trigger to implementation, time of year and duration)	<1 week	<1 week	<1 week	In excess of 12 months	One week to finalise drought permit application. EA decision expected within 12 days.
Any permissions we need or constraints that apply	None	Internal DAT decision	None	Refer to Table 10	Internal DAT decision & EA permission
Risks associated with this action e.g. effects on the environment, social and economic factors and uncertainties associated with timing, quantity, quality or cost	None	None	None	As above	Refer to earlier sections describing effects of this drought permit.

In section in 3.4.2 we have annotated our Derwent Valley reservoir drought curve from 1995 - 1996 with our drought actions. For additional information we include the Derwent Valley (2018) annotated drought curves Figure 38.

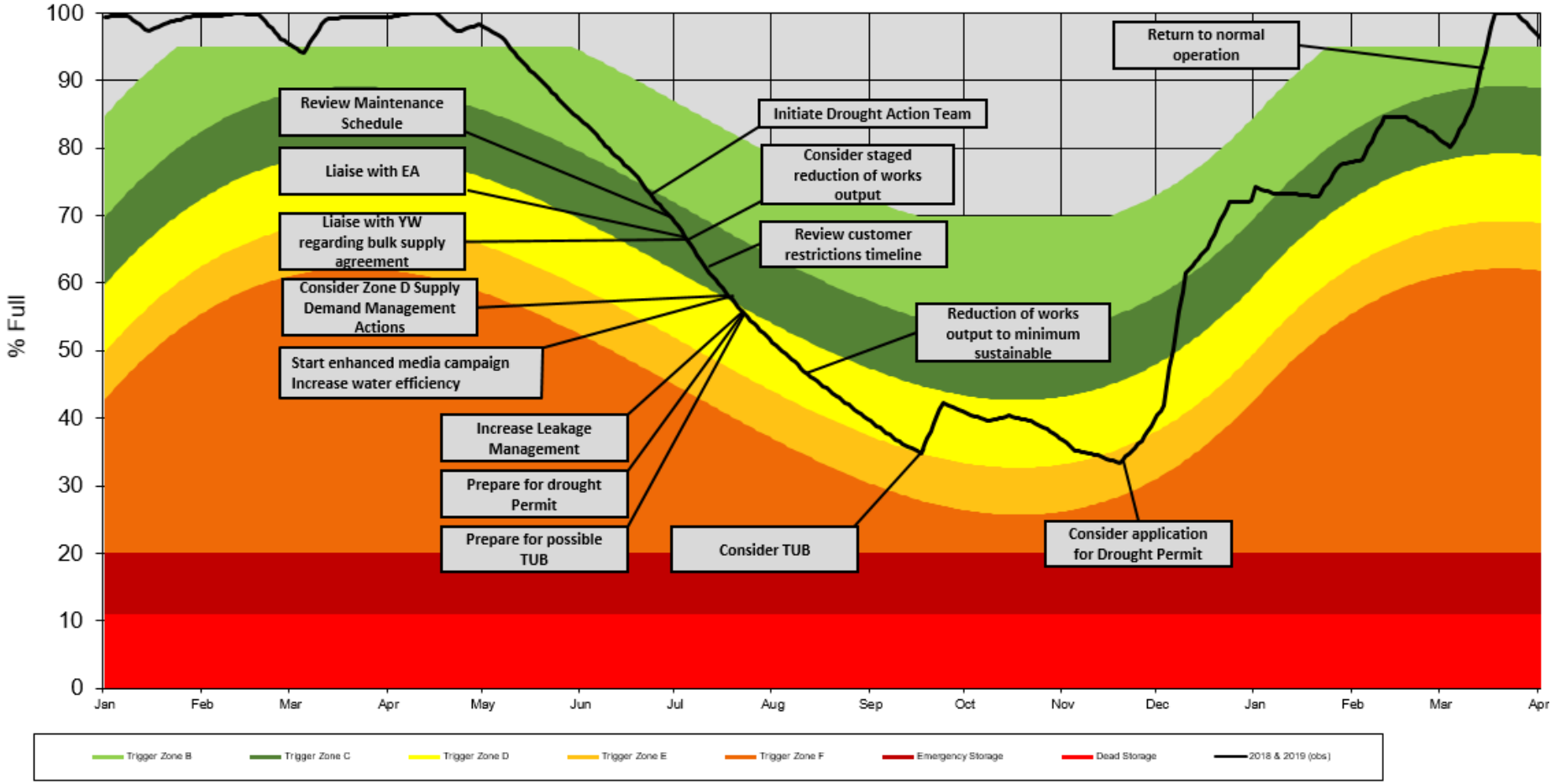


Figure 38 Derwent Valley example dry year 2018 drawdown and the annotated demand-side and supply-side actions

Strategic Grid South

Our drought management actions and the triggers for the Strategic Grid South are shown in Figure 39, Figure 40 and Table 32.

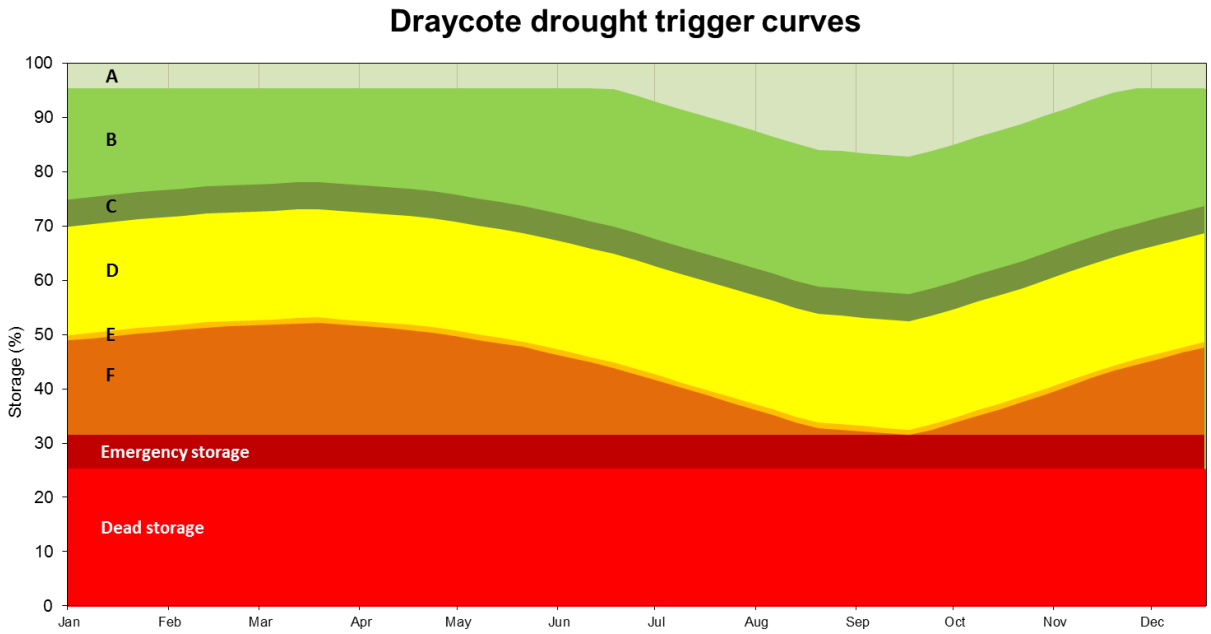


Figure 39 Draycote drought trigger curves

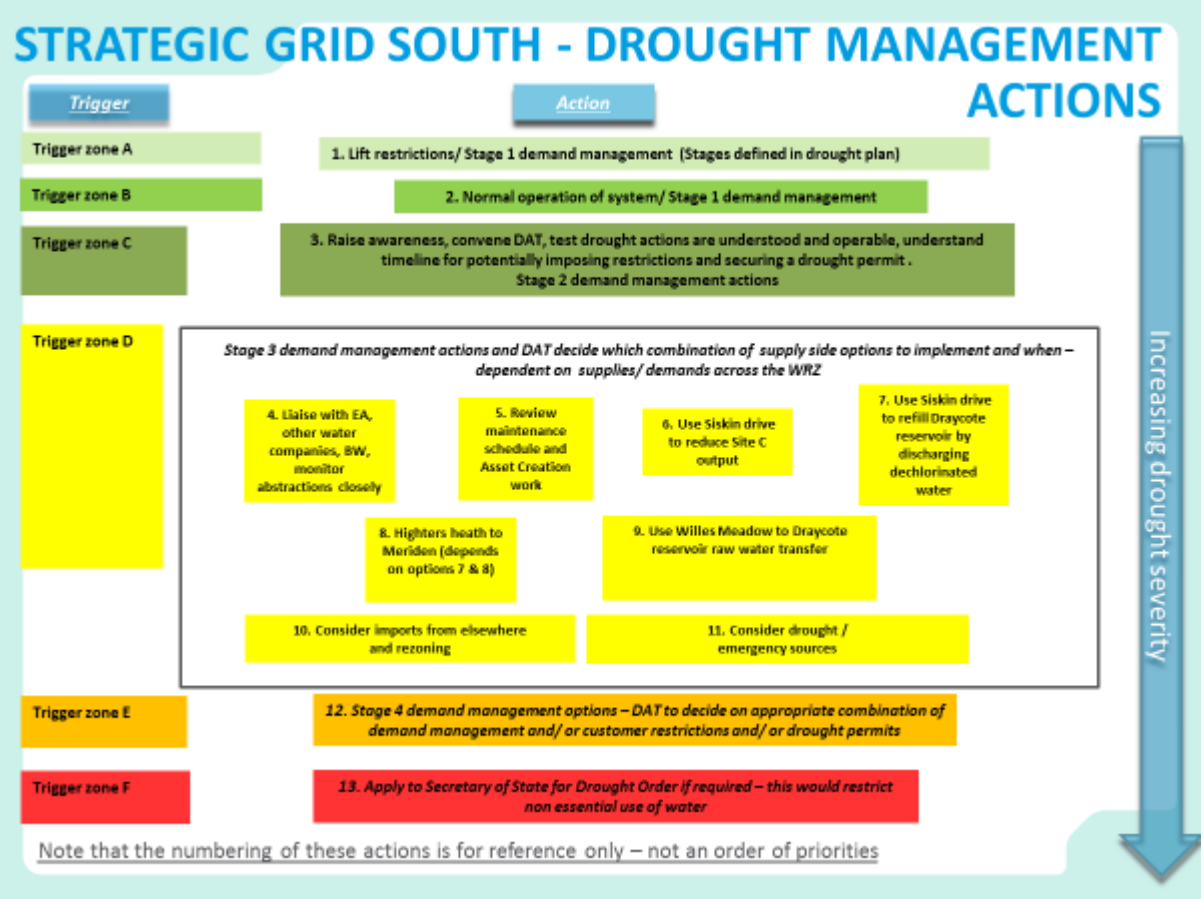


Figure 40 Strategic Grid South drought management actions

Table 32 Strategic Grid South drought management action impacts

Supply-side action to help maintain supply	Actions 1-5	Action 6, 8 and 9	Action 7	Action 10	Action 11	Action 12 & 13
Description of action	Essentially these are increasing our readiness	These are essentially maximising / balancing existing sources	Use Siskin and discharge dechlorinated water to Draycote reservoir	Transfers/ re zoning options	Drought/ emergency sources - Witcombe	Action 12 could involve the Avon and R. Leam drought permit. There are no drought orders identified so action 13 is n/a
Trigger for this action (or the preceding action that leads to this action)	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram
Yield/ DO of the action	None	No extra DO because included in base modelling	Depends on availability of treated water in the rest of the Grid WRZ	No extra DO because included in base modelling	As shown in Table 10Table 10	No DO increase – as shown in table 10 of WRMP tables
Location	Grid WRZ (South)	Grid WRZ (South)	Draycote reservoir	WRZ(s) in question	As shown in Table 10	See Figure 23

Implementation timetable (time from trigger to implementation, time of year and duration)	<1 week	<1 week	Approx. 2-3 weeks	<1 week	In excess of 12 months	One week to finalise drought permit application. EA decision expected within 12 days.
Any permissions we need or constraints that apply	None	Internal DAT decision	EA consent re. discharge and internal DAT decision	None	Refer to Table 10	Internal DAT decision & EA permission
Risks associated with this action e.g. effects on the environment, social and economic factors and uncertainties associated with timing, quantity, quality or cost	None	None	As occurred during the 2010-12 drought we would agree an appropriate sampling programme and seek EA approval before we commenced this action	None	As above	Refer to earlier sections describing effects of this drought permit.

Strategic Grid West

Our drought management actions and the triggers for the Strategic Grid West are shown in Figure 41, Figure 42 and Table 33.

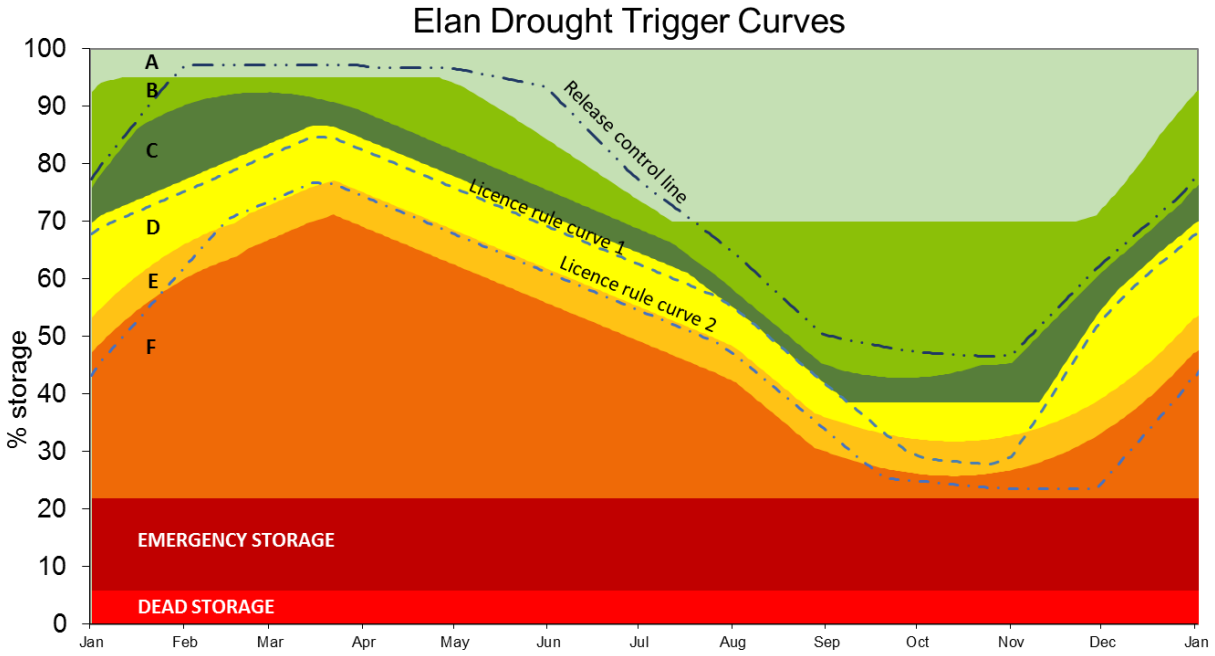


Figure 41 Elan drought trigger curves

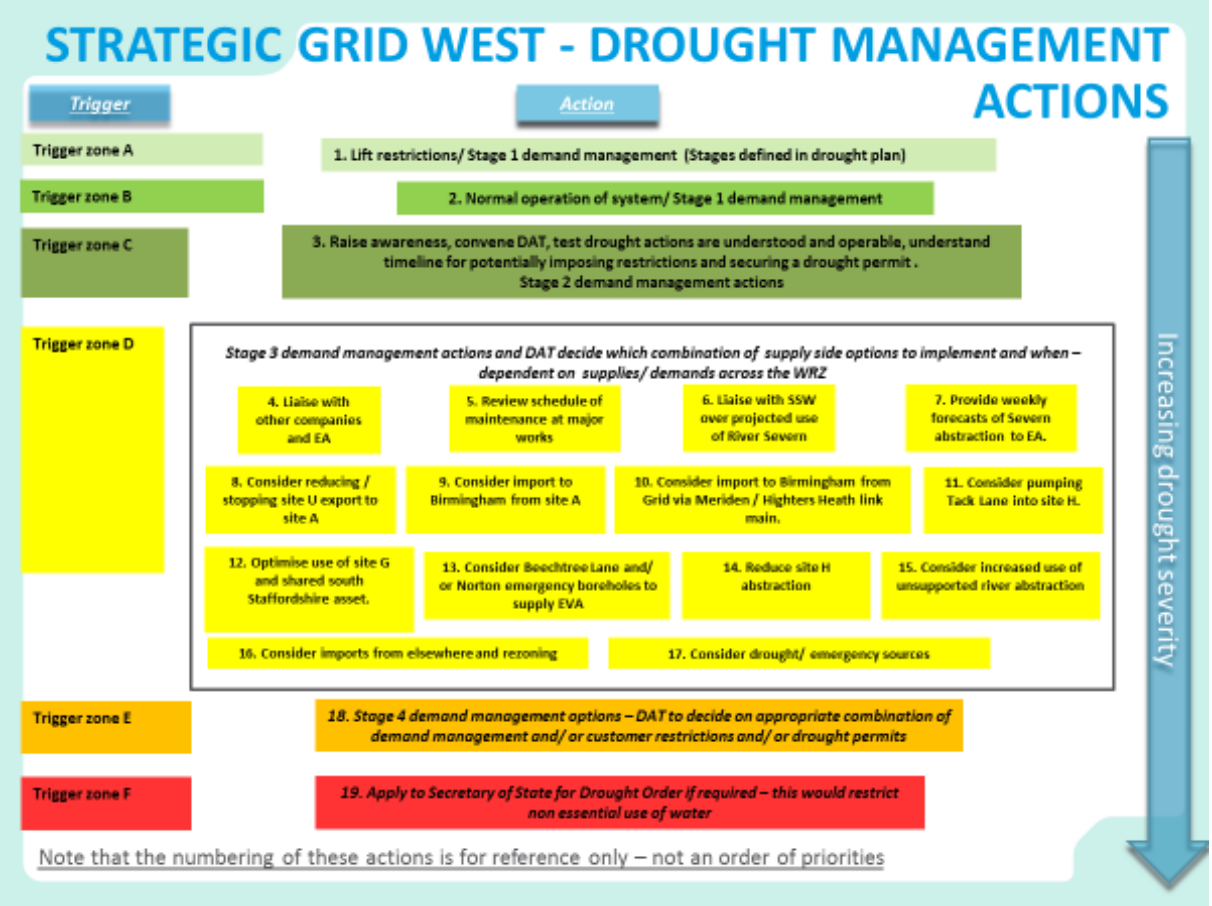


Figure 42 Strategic Grid West drought management actions

Table 33 Strategic Grid West drought management action impacts

Supply-side action to help maintain supply	Actions 1-5	Action 6-15 excluding 13	Action 16	Action 13 & 17	Action 18 & 19
Description of action	Essentially these are increasing our readiness	These are essentially maximising/ balancing existing sources	Transfers / re zoning options	Drought/ emergency sources	Action 18 & 19 could involve the site G drought permit/ orders.
Trigger for this action (or the preceding action that leads to this action)	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram	As shown in flow diagram
Yield/ DO of the action	None	No extra DO because included in base modelling	No extra DO because included in base modelling	As shown in Table 10	DO increase of 8 Ml/d – as shown in table 10 of WRMP tables
Location	Grid WRZ (West)	Grid WRZ (West)	WRZ(s) in question	As shown in Table 10	See Figure 23
Implementation timetable (time from	<1 week	<1 week	<1 week	In excess of 12 months	One week to finalise drought permit

trigger to implementation, time of year and duration)					application. EA decision expected within 12 days. 28 days required for Defra to decision
Any permissions we need or constraints that apply	None	Internal DAT decision	None	Refer to Table 10	Internal DAT decision and/ or EA permission and/or Defra permission
Risks associated with this action e.g. effects on the environment, social and economic factors and uncertainties associated with timing, quantity, quality or cost	None	None	None	As above	Refer to earlier sections describing effects of this drought permit/ order.

In section in 3.4.2 we have annotated our Derwent Valley reservoir drought curve from 1995 – 1996 with our drought actions. For additional information we include the Elan Valley (1975-76) annotated drought curves in Figure 43.

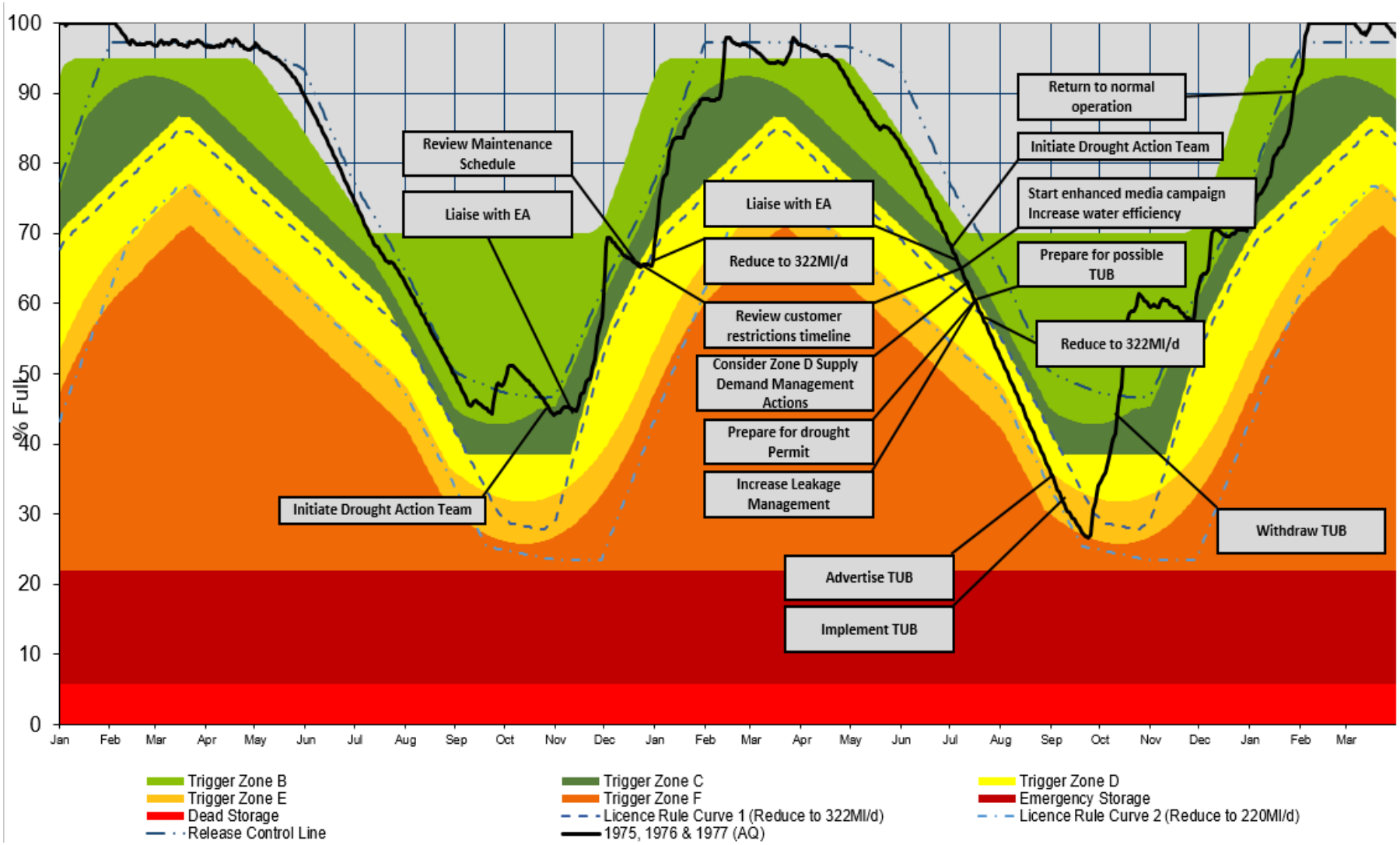


Figure 43 Elan Valley example dry year 1975-1976 drawdown and the annotated demand-side and supply-side actions

Chester

The drought triggers for the Chester WRZ are dictated by the Dee General Directions which govern the Dee Storage System.

The River Dee is regulated by Natural Resources Wales (NRW) using reservoirs in the Welsh hills, according to the Dee General Directions. For severe droughts, the General Directions define the drought triggers and the actions that we are required to take in response to these triggers. The triggers are associated with the amount of water available in the Dee Storage System. As stocks decrease, trigger points are crossed which prompt drought management actions to be taken.

The Dee Drought General Directions specify the principles and detail under which the prescribed flows and abstractions must be reduced in a drought. During Normal General Direction the target is to achieve a minimum residual daily mean flow over Chester Weir of 4.2m3/s (362.88 Ml/d). Chester Weir residual flow is calculated using flows measured at Chester Suspension Bridge by an ultrasonic flow gauge less abstraction taken by United Utilities from the Chester Weir intake.

From historic data, a system conservation curve and a series of drought management curves (see Figure 44) have been developed which indicate the level of storage within the Dee Storage System and thus how much can be safely abstracted. Figure 45 summarises the triggers and actions of the River Dee Drought General Directions.

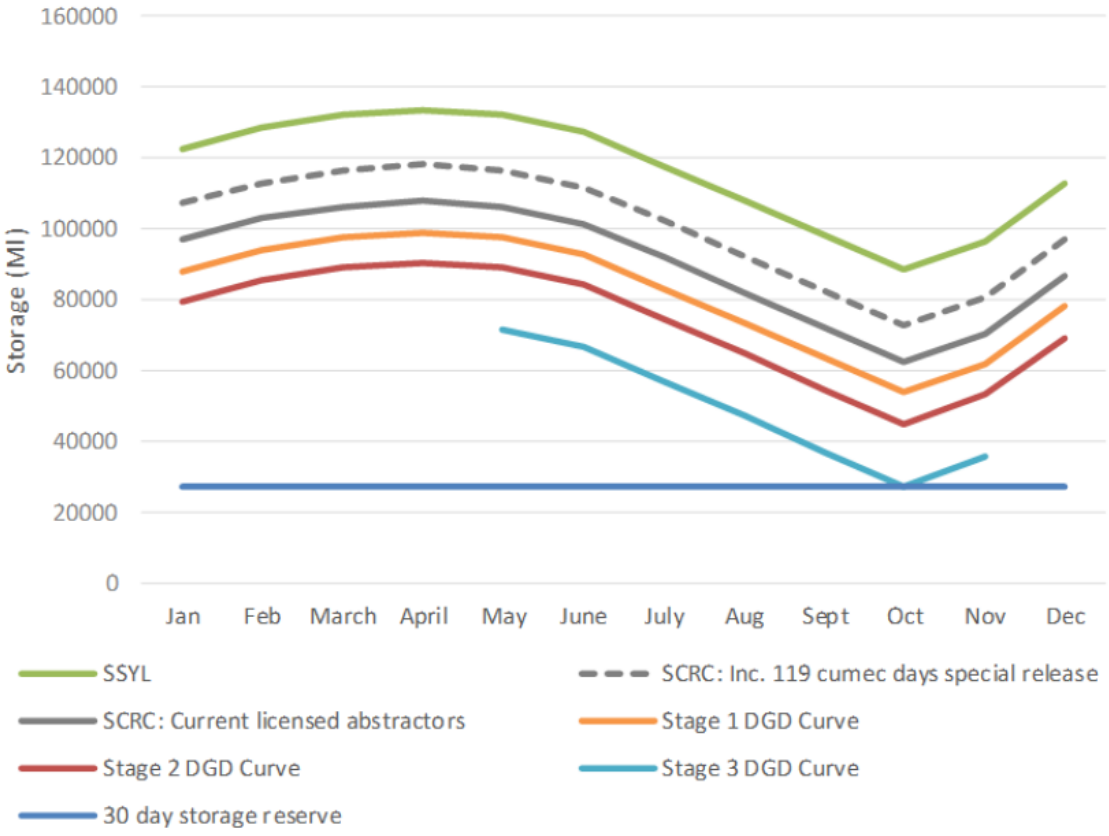


Figure 44 - Dee Storage System conservation rule curve and drought management curves

Figure 45 - Trigger and action diagram for the Dee Drought General Directions

The Dee General Directions (as published in June 2016) sets out the volumes that we can abstract under different conditions. NRW authorises four levels of abstraction from the Dee at each of our abstraction points as shown in Table 34; the abstraction volumes authorised under Stage 1 and Stage 2 cutbacks in drought conditions are reliant upon augmentation of the River Dee from Hafren Dyfrdwy's Pen Y Cae Lower reservoir for which a transfer agreement has been put in place between the companies.

Table 34 River Dee abstractions as set out in the Dee General Directions

Abstraction Regime	Barrelwell Hill / Dee Chester Abstraction Limit (Ml/d)
Above system safe yield line	32.5
Safe yield allocation	28.8

Stage 1 cutbacks	28.8 Note 1
Stage 2 cutbacks	28.8 Note 2

Note 1: Based on augmentation of 0.4Ml/d from Pen Y Cae
Note 2: Based on augmentation of 0.8Ml/d from Pen Y Cae

Appendix C Environmental assessment information for non-EAR sites

We detail in section 6.2 that we must assess our supply actions in terms of environmental assessment. For each of our supply actions (where agreed with the EA) we provide a high-level summary of the environmental assessment utilising the template from the EA's 2020 Environmental assessment for water company drought planning supplementary guidance. We have also included our emergency sources. The tables below provide this information for each action/source.

Supply side action information	Supply side action	Priortise Carsington refill
	Trigger/previous action	When in trigger zone D at Carsington Reservoir this option will be considered
	Deployable output of action	There will not be a DO benefit to this option but by having Carsington full, this will enable the existing output to be maintained.
	Implementation timetable	Ready to implement
	Permissions required and constraints	No specific permissions required. The surface water abstraction would still be within abstraction licence limits
	Risks associated with the option	No supply side risks
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Minor
	Level of confidence (H, M, L)	Moderate
	Summary of likely environmental impacts	The operation of the drought action could have minor adverse effects as a result of the potentially slower and/or later refill to Ogston Reservoir.
	Summary of baseline information used	Waterbodies which lie within the study area and their current WFD status. Used the Source-Pathway-Receptor approach to identifying potential impacts
	Summary of additional monitoring required	See section 6.3
	Summary of mitigation measures	See Section 6.4
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

Supply side action information	Supply side action	Use of raw water transfer from Willes Meadow to Draycote
	Trigger/previous action	When in trigger zone D/E at Draycote Reservoir this option will be considered
	Deployable output of action	Up to 10 Ml/d, but more likely circa 5 Ml/d
	Implementation timetable	Ready to implement
	Permissions required and constraints	No specific permissions required
	Risks associated with the option	No supply side risks
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Minor
	Level of confidence (H, M, L)	High
	Summary of likely environmental impacts	Limited as abstraction on the Leam would still be within recent actual rates and subject to the Prescribed Flow conditions

	Summary of baseline information used	Waterbodies which lie within the study area and their current WFD status. Used the Source-Pathway-Receptor approach to identifying potential impacts
	Summary of additional monitoring required	See section 6.3
	Summary of mitigation measures	See Section 6.4
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

Supply side action information	Supply side action	Consider pumping Tack Lane into EVA
	Trigger/previous action	When in trigger zone D at Elan Valley this option will be considered
	Deployable output of action	12.2 Ml/d
	Implementation timetable	Ready to implement
	Permissions required and constraints	No environmental permissions/constraints
	Risks associated with the option	DWI water quality
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Minor
	Level of confidence (H, M, L)	Moderate
	Summary of likely environmental impacts	Minor adverse effects on the groundwater flow regime, material assets and resource use (short term increase in energy use) and air and climate (short term increase in emissions to air and GHG emissions).
	Summary of baseline information used	Impact from current operations
	Summary of additional monitoring required	See section 6.3
	Summary of mitigation measures	See Section 6.4
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

Supply side action information	Supply side action	Beechtree Lane emergency borehole supply to Aqueduct
	Trigger/previous action	Once Level 3 drought restrictions have been implemented and before imposing Level 4 restrictions - this is included in the plan as an 'extreme supply action'
	Deployable output of action	Variable - potentially up to 12 Ml/d
	Implementation timetable	Ready to implement
	Permissions required and constraints	Will need permission from the EA to use as licence will not permit this use once the licence has been re-issued following the application Severn Trent currently has in with the EA
	Risks associated with the option	DWI water quality is a consideration/risk

Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Minor
	Level of confidence (H, M, L)	Moderate
	Summary of likely environmental impacts	The operation of this 'extreme drought action' would have minor adverse effects on material assets and resource use (short term increase in energy use) and towards the groundwater flow regime and air and climate (short term increase in emissions to air and GHG emissions)
	Summary of baseline information used	Impact from current operations
	Summary of additional monitoring required	See section 6.3
	Summary of mitigation measures	See Section 6.4
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

Supply side action information	Supply side action	Blackbrook reservoir
	Trigger/previous action	Consider use in drought trigger zone D but long lead in time means unlikely to be implemented until zone E/F
	Deployable output of action	6 Ml/d average
	Implementation timetable	9-12 months
	Permissions required and constraints	Need to test water quality of the reservoir and build infrastructure to either transfer to Site B or, less likely, install on-site treatment and construct infrastructure to get treated water into our grid
	Risks associated with the option	DWI water quality
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Unknown - long lead in time will provide the ability to understand this
	Level of confidence (H, M, L)	N/A
	Summary of likely environmental impacts	N/A
	Summary of baseline information used	N/A
	Summary of additional monitoring required	See section 6.3
	Summary of mitigation measures	See Section 6.4
	Permits/approvals needs for mitigation measures	Potentially required based on the mitigation measure - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	Unknown but likely to be limited - long lead in time will provide the ability to understand this

Supply side action information	Supply side action	Linacre reservoir group
	Trigger/previous action	Consider use in drought trigger zone D but long lead in time means unlikely to be implemented until zone E/F
	Deployable output of action	6.8 Ml/d average

	Implementation timetable	In excess of 12 months
	Permissions required and constraints	Need to test water quality of the reservoir and build infrastructure for on-site treatment and construct infrastructure to get treated water into our grid
	Risks associated with the option	DWI water quality
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Unknown - long lead in time will provide the ability to understand this
	Level of confidence (H, M, L)	N/A
	Summary of likely environmental impacts	N/A
	Summary of baseline information used	N/A
	Summary of additional monitoring required	See section 6.3
	Summary of mitigation measures	See Section 6.4
	Permits/approvals needs for mitigation measures	Potentially required based on the mitigation measure - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	Unknown but likely to be limited - long lead in time will provide the ability to understand this

Supply side action information	Supply side action	Monksdale borehole
	Trigger/previous action	Consider use in Derwent Valley drought trigger zone D but long lead in time means unlikely to be implemented until zone E/F
	Deployable output of action	1.5 Ml/d average
	Implementation timetable	Long lead in time, modest yield and limited environmental data available. We expect to need this source less frequently than we would use NEUBs
	Permissions required and constraints	Need to test water quality of the raw water, build on-site treatment and construct infrastructure to get treated water into our grid
	Risks associated with the option	DWI water quality. WFD No Deterioration.
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Unknown - long lead in time will provide the ability to understand this
	Level of confidence (H, M, L)	N/A
	Summary of likely environmental impacts	N/A
	Summary of baseline information used	N/A
	Summary of additional monitoring required	See section 6.3
	Summary of mitigation measures	See Section 6.4
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

	Supply side action	Stanley Moor borehole

Supply side action information	Trigger/previous action	Consider use in Derwent Valley drought trigger zone D but long lead in time means unlikely to be implemented until zone E/F
	Deployable output of action	0.5 Ml/d average
	Implementation timetable	Long lead in time, modest yield and limited environmental data available. We expect to need this source less frequently than we would use NEUBs
	Permissions required and constraints	Need to test water quality of the raw water, build on-site treatment and construct infrastructure to get treated water into our grid
	Risks associated with the option	DWI water quality. WFD No Deterioration.
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Unknown - long lead in time will provide the ability to understand this
	Level of confidence (H, M, L)	N/A
	Summary of likely environmental impacts	N/A
	Summary of baseline information used	N/A
	Summary of additional monitoring required	See section 6.3
	Summary of mitigation measures	See Section 6.4
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

Supply side action information	Supply side action	Witcombe reservoir
	Trigger/previous action	Consider use in drought trigger zone D but long lead in time means unlikely to be implemented until zone E/F
	Deployable output of action	1.4 Ml/d average
	Implementation timetable	Long lead in time, modest yield and limited environmental data available. We expect to need this source less frequently than we would use NEUBs
	Permissions required and constraints	Need to test water quality of the raw water, build on-site treatment and construct infrastructure to get treated water into our grid.
	Risks associated with the option	DWI water quality
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Unknown - long lead in time will provide the ability to understand this
	Level of confidence (H, M, L)	N/A
	Summary of likely environmental impacts	N/A
	Summary of baseline information used	N/A
	Summary of additional monitoring required	See section 6.3
	Summary of mitigation measures	See Section 6.4

	Permits/approvals needs for mitigation measures	Potentially required based on the mitigation measure - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	Unknown but likely to be limited - long lead in time will provide the ability to understand this

Supply side action information	Supply side action	Norton emergency borehole
	Trigger/previous action	When in trigger zone D at Elan Valley this option will be considered
	Deployable output of action	0.7 Ml/d average
	Implementation timetable	Ready to use almost immediately
	Permissions required and constraints	5 year abstraction licence limit. Standard internal water quality process involving sampling to bring back into supply
	Risks associated with the option	DWI water quality
Summary of environmental assessment	Overall environmental impact (minor, moderate, major or uncertain)	Minor
	Level of confidence (H, M, L)	Medium
	Summary of likely environmental impacts	Short term groundwater abstraction will not have an impact on WFD No Deterioration
	Summary of baseline information used	Licence is used as BAU with emergency boreholes available as this action. Using the recent actual abstraction gives us a baseline to consider the environmental impact of a short term fairly small yield increase
	Summary of additional monitoring required	See section 6.3
	Summary of mitigation measures	See Section 6.4
	Permits/approvals needs for mitigation measures	Unlikely to be required - would be agreed with the EA on a case by case basis
	Impact on other activities for example fisheries, industry	N/A

Appendix D Drought scenarios

Our water resources model is Aquator, which is software that simulates the movement of water around our company region to determine our deployable output and determine whether we can supply sufficient water to meet customer demand. The Aquator tool has enabled us to construct a model of our system, apply specific operating rules and use an optimisation algorithm to find the best solution for daily water movement. It uses 95 years of historical flow data derived from a catchment model (as per WRMP19 data). Our model takes into consideration climate change, demand, work capacities, 3rd party abstractors, bulk supplies, abstraction licences, constraints & compliance.

We have used three techniques to investigate how our water resource system copes with a variety of droughts including a range of severities and durations. Section 4.6 of the current Water Resources Planning Guidelines (WRPGs) states that we should:

"Assess the resilience of your current supply system to a range of droughts of differing severity and duration."

Not only are we are considering our worst observed droughts on record between 1920 and 2014, our approach also considers:

- Late 19th Century droughts.
- Drought response surfaces (we describe what these are in section D.2)
- Stochastically generated drought scenarios (we describe what these are in section D.3).

D.1 Late 19th Century droughts

Our baseline modelling to assess deployable output uses 95 years (1920-2014) of climate data and this period captures a number of historic droughts (1921, 1933-34, 1975-76). This allows us to test how our current water resource system would respond if those events were to occur within our 25 year planning period (2020-2045). However, as each drought is unique (in duration and severity), it is important to understand how our system responds to different droughts. We simulated what could happen to our current system if we had a repeat of the long dry periods that occurred between the 1880s and 1910s. We know through Research and Development (R&D) work with the University of Liverpool that some of these droughts were more severe or lasted for longer than the droughts observed in our 95 year observed record. Part of this R&D work involved the co-funding of a PhD project which used historic climatic data to improve our understanding of drought characteristics, propagation and impacts on water resources across the Severn Trent region. This research has better enabled us to quantify this challenge.

Our analysis of historic climate data identified two notable droughts- (1) 1887-89 and (2) 1892-97. The 1887-89 drought ranks as one of the most severe 24 month droughts in the 1884 – 2014 record in our region (Figure 46). Between January 1887 and December 1889 25 of the 36 months have flows below the long-term average conditions. Whilst the 1887-89 drought was identified as a severe flow deficit event, the 1892-97 drought was one of the longest duration events observed in our region (Figure 46). We used historic records of rainfall available across our region dating back to 1884 to create a 131 year dataset to investigate the impact of the identified historic droughts. We used this rainfall data to model river flows using the same rainfall-runoff modelling approach we use in all of our WRMP and drought planning work. We also used groundwater models with the historic climate data to reconstruct groundwater levels and borehole deployable output for the extended analysis period. We then used this modelled river flow and groundwater data in our water resource system model (Aquator) to assess whether the historic droughts had an impact on deployable output. Results of this extended modelling showed that the late 19th Century events did not reduce the deployable output values calculated using our 95 year baseline record. However, our extended 1884-2014 modelling results did highlight

the severity of these earlier droughts. For example, we would have had to implement temporary use bans in 1896 and 1897, the final two years of the 1892-1897 drought. As this work is based on a limited number of rain gauges, there is more uncertainty than there is in our current 95 year record. Therefore, we are only using these droughts as scenarios to test our water resources system rather than part of our baseline deployable output modelling.

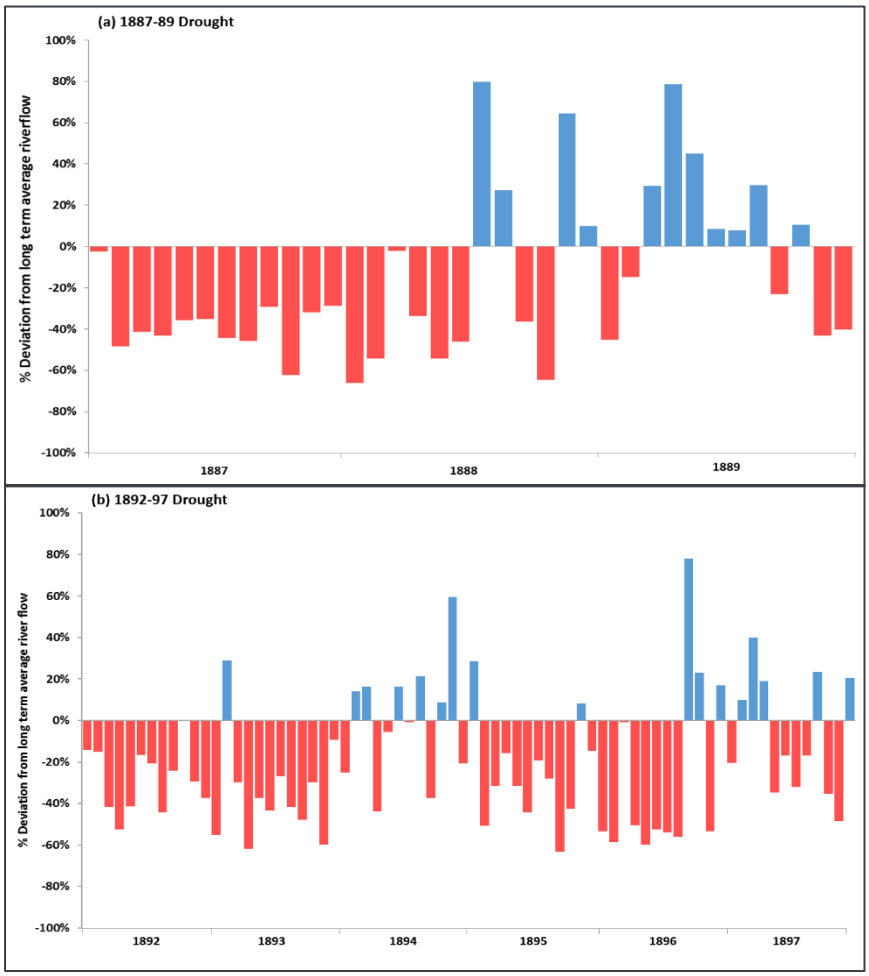


Figure 46 Late 19th Century Drought events- (a) 1887-89 and (b

D.2 Drought Response Surfaces

The EA produced a report in 2016 entitled "Understanding the performance of water supply systems during mild to extreme droughts". We have used the approach outlined in the report to show the impact on customers of droughts with different durations and different river flow deficits (severities). A river flow deficit is a way of saying how much drier a drought is compared with average conditions. For example, if a certain six month period has half as much water flowing down a river than average we would refer to this as a 50% of long term average (LTA) river flow deficit. Figure 47 below illustrates this. Each of the 81 boxes represents a different drought scenario. For example, the box in the bottom right represents the exceedingly unlikely scenario in which there is only 10% of average river flow for 60 months (5 years). By contrast the box in the top left is the much more likely scenario of having 90% of average river flow for six months.

In the example below (Figure 47) using WRMP19 data, we have used colour coding to show the proportion of demand that would not be met for each of the 81 drought scenarios. The grey boxes show that all water demands can be met whilst the boxes shaded from yellow to dark red indicate the proportion of demand that

would be not met under each drought scenario. We have developed drought response surfaces for the WRZs that we model in Aquator. As this approach requires Aquator modelling we did not use it for the other (groundwater only) WRZs. These other WRZs are more drought resilient (see section on drought risk composition). We consider that producing drought response surfaces would be disproportionately complex for the WRZs that have high drought resilience.

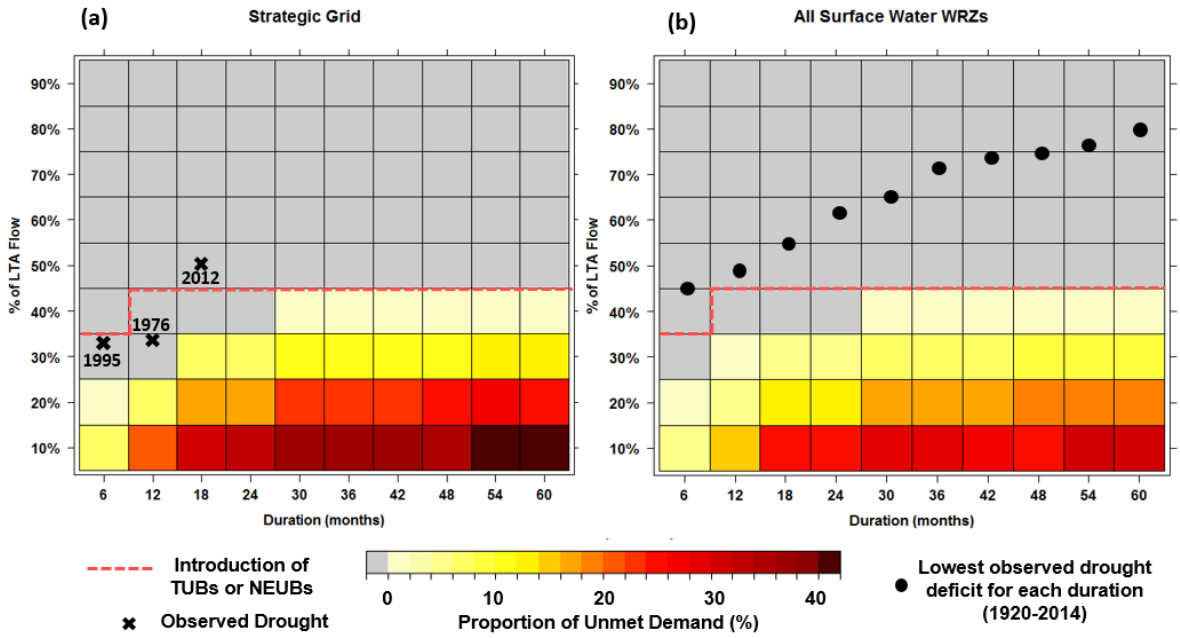


Figure 47 Drought Response Surface for the (a) Strategic Grid WRZ and (b) all surface water WRZs

We developed these drought response surfaces by using synthetic droughts for severity and duration characteristics. These synthetic droughts had durations of between 6 and 60 months with river flow deficits between 10% (most severe) and 90% (least severe) of the long-term average conditions. We created 81 synthetic drought scenarios using our baseline observed data from 1920 and 2014. We produced these synthetic droughts by selecting a month known to have been part of a drought e.g. January 1976, February 1995 etc. for each month of the year to develop a "drought profile" to represent river flow characteristics during a drought which could then be scaled to reflect each of the duration/severity scenarios. Under each scenario the drought begins in April with a varying end month to reflect the drought duration e.g. a 6 month drought would have an end date of September. We used this process to create scenarios for the 64 river catchments we use in our Aquator water resources model.

We then used each scenario to model whether supply can meet demand. We plotted the results of this onto a grid using a range of colours to represent the impacts. We added additional information to the drought response surfaces to show the characteristics of past significant droughts and the lowest observed river flow deficit for all durations between 6 and 60 months (see Figure 47). This information provides useful context for how plausible the synthetic drought scenarios are compared to observed events. We have used elements of the UKWIR Drought Vulnerability Framework project when preparing this.

D.3 Stochastic Drought Scenarios

In order to test how our water resources system responds to droughts that are worse than those observed in our baseline and in the 19th Century analysis we adopted an additional approach. The approach we selected

was the creation of a number of stochastically generated drought 'what if' scenarios that haven't happened but plausibly could. The WRMP 2019 Methods – Risk Based Planning: Guidance (UKWIR, 2016) has informed the techniques we have used to develop our stochastic drought scenarios. We created our scenarios using a stochastic weather generator to develop 200 'what if' drought scenarios. Stochastic weather generation is a modelling technique which uses the relationship between climate drivers and our observed rainfall data over the 20th Century. We then used these 200 sets of rainfall data and corresponding evapotranspiration data to model river flows using the same rainfall-runoff methods used for our baseline DO assessment and the 19th Century drought assessment. We also used the stochastic rainfall and evapotranspiration data to model groundwater level changes within spreadsheets. We then transposed these data onto Source Performance Diagrams (explained more in section 2.2.3 and Appendix J) to determine the corresponding borehole deployable output.

To select drought scenarios which are more severe than observed events we used extreme value analysis techniques to assign return periods to observed droughts and to estimate the return periods of more severe events. The graph in Figure 48 shows an example of how we have used these techniques. This example is for 18 month duration droughts but we have also used similar techniques for droughts of different durations. The blue circles represent actual river flows accumulated over an 18 month period for each year across the 130 year flow record. We derived the red line statistically from the observed data and used it to estimate the return periods of 18 month droughts up to 1 in 1000 year events. We used the same type of extreme value analysis approach to estimate the return periods of 24 month and 30 month droughts with return periods up to 1 in 1000 years.

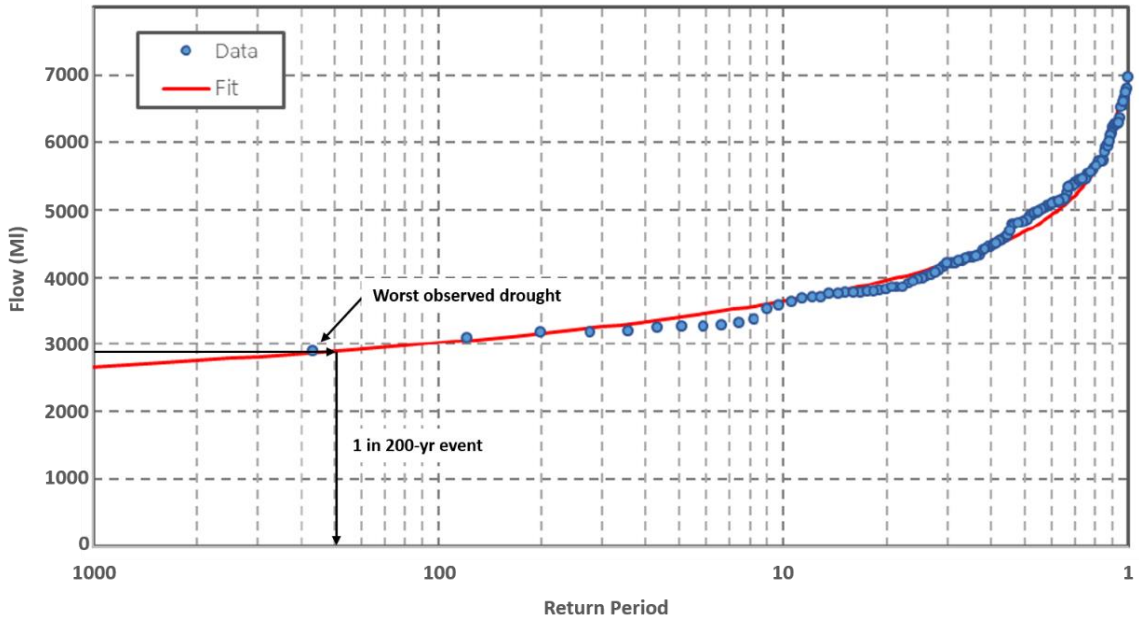


Figure 48 Example of Extreme Value Analysis to estimate drought return periods

The extreme value analysis enabled us to estimate what the total accumulated river flows would be across our region for droughts with a specific event duration and return period (severity). For example, in Figure 48 an 18 month duration 1 in 200 year event has an estimated 18 month flow total of 2900 Ml. We then searched the 200 stochastic flow scenarios to identify a similar 18 month accumulated flow value. We repeated this process a number of times to identify suitable droughts to test our water resources system for droughts with duration characteristics of 18, 24 and 30 months and for return periods (drought severity) up to approximately 1 in 1000 years. From the 200 stochastic scenarios, we selected 30 for analysis in our Aquator model. See Figure 49 for an overview of our stochastic drought scenario generation and modelling.

We have also added borehole deployable output (DO) values in to our Aquator model to account for changes in output from our groundwater sources (see Figure 49). As the surface and groundwater drought stochastic scenarios were developed using differing methods the borehole deployable output values have a smaller range of return periods (1 in 200 years and 1 in 500 years) than the surface water scenarios. In our Aquator modelling the surface water scenarios with a return period greater than 1 in 500 years are all modelled using 1 in 500 year groundwater DO values. As there is little variability between the stochastic groundwater DO values we consider this a suitable modelling approach.

Our modelling results indicated that for a range of drought scenarios between 1 in 190 years to 1 in 330 years there is a small reduction in DO in the Forest and Stroud WRZ. This is a reduction of 2 Ml/d. In all other WRZs these drought scenarios had no reduction in DO from the baseline 1920-2014 modelling. We found that larger decreases in deployable output occurred for scenarios with return periods between 1 in 500 years and 1 in 1000 years with a maximum deployable output reduction of approximately 200 Ml/d (mega litres, or million litres, per day) for a 1 in 1000 year 24 month drought. We have presented a selection of drought scenario DO values in Tab 10 of our WRMP data tables.

We note that drought is a complex phenomenon. The events we have selected for analysis provide an understanding of how future severe droughts could impact our water resource system however the results should only be regarded as estimates. This is recognised by the EA guidance on the completion of WRMP19 tables which describes some of the more extreme scenario values they expect to be in WRMP tab 10 as “a series of estimates”. Although this is true we will continue to stay abreast of relevant R&D and innovation as techniques, modelling and knowledge improves. We will reflect these advances in our future plans. Whilst two drought events could have the same return period and duration (e.g. a 1 in 500 18 month event) the unique characteristics of these droughts could result in different water supply impacts. However, by analysing a large number of drought scenarios with varying drought characteristics we are able to better understand a range of potential impacts and provide challenging drought scenarios for our investment modelling.

We also note that there is some uncertainty in estimating the return periods of our extreme droughts. Whilst extreme value analysis is a very useful method, return period estimates are dependent on a number of factors including data length and the choice of statistical analysis approaches. We have improved the robustness of our extreme value analysis estimates by using our extended flow records developed through the 19th Century drought analysis. This provided 130 years of data rather than the 95 years of our baseline data. The longer dataset provided a wider range of flow conditions including a larger number of droughts which has resulted in a better quantification of drought return periods.

We have worked in close collaboration with South Staffordshire Water (SSW) to ensure we assess the impact of extreme droughts in a way that is consistent with this neighbouring company. It is particularly important that we are consistent with SSW in work of this sort as we both operate within the River Trent and River Severn hydrological catchments. We share one source on the River Severn (shared South Staffordshire asset) and we share our Aquator models and output too. We have also been in contact with Dwr Cymru Welsh Water (DCWW) to compare consistency between our stochastic drought inflows for the Elan Valley Reservoirs. In addition we continue to work with neighbouring water companies such as Thames Water, Anglian Water and other stakeholders in groups such as WRW (Water Resources West), WRE (Water Resources in the East) and WRSE (Water Resources in the South East).

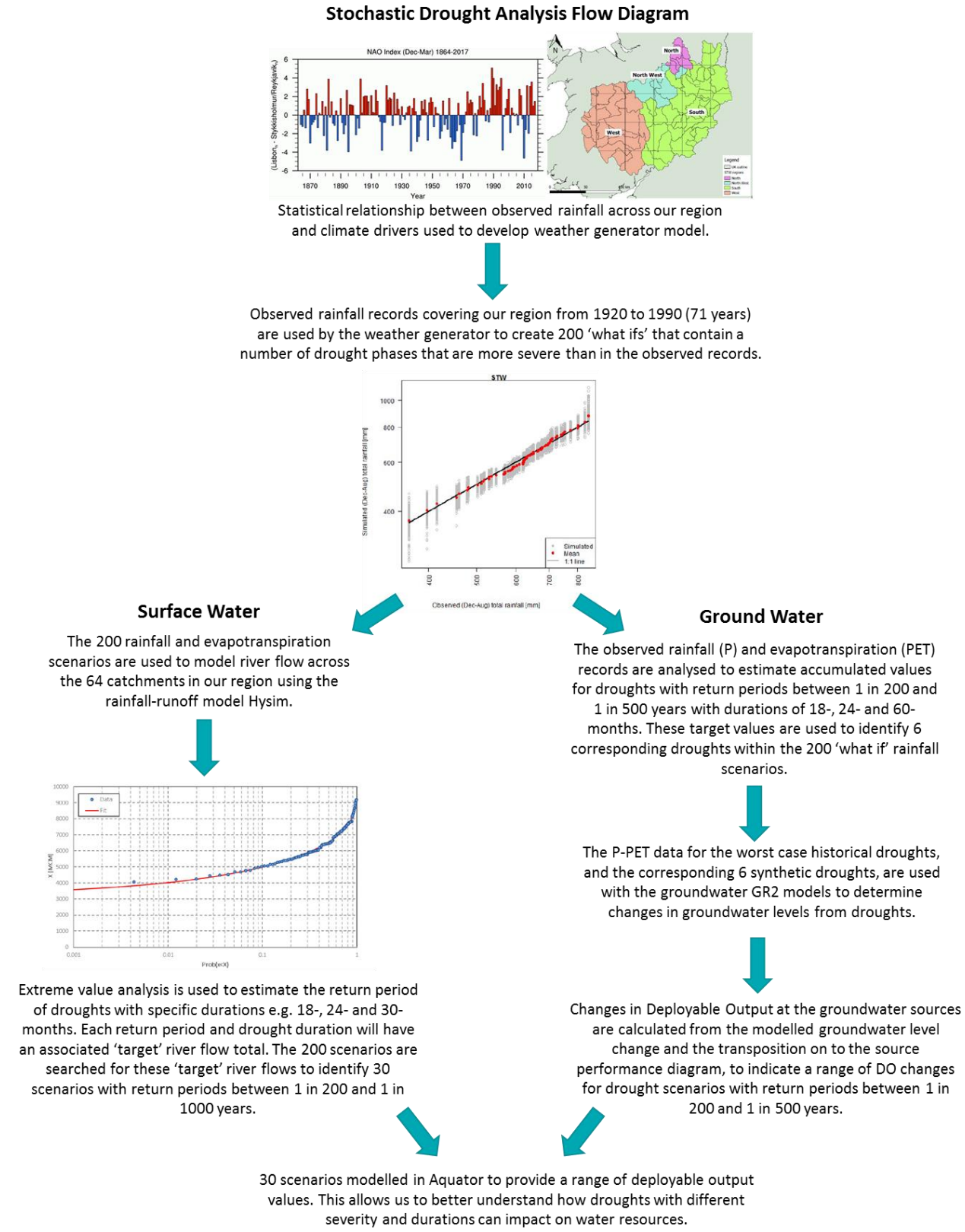


Figure 49 Stochastic Drought Analysis Flow Diagram

D.4 Design Drought

The 2017 Water Resource Management Plan Guidelines state that our base supply forecast should be based on a design drought which should be either (1) our worst drought on record or (2) a more challenging event. Our base supply forecast uses our baseline flow record (1920-2014) therefore, our design drought is our worst historic drought; 1975-76. Analysis of our baseline flow record and our extended 19th Century record indicated that accumulated river flows in the 18 months from April 1975 to September 1976 were the lowest across our region. The selection of our worst historic drought was also informed by our stochastic drought modelling results which identified a very minor change in DO between the baseline data (1920-2014) and a 1 in 200 year stochastic event (-2 Ml/d). We observed significant reductions in DO for droughts with return periods between 1 in 500 years and 1 in 1000 years, and we will be considering the 1 in 500 year events for our WRMP24.

In addition to our modelled findings, our customer research to date has indicated that customers show little appetite to pay for increased drought resilience, however, our customer research is ongoing (see section 1 for more information). Figure 50 shows the modelled storage levels in four of our reservoirs during the design drought. We have plotted these with our drought trigger zones to highlight the impact of this event on the water resource system. These results show that this drought has the greatest impact on the Elan Valley and Derwent Valley reservoirs.

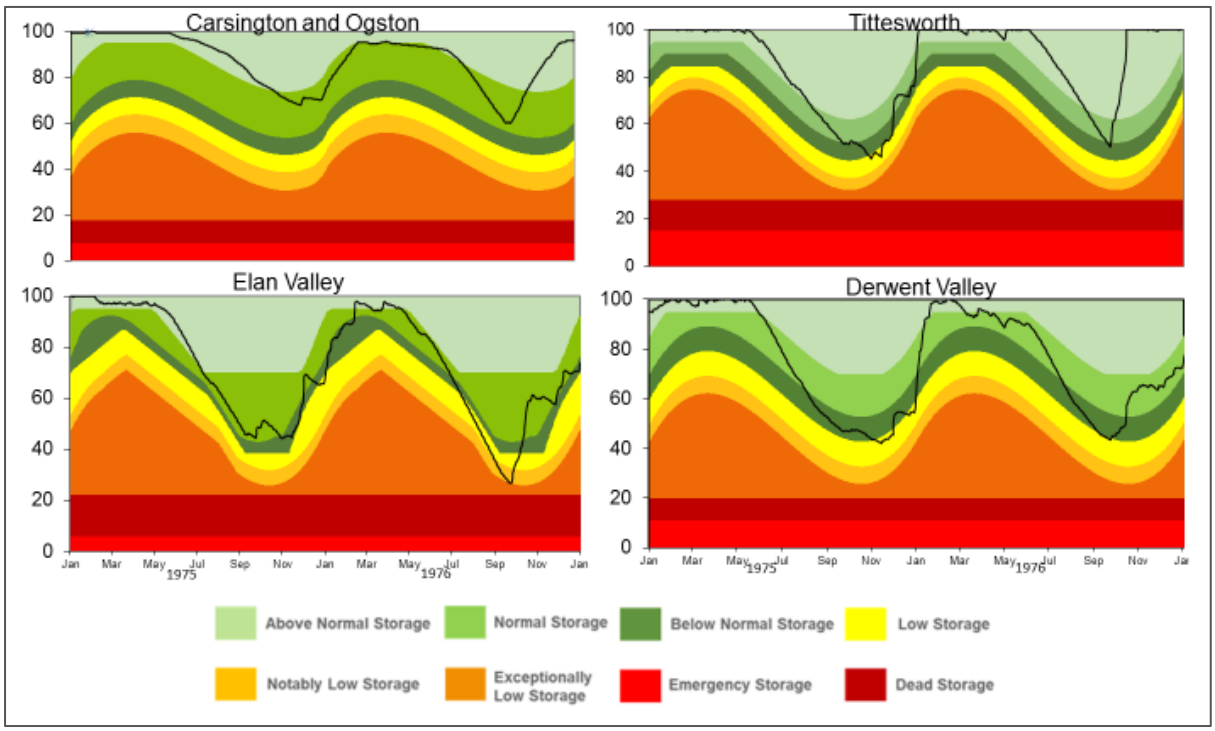


Figure 50 Reservoir Storage during Design Drought

Appendix E Full Temporary Use Ban (TUB) and Non-Essential Use Ban (NEUB) restrictions and exemptions

The detailed restrictions and exceptions of Temporary Use Bans (TUBs) are shown in Table 35.

Table 35 Detailed restrictions and exceptions of Temporary Use Bans

Activity restricted by TUBs	Statutory exception	Discretionary exceptions	Notes
1) Watering a garden using a hosepipe	Using a hosepipe to water a garden for health or safety reasons. NB In this category, the definition of "a garden" includes "an area of grass used for sport or recreation". Therefore it should be noted that watering areas of grass, which are used for sport or recreation, is covered by a Statutory Exception for health & safety only in relation to the active strip/playing area, not the entire ground.	To Blue Badge holders on the grounds of disability. Use of an approved drip or trickle irrigation system fitted with a pressure reducing valve (PRV) and timer. To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge.	The whole of the sports pitch can still be watered using other methods. Some companies may wish to grant a Discretionary Concessional Exception to allow the use of a hosepipe to water other grassed areas used for sport where there is no health and safety risk.
2) Cleaning a private motor-vehicle using a hosepipe	A "private motor-vehicle" does not include (1) a public service vehicle, as defined in section 1 of the Public Passenger Vehicles Act 1981(c), and (2) a goods vehicle, as defined in section 192 of the Road Traffic Act 1988(d)	1) To Blue Badge holders on the grounds of disability. 2) Use of hosepipe in the course of a business to clean private motor vehicles where this is done as a service to customers. To customers on the company's Vulnerable Customers List who have mobility issues but are not	Taxis and minicabs are not considered to be public service vehicles and so are subject to bans[2].

[2] The position that taxis are not classed as public service vehicles is as follows. The current legislation (Section 76(2)(b) of the Water Industry Act 1991) allows TUB restrictions to be imposed on "*private motor vehicles*". The definition of a private motor vehicle in the Water Use (Temporary Bans) Order 2010 (Regulation 5) excludes public service vehicles as defined by Section 1 of the Public Passenger Vehicles Act 1981. This definition includes vehicles not adapted to carry more than eight passengers and "*used for carrying passengers for hire or reward at separate fares in the course of a business of carrying passengers*." Each element of this definition must be satisfied. In other words, it must be a vehicle which: is not adapted to carry more than eight passengers; ... used for carrying passengers for hire or reward; ... at separate fares; ... in the course of a business. In the case of taxis, elements 1,2 and 4 are satisfied, but (usually) not 3. A taxi, unlike a bus, does not (usually) carry passengers at separate fares. There is a fare for the journey undertaken rather than separate fares for each passenger in the vehicle.
Further, in the DfT document (dated November 2011) Public Service Vehicle Operator Licensing Guide for Operators, there is a statement that "*separate fares mean an individual payment by each passenger to the driver, conductor or agent of the operator for the journey undertaken*" This is not how taxis operate, so they therefore fall within the definition of private motor vehicle in the WIA. Taxis will be licensed by the local authority, but is clear from the DfT guidance that if they don't carry passengers at separate fares, they do not require a PSV licence, because they are not PSVs as defined.

		in possession of a Blue Badge.	
3) Watering plants on domestic or other non-commercial premises using a hosepipe	Does not include watering plants that are (1) grown or kept for sale or commercial use, or (2) that are part of a National Plant Collection or temporary garden or flower display.	1) To Blue Badge holders on the grounds of disability. 2) Use of a hosepipe in the course of a business to clean private motor vehicles where this is done as a service to customers. To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge.	The water restriction does not apply to the watering of plants that are grown or kept for sale or commercial use by horticultural businesses e.g. plant nurseries etc.
4) Cleaning a private leisure boat using a hosepipe	(1) cleaning any area of a private leisure boat which, except for doors or windows, is enclosed by a roof and walls. (2) Using a hosepipe to clean a private leisure boat for health or safety reasons.	1) Commercial cleaning 2) Vessels of primary residence 3) Cases where fouling is causing increased fuel consumption Engines designed to be cleaned with a hosepipe.	-
5) Filling or maintaining a domestic swimming or paddling pool	(1) filling or maintaining a pool where necessary in the course of its construction. (2) filling or maintaining a pool using a hand-held container which is filled with water drawn directly from a tap. (3) filling or maintaining a pool that is designed, constructed or adapted for use in the course of a programme of medical treatment. (4) filling or maintaining a pool that is used for the purpose of decontaminating animals from infections or disease. (5) filling or maintaining a pool used in the course of a programme of veterinary treatment. (6) filling or maintaining a pool in which fish or other aquatic animals are being reared or kept in captivity.	None	1) Hot tubs are not classed as pools 2) Pools with religious significance are not domestic pools Pools used by school pupils for swimming lessons should be excluded: they are covered by Drought Order legislation
6) Drawing water, using a hosepipe, for	None	None	-

domestic recreational use			
7) Filling or maintaining a domestic pond using a hosepipe	Filling or maintaining a domestic pond in which fish or other aquatic animals are being reared or kept in captivity	1) Blue Badge holders on the grounds of disability To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge	Filling and topping up of a pond by fixed and buried pipes is not restricted
8) Filling or maintaining an ornamental fountain	Filling or maintaining an ornamental fountain which is in or near a fish-pond and whose purpose is to supply sufficient oxygen to the water in the pond in order to keep the fish healthy	None	-
9) Cleaning walls, or windows, of domestic premises using a hosepipe	Using a hosepipe to clean the walls or windows of domestic premises for health or safety reasons	1) To Blue Badge holders on the grounds of disability 2) Commercial cleaning 3) To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge Where very low water use technologies are employed and approved by the water company	1) The use of water-fed poles for window cleaning at height is permitted under the H&S statutory exception The restrictions do not apply where the cleaning apparatus is not connected to mains supply
10) Cleaning paths or patios using a hosepipe	Using a hosepipe to clean paths or patios for health or safety reasons	1) To Blue Badge holders on the grounds of disability 2) Commercial cleaning 3) To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge Where very low water use technologies are employed and approved by the water company	-
11) Cleaning other artificial outdoor surfaces using a hosepipe	Using a hosepipe to clean an artificial outdoor surface for health or safety reasons	1) To Blue Badge holders on the grounds of disability 2) Commercial cleaning 3) To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge	1) The use of water-fed poles for window cleaning at height is permitted under the H&S statutory exception The restrictions do not apply where the cleaning apparatus is

	Where very low water use technologies are employed and approved by the water company	not connected to mains supply

The detailed restrictions and exceptions of Non Essential Use Bans (NEUBs) are shown in Table 36.

Table 36 Detailed restrictions and exceptions of Non Essential Use Bans (NEUBs)

Activity restricted by NEUBs	Statutory exception	Discretionary exceptions
Purpose 1: watering outdoor plants on commercial premises	The purpose specified does not include water plants that are: a) Grown or kept for sale or commercial use; or b) Part of a National Plant Collection or temporary garden or flower display	Use of an approved drip or trickle irrigation system fitted with a PRV and timer
Purpose 2: filling or maintaining a non-domestic swimming or paddling pool or hot tub/jacuzzi	The purpose does not include: (a) filling or maintaining a pool that is open to the public; (b) filling or maintaining a pool where necessary in the course of its construction; (c) filling or maintaining a pool using a hand-held container which is filled with water drawn directly from a tap; (d) filling or maintaining a pool that is designed, constructed or adapted for use in the course of a programme of medical treatment; (e) filling or maintaining a pool that is used for the purpose of decontaminating animals from infections or disease; (f) filling or maintaining a pool that is used in the course of a programme of veterinary treatment; (g) filling or maintaining a pool in which fish or other aquatic animals are being reared or kept in captivity; (h) filling or maintaining a pool that is for use by pupils of a school for school swimming lessons. Note that a pool is not open to the public if it may only be used by paying members of an affiliated club or organisation.	None
Purpose 3: filling or maintaining a pond	The purpose does not include: (a) filling or maintaining a pond in which fish or other aquatic animals are being reared or kept in captivity (b) filling or maintaining a pond using a hand-held container which is filled with water drawn directly from a tap	1) To Blue Badge holders on the grounds of disability 2) To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge

Purpose 4: operating a mechanical vehicle-washer	Operating a mechanical vehicle-washer for health or safety reasons	On bio security grounds
Purpose 5: cleaning any vehicle, boat, aircraft or railway rolling stock	Cleaning any vehicle, boat, aircraft or railway rolling stock for health or safety reasons	None
Purpose 6: cleaning non-domestic premises	Cleaning of any exterior part of a non-domestic building or a non-domestic wall for health or safety reasons	None
Purpose 7: cleaning a window of a non-domestic building	Cleaning a window of a non-domestic building using a hosepipe for health or safety reasons	None
Purpose 8: cleaning industrial plant	Cleaning industrial plant using a hosepipe for health or safety reasons	None
Purpose 9: suppressing dust	Suppressing dust using a hosepipe for health or safety reasons	None
Purpose 10: operating cisterns (in unoccupied buildings)	None	None

Appendix F Additional information regarding the emergency sources

Our emergency sources are detailed in section in 3.2.1. however for completeness we have included some additional relevant information relating to these sources per WRZ in Table 37.

Table 37 Emergency sources additional information

WRZ	Emergency sources	Comment
North Staffs	None	N/A
Strategic Grid	Witcombe reservoir	We assume licence constrained but we'd undertake flow gauging and/ or a hydrological yield assessment if we were seriously thinking of using it. We would also carry out a detailed assessment of the potential environmental and WFD impacts. Because there is a such a long lead in time before we could ever need to use these options we would have the time needed and we would have already instigated increased 'in drought' monitoring at several locations across our region.
Strategic Grid	Monksdale boreholes	As above
Strategic Grid	Stanley Moor boreholes	As above
Strategic Grid	Norton emergency boreholes	As above. In addition, we can't split out a daily/ peak max for the emergency part of this licence as much of the overall daily total of 24 Ml/d is used BAU for public supply. The real constraint to this emergency supply is the 5 year maximum.
Strategic Grid	Blackbrook reservoir	We calculated a dry year hydrological yield of 6 Ml/d by using Q70 inflows, 10 % unusable storage, compensation flow of 0.136 Ml/d and a critical period of 18 months (548 days). We also used the minimum cumulative 548 day inflows and that also gave a 'yield' of 6 Ml/d so this adds to the reliability of the Q70 estimate. We'd undertake flow gauging/ a hydrological yield assessment and a detailed assessment of the potential environmental and WFD impacts if we were seriously thinking of using it.
Strategic Grid	Linacre reservoir group	We assume licence constrained but we'd undertake flow gauging/ a hydrological yield assessment and a detailed assessment of the potential environmental and WFD impacts if we were seriously thinking of using it. Note that this is a North East EA abstraction licence.
Nottinghamshire	None	Covered by the Strategic Grid East actions that affect the Grid to Notts transfer.
All of the other WRZs	None	N/A

Appendix G The purpose of the other plans we produce that could affect our ability to manage drought

Table 38 below shows the different types of plan that, as a business, we produce that relate in some way to drought planning. It also summarises the purpose of each of these plans:

Table 38 Other plans that we produce

Plan	Purpose of Plan	Comment
Business Plan	This plan sets out what we expect to invest across the business over the next 5 years and beyond. It covers clean water, waste water, customer service and it shows what the impact of our proposed investment programme would have on customers' bills and company returns. We submit these plans to Ofwat for them to make a determination on what to allow within price limits. This means that they decide on how much we can charge our customers in the next 5 years. Supply demand and resilience to events like droughts are components within our company wide business plan	We update these every 5 years
Drought Plan	This is an operational plan to show how we will manage supplies and demands for water in a prolonged dry period	We review these annually and update the within 5 years
Emergency Plans	These plans describe what we will do in an emergency situation. This may be caused by a more extreme drought than we have ever experienced but could also become applicable after a major flood, asset failure and potential loss of services to customers. This plan includes arrangements to use emergency measures such as tankers and bottled water.	These plans are not published in the public domain due to their sensitivity
Water resources management plan (WRMP)	The plan explains our proposals for making sure we have enough water available, in the right place and at the right time to supply our customers in an affordable and sustainable way over the next 25 years. Although there is an overlap between a WRMP and a drought plan, the WRMP is a more strategic longer term plan.	We update these every 5 years
Regional water resources plan	A regional plan needs to identify how best to provide an efficient, sustainable and resilient supply of water for all water users in a region over at least 25 years	First final regional plans to be completed by September 2023

Appendix H Water Resources West TUBs messaging

Water Industry Act 1991
[Company name]

Temporary Ban on Water Use

[Company name] gives notice that, pursuant to sections 76 and 76A–C of the Water Industry Act 1991, the following uses of water supplied by [Company name] are restricted.

This notice, and further details concerning the prohibitions, current drought and water efficiency advice may be found on the website of the [Company name] here: [website address]

Water use restrictions will start on [date] at 0800 hours and continue until further notification. The restriction applies to [all] of the water resource zones defined in [Company name]'s statutory drought plan and as indicated on the map.

Prohibited Uses

The use of a hosepipe, including using sprinklers, dripper hoses, automatic irrigation systems and similar devices, is prohibited for the following:

1. Watering a garden using a hosepipe;
2. Cleaning a private motor-vehicle 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.

Note that 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.

The following definitions apply:

- "Using a hosepipe" includes the drawing of water supplied by [Company name] from a container through a hosepipe; and filling a container by means of a hosepipe with water supplied by [Company name];
- "Garden" includes a park, gardens open to the public, a domestic garden, a lawn, a grass verge, an allotment used for non-commercial purposes and any other green space;
- "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 for example; and

- "Using a hosepipe for domestic recreational use" includes operating water slides and other recreational equipment.

These prohibited water uses are covered by the Water Industry Act 1991 section 76 as amended by the Flood and Water Management Act 2010. Further definitions may be found in the Water Use (Temporary Bans) Order 2010, which is available at:
legislation.gov.uk/uksi/2010/2231/contents/made

Statutory Exceptions

Customers who meet the requirements below can continue to use water without having to make representation to [Company name] to receive permission. In using water, it is requested that customers use water wisely and adopt water efficient practices:

- Using a hosepipe for health or safety reasons, where this includes (a) removing or minimising any risk to human or animal health or safety; and (b) preventing or controlling the spread of causative agents of disease;
- Watering plants that are (1) grown or kept for sale or commercial use, or (2) that are part of a National Plant Collection or temporary garden or flower display;
- Cleaning any area of a private leisure boat which, except for doors or windows, is enclosed by a roof and walls;
- Filling or maintaining a pool where necessary in the course of its construction;
- Filling or maintaining a pool that is designed, constructed or adapted for use in the course of a programme of medical treatment;
- Filling or maintaining a pool that is used for the purpose of decontaminating animals from infections or disease;
- Filling or maintaining a pool used in the course of a programme of veterinary treatment;
- Filling or maintaining a pool in which fish or other aquatic animals are being reared or kept in captivity;
- Filling or maintaining a domestic pond in which fish or other aquatic animals are being reared or kept in captivity;
- 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.

NB Watering areas of grass, which are used for sport or recreation, is covered by a Statutory Exception for health and safety only in relation to the active strip/playing area, not the entire ground.

Discretionary Exceptions

Customers who meet the criteria below for a Discretionary Exception can continue to use water without having to make representation to [Company name] to receive permission to use water for the following restricted uses. It is requested that customers that meet the requirements for a Discretionary Universal Exception use water wisely and adopt water efficient practices.

The criteria for Discretionary Exceptions include:

- Commercial customers that use hosepipes in the course of their day-to-day cleaning business operation as a service to customers to clean private motor vehicles, private leisure boats, walls and windows of domestic premises, patios, paths or artificial outdoor surfaces.
- Customers that hold who hold a Blue Badge or are registered on Priority Services Register of [Company name] and who have mobility issues but are not in possession of a blue badge may use a hosepipe to carry out the following activities;

  - Watering a garden attached to a domestic dwelling, or watering plants on domestic premises;
  - Cleaning a private motor-vehicle;
  - Watering plants on domestic or other non-commercial premises
  - Filling or maintaining a domestic pond using a hosepipe
  - Cleaning walls or windows of domestic premise;
  - Cleaning paths or patios or other artificial outdoor surfaces,
- Cleaning a private leisure boat using a hosepipe in any of the following circumstances:
  - Where the boat is a primary residence,
  - where fouling is causing increased fuel consumption,
  - the engines are designed to be cleaned with a hosepipe

The following definition applies:

- "Blue Badge" means a current valid Blue Badge issued by the relevant Local Authority.

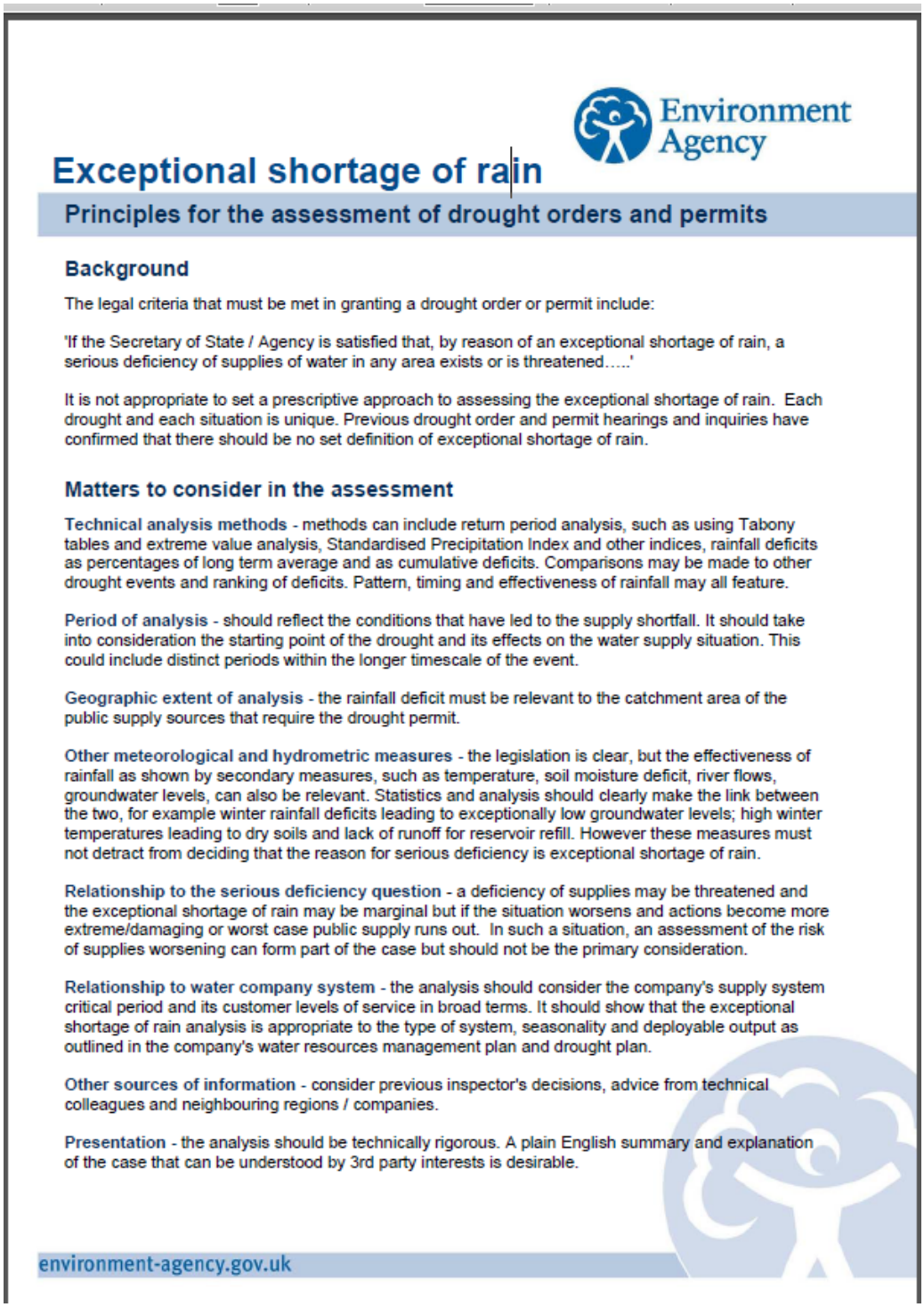
Representations

Representations concerning any of these prohibitions may be made in writing at [email address].To be considered representations must be received by [date] at 1700 hours. If, as a result of any representation, [Company name] decides to vary any terms of the prohibition, a further notice will be published. Subject to this, the prohibitions will have effect from the stated date and will remain in force until further notice. 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.

[Resource zone map]

Appendix I Exceptional shortage of rainfall note

To provide the industry with clarity the EA produced a guidance note entitled 'Exceptional shortage of rain: Principles for the assessment of drought orders and permits'. This note can be seen in Figure 51 below.



Environment Agency

Exceptional shortage of rain

Principles for the assessment of drought orders and permits

Background

The legal criteria that must be met in granting a drought order or permit include:

'If the Secretary of State / Agency is satisfied that, by reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened…..'

It is not appropriate to set a prescriptive approach to assessing the exceptional shortage of rain. Each drought and each situation is unique. Previous drought order and permit hearings and inquiries have confirmed that there should be no set definition of exceptional shortage of rain.

Matters to consider in the assessment

Technical analysis methods - methods can include return period analysis, such as using Tabony tables and extreme value analysis, Standardised Precipitation Index and other indices, rainfall deficits as percentages of long term average and as cumulative deficits. Comparisons may be made to other drought events and ranking of deficits. Pattern, timing and effectiveness of rainfall may all feature.

Period of analysis - should reflect the conditions that have led to the supply shortfall. It should take into consideration the starting point of the drought and its effects on the water supply situation. This could include distinct periods within the longer timescale of the event.

Geographic extent of analysis - the rainfall deficit must be relevant to the catchment area of the public supply sources that require the drought permit.

Other meteorological and hydrometric measures - the legislation is clear, but the effectiveness of rainfall as shown by secondary measures, such as temperature, soil moisture deficit, river flows, groundwater levels, can also be relevant. Statistics and analysis should clearly make the link between the two, for example winter rainfall deficits leading to exceptionally low groundwater levels; high winter temperatures leading to dry soils and lack of runoff for reservoir refill. However these measures must not detract from deciding that the reason for serious deficiency is exceptional shortage of rain.

Relationship to the serious deficiency question - a deficiency of supplies may be threatened and the exceptional shortage of rain may be marginal but if the situation worsens and actions become more extreme/damaging or worst case public supply runs out. In such a situation, an assessment of the risk of supplies worsening can form part of the case but should not be the primary consideration.

Relationship to water company system - the analysis should consider the company's supply system critical period and its customer levels of service in broad terms. It should show that the exceptional shortage of rain analysis is appropriate to the type of system, seasonality and deployable output as outlined in the company's water resources management plan and drought plan.

Other sources of information - consider previous inspector's decisions, advice from technical colleagues and neighbouring regions / companies.

Presentation - the analysis should be technically rigorous. A plain English summary and explanation of the case that can be understood by 3rd party interests is desirable.

environment-agency.gov.uk

Figure 51 Environment Agency 2016 note on exceptional shortage of rainfall

Appendix J Groundwater source performance diagrams

As part of our PR19 work we validated and updated all of our groundwater DOs and source performance diagrams (SPDs). These SPDs plot operational and drought water levels against site output. They help to provide a qualitative assessment of risk. We have included an example SPD in Figure 52.

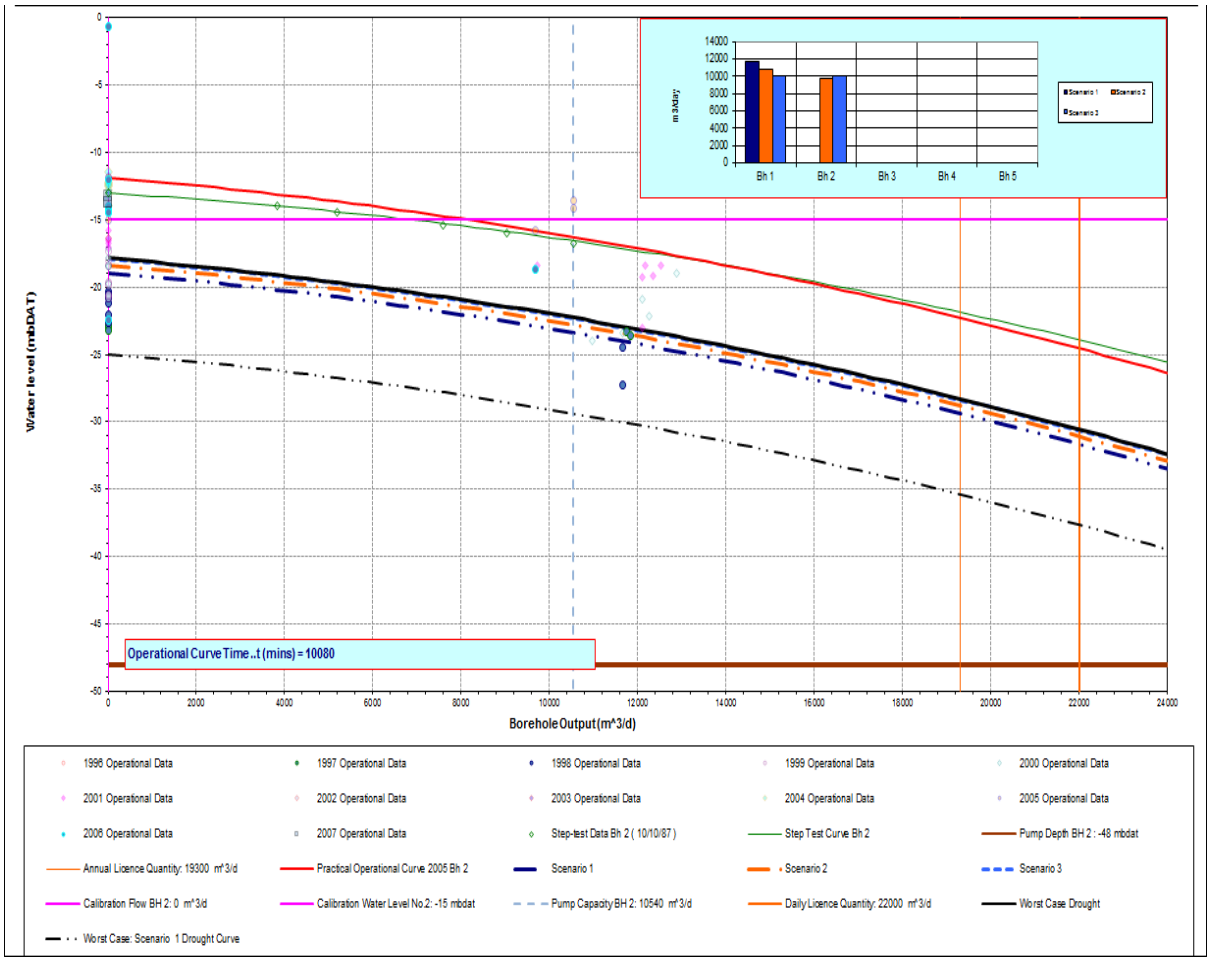


Figure 52 Illustrative source performance diagram (SPD)

This SPD is for a borehole in Staffordshire. The transition from zone A to F on the SPD is not absolute as the performance of many groundwater sites is dependent on the operational use of the borehole. The predicted drought curve (and trigger levels) may be influenced by the number of boreholes in operation, the duration of pumping, the pumping rates at that specific time and also regional influences.

It is important to remember that many of our groundwater sources are not constrained by level. The majority of our groundwater sources are located in Permo-Triassic sandstone and this does not exhibit significant variations in water level. As a result we consider that these sources are highly resilient to groundwater drought impacts. Generally, the difference in water level between wet and the most severe drought years is in the order of 5m to 7m. Therefore the risk of these groundwater levels falling below the current drought bounding curve (i.e. moving into Drought Management Action Stage D, or below), is minimal.

In most cases, even if groundwater levels fall below the drought bounding curve, the output of the source will not decline. For example, where the source is licence constrained; groundwater levels may fall tens of metres

below the drought bounding curve before the constraint changes from being the licence, to being a physical aquifer constraint (such as Deepest Advisable Pumped Water Level).

For our groundwater DO assessments we have followed current best practice. This is as outlined in both the 1995 UKWIR A Methodology for the Determination of Outputs of Groundwater Sources (95/WR/01/2) and 2000 UKWIR Unified Methodology for the Determination of Deployable Output (00/WR/18/1). We have assessed our groundwater sources' deployable output in the worst drought season and the worst-case drought week. We have taken this approach for all of our groundwater sources across the company and use the same approach in both England and Wales. We address the topic of droughts that are more extreme than any we have experienced in the past and how they affect our groundwater sources earlier in this plan (section 2.1).

Appendix K References

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