Water Resources Management Plan 2024

Appendix I: Drought 2022 Review

WONDERFUL ON TAP

SEVERN TRENT

Contents

Appendix I: 2022 Drought Year Review

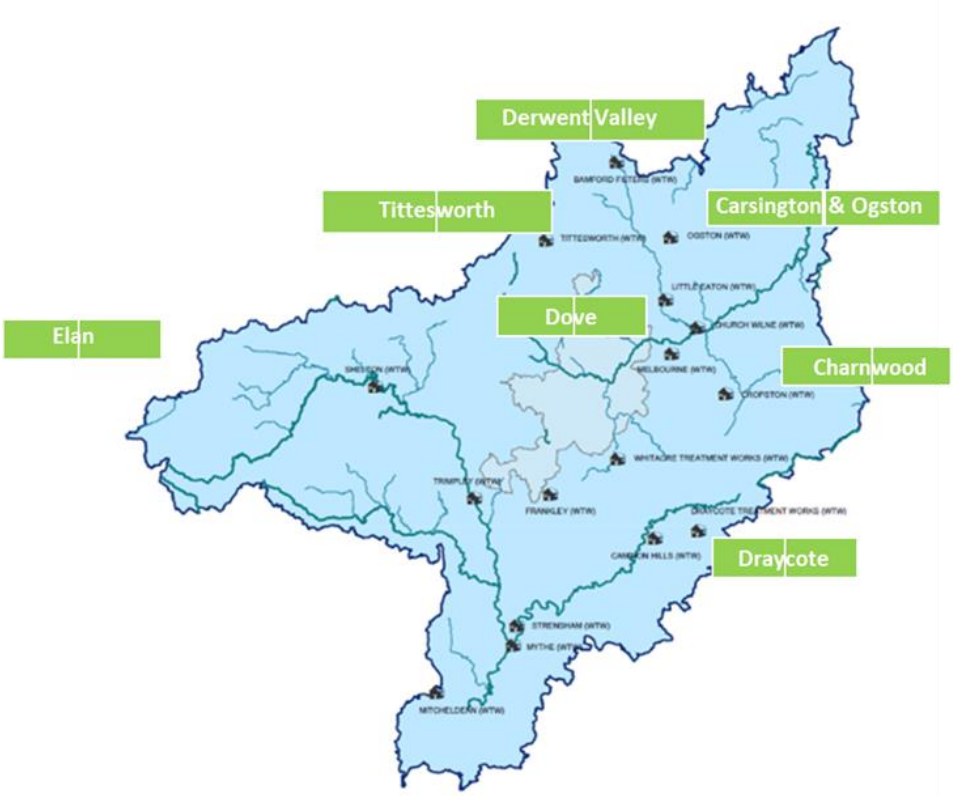
I1 A Summary of the 2022 Drought in the Severn Trent Region

Timeline of 2022 Drought

Below is a summary of the drought effects and actions we took to mitigate them during 2022. More detail of the drought effects and our actions can be found in the justification of need documents for the drought permit applications submitted in 2022 (Derwent Reservoirs, River Churnet and Dove Reservoirs).

- February 2022 – Very heavy rainfall, following a reasonably dry winter refilled our reservoirs, putting us in a good position for the start of the new drawdown year.
- March 2022 – We started the month in an excellent position with 96% storage across our reservoirs and raw water resources. March was a very dry month with many of our catchments receiving less than 50% of long-term average rainfall. Our overall drought status remained green/level 0 in March (See Figure I1.1).

Figure I1.1: Our overall drought status was in green/level 0 drought in March 2022



- April 2022 – During April all catchments continued to receive below average rainfall. By the end of April our Derwent Valley reservoirs were below normal levels.
- May 2022 – We convened our Drought Action Team and started regular dry weather catch-ups with the Environment Agency (EA) and our surrounding water companies. We proactively reduced output from our reservoirs at Derwent Valley and Tittesworth, both of which had dropped into Level 1a drought status.
- June 2022 – Continued dry weather saw Elan Reservoir drop into drought level 1a (Lower than 1976 for Elan for this month) and Derwent Valley reservoirs drop into level 1b. We continued activities to reduce demand on our reservoirs, by increasing abstraction from our river and groundwater sources and

started our Water Saving Heroes campaign in the media. At this point we began our preparations in case we needed to apply for a Temporary Use Ban (TUB) and/or drought permit at Derwent Valley or Tittesworth reservoirs.

- July 2022 - Dry weather continued with some of our catchments receiving less than 50% of Long-Term Average (LTA) rainfall. July also had a long hot spell that saw the hottest day on record. This increased demand significantly across the region. Our media and socials campaign continued to ask customers to use water carefully. We also sent out text messages and emails to all customers asking them to try and reduce their use. Elan and Tittesworth reservoirs crossed into drought level 1b and some spring source yields began to drop. We increased our take from Derwent Valley reservoirs for a short period to keep customers on supply during peak demand periods. In North Staffordshire we brought boreholes that were out of supply back in to help reduce demand on Tittesworth.
- August 2022 - Our Derwent Valley catchment had experienced the driest six months on record, there had been 50% of LTA over the past six months. Derwent Valley dropped into drought level 2 towards the end of August, followed by Tittesworth at the end of August. From mid-August onwards we reduced abstraction from Derwent Valley reservoirs to both ourselves and Yorkshire Water to absolute minimum flows. Tittesworth achieved a new minimum sustainable flow of 8Ml/d, further reducing demand on the reservoir.
- During the 2nd half of August 2022, we carried out detailed analysis to help support a decision to either impose a TUB (locally or regionally) or carry out a wider/deeper media and door to door water saving / water efficiency campaign, choosing eventually to opt for the communication campaign. This was based on seeing reducing demand from mid-August onwards across our region due to cooler temperatures and overcast skies, alongside our ongoing communication campaign. Analysis of diurnal usage patterns suggested minimal outdoor / discretionary use, with patterns matching typical winter profiles.
- September 2022 – We had seen significantly below average rainfall for seven months by September; our drought status across our region had gone from Green/level 0 in March to Red/level 2 (See figure I1.2) over this time. September did see some brief respite from the dry weather with some rainy days recorded, which continued to help keep demand down. However, storage at some of our key reservoirs continued to decline and we took the decision to apply for a drought permit at Derwent Valley reservoirs. We worked closely with the EA during September, sharing draft copies of our Drought Permit justification of need and environmental reports, to ensure the permit for which we applied would cause minimal environmental harm or disruption. Figure I1.3 shows the reservoir levels in the Derwent Valley reservoirs by the end of September 2022.

Figure I1.2: Our overall drought status was in Red/level 2 drought by Sept 2022

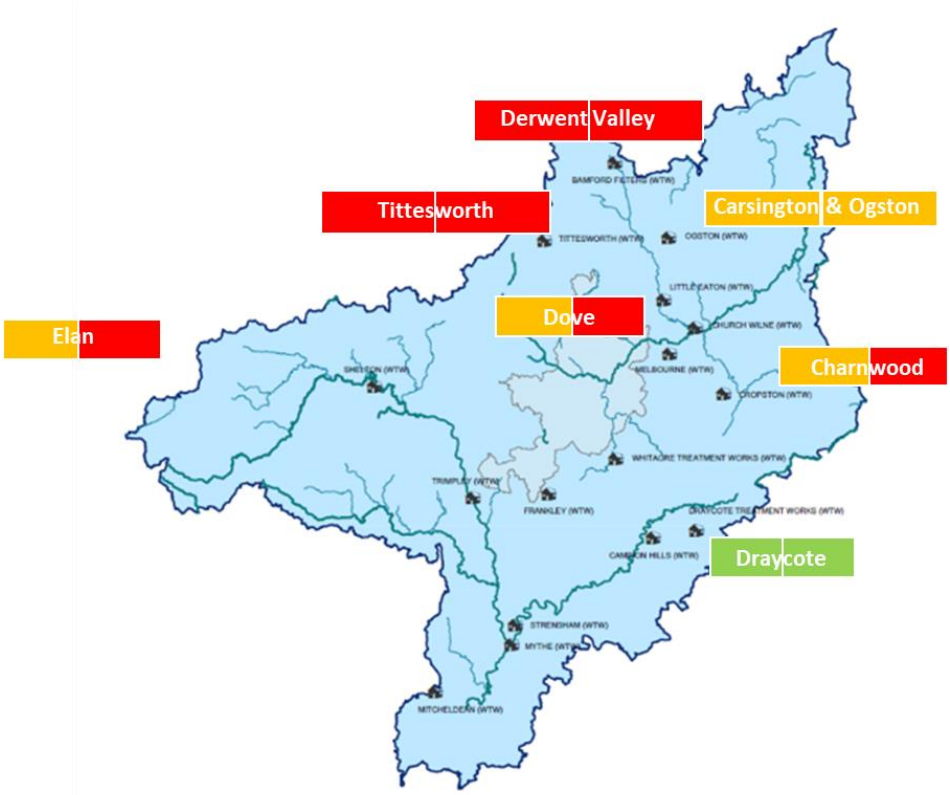
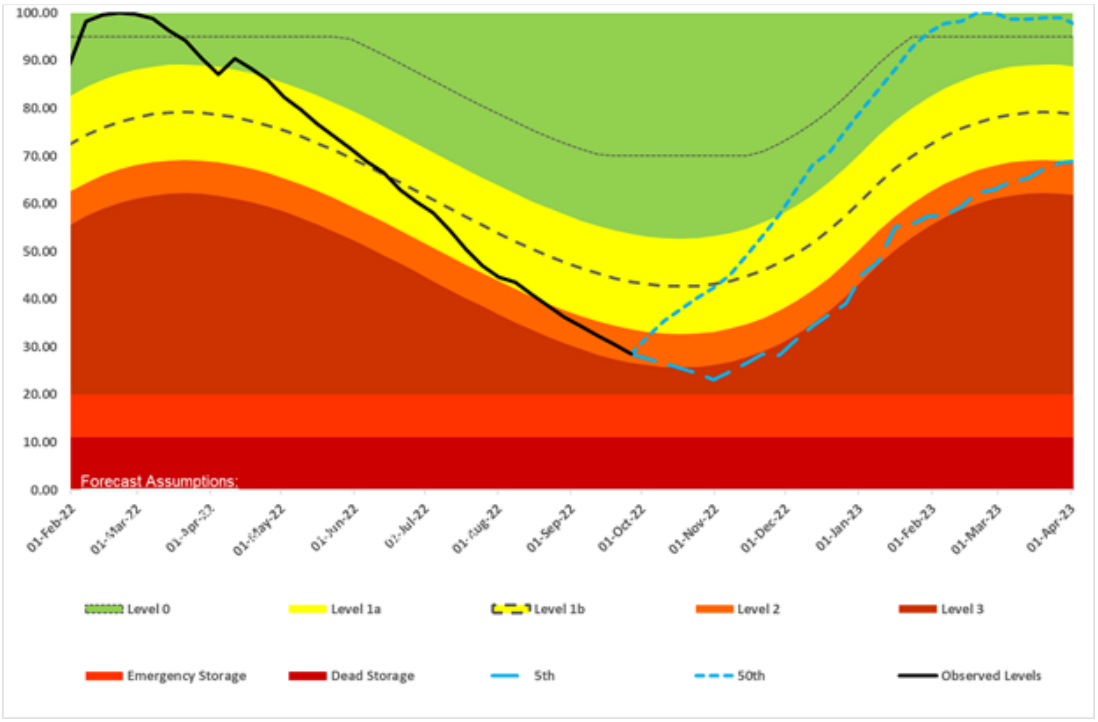
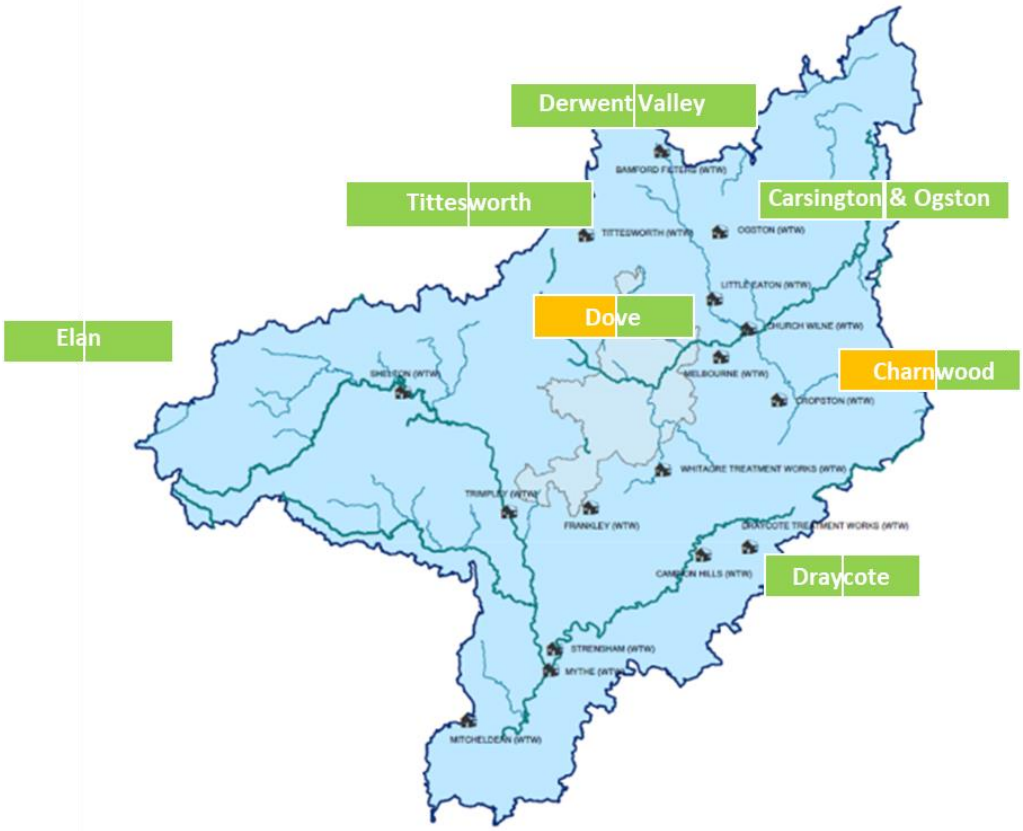


Figure I1.3: Derwent Valley reservoir level to September 2022 (with projections, no permit)



- October 2022 – This was the first month since February with above average rainfall, however at the start of the month the reservoir levels remained very low. We applied for and were granted a drought permit at Derwent Valley reservoirs to reduce the amount of compensation flow from the reservoir by 20Ml/d (approximately 1/3). We also applied for a drought permit on the River Churnet, to reduce compensation from Tittesworth Reservoir, again working with the Environment Agency to ensure the permit was suitable. River Severn regulation went well over 100 days of regulation.
- November 2022 – We saw continued wet weather which helped Tittesworth and Elan reservoirs recover to pre-drought levels (back to drought level 0). We took the decision to withdraw our drought permit application for Tittesworth/River Churnet due to the improved situation. We did however continue with an application for a drought permit at the Dove Reservoirs to increase our annual abstraction from these reservoirs. This was to help ensure we could refill our Derwent Valley and Charnwood reservoirs should the dry weather return across winter.
- December 2022 – Our application for the Dove reservoirs drought permit was granted. Reservoir levels across our system continued to refill, with most levels back to normal by mid-December (see figure I1.4). It is worth noting that our spring sources and some groundwater sources remained below normal during December.

Figure I1.4: Overall drought status December 2022



- January–March 2023 – Reservoir levels were generally back to normal. Some of our pumped storage reservoirs were slightly below normal at the start of March (Foremark, Draycote, Carsington) partially due to the dry January/February we had, although these were back to normal levels by May.

Where does 2022 sit against previous droughts?

As can be seen from figure I1.5 (Derwent headwater rainfall data), for some of our catchments the 2022 drought ranked as the driest period in the 131-year record of historic data we own. Particularly July, August and September, which were ranked as the driest five, six and seven consecutive months on record for those periods.

Figure I1.5: Derwent headwaters – Monthly rainfall rankings

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
1 month	13	130	17	30	41	35	10	13	62
2 month	60	118	126	9	21	21	9	6	22
3 month	43	120	96	115	8	8	5	5	9
4 month	47	110	104	78	104	6	3	3	11
5 month	43	107	90	91	66	90	1	4	6
6 month	31	100	96	83	86	53	60	1	3
7 month	44	90	84	85	73	73	28	35	1

Our Strategic Grid WRZ as a whole was classified as extremely dry based on standardised precipitation, ranking with the wider Derwent catchment as third driest on record. As mentioned, for long periods during the summer our reservoirs levels, for example at Elan, were below those seen in 1976.

Where does the 2022 drought sit against our 19,200-year stochastic rainfall dataset?

We have analysed the severity of the 2022 drought against our 19,200 years of stochastic rainfall data. The Derwent Valley reservoirs were the most severely affected part of our system, and we required a drought permit at these reservoirs. We have shown below the outputs of the analysis for this catchment.

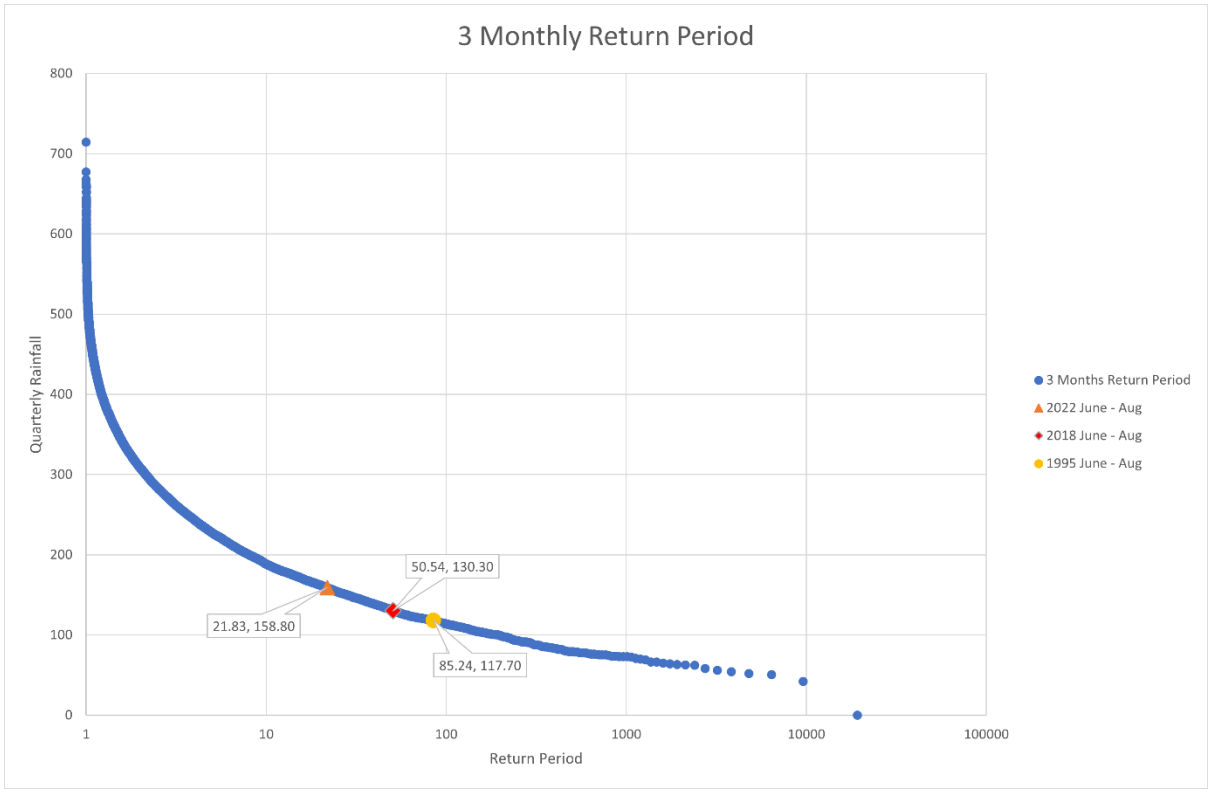
The three and six month accumulations are based on the driest periods across 2022. Three months is June to August and six months is March to August. The twelve months data is based on January to December.

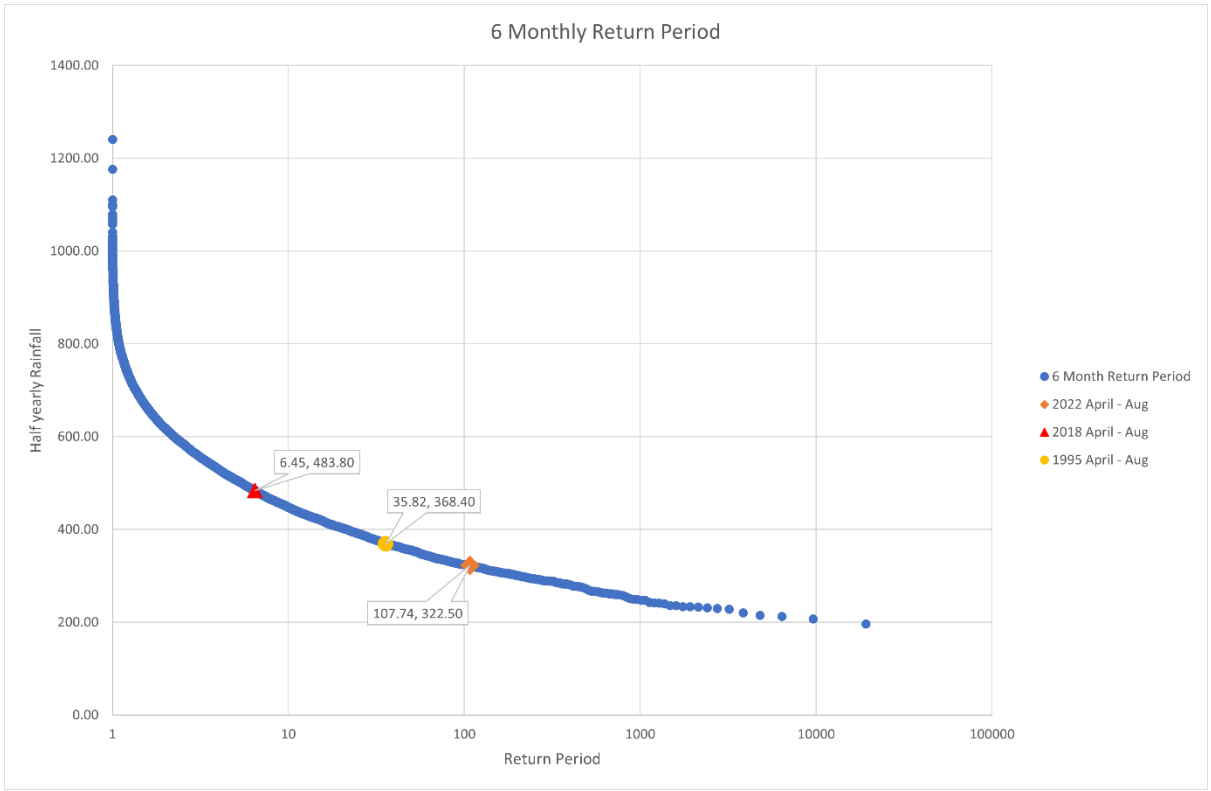
Table I1.1: 1995, 2018 and 2022 rainfall return periods for Upper Derwent Valley against 19,200 years of stochastic data

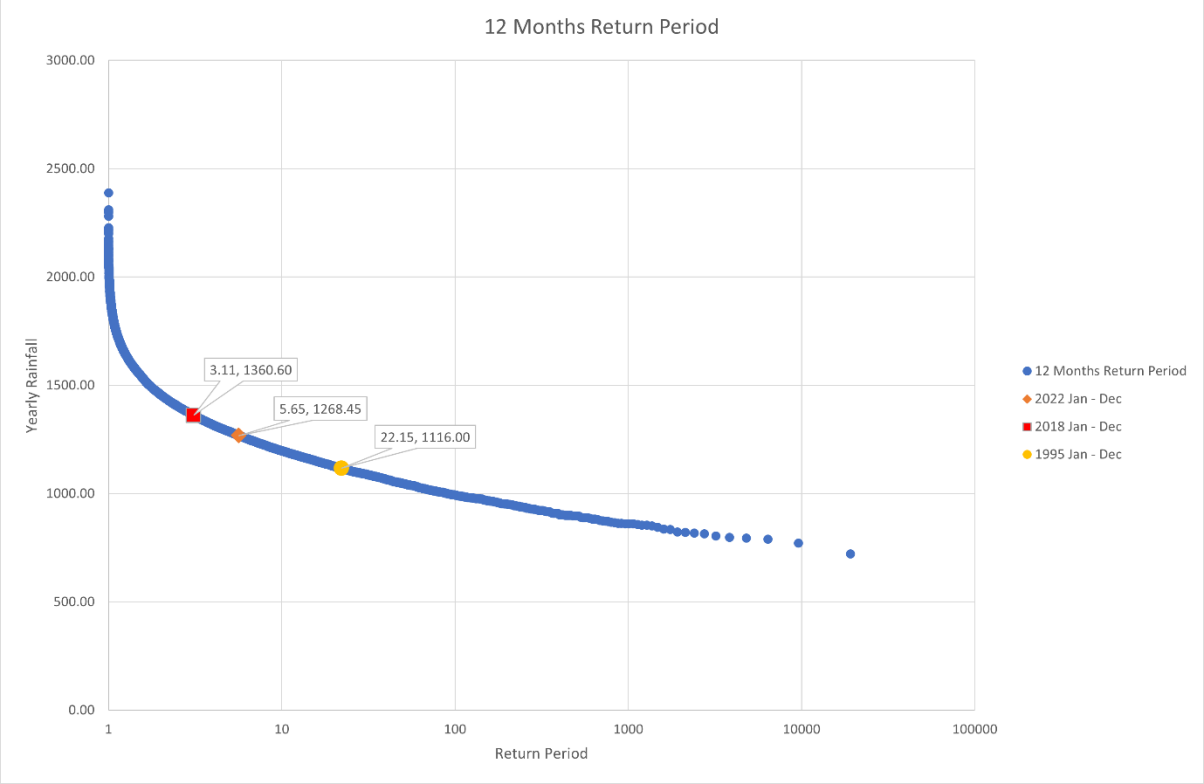
Year	3 Months	6 Months	12 Months
1995	1 in 85	1 in 35	1 in 22
2018	1 in 50	1 in 6	1 in 3
2022	1 in 21	**1 in 108**	1 in 6

The six-month accumulation return period is around 1 in 110, which is close to the 1 in 130 return period found from historic datasets (the six month accumulation that has the most severe return period). We have plotted 1995, 2018 and 2022 rainfall accumulations against return period alongside the stochastic data in the below figures.

Figure I1.6: Upper Derwent Valley 3, 6 and 12 month rainfall accumulations against return period for 1995, 2018 and 2022 and 19,200 years of stochastic data






12 Months Return Period
3000.00
2500.00
2000.00
1500.00
1000.00
500.00
0.00
Yearly Rainfall
1
10
100
1000
10000
100000
Return Period
3.11, 1360.60
5.65, 1268.45
22.15, 1116.00
12 Months Return Period
2022 Jan - Dec
2018 Jan - Dec
1995 Jan - Dec

I2 Lessons Learned from 2022

Following the 2022 drought event, we have conducted internal workshops with our colleagues, and external workshops with the EA. We used these to review the challenges that we experienced and identify any lessons learned to further improve our drought resilience. Our key lessons learned from 2022, and how we need to integrate them into our plans going forward are set out in the table below. An early view of the updates for the draft drought plan 2025 has been shared with the EA at the end of 2024 in line with their request ahead of the statutory publication as part of our early stakeholder pre-consultation.

Table I2.1: 2022 Drought event key lessons learned

Lesson Learned	Update: When and where we will apply the learning
We have successfully trialled and implemented reducing our Tittesworth works production below previously identified levels. This helped us protect the storage in the reservoir last year and has been incorporated into our reservoir control philosophy going forward.	**Complete: Incorporated into our business as usual operations and drought operational practices.**
We have improved our management of our groundwater sources in the North Staffordshire Water Resource zone (WRZ) in drought conditions, including new measures and mitigation for borehole operational issues and network rezoning.	**Draft Drought Plan 2025:** We will include all relevant new Level 1 actions into the Drought Management Action table for North Staffordshire.
We have proactively decreased our abstraction from our Derwent Valley reservoirs early in the year before reaching Level 1, which helped us protect storage to use for peak demands later in the year.	**Draft Drought Plan 2025:** We will include this strategy in the plan which is in addition to the Level 1 action of reducing abstraction.
We identified key licence changes that will help our drought resilience for future dry periods.	**Draft Drought Plan 2025:** We have added this potential change to our licencing plan and will include it in the next draft plan once completed.
We have improved our overall understanding of asset capability and process control mechanisms in drought conditions: minimum and maximum flows, spring source constraints, maintenance and interventions required etc.	**Complete: Incorporated into our BAU & drought operational practices.**
We managed our network through unprecedented high temperatures and peak demand periods; we reviewed this against previous peak demands to further our understanding around our demand assumptions and outage forecasts.	**Draft Drought Plan 2025:** We conducted a demand review post-drought in 2022 and have improved our demand forecasting tool. We will include further detail in the next draft drought plan. **PR24 plan:** we undertook extensive analysis of the peak demand issue and how this may be affected in future by climate change and growth. We have proposed additional investment in our PR24 plan to address this issue.
We have a better understanding of our drought sources and have identified alternative opportunities that can be invested in now for future dry periods.	**Final WRMP24:** We identified new options, for example a transfer option from Rudyard reservoir to support Tittesworth reservoir.
Our Tittesworth drought option using Abbey Green borehole was applied for as a drought permit instead of a drought order as specified in our drought plan, based on new advice from the EA.	**Revised Drought Plan 2022-2027 (update in 2024):**

Lesson Learned	Update: When and where we will apply the learning
	We will amend this within the plan with an explanation for the change from drought order to permit.
We now better understand the level of internal resource required from the business when applying for multiple permits.	**Complete and included in our internal planning.**
We have further improved our understanding of the EA's requirements for drought permit/order applications in relation to the associated environmental reports and monitoring requirements.	These are included in the associated drought plan environmental documents when updated.
We may need to adjust and update our drought projections and reservoir control curves and will be conducting a review of these, in addition to the work we have done for the emergency storage for this WRMP.	**Draft Drought Plan 2025:** We will have completed a full control curve review and will update the next draft drought plan to include any changes to the reservoir control curves in addition to the emergency storage updates done for WRMP24.
We have an improved understanding of the drought permit application process if objections from stakeholders are received.	**Draft Drought Plan 2025:** We will expand our plan in relation to the process and timeframes for permit applications that receive stakeholder objections.
Leakage challenges were aided by new innovation technologies focused in the most impacted areas of our region.	**Draft Drought Plan 2025:** We will include these methods in the next draft plan with examples and results from 2022.
We were able to increase water efficiency awareness to our customers due to the new methods of agile communications we used, and by specifically targeting focus areas.	**Draft Drought Plan 2025:** We will include these methods in the next draft plan with examples and results from 2022.
We applied agile comms for our demand management strategy – multi channel communications repeating consistent messaging for a sustained period through traditional media channels (TV, Radio, Print) alongside social media channels to engage customers delivered high recognition and stated intent on behaviour change.	**Draft Drought Plan 2025:** We will include these methods in the next draft plan with examples and results from 2022.

I3 Our Decision around Temporary Use Bans

We reached level two triggers in two WRZs (North Staffs and Strategic Grid) in late August 2022. Level two is the trigger for considering implementation of TUBs in our drought plan.

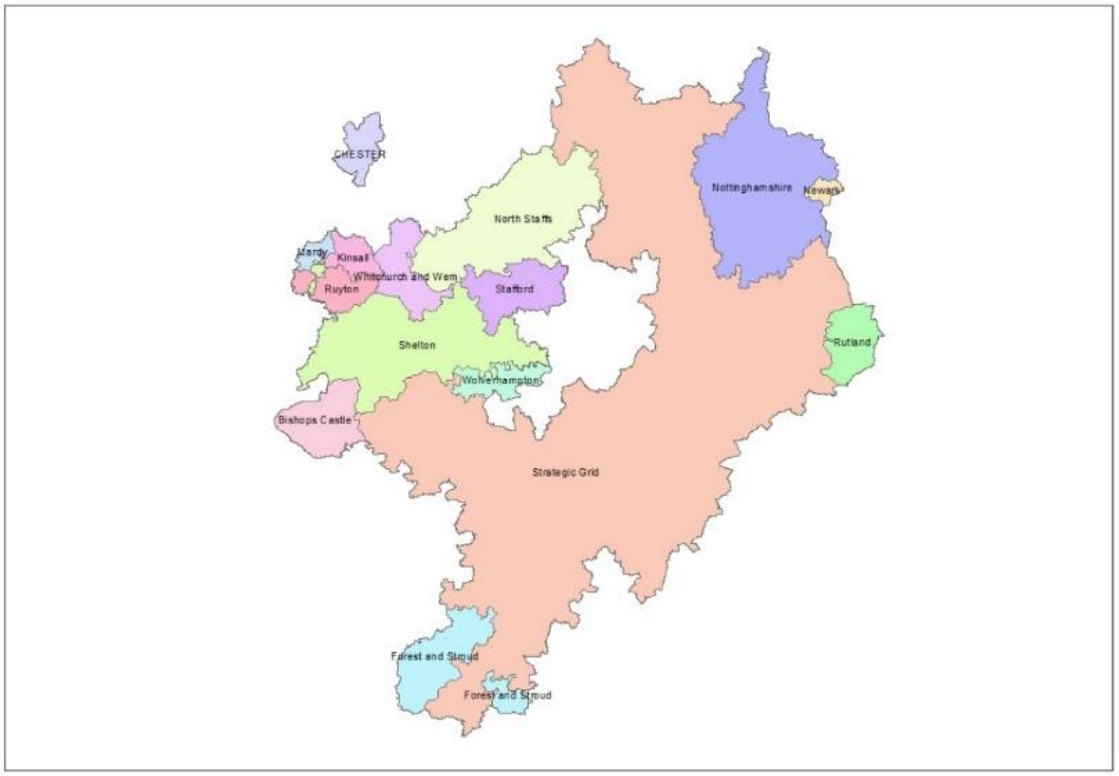
We had already seen a shift in diurnal water patterns which showed a reduction in outdoor discretionary use. We also continued to act to significantly reduce abstraction in impacted areas alongside demand management activities, which was factored into our decision not to implement TUBs.

Following the experiences of 2022 and using the outputs from the updated UKWIR Drought Code of Practice (due summer 2023), we have committed to reviewing and updating our Drought Plan. We will follow and apply our Drought Plan, as is in place at the time and as necessary.

I4 Reviewing our Water Resource Zones

Figure I4.1 shows the 15 WRZs that had been amended in 2019 to reflect the new company boundaries and were used in WRMP19. For our most recent WRMP, we had carried out a simple review and decided that these zones remained appropriate for our draft plan.

Figure I4.1: Severn Trent Water Resource Zones



However, during the 2022 drought year, it has become apparent we need to further review our WRZs. When looking at our options to implement a Temporary Use Ban (TUB) in August/September 2022, we decided that the most suitable option, if a TUB was required, would be to put this on for only the northern part of our Strategic Grid zone. For our previous 2014 Drought Plan we did have the option to use sub-zonal TUBs. This indicated that a review of the Strategic Grid zone would be required to assess its compliance to the EA's guidance on WRZ integrity that states 'risk of supply in a single WRZ should be the same'. Furthermore, the scheme options within our fWRMP include options to improve connectivity between the northern part of the Strategic Grid WRZ and the Nottingham WRZ, which may also change the risk/level of service within these zones.

We therefore agree with the Environment Agency that we should carry out a full review of our WRZs, specifically focusing on whether the Strategic Grid zone should be split up. We will also take this opportunity to review all WRZs across the company.

In their consultation response, the EA have asked us to report on this as part of our WRMP Annual Review. We therefore have initiated this activity and will report on the progress and outcome of the analysis in our WRMP Annual Reviews. We would propose to shadow report our WRMP Annual Review using both our current and new WRZs in parallel for leakage, water balance and the Supply-Demand Balance Index (SDBI). Our initial outputs and proposed changes to WRZ configuration had been shared with the EA by end 2024 as they have requested included in an early view of what we will update in our draft Drought Plan 2025 we shared with the EA as part of pre-consultation. First external publication of the proposed WRZ updates would be as part of our June 2025 WRMP Annual Review if approved by the EA. The new draft Drought Plan 2025 will follow the statutory timeline with formal consultation and publication in Autumn 2025 (subject to Defra approval).

We will continue to use our current zonal structure for this WRMP24 and PR24. We detail our proposed work plan in Table I4.1.

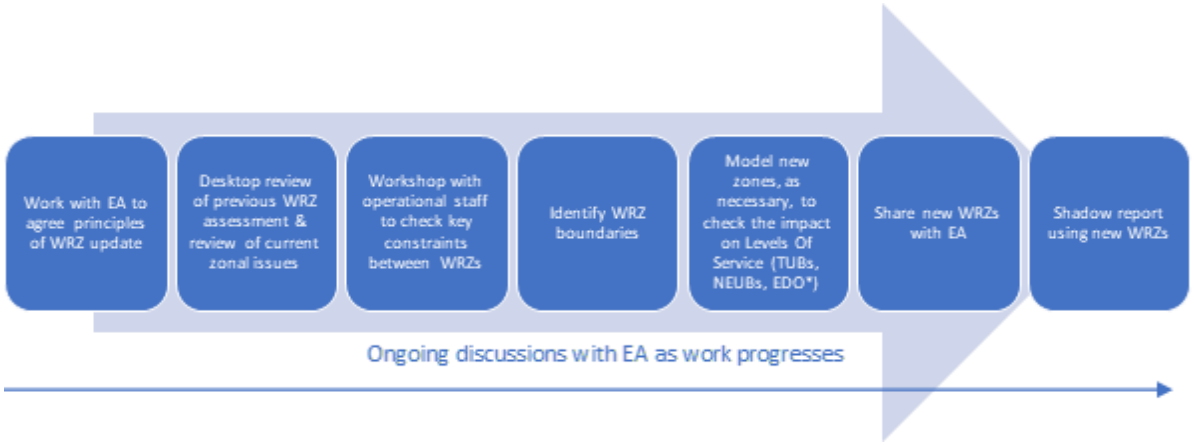
Table I4.1: Our Plan to update our Water Resource Zones (Key Dates)

Action	Complete by
Carry out a full risk-based review of our WRZs, sharing draft outputs with the EA during our regular meeting and including in our draft drought plan pre-consultation discussions	Dec 2024
Share the final outputs of the review and updated WRZ structure with our regulators and demonstrate drought plan links	Spring 2025
Publish updated proposed zonal structure at WRMP AR 2025.	June 2025
Update our internal reporting models and systems for new WRZs to allow shadow reporting. Shadow reporting, both current (WRMP24) WRZs and new WRZs for leakage, Water Balance and SDBI.	APR26, WRMP AR 26, EPA SDBI 2026
Report using only new WRZs from APR / WRMP AR 2027 onwards.	April 2027
Use our new zones for development of WRMP29 and PR29.	2027

The process we will use to update our WRZs

We will update the zones following the EA's 2016 guidance note on WRZ integrity. Figure I4.2 shows a flow chart of the key activities to ensure the new zones are compliant with this EA Guidance, and that they make sense operationally and within our models. As agreed with the EA this work was completed post submission of our WRMP with the initial view of any revision to our WRZs shared with the EA at the end 2024 and finalised in early 2025. We will report on implementation and tracking of the new resource zones in our WRMP Annual Review reporting.

Figure I4.2: The process to review our WRZs



*Temporary Use Bans (TUBs), Non-Essential Use Bans (NEUBs), Emergency Drought Orders (EDOs)

Resolving other Network Resilience Issues

For our PR24 plan we have undertaken extensive analysis of peak demand issues and how this may be affected in future by climate change and growth. We have proposed additional investment in our PR24 plan to begin to address this issue.

Case for Change

Extreme peak demand for water, most often driven by hot weather, represents a current and growing risk for the resilience of our water supply network. It is the most urgent hazard for which we require significant investment over and above the normal base expenditure, for the following reasons:

• Prolonged hot weather events are projected to increase significantly. Met Office data projections show more frequent hot weather (25°C+) and extreme hot weather (30°C+) events by 2050. Prolonged hot weather events will be more frequent than today: the hot weather event in late June 2018 (historically a 1 in20-year event), in which customers experienced severe supply disruption, can be expected to be a 1 in10-year event by 2050;

• Peak demand will increase in line with these changes to the weather. While average per capita consumption (PCC) has remained stable over the last decade and is now decreasing, water demand on hot days has increased significantly compared with cooler days over the same time period; and

• Customers are more likely to be impacted by supply disruptions. Our analysis predicts a 5% increase in supply interruptions per year, and a 10% increase in warnings that the network is running out of storage capacity. Any deterioration in service is unacceptable to customers and regulators.

Long-term solution

In the long term, our goal is to improve the resilience of our water supply network so that it can cope with the impacts of climate change. Driving this transformation will require a multi-AMP investment strategy to ensure all customers have water supplies that are resilient to climate change. The best available scientific forecast indicates we need to plan for a 30-day extreme event in order to protect services for the next 25 years.

AMP8 proposal

We propose an enhancement investment of £128m to deliver priority interventions – local and regional water transfers – to protect the customers at greatest risk of supply interruptions during hot weather. This will deliver the following benefits:

• Protecting our customers. Providing 280,643 customers with a water supply that can withstand a 30-day extreme peak demand event. This requires us to make adjustments to our systems to unlock 282Ml/d of water to ensure it is available during peak demand events; and

• Increasing system resilience. The AMP8 interventions will contribute to the system resilience required to ensure assets are resilient to the conditions experienced during periods of peak demand.

I5 Peak Demand and Critical Period Review

We have reviewed the peak week and peak month demand as seen in 2022 against our previous critical period review to test whether any other water resources become critical period constrained based on 2022 demands.

We have also reviewed operationally whether any WRZs were affected more in 2022 than in previous hot weather periods, such as 2018. Even though 2022 saw the hottest day on record and two prolonged hot spells alongside the very dry summer, we had fewer operational demand issues in 2022 than in 2018. Fewer customers went without water, and we remained within our daily abstraction licence at all sites across the summer.

Our lessons learned and overall review of 2022 has shown that we have become more resilient to short term demand issues, and planning based on Dry Year Annual Average (DYAA) remains appropriate for our WRZs.

The conclusion of our review of peak demands in 2022 is that there is no change to our previous critical period analysis which showed that currently none of our WRZs show a critical period constraint on the WRZ that give a worse SDB than our DYAA constraints. This was because overall peak demands in 2022 did not exceed those which we had tested during our critical period analysis.

However as per our PR24 Network Resilience workstream, peak demands are a growing issue, we are proposing investment in AMP8 to tackle these challenges. This work will help to ensure that critical period issues don't become a bigger problem in the future.

As we are reviewing our WRZs (Section I4) we will further appraise whether any changes to the WRZs highlight new critical period issues in WRMP29.

I6 Drought Permits

As described in our summary of 2022, we applied for three drought permits across the autumn. These were:

- River Derwent at Derwent Valley reservoirs – to reduce compensation from 54Ml/d to 34Ml/d.
    - This was granted on 14 October 2022 and was rescinded on 4 January 2023.
- River Churnet at Tittesworth Reservoir – to reduce compensation from 14.8Ml/d to 8Ml/d.
    - We applied on 14 October and withdrew our application on 4 November 2022.
- Dove Reservoirs (Staunton Harold and Foremark) – to increase annual abstraction by 3500Ml in the year to 31 Mar 2023.
    - This permit was granted 19 December and remained active up to 31 March 2023.

The Derwent and Churnet permits have been in our Drought Plans for many years. The Dove permit was first used in 2018 and added to our latest Drought Plan. Following feedback on our dWRMP, we are considering adding the Dove drought permit licence increase as a permanent scheme option to our future options list.