Water Resources Management Plan 2024

Appendix I: Drought 2022 Review

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Appendix I: 2022 Drought Year Review

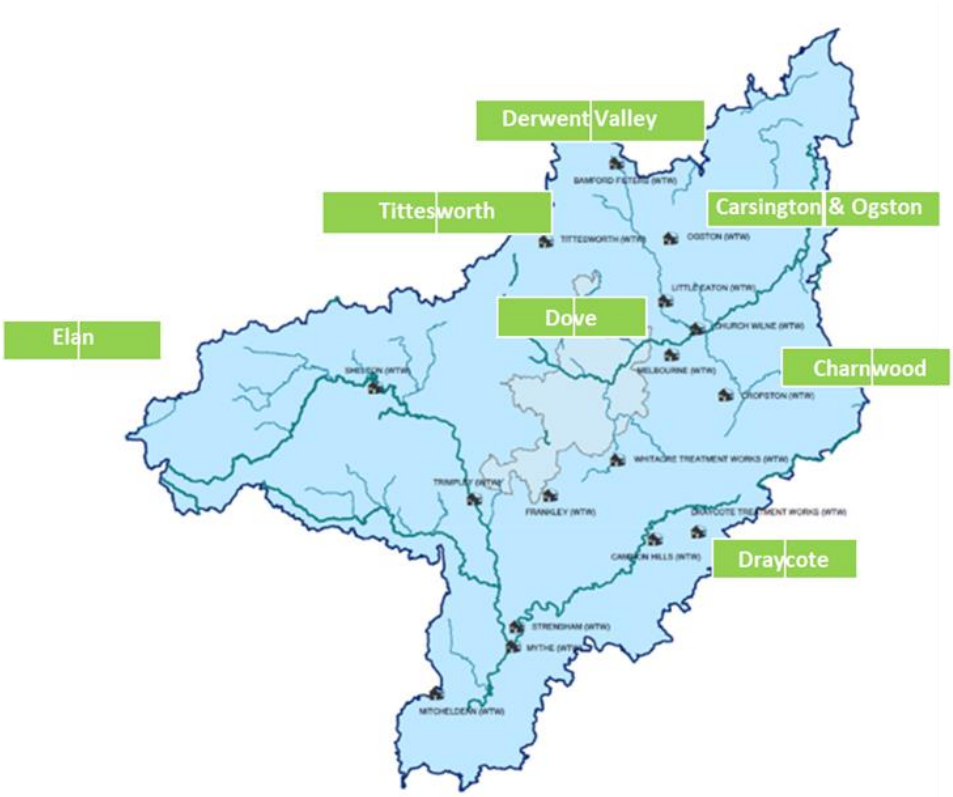
I1 A Summary of the 2022 Drought in the Severn Trent Region

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, 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 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 company. Our media and socials campaign continued asking customers to use water carefully. We also sent out text messages and emails to all costumers 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 6 months on record, there had been on 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

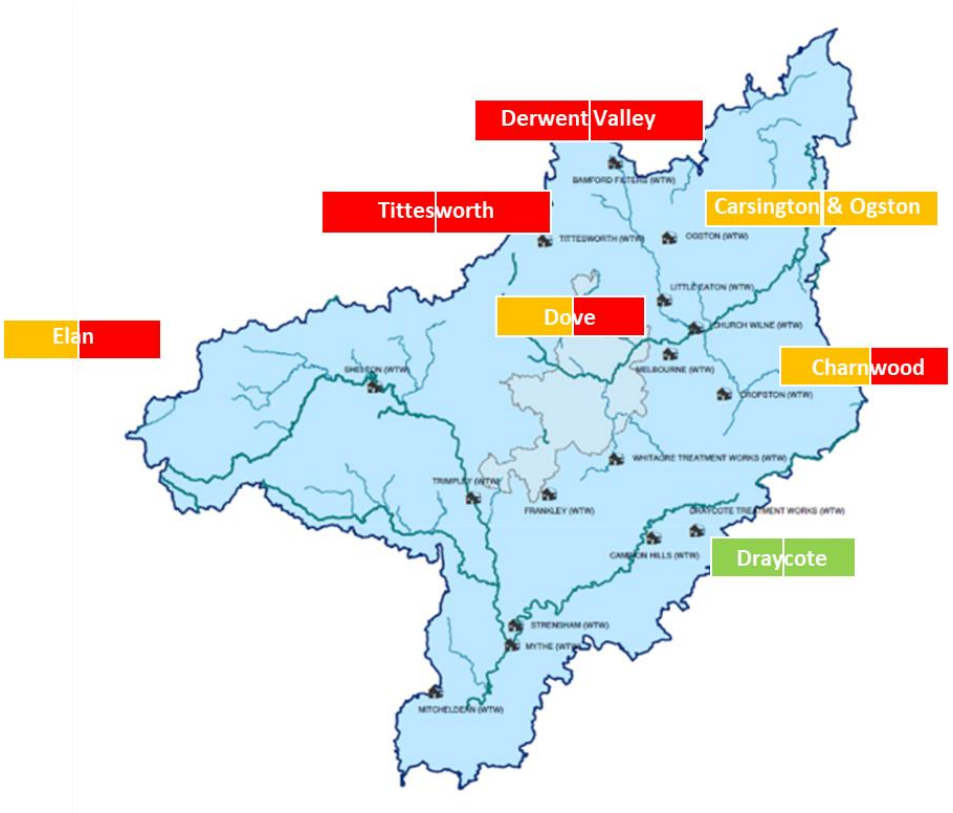
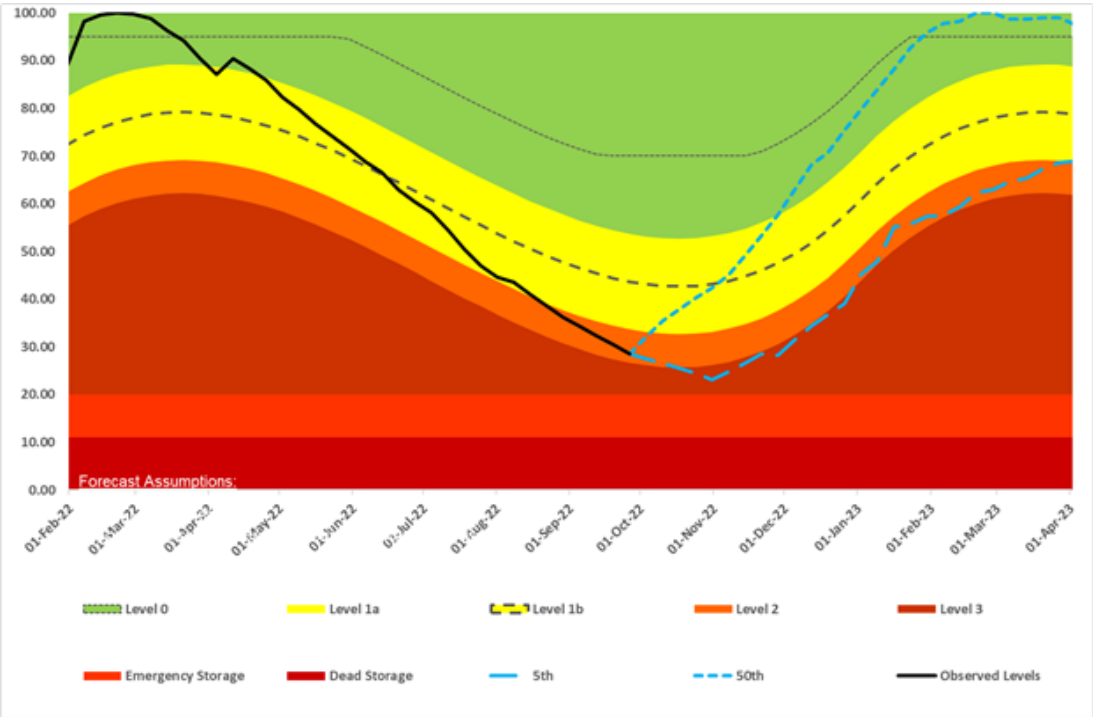
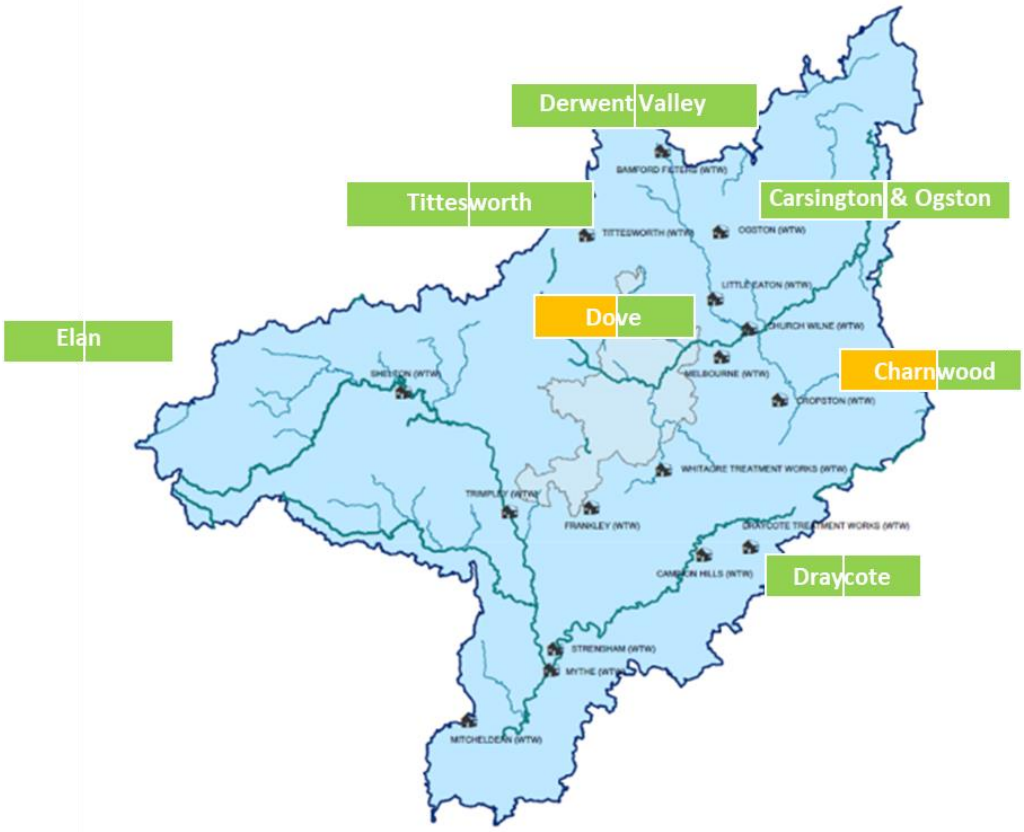


Figure I1.3 - Derwent Valley reservoir level to September 2022 (with projections, no permit)



- 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 are now 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 19200-year stochastic rainfall dataset?

We have analysed the severity of the 2022 drought against our 19200 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.

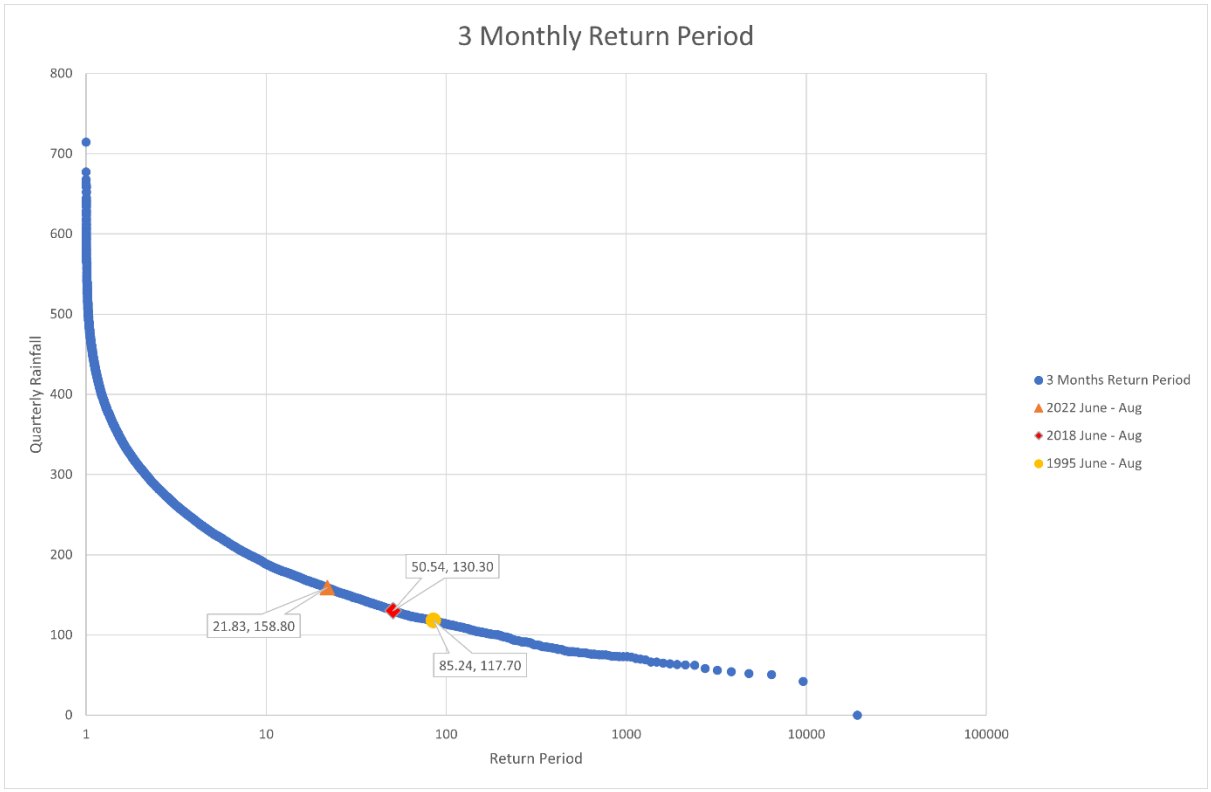
The three and six month accumulations are based on the driest periods across 2022. Three months is June to August and six months is March to August. The twelve months data is based on January to December.

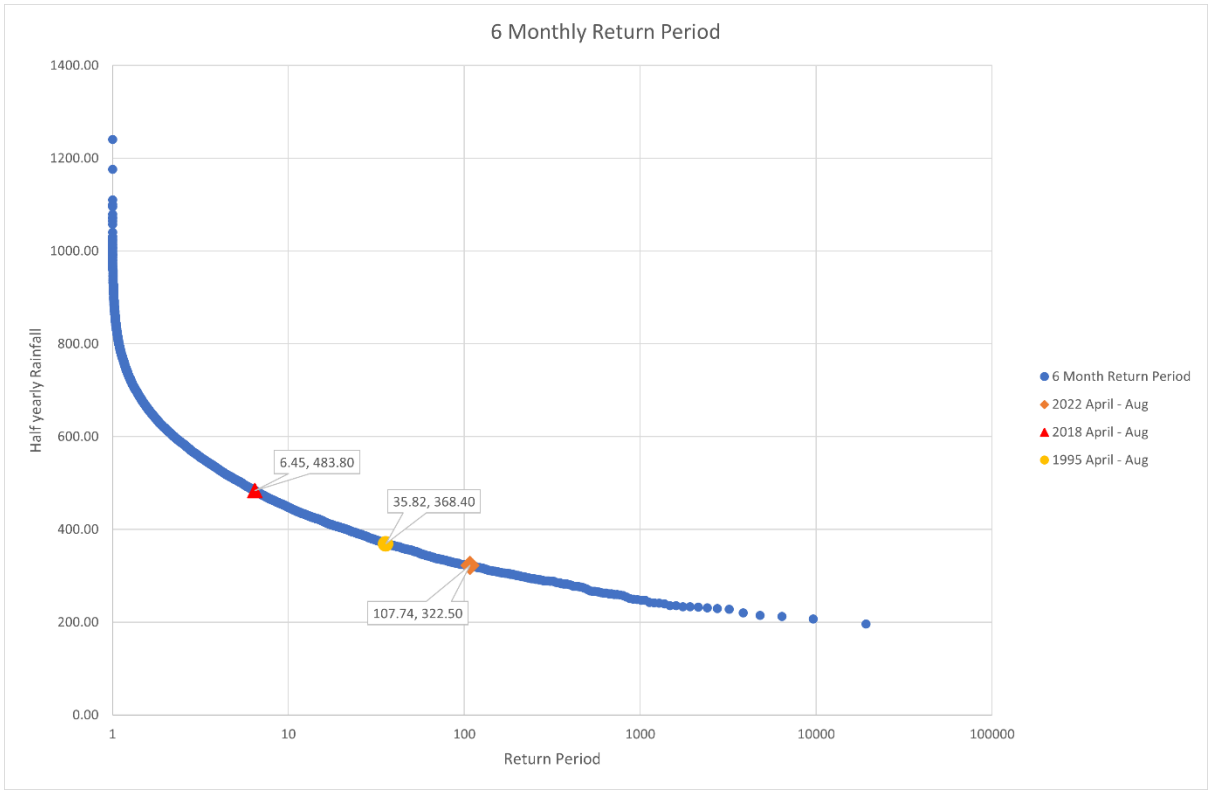
Table I1.1 - 1995, 2018 and 2022 rainfall return periods for Upper Derwent Valley against 19,200 of stochastic data

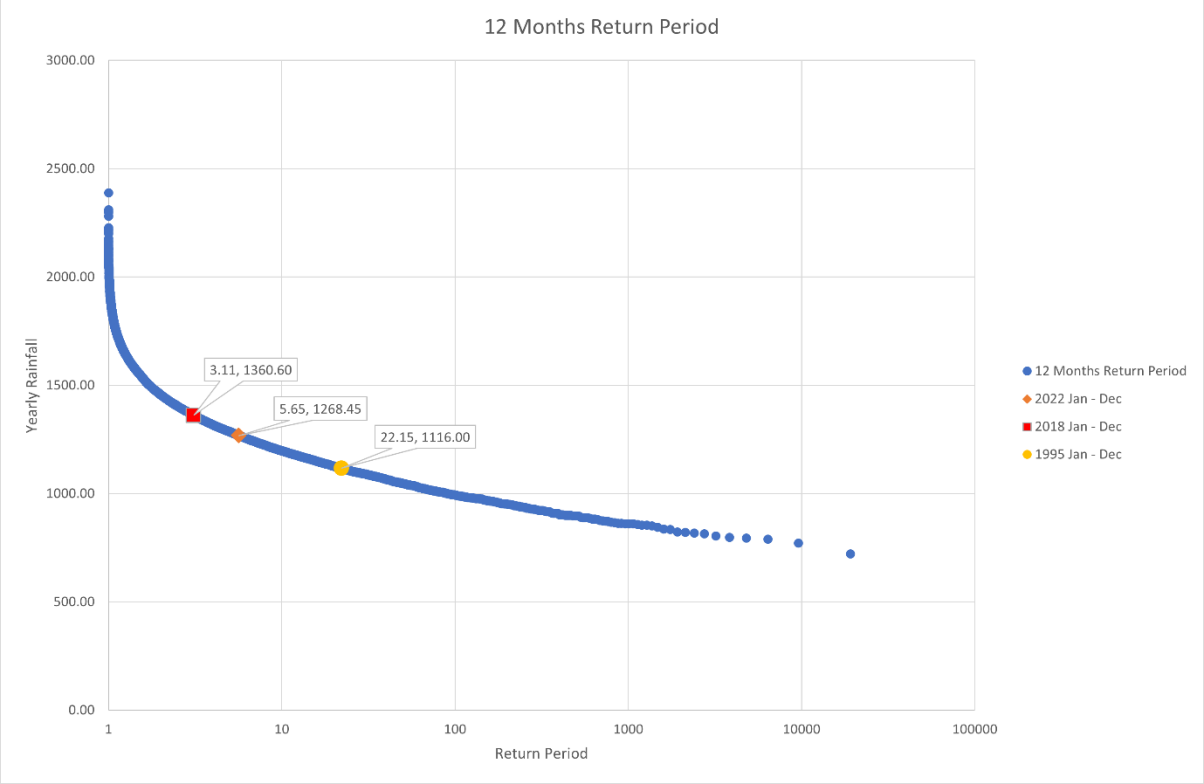
Year	3 Months	6 Months	12 Months
1995	1 in 85	1 in 35	1 in 22
2018	1 in 50	1 in 6	1 in 3
2022	1 in 21	**1 in 108**	1 in 6

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 19200 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 Severn Trent 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. We have included our key lessons learned from 2022 in the table below.

Table I2.1 - 2022 Drought event key lessons learned

Lesson Learned
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 will be incorporated into our reservoir control philosophy going forward.
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.
We have proactively decreased our abstraction from our Derwent Valley reservoirs early on in the year, which helped us protect storage to use for peak demands later in the year.
We identified key licence changes that will help our drought resilience for future dry periods.
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.
We managed our network through unprecedented high temperatures and peak demand periods; we are reviewing this against previous peak demands to further our understanding around our demand assumptions and outage forecasts.
We have a better understanding of our drought sources and have identified alternative opportunities that can be invested in now for future dry periods.
Our Tittesworth drought option utilising 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.
We now better understand the level of internal resource required from the business when applying for multiple permits.
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.
We may need to adjust and update our drought projections and reservoir control curves and will be conducting a review of these.
Improved understanding of the drought permit application process if objections from stakeholders are received.
Leakage challenges were aided by new innovation technologies focused in the most impacted areas of our region.
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.
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.

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.

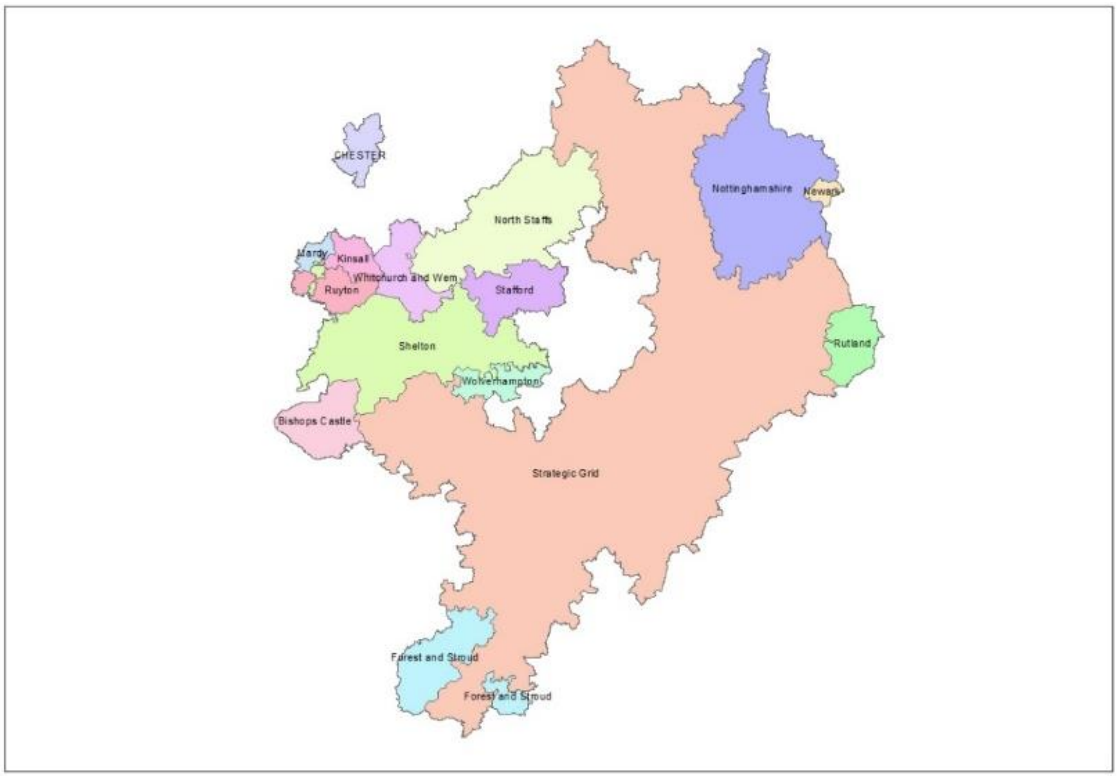
We had already seen a shift in diurnal water patterns which showed a reduction in outdoor discretionary use. We also continued to act to significantly reduce abstraction in impacted areas alongside demand management activities, which was factored into our decision not to implement TUBs.

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 dWRMP, 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 propose to carry this activity out over the next 18 -24 months, and will report on the progress and outcome of the analysis in the WRMP Annual Reviews. If the WRZ's are changed, 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).

We would like to work with the EA to agree the scope of the work we will undertake. We will continue to use our current zonal structure for this WRMP24 and PR24. We detail our proposed work plan in Table !4.1.

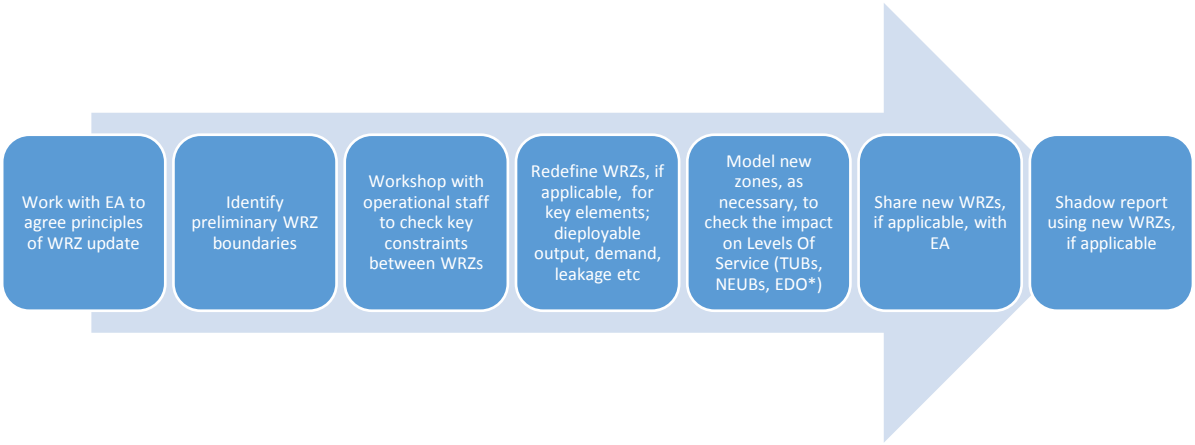
Table I4.1 - Our Plan to update our Water Resource Zones (Key Dates)

Action	Complete by
Carry out a full risk-based review of our WRZs, sharing draft outputs with the EA during our regular meetings and in the WRMP Annual Reviews.	May 2025
Publish updated proposed zonal structure, as necessary, at WRMP AR 2025.	June 2025
Shadow report, if applicable, 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, if applicable, from ARP / WRMP AR 2027 onwards.	April 2027
Use our new zones, if applicable, for development of WRMP29 and PR29.	2027

The process we will use to update our WRZs

We will update the zones, as necessary, following the EA's 2016 guidance note on WRZ integrity. Figure I4.2 shows a flow chart of the key activities we will carry out to ensure the new zones are compliant with this EA Guidance, and also that they make sense operationally and within our models.

Figure I4.2 - The process we will undertake to review our WRZs



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

I5 Peak Demand and Critical Period Review

We have reviewed the peak week and 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.

I5 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.