Draft Drought Plan

Appendix 1: Testing our Drought Plan

Appendix 1: Testing our Drought Plan

A1.1. Testing our Drought Plan against a range of drought scenarios

The latest Environment Agency Drought Plan guidance[1] requires us to test our drought triggers using selected worked examples. These should demonstrate how we would expect our Drought Plan to work under a range of droughts, including:

- How our drought triggers would work in different droughts.
- What actions we take in different droughts.
- The expected time frames and durations for our actions.
- The effects of a range of droughts such as the worst on the record.

The scenarios used should include the same severity of drought used in our baseline planning assumptions for the WRMP24 and a plausible more extreme drought.

In line with this guidance, we have carried out drought scenario analyses to test our drought triggers across all Water Resource Zones (WRZs) and the outcome of these analyses are provided for each WRZ in this appendix. These analyses included using individual WRZ design droughts, which the WRMP24 baseline supply forecast calculated for a 1 in 500 drought return period, and more severe droughts from our drought libraries.

In each drought scenario we modelled a demand scenario which was the greater of the annual average dry year demand forecast from our WRMP24 or a historical observed high demand year, such as 2022.

The scenario testing has been carried out using mass balance models of our WRZs that reflect the water supply system and are designed in terms of raw water storage, licence and infrastructure constraints. This approach allows us to input river flows and supply demands from simulated and historical droughts into the model and simulate the operation of our WRZs under these conditions.

The analysis of the modelling assessment, and the performance of the WRZ in the context of each drought, focuses on the key attributes of the system. This typically requires comparing the simulated raw water storage against our drought management zones defined by the reservoir control curves. Storage therefore can be used to determine our operational response during a drought and under normal operation.

In our WRZs that experience a peak demand risk due to drought conditions our testing is carried out by comparing forecast demand over the planning period of the drought plan against existing infrastructure and licence constraints.

A1.2. Colliford WRZ drought assessments

The Colliford WRZ covers most of Cornwall, from Saltash north to Launceston, then west to Boscastle. There are multiple raw water reservoirs in this zone but the largest is Colliford reservoir, situated on Bodmin Moor. There is a transfer between the Roadford and Colliford WRZ, with water predominantly transferred into the Colliford WRZ. The WRZ's key

[1] Defra (2025) *Water Company Drought Plan Guideline (2025).* Available at: https://www.gov.uk/government/publications/water-company-drought-plan-guideline-2025/water-company-drought-plan-guideline-2025

abstraction is licenced via the River Fowey abstraction licence, which covers abstraction for public water supply and the Colliford reservoir winter pumped storage scheme. Colliford reservoir has a pumped storage scheme that permits abstractions from the River Fowey to be pumped into Colliford reservoir, supplementing the natural inflow to the reservoir and therefore boosting winter refill.

The drought resilience of Colliford WRZ is mainly determined by the availability of raw water held in storage, therefore reservoir control curves are used as drought triggers to inform how we respond operationally to drought. The triggers also help us consider when we should implement drought actions to reduce to demand and, if necessary, obtain additional water supply.

A specified volume of Colliford reservoir storage is reserved for fisheries bank releases. The Environment Agency decides when and how the fisheries bank will be used during the year. South West Water makes fisheries bank releases as and when the Environment Agency requests them.

The reservoir control curves for Colliford WRZ have been updated since Drought Plan 2022 based on the lessons learned from the 2022 drought. The changes were primarily raising the storage levels that each drought management zone is triggered and creating a larger area between each zone, allowing drought measures to be prepared earlier and implemented with enough time to provide a benefit. Additionally, this update moves to a single strategic reservoir curve at Colliford Reservoir, rather than triggers associated with multiple reservoirs across the WRZ. One set of triggers gives clarity to the timing of drought actions, reducing the complexity of multiple triggers, some of which don't lead to distinct actions. These drought levels align to the Environment Agency's drought zones. The new control curves, shown in Figure 1.1, were derived using the gauged historical river flow record and scenario testing against our worst historical and design drought, which is explored in the next section.

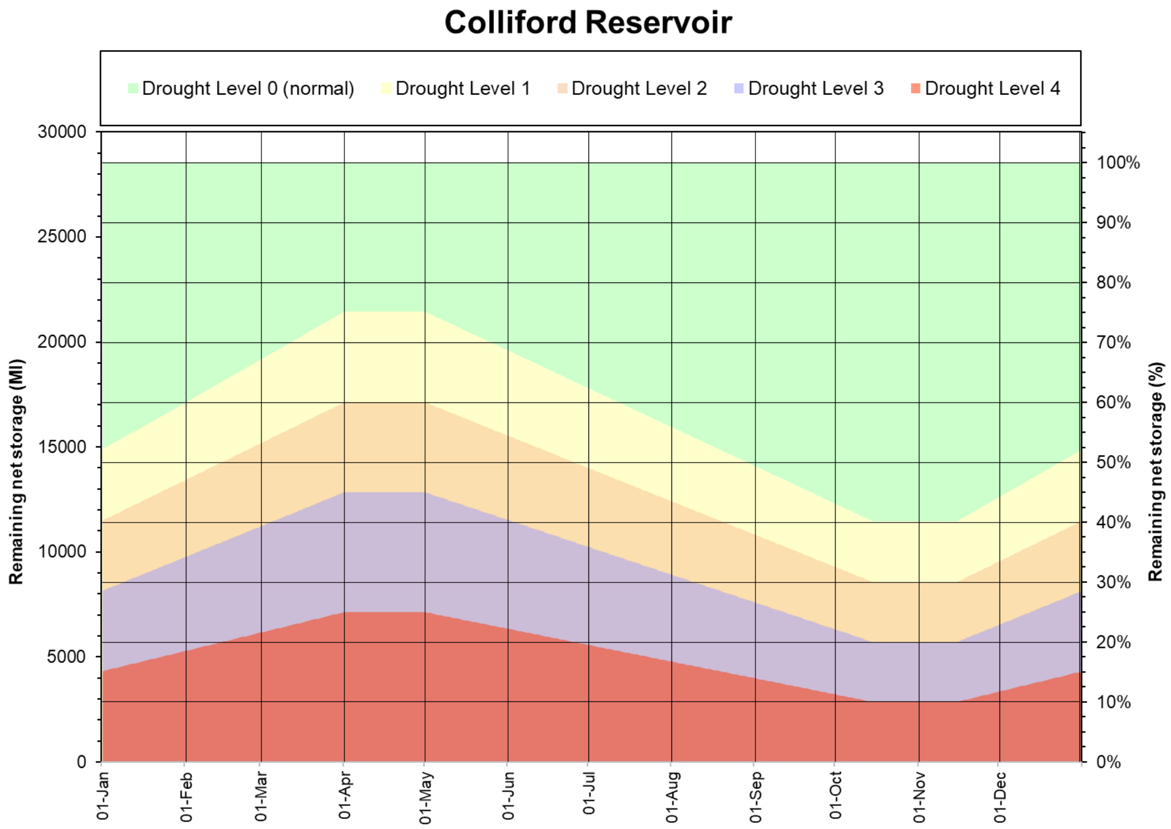

Figure 1.1: Reservoir storage drought trigger curves for Colliford Reservoir

Table 1.1: Colliford drought management zones, corresponding EA drought levels and potential actions that can be taken within each zone

EA Drought Stage	EA Drought Level	Company Drought Level	Demand Actions	Supply Actions
Normal	0 (BAU)	0	Routine demand management actions	No additional actions – use of existing sources
Prolonged dry weather	1	1	• Enhanced media campaign • Increased leakage management • Increase company water efficiency	• Optimisation of supply network • Reduction of treatment works losses • Drought action: College WTW - booster pumping to support Wendron WTW supply area
Drought	2	2	• Temporary Use Bans (TUBs) • Further enhanced media campaign • Further water efficiency • Leakage management	• Further optimisation of network Drought permits with minor environmental impacts: • River Fowey at Restormel - increase annual abstraction limit • Park Lake - increase daily abstraction limit • Hawk's Tor Pit - abstract from new source • River Cober at Wendron - increase annual abstraction limit
	3a	3a	• Non-Essential Use Bans (NEUBs) • Media campaign tied in to national messaging	Drought permits with moderate environmental impacts: • Stannon Lake - increase daily abstraction limit • Colliford Reservoir - reduce compensation flow • Siblyback reservoir – reduce compensation flow
Severe drought	3b	3b	• Pressure management • Some exemptions removed from TUBs and NEUBs	Drought permits with major environmental impacts: • Drift reservoir – reduce compensation flow

South West Water Bournemouth Water BRISTOL WATER Isles of Scilly Water

				• Stithians reservoir – reduce compensation flow • Colliford – reduce fish bank release
	4	4	Emergency plan for drought	Emergency plan for drought

A1.2.1. Colliford WRZ worst historical drought

The worst historical drought on record in Colliford WRZ is 1975-1976. Due to the multi-season nature of this WRZ, the below scenario represents 7 years from 1975-1981 inclusive, allowing it to show a full recovery to spill after drought. This worked example uses 2022 unconstrained DI.

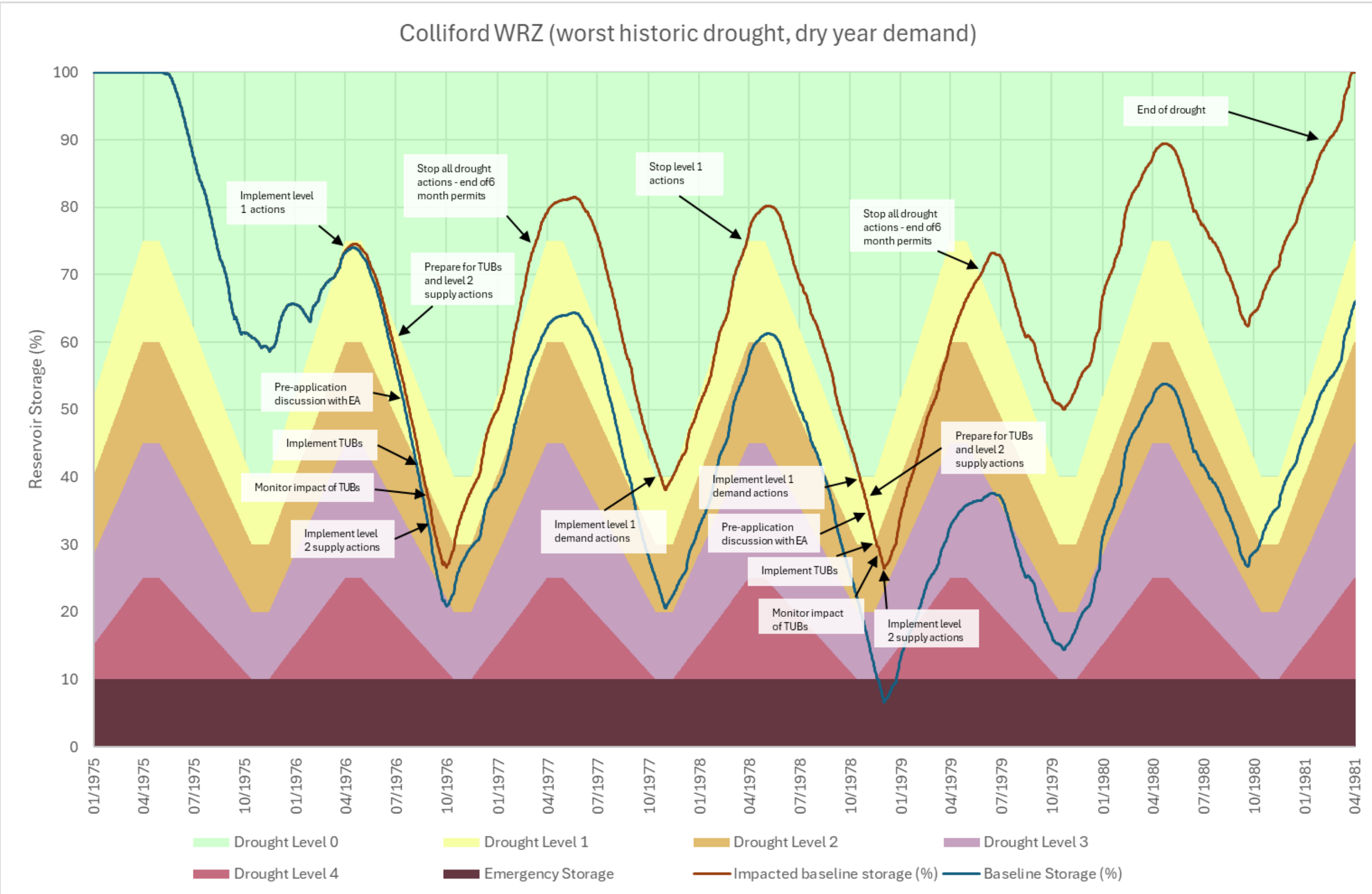

Figure 1.2: Colliford reservoir storage projections for the historical 1975/76 drought. The baseline storage (blue line) is the simulated reservoir storage with no drought actions. The forecast storage scenario (red line) is the simulated reservoir storage for the same drought with supply and demand drought actions applied as outlined by the annotations.

Table 1.2: Example of the timing and implementation of actions and decisions that would be made if the Colliford WRZ experienced a repeat of the 1975/76 historical drought.

Time period, drought level, operational mode	Actions and Decisions	Environmental Monitoring
January 1975 – October 1975	Routine monitoring of water resource position	Normal level of monitoring

South West Water Bournemouth Water BRISTOL WATER Isles of Scilly Water

Level 0 – Normal Operation		
November – March 1976 Level 0 – Normal Operation	Routine winter recharge • Operation of Restormel winter pumped storage scheme Level 1 preparation • Prepare for enhanced media campaign • Prepare for level 1 leakage reductions • Prepare level 1 company action: College WTW - booster pumping to support Wendron WTW supply area	Enhanced monitoring
April 1976 Level 1 – Drought Plan Operation Invoke Drought Plan	Reservoir storage enters drought level 1 • Enhanced media campaign • Company level 1 actions: increase leakage management, optimise supply network, increase company water efficiency, reduce treatment works losses, College WTW - booster pumping to support Wendron WTW supply area	Enhanced monitoring
June-July 1976 Level 1 – Drought Plan Operation	Preparation for drought level 2 • Prepare material for TUBs • Update ESoR, drought permits and EARs • Site maintenance required for level 2 permits • Hold pre-application discussions with EA on TUBs and drought permits	Relevant monitoring for level 2 permits
August 1976 Level 2 - Drought Plan Operation	Reservoir storage enters drought level 2 • Implement TUBs • Submit drought permit applications to EA • Further enhanced media campaign • Further company water efficiency and leakage management • Monitor effectiveness of DI management actions	Relevant monitoring for level 2 permits
September 1976 – March 1977 Level 2 - Drought Plan Operation	Implement level 2 supply-side actions: • River Fowey at Restormel - increase annual abstraction limit (effective from November) • Park Lake - increase daily abstraction limit • Hawk's Tor Pit - abstract from new source • River Cober at Wendron - increase annual abstraction limit	Relevant monitoring for level 2 permits
March 1977 Level 0 – Normal Operation	Level 2 actions end as permits run out • Storage has recovered to level 0 • TUBs were kept on whilst level 2 actions in use, now stopped • Level 1 actions cease	Relevant monitoring for level 2 permits
March – October 1977 Level 0 – Normal Operation	Routine monitoring of water resource position, with attention paid to recovery	Normal level of monitoring

November 1977 – April 1978 Level 1 – Drought Plan Operation	Reservoir storage enters drought level 1 • Enhanced media campaign • Company level 1 actions: increase leakage management, optimise supply network, increase company water efficiency, reduce treatment works losses, College WTW - booster pumping to support Wendron WTW supply area	Enhanced monitoring
May – October 1978 Level 0 – Normal Operation	Routine monitoring of water resource position, with attention paid to drawdown rate	Normal level of monitoring
Early November 1978 Level 1 – Drought Plan Operation Invoke Drought Plan	Reservoir storage enters drought level 1 • Enhanced media campaign • Company level 1 actions: increase leakage management, optimise supply network, increase company water efficiency, reduce treatment works losses, College WTW - booster pumping to support Wendron WTW supply area	Enhanced monitoring
Mid November 1978 Level 1 – Drought Plan Operation	Preparation for drought level 2 • Prepare material for TUBs • Update ESoR, drought permits and EARs • Site maintenance required for level 2 permits Hold pre-application discussions with EA on TUBs and drought permits	Relevant monitoring for level 2 permits
Late November 1978 Level 2 - Drought Plan Operation	Reservoir storage enters drought level 2 • Implement TUBs • Submit drought permit applications to EA • Further enhanced media campaign • Further company water efficiency and leakage management Monitor effectiveness of DI management actions	Relevant monitoring for level 2 permits
December 1978 – June 1979 Level 2 - Drought Plan Operation	Implement level 2 supply-side actions: • River Fowey at Restormel - increase annual abstraction limit (effective from November) • Park Lake - increase daily abstraction limit • Hawk's Tor Pit - abstract from new source • River Cober at Wendron - increase annual abstraction limit	Relevant monitoring for level 2 permits
June 1979 Level 0 – Normal Operation	Level 2 actions end as permits run out • Storage has recovered to level 0 • TUBs were kept on whilst level 2 actions in use, now stopped • Level 1 actions cease	Relevant monitoring for level 2 permits
July 1979 – February 1980	Storage remains in level 0 • Continued monitoring of reservoir recovery	Normal level of monitoring

Level 0 – Normal Operation		
February 1980 Level 0 – Normal Operation	Reservoir storage surpasses 90% before April, meaning drought officially ended	Normal level of monitoring

In summary, this worked example shows the impact of a multi-season drought and prolonged period of low rainfall on Colliford WRZ. April to August 1976 contained 2 heatwaves with extremely high temperatures, with the main heatwave coinciding with the summer holiday season.

Drought actions are shown to be vital in recovery, as shown by the cumulative difference between reservoir storage with and without actions implemented. When storage drops below level 1, temporary booster pumps allow College WTW to support the Wendron supply area. Once in level 2, drought permits for the River Fowey at Restormel, Park Lake, Hawk's Tor Pit and the River Cober at Wendron help to increase supply available.

Colliford is considered to be recovered from drought when storage reaches 90% at the beginning of spring, in time for the proceeding summer drawdown. In this example, recovery begins in the summer of 1979 when drawdown is not as high as previous years, leading to full recovery by spring 1981.

A1.2.2. Colliford WRZ 1:500 design drought

The following worked example is a stochastic variant of 1975-80 historical flows, and was calculated as having an approximately 1 in 500 year return period. This drought has been used to show the type of actions that may be taken in response to such conditions in Colliford WRZ.

The response of the Colliford reservoir storage to this drought under the unconstrained 2022 demand scenario is set out in the graph in Figure **Error! No text of specified style in document.**.3. Further details of how we would prepare and implement demand and supply actions under this scenario is shown in Table 1.3: Example of the timing and implementation of actions and decisions that would be made if the Colliford WRZ experienced in the WRMP24 1 in 500 design drought.

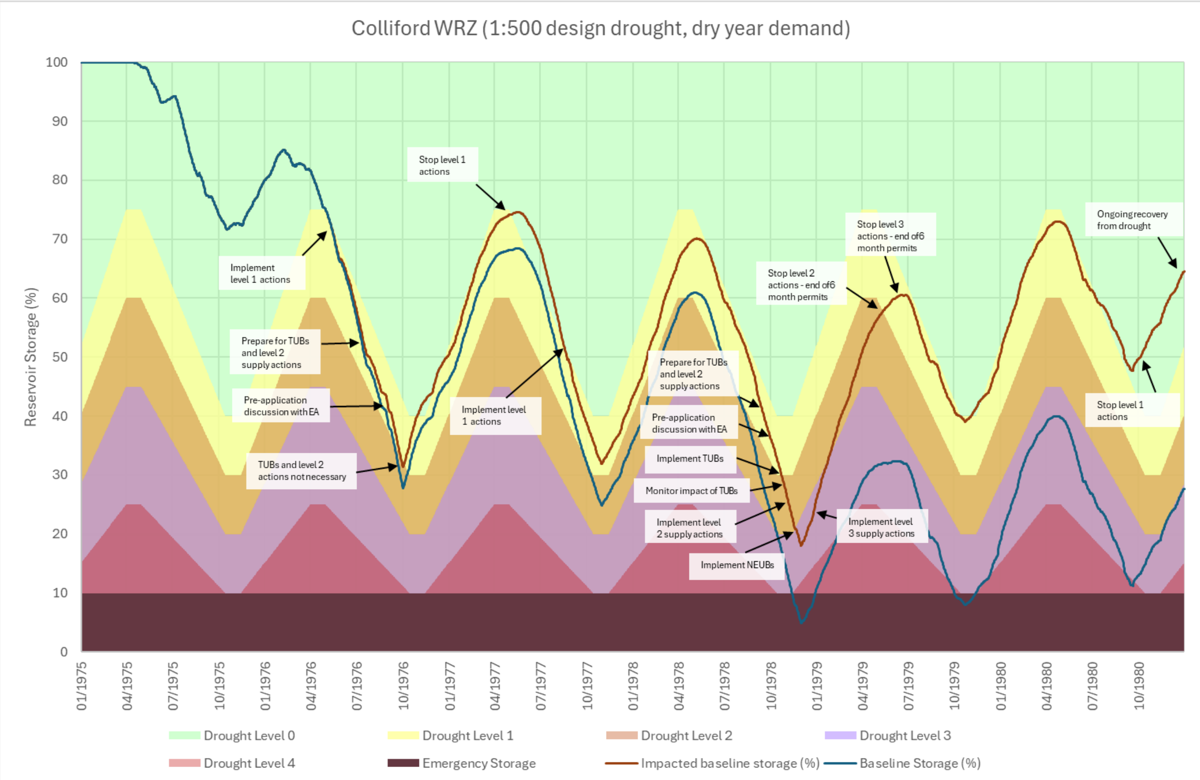

Figure 1.3: Colliford reservoir storage projections for the WRMP24 1 in 500 design drought. The baseline storage (blue line) is the simulated reservoir storage with no drought actions. The forecast storage scenario (red line) is the simulated reservoir storage for the same drought with supply and demand drought actions applied as outlined by the annotations.

Table 1.3: Example of the timing and implementation of actions and decisions that would be made if the Colliford WRZ experienced in the WRMP24 1 in 500 design drought

Time period, drought level, operational mode	Actions and Decisions	Environmental Monitoring
January 1975 – March 1976 Level 0 – Normal Operation	Routine monitoring of water resource position	Normal level of monitoring

April - May 1976 Level 0 – Normal Operation	Level 1 preparation • Prepare for enhanced media campaign • Prepare for level 1 leakage reductions • Prepare level 1 company action: install College WTW - booster pumping to support Wendron WTW supply area	Enhanced monitoring
May - July 1976 Level 1 – Drought Plan Operation Invoke Drought Plan	Reservoir storage enters drought level 1 • Enhanced media campaign • Company level 1 actions: increase leakage management, optimise supply network, increase company water efficiency, reduce treatment works losses, College WTW - booster pumping to support Wendron WTW supply area	Enhanced monitoring
July - September 1976 Level 1 – Drought Plan Operation	Preparation for drought level 2 • Prepare material for TUBs • Update ESoR, drought permits and EARs • Site maintenance required for level 2 permits • Hold pre-application discussions with EA on TUBs and drought permits	Relevant monitoring for level 2 permits
October 1976 Level 1 - Drought Plan Operation	Reservoir storage does not invoke level 2 of Drought Plan	Relevant monitoring for level 2 permits
October 1976 – May 1977 Level 1 - Drought Plan Operation	Drought level 1 actions continue as before	Enhanced monitoring
May - September 1977 Level 0 – Normal Operation	Drought level 1 actions stop	Normal level of monitoring
September 1977 – September 1978 Level 1 – Drought Plan Operation	Reservoir storage enters drought level 1 • Enhanced media campaign • Company level 1 actions: increase leakage management, optimise supply network, increase company water efficiency, reduce treatment works losses, College WTW - booster pumping to support Wendron WTW supply area	Enhanced monitoring
September 1978 Level 1 – Drought Plan Operation	Preparation for drought level 2 • Prepare material for TUBs • Update ESoR, drought permits and EARs • Site maintenance required for level 2 permits Hold pre-application discussions with EA on TUBs and drought permits	Relevant monitoring for level 2 permits

October 1978 Level 2 - Drought Plan Operation Invoke Drought Plan	Reservoir storage enters drought level 2 • Implement TUBs • Submit drought permit applications to EA • Further enhanced media campaign • Further company water efficiency and leakage management • Monitor effectiveness of DI management actions	Relevant monitoring for level 2 permits
Early November 1978 Level 2 – Drought Plan Operation	Implement level 2 supply-side actions: • River Fowey at Restormel - increase annual abstraction limit (effective from November) • Park Lake - increase daily abstraction limit • Hawk's Tor Pit - abstract from new source • River Cober at Wendron - increase annual abstraction limit	Relevant monitoring for level 2 permits
Late November 1978 Level 3 - Drought Plan Operation	Reservoir storage enters drought level 3 • Implement NEUBs	Relevant monitoring for level 2 and 3 permits
Late December 1978 Level 3 – Drought Plan Operation	Implement level 3 supply-side actions: • Stannon Lake - increase daily abstraction limit	Relevant monitoring for level 2 and 3 permits
May 1979 Level 2 – Drought Plan Operation	Level 2 actions end as permits run out • Storage has recovered to level 2, and very nearly level 1 • TUBs were kept on whilst level 2 actions in use, now stopped	Relevant monitoring for level 2 and 3 permits
June 1979 Level 1 – Drought Plan Operation	Level 3 actions end as permits run out • Storage recovered to level 1 • NEUBs were kept on whilst level 3 actions in use, now stopped	Enhanced monitoring
October 1980 Level 0 – Normal Operation	Reservoir storage recovers to level 0 and shows signs of recovery	Normal level of monitoring
December 1980 Level 0 – Normal Operation	Reservoir has not fully recovered to 90% by April, showing the multi-season nature of Colliford refill. However, recovery has improved on recent drought years.	Normal level of monitoring

In summary, this worked example shows the impact of an extreme 1 in 500 multi-season stochastic drought and prolonged period of low rainfall on Colliford WRZ.

Drought actions are shown to be vital in ensuring drought resilience, as shown by the cumulative difference between reservoir storage with and without actions implemented. When storage drops below level 1, temporary booster pumps allow College WTW to support the Wendron supply area. Once in level 2, TUBs reduce demand and drought permits for the River Fowey at Restormel, Park Lake, Hawk’s Tor Pit and the River Cober at Wendron help to increase supply available. In level 3, NEUBs reduce demand and a drought permit at Stannon Lake increases supply.

Colliford is considered to have recovered from drought when storage reaches 90% at the beginning of spring, in time for the proceeding summer drawdown. The reservoir does not fully recover within this scenario’s timeframe, showing the multi-season nature of Colliford WRZ.

A1.3. Roadford WRZ drought assessments

Roadford WRZ largely covers Devon from Plymouth, the South Hams and Torbay in the South, to Bideford and Barnstable in the North. The zone also includes parts of North East Cornwall. Roadford reservoir is used in conjunction with other localised reservoir sources and groundwater sources in the zone. Since the last drought plan, a licence has been granted for a pump storage scheme from the river Lyd into Roadford reservoir to aid storage recovery over the winter months (1st November – 31st March inclusive) which came into operation in spring 2023. A small proportion of water is supplied from the Wimbleball zone for a month in the summer. There is also one small transfer from Colliford WRZ to Roadford WRZ via the Camelford to Bude transfer and one small transfer from Roadford WRZ to Colliford WRZ from the Plymouth to Saltash.

A specified volume of Roadford reservoir storage is reserved for fisheries bank releases. The Environment Agency decides when and how the fisheries bank will be used during the year. SWW makes fisheries bank releases as and when the Environment Agency requests them.

The drought resilience of Roadford WRZ is mainly determined by the availability of raw water held in storage, therefore reservoir control curves are used as drought triggers to inform how we respond operationally to drought. The triggers also help us consider when we should implement drought actions to reduce to demand and, if necessary, obtain additional water supply.

The reservoir drought trigger curves for Roadford have been updated since Drought Plan 22 based on the lessons learned from the 2022 drought. The key change being that drought levels 3 and 4 that have been raised and that drought level 1 has been lowered in winter, in order to improve the timing of triggering actions as a drought develops. The new control curves, shown in Figure 1.4, were derived using naturalised historical river flows including 2022 flows and scenario testing against our worst historical and Design drought, which is explored in the next section. These drought levels align to the Environment agency's drought zones.

Since Drought Plan 22, drought trigger curves have been removed from the smaller local reservoirs in the WRZ as they do not trigger specific drought actions. Drought actions are triggered from the strategic Roadford Reservoir in the WRZ.

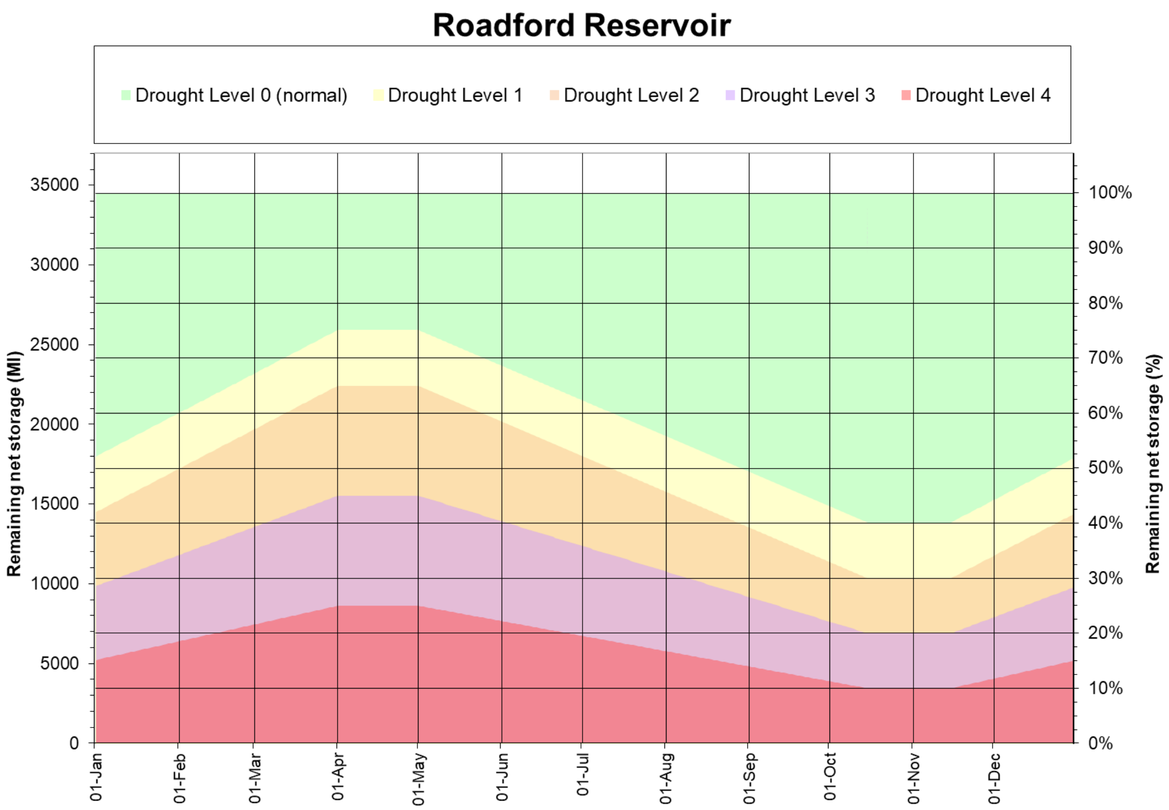

Figure 1.4: Reservoir storage drought trigger curves for Roadford Reservoir

Table 1.4: Roadford drought management zones, corresponding EA drought levels and potential actions that can be taken within each zone

EA Drought Stage	EA Drought Level	Company Drought Level	Demand Actions	Supply Actions
Normal	0 (BAU)	0	Routine demand management actions	No additional actions normal operation of existing sources
Prolonged dry weather	1	1	• Enhanced media campaign • Increased leakage management • Increase company water efficiency	• Optimisation of supply network • Reduction of treatment works losses
Drought	2	2	• Temporary Use Bans (TUBs) • Further enhanced media campaign • Further water efficiency • Leakage management	• Further optimisation of network including drought action abstraction from Slade Drought permits with minor environmental impacts: • Littlehempston boreholes and river Dart aggregate daily and annual licence

				• Roadford reservoir reduce compensation flow
	3a	3a	• Non-Essential Use Bans (NEUBs) • Media campaign tied in to national messaging	Drought permits with moderate environmental impacts: • Extend Lyd to Roadford April - May
Severe drought	3b	3b	• Pressure management • Some exemptions removed from TUBs and NEUBs	Drought permits with major environmental impacts: reduce compensation flows • Avon • Burrator • Fernworthy • Trenchford • Meldon • Upper Tamar lake • Roadford reduce fish bank release
	4	4	Emergency plan for drought	Emergency plan for drought

A1.3.1. Roadford WRZ worst historical drought

The historical record is based on 67 years of flow data spanning from 1957-2024. The worst historical drought on record in Roadford WRZ is 1975-1976 with a return period of around 1 in 200 years. Roadford Reservoir is a multi-season reservoir and hence is more vulnerable to longer periods of drought. Therefore, this worked example represents an extended period of drought including years from January 1975- April 1980 inclusive, to show when Roadford has fully recovered. This event shows the impact of a dry winter that was experienced in 1975-1976 which hindered the recharge of Roadford storage meaning Roadford would be approaching level 1 drought conditions ahead of the summer drawdown.

The response of Roadford reservoir storage to this drought under unconstrained 2022 demand is set out in the graph in Figure 1.5 and includes storage responses with and without drought actions. Further details of how we would prepare and implement demand and supply actions under this scenario is shown in Table 1.5.

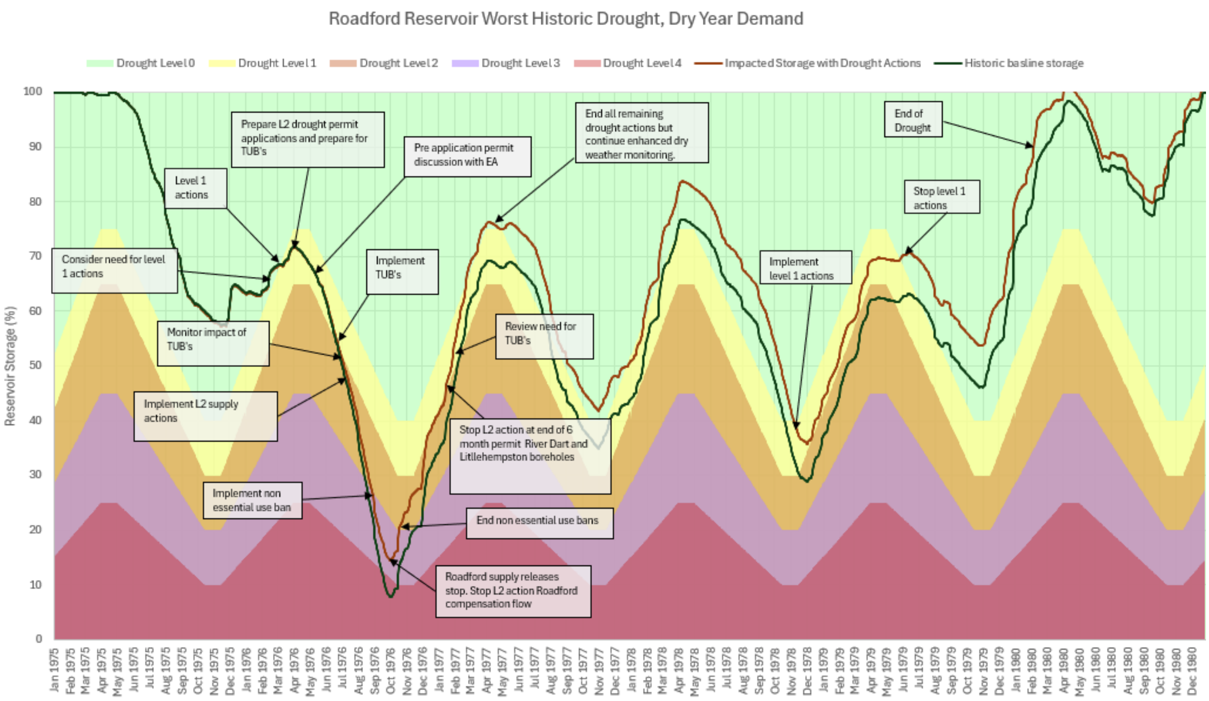

Figure 1.5: Roadford reservoir storage projections for the historical 1975/76 drought. The baseline storage (blue line) is the simulated reservoir storage with no drought actions. The forecast storage scenario (red line) is the simulated reservoir storage for the same drought with supply and demand drought actions applied as outlined by the annotations.

Table 1.5: Example of the timing and implementation of actions and decisions that would be made if the Roadford WRZ experienced a repeat of the 1975/76 historical drought.

Time period, drought level, operational mode	Actions and Decisions	Environmental Monitoring
January – December 1975 Level 0 – Normal Operation	Routine operation and monitoring of water resource position	Normal level of monitoring
November 1975 – January 1976 Level 0 – dry weather operation	• Dry weather experienced over winter month resulting in reduction of storage ability to recover	Normal level of monitoring
February 1976 Level 0 – dry weather operation	• Roadford storage on upward trend but is approaching level 1 • Prepare for level 1 demand actions, enhanced messaging, leakage and pressure management.	Normal level of monitoring
March 1976 – April 1976	• Continued dry weather resulting in river flows dropping and requiring	Enhanced monitoring

Level 1 - Drought plan Operation	Roadford supply releases to start in April • Beginning of March Roadford drops into level 1 • Implement Company level 1 actions: increase leakage management, optimise supply network, increase company water efficiency, reduce treatment works losses. • Prepare for TUBs	
May 1976 – June 1976 Level 1 - Drought Plan Operation	• End of May Projections indicate that storage is likely to drop to Drought Level 2 in around 4 weeks time • Prepare for TUBs • Prepare drought permits, EAR, ESOR • Undertake any site maintenance required for level 2 permits • Mid June projections indicate storage likely to drop to level 2 in ~ 2 weeks • Pre application discussions with EA mid June	Enhanced monitoring
End June 1976 - July 1976 Level 2 – Drought Plan Operation	• End of June storage drops to drought level 2 • Implement TUBs end of June • Submit drought permit applications to EA end of June for determination of drought permit application • Monitor effectiveness of DI management actions • Continue level 1 actions • Implement level 2 supply action abstraction from Slade	Enhanced monitoring • Monitoring related to level 2 permits
July 1976 – end August Level 2 – Drought Plan Operation	Reservoir storage in level 2 • Further enhanced media campaign • Further company water efficiency and leakage management • Continue to analyse demand reductions from TUBs and enhanced media campaign over July • Implement level 2 supply side actions. - Roadford comp flow used for abstraction when Roadford making supply releases - Increase abstraction from River Dart and Littlehempston Boreholes	Enhanced monitoring • Monitoring related to level 2 permits

	• Projections indicate storage will drop into level 3 end of August • Prepare for NEUBS beginning of August • Implement NEUBS end August • Prepare for Level 3a Drought permits Prepare for Level 3b Drought Permits/Orders	
September 1976 Level 3a – Drought Plan Operation	Reservoir storage in drought level 3a • Monitor effectiveness of NEUBs • Due to time of year in level 3a, no level 3a supply side actions implemented • Beginning of period of rainfall late September/ beginning of October, storage begins on upward trend	Enhanced monitoring • Monitoring related to level 2 permits
October 1976 Level 3a – Drought plan operation	• Continued significant rainfall • River flows recovered enough to stop Roadford Supply releases • Updated storage forecasts suggest storage will be out of level 3a mid-end October. • Decide not to implement 3b actions • Stop drought permit Roadford compensation flow	Enhanced monitoring • Monitoring related to level 2 permits
Late October 1976 – mid January 1977 Level 2 – Drought plan operation	Storage in level 2 • End NEUBs • Continue with level 1 and level 2 demand side actions • Continue use of River Dart and Littlehempston drought permit • Significant continuation of rainfall • Start Lyd to Roadford pump storage November to aid winter recovery	Enhanced monitoring • Monitoring related to level 2 permits
Mid January 1977 Level 1 – Drought plan operation	Storage recovers to Drought level 1 • End TUBs • End of 6 month permit period for River Dart and Littlehempston, stop using permit. • Continue level 1 drought actions • Continue operation of Lyd to Roadford pump storage	Enhanced monitoring
End January – March 1977 Level 1 – Drought plan operation	• Review the need for TUBs • Continue level 1 drought actions • Continue operation of Lyd to Roadford pump storage	Enhanced monitoring

April – December 1977 Level 0	Storage out of drought level 1 beginning April • End all level 1 drought actions and TUBs • Monitor storage using storage projections as levels still close to level 1 drought zone • Lyd to Roadford pump storage begins November	Normal level of monitoring
January 1978 Level 1 – consider need for drought plan operation	Storage enters level 1 • Review the need for level 1 drought actions • End of January storage rises out of drought level 1, decide not to implement actions	Enhanced monitoring
February 1978 – October 1978	Routine operation and monitoring of water resource position • Winter operation of Lyd to Roadford pump storage feb – March • End October 1978 consider the need for level 1 drought actions	Normal level of monitoring
November - December 1978 Level 1 – Drought plan operation	Storage enters level 1 • Implement Company level 1 actions: increase leakage management, optimise supply network, increase company water efficiency, reduce treatment works losses. • Monitor storage projections closely • Consider the need for TUBs and drought permit applications • Operation of Lyd – Roadford pump storage	Enhanced monitoring
January 1979 – May 1979	Storage in level 1 • Continue level 1 drought actions • Storage on upward trend • Projections indicate low risk of storage dropping into level 2 • Decide to not implement level 2 drought actions	Enhanced monitoring
June 1979 – Jan 1980 Level 0	Routine monitoring of water resources	Normal level of monitoring
Feb 1980 – April 1980	Storage reaches 90% target in February. Storage continues to rise and is spilling in spring	Normal level of monitoring

Under this type of drought Roadford storage is significantly impacted due to low rainfall over winter 1975 resulting in a lack of storage recovery ahead of the summer drawdown period. Dry weather continued in spring meaning that river flows dropped below prescribed flow thresholds triggering the need for Roadford supply releases early in the spring, further accelerating storage draw down.

This worked example shows how drought actions aid storage recovery compared to storage with no drought actions. Level 2 supply action, abstraction from Slade reservoir provides additional water to prevent DI deficits in the Slade/Wistlandpound supply area of the WRZ and gives a small benefit to preserving Roadford storage. In this scenario the requirement of supply releases from Roadford is triggered from April to end of September due to low river flows. When storage drops into level 2 in July the level 2 action – abstracting Roadford compensation flow instead of making the additional release for compensation is implemented. This action alongside TUBs successfully reduces the rate of storage decline and prevents storage dropping into level 4.

Under this drought scenario River Dart & Littlehempston drought permit is implemented for 2 weeks in September when flows at the River Dart are high enough to increase abstraction above the daily licenced volume at the same time as Roadford is making supply releases. The available use of this permit will vary depending on the type of drought the WRZ experiences. Late autumn/winter experienced significant rainfall so river flows quickly recover and Roadford supply releases stop at the end of September 1976, therefor also ending the Roadford compensation flow drought permit.

Roadford is considered to be recovered from drought when storage reaches 90% at the beginning of spring in time for the proceeding summer drawdown. Recovery starts in the Autumn/winter of 1979 when storage is out of level 1 and projections indicate that storage will reach 90% before the following spring.

Although storage is out of drought level 1 in the spring of 1977 storage is not at the 90% target to be considered fully recovered from drought therefore storage position for the zone would remain under close monitoring.

A1.3.2. Roadford WRZ 1:500 design drought

In our WRMP24 we simulated a range of stochastically generated drought events in our water resources simulation model. In all of the events we tested, we found the impacts of 1 in 500 year drought event were no worse than our worst historical event. This is primarily driven by the key constraint on Roadford WRZ water resources availability being the overall water treatment works capacity in the south of the WRZ and not the volume of water held in our reservoirs. We have ongoing work in parallel to our Drought Plan consultation to identify how these treatment works constraints interact with our current design drought events.

In addition, we are currently developing new rainfall-runoff models across our South West Water WRZs which will enable us to simulate a wider range of design drought events. As these models become available over summer 2026 we will explore the new range of drought events that these provide. Where appropriate we will include these new findings in our Revised Draft Drought Plan for all our WRZs and will discuss these ahead of this time with the Environment Agency.

At this time we have not included a 1 in 500 year drought scenario because it does not materially differ from the worst historical drought event – as demonstrated in our WRMP24 Deployable Output assessment.

A1.4. Wimbleball WRZ drought assessments

The Wimbleball WRZ covers parts of North Devon, the whole of East Devon and extends into Somerset and Dorset. Wimbleball reservoir is the only raw water reservoir in this WRZ and it is used conjunctively with groundwater sources. The reservoir is used principally for releases to the River Exe to support our abstractions downstream. Wimbleball reservoir storage can also be supplemented by a winter pumped storage scheme from the River Exe. The reservoir is also an important source of water for Wessex Water, who abstract from the reservoir year-round.

The drought resilience of Wimbleball WRZ is mainly determined by the availability of raw water held in storage, therefore reservoir control curves are used as drought triggers to inform how we respond operationally to drought. The triggers also help us consider when we should implement drought actions to reduce to demand and, if necessary, obtain additional water supply.

The Wimbleball WRZ water resources model requires simulated river inflows for the River Exe and Wimbleball Reservoir. We have worked with Wessex Water in preparation of the draft drought plan 2027 to develop rainfall-runoff models for these river catchments. Historical and stochastic inflows were generated using these models, allowing both companies to simulate the same drought events in their respective water resources models.

Analysis of the modelled historical simulations has enabled Pennon Group and Wessex Water to improve their understanding of when each company triggers drought actions and begin work towards a joint agreement for the utilisation of Wimbleball reservoir storage during a drought. Work to support this agreement will continue to be developed beyond this drought plan but the principles of abstraction and drought management for the reservoir will be applied in this drought plan.

The reservoir control curves for Wimbleball reservoir have been updated since Drought Plan 22 based on the lessons learned from the 2022 drought. The changes were primarily raising the storage levels that each drought management zone is triggered and creating a larger area between each zone, allowing drought measures to be prepared earlier and implemented with enough time to provide a benefit. The new control curves were derived using the gauged historical river flows from 2022 and scenario testing against our worst historical and Design drought which is explored in the next section.

The latest rainfall run-off models also enabled a longer historical period of river flows, 1900-2024, to be simulated in the Wimbleball WRZ when compared to Drought Plan 22. Analysis of the simulated historical river flows before 1959 has identified that the single season drought occurring in 1921 and the multi-season drought occurring in 1933 and 1934 are drier and more severe than any droughts experienced post 1959. Therefore, the Drought Plan has been tested against these two historical droughts as well as the WRMP24 1 in 500 Design Drought.

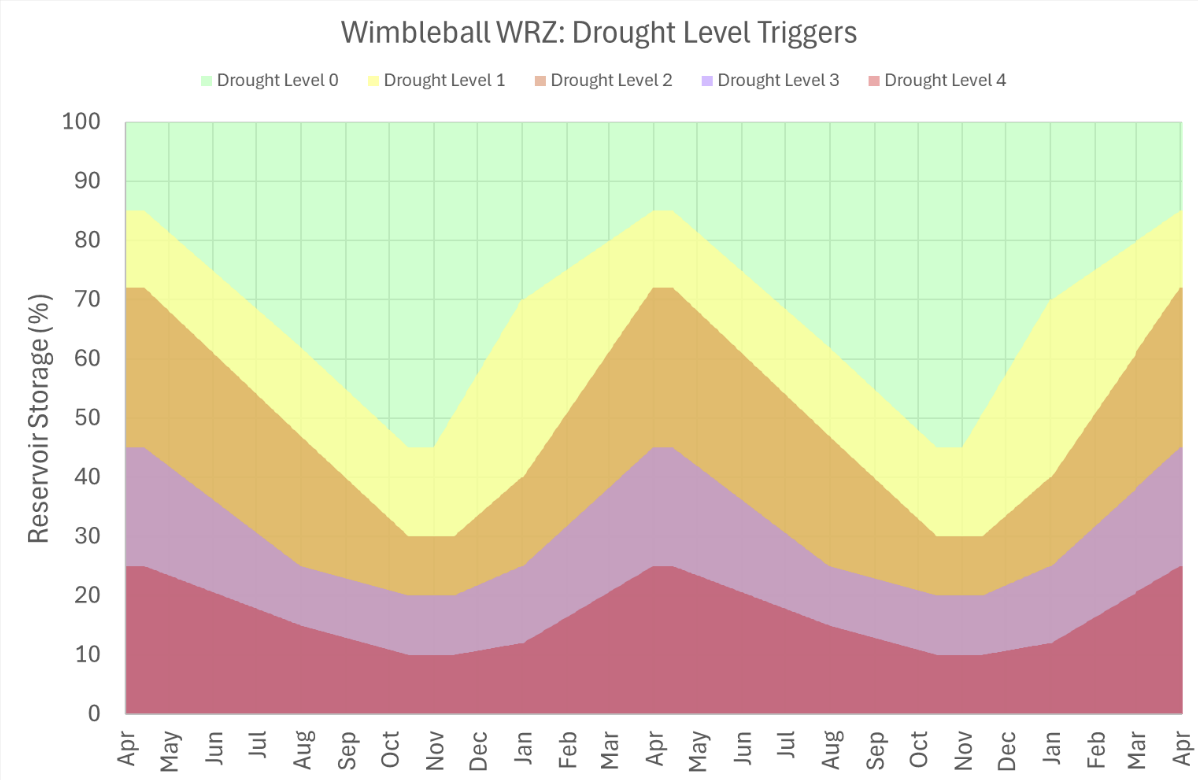

Figure 1.6: Reservoir storage drought trigger curves for Wimbleball Reservoir

Table 1.6: Wimbleball drought management zones, corresponding EA drought levels and potential actions that can be taken within each zone

EA Drought Stage	EA Drought Level	Company Drought Level	Demand Actions	Supply Actions
Normal	0 (BAU)	0	Routine demand management actions	No additional actions – use of existing sources
Prolonged dry weather	1	1	• Enhanced media campaign • Increased leakage management • Increase company water efficiency	• Optimisation of supply network • Reduction of treatment works losses
Drought	2	2	• Temporary Use Bans (TUBs) • Further enhanced media campaign • Further water efficiency • Leakage management	Optimisation of supply network to reduce demand on Wimbleball Reservoir (Pennon Group and Wessex Water) Drought Action: • Colaton Raleigh VSD installation • Reduce abstraction from Wimbleball Reservoir

				Drought permits with minor environmental impacts: • Wimbleball Reservoir reduce compensation flow • River Exe pumped storage season extension until end of May
	3a	3a	• Non-Essential Use Bans (NEUBs) • Media campaign tied in to national messaging	Optimisation of supply network to reduce demand on Wimbleball Reservoir (Pennon Group and Wessex Water) Drought permits with moderate environmental impacts: • Brampford Speke and Stoke Cannon Borehole river augmentation
Severe drought	3b	3b	• Standpipes • Rota cuts • Pressure management • Some exemptions removed from TUBs and NEUBs	Drought permits with major environmental impacts: • Wimbleball Reservoir reduce fish bank releases
	4	4	Emergency plan for drought	Emergency plan for drought

A1.4.1. Wimbleball WRZ historical single season 1921 drought

The simulated river flows for 1921 summer and winter, derived from our rainfall-runoff models in the Wimbleball WRZ, is our most severe historical single season drought. The simulated drought response for Wimbleball WRZ is shown in Figure 1.7 and explained in Table 1.7.

South West Water Bournemouth Water Bristol Water Isles of Scilly Water

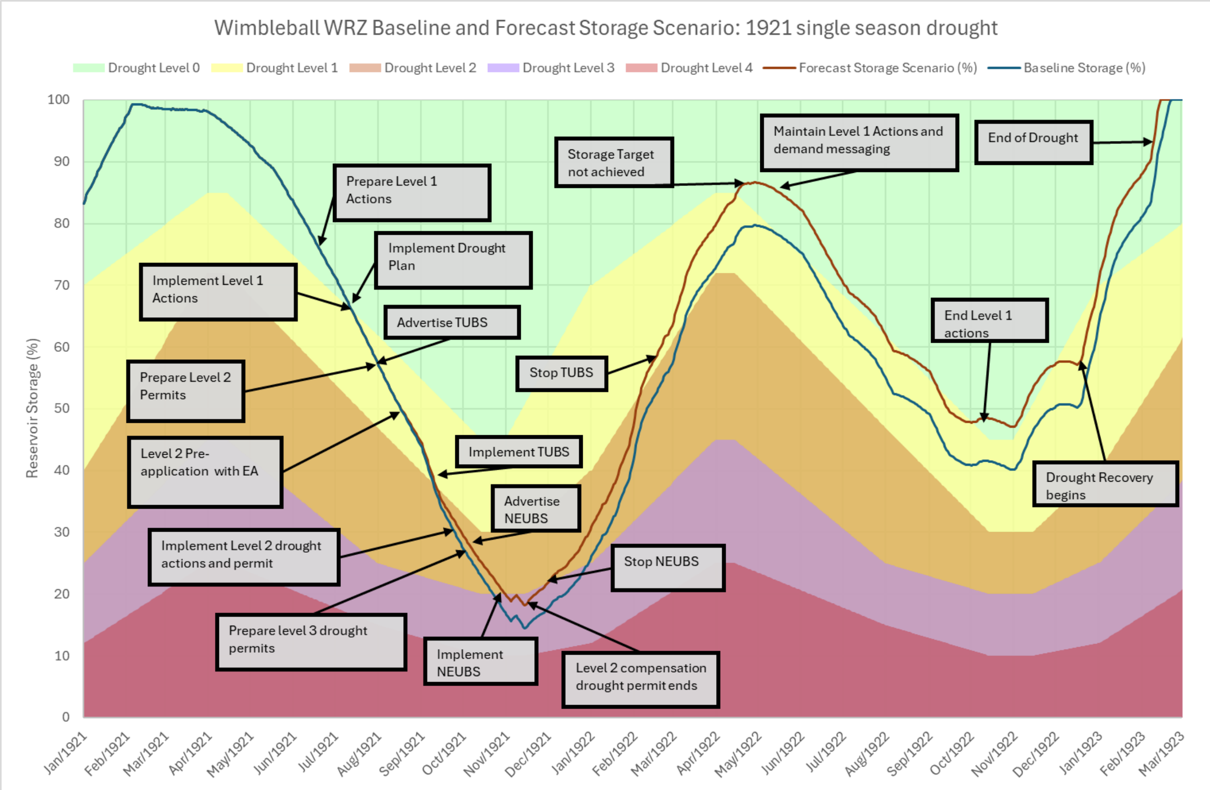

Figure 1.7: Wimbleball reservoir storage projections for the historical 1921 drought. The baseline storage (blue line) is the simulated reservoir storage with no drought actions. The forecast storage scenario (red line) is the simulated reservoir storage for the same drought with supply and demand drought actions applied as outlined by the annotations.

Table 1.7: Example of the timing and implementation of actions and decisions that would be made if the Wimbleball WRZ experienced a repeat of the 1921 historical drought.

Time period, drought level, operational mode	Actions and Decisions	Environmental Monitoring
January – March 1921 Level 0 – Normal Operation	Routine monitoring River flows on the Exe are high enough to utilise winter pumped storage through season. Reservoir storage at 98% target end of March 1921.	Normal level of monitoring
April -May 1921 Level 0 – Normal Operation	• Dry warm weather experienced in late April 1921, river flows begin to recede below prescribed flow at Thorverton gauge by mid-May 1921 • Supply releases begin in mid-May 1921	Normal level of monitoring
June 1921 Level 0 – Dry Weather Operation	• Warm and dry weather experienced in since April • River flows continuing to fall. • Reservoir storage forecasts likely to suggest storage will fall into level 1	Enhanced monitoring

South West Water Bournemouth Water Bristol Water Isles of Scilly Water

<table>
<tr><td></td><td>in July and Level 2 in September should weather conditions persist.
• Prepare for enhanced media campaign
• Prepare for Level 1 leakage reductions</td><td></td></tr>
<tr><td>Early July 1921

Level 1 - Drought Plan Operation</td><td>Reservoir storage enters Level 1 Drought Zone
• Enhanced media campaign
• Company level 1 actions: increase leakage management, optimise supply network, increase company water efficiency, reduce treatment works losses
• Continue Media Campaign
• Storage forecasts suggest Level 2 likely by mid-September if dry conditions persist</td><td>Enhanced Monitoring</td></tr>
<tr><td>Mid July-Early August 1921

Level 1 - Drought Plan Operation</td><td>• Continuing warm and dry weather
• Prepare TUBS in July
• Advertise TUBS in Early August
Prepare level 2 actions in Early August
• Prepare Level 2 company actions, e.g. Colaton Raleigh boreholes VSD action.
• Prepare for level 2 permit, Wimbleball Reservoir - reduce compensation flow</td><td>Enhanced Monitoring</td></tr>
<tr><td>Mid-Late August 1921

Level 1 - Drought Plan Operation</td><td>• Continued hot and dry weather with no cessation of supply releases
• High peak demands experienced in August
• Continue advertising TUBs
• Analyse demand reductions from media campaign and leakage management.
• Start pre-application for level 2 permit, Wimbleball Reservoir - reduce compensation flow</td><td>Enhanced Monitoring</td></tr>
<tr><td>September 1921

Level 2 - Drought Plan Operation</td><td>Reservoir storage enters Level 2 Drought Zone
• Implement TUBs
• Undertake ESOR analysis
• Further enhanced media campaign
• Further company water efficiency and leakage management
• Peak demands experienced in late September
Forecast storage shows level 3 risk in Late October and Level 3b/4 in Late November.
• Prepare for NEUBS</td><td>Enhanced Monitoring</td></tr>
</table>

	• Prepare for Level 3a Drought permits • Prepare for Level 3b	
Early-Mid October 1921 Level 2 - Drought Plan Operation	Storage forecasts suggest level 3 drought trigger will be breached at the end of October if dry weather continues. Analyse demand saving measures, reduction in demand expected over autumn months however weather is still warm and dry. River flows have only just begun marginal recovery. Level 2 actions: • Implement Colaton Raleigh VSD drought action • Implement Wimbleball reservoir reduce compensation flow permit since supply releases are still occuring Prepare for level 3 drought • Advertise NEUBS • Continue preparing level 3a Drought permits and level 3b permits/orders	Enhanced Monitoring
Late October 1921 Level 3 - Drought Plan Operation	Reservoir Storage enters Level 3 Drought Zone • Weather forecast suggests river flows will increase in early November and supply releases will end. • Reservoir storage forecasts suggest with average rainfall storage recovery target of 98% can still be achieved by March 1922 • Delay NEUBS Implementation • Undertake ESOR analysis Forecast storage suggests level 3b/4 risk in Late November is low. • Continue preparing for emergency drought plan • Begin preparation for level 4 drought permits/orders	Enhanced Monitoring
Early November Level 3 - Drought Plan Operation	River levels have slightly recovered but supply releases from Wimbleball are still ongoing. Weather forecast suggests river flows will not significantly increase across November, but pumped storage scheme should be available in 2-3 weeks. • Implement NEUBS to enable level 3a drought permits	Enhanced Monitoring

	• Start Pre-application for level 3a drought permits to aid recovery in Spring if extreme dry winter weather continues • Continue preparing for emergency drought plan • Continue preparation for level 3b and 4 drought permits/orders	
Mid-Late November Level 3 - Drought Plan Operation	River flows slowly recovering. Reservoir storage forecasts suggest 98% target storage by March 1922 will be possible if greater the long-term average rainfall experienced across Late Autumn/Winter. • Winter pumped storage scheme is maximised from mid-November • Level 2 Wimbleball compensation flow permit now no longer providing benefit Storage is forecast to rise above level 3 drought trigger in early December. • Cease preparation for level 3b and level 4 drought permits/orders.	Enhanced Monitoring
December 1921 Level 2 – Drought Plan Operation - Recovery	Reservoir storage rises above level 3 trigger in early December. Rainfall remains below long term average for November/December and River flows are lower than average until late December. Hence, storage recovery is constrained despite maximising winter pumped storage scheme. Reservoir storage forecasts suggest between 80 and 90% storage recovery by March 1922 and very low risk storage will fall into level 3 in early 1922. • De-implement NEUBS • Cease pre-application for level 3a permits	Enhanced Monitoring
January 1922 Level 2 – Drought Plan Operation - Recovery	Rainfall in January increases river flows and reservoir storage recovery reaches 50% by the end of January 1922. Storage forecast to rise above level 2 in early February.	Enhanced Monitoring
February 1922	Reservoir storage rises above Level 1 in early February and weather forecast	Enhanced Monitoring

Level 1 – Drought Plan Operation - Recovery	suggests river flows will continue to be significant for the month. Storage forecasts suggest storage will reach approximately 80% at the end of March, which is 18% below target of 98%. Weekly monitoring of water resource position and other indicators of a dry winter/spring will be closely monitored. The risk of re-entering level 2 drought is low, based on historical catchment behaviour and current weather forecasts. Additionally, storage has recovered sufficiently by mid-February to make the implementation of the level 2 permit – extend winter pumped storage scheme, unlikely: • De-implement TUBS and Level 2 drought permits • Maintain enhanced messaging and continue enhanced leakage management.	
March 1922 Level 1 – Drought Plan Operation - Recovery	Reservoir storage position at the end of March is 80% meaning target recovery has not been reached and the WRZ is at an increased risk of drought in 1922. Winter pumped storage scheme ceases on 31st March due to abstraction licence conditions • Maintain enhanced messaging and continue enhanced leakage management.	Enhanced monitoring
April-July 1922 Level 0 – Drought Plan Operation – Recovery	Reservoir storage recovery continues until mid-April (85% maximum storage) at which point river flows begin to recede however prevailing weather through April and May is not exceptionally dry meaning reservoir supply releases are not required until June. Storage forecasts in April suggest Level 1 trigger will be entered in mid-July Reservoir storage recession slows in July due to significant rainfall event, ceases supply releases, and delaying level 1 trigger into August.	Normal monitoring

	Storage forecasts begin to show an reduced risk of entering level 2 and 3 drought levels in this year. • Maintain enhanced messaging and continue enhanced leakage management. Conduct summer/winter drought plan review.	
August-September 1922 Level 1 - Drought Plan Operation Recovery	Reservoir storage enters Level 1 at the start of August. Significant rainfall event at the beginning of August increases river flows above prescribed flow and supply releases from Wimbleball cease. This raises storage above level 1 drought level until early September and level 1 drought persists until October. • Maintain enhanced messaging and continue enhanced leakage management. Storage forecasts, after significant rainfall events suggest risk of entering level 2 storage are minimal in this year. Long range forecasts for October are for wetter weather.	Normal monitoring
October 1922 Level 0 - Drought Plan Operation Recovery	Wetter weather experienced and river flows begin to recover in early October. Reservoir storage stops declining and remains around 45% until November. Storage is forecast to remain in level 0 if average rainfall continues, high likelihood of reaching 98% storage in March 1932 • Cease enhanced messaging at the end of October.	Normal monitoring
November 1922 Level 0 Drought Plan Operation Recovery	Winter pumped storage scheme is enabled at the beginning of November and river flows enable maximum abstraction. Reservoir storage begins to recover, following the profile of the level 1 drought curve.	Normal monitoring

	Rainfall from early-November is unusually low, river flows begin to reduce gradually and the maximum abstraction from the winter pumped storage scheme is reduced by around 10 Ml/d in the last week of November.	
December - 1922 Level 1 – Drought Plan Operation Recovery	River flows continue to recede into December until significant rainfall events in the last 2 weeks of December. Storage crosses into level 1 drought during this time however based on prevailing storage, the time of year, weather forecasts and catchment conditions the level 1 drought actions would not be implemented	Normal monitoring
January – February 1923 Level 0 – Normal Operation	Storage recovers to 100% in February. End of drought is announced. Complete post-drought review.	Normal monitoring

A1.4.2. Wimbleball WRZ historical multi-season 1933-34 drought

The simulated river flows for 1933 and 1934, derived from our rainfall-runoff models in the Wimbleball WRZ, demonstrate an approximately 18 month drought with significantly low rainfall from spring 1933 until autumn 1934. The drought response surface from Wimbleball WRZ is shown in Figure 1.8. This scenario includes an extraordinarily low winter recharge period into 1934, demonstrating the benefit of the level 2 drought permit which enables the extension of the River Exe winter pumped storage scheme from November to March into April and May inclusive.

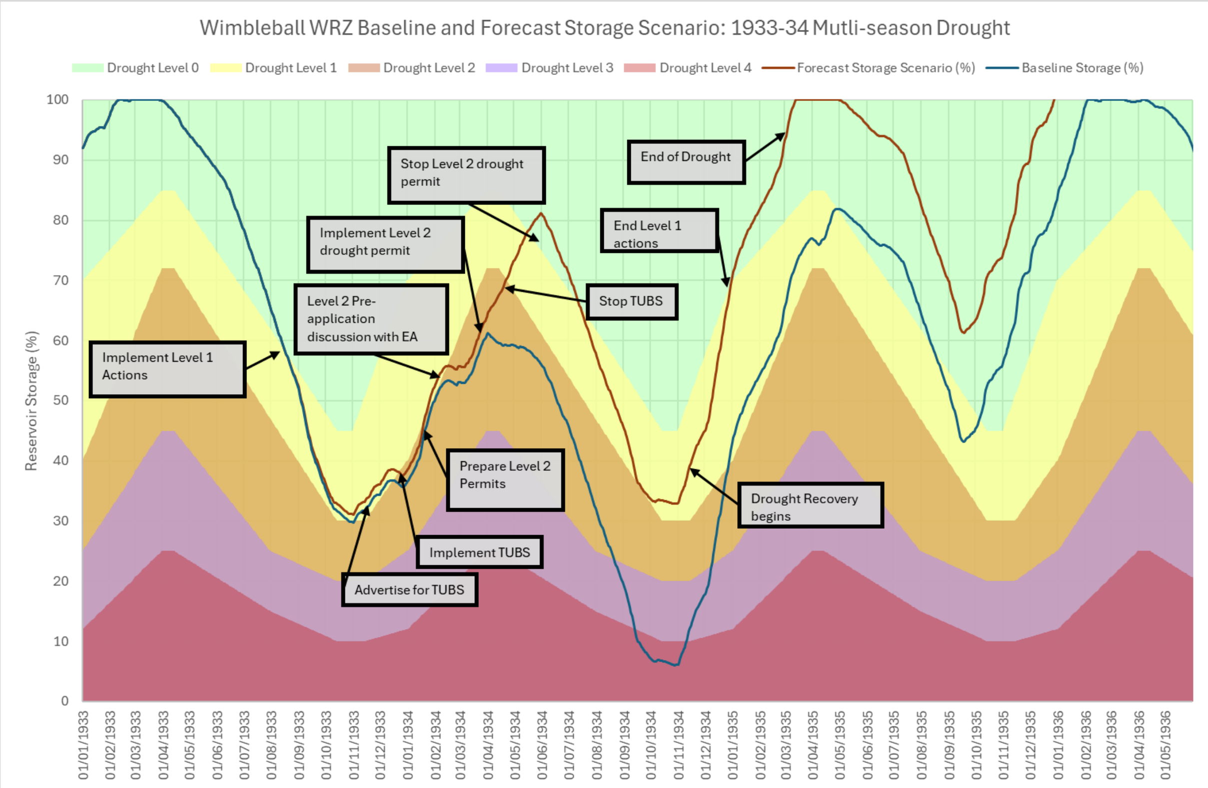

Figure 1.8: Wimbleball reservoir storage projections for the historical 1933-34 drought. The baseline storage (blue line) is the simulated reservoir storage with no drought actions. The forecast storage scenario (red line) is the simulated reservoir storage for the same drought with supply and demand drought actions applied as outlined by the annotations.

Table 1.8: Example of the timing and implementation of actions and decisions that would be made if the Wimbleball WRZ experienced a repeat of the 1933-34 historical drought.

Time period, drought level, operational mode	Actions and Decisions	Environmental Monitoring
January – July 1933 Level 0 – Normal Operation	Routine monitoring Wimbleball Supply releases begin in June as river flows fall below prescribed flow at Thorverton Gauge. Storage Projections in May/June will suggest Level 1 drought trigger will be breached in August, with persistently dry weather	Normal level of monitoring
Early August 1933 Level 0 – Normal Operation	Prepare Enhanced messaging for Drought Level 1 • Storage forecast suggest Level 1 figure will be breached in Mid August	Enhanced Monitoring
Mid August 1933	Reservoir Storage falls below Level 1 Drought Trigger • Initiate Drought Plan	Enhanced Monitoring

Level 1 – Drought Plan Operation	• Implement Enhanced messaging and leakage management. •	
Late August – Early October 1933 Level 1 – Drought Plan Operation	Reservoir storage continues to fall steeply though September and October due to dry weather. Wimbleball supply releases end in Early October due to rainfall events raising river flows. Reservoir storage forecasts at this stage would likely predict refill within the level 1 drought zone with average November rainfall. If lower than average rainfall is predicted in November and December then storage forecasts may predict crossing of Drought Zone Level 2 in January Maintain Drought Zone level 1.	Enhanced Monitoring
Mid October – November Level 1 – Drought Plan Operation	Rainfall throughout October and November is below the long-term average. • Winter pumped storage scheme is maximised • Storage Forecasts suggest level 2 drought figure will be breached in late December unless greater than long term average rainfall is experienced.	Enhanced Monitoring
Early – Mid December - 1933 Level 1 Drought Plan Operation	Winter Recovery has been severely limited by low rainfall and low river flows with some weeks limiting winter pumped storage abstraction below 75 Ml/d. Forecasts suggests drought level 2 in Late December • Advertise TUBS, • Analyse demand reductions from media campaign and leakage management. • Demand restrictions unlikely to have significant impact on demand due to time of year. • Undertake ESOR Analysis	Enhanced Monitoring
Late December – 1933 Level 2 Drought Plan Operation	Reservoir storage transitions into Level 2 Drought Trigger • Implement TUBS • Further enhanced media campaign • Further company water efficiency and leakage management	Enhanced Monitoring
January – February - 1934	River flows recover marginally in January, winter pumped storage scheme is maximised except for a very dry period in the 2nd half of February	Enhanced Monitoring

Level 2 Drought Plan Operation	Prepare Level 2 drought permits in Early February • Prepare Level 2 drought permit to extend the pumping season of the River Exe Winter Pumped Storage • Prepare Level 2 Wimbleball compensation flow drought permit Late February • Start Pre-application process for Level 2 permits	
March – 1934 Level 2 Drought Plan Operation	Reservoir storage forecasts suggest, without Level 2 drought permits, in a DYAA year emergency storage could be breached in September 1934. • Maintain Enhanced messaging and Leakage Management. • Continue level 2 permit pre-application Weather forecast and current river flow recession suggest water will be available for extended winter pumped storage permit in April and May and compensation flow permit could be utilised in Late May at the earliest.	Enhanced Monitoring
Early April 1934 Level 2 Late April Level 1 Late May - Level 0 Drought Plan Operation	Implement Level 2 Drought permit - extended Winter Pumped storage scheme on 1st April. Reservoir storage: • Enters Level 1 drought zone in late-April • Enters Level 0 drought Zone in mid-May • Recovers to 80% in Late May. Extended Winter pumped storage permit ceases on 31st May.	Enhanced Monitoring
June 1934 Level 0 Drought Plan Operation	Wimbleball supply releases begin in Early June. Storage forecasts suggest • Level 1 drought zone will be crossed in Mid June • Level 2 drought zone is most likely to trigger at the end of October. Level 2 Wimbleball compensation permit will not be implemented. Enhanced messaging and leakage management will continue, due to short time period before level 1 drought zone trigger and due to starting the year 18% below target storage	Normal Monitoring

July-December 1934 Level 1 – Drought Plan Operation Recovery	Reservoir storage remains within Drought Zone Level 1. Drought Recovery begins in early November with maximum winter pumped storage and significant rainfall benefiting recovery to drought zone 0 at the end of December	Normal Monitoring
January-March 1935 Level 0 – Normal Operation	End of Drought announced in February 1935 when target storage of 98% is reached. Complete Post Drought Review	Normal Monitoring

A1.4.3. Wimbleball WRZ 1:500 design drought

The drought used to determine Deployable Output of Wimbleball WRZ in WRMP24 was derived from our WRMP24 stochastic ensembles and was calculated as having an approximately 1:500 return period with similar rainfall patterns across the catchments of the River Exe and Wimbleball Reservoir. The nature of calculating stochastic inflows means that the new rainfall-runoff models developed with Wessex Water could not yet be used to recreate this design drought. A new stochastic analysis to identify a representative 1:500 drought was not completed for this drought plan because of the computational limitations of our current generation of mass balance models and the need for alignment with WRMP24 but we will be reviewing this as further work ahead of the revised drought plan.

The drought plan worked example of Wimbleball reservoir storage for this drought under the 2022 demand scenario is set out in Figure 1.9. Further details of how we would prepare and implement demand and supply actions under this scenario is shown in Table 1.9.

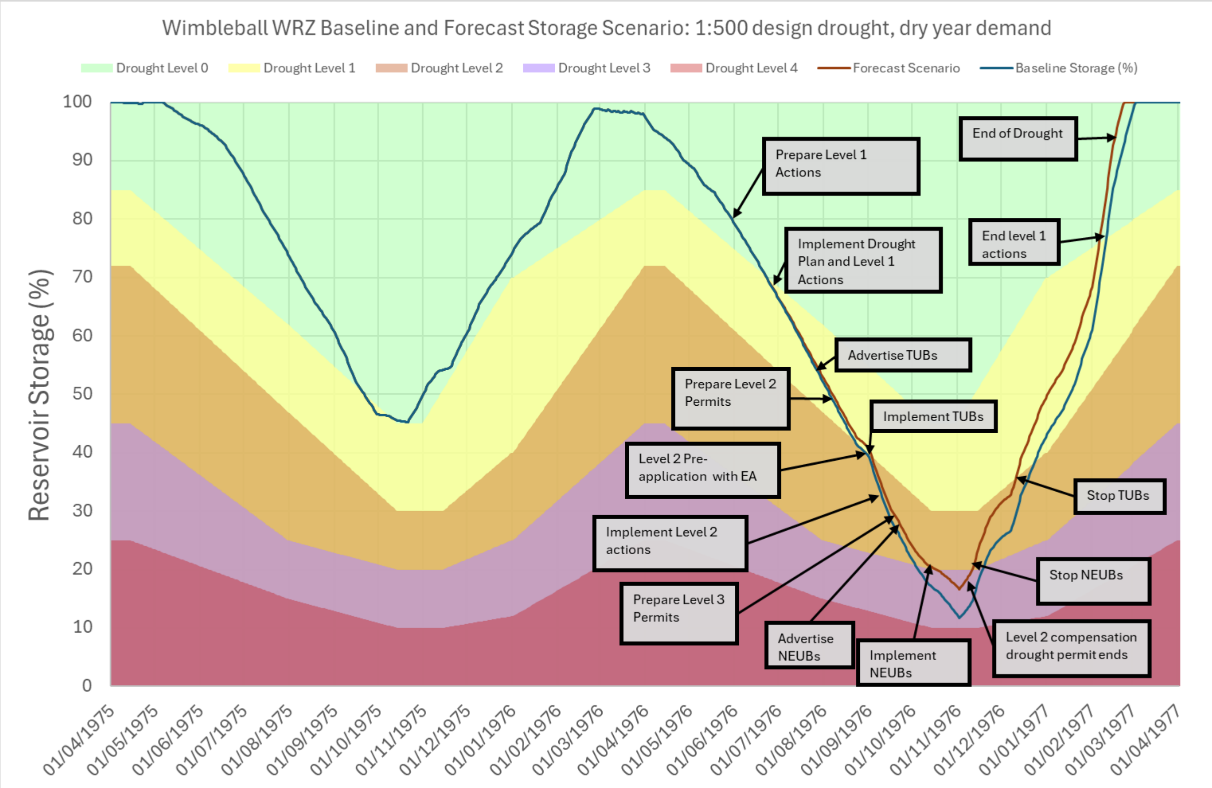

Figure 1.9: Wimbleball reservoir storage projections for the WRMP24 1 in 500 design drought. The baseline storage (blue line) is the simulated reservoir storage with no drought actions. The forecast storage scenario (red line) is the simulated reservoir storage for the same drought with supply and demand drought actions applied as outlined by the annotations.

Table 1.9: Example of the timing and implementation of actions and decisions that would be made if the Wimbleball WRZ experienced in the WRMP24 1 in 500 design drought.

Time period, drought level, operational mode	Actions and Decisions	Environmental Monitoring
January 1975	Routine monitoring	Normal level of monitoring

South West Water Bournemouth Water BRISTOL WATER Isles of Scilly Water

Level 0 – Normal Operation		
January – March 1976 Level 0 – Normal Operation	• Operation of winter pumped storage scheme targeting 98% storage by Late March 1976. • Dry weather experienced January to March • River Flows fall sufficiently to require Wimbleball supply releases on 31st March due to dry end of Winter.	Normal level of monitoring
April 1976 Level 0 - Normal Operation	• Warm and dry weather experienced in April • River flows continuing to fall. • Reservoir storage forecasts likely to suggest storage will fall into level 1 in July and Level 2 in September should weather conditions persist. • Prepare for enhanced media campaign • Prepare for Level 1 leakage reductions •	Normal level of monitoring
May 1976 Level 0 - Dry Weather Operation	• Continuing warm and dry weather • Brief 7 day cessation of supply releases in early may due to short rainfall periods. • Undertake ESOR analysis • Prepare for possible TUBs • Prepare to implement enhanced media campaign	Enhanced monitoring
Late June 1976 Level 1 - Drought Plan Operation Invoke Drought Plan	Reservoir storage enters Level 1 Drought Zone • Enhanced media campaign • Company level 1 actions: increase leakage management, optimise supply network, increase company water efficiency, reduce treatment works losses • Continue Media Campaign Preparing for Level 2 in September • Update ESOR • Storage forecast suggest Level 2 likely by Late August if dry conditions persist	Enhanced monitoring
July 1976 Level 1 -	• Continued hot and dry weather with no cessation of supply releases • High peak demands experienced in mid June • Advertise TUBs at end of July	Enhanced monitoring

Drought Plan Operation	•	
August 1976 Level 1 - Drought Plan Operation	• Reservoir Storage continues to fall • Update ESOR • Brief intense rainfall period at the end of August temporarily stops supply releases, delaying Level 2 storage into Early September • Continued TUBs advertisement • Analyse demand reductions from media campaign and leakage management. • Prepare Level 2 company actions, including Colaton Raleigh boreholes VSD action. • Start pre-application for level 2 permit, Wimbleball Reservoir - reduce compensation flow	Enhanced monitoring
Early – Mid September 1976 Level 2 - Drought Plan Operation	Reservoir storage enters Level 2 Drought Zone • Implement TUBs • Further enhanced media campaign • Further company water efficiency and leakage management • Analyse demand reductions from TUBs and enhanced media campaign over September • Peak demands experienced in late September Forecast storage shows level 3 risk in Mid October and Level 3b/4 in November • Prepare for NEUBS and advertise in late mid September • Prepare for Level 3a Drought permits • Prepare for Level 3b and 4 Drought Permits/Orders	Enhanced monitoring
Late September Level 2 - Drought Plan Operation	Implement Level 2 Drought Actions: • Colaton Raleigh boreholes VSD action. • Wimbleball Reservoir - reduce compensation flow permit	Enhanced monitoring
Early – Mid October 1976 Level 3 - Drought Plan Operation	Reservoir Storage enters Level 3 Drought Zone • Implement NEUBS • Prepare to implement 3a drought permits 3-4 weeks after NEUBS • Continued dry weather forecast for October	Enhanced monitoring

	• Supply releases will continue however demand reduces in October thus releases are smaller. Forecast storage suggests level 3b/4 risk in Mid November • Prepare for emergency drought plan • Continue preparation for level 3b and 4 drought permits/orders • Prepare emergency drought orders • Analyse demand reductions of NEUBS and TUBS	
Late October 1976 Level 3 - Drought Plan Operation	Decision required on whether to implement level 3a drought supply actions. • Significant rainfall is forecast in early November • Updated storage forecasts suggest storage can still recover to 98% by March 97 using winter pumped storage scheme with consistent annual average rainfall. Decision is made to delay implementation of level 3a drought permits and re-evaluate on a weekly basis.	Enhanced monitoring
Early November 1976 Level 3 - Drought Plan Operation	• Significant rainfall occurs from the start of November • River levels recover very quickly, supply releases no longer required • Demand reduces significantly due to time of year and rainfall Continue to delay implementation of level 3a drought permits.	Enhanced monitoring
Mid November Level 2 - Drought Plan Operation	Continued rainfall forecast throughout November Reservoir storage rises above level 3 drought trigger ~17th November. • Significant rainfall continues, supply releases are still no longer required • Demand continues to remain low. • Storage forecasts suggest storage recovery on target for 98% recovery by March 97. • Reservoir storage rises above level 3 drought trigger ~17th November. Decision making now being made based on our Recovery from Drought.	Enhanced monitoring
Late November Level 2 - Drought Plan Operation -	Decision to de-implement TUBS in Late November based on: • Continued rainfall forecast throughout December	Enhanced monitoring

Drought Recovery	• Prevailing river flows in the Exe enabling maximum winter pumped storage • Reservoir storage recovery above level 3 trigger for >1 week with low risk of returning to level 3 drought level. • Existing level 2 drought permits are no longer providing benefit to reservoir storage due to the nature of the permits. Level 3a drought options no longer require implementation, preparation of level 3b and 4 drought order/permits can end.	
Early December-Mid January Level 1 - Drought Plan Operation - Drought Recovery	Continued reservoir storage recovery. • Reservoir storage on target to recovery to 98% by March 97. • Storage rises above Level 2 drought trigger in Mid-December • River flows, soil moisture deficit and groundwater levels at normal levels across all catchments	Enhanced monitoring
Late January Level 1 - Drought Plan Operation – Drought Recovery	Decision to de-implement TUBS based on: • Reservoir storage is significantly above level 2 trigger and will raise above level 1 within 2 weeks. • Weather forecast and storage forecast suggest reaching 98% storage is the most likely scenario. • There is a very low risk of falling below level 2 before March 97 even with lower than average rainfall • Level 2 permits are officially de-implemented, though they were not in use since Early December 96.	Enhanced monitoring
Early -Mid February Level 0 – Dry Weather Operation – Drought Recovery	Reservoir storage raises above level 1 storage: • Maintain enhanced messaging until 98% storage target is reached in March. • All reservoir storage forecasts now suggest target will be reached by the end of the month • Begin review of drought response to inform operational decision making for the year ahead	Normal level of monitoring
Late February Level 0 End of Drought –	Reservoir storage reaches 100% and begins to overspill. • All groundwater, river flow, rainfall and other drought indices suggest drought conditions have ended Announce end of drought and de-escalate from drought plan operation	Normal level of monitoring

Normal Operation	Continue review of drought response	
March Level 0 – Normal Operation	• Finalise post drought review	Normal level of monitoring

A1.5. Bournemouth WRZ drought assessments

Bournemouth WRZ covers parts of East Dorset, Hampshire and Wiltshire, supplying the major settlements of Bournemouth, Christchurch, Lymington and Fordingbridge. The principal water sources are river abstractions from the lower reaches of the Hampshire Avon and the Dorset Stour. There are also two small lakes, at Longham which provide short-term bankside storage. Groundwater abstractions provide water to the more rural parts of the WRZ but their supply can be supported by our river abstraction due to the conjunctive nature of the zone. Bournemouth is isolated from our other WRZs and whilst a clean water network transfer exists with Wessex Water it has a 0 ML/d net benefit.

The Water Available for Use (WAFU) for Bournemouth WRZ is not limited by raw water availability or our annual abstraction licence limits and there is no significant raw water storage in the zone. The drought resilience of Bournemouth WRZ is based on our ability to meet extreme levels of demand. Therefore, the key constraint in the system is how much water can be treated and distributed which corresponds to our peak combined water treatment works output and our network infrastructure constraints. Hence, our drought management zones are based on demand levels where our prevailing drought level increases as demand rises closer to our maximum combined water treatment works output.

A water resource simulation model and rainfall-runoff models for Bournemouth WRZ are under development for WRMP29. These were not available for the draft Drought Plan 27 but because the current system is not constrained by raw water availability this is not required.

The demand scenarios being assessed are the actual 2020-21 distribution input which provides a higher peak demand than the worst historical drought dry year demand scenario tested in Drought Plan 22. Additionally, an equivalent to the 2020-21 distribution input plus WRMP24 target headroom scenario has been included to provide a more severe scenario to test the drought plan.

The demand management zones, linked to the EA Drought zones, are now derived from maximum treatment works outputs and the scenario testing of these demand levels are provided in Figure 1.10 and Table 1.10.The maximum water treatment works outputs has increased since Drought Plan 2022 because of the delivery upgrades to Alderney WTW and Knapp Mill WTW in 2026.

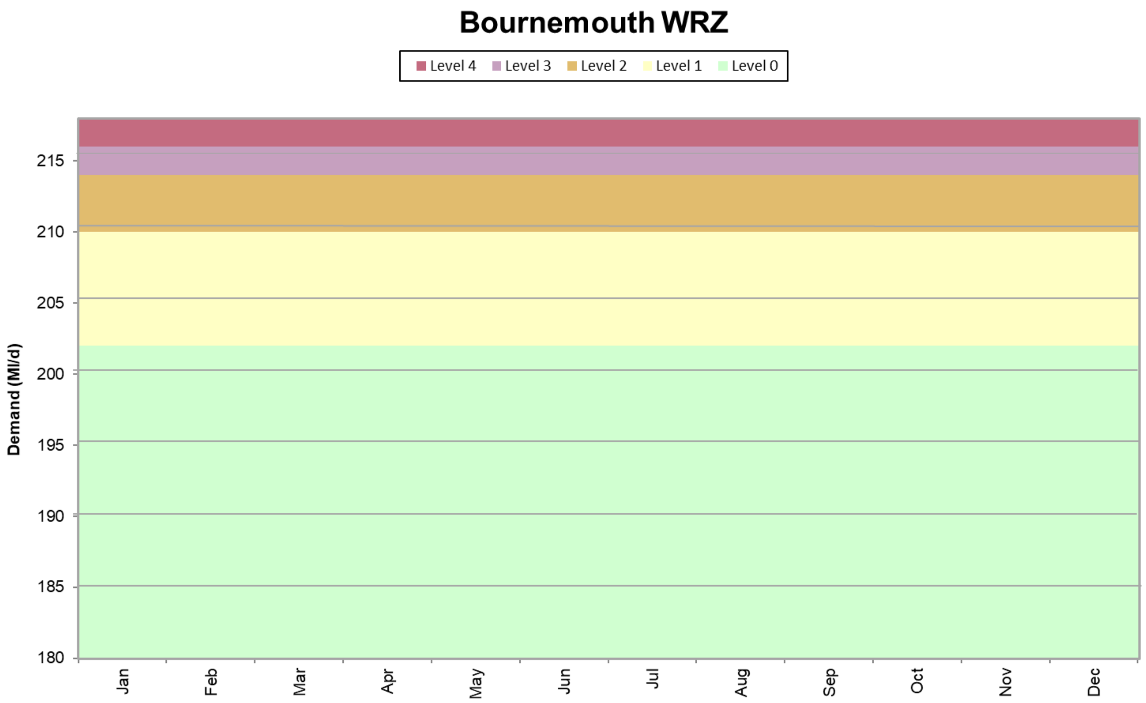

Figure 1.10: Bournemouth WRZ drought management zones displayed as demand zones. Demand zones are calculated based on a proportion of maximum water treatment works capacity, with the highest demand in zone 4/EA level 4 equivalent to the maximum water treatment works capacity.

Table 1.10: Bournemouth WRZ Drought Management Zones, corresponding EA Drought Levels and the corresponding supply and demand actions available for each zone or level.

EA Drought Stage	EA Drought Level	Company Drought Level	Demand Actions	Supply Actions
Normal	0 (BAU)	0	Routine demand management actions	No additional actions – use of existing sources
Prolonged dry weather	1	1	• Enhanced media campaign • Increased leakage management • Increase company water efficiency • Request large industrial supplier to reduce consumption to contractual minimum	• Optimisation of supply network • Reduction of treatment works losses • Optimisation of water treatment work maintenance.
Drought	2	2	• Temporary Use Bans (TUBs) • Further enhanced media campaign • Further water efficiency • Leakage management	Optimisation of supply network and water treatment work maintenance to reduce peak demand risks.

	3a	3a	• Non-Essential Use Bans (NEUBs) • Media campaign tied in to national messaging	Continued optimisation of supply network and water treatment works. Drought permits with moderate environmental impacts: • Increase daily maximum abstraction at Stanbridge Boreholes • Relax weekly abstraction licence at Longham on R. Stour
Severe drought	3b	3b	• Standpipes • Rota cuts • Pressure management • Some exemptions removed from TUBs and NEUBs	Drought permits with major environmental impacts: • Relax prescribed flow constraint on R.Stour at Longham
	4	4	Emergency plan for drought	Emergency plan for drought

A1.5.1. Bournemouth WRZ worst historical drought, dry year demand

The worst historical drought dry year demands on record, based on assessment of magnitude and duration of low river flows on the Hampshire Avon and Dorset Stour, was the 2022/23 drought. The example below shows the observed 2022/23 distribution input against Bournemouth WRZs drought management zones.

South West Water Bournemouth Water Bristol Water Isles of Scilly Water

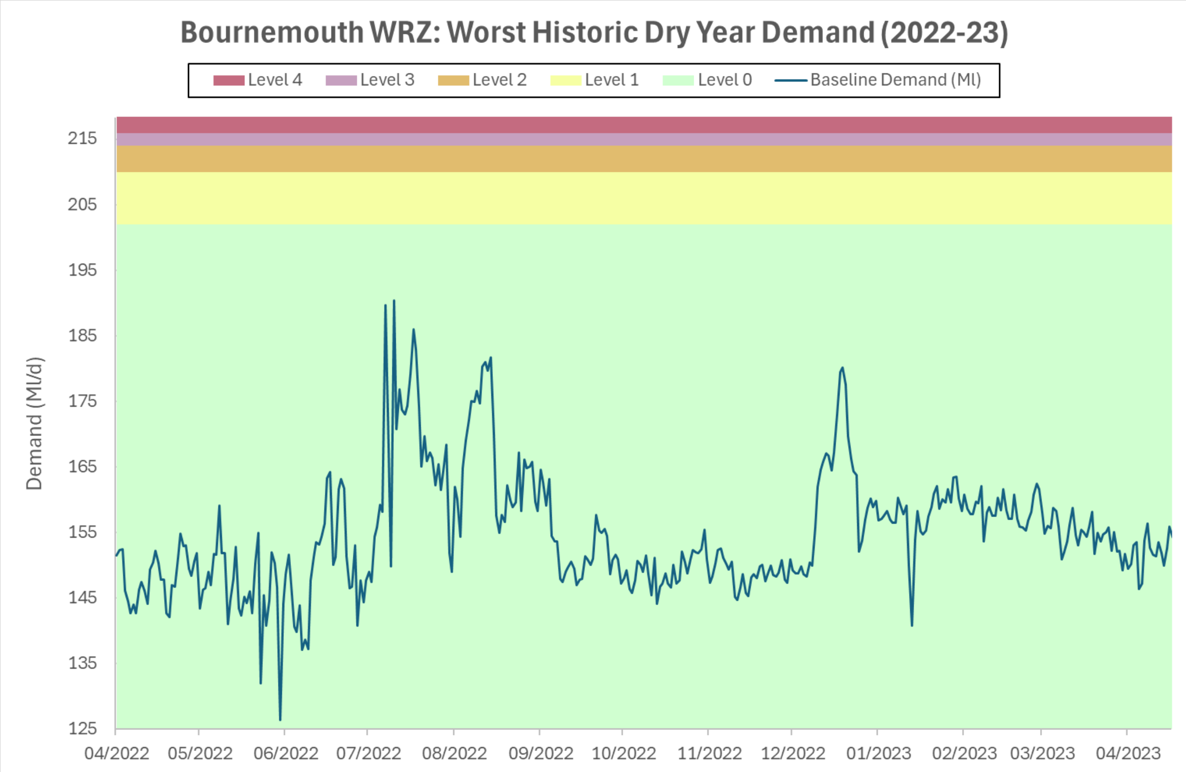

Figure 1.11: The worked example graph overlaying the forecast demand scenario on the Bournemouth WRZ Demand management zones for the worst historic drought, dry year demand. The forecast demand trend is the simulated demand however no supply or demand actions are triggered in this event.

Table 1.11: Bournemouth WRZ worst historic drought, dry year demand worked example table, showing the timing and decision and actions.

Time period, drought level, operational mode	Actions and Decisions	Environmental Monitoring
April – May 2022 Level 0 – Normal Operation	Routine monitoring Typical demand for the time of year, normal operation of sources. No significant late may bank holiday demand forecast.	Normal level of monitoring
June 2022 Level 0 – Normal Operation	Extended warm dry weather raises demands to approximately 165 Ml/d. Forecast potential July peak demand risk based on: • Prevailing average demand (domestic, and leakage) • Large industrial supply Consumption. • Weather forecasts (temperature, rainfall, sunshine hours and length of time since last rainfall) • Monitor pumping and observation groundwater levels, compare	Normal level of monitoring

	against historical levels and assess GW yield risk. • River flow data (River Stour, River Avon, River Allen) • Monitor Stanbridge/Loverly Farm gauge augmentation scheme to understand prevailing catchment conditions. No/very low risk identified, continue normal operation.	
July 2022 Level 0 – Normal Operation	Early summer peak demands are all within level 0. Extended hot dry weather is forecast for the beginning of August. Forecasts of peak demand risk will be made based on, but not limited to, the factors mentioned in June. Continue regular monitoring Stanbridge augmentation scheme .	Normal Level of monitoring
August 2022	Peak demands remain within level 0, below the early summer peak demands. Weather forecasts for end of August and September do not suggest further peak demands expected.	
September – November 2022 Level 0 – Normal Operation	Peak Demand reduces at the end of August and demands remain in Level 0	Normal Level of monitoring
December 2022 – January 2023 Level 0 – Normal Operation	Demand rises in December due to an increase in leakage associated with cold weather and free-thaw processes. Seasonal peak demand is not a risk in December however leakage management activities for the winter period are employed to reduce leakage.	Normal Level of monitoring
January – April 2023	Normal level of demand ahead of the next years late spring and early summer demand increases. No increased risk of demand deficits.	Normal Level of monitoring.

A1.5.2. Bournemouth WRZ worst historical dry peak week demand

The historical dry year with the highest peak demands sustained for the longest period in Bournemouth WRZ was 2020 as shown in Figure 1.12. In this scenario, demand stays within level 0 and therefore no demand or drought actions would be implemented. Whilst 2020 was within the COVID19 lockdown period, which may not be entirely representative of current conditions, the August peak demand is the highest and most sustained historical peak demand experience. This period aligned with a significant lockdown restriction easing and the typical school summer holiday period. Peak demands of this magnitude in the late summer period are consistent with peak tourism and summer demand in other typical years.

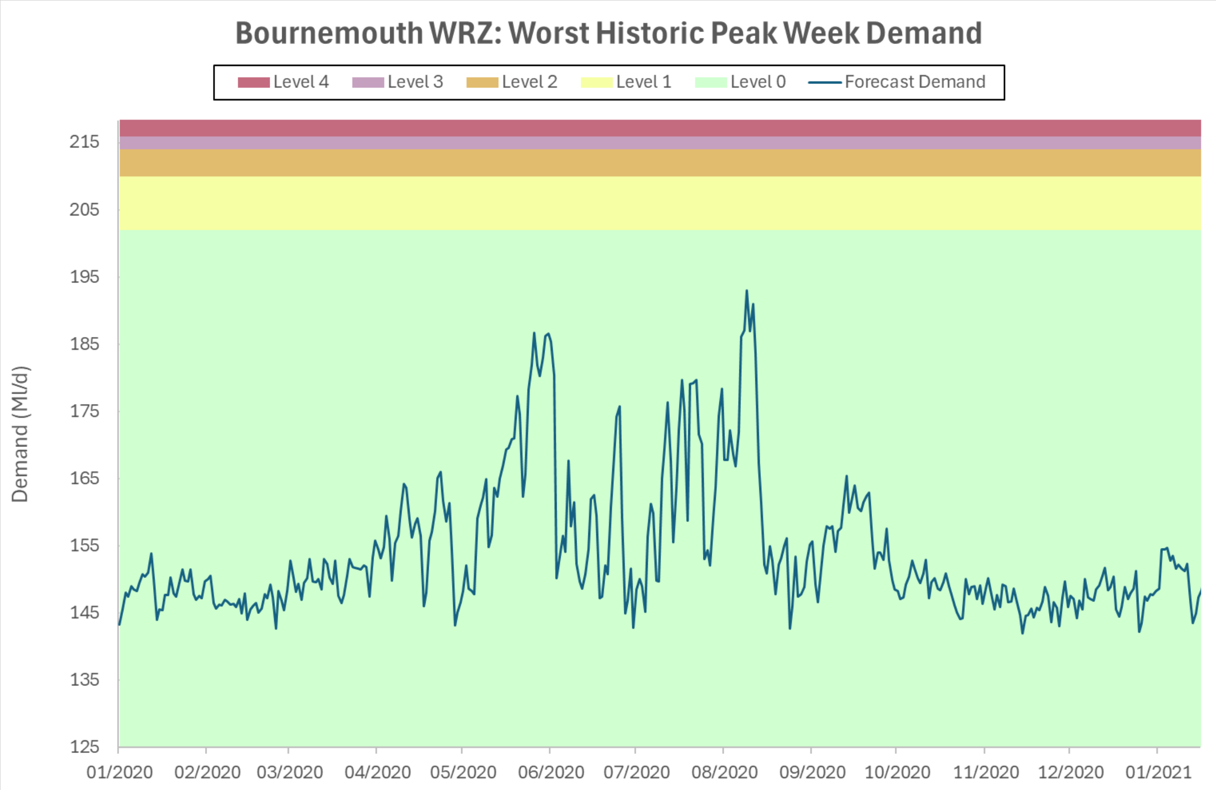

Figure 1.12: The worked example graph overlaying the forecast demand scenario on the Bournemouth WRZ demand management zones for the worst historic peak week demand. The forecast demand trend is the simulated demand however no supply or demand actions are triggered in this event.

Table 1.12: Bournemouth WRZ worst historic peak week demand worked example table, showing the timing and decision and actions.

Time period, drought level, operational mode	Actions and Decisions	Environmental Monitoring
January – April 2020 Level 0 – Normal Operation	Routine monitoring Typical demand for the time of year, normal operation of sources.	Normal level of monitoring
Early-mid May 2020 Level 0 – Normal Operation	Forecast potential late May bank holiday peak demand risk based on: • Prevailing average demand (domestic, and leakage) • Large industrial supply Consumption. • Weather forecasts (temperature, rainfall, sunshine hours and length of time since last rainfall)	Normal level of monitoring

	• Monitor pumping and observation groundwater levels, compare against historical levels and assess GW yield risk. • River flow data (River Stour, River Avon, River Allen) • Monitor Stanbridge/Loverly Farm gauge augmentation scheme to understand prevailing catchment conditions. No/very low risk identified, continue normal operation.	
Late May 2020	No peak demand risk from May bank holiday weekend	Normal level of monitoring
June – August 2020 Level 0 – Normal Operation	Early summer peak demands are all within level 0. Extended hot dry weather is forecast for the beginning of August. Forecasts of peak demand risk will be made based on, but not limited to, the factors mentioned in Early-mid May. Continue regular monitoring Stanbridge augmentation scheme .	Normal Level of monitoring
September – December 2020 Level 0 – Normal Operation	Peak Demand reduces at the end of August and demands remain in Level 0 for the remainder of the year.	Normal Level of monitoring

A1.5.3. Bournemouth WRZ worst historical peak week demand, plus WRMP24 target headroom

To further test the Bournemouth WRZ drought plan a high demand scenario was created by scaling the worst historical peak week demand by adding 18.35 Ml/d of target headroom to each day's demand as defined in WRMP24.

There is no precedent for this demand scenario, it has been chosen to demonstrate the implementation of our drought actions for the purposes of the drought plan. However, the important difference is that if the average demand for Bournemouth WRZ was 18.35 Ml/d higher, then the baseline preparedness of our demand management approaches would be at a higher annual frequency and magnitude than is currently required.

The implementation of the level 1 action requesting a large industrial consumer to reduce their consumption voluntarily to the contractual minimum has a significant impact on the drought demand risk on the Bournemouth WRZ. In the scenario below, we choose to take all demand reduction actions available within each zone because in practice we must mitigate any risk of the industrial consumption not achieving the minimum contractual consumption.

When making the decision to de-escalate from level 1 to level 0, a calculation of total demand is required that forecasts the large industrial consumer's demand after the voluntary reduction ends. Therefore, if our forecast domestic demand plus unrestricted industrial demand is lower than the level 1 trigger then we will consider de-escalating to Level 0.

The decision to prepare demand and supply actions needs to be completed early enough to implement within a 12 hour window. Currently, any demand reduction actions would be implemented the day of a peak demand period therefore the early advertisement of the requirement for demand reductions is key to mitigating the risk.

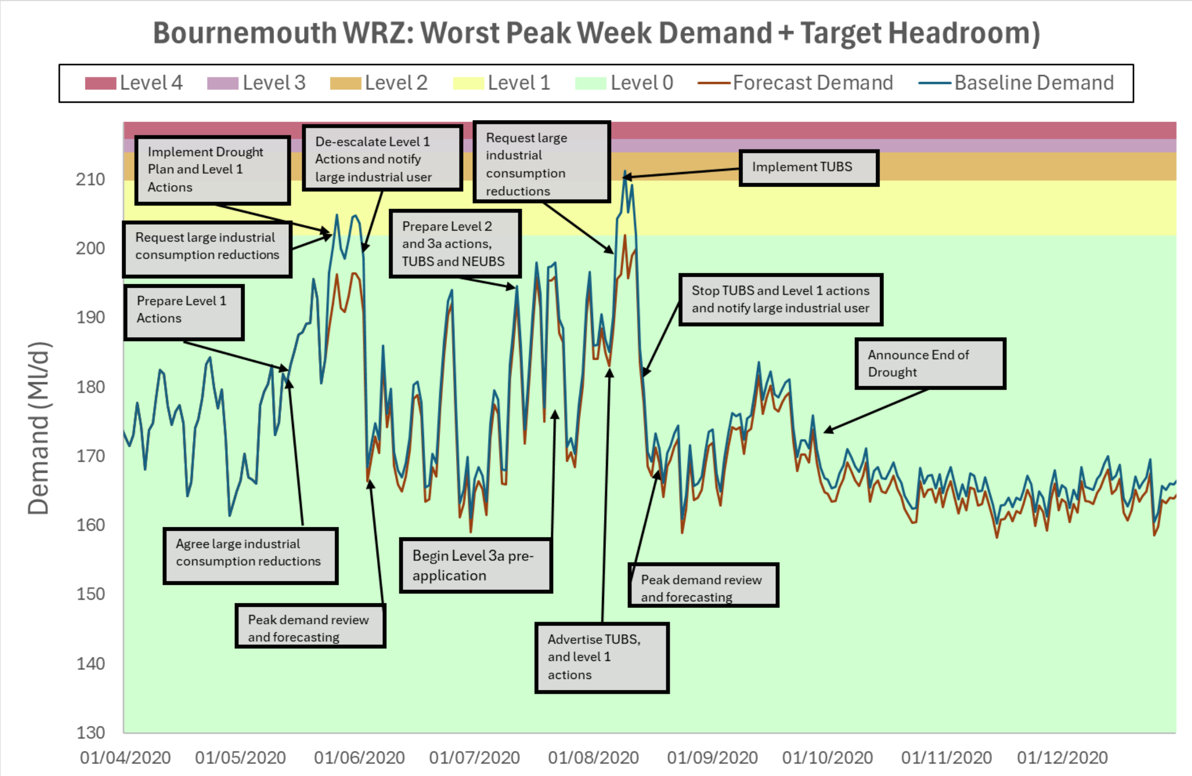

Figure 1.13: The worked example graph overlaying the Baseline and Forecast demand scenario on the Bournemouth WRZ Demand management zones for the worst historic drought, dry year demand plus target headroom. The Baseline demand trend is the simulated demand with no demand or supply actions, the forecast scenario trend is the simulated demand with demand and supply actions included.

Table 1.13: The table demonstrates an example of the timing and implementation of actions and decisions that would be made if the Bournemouth WRZ experienced the worst historic peak week plus target headroom, added as a 18.35 Ml/d annual uplift in demand, for the forecast demand simulation.

Time period, drought level, operational mode	Actions and Decisions	Environmental Monitoring
April-May 2020 Level 0 – Normal Operation	• Routine monitoring • Begin regular weather forecast monitoring to plan operational maintenance procedures around peak demand periods • Prepare Enhanced messaging, leakage campaigns and Level 1 actions ahead of late Spring peak demand period	Normal level of monitoring

Early - Mid May Level 0 – Normal Operation	Routine monitoring Weather Forecast suggests Late May into June will have high temperatures during May Bank Holiday and end of school half term. Based on average demand in May, a peak demand above Drought Level 1 is possible. • Advertise targeted peak periods media campaign • Prepare for targeted leakage management • Agree voluntary demand reduction period with large industrial customer • Ensure Longham Bankside Storage is filled ahead of hot weather forecast. • Identify whether TW process operational maintenance is required prior to peak demand. E.g. Slow sand filters.	Normal level of monitoring
Late May Level 1 – Dry Weather Operation	Hot, dry, sunny weather experienced Baseline Demand is forecast to rise above Level 1 Drought for 9 days with a short 1 day recession below level 1. Initiate Drought Plan Implement Level 1 actions the day : • Implement Enhanced messaging targeting high demand areas • Enhanced leakage management. • Request voluntary demand reduction with large industrial customer Maintain level 1 actions until current demand plus large industrial customer's forecast demand (or agreed future demand) falls below level 1.	Enhanced monitoring
Early June Level 0 – Drought Plan Operation	Review end of May demand peak, concluding that summer demand peak will likely enter level 2, potentially level 3, if hot and dry weather persists. • Monitor company assets and plan necessary maintenance to ensure they can be maximised during peak summer demand. • Prepare TUBs • Prepare NEUBS • Prepare level 3a drought actions	Enhanced monitoring
Mid June Level 0 –	Total demand reduces below Level 0 and demand forecasts throughout June/July do not highlight significant demand risk.	Enhanced monitoring

Drought Plan Operation	Complete demand forecast and conclude limited risk of Level 2 peaks in June. Continue preparing TUBS and NEUBS and level 3a drought actions	
July Level 0 – Drought Plan Operation	Risk of level 3 peak demand still persists for August. • Implement enhanced messaging targeting peak demand areas for August • Advertise TUBS • Preparing NEUBS • Begin Pre-application process for level 3a drought options. Agree voluntary demand reduction with large industrial customer and align forecast consumption estimates.	Enhanced monitoring
Early August Level 2 – Drought Plan Operation	First day of peak demand rises to Level 1 and demand is forecast to increase further • Implement enhanced messaging • Prepare for NEUBS and Level 3a actions • Request voluntary demand reduction with large industrial customer Second day demand peak reaches level 2 drought, high demands forecast for 2-3 more days however temperatures are reducing • Implement TUBS • Assess stress on network infrastructure including service reservoir storage and water quality performance metrics. Third and fourth day demand peaks are consistently in Level 1 • Maintain TUBS • Do not trigger NEUBS and level 3a actions. Fifth day demand peaks reduce to normal operation • De-escalate TUBS and enhanced messaging • Agree return to normal operation with large industrial customer.	Enhanced monitoring
Mid August Level 0- Drought Plan Operation	Return of demand levels to normal operation. Assess risk of future demand peaks based on possible peak demand periods. Complete post drought demand review	Normal level of monitoring

Late August – September Level 0 – Normal Operation	Weather and demand forecasts for September do not suggest a peak demand risk. No risk of domestic consumption based peak demand constraints over Autumn and Winter. End of Drought announced at the end of September	Normal level of monitoring

A1.6. Bristol WRZ drought assessments

The Bristol Water WRZ covers the City of Bristol, North Somerset and areas of Bath, North East Somerset and South Gloucestershire.

The Bristol WRZ recently transferred their water resources model from MISER to Aquator during WRMP24, representing a step change in sophistication of modelling capabilities and techniques.

The WCWE stochastic datasets produced by Atkins were used to provide stochastic flow simulations for five GR6J models, with each GR6j model containing 400 x 48-year stochastic replicates (representing a period of 1950-1997). Transposition factors were then applied to the simulated stochastic flows to create specific inflows for the Aquator model.

In addition to the historical inflows, spanning 124 years (1901-2024, inclusive), four stochastic scenarios identified in WRMP24 were tested as part of this exercise. Two stochastic scenarios that are representative of a 1:500 year drought event (stochastic scenarios 44 and 225) and two that are representative of a 1:200 year drought event (stochastic scenarios 203 and 337), with each return period containing a single season and a multi-season event. Analysis of baseline storage outputs showed stochastic scenario 337 exhibited the greatest level of drawdown when simulated with drought plan demand and as such, was taken forward for testing with drought actions applied.

Several historical demand scenarios were tested against the historical and 1:500 year drought events. Simulations derived from the observed 2018/19 distribution input data produced the greatest impact on reservoir storage when compared to other key drought years.

A single set of drought trigger curves are used, based on the combined storage of the four major reservoirs: Chew Valley Lake, Blagdon, Cheddar and Barrow. These define the drought zones within which specific drought actions may be implemented. The combined reservoir control curves are indicated in Figure 1.14.

Due to the integrated nature of the Bristol WRZ, the combined volume of water stored within our reservoirs informs our drought management decisions. The combined storage approach is reflective of how the system would be managed in practice, with the whole resource zone subject to the same level of risk in terms of water use restrictions, should a drought materialise.

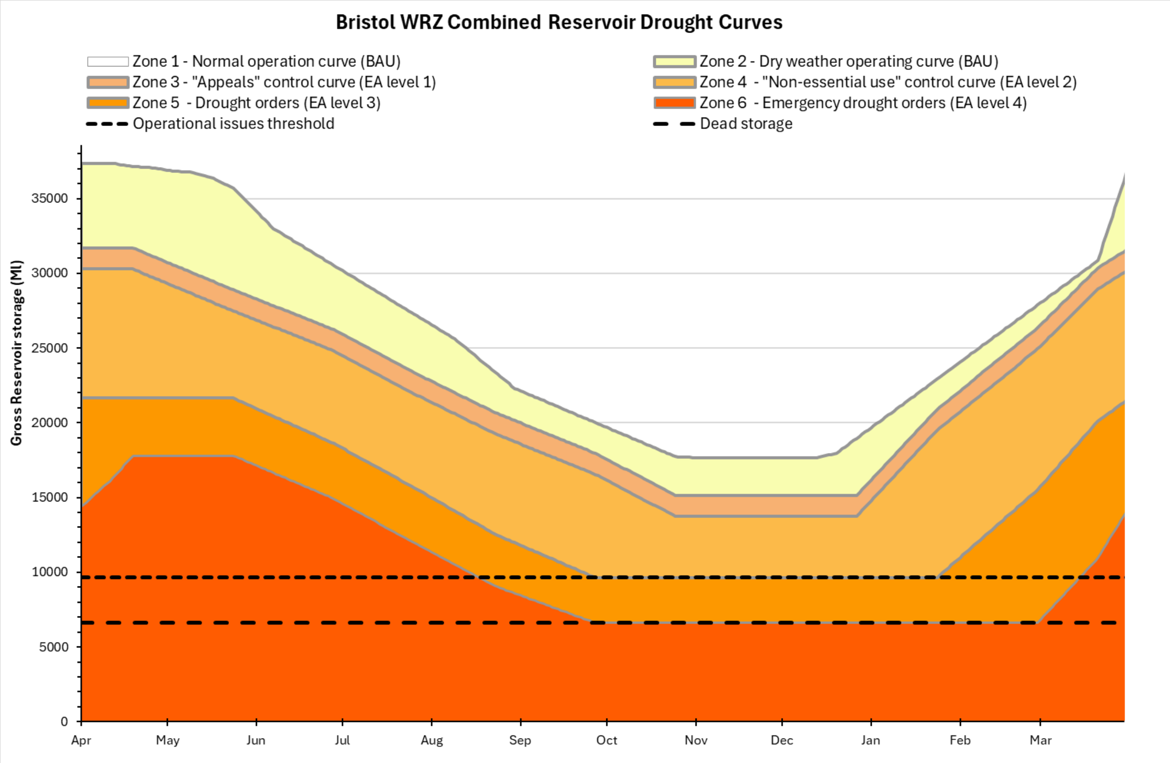

Figure 1.14: The graph shows Bristol WRZ reservoir drought curves. The combined storage is calculated as the gross combined reservoir storage of Barrow Reservoirs, Chew Valley Lake, Blagdon Lake and Cheddar Reservoir. Maximum combined gross storage is 38571 Ml; dead storage, the level at which water cannot be abstracted from the reservoir using existing infrastructure, is 6612 Ml; the threshold for operational issues, such as water quality, is 9641 Ml. The drought curves are separated into zones, within each zone we will consider implementing the demand and supply actions of the corresponding EA drought levels described in the table below.

Table 1.14: Bristol WRZ drought management zones corresponding Environment Agency drought levels and potential actions that can be taken within each zone.

EA Drought Stage	EA Drought Level	Bristol WRZ DMZ	Demand Actions	Supply Actions
Normal	0 (BAU)	1	Routine demand management actions	Normal operation
	0 (BAU)	2		Dry weather operation • Reservoir storage optimisation by maximising abstraction from the G&S canal and groundwater sources.
Prolonged dry weather	1	3	• Appeals for restraint • Leakage reduction and pressure management • Increase company water efficiency	• Reduce bulk supplies within established agreement • Delay reservoir water bank releases
Drought	2	4	• Temporary Use Bans (TUBs) • Further enhanced media campaign • Further water efficiency	• Reduce bulk supplies with temporary variation to established agreement L2

			• Leakage management	• River Axe to Cheddar Reservoir - early commissioning of pumped storage abstraction • Request Increase of Cowbridge transfer from Wessex Water
	3a	5	• Non-Essential Use Bans (NEUBs) • Media campaign tied-in to national messaging	• Reduce reservoir compensation flows • Extend River Axe to Cheddar Reservoir pumping season • Optimise/reduce bulk supplies with temporary variation where feasible
Severe drought	3b	5	• Standpipes • Rota cuts • Pressure management • Some exemptions removed from TUBs and NEUBs	No proposed drought permits with major environmental impacts.
Severe drought	4	6	Emergency plan for drought	Emergency plan for drought

We intend to carry out a review of our drought curves with external support, following submission of the draft drought plan, with the outcome of this work to be reflected in the revised draft or final drought plan. Further details of this work are contained within Section 10 of the Drought Plan Main Report.

A1.6.1. Bristol WRZ worst historical drought

The following worked example is the worst historical drought in the Bristol WRZ, from 1933-35 simulated using rainfall runoff models from historical PET and HADUK rainfall data.

The response to this drought under the 2018/19 demand scenario is set out in the graph in Figure 1.15. Further details of how we would prepare and implement demand and supply actions under this scenario is shown in Table 1.15.

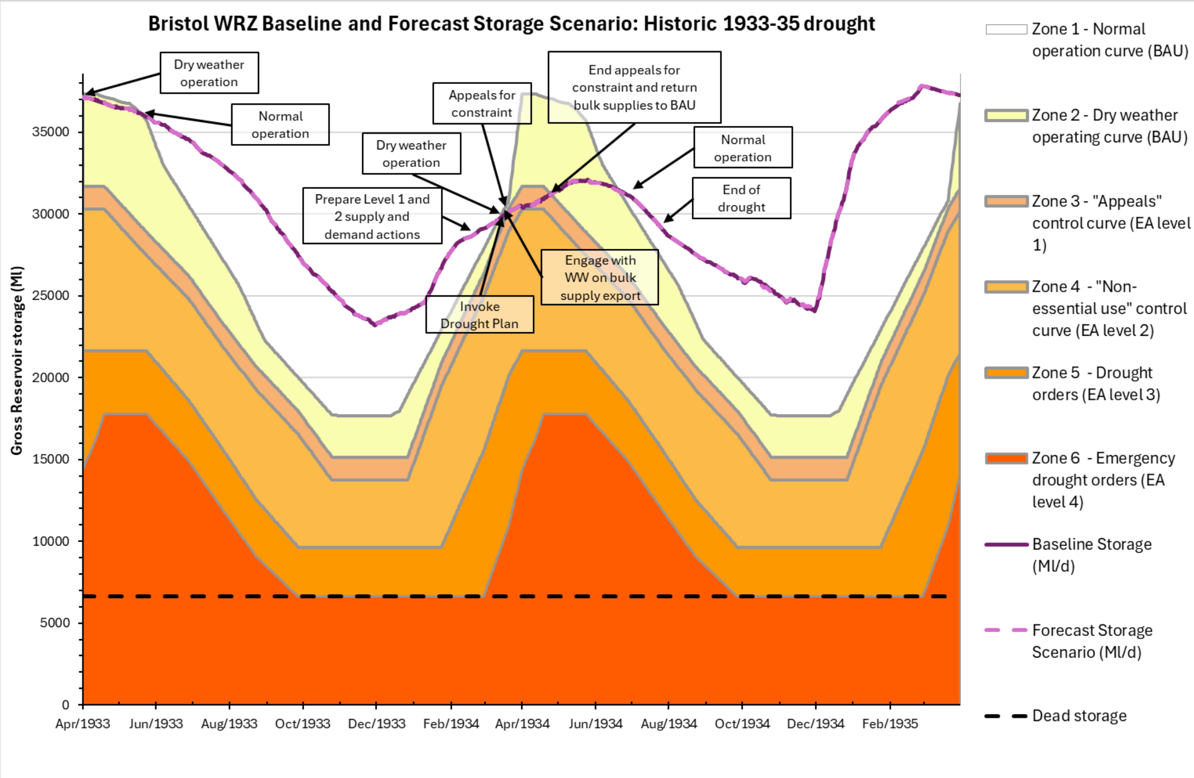

Figure 1.15: The graph shows 2 reservoir storage projections overlain on the current Bristol WRZ drought curves. The baseline storage is the simulated combined reservoir storage for the 1933-35 drought with no drought actions. The forecast storage scenario is the simulated combined reservoir storage for the 1933-35 drought with supply and demand drought actions applied where necessary. The storage is measured in gross reservoir storage, where maximum storage is 38571 Ml, and dead storage, the level at which water cannot be abstracted from the reservoir using existing infrastructure, is 6612 Ml.

Table 1.15: The table demonstrates an example of the timing and implementation of actions and decisions that would be made if the Bristol WRZ experienced a repeat of the historical 1933-35 drought for the Forecast Scenario (with actions) simulation. EA drought levels are shown in the first column and the corresponding Bristol drought management zone (DMZ) in the second column.

Time period, EA drought level, operational mode	**Bristol water DMZ**	**Actions and decisions**	**Environmental monitoring**
April – May 1933 Dry Weather Operation – EA Level 0	2	Reservoir storage in April 1933 is below 100%. A balanced Dry Weather operation / Normal operation would be undertaken since weather and storage forecasts would not suggest storage is most likely to remain in DMZ 1 throughout Spring/summer.	Normal level of monitoring
June 1933 – February 1934 Normal operation – EA Level 0	1	Normal Operation from June since storage enters DMZ1. November: November 1933, significant reservoir refill does not occur. Rainfall is below average in October and November, river flows are below normal.	Normal level of monitoring

		• Increase monitoring of rainfall, groundwater and river flows. Refill over December and January is minimal due to a significantly lower rainfall than average. Storage forecast in February based on antecedent conditions suggest refill may only reach 70% by April. Storage likely to recover to DMZ 4 (EA level 2) in April if rainfall is lower than average. February: • Prepare Level 1 and Level 2 Demand and Supply actions. • Prepare TUBS • Prepare appeal for constraint • Begin discussions on bulk supplies with Wessex Water	
Early March 1934 Dry weather operation - EA Level 0	2	Storage enters DMZ 2 in Early March. Storage forecasts suggest storage will enter DMZ3 in March. Change to dry weather operation	Enhanced monitoring
Mid March – Mid April 1934 Drought Plan – EA Level 1	3	Storage enters DMZ3 in March. Assess environmental drought indicators and risk of drought over the next 6-12 months. Invoke Drought Plan • Undertake ESoR analysis. • Implement appeal for constraints level 1 demand actions • Engage with Wessex Water to ensure bulk supply between Bristol and Bath is operating to agreed profile Storage forecasts suggest, without greater than average rainfall, storage may continue in DMZ3 in early spring.	Enhanced monitoring
Late April 1934 Drought Plan – EA Level 1	3	Rainfall in April raises river flows enabling increase in storage recovery. Updated storage forecasts suggest storage will recover to DMZ2 in May.	Enhanced monitoring

May – June 1934 Dry weather operation – EA level 0	2	Storage continues to recover into June, remaining in DMZ2 and crossing the DMZ1 drought curve into normal operation in Late June. • De-implement appeals for constraint • Return bulk supply exports to normal operation/BAU Risk of drought has significantly reduced and weather forecasts do not suggest an increased risk of drought in the Bristol WRZ.	Normal level of monitoring
July 1964 – March 1965	1	Storage recovers into DMZ1. End of drought announced Conduct post-drought review.	Normal level of monitoring

A1.6.1. Bristol WRZ 1:500 design drought

The following worked example is a stochastic variant of 1963-67 with a 1 in 500 year return period (based on system response). This winter drought has been used to show the type of actions that may be taken in response to limited storage recovery conditions in the Bristol WRZ.

The response to this drought under the 2018/19 demand scenario is set out in Figure 1.16. Further details of how we would prepare and implement demand and supply actions under this scenario are shown in Table 1.16.

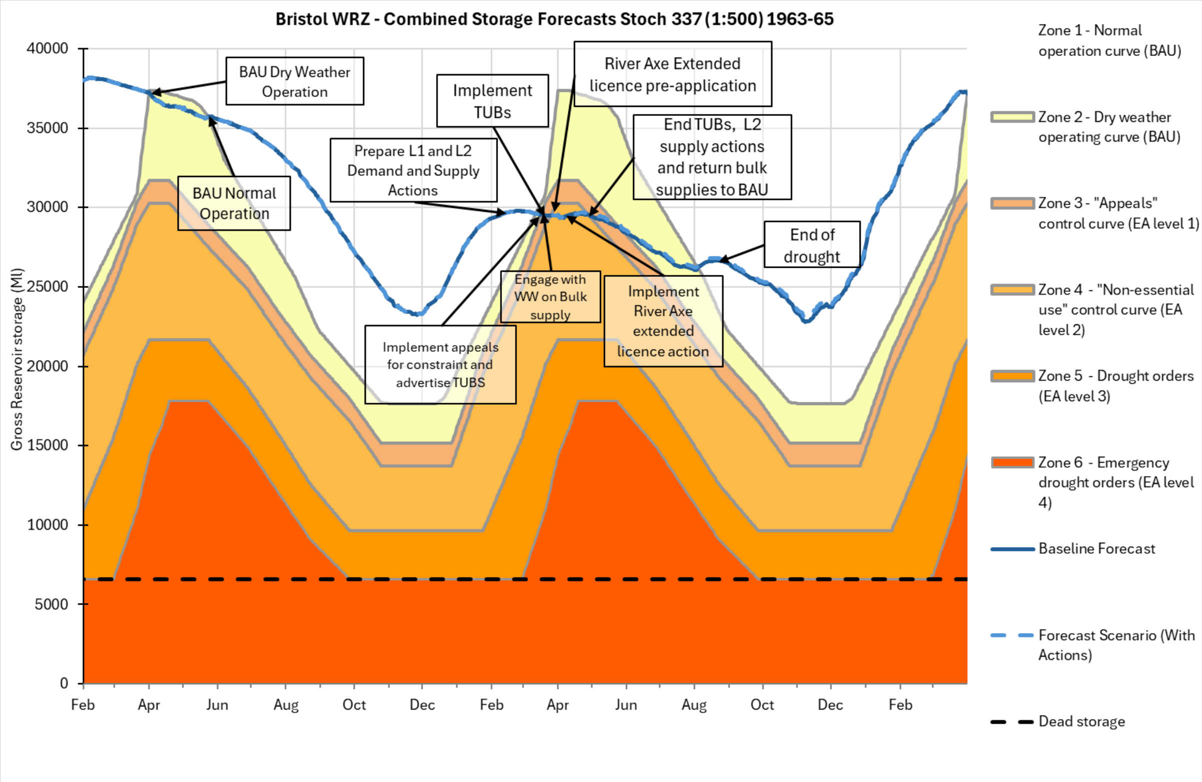

Figure 1.16: The graph shows 2 reservoir storage projections for a 1:500 year return period drought overlain on the current Bristol WRZ drought curves. The baseline storage is the simulated combined reservoir storage for stochastic replicant 337 1963-65 drought with no drought actions. The forecast storage scenario is the simulated combined reservoir for the same drought with supply and demand drought actions applied where necessary. The storage is measured in gross reservoir storage, where maximum storage is 38571 Ml, and dead storage, the level at which water cannot be abstracted from the reservoir using existing infrastructure, is 6612 Ml

Table 1.16: The table demonstrates an example of the timing and implementation of actions and decisions that would be made if the Bristol WRZ experienced a 1:500 return period drought under the conditions of stochastic replicant 337 1963-65 for the Forecast Scenario (with actions) simulation. EA drought levels are shown in the first column and the corresponding Bristol drought management zone (DMZ) in the second column. WW = Wessex Water.

Time period, EA drought level, operational mode	Bristol water DMZ	Actions and decisions	Environmental monitoring
February 1964 Level 0 – Normal Operation	1	Storage begins to recede in February 1964 due to low inflows, despite subdued demands over winter. Storage forecasts suggests Storage will enter DMZ2 in April 1964 but very low likelihood storage will remain in or below DMZ2 in 1964.	Normal level of monitoring
April 1964 Level 0 – Dry weather Operation	2	Storage crosses into DMZ 2, EA drought level 0, at the start of April. Implement Dry Weather Operation, maximising abstraction from the Gloucester and Sharpness Canal to conserve reservoir storage.	Normal level of monitoring

		Weather Forecasts suggest increased rainfall throughout April will sustain river flows. Storage forecasts and prevailing weather forecasts indicate high likelihood of entering DMZ0 in June	
May-October 1964 Level 0 – Normal Operation	1	Storage enters DMZ 0 in Late May. Normal Operation.	Normal level of monitoring
May 1964 – February 1965 Level 0 – Normal Operation	1	Rainfall in late October enables recovery of soil moisture deficit however not enough for significant recharge which does not start until late November, river flows are well below normal. Storage forecasts in October suggest without significant future rainfall, storage may not recover above 70% by February. Extremely low rainfall in December leads to very low river flows. Rainfall runoff and water resource modelling identify a significant risk. Storage recovery begins to taper-off in December and weather forecast for late Winter/spring suggests rainfall will not enable significant recharge. December: • Prepare level 1 and 2 supply and demand actions. • Discuss bulk supply reductions with Wessex Water • Begin TUBS preparation • Reservoir water bank release level 1 supply actions not beneficial until following winter.	Normal level of monitoring
Early March 1965 Level 0 – Dry Weather Operation	2	• Continue level 1 and 2 supply and demand action preparations	Normal level of monitoring

Mid March - January 1965 Level 1 – Drought Plan operation	3	Undertake ESoR analysis Invoke Drought Plan, storage enters DMZ3. Request weekly rainfall and groundwater level reports from the Environment Agency and begin weekly reporting of water resources position. Storage highly likely to breach DMZ4 in late January. • Continue appeals for restraint • Implement enhanced leakage and pressure management. • Engage with Wessex Water to ensure bulk supply between Bristol and Bath is operating to agreed profile and determine whether an increase in Cowbridge transfer is possible. • Advertise TUBS, intending to implement in early February. • Start Level 2 supply actions pre application (River Axe extended pumping season)	Enhanced monitoring
Late March-April 1965 Level 2 – Drought Plan operation	4	Storage enters DMZ4 in Late March. • Implement TUBS – although limited impact on demand is expected. • Request reduction of bulk transfers to Wessex Water in line with TUBs implementation in Bristol. • Request Cowbridge transfer increase if possible. • Forecast likely benefit of River Axe Licence extension (based on current/future river flows) In Mid-April implement Level 2 supply actions: • Extend River Axe licenced pumping season to 31st April.	Enhanced monitoring
May 1965 Level 1 – Drought plan operation	3	River Axe ends abstraction on 31st April. Storage enters DMZ 3 in early May. • Weather forecast for May – June suggest mild weather, with average rainfall. • Storage and rainfall runoff modelling suggest reservoir drawdown will be moderate	

		through early summer with prevailing weather. • Remove TUBs and L2 supply actions • Return Bulk supply with Wessex Water to BAU profile	
June – July 1965 Level 0 – Dry Weather operation	2	Storage enters DMZ 1 in early June. EA Drought Level 0. Prevailing weather is wetter than average, leading to reduced drawdown.	
August 1965 Level 0 – Normal Operation	1	Significant rainfall event at end of August enables recovery of storage into DMZ 1. Storage forecasts suggest likelihood of reaching 100% full by April is now highly likely. Risk of Drought has now significantly reduced and WRZ can operate under BAU. End of Drought announced. Complete post drought-review process.	

This stochastic drought simulations shows the resilience of the Bristol WRZ to an exceptionally dry winter period. The demand and supply drought actions are applied across the winter period which means that demand actions such as TUBs have a limited benefit of the already subdued winter demand. However, the drought action to extend the pumping season of the River Axe pumped storage scheme is able to make a moderate improvement to storage at the end of April. Recovery from the winter drought in this example is shown as entering DMZ 1 during the end of summer because the likelihood of entering a drought before the end of the year would be assessed to be highly unlikely based on storage and weather forecasts. On the current drought curves, Environment Agency drought level 1 and 2 are crossed within a single month, hence level 1 and 2 supply actions are prepared in advance of this event, however the drought curves are being reviewed for the revised drought plan. It is important to note that Drought Management Zone 1 and 2 fall within the Environment Agency's 'drought level 0'. In revised curves, this would be aligned to EA drought levels.

A1.7. Isles of Scilly WRZ drought assessments

The Isles of Scilly WRZ covers the five inhabited islands in the Isles of Scilly archipelago, namely St Mary's, Tresco, Bryher, St Martins and St Agnes. The principal water source on the islands is groundwater, supplemented equally on St Mary's by seawater desalination. Each of the islands are operated as distinct and separate sub zones, with no inter-island connectivity of the water supply network. The population varies seasonally, with a significant influx of visitors between Easter and October school half term. Peak demands typically occur immediately prior to, and over, the August bank holiday weekend.

The drought resilience of the Isles of Scilly is determined by a combination of raw water availability, abstraction capacity and water treatment works capacity. Abstraction licences, originally issued in 2021, have subsequently been revised where necessary to reflect recent operational improvements and more comprehensive data records. Our key drought triggers therefore reflect each of these constraints, where relevant.

Groundwater level triggers on St Mary's are used to provide an indication of overall water resource availability for the zone and are considered in combination with demand triggers specific to each of the five islands. The passing of either environmental or demand drought thresholds does not by itself require specific action. Decisions will also consider other factors including weather forecasts, time of year (e.g. holiday periods) and their impact on demand.

Groundwater models, which use rainfall recharge and groundwater recharge/recovery to simulate water resource availability and associated environmental impacts, are currently being developed but not available for the draft Plan. These require further calibration and verification, which will be completed once sufficient data has been collected via the recently installed environmental data monitoring network.

As the groundwater recharge models are not available to inform draft drought plan 2027, groundwater level triggers are based on interpretation of the available historical groundwater level data for Carrs Well on St Marys and further informed by the operational actions required during the 2022 drought event and further informed by the 2018 extended dry weather event.

The Carrs Well drought trigger curve has been updated for this draft Drought Plan with changes in autumn to reflect recent operational experience of the profile of groundwater recovery at this time of year. This updated curve is shown in Figure 1.17.

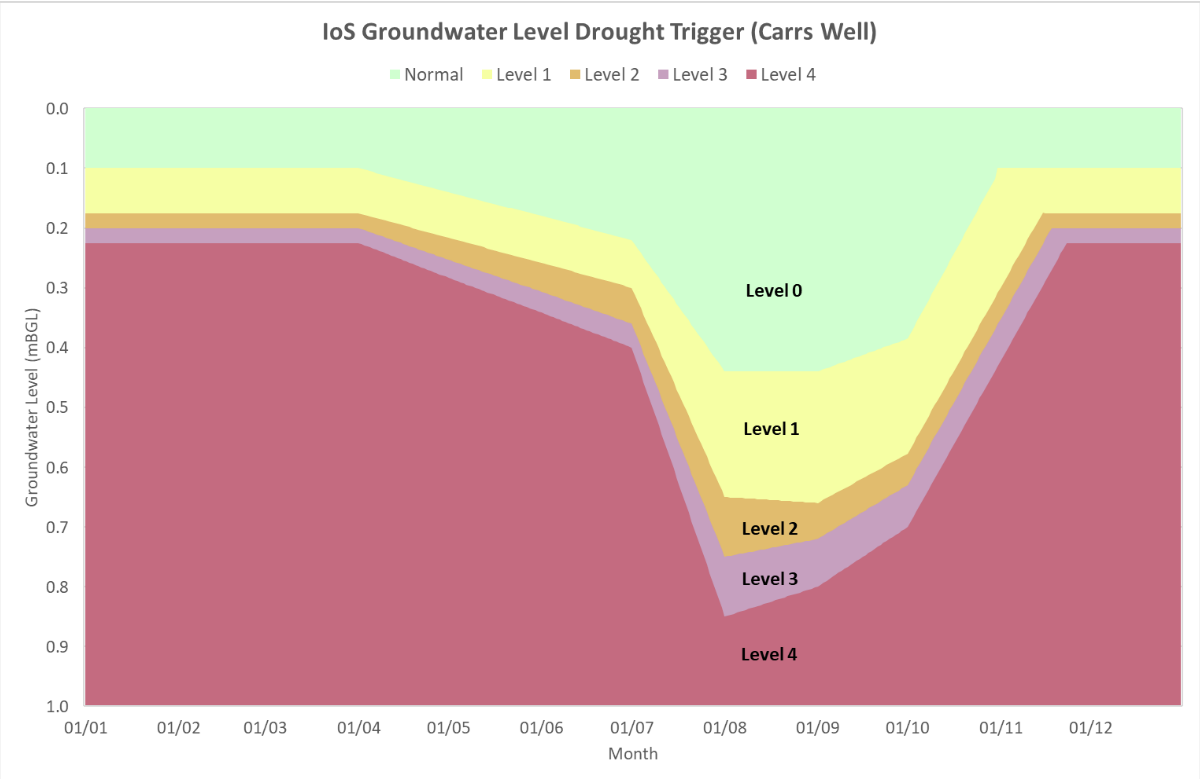

Figure 1.17: IoS Groundwater level drought trigger curve based on Carrs Well, St Mary's.

Our demand trigger curves have been updated from recent experience. The main change to these curves has been to represent them as constant annual profiles aligned with our water treatment capacity. For St Mary's our capacity to treat water increases when we deploy our seawater intake which means we have now included a deployment window to our triggers which will vary each year. The demand triggers for each island are included in Sections A1.7.1to A1.7.5.

The combination of demand and supply actions associated with each drought level on the Isles of Scilly are presented in Table 1.17 below.

Table 1.17: Isles of Scilly drought management zones, corresponding EA drought levels and potential actions that can be taken within each zone.

Drought Stages	Drought Level	Demand Actions	Supply Actions
Normal (green)	Business as usual	Routine demand management actions	No additional actions – use of existing sources
Prolonged dry weather (yellow)	1	Annual media campaign (see comms plan)	Outage minimisation, optimising sources (inc. desalination processes on St Mary's & Bryher). Seasonal optimisation of abstraction from borehole sources within existing licence conditions on St Mary's and Tresco, or within 20m3/d threshold on St Agnes and St Martins.
Drought (amber)	2	• Temporary Use Bans (TUBS) • Enhanced media campaign • Discussion with large commercial customer re timing of highest water use to avoid peak demand periods. • Community Drought Liaison Officer (Enhanced media campaign Phase 1). Preparation 4 weeks before Level 1, plus 1 week for implementation.	
	3a	• Non-essential use bans Advertising time and period for representations Typically, the preparation would start 4-6 weeks prior to implementation. Advertised 1 week before implementation. All possible actions to avoid emergency drought orders	Increase abstraction from boreholes above existing licence volumes or greater than $20m^3/d$ threshold (St Martins).

Severe Drought (red)	3b	• Blitz/aggressive media campaign • Free water saving devices to commercial and domestic customers • Reduced water consumption by large commercial customers • Enhanced customer side leakage • Rewards through billing	
Extreme drought	4	• Emergency Drought Plan e.g. bottled water, direct abstraction from Great Pool &/or Abbey Pool, Tresco.	

A1.7.1. St Marys demand triggers

On St Mary's, a key factor impacting our ability to meet demand is the annual deployment of the seasonal seawater intake, which allows us to increase the output of the desalination plant on St Marys. Our Marine Management Organisation (MMO) licence allows us to deploy the direct seawater intake between 1st March and 30th November each year. However, deployment of the direct seawater intake is further constrained by our ability to deploy and maintain the infrastructure during periods of unsettled or stormy weather.

The shape of the Demand Drought Trigger curve therefore represents this uncertainty, with separate thresholds delineating early and late deployment of the intake. This is generally less of a concern at the end of the season (i.e. Oct./Nov.), as there is a significant reduction in demand in early September, coinciding with the end of the 'summer' holiday period.

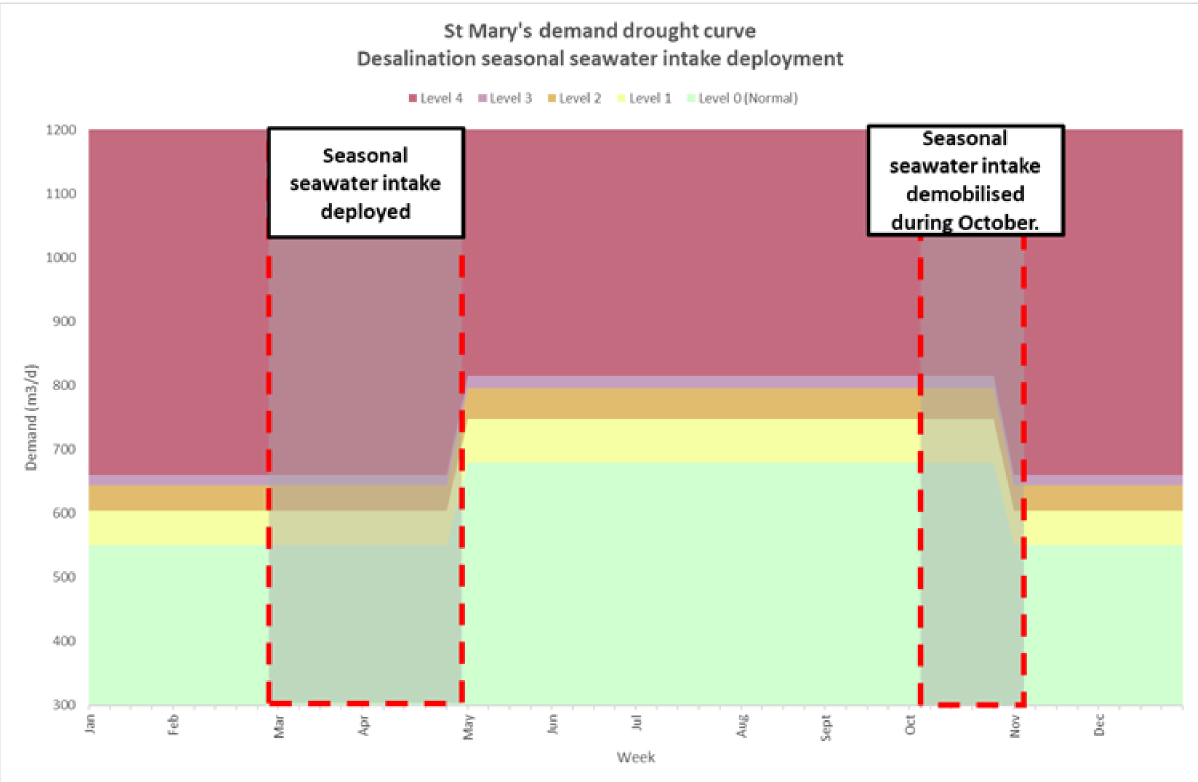

Figure 1.18: St Mary's demand drought trigger curve

A1.7.2. St Martins demand triggers

The implementation of drought actions on St Martins is based a combination of groundwater level stress curves and demand curves as outlined previously.

The demand triggers have been derived using the recently available demand data for St Martins with particular focus on annual demand profiles and key periods of high demand. These include Easter, the annual Gig Boat Racing Championships, the Summer Holiday period and October Half term. Water Treatment works output and operational constraints have been used to help define appropriate trigger thresholds.

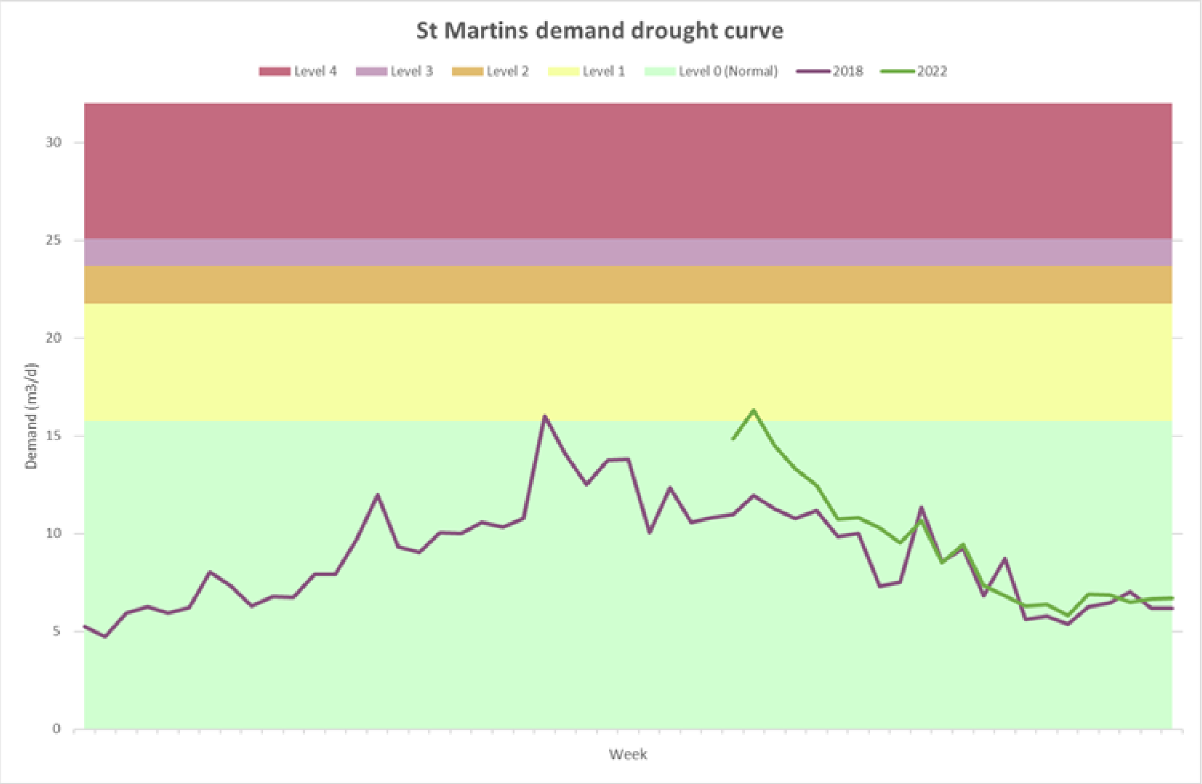

Figure 1.19: St Martins demand drought trigger curve

A1.7.3. St Agnes drought triggers

The implementation of drought actions on St Agnes is based a combination of groundwater level stress curves and demand curves as outlined previously.

The demand triggers (Figure 1.20) have been derived using the recently available demand data for St Agnes with particular focus on annual demand profiles and key periods of high demand. These include Easter, the annual Gig Boat Racing Championships, August Bank Holiday and October Half term. Water Treatment works output and operational constraints have been used to help define appropriate trigger thresholds.

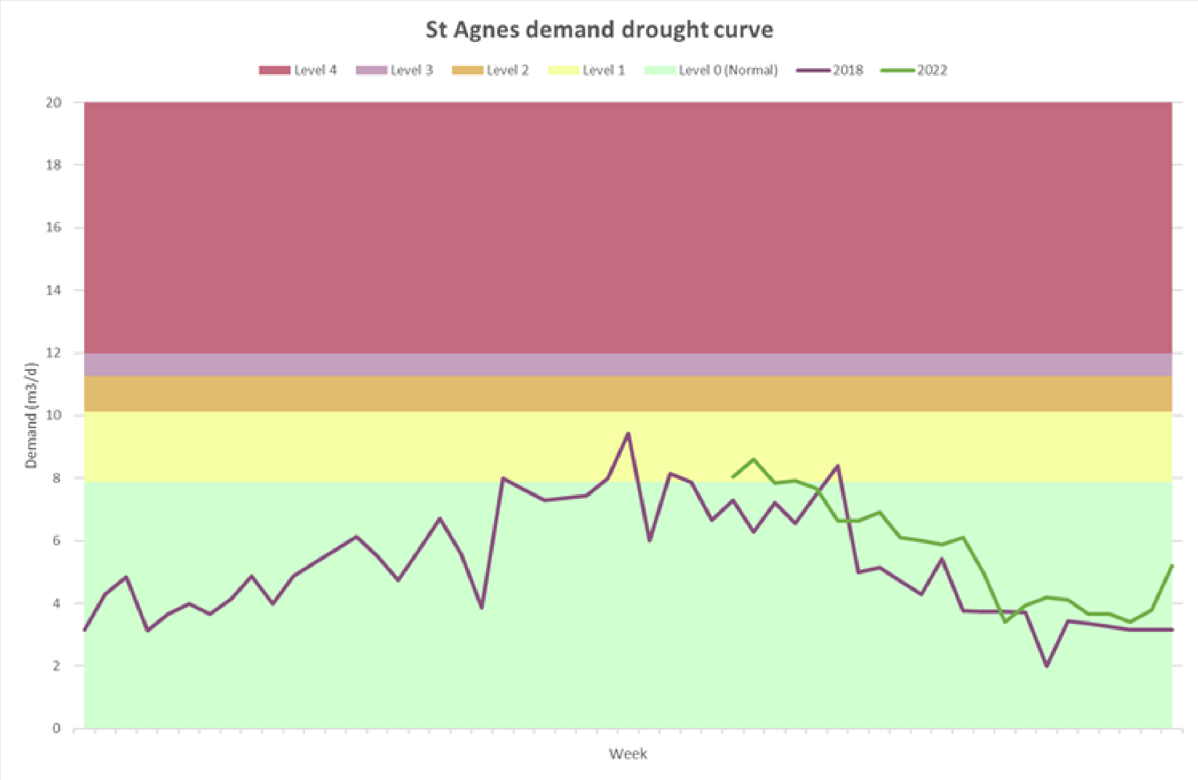

Figure 1.20: St Agnes demand drought trigger curve

A1.7.4. Tresco drought triggers

The implementation of drought actions on Tresco is based a combination of groundwater level stress curves and demand curves as outlined previously.

The demand triggers (Figure 1.21) have been derived using the recently available demand data for Tresco with particular focus on annual demand profiles and key periods of high demand. These include Easter, the annual Gig Boat Racing Championships, August Bank Holiday and October Half term. Water Treatment works output and operational constraints have been used to help define appropriate trigger thresholds.

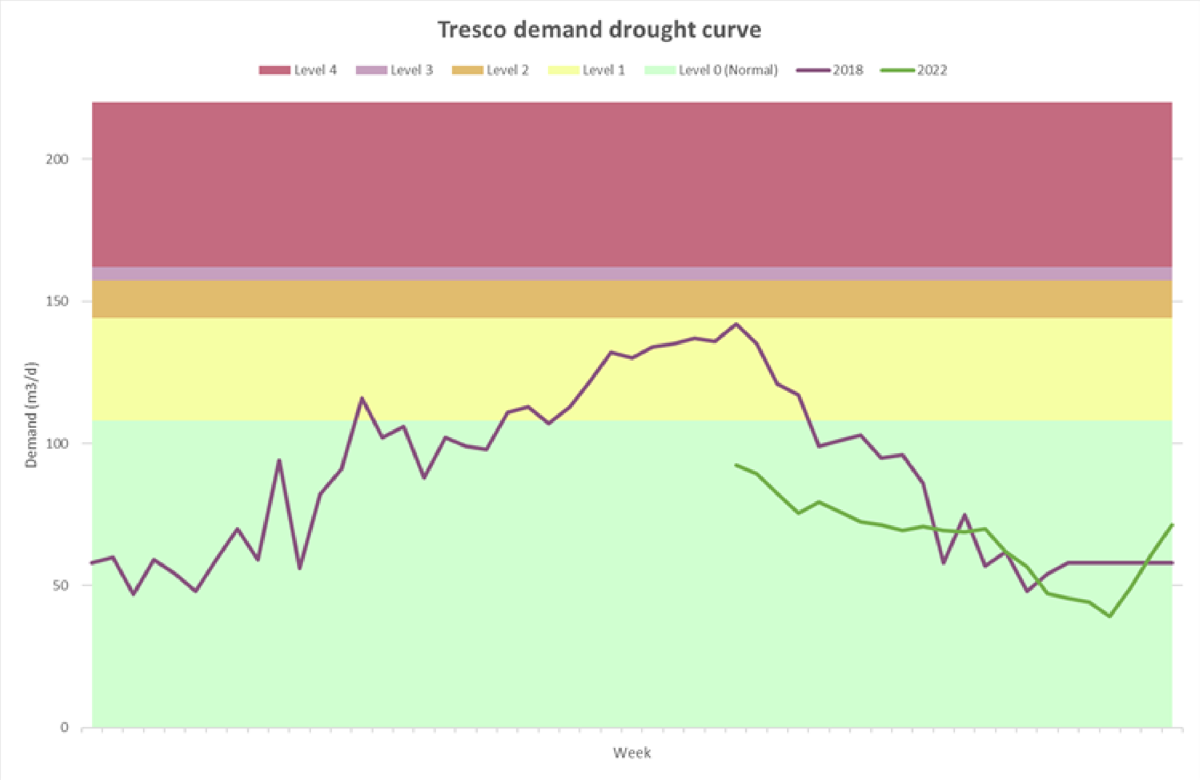

Figure 1.21: Tresco demand drought trigger curve

A1.7.5. Bryher drought triggers

The drought triggers for Bryher utilise a combination of groundwater level stress curves and demand curves as previously outlined.

The demand triggers (Figure 1.22) have been derived using the recently available demand data for Bryher with particular focus on annual demand profiles and key periods of high demand. These include Easter, the annual Gig Boat Racing Championships, August Bank Holiday and October Half term. Water Treatment works output and operational constraints have been used to help define appropriate trigger thresholds.

Although relatively small, demands on Bryher can vary significantly throughout the season and gaining sensible records without impacting outputs can be challenging. This was the case during the period of high demands in 2022. For this reason, we have constructed a composite maximum demand profile to better represent the demand profile on Bryher.

NB: Groundwater abstraction on Bryher is subject to a reverse osmosis (RO) desalination process to ensure adequate water quality. The wastewater stream from the RO plant can account for process losses of up to 60% of the total groundwater abstraction. The demand curve as shown is the post-desalination works output and does not include these process losses.

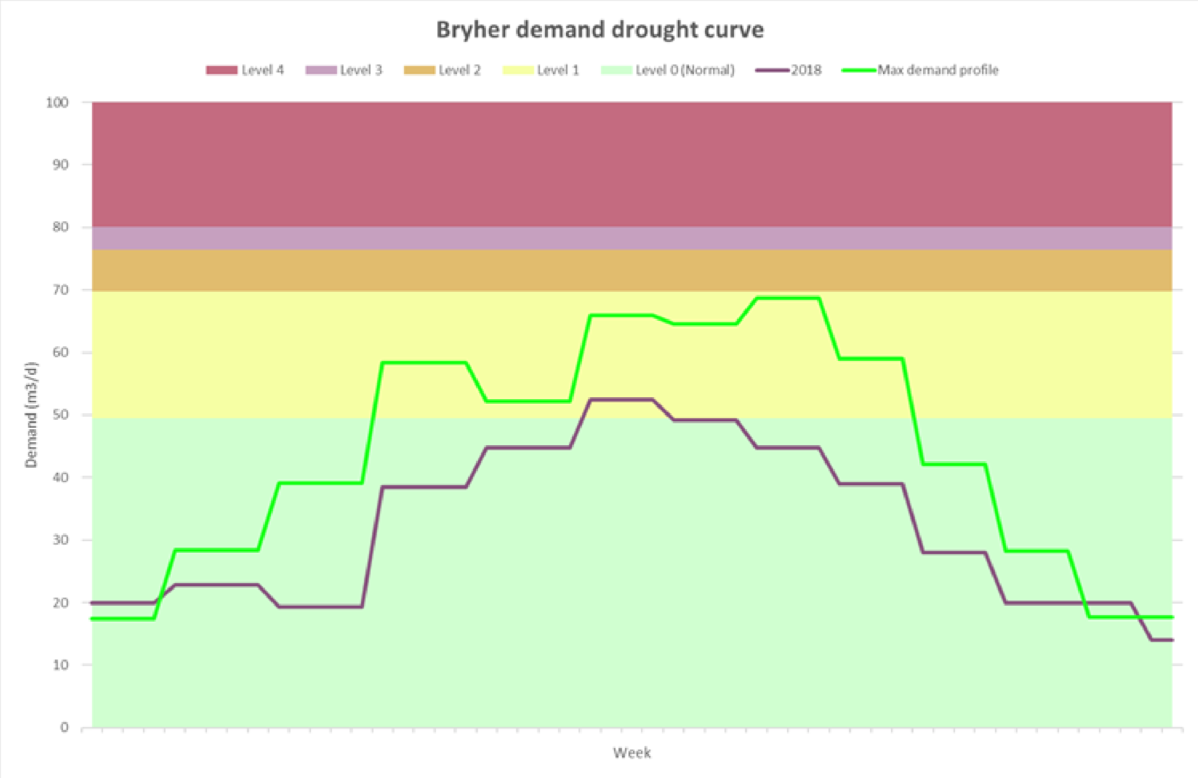

Figure 1.22: Bryher demand trigger curve

A1.7.6. Isles of Scilly historical assessment

A lack of calibrated groundwater recharge models means that it is not currently possible to translate the impacts of rainfall and demand into a combined impact on the available groundwater resources. This precludes the use of historical rainfall records as the basis for detailed analysis of historical drought impact and severity. In lieu of an alternative approach, we have used the available Met Office rain gauge data spanning 1930 to date (infilled with HadUK 1km data where missing) to assess the likely severity of historical rainfall deficits to help inform environmental drought risk.

Hydrological analysis of historical rainfall data has been undertaken using standard Water Years (i.e. 1st October to 30th September), as these better reflect both the antecedent Autumn/Winter recharge conditions, as well as the spring/summer recessional period, compared to assessment based on calendar years.

The analysis ranks the 2022 event as 8th in terms of total rainfall deficit for the water year (i.e. Autumn 2021 to September 2022), whilst 1976 is ranked 2nd by this measure. The ranked data has been used to calculate an empirical return period based on 94 years of rainfall data from 1930 to 2023. This analysis indicates that drought severity in 2022 was around a 1 in 10 year return period, compared to 1976 with around a 1 in 50 return period.

Note: the 1944 event, ranked 1st, (est. 1 in 95 year return period) was notable as it occurred at the end of an extended period of dry weather, spanning from October 1941 to June 1944. However, this event is not considered sufficiently representative as, although the cumulative annual rainfall is the lowest on record, the extended dry weather period ended with locally significant rainfall in late June/early July 1944 i.e. before the contemporary peak demand period. The lack of groundwater level and demand data for this period also means we have no knowledge of how the extended dry weather period impacted on the availability of water resources on the islands.

It is notable that the 1975-1980 drought period is considered the worst historical drought on record for Colliford WRZ. This provides further confidence in 1976 as a suitable choice for the worst historical drought on record for the Isles of Scilly. However, as the Colliford WRZ is reliant on a surface water reservoir with multi-season refill, it is not possible to directly compare the return period for the Isles of Scilly 1976 event from the event analysis for the mainland.

The 2022 and 1976 droughts developed similarly. Both were preceded by very dry autumn/winter recharge periods, followed by exceptionally dry spring/summer recessions. Both events also ended in the first two weeks of September, with locally significant rainfall marking the start of the Autumn/Winter recharge season. The 2022 event was less severe, in part due to a summer storm which occurred in mid-August, which constrained demands and provided a brief period of aquifer recharge. The 1976 event also extended an additional seven days into September.

Due to the lack of available records for 1976, our worst historical drought is based on water resource and demand scenarios from the exceptionally warm and dry spring/summer of 2022, further informed by operational experience from the preceding dry weather event in 2018.

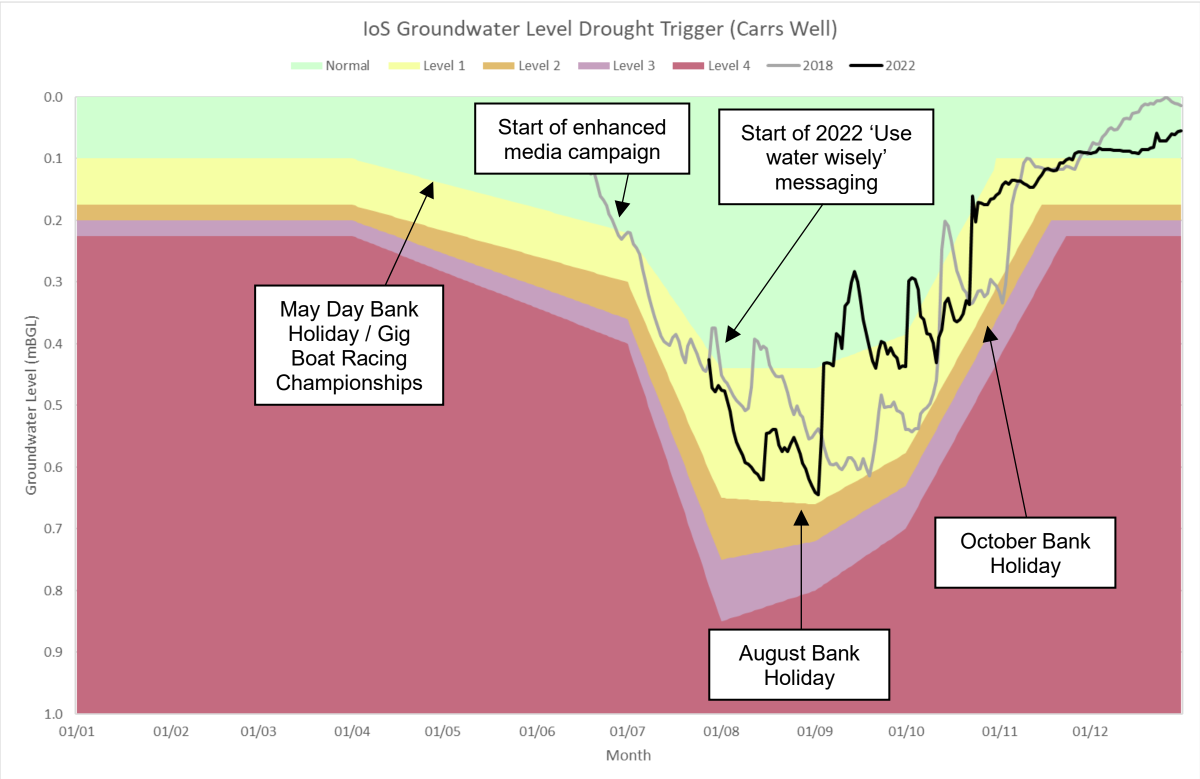

Figure 1.23: Example of the timing and implementation of actions and decisions that would be made if the Isles of Scilly WRZ experienced a repeat of the 2018/2022 historical events

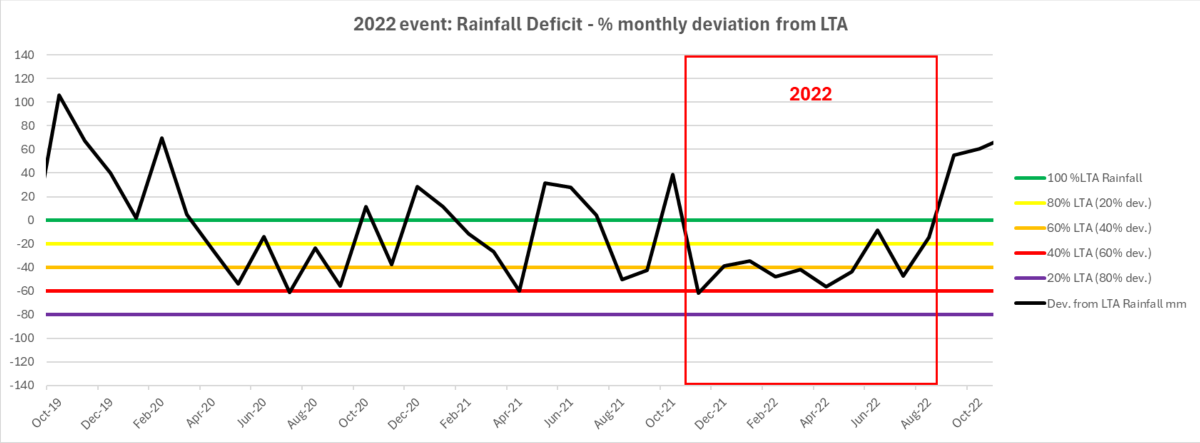

Figure 1.24: Percentage monthly rainfall deficits for the 2022 drought relative to LTA (1991-2020). The cumulative total for WY2021 (i.e. Oct. 2021 to Sept. 2022) was 69% LTA, and the total for the spring/summer recession (March-August) was c.58% LTA.

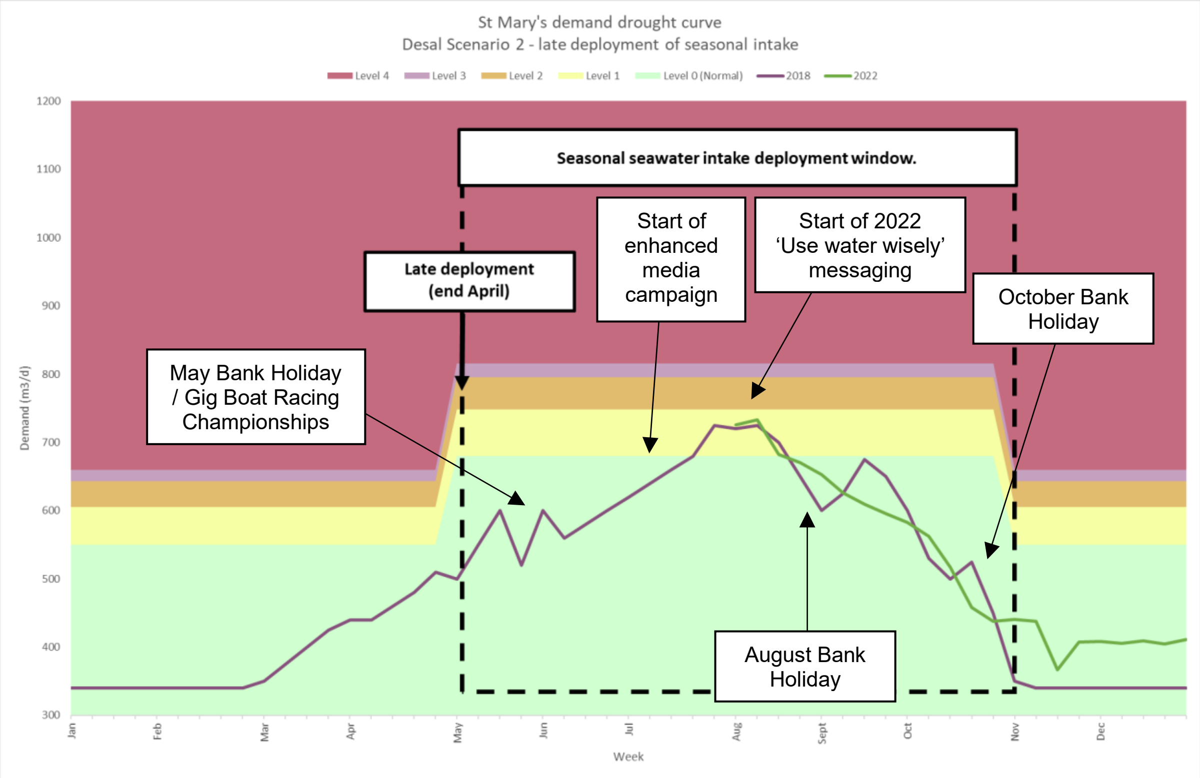

Figure 1.25: Example of the timing and implementation of actions and decisions that would be made against the demand profiles for the 2022 drought (supplemented by the 2018 profile) on St Mary's. The trigger profile for the late deployment of the seasonal seawater intake has been applied. Peak demands occur immediately prior to and over the August bank holiday weekend.

Table 1.18: Example of the timing and implementation of actions and decisions that would be made if the Isles of Scilly WRZ experienced the drought shown in Figure 1.25.

Time period, drought level, operational mode	Actions and decisions	Environmental monitoring*
January – late June 2022 Level 0: Normal operation	Routine monitoring Dry winter, then warm spring followed by hot, sunny & dry May/early June. Deployment of seasonal seawater intake in April.	Normal level of monitoring
Early July 2022 Level 0: Normal operation, dry weather warning	Continued hot dry weather, increasing demand & steep downwards GW recession. Dry forecast > enhanced media campaign considered.	Level of monitoring increased
Mid July 2022 Level 1 – enhanced media campaign	Short break in weather results in short temporary slow-down in rate of GW level recession then further hot dry weather sees return to steep recession. Further hot dry weather forecast. Enhanced media campaign launched. Optimisation of sources and outage minimisation.	Increased level of monitoring
Late July-early August 2022 Level 1 – enhanced media campaign	General pattern of hot dry weather with limited showers. Forecast remains largely settled, hot and dry. Media campaign ramped up with regular media updates in lead up to August bank holiday peak visitor period. Reduced demands following success of media campaign. Optimisation of sources and outage minimisation.	Increased level of monitoring
Mid August Level 1: media campaign continues	Intense summer storm on 15th, followed by a few days of showers. Greater uncertainty in the forecast although still risk of hot dry weather in short term. Rapid but relatively small increase in groundwater levels, sustained for brief	Increased level of monitoring

	period of unsettled weather. Return to rapid GW level recession as weather improves in last week of August. Reduced demands due to combined impact of media campaign and unsettled weather. Optimisation of sources and outage minimisation.	
Early September 2022 Level 1: media campaign continues	Weather breaks and forecast changes to more unsettled period with more rainfall. GW recession slows then rapidly recovers to Level 0/1 boundary, then well into Level 0. Return to school sees drop in visitor numbers & demand.	Normal level of monitoring – watching brief
Mid/late September 2022 Level 0: normal operation	Return of dry weather sees rapid recession in GW levels back into Level 1. Further drop in demand as visitor numbers reduce. Media campaign no longer required.	Return to normal level of monitoring
October 2022 Level 0: normal operation	Variable weather conditions leads to GW levels fluctuating in zone 1 before recovering to level 0/1 boundary at end of month. Demand remains steady with reduced visitor numbers. Media campaign no longer required.	Normal level of monitoring
October – December 2022 Level 0: normal operation	Low demand, GW levels continue to recover, returning to Level 1 towards the end of November and to 'typical' winter levels by the end of December.	Normal level of monitoring

The 2022 drought event on the Isles of Scilly is characterised by a very dry winter and spring, resulting in limited groundwater recharge, followed by a very warm, dry summer. As a result of the hot, dry weather demands on the islands were very high, peaking in early/mid-

August. A combination of enhanced drought messaging, followed shortly after by a break in the weather, resulted in significant groundwater recharge and reduced demand. The end of the drought was signified by reducing demands in early September coupled with recovering groundwater storage. However, despite further rainfall and reductions in demand during the Autumn months, groundwater storage did not recover to 'normal' levels until late December.

A1.7.1. Isles of Scilly stress test assessment

In the absence of available event data for 1976, we have simulated the impact of rainfall deficits for an event similar to 1976 by extending the dry conditions experienced in 2022 for a further 7 days to the 10th September, which marked the start of the 1976 recharge period. This removes the uptick in aquifer recharge observed in the groundwater level trigger following the mid-August 2022 storm event and prolongs the recovery period.

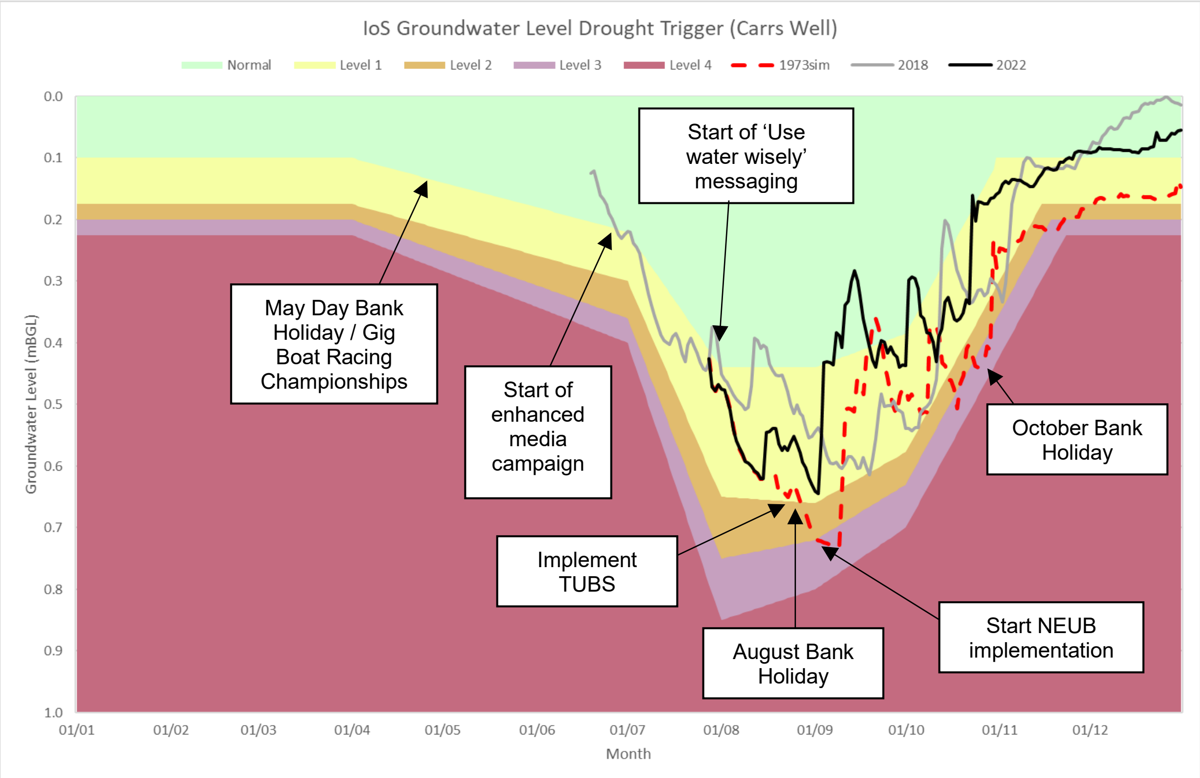

Figure 1.26: Isles of Scilly groundwater level projections for the stress test assessment. The red dashed line shows the simulated levels with supply and demand drought actions applied as outlined by the annotations.

Demand profiles for the 2022 drought (supplemented by the 2018 profile) on St Mary's are shown in Figure 1.27. The trigger profile for the early deployment of the seasonal seawater intake has been applied due to the preceding dry autumn/winter recharge period. Peak demands occur immediately prior to and over the August bank holiday weekend.

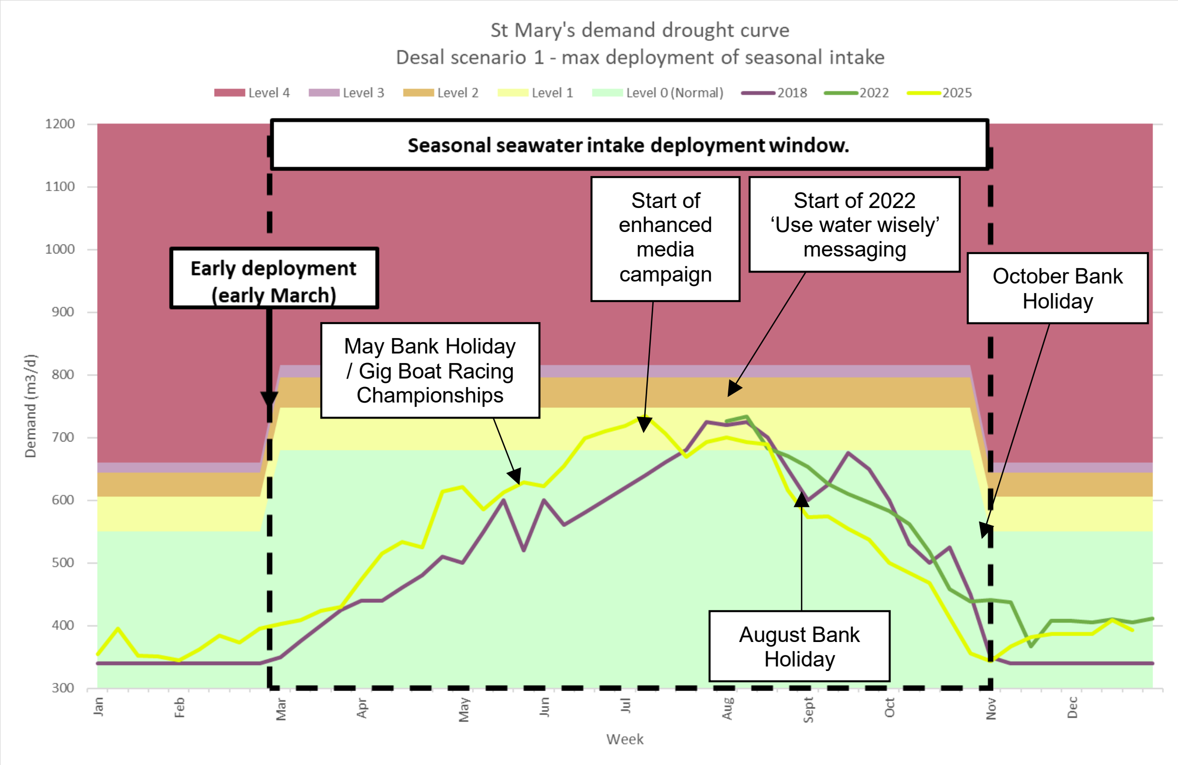

Figure 1.27: Isles of Scilly demand 2018 and 2022 profiles for the stress test assessment, with max possible deployment of seasonal desal intake.

Table 1.19 below sets out the timeline for the simulated plausible drought, based on 1976, including action timing and implementation under each demand scenario. It is likely that if the 1976 drought conditions (rainfall deficits) were to occur under current seasonal demands, the impact on groundwater levels would be seen earlier and more severely than shown.

Table 1.19: Example of the timing and implementation of actions and decisions that would be made if the Isles of Scilly WRZ experienced the simulated stress test assessment.

Time period, drought level, operational mode	Actions and decisions	Environmental monitoring*
January – late June 1976 (sim.) **Level 0: Normal operation**	Routine monitoring Dry winter, then warm spring followed by hot, sunny & dry May/early June. Deployment of seasonal seawater intake in April.	Normal level of monitoring
Early July 1976 (sim.) **Level 0: Normal operation, dry weather warning**	Continued hot dry weather, increasing demand & steep downwards GW recession. Dry forecast > enhanced media campaign considered.	Level of monitoring increased
Mid July 1976 (sim.) **Level 1:** • **Enhanced media campaign** • **Preparation for TUBS**	Short break in weather results in short temporary slow-down in rate of GW level recession then further hot dry weather sees return	Increased level of monitoring

	to steep recession. Further hot dry weather forecast. Optimisation of groundwater sources Enhanced media campaign launched.	
Late July-early August 1976 (sim.) **Level 1:** • **Enhanced media campaign** • **Prepare for TUBS**	General pattern of hot dry weather with limited showers. Forecast remains largely settled, hot and dry. Media campaign ramped up with regular media updates in lead up to August bank holiday peak visitor period. Reduced demands following success of media campaign.	Increased level of monitoring
Mid-late August **Level 2:** • **Enhanced media campaign continues** • **Implement TUBS** • **Prepare for NEUBS**	General pattern of hot dry weather with limited showers. Forecast remains largely settled, hot and dry. Media campaign ramped up with regular media updates in lead up to August bank holiday peak visitor period. Reduced demands following success of media campaign. Implement Temporary use bans (TUBS). Discussion with large commercial customer re timing of highest water use to avoid peak demand periods. Community Drought Liaison Officer (Enhanced media campaign Phase 1).	Increased level of monitoring
Early September 1976 (sim.) **Level 3a:** • **Enhanced media campaign continues** • **Implement NEUBS**	General pattern of hot dry weather with limited showers. Forecast suggests initially settled, hot and dry but with change to unsettled conditions with potentially significant rainfall imminent. Media campaign maintained with regular media updates. Reduced demands following success of media campaign	Enhanced level of monitoring

	further helped by return to school and drop in visitor numbers. Review requirement for non-essential use bans (NEUBS) on balance of evidence: consider demand, groundwater levels and rainfall forecast. Implement NEUBS if appropriate. Consider increasing abstraction from boreholes above existing licence volumes or greater than 20m3/d threshold where required to meet demand, (assuming water available).	
Mid/late September 1976 (sim.) **Level 1:** • **Enhanced media campaign**	Break in weather and intense rainfall leads to rapid recession in GW levels back into Level 1. Further drop in demand as visitor numbers reduce. Enhanced media campaign maintained to maximise groundwater recovery.	Normal level of monitoring – watching brief
October-November 1976 (sim.) **Level 1:** • **Enhanced media campaign**	Variable rainfall leads to GW levels continuing to recover but fluctuating between zone 1,2 & 3a before recovering to level 0/1 boundary in November. Demand remains low and steady with reduced visitor numbers > combined drought level considered zone 1 while overall trend is upward. Media campaign maintained to maximise groundwater recovery.	Normal level of monitoring – watching brief
December 1976 (sim.) into 1977 **Level 1:** • **Enhanced media campaign**	Low demand, GW levels continue to recover, returning to Level 1 towards the end of November. Remain in Level 1 through December. Demand remains low and steady with reduced visitor numbers > combined drought	Normal level of monitoring – watching brief

	level considered zone 1 while overall trend is upward. Media campaign maintained to maximise groundwater recovery.	
January/February 1976 (sim.) **Level 0: Normal operation**	Low demands and further rainfall results in recovery of groundwater storage to normal levels. Enhanced media campaign ended.	Normal level of monitoring

The simulated plausible drought scenario for the Isles of Scilly is based on the 1976 drought event and is characterised by a very dry winter and spring, resulting in limited groundwater recharge, followed by a very warm, dry summer, extending into September. As a result of the hot, dry weather demands on the islands are very high, peaking in late August.

A combination of enhanced drought messaging followed by the implementation of TUBS, successful discussions with large commercial customers and the deployment of community drought liaison officer, is likely to result in sufficiently reduced levels of demand to prevent the requirement for NEUBS. However, if the drought had started earlier and/or demands had not reduced as a result of the early implementation of Level 1 & 2 actions, it is likely that the implementation of NEUBS and Level 3a supply side actions would have been necessary.

Despite further winter rainfall/recharge, reductions in demand and continued messaging during the Autumn/Winter months, the recovery of groundwater storage to Level 0 ‘normal’ does not occur until early the following year, marking the end of the drought.