DROUGHT PLAN 2027

Appendix

March 2026

DOCUMENT CONTROL SHEET

Report Title	Northumbrian Water Drought Plan 2027 Appendix
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21.05.2026	2	First Draft	Publication – completed Environmental Assessment information will be included in version 3, which will be available on our website from 7 July

DOCUMENT SIGNOFF

Nature of Signoff	Person	Date	Role
Reviewed by	William Robinson	20/03/2026	Water Resources & Supply Strategy Manager
Reviewed by	Katie Davis	21/03/2026	Head of Water Service Planning
Approved by	Kieran Ingram	27/03/2026	Water Director

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EXCLUSIONS ON THE GROUNDS OF NATIONAL SECURITY

Northumbrian Water Limited has not excluded any information from this plan on the grounds that the information would be contrary to the interests of national security.

Under Section 37B(10)(b) of the Water Industry Act 1991, as amended by the Water Act 2003 (“the Act”), the Secretary of State can direct the company to exclude any information from the published Plan on the grounds that it appears to him that its publication would be contrary to the interests of national security.

APPENDIX 1: PEAK DEMAND DURING DROUGHT

Water use in the public water supply exhibits seasonality, usually peaking in the summer. Several key factors drive water demand during the summer season. The period of hot dry weather triggers both an increase in outdoor water use, such as garden watering, and an increase in the frequency of personal showering and clothes washing[1].

The household type can also influence the level of water demand, as different metered property types have varying water use levels. However, peaks should occur for each household type at the same time through climatic variations. Measured customers may be subdivided into optants, selectives, new builds and existing metered as it has been shown that their overall demand and peak behaviour vary[2]. Occupancy and house type are also significant within the household groups. This report provides an update of the peak demand results for the current year.

Methodology

The sample selection uses all available smart metered data, which is only available in our Essex region, split by NHH's and HH optants, selectives, existing and new builds. The unmeasured data also uses smart metered household data but uses those that are on an unmeasured tariff. The peak demand study has now incorporated non-household data, which is logged data from our largest NHH consumers[3]. All property types use daily consumption data, and the results are shown in litres per property per day.

Data Quality

106,990 properties are included in this study, which varies by day depending on data validity, of which:

- 11,128: New Build
- 14,011: Metered Optant
- 17,042: Metered Selectives
- 50,886: Existing Measured
- 13,144: Unmeasured properties
- 779: Non-Households

The data that could not be used was due to a variety of reasons, namely leaks found, loss of data for the time period, unrealistically high consumption values, negative flow values, and periods of inconsistent data. These were mostly due to connection problems between the meter and the logger. The time period for cleaned data ran from 01/05/2025 until 31/08/2025.

[1] Billings, R B, Vaughan Jones, C (2008) Forecasting Urban Water Demand
[2] UKWIR A framework Methodology for Estimating the Impact of Household Metering on Consumption (2003) and The Impact of Household Metering on Consumption: Further Analysis (2004)

[3] Large users defined as using >20,000M3 per annum.

Weather Summary

The Met Office[4] describes the summer of 2025 as the warmest summer on record, with an average temperature of 16.10°C, surpassing the previous record of 15.76°C from 2018. June, July and August all saw below average rainfall and above average temperatures. There were a number of heatwaves throughout, with temperatures reaching 35.8°C (recorded in Faversham, Kent) on 1st July.

Temperature and Rainfall

Table 1: The number of days each month that reached above 25ºC in 2025 compared to previous years.

Table of number of days each month with temperatures greater than 25°C																	
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	**Average**
June	9	3	1	2	2	6	1	5	8	2	4	4	2	20	3	17	**5**
July	15	2	4	20	19	10	9	9	24	5	5	7	17	13	7	12	**11**
August	1	4	4	3	4	9	11	5	10	7	11	0	18	13	13	13	**8**
Totals	**25**	**9**	**9**	**25**	**25**	**25**	**21**	**19**	**42**	**14**	**20**	**11**	**37**	**46**	**23**	**42**	**25**

The daily maximum temperature over the summer is shown in Figure 1. High temperatures were experienced throughout the summer months in Essex, with a peak of 34.5 °C on 1st July (recorded at Writtle weather station).

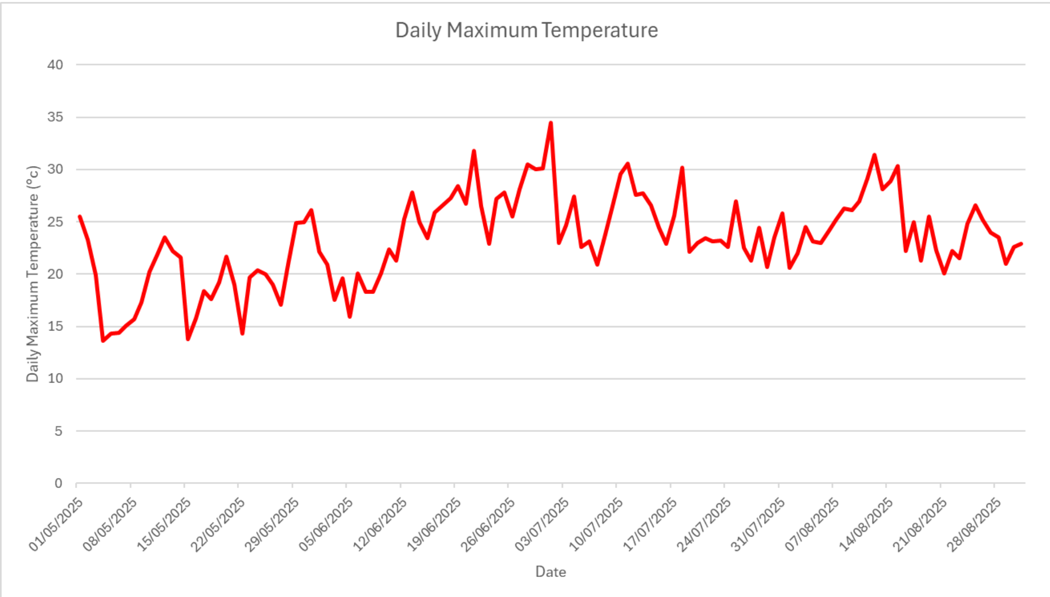


Figure 1: Maximum daily temperatures for Essex over the summer.

Table 2: The total number of days each year during the summer months where the total rainfall (mm) is less than 2mm on any one day and the two preceding days

Total number of days where total rainfall is less than 2mm on the day and two previous days																	
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	**Average**
June	22	5	0	19	28	15	3	17	27	12	21	13	19	23	23	18	**16**
July	23	15	6	18	12	17	21	9	27	23	18	8	31	15	18	19	**17**
August	8	8	4	19	13	26	21	11	11	18	15	18	22	10	24	24	**16**
Totals	**53**	**28**	**10**	**56**	**53**	**58**	**45**	**37**	**65**	**53**	**54**	**39**	**72**	**48**	**65**	**61**	**50**

[4] MET Office (2025) https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/summaries/seasonal-assessment---summer-25.pdf

The temperature and rainfall for Essex during the summer period is shown in Figure 2. It has previously been found that average consumption related best to temperature and rainfall and so analysis has employed these two variables. It was dry for large periods of the summer with the highest daily rainfall was on 28th August seeing 10.6mm fall. Most peak days fell between mid-June through to mid-July and the second week of August.

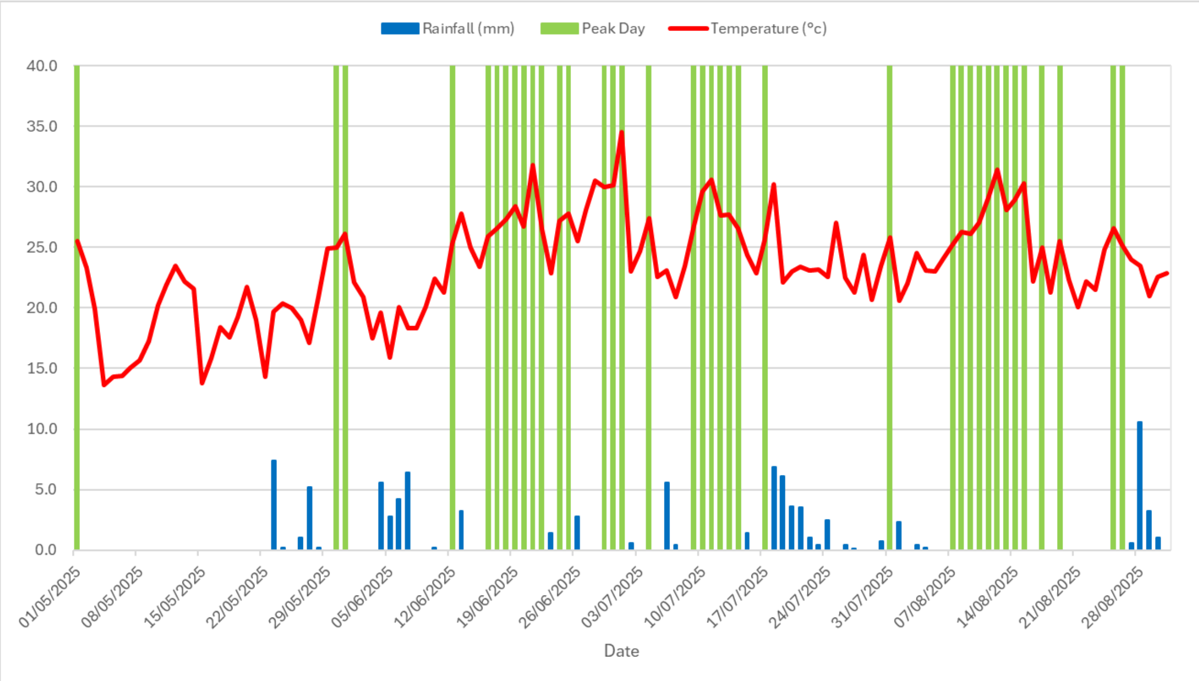


Figure 2: Total rainfall and maximum temperature experienced during the summer months and corresponding peak days.

Average Consumption

Water consumption peaked on the weekend leading up to the hottest day of the year as can be seen across all HH types in **Error! Reference source not found.** 3. Average consumption is calculated from the average of sampled households. The highest consumption out of the measured billed household types is the Metered Selective, followed by Existing Metered, New Builds and lastly by the Metered Optant. As expected, unmeasured billed customers have the highest consumption of all metered HH types. Throughout the summer months, all HH types follow a similar trend but selective and unmeasured HH's consumption is impacted the most by hot weather. Whilst NHH consumption follows a similar trend, the peak demand day occurred further into the summer, which suggests other factors are influencing demand and possibly a prolonged period of warm and dry weather is needed to see a noticeable difference in NHH demand (Figure 4).

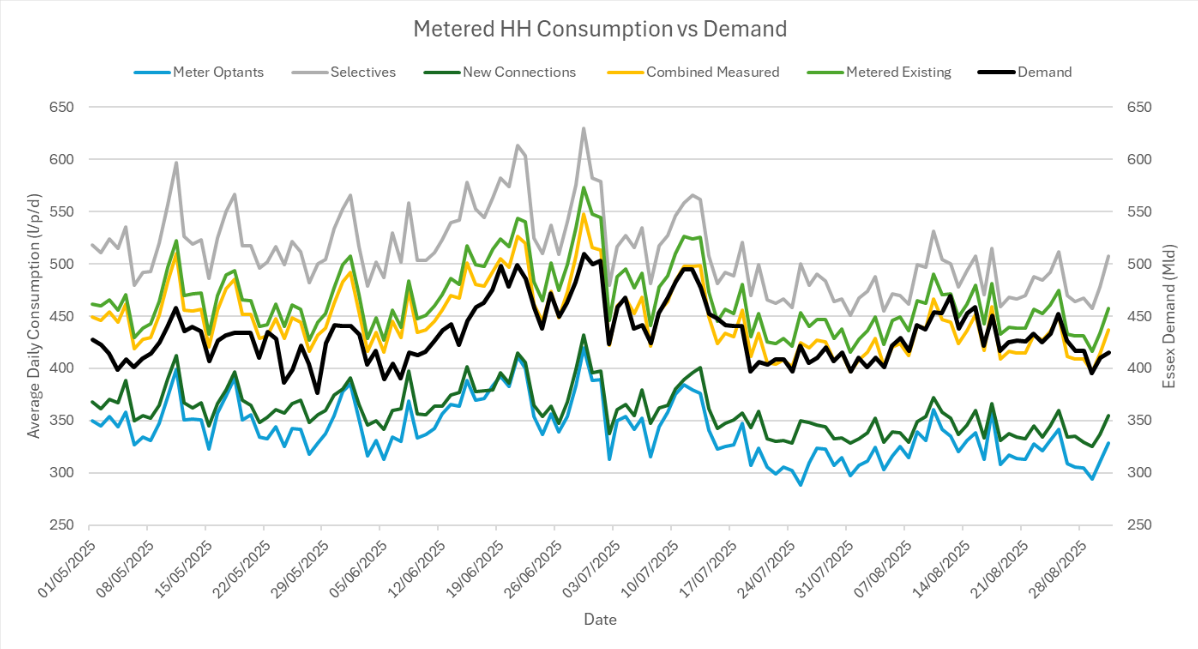


Figure 3: The relationship between the daily total demand for Essex and the measured HH types consumption over the summer period.

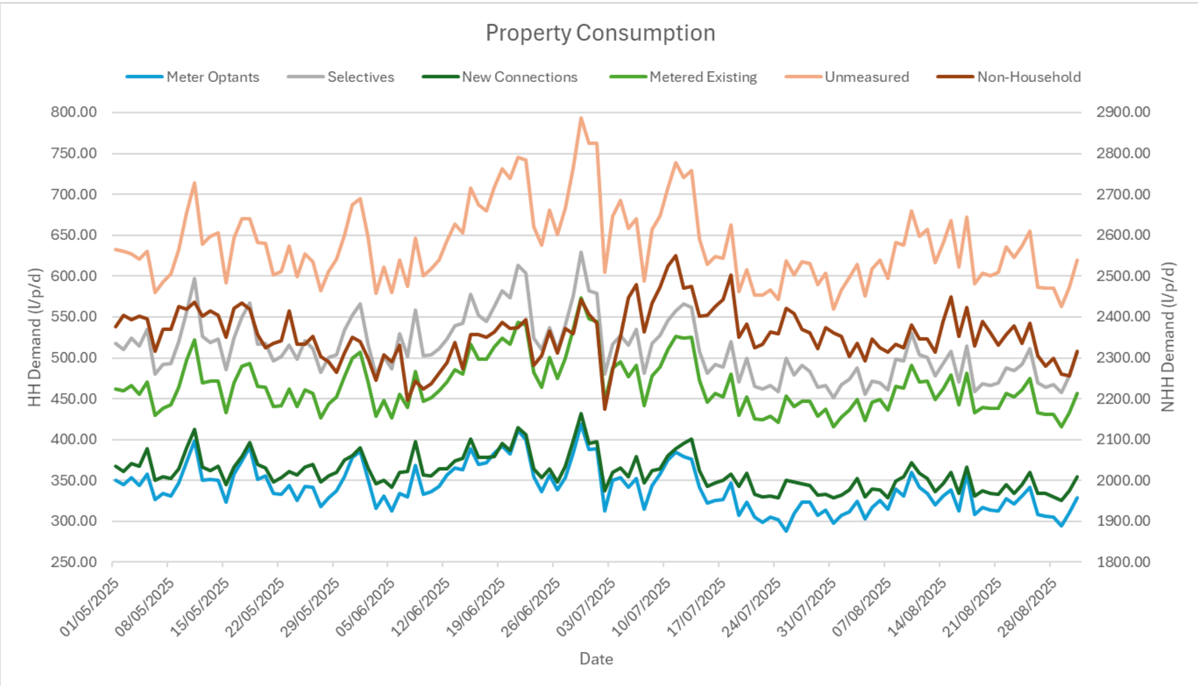


Figure 4: The relationship between unmeasured, measured HH types and NHH's

The peaks in total demand consumption corresponds well with the major peaks of the study data and points out the high consumption of selectives compared to the other household types.

Peak Demand

The peak demand for 2025 was 629.28 litres / property / day (l/p/day) which occurred on 29th June. The addition of smart meter data means that unmeasured billed customers have also been added, with a peak day of 793.92 l/p/day, which also fell on 29 June. Table 3 shows the peak demand yearly change since 2008. The 2025 peak demand is higher than last year and occurred in the selective category. All yearly peak demands previously have occurred in the selective metered category, except 2019 where new builds had the highest peak demand day. Although, before the addition of smart data the sample base was small.

Table 3: Peak demand summer yearly change since 2008. The average measured peak demand between 2008-2019 and 2024-2025 is 603.28 l/p/d.

Measured	
Peak Demand Yearly Change (l/p/d)	
2025	**629.28**
2024	623.37
2019	554.73
2018	588.15
2017	611.5
2016	558.27
2015	634.7
2014	646.19
2013	624.27
2012	478.98
2011	659.6
2010	610
2009	548.6
2008	678.3

Unmeasured	
Peak Demand Yearly Change (l/p/d)	
2025	**793.92**

Metered Selective

Throughout the peak demand studies, it has been consistently shown that metered selective customers have the highest consumption of the measured household types (see **Error! Reference source not found.** 4). Figure 5 shows the relationship between metered selective average daily consumption and the rainfall and temperature data. The average consumption over the summer period for selectives was 511.25 l/p/d, 49.84% higher than metered optants average consumption. As the linear trend line shows in Figure 5 the consumption decreases through the season.

Selective consumption peaks compared to the other household types are higher and cover a greater time period. Peaks correspond well with periods of no rainfall and temperature increases over the summer, showing a direct relationship between temperature, rainfall and water consumption.

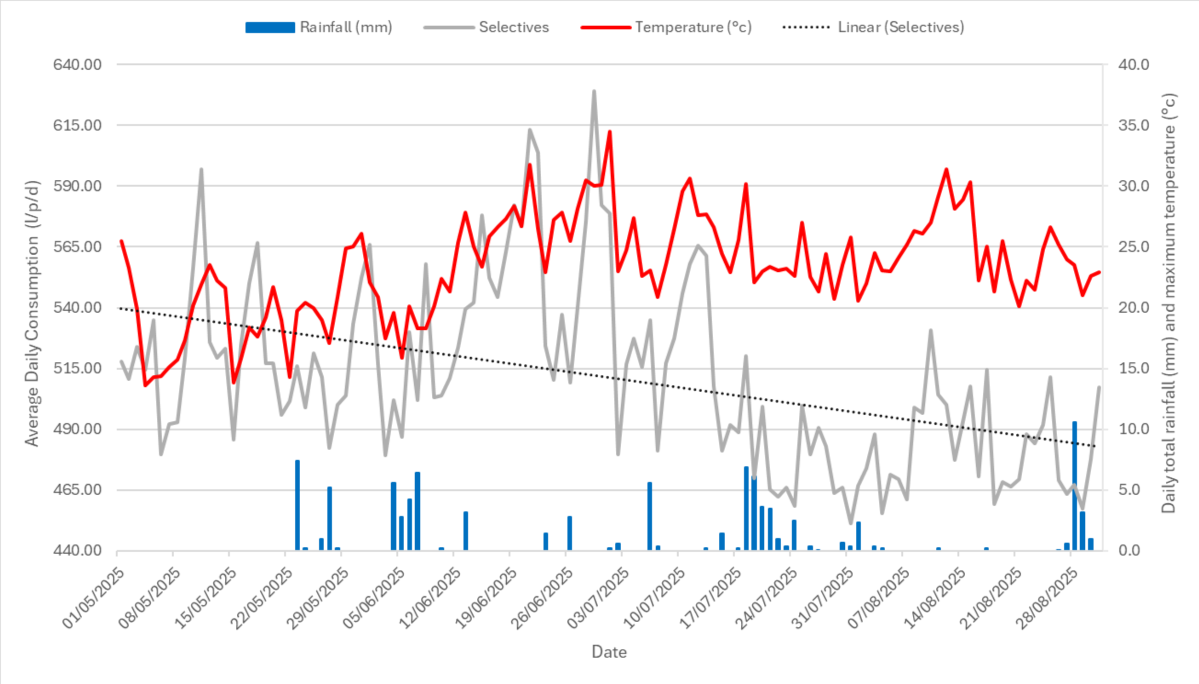


Figure 5: Selective metering average daily consumption in comparison to temperature and rainfall

New Builds

New Build water consumption tends to sit in the middle between metered optant and metered selective consumption. Figure 6 shows the relationship between summer rainfall and temperature and the new build demand. The average consumption for the new build household type is 359.85 l/p/d.

New Build consumption peaks are less pronounced and show less difference between the peak and the trough than selectives and also do not cover such a long period of time. Consumption follows a similar profile to meter optants and relates well to rainfall and temperature changes.

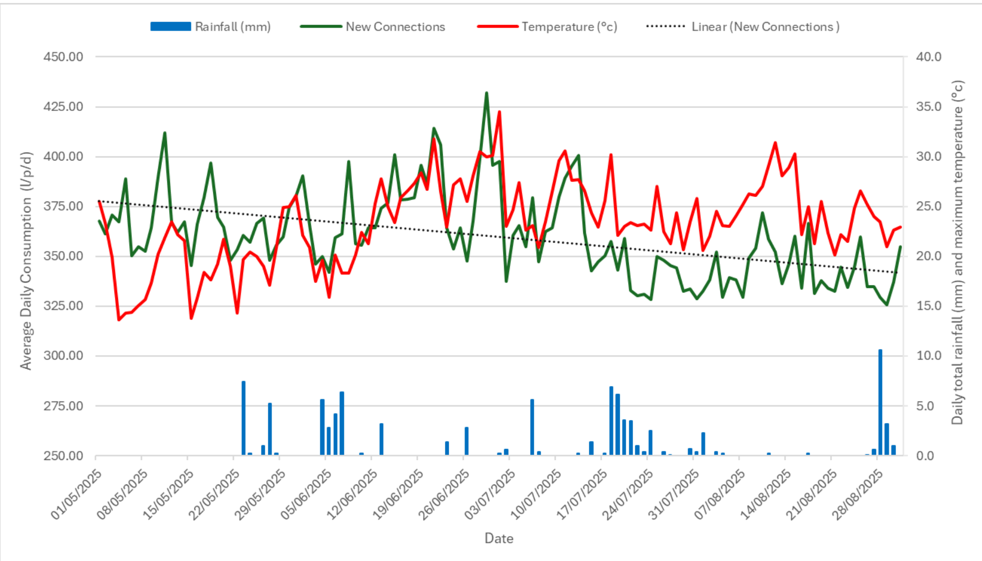


Figure 6: New Connections average daily consumption in comparison to temperature and rainfall

Metered Optants

Out of the various measured HH types, metered optants have the lowest summer water use. Figure 7 shows the metered optant consumption in relation to the rainfall and temperature data for this summer. The average consumption for this household type is 341.20 l/p/d. Optant water use is similar to that of New builds during peak demand but days with low consumption fall well below the lows seen for New builds.

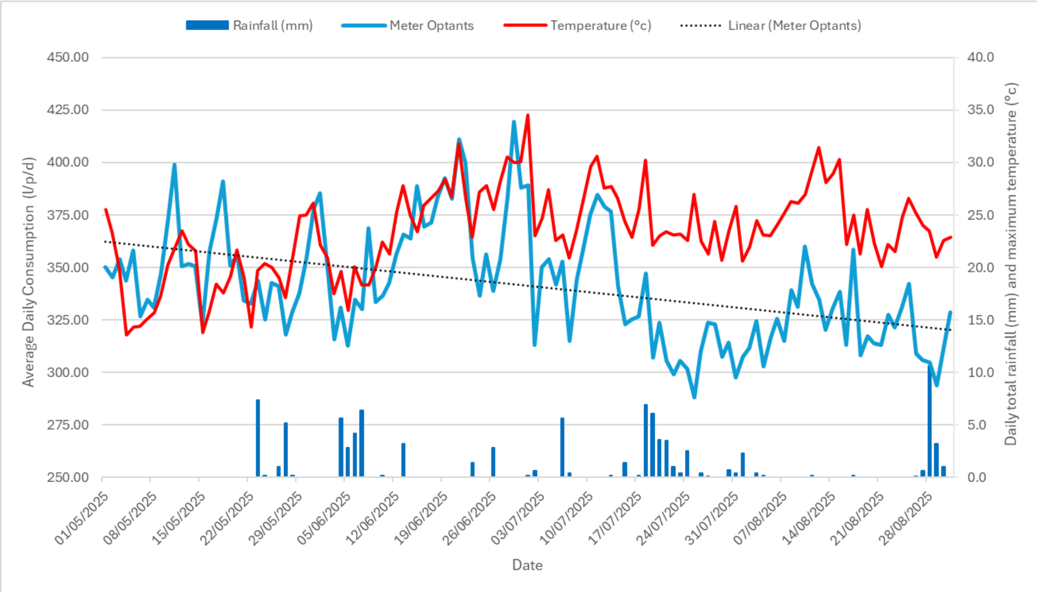


Figure 7: Metered Optant average daily consumption in comparison to temperature and rainfall

Metered Existing

Existing households are those that have been metered in the prior AMP. Metered existing has a similar profile to selectives consumption through the summer. The average consumption for metered existing is 466.21 l/p/d. This falls between selectives who have higher average consumption and meter optants and new builds who both have lower average consumption. **Error! Reference source not found.** 8, shows that high temperatures and low rainfall have a greater impact on existing metered customers water use.

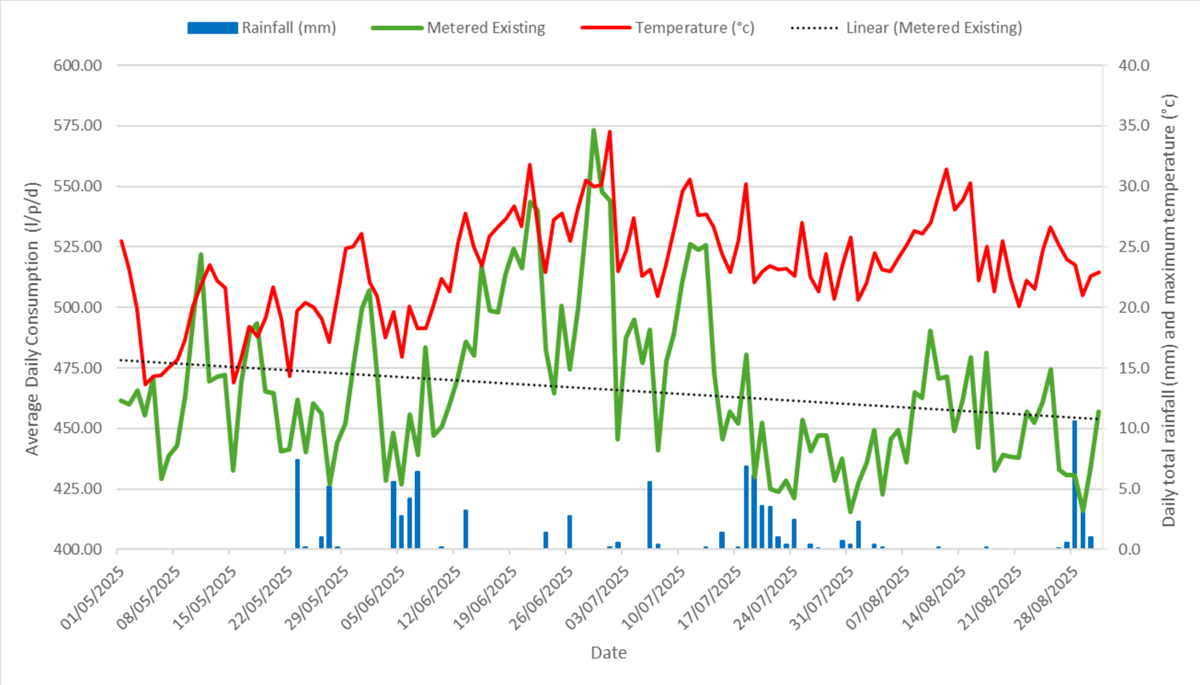


Figure 8: Meter existing daily consumption in comparison to temperature and rainfall

Unmeasured

It is interesting to also have a look at unmeasured consumption through the season as well. The sample is taken from our unmeasured billed customers, who have a smart meter installed but remain on an unmeasured tariff. There were 13,144 properties included in the sample with an average consumption for the period of 638.66 l/p/d, which as expected is higher than any of the measured meter types. The profile of consumption during the summer period shows much wider peaks and troughs showing the unmeasured customers are more reactive to high temperatures and low rainfall (Figure 9).

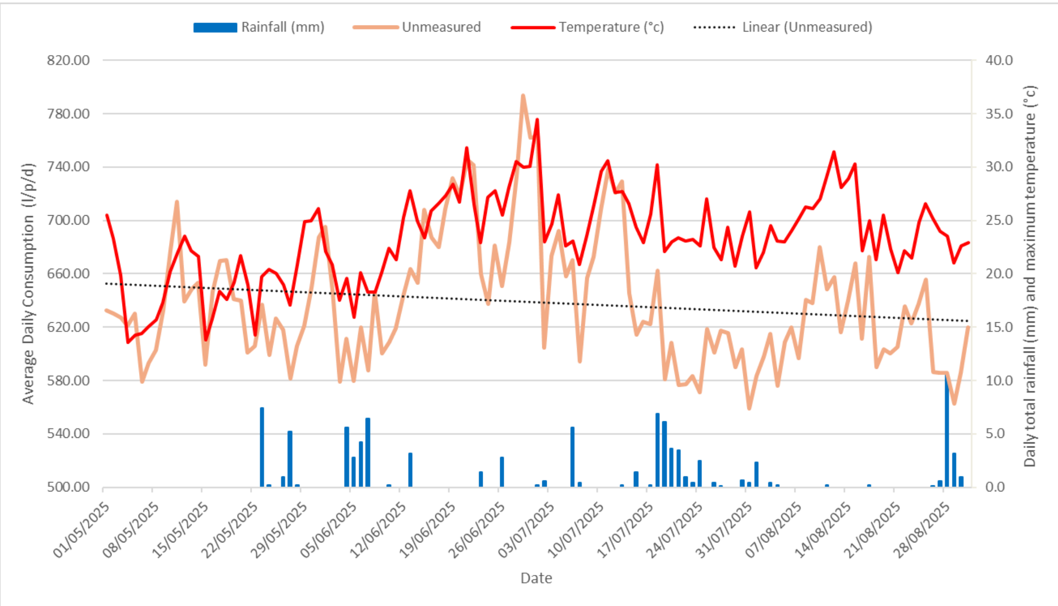


Figure 9: Unmeasured average daily consumption in comparison to temperature and rainfall

Non-Households

With more smart meters implemented across our Essex region, NHH's have been added to the study. **Error! Reference source not found.** 10 shows that although there is some response to high temperatures and low rainfall, the trend remains relatively flat, which indicate that weather events impact NHH demand less. Peak day for NHH demand fell on Friday 11th July, where Writtle weather station recorded 30.6°C. This occurred after a prolonged period of low rainfall, high temperatures and numerous peak weather days. Although the peak demand day occurred on a hot day and the weather likely had some impact on high demand, the range of daily NHH demand is only 16% of the mean, which is less than half of the 34% for HH demand. Providing evidence that weather impacts NHH demand to a lesser extent. However, it is worth noting that the sample size of NHH's is much smaller, which may have impacted these results.

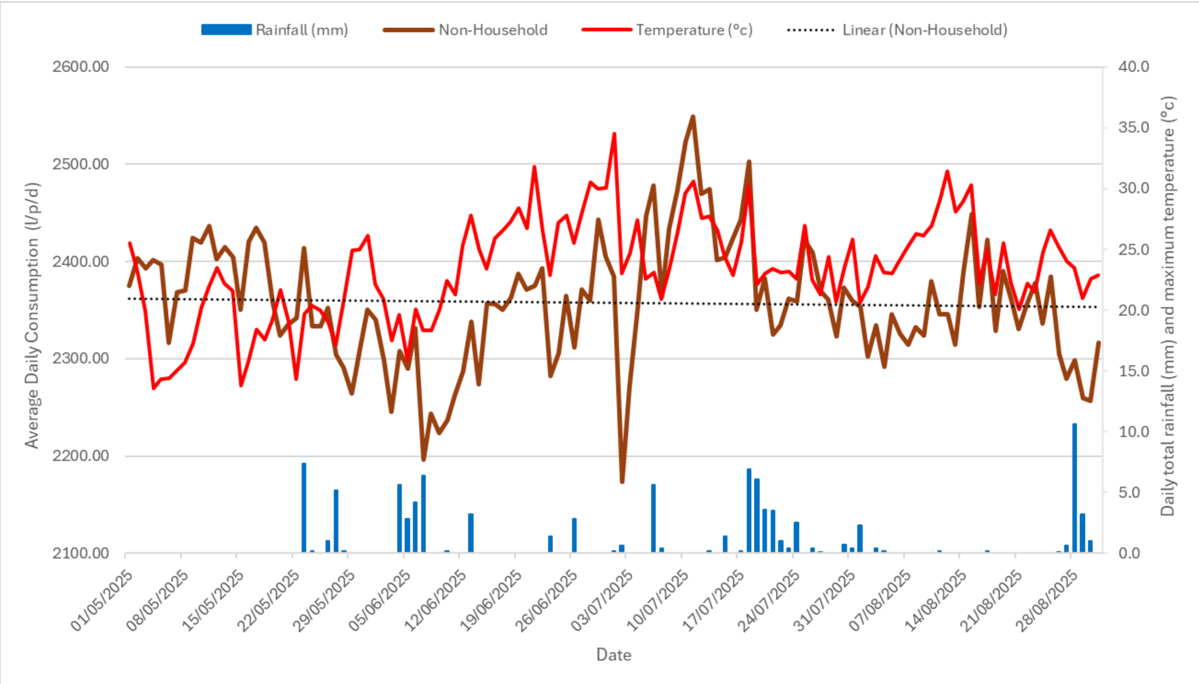


Figure 10: Non-Household average daily consumption in comparison to temperature and rainfall

In summary, each household type shows very similar peak demand response to previous years of this study, with unmeasured customers having the highest demand amongst all types and selectives amongst measured HH's, with optants the lowest. As expected NHH demand is less reactive to the weather but there is some correlation between peak days and peak demand.

Total Demand Change since 1987

It is interesting to compare this year's peak demand data with previous years demand. Figure 11 shows how the total demand and temperature have changed over the last 40 years, since 1987. Figure 12 shows the total demand and rainfall. Figure 13 shows rainfall over the last 10 years and how 2025 has been particularly dry.

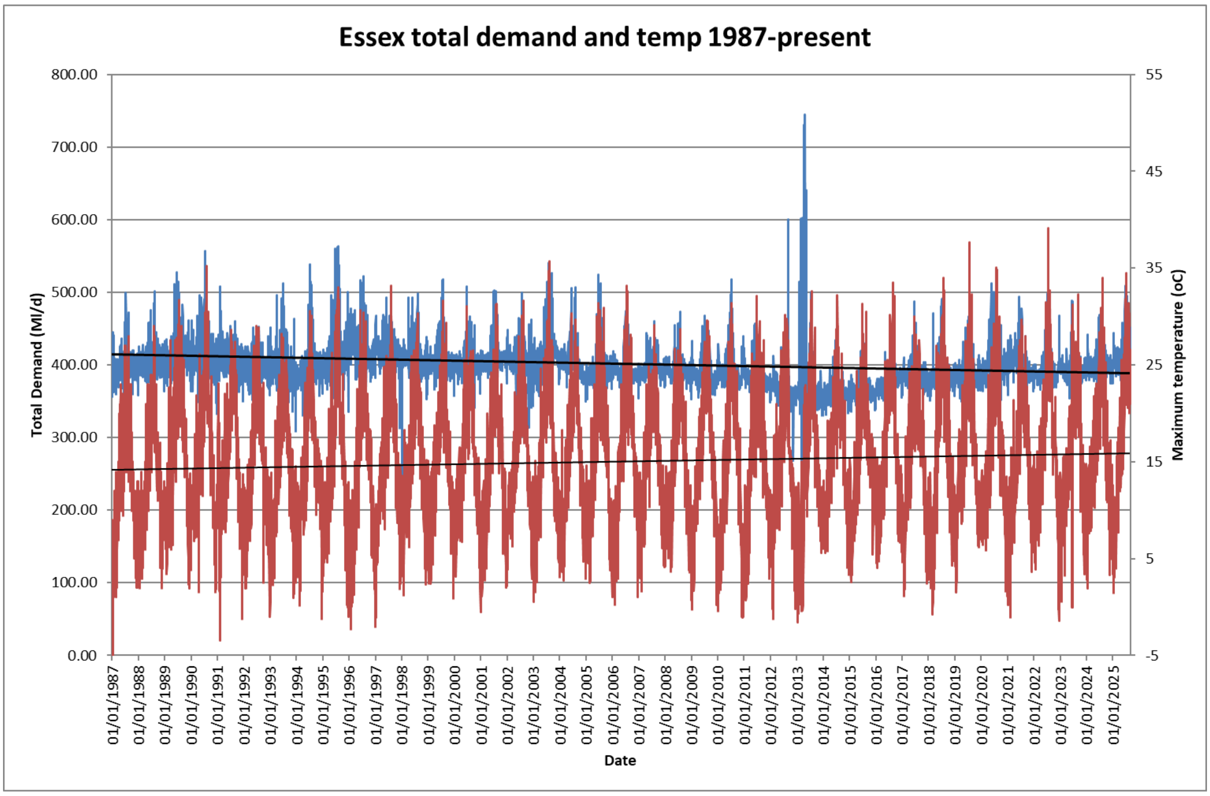


Figure 11: Total demand and monthly temperature (1987 – present).

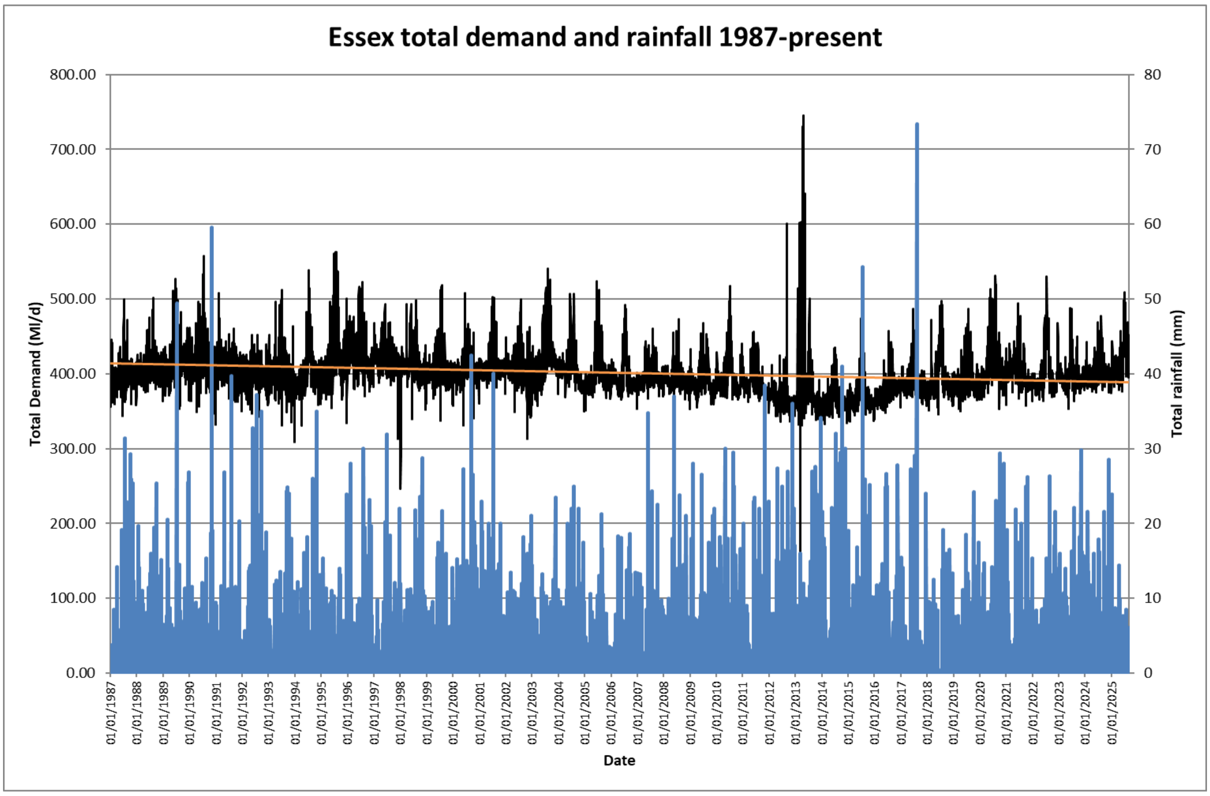


Figure 12: Total demand and monthly rainfall (1987 – Present).

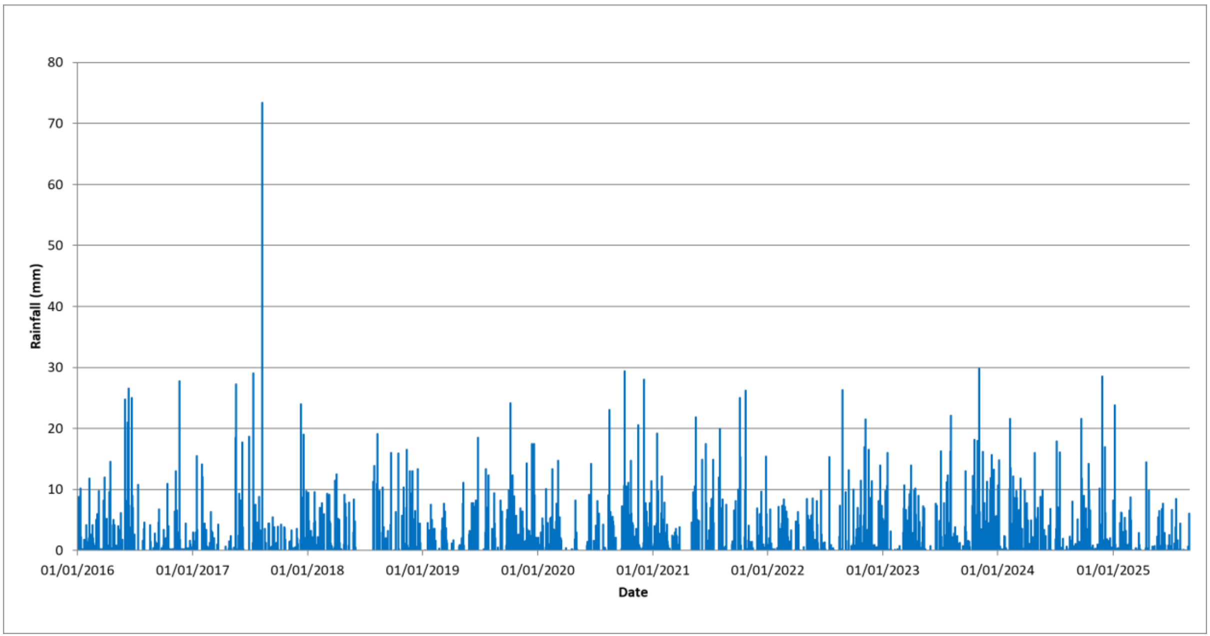


Figure 13: Total rainfall (2016 - Present).

Discussion

From this study on peak demands over the summer season, we have found the peak water consumption is best related to peak days[5] (see Figure 14). It is interesting to see that peaks in demand match closely to peak days of dry weather. Optant and new connections water consumption have smaller peaks when compared to the high selective and unmeasured consumption. The highest peaks in consumption usually occur on or after a period of a few peak days. It is therefore assumed that the highest consumption arises when consecutive days of high temperatures and no rainfall occur.

Unmeasured billed customers consumed the most amongst all measured HH types, whilst for measured billed customers, metered selective customers consumed the most with metered optants the least, as has been found in previous studies. Metered selective customers reacted promptly to a change in climate whereas increased water consumption for optant and new connection customers took a longer amount of time to become noticeable.

[5] A day when the maximum temperature equals or exceeds 25°C and the daily total rainfall is less than 2mm on the day and the two previous days. MTP BNWAT06 (March 2011), Domestic water use in new and existing buildings, pp9, footnote 9.

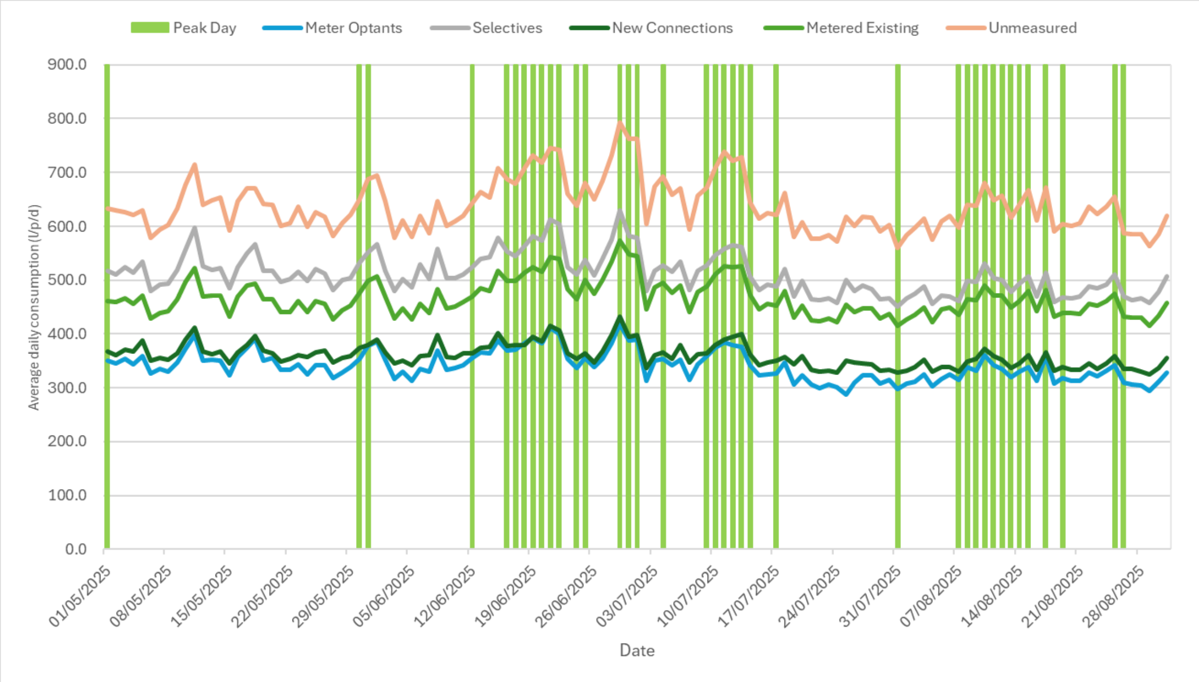


Figure 14: Relationship between 2025 peak days and measured consumption types.

Non-Household customer water consumption does show peak days impacting demand but it's more erratic. The period in May where no peak days fell shows demand relatively high and drops off during the peak at the start of June. Demand does increase but it took a considerable number of peak days to impact NHH demand. This can be seen in more detail in Figure 15.

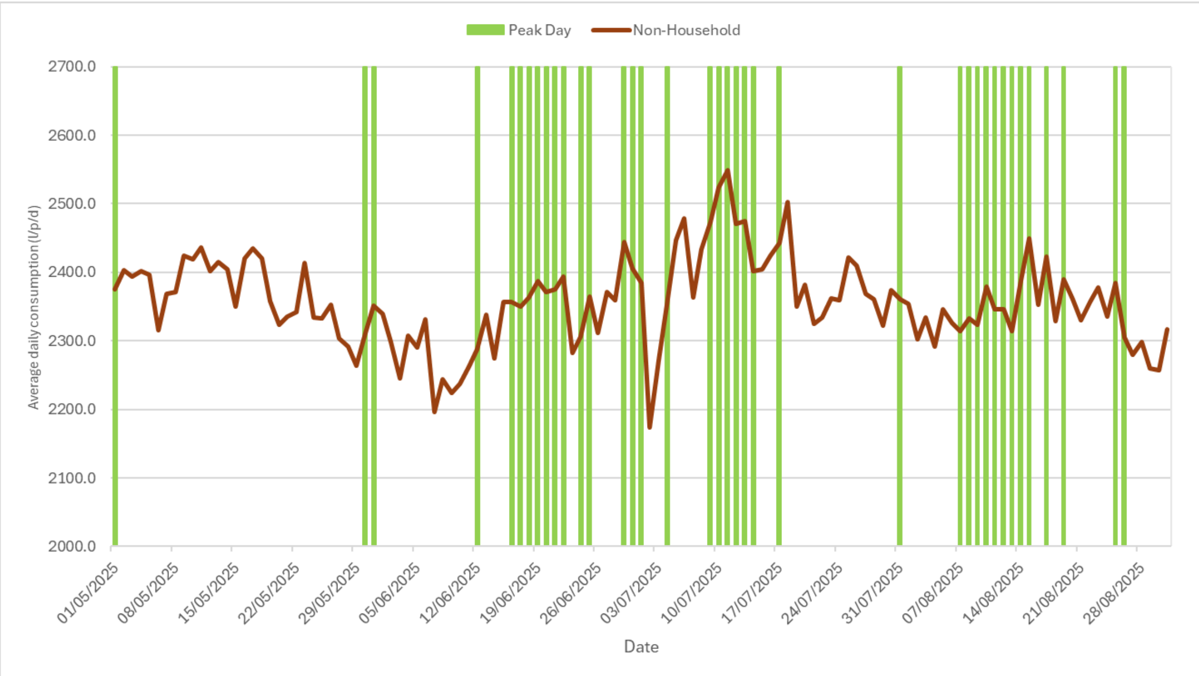


Figure 15: Relationship between 2025 peak days and NHH demand.

Representation

In order to check the representativeness of the data, the peak demand study data was compared to the total demand for the area (see Figure 16). From this we can see that Essex total demand mirrors the peak demand monitored results, and major peaks correspond well. Overall, this indicates a representative sample of households used in the study.

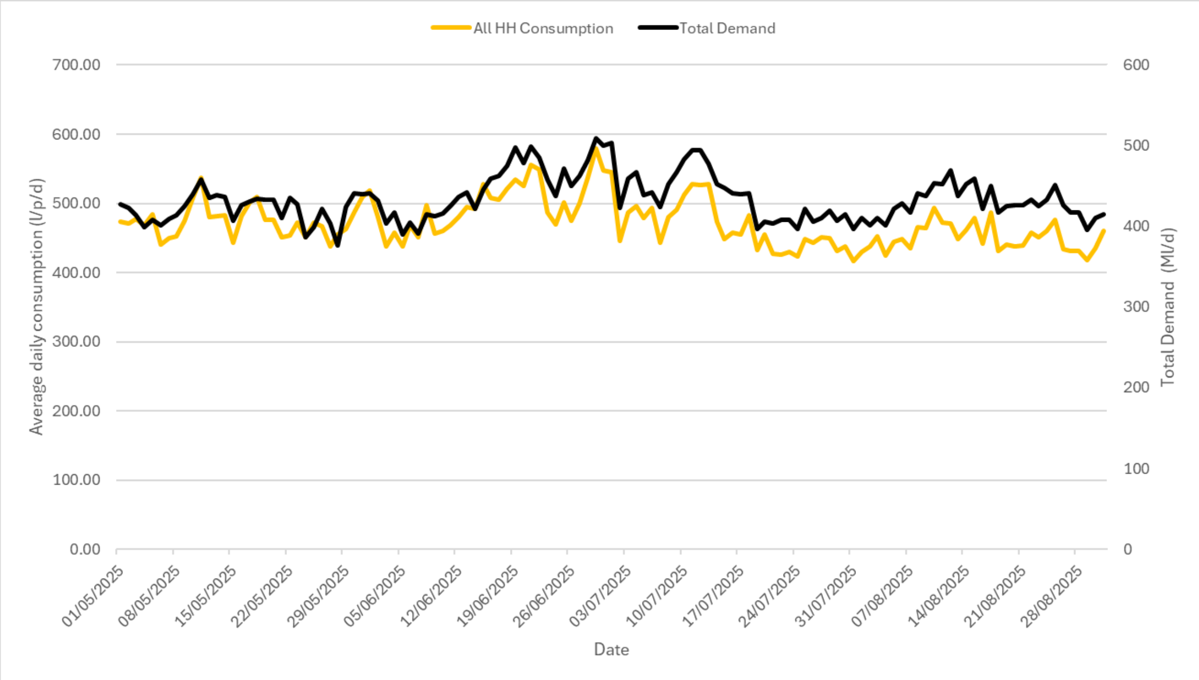


Figure 16: Relationship between total demand and all HH consumption

Data Cleaning

To ensure data quality, there was some property data that could not be used. This was for a variety of reasons, namely leaks found, loss of data for the time period, unrealistically high consumption values, negative flow values, and periods of inconsistent data. Whilst data has been cleaned, some erroneous data is likely to remain in the dataset. However, with the study now containing over 100,000 metered properties, the impact will be insignificant.

Conclusion

In conclusion the peak demand study yielded interesting and valuable results and the addition of further data from smart measured properties was beneficial. This summer had above average temperatures and lower than average rainfall. Consumption across the metered types peaked during days following no rainfall and high temperatures. NHH consumption does show signs of being impacted by peak weather days, especially if this is prolonged but from the data its clear other non-peak day weather events are also an influence.

APPENDIX 2: RELEVANT LEGISLATION AND GUIDANCE

In producing this draft Drought Plan, reference was made to the following guidance and legislation:

- Drought permits and drought orders supplementary guidance, March 2025, Environment Agency.
- Environmental assessment for water company drought planning, March 2025, Environment Agency.
- Environmental Assessment of Plans and Programmes Regulations 2004.
- Flood and Water Management Act 2010 where s.36 amends the Water Industry Act 1991 by substituting a new s.76.
- Government expectation for water company drought plans, 22 July 2025.
- Hydrological guidance for the assessment of ESoR, March 2025, Environment Agency.
- "Managing through drought: Code of practice and guidance for water companies on water use restrictions – 2023 (Incorporating lessons from the 2022 drought).
- Position note on compensation-only reservoirs in dry weather, June 2019.
- Security and Emergency Measures Direction (SEMD) 2024.
- Spotlight on Drought 2022: Water companies in England, December 2023.
- The Conservation of Habitats and Species Regulations 2017.
- The Drought Plan (England) Direction 2025.
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
- Water Act 2003 where s.63 inserts new sections 39B & 39C into the Water Industry Act 1991 and s.62 inserts new sections 37B-D into Water Industry Act 1991.
- Water Company Drought Plan Guideline 2025, LIT 74637, Environment Agency.
- Water Industry Act 1991.
- Water Use (Temporary Bans) Order 2010.
- Wildlife and Countryside Act 1981 as amended by the Countryside and Rights of Way Act 2000, Section 28G.

APPENDIX 3: COMPENSATION ONLY RESERVOIRS

A Compensation Only Reservoir (COR) is a reservoir that is owned and operated by a water company but that has no links whatsoever (direct or indirect) to that company's public water supply network. So for example, the COR would not be listed as a source of supply in the company water resources management plan or as an option to provide public water supply in its drought plan. The main or sole function of the COR is to provide a discharge of water (known as a compensation flow) to the downstream watercourse.

We have one such reservoir, Scaling Dam, at the extreme south east of our region. Built in 1953 with a capacity of 1690 Megalitres (Ml) it originally supplied Scaling Water Treatment Works. The treatment works were abandoned in 1999 and the reservoir is now used only for leisure purposes.

Under the Cleveland Water Order 1950 we must make a continuous compensation release of not less than 0.682 Ml.

Figure 1 shows the storage in the reservoir prior to and after the abandonment of the treatment works.

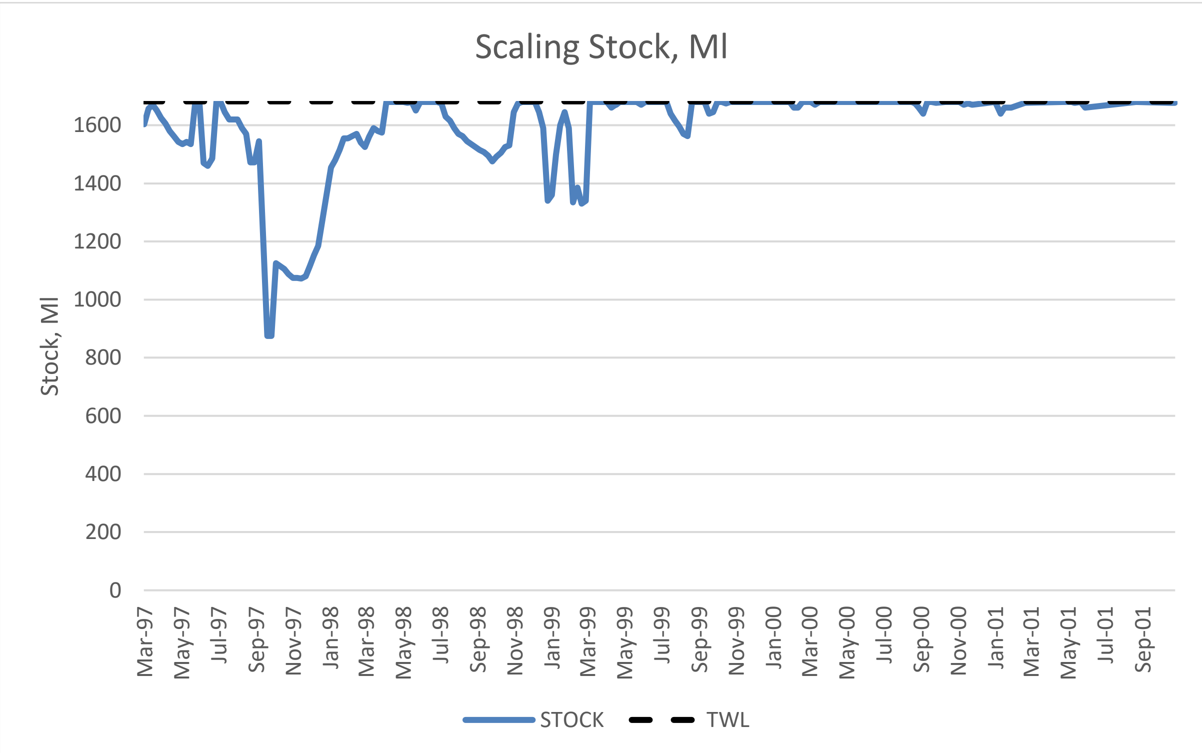


Figure 1: Scaling Reservoir historical stock levels

The key legislation for drought incident management in relation to CORs is set out in the Water Resources Act 1991 (WRA 1991, Part 2, Chapter 3) which states:-

If the Secretary of State is satisfied that, by reason of an exceptional shortage of rain, there exists or is threatened:

(a) a serious deficiency of supplies of water in any area, or
(b) such a deficiency in the flow or level of water in any inland waters as to pose a serious threat to any of the flora or fauna which are dependent on those waters,
then, subject to the following provisions of this Chapter, he may by order (in this Chapter referred to as an “ordinary drought order”) make such provision authorised by this Chapter as appears to him to be expedient with a view to meeting the deficiency.
In the case of a drought the assumption is that the necessity for action would be in line with b) above and the requirement would be to alter the compensation flow.

Currently the reservoir generally operates at or close to its Top Water Level (TWL) and the only adjustments we make are to increase the downstream flows above compensation in an attempt to avoid the reservoir overflowing.

From the graph above it can be seen that in Sept 1997 the level dropped to 875 Ml.

Based on an example where the level starts just below the TWL with a storage volume of 1600 Ml and it can be dropped to the 1997 low level of 875Ml then the compensation flow could be maintained for some 1063 days or just under 3 years with no water entering the reservoir, which is highly unlikely scenario.

Similarly, if the compensation release was to be doubled then it could be maintained for some 18 months. These duration of these extreme examples could be extended by allowing the reservoir to fall below the 1997 value.

We therefore conclude that there is very little likelihood of the requirement for a Drought Order with regards to Scaling Dam.

APPENDIX 4: WREN REGIONAL STATEMENT OF INTENT

WATER RESOURCES NORTH
REGIONAL DROUGHT GROUP STATEMENT OF INTENT

We know our changing climate means we will likely experience more frequent and more severe droughts in the coming years. As a regional multi-sector group, the role of Water Resources North (WReN) during drought is therefore becoming even more important, as collaboration between and within sectors is critical to successfully reduce the impacts on the environment and on society. Water Resources North (WReN) is committed to promoting collaborative and proactive drought management across our diverse region from the Peak District to the Scottish border. We recognise that effective drought management requires coordinated communications and action across all sectors that depend on water resources. This statement of intent outlines our approach to regional drought management, collaboration and planning.

1 OUR INTENT

We have now launched our WReN multi-sector Drought Group which serve as a regional forum that facilitates collaboration between sector groups (i.e. public water supply, agriculture, energy and navigation), regulators and wider stakeholders to enhance regional preparedness for periods of prolonged dry weather and drought events.

The groups aims and operations will change before, during and after drought as summarised in the table below.

<table>
<tr><th>Before Drought (Preparedness Phase)</th><th>During Drought (Response Phase)</th><th>After Drought (Recovery Phase)</th></tr>
<tr><td colspan="3">▪ Monitor and share sector information on the current and forecast water situation
▪ Where beneficial to do so, align communications and messaging between sector groups, stakeholders and the public during drought
▪ In the development of water management plans, actively seek drought management options that provide wider benefits including resilience to both floods and droughts, improvements to water quality; and enhanced resilience of drainage and wastewater systems</td></tr>
<tr><td>▪ Promote the development of sector drought plans with monitoring plans and early warning indicators</td><td>▪ Identify areas of water availability and stress across the region during drought
▪ facilitate discussion to identify opportunities for water rights trading and sharing between abstractors to manage drought response</td><td>▪ Incorporate drought learning into medium and long-term water resource planning
▪ Evaluating the effectiveness of drought response measures</td></tr>
</table>

WReN will work with other regional groups to share best practice and lessons learnt recognising that other regions may be in drought while WReN is not and vice versa.

It is important to note that the role of WReN does not include the development of a regional Drought Plan, nor does it aim to override an organisation's own Drought Plans. It seeks to support in the facilitation of collaborative discussion within and between sectors where this helps the overall outcomes of managing drought response for society and the environment.

2 GROUP MEMBERSHIP AND CADENCE

WReN's programme manager will organise meetings and provide secretariat services for the group, with additional activities funded by separate agreement as needed.

Our drought group will:

1. Complement, not replace, existing drought management structures and authorities
2. Meet on Microsoft Teams:
    - twice yearly (April and September) during non-dry weather conditions; and
    - monthly once a period of prolonged dry weather or an environmental drought has been declared by the Environment Agency (EA)
3. Maintain a rotating chair structure across different sectors

The group will include representatives from:

- Water companies serving the region
- Key water-dependent sectors (agriculture, energy, navigation, tourism, etc.)
- Regulatory bodies (Environment Agency, Natural England, CCW)
- Abstraction groups and other relevant stakeholders

We intend the WReN drought group will report its regional position to the WReN Board and National Drought Group.

3 ENVIRONMENTAL AND SOCIAL COMMITMENT

In all drought management activities, the needs of the environment, including water-dependent habitats and other sensitive environmental sites, will be a key consideration. Working with the Environment Agency and Natural England representatives (whose principal role is to protect and improve the environment), the group commits to pursuing drought management solutions that protect and enhance the natural environment.

Social needs will also be a key consideration in all drought management activities. Working with CCW and the water-dependent sectors alongside the water companies (who bring knowledge of their customers e.g. through significant customer research), the group commits to pursuing drought management solutions that protect social needs.

WATER RESOURCES NORTH
REGIONAL DROUGHT GROUP STATEMENT OF INTENT

4 ADOPTION AND REVIEW

Following adoption, this statement of intent and the WReN Drought Group Terms of Reference will be reviewed annually to ensure they remains fit for purpose and aligned with regulatory expectations.

Document Control

Version	Changes	Date
1.0	First draft	28/11/24
1.1	Update to reflect WReN leads comments	07/05/25
2.0	Final incorporating Drought Group member comments	14/10/2025

APPENDIX 5: TEMPORARY USE BAN REGIONAL ALIGNMENT

The majority of Water Resources North (WReN) including Northumbrian Water, have agreed the following universal TUB enforcement policy.

The following enforcement policy is a universal document for water companies to use when implementing a TUB.

TEMPORARY USE BAN ENFORCEMENT POLICY

Introduction

Northumbrian Water is the statutory water and sewerage undertaker for an area covering approximately [add a broad descriptive geographical].

A map showing the region for which Northumbrian Water is appointed to act as the statutory water undertaker is shown shaded in blue and attached to this document as Appendix A. This area is referred to within this document as "the Northumbrian Water Region".

On [date] Northumbrian Water imposed, throughout the Northumbrian Water Region, a prohibition on the use of water for a number of specified categories of use, in accordance with section 76 of the Water Industry Act 1991. This is referred to as the Temporary Use Ban or TUB. The TUB was imposed because of the serious deficiency of water available for distribution and its terms are as follows:

The TUB took effect from midnight on [date] following publication of the notice on the Northumbrian Water website and in the [insert newspaper name], The Times and the Daily Mail newspapers on [date]. The terms of the TUB are attached to this document as Appendix B.

Under the terms of section 76(5) of the Water Industry Act 1991, if any person fails to comply with the terms of the TUB that person shall be guilty of an offence and liable on conviction in the Magistrates' Court to a fine of up to £1000.

This enforcement policy sets out the standards and guidance that will be applied by Northumbrian Water when undertaking its enforcement role within the provisions of the Water Industry Act 1991.

Where infringements and contraventions are found, Northumbrian Water will respond in a manner commensurate with the need to safeguard the availability of water available for distribution. Wherever possible, Northumbrian Water will offer advice to those who may have contravened the prohibition in a bid to remedy infringements in a timely and cost-effective manner. However, in particular cases, offenders may face prosecution.

The purpose of this enforcement policy is to seek to ensure that when enforcement action is required, it is pursued in a consistent, balanced and fair manner.

Overall Aim

It is intended that this policy will seek to ensure compliance with the TUB within the Northumbrian Water Region, in an attempt to conserve water, in a fair, open and consistent manner having regard, where appropriate, to the circumstances of each individual case and the extent to which the terms of the TUB have been contravened.

Guiding Principles

Whilst undertaking its regulatory and enforcement role in connection with the TUB, Northumbrian Water will have regard to the following Guiding Principles:

- Any decision regarding enforcement action will be impartial and objective, and will not be affected by race, politics, gender, sexual orientation or the religious beliefs of any alleged offender, victim or witness.
- Northumbrian Water will use as its starting position when considering enforcement of the TUB the belief that the vast majority of persons wish to comply with the terms of the TUB and should be assisted in doing so by Northumbrian Water following the Investigational Phase process set out in Appendix C below ("the Investigational Phase"), if reasonably practicable.
- There will be a consistent approach to enforcement whilst recognising individual circumstances.
- Prosecution for an offence under the Water Industry Act 1991 will be considered in all cases, but particularly where a serious, severe, persistent and/or blatant breach of the relevant legislation has taken place or where alternative methods of resolution have failed.

Standards

Northumbrian Water will try to meet the highest standards of service whilst undertaking its regulatory and enforcement function in connection with the TUB. The following specific level of service standards will be applied in connection with the TUB: -

- Matters relating to enforcement of the TUB will be dealt with promptly with written enquiries and complaints receiving a response or acknowledgement within ten working days.
- Employees of Northumbrian Water employed to monitor compliance with the TUB will announce themselves on arrival at any premises and promptly show credentials/identification unless they are already known to the person or persons on such premises.
- Employees of Northumbrian Water employed to monitor compliance with the TUB will provide their name and a Northumbrian Water contact telephone number to those persons with whom they are in written contact concerning enforcement of the TUB.
- Complaints relating to persons failing to comply with the TUB will be dealt with promptly, though we will always request the name and address of the complainant. Any such identification will be treated in confidence, but may need to be disclosed (with prior consent) should formal legal proceedings be taken against the person or persons to which the complaint relates. Anonymous complaints, however, will still be investigated.

- Northumbrian Water will be professional, courteous and helpful in its enforcement of the TUB and wherever possible will seek to work with persons towards compliance using the Investigational Phase.
- In accordance with the Investigational Phase at the onset of considering enforcement action Northumbrian Water will provide the person(s) believed to be contravening the TUB in writing with full details of the manner in which it is alleged the TUB has been breached and the steps that are required to be undertaken and by when to avoid enforcement action being taken.

Consistent Enforcement

Consistent enforcement action is desirable, but absolute uniformity would be unfair by failing to recognise individual circumstances that may modify action to be taken where it is permissible. Consistency of approach whilst allowing a degree of discretion will be encouraged by:

- Appropriate training and supervision of those employed by Northumbrian Water to monitor and enforce compliance with the TUB. Amongst other things, they will be made fully conversant with the terms of this Enforcement Policy and its Appendices.
- Ensuring there is compliance with the standards set out in this policy by Northumbrian Water.
- Recognition that it may not be in the interests of justice to prosecute a person found to be breaching the terms of the TUB in those cases where there is only sufficient evidence to prove a minor infringement.
  The final decision whether or not to prosecute will be taken by Northumbrian Water's Executive Management Team, who will be aware that each case is unique and must be treated on its own merits.

Assessing Appropriate Action (in cases of infringement)

The Investigational Phase that will be undertaken by Northumbrian Water sets out the detailed steps that will be taken by Northumbrian Water **before** enforcement action is taken against a person found to be contravening the TUB. Northumbrian Water will seek to ensure that the process identified in the Investigational Phase attached below as Appendix C as it applies to each individual case will be followed to allow a person sufficient time to demonstrate compliance with the terms of the TUB before enforcement action will be taken.

Prosecution will normally be considered where one or more of the following criteria are satisfied:-

- There is a need to protect the public interest and the interests of the environment, health, safety and such other interests.
- Informal approaches have failed.
- The persons concerned have ignored requests for compliance with the TUB.
- There has been a repeated serious and/or blatant contravention which is a clear overt challenge to the TUB and has potential to undermine customer confidence in the fairness of the restriction.

Northumbrian Water accepts that the decision to institute criminal proceedings against a person or persons who fail to comply with the terms of the TUB is a serious one that should only be taken after full consideration of all the facts.

Northumbrian Water is not bound by, but chooses to accept the provisions of the Code for Crown Prosecutors, January 2013 As such, Northumbrian Water will only institute criminal proceedings when it is satisfied that the two stages of the Full Code Test: (i) the evidential stage; and (ii) the public interest stage, have been met.

The evidential stage is passed when there is sufficient evidence to provide a realistic prospect of conviction against each defendant on each charge. A realistic prospect of conviction means that a bench of magistrates, properly directed in accordance with the law, is more likely than not to convict the defendant of the charge alleged.

The public interest stage is applied by balancing public interest factors for and against prosecution. A prosecution will usually take place unless there are public interest factors tending against prosecution which clearly outweigh those tending in favour. Public interest factors that can affect the decision to prosecute usually depend on the seriousness of the offence or the circumstances of the offender. Some factors may increase the need to prosecute but others may suggest that another course of action would be better.

Both the evidential and public interest stages will be considered fairly and objectively by Northumbrian Water.

[Date]

Appendix A Map of Northumbrian Water Region

Insert a map showing the geographical area for which Northumbrian Water is appointed as the statutory water (“the Northumbrian Water Region”)

Appendix B Terms of the Temporary Use Ban

Temporary Use Ban:
Section 76 Water Industry Act 1991
Potable water supplied throughout the area of [Company name] Utilities Limited must NOT be used for the following purposes:

1. watering a ‘garden’ using a hosepipe;
2. cleaning a private motor-vehicle using a hosepipe;
3. watering plants on domestic or other non-commercial premises using a hosepipe;
4. cleaning a private leisure boat using a hosepipe;
5. filling or maintaining a domestic swimming or paddling pool (except when using hand held containers filled directly from a tap);
6. drawing water, using a hosepipe, for domestic recreational use;
7. filling or maintaining a domestic pond (excluding fish ponds) using a hosepipe;
8. filling or maintaining an ornamental fountain;
9. cleaning walls, or windows, of domestic premises using a hosepipe;
10. cleaning paths or patios using a hosepipe;

11. cleaning other artificial outdoor surfaces using a hosepipe.

Definition of a garden

A "garden" includes all of the following: a park; gardens open to the public; a lawn; a grass verge; an area of grass used for sport or recreation; an allotment garden, as defined in section 22 of the Allotments Act 1922; any area of an allotment used for non-commercial purposes; and any other green space.

Exemptions
The following will be exempted from the restrictions:

i) using a hosepipe in a garden or for cleaning walls or windows of domestic premises, paths or patios, a private leisure boat or an artificial outdoor surface, where such use is necessary for health and safety reasons.

ii) people with severe mobility problems who hold a current Blue Badge as issued by their local authority will not be prohibited from using a hosepipe to water a garden attached to a domestic dwelling, plants on domestic premises, or allotments where the Blue Badge holder is the tenant.

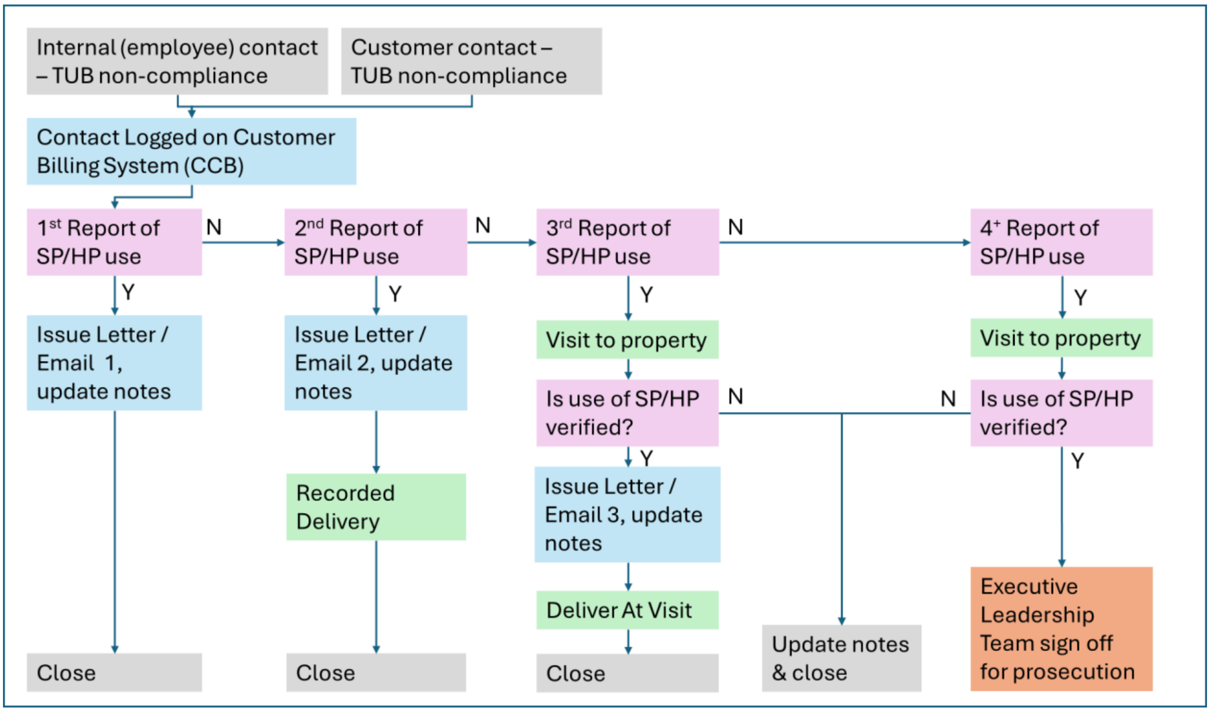
iii) using a hosepipe to clean a private motor vehicle, walls and windows of domestic premises, or paths, patios and other outdoor surfaces where this is done as a service to customers during a business.

iv) using a hosepipe to water an area of grass or artificial outdoor surfaces used for sport or recreation, where this is required in connection with a national or international sports event. A list of qualifying events will be published on [Company name]'s website and updated as and when required.

v) drip or trickle irrigation watering systems, fitted with a pressure reducing valve and a timer, that are not handheld, that place water drip by drip directly onto the soil surface or beneath the soil surface, without any surface run off or dispersion of water through the air using a jet or mist.

Appendix C: TUB Non-compliance Investigational Phase (Flowchart)

Figure 1: TUB Compliance Process



APPENDIX 6: POTABLE WATER BULK SUPPLIES

We have a number of potable water imports and exports which are detailed below. For the purposes of this Drought Plan we have assumed that the full quantity outlined in our water supply agreements will be available during a drought. Requests to increase transfers (within the capacity of the transfer mains) will be considered against our own water resources position and would only be supported if our modelling confirmed no significant increase in risk to our own customers' water supplies.

Contractual external bulk imports include the United Utilities import into the Kielder WRZ is 0.3Ml/d, and the Anglian Water import at Wynyard into the Kielder WRZ is 0.15Ml/d.

Contractual external bulk exports include the United Utilities export out of the Kielder WRZ is 1.3Ml/d.

New Appointments and Variations (NAV's) are increasing within our supply area with a current registered total of 47 in the Kielder WRZ. The contractual volume for the operational NAVs is 7.71Ml/d, as of April 2025. There are currently no NAVs in the Berwick WRZ.

APPENDIX 7: SECLI FIRM OFWAT INNOVATION FUND PROJECT

Background

This project intends to use the findings and intellectual property (IPR) from a Horizon 2020 funded project called SECLI-FIRM which looks at the added value of seasonal climate forecasting for integrated risk management. The SECLI-FIRM project successfully demonstrated that more reliable weather dependant decisions can be made out to 2-4 weeks if tailored sub-seasonal forecasts are utilised. The project used the Met Office IPR called 'Decider' along with historic demand data from Northumbrian Water to build a sub-seasonal water demand forecast model. The Decider forecasting tool (to be used as background IPR) developed by the Met Office, uses the predictability of large weather systems (or weather patterns), and the resulting model exploits the relationships between these weather patterns and water company's demand. The result was a demand forecast model that gives Northumbrian Water up to four weeks' notice of significant changes in weather, allowing them to be better prepared for large changes in water demand.

Aims and Objectives

The project aimed to achieve an in-depth understanding of weather-related water demand. A forecast that can produce alerts to high customer demand events in the summer but also freeze thaw events that would increase demand through leakage. The model aims to provide alerts up to a month in advance, which would enable the business to plan further in advance to these high demand events but also to low demand events which would help in identifying the most appropriate time for maintenance. The forecast ensures the business can plan according to the low and high demand events to efficiently allocate production and maintenance costs, rather than rely on a worst-case scenario approach. With a greater lead time, leakage resources can be appropriately allocated, which would mean better control and quicker reduction during high leakage events. The model could be used as an indicator to the severity and length of time that extreme weather is likely to persist, which could be used to decide whether drought actions or any other demand reduction measures might be needed.

Methodology

This project builds on the insights, solutions and methodologies that were developed during the EU H2020 project SECLI-FIRM. The purpose of SECLI-FIRM was to demonstrate the added value of seasonal climate forecasting for integrated risk management in both the energy and water sector. Consequently, the project has built up a wealth of expertise on the best approach to develop and deliver industry-tailored forecast services that are designed to maximise the benefits to operational decision-makers at sub-seasonal (2-4 weeks) and seasonal (1-3 month) time frames. As part of the SECLI-FRIM project, a demand forecast that extends out to 30-day days ahead has been developed and calibrated for Northumbrian Water. It demonstrates that by following the methodology developed in the SECLI-FIRM project, real-time tailored sub-seasonal forecast services can be successfully integrated into the water sector's operational decisions improving operational efficiency and resilience. The methodology to develop this forecast exploited, for the first time, the skill in forecasting broad-scale circulation patterns and the latest demand modelling approaches6.

At longer lead-times, broad-scale circulation types are more predictable than the actual weather itself. The water demand forecast was extended from 14+ days ahead to sub-seasonal lead times (1 month +) over the winter and summer using weather patterns which are representative of the variability in large-scale atmospheric circulation over the UK and surrounding area. There are 30 weather patterns (Figure 1) that are used in the model, ranked from most to least common.

Current weather conditions are used in the decider tool to predict the likely weather transitions based on historic weather data. This is shown in better detail in Figure 2 where regimes are given a probability out of 100. As the period of the forecast increases, there is more uncertainty and so there is a chance that several outcomes may occur. However, the tool will give an indication of which weather regime is most likely to occur based on the historic data.

The decider tool provides quick and comprehensive advice to forecasting teams to ensure that decision makers working in weather-sensitive trades are fully informed. As an overview the tool aims to:

- Access an alternative view of weather conditions up to 32 days ahead that utilises the most accurate weather models in medium range weather forecasting.
- Review the confidence in the forecast and make risk-based decisions accordingly.
- Clearly identify changes and transitions over the forecast period.
- Quickly see how weather patterns will impact on climatologies for different regions.
- Summarise a broad range of information, including circulation biases, regime seasonality, distance and correlation values which supports decision making.
- Identify clear correlations between weather regimes and your own data, enhancing the quality and confidence of your decision making.
- Recognise impacts on energy generation and demand, as a result of several weather parameters, including wind, precipitation and temperature anomalies7.

[6] Met Office
https://www.metoffice.gov.uk/services/business-industry/energy/decider
[7] The Added Value of Seasonal Climate Forecasts for Integrated Risk Management Decisions | SECLI-FIRM | Project | News & Multimedia | H2020 | CORDIS | European Commission

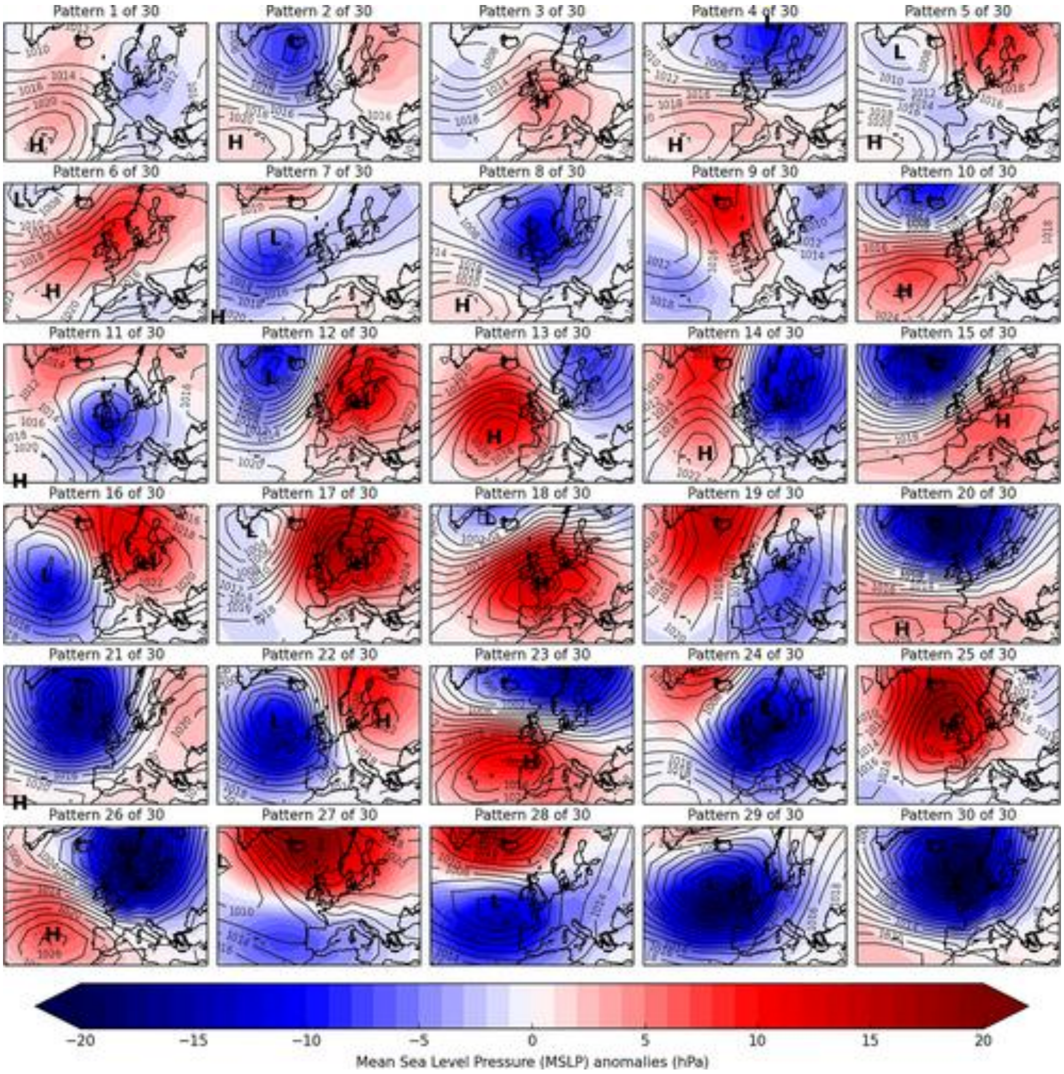


Figure 1: 30 weather patterns set out by the Met Office.

INTERACTIVE TABLE: Probability of each regime occurring at each lead time (30 regimes) – UK

Click on probabilities to show regime climatologies. Hover over probabilities to show a list of members. Probabilities in bold contain the control member. Regime definitions are available by hovering over or clicking on the regime links in the first column.

	Wed 1 Dec	Thu 2 Dec	Fri 3 Dec	Sat 4 Dec	Sun 5 Dec	Mon 6 Dec	Tue 7 Dec	Wed 8 Dec	Thu 9 Dec	Fri 10 Dec	Sat 11 Dec	Sun 12 Dec	Mon 13 Dec	Tue 14 Dec	Wed 15 Dec	Thu 16 Dec	Regime Descriptions (UK)	Historic Occurrence N/D/J
Regime 1					45	16		3	6	3							Unbiased NWly	2.0%
Regime 2						13	10		10	3	6						Cyclonic SWly, returning Pm airmass	2.8%
Regime 3															3		Anticyclonic SWly, ridge over N France	2.3%
Regime 4						6						3	10	3	3		Unbiased Wly	2.6%
Regime 5						6	6	6									Unbiased Sly, high over Scandinavia	2.6%
Regime 6					23	16											Anticyclonic, Azores high ext.	2.8%
Regime 7														3	3		Cyclonic SWly, low WNW of Ireland	2.2%
Regime 8			16		3	10	19	16	6		3						Cyclonic Wly, low near Shetland	3.1%
Regime 9																	Anticyclonic N-NEly, high near Iceland	2.6%
Regime 10					10	26	26	26	13	10	6		3	3			Anticyclonic W-SWly, slight Azores ridge	3.4%
Regime 11								3	3								Cyclonic, low centred over southern UK	2.4%
Regime 12						3			6	3	3	3	10	10	3	16	Anticyclonic Sly, high over Poland	4.2%
Regime 13					6											3	Anticyclonic NWly, high SW of Ireland	4.4%
Regime 14	100	100		90	3		3	3									Cyclonic N-NWly, low near S Sweden	4.1%
Regime 15						3	3	6	3	16	10	19	13	16	26	16	Unbiased SWly, very windy NW Britain	4.6%
Regime 16													3	3			Anticyclonic S-SEly, high E of Denmark	2.7%
Regime 17										3	3	3			6	3	Anticyclonic E-SEly high over Denmark	4.2%
Regime 18								3	3		3		6	13	3	10	Anticyclonic SWly, high over N France	4.6%
Regime 19					10			3									Unbiased Nly, low E of Denmark	4.1%
Regime 20			13				13	3	29	13	23	26	10	10	13	6	Cyclonic Wly, intense low near Iceland	4.1%
Regime 21									6	23	10	10	6	6	3		Cyclonic SWly, deep low S of Iceland	3.8%
Regime 22												3	3	3	3	6	Cyclonic Sly, low W of Ireland	3.2%
Regime 23							3	10		3	13	16	19	13	10	16	Unbiased Wly, windy in N	4.1%
Regime 24								6	3	3							Cyclonic Nly, low in N Sea	3.2%
Regime 25													3	3	6	3	Anticyclonic Nly, high centre Irish Sea	3.7%
Regime 26			71	10			13	10	6	10	3	6	10	3	6	3	Cyclonic NWly, low near Norway, windy	3.5%
Regime 27																3	Anticyclonic Ely, high in Norwegian Sea	3.7%
Regime 28																	Cyclonic SEly, low SW of UK	2.8%
Regime 29										3	3	3			3		Cyclonic S-SWly, deep low W of Ireland	2.9%
Regime 30							3		3	6	13	6	3	10	6	13	Cyclonic W-SWly, deep low SE of Iceland	3.0%
Total Members	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	---	---

Sort regimes by 2m temperature (°C), precipitation (mm/day), 10m wind speed (knots), cloud cover (%) or snowfall (cm/day) anomalies.
View a list of members assigned to each regime

Figure 2: The probability of each regime.

Phase 1 – Exploration and Data Collation

The first phase included the collation of demand data for our Essex area. This was an extensive task, where the Met Office required as much historic data as possible to ensure there was a high enough temporal frequency to assist with the accuracy of the model. Therefore, this phase was crucial in ensuring that the project provided reliable forecasts and met the initial aims and objectives we hoped to achieve.

This exploration stage was largely successful, where data was shared in a timely manner. In some instances, issues were identified with data through the application of the Met Office's quality control procedures and expertise in impact modelling. These were addressed with a final dataset created, ready to be used for the forecast model.

Phase 2 – Set Up Forecast Service

Phase 2 involved the development of a bespoke water demand model for Northumbrian Water from the data provided in phase 1. This process involved:

- Generating modelled impact time series, quantifying the performance of the model against the observed time series
- Developing climatologies of the impact on demand with the 30 weather patterns (**Error! Reference source not found.** 2)
- Showing the performance and potential of the forecast model using verification statistics
- Developing prototype visualisations for a forecast service, showcasing the potential by generating forecasts 'as it would have looked' for known impactful events

During the development stage, initial observations indicated that the model produced over and under confident forecasts dependent on seasonality, which meant further refinement to produce a tool that could provide accurate forecasts and reduce the risk of false alarms.

Phase 3 – Trial Forecast Service

The project entered phase 3 with the service going live. Weekly forecasts (Figure 3) were provided by the Met Office for the month ahead. Monthly stakeholder meetings with the Met Office and partnering water companies were held to dissect the forecasts in detail, provide feedback and opportunities for improvement to the service. During this phase the forecasts were compared against actual demand to evaluate the level of accuracy the model provided.

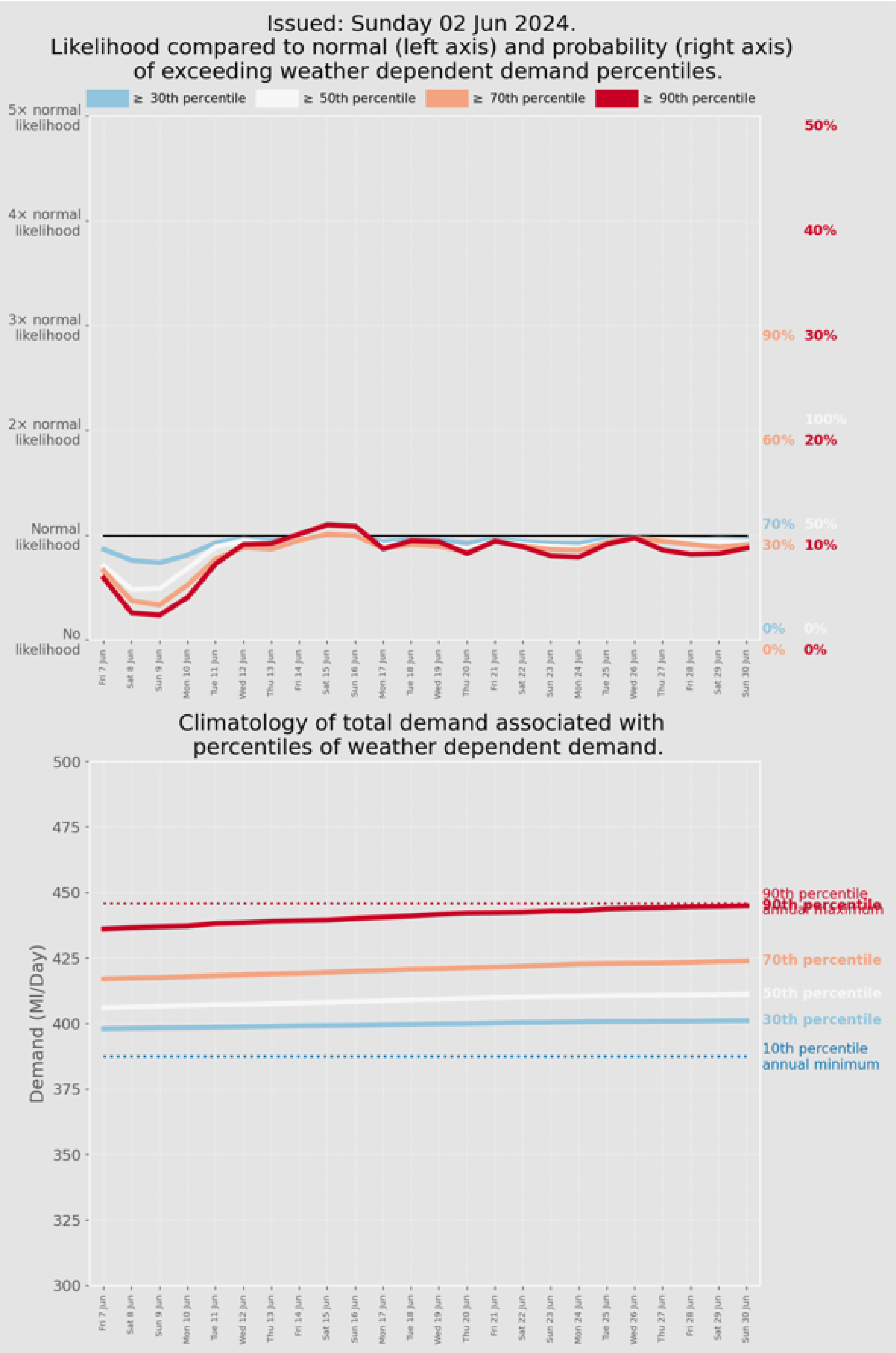


Figure 3: Weekly forecast issued on 2nd June 2024 by the Met Office for 7th June – 30th June, showing the likelihood of high or low demand and corresponding demand percentiles.

Results

The project analysis has been split into four parts, one for each season. With particular focus on the summer due to an increase in customer demand and winter periods, where leakage peaks due to freeze-thaw events as seen in Figure 4. This data was used throughout the trial to evaluate the performance of the model.

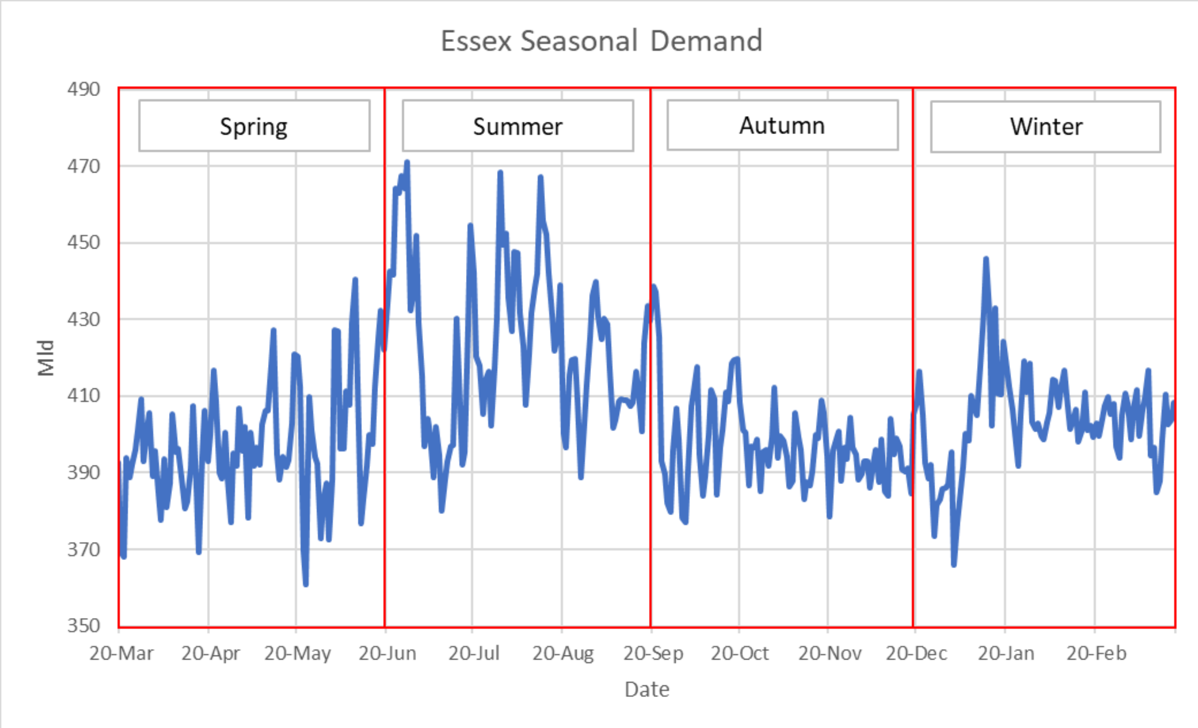


Figure 4: Daily demand in Essex 20th March 2024 – 19th March 2025 showing shifts in demand by season.

Spring 2024

The forecast was fairly accurate during this period at predicting the higher-than-average demand (Figure 5). It failed to identify the high demand at the start of the forecast, which fell between the 70th and 90th percentiles, where the model had predicted a lower-than-normal likelihood of high demand. However, it is worth noting that demand is less weather dependent during this period, and likely impacted by unrelated factors, especially given the average weather experienced.

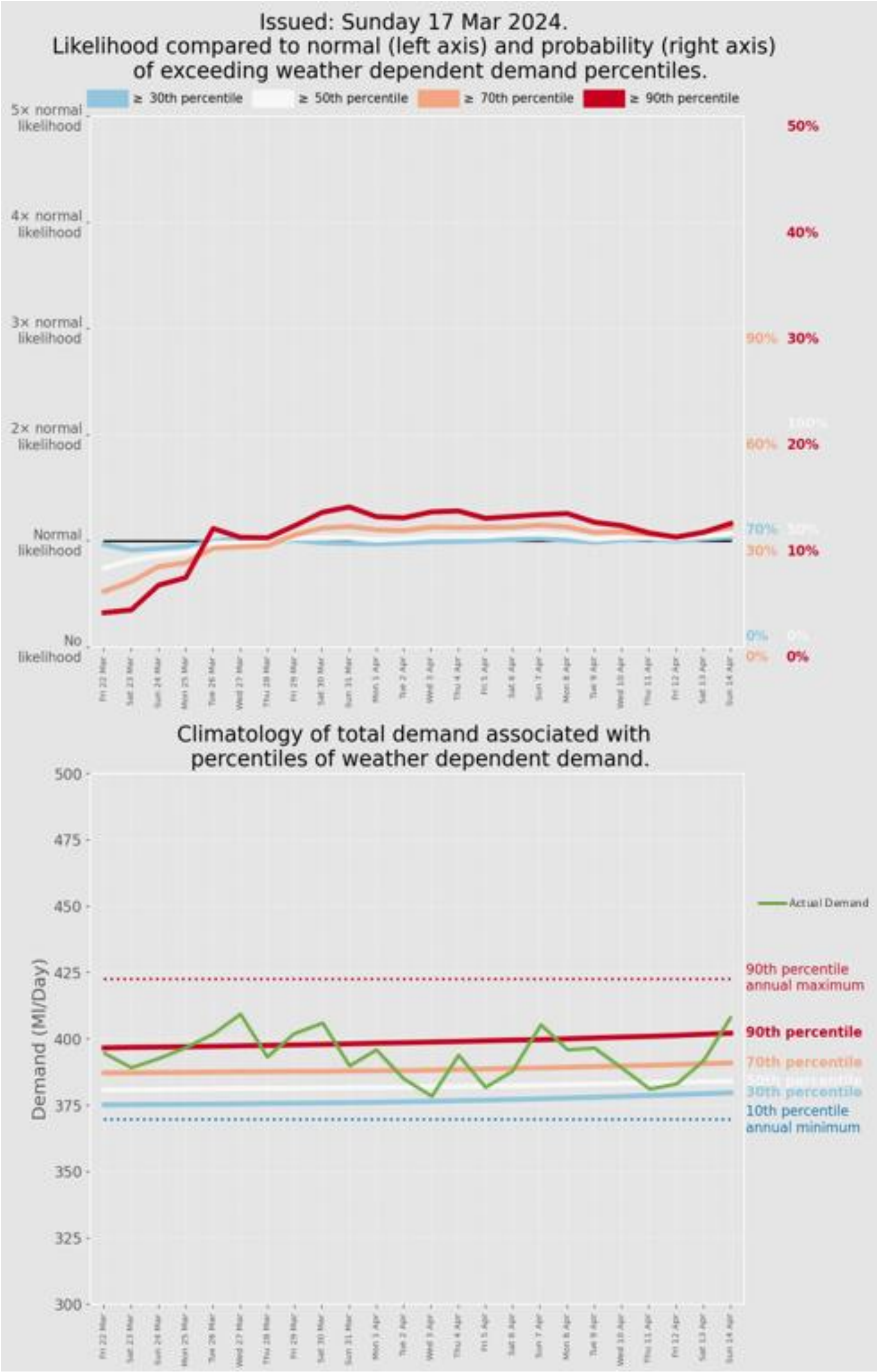


Figure 5: Forecast issued on 17th March 2024 for 22nd March – 14th April, with actual demand included for comparison.

Summer 2024

Entering the summer months is where we expected the forecast to be most beneficial as this is usually when customer demand peaks due to the weather. The forecast (Figure 6) correctly identified both the peak at the start of the period and the lower demand from the beginning of July onwards.

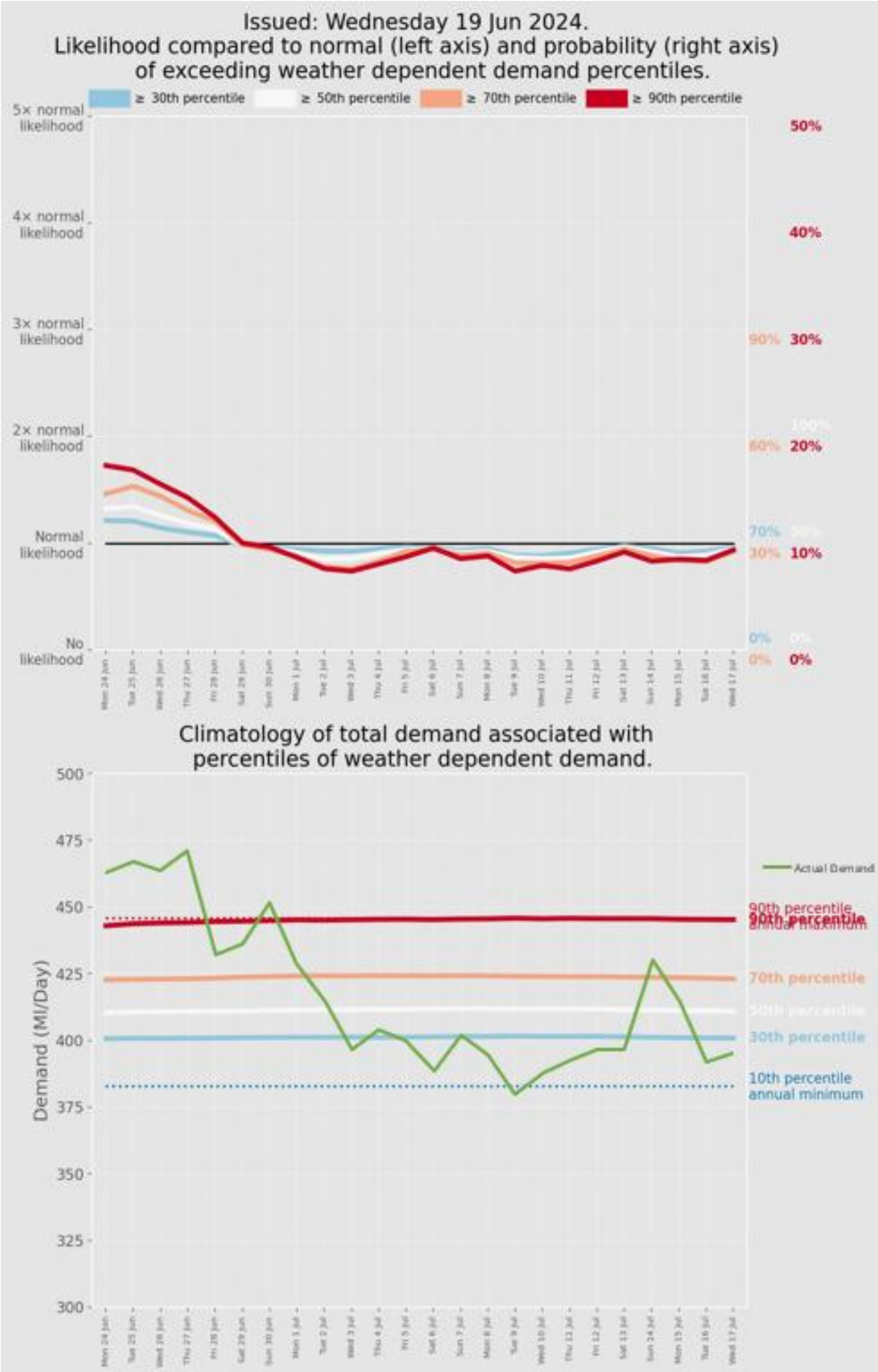


Figure 6: Forecast issued on 17th June 2024 for 24th June – 17th July, with actual demand included for comparison.

Although the summer of 2024 was largely uneventful in comparison to the extremes seen in the previous few summers, there was a period of warm and dry weather between 19th July and 12th August. Likelihood and actual demand in Figure 7 show that the model was accurate at predicting the peaks and troughs during this period with similar trend lines. However, when comparing actual demand against the corresponding percentiles, the model underestimated demand during this period with only 2 days dropping below the 50th percentile. Therefore, further fine tuning and possible sensitivity increases are necessary to ensure that the model doesn't miss these events in the future.

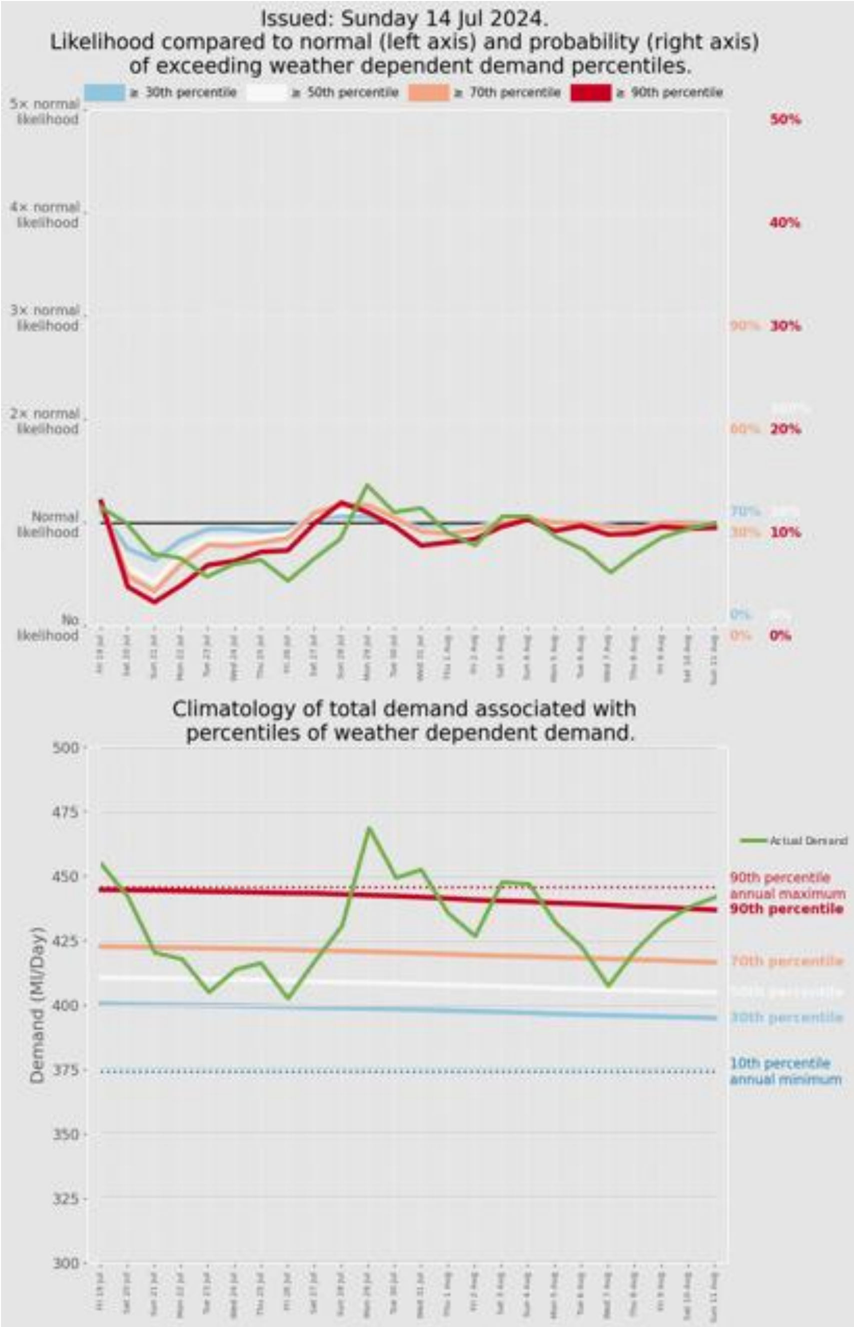


Figure 7: Forecast issued on 14th July 2024 for 19th July – 11th August, with actual demand included for comparison.

Autumn 2024

As expected, there were a few peak demand days at the beginning of this period but smaller in comparison to the summer. However, the model predicted an increased likelihood of demand reaching the 90th percentile throughout November, which was accurate when comparing the percentiles to actual demand (Figure 8). November saw temperatures only slightly above average but more importantly it was unseasonably dry which is likely what the forecast used to predict high demand for this period (Figure

9). With continuous improvement ongoing, a RAG rating accompanying the forecasts was added in October, which showed the level of certainty of high or low demand event.

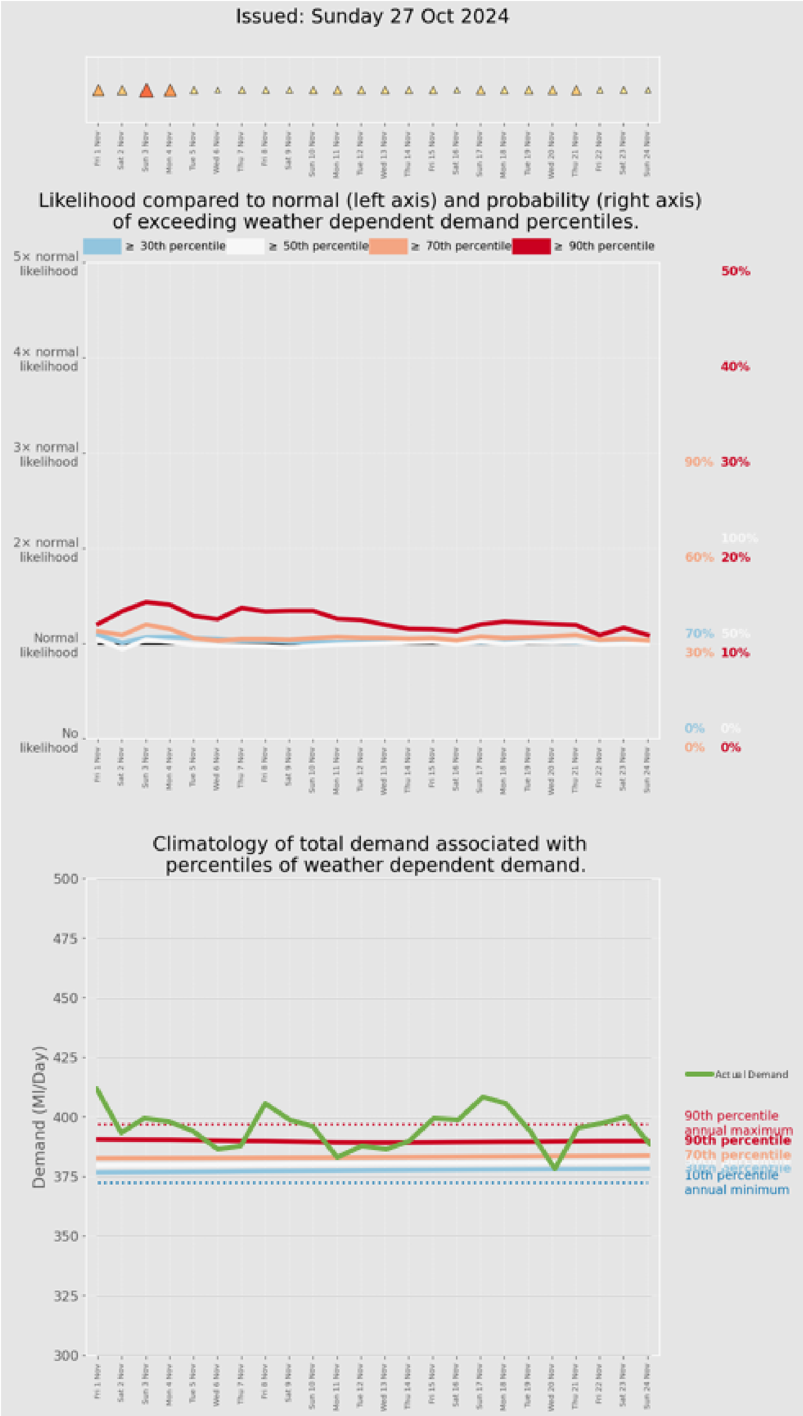


Figure 8: Forecast issued on 27th October 2024 for 1st November – 24th November with actual demand included for comparison.

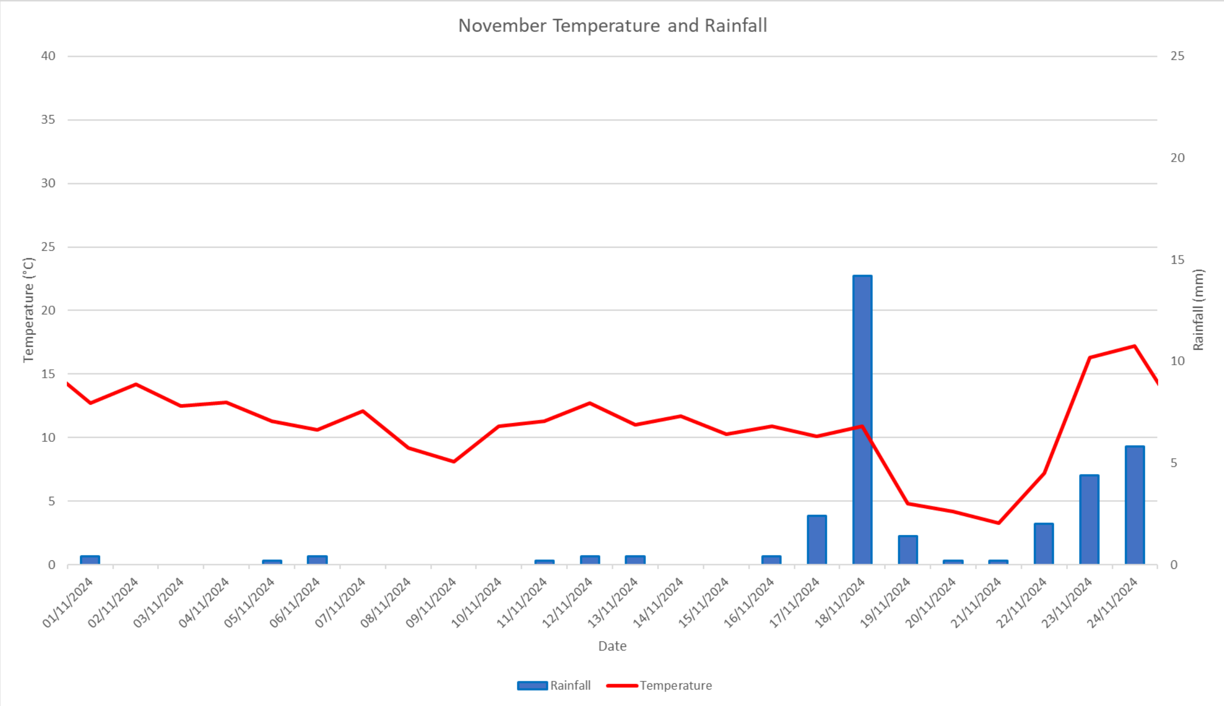


Figure 9: Graph showing temperature and rainfall for 1st November – 24th November.

Winter 2024 – 2025

Demand was relatively stable throughout the winter except for a spike at the start of 2025, resulting from increased leakage after a period of cold weather. The high demand event was first identified in the forecast issued on 22nd December (**Error! Reference source not found.** 10), the forecast was fairly accurate at identifying both high demand and the low demand between. However, the subsequent forecast, Figure 11, which was only issued a few days later seemed to underestimate the length and severity of the event. It was again picked up in the following forecast (Figure 12) which indicated a more significant high demand event.

In this instance, although the event was identified throughout, it seems that the model lacked confidence and showed a level of uncertainty in the forecast. This indicates that the model may need to be adjusted during the winter months to increase sensitivity to possible freeze thaw events.

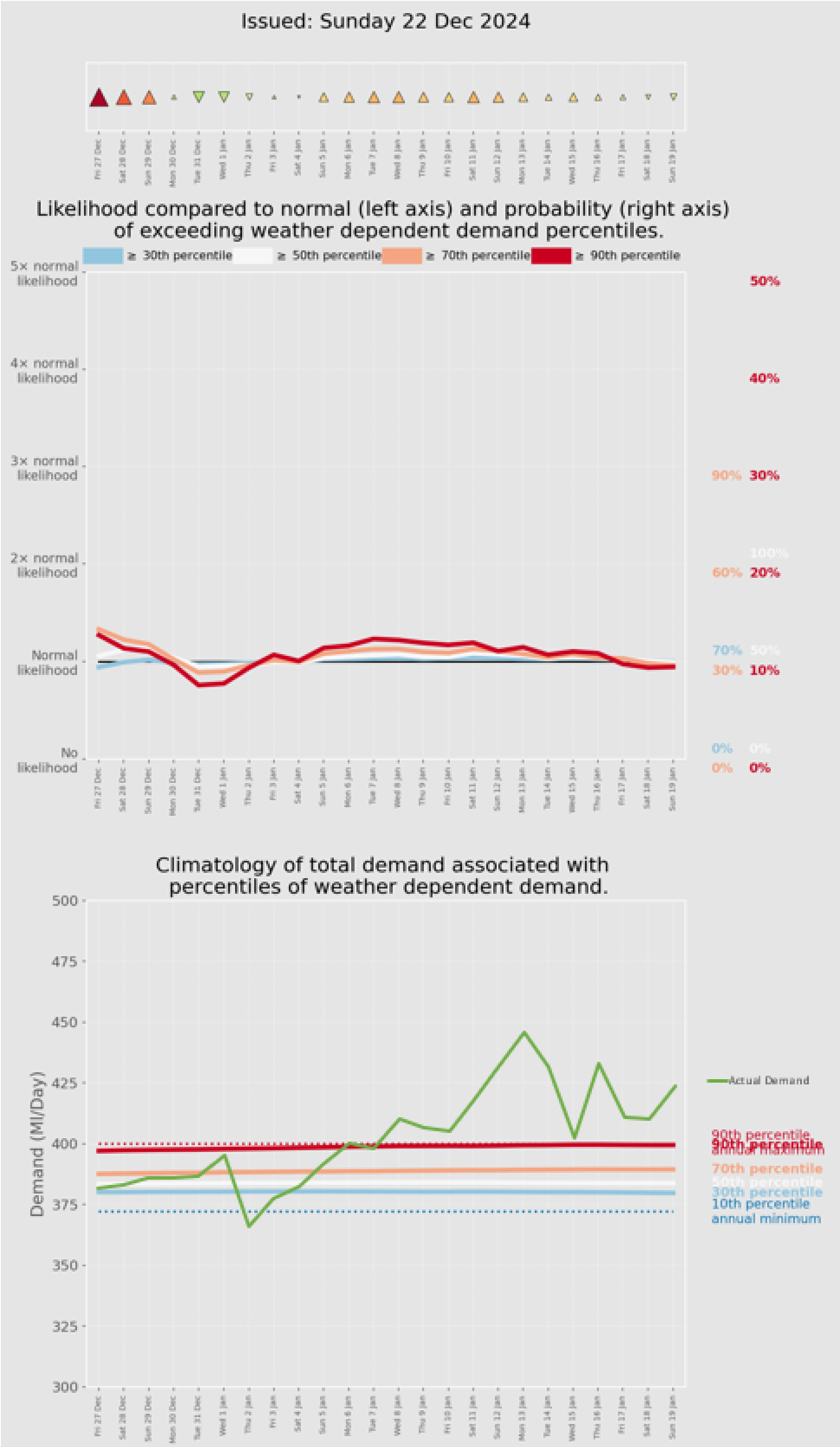


Figure 10: Forecast issued on 22nd December 2024 for 27th December – 19th January.

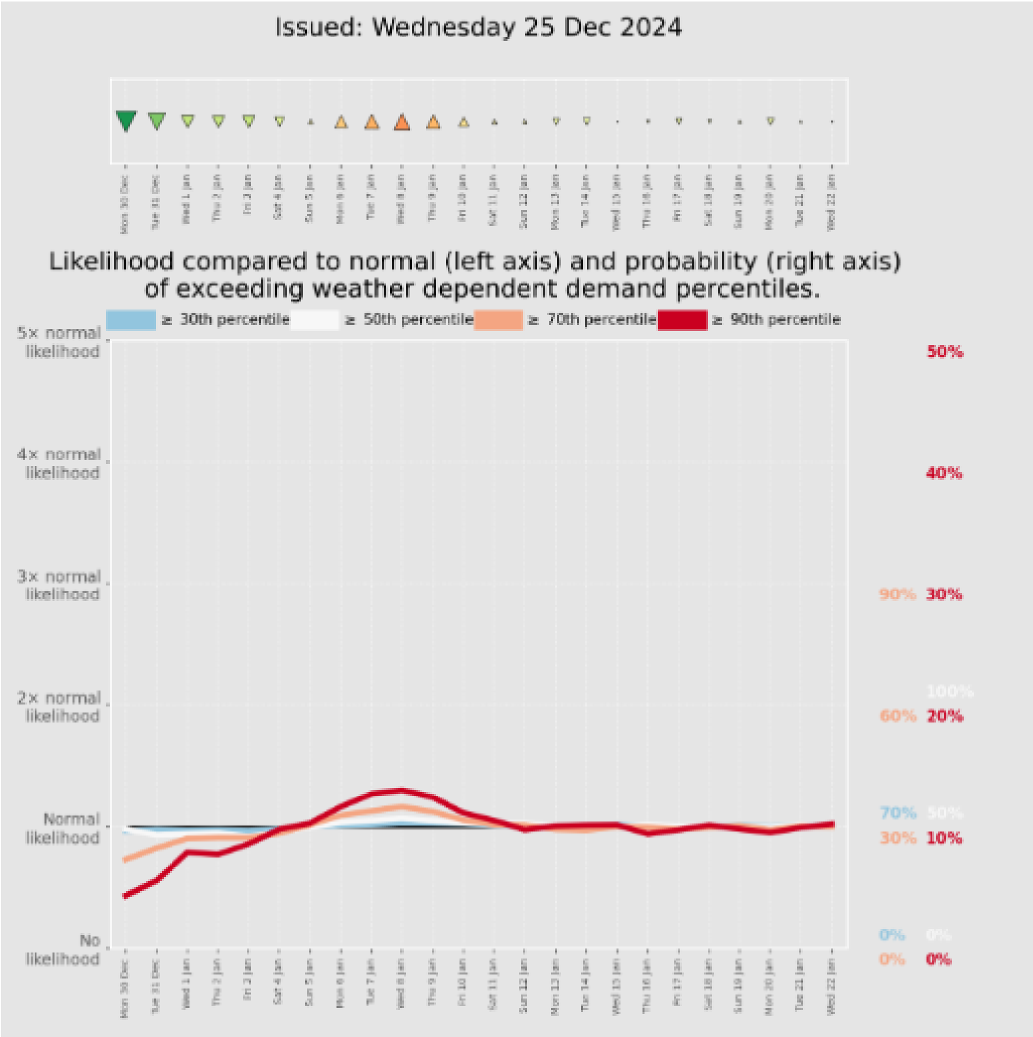


Figure 11: Forecast issued on 25th December 2024 for 30th December – 22nd January.

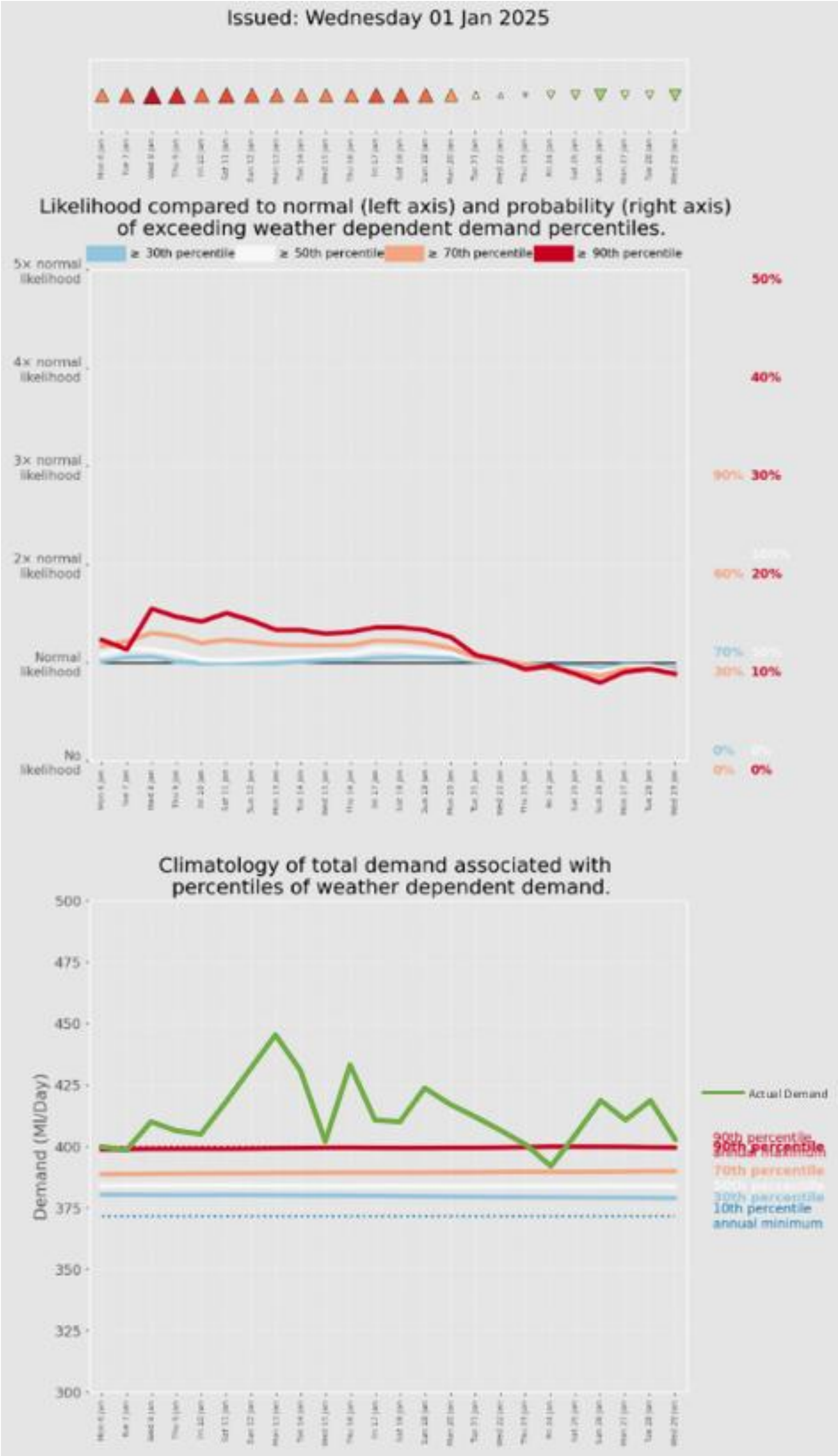


Figure 12: Forecast issued on 1st January 2025 for 6th January – 29th January with actual demand included for comparison.

Spring 2025

Although most of spring 2025 was generally mild, it was unusually dry, with less than half of the average rainfall for March to June (Figure 13). This meant an increase in demand compared to normal. The majority of forecasts during this period underestimated demand (Figure 14 and 15) where actual demand was nearing the 90th percentile for large parts of spring. The model was correct in predicting a spike in demand at the end of April which gave 3 weeks of notice. With the forecast issued in May (Figure 15) demand was forecast to be lower than average for large parts of the month. However, actual demand only dropped below the 50th percentile for 2 days.

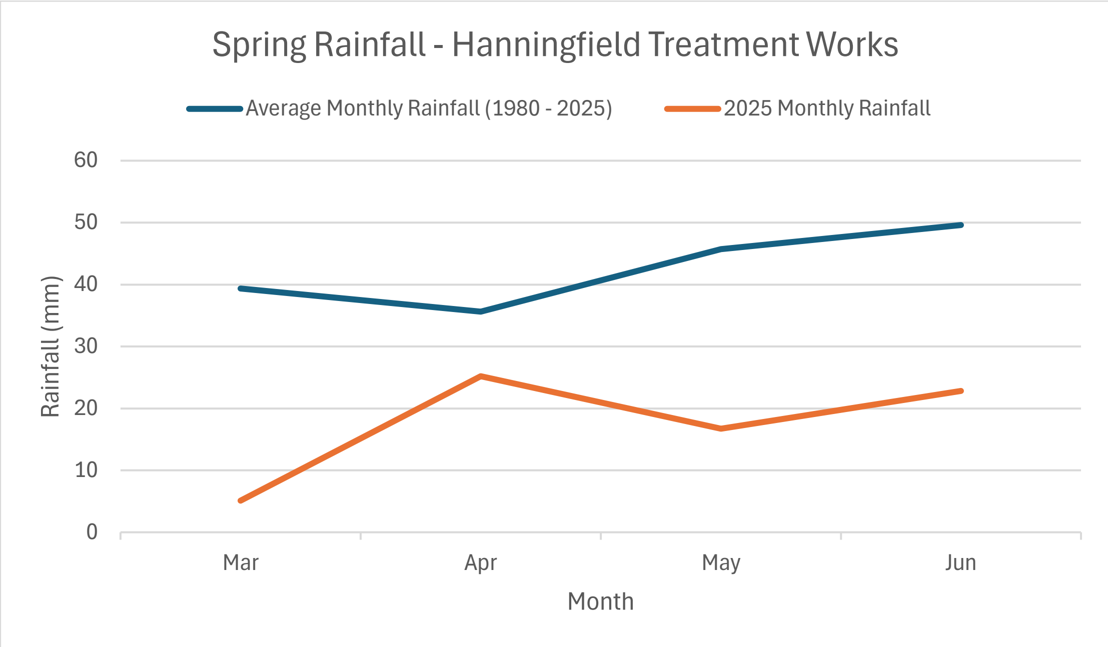


Figure 13: Graph showing rainfall for March – June 2025 and average between 1980 – 2025.

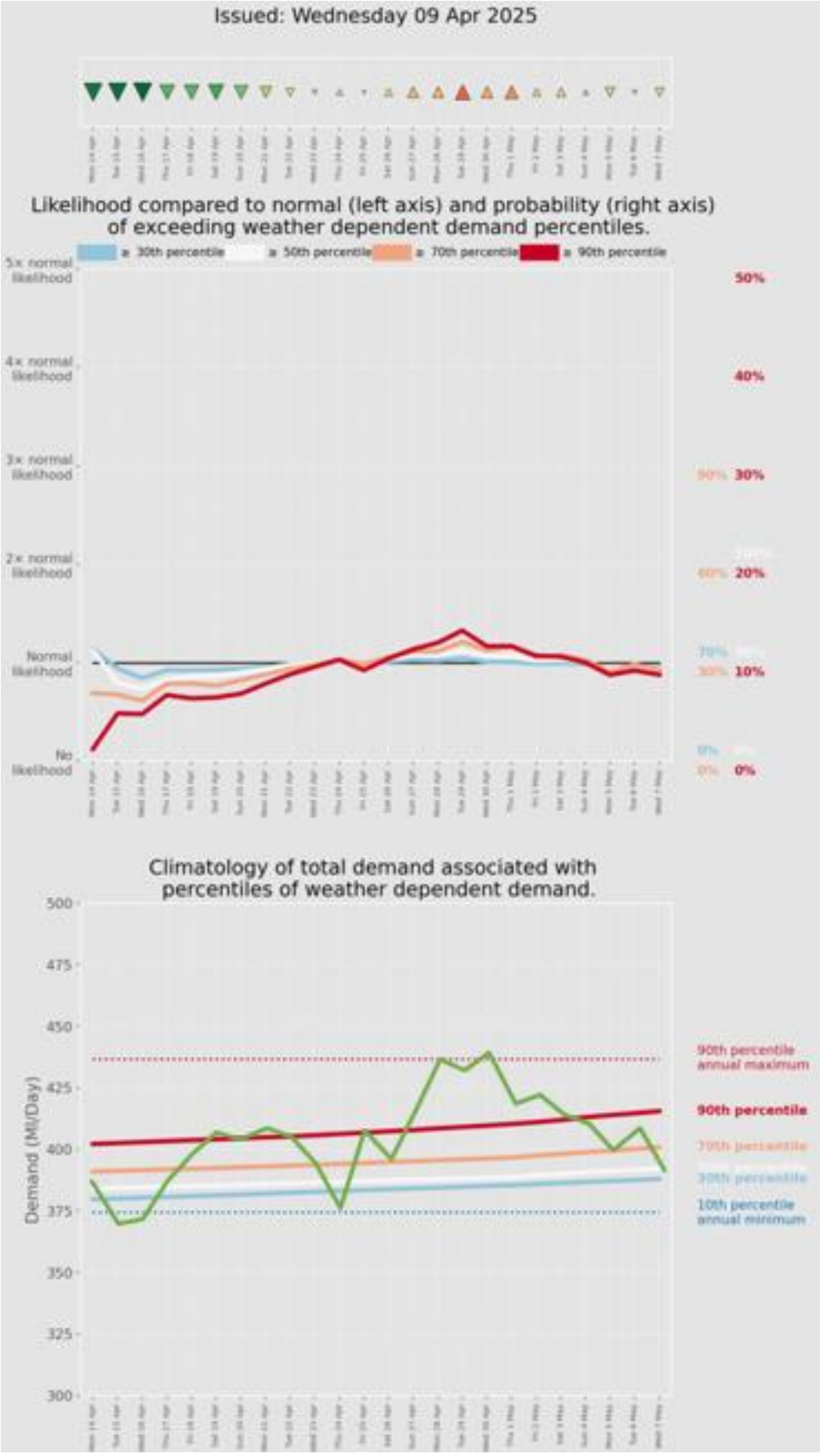


Figure 14: Forecast issued on 9th April 2025 for 14th April – 7th May with actual demand included for comparison.

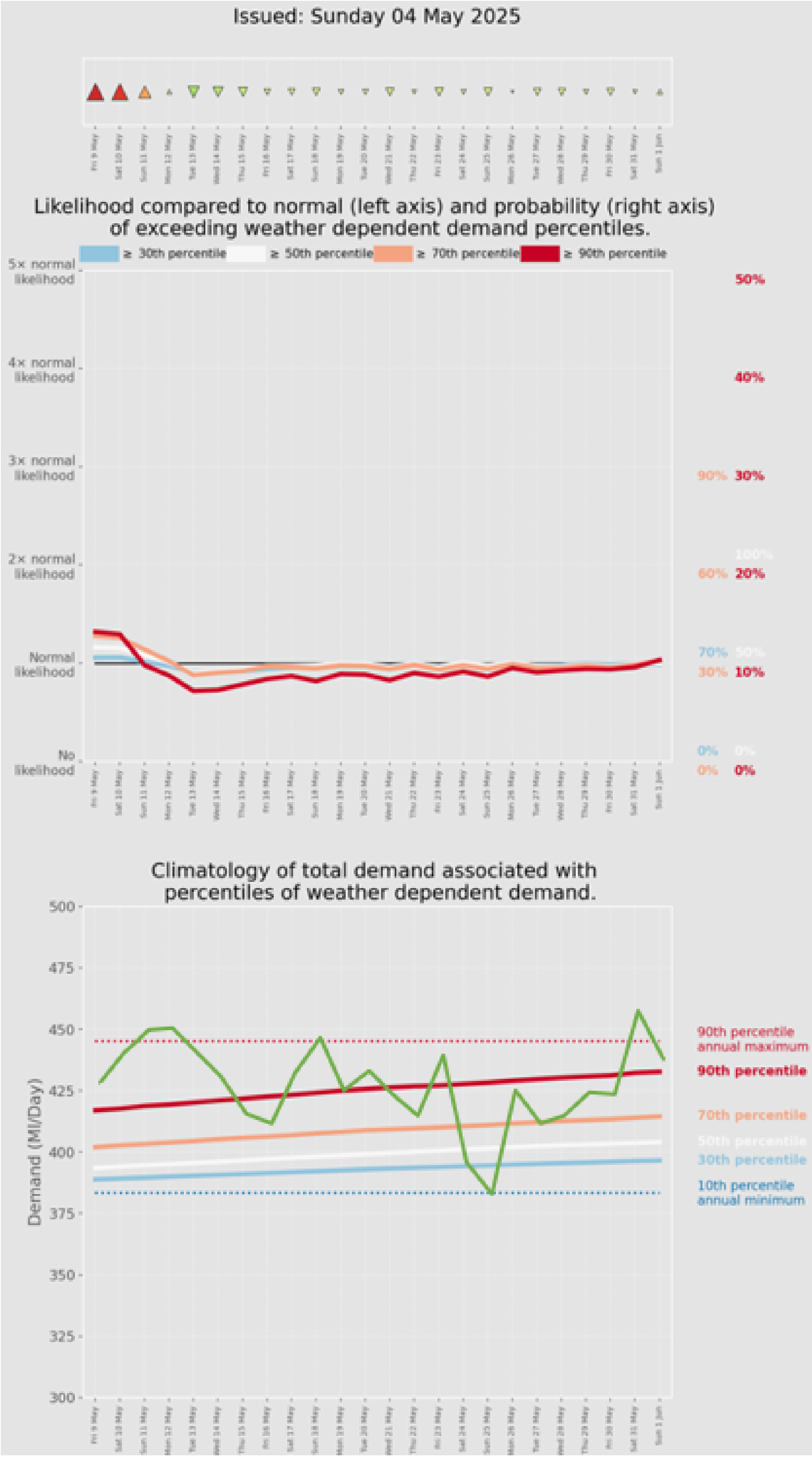


Figure 15: Forecast issued on 4th May 2025 for 9th May – 1st June with actual demand included for comparison.

Summer 2025

Dry weather continued into the summer months, where temperatures also started to increase as can be seen in Figure 16. The forecast issued at the beginning of June, suggested that high demand would be experienced, followed by lower-than-normal demand towards the end of the month. However, actual demand remained very high throughout the month. Subsequent forecasts throughout June were updated each time with increased likelihoods of high demand, which can be seen in Figure 18, where high demand was forecast, where originally it wasn't in the forecast provided earlier in the month (Figure 17).

The forecast provided at the beginning of July was far more accurate at predicting demand for the month than June's forecasts (Figure 19). There is clear correlation between actual demand and the forecast. In this instance, demand was slightly overestimated for the second part of the forecast. However, the forecast did well at identifying high and low demand events in a period of prolonged dry and warm weather.

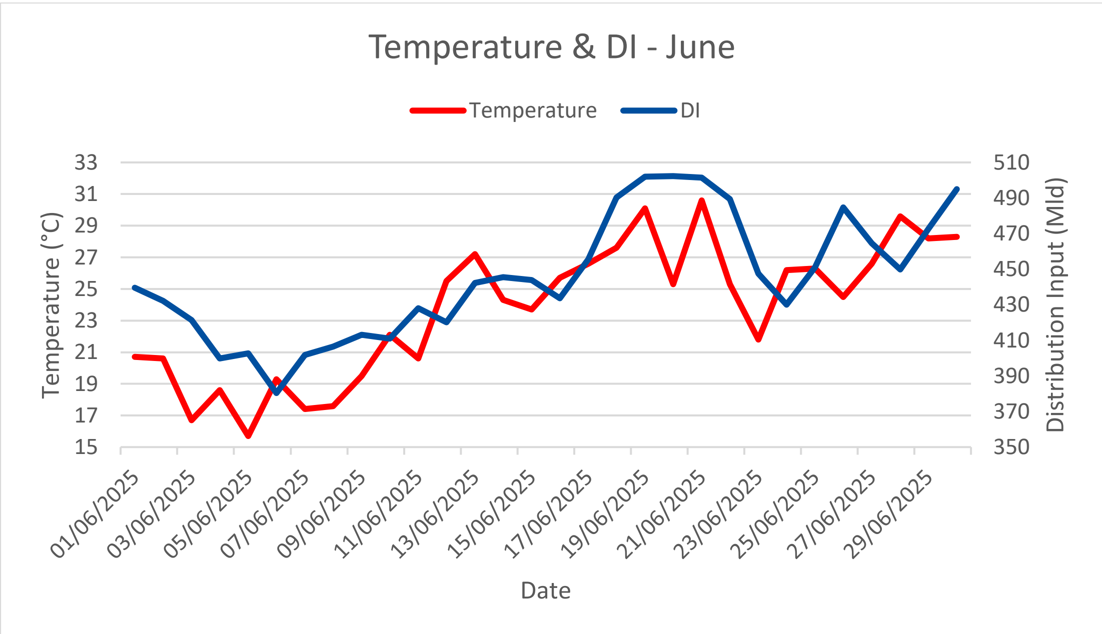


Figure 16: Graph showing temperature and DI for 1st June – 30th June.

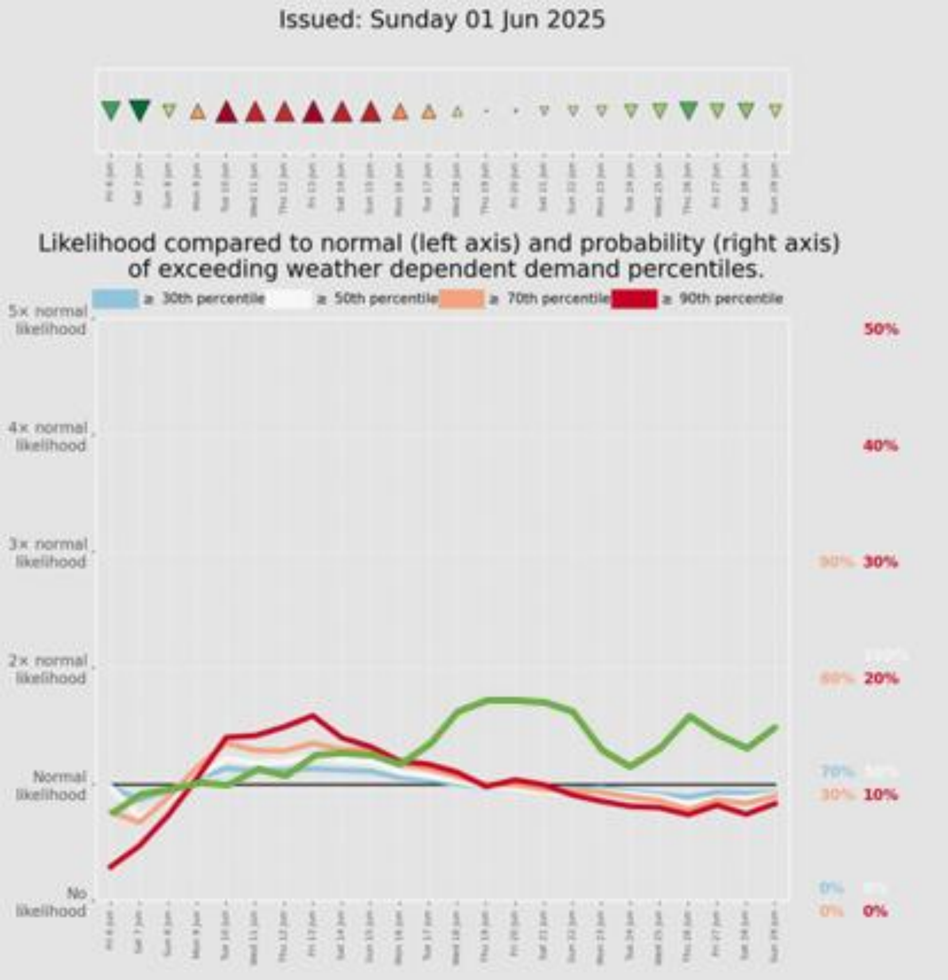


Figure 17: Forecast issued on 1 June 2025 for 6 June – 29 June with actual demand included for comparison.

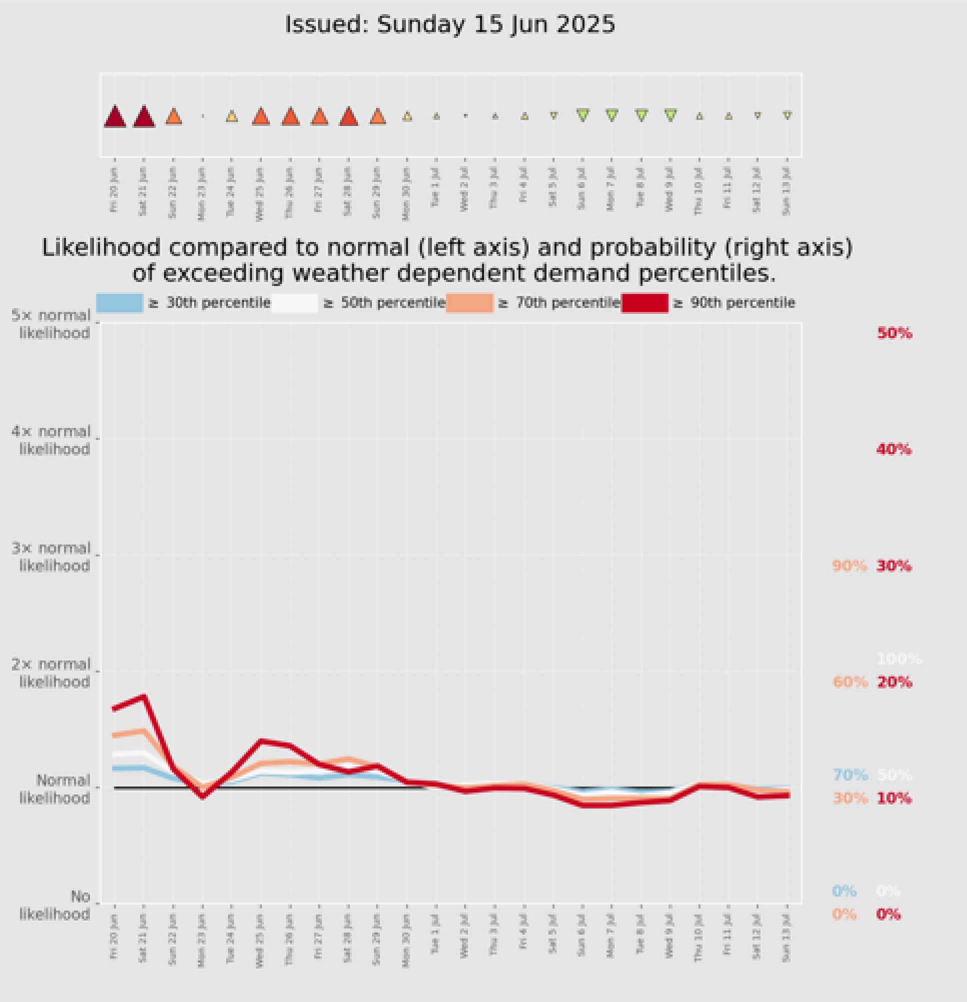


Figure 18: Forecast issued on 15 June 2025 for the 20 June – 13 July.

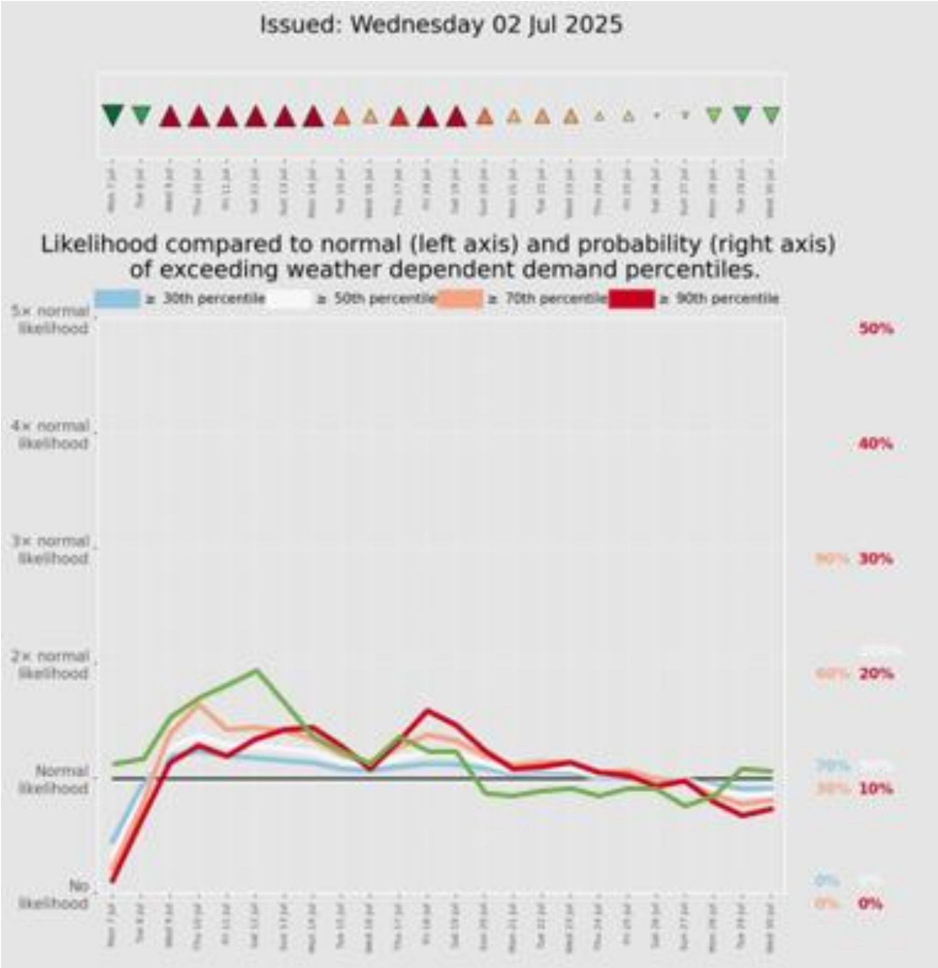


Figure 19: Forecast issued on 2 July 2025 for 7 July – 30 July with actual demand included for comparison.

Evaluation

The key benefit achieved from this project was up to 4 weeks' notice of high demand events, significantly longer than the normal 10 day. This has been useful to prepare in advance for potential leakage events during winter and high customer demand events during the summer. The advance notice can allow operational activities more time to prepare for an event to reduce the impact of the high demand on both our customers and the business. It also has the potential to reduce demand from these events, therefore benefiting the environment from lower abstraction. For example, sending out customer communications to encourage using water wisely prior to a hot and dry weekend in the summer.

The forecast has been fairly accurate at identifying weather events that will impact demand. Seeing high/low demand likelihood weeks in advance and plotting actual demand against this to see an accurate picture gives confidence and going forward this tool can be used with greater certainty, allowing for a measured response. From our comparisons of the forecast, this has been a useful tool for predicting demand. Having this data, could prove useful during reporting periods when weather had a direct impact on water use.

The weekly forecasts issued were clear and easy to understand. Although no extreme weather events were experienced last year, having the ability to also see the likelihood and potential demand impact by using percentiles would be a useful tool in the future. This should allow for an appropriate level of preparedness.

We have adopted the project outputs into our daily workplan, whereby the weekly email outputs have been shared to teams impacted by high demand on a weekly basis. Where a significant high demand event is forecast further messaging to highlight the issue is shared around the business prompting action plans to begin to reduce the impact of these events.

Receiving weekly updates gave timely notice for weather events which would impact demand. The graphs enabled us to plot these events against our actual demand on a weekly basis and compare the accuracy as to whether we experienced high/low demand. Being in a water stressed area, we didn't experience any prolonged periods of high demand, but this would be a key source of information to prepare in the event of one.

Recommendations

Our next steps as a business are disseminating the full 12 months results to the wider business which compares actual demand to forecasted demand from this project. This will then inform the cost-benefit assessment of this project internally. We would like to continue using this Met Office service, especially in our southern operating area (Essex & Suffolk Water) as it has shown benefits from knowing of high demand events in advance.

There are some improvements that can be made with the data currently provided, such as the provision of the data in a CSV file, which can enhance the functionality and improve the usability of the current data, allowing to plot the data against actual demand as well as plot forecasted demand. Being able to plot all historic high demand weather events against historic demand would help in determining the demand we are likely to see. Overall, having data that is more transferable and easier to use will benefit us.

The sensitivity of the model could be adjusted, as some high/low demand events were missed. This would need further discussion as we wouldn't want to cause false alarms/reduce the values on the X axis so we can see with better accuracy whether an event will result in high or low demand. The graphs at times were too stable and unless there was a high impact weather event, high demand was missed.

Conclusion

The impact of this project has been the advanced warning of high impact high demand events up to 4 weeks in advance. This has been useful to prepare for potential leakage events during winter and high customer demand events during the summer. Although the summer was relatively temperate, the model shows promise in predicting high demand events much further in advance than previously available. Ultimately, the potential of the model wasn’t truly tested over the last year. However, in the event of a sustained period of hot and dry weather, the model would prove useful in planning ahead and potentially assist in decision making during future droughts.

APPENDIX 8: DROUGHT VULNERABILITY ASSESSMENT

We are required to test the plan against different types of droughts (in terms of magnitude and duration) and identify when our supply is likely to be vulnerable.

In order to carry out this assessment we have completed the following:

- an assessment which uses the principles of the UKWIR 'Drought Vulnerability Framework' (17/WR/02/12).
- Stochastic drought modelling.

The UKWIR guidance provides an approach that water companies can use to improve the understanding of the vulnerability of their systems to drought and demonstrate this graphically by producing 'Drought response surfaces' (DRS) for their Water Resource Zones (WRZs).

The guidance recommends several different calculation approaches based on the data availability and the level of modelling available for each WRZ, these approaches are detailed in the table below.

Nature of Drought Rainfall Data and Hydrological Modelling	Nature of WRZ and Deployable Output Assessment	Approach Number	Notes/Comments
Stochastically based rainfall data (normally includes hydrological models, but can include multi-site flow generation)	Conjunctive with *rapid* simulator	1a	Where direct flow generation has been used then rainfall deficit/flow analysis required
	Conjunctive but *no* rapid simulator	1b	Uses a sample of the full stochastic data set ('drought libraries')
Synthetically based rainfall data	All	2	Requires Extreme Value Analysis (EVA) to estimate risk/return period
Historic rainfall data with rainfall/runoff and/or groundwater models	SW storage dominated (with behavioural model)	3a	Requires EVA of rainfall, and yield/return period behaviour
	Groundwater or run of river only	3b	Requires EVA of rainfall and flow/level return period behaviour
Historic rainfall data with no hydrological models	SW storage dominated (with behavioural model)	4a	Rainfall EVA and rainfall deficit/inflow relationships needed
	Groundwater or run of river only	4b	Rainfall EVA and rainfall deficit/level/flow relationships needed

For the Kielder WRZ approach 4a was deemed to be the most appropriate due to not having, at the time, a full coverage of rainfall runoff models for the WRZ.

The calculation steps for Approach 4a as set out in the UKWIR guidance are detailed below.

1. Carry out EVA to determine the probability of each deficit/duration cell

2. Systematically generate synthetic events (intensity & duration) for a selection of deficit/duration cells using the historic record.

3. Run behavioural model for the selected level of demand

4. Calculate the number of days deficit for each synthetic event.

5. Scale impacts (see Section 6.1). Smooth 'days failure' figures in the matrix as appropriate. Compare the EVA plot of minimum levels or flows against the critical duration drought outputs to scale the DRS inputs

6. Plot DRS

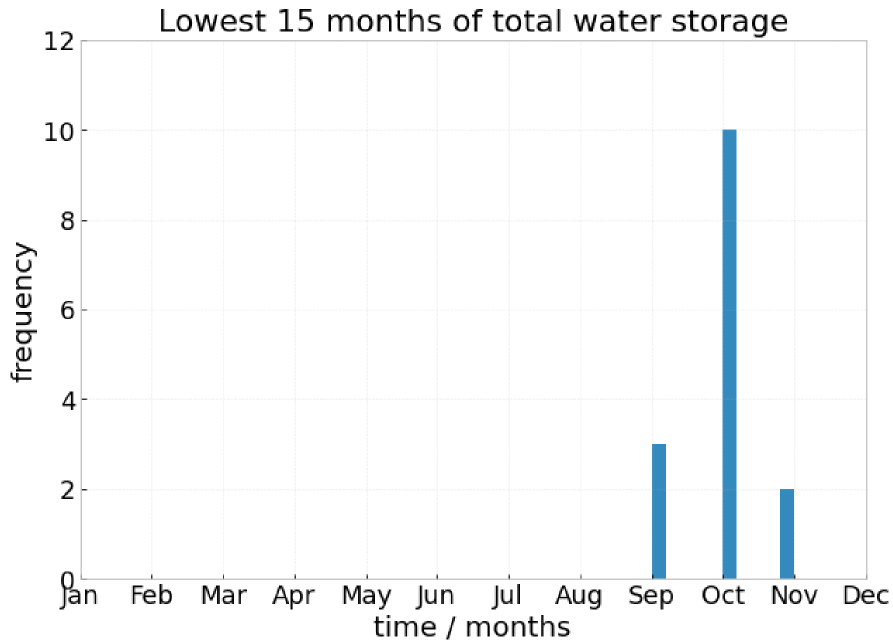
Prior to carrying out the calculations required to complete the drought vulnerability analysis there are two common decisions that need to be made:

- Decide upon which 'month ending' timings should be used to generate the DRS.
- Decide upon what level of demand the analysis should be run at.

Selection of 'Month Ending'

The guidance recommends that for a WRZ with a high level of storage that is driven by the annual average DO the month ending parameters are set 3 months apart, historically the lowest storage levels experienced have been in October.

Analysis of minimum storage levels within the Kielder WRZ was carried out by summing the monthly storage values for all reservoirs in an Aquator model run, using DO demands, and finding the month with the minimum storage value in each year from 1926-2014 (89 years). The minimum storage in each year was ranked, and the frequency of months containing the minimum storage in the 15 lowest years were plotted. Of these 15 years, 13 of the lowest storages occurred in October and, since this significantly dominated the sample of the most extreme years, only October was used in the analysis.



Level of Demand Used

To carry out this assessment several different levels of demand could be used such as.

- Total demand (DI)
- Total demand plus Target Headroom
- Total demand plus Target Headroom plus Outage
- Demand equivalent to DO

As deployable output is circa 123% of demand in the Kielder WRZ, and the system is constrained by licence/pumping capacities running the Aquator model at anything less than a demand equal to DO, would not place the system under enough stress to fully assess the risk to supplies during an extreme drought.

Rainfall Analysis

The daily catchment rainfalls, as used to construct the flow sequences for Aquator, for Burnhope, Cow Green, Derwent and Kielder were averaged to produce a single daily time series. This single timeseries of rainfall data was taken forward for the analysis.

The DVF manual requires rainfall frequency analysis for different drought durations to be based on the same end-months as the selected drought end-month for the water resources system. As only October was identified as a critical end-month for reservoir drawdown, rainfall analysis should be based on rainfall totals up to the end of October for every year of record.

Further analysis of the rainfall data was undertaken to assess if the October end month durations (6, 12, 18, 24 and 36 months) were representative of the population rainfall distribution, a Kolmogorov-Smirnov (K-S) test was carried out for all month ends, for each duration. For the purposes of this investigation we extended the sampling regime to include month-end durations that were not significantly different from the central one of interest.

Rainfall series of various durations were then tested against several extreme value (EV) distributions. Overall, they fitted best with a three-parameter GEV distribution, the results of this analysis are in the table below.

Table of rainfall depths as percentage of LTAs

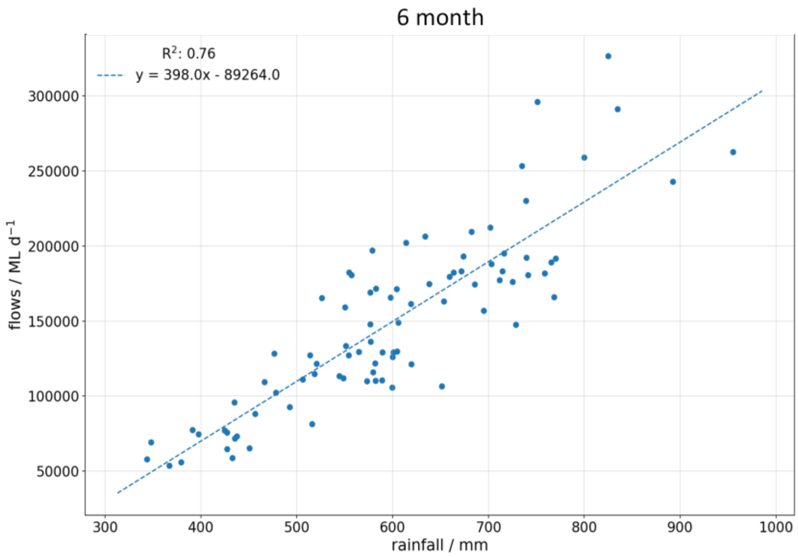
Return period	Duration				
	6month	12month	18month	24month	36month
2	74%	92%	100%	181%	116%
5	62%	80%	86%	92%	97%
20	52%	70%	75%	83%	88%
50	46%	64%	70%	79%	84%
100	43%	61%	67%	77%	81%
200	41%	58%	64%	75%	79%
500	38%	54%	61%	72%	77%
1000	34%	52%	59%	70%	75%

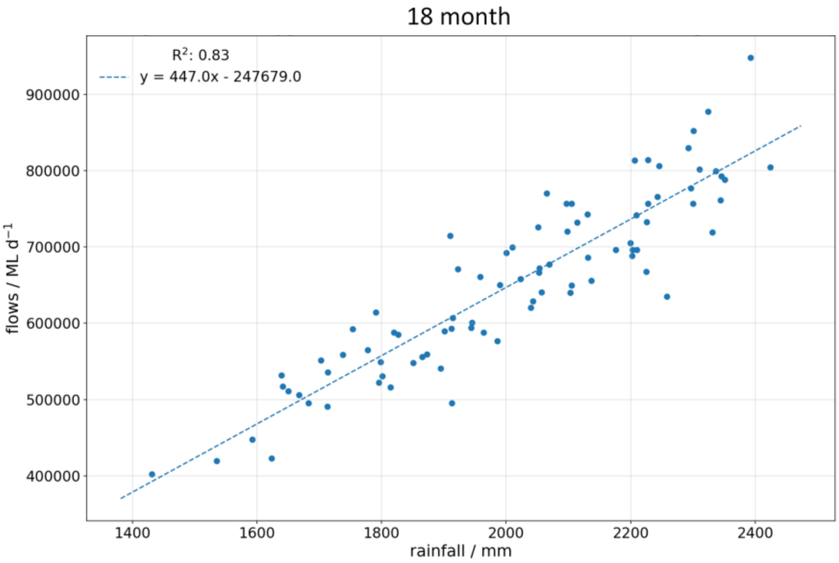
Generation of synthetic events

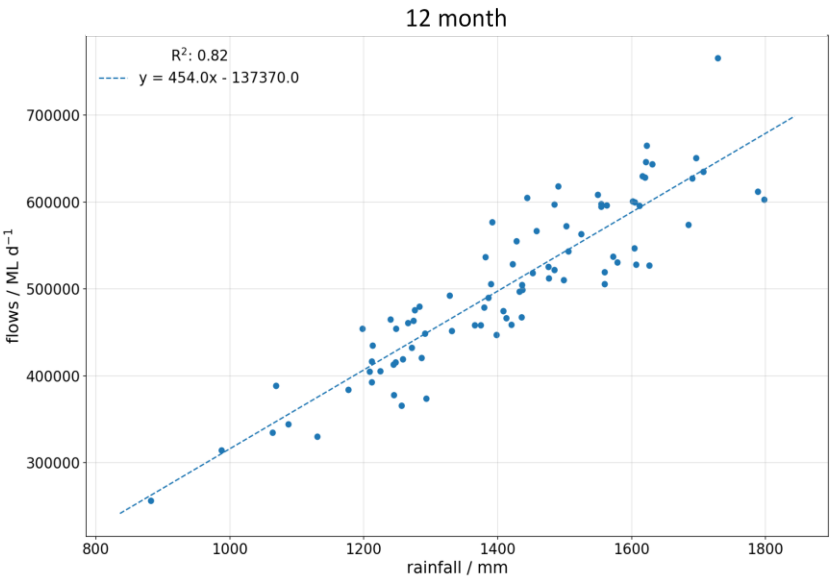
Method 4a requires the creation of river flow sequences representing droughts of different durations and return periods. This is achieved by defining a relationship between rainfall over a given duration and the runoff volume accumulated over the same duration for the same events in the same catchments. This relationship is then used to generate runoff totals from the return period rainfall totals derived from the GEV analysis. Once the runoff volume has been estimated it must then be translated into a daily flow series for onward use in the water resources model.

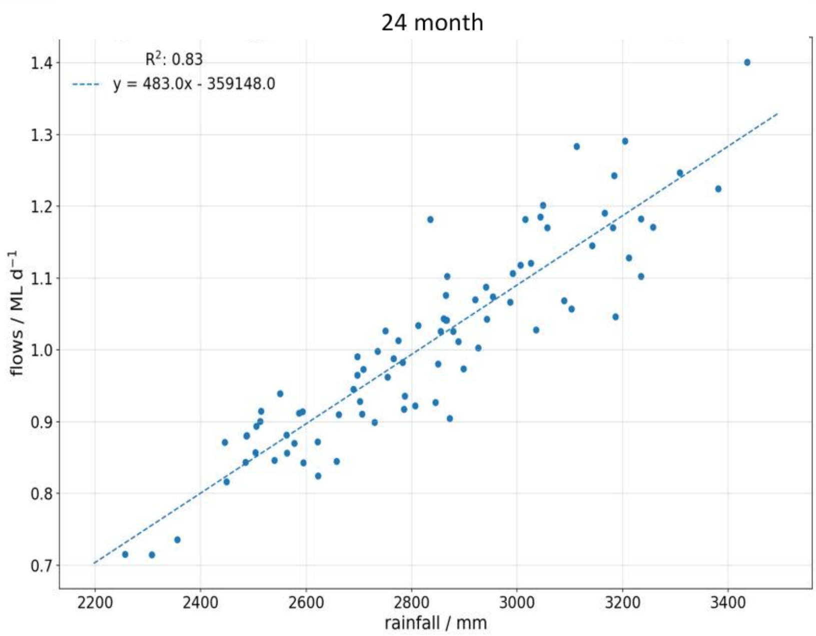
The key assumption in the approach is that the return period for the rainfall total and duration of interest translate directly over into the same return period for a given duration and volume of runoff.

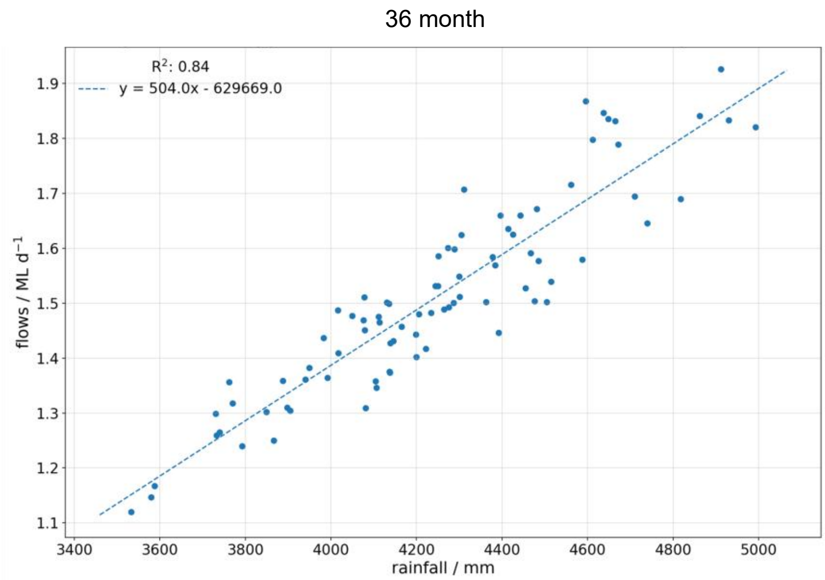
The figures below show the catchment rainfall (mm) against recorded runoff (Ml/d) over the same period for durations from 6 months through to 36 months. The dashed line is the line of best fit using linear regression model, the equation of which is displayed in the legend.


6 month
R2: 0.76
y = 398.0x - 89264.0
flows / ML d−1
rainfall / mm
50000
100000
150000
200000
250000
300000
300
400
500
600
700
800
900
1000


18 month
R2: 0.83
y = 447.0x - 247679.0
flows / ML d−1
rainfall / mm
400000
500000
600000
700000
800000
900000
1400
1600
1800
2000
2200
2400

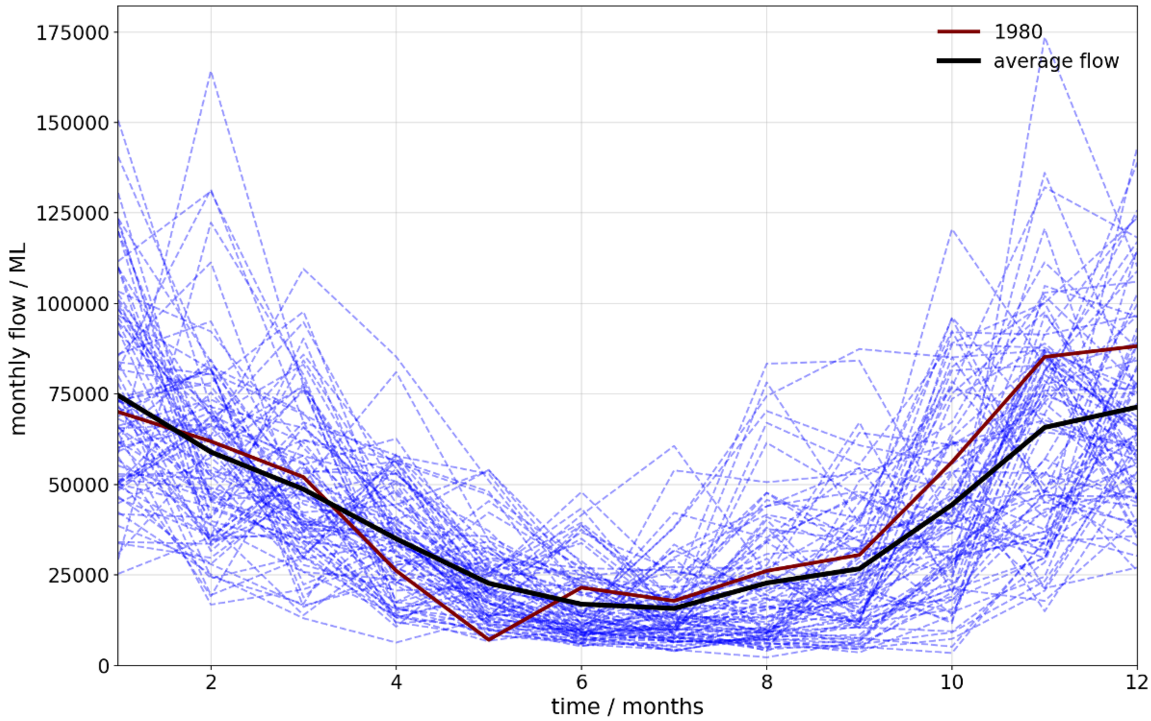

12 month
R2: 0.82
y = 454.0x - 137370.0
flows / ML d−1
rainfall / mm
300000
400000
500000
600000
700000
800
1000
1200
1400
1600
1800





To estimate the flow for the various return periods for each duration, the drought rainfall factors were used to estimate the extreme rainfall totals for that drought.
The linear regression relationships established between the rainfall and flows were used to turn the extreme rainfalls needed for each drought into a consequential runoff volume. From this, the ratios were calculated between the 'normal' flow for that duration and the newly derived drought flows from the linear regressions.

The DVF manual instructed to find a 'normal' year of flow data which would be used to create the artificial drought series, a least squares estimate (LSE) method was used to find a year whose monthly flow closest matched the average monthly flow across all years.



The 'normal' year daily flow data were the basis of every year in the artificial drought time series. The ratios calculated from the rainfall/flow relationship (explained above) were multiplied by the 'normal' year for the months of the duration of interest and strung together with multiple 'normal' year flows acting as refill years in between droughts.

The general structure of the drought time series was as follows for a given duration:

- 2 warm-up years
- 1 in 100 return period drought (this was 1-3 years, depending on the duration. For 12+ month durations, the drought year, which ended in October, would overlap with the previous year. To account for this, the drought period spanned over 2 or more years)
- 1 cool down year
- 2 warm-up years
- 1 in 200 return period drought

And so forth, until the final return period and a cool down year.

Aquator Modelling

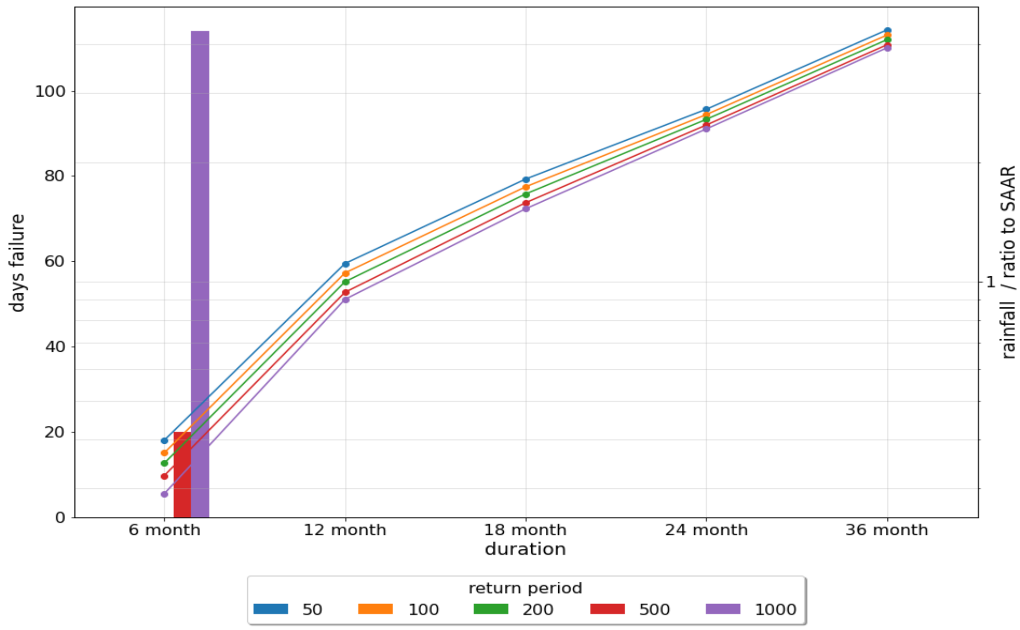
The drought time series for each catchment were input into Aquator Version 4.3 for the Northumbrian Water system and ran with demand set at DO levels (836Ml/d). Failure days occurred when the demand could not be met, or the emergency reservoir storage was used.

The table below summarises the number of failure days for each duration and given return period. Only the 1 in 500 and 1 in 1000 droughts for the 6 month duration had any failure days.

Rainfall return period	Duration (months)				
	6	12	18	24	36
50	0	0	0	0	0
100	0	0	0	0	0
200	0	0	0	0	0
500	**20**	0	0	0	0
1000	**114**	0	0	0	0

Drought Response Surface

An alternate plot to the DRS recommended in the guidance is shown below, that we hope offers more clarity while showing the relevant information. The graph displays the number of failure days (left-hand axis) for the Kielder system as a bar chart and the rainfall (as a ratio of SAAR) on the right-hand axis as a line plot. Duration lengths are along the x-axis and the colours represent the different return periods.



Surface water stochastic modelling

Long-periods of ‘stochastic hydrological’ data (plausible synthetic scenarios based on historical hydrological patterns) were used to develop inputs to our Aquator XV water resources models. This allows us to better understand the drought resilience of our WRZs as well as being able to evaluate the frequency that Level 4 restrictions may be required.

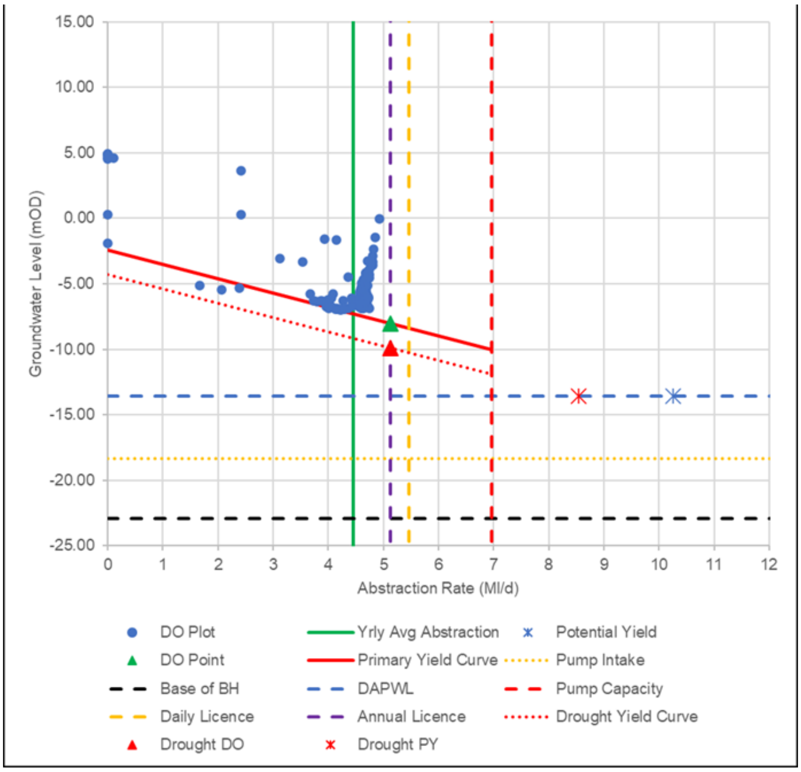
The stochastic timeseries were ran through Aquator XV using the permitted failure method, this is where a water resources model is run multiple times using a long hydrological record and incrementally increasing demand, to get a sense of the system response of the WRZ. The results of the Aquator XV runs were used to produce a profile of return period to DO, this allowed us to determine a representative DO (825.27Ml/d) for a 1:500-year return period based on Level 4 restrictions being a system failure. This DO level may not be associated directly with a specific model run, but rather be interpolated from the DO profile graphed.

The stochastic timeseries were then ran though Aquator XV with the demand fixed at the 1:500 year DO to stress test the system against a wide range of hydrological conditions.

Groundwater synthetic drought modelling

The calculated reduction in groundwater level has been modelled for 1:200 and 1:500 stochastic drought events. These values are used to lower the current DO curve for a specific borehole to calculate the 1:200 and 1:500 DOs.

An example borehole performance graph, from our WRMP24, is shown below.



The graph shows the baseline response (based on 2019 data) of the borehole groundwater level to pumping (Solid red line) and the DO calculated from this (Green

Triangle: 5.13Mld at GWL=-8mOD). Baseline response of borehole GWL to pumping is determined manually to include most data available.

The dashed red line shows the impact of a 1:200 year return period drought to the response baseline (drawdown of 1.88m from baseline calculated using Wear Magnesian Limestone Groundwater Model) and the recalculated DO (red triangle: 5.13Mld at GWL=-9.88mOD). Purple (vertical) dashed line = Annual average licenced abstraction rate (Primary DO constraint). Blue (horizontal) dashed line = DAPWL. Red star = DO at DAPWL for 1:200 return period drought (Calculated based on intercept with DAPWL constraint with plotted borehole response of groundwater level to pumping for 1:200 year return period).

The results, reduction in groundwater level, of the stochastic modelling is shown below.

Borehole	1:200 Additional drawdown	1:500 Additional drawdown
Fulwell	1.88	1.66
Stonygate	- **	- **
North Dalton	3.11	2.45
Dalton	3.02	2.28
Hawthorn	2.86	2.08
Thorpe	2.25	1.70
Peterlee	4.52	3.73
New Winning	15.48	11.35

**The modelled values obtained for Stonygate are considered to be invalid. The borehole is known to be recharged via fracture flow. The current Magnesian Limestone groundwater model cannot model recharge via fracture flow. An alternative methodology to derive a meaningful impact on groundwater level and DO of climate change and drought is to use the model values calculated for Borehole 14 which is analogous to the hydrogeological response of the Borehole 11 to abstractions. It is anticipated for the WRMP29, a new groundwater model for the Magnesian Limestone will be available.

It should be noted that the modelled impact of the 1:200 return period drought is greater than the impact for the 1:500 return period drought. This factor is also observed in the Fell Sandstone and Essex and Suffolk regional Chalk groundwater modelling. At present this is considered to be a consequence of the selection of the rainfall data used in the groundwater model. The rainfall pattern prior to the drought (the timing of the start of the drought period), and the duration of the drought, will both have a significant impact on the results of groundwater modelling. The results of stochastic modelling on the Fell Sandstone Groundwater Model will be used to evaluate this observation.

The deployable output values to be used in the drought plan are those calculated for the 1:500 event. Those boreholes constrained by DAPWL are also constrained by the Trigger Level assign to that specific borehole and therefore have lower DO values.

Borehole	DO	Constraint
Fulwell	5.13	Licence
Stonygate	4.01	Licence
North Dalton	6.99	DAPWL/Control Level
Dalton	6.30	DAPWL/Control Level
Hawthorn	4.59	Licence
Thorpe	4.04	Licence
Peterlee	2.24	DAPWL/Control Level
New Winning	5.59	DAPWL/Control Level
Total	41.47	

Based on the DAPWL DO data above, it may be seen that the greatest impact of a drought on the Kielder WRZ Groundwater sources is on North Dalton, Dalton, Peterlee and New Winning. Thus for operational purposes, during a drought, groundwater abstraction rates would be decreased down to the DO levels shown in the table above at these four vulnerable boreholes and increased up to the DO levels shown above at Fulwell, Stonygate, Hawthorn and Thorpe in order to maintain the total Deployable Output for the Sunderland GWS of 41.47mld. Should this combined abstraction rate fall short of what is required (due to operational or water quality requirements) then the deficit would need to be made up using the Central Zone surface water supplies. This is considered achievable by increasing water supply at Mosswood and/or Lumley.

Berwick and Fowberry WRZ

Drought simulations for the Berwick WRZ, which is supplied entirely from the Fell Sandstone groundwater aquifer, were performed using the United States Geological Survey's 'MODFLOW 6' software. A bespoke MODFLOW model was built on behalf of NWL by the British Geological Survey (BGS) based on the most recent geological interpretation of the area by NWL (2018) and Ford et al. (2019). The model was calibrated with groundwater-level data from EA observation wells and NWL abstraction wells for the period 01/01/1988 to 01/12/2018. It simulates transient groundwater flow on daily time steps but with monthly stress period inputs of recharge and abstraction rate. Recharge inputs were calculated from historic rainfall data using the BGS' ZOODRM software, an object-oriented distributed recharge model.

From WReN rainfall and potential evapotranspiration data it was calculated that, under 1 in 200 year return period drought conditions lasting 24 months, rainfall would fall to approximately 75% of its long term average. These data are from the nearest possible rain gauge, though it is outside the confines of the modelled area. ZOODRM was used to estimate a relationship – specific to the recharge zone of the Fell Sandstone aquifer – between such a reduction in rainfall and the concomitant reduction in recharge. This relationship is represented by a numerical factor (0.19), which was applied to the historic recharge inputs to the MODFLOW model for 24 months, beginning at the end of 2009. Retaining the original recharge inputs and representing the drought as a reducing factor like this provides the opportunity to perturb the model with novel climate scenarios whilst staying relatively true to BGS' original calibration. The aim of this method is to introduce as little additional uncertainty as possible. By comparing the outputs from this amended recharge scenario with those of the baseline historic simulation, a time series of "additional drought drawdown" was produced for each NWL groundwater station. The maximum value of additional drawdown due to the 1 in 200 year drought was assessed against the abstraction constraints (sustainable rates; annual and daily licenced rates) and groundwater level constraints (pump intake; deepest advisable pumped water level; base of borehole) for each well, from which it was possible to identify if there would be a reduction in deployable output under drought conditions.

There were three distinct types of response to the drought. Sources 6 and 7 showed a relatively rapid and significant decrease in water level of up to 13.47m and 11.68m respectively, after which they began to recover. The Thornton Bog boreholes (which were modelled together due to their proximity) displayed the same trend of rapid response followed by recovery, but to a much less significant maximum addition drawdown of 0.86m. Sources 3 and 4 (Bleak Ridge and Felkington?) showed similarly small additional drawdowns but at the end of the simulation, seven years after the end of the drought, had not yet begun to recover. At this point, the additional drawdown of their water levels had equilibrated at 1.91m and 0.73m respectively. The modelling results suggest that those wells with greater values of transmissivity are most resilient to changes in recharge due to drought conditions.

For most of the wells, their abstraction is voluntarily constrained by NWL at sustainable rates calculated by the BGS during development of the MODFLOW model. These rates are significantly below the EA-mandated licences and afford NWL with resilience against future changes in groundwater level. The only well which requires a reduction in deployable output during a 1 in 200 year drought event is Source 3 as here the abstraction is constrained by the pump intake level, due to a very steep yield curve. The loss in DO would be 0.45m3/hr, or, 0.0108Ml/d, although this loss could be recouped by lowering the pump.

APPENDIX 9: GROUNDWATER TRIGGER DEVELOPMENT

The raw water system in the Berwick & Fowberry DMA has only existed in its current compete form since the late 1990s. As a result, we do not have abstraction borehole groundwater levels for key historic drought events such as in the mid-1990s and mid-1970s.

There is an extensive network of observation boreholes in the DMA, drilled by the National Rivers Authority (NRA), now maintained by its successor, the Environment Agency, but the data record from these boreholes only goes as far back as the early 1990s.

For our WRMP24, we employed the British Geological Survey (BGS) to build a digital groundwater model of the Berwick system, which we used to measure the resilience of our abstractions to significant drought events, like a 1 in 200 year return period or 1 in 500 year return period drought. Due to the limitations and uncertainties in groundwater modelling, however, the outputs of the model were treated as relative, not absolute values. That is, the model was used to calculate what magnitude of *change* we would expect to see in our groundwater levels during severe drought. That change was then applied to real observed data, through "curve shifting," to determine whether a drought would drawdown water levels to such an extent that our ability to supply would be impacted. This method showed that there was sufficient capacity for additional drawdown in our boreholes that we would not expect to lose supply.

Unfortunately, the limitations inherent in all groundwater modelling, but especially in a model calibrated on such a relatively short data record, are such that, while one may place confidence in the predicted relative changes, it would not be appropriate to rely on predicted absolute values as drought triggers; we would not enact drought actions because a modelled condition had been triggered while real life data showed no stress, nor would we hold off from triggering drought actions while real life sources failed but a model assured us that all was well. In light of this, we have sought to ground our Berwick & Fowberry drought triggers in real-life, observable data from observation boreholes.

Of the aforementioned NRA observation boreholes, most measure groundwater levels in sandstone sub-units of the Fell Sandstone aquifer that are abstracted from by our supply boreholes, but there are two boreholes in sandstones up-hydraulic gradient and separated from our abstractions by impermeable mudstone units: Royalty Farm[8] and Thornton Park[9]. Data from the Royalty Farm borehole is used by both the Environment Agency in their monthly water situation summaries[10] and by the British Geological Survey for various research and analysis purposes, such as their historic drought reconstructions[11]. However, in the borehole log, available on BGS's GeoIndex database[12], it states that "There is an abstraction borehole at Royalty Steading (21-0-23) which is still in use. This hole is to provide a control for aquifer levels near this hole

[8] https://environment.data.gov.uk/hydrology/station/f6487e6c-c35b-4fb0-851f-37e13d945bde
[9] https://environment.data.gov.uk/hydrology/station/39daa6c2-8be9-4e52-86f8-934ecc7d93d4
[10] Water situation: area monthly reports for England - GOV.UK
[11] https://catalogue.ceh.ac.uk/documents/ccfded8f-c8dc-4a24-8338-5af94dbfcc16
[12] https://api.bgs.ac.uk/sobi-scans/v1/borehole/scans/items/613597

in case of future aquifer development."[13] Examining the data record, there appears to have been a step increase in the annual average groundwater level around 2012, although it is difficult to discern exactly when due to seasonal fluctuation. We suggest that this may represent the cessation of pumping at the Royalty Steading farm supply borehole, although this has not been corroborated with the landowner. There is also an increase in how often the data were collected. From 1994 to 2011, daily average groundwater levels are only reported on a monthly basis, perhaps because they were taken as manual dips, not recorded on an in-situ logger. A change in monitoring equipment, of differing accuracy, circa 2012, could also explain this apparent step-change. A time series of the groundwater level data from Royalty observation borehole is shown in Figure 1.

Due to the uncertainty of abstraction impact on this observation borehole and because the change in temporal resolution around 2012 gives undue weighting to the most recent data when calculating means, Q95s, etc., it does not seem like a good candidate for the analysis of natural long-term trends and, for this reason, we shall deviate from the example set by the Environment Agency and instead use data from the Thornton Park observation borehole for our drought planning. The Thornton Park observation borehole was, likewise, drilled in the early 1990s for the National Rivers Authority but there is no evidence to suggest that there has ever been any abstraction from this unit. The data record is also much better quality as there are far fewer gaps than in that of Royalty Park.

For the creation of our drought triggers, daily average groundwater level data from Thornton Park OBH, from the beginning of the record on 14/01/1991 up to and including 31/12/2024, were used. The mean groundwater level on every calendar day was calculated and plotted, resulting in a sinusoidal curve that reflects seasonal variation in effective rainfall recharge. The result shows that in an average year natural groundwater levels are at their lowest in October, following the summer, when potential evapotranspiration is at its highest and when dry ground with high soil moisture deficits encourages rainfall to runoff into surface water bodies rather than infiltrating the ground. In the average year there is then a swift autumnal increase to peak groundwater levels in February, followed by a relatively slower decline back to lows the following October. The seasonal range of mean daily average groundwater levels at Thornton Park is around 0.75m. The maximum and minimum levels for each calendar day were also calculated. These follow the same approximate seasonal pattern but are spikier due to outliers and extreme events. The total range of groundwater level values for Thornton Park OBH, between 1991 and 2024 was 3.07m, from a minimum of 39.88mOD in November 1995 to a maximum of 42.95mOD in February 2021.

A curve was fitted to the mean daily groundwater levels. Some minor manual smoothing was applied to allow the curve to be plotted back to back without a step between 31 December and 1 January and to bridge 29 February in leap years. This mean curve was fitted to both the daily minimum and daily maximum by using Excel solver: the modelled mean was adjusted either up or down by a factor, MinA or MaxA, and Excel Solver used to find the factor which gave the smallest value for the sum of the residual of the modelled min/max and the historic actual. The resulting band of

[13] https://api.bgs.ac.uk/sobi-scans/v1/borehole/scans/items/613597

groundwater levels, approximately 2m wide, represents "normal" groundwater levels at Thornton Park OBH between 1991 and 2024. This is shown below in Figure 2. The red dashed line – the modelled or "expected" minimum – represents our drought trigger.

Comparing this trigger with the real data from Thornton Park OBH, as shown in Figure 3, shows that this method has successfully identified the mid-1990s, early-2000s and 2018 droughts or dry-periods as "abnormal" events.

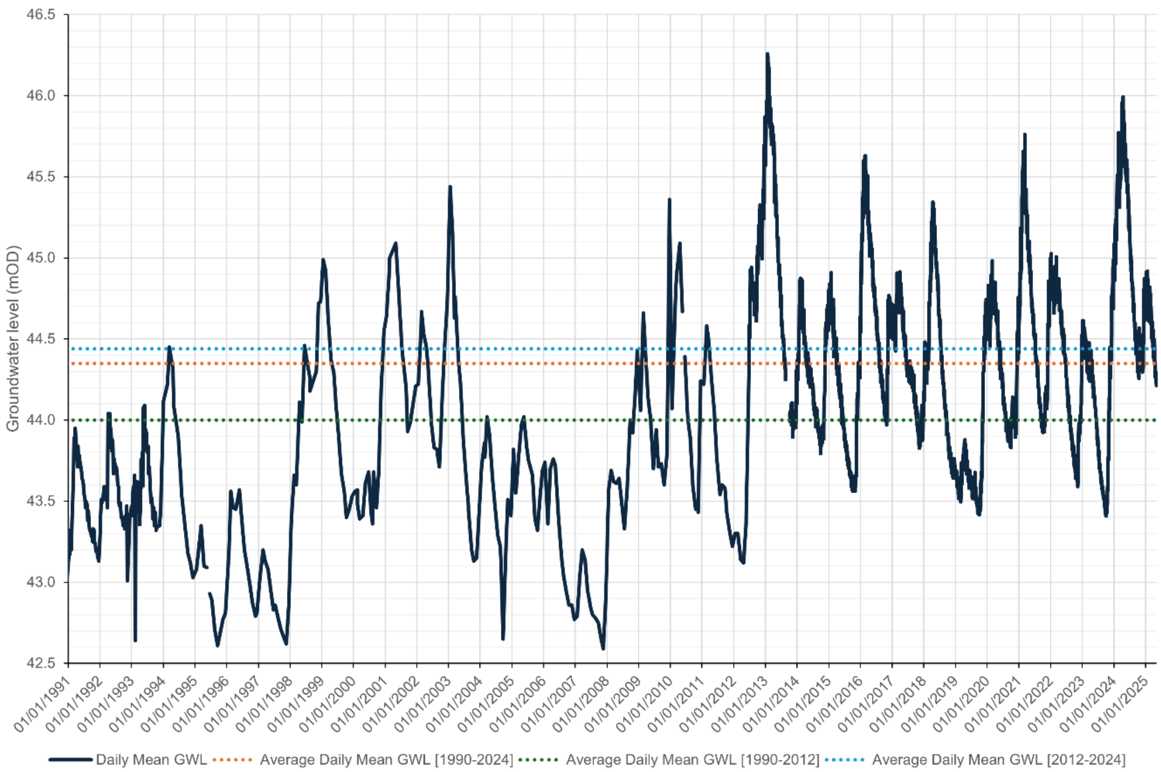


Figure 1: Royalty OBH groundwater level time series

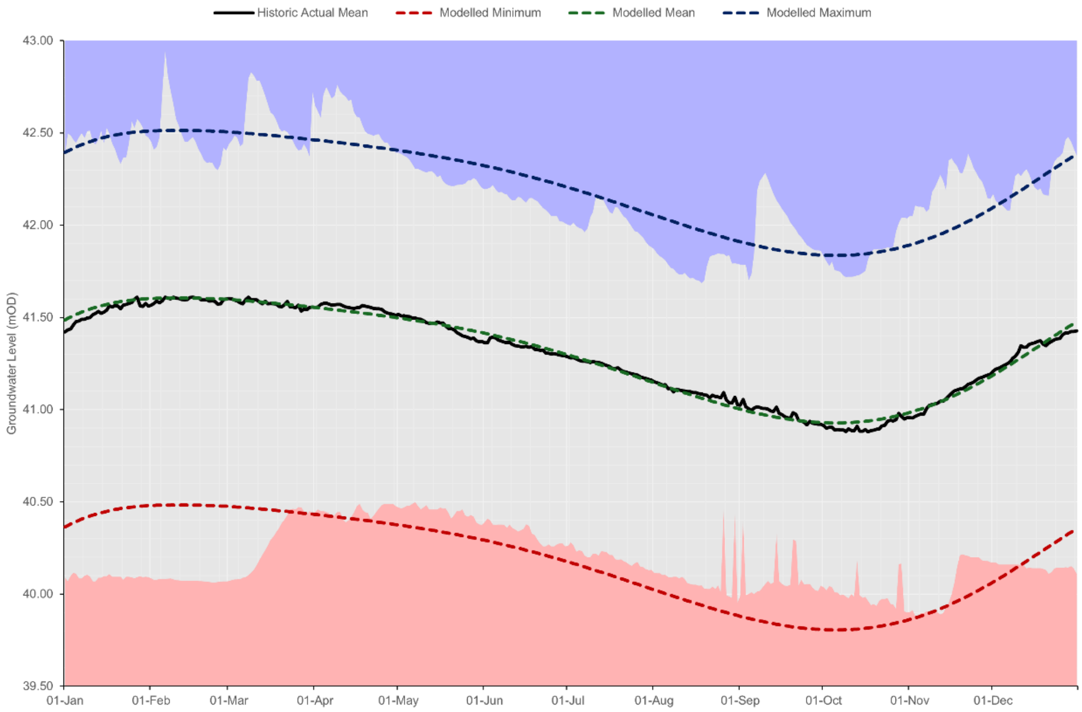


Figure 2: Historic actual vs modelled groundwater levels.
Red and blue envelopes represent lowest and highest historic actual levels on each day over the period of record.

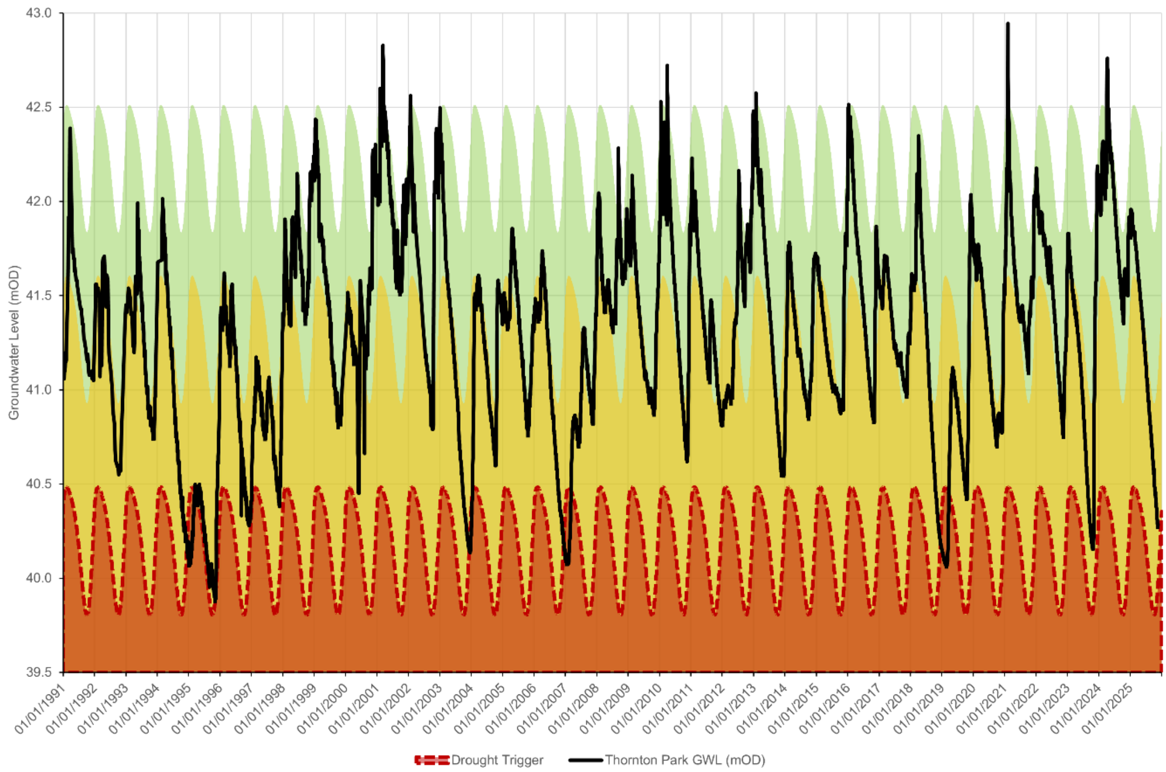


Figure 3: Time series of Thornton Park OBH groundwater level and drought trigger.

APPENDIX 10: DROUGHT TRIGGERS – WORKED EXAMPLES

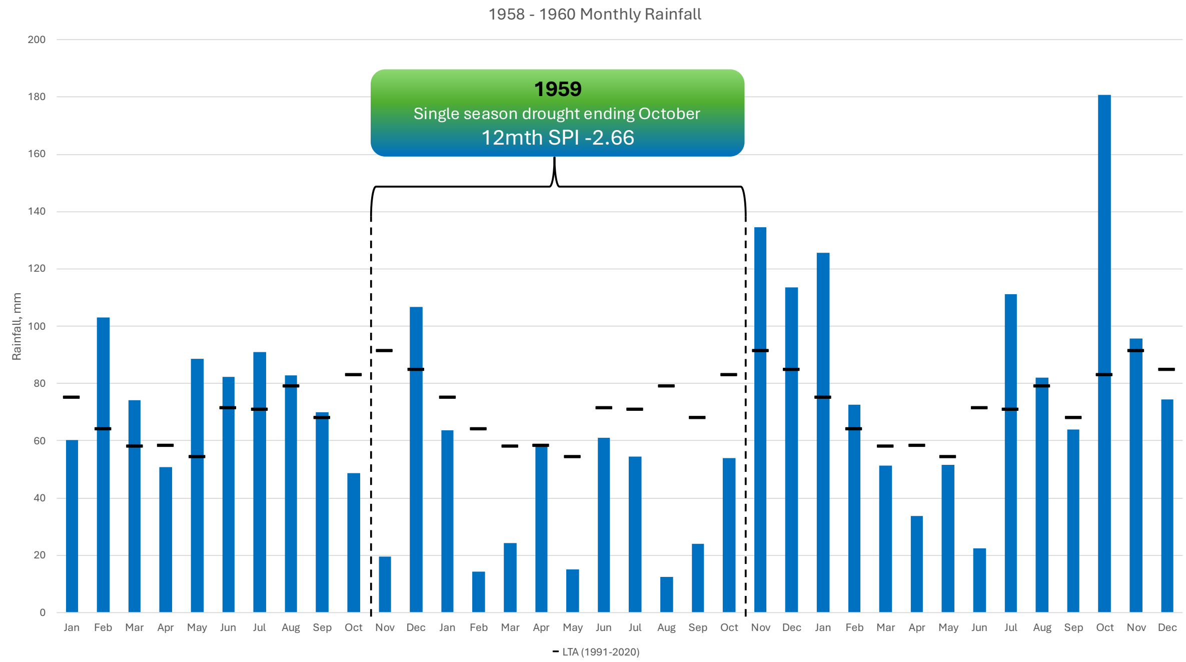
As part of WRMP24 we reviewed and confirmed our planned Level of Service (LoS) that customers can expect to receive. These are shown below. LoS are expressed in terms of expectations about the frequency of restrictions on use of water during dry years and set out the standard of service that customers can expect to receive from their water company.

Drought Level	Level of service	What this means	Stated return period
Level 1	Appeal for restraint	Ask our customers to use water wisely. For example, watering plants at night and not watering the lawn because grass is resilient to drought.	1 in 10 years (10% probability in any one year)
Level 2	Temporary Use Ban	Applies mainly to the domestic use of water and stops the use of a hosepipe or sprinkler for any garden watering or cleaning.	1 in 150 years (0.66% probability in any one year)
Level 3	Drought Order Ban	Expands what has been applicable to the domestic customer under the Temporary Use Ban, to non-domestic or commercial customers.	1 in 200 years (0.5% probability in any one year)
Level 4	Standpipe and Rota cuts	A temporary reduction or nil supply of water at the customer tap and use of stand pipes to fill containers.	1 in 500 years (0.4% probability in any one year)

Surface water

Below are some worked examples of historic droughts. All model runs are run with demand equal to DO. Using DO in the model runs ensures that we are confident that along with meeting demand we can also meet target headroom and outage allowance.

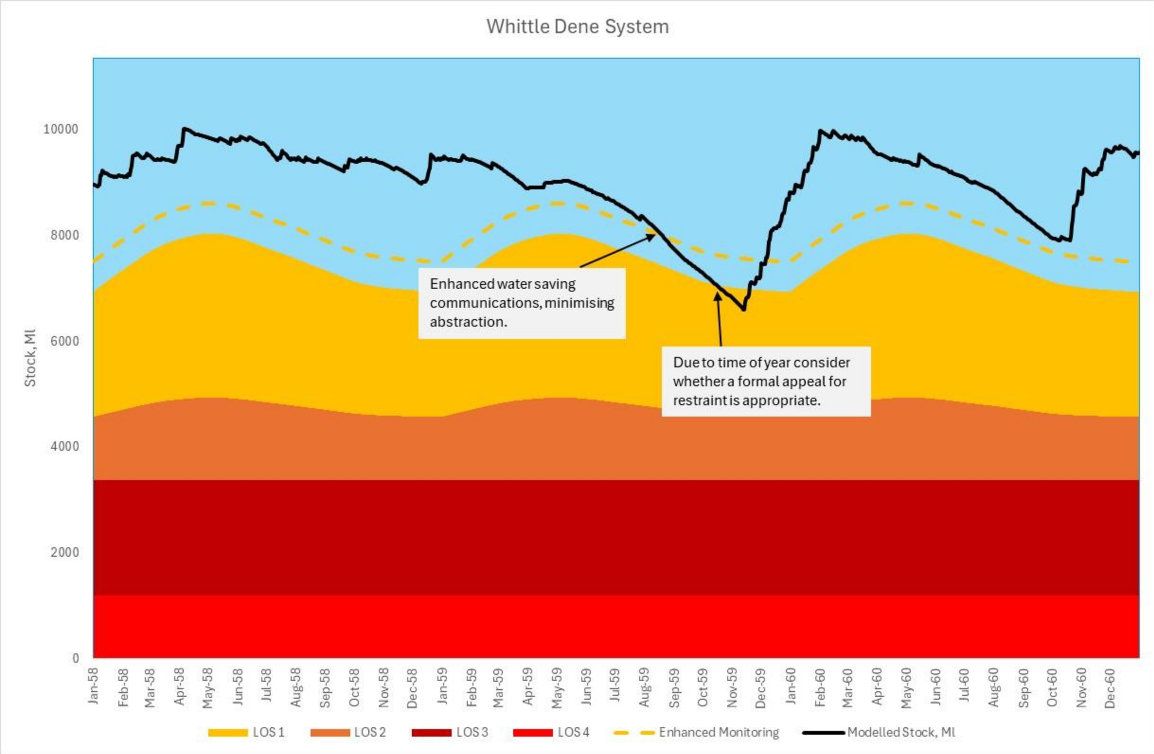
Single Season Drought - 1959



The 12-month period between November 1958 and October 1959 saw rainfall in the north east of 59% of long-term average, with the 6-month period of May 1959 to October 1959 seeing 51% of long-term average rainfall.

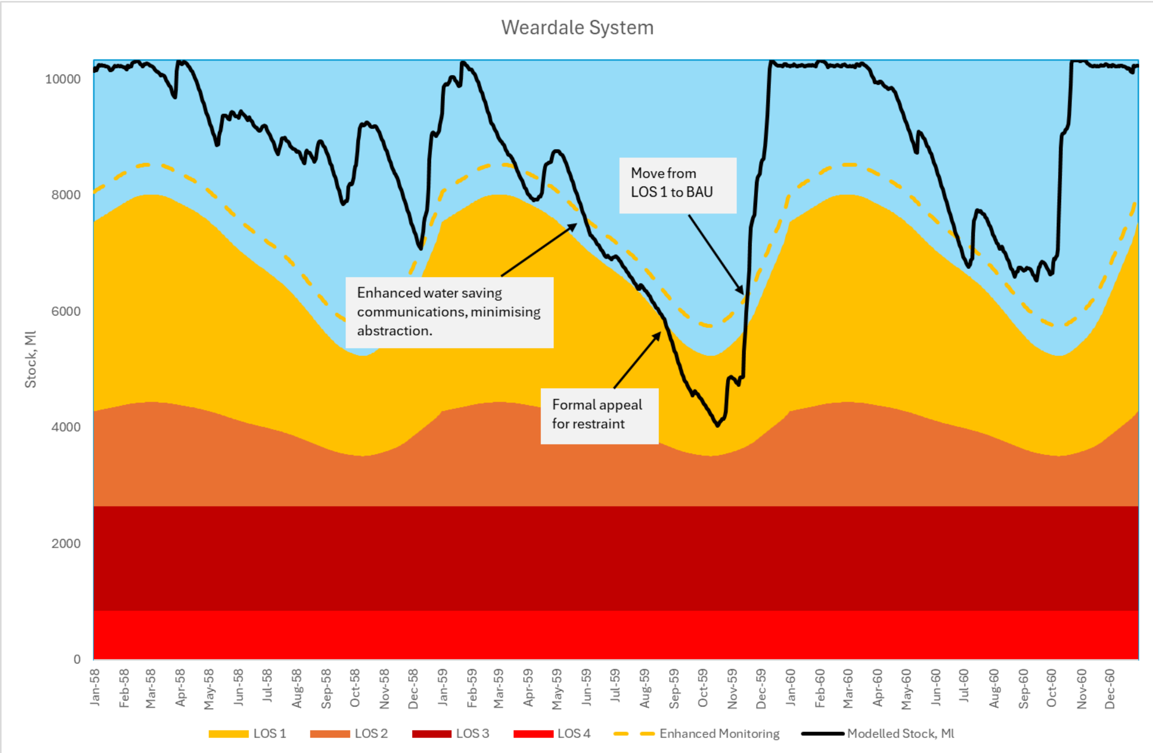
Northumberland & Tyne Drought Management Area

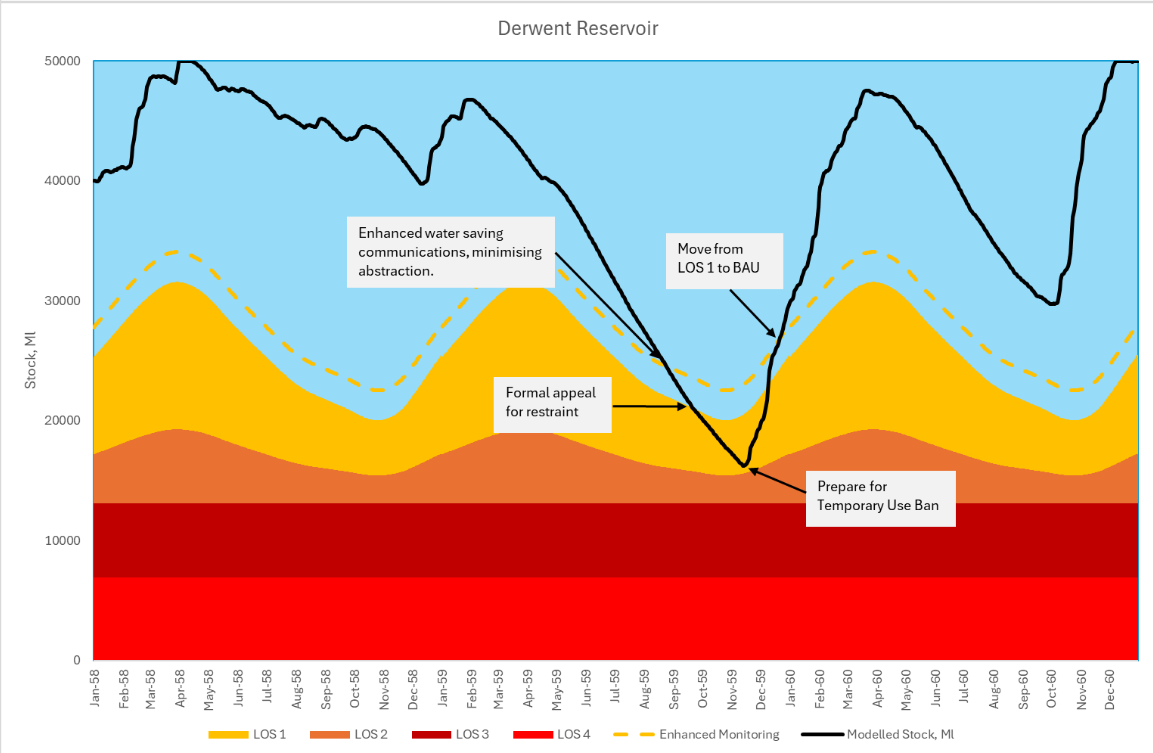
The modelling shows that in mid-August 1959 we would increase our communications regarding water usage and minimise the abstraction from the Whittle Dene reservoir group. Stock levels then continue to decline and cross the Level of Service 1 trigger in mid-October, given the time of year we would consider whether it would appropriate to introduce a formal Appeal for Restraint, in making this decision we could consider the short and long term weather forecasts, current demand levels and the headroom in the Weardale & Durham DMA and if there is any export from that DMA available.



Weardale & Durham Drought Management Area

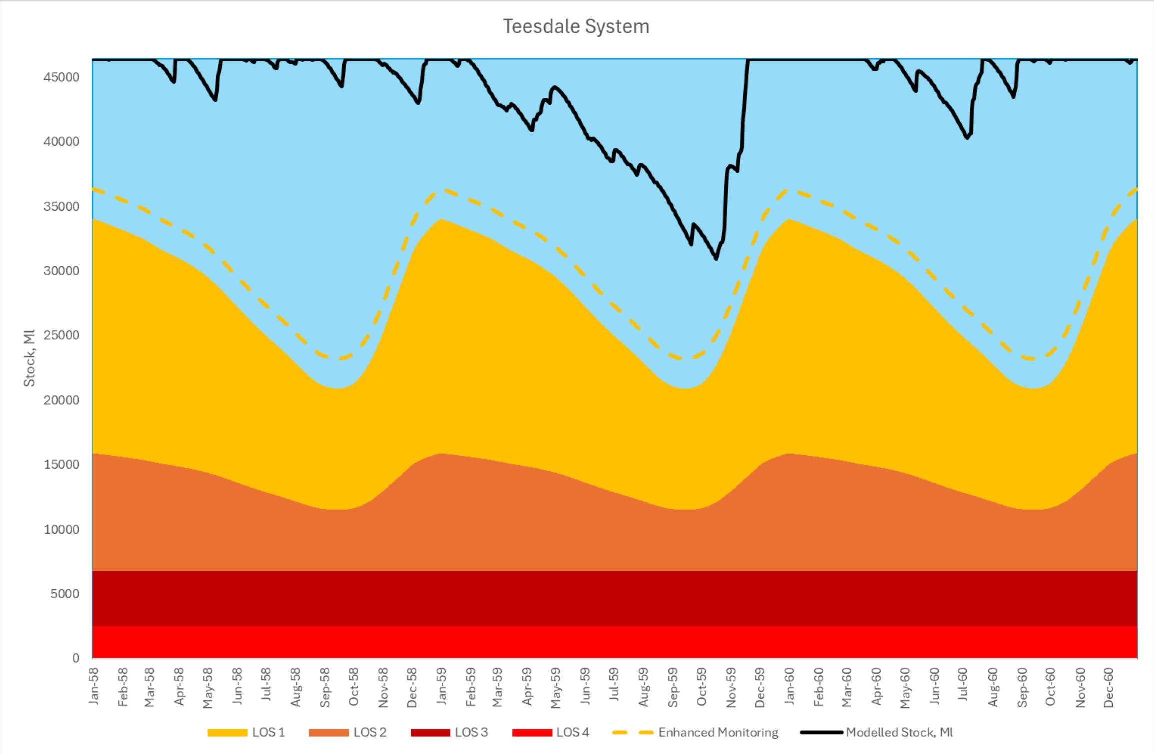
The modelling shows that in June 1959 we would increase our communications regarding water usage and minimise the abstraction from the Weardale reservoir group. Stock levels then continue to decline but don't cross the Level of Service 1 trigger until late August, given the time of year we would introduce a formal Appeal for Restraint. Derwent reservoir remains healthy until the end of August at which point we start to minimise abstraction from the reservoir, there is already a LoS 1 appeal for restraint in the Weardale & Derwent DMA due to the stock levels in the Weardale reservoir group. Derwent reservoir crosses the Level of Service 1 trigger in late September, with both Derwent reservoir and the Weardale reservoir group below the LoS 1 trigger the DMA would remain in Level 1 Appeal for Restraint. By mid-November Derwent level is still falling and we would be preparing to issue a Level 2 Temporary Use Ban. In making this decision we could consider the short and long term weather forecasts, current demand levels and the headroom in both the Northumberland & Tyne DMA and the Teesdale DMA to see if there is any additional export from either DMA available. By the end of December both sources have recovered to normal operating levels and we would move from LoS appeal for restraint to BAU.



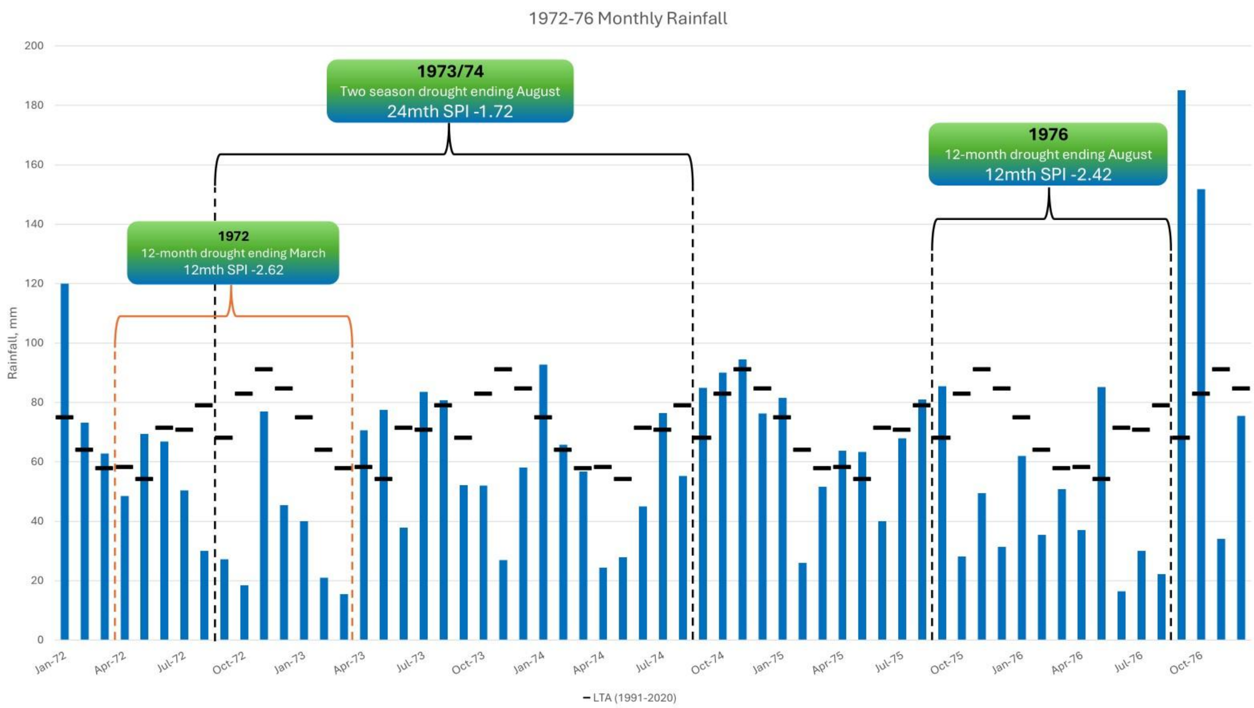


Tees Drought Management Area

As can be seen in the Tees DMA we would not need to impose restrictions of any kind. The capacity of the reservoirs relative to the demand is such that we do not need to implement any restrictions.



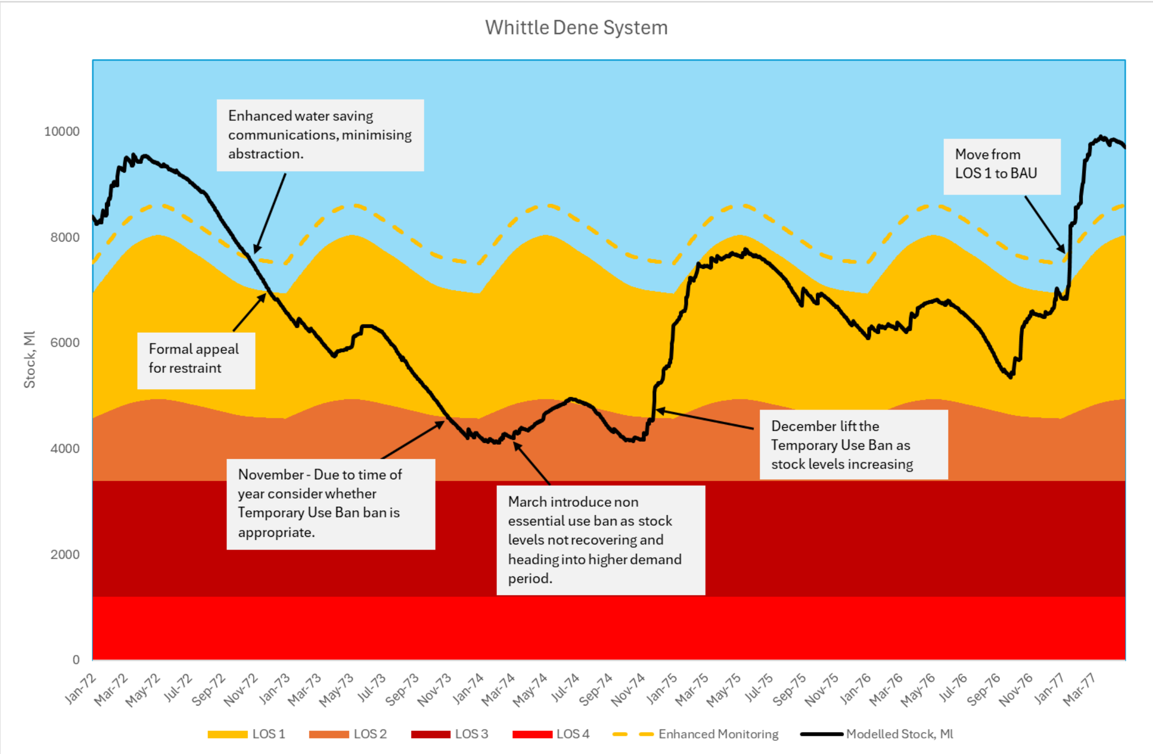
Multi Season Drought – 1972 to 1976



The mid-1970s saw an extended period of low rainfall with several notable droughts particularly affecting the Tyne catchment in the North East. During the four year period between 1972 and 1976 the North East experienced 83% of long term average rainfall.

Northumberland & Tyne Drought Management Area

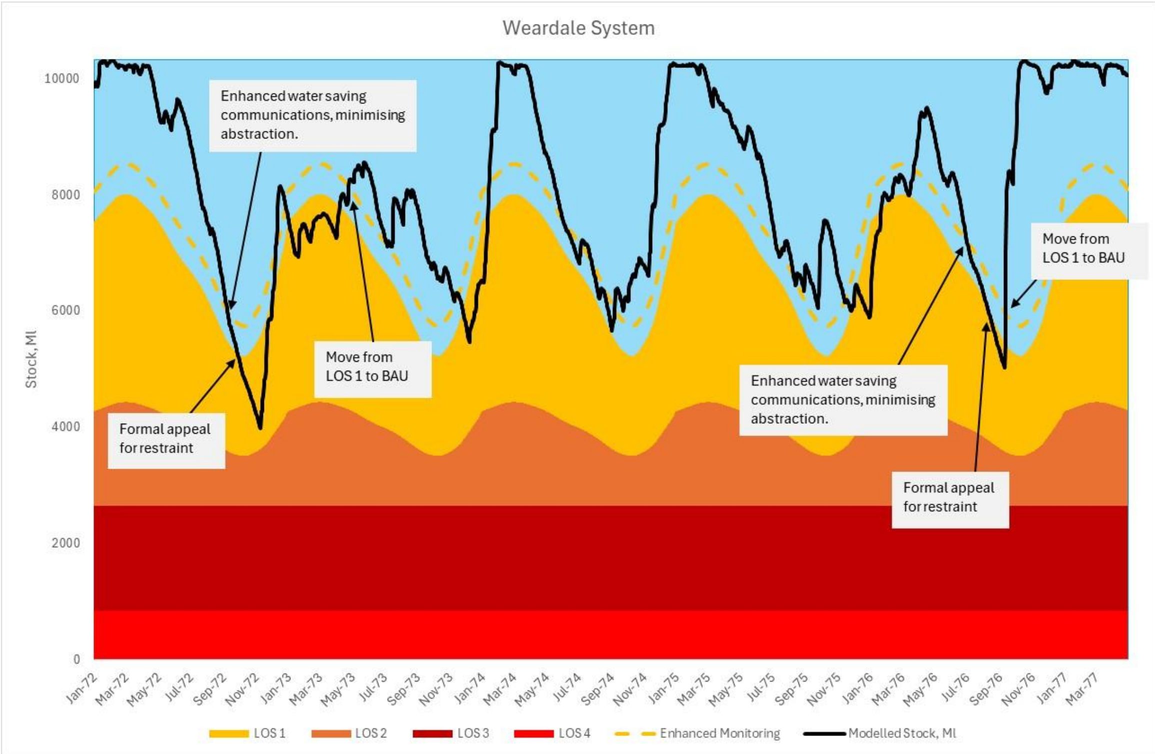
The modelling shows that in October 1972 we would increase our communications regarding water usage and minimise the abstraction from the Whittle Dene reservoir group. Stock levels then continue to decline and cross the Level of Service 1 trigger in December, given the time of year we would consider whether it would appropriate to introduce a formal Appeal for Restraint, in making this decision we could consider the short and long term weather forecasts, current demand levels and the headroom in the Weardale & Durham DMA and if there is any export from that DMA available. As stock levels continue to decline, we would introduce a formal Level 1 Appeal for Restraint in early spring ahead of the typical increase in demand.
Modelling then shows stock levels continuing to decline and crossing the Level 2 Temporary Use Ban trigger in November, given the time of year we would consider whether it would appropriate to introduce a Temporary Use Ban, in making this decision we could consider the short and long term weather forecasts and current demand levels. As stock levels do not recover over the winter refill period, we would introduce a Level 2 Temporary Use Ban in early spring ahead of the typical increase in demand, his would remain in place all year until the stock levels begin to recover in December when the Level 2 Temporary Use Ban would be lifted, the Level 1 Appeal for Restraint would remain in force for the next year.

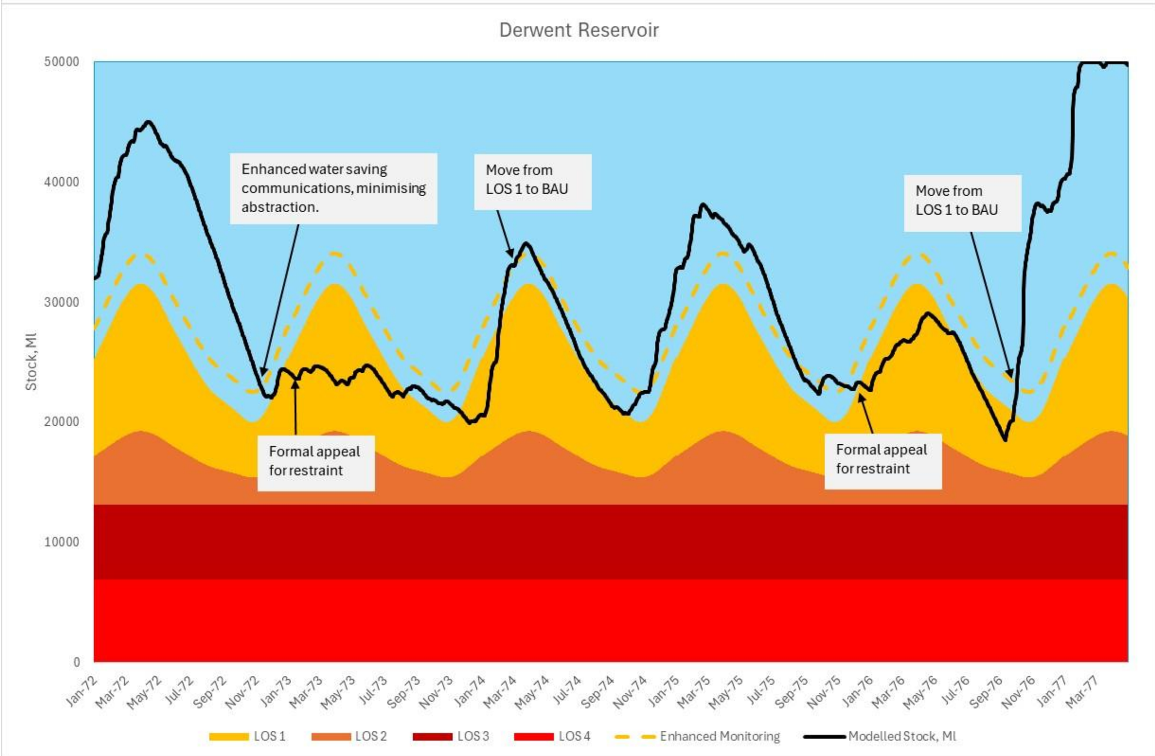


Weardale & Durham Drought Management Area

The modelling shows that in September 1972 we would increase our communications regarding water usage and minimise the abstraction from the Weardale reservoir group. Stock levels then continue to decline but don't cross the Level of Service 1 trigger until late September, Derwent reservoir remains healthy until the end of November at which point we start to minimise abstraction from the reservoir, given bot the Weardale reservoir group and Derwent are below their Level 1 triggers a formal

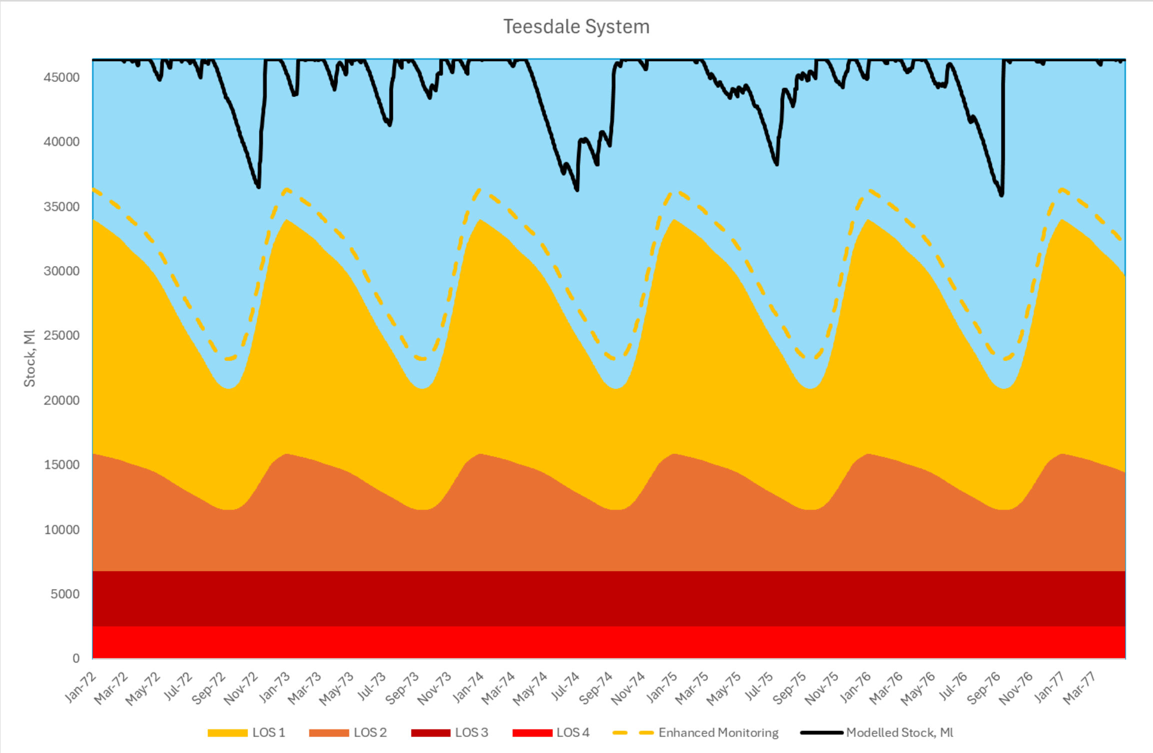
Level 1 Appeal for Restraint would be introduced ahead of the spring. Due to the level of Derwent reservoir the DMA would remain in Level 1 Appeal for Restraint until early 1974. However Derwent reservoir does not fully recover until late 1976 so we continue with our enhanced water saving communications and minimising abstraction from our reservoirs. A further formal Level 1 Appeal for Restraint would be introduced ahead of the spring of 1976 due to the low level in Derwent reservoir and declining stock in the Weardale reservoir group, this would be in place until October 1796 when the stock levels in both the Weardale reservoir group and Derwent reservoir recover.





Tees Drought Management Area

As can be seen in the Tees DMA we would not need to impose restrictions of any kind. The capacity of the reservoirs relative to the demand is such that we do not need to implement any restrictions.



Berwick & Fowberry Drought Management Area

The single-season dry weather of 2018 is used as an example of monitoring groundwater level trends and the decision making/actions associated therewith in the Berwick & Fowberry DMA. Figure 1 shows how the situation would have appeared to our Water Resources team on 15 December 2018, when the groundwater level fell below the drought trigger for the first time since 2007. Both May and June of 2018 were very dry and then June and July were very warm, leaving the ground in a moisture deficit and resilient to infiltration that would facilitate recharge of the aquifer. Under normal conditions, the groundwater level would be expected to have begun rising in October, with the rate of increase then accelerating through November and December. In 2018, however, the expected autumn rise did not materialise and, instead, groundwater levels continued to decline, breaching the drought trigger in mid-December. There is no suggestion that there would have been issues meeting supply needs at this point; because of the seasonal nature of the drought trigger, the trigger that had been breached was still at a higher groundwater level than what would be considered a "normal" October groundwater level; the trigger is designed to alert us to the fact that, without considerable recharge, groundwater levels may be at problematic lows the following summer. This appeared to be the case in 2018, as projections of what the groundwater level would do next showed that in 8 of 10 scenarios it would be at a record-breaking low by the end of summer 2019. It would be in June, July and August of 2019, when demand would be highest too, that we would expect to the possibility of impacts on our abstraction borehole water levels.

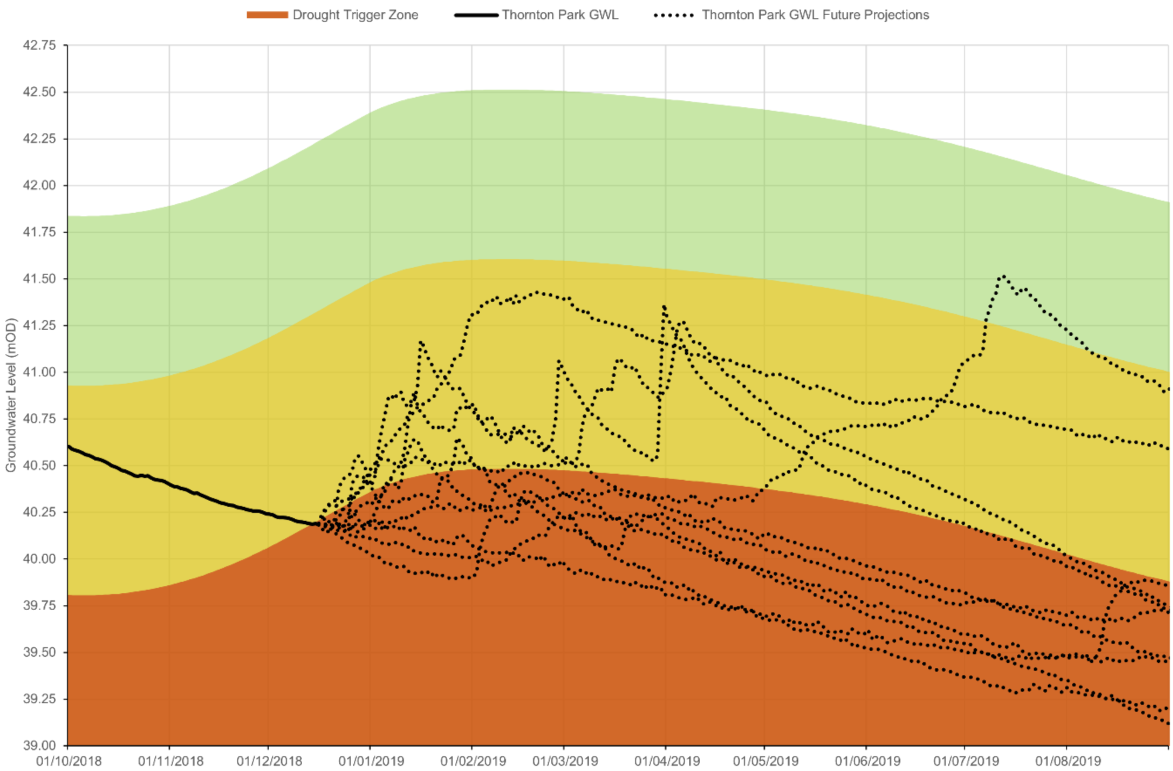


Figure 1: Thornton Park OBH groundwater levels 2018-19 with projections

At that point, in mid-December, the fact that the drought trigger had been breached would be escalated to the Drought Management Group, who would appoint a project manager to begin setting up a contract with our contractors to lower our borehole pumps, including ordering new lengths of rising main, if necessary. As demand in the Berwick & Fowberry DMA is very seasonal – with significantly higher demand over the summer period – preparations would be made for the winter and spring to be utilised for planning and proactive maintenance, in addition to the drought actions of lowering the pumps. This would put us in the best possible position to meet the challenges of a possible second year of drought.

The observed data from December 2018 onwards are shown in Figure 2. In reality, the groundwater level at Thornton Park continued falling until late February 2019. At this point it began recharging and rose swiftly through March, leaving the drought trigger zone on 23 March 2019. The rise plateaued and then the groundwater level began falling again in May, but for the remainder of the summer of 2019 it stayed within what would be considered a “below average but normal” level. During the time between December 2018 and March 2019, when the drought trigger had been triggered, the groundwater level in our abstraction boreholes did not fall below their pump inlet safety offsets, and so it was not necessary to enact the pump lowering that had been prepared. For comparison against the OBH levels, the groundwater level at Murton which makes up approximately 25% of the Berwick supply is shown in Figure 3

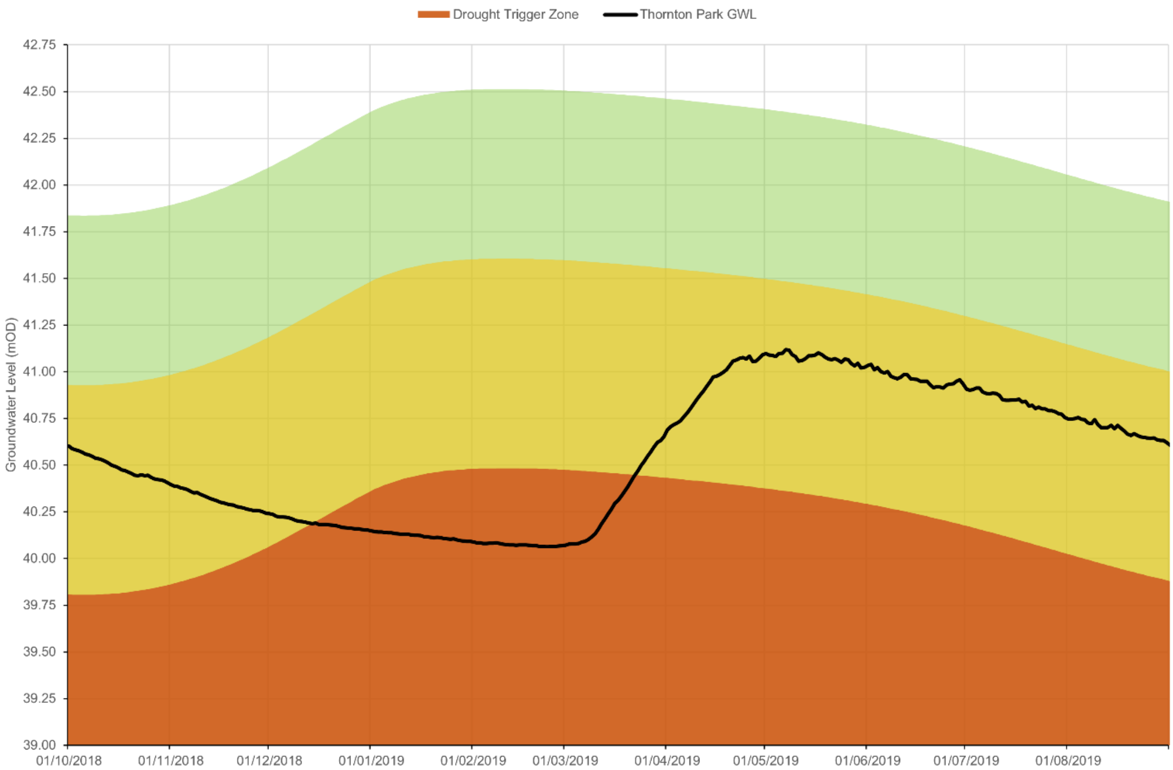


Figure 2: Observed Thornton Park OBH groundwater level data 2018-2019

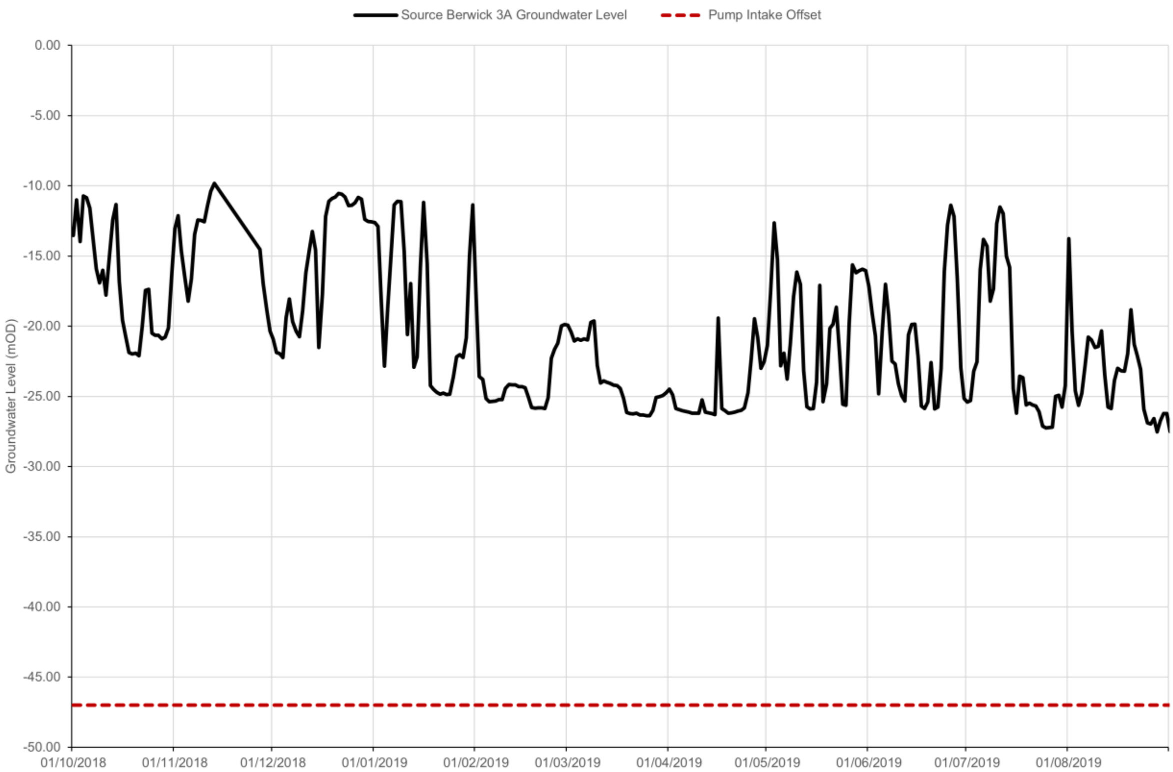


Figure 3: Murton groundwater level following 2018 dry period

APPENDIX 11: DEMAND SIDE DROUGHT ACTIONS

This appendix provides detail of the demand side drought actions that we may implement to address potential water supply shortages during a drought. It includes the estimated demand savings, implementation timetables and risk assessments for the demand side actions which fall into three categories; water efficiency actions, leakage and network actions and other demand side actions.

Please refer to the following accompanying spreadsheets for our unconstrained and constrained lists, risk assessments and implementation timetables.

Demand Side Drought Actions_Table of Actions: which is a table of all our demand side drought actions including our unconstrained list and constrained list of actions.

Demand Side Drought Actions_Implementation Timetables: which includes the implementation timetables for all our demand side drought actions.

Demand Side Drought Actions_Risk Assessments: which includes all the risk assessments for all the demand side drought actions.

Table 1 gives a summary of all the demand side drought actions. It is split between actions that are already included in our current plan and new actions we are proposing for this plan and includes the average saving per action at the respective drought level.

Table 2 gives the savings for drought actions at a WRZ level. Certain drought mitigation actions may yield varying levels of savings across different zones, depending on differences in population density, property characteristics, and geographic conditions.

Figure 1 provides the process flow for initiating demand side drought actions through the levels of drought.

Table 1: Demand Side Drought Actions

Drought Stage	Drought Level	DP22 Demand-side actions	New actions for DP27	Average Saving per action in drought level Ml/d
Normal	Level 0 (BAU)	**BAU** Network optimisation to reduce output of Water Treatment Works (WTWs) which are supplied by a stressed water resource Customer communications As per our WRMP24 demand management selected options: • Leakage detection and repair suite of options • Water efficiency activity (non-household and household) • Smart metering installations • Government led interventions		**Please see WRMP24**
Prolonged dry weather	Level 1	**APPEAL FOR RESTRAINT** Enhanced dry weather messaging Additional resource for find & fix leakage teams Encourage reporting of leaks Stop proactive flushing Optimising water supply and network to reduce output of Water Treatment Works (WTWs) which are supplied by a stressed water resource; as well as increased control over potable water storage levels.	High water use alerts to customers Water saving calculator promotion Target 15m head at the critical point in each pressure managed area	**1.22**
Drought	Level 2	**TUB** Further additional resource to find and fix leaks Offer to repair the highest volume Customer-side leaks (CSLs)	Challenge illegal use Water Efficiency Home Audits to targeted areas Education workshops - community and schools Community Outreach & business funding Tourism support	**2.19**
	Level 3a	**NEUB** Minimise WTWs outflows at all water stressed sourced WTWs and maximise elsewhere Manage the network to use potable water stored as resilience for changeable demands, managing our network storage levels at low levels, increasing risk of maintaining supply to customers.	Hard hitting communications Target 10m head at the critical point in each pressure managed area Installation of flow regulators to Household's (HHs) Shower device offering Flow restrictors to Non-Households (NHHs)	**3.04**
Severe drought	Level 3b	**EXTREME DROUGHT ACTIONS** Reduce Ships Watering Removal of Statutory Exceptions on TUBs and NEUBs Manage Strategic Operational Plan (SOP) storage to low-low alarm levels, increasing risk of maintaining supply to customers.	Seasonal Tariffs for smart metered customers	**0.34**

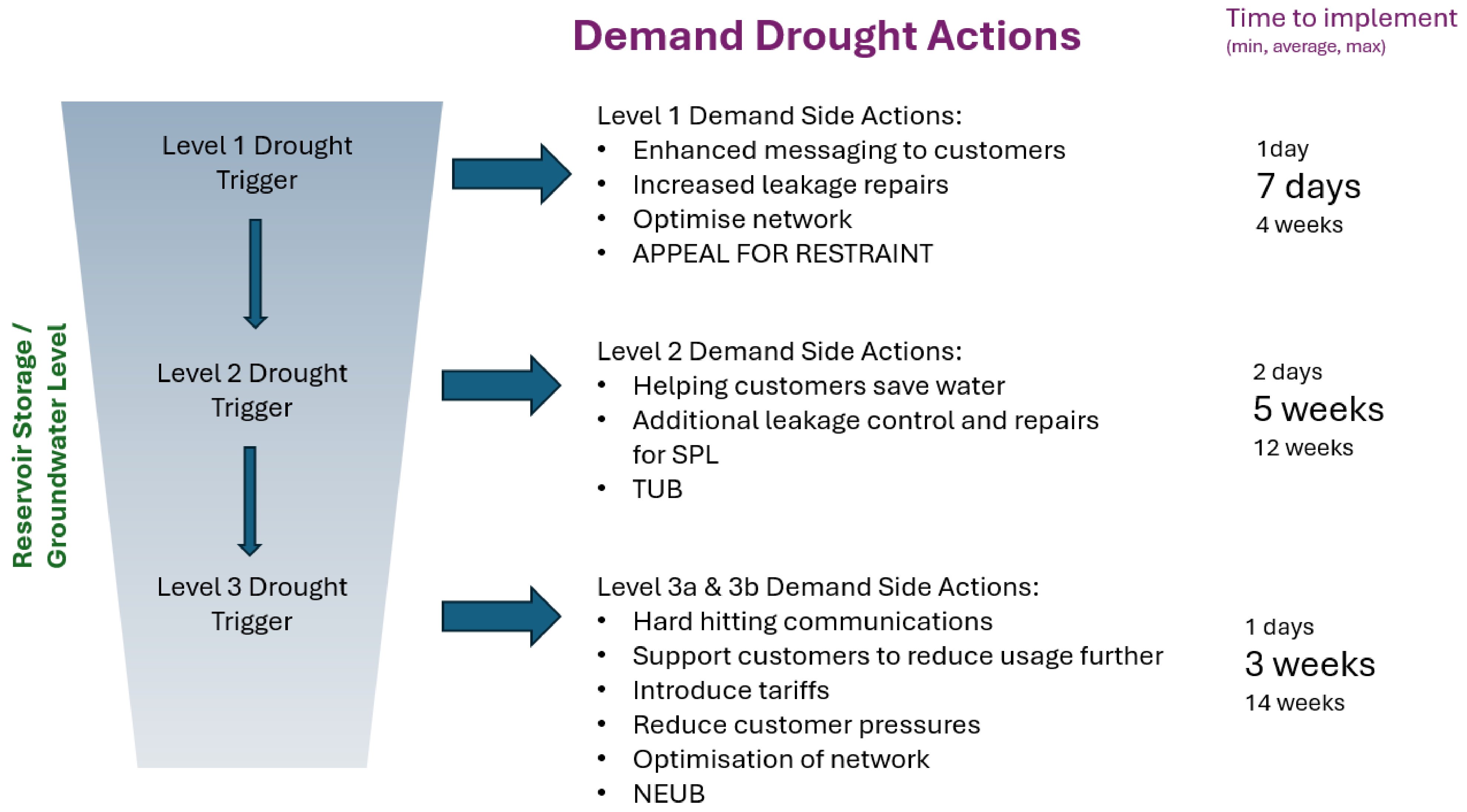


Figure 1: Demand side drought actions process flow

Table 2: Demand Side Drought Actions Savings per WRZ in Ml/d

Drought Level	Drought Severity	Demand Actions	Berwick	Kielder
1	Prolonged dry weather	Appeal For Restraint	0.14	11.66
		Water Efficiency Drought Actions	0.47	5.05
		Leakage & Network Drought Actions	0.18	10.32
		Demand (Other) Actions	0.03	3.99
		SUM	**0.83**	**31.02**
2	Drought	TUB	0.21	26.55
		Water Efficiency Drought Actions	0.03	1.41
		Leakage & Network Drought Actions	0.07	0.18
		Demand (Other) Actions	0.00	0.02
		SUM	**0.31**	**28.16**
3a		NEUB	0.16	13.71
		Water Efficiency Drought Actions	0.00	0.01
		Leakage & Network Drought Actions	0.08	10.17
		Demand (Other) Actions	0.05	6.16
		SUM	**0.30**	**30.06**
3b	Severe drought	Removal of Exceptions on TUBs and NEUBs	0.02	1.26
		Leakage & Network Drought Actions	0.00	0.00
		Demand (Other) Actions	0.00	0.09
		SUM	**0.02**	**1.35**

Demand-side Drought Actions Rejection Register

Table 3 details those demand-side drought actions included in our unconstrained list, but which were screened out as being infeasible. The drought action is described and the rejection reason given.

Table 3: Demand-side Drought action rejection register

Type of demand-side action	Summary of action	Time to implement	Rejection Reason
Demand	Refocus smart meter installation on replacements to specific area	2 weeks	Not a fast enough demand saving for use in drought as relies on network being in place.
Demand	Refocus smart meter installation for compulsory metering to specific area	2 weeks	Not a fast enough demand saving for use in drought as relies on network being in place and customer's receiving bills.
Demand	Encouraging more customers to opt for a meter	5 days	Not a fast enough demand saving for use and technicians to install would be diverted to leakage reduction
Demand	Relocate farm stock / businesses	28 days	Extreme drought action, would require government intervention
Leakage	Use smart meter data to identify customers with high usage or continuous flow and contact them about reducing their consumption	1 day	Action is already included under the water efficiency drought actions.
Water Efficiency	Office visits	4 weeks	Already at full capacity
Water Efficiency	Restaurant visits	4 weeks	Already at full capacity
Water Efficiency	Shop visits	4 weeks	Already at full capacity
Water Efficiency	Hairdresser visits	4 weeks	Already at full capacity
Water Efficiency	Educational Building retrofit and reviews (University/College)	4 weeks	• Already at full capacity • Already to be delivered
Water Efficiency	Water Efficiency Training to Retailers	6 weeks	Already to be delivered
Water Efficiency	Water Reuse inc Rainwater Harvesting	20 weeks	Too long of a delivery timeframe.
Water Efficiency	Free Water Efficiency Assessments for NHHs (identification of opportunities for NHH to take action on)	8 weeks	No guaranteed water savings.
Water Efficiency	Find & Fix - Leaky Loos (NHH)	6 weeks	Already to be delivered.
Water Efficiency	Water Saving Kits for Businesses	10 weeks	Already to be delivered.

Water Efficiency	Nationwide Challenge - Water in Business Week	N/A	May not fall during a drought event.
Water Efficiency	Golf courses	25 weeks	• Already restricted by TUBs/NEUBs • Too long of a delivery timeframe.
Water Efficiency	Water Warden	16 weeks	• Would require engagement to see water saving benefit. • Would require recruitment. • More of a long-term solution.
Water Efficiency	Business-level Water efficiency rankings	6 weeks	Permissions to implement are uncertain.

Water Efficiency Drought Actions

Overview

We have been running a wide variety of water efficiency projects since 1997 including large-scale home retrofit projects, school audits and education, business audits, research projects and initiatives with partners such as housing associations. Our water efficiency strategy has demonstrated its value by delivering quantifiable and sustainable water savings through innovative, creative and leading projects.

A critical part of our ongoing programme is the monitoring of results to quantify actual water demand savings and how sustainable they are. We strive to be proactive and innovative. This has involved researching the most cost-effective methods of reducing water consumption, developing new analysis techniques, and improving our understanding of people's behaviour and motivations to evaluate the most beneficial approaches to promoting water efficiency as well as providing practical advice and help to customers.

We have reviewed our strategy as part of our Water Resources Management Plan 2024 and our strategy continues to be based on a process of reviewing effectiveness, making improvements and responding to new opportunities to trial new products, evaluate new methods of working, work with new partners and improve our measurement and analysis techniques.

During drought conditions, we will continue with our AMP8 projects as outlined in the WRMP24, in addition to activities summarised in Table 4.

Outside of this, customers are able to purchase water butts at low prices through a partnership we have with a water butt supplier.

In the event of a drought, the scale and pace of the campaign can be increased and focused particularly on the delivery of key water efficiency messages to encourage customers to request free water saving devices.

Table 4: Water efficiency drought actions

Drought level	Drought severity	Water Efficiency Drought Actions
0	Normal	AMP 8 projects as outlined in the WRMP24 for both household and non-households.
1	Prolonged dry weather	**Household** • High water use alerts that for both area and customer specific. • Promote water saving calculator • Continuous flow messaging from smart meters. • Behaviour change: internal Water Efficiency awareness **Non-Household** • High water use alerts for non-household properties, this could be either area or customer specific. • Reduce NWGs water consumption across sites. • Visible water efficiency / drought awareness messaging for visitors to NWG sites.
2	Drought (TUB in place)	**Household:** • Targeted areas for Water Efficiency Home Audits. • Educational workshops delivered through the Ripple Effect • Community outreach – Water Warrior **Non-Household:** • Community funding. • Home away from home support.
3a	Drought (NEUB in place)	**Household:** • Installation of flow regulators (NRV2s) – install rate 1 in 10. • Shower use intervention – digital device for customers. **Non-Household:** • Installation of flow regulators (NRV2s).

Forming the constrained list

For the WRMP24, a list of unconstrained Water Efficiency activities was identified. This list gave us a head start for potential drought actions. We sifted through this initial list and removed actions that were not appropriate for drought scenarios, for example Rainwater Harvesting. A new list of unconstrained options was then created. In total there were around 69 options in the unconstrained list, that took into consideration household (HH), non-household (NHH) and activities that would fit better with Internal and External Communications.

For HH actions, originally there were 38 actions, now there are 19 to take forward. Similarly, for NHH, there were originally 39 options, and now there are 10 options. The primary reason for options to be removed was that they are already planned to be delivered in AMP 8; therefore, wouldn't be feasible to increase capacity or are very similar to actions already proposed.

Next, the constrained list was assessed against the following criteria:

- Drought level action implementation, Trigger for action, and plan and prepare for action in which drought level.
- Time to implement action.
- Estimated demand savings.
- How will effectiveness be monitored? How can it be tracked?
- Location of action? Where is it most effective? Company, region, resource zone, DMA, town, and street?
- Time of year action is most effective. Spring, Summer, Autumn, or Winter?
- Justification of time of year selected.
- Permissions required? Or Constraints that apply? If yes, provide information.
- Risk assessment completed + link to risk assessment.
- Impact on drought levels of service.
- How can you fast track the action? Or how can you scale up the action if the drought gets worse?
- How will you engage with NAVs and / or water retailers to implement the action?
- Require Comms Team Support?
- Include in Drought Plan Yes/No

The assessment was a beneficial tool to analyse which options were suitable and feasible in the event of a drought. This assessment allowed the opportunity to remove further options, based on the outcome of the assessment. We removed 14 options, some of these were due to unquantifiable savings, challenging for scaling up and time constraints. The refreshed constrained list consists of 17 options, which will be explored below.

Level 1 Drought Actions

WE002 Promote Water Saving Calculator

Time to implement action:	1 week
Estimated saving:	Negligible

In the event of a Level 1 drought, there will be external communications about the promotion of the Water Saving Calculator and tips on saving water. This action can be fast tracked via escalated communications. Effectiveness will be monitored through google analytics, clicks and visits to websites etc. This promotion is at a regional level and would be most effective during spring/summer as it would help raise awareness of water use in the lead up to summer. The biggest risk would be the lack of customer engagement; to help mitigate this, external communications would effectively raise awareness of the water saving calculator.

WE025/ WE026 High water use alerts for households

Time to implement action:	**2 weeks**
Estimated saving:	3% of PCC target

This is a new activity for Drought Plan 2027 that has emerged. High water use alerts can be for either customer or area specific by using smart meter data. It can be implemented in a Level 1 drought.

Alerts that are customer focused (WE026): "we have noticed your use is higher than normal" based on a 3-month average. The alert could make customers consider other actions they could do to prevent their consumption increasing, "Do you have a leak?" and to also encourage them to tell us if circumstances have changed, bettering the data we hold. Alerts that are area focused (WE025): "There is high demand in your area. Please consider reducing your water use". The alert could make customers consider other actions they could do to prevent consumption increasing.

Effectiveness would be monitored through tracking engagement and responses to how people reduced water use. There is no current scope to fast track this activity due to the work involved. The key risks associated with this activity are complaints and the wrong customer or area is targeted, which could impact C-MeX. To mitigate this, targeted areas and data to be reviewed by multiple people.

WE065NHH/ WE066NHH High water use alerts for non-households

Time to implement action:	**4 weeks for NHH**
Estimated saving:	2% of use NHH

This is a new activity for Drought Plan 2027 that has emerged. High water use alerts can be for either customer/business or area specific, by using smart meter data. It can be implemented in a Level 1 drought.

Alerts that are customer focused (WE066NHH): "we have noticed your use is higher than normal" based on a 3-month average. The alert could make customers consider other actions they could do to prevent their consumption increasing, "Do you have a leak?" and to also encourage them to tell us if circumstances have changed, bettering the data we hold. Alerts that are area focused (WE065NHH): "There is high demand in your area. Please consider reducing your water use". The alert could make customers/businesses to consider other actions they could do to prevent consumption increasing.

Effectiveness could be monitored by DMA reads, can be implemented all year round at a company scale. For NHH customer high use alerts, effectiveness would be monitored by tracking meter reads at each site.

There is no current scope to fast track this activity due to the work involved. The key risks associated with this activity are complaints, BR-MeX and the wrong customer or area is targeted. This could impact BR-MeX scores and potential savings. To mitigate this, targeted areas and data to be reviewed by multiple people.

WE005 Continuous flow messaging

Time to implement action:	**1 week**
Estimated saving:	24 l/prop/d

Remind customers to act if their smart meter identifies a continuous flow. Can be implemented in Level 1. The effectiveness of this activity can be measured through engagement and continuous flow changes. This activity will also be at a regional level and can be implemented at any time of the year. Additional resources on fixing leaks to be shared, aiding customers to get leaks repaired.

This activity can be fast tracked by escalating external communications, encouraging customers to repair any leaks identified by the smart meter. The biggest risk to this activity is that data on continuous flow is not available due to technical reasons. There are no recommended actions to mitigate this.

WE015 Behaviour change: Internal Water Efficiency awareness

Time to implement action:	**1 week**
Estimated saving:	0 l/d

Offering employees water saving tips and easy ways to reduce water consumption, have a stall in offices raising awareness of this. A water efficiency lunch and learn or an e-learning module. Can be implemented in Level 1 and effectiveness can be monitored by engagement with internal posts or emails. This activity is at a company level and sharing water efficiency messaging can happen at any time of year.

This activity can be fast tracked/scaled up through escalated communications via internal saving water posts and articles on our internal intranet). The key risk to this activity is if there is a lower impacted than expected.

WE037 Clear information for visitors at NWG sites

Time to implement action:	**3 weeks**
Estimated saving:	0 l/d

Posters, information on screens around offices to raise awareness of drought status and share saving water tips. Can be implemented in Level 1 and the effectiveness can be measured by the number of visitors at the various sites or offices. Implementation of activity likely to be in the summer months. Lack of engagement would be the biggest risk associated to this action. This activity can be fast tracked by focusing on information on screen within offices to share water saving tips.

WE049 Reduce NWGs water consumption across all sites

Time to implement action:	**4 weeks**
Estimated saving:	2% of office use

NWG focus on own water use across all sites including treatment works; therefore, it is a companywide activity. Can be implemented in Level 1. We would monitor the effectiveness of the activity by tracking meter reads at each site. This could be implemented all year round. The biggest risk would be backlash from employees, asking why this action is not already implemented; however, to mitigate this we could share what the company has done to help reduce wasting water.

Level 2 Drought Actions

WE001 Water's Worth Saving Home Audits

Time to implement action:	**8 weeks**
Estimated saving:	60 l/prop/d

This project in the WRMP24 is known as the "Top 5% Highest Users Visits". For consistency, with internal and external communications, the project is now referred to as the "Water's Worth Saving" project. This project involves plumbers, via a contractor, to undertake an audit at the customer's property. The plumber will check for any dripping taps, showers or leaky loos and will repair where possible. Ideally the customer joins the plumber whilst they are carrying out this audit to increase engagement. There is also a survey done to help understand the customer's water uses, and any behaviours that might explain the high use. Water saving devices are installed and left where appropriate. Meter reads are taken two weeks before the audit, at the audit and two weeks after the audit to measure the change in water consumption from pre and post audit.

This project is already running at full capacity, so we would be unable to increase the volume of visits in the event of a drought. However, with enough warning, we would be able to adjust the areas/postcodes that are sent invitations. Due to the planning time and dependant on customer uptake of the offer this has been placed as an option if we entered a Level 2 drought.

As mentioned above, we can be flexible with the postcodes that receive invites for visits. Therefore, if certain areas needed increased activity we could fast-track certain postcodes. The biggest risk with this activity is lack of customer engagement and uptake of visits, which can impact savings.

WE010 The Ripple Effect

Time to implement action:	**8 weeks**
Estimated saving:	6 l/prop/d

The Ripple Effect is our Water Efficiency education programme initiative:
www.nwg.co.uk/responsibility/working-with-schools/the-ripple-effect/

The Ripple Effect encourages everyone to learn more about water and make small changes to protect our water supply. Everyone can become a part of The Ripple Effect by becoming Water Trackers who are expert protectors of water and guardians of the water cycle. Learning is through a range of films, interactive games and activities for 8- to 11-year-olds.

We promote this initiative all year round and can increase promotion during prolonged dry weather to provide an educational resource to schools in order to change the water using behaviours of future generations at a large scale, known as The Ripple Effect.

The effectiveness of the promoting the scheme would be measured by the number of schools and children taking part. It is more about engagement and learning rather than direct savings. There is a limitation to this activity, it has to take place during term time and often requires being booked a couple of months in advance. The biggest risk related to this activity is lack of engagement from schools, resulting in the programme not being delivered.

WE052NHH Community funding

Time to implement action:	**12 weeks**
Estimated saving:	1%

Establishing Business fund to offer financial support to businesses to enable water saving, this is a Level 2 option and estimated to take three months to implement. Success of the activity would be monitored by tracking engagement and responses to how people reduced their water use. This activity could be implemented all year round and there is no method currently in place to fast-track this activity. Again, lack of engagement is a key risk to this activity, if businesses do not engage with the funding opportunity, then this activity will be unsuccessful.

WE019 Community Outreach

Time to implement action:	**4 weeks**
Estimated saving:	0 l/d

Invest in/recruit a reputable, well liked and well-known water warrior – someone to become our own influencer or community lead. Education, support, liaising with contacts in businesses and recruiting water saving champion customers to support with our water saving activity as integral members of communities which are hard to reach or disengaged from NWG. This could take 4 weeks to implement and is measured via engagement or number of events and could be implemented all year round. The outcome of this activity leads to increased awareness and engagement on saving water; however, there are no current methods to fast track this activity.

One risk is that the identification of the champion might be ineffective, causing lower delivery. To overcome this, more than one champion within a community could be recruited.

WE051NHH Home away from home support

Time to implement action:	**12 weeks**
Estimated saving:	10% (similar to home audits)

Working with Airbnb, holiday homeowners etc to reduce water use. Billboard equivalent at local tourist attractions with drought messaging. Success of this activity would be measured by monitoring engagement from Airbnb and holiday-home owners. We have estimated this might take around twelve weeks to implement this activity and could happen all year round, although would be most effective in holiday seasons.

Similar to other actions, lack of engagement is one of the biggest risks, followed closely by the impact is lower than proposed. Both risks will impact the potential savings.

Level 3a Drought Actions

WE003 / WE067 NHH Installation of flow regulators

Time to implement action:	**4 weeks**
Estimated saving:	21 l/prop/d (HH) 21 l/NHH

Installation of flow regulators on HH properties which fit a certain criterion (based on propensity to save water based on data model which is periodically refreshed). The effectiveness can be monitored via reduced water consumption on properties where they have been installed. This will take four weeks to implement and is stock dependent. There is an associated saving of 21 l/prop/d and can be installed any time of year, as this is already business as usual.

Where possible, if a NHH property fits criteria a flow regulator would be installed to reduce consumption by reducing water flow. This activity would be measured by taking meter reads at each site at time of installation and will take four weeks to implement. There is an associated saving of 21 l/NHH/day. Like HH properties, there is opportunity to implement this activity all year round.

There are two key risks associated with this activity. The first risk is lack of product for delivery; to mitigate this, drought risk will be monitored and adjust stock requirements as necessary. Similarly, the second risk is complaints and refusal of installation which could impact both C-Mex and BR-Mex. To mitigate this risk, ensure information about product and installation process is available to the customer or business.

WE028 Shower use intervention – digital device

Time to implement action:	**12 weeks**
Estimated saving:	5% of shower use

Digital devices for customers. Promoting reducing amount of time spent in the shower by providing customers with e.g. Aguardio shower sensor devices. During a level 3 drought, these devices could be distributed during the Water's Worth Saving audits. There Is a 12-week lead on this as we would need to order the devices, distribute to plumbers in areas of drought. Reporting within the project scope may need adapting to flag which properties have received an Aguardio shower sensor. This activity can be monitored by keeping record of which properties received a device and to see if consumption has changed over time with use of device.

Lack of product for delivery is a risk for this activity too; to mitigate this, drought risk will be monitored and adjust stock requirements as necessary.

Leakage and Network Drought Actions

Overview

Prolonged periods of drought may result in soil shrinkage and increased ground movement causing mains to fracture and leakage values to increase. We have made significant progress in reducing leakage from our network over the last five years. However, we recognise that we must reduce leakage further and have agreed with our regulators that we will reduce leakage 55% by 2050 compared to our 2017/18 baseline. We will achieve this through the use of innovative technologies to find leaks, through additional resource for find and fix and through mains renewal.

Our supply network is divided up into District Metered Areas (DMAs) which are small managed areas of the network with flow meters monitoring inlet flows. All of our DMAs are reviewed on a weekly basis to prioritise the areas for leakage detection activities. This period can be shortened during drought or severe weather events and can be prioritised to address specific issues and areas of severe drought. We will also use historic data to understand the most likely part of a DMA to be leaking based on the weather conditions which will help us to find the problem quicker.

On top of these BAU activities we have looked at what additional actions we could take at the different drought levels to try to reduce leakage further. These are detailed in Table 5.

Table 5: Leakage and network drought actions

Drought level	Drought severity	Leakage and Network Drought Actions
0	Normal	BAU including leakage network optimisation and WRMP24 leakage reduction strategy for leakage detection and repair suite of options.
1	Prolonged dry weather	Extended working hours for LT's and crews Redeploy internal teams Adapt DMA prioritising process for leakage Use mains risk modelling to identify pipe failure hotspots Prioritise leak repairs Encourage reporting of leaks Stop proactive flushing Optimising water supply and network. Reduce all customer pressures to 15m high.
2	Drought (TUB in place)	Additional resource to find leaks (contractors, sniffer dogs, satellites, noise loggers) Repair all outstanding CSL's
3a	Drought (NEUB in place)	Reduce customer pressures to 10m high. Minimise WTWs outflows at all water stressed sourced WTWs and maximise elsewhere. Manage the network to use potable water stored as resilience for changeable demands, managing our network storage levels at low levels.
3b	Severe drought (Extreme actions)	Manage SOP storage to low-low alarm levels

Forming the constrained list

All of the unconstrained actions were reviewed to understand whether they would be possible to implement, how quickly they could be started and how much they would cost against the potential benefit. Anything that wasn't a viable option was removed from the final constrained list.

Level 1 Drought Actions

L001 & L010 Extended working hours for LT's and Crews

Time to implement action: 1 day

Estimated saving: 0.5m3/d/person or 8m3/d/job

We will maximise the work time of our existing experienced technicians, particularly on night shifts when the network is quieter. This could be implemented quickly but is dependent on the willingness of staff to work overtime. The benefit would be tracked through the LT performance dashboard which monitors leak jobs raised and night line reduction.

L002 Redeploy internal teams

Time to implement action: 1 day
Estimated saving: 0.5m3/d/person

We can mobilise people from other business units to support leak detection activities, although this is not as effective due to a lack of skill and equipment, they are most likely to identify visible leaks. This could be implemented quickly but is dependent on the willingness of staff to carry out activities different to their normal role. It would be difficult to track individuals' performance but there should be a general uplift in leakage jobs raised.

L007 Adapt DMA prioritisation process

Time to implement action: 1 day
Estimated saving: 0Ml/d at a company level

Normally DMAs are targeted based on the highest excess of leakage across the whole region but in drought conditions there might be some areas at a higher risk than others, so these need to be prioritised accordingly. This can be implemented quickly, and communication channels remain open between the control room and leakage analysts to update on the key areas of focus. There is a risk that targeting the highest risk areas rather than the highest leakage, could be detrimental to the leakage performance at a company level but this will be closely managed. The benefit could be tracked by monitoring the impact on the reported leakage and DI figures in the area of concern.

L008 Mains risk model utilisation

Time to implement action: 1 day
Estimated saving: 8m3/d/job

Use historic failure data and weather models to predict the most likely part of the network to leak based on the current weather conditions. This will help to reduce survey times by finding leaks quicker and so Leakage Technicians can get through more areas. There is a risk that the leaks occur on a different part of the network than highlighted and there is limited time saved compared to a full survey. We would be able to monitor the actual survey times against the expected for each DMA to see if they are being completed quicker, the number of DMAs surveyed per LT should increase as well.

L009 Prioritisation of leak repairs

Time to implement action: 1 day
Estimated saving: 8m3/d/job

Prioritise leak repairs over all other work in the job basket to ensure they are fixed as quickly as possible, reducing the water lost during this time. This can be implemented quickly within the planning and scheduling team but will put the performance of other service level agreements at risk. Performance can be tracked through dashboards that monitor the number of outstanding leakage jobs and average leak repair times.

L014 & L015 & L016 Encourage customers to report leaks

Time to implement action: 1 day to 1 week
Estimated saving: 8m3/d/job

Encourage customers to look out for leaks and report any issues into the leakage portal on our website. Easy to implement but could generate lots of additional contacts that need investigation and potentially a lot of false positives (ie. Not leaks). Can be monitored through analysis of customer reported leaks compared to the average expected.

L018 Stop Proactive Flushing

Time to implement action: 1 day
Estimated saving: 0.1Ml/d

Temporarily pause proactive flushing of the network to reduce the amount of potable water wasted. This can be stopped immediately and the flushing technicians put onto other work to support leakage activities (L002). There is a risk that this could have a detrimental impact on our water quality contacts performance but as this is a proactive programme, a short break shouldn't be significant. A reduction in water use will be seen on the standpipe meters which are used to record the volume used for flushing.

L023 Optimise Water Supply

Time to implement action: 1 day
Estimated saving: 0Ml/d at a company level

Minimise impounding reservoirs sourced Water Treatment Works and maximising river sourced Water Treatment Works, subject to the conditions of the water course. This is likely to be more expensive to treat the water as we move away from the optimised production plan and is still limited by the treatment capacity at each WTW. Benefits can be monitored through the DI figures at each WTW.

L024 Optimise Water Network

Time to implement action: 1 day
Estimated saving: 0Ml/d at a company level

Remotely and manually change sections of the network to be supplied by river sourced Water Treatment Works. Any valve operations or network changes pose a risk but with the right mitigations in place the impact to customers can be minimised. Benefits can be monitored through the DI figures at each WTW.

L025 Manage customer pressures to 15m high

Time to implement action: 2 weeks
Estimated saving: 15% in PMAs

Reduce pressure managed areas to 15m at the highest point which is the minimum target pressure in the mains to achieve our minimum standards to customers. Analysis will need to be done to identify the target pressure for each PRV in order to deliver 15m at the highest point. Where PRV controllers are installed, these can be remotely changed, and the settings will be implemented the next time the device communicates. For fixed outlet PRVs, these will need to be visited by an engineer and the settings manually adjusted, which will take longer to get around all the sites. Customers are likely to notice a drop in pressure and may have issues with some of their appliances, like showers and boilers not working. These will need to be managed individually to see if they can be resolved locally or if the pressure needs to go back up slightly. This will need to be supported with customer comms to make it clear that a supply of water at lower pressure is required to prevent running out of water in future. The impact can be monitored through the DMA night lines once a pressure reduction has been carried out.

L026 Optimise Network Storage

Time to implement action: 1 day
Estimated saving: 0Ml/d at a company level

Manage large size grouped area (SOP) storage to below normal target levels (low alarm). The water in storage will be allowed into the network to be consumed by customers, this would put us at a higher risk of an interruption to supply if there are any issues on the network, like a significant burst, because there is less water in reserve to cope with a demand spike. The extra water made available could be calculated from the drop in service reservoir storage.

Level 2 Drought Actions

L003, L004, L005, L006, L011 Additional resources

Time to implement action: 4 to 6 weeks
Estimated saving: 5m3/d/person

Work with our contract partners and supply chain to bring in additional find and fix short term resources to help us to find and repair more leaks. We can speak to contractors to find out what resources they have available but there is often a lead time to bring people in from other projects. Other water companies are normally in a similar position so there is a high demand and limited availability. It is also expensive to bring in experienced resources on a short-term basis. We may look to use technologies, like satellite imagery or acoustic noise loggers, to help make our existing technicians more productive rather than getting additional people. Benefits can be tracked through additional leaks raised/repaired and the impact on DMA night lines.

L012 Repair the highest volume CSL's

Time to implement action: 2 weeks
Estimated saving: 5m3/d/job

Our current supply pipe repair policy supports customers to fix their own pipes which on average takes about 30 days. We could repair all the outstanding CSL jobs we are aware of to get a quick reduction in leakage. We would need to have the resource available to repair these jobs ourselves and we would need the customers permission to carry out the repair on their pipe. This would be a temporary change to policy which could be seen as an enhanced service to some customers. Leakage reductions would be calculated through DMA night lines once the repair has been done.

Level 3a Drought Actions

L027 Optimise Water Supply

Time to implement action: 3 days
Estimated saving: 0Ml/d at a company level

Minimise below normal Water Treatment Works' minimum flows at all impounding reservoirs sourced Water Treatment Works and maximising river sourced Water Treatment Works above normal parameters. This is likely to be more expensive to treat the water as we move away from the optimised production plan and is still limited by the treatment capacity at each WTW. Benefits can be monitored through the DI figures at each WTW.

L028 Optimise Water Network

Time to implement action: 1 day
Estimated saving: 0Ml/d at a company level

Remotely and manually change sections of the network to be supplied by river sourced Water Treatment Works. Any valve operations or network changes pose a risk but with the right mitigations in place the impact to customers can be minimised. Benefits can be monitored through the DI figures at each WTW.

L029 Managing customer pressures

Time to implement action: 2 weeks
Estimated saving: 30% in PMAs

Reduce pressure at the high point below the target levels of service so customers experience low pressure but will hopefully reduce the demand enough that the water doesn't run out. Analysis will need to be done to identify the target pressure for each PRV. Where PRV controllers are installed, these can be remotely changed, and the settings will be implemented the next time the device communicates. For fixed outlet PRVs, these will need to be visited by an engineer and the settings manually adjusted, which will take longer to get around all the sites.

L030 Network storage

Time to implement action: 1 day
Estimated saving: 0Ml/d at a company level

Manage large size grouped area (SOP) storage to below normal target levels (low alarm). The water in storage will be allowed into the network to be consumed by customers, this would put us at a higher risk of an interruption to supply if there are any issues on the network, like a significant burst, because there is less water in reserve to cope with a demand spike. The extra water made available could be calculated from the drop in service reservoir storage.

Level 3b Drought Actions

L032 Network storage

Time to implement action: 1 day
Estimated saving: 0Ml/d at a company level

Manage large size grouped area (SOP) storage to below normal target levels (low low alarm). The water in storage will be allowed into the network to be consumed by customers, this would put us at a higher risk of an interruption to supply if there are any issues on the network, like a significant burst, because there is less water in reserve to cope with a demand spike. The extra water made available could be calculated from the drop in service reservoir storage.

Demand (Other) Actions

Overview

There are a number of drought actions that sit outside of water efficiency, leakage or network planning activities which are detailed in this section (Table 6). These include changes to unbilled use, communication campaigns as well as the overarching drought actions for each level; appeal for restraint, TUBs and NEUBs. We have reviewed a wide range of demand drought actions for this plan and our constrained list builds on our normal BAU activity.

Further detail for TUBs and NEUBs is also available in Appendices 14-18.

Table 6: Demand (Other) drought actions

Drought level	Drought severity	Demand side Drought Actions
0	Normal	WRMP24 Demand Management Options (including enhanced optant smart metering strategy, government led interventions and customer communications).
1	Prolonged dry weather	Appeal for restraint Requesting local council promotion of drought communications Enhanced dry weather messaging
2	Drought (TUB in place)	TUB Challenging illegal use
3a	Drought (NEUB in place)	NEUB Hard hitting customer communications
3b	Severe drought	Removal of Statutory exceptions and discretionary universal exceptions on TUBs and NEUBs Seasonal tariffs for smart meter customers Reduction in ships watering

Forming the constrained list

There were 14 actions in our unconstrained list for demand (other) actions. To form our constrained list we estimated the implementation time, tracking capability, demand savings and how appropriate it was for a range of droughts. Assessing each of these components for each action gave us an insight early on into the perceived effectiveness of the action in drought conditions. Four actions were not taken through to the constrained list. Three of these actions related to meter installs:

- Refocus smart meter installation on replacements to specific area
- Refocus smart meter installation for compulsory metering to specific area
- Encouraging more customers to opt for a meter

These were discounted as the demand saving would not be achieved quick enough to have an impact during drought. The reliance on network installation to receive reads and the timing of customer bills would increase the length of time before a saving would be seen. The technician resource to refocus smart meter installation would also likely be redeployed for leakage activity during drought as well.

For more information on our metering activity please see Appendix 13.

One other action was discounted which was the relocation of farm stock and businesses during drought. This was discounted as it would require a national effort to undertake and decisions would sit within Government as to management. Given drought tends to effect large parts of the UK at the same time then longer distances and multiple areas of the UK would be vying for the same relocation for farm stock and businesses. It is an action that could be considered during emergency drought status if the drought was constrained to a small locale.

Level 1 Drought Actions

D003 Requesting local councils to promote drought communications

Time to implement action:	2 days
Estimated saving:	0.8 litres/property/day

This action looks at collaborating with local councils to promote drought communications. The benefit is that customers should receive the same messaging but from another trusted source with the aim of increasing behaviour change of our customers. We already have good relationships with our councils therefore we believe the implementation time of this action should be short with councils promoting messaging within a week. Estimated demand savings have been calculated using our WETT tool which estimates based on engagement level a l/p/d value. The effectiveness would be tracked by visual confirmation of the messaging going out into the local council's area. The action could be fast tracked through engagement with local councillors and MP's.

The key risks associated with the action relate to the council's declining to collaborate during drought or delaying the action. This should be mitigated through early liaison with the councils during the drought.

D010 Enhanced dry weather messaging

Time to implement action:	2 days
Estimated saving:	2.7 litres/property/day

Following a period of sustained dry weather and once the Environment Agency has announced our supply area is in an environmental drought, then we will increase the level of dry weather and water efficiency messaging we undertake. We will convey strong messages to customers in relation to how dry weather is affecting the environment and our water resources and how they can help by reducing the water use and using water wisely.

This action would link directly into the communications plan and involves supplementing water efficiency messaging with specific messages for the customers in water resource zones including current drought conditions, weather, PCC and reservoir / groundwater levels. The aim is to give customers the detail to make an informed decision to take action themselves. It is expected to primarily use social media and therefore implementation time is short and effectiveness tracked through the number of interactions with social media content. It is estimate to produce a 2.7 l/prop/d saving based on WETT behavioural change estimates with low levels of engagement although more effective during spring/summer due to associating with current drought conditions.

The key risks relate to delays in content design which should be mediated through advance planning and customer complaints which with a clear call to action should be minimised.

D011 Appeal for Restraint

Time to implement action:	5 days
Estimated saving:	1.7% reduction in DI

Some droughts, typically those of short duration, do not require us to place restrictions on the use of water. We would always ask our customers to use water wisely. However, as a period of prolonged dry weather develops, we may need to implement a formal Appeal for Restraint. We would use all of our communication channels (e.g. social media and press releases) to formally ask our customers to Use Water Wisely. Examples of messages are detailed in our Communications Plan (see Section 10 of our main Drought Plan report) and include ‘having a shorter shower – we recommend 4 minutes’ and use a water butt to collect and store rainwater’.

We would expect to be able to implement this within five days as part of the Communications Plan. The estimated saving is set at 1.7% as per the latest UKWIR report findings from the 2022 drought on level 1 actions[14]. The effectiveness of the formal appeal can be tracked through a reduction in daily DI.

The largest risks include the aforementioned reduction in expected demand savings, customer complaints, and delays in implementation. Monitoring daily DI, clear calls to action and good relations with media partners should alleviate these risks.

Level 2 Drought Actions

D006 Temporary Use Bans

Time to implement action:	9 days
Estimated saving:	6.6% reduction in household demand 3.34% reduction in DI

Temporary Use Bans, commonly referred to as TUBs (and historically referred to as a hosepipe ban) are powers granted to water companies to impose restrictions on customers’ water use. They predominantly focus on water use by domestic customers as this provides the largest water saving. TUBs can be introduced quickly just seven days after an advert is placed.

[14] UKWIR (2023) Review of the 2022 Drought demand management measured 23/WR/02/18

Following a review of the 2022 drought demand management measures[15] the introduction of a TUB produced a 3.34% reduction in DI and a 6.60% reduction in household demand and is deemed to have a significant impact on demand reduction. To maximise the effectiveness of TUBs it is recommended that they are implemented early on in the Spring-Summer season.

We aim to implement TUBs at a Company level (e.g. Northumbrian Water). Any lower geographical area may cause confusion amongst our customers.

The largest risks to TUBs is that there is no demand reduction and customer complaints. Clear advice on why the ban is in place alongside government and media advocation should help alleviate customer complaints. Daily monitoring of DI ensures TUB effectiveness is reviewed regularly.

More detailed information on TUBs is found in Appendices 14-16.

D004 Challenging Illegal Use

Time to implement action:	2 days
Estimated saving:	0.01 Ml/d

Day to day water is illegally abstracted from the water network namely from void properties (customers and present but are not paying for their water) and standpipe use (companies using other water company standpipes on our network). This use is challenged as BAU however during a drought we would increase this activity with more internal employees trained to challenge suspicious standpipe activity.

We would expect to be able to implement this action within two days with training available online and managers promoting to their teams. The number of challenges recorded by teams will provide a way to gauge the effectiveness of the action and the action can be scaled up through employee incentivisation. The largest risk to the action would be customer complaints impacting DMEX, with clear customer actions and messaging a way to counter this.

The saving is estimated at 0.01Ml/d based on current illegal use activity.

Level 3a Drought Actions

D013 Hard hitting customer communications

Time to implement action:	7 days
Estimated saving:	10.8 l/prop/d

As a severe drought develops we will change customer communications to specific hard-hitting messaging on the water resource situation. This will present the critical

[15] UKWIR (2023) Review of the 2022 Drought demand management measured 23/WR/02/18

situation clearly and concisely to our customers, and we envisage a similar level of messaging to that used in 2018 Cape Town 'Day Zero' drought campaign.

We expect this to take a maximum of 7 days to implement and expect to achieve 10.8 litres per property per day reduction based on WETT behavioural change estimates with high levels of engagement.

The largest risks to this action is delays in getting the messaging out through advertising partners and customer complaints. Using advertising partners we already have an relationship and contacting them early should alleviate delays. Clear calls to action and the reason behind the messaging should help reduce the number of complaints.

D007 Non-Essential Use Ban

Time to implement action:	3-14 weeks
Estimated saving:	2% reduction in DI 9% reduction from NHH consumption

Non-Essential Use Bans (NEUB's) are tougher restrictions on the use of water when drought conditions persist and primarily impacts businesses prohibiting them for using water for non-essential purposes.

It is very difficult to estimate the effect of this type of water use restriction on customer demand as there is very little data available. We have assumed that further restrictions on water use beyond that of temporary use ban will yield an additional reduction in DI of 2% of about 3.3% reduction in NHH demand (half of TUB saving for household demand).

The timescales for implementing a NEUB are significantly longer than a TUB as the Secretary of State would typically require a public enquire to be held if an objection were received. As an absolute minimum with no objections or delays it could be in place within 3 weeks but is more likely to take far longer.

We aim to implement NEUBs at a Company level (e.g. Northumbrian Water). Any lower geographical area may cause confusion amongst our customers.

The largest risks are that there is no demand reduction and customer complaints. Clear advice on why the ban is in place alongside government and media advocation should help alleviate customer complaints. Daily monitoring of DI ensures NEUB effectiveness is reviewed regularly.

More detailed information on NEUBs is found in Appendix 17.

Level 3b Drought Actions

D008 Reduction in Ships Watering

Time to implement action:	7 days

Estimated saving:	0.09 Ml/d

Other potential demand reducing measures to be considered include ships watering from our ports along the east coast. In a drought the quantity of water supplied could potentially be reduced by only supplying the essential amount of water required for a ship to get to its next port. It is estimated that only a relatively small quantity (approximately half) would be saved in a year.

This option would not require a drought permit or drought order and could be more effective during the summer months when more cruise ships are active. Customer complaints are thought to be the biggest risk for this action with clear advice and enough notification to ports a way to relieve.

D005 Introducing seasonal tariff for smart meter customers

Time to implement action:	28 days
Estimated saving:	3-5% reduction in PCC

For a Water Resource Zone that is fully smart metered we would introduce a seasonal tariff during a very severe drought. For example, this could be anything greater than 110 litres per head per day is charged at a higher rate or all water for the next 6 weeks is charged at a higher rate. We estimate this could give a 3-5% reduction in PCC and take a minimum of 28 days to implement which includes a 14-day notice period for customers.

The biggest risk is customer complaints and disadvantaging our vulnerable customers. Clear communication and a good notice period should help reduce the impact on complaints. Ensuring Watersure and Priority Services are accounted for will help reduce the impact on our vulnerable customers.

D012 Removal of Statutory Exceptions and Discretionary Universal Exceptions on TUBs and NEUBs

Time to implement action:	21 days
Estimated saving:	1% of NHH consumption

The implementation of TUBs and NEUBs in earlier drought levels will come with some statutory exemptions. In the case of very severe droughts these exemptions will be removed. It is estimate this could save approximately 1% from NHH consumption and take 21 days to implement although will require Government support. The biggest risks are customers not adhering to the ban alongside customer complaints. Government support alongside clear messaging should help resolve these risks.

More information on the removal to exceptions can be found in Appendix 17 and 20.

APPENDIX 12: SUPPLY SIDE DROUGHT ACTIONS

This Appendix outlines our L1 to L3b supply side drought actions, and the drought permits/orders we would consider implementing during a drought. A summary of the environmental assessments carried out for all supply-side drought actions can be found in Appendix 12.

Drought Action name	Road Tankering to Allenheads and Carshields water treatment works
Drought Level	Level 1
Water Resource Zone	Kielder WRZ
Drought Management Area	Northumberland and Tyne
Summary of Action	Road tankering from Whittle Dene WTW to service reservoirs to augment spring supplies at Allenheads and Carrshields WTW.
Trigger for action	Decision made through supply meetings based on routine monitoring of water resource utilisation; treatment works utilisation, network storage and weather predictions.
Estimated benefit/saving	Depends on resource availability and quantity of barrels. Estimates of around 4 tankers a day (24 m^3 per tanker) for the required duration.
Barriers to implementation	• Relies on available hydrants to inject water into the network without causing issues • Volume is dependent on resource availability.
Environmental impacts	See Appendix 13.
Timescales	Implemented within 24 hours for 4 tankers (additional barrels require longer), can be in place for duration of the drought event, decided through regular supply meetings.

Priority order for implementation	• Demand-side actions would be prioritised first. • As a level 1 drought action, this will be one of the first drought actions to be implemented ahead of Level 2 and Level 3 actions due to its minimal anticipated environmental impact. • This drought action is geographically specific and will only be implemented if the sources at Allenheads and Carshields are identified as needing additional support.

Drought Action name	**Burnhope Reservoir compensation discharge reduction**
Drought Level	Level 3a
Water Resource Zone	Kielder WRZ
Drought Management Area	Weardale and Durham DrMA
Summary of Action	Reduce compensation discharge from Burnhope Reservoir from 9.09 Ml/D to 4.55 Ml/D
Trigger for action	Weardale System reservoir control curve entering emergency storage.
Estimated benefit/saving	4.55 Ml/D
Barriers to implementation	Drought permit required (risk of refusal).
Environmental impacts	See Appendix 13.
Timescales	4-6 weeks to apply for drought permit, ≤ 6 months with permit in place.

Priority order for implementation	• Demand-side actions would be prioritised first. • This drought action is a level 3a which means it will not be implemented until the trigger has been met and the applicable Level 1 and 2 supply-side drought actions have been fully implemented within the relevant WRZ. • As the only Level 3 drought action within the Weardale and Durham DrMA, this drought action will be prioritised for implementation if this DrMA is deemed to have a supply shortage during a drought.

Drought Action name	Cessation of environmental spate releases
Drought Level	Level 3a
Water Resource Zone	Kielder WRZ
Drought Management Area	Northumberland and Tyne DrMA
Summary of Action	There are two individual drought actions within this category involving the temporary cessation of environmental spate releases. These are: • Derwent Reservoir • Fontburn Reservoir Note, that we make spate flow releases at the additional three sites below, but these have been rejected as feasible drought actions (see Rejection Register below): • Grassholme Reservoir • Hury Reservoir • Waskerley Reservoir Environmental spate releases are compensation flows designed to improve ecological functioning of heavily modified water bodies (HMWB) downstream of impoundments. Our spate flow regimes flow UKTAG guidance and involve the following: • An annual minimum flow (licenced compensation flow) • Spring flow elevations – to support fish migration • Late summer elevations – to disperse biota and superficial channel debris • Flood flows – to refresh channel habitats • Autumn/winter elevations – for dispersal and fish migration Seasonal flow elevations occur infrequently and for short periods of time (less than 24 hours).

<table>
<tr><td>Trigger for action</td><td>Weardale System, Derwent Reservoir, and Teesdale System reservoir control curves entering emergency storage.</td></tr>
<tr><td>Estimated benefit/saving</td><td>Dependent on location and season. See table below for maximum seasonal deployable output savings.
<table>
<tr><th></th><th colspan="3">Seasonal Flow Elevation Volume (Ml)</th></tr>
<tr><th>Drought Action</th><th>Spring</th><th>Later Summer</th><th>Autumn and Winter</th></tr>
<tr><td>Derwent Reservoir</td><td>132.3</td><td>136.1</td><td>3628.8</td></tr>
<tr><td>Fontburn</td><td>12.3</td><td>50.5</td><td>67.7</td></tr>
</table></td></tr>
<tr><td>Barriers to implementation</td><td>Drought permits required (risk of refusal).</td></tr>
<tr><td>Environmental impacts</td><td>See Appendix 13.</td></tr>
<tr><td>Timescales</td><td>4-6 weeks to apply for drought permit, ≤ 6 months with permit in place.</td></tr>
<tr><td>Priority order for implementation</td><td>Demand-side actions would be prioritised first.
This drought action is a level 3a which means it will not be implemented until the trigger has been met and the applicable Level 1 and 2 supply-side drought actions have been fully implemented within the relevant WRZ.
Implementation will be determined by storage level in each reservoir.</td></tr>
</table>

Drought Action name	Lowering Murton, Thornton Mains and Bleak Ridge Borehole Pumps
Drought Level	Level 3b
Water Resource Zone	Berwick & Fowberry WRZ
Drought Management Area	Berwick & Fowberry DrMA
Summary of Action	Lower borehole pumps in order to be able to maintain licenced output at increased drought groundwater level drawdown rate.
Trigger for action	If the groundwater level in Thornton Park observation borehole goes below the long-term average minimum this action will be put before the DMG for consideration. The action should be triggered if the groundwater level in an abstraction borehole is at ≤5m above its pump intake.
Estimated benefit/saving	The purpose of this action is to maintain normal operation.
Barriers to implementation	Contractor availability.
Environmental impacts	See Appendix 13.
Timescales	2-4 weeks
Priority order for implementation	This has been given an extreme drought action priority ranking of 1.

Drought Action name	Drought Permit at Bleak Ridge
Drought Level	Level 3b
Water Resource Zone	Berwick & Fowberry WRZ
Drought Management Area	Berwick & Fowberry DMA
Summary of Action	Increase abstraction licence from 1.55 Ml/d to 3.00 Ml/d (value derived from AMP6 sustainability investigation reported in NW, 2022).
Trigger for action	If the groundwater level in Thornton Park observation borehole goes below the long-term average minimum this action will be put before the DMG for consideration. The action should be triggered if it is considered that there is a risk of failure at any of the other boreholes.
Estimated benefit/saving	Gain an additional 1.45 Ml/d to support increased demand or if other supplies are struggling.
Barriers to implementation	Drought permit required (risk of refusal).
Environmental impacts	See Appendix 13.
Timescales	4-6 weeks to apply for drought permit, ≤ 6 months with permit in place.
Priority order for implementation	• This has been given an extreme drought action priority ranking of 2. • Demand-side actions would be prioritised first. • This drought action is a level 3b which means it will not be implemented until the trigger has been met and the applicable Level 1 and 2 supply-side drought actions have been fully implemented within the relevant WRZ.

Supply Side Drought Actions Rejection Register

This appendix details those supply-side drought actions included in our unconstrained list, but which were screened out as being infeasible. The drought action is described and the rejection reason given.

Drought Action name	Summary of action	Water Resource Zone	Rejection Reason
Cessation of environmental spate releases	The following four drought actions involving the temporary cessation of environmental spate releases have been rejected: • Grassholme Reservoir • Hury Reservoir • Waskerley Reservoir	Kielder WRZ	• These drought actions have been rejected due to the negligible likelihood they will ever be triggered. • In the full historical run of data available for Hury, Grassholme and Waskerley (1901 – 2016) they have never reached emergency storage level which is the trigger for the drought action. • The lowest levels recorded for Grassholme, Hury and Waskerley are 82.4%, 41.4% and 53.1% respectively. • Their respective triggers are 27.1%, 20.0 % and 26.0%. • As a result, the drought action does not meet the criteria for even an extreme (Level 3b) drought action.
Cessation of environmental spate releases	The following drought action involving the temporary cessation of environmental spate releases have been rejected: • Burnhope Burn Catchwater	Kielder WRZ	• This drought action has been rejected due to a lack of PWS benefit. • In our most recent drought (2025), the Burnhope Burn delivered baseline compensation flows into the Burnhope

			Burn throughout and the catchwater delivered 0 Ml/d into Derwent Reservoir between May and September. • Ceasing spate flows and reverting to baseline compensation flow will have no demonstrable impact on contributing water in Derwent Reservoir for abstraction for PWS, as demonstrated in 2025.
Sea Tankering	A service provided by EDRS (Extreme Drought Resilience Service https://edrsl.com/) to transport pristine raw water from Norway via sea tanker to a coastal location within our operational area.	Kielder Berwick & Fowberry	• High uncertainty with regards to regulatory support for activity from Defra, Environment Agency and Drinking Water Inspectorate. • Unquantified risk of INNS contamination.
Halton Lea Gate	Bring old, unused licence for small spring sites back into use, to ease pressure on reservoir fed systems. Licenced volume: 20-30m^3/hr.	Kielder	• Uncertain drought resilience of spring supply. • High cost as treatment infrastructure no longer exists. • Historical poor and variable water quality. • Disproportionately costly for volume of water gained.
Temporary Desalination	Desalination of Brackish Water via skid-mounted mobile Reverse Osmosis plant.	All	• Yield would be small (~5 Mld), constrained by the maximum size of plant transportable by road. • The locations for such a unit with an adequate supply of brackish water are limited to coastal or estuarine areas. • To feed directly into the network, every component of the plant would need to be Reg 31 compliant.

- Extensive testing required on source water for a large range of compounds to understand the requirement of the RO unit.
- DWI requirements for customer acceptability means blending capability would likely limit feasibility.
- The lead-in time to order, agree contractual arrangements with a supplier, plant delivery, plant commissioning and testing, and providing linkage to the supply network, is such that this action is infeasible.

Drought Permits/Orders

Drought permits and order are designed to help water companied manage water resources during drought. They are used when normal drought management measures, such as demand reduction, leakage control and Temporary Use Bans (TUBs) are insufficient.

A drought permit is issued by the Environment Agency (or Natural Resources Wales for Wales) under Section 79A of the Water Resources Act 1991. It authorises a water company to:

- Take water from a specified source.
- Temporarily modify or suspend restrictions or obligations on an existing abstraction or impoundment licence.

A drought order is made by the Secretary of State (or Welsh Ministers) under Sections 73–75 of the Water Resources Act 1991. There are two types:

- Ordinary drought order – allows actions such as:
    - Taking water from specified sources.
    - Restricting non-essential water uses (under Drought Direction 2011).
    - Suspending or modifying obligations on water abstraction, discharge, or supply.
- Emergency drought order – includes all ordinary drought order powers plus:
    - Setting up standpipes, rota cuts, or water tanks for emergency supply.

Our Drought Plan includes drought permits which cover a range of actions including:

- Reducing reservoir compensation flow
- Stopping UKTAG environmental spate flows
- Increasing groundwater abstraction

NW does not have any proposed drought actions which require a drought order. Table 1 lists our proposed drought permits. The actual final drought permits we will seek, will depend on the severity of the drought even, the time of year, and the specific location where water resources are scarce. It is also possible that additional drought permits/orders not included here, may be required. Each application for a drought permit will be assessed by the Environment Agency and there is no guarantee that it will be granted.

Table 1: Potential drought permits in the NW supply area

Drought Permit	Drought Action Summary
Burnhope Reservoir	Reduce compensation flow from 9.09 to 4.55 Ml/d
Derwent Reservoir	Stop environmental spate flows and revert to baseline compensation flow.
Fontburn Reservoir	Stop environmental spate flows and revert to baseline compensation flow.

Bleak Ridge Borehole	Increase abstraction licence from 1.55Ml/d to 1.92Ml/d

Drought Permit Applications

Each drought permit or drought order requires and application as well as supporting information. Please see Appendix 21 for detail on our drought permit applications.

APPENDIX 13: SUPPLY-SIDE ENVIRONMENTAL ASSESSMENT OUTCOMES

The following appendix provides a summary of the environmental assessments carried out for all of our supply-side drought actions. An Environmental Assessment Report (EAR) has been prepared for five of our supply-side drought actions: Burnhope Reservoir compensation discharge reduction, Derwent and Fontburn Reservoir cessation of environmental spate releases, Drought Permit at Bleak Ridge and the Kielder Transfer Scheme. Where an EAR has not been prepared, the Strategic Environmental Assessment (SEA) will be used to summarise the assessed environmental impact.

At the time of publication, the SEA is incomplete for our Drought Plan 2027. Please return on 7 July 2026 for a completed summary of the Strategic Environmental Assessment for each supply-side drought action without an EAR.

Raw water and water treatment works optimisation

Supply Side Drought Action Name		WTW optimisation
Supply side action information	**Supply action**	WTW optimisation - various activities including maximising water from non-stressed sources.
	Location (WRZ)	Kielder, Berwick & Fowberry
	Likelihood / Level of action	Level 0 (Business as usual)
	Trigger(s) Or preceding actions	On formation of Drought Management Group.
	Demand Saving or DO of action (Mld)	Dependent on WTW where activities possible.
	Implementation Timetable Preparation time, time of year effective, duration	Less than one week. During early stages of drought. Effectiveness of action may be dependent on raw water quality.
	Permissions required and constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	No permissions required.

	Risks associated with action	Effectiveness of action may be dependent on raw water quality.
Summary of environmental assessment (incl. mitigation measures)	**Overall environmental impact** (minor, moderate, major or uncertain)	
	Level of confidence (H, M, L)	
	Summary of likely environmental impacts	
	Summary of baseline information used	
	Summary of additional monitoring required	
	Summary of mitigation measures	
	Permits / approvals needs for mitigation measures	
	Impact on other activities, e.g. fisheries, industry	

The Kielder Transfer Scheme

Supply Side Drought Action Name		The Kielder Transfer Scheme
Supply side action information	**Supply action**	Kielder Transfer Scheme
	Location (WRZ)	Kielder WRZ
	Likelihood / Level of action	Level 0
	Trigger(s) Or preceding actions	Reservoir control curves and river minimum maintained flows are specified in the Kielder

		Operating Manual that set out how the Kielder Transfer Scheme is operated.
	Demand Saving or DO of action (Mld)	NA
	Implementation Timetable Preparation time, time of year effective, duration	NA
	Permissions required and constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	None. Transfers are within current licence.
	Risks associated with action	None.
Summary of environmental assessment (incl. mitigation measures)	**Overall environmental impact** (minor, moderate, major or uncertain)	Minor - The EAR demonstrates that the drought action will result in negligible to low changes in flow, hydraulics, water quality and geomorphological processes relative to baseline and drought conditions. Where changes are predicted, these are small in magnitude, localised and temporary in nature, and remain within the range of natural variability or within WFD class thresholds.
	Level of confidence (H, M, L)	• Confidence levels vary across receptors and impact pathways, reflecting data quality, baseline monitoring duration, and understanding of sensitivity thresholds. • High confidence assessments include geomorphology, and protected rights. • Medium confidence assessments include designated and non-statutory designated sites, priority habitats and protected species, INNS, invertebrates, and fish. • Other medium confidence assessments include recreation and tourism, economic, physical, and cultural. • Medium to low confidence assessment include macrophytes, and phytobenthos.
	Summary of likely environmental impacts	• Geomorphological impacts are limited to a short reach downstream of the TTT, where minor reductions in flow may result in temporary and reversible changes to sediment deposition and wetted margins.

		No long-term changes to channel form or function are anticipated. • Water quality modelling indicates minor changes in nutrient concentrations associated with altered source water composition; however, these do not result in deterioration of WFD status (with the exception of a localised reduction from High to Good for phosphate at Frosterley, which remains within acceptable ecological limits). Dissolved oxygen concentrations remain within High status across all scenarios. • Ecological receptors, including macroinvertebrates, fish, macrophytes and phytobenthos, are assessed as having low sensitivity to the predicted changes, reflecting their demonstrated resilience to historical variability within the catchments. No significant impacts are predicted on designated sites, priority habitats or protected species.
	Summary of baseline information used[16]	**EA Hydrology Data Explorer:** ▪ River flow at Reaverhill and Bywell, 1958 - present ▪ Rainfall data at Catcleugh Station, 1982 – present ▪ Groundwater level monitoring at Jubilee Bridge, Whitworth Hall, High Burnigill and Houghhall. **Water Quality Explorer:** ▪ Groundwater quality monitoring at Acomb (NE-400A0050), Old Westerton (NE-400H0067), Vinovium (NE-400H0048), Page Bank (NE-400H-0049) and Chester Moor (NE-400H0055). **Internal NW Data:** ▪ Kielder Reservoir level data, 1998 to present **EA Water Quality Archive:**

		▪ Surface water quality data at Kielder (EA WIMS sampling point NE-4310016) and Catcleugh (EA WIMS sampling point NE-431000104 & NE-43100100) **WFD water body information:** • EA Catchment Explorer **Geology:** • BGS Geology Viewer **Ecological Data:** • Ecology and fish data explorer (https://environment.data.gov.uk/ecology/explorer/). • Living England Habitat Map • National Biodiversity Network (NBN) Atlas for Invasive Non-Native Species (INNS) records (nbn.org.uk) • AMBER Barrier Atlas (https://amber.international/barrier-atlas/) • MAGIC Map (https://magic.defra.gov.uk/) • Natural England (https://designatedsites.naturalengland.org.uk/SiteSearch.aspx)
	Summary of additional monitoring required	**Baseline:** Macrophytes and Phytobenthos: LEAFPACS-compliant macrophyte survey • One survey prior to drought action **In-drought (per-permit application) & In-drought (post-implementation):** Water quality (Dissolved Oxygen): Spot measurement using handheld probe • Once prior to drought action implementation

		• Weekly during initial drought action implementation Fish: Walkover surveys and observational monitoring • Once prior to drought permit implementation • Weekly during initial drought permit implementation **Post-drought:** Macrophytes and Phytobenthos: LEAFPACS-compliant macrophyte survey • One survey during drought summer (if applicable) and one survey within 12 months post-drought
	Summary of mitigation measures	**Pre-drought:** All ecological receptors - Operation in accordance with agreed trigger thresholds and adaptive management through the Drought Management Group (DMG) **In-drought:** All ecological receptors - Operation in accordance with agreed trigger thresholds and adaptive management through the Drought Management Group (DMG) Water quality (all parameters) - Increased monitoring and review of operational regime; adjustment only if required Fish and aquatic ecology - Investigation and adaptive response if linked to drought action Designated sites - Site-specific review and consultation; adaptive management if required **Post-drought:** All receptors - Post-event review of monitoring data to confirm recovery to baseline conditions
	Permits / approvals needs for mitigation measures	None
	Impact on other activities, e.g. fisheries, industry	None

Coordination planning to minimise planned outage

Supply Side Drought Action Name		Outage reduction
Supply side action information	**Supply action**	Reduction of planned maintenance and / or bringing forward maintenance at all WTWs during early drought period.
	Location (WRZ)	Kielder, Berwick & Fowberry
	Likelihood / Level of action	Level 0 (Business as usual)
	Trigger(s) Or preceding actions	On formation of Drought Management Group.
	Demand Saving or DO of action (Mld)	Depends on types of maintenance activities able to be postponed or brought forwards.
	Implementation Timetable Preparation time, time of year effective, duration	Less than 1 week.
	Permissions required and constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	No permission required. Constraints and ability to deliver will vary depending on demand and outages elsewhere.
	Risks associated with action	Action not able to deliver benefits required.
Summary of environmental assessment (incl. mitigation measures)	**Overall environmental impact** (minor, moderate, major or uncertain)	
	Level of confidence (H, M, L)	
	Summary of likely environmental impacts	

	Summary of baseline information used	
	Summary of additional monitoring required	
	Summary of mitigation measures	
	Permits / approvals needs for mitigation measures	
	Impact on other activities, e.g. fisheries, industry	

Road Tankering to Allenheads and Carshields water treatment works

Supply Side Drought Action Name		**Tankering NW**[17]
Supply side action information	**Supply action**	Road tankering from Whittle Dene WTW to service reservoirs to augment spring supplies at Allenheads and Carshields WTW.
	Location (WRZ)	Kielder WRZ
	Likelihood / Level of action	Level 1
	Trigger(s) Or preceding actions	There are a few scenarios when we would consider moving water by road tanker: a) An immediate event or incident where customers are either off water or likely to go without water in the near future. b) In situations where we have a treatment or resource constraint that is likely to cause a supply deficit at periods of high demand typically the summer months. c) In situations where the network limits the transfer of water to certain parts of a supply zone i.e. we have sufficient water available but infrastructure restricts distribution. In terms of monitoring and escalation, the network analysis and coordination team would monitor the daily demands in all of the supply

[17] Essex & Suffolk Water (ESW) (2026). ESW Drought Plan 2027 Strategic Environmental Assessment (SEA) Environment Report

		zones. When demands are starting to increase we would start to hold regular supply meetings between key stakeholders, principally water supply, water networks, network analysis and coordination, and water resources teams. Key drivers for the need for tanker deployment would be: treatment works utilisation, storage situation and predicted weather. So if for example we were not filling a storage site overnight, then we would look at network or treatment interventions and if there are none then tanker deployment would be considered. Another example may be that all treatment works in a supply zone are at 100% capacity and therefore any increase in demand would result in a deficit, and this could lead to tanker deployment also.
	Demand Saving or DO of action (Mld)	Estimates of around 1 tanker a day (24 m^3 per tanker) per site for the required duration of the drought which conserves 0.03 Ml/d per tanker.
	Implementation Timetable Preparation time, time of year effective, duration	Within 24 hours for up to 4 tankers per day. Additional tankers would require a longer lead in.
	Permissions required and constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	No permissions required. Constraints TBC upon publication of NW SEA Report.
	Risks associated with action	Cannot obtain sufficient tankers. Cannot achieve volumes required.
Summary of environmental assessment (incl. mitigation measures)	**Overall environmental impact** (minor, moderate, major or uncertain)	
	Level of confidence (H, M, L)	
	Summary of likely environmental impacts	

	Summary of baseline information used	
	Summary of additional monitoring required	
	Summary of mitigation measures	
	Permits / approvals needs for mitigation measures	
	Impact on other activities, e.g. fisheries, industry	

Burnhope Reservoir

Supply Side Drought Action Name		**Burnhope Reservoir compensation discharge reduction**
Supply side action information	**Supply action**	Reduce compensation flow from Burnhope Reservoir from 9.09 Ml/d to 4.55 Ml/d
	Location (WRZ)	Kielder WRZ
	Likelihood / Level of action	Level 3a
	Trigger(s) Or preceding actions	Weardale System reservoir control curve entering emergency storage.
	Demand Saving or DO of action (Mld)	4.55 Ml/D
	Implementation Timetable Preparation time, time of year effective, duration	4-6 weeks
	Permissions required and constraints Including details of liaison carried out with bodies responsible for giving	Drought permit required from the Environment Agency

	any permits or approvals	
	Risks associated with action	Drought permit not granted.
Summary of environmental assessment (incl. mitigation measures)	**Overall environmental impact** (minor, moderate, major or uncertain)	Minor – The EAR demonstrates that this drought action will result in predominantly short-term, temporary, and fully reversible environmental impacts.
	Level of confidence (H, M, L)	• Confidence levels vary across receptors and impact pathways, reflecting data quality, baseline monitoring duration, and understanding of sensitivity thresholds. • High confidence assessments include hydrology, water quality, priority habitats, designated sites, socio economic, and heritage receptors. • High to medium confidence assessments including fish • Medium confidence assessments include geomorphology, macroinvertebrates, macrophtyes and phytobenthos, protected species, recreation, and INNS.
	Summary of likely environmental impacts	• Hydrological modelling demonstrates that the drought action will result in a worst case of 50% flow reduction immediately downstream of Burnhope Reservoir, declining progressively to <15% reduction as tributary inflows increase catchment yield. • Water quality modelling indicates that all physico-chemical parameters (dissolved oxygen, temperature, ammonia, phosphate, BOD, pH) will remain within WFD high classification thresholds across all modelled drought scenarios. • The temporary reduction in flow will lower water levels and flow energy, resulting in reduced sediment transport capacity, fine sediment deposition on riffle substrates, potential smothering of gravel habitats, and reduced floodplain connectivity. • Minor impacts are also predicted for priority habitats and designated sites, socio-economic and heritage receptors and INNS.

		• Ecological impacts range dependent on timing of implementation, with moderate impacts on fish populations, and minor impact on macrophytes, macroinvertebrates, and phytobenthos.
	Summary of baseline information used	**EA Hydrology Data Explorer:** - Rainfall data at Burnhope station 021228, 1990 to present ▪ River flow at Stanhope station 24003, 1958 to present **Internal NW Data:** ▪ Burnhope Reservoir level data, 1998 to present **EA Water Quality Archive:** ▪ Surface water quality data at Wear at West Blackdene NE-44100221, Wear at Huntshield NE-44100408, Wear at Shallow Ford NE-44100272, Wear at Westgate NE-44100199, Wear downstream of Western Area NE-44100426, Wear upstream of Cambokeel Mine Discharge NE-44100427, Wear downstream of Cambokeel Mine NE-44100428, Wear upstream of Rookhope Burn NE-44100429, Wear at Eastgate NE-44100027, Wear downstream Stanhope Gauging Station NE-44100335, Wear upstream of Shittlehope Burn NE-44100003, Wear downstream Frosterley Bridge NE-44100423, 2000 to present **WFD water body information:** • EA Catchment Explorer **Geology:** • BGS Geology Viewer **Ecological Data:** • Ecology and fish data explorer (https://environment.data.gov.uk/ecology/explorer/).

		• National Biodiversity Network (NBN) Atlas for Invasive Non-Native Species (INNS) records (nbn.org.uk) • AMBER Barrier Atlas (https://amber.international/barrier-atlas/) • MAGIC Map (https://magic.defra.gov.uk/) • Natural England (https://designatedsites.naturalengland.org.uk/SiteSearch.aspx) • River Wear fish counts - GOV.UK
	Summary of additional monitoring required	**Baseline:** ▪ Continuous flow monitoring of Burnhope Burn ▪ Quantitative fish, macroinvertebrate and macrophyte and phytobenthos surveys In-drought (per-permit application): ▪ Spot gauging, water quality sampling and fish observation walkovers once immediately before drought permit application **In-drought (post-implementation):** ▪ Spot gauging once within 2 weeks of drought permit implementation ▪ Water quality sampling weekly during drought permit implementation ▪ Fish walkovers twice weekly for first 2 weeks of drought permit implementation then weekly thereafter. **Post-drought:** ▪ Spot gauging once within 2 weeks of cessation of drought permit. ▪ Fish (quantitative) early September in year following drought permit cessation. ▪ Macroinvertebrate surveys spring and autumn at 6-, 12-, and 24-months post-drought Summer macrophyte survey. Diatoms: spring and autumn at 6- and 12-months post-drought

	Summary of mitigation measures	**Pre-drought:** Avoiding implementation in critical ecological periods Advanced warning of drought action implantation to recreational users and water dependent businesses **In-drought:** Freshets for water quality and fish impeded by barriers, river aeration for water quality Fish rescue for fish in distress Lowering of equipment for abstractors unable to access lower river levels
	Permits / approvals needs for mitigation measures	Any mitigation measures implemented on third party land will require landowner permission.
	Impact on other activities, e.g. fisheries, industry	None predicted

Derwent Reservoir cessation of environmental spate flows

Supply Side Drought Action Name		**Derwent Reservoir cessation of environmental spate flows**
Supply side action information	**Supply action**	Cease environmental spate releases and revert to licenced compensation flow.
	Location (WRZ)	Kielder WRZ
	Likelihood / Level of action	Level 3a
	Trigger(s) Or preceding actions	Derwent Reservoir control curve entering emergency storage.
	Demand Saving or DO of action (Mld)	Dependent on season: • Spring – 132.2 Ml • Late Summer – 136.1 Ml • Autumn/winter – 1814.4 Ml
	Implementation Timetable	4-6 weeks to apply for drought permit, ≤ 6 months with permit in place.

	Preparation time, time of year effective, duration	
	Permissions required and constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Drought permit required from the Environment Agency
	Risks associated with action	Drought permit not granted.
Summary of environmental assessment (incl. mitigation measures)	**Overall environmental impact** (minor, moderate, major or uncertain)	The EAR identifies predominantly low- to medium-magnitude environmental effects that are short-term and reversible. Hydrological changes occur only during the periods when spate releases would otherwise take place, resulting in temporary reductions in flow depth, velocity and wetted perimeter. These effects are limited in duration and spatial extent, and normal flow variability would be restored once the programmed spate flow regime resumes following drought conditions.
	Level of confidence (H, M, L)	• Confidence levels vary across receptors and impact pathways, reflecting data quality, baseline monitoring duration, and understanding of sensitivity thresholds. • Medium confidence assessments include statutory and non-statutory designated sites, priority habitats and species, INNS, invertebrates, phytobenthos, and fish. • Other medium confidence assessments include protected rights, recreation, economic, and cultural receptors. • Low confidence assessments include macrophytes
	Summary of likely environmental impacts	• Water quality analysis indicates that the drought action is unlikely to cause deterioration in physico-chemical parameters and may result in a minor beneficial effect downstream due to the reduced release of reservoir water relative to natural river flows. • Geomorphological responses are predicted to be minor and temporary, reflecting reduced short-duration sediment mobilisation during missed spate events,

		with recovery expected following reinstatement of the normal flow regime. • Ecological receptors are generally assessed as having low sensitivity, with minor significance of effect identified for most receptor groups. Fish populations are assessed as having medium sensitivity due to their reliance on riffle habitats and flow variability; however, predicted impacts remain temporary and reversible. Temporary reductions in riffle habitat availability may affect foraging conditions for species such as dipper, kingfisher and certain invertebrates, but population-level effects are not anticipated. • Statutory and non-statutory designated sites within the ZoI are not expected to experience adverse effects as a result of the drought action. Predicted changes in flow conditions remain within the range of natural hydrological variability experienced within the catchment. • Risks associated with invasive non-native species are considered low and limited to temporary exposure of marginal habitats. • Potential effects on recreation, tourism and local amenity are expected to be minimal. Access to Derwent Reservoir and the wider river corridor would remain unchanged, and any visual changes to river conditions during implementation would be temporary. • Cultural heritage receptors are not directly affected and no structural risks to heritage assets have been identified.
	Summary of baseline information used	**EA Hydrology Data Explorer:** ▪ River flow at Eddys Bridge. ▪ Rainfall data at Tunstall Station, 1982 – present **Internal NW Data:** ▪ Derwent Reservoir level data, 1998 to present **EA Water Quality Archive:** • Surface water quality data at Derwent from Nookton Burn to Burnhope Burn Upstream of Whiteheaps Mines NE-43400234 , Boltsburn D/S Boltswell Sike NE-43400006, Bolts Burn at Stanhope Road Bridge NE-43400009, Bolts Burn Upstream

		of Dehorah Mine Site NE-43400244, Bolt Burn U/S Derwent Confluence NE-43400012, Derwent U/S Bolts Burn NE-43400004, Shilton Burn at Blanchland NE-43400216, River Derwent U/S Shildon Burn adj to Play Area NE-43400246, River Derwent U/S Blanchland STW NE-43400247, Derwent at Carnchs Picnic Site (Ruffside Hall) NE-43400042, Derwent Reservoir at the Dam Wall Southern End NE-43400210, Derwent Reservoir at Mosswood WTW NE-43400144, Derwent D/S Derwent Reservoir (Derwent Bridge) NE-43300156 **WFD water body information:** • EA Catchment Explorer **Geology:** • BGS Geology Viewer **Ecological Data:** • Ecology and fish data explorer (https://environment.data.gov.uk/ecology/explorer/). • Living England Habitat Map • Joint Nature Conservation Committee • National Biodiversity Network (NBN) Atlas for Priority Species and Invasive Non-Native Species (INNS) records (nbn.org.uk) • AMBER Barrier Atlas (https://amber.international/barrier-atlas/) • MAGIC Map (https://magic.defra.gov.uk/) • Natural England (https://designatedsites.naturalengland.org.uk/SiteSearch.aspx)
	Summary of additional monitoring required	**Baseline:** Water quality (Temperature, DO): Spot measurement using handheld probe

		• Once prior to drought permit implementation Fish: Walkover surveys and observational monitoring • Once prior to drought permit implementation Invertebrates: Standard 3-minute kick sampling • Once prior to drought permit implementation **In-drought (per-permit application) & In-drought (post-implementation):** Geomorphology: Habitat walkover surveys • Monthly during drought permit implementation Water quality (Temperature, DO): Spot measurement using handheld probe • Weekly during initial drought permit implementation Fish: Walkover surveys and observational monitoring • Weekly during initial drought permit implementation Invertebrates: Standard 3-minute kick sampling • Additional sampling post-implementation if drought persist for ≥ 3 months **Post-drought:** Geomorphology: Habitat walkover surveys • Once at 6-12 months post-drought Fish: Observational monitoring • 1 walkover following cessation of drought action Invertebrates: Standard 3-minute kick sampling

		• Spring and autumn surveys at 6, 12 and 24-months post drought Macrophytes and Phytobenthos: LEAFPACS-compliant macrophyte survey • Optional survey at 12 months post-drought
	Summary of mitigation measures	**Pre-drought:** All ecological receptors - Operation in accordance with agreed trigger thresholds and adaptive management through the Drought Management Group (DMG) **In-drought:** All ecological receptors - Operation in accordance with agreed trigger thresholds and adaptive management through the Drought Management Group (DMG) Water quality (all parameters) - Increased monitoring and review of operational regime; adjustment only if required Fish and aquatic ecology - Investigation and adaptive response if linked to drought action Designated sites - Site-specific review and consultation; adaptive management if required **Post-drought:** All receptors - Post-event review of monitoring data to confirm recovery to baseline conditions
	Permits / approvals needs for mitigation measures	Any mitigation measures implemented on third party land will require landowner permission.
	Impact on other activities, e.g. fisheries, industry	No impacts predicted.

Fontburn Reservoir

Supply Side Drought Action Name	Fontburn Reservoir cessation of environmental spate flows

Supply side action information	**Supply action**	Stop environmental spate releases and revert to licenced compensation flow.
	Location (WRZ)	Kielder WRZ
	Likelihood / Level of action	Level 3a
	Trigger(s) Or preceding actions	Teesdale system reservoir control curve entering emergency storage.
	Demand Saving or DO of action (Mld)	Dependent on season: • Spring – 12.3 Ml • Late Summer – 50.5 Ml • Autumn/winter – 67.7 Ml
	Implementation Timetable Preparation time, time of year effective, duration	4-6 weeks
	Permissions required and constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Drought permit required from the Environment Agency
	Risks associated with action	Drought permit not granted.
Summary of environmenta l assessment (incl. mitigation measures)	**Overall environmental impact** (minor, moderate, major or uncertain)	Minor – the EAR demonstrated short-term, localised and reversible, and baseline conditions would be restored following reinstatement of the normal flow regime.
	Level of confidence (H, M, L)	• Medium confidence in - water quality assessment, hydraulic modelling, geomorphology, macrophytes, priority habitats/species, designated sites, INNS, fish, protected rights, recreation/tourism, economic receptors, heritage receptors and physical/cultural receptors. • Low confidence in invertebrates and phytobenthos

	Summary of likely environmental impacts	• Hydraulic modelling indicated a medium level of impact on both velocity and depth across all seasons, however this would only occur for short periods of time where the spate flows are removed. • Water quality analysis indicated that the drought action is unlikely to cause deterioration in physico-chemical WFD classification as no change in concentration of point source or diffuse inputs is expected at Q50 flows. Water quality in Fontburn Reservoir and the River Font are considered similar, so no changed is expected when less water is released. • Geomorphological responses are predicted to be minor and temporary, reflecting reduced short-duration sediment mobilisation during missed spate events, with recovery expected following reinstatement of the normal flow regime. • Invertebrates were assessed to have medium sensitivity and macrophyte/phytobenthos were assessed to have low sensitivity, with minor significance of effect identified for both receptor groups. Fish populations were assessed as having medium sensitivity due to their reliance on riffle habitats and flow variability; however, predicted impacts remain temporary and reversible. • Statutory and non-statutory designated sites within the ZoI are not expected to experience adverse effects as a result of the drought action. • Risks associated with invasive non-native species were considered low all INNS are already present in the watercourse, and reduced flow limits seed transport. • Protected and priority species/habitats were assessed as having low sensitivity with minor impact across all seasons. • Sensitivity of designated sites ranged from non-sensitive to minor sensitivity, with all sites being assessed to have an impact of Minor by the drought action. • Potential effects on recreation, tourism and local amenity are expected to be minimal. Access to Fontburn Reservoir and the wider river corridor would remain unchanged, and any visual changes to river conditions during implementation would be temporary.

		• Cultural heritage receptors are not likely to be directly affected and no structural risks to heritage assets have been identified. • No significant cumulative or in-combination effects are predicted.
	Summary of baseline information used	**EA Hydrology Data Explorer:** ▪ River flow at Mitford Station, 1963 - present. ▪ Rainfall data at Font Station, 1982 – present ▪ Flow gauging station at Nunnykirk. **Internal NW Data:** ▪ Abstraction data from Fontburn Reservoir. ▪ Weekly water level dips from Fontburn Reservoir. **EA Water Quality Archive:** • Surface water quality data at Fontburn Reservoir Water Body (GB30327677) from Fallowlees Burn U/S Fontburn Reservoir (NE-42500181), Newbiggin Burn U/S Fontburn Reservoir (NE-42500182), Fontburn Reservoir (NE-42500013), Fontburn Reservoir at Boat Jetty (NE-42500104). • Surface water quality data at Font from Source to Wansbeck Water Body (GB103022076510) from RSN0431 Newbiggin Burn at Fallowelees (NE-RSN0431), Fontburn WTW U/S Fish Rearing Ponds (NE-42500011), Font Adjacent to Fontburn WTW (NE-42500204), River Font at Nunnykirk (NE-RTN0054), Font at Netherwitton (NE-42500135), Font at Mitford (NE-42500136). • Surface water quality data at Wansbeck from Font to Bothal Burn Water Body (GB103022077061) from Wansbeck at Mitford (NE-42500031), Wansbeck at Mitford Intake (NE-42500139), Wansbeck C.25M D/S Bakehouse Steps (NE-42500224), Wansbeck Just Upstream Morpeth STW (NE-42500091), Wansbeck Just U/S Confluence of How Burn (NE-42500093), Wansbeck at Mill House (Bothal Bridge) (NE-42500094). • Surface water quality data at Wansbeck from Bothal Burn to North Sea

		(GB103022077062) from Wansbeck at Bothal Castle Footbridge (NE-42500225) and Wansbeck at Sheepwash Dam (NE-42500030). **WFD water body information:** • EA Catchment Explorer **Geology:** • BGS Geology Viewer **Ecological Data:** • Ecology and fish data explorer (https://environment.data.gov.uk/ecology/explorer/). • Living England Habitat Map • Joint Nature Conservation Committee • National Biodiversity Network (NBN) Atlas for Priority Species and Invasive Non-Native Species (INNS) records (nbn.org.uk) • Environmental Records Information Centre for the North East of England (ERICNE) • River Obstacles platform. • MAGIC Map (https://magic.defra.gov.uk/) • Natural England (https://designatedsites.naturalengland.org.uk/SiteSearch.aspx)
	Summary of additional monitoring required	**Baseline:** Water Quality - physico-chemical (temperature, dissolved oxygen and pH): • Spot measurements using handheld multi-parameter probe during habitat walkover in Spring and Autumn. Fish: • Surveys to count and map salmon/trout redds in the winter for 2 seasons. • Electrofishing survey at 2 sites to establish a baseline to supplement existing datasets. Invertebrates:

		• 3-minute kick sampling at 4 EA monitoring sites in Spring and Autumn prior to drought application. **In-drought pre-permit application and in drought post-implementation:** Water Quality - physico-chemical (temperature, dissolved oxygen and pH): • One spot measurement immediately prior to application and monthly during implementation, with frequency to be re-visited following monitoring of environmental triggers. Fish: • One winter survey to count and map salmon/trout redds. • Non-intrusive behavioural observations during drought. • One fish habitat condition survey immediately prior to drought permit implementation, increasing to monthly during implementation. Invertebrates: • 3-minute kick sampling at 4 EA monitoring sites in Spring and Autumn prior to drought application if baseline data gap is identified. • Additional sampling if drought permit implementation exceeds 3 months, or ecological trigger monitoring indicates a potential impact. **Post-drought frequency:** Fish: • Winter redd survey in winters following drought to assess spawning recovery. • Electrofishing survey every 3 years. Invertebrates: • Optional verification 3-minute kick sampling at 4 EA monitoring sites post-drought if ecological change is suspected.
	Summary of mitigation measures	• Drought action planning to try avoid ecologically sensitive periods. • If dissolved oxygen or temperature approach trigger values-

		– Consider re-introduction of some spate flows. – Deployment of temporary aeration measures. – Consider early withdrawal or modification if conditions exceed 5 days. • Assess need to local habitat adjustments or fish rescue if fish distress is observed. • Consider re-introduction of some spate flows where salmonids are seen to migrate and become trapped downstream of barriers/sediment is smothering the gravel bed.
	Permits / approvals needs for mitigation measures	Any mitigation measures implemented on third party land will require landowner permission.
	Impact on other activities, e.g. fisheries, industry	None identified.

Drought Permit at Bleak Ridge

Supply Side Drought Action Name		**Drought Permit at Bleak Ridge**
Supply side action information	**Supply action**	Increase abstraction licence from 1.55 Ml/d to 3.00 Ml/d
	Location (WRZ)	Berwick & Fowberry
	Likelihood / Level of action	Level 3b
	Trigger(s) Or preceding actions	• If the groundwater level in Thornton Park observation borehole goes below the long-term average minimum this action will be put before the DMG for consideration. • The action should be triggered if it is considered that there is a risk of failure at any of the other boreholes.
	Demand Saving or DO of action (Mld)	1.45 Ml/d
	Implementation Timetable	4-6 weeks

	Preparation time, time of year effective, duration	
	Permissions required and constraints Including details of liaison carried out with bodies responsible for giving any permits or approvals	Drought permit required from the Environment Agency
	Risks associated with action	Drought permit not granted.
Summary of environmental assessment (incl. mitigation measures)	**Overall environmental impact** (minor, moderate, major or uncertain)	Minor – The EAR demonstrates that this drought action will result in predominantly short-term, temporary, and fully reversible environmental impacts.
	Level of confidence (H, M, L)	• Confidence levels vary across receptors and impact pathways, reflecting data quality, baseline monitoring duration, and understanding of sensitivity thresholds. • High confidence assessments include absence of groundwater-surface water connectivity, supported by comprehensive hydrological analysis demonstrating that local watercourses are maintained by rainfall runoff rather than aquifer baseflow during low-flow conditions. • High confidence also applies to socio-economic and geomorphological assessments given confirmed absence of impact pathways through receptor screening and field verification. • Medium confidence assessments include groundwater quality chemistry predictions, habitat recovery timescales ranging from 6 to 24 months, and abstraction impact magnitude on groundwater levels at specific observation boreholes. • Low to medium confidence assessments include groundwater dependence of lowland raised bog and lowland fen habitats.

	Summary of likely environmental impacts	• Groundwater level drawdown in the Till Fell Sandstone aquifer is constrained by geological barriers and limited to the immediate zone of influence, with recovery expected within 6-12 months. • No groundwater-surface water connectivity exists during drought conditions, eliminating impact pathways to local watercourses, geomorphological processes, and aquatic ecology. • Water quality changes are expected to remain within acceptable ranges and WFD thresholds, reversible within 3-6 months post-drought. • Minor adverse effect on priority habitats outside of ZoI (lowland raised bog and lowland fen) as they are predominately rainfall-fed. • Protected species (water vole and great crested newt) have no confirmed recent presence or viable impact pathways given absence of groundwater-surface water connectivity. • No statutory designated sites including within or adjacent to the ZoI have ecological features reliant upon groundwater from the Fell Sandstone aquifer. • No hydraulic connectivity with other water abstraction licences or abstraction protected rights were identified within the ZoI, eliminating impact pathways to downstream water users. • No recreational facilities, heritage assets, tourism attractions, or public access areas exist within the ZoI or immediate surroundings. • Existing economic receptors within the ZoI are unaffected as no ground disturbance or construction is proposed.
	Summary of baseline information used	**Abstraction data:** • Internal NW data for recent actual at Bleak Ridge borehole **Rainfall:** • EA Hydrology Data Explorer - Berwick station, 1999 - present **WFD water body information:**

		• EA Catchment Explorer **Geology:** • BGS Geology Viewer • Academic papers **Groundwater Level Monitoring:** • Bleak Ridge borehole groundwater levels • EA observation borehole groundwater levels. **Ecological Data:** • Magic (https://magic.defra.gov.uk/) • Natural England (https://designatedsites.naturalengland.org.uk/SiteSearch.aspx) • Living England Habitat Map
	Summary of additional monitoring required	**Baseline:** Groundwater levels : • Monthly manual dips at EA Observation Boreholes for a period greater than 12 months to establish a baseline. • Continue operational baseline continuous pressure transducer with telemetry at Bleak Ridge. Water quality - Physico-chemical (Temperature °C, pH, Electrical Conductivity µS/cm, Dissolved Oxygen mg/l): • Continuous in-line telemetry probes at Bleak Ridge with continuous data, probes calibrated monthly. Water quality – Chemical Determinands (Nitrate NO_3, Nitrite NO_2, Ammonium NH_4, Phosphate PO_4, major ions Ca Mg Na K Cl SO_4, trace metals Fe Mn As Pb): • Monthly Laboratory analysis at Bleak Ridge for a period greater than 12 months to establish a baseline.

		In-drought (post-implementation): Groundwater levels: • Weekly manual dips at EA Observation Borehole. • Real-time review of continuous pressure transducer with telemetry at Bleak Ridge Water quality - Physico-chemical (Temperature °C, pH, Electrical Conductivity µS/cm, Dissolved Oxygen mg/l) : • Real-time review of continuous data from telemetry probes at Bleak Ridge, with automated alerts for anomalies. Water quality – Chemical Determinands (Nitrate NO_3, Nitrite NO_2, Ammonium NH_4, Phosphate PO_4, major ions Ca Mg Na K Cl SO_4, trace metals Fe Mn As Pb): • Monthly Laboratory analysis at Bleak Ridge. **Post-drought:** Groundwater levels : • Monthly for 12 months manual dips at EA Observation Borehole, with a final survey at 24-months. • Continuous for 6 months pressure transducer with telemetry at Bleak Ridge, then revert to operational. Water quality - Physico-chemical (Temperature °C, pH, Electrical Conductivity µS/cm, Dissolved Oxygen mg/l): • Continuous for 6 months in-line telemetry probes at Bleak Ridge with continuous data, then revert to operational monitoring. Water quality – Chemical Determinands (Nitrate NO_3, Nitrite NO_2, Ammonium NH_4, Phosphate PO_4, major ions Ca Mg Na K Cl SO_4, trace metals Fe Mn As Pb):

		• Monthly for 6 months laboratory analysis at Bleak Ridge, then revert to operational monitoring.
	Summary of mitigation measures	• Implement early withdrawal protocol with staged abstraction reduction (3.0 → 2.5 → 2.0 → 1.55 Ml/d) if environmental monitoring indicates ecological stress. • Full withdrawal to original licence (1.55 Ml/d) within 48 hours if severe triggers breached. • Share monthly groundwater quality data from the Till Fell Sandstone catchment with the EA during and post-drought. Request notification of any pollution incidents or consented discharges during drought period to distinguish drought action effects from external pollution sources.
	Permits / approvals needs for mitigation measures	None
	Impact on other activities, e.g. fisheries, industry	Socio-economic, heritage, and physical receptors within the Zone of Influence were screened out. No abstraction licences, recreational activities, heritage assets, or cultural features are present within the Zone of Influence that would be sensitive to groundwater abstraction. Existing infrastructure is unaffected.

APPENDIX 14: METERING

Water metering is an important part of our strategy for managing demand. Meter penetration in our region currently stands at 47.5% (as of 01 January 2026).

We actively promote the benefits of installing a water meter to our customers including that installation is free, that it can help reduce usage and therefore reduce their water bill.

It is our policy to meter the following types of domestic property:

- all customers who opt to have a meter;
- all new properties; and
- properties where water is used in significant quantities, including:
  - for garden watering, other than by hand-held apparatus. This includes the use of sprinklers; and
  - for the automatic replenishing of ponds or swimming pools with a capacity greater than 10,000 litres. Unmetered bills will draw customers' attention to this.

Customers are required to notify us if they are using water for any of these purposes. Arrangements will be then made to fit a meter at no cost to them. During a drought, particularly prior to the introduction of any restrictions on water use, the requirement for large discretionary users of water to have a meter installed will be emphasised in our drought communications.

We have made considerable progress over recent years to increase meter penetration in order to support customers in reducing their water use and bills. This has included encouraging customers to opt for a free meter by giving annual information on free meter installation in our billing documentation, numerous metering campaigns over the years and a programme of selective meter installations on non-household properties.

As per our WRMP24, in April 2025 we introduced a whole area metering scheme, where we would install meters in existing boundary boxes, however, the customer will not automatically be charged by the meter. These customers would be given 6 monthly comparison letters to enable them to decide whether a measured tariff would be beneficial to them.

If a customer opts to switch to a measured tariff, they will have the same rights to revert to an unmeasured tariff within two years of them switching, as a customer applying for a meter would. Any change in occupation on these premises that have not switched to the measured tariff, will automatically be charged by the meter when the new occupier moves in.

During drought, we will enhance our promoting of the uptake of water meters.

APPENDIX 15: TEMPORARY USE BANS DEFINITIONS

Definition of "using a hosepipe"

For the purposes of a TUB, we have used the definition of "using a hosepipe" as that given in the Water Use (Temporary Bans) Order 2010 as follows:

a) Drawing relevant water through a hosepipe;
b) Drawing relevant water through a hosepipe from a container and applying it for the purpose; and
c) Filling or partly filling a container with relevant water by means of a hosepipe and applying it for the purpose.

A reference to a hosepipe includes anything designed, adapted or used for the same purpose as a hosepipe. "Relevant water" refers to mains water i.e. supplied by the water undertaker; it does not include water supplied before the water restriction was implemented.

The legislation does not state any exemptions to the definition of a hosepipe.

We considered whether micro-irrigation systems should be exempted from a temporary use ban but concluded that they should not be exempted. Whilst we recognise micro-irrigation systems use water more efficiently than a hosepipe or sprinkler, a 1 in 20 year ban is more about conserving water than using water more efficiently. If micro-irrigation was exempted from a hosepipe ban, more systems would be sold during the ban thereby decreasing some of the volume of water conserved from the imposition of the hosepipe ban.

The above definition of a hosepipe applies to all of the 11 categories detailed below:

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

Although all of these uses of hosepipes are banned, it is important to note that during any TUB, gardens may still be watered:

- by hand using a bucket or watering can;
- with grey-water (ex bath/ washbasin water) through a hosepipe; and / or
- using rainwater from a water-butt through a hosepipe (assuming sufficient rainfall).

Further explanation of uses to be banned

Watering a garden using a hosepipe

The definition of "a garden" has been widened and clarified under the Water Use (Temporary Bans) Order 2010. We intend to ban the use of watering using a hosepipe for all categories allowed to be banned, with no exceptions.

The areas where watering a garden using a hosepipe will be banned under Phase 1 are:

a) a domestic garden
b) a park
c) gardens open to the public
d) a lawn
e) a grass verge
f) an area of grass used for sport or recreation
g) an allotment garden
h) any area of an allotment used for non-commercial purposes
i) any other green space

Exemptions: Under legislation a "garden" does not include the following, meaning hosepipe use is allowed to continue in these areas under a Phase 1 temporary use ban.

a) agricultural land
b) other land used in the course of a business for the purposes of growing, for sale or commercial use, any crops, fruit, vegetables or other plants.
c) land used for the purpose of a National Plant Collection.
d) a temporary garden or flower display
e) plants (including plant organs, seeds, crops and trees) which are in an outdoor pot or in the ground, under cover. NB for domestic purposes watering of these by a hosepipe is still banned under our Phase 1 but it comes under a different category in the legislation.

(Legislation excludes the banning of "watering a garden using a hosepipe" when the use is for "health or safety reasons". However, use of this exclusion is likely to be rare and the company would scrutinize the genuineness of such a claim).

Cleaning a private motor-vehicle using a hosepipe

Washing of any private motor vehicle, using a hosepipe is banned. This includes commercial car wash businesses that use hosepipes or pressure washers to wash customer's cars. Private cars can still be washed by householders and commercial businesses by hand using water from a bucket.

Exemptions: Legislation excludes:

a) a public service vehicle, as defined in section 1 of the Public Passenger Vehicles Act 1981; and
b) a goods vehicle as defined in section 192 of the Road Traffic Act 1988.

NB. Taxis and minicabs are public service vehicles and are therefore excluded from the ban.

Commercial carwashes, that do not use a hosepipe or similar apparatus, are also exempt from this ban.

Watering plants on domestic or other non-commercial premises using a hosepipe

This category covers the banning of watering by a hosepipe of plants which are in an outdoor pot or in the ground, under cover (predominantly plants growing in a greenhouse border).

"Domestic or other non-commercial premises" means

a) Any land, building or other structure used or enjoyed in connection with the use of any of the following which is used principally as a dwelling:

   - A building or part of a building
   - A caravan
   - A boat
   - Any land or premises which is not used principally for the purpose of a business

Exemptions: Legislation defines some exemptions: -

- Plants in outdoor pots and in the ground, undercover in public authority premises
- Plants in outdoor pots and in the ground, undercover in commercial premises
- Plants grown or kept for sale or commercial use
- Plants that are part of a National Collection or temporary garden or flower display.

Whilst Local Authorities are not restricted in their watering of plants, using a hosepipe, in outdoor pots or in the ground, under cover by the Phase 1 ban, we would expect them to also cease watering this category when a ban is imposed. This is likely to be seen to be fairer by the public and helps to fulfil a Local Authority's duty under the Water Act 2003 to conserve water.

Cleaning a private leisure boat using a hosepipe

Using a hosepipe to clean a private leisure boat is banned. A private leisure boat is defined as "a vessel or other thing, other than a seaplane, which is designed, constructed or adapted to move through, in, on or over water". Boats in private ownership only are included, whether trailer launched or not. The ban includes all small watercraft also e.g. canoes, kayaks, jet skis etc.

Exemptions: Legislation exempts the following:

- Vessels used in the course of a business
- Vessels made available or accessible to the public

- Cleaning of any area of a private leisure boat which, except for doors and windows, is enclosed by a roof and walls
- Using a hosepipe to clean a private leisure boat for health or safety reasons.

Filling or maintaining a domestic swimming or paddling pool

A domestic swimming or paddling pool is defined as swimming or paddling pool, other than a pool that is being used for the purpose of a business, which is:

a) in a building or part of a building used principally as a dwelling; or
b) on any land or in any building that is used or enjoyed in connection with (a).

Exemptions: Legislation excludes filling or maintaining a pool:

a) where necessary in the course of its construction
b) using a hand-held container filled with water drawn directly from a tap
c) that is designed, constructed or adapted for use in the course of a programme of medical treatment
d) used for the purpose of decontaminating animals from infections or disease
e) used in the course of a programme of veterinary treatment
f) in which fish or other aquatic animals are being reared or kept in captivity.

Drawing water, using a hosepipe, for domestic recreational use

This category covers the banning of the use of a hosepipe to operate water slides or other domestic recreational equipment. This is interpreted to mean both slides designed to be used with water and any temporary or ad hoc water slides or sprinklers. Recreational use covers the use by adults or children.

Exemptions: There are no legislative exemptions.

Filling or maintaining a domestic pond using a hosepipe

This restriction is fairly limited in the number of ponds likely to be affected. A wider ban on filling ponds comes in under the Phase 2 restrictions and requires the company obtaining a Drought Order under the Drought Direction 2011. A “domestic pond” is defined as a pond, including a swimming pond, on land that is used in connection with a building, or part of a building, used principally as a dwelling; and is not being used for the purpose of a business. A pond can be natural or man-made and can be internal or external and includes ornamental ponds.

Exemptions: Legislation excludes filling or maintaining a pond in which fish or other aquatic animals are being reared or kept in captivity.

Filling or maintaining an ornamental fountain

This category covers any water fountain or water cascade that serves a purpose that is primarily decorative. This includes sculptures that have a water component. Filling by any means is banned including permanent plumbing.

This ban applies equally to fountains, cascades and sculptures using water that are privately owned or publicly owned. It also applies to features that use recycled water.

Exemptions; Legislation exempts the filling or maintaining of an ornamental fountain which is on or near a fishpond and whose purpose is to supply sufficient oxygen to the water in the pond in order to keep the fish healthy.

Cleaning walls, or windows, of domestic premises using a hosepipe

This category refers to the cleaning of walls or windows on domestic premises using a hosepipe. The restriction also applies to businesses cleaning domestic walls or windows using such apparatus as water-fed poles.

A domestic premise is defined as:

a. A building used principally as a dwelling or dwellings
b. A garage, shed, outbuilding or other building or structure used or enjoyed in connection with a building used principally as a dwelling; or
c. A wall or other means of enclosure within the cartilage of a building used principally as a dwelling.

Exemptions: Legislation exempts cleaning activities for health and safety reasons. However, these are likely to be rare with health or safety reasons likely to be restricted to:

- Removing or minimising any risk to human or animal health or safety; and
- Preventing or controlling the spread of causative agents of disease.

Cleaning paths or patios using a hosepipe

This ban on use applies regardless of who is carrying out the cleaning and regardless of whether they are on domestic or commercial premises. The ban applies whatever the paths or patios are made of.

Exemptions: Legislation only exempts cleaning using a hosepipe for health or safety reasons. Again, these exemptions are likely to be rare and similar to the exemptions for H & S given in (**9**).

Cleaning other artificial outdoor surfaces using a hosepipe

This category bans the use of a hosepipe for outdoor cleaning of artificial surfaces regardless of who is doing the cleaning and regardless of whether the premises are domestic or commercial. Artificial outdoor surfaces are defined as:

a) Any area outdoors which is paved or laid with hard or artificial material;
b) Timber decking;
c) A quay (including a jetty, pontoon, wharf or slipway).
d) A trailer designed, constructed or adapted to launch boats or other vessels or craft into water, other than a private motor vehicle
e) The roof of any domestic premises.

Exemptions: Legislation only exempts cleaning using a hosepipe for health or safety reasons. Again, these exemptions are likely to be rare and similar to the exemptions for H & S given in (**9**).

APPENDIX 16: TEMPORARY USE BANS IMPLEMENTATION

Temporary Use Bans, commonly referred to as TUBs, are powers granted to water companies to impose restrictions on customers' water use. Previously these were referred to as 'hosepipe bans' but they were modified in 2010 under the Flood and Water Management Act to cover a wider range of restrictions.

TUBs can be introduced quickly – seven days after an advertising the affected area. They predominantly focus on water use by domestic customers because this provides the largest water saving and helps protect public services and the economy.

Following a review of the 2022 drought demand management measures[18] the introduction of a TUB produced a 3.34% reduction in DI and a 6.60% reduction in household demand and is deemed to have a significant impact on demand reduction. To maximise the effectiveness of TUBs it is recommended that they are implemented early on in the Spring-Summer season.

When we need to introduce a TUB, we will take account of the WaterUK / UKWIR Code of Practice and Guidance on Water Use Restrictions. This provides guidance on the effective implementation of water use restrictions by way of Temporary Use Bans (TUBs) and Drought Orders (DO) to help manage demand during times of drought.

We will ensure that we implement a TUB in a proportionate manner, by considering the balance between any impact on an individual or group of customers and overall public interest. In line with the Code of Practice, we will consider among other aspects:

- the nature and seriousness of the water supply situation;
- the water savings from introducing the TUB;
- the feedback from stakeholders including neighbouring water companies and Water Resources East; and
- whether the restriction will impact on vulnerable customers or groups.

Trigger for a TUB

The Drought Management Group will consider a TUB once reservoir storage falls below the TUB control curve or when Berwick groundwater levels fall below the TUB control curve. Worked examples illustrating when our DMG will prepare for a TUB are presented in Appendix 8.

We will ensure that TUBs are always in place before the need to apply for a drought permit or order (between 1 April and 1 October) and will ensure they are in place long enough to have a measurable impact on customer demand. We measure customer demand daily and would expect to see a reduction in demand within 1 to 2 weeks.

Areas of Restrictions

If needed we may introduce a TUB either across the whole company supply area or in a Drought Management Area (i.e. Kielder and Berwick Water Resource Zones). This is because the two resource zones are separate with no link between them.

[18] UKWIR (2023) Review of the 2022 Drought demand management measured 23/WR/02/18

Phasing of Restrictions

As the introduction of TUBs gives water companies a wider range of powers it is important we give careful consideration to the phasing of restrictions. Different levels of drought will be triggered at different times, according to each water company's water resource limits, so companies can decide to implement restrictions in stages according to local conditions, rather than apply them in full at once. This helps mitigate the impact of restrictions on business which undertake water use activities as part of their core business, such as car washes.

However, we will apply the full TUB powers before progressing to the next restriction, for example, implementing TUBs before applying for a Drought Order.

Please refer to Appendix 23 for the basis for the variability of responses to water use restrictions from different water companies.

Communicating the Introduction, Phasing In and Lifting of Temporary Restrictions

We will inform our customers of the introduction and lifting of temporary use restrictions by email (where we have an email address), through our website (www.nwl.co.uk), through our social media channels and through the issue of press releases to both national and independent radio stations and television channels.

We will inform neighbouring water companies, Water Resources North (WReN), NAVs and water retailers for business by email through our agreed communication contact.

Advertising and timeline to implementation

Section 76B(2) of the Water Industry Act 1991 sets out the procedure for implementing a TUB:

> *"Before the period for which a prohibition is to apply the water undertaker must give notice of the prohibition and its terms-*
>
> *a. in at least two newspapers circulating in the area to which it is to apply, and*
> *b. on the water undertaker's internet website."*

The notice of prohibition must set out clearly the terms and extent of the proposed prohibition and specify the date on which the prohibition will commence and the area to which the ban will apply. We must also provide details of how customers can make representations about the proposed prohibitions to us and leave a reasonable period for the representations to be made.

We consider a reasonable period to be 21 days from when the notice of the prohibition is posted on our website. This allows the advertisement of the ban to appear in the local newspapers, which may only be published weekly, and 14 days for representations to be made as a result of the newspaper advertisement. In the event that we receive an un-expectedly large response to the TUB consultation, we will bring in extra resource to manage this.

The majority of Water Resources North have agreed a universal TUB enforcement policy which we will follow (see Appendix 4).

Aligning our approach

We will work with neighbouring water companies and Water Resources North to ensure that we align our approach to drought messaging and the introduction of TUBs. We will ensure that we share our supply demand position in a timely manner, will consult on our messaging and will ensure they are aware of our intention to implement a TUB in a timely manner.

There could be a situation where our neighbouring water companies need to introduce a TUB but we do not because our TUB triggers have not been met. This has been the case in all recent droughts in 2022 and 2025. In this instance, we do not believe that we should introduce a TUB simply because a neighbouring water company has done, however we would ensure that our drought messaging was supportive of our neighbouring water companies' positions.

More information for the basis on the variability of responses to water use restrictions by water companies can be found in Appendix 25.

Exceptions

Water companies can grant statutory and discretionary exceptions from these restrictions for customers and businesses. These exceptions aim to minimise the impact on vulnerable customers and the economy. Please see Appendix 17 for our list of exceptions which is in line with other water companies and our regional group.

Exemptions

Following the implementation of a TUB, we will consider any appeals for exemptions made to us and will take account of other water companies' experience of exemptions during similar droughts.

We intend to introduce company exemptions additional to legislative exemptions that will benefit vulnerable customers and, in the initial stages at least, reduce to a minimum the economic consequences of a drought on our non-household customers. The precise groups and activities to be exempted during any TUB will form part of the advertisements that are necessary to introduce a drought and will also appear on our website. The extent of exemptions granted will be dependent on the severity of the drought that we are in and some possible exemptions may not be allowed.

We intend to allow:

- customers who hold a Blue Badge to water their own garden with a hosepipe, if no other fully able-bodied person is permanently resident at the property;
- the commercial cleaning of windows using a pole attached to a hose;
- the commercial washing of private motor vehicles;

- watering of playing surfaces used for International or National sporting events; and
- depending on the severity of the drought, and the outcome of studies into their impact, we will consider exempting:

  - the filling of domestic swimming pools if they are filled in accordance with Best Practice Guidance;
  - the watering of newly laid turf if done in accordance with Best Practice Guidance; and
  - the use of certain micro-irrigation systems if proven to be water efficient.

We will also consider, at the time of implementing a TUB, any other reasonable cases made for exempting any particular group or activity covered by the ban.

Reimbursement of licence fees paid by customers

A TUB or Drought Order Ban forms part of the Level of Service we have with our customers and no general refund of any part of the customers water bill is refundable as a consequence of a ban being introduced. However, a very small number of customers who have a large water use, but whose property we are unable to install a meter at, pay for this additional water by an annual licence. The three groups requiring this type of licence are the unmeasured customers with either:

- a swimming pool (circulating);
- a swimming pool (un-circulating); and
- a sprinkler.

However currently we have none of these customers in Northumbrian Water.

In the years when a TUB is required, each of these customer's will be reimbursed 1/12 of their annual licence fee for each calendar month, or part of any month, for which their use of water for which the licence is required, is restricted.

APPENDIX 17: TEMPORARY USE BANS EXCEPTIONS

Water companies can grant exceptions from these restrictions for customers and businesses. These exceptions aim to minimise the impact on vulnerable customers and the economy. The following pages set out who can apply for exceptions and what they cover.

There are two types of exceptions to these restrictions which can be applied by water companies:

- Statutory Exceptions – activities/water uses which are exempt from the legislation; and
- Discretionary Exceptions – activities/water uses which are not covered by a statutory exception, but water companies can grant the use of a hosepipe under certain circumstances.

Discretionary Exceptions can be further split into two categories:

- 'Universal' – these exceptions have been agreed by all companies who signed up to the Drought Code of Practice (a document which aims to ensure a common approach to drought management by UK Water companies). Such exceptions do not require customers to write or make representation to the water company to obtain permission; and
- 'Other concessions' – these are exceptions which individual water companies can choose to offer customers, depending on the particular circumstances. These exceptions do require customers to write or make representation to the water company to obtain permission.

Summary of exceptions

Table 1 sets out the statutory, universal discretionary and agreed discretionary temporary use ban exceptions for Essex & Suffolk Water which is in line with most other water companies in the Water Resources East and Water Resources South East regions.

Table 1: Temporary Use Ban Exceptions

TUB Category	Statutory exception	Discretionary Universal Exception (granted by all water companies)	Suggested Discretionary Concessional Exception (granted by individual water companies)
1. Watering a garden using a hosepipe	Using a hosepipe to water a garden for health or safety reasons. NB In this category, the definition of “a garden” includes “an area of grass used for sport or recreation”. Therefore, it should be noted that watering areas of grass, which are used for sport or recreation, is covered by a Statutory Exception for health & safety only in relation to the active strip/playing area, not the entire ground.	▪ To Blue Badge holders on the grounds of disability ▪ Use of an approved drip or trickle irrigation system fitted with a pressure reducing valve (PRV) and timer	▪ To customers on the company’s Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge ▪ To water newly laid turf for first 28 days
2 Cleaning a private motor-vehicle using a hosepipe	A “private motor-vehicle” does not included (1) a public service vehicle, as defined in section 1 of the Public Passenger Vehicles Act 1981 (c), and (2) a goods vehicle, as defined in section 192 of the Road Traffic Act 1988 (d)	▪ To Blue Badge holders on the grounds of disability ▪ Use of a hosepipe in the course of a business to clean private motor vehicles where this is done as a service to customers	▪ To customers on the company’s Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge
3. Watering plants on domestic or other non-commercial premises using a hosepipe	Does not include watering plants that are (1) grown or kept for sale or commercial use, or (2) that are part of a National Plant Collection or temporary garden or flower display.	▪ To Blue Badge holders on the grounds of disability ▪ Use of an approved drip or trickle irrigation system fitted with a PRV and timer	▪ To customers on the company’s Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge ▪ To water newly laid turf for first 28 days
4. Cleaning a private leisure boat using a hosepipe	(1) cleaning any area of a private leisure boat which, except for doors or windows, is enclosed by a roof and walls. (2) Using a hosepipe to clean a private leisure boat for health or safety reasons.	▪ Commercial cleaning ▪ Vessels of primary residence ▪ Cases where fouling is causing increased fuel consumption ▪ Engines designed to be cleaned with a hosepipe	▪ To prevent or control the spread of non-native and/or invasive species

TUB Category	Statutory exception	Discretionary Universal Exception (granted by all water companies)	Suggested Discretionary Concessional Exception (granted by individual water companies)
5. Filling or maintaining a domestic swimming or paddling pool	(1) filling or maintaining a pool where necessary in the course of its construction (2) filling or maintaining a pool using a hand-held container which is filled with water drawn directly from a tap (3) filling or maintaining a pool that is designed, constructed or adapted for use in the course of a programme of medical treatment (4) filling or maintaining a pool that is used for the purpose of decontaminating animals from infection or disease (5) filling or maintaining a pool used in the course of a programme of veterinary treatment (6) filling or maintaining a pool in which fish or other aquatic animals are being reared or kept in captivity	None	
6. Drawing water, using a hosepipe, for domestic recreational use	None	None	
7. Filling or maintaining a domestic pond using a hosepipe	Filling or maintaining a domestic pond in which fish or other aquatic animals are being reared or kept in captivity	▪ Blue Badge holders on the grounds of disability	▪ To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge
8. Filling or maintaining an ornamental fountain	Filling or maintaining an ornamental fountain which is in or near a fish-pond and whose purpose is to supply sufficient oxygen to the water in the pond in order to keep the fish healthy	None	▪ To operate water features with religious significance
9. Cleaning walls, or windows, of domestic	Using a hosepipe to clean the walls or windows of domestic premises for health or safety reasons	▪ To Blue Badge holders on the grounds of disability ▪ Commercial cleaning	▪ To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge

TUB Category	Statutory exception	Discretionary Universal Exception (granted by all water companies)	Suggested Discretionary Concessional Exception (granted by individual water companies)
premises using a hosepipe			
10. Cleaning paths or patios using a hosepipe	Using a hosepipe to clean paths or patios for health or safety reasons	▪ To Blue Badge holders on the grounds of disability ▪ Commercial cleaning	▪ To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge
11. Cleaning other artificial surfaces using a hosepipe	Using a hosepipe to clean an artificial outdoor surface for health or safety reasons	▪ To Blue Badge holders on the grounds of disability ▪ Commercial cleaning	▪ To customers on the company's Vulnerable Customers List who have mobility issues but are not in possession of a Blue Badge

APPENDIX 18: NON ESSENTIAL USE BAN IMPLEMENTATION

On average, once every 200 years, a drought and corresponding shortage of raw water may become so acute that we have to implement restrictions on the use of water that are more severe than those introduced in Level 2 under a Temporary Use Ban (TUB). These tougher restrictions are known as a Non-Essential Use Ban (NEUB).

NEUBs are a set of measures granted to water companies to impose further restrictions on the use of water as long as certain legislative test are met. These powers are sought by applying to the Secretary of State at Defra for a drought order.

It is very difficult to estimate the effect of this type of water use restriction on customer demand as there is very little data available. We have assumed that further restrictions on water use beyond that of temporary use ban will yield an additional reduction in DI of 2% made up of a 9% reduction in NHH demand. This will bring the total demand saving (Appeal for Restraint +TUB + NEUB) to 10.3% reduction in DI.

Before applying for a Drought Order to restrict water use, water companies are expected to have made full use of their powers under the WIA 1991, as stated in the Explanatory Memorandum to the Water Use (Temporary Bans) Order 2010:

> *"By extending the water uses that water undertakers may prohibit under section 76(1) of the Act [WIA 1991], water undertakers may be able to delay or avoid the need for drought orders under the Water Resources Act 1991"*

The Drought Direction 2011 sets out the restrictions available under an Ordinary Drought Order, as allowed for under Section 73 of the Water Resources Act 1991 (WRA 1991). These are:

- Watering outdoor plants on commercial premises;
- Filling or maintaining a non-domestic swimming or paddling pool;
- Filling or maintaining a pond;
- Operating a mechanical vehicle-washer;
- Cleaning any vehicle, boat, aircraft or railway rolling stock;
- Cleaning non-domestic premises;
- Cleaning a window of a non-domestic building;
- Cleaning industrial plant;
- Suppressing dust; and
- Operating cisterns.

NEUB definitions are found in Appendix 17.

In order to grant a Drought Order under the WRA 1991 73(2), the Secretary of State must be satisfied that: "By reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened".

The potential timescales for introducing restrictions by recourse to a Drought Order are significantly longer than those for Temporary Use Bans under the WIA 1991, and the Secretary of State would typically require a public inquiry or hearing to be held if an objection were received.

Under Schedule 8, paragraph 3(c) of the WRA 1991, we would be required to publish a notice of our application for a Drought Order to restrict water use, which would state that objections to the application may be made to the Secretary of State within seven days from the date on which it is served or published.

Trigger for a NEUB

Our Drought Management Group will consider a NEUB once reservoir storage or Berwick groundwater levels fall below their respective NEUB control curves. We measure customer demand daily and would expect to see a reduction in demand within 1 to 2 weeks.

Worked examples illustrating when our DMG will prepare for a NEUB are presented in Appendix 9.

Areas of Restrictions

In alignment with the TUB restriction areas, we will either introduce a NEUB across the whole company supply area, a Water Resource Zone, in a Drought Management Area depending on the nature of the drought.

Communicating the Introduction, Phasing In and Lifting of Restrictions

As non-essential use bans directly impact non-household customers more than TUB restrictions, the majority of the communications with our business customers will be conducted through the retailer through an agreed communication contact.

We will inform our household customers of the introduction and lifting of non-essential use restrictions by email (where we have an email address), through our website (www.nwl.co.uk), through our social media channels and through the issue of press releases to both national and independent radio stations and television channels.

We will inform neighbouring water companies, Water Resources North, and NAVs by email through our agreed communication contact.

Timeline to implementation

The programme for implementing a Drought Order is best considered in 3 stages:

Stage 1: Preparing and lodging an application

Our application will:

i. state the reasons why a Drought Order is being sought;
ii. include an environmental report with supporting information, including how we have enacted our Drought Plan up to that time;
iii. include a section on the social and economic impacts that the additional powers to restrict the use of water will have. Whereas our Temporary Use Ban

predominantly restricts the use of our domestic customer base, a Drought Order Ban is likely to have a greater economic effect on commercial businesses.

iv. Include copies of the required advertisements, meaning that the Drought Order must be advertised prior to the application being made to Defra.

Applicants are required to publish a notice of the Drought Order Application in local newspapers and the London Gazette. The Environment Agency and all Local Authorities in the company's area must be sent a service notice by priority mail. The company must also make a copy of the application available for viewing and advise that objections should be made to the Secretary of State within a seven-day period. We would include all of the application documentation and advertisements on our website during the advertising period.

Stage 2: Hearings or inquiries

If any objections are received, the Secretary of State must hold a local inquiry or hearing unless he/she considers the Drought Order must be made urgently.

The process around the inquiry or hearing is a lengthy one. An inspector must be appointed, a location identified, and a date agreed upon. The company is then required to advertise the hearing in the same manner as it advertised the application. Again, a seven-day advertising period is required by statute.

Following the hearing, the Inspector must prepare a report setting out their recommendations to the Secretary of State. The Secretary of State will then make their decision and advise the company accordingly.

Although theoretically this whole process could be completed in 26 days, in reality we would allow at least three months. This time scale and the need to minimise any hearing or inquiry to a single event, dictates that we will seek all permissions in one go, but may impose them flexibly.

Stage 3: Implementation

Once the Drought Order has been approved, and before it can be enacted, the company must again advertise, in the same manner as previously, that it will be implementing the drought order that has been granted.

Depending on the prevailing conditions, including the time of year, we would intend to enact all the prohibitions granted under the Drought Order at once, or introduce only those necessary at that time to preserve water. This phased approach of selectively banning certain actions granted under the Drought Order is the most proportionate response to the situation. The decision on which order to introduce certain restrictions on use will only be decided after the Drought Order is granted. This will ensure that we can restrict the minimum uses of water necessary at any time whilst minimising any economic impact.

A Drought Order can only be granted for a maximum of 6 months and extended for up to a further six months. The order can only be extended by further application to the Secretary of State.

Aligning our approach

We will work with neighbouring water companies and Water Resources North (WReN) to ensure our approach to drought communications and the introduction of NEUBs is aligned. We will share our supply demand position promptly, consult on our messaging, and ensure they are informed in good time of our intention to implement a NEUB.

Exceptions

A summary of the statutory, universal and discretionary exceptions relating to NEUBs is found in Appendix 18. These have been agreed between the water companies and WReN.

Compensation arrangements

Individuals who suffer a loss or damage as a result of a drought permit or drought order are entitled to compensation (e.g. owners of a water source or those who have an interest in a source). The rules for compensation are set out in Schedule 9 to the Water Resources Act 1991.

In the unlikely event that a third party incurs loss or damage as a result of a drought order or permit overriding their rights to the water, the process to apply for compensation is as follows:

- The claimant must serve notice on our parent company (Northumbrian Water Limited) stating the grounds of the claim and the amount claimed. The Environment Agency is not involved in the claims process;
- Claims must be made within six months of the date of expiry of the permit; and
- Disputes are referred by the claimant or applicant to the Upper Tribunal and are not a matter dealt with at a hearing. The Upper Tribunal may make an award during the duration of the permit in respect of likely damage, though in so doing it may have regard to the amount of water which was likely to have been available to the claimant as against others.

APPENDIX 19: NON-ESSENTIAL USE BAN DEFINITIONS

Commercial Premises

- For the purpose of a Drought Order, commercial premises are defined as: - "any land, building, other structure or premise not being domestic or other non-commercial premises within the meaning of the Temporary Water Use Ban".

Watering outdoor plants on commercial premises using a hosepipe

- This banning of activity covers:
    - Plants which are in a pot or other container that is outdoors or undercover
    - Plants which are in the ground under cover.

Exemptions:

Legislation exempts the watering of plants using a hosepipe that are: -
- Grown or kept for sale or commercial use; or
- Part of a National Collection or temporary garden or flower display.

Filling or maintaining a non-domestic swimming or paddling pool

a) For the purpose of the Drought Order, the Drought Direction 2011 defines non-domestic swimming or paddling pools as "a swimming or paddling pool as defined and covered by the Water Industry Act S76(2)(e). The intention is that filling of domestic pools will already have been banned under the Temporary Water Use Ban.

Exemptions:

Legislation exempts the following from filling or maintaining pools:
a. That is open to the public
b. Where necessary in the course of its construction
c. That is designed, constructed or adapted for use in the course of a programme of medical treatment
d. That is used for the purpose of decontaminating animals from infections or disease
e. Used in the course of a programme of veterinary treatment
f. In which fish or other aquatic animals are being reared or kept in captivity
g. That is for use by pupils of a school for school swimming lessons

- For the purpose of exemptions "Open to the public" is defined as: A pool is **not** open to the public if it may only be used if the user is a paying member of an affiliated club or organisation i.e. these are not exempt.

Filling or maintaining a pond

- This extends the areas of pond filling or maintaining being banned beyond those already covered by the Temporary Water Use Ban. Non-domestic ponds are now also covered by the ban on the use of hosepipes and both domestic and non-domestic ponds are banned from having water added by a fixed pipe. Ponds include manmade and natural ponds of any size.

Exemptions:

Legislation exempts the filling of any ponds, domestic or non-domestic, by hosepipe or fixed pipe, which contains fish or other aquatic animals that are being reared or kept in captivity. It also excludes the filling of any ponds using a hand-held container which is filled with water directly drawn from a tap.

Operating a mechanical vehicle-washer

- This is fully defined as "operating a mechanical vehicle-washer, whether automatic or not".

Exemptions:

There are no exemptions in legislation. While we are not considering any outright exemptions, we would intend to delay implementing this ban, for as long as we consider sensible, for mechanical washers that recycle water and use less than 23 litres of water per vehicle wash.

Cleaning any vehicle, boat, aircraft or railway rolling stock using a hosepipe

- A boat is interpreted, in this case, as a vessel or other thing that:
  - Is designed, constructed or adapted to move through, in, on or over water; and
  - Is not a private leisure boat within the meaning applied under the Temporary Water Use Ban.
- A vehicle is defined as any of the following which is not a private motor vehicle within the meaning of the Temporary Water Use Ban:
  - A vehicle, designed, constructed or adapted for use on roads; or
  - A trailer or other thing designed, constructed or adapted for attachment to a vehicle falling within a) above.
  - Railway rolling stock is interpreted to include passenger train cars, freight train cars, locomotives and tube trains.
  - Aircraft are interpreted to include privately and commercially owned airplanes, helicopters, gliders and hot air balloons.

Exemptions: The only exemption in legislation is on the grounds of health or safety reasons.

Cleaning non-domestic premises using a hosepipe

- The activity to be banned is defined as:
  - Any exterior part of a non-domestic building other than a window
  - A non- domestic wall

Exemptions: The only exemption in legislation is on the grounds of health or safety.

Cleaning a window of a non-domestic building using a hosepipe

- This restriction is equivalent in all ways to that covered under the Temporary Water Use Ban for domestic properties. The ban extends to the use of water fed poles where mains water is the source used to create the de-ionised water.

Exemptions: The only exemption in legislation is on the grounds of health or safety.

Cleaning industrial plant using a hosepipe

- In this restriction "plant" is defined to mean "*The equipment, including machinery, tools, instruments and fixtures necessary for an industrial operation"*

Exemptions: The only exemption in legislation is on the grounds of health or safety.

Suppressing dust using a hosepipe

- The Drought Direction 2011 defines "using a hosepipe" as:
    - Drawing relevant water through a hosepipe from a container and applying it for the purpose; and
    - Filling or partly filling a container with relevant water by means of a hosepipe and applying it for the purpose.
- This also includes anything designed, adapted or used for the same purpose as a hosepipe.

Exemptions: The only exemption in legislation is on the grounds of health or safety.

Operating a cistern in any building that is unoccupied and closed

A cistern is defined as meaning an automatically operated flushing cistern which services a WC pan or urinal. Occupation of a building by security staff is interpreted to comprise a building that is "unoccupied".

APPENDIX 20: NON-ESSENTIAL USE BAN EXCEPTIONS

Table 1 summarises the statutory, universal and discretionary exceptions relating to a NEUB that have been agreed between Water Resources South East (WRSE) and Water Resources East (WRE) water companies.

Table 1: NEUB Exceptions

No.	Drought Order Category	Statutory Exemptions	Universal Exception	Discretionary Exception	UKWIR Suggested Discretionary Exceptions
1	**Watering outdoor plants on commercial premises**	This includes plants which are in a pot or container that is outdoors or under cover and plants which are in the ground under cover.	None	Use of an approved drip or trickle irrigation system fitted with a PRV and timer is set for use in the evening or night.	Use of an approved drip or trickle irrigation system fitted with a PRV and timer
		This does not include plants grown (i.e. cultivated or propagated) or kept for sale or commercial use or plants part of a National Plant Collection or temporary garden or flower display.		Water newly bought plants for the first 28 days after the implementation of the ban.	Watering newly-bought plants
2	**Filling or maintaining a non-domestic swimming or paddling pool**	This restriction shall not apply to: ▪ Pools open to the public (a pool is not open to the public if it may only be used by paying members of an affiliated club or organisation). ▪ Filling or maintain a pool that is used by pupils of a school for swimming lessons. ▪ filling or maintaining a pool where necessary in the course of construction.	None	None.	
					Swimming pools with covers
					Pools with religious significance
					Pools fitted with approved water conservation or recycling systems
					Pools that are subject to significant repair and innovation

No.	Drought Order Category	Statutory Exemptions	Universal Exception	Discretionary Exception	UKWIR Suggested Discretionary Exceptions
		▪ filling or maintaining a pool using a hand-held container which is filled with water drawn directly from the tap. ▪ filling or maintaining a pool designed, constructed or adapted for use in the course of a programme of medical treatment. ▪ filling or maintaining a pool that is used to decontaminate animals from infections or disease. ▪ filling or maintaining a pool used in the course of veterinary treatment. ▪ filling or maintaining a pool in which fish or other aquatic animals are being reared or kept in captivity.			
3	**Filling or maintaining a pond**	This restriction shall not apply to ponds in which fish or other aquatic animals are being reared or kept in captivity or to filling or maintaining the pond with a hand-held container which is filled with water directly from the tap.	Blue Badge holders on grounds of disability	None	Customers on the company's Vulnerable Customer List who have mobility issues but are not in possession of a Blue Badge
4	**Operating a mechanical**	None	None		Washers which recycle water and

No.	Drought Order Category	Statutory Exemptions	Universal Exception	Discretionary Exception	UKWIR Suggested Discretionary Exceptions
	vehicle washer			On biosecurity grounds	thus use less than 23 litres per wash On biosecurity grounds
5	**Cleaning any vehicle, boat, aircraft or railway rolling stock**	Cleaning any vehicle, boat, aircraft or railway rolling stock for health and safety reasons	None	On biosecurity grounds	Low water use technologies Small businesses whose sole operations are cleaning of vehicles using hosepipes Those using vessels as a primary residence Cases where fouling of hulls causes fuel consumption To remove graffiti To prevent of control the spread of non-native and/or invasive species
6	**Cleaning any exterior part of a non-domestic building or non-domestic wall**	Cleaning any exterior part of a non-domestic building or non-domestic wall for health and safety reasons	None	To remove graffiti by applying to the wholesale supplier	Small businesses whose sole operations are cleaning of buildings using hosepipes Low water use technologies To remove graffiti
7	**Cleaning a window of non-domestic building**	Cleaning a window of non-domestic building using a hosepipe for health and safety reasons	None	Small businesses whose sole operations are cleaning of windows using hosepipes.	Small businesses whose sole operations are cleaning of windows using hosepipes
8	**Cleaning industrial plant**	Cleaning industrial plant using a hosepipe for health and safety reasons	None	Biosecurity	To remove graffiti
9	**Suppressing dust**	Suppressing dust using a hosepipe for health and safety reasons	None	None	None
10	**Operating cisterns on**	None	None	None	None

No.	Drought Order Category	Statutory Exemptions	Universal Exception	Discretionary Exception	UKWIR Suggested Discretionary Exceptions
	unoccupied buildings				

APPENDIX 21: TEESIDE DEMAND DURING DROUGHT

The analysis below is based on the Teeside industrial area, which is located in the DMA, TC074. This DMA currently comprises of 99 non-households and 1 household. Household measured and non-household measured consumption is determined through meter readings. Figure 1 is using the measured household and non-household consumption.

When comparing 2022 drought year as well as 2025 up until the 27 August 2025 on NHH Consumption, the following can be observed. The drought season in 2022 seems to have very little impact on demand in the Teeside industrial area as there is no clear indication the drought year is higher than prior or subsequent years. 2025 does show signs that the drought weather has had an impact on NHH Consumption as this is higher by 0.03 Ml/d on average for each month excluding May 2021 (See Figure 1). This equates to a percentage growth of 19.3 % on average per summer month. In comparative from 2021 to 2025 split by months, the highest NHH Consumption within this DMA was in May 2021 which was not a drought year.

Teeside Industrial Estate consists predominantly of Workshops and premises, Warehouse and premises, and Factories. Some would have been considered essential businesses during COVID and would be allowed to operate under strict safety guidelines. Due to stricter guidelines, more water would be used and would contribute to this time frame being higher.

	May	Jun	Jul	Aug	Sep
2021	0.21	0.17	0.16	0.15	0.16
2022	0.15	0.13	0.15	0.15	0.14
2023	0.13	0.14	0.15	0.13	0.15
2024	0.15	0.14	0.16	0.14	0.14
2025	0.16	0.18	0.18	0.17	

Figure 1: Teeside NHH Consumption from 2021-2025

APPENDIX 22: DROUGHT PERMIT 'APPLICATION READINESS'

This Appendix outlines the information we have prepared to demonstrate our Drought Plan's 'application readiness'. We have provided summaries below of the documents that we plan to provide in full as part of any Drought Permit or Drought Order application. We have used Table 5 from Appendix D of the EA's guidance document[19] to identify the key documents and supplementary information we may need.

The documents that we have identified as being required to demonstrate our 'application readiness':

1. Drought Permit Application – Supporting Information
2. Draft drought permits

Each drought action requiring a drought permit will have its own versions of these documents. Copies of these documents are being submitted alongside our Drought Plan.

Drought Permit Application - Supporting Information

This document will contain the following:

1. An Executive Summary outlining the strategic rationale for the application
2. A Description of Proposals including location, current licence conditions and proposed changes, a summary of the environmental impacts and proposed permitting dates.
3. Draft Drought Permit (see below)
4. Statement of Reasons including the case for Exceptional Shortage of Rain (ESOR) (see below)
5. Consent from the Navigation Authority (if required)
6. Copy of Notices and Advertisements
7. Public Inspection Arrangements
8. Existing Abstraction Licences, Acts or Orders
9. Environmental Reports
10. Consultees
11. Objections
12. Appendices

Draft Permits

We have prepared a draft drought permit/order for each of our Drought Actions identified as requiring a drought permit or order in Appendix 11. For Drought Permits, we have used the template provided in Appendix E of the EA's guidance'[20]. There are no requirements for Drought Orders in the NW supply area,

The need for inclusion of draft Drought Permits/Orders will be noted in the Drought Permit Application – Supporting Information document, with drafts of the full permits/orders provided separately.

[19] Environment Agency. Drought permits and drought orders supplementary guidance.
[20] Environment Agency. Drought permits and drought orders supplementary guidance.

ESOR

We have used the Environment Agency guidance document 'Hydrological guidance for the assessment of an Exceptional Shortage of Rain (ESoR) March 2025'[21] to undertake ESOR assessments. This guidance states that 'A drought order or a drought permit cannot be granted if the serious deficiency of supplies, or threat to (or serious threat to flora and fauna) has not been caused by an exceptional shortage of rain.' (page 7). It is therefore incumbent on us as the water company to demonstrate that the lack of rain qualifies as 'exceptional'. Our detailed approach to demonstrating this is in the 'Drought Permit Application [Drought Action Name] – Supporting Information' document for each relevant drought action.

[21] Environment Agency, 2025. Hydrological guidance for the assessment of an Exceptional Shortage of Rain (ESoR) March 2025'

APPENDIX 23: LESSONS LEARNT FROM 2022 DROUGHT

Introduction

2022 was the warmest year on record for the UK with extreme heatwaves in the summer months that included temperatures in excess of 40ºC being recorded for the first time in the UK. It was the also the driest January-August period since 1976 and drought conditions were declared across parts of England and Wales including East Anglia. Mean temperature, rainfall, and sunshine for summer 2022 is shown in Figure 1. Total Northumbrian Water demand, daily total rainfall and daily max temperature for Apr-Oct 2022 are show in Figure 2.

For the WRMP we are required to set out the lessons we have identified as a result of our experiences during the prolonged dry weather / drought event in 2022, with particular consideration given to:

- how you can improve the resilience of your supply system to similar events
- whether any new temporary schemes implemented during the drought could be made permanent, ensuring they are assessed as an option in your plan
- include any newly identified drought permits as an option in your plan
- ensuring the assumed benefits in your options list for drought interventions (such as drought permits/orders and Temporary Use Bans) implemented this year reflect your latest understanding
- reviewing your planned level of service
- updating deployable outputs where you have gained an improved understanding of how your sources respond to drought
- ensuring your planning assumptions for dead storage and emergency storage are accurate
- reviewing your demand forecast assumptions, following your experience of the impact of 2022 drought and heatwaves on household and non-household customer demand, including the extent and duration of peak demands
- if you do not currently use dry year critical period scenario/s, consider whether you should introduce this scenario in your planning
- ensuring you consider high demand (leakage) resulting from all extreme weather - including heat waves, as well as freeze-thaw events
- considering whether you need to include any schemes as part of your business plan to improve connectivity and zone integrity
- reflecting any updates to bulk supply agreements, including pain-share agreements discussed during the drought
- reviewing your forecast outage, as this is particularly important in acute drought events.

Weather during summer 2022

The following represents a provisional assessment of the weather experienced across the UK during Summer 2022 (June, July and August), and how it compares with the 1991 to 2020 average.

The summer was warmer than average and maximum temperatures were especially far above average over most of England. There were hot spells in each month, and the summer will be remembered for a new UK record of 40.3 °C at Coningsby (Lincolnshire) on 19th July. The weather was settled for much of the time, with little rain in many areas during most of July and early August. Sunshine was above average overall in each individual month, especially in England.

Both June and July began on the cool side, but all three summer months saw above average temperatures overall, more especially in eastern areas, with maximum temperatures broadly further above average than minima. Overall mean temperatures for June were 0.6 °C above average, and July was 1.3 °C above average, with August then 1.5 °C above average.

Rainfall in June was rather below average in most southern and eastern areas, with only a few western counties exceeding the average, giving a UK-wide figure of 76% of average. July was notably dry in many areas and the UK had 56% of average rainfall. August was dry also for many areas, though localised thunderstorms contributed to rainfall totals in some places, with an overall figure of 54% of average.

Most areas were somewhat sunnier than average in June, and August was a sunny month generally. Overall sunshine percentages of average were 114% in June, 103% in July and 128% in August.

For the months of June, July, and August, Northumbrian experienced no rainfall for 59 out of the 92 days. The highest temperature recorded in Northumbrian for 2022 of 36.9°C occurred on the 19 July.

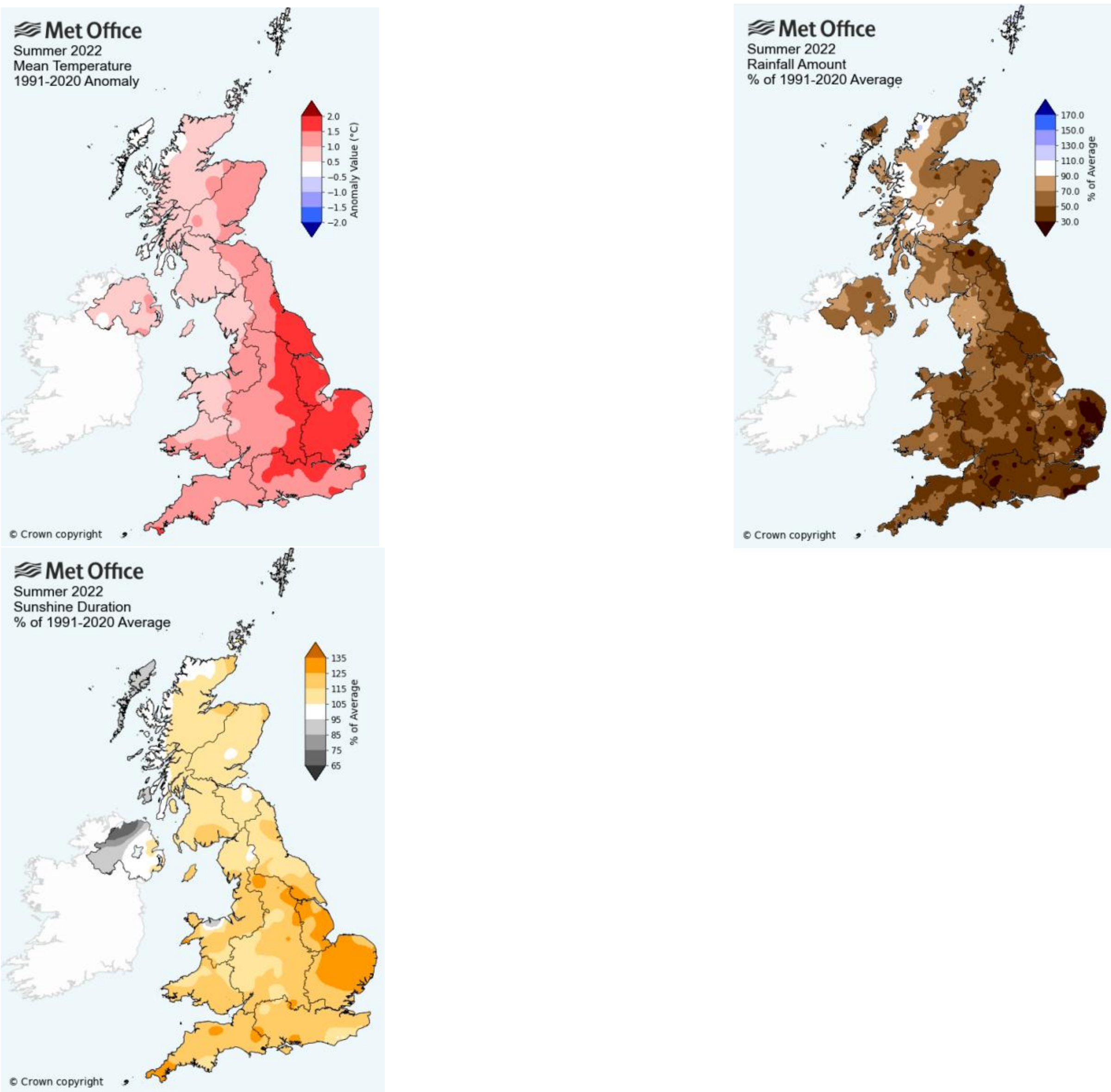


Figure 1: Mean temperature, rainfall, and sunshine for summer 2022.

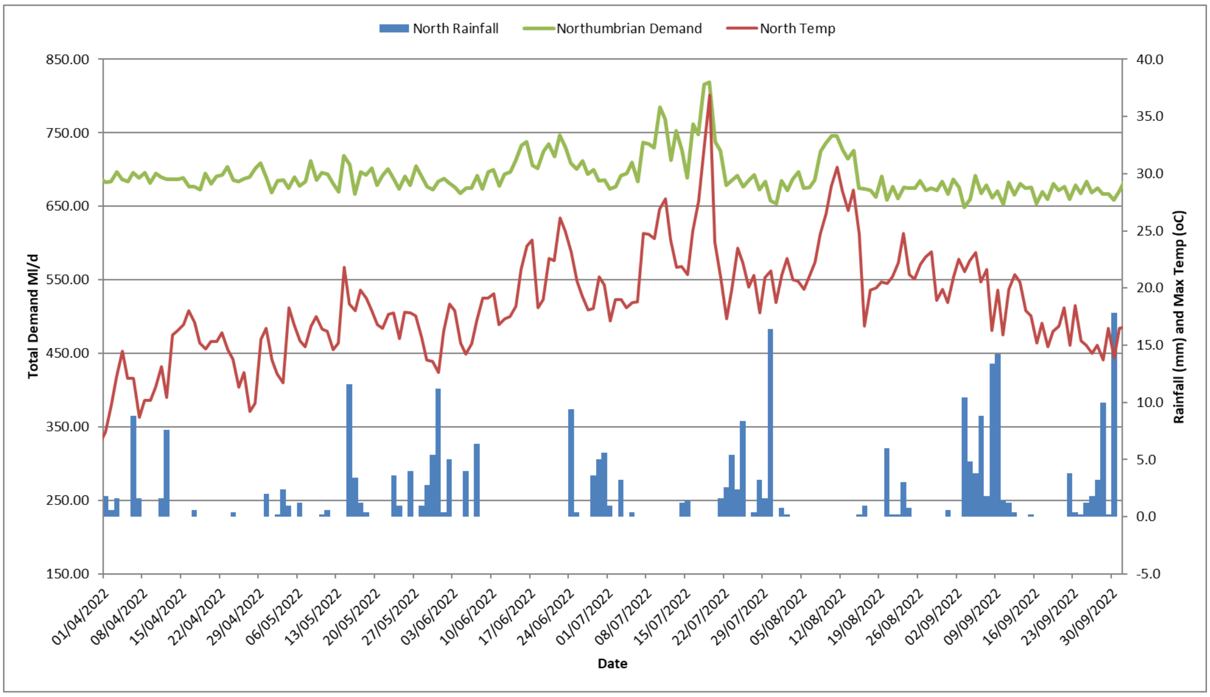


Figure 2: Northumbrian (green) total demand (Ml/d) against daily total rainfall (blue) and daily max temperature (red) for Apr-Oct 2022

Plotting rainfall and temperature data in quadrants (Figure 3) can graphically represent the weather conditions and show if a year would be classified as 'dry', 'normal' or 'wet'. The following graph demonstrates how Northumbrian was classed as 'dry' for 2022. The Northumbrian area experienced 14 days greater than 25°C. This is considerably higher than the average of 5 days. The area experienced less than 750mm of cumulative rainfall for the year, which is the lowest rainfall in the data set.

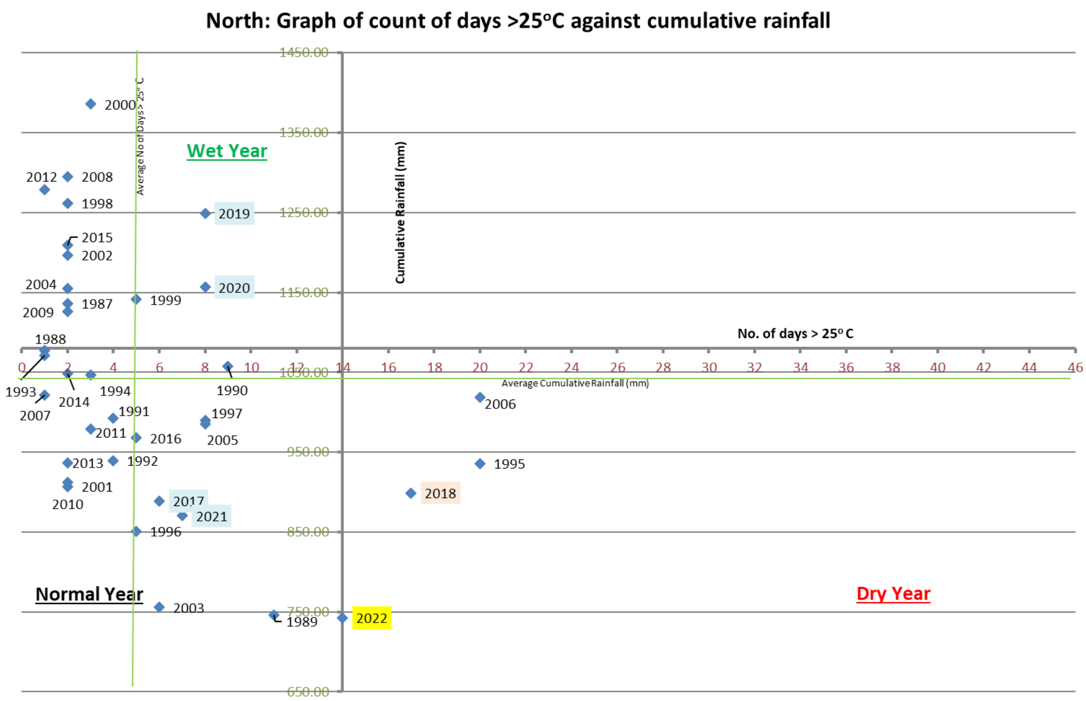


Figure 31: Quadrant graph for Northumbrian 2022 showing number of days with temperature greater than 25°C against cumulative rainfall.

Restrictions on customer water use in 2022

- During the 2022 we did not place any restrictions on customer water use across our area of supply.
- We did not introduce a TUB in our area of supply during 2022.
- We implemented Level 1 for demand side actions of our drought plan during the summer 2022.

Lessons Learnt:

How you can improve the resilience of your supply system to similar events

As part of our water resources planning process, we are required to update our Water Resources Management Plan under the current periodic review for 2024 (PR24). As part of this work, we have updated the Supply Demand Balance (SDB) for each of our water resource zones, as required under the Environment Agency's Water Resource Planning Guidelines (2021). We are planning to be resilient to a 1-500 drought event, i.e., increasing the likely frequency of implementing level 4 restrictions to 1 in 500 years on average.

Whether any new temporary schemes implemented during the drought could be made permanent, ensuring they are assessed as an option in your plan

We did not introduce any temporary use schemes in our area of supply during 2022.

Include any newly identified drought permits as an option in your plan

We did not identify any drought permits during 2022. However, we did identify opportunities to ensure we are more resilient to droughts going forward.

One action that has already be implemented is the refurbishment of the low lift pumps at Derwent reservoir. This allows us to access an additional 5,000Ml of water during a drought.

A longer-term option that we are looking to implement is altering the way in which we support Derwent reservoir from the Tyne Tees Tunnel (Kielder transfer scheme). Currently we can release water from the Tyne Tees Tunnel directly into the river Derwent to replace compensation water from the reservoir. This is becoming less sustainable in recent years as water quality parameters are getting tighter. We are currently investigating the option of transferring water directly from the Tyne Tees Tunnel into Derwent reservoir. This would have the benefit of removing the risk of poor raw water quality water going onto Mosswood WTW, by blending the river water with reservoir water prior to abstraction. Additionally, the river Derwent would receive compensation water from the reservoir year round, maintaining a consistent quality of water rather than switching between 100% reservoir water and 100% river water.

Ensuring the assumed benefits in your options list for drought interventions (such as drought permits/orders and Temporary Use Bans) implemented this year reflect your latest understanding

We did not implement any drought actions in 2022. We do benefit from our previous experience of implementing TUBs in our Essex & Suffolk Water operating area, the most recent being in 1997/98. Also, the ongoing UKWIR project on the impact of TUBs on demand will help inform our understanding of the benefits of such measures going forward.

Reviewing your planned level of service

As part of the WRMP24 process we have reviewed our planned levels of service. We have not changed our planned frequency of implementation of Level 1, level 2, or level 3. In-line with the Environment Agency's Water Resource Planning Guidelines (2021) we are planning to be resilient to a 1-500 drought event, i.e., increasing the likely frequency of implementing level 4 restrictions to 1 in 500 years on average.

Updating deployable outputs where you have gained an improved understanding of how your sources respond to drought

As part of the WRMP24 process we have undertaken stochastic modelling to derive updated deployable outputs (DO) for our WRZs. The stochastic timeseries used in the DO modelling includes synthetic droughts of varying intensity and duration. This will enable us to plan to be resilient to not just the worst historic droughts, but also potential future droughts that are more severe.

Ensuring your planning assumptions for dead storage and emergency storage are accurate

As part of our continuous improvement, we have invested in new rainfall-runoff models (GR6j) and have updated our historic inflow timeseries to include the recent droughts of 2018 and 2022. We are committed to revising all our reservoir control curves, including the emergency and dead storage levels, prior to the first annual review of the WRMP24.

Reviewing your demand forecast assumptions, following your experience of the impact of 2022 drought and heatwaves on household and non-household customer demand, including the extent and duration of peak demands

We have updated our revised draft demand forecast to include the impact of the 2022 drought. This is completed through updating our critical period and peak demand analysis and resulting assumptions.

Peak Demand

Historic daily weather and demand data is collected for assessing the peak demand and critical period uplift. The demand data consists of daily DI data and daily PCC (split measured and unmeasured) data for each WRZ for a minimum of 12 years and has been updated to include data from 2022. The weather data consists of daily maximum temperature data, daily rainfall data and daily sunshine hours data.

A peak week has been determined as a period of 7 days. This aligns with our regional group. The maximum 7-day rolling average DI for the last 12 years, including 2022, is shown below for NW along with the reasons for the peak.

Table 1: Max 7-day rolling average of DI for NW, for the last 12 reporting years.

Reporting year	2011 / 12	2012 / 13	2013 / 14	2014 / 15	2015 / 16	2016 / 17	2017 / 18	2018 / 19	2019 / 20	2020 / 21	2021 / 22	2022
Max 7 day rolling average DI (Peak)	730.47	720.66	739.57	716.81	711.80	694.30	734.81	769.76	704.05	783.81	754.01	775.17
Date of Peak	08/06	29/05	20/07	13/02	05/07	31/01	10/03	04/07	10/03	03/06	24/07	24/12

1. 2011/12- Peak demand followed a week of no rainfall and high temperatures during the half term school holiday week. High temperatures and low rainfall are synonymous with peaks in demands and occurring during a school holiday week when people are at home more increases demand more than normal.
2. 2012/13- The peak in demand followed 10 days on no rainfall and high temperatures ending with the late May bank holiday weekend. High temperatures and low rainfall are synonymous with peaks in demands and with a bank holiday weekend when people are at home more will increase demand as well.
3. 2013/14- The peak in demand followed a period of 17 consecutive days with no rainfall and high temperatures, during a heat wave which effected the UK between 3-23rd July 2013.
4. 2014/15- The peak in demand followed a winter period where temperatures jumped by 5°C within 24 hrs. Large increases and decreases in temperatures in a short period of time are known to increase the potential for bursts to occur. 2014/15 was classed as a 'wet' year therefore peaks in the summer period were not as large as normal.
5. 2015/16- The peak demand followed a week which included the hottest July temperature on record for the UK at the time. In the north-east this saw temperatures above 31°C.
6. 2016/17- Leakage caused the peak demand for this year with a winter seeing five named storms occurring in succession between January and March. The year also saw a wet June therefore peaks during part of the summer period were lessened.
7. 2017/18- Leakage once again caused the peak demand in the Northumbrian Water area due to the 'Beast from the East' which saw very cold prolonged conditions hitting the UK.
8. 2018/19- This was classed as a dry year in the North East. The peak in demand followed a period of two weeks with extremely small rainfall combined with high temperatures.
9. 2019/20- The lowest peak in demand was seen for this year. A 'wet' year was experienced in the North East of England albeit a warmer 'wet' year than previously recorded 'wet' years. The peak in demand occurred in March due to a spike in leakage at this point.
10. 2020/21- The peak in demand occurred during June for this year and followed a period of 10 days with very little rainfall and warm temperatures. However this was also coupled with lockdowns due to the Covid

pandemic which also increased demand over and above what would normal be expected for the time of year. This is predominantly due to more people being at home all the time, not being able to travel for holidays either and increased hand-washing, cleaning activities.

11. 2021/22- The end of July saw the peak in demand for this year. This followed a period of no rainfall (12 days) and high temperatures (six days in a row of temperatures of 25°C and above). The Covid pandemic is still found to be impacting demand for water causing a further increase. This is predominantly due to people working from home more and staycations being the holiday of choice for the year[22].

12. 2022/23- Although the warmest year on record for the UK with all months except December being warmer than average, it was in December due to most likely leakage and in parts Christmas household demand which drove the peak in demand for this year. The Met Office reported it was the UK's coldest December since 2010.

Critical Period

We have updated our critical period analysis to include weather and demand data from the whole of 2022. The resulting critical period uplifts that include the data from 2022 are as follows:

Critical period uplift (%)	Unmeasured HH	Measured HH	NHH
Berwick	24.8%	23.0%	0% (N/A)
Kielder	24.8%	23.0%	0% (N/A)

Including the 2022 data in the critical period analysis has increased the Unmeasured Household (HH) % uplift by an average 3% and decreased the Measured HH uplift by -1% on average across NW. There was no change to NHH.

Dry Year

The 2022 dry year data has not been included in the estimate of dry year uplift. This is because reported figures for PCC and DI for 2022/23 were not finalised in time to be included in the revised draft demand forecast. There was also a concern that the impact of Covid could still be affecting demand. However draft PCC and DI figures for 2022/23 did not differ significantly from the previous 2018 dry year therefore we feel the 2022 dry year impact will be accounted for sufficiently in our dry year uplift already.

Met Office - Building COVID and Non COVID Demand models for COVID PCC comparisons – Update 2022

We commissioned work with the Met Office to understand the effects of weather and Covid-19 on our demand during 2020 and 2021. We once again commissioned the Met Office to update this analysis for 2022 to continue to understand the impact of Covid on both weather and non-weather dependant demand for the third year since

[22] Staycations.pdf (accumulatecapital.co.uk)

the pandemic began. We were particularly interested in the impact of the 2022 drought on demand in conjunction with the impact of Covid which we requested the Met Office to conduct further analysis on.

A summary of the report[23] is provided below. The report is available upon request.

The Met Office produced a water demand model that splits total water usage into base usage and weather-dependent usage, thereby enabling all three to be analysed and addressed. Warm weather and cold weather aspects are covered to produce a capability that can be used throughout the year.
A pre-Covid normal demand model has been developed for each of the three regions (Essex, Suffolk and Northumbrian). This takes observed demand over the last 10 years, and this is used to create a model of this demand which splits out base demand and weather dependant demand. Not only are weather variables investigated but also day, week, year, and time series analysed to ensure differences in seasonal, bank holiday, weekday vs. weekend and general long-term trend in demand are considered. The modelled data matches historic observed data very well in all three areas.

Demand data from 2020 is then used to create a COVID model suitable for use in the Northumbrian, Essex, and Suffolk regions. The need to extract suitable weather data from Met Office archives remains the same as for non-COVID modelling. Having removed any potentially erroneous data, data from Northumbrian, United Utilities and Yorkshire Water is combined and data from Essex and Suffolk regions is combined to give better prospects of developing a stable model.

This Pre-Covid model is then run with a Covid demand model for the weather data from 2020 through to the end of 2022.
Pre-Covid model = model of normal demand for weather experienced and…
Covid model = model of lockdown demand for weather experienced. (Lockdown demand is the increased demand experienced because of the lockdown due to Covid).
Previously calibrated demand models for 2020 have been applied to more recent weather data for 2022. For both the pre-Covid and Covid models base demand and weather dependant demand have been modelled separately before being looked at together in comparison with observed demand. Demand has been analysed both as total demand and PCC.

Northumbrian:
Northumbrian observed demand minus excess leakage is analysed against modelled demand for 2022 (see Figure 4). After accounting for changes in leakage relative to the model calibration period, the observed demand is more accurately predicted by the pre-COVID model, particularly in April. The COVID model performs less well, predicting too large fluctuations and systematically overestimating demand from the end of July onwards. There are some spikes in demand which neither model fully captures (in mid-July, for example) and some sharp drops in demand are not accurately modelled by either model, particularly in August.

[23] Met Office (2023) **Building COVID and Non COVID Demand models for COVID PCC comparisons – Update 2022**

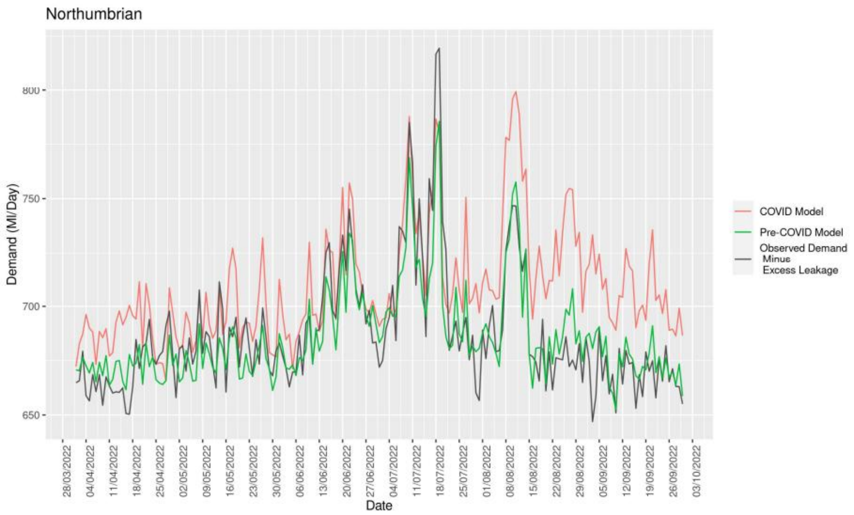


Figure 4: Observed demand minus excess leakage compared to covid and pre-covid models for Northumbrian between Apr-Sep 2022.

Between April and September, the pre-COVID model appears to be a better fit for observed demand than the COVID model, with a R^2 of 0.78 meaning that 78% of the variation in the observed demand is explained by the pre-COVID model, as opposed to 50% by the COVID model (Figure 5). An R^2 so close to 1 implies that usage has largely returned to the pre-lockdown levels, in particular in terms of weather sensitivity.

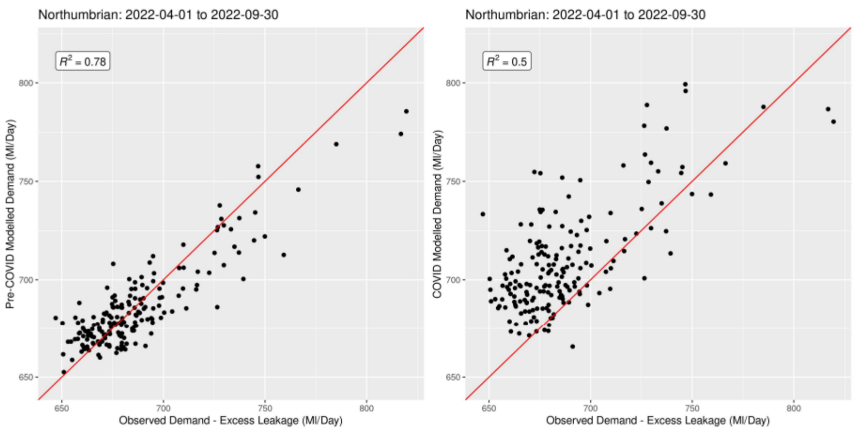


Figure 5: Scatter plots showing observed demand minus excess leakage compared to covid and pre-covid models for Northumbrian between Apr-Sep 2022.

The predictions of the pre-Covid models for Northumbrian area perform well against the observed demand between April and September 2022, whereas the COVID models perform poorly. This indicates that demand has returned to pre-COVID weather sensitivity and base usage levels. There are some periods where neither model is able to fully predict the weather dependent demand that is observed, leading to some under and overestimation of monthly demand totals by the pre-COVID model in particular.

Total demand across all three regions appears to have returned to pre-COVID weather sensitivity and base usage. The additional increase in demand that could be attributed to Covid was small (0.5 % for NWG) and is more likely due to the drought conditions of 2022 causing weather-dependant demand to be higher than modelled.

The overall impact on average PCC saw a small increase of 0.9-5.2 l/hd/d. This represents an increase of 0.6% in Northumbrian, an average of 1.65% increase in PCC for NWG (weighted on population). This increase can be attributed to the ongoing impact of Covid but is more likely to be attributed to the extreme weather in 2022.

The relationship between weather and demand (pre-COVID, observed) has been investigated further. Key findings include:

- All three areas experienced some days of notably low demand, thought to be related to high rainfall or non-weather factors, that were not predicted by the model. This resulted in some slightly high predictions of monthly totals.
- The largest differences between the observed demand and modelled demand were found on particularly high usage days. The summer of 2022 was notably hot and dry, with the UK experiencing 40°C for the first time on record. Investigation into these periods found that for Essex and Northumbrian, the model was unable to fully capture the extent of spikes in demand occurring at particularly high temperatures. This is thought to be due to previously unseen high temperatures that were not included in part of the model calibration. For Northumbrian this resulted in 7.4 Ml/Day additional usage through July.

The modelled weather dependent usage for each April to September period from 1961 to 2022 was calculated and ranked. In 2022 Northumbrian had the 7th highest modelled weather dependent usage since 1961. However, weather dependent usage in 2022 may have ranked higher due to known underestimation of the model due to previously unseen weather conditions.

Due to underestimation, the weather dependant percentage of total usage was calculated using the modelled base usage and total observed usage. The weather dependent usage as a percentage of total usage was calculated for Essex and Northumbrian Water operating areas.

For Northumbrian, weather dependent usage reached a maximum of 21.2% of total usage in one day. Between April and September 2022, 7.3% of usage was weather dependent.

Impact of Covid

The impact of the Covid-19 pandemic and the associated measures to reduce transmission continue to affect the activities of society and have also had unforeseen outcomes within the water industry. The large impact on water consumption in homes and businesses as a result of restrictions and lockdowns, combined with the hot and dry weather of 2020 resulted in some of the highest peaks in water demand water companies have ever seen.

From the outset we wanted to understand the impacts of this pandemic both on demand, including PCC, but also on our customer's behaviour. We took to collecting DI, total demand and logged metered and unmetered customer consumption data since the beginning of the pandemic. We also conducted a number of customer surveys to understand how customers may be using water differently. Research, regarding the pandemic's effects, was also conducted in projects with partners, by the wider water industry and also outside of the industry as well.

We have prepared a report ('Impact of Covid-19 on demand - NWG') that documents the evidence collected and collated over the last three years (April 2020 – April 2023) to demonstrate the impact Covid-19 has had on demand and PCC both through our own data collection and action as well as involvement in industry projects, wider research and water efficiency activity.

All the research and data summarised in the report24 indicate that demand and PCC have been greatly impacted by the effect of the Covid-19 pandemic during 2020 and 2021. Namely that Household (HH) demand has increased, and Non-household (NHH) demand has decreased, with overall total demand increasing. In 2022 information from the Met Office and other sources suggests that the Impact of Covid on demand and PCC has lessened with the drought of 2022 having a greater impact than Covid.

Demand Management Options

Our demand management options were impacted by the drought 2022 and the lessons learnt from this period are described below.

Leakage

Leakage increased gradually through the summer of 2022 as we saw a 13% increase in leakage jobs compared to the summer period in 2021. A combination of the hot/dry weather causing ground movement and additional customer consumption on the network results in more pressure on the pipes which in turn leads to more failures. We reacted to this additional workload well and managed to reduce the average daily leakage by 11.2Ml/d in 2022/23 compared to 2021/22. The impact of these weather events is something that we take into consideration when developing our plan to deliver future leakage targets.

Water Efficiency

Our typical water efficiency interventions outlined in our water efficiency strategy were delivered throughout the summer of 2022 as planned. In addition, a significant communications campaign was also delivered with the purpose of the upscaled communications activity being to communicate effectively with customers around the Water's Worth Saving message resulting in significant reach. Taking a multi-channelled approach to the campaigns, we leveraged greater engagement with significantly larger proportion of our customers. Following the 2022 campaign, there was a significant increase in those who reported being highly aware of water stress in their areas (from 10% to 32%). Successfully, the top message 'Simple changes in your daily routine can help water efficiency ' was well communicated with a score of 63%. 61% of participants claimed to take/taken action as a result of seeing the

[24] Impact of Covid-19 on demand in NWG (June 2022), NWG – report is supplied with this annual update.

communication. There was also a significant rise in the proportion who were aware of and/or have made use of the Leaky Loo programme (from 7% to 23%).

Whilst successful, a key learning point from 2022 was to start communicating with customers earlier in the year, in order to encourage water-efficient practices and behaviours before the impacts of weather would start to take effect. We recognise that we need to engage customers with tailored Water's Worth Saving communications all year round, with amplified communications leading up to periods of particularly heavy water usage (i.e. March-October). This should involve a multi-channelled approach including TV, cinema, streaming, digital, social-media, direct marketing and involving employees, stakeholders and water retailers. This has been applied in 2023.

If you do not currently use dry year critical period scenario/s, consider whether you should introduce this scenario in your planning

We have already included dry year and critical period scenarios as part of the draft WRMP24 for all water resource zones. We have included 2022 weather and demand data in our critical period analysis and have updated assumptions accordingly.

Ensuring you consider high demand (leakage) resulting from all extreme weather - including heat waves, as well as freeze-thaw events

We have included all demand data (including leakage) from the entire year of 2022 in our assessment of critical period. Historic daily weather and demand data is collected for assessing the peak demand and critical period uplift. The demand data consists of daily DI data and daily PCC (split measured and unmeasured) data for each WRZ for a minimum of 12 years and has been updated to include data from 2022. The weather data consists of daily maximum temperature data, daily rainfall data and daily sunshine hours data. This allows us to make sure both heatwaves during the summer and freeze-thaw events during the winter are included in our assessment of critical period, and therefore in the uplift applied to demand for critical period.

Considering whether you need to include any schemes as part of your business plan to improve connectivity and zone integrity

There is already significant connectivity within the Kielder WRZ, with the Kielder Transfer Scheme being able to support, Horsley WTW, Mosswood WTW and Honey Hill WTW along with the ability to make releases to regulate the river North Tyne, river Tyne, river Derwent, river Wear and river Tees along with a transfer into West Hallington. As such no schemes are required to improve connectivity of the WRZ.

Reflecting any updates to bulk supply agreements, including pain-share agreements discussed during the drought

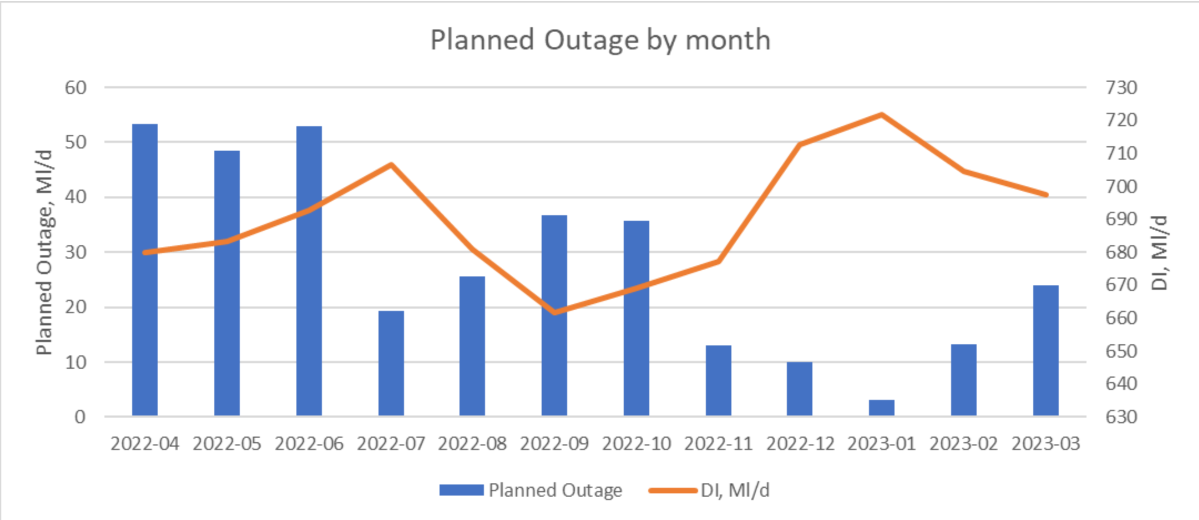
We encouraged the New Appointments & Variations (NAV's) operating within our area to increase the water efficiency messaging to their customers during the drought of 2022 in line with our drought plan. We did not impose any customer water use restrictions during the drought and kept our NAV's informed of this. We also have since repeated our drought plan to our NAV's alongside the expected timescales between each drought plan level option to ensure they understand the length of time they would have to inform their customers of any restrictions that may take place.

There is a small potable bulk supply of 1.3Ml/d from Wear Valley WTW to United Utilities. This is considered sustainable under drought conditions.

Reviewing your forecast outage, as this is particularly important in acute drought events.

As part of the WRMP24 process we have revised our outage allowance, included in this is a critical period outage allowance.

Operationally to assess the risk to security of supply, all planned outages are risk assessed as part of our coordination planning process. As can be seen the 2022/23 graph below as DI increased in the summer months due to the dry hot weather, as well as in the winter months due to freeze-thaw events the amount of planned outage was minimised to ensure there was no risk to security of supply.



APPENDIX 24: LESSONS LEARNT FROM 2025 DROUGHT

Drought Summary

2025 marked one of the most challenging hydrological periods for our operating area in recent decades, driven by persistently low rainfall, high temperatures, and declining reservoir and river levels. The EA declared the North East region to be in Prolonged Dry Weather status in early May 2025, reflecting the rainfall deficits after one of the driest early-year periods on record (Figure 1) and the warmest spring ever recorded.

Rainfall

- April 2025 was the fourth driest April on record in NE England, with records dating back to 1871.
- Parts of Northumbria had their driest start to the year since 1929.
- The UK experienced its driest first six months since 1976, strongly affecting the NE region.
- By summer 2025, rainfall for the wider England east & northeast region totalled only 128.6 mm, just 62% of the long-term average

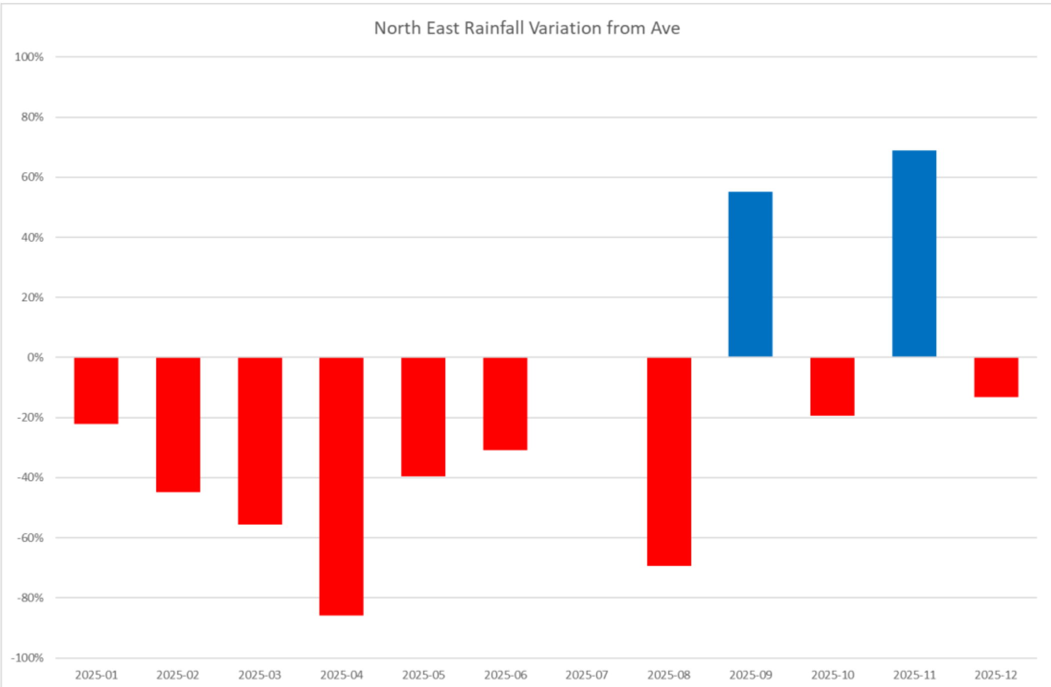


Figure 1: North East UK Rainfall variation from average rainfall for the month.

The exceptionally wet November 2025 eased conditions enough for the EA to move the North East into recovery status in January.

Temperature

Temperature trends played a significant role in intensifying drought impacts. The Met Office reported that Spring 2025 was the warmest on record since 1884, contributing to enhanced evaporation and drying of soils. The summer of 2025 saw average max temperatures of 21.58 °C in northeast region (Figure 2).

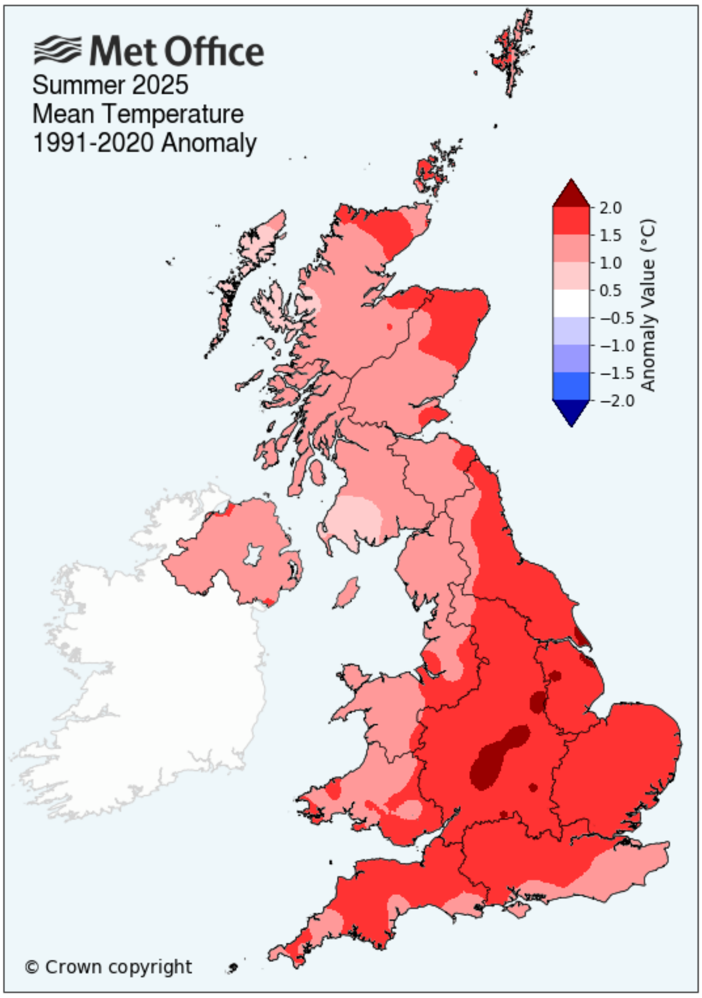


Figure 2: Summer 2025 mean temperature anomalies for the UK

River Flows

River levels reached their lowest levels in the period March to May when all our main rivers (Till, South Tyne, Coquet, Wear, Greta and Tees) were classified as either Notably Low or Exceptionally Low, with several rivers at their lowest levels for decades. There was a marginal improvement in June when the South Tyne moved to Above Normal and the Tees catchment was classed as Normal, however in July the South Tyne has moved back to Normal and in July all rivers were again classified as either Notably Low or Exceptionally Low. September was a very month and saw the beginning of the recovery of river levels particularly in the Tyne catchment, after some decreases in river flows in October November was another a wet month and as a result all river levels were classified as either Above Normal or Notably High. Figure 3 shows the number of rivers in each of the EA classifications for 2025.

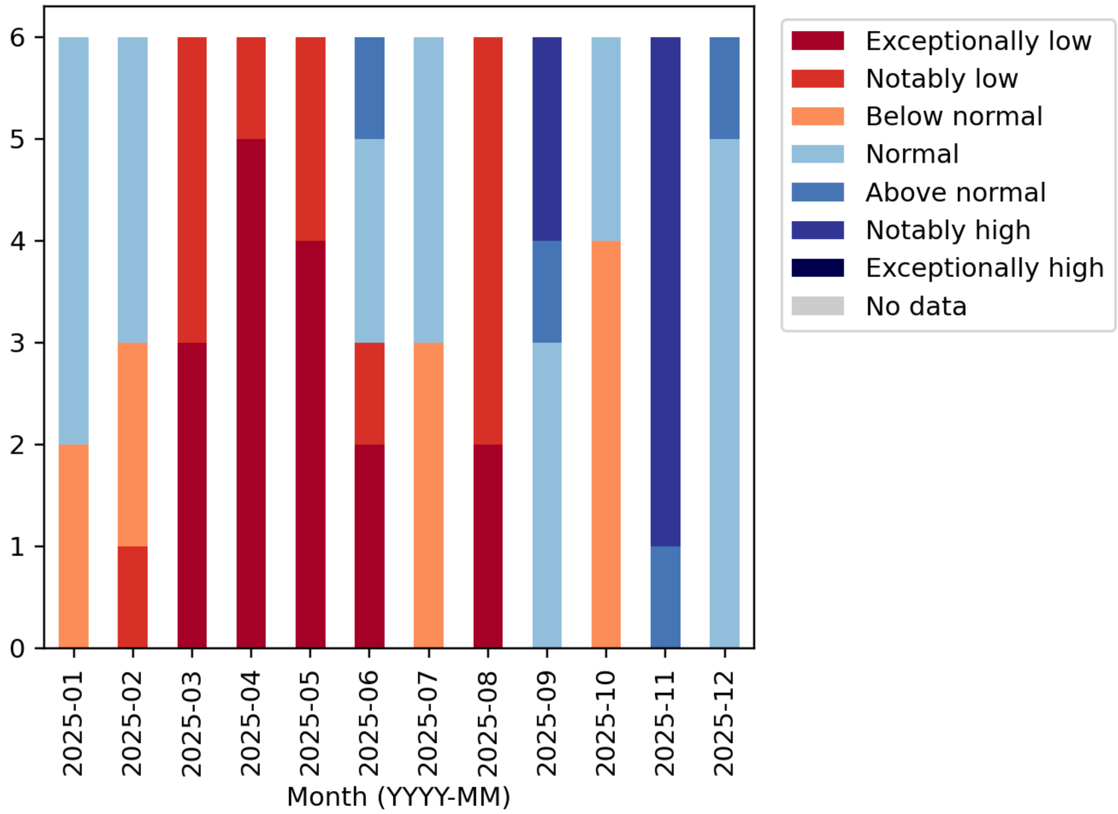


Figure 3: Classifications of rivers by EA.

Soil Moisture Deficit

Through April and May SMDs began to rise sharply with the EA classify nearly all northeast catchments as notably or exceptionally dry during this period. SMDs remained high during June, July and August, following a wet September SMDs began to recover and by October the upland catchments had returned to normal levels. Another wet month in November raised the SMD across the region to <10mm indicating complete soil saturation, this continued into December.

Groundwater

In spite of the prolonged dry weather experienced at surface and a marked decline in aquifer levels throughout 2025, the groundwater level in Thornton Park observation borehole did not cross below our drought trigger. This may be explained by the wetter than average conditions of winter 2023/24 which recharged the aquifer to remarkably high levels. Though there were challenges in 2025 from increased demand as a result of the warm and dry weather, we were able to meet these challenges from a very strong starting position. No impacts of the dry weather were felt on our ability to abstract and supply water. A time series of groundwater levels at Thornton Park from January 2024 to the end of 2025 are shown in Figure 4.

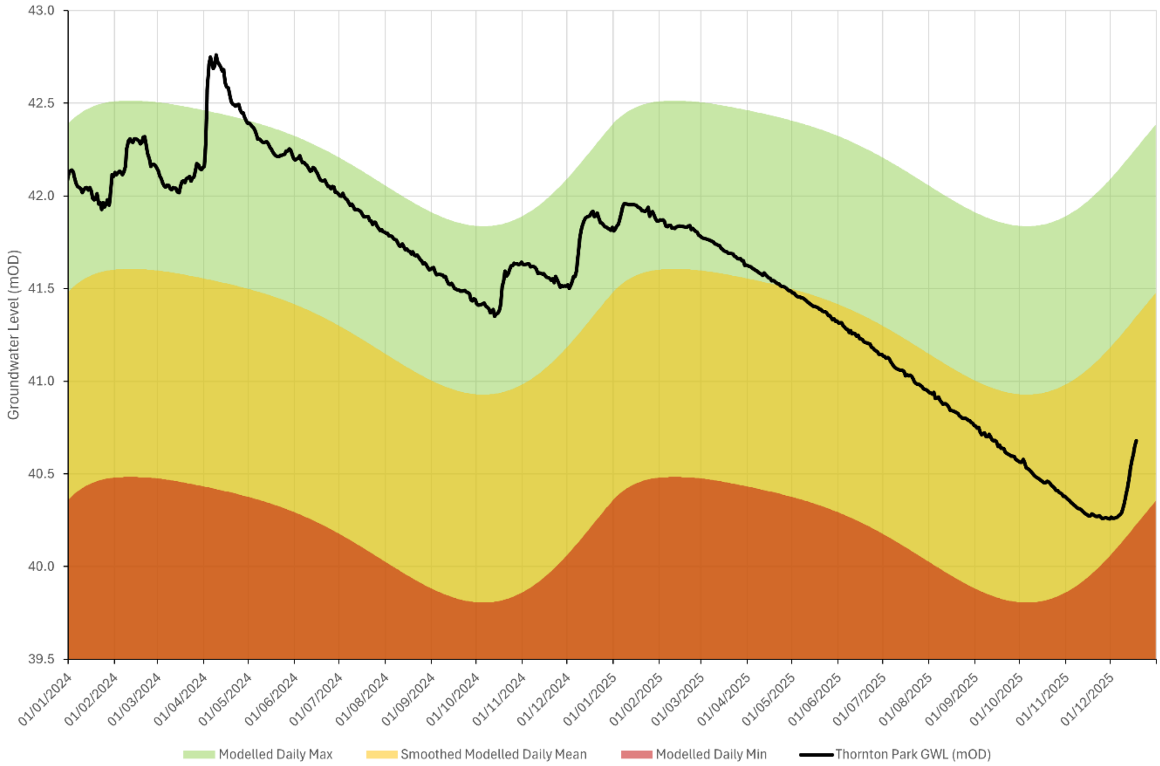


Figure 4: Thornton Park OBH groundwater level relative to drought trigger, 2024-2025

The impact of 2025's dry weather on groundwater abstractions is more likely to be felt in the summer of 2026, depending on recharge conditions dictated by rainfall and temperatures in winter 2025/26.

DI

Average DI for NW during 2025 was 717Ml/d compared to the average of 690Ml/d from the two previous dry years of 2022 and 2018. As expected peaks in demand aligned with days of high temperatures and following days with little rainfall (Figure 5).

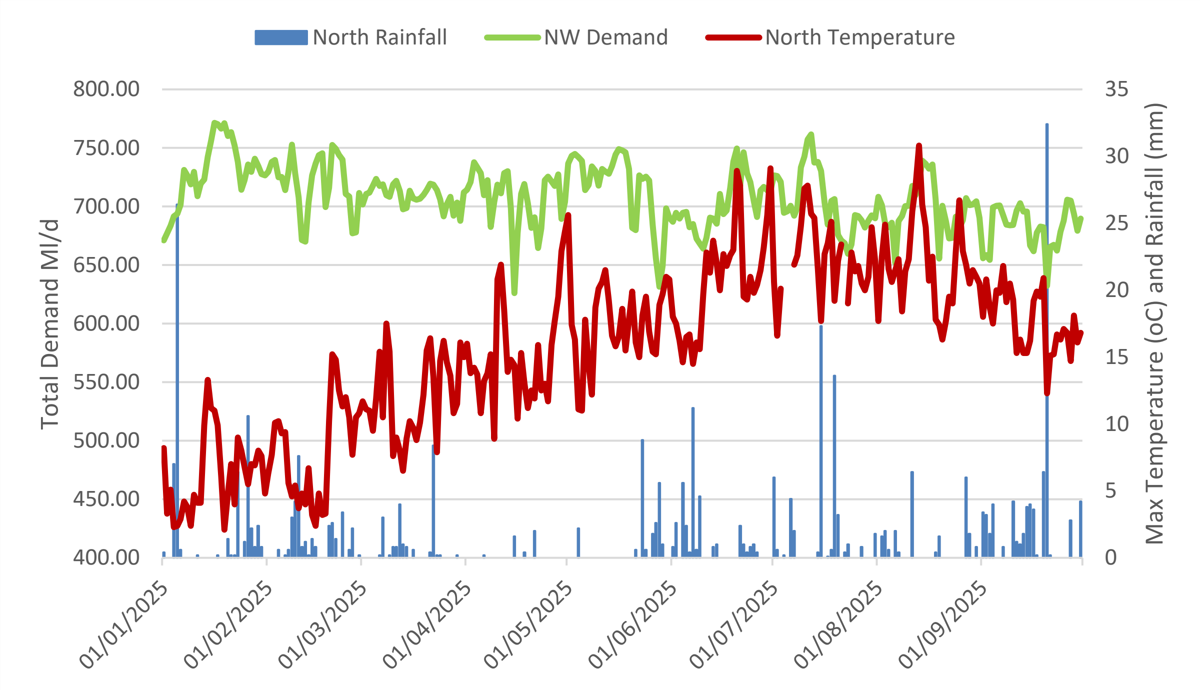


Figure 5: Demand plotted against rainfall and temperature for Jan-Sep 2025

2025 Classification

Plotting rainfall and temperature data in quadrants can graphically represent the weather conditions and show if a year would be classified as ‘dry’, ‘normal’ or ‘wet’. Figure 6 demonstrates how Northumbrian was classed as ‘dry’ for 2025. The Northumbrian area experienced 15 days where temperatures were greater than 25°C. This is considerably higher than the average of 6 days. The area experienced 705mm of cumulative rainfall for the year, which is the lowest rainfall in the data set that starts in 1987.

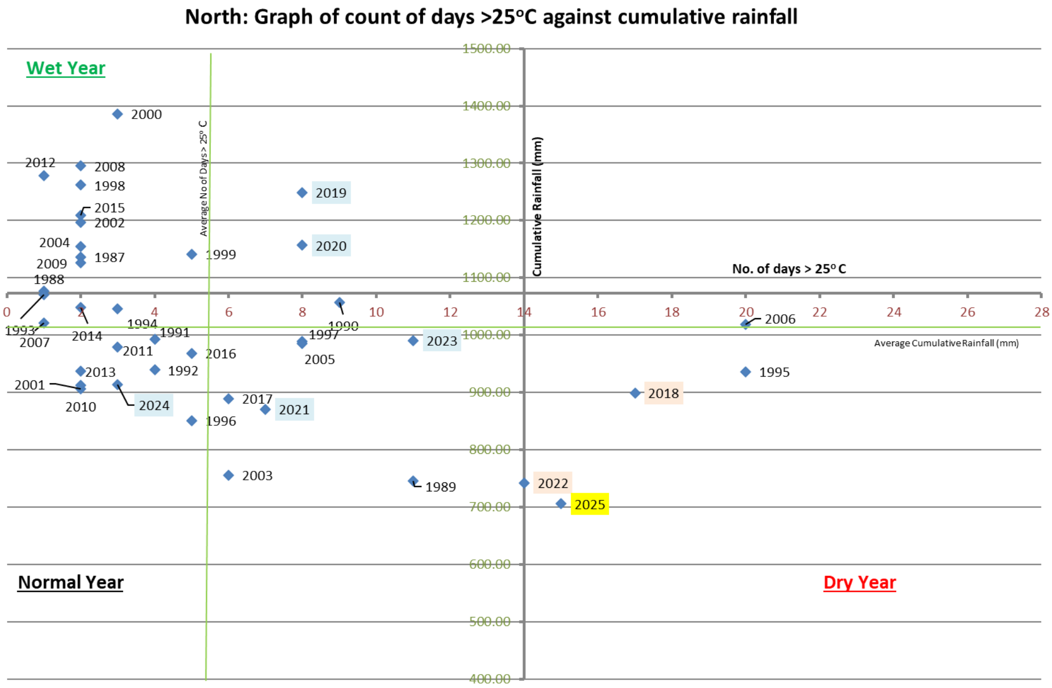


Figure 6: Quadrant graph for Northumbrian showing number of days with temperature greater than 25°C against cumulative rainfall.

Actions taken and restrictions on customer water use in 2025

A list of actions taken and notable events during 2025 are listed below.

- 5 February 2025 started Barrasford RWPS to support the Hallington reservoirs
- 1 May 2025 started regulating the North Tyne from Kielder
- 6 May 2025 NW Drought Management group convened, actions taken were:
    - Enhanced dry weather communications
    - Enhanced leakage control
    - Pressure management
    - Reduction of mains flushing
    - Limiting planned outage at WTW
    - Enhanced proactive maintenance to reduce WTW unplanned outage
- 7 May 2025 EA declared Prolonged Dry Weather in the North East region
- 12 May 2025 start the Waskerley Airshaft Pumps, to support Waskerley reservoir
- 14 July 2025 proactively tested the TTT outfall at Eggleston to the river Tees in case we needed to regulate the Tees from the TTT
- 24 July 2025 replaced Derwent compensation water with TTT water
- 28 July 2025 resumed mains flushing
- 1 August 2025 started releasing water into river Wear from TTT to improve the raw water quality.

- 1 September 2025 started sending TTT water directly to Mosswood WTW, to further support Derwent reservoir
- 26 September 2025 instigated a formal Level 1 Appeal for Restraint
- 12 - 14 November 2025 Storm Claudia brought prolonged heavy rainfall to the region
- 10 December 2025 moved back into BAU
- January 2026 EA moved the North East from Prolonged Dry Weather to Recovery

Lessons Learnt

Improving supply resilience

Despite the very dry spring and summer of 2025, the minimum level in Kielder reservoir was 80% (reached at end of May 2025) which equates to 147,570Ml of usable stock. Despite us supporting reservoirs and rivers (where required) via the Kielder Transfer Scheme there was still an abundance of water available in Kielder that could have been utilised to further support the stressed sources. As a result, we have identified two options to increase the resilience of the Kielder WRZ to drought.

1. Increase in abstraction licence for Barrasford RWPS from 60Ml/d to 75Ml/d, this would allow us to run 4 pumps at Barrasford RWPS increasing the Kielder support to Hallington reservoirs.
2. New transfer licence to allow more TTT water to be discharged into the stilling basin at Derwent reservoir and the pumped, via overland mains, into Derwent reservoir directly.

A longer-term option that we are looking to implement is altering the way in which we support Derwent reservoir from the TTT. Currently we can release water from the TTT directly into the river Derwent to replace compensation water from the reservoir and also discharge TTT water directly into the mains going to Mosswood WTW so Mosswood WTW receives a blend of reservoir and river water. This is becoming less sustainable in recent years as water quality parameters are getting tighter. We are currently investigating the option of transferring water directly from the Tyne Tees Tunnel into Derwent reservoir. This would have the benefit of removing the risk of poor raw water quality water going onto Mosswood WTW, by blending the river water with reservoir water prior to abstraction. Additionally, the river Derwent would receive compensation water from the reservoir year round, maintaining a consistent quality of water rather than switching between 100% reservoir water and 100% river water.

Whether any new temporary schemes implemented during the drought could be made permanent, ensuring they are assessed as an option in your plan

We did not introduce any temporary use schemes in our area of supply during 2025.

Newly identified drought permits

We have identified several new drought permits during 2025, see Appendix 12 for more details.

Ensuring the assumed benefits in your options list for drought interventions (such as drought permits/orders and Temporary Use Bans) implemented this year reflect your latest understanding
We have updated the benefits in our options in our latest drought plan to reflect our latest understanding. We have included the results from the UKWIR project on the impact of TUBs[25] and will also include in the final Drought Plan 2027 the results from the latest UKWIR project on TUBs which assesses savings from 2025.

Reviewing your planned level of service

As part of the WRMP24 process we have reviewed our planned levels of service. We have not changed our planned frequency of implementation of Level 1, level 2, or level 3. In-line with the Environment Agency's Water Resource Planning Guidelines (2021) we are planning to be resilient to a 1-500 drought event, i.e., increasing the likely frequency of implementing level 4 restrictions to 1 in 500 years on average.

Updating deployable outputs where you have gained an improved understanding of how your sources respond to drought

As part of the WRMP24 process we have undertaken stochastic modelling to derive updated deployable outputs (DO) for our WRZs. The stochastic timeseries used in the DO modelling includes synthetic droughts of varying intensity and duration. This will enable us to plan to be resilient to not just the worst historic droughts, but also potential future droughts that are more severe.

Ensuring your planning assumptions for dead storage and emergency storage are accurate

As part of our continuous improvement, we have invested in new rainfall-runoff models (GR6j) and have updated our historic inflow timeseries to include the recent droughts of 2018 and 2022. We are committed to updating the rainfall-runoff models with 2025 inflows and revising all our reservoir control curves, including the emergency and dead storage levels, for WRMP29.

Reviewing your demand forecast assumptions, following your experience of the impact of 2025 drought and heatwaves on household and non-household customer demand, including the extent and duration of peak demands

We will incorporate the impact of the 2025 drought on household and non-household demand in our demand forecast for WRMP29. This is done through the critical period and peak demand analysis and resulting assumptions.

Peak Demand

Historic daily weather and demand data is collected for assessing the peak demand and critical period uplift. The demand data consists of daily DI data and daily PCC

[25] UKWIR (2023) Review of the 2022 Drought demand management measured 23/WR/02/18

(split measured and unmeasured) data for each WRZ for a minimum of 12 years and will be updated for WRMP29 to include data from 2025. The weather data consists of daily maximum temperature data, daily rainfall data and daily sunshine hours data.

A peak week has been determined as a period of 7 days. This aligns with our regional group. The maximum 7-day rolling average DI for the last 12 years, including 2022, is shown in Table 1 for NW along with the reasons for the peak.

The results of the latest UKWIR project on improving approaches to demand forecasting, which includes a section of peak demand reporting, will be included in WRMP29 demand forecasts.

Table 1: Max 7-day rolling average of DI for NW, for the last 12 reporting years.

Reporting year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025
Max 7 day rolling average DI (Peak)	716.81	711.80	694.30	734.81	769.76	704.05	783.81	754.01	775.17	749.77	765.31	742.92
Date of Peak	13-Feb	05-Jul	31-Jan	10-Mar	04-Jul	10-Mar	03-Jun	24-Jul	24-Dec	18-Jun	21-Jan	15-Jul

Dry Year and Critical Period

We will update our dry year and critical period analysis to include weather and demand data from the whole of 2025 for WRMP29 demand forecasts.

Demand Management Options

Our demand management options were impacted by the drought 2025 and the lessons learnt from this period are described below.

Leakage

In an average year we would expect leakage to remain stable or even reduce slightly through the summer period, as we see lower levels of breakout and we can drive DMAs down towards historical minimums. In 2025 however, between June and September, we saw an increase in leakage of 14Ml/d compared to a reduction of 3Ml/d during the same period the previous year. In terms of job numbers, we repaired almost 2,000 more leaks between April and October in 2025 compared to 2024, which is an increase of about 38%.

A combination of the hot/dry weather causing ground movement and additional customer consumption on the network results in more pressure on the pipes which in turn leads to more failures. We also see a rewetting of the soils in autumn causing a second wave of failures as the ground moves significantly again.
It is difficult to prevent these weather events as the impact is so widely spread but we can identify sections of the network with the highest risk and put measures in place, like fixed acoustic loggers, to be able to respond quicker and more efficiently to the failures in future.

Other actions, like pressure reductions, worked well to reduce demand on the network and these have been included extensively in the 2027 drought plan. At the moment, the majority of our Pressure Reducing Valves (PRVs) need to be adjusted manually, which can take a long time to get around all of the sites. An increase in PRV controllers would give us the ability to remotely change settings and be more flexible with the pressure profile so we could deliver more reductions quicker.

Water Efficiency

Our typical water efficiency interventions outlined in our water efficiency strategy were delivered throughout the summer of 2025 as planned. In addition, a significant communications campaign was also delivered with the purpose of the upscaled communications activity being to communicate effectively with customers around the Water's Worth Saving message resulting in significant reach. Taking a multi-channelled approach to the campaigns, we leveraged greater engagement with significantly larger proportion of our customers.

Whilst successful, a key learning point from 2025 was to start communicating with customers earlier in the year, in order to encourage water-efficient practices and behaviours before the impacts of weather would start to take effect. We recognise that we need to engage customers with tailored Water's Worth Saving communications all year round, with amplified communications leading up to periods of particularly heavy water usage (i.e. March-October). This should involve a multi-channelled approach including TV, cinema, streaming, digital, social-media, direct marketing and involving employees, stakeholders and water retailers.

If you do not currently use dry year critical period scenario/s, consider whether you should introduce this scenario in your planning

We have already included dry year and critical period scenarios as part of the WRMP24 for all water resource zones.

Ensuring you consider high demand (leakage) resulting from all extreme weather - including heat waves, as well as freeze-thaw events

As mentioned previously we have observed in 2025 that leakage increased due to the exceptionally dry weather experienced in our Northumbrian region. We have previously not applied a dry year uplift to leakage in the demand forecasts however results from 2025 have proved otherwise. Therefore we will now apply a dry year uplift to leakage for the WRMP29 forecasts. All demand data (including leakage) is already included in the assessment of critical period.

Considering whether you need to include any schemes as part of your business plan to improve connectivity and zone integrity

There is already significant connectivity within the Kielder WRZ, with the Kielder Transfer Scheme being able to support, Horsley WTW, Mosswood WTW and Honey Hill WTW along with the ability to make releases to regulate the river North Tyne, river Tyne, river Derwent, river Wear and river Tees along with a transfer into West Hallington. 2025 highlighted the fact we can't fully utalise the licenced volumes from the TTT to Mosswood WTW due to water quality constraints, as a result we have applied for a transfer licence to allow us to release water from the TTT into the stilling basin of Derwent reservoir and then pump it into Derwent reservoir increasing the support available to Derwent Reservoir from Kielder.

Reflecting any updates to bulk supply agreements, including pain-share agreements discussed during the drought

We encouraged the New Appointments & Variations (NAV's) operating within our area to increase the water efficiency messaging to their customers during the drought of 2025 in line with our drought plan. We did not impose any customer water use restrictions during the drought and kept our NAV's informed of this. We are reviewing the best way to communicate with our NAVs in our draft drought plan 2027.

There is a potable bulk supply of 1.3Ml/d from Wear Valley WTW to United Utilities. This is considered sustainable under drought conditions.

Reviewing your forecast outage, as this is particularly important in acute drought events.

As part of the WRMP24 process we have revised our outage allowance, included in this is a critical period outage allowance.
Operationally to assess the risk to security of supply, all planned outages are risk assessed as part of our coordination planning process.

APPENDIX 25: IMPACT OF NEIGHBOURING TUBS

Three types of analysis were used to assess the effect of Yorkshire Water's TUB on our Kielder WRZ water demand during 2025. Yorkshire Water announced their TUB on the 8 July 2025 and it came into effect on the 11 July 2025.

The first analysis compared observed demand during the summer months in 2025 with the same months in 2024, as well as 2022. The reason for using 2024 was to compare demand to the previous year and how this has changed year on year. 2022 was used as a comparative as well due to Yorkshire water implementing a TUB from August 2022 to December 2022. Populating demand that had similar temperatures for all the summer months and years the following can be observed:

	2022			2025			Percentage Change		
Avg. Demand at each temperature	June	July	August	June	July	August	June	July	August
19 - 20	689.33	680.48	666.89	693.02	674.22	686.71	0.54%	-0.92%	2.97%
20 - 21	682.88	686.56	678.01	689.3	688.02	687.26	0.94%	0.21%	1.36%
21 - 22	710.26	694.78	677.19	704.34	681.84	670.84	-0.83%	-1.86%	-0.94%
23 - 24	725.495	705.83	664.05	717.24	687.695	673.07	-1.14%	-2.57%	1.36%

	2024			2025			Percentage Change		
Avg. Demand at each temperature	June	July	August	June	July	August	June	July	August
18 - 19	667.32	674.52	642.88	682.06	665.97	692.88	2.21%	-1.27%	7.78%
19 - 20	684.34	663.37	657.61	693.02	674.22	686.71	1.27%	1.64%	4.43%
20 - 21	687.68	665.85	667.29	689.3	688.02	687.26	0.24%	3.33%	2.99%
21 - 22	698.64	673.81	675.85	704.34	681.84	670.84	0.82%	1.19%	-0.74%
22 - 23	684.47	651.3	667.6	655.92	694.03	699.98	-4.17%	6.56%	4.85%

Table 1 and 2: Average Daily Demand based on Max temperature where all months are populated for June, July and August

As seen above, the difference is not significant comparing month to month, and all percentage changes are relatively the same. The movement from June 2025 to July 2025 does show a slight dip in most of the temperature brackets, with a mix of decreases and increases from July 2025 to August 2025. Looking at rainfall and comparing demand within rainfall brackets yielded fewer comparatives within the summer months with little significance.

The second approach was to forecast what the demand would be based on the temperature for a particular day. Polynomial regression was used to determine demand where the data from January 2023 to August 2025 was used due to a TUB in place by Yorkshire Water in 2022. Figure 1 depicts the difference between actual and the forecast when the TUB was announced as of the 8th July 2025. There is a slight indication that this may affect spikes in demand as the spikes in June 2025 and July 2025 are not observed within the beginning of August 2025.

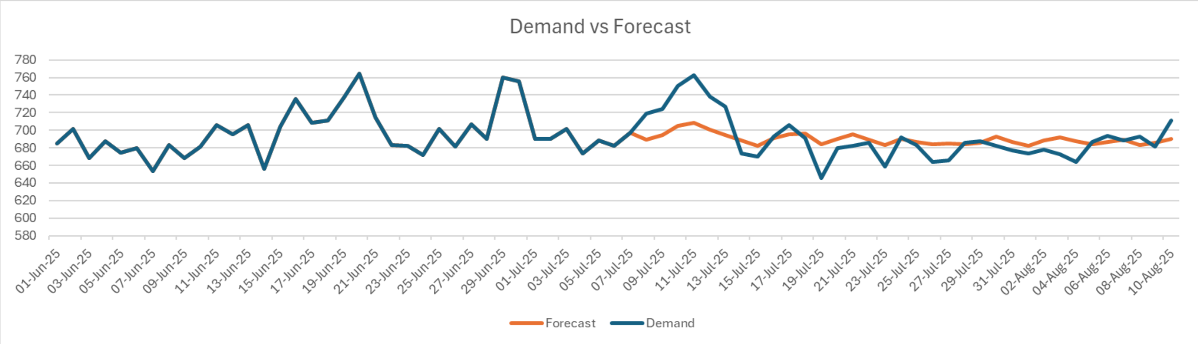


Figure 1: The difference between actual and forecast demand at the point a TUB was announced.

The final approach was looking at a weekly daily average during the summer months. A comparison was made between 2022 and 2025 (Figure 2), as well as a comparative comprising of an average of 2023 and 2024 (baseline) verses 2025 (Figure 3). Please note that the word week or weekly in the below analysis is not a calendar week but a 7-day rolling period before and after the event. The trend indicates that the TUB may have a short-term effect on demand as there is a reduction in demand in Week 1 to Week 2 in 2025 (by –4.7%) but demand starts to increase again following this.

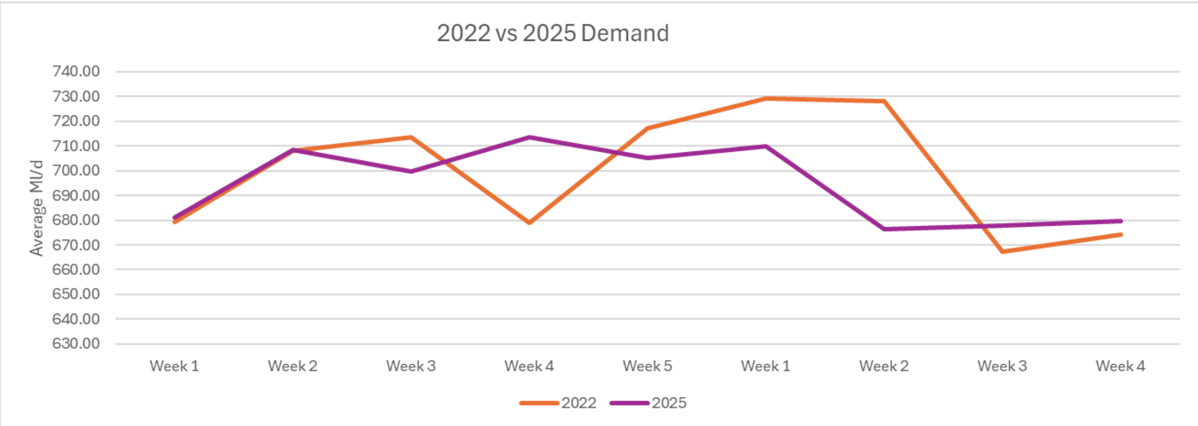


Figure 2: Average daily demand per week in 2022 verse average daily demand per week in 2025

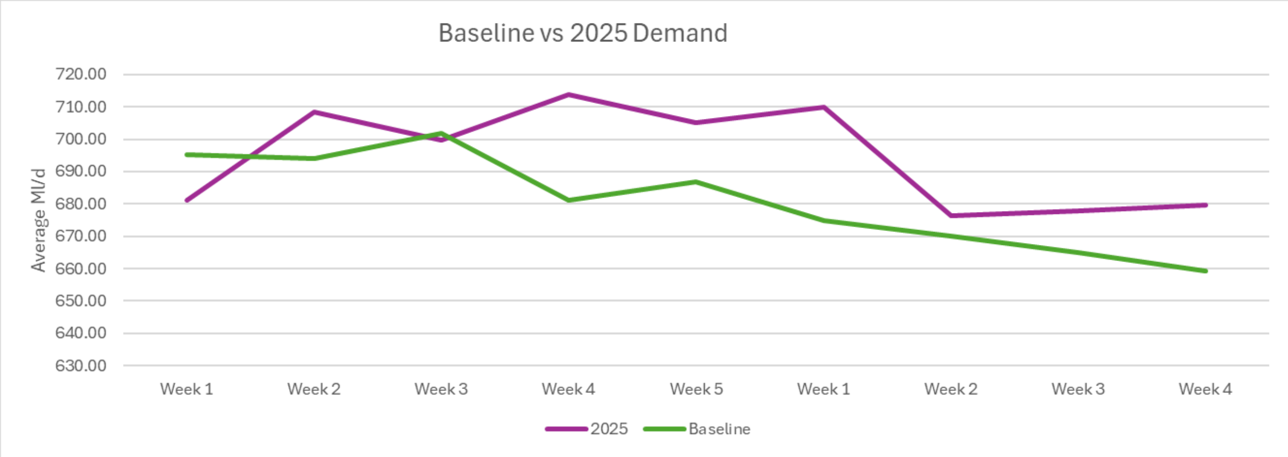


Figure 3: Average daily demand per week for Baseline (2023 and 2024) verse average daily demand per week in 2025

In conclusion there were small benefits to the TUB implementation, where spikes in demand were reduced as well as short term reduction in weekly demand. There is no indication that a neighbouring TUB had a benefit in our NW area.