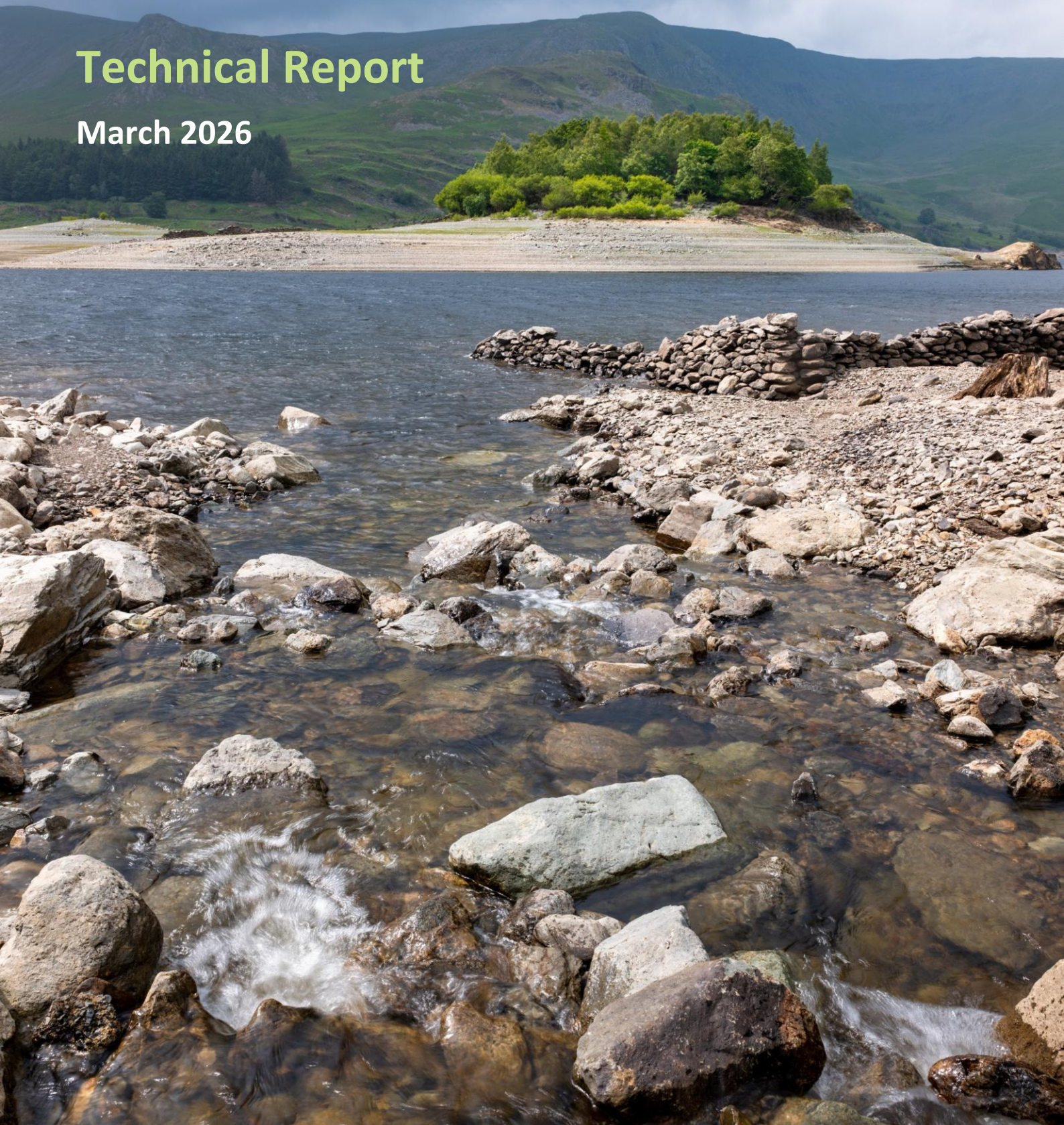


Draft Drought Plan 2027

# How we developed the plan

Technical Report

March 2026



# 1. Introduction

**We supply water to eight million people and over 150,000 businesses in the North West of England covering a large area from Cumbria to Cheshire, and from the Pennines to the West coast. On average, more than 90 per cent of the water we supply is abstracted from surface water sources, including more than 100 reservoirs, as well as river and stream intakes and lake abstractions. The remainder of our supply is sourced from groundwater sources. The water that we abstract is treated at water treatment works before being supplied to customers through our expansive aqueduct and water main network.**

Our drought plan helps to ensure that we can maintain a resilient supply to customers during droughts and protect the environment. This plan represents a significant update from the previous one published in 2022. This technical report highlights some of the key changes:

- Best practice and guideline updates;
- Lessons learned from recent dry weather events;
- New hydrological data;
- Optimising our Strategic Resource Zone;
- New Pennine drought levels;
- Communication action updates;
- Demand actions and timeline updates;
- Extreme drought measures; and
- Adaptive planning.

The 2022 Drought Plan established an operationally focused approach underpinned by enhanced modelling capability and increased flexibility in system management. A key development was the introduction of an enhanced monitoring and operational threshold within the drought level framework, designed to initiate a defined escalation in operational activity during periods of sustained dry weather.

This updated plan builds on that methodology by ensuring that water resource models reflect real operational practice while maintaining the adaptability required to manage atypical drought patterns and system contingencies. We recognise that drought events are inherently variable, and an effective response relies on dynamic, context-specific decision-making rather than rigid procedures.

It is important to retain flexibility both in our models and in day-to-day operations to deal with drought patterns we have not encountered before and routine challenges such as source outages. For the Strategic Resource Zone in particular, it is not practical to produce a prescriptive list or flow chart of actions to follow during dry weather and drought events. Instead, our approach is designed to provide a resilient supply system and an effective drought plan by building in the flexibility required to respond to changing conditions. This flexibility is essential; it helps us keep water supplies resilient and ensures our drought plan can adapt to changing conditions.

## 1.1 Best practice and guideline updates







In developing our Drought Plan 2027, we have closely adhered to the latest regulatory and industry guidance to ensure our plan reflects current best practice and is robust under future drought conditions.

Since the publication of our previous drought plan, we actively contributed to the development of the UKWIR Drought Code of Practice, published in 2023. We helped shape the document so that it is more practical, inclusive and aligned with the sector’s current needs. The code includes new appendices reflecting lessons from the 2022 drought, clearer terminology for exceptions, refined temporary use ban categories, and updated roles and responsibilities of wholesalers and retailers during drought. As a member of the Project Steering Group, we provided feedback throughout the process to update the Code. This included improving fairness, clarity of exceptions, consistency of messaging, and the overall usefulness of the Code. We placed particular emphasis on communication, developing strategies for timing, platforms, and messaging to ensure customers understand restrictions and their implications. Our contributions aimed to make the Code more practical, inclusive, and responsive to the evolving needs of the sector and its customers.

In parallel, we have incorporated the Environment Agency’s 2025 update to the water company drought plan guidelines, which introduced a range of improvements based on recent drought experiences, evolving policy, and stakeholder feedback. These changes are summarised in Table 1 and are reflected throughout our plan.

Together, these updates have informed the structure, content, and operational logic of our Drought Plan 2027. You will see these influences embedded in our drought level framework, response actions, communication strategy, and integration with emergency planning.

**Table 1: Key themes in the Environment Agency’s updated water company drought plan guidelines**

Theme	Key changes
 <p>Learning from experience</p>	Lessons from recent droughts integrated to improve public water supply resilience.
 <p>Policy, Regulation &amp; Alignment</p>	Reflected legislative and environmental policy updates. Aligned with Natural Resources Wales guidance. Incorporated stakeholder feedback.
 <p>Clarity &amp; Presentation</p>	Improved structure and readability of the guideline. Enhanced guidance for non-technical summaries.
 <p>Industry Integration &amp; Collaboration</p>	Incorporated UKWIR 2023 drought management updates. Defined roles for NAVs and water retailers. Added guidance on firefighting water supply.
 <p>Emergency &amp; Operational Planning</p>	Expanded emergency drought planning guidance. Introduced annual drought plan health check. Further detail on drought recovery. Updated extreme drought actions and alternative pathways.
 <p>Drought Action Framework</p>	Updated drought levels table. Required programme of work for environmental readiness. Guidance on grouping permit/order applications. New section on further domestic demand reduction actions.

## 1.2 Lessons learned

Our response to the dry weather and drought events of 2022 and 2025 has provided valuable operational insights that have directly shaped the development of Drought Plan 2027. The 2025 drought occurred while this draft plan was in development, and a formal review of lessons learned is currently underway in collaboration with the EA. Where possible, early lessons from 2025 have already been incorporated into this draft plan, particularly in relation to timely drought action and effective communication.

Where lessons require further investigation, data collection, or longer-term development such as improving the quality of data that is transferred, these are being captured within a programme of work with defined timescales and monitoring arrangements. Progress will be reported through the annual drought health check and where required through the Annual WRMP review process. Any remaining lessons identified through the ongoing joint United Utilities-Environment Agency review will be concluded and considered in the final version of the Drought Plan 2027. Further information is included in our 'Lessons learned from the 2025 drought' technical report.

## 1.3 New hydrological data

For this Drought Plan and our upcoming Water Resources Management Plan 2029 (WRMP29), we have updated all reservoir and river source inflow series using the GR6J rainfall–runoff model. This marks a significant enhancement in how inflows are represented across our system. The updated inflow datasets were developed to improve the representation of catchment inflows in our water-resource models, with benefits for smaller reservoir systems. These updates provide a more robust assessment of raw water availability across the region. Local Environment Agency hydrology specialists were involved throughout the process and supported both the selection of modelling approaches and the calibration of the inflow series.

### 1.3.1 Reduce uncertainty at smaller reservoirs

Previously, inflows for smaller reservoir catchments were estimated by scaling flows from larger “parent” catchments. While this method is well-established, it introduced additional uncertainty due to ignoring hydrological differences between catchments.

We have now adopted bespoke, calibrated GR6J models for each smaller reservoir group. This enables the generation of locally representative inflow simulations, reducing reliance on scaling relationships and improving confidence in both drought assessments and yield analyses.

### 1.3.2 Ensure consistency across all inflow datasets

The GR6J model has been applied systematically across all sources, covering both historic naturalised flows and stochastic flow generation. This consistent modelling framework ensures:

- Direct comparability between datasets;
- A coherent basis for water resource planning; and
- Alignment between observed and simulated inflows under both historic and future climate scenarios.

These improvements represent a step change in inflow modelling and provide a more robust foundation for drought planning and long-term resource management.

## 1.4 Optimising our Strategic Resource Zone

Following the introduction of GR6J hydrological models and updated inflow datasets for sources across our region we have undertaken a significant and pioneering optimisation project for our Strategic Resource Zone. For Drought Plan 2027 we have simultaneously optimised reservoir control curves and drought levels across the entire resource zone – an industry first. This marks a shift to a system-led response, enabling us to identify the best integrated system-wide performance of the resource zone. We used a multi-objective evolutionary algorithm to optimise both the position of reservoir control curves and drought levels, allowing us to explore performance across multiple objectives and understand the interplay and trade-offs between them:

- The return periods or level of service for drought action events, including;
  - Temporary use bans,
  - Drought orders and permits;
  - Ordinary drought orders to ban non-essential use; and
  - Emergency drought orders; as well as,

- Operational cost.

Additional constraints were incorporated to reflect the timeline and critical path for drought action implementation, ensuring actions are sequenced appropriately and with sufficient lead time.

For the optimisation, conditions were aligned with the start of the Drought Plan 2027 window, except for demand where FY24 observed figures were used rather than forecast. At the time of modelling, the demand forecast was in the process of being updated. As a result, the observed FY24 demand was used as the best available information. Median climate change impacts were incorporated for a central 2027 scenario, with catchment inflows scaled accordingly<sup>1</sup>.

The approach is computationally intensive and represents a step change in how drought levels and control curves are generated. In the 2022 Drought Plan each drought level location was assessed individually, using a multi-objective evolutionary algorithm to optimise the positions of those drought levels. In contrast, for Drought Plan 2027 the entire Strategic Resource Zone has been optimised holistically, resulting in a preferred set of drought levels selected based on a comparison of optimisation objectives and other key metrics:

- Average system cost;
- Return periods of key drought actions (temporary use bans, drought permits/orders, non-essential use bans, and emergency drought orders);
- Return period of level crossings; and
- Shape relative positioning of drought levels.

In addition to this methodological advancement, we have also considered the spatial configuration of drought level locations in the Strategic Resource Zone to better identify when drought action is required. Previous plans included drought level locations at Haweswater reservoir and Dee (combined storage of Celyn and Brenig reservoirs) – strategic sources in the north and south of the zone, respectively. For Drought Plan 2027 we assessed the viability of introducing drought levels in the Pennines, and this proposed addition is described further in the following section.

For our remaining resource zones, we conducted a thorough review of where we have drought levels and assessed the existing drought levels on their suitability for Drought Plan 2027. Following this review, we have retained the existing configuration for the Carlisle, North Eden, and Barepot resource zones.

## 1.5 New drought levels on the Pennines

We review the geographical locations of drought levels for each drought plan. In recent years, dry weather has affected water sources in the Pennine area of the Strategic Resource Zone, so we undertook a review to ensure drought levels are set in the right places to provide clear and effective guidance for operational decision-making. This review forms part of our commitment to continuous improvement and maintaining a resilient approach to drought planning.

Historically, drought levels have been located at our strategic sources: Haweswater Reservoir in the north and Dee storage (combined Celyn and Brenig reservoirs) in the south. These locations have provided strong indicators of system stress and were representative of overall water resource status for the zone. However, recent analysis and operational experience highlighted an opportunity to better represent the balance between local and strategic sources within the resource zone.

Using hydrological modelling and system optimisation, we found that drought levels in the Pennines complement existing levels at Haweswater and Dee. Together, these three locations provide a more integrated and

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<sup>1</sup> Climate change perturbations were applied using monthly change factors derived from the UKCP18 Regional Climate Model ensemble, with RCM\_06 under RCP8.5 used to represent the Central (“median change”) scenario, consistent with UU WRMP24 modelling. Monthly factors originally produced for 2070 were scaled to represent earlier time slices using the same WRMP24 scaling approach.

representative view of drought conditions across the Strategic Resource Zone. The Pennines levels<sup>2</sup> were designed to work conjunctively with the existing strategic levels, ensuring that drought actions are informed by a broader and more balanced set of indicators.

Extensive scenario testing was undertaken to stress-test the proposed drought levels and associated actions. This demonstrated that the plan is robust and capable of delivering an effective response under a range of challenging conditions.

The Pennines level's real-world performance will be monitored following adoption. We will review their effectiveness during the next five years and consider our approach for the following drought plan.

## 1.6 Communication actions

Our latest communication actions plan represents a significant step forward in how we engage with customers, regulators and stakeholder during periods of dry weather and drought.

One of the most notable advancements is the embedment and further promotion of an agile, insight-driven communication model. This now allows us to adjust messaging and channels in real time based on drought severity, customer behaviour and campaign performance - helping us target communications more effectively and support more meaningful behaviour change (see section 6 of our 'Communication actions' technical report).

We have refreshed and expanded our stakeholder mapping, adding a new section on coordinated communications to improve consistency in our communications and strengthen stakeholder engagement. This includes clearer protocols and regular liaison with NAVs, retailers, other water companies, regulators, government bodies and environmental groups, ensuring collaboration scales appropriately with the drought level (see section 2 and 3, 'Communication actions' technical report).

Our communication actions are now more clearly structured around defined drought levels, from early warnings through to post-drought recovery. Each level sets out who we communicate with, how and when, improving clarity, consistency and public trust. We have also introduced a new stage covering the lifting of temporary restrictions, reflecting the need for clear communication as measures are eased (see Table 2, 'Communication actions' technical report').

Performance measurement has also been improved, supported by stronger feedback loops and post-event reviews. Learning from recent dry weather events has already helped us enhance message timing, stakeholder coordination and campaign design (see 'Lessons learned from the 2025 drought' technical report).

## 1.7 Demand actions and timeline

We have strengthened and refined our demand actions plan through a more robust and evidence-based approach. The demand action savings and benefits have been updated using updated models and supported by wider industry benchmarking, as well as a comprehensive review of literature to ensure our assumptions are both realistic and consistent with best practice across the sector.

We have also enhanced the timelines for implementing each demand action by considering the full sequence of activities - from preparation and mobilisation to communication, implementation, and the point at which benefits are expected to be realised. This has improved the accuracy of our planning and provided a clearer understanding of the practical delivery of each action. These improvements have directly informed and strengthened our drought modelling, supporting the development of updated drought levels and control curves that more accurately reflect the timing and effectiveness of our demand management interventions. The implementation timetable of demand actions at each associated drought level is shown in Table 9 'Demand actions' technical report. To improve clarity, we have strengthened the way we describe our approach to managing water use

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<sup>2</sup> The Pennines drought levels refer to the combined storage of Pennine source reservoirs and impounding reservoirs, comprising: Rivington, Stocks, Whitebull, Burnley, Mitchells, Fishmoor, Langthwaite, Barnacre, Parsonage Dean, Guide/Pickup Bank, Grizedale Dock, Rochdale, Oldham, Buckton Castle, Longdendale, Bolton, Rossendale, Macclesfield, and Wybersley.

restriction exceptions (see Section 4.1, 'Demand actions' technical report). In addition, our approach to non-statutory exceptions has been further developed to set out clearly how these would be applied in practice, drawing on learning from how we would have managed temporary use ban exceptions during 2025. This enhanced explanation provides greater transparency for customers and stakeholders and ensures a consistent and fair approach, with particular consideration given to protecting vulnerable customers. We have also evaluated the appropriate geographic scale for applying water use restrictions i.e. implementing a temporary use ban may be considered at Water Resource Zone (WRZ) level or on a more local basis, depending on the circumstances and operational requirements at the time. This has drawn on the lessons learned from the 2025 drought and ensures our actions are proportionate and targeted to the areas most affected. A temporary use ban notice example based on our 2025 experience is included in Appendix A of the 'Demand actions' technical report.

## 1.8 Extreme measures

Since our previous plan, we have further developed and strengthened our approach to managing extreme drought by adopting a more adaptive and evidence-based planning framework. The updated plan expands the range of actions available to delay the need for emergency restrictions on household/domestic water use and non-household customers. It includes a broader suite of innovative demand management measures, such as the removal of non-statutory exceptions (for example, temporary use bans and non-essential use bans, alongside the increased promotion of water-saving devices, efficient appliances, and, where appropriate, water butts to encourage household water reuse). Targeted smart metering initiatives have also been incorporated to promote efficient water use and enhance customer awareness during drought conditions. Collectively, these updates provide a more comprehensive and flexible set of demand and supply-side measures to manage severe droughts.

We have developed and prioritised these actions using a multi-criteria assessment that considers potential benefit, environmental impact, implementation readiness, scalability, and customer impact. While all factors are important, greater weight has been placed on potential benefit, ensuring that measures delivering the greatest impact are prioritised to reduce the need for more disruptive or higher-risk interventions later. Based on this assessment, options are grouped into three tiers according to their complexity, cost, and resource requirements. This tiered approach ensures that lower-risk, modular interventions (Tier 1) are implemented first, while higher-risk or capital-intensive measures (Tier 2 and Tier 3) are reserved for later stages of response when justified by prevailing drought conditions.

The Environment Agency Emergency Drought Plan guideline has now been provided and has informed our approach to emergency planning within this framework, ensuring alignment with regulatory expectations in relation to the development, trigger points and implementation of emergency drought measures.

## 1.9 Adaptive planning

We have built adaptive pathways into our plan to ensure we plan for uncertainty due to the varying nature of drought. Every drought is different, and this inherently variable nature of droughts highlights the need for a flexible and adaptable response accounting for conditions at the time and contextual decision-making. Instead of relying on a fixed, linear sequence of actions, we've adopted a flexible model that allows lower-priority extreme drought measures to be deployed in different combinations or orders, depending on how drought conditions develop. This helps us avoid acting prematurely while still ensuring we can escalate quickly when the situation demands it.

The structure is organised around three stages - preparation, mobilisation, and implementation, so each action is triggered with enough lead-in time to deliver meaningful benefits. By keeping multiple routes open and progressing some actions in parallel, such as preparing Tier 2 measures while delivering Tier 1 interventions, we maintain readiness and stay responsive throughout the evolving situation. Overall, this approach ensures our drought response remains proportionate, agile, and effective (see section 5, 'Testing our plan' technical report).

**United Utilities Water Limited**  
Haweswater House  
Lingley Mere Business Park  
Lingley Green Avenue  
Great Sankey  
Warrington  
WA5 3LP  
[unitedutilities.com](http://unitedutilities.com)



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