

Draft Final Drought Plan 2022

Appendix D: Supply side options and permits



1 Introduction

This Appendix outlines the drought management supply side options and drought permits that we would consider implementing during a drought event. Actions will only be pursued if they are right for the current drought situation, and the plan for dealing with a specific drought event is likely to comprise of a variety of actions. The drought levels are designed to provide sufficient time between them to allow these actions to be implemented. The drought levels are decision areas to review possible actions and determine the appropriate course of action in the drought event.

2 Supply side options

These are actions or additional water sources that may be used in the event of a severe drought. These include the use of reservoir dead water, increasing the usual outputs of certain sources and tightening control on compensation flow releases from our reservoirs.

These options are not required to prevent reservoirs emptying in a repeat of the worst drought on record, even when the forecast effects of climate change are taken into account. However, we may take action to bring supply side options in to use as a precaution against the risk of a more severe drought occurring. The supply side options which could be used during a drought are shown below in Table 1. The Castle Carrock deadwater option could allow access to up to 170MI of additional water, however treatability and access would need to be taken into account.

Table 1 Supply side options associated with each drought level

Source	Deployable Output (MI/d) (estimated in a drought)	Estimated time to implement	Benefit
Castle Carrock reservoir, deadwater storage	6.0	1 month	Carlisle resource zone

As a result of the dry weather in 2018, several previous supply side options sources were commissioned and brought online. These sources are now part of our normal operating suite of sources and their output could be increased (within licence limits) during a drought, these include the Widnes Boreholes: Stockswell, Netherley, Pex Hill and Water Lane. A review of the remaining non-commissioned sources was undertaken to assess the availability and benefit they would provide and it was determined that these would be removed from the drought plan. By bringing the non-commissioned sources into regular use, utilisation of such sources will assist in taking demand off the regional or local water supply system, making it more resilient overall compared to the previous suite of supply options.

Drinking water quality needs to be maintained during drought conditions. We are required by legislation to provide drinking water that meets the statutory water quality standards and this would continue to be the case during drought conditions. If a source has not been in supply for a certain length of time, the water source is tested prior to being used in line with the sampling provisions set out in Section 15 of the Water Supply (Water Quality) Regulations 2000 (as amended) to ensure we are able to treat the water to the required potable standards. In some cases, the source may not comply with these regulations resulting in it being unavailable for use. Water quality sampling can take several weeks to complete before the source can be brought in to operation and needs to be considered from the enhanced monitoring and operations curve.

The increase in borehole usage would be in response to an increase in demand or declining reservoir supplies, however from a water quality acceptability point of view we will always remain mindful of achieving an acceptable blend of borehole water with other sources. In some cases, for example when a reservoir source is changed for a groundwater source, customers may notice a change in the type of water e.g. from soft to hard water. In these cases, we will assess the change in water blend and undertake proactive customer communications as necessary as we regard it as very important to keep our customers informed of any water supply alterations. In the event of any concerns about drinking water quality arising from drought conditions, we would liaise closely with Public Health England, Local Authorities and the Drinking Water Inspectorate.

One of the options is the implementation of closer control of compensation flows from impounding reservoirs. There are several factors taken into account when aligning the compensation release to the statutory compensation flow requirement, some of those being: wave/wind action on a reservoir, position of measuring point in relation to compensation release location, additional downstream activities, head-loss as the reservoir water level drops etc. During drought conditions, the level of risk associated with these factors is reviewed and where possible compensation is tightened as close to statutory as possible thereby reducing any compensation over-release.

We are mindful that there are other activities which can play a role in increasing the resilience of a source to the effects of dry weather. Catchment based solutions such as ‘slow the flow’ techniques and the restoration of bogs and peatland can make surface water catchments more resilient to dry weather by retaining and supporting baseflows. We have a comprehensive programme of catchment interventions planned for the present and future. However, catchment based solutions take a very long time (in some cases over a decade) to have a measurable effect, and therefore such plans cannot be part of a reactive drought plan and must therefore fall beyond the scope of this document.

Finally, we are working closely with the Environment Agency to determine the long term sustainability of our abstractions. We have a significant programme of WINEP (Water Industry National Environment Programme) investigations exploring the potential impact of abstraction and we are working with our partners in Water Resources West to develop a long term destination for patterns of sustainable abstraction across the region. The results of these investigations will be built into our patterns of abstraction in the future, however the earliest WINEP investigations will not report until 2022, and the results will be used to inform future iterations of the Water Resources Management Plan (WRMP). Similarly, our patterns of abstraction may need to change for operational reasons, for example in the future we may need to abstract more than the historic average from a particular source (whilst remaining within licence limits) either as a response to dry weather or as part of an operational change, enabling us to meet evolving patterns of demand. The environmental consequences of any such changes will be investigated and managed through future iterations of the WINEP and the outcomes of those investigations will inform future iterations of the WRMP.

During droughts we manage our compensation flows from reservoirs carefully to minimise over-releases; this is to preserve water in our reservoirs in order to secure future compensation flow releases as well as public water supply abstraction. The compensation flow requirements, set in our abstraction licences or Acts of Parliament, are minimums and we carefully control our releases to ensure we meet these minimum requirements; we will only lower compensation flows below these minimum requirements where a drought permit/order is in place to authorise this and an environmental assessment will have been completed to support a drought permit/order application. A drought permit/order issued by the EA/Secretary of State may include environmental monitoring conditions (including water quality or environmental impacts).

During drought periods we actively work to protect and support the environment. For example, we have set trigger levels across all our reservoirs detailing when we need to undertake water quality monitoring to inform the need for fish and/or crayfish rescues. We also support a multi-agency approach to deal with moorland fires. We affirm our continuing commitment to providing such support in the future.

3 Drought permits/orders

Drought permits and drought orders are drought management actions that, if granted, can allow more flexibility to manage water resources and the effects of drought on public water supply and the environment.

Drought permits are granted by the Environment Agency or Natural Resources Wales (depending on the geographical location of the water source) and can modify or suspend conditions on an abstraction licence. Drought orders are granted by the Secretary of State or Welsh Ministers and consent some additional actions (over and above those provided by drought permits) and are usually applied for when the actions proposed are concluded to result in adverse impacts on designated sites. For drought permits and drought orders, the water company is responsible for the application and must prove that a serious deficiency of public water supplies exists or is threatened because of an exceptional shortage of rain. Table 2 explains drought permits and orders further.

Table 2 Drought permits and orders explained

Legislation allows water companies to apply for both drought permits and drought orders to manage a drought situation	
Drought Permits: Environment Act 1995	The Environment Act 1995 introduced drought permits – prior to this only drought orders existed. Drought permit applications are determined by the Environment Agency or Natural Resources Wales. They can alter an abstraction licence e.g. to allow abstraction by pumping or increase the volume of water allowed to be abstracted. The Environment Agency or Natural Resources Wales can hold a local public hearing to discuss the application if it deems one is necessary. A drought permit lasts for a maximum of 6 months but can be extended by a further 6 months if necessary.
Drought Orders: Water Resources Act 1991	Drought order applications are determined by the Secretary of State or Welsh Ministers and they have the same powers as drought permits but can also authorise the water company to enter/occupy land to carry out necessary works and to discharge water. Defra expects water companies to apply for orders rather than permits for applications that are likely to have significant impacts on flora and fauna and/or designated sites. A local public hearing or public inquiry can be called if it is deemed one is necessary. A drought order lasts for a maximum of 6 months but can be extended by a further 6 months if necessary (note that water companies can also apply for drought orders to restrict the non-essential use of water).

In the case of reservoirs whose sole purpose is to provide a compensation flow release to the downstream river (i.e. they are not used for public water supply), the Environment Agency are responsible for applying for a drought order to Defra (see Appendix G for further information).

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

- Reducing compensation flow releases from reservoirs to downstream rivers to conserve storage in the reservoir for future abstraction (for both public water supply and for continued release to the rivers)
- Relaxing abstraction licence limits such as annual volumes of water that can be abstracted or flow/level limits below which abstraction cannot occur
- Reducing prescribed flow constraints (also known as hands-off flows) on rivers to allow continued abstraction for public water supply below the level where abstraction would normally cease

There is the potential to need a drought permit/order at any of our abstractions across the region, however it is unlikely at most locations. In Figure 1 we have identified the locations where we consider there is a reasonable chance that we may apply for a drought permit/order in the future; the drought permit catchments show the area used to provide the rainfall data to calculate the exceptional shortage of rainfall. In order to maintain flexibility within our drought planning, this list is not exhaustive and there could be other locations that may require a drought permit/order application; in this event we would liaise closely with the Environment Agency and other relevant stakeholders.

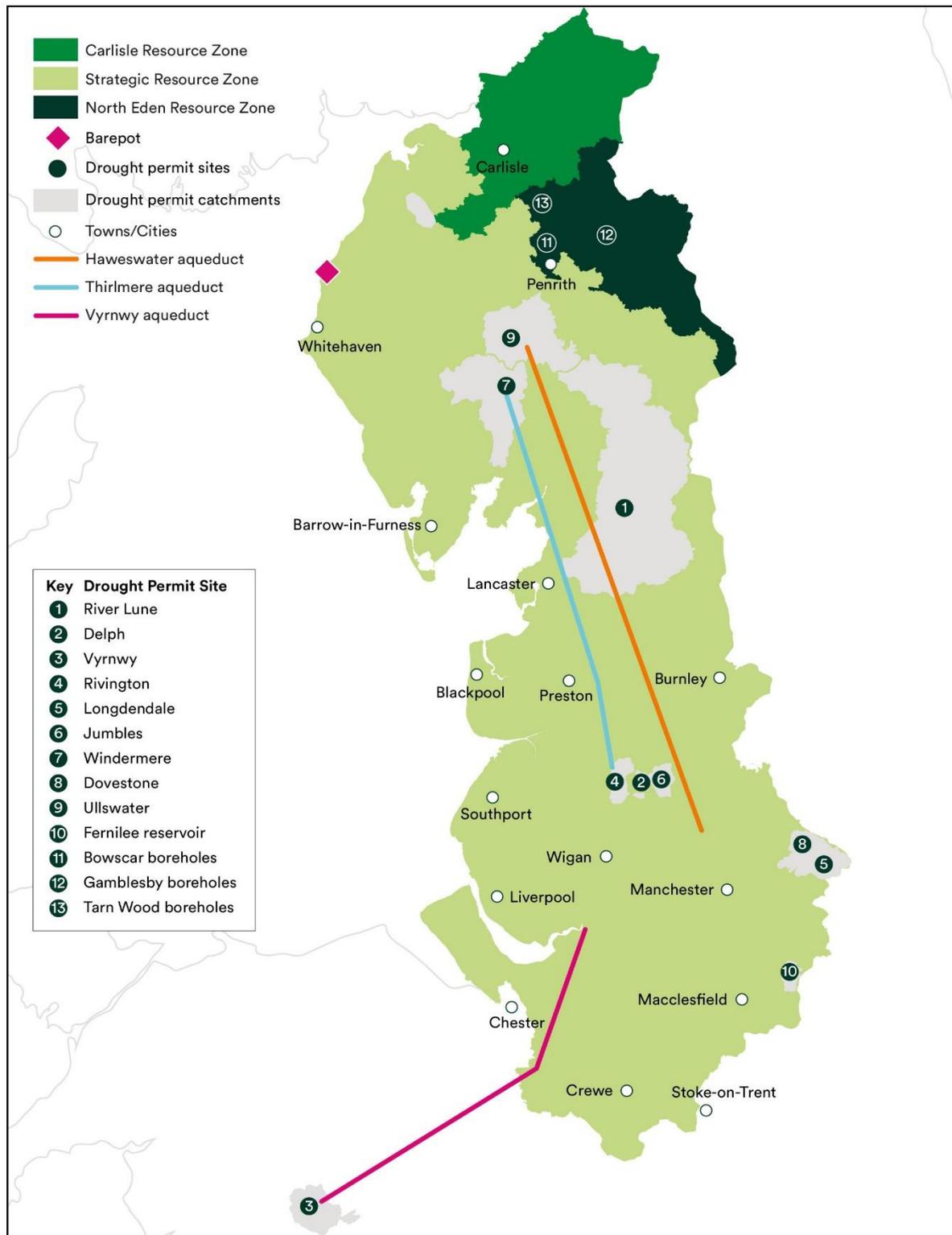


Figure 1 - Map of the drought permit sites

This plan comprises only drought permits linked to our public water supply reservoirs and river abstractions, as shown in Table 3.

Table 3 lists our drought permit sites, together with details of the change that could be sought in a future application. The actual powers applied for in the future depend on the severity of the drought event, the time of year and the current situation at that time and therefore at some sites, there are two potential options. Not all of the actions would necessarily be implemented to their full extent or for the full period of a permit. It is also possible that additional drought permits/orders at sites not included in Table 3 may be required. There is no guarantee that applications for drought permits/orders will be granted as each application needs to be assessed by the Environment Agency/Natural Resources Wales/Secretary of State/Welsh Ministers (as appropriate) taking account of current conditions in the specific drought situation.

The need for drought permits would be considered within drought level 2 and the required information to support an application would be prepared. We will discuss any plans for drought permits/orders with the environmental regulators (Environment Agency, Natural England and Natural Resources Wales) and Defra as appropriate. We expect to apply for drought permits within drought level 2, followed by implementation if granted.

Table 3 Potential drought permit sites

Drought permit site	Drought permit conditions
Delph	Reduce compensation flow from 3.7 to 1.0 MI/d
Dovestone	Reduce compensation flow from 15.9 to 10.0 MI/d or 5.0 MI/d
Fernilee	Reduce maintained flow from 13.6 to 6.8 MI/d
Jumbles	Reduce compensation flow from 19.9 to 12.0 MI/d or 6.0 MI/d
Longdendale	Reduce compensation flow from 45.5 to 22.5 MI/d or 15.0 MI/d
River Lune LCUS	Reduce hands-off flow from 365 to a minimum of 200 MI/d
Rivington (Brinscall Brook)	Reduce compensation flow from 3.9 to 2.0 MI/d
Rivington (White Coppice)	Reduce compensation flow from 4.9 to 2.0 MI/d
Ullswater	Reduce hands-off flow to a minimum of 175 MI/d and relax 12-month rolling abstraction licence limit
Lake Vyrnwy	Reduce compensation flow from 45.0 to 25.0 MI/d
Windermere	Reduce hands-off flow to a minimum of 95 MI/d and relax 12-month rolling abstraction licence limit
Bowscar boreholes	Increase annual licence limit to enable continuation at the maximum daily abstraction rate
Gamblesby boreholes	Increase annual licence limit to enable continuation at the maximum daily abstraction rate
Tarn Wood boreholes	Increase annual licence limit to enable continuation at the maximum daily abstraction rate

3.1 Drought permit applications

Over recent years we have completed a lot of work to ensure we are prepared for drought permit applications and are able to produce the information required in a timely manner. This has included collating the following information for each drought permit site:

Table 4 Drought permit application preparation

Drought permit application preparation
Drought permit application form WR80 and cover letter (note there is no formal form for a drought order application)
A draft of the drought permit (produced by the Environment Agency or Natural Resources Wales as appropriate)
Draft statement in support of the application
Location map (normally included in draft statement)
Draft notice of application (as will appear in newspapers and sent to relevant parties)

Contact details for those on whom notice would be served – both statutory and out of courtesy
Abstraction/impoundment licence and associated agreements
Relevant Act(s) of Parliament
Environmental Assessment Report (including an Environmental Monitoring Plan)
Details of newspapers where notice will be advertised
Details of local venues suitable for the public to view a copy of the application

In accordance with the Environment Agency’s guidance (April, 2020) we have:

- Prepared environmental assessments of all our drought permit sites. In a drought event we will update and tailor the relevant environmental assessment reports to reflect the timing of the permit being applied for and include recent data (where relevant to do so). The environmental assessment reports also include our proposals for monitoring, both before and during implementation of the drought permit and post drought recovery. Our Environmental Monitoring Plans have been agreed with the environmental regulators and are reviewed annually. We also review the need to update any of the ‘shelf-copy’ Environmental Assessment Reports annually
- Identified and undertaken baseline monitoring required to support our drought permit applications;
- Discussed our drought permits with key stakeholders. For each of our drought permit environmental assessments we establish a Project Steering Group comprising the environmental regulators. We also engage with key stakeholders where identified
- Identified the advertising arrangements for each of our drought permits including local newspapers and venues for displaying the application documents
- Identified potential venues for public hearings
- Set out the process we will follow to demonstrate an exceptional shortage of rain (see Section 5).

Our supporting statement, to accompany a drought permit application, will also include:

- An assessment of the benefit of the drought permit and the risks to the water supply situation if the application is not granted
- Proof that a serious deficiency of water supplies exists or is threatened due to an exceptional shortage of rain
- Details of the actions we have taken to manage the water resources situation and conserve supplies including demand management actions, operational actions and communication actions

Further details on each drought permit site are included in Section 6.

4 Environmental assessments

4.1 Statutory duties for designated sites

At all times, not just in times of drought, we adhere to our statutory duties for designated sites. This is particularly important due to the location of many of our water abstractions within, adjacent or upstream of designated sites, and the large area of catchment land owned by us. The relevant statutory duties include:

- Conservation of Habitats and Species Regulations 2017. Statutory responsibilities to Special Areas of Conservation (SAC) and Special Protection Areas (SPA)
- Government policy is to apply the same protection framework to Ramsar sites as to SPAs and SACs (Defra, 2006)
- The Environment Act, 1995. Section 62 to have regard to the purposes for which National Parks are designated
- The Water Resources Act 1991 (as amended by the Water Act 2003). Any work which may affect SSSIs, or other land of special interest, must involve consultation with Natural England before authorisation of the works
- Section 28G of the Wildlife and Countryside Act 1981, as inserted by Section 75 and Schedule 9 to the Countryside and Rights of Way Act 2000. This places a duty on public authorities, including water companies, to take reasonable steps consistent with the proper exercise of their functions to further the conservation and enhancement of SSSIs
- The Wildlife and Countryside Act 1981 and Section 85 of the Countryside and Rights of Way Act 2000. To have regard to the purpose of conserving and enhancing an Area of Outstanding Natural Beauty (AONB) when exercising or performing any function that will affect land in an AONB
- The Natural Environment and Rural Communities (NERC) Act 2006. An extension of the Countryside and Rights of Way Act 2000 biodiversity duty to ensure due regard to the conservation of biodiversity (particularly Section 40)
- The Environment (Wales) Act 2016
- Water Industry Act 1991: Code of Practice on Conservation, Access and Recreation – Guidance for the Environment Agency and Water and Sewerage Undertakers

The drought option proformas in Section 6 identify if potential supply side or drought permit sites are associated with statutory designated sites (including SACs, SPAs, Ramsar sites and SSSIs).

4.2 Drought permit environmental assessments

4.2.1 Drought permits

The Environment Agency water company drought plan guideline specifies that water companies must carry out an environmental assessment and produce an environmental monitoring plan for each supply side action (including drought permits) in the drought plan. Environmental assessments should also include mitigation measures and an environmental monitoring plan should also be produced.

Environment Agency supplementary guidance on environmental assessment specifies that environmental assessments should:

- Identify the supply side action
- Set out the likely changes to the level/flow regime (and associated effects on habitats) due to this action
- Identify the key features of the environment which are likely to be affected by these changes and assess their sensitivity
- Assess the likely impact on these features as major, moderate, minor or uncertain (and allocate a level of confidence)
- Set out mitigation measures
- Set out an Environmental Monitoring Plan for baseline, pre, during and post drought permit implementation monitoring

Detailed environmental assessment studies have been completed for each drought permit site listed in Table 3. In line with Environment Agency guidance, each assessment considers impacts of the drought permit on:

- Hydrology (water flow or level regimes) and hydrogeology (where appropriate)
- Water quality
- Ecology, including ecological status, as well as quantitative status of groundwater as identified in river basin management plans (RBMPs) and fish populations
- Habitats and geomorphology
- Water Framework Directive status/potential
- Designated sites and priority habitats and species
- Conservation of biodiversity
- Other physical, economic, cultural and heritage issues including landscape and visual amenity
- The spread of invasive non-native species

The Environment Agency, Natural Resources Wales and Natural England (as appropriate) were involved in each environmental assessment study.

Each environmental assessment report presents the environmental baseline i.e. habitats, species, designated sites and environmental pressures (including flow and water quality) in the zone of influence without the drought permit in place, using a description of the catchment, geomorphology, features and water quality. Key changes to the physical environment as a result of implementing the drought permit are identified and described and this information is used to frame and support the assessment of impacts on sensitive features. Where significant impacts on sensitive features have been identified, mitigation measures have been proposed to avoid or reduce the impacts on the environment.

Figure 2 and Figure 3 show the location of drought permit sites in relation to statutory designated sites. The impacts on any designated sites are assessed within each environmental assessment report.

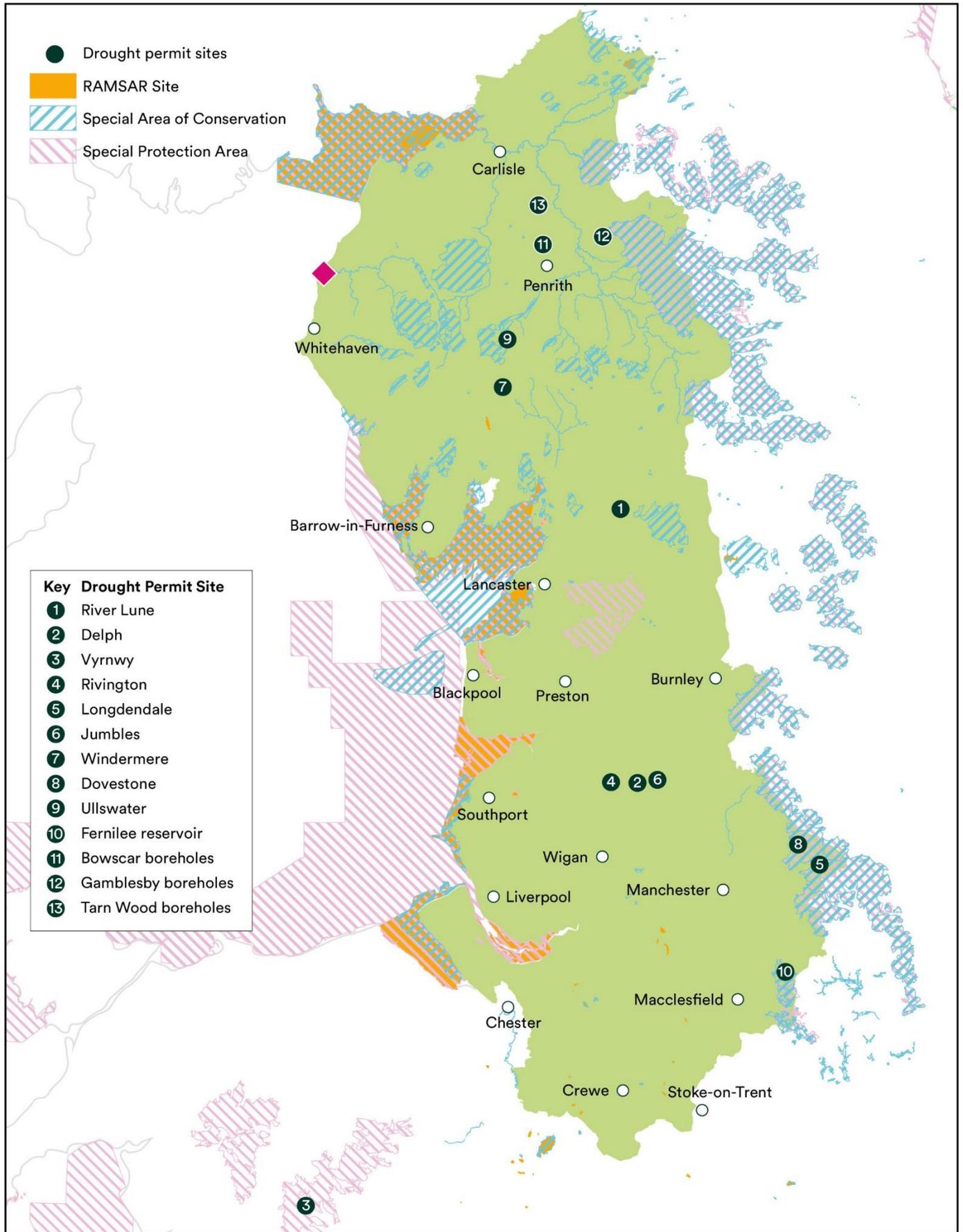


Figure 2 - Map of designated sites showing drought permit sites and supply side options (Ramsar, Special Areas of Conservation (SAC), and Special Protection Areas (SPA))

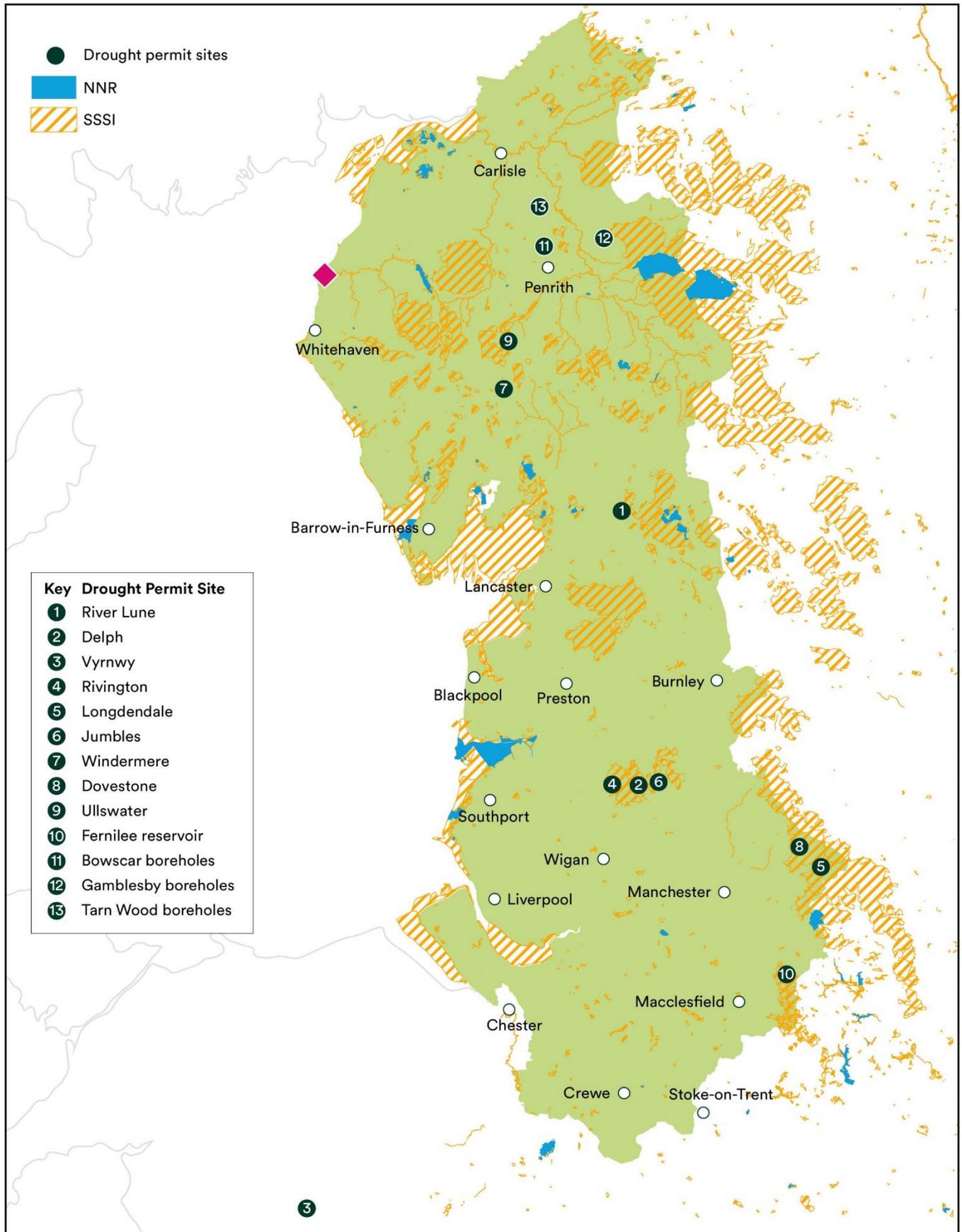


Figure 3 - Map of nationally designated sites showing drought permit sites and supply side options (Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), and Marine Conservation Zones (MCZ))

The reports also present an Environmental Monitoring Plan (EMP) for each site, which puts forward any additional baseline data collection that is required (for example to fill gaps in the existing data and make the assessments more

robust), monitoring that would be required just before or during implementation of a drought permit, and requirements for monitoring after a drought permit, to measure any impacts and monitor recovery of the site. Monitoring has been specified on a site by site basis, depending on the sensitive features and the predicted magnitude of potential impacts of drought permit implementation. Environmental monitoring includes both routine data which is collected (e.g. water level) and data collected during surveys carried out by environmental consultants commissioned by ourselves. Environmental monitoring associated with the implementation of a drought permit (i.e. during and post-implementation) is our responsibility. We share environmental monitoring data freely with the Environment Agency, Natural Resources Wales and Natural England. We have a single master record of the EMP requirements for all our drought permit sites which we review and share annually with the Environment Agency.

Further details on each drought permit site are included in Section 6. These contain a summary of the impacts identified by the environmental assessment report, together with monitoring and mitigation measures. Copies of our environmental assessment reports for our drought permits are available on request (you can contact us at water.resources@uuplc.co.uk).

The environmental assessments we have prepared are designed to be ‘shelf-copy’ reports. In the event of needing to apply for an actual drought permit, the environmental assessment report would be updated to reflect the current conditions, as well as to incorporate any relevant new information available since the study was completed.

We will review and determine the need to revise or update our environmental assessment reports annually in agreement with the Environment Agency, Natural Resources Wales and Natural England.

4.2.2 Drought orders

A compensation only reservoir (COR) is a reservoir that has no links (direct or indirect) to a water company's public water supply network. The main or sole function of a COR is to provide compensation flow to the downstream river. For reservoirs that are linked (either directly or indirectly) to a water company public water supply network then it is the responsibility of the water company to apply for a drought permit or drought order, for example to change a compensation flow during a drought (see Section 3). Although there is no public water supply benefit from a COR, in some circumstances during a natural drought, a drought order may be required to reduce compensation flow to preserve reservoir storage to allow continued release of compensation flow and therefore protect downstream flora and fauna until significant rainfall arrives and the reservoir level recovers. It is the responsibility of the Environment Agency to apply to the Secretary of State at Defra for a drought order in these circumstances.

In June 2019 the Environment Agency issued water companies with a position statement which set out roles and responsibilities with respect to CORs. Previously, the Environment Agency had included drought orders for CORs within their drought plan and had been responsible for preparing environmental assessment reports (EARs) and applications for drought orders. The revised position statement in June 2019 requires water companies to:

- Lead on work to develop drought triggers for CORs that allow timely actions to be taken in dry weather (feeding into both the company and Environment Agency local drought plans)
- Produce an Environmental Assessment Report for drought order implementation, including an Environmental Monitoring Plan and mitigation proposals
- Work with the Environment Agency to draft all of the written material that would need to be submitted to Defra in a drought order application for a COR. However, the Environment Agency is still responsible for making any drought order submissions to Defra for a COR during a drought incident

We have worked with the Environment Agency to refine and agree a list of CORs. It was agreed that shelf-copy environmental assessment reports did not need to be prepared if the risk of implementation of a drought order in the future was low, for example, the compensation flow is small compared to storage in the reservoir.

It has been agreed that currently no shelf-copy environmental assessment reports are required for any of our CORs.

4.3 Habitats Regulations Assessment

As a competent authority under the Habitats Regulations (Conservation of Habitats and Species Regulations 2017), we must ensure that the drought plan meets the requirements of the Habitats Directive. Therefore, the drought plan has been subject to Habitats Regulations Assessment. There are four stages of assessment:

- Stage 1: Screening to determine if drought options are likely to have a significant effect on Habitats Regulations designated sites
- Stage 2: Appropriate Assessment of options with likely significant effects to determine if they adversely impact the integrity of the designated site (both alone and in-combination with other plans and projects)
- Stage 3: Consideration of alternative options where significant adverse effects are identified at Stage 2
- Stage 4: Compensatory measures in the case that no alternative options exist and where Imperative Reasons of Overriding Public Interest can be demonstrated

4.3.1 Stage 1 HRA Screening

Stage 1 HRA screening has been undertaken on all supply side options and drought permits proposed in this drought plan. For drought permit sites, the environmental assessment reports we have prepared have been used to inform the assessment.

The HRA screening assessment identifies potential impacts of the options that are included in this plan to determine whether or not they could adversely affect the integrity of a designated site (SAC, SPA and Ramsar and candidate SACs/SPAs). If this is the case, then a detailed Appropriate Assessment of the option is required (HRA Stage 2). HRA Screening considered:

- Whether a scheme is likely to have a significant effect on a designated site(s)
- Whether the option would have an in-combination effect with existing consents
- Whether there would be an in-combination effect with other drought options in the plan

The HRA Screening Report is published alongside this plan. The European designated sites associated with each drought permit and the conclusions of HRA screening are identified in Table 5. Details of the designated sites associated with the supply side options are listed in the HRA Screening Report.

Table 5 Details of drought permit environmental studies and conclusions of HRA Screening

Drought permit/order site	Resource zone	Date of environmental study report	Statutory designated sites considered in the Environmental Assessment	Conclusion of HRA Screening – will the option result in likely significant effects on European sites? ¹
Delph	Strategic	2021	None	No
Dovestone	Strategic	2021	Rochdale Canal SAC	No
Fernilee	Strategic	2021	None	No
Jumbles	Strategic	2021	None	No
Longdendale	Strategic	2021	South Pennine Moors SAC	No
River Lune LCUS	Strategic	2021	Morecambe Bay SPA/SAC/SSSI/Ramsar	No

¹ Draft conclusion whilst HRA Screening is finalised

Drought permit/order site	Resource zone	Date of environmental study report	Statutory designated sites considered in the Environmental Assessment	Conclusion of HRA Screening – will the option result in likely significant effects on European sites? ¹
Rivington (White Coppice and Brinscall Brook)	Strategic	2021	None	No
Ullswater	Strategic	2021	River Eden SAC/SSSI	No
Lake Vyrnwy	Strategic	2020	Severn Estuary SAC/SPA/Ramsar, Berwyn SPA, and the Berwyn and South Clwyd Mountains SAC, Montgomery Canal SAC	No
Windermere	Strategic	2021	Morecambe Bay SPA/SAC/SSSI/Ramsar Low Wray Bay SSSI, Roudsea Wood & Mosses SAC & SSSI	No
North Eden boreholes - Bowscar	North Eden	2021	River Eden SAC/SSSI, River Eden SPA, North Pennine Moors SPA	No
North Eden boreholes - Gamblesby	North Eden	2021	River Eden SAC/SSSI, River Eden SPA, North Pennine Moors SPA	No
North Eden boreholes - Tarn Wood	North Eden	2021	River Eden SAC/SSSI, River Eden SPA, North Pennine Moors SPA	No

HRA Screening of supply side and drought permit options has concluded that none of the options will result in likely significant effects on European designated sites (both alone and in-combination with other plans or projects), and therefore, no further stages of HRA are required.

4.4 Strategic Environmental Assessment

4.4.1 Requirements for SEA

Strategic Environmental Assessment (SEA) of plans and programmes is a statutory requirement under the Environmental Assessment of Plans and Programmes Regulations 2004 (the SEA Regulations). The purpose of SEA is to provide high level and strategic protection of the environment by incorporating environmental considerations into the preparation of plans and policy. In the context of drought planning, SEA assists in the identification of the likely significant environmental effects of our drought options and determines how any adverse impacts might be mitigated.

The key stages of SEA are:

- Screening to determine if SEA is required. Environment Agency, Natural England, Natural Resources Wales, Cadw and Historic England should be consulted before taking the screening decision
- Deciding the scope and level of detail required for the SEA
- Assess the effects of the plan/programme and its reasonable alternatives and prepare an environmental report

- Consultation on the environmental report and draft plan/programme
- Adoption of the plan/programme and monitoring of any significant environmental effects

This section of the plan details the process which we have taken in preparing the SEA, and the outcomes and influences on this drought plan.

SEA was undertaken in line with government best practice guidance and UKWIR guidance which has been prepared specifically for water resource management plans and drought plans.

4.4.2 SEA Screening

The first step of the SEA process is to carry out a screening assessment to determine whether an SEA is required. We believe that an SEA is required because this plan includes drought options that require assessment under the Habitats Regulations. This was confirmed with the statutory consultees for SEA who are Natural England, Natural Resources Wales, Environment Agency, Cadw and Historic England.

4.4.3 SEA Scoping

SEA scoping presents information on the scope of, and approach to work to be carried out to inform the SEA assessments presented in the Environmental Report. A scoping report was produced which described: the types of alternative drought measures that might be available to meet the need for water during a drought; the policies and other plans and programmes influencing the selection of measures that may be used; the environmental issues which will need to be considered; and the assessments that will be carried out to identify the environmental effects of saving and supplying water which will assist in the identification of preferred measures for implementation during a drought scenario.

Under the SEA Regulations, when deciding upon the scope and level of detail of the information to be included in an Environmental Report, we are required to undertake consultation with statutory consultees (Natural England, Natural Resources Wales, Environment Agency, Cadw and Historic England). The scoping report was used as the basis of that consultation process and underwent a statutory 5-week consultation period during March-April 2020. Feedback from the Project Steering Group of statutory consultees was incorporated into the SEA Draft Environmental Report.

4.4.4 SEA Environmental Report

The findings of the SEA are reported in the Draft SEA Environmental Report, due to be completed after the draft drought plan is submitted, and will be finalised for final submission. The assessment was 'objectives-led'. SEA objectives were derived from environmental objectives established in law, policy or other plans and programmes, and from a review of the baseline information. The SEA objectives were categorised under the following topic areas: biodiversity, flora and fauna; population and human health; material assets and resource use; water; soil, geology and land use; air and climate; archaeology and cultural heritage; landscape and visual amenity; and inter-relationships. The overall findings of the SEA describe the extent to which objectives for each topic are met by each of the drought options.

The outputs of the assessment are a completed appraisal framework table for each drought option, and a colour coded summary matrix (ranging from major beneficial impacts to major adverse impacts) which provides a comparative assessment of the residual environmental effects of implementing each drought option (i.e. those impacts remaining after the implementation of mitigation measures). The visual evaluation matrix and key for drought permit and order options is presented in Table 6.

A cumulative, or in-combination, assessment has also been undertaken which has involved examining the likely significant effects of each of the drought options in combination with each other (both intra- and inter- water resource zone) and in combination with the implementation of other relevant plans and programmes.

Table 6 Visual evaluation matrix summary for drought permit options

Option		SEA Topics and Objectives																			Commentary	
		Biodiversity, flora and fauna		Population and human health			Material assets and resource use		Water				Soil, geology and land use			Air and climate			Archaeology and Cultural Heritage	Landscapes and Visual Amenity		Inter-relationships
		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	6.3	7.1	8.1		9.1
Strategic Resource Zone																						
Delph Reservoir	Adverse	Yellow	Light Blue	Light Blue	Light Blue	None	None	None	Yellow	Yellow	Light Blue	None	Yellow	None	None	None	None	None	Light Blue	Yellow	Yellow	Overall, minor adverse effects were identified relating to the impact of riverine flow reduction on biodiversity, water quality, fluvial geomorphology and landscape and visual amenity. The impact of inter-relationships has been assessed as minor.
	Beneficial	None	None	Green	None	Green	Light Blue	Light Blue	None	None	None	None	None	None	None	None	None	None	Green	None	Green	None
Dovestone Reservoir 10 MI/d	Adverse	Yellow	Yellow	Light Blue	Light Blue	None	None	None	Yellow	Yellow	Light Blue	None	Yellow	None	None	None	None	None	Light Blue	Yellow	Yellow	Minor adverse effects were identified relating to the impact of river flow reduction on biodiversity, water quality, fluvial geomorphology and landscape and visual amenity. The effect on inter-relationships has been assessed as minor.
	Beneficial	None	None	Green	None	Green	Light Blue	Light Blue	Light Blue	None	None	None	None	None	None	None	None	None	Green	None	None	Light Blue
Dovestone Reservoir 5 MI/d	Adverse	Yellow	Yellow	Light Blue	Light Blue	None	None	None	Yellow	Yellow	Light Blue	None	Yellow	None	None	None	None	None	Light Blue	Yellow	Yellow	Minor adverse effects were identified relating to the impact of river flow reduction on biodiversity, water quality, fluvial geomorphology and landscape and visual amenity. The effect on inter-relationships has been assessed as minor.
	Beneficial	None	None	Green	None	Green	Light Blue	Light Blue	Green	None	None	None	None	None	None	None	None	None	Green	None	None	Light Blue
Fernilee Reservoir	Adverse	Yellow	Light Blue	None	Light Blue	None	None	None	Yellow	Yellow	Light Blue	None	Yellow	None	None	None	None	None	Light Blue	Light Blue	Yellow	Minor adverse effects are anticipated to biodiversity, water flow and levels and fluvial geomorphology. The effect on inter-relationships has also been assessed as minor.
	Beneficial	None	None	Green	None	Green	Light Blue	Light Blue	None	None	None	None	None	None	None	None	None	None	Green	None	None	Light Blue
Jumbles Reservoir 12 MI/d	Adverse	Light Blue	Yellow	None	Light Blue	Light Blue	None	None	Yellow	Yellow	Light Blue	None	Yellow	None	None	None	None	None	Light Blue	Yellow	Yellow	The implementation of this drought option would result in minor adverse effects on the spread of INNS, water levels and flows, water quality, fluvial geomorphology and visual amenity. Subsequently, the impacts on inter-relationships have been assessed as minor.
	Beneficial	None	None	Green	Green	Green	Light Blue	Light Blue	None	None	None	None	None	None	None	None	None	None	Green	None	Green	Light Blue
	Adverse	Yellow	Yellow	None	Light Blue	Light Blue	None	None	Orange	Orange	Yellow	None	Yellow	None	None	None	None	None	Light Blue	Yellow	Yellow	The implementation of this drought option would result in moderate adverse impacts to water levels and flows, and water quality. Minor adverse impacts

Option		SEA Topics and Objectives																			Commentary	
		Biodiversity, flora and fauna		Population and human health			Material assets and resource use		Water				Soil, geology and land use			Air and climate			Archaeology and Cultural Heritage	Landscape and Visual Amenity		Inter-relationships
		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	6.3	7.1	8.1		9.1
Jumbles Reservoir 6 MI/d																					are anticipated to biodiversity. A reduction in water levels would also result in minor adverse impacts upon WFD status, fluvial geomorphology, and landscape and visual amenity. Therefore the impact upon inter-relationships has been assessed as minor adverse.	
	Beneficial	None	None																		Improved resilience of water supplies to drought is assessed to have a moderate beneficial impact on adaptation to climate change. Moderate beneficial effects were also identified in relation to population and human health based on continued supply of drinking water. More water retained in the reservoir is anticipated to have a minor beneficial impact on recreation and landscape and visual amenity.	
Longden- dale Reservoirs 25 MI/d	Adverse																				Moderate adverse impacts are anticipated on water levels and flow. The implementation of this drought option would result in minor adverse impact on biodiversity, water quality and on water dependent ecosystems in the affected reach. There would also be minor adverse impacts on the aesthetics and landscape of the study area	
	Beneficial	None	None																		Overall two major beneficial effects were identified relating to population and human health based on continued supply of drinking water. There would also be a minor beneficial impact from the drought option for adaptation to climate change. The remaining beneficial impacts on material assets and resources would be negligible.	
Longden- dale Reservoirs 15 MI/d	Adverse																				Moderate adverse impacts are anticipated on water levels and flow. The implementation of this drought option would result in minor adverse impact on biodiversity, water quality and on water dependent ecosystems in the affected reach. There would also be minor adverse impacts on the aesthetics and landscape of the study area	
	Beneficial	None	None																		Overall two major beneficial effects were identified relating to population and human health based on continued supply of drinking water. There would also be a minor beneficial impact from the drought option for adaptation to climate change. The remaining beneficial impacts on material assets and resources would be negligible.	
River Lune LCUS abstraction	Adverse																				Minor adverse effects were identified relating to population and human health due to the impact upon recreation including angling and navigation. The effect on inter-relationships has also been assessed as minor.	
	Beneficial	None	None																		Minor to moderate beneficial effects were identified relating to population and human health based on continued supply of drinking water. Improved resilience of water supplies to drought is assessed to have a minor beneficial impact on adaptation to climate change.	
Rivington Reservoirs – Brinscall Brook	Adverse																				Overall minor adverse effects were identified relating to the impact of riverine flow reduction on biodiversity, flora and fauna, water quality, fish populations, ecosystem functions and services and landscape and visual amenity. Negligible adverse impacts are anticipated to the spread of INNS, angling, fluvial geomorphology, archaeology and visual amenity. The impact upon inter-relationships has been assessed as moderate.	
	Beneficial	None	None																		Two moderate beneficial effects were identified relating to population and human health based on continued supply of drinking water. Improved resilience of water supplies to drought is assessed to have a minor beneficial impact on adaptation to climate change.	
Rivington Reservoirs – White Coppice	Adverse																				Overall minor adverse effects were identified relating to the impact of riverine flow reduction on biodiversity, flora and fauna, water quality, fish populations, ecosystem functions and services and landscape and visual amenity. Negligible adverse impacts are anticipated to the spread of INNS, angling,	

Option		SEA Topics and Objectives																			Commentary	
		Biodiversity, flora and fauna		Population and human health			Material assets and resource use		Water				Soil, geology and land use			Air and climate			Archaeology and Cultural Heritage	Landscapes and Visual Amenity		Inter-relationships
		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	6.3	7.1	8.1		9.1
																					fluvial geomorphology, archaeology and visual amenity. The impact upon inter-relationships has been assessed as moderate.	
	Beneficial	None	None		None																Two moderate beneficial effects were identified relating to population and human health based on continued supply of drinking water. Improved resilience of water supplies to drought is assessed to have a minor beneficial impact on adaptation to climate change	
Ullswater	Adverse			None		None															Minor adverse effects were identified relating to material assets and resource due to increased energy requirements.	
	Beneficial	None	None		None																Overall, minor beneficial effects are anticipated to population and human health based on continued provision of public water supplies. Improved resilience of water supplies to drought is assessed to have a minor beneficial impact on adaptation to climate change.	
Lake Vyrnwy	Adverse			None			None	None													Overall minor adverse effects were identified relating to the impact on biodiversity, population and human health, and water. The effect on inter-relationships has also been assessed as minor.	
	Beneficial	None	None		None																Moderate beneficial effects were identified relating to population and human health based on continued supply of drinking water. Improved resilience of water supplies to drought is assessed to have a moderate beneficial impact on adaptation to climate change.	
Lake Windermere	Adverse			None		None		None													Minor adverse impacts were identified relating to biodiversity and material assets and resource use. The abstraction of water from Windermere will increase energy consumption and, therefore, greenhouse gas emissions, having a minor adverse impact upon air and climate. The effect on inter-relationships has also been assessed as minor.	
	Beneficial	None	None		None																The impact of the drought option on population and human health has been assessed as major beneficial based on continued provision of public water supplies. Improved resilience of water supplies to drought is assessed to have a moderate beneficial impact on adaptation to climate change.	
Carlisle Resource Zone																						
None																						
North Eden Resource Zone																						
Eden Valley boreholes - Bowscar boreholes	Adverse		None	None		None															Overall one minor adverse effect was identified relating to the impact of riverine flow reduction on third party abstractors.	
	Beneficial	None	None		None																Overall, moderate beneficial effects are anticipated to population and human health based on continued provision of public water supplies. Improved resilience of water supplies to drought is assessed to have a moderate beneficial impact on adaptation to climate change.	
Eden Valley boreholes - Gamblesby boreholes	Adverse		None	None		None															Overall one minor adverse effect was identified relating to the impact of riverine flow reduction on third party abstractors.	
	Beneficial	None	None		None																Overall, minor beneficial effects are anticipated to population and human health based on continued provision of public water supplies. Improved resilience of water supplies to drought is assessed to have a minor beneficial impact on adaptation to climate change.	

Option		SEA Topics and Objectives																			Commentary	
		Biodiversity, flora and fauna		Population and human health			Material assets and resource use		Water				Soil, geology and land use			Air and climate			Archaeology and Cultural Heritage	Landscapes and Visual Amenity		Inter-relationships
		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	4.4	5.1	5.2	5.3	6.1	6.2	6.3	7.1	8.1		9.1
Eden Valley boreholes - Tarn Wood boreholes	Adverse		None	None		None																Overall one minor adverse effect was identified relating to the impact of riverine flow reduction on third party abstractors.
	Beneficial	None	None		None		None	None	None	None	None	None	None	None	None	None	None		None	None		Overall, moderate beneficial effects are anticipated to population and human health based on continued provision of public water supplies. Improved resilience of water supplies to drought is assessed to have a minor beneficial impact on adaptation to climate change.

Legend:

Major Beneficial	
Moderate Beneficial	
Minor Beneficial	
Negligible	
Minor Adverse	
Moderate Adverse	
Major Adverse	
NOT APPLICABLE	None
Uncertain - Insufficient data available to undertake assessment	

In summary, the SEA Environmental Report concluded:

- Supply side options – there is one supply side option which is deadwater storage utilisation at Castle Carrock
- Demand side measures - serve to reduce pressure on water resources by reducing customer demand for water, and therefore reducing the abstraction at source. This will in turn contribute to reducing the amount of energy needed for water abstraction, treatment and distribution. Overall, impacts for these drought options are considered to be negligible to major beneficial
- Drought permit options - the magnitude of impacts on SEA objectives for drought permit options (i.e. where there is modification to the conditions of an existing abstraction licence) varies between and within the options, ranging from major beneficial for the SEA objective for population and human health, to minor adverse for the SEA objective for biodiversity, flora and fauna. The latter were associated with adverse changes to surface water levels and flows.
- Cumulative impacts - the assessment identified the potential for adverse impacts if two drought options were to be implemented at the same time, either intra- or inter- water resource zone. In the majority of combinations, no impacts are considered likely, however, in some cases, impacts have been identified where, for example, both options draw on the same water resource (e.g. same groundwater catchment or same river). Due to the uncertainty of timing of implementation of drought options, assessments of each drought option with each other drought option have been undertaken with the intention that in the event of a drought, the findings of the SEA be reviewed and a cumulative assessment made of the options proposed for implementation at that time, based on the findings of the one-on-one assessments
- Assessment of our drought plan with other plans and programmes, including our Water Resources Management Plan 2019, Environment Agency/Natural Resources Wales drought plans, other water company drought plans and National Policy Statements, concluded that no significant cumulative, or in-combination, effects are anticipated

Consideration of mitigation measures has been an integral part of the SEA process. The SEA appraisals have been based on residual impacts, i.e. those impacts likely to remain after the implementation of reasonable mitigation. Mitigation measures are described in the environmental assessment reports that have been prepared for each drought permit option.

During implementation of one or more drought options, appropriate monitoring will be undertaken to track any potential environmental effects which will in turn trigger deployment of suitable and practicable mitigation measures. Prior to implementation, we will review the specific requirements for environmental monitoring in consultation with the Environment Agency, Natural England and Natural Resources Wales.

4.4.5 Consultation

The findings of the SEA are reported in the SEA Environmental Report, which is open for public consultation alongside the Draft Drought Plan 2022.

We have worked closely with a project steering group comprised of representatives from Natural England, Natural Resources Wales, Environment Agency, Cadw and Historic England throughout the SEA process.

4.4.6 SEA post-adoption statement

An SEA post-adoption statement will be produced and published alongside the final drought plan.

The SEA post adoption statement describes:

- How environmental considerations have been integrated into the final drought plan
- How the Environmental Report has been taken into account
- How responses to consultation have been taken into account

- Reasons for choosing the final drought plan as adopted, and why other reasonable alternatives were rejected
- The measures that are to be taken to monitor the significant environmental effects of implementation of the final drought plan

5 Exceptional shortage of rainfall

It is a requirement for any drought permit/order application to show that '...by reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened...'. The Environment Agency has produced guidance on exceptional shortage of rain and the principles for the assessment of drought permits and orders (Environment Agency, 2020). Our process for demonstrating exceptional shortage of rain follows this guidance.

A summary of the process involved in analysing rainfall and other climate data and reviewing the evidence for an exceptional shortage of rain is shown in Figure 4 below.

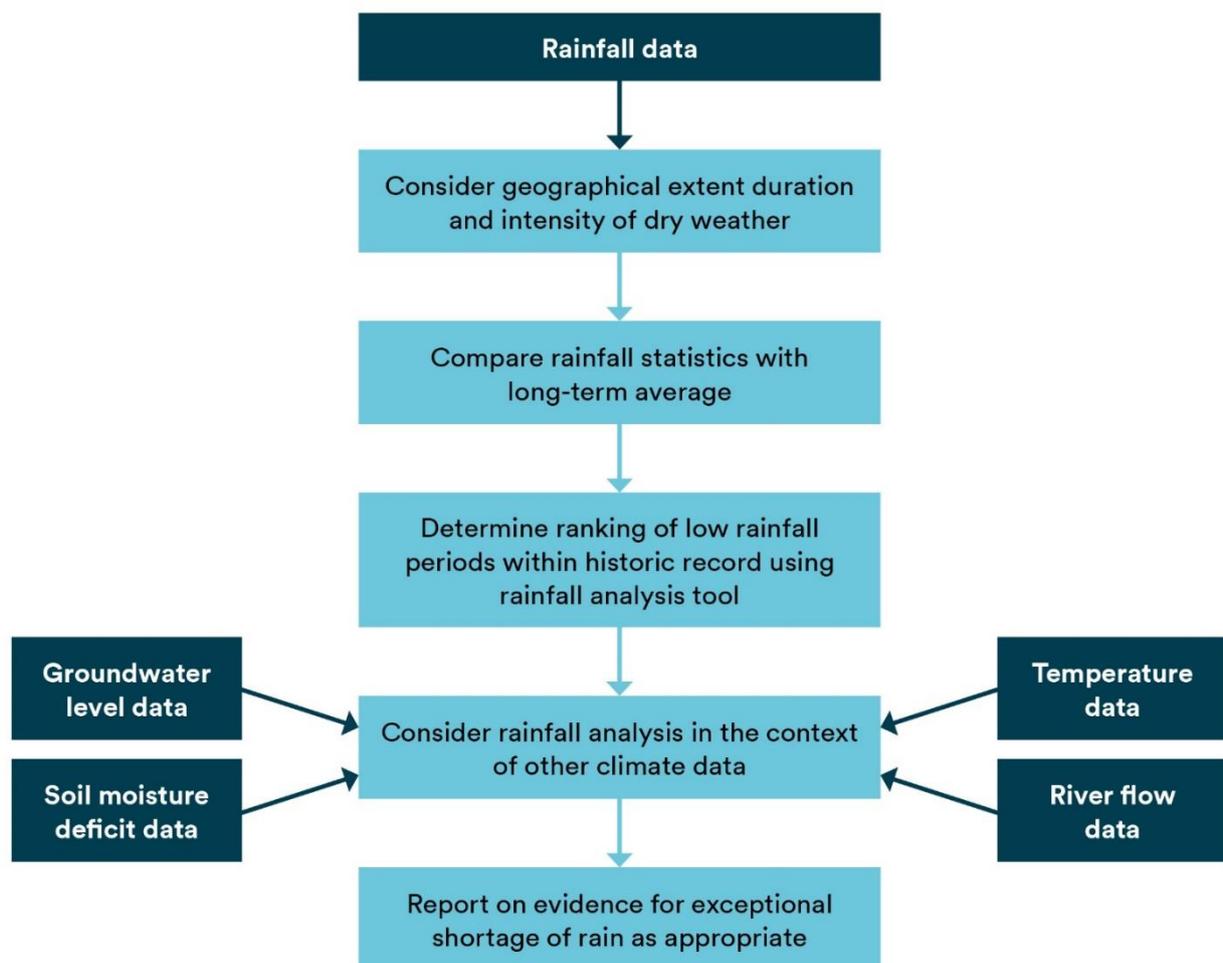


Figure 4 - Summary of rainfall analysis process

A key indicator in assessing drought conditions is a significant shortage of rain in the period leading up to a drought. Rainfall data is collected and analysed as part of our routine water situation monitoring and enhanced as drought conditions develop.

Each drought event has different characteristics and therefore it is not possible to define the exact process of rainfall assessment in advance of a drought occurring. A range of data and technical and statistical analysis approaches may be appropriate to assess and report on the significant shortage of rain which has caused drought conditions to develop. Rainfall data is also assessed in the context of other relevant climate variables, such as temperature, soil moisture deficit and effective rainfall (the amount of rainfall remaining after evapotranspiration is taken into account), as such factors can influence the water resources response that results during a drought event.

Daily areal rainfall data is provided by the Environment Agency on a regular basis for 11 of our catchments² across the North West (Vyrnwy, Woodhead, Holden Wood, Langley Bottoms, Rivington, Stocks, Barnacre, Ulpha, Ennerdale, Dalehead, Burnbanks and Geltsdale), which correspond to our key water sources displayed in Figure 1. The period of available data for each catchment is 130 years, and monthly long term average is for the 30-year period from 1961 to 1990 used for standard comparisons between sites.

Factors considered in selecting the time period to support a drought permit/order application will depend on the duration and intensity of the dry weather experienced and the geographical location and extent of these weather conditions. Typically for a single season drought it may be appropriate to analyse rainfall totals for the six month period from April to September (or from the point of initial reservoir drawdown), however for droughts continuing into the autumn/winter season it may be necessary to extend this to longer periods to correspond with the duration of dry weather conditions. Shorter periods may also be selected, particularly for compensation only reservoirs where reservoir drawdown can be rapid in response to a significant shortage of rainfall. As the length of drought events can only be defined with certainty in hindsight, at the time of application for drought powers, the period of rainfall analysis may be shorter than the length of the dry weather period in the historic record.

For dry conditions affecting only certain parts of our region and/or supply system it may be appropriate to focus on specific catchments, however, for droughts affecting all or large parts of our region then we also consider the average rainfall across the region (e.g. an average across our 10 catchments within the Strategic Resource Zone).

The primary data source will be areal rainfall data, however dependent on the date of application this will need to be supplemented with point rainfall data from the Environment Agency (to ensure it is as recent as possible) and forecast rainfall data using the Met Office forecast³ to provide a complete month of rainfall data.

5.1.1 Areal rainfall analysis

Monthly rainfall totals are calculated for each catchment and analysed within our rainfall analysis tool, which enables recent rainfall totals to be ranked within the overall historic data record using the **Cunnane plotting** position for the r^{th} ranked (from largest to smallest) datum from a sample of size n . It is used when quantile unbiased values are desired.

This statistical analysis takes a selected catchment area and provides an unbiased ranking for the rainfall over varying periods. Table 7 below shows the Cunnane analysis for Longdendale in 2018. The plotting position shows the 4 month period from May to August being ranked 2nd out of 130 years' worth of data. In total there were 11 cells categorised as 'Exceptionally low' based on the Cunnane index.

Table 7 Cunnane plotting position for Longdendale in 2018

² The catchment boundaries for this rainfall assessment have been agreed with the Environment Agency. The data are sourced from Met Office Had-UK validated dataset (1891-2019) and EA Daily Rainfall Tool (DRT) un-validated datasets from 2020 onwards.

³ The Met Office forecast is received on a Monday and Thursday and provides detailed information for the following five days, and a higher level forecast for the next 10 days.

Rainfall ranking (out of 130 years)

Shaded cells show periods classified as 'exceptionally low' according to the Cunnane plotting position

Duration (months) Month ending	1	2	3	4	5	6	7	8	9	10	11	12
Jan - 2018	120	105	101	104	119	113	114	119	114	105	111	117
Feb - 2018	51	98	88	90	93	108	104	109	115	110	100	110
Mar - 2018	93	70	106	98	96	100	113	105	111	115	110	103
Apr - 2018	108	106	89	111	109	101	108	116	114	118	120	117
May - 2018	20	60	84	67	102	97	93	100	109	104	108	115
Jun - 2018	3	1	12	34	28	70	69	67	72	94	91	91
Jul - 2018	25	3	1	6	20	11	50	53	53	61	81	74
Aug - 2018	19	14	3	2	5	12	7	31	35	40	42	66
Sep - 2018	92	56	32	15	8	14	27	17	42	48	48	51
Oct - 2018	24	52	31	17	10	5	10	15	11	30	35	36
Nov - 2018	31	16	32	20	11	6	5	7	12	8	24	27
Dec - 2018	101	68	36	52	30	22	13	9	13	20	14	35

Table 8 Cunnane calculation and index

$$\text{Cunnane plotting position} = \frac{\text{Rank} - 0.4}{n + 0.2}$$

Category	Probability of value being surpassed by lower value P (X)	Probability of occurrence
Exceptionally high	>0.95	0.05 (5%)
Notably High	0.87 - 0.95	0.08 (8%)
Above normal	0.721 - 0.869	0.15 (15%)
Normal	0.28 - 0.72	0.44 (44%)
Below normal	0.131 - 0.279	0.15 (15%)
Notably low	0.05 - 0.13	0.08 (8%)
Exceptionally low	<0.05	0.05 (5%)

Standardised precipitation index

Additional evidence is also provided using the Environment Agency SPI analysis tool. The Standardised Precipitation Index (SPI) is an internationally recognised method of characterising how the observed cumulative rainfall deviates from the climatological average. It is a statistical indicator that compares rainfall totals in a particular location or catchment over a chosen accumulation period with the long term rainfall distribution for the same accumulation period.

SPI is calculated on a monthly basis for a moving window of n months, where n indicates the rainfall accumulation period which is typically between 1 and 36 months.

Table 9 below provides a summary of the SPI values and associated descriptive categories. It also provides an indicative estimate of the rarity of the event. This standard approach enables comparison between historical and current droughts (or wet periods) and between different climatic and geographic locations.

Table 9 Standardised precipitation index

SPI value	SPI category	Probability of occurrence in any year
>=2.0	Extremely wet	~2.5%
+1.5 to 1.99	Severely wet	~5%
+1.0 to +1.44	Moderately wet	~10%
-0.99 to +0.99	Near normal	~65%
-1.0 to -1.44	Moderately dry	~10%
-1.5 to -1.99	Severely dry	~5%
<=-2.0	Extremely dry	~2.5%

Figure 5 below shows the entire time series of SPI values for Ennerdale catchment. The chart title denotes the cumulative period that is plotted on the chart – in this example ‘SPI – 3 (May)’ indicates that this is a 3 month accumulation ending in May (March – May).

SPI - 3 (May): TPD_NW_4

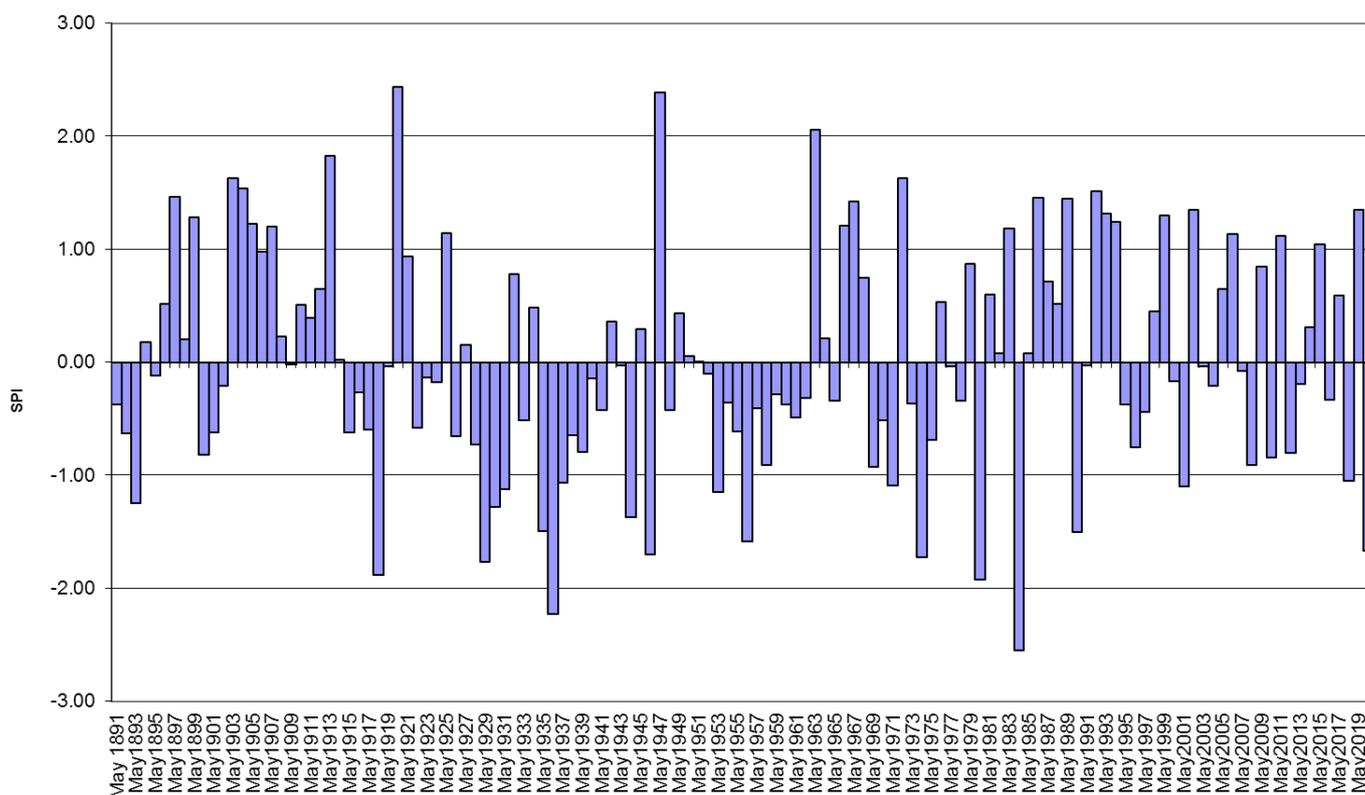


Figure 5 - Example SPI bar chart for Ennerdale catchment

5.1.2 Supportive data analysis

Other types of analysis include comparison with rainfall patterns experienced in other recent drought events such as 1995/96, as well as percentage deficits compared to expected (long term average) rainfall over monthly or longer periods. If monthly or cumulative deficits are high, and/or periods of low rainfall have a high ranking relative to the historic data record, then this indicates an exceptional shortage of rain in support of drought permit/order

applications. Figure 6 below shows a comparison of 2017/2018 Longdendale monthly rainfall totals against the long term average⁴.



Figure 6 - Comparison of 2017/2018 Longdendale monthly rainfall totals against the long term average

Figure 7 shows the percentage difference for Longdendale 2018 monthly totals against the long term average. This highlights that each month from May to August fell below the long term average, providing further evidence of an exceptional shortage of rain.

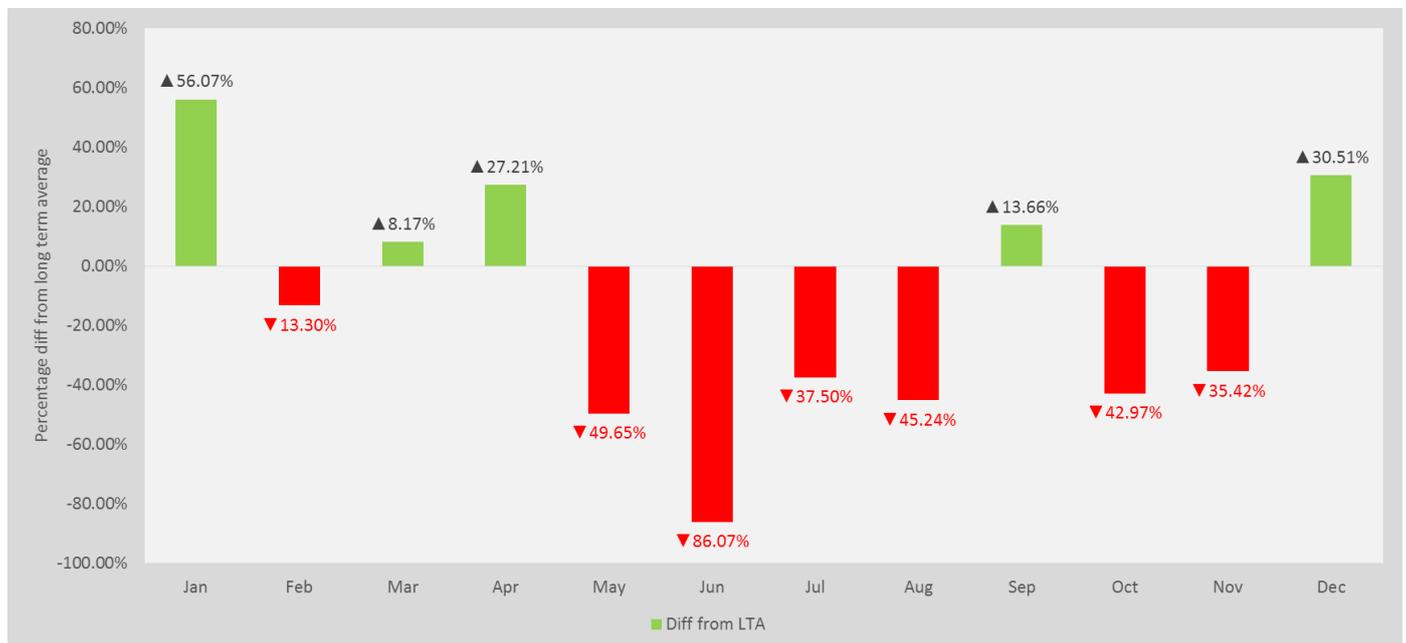


Figure 7 - Percentage difference of monthly total from the long term average

Another method of analysis carried out is looking at the number of days without rainfall. Figure 8 shows the number of days without rainfall in the period 1 January 2020 to 16 June 2020 at Longdendale. This displays how the no rainfall days coincided with the drop in water level in the Longdendale reservoirs⁵.

⁴ Monthly totals calculated using areal catchment data

⁵ No rainfall days analysis uses EA point data which is received on a Wednesday (Woodhead point data)

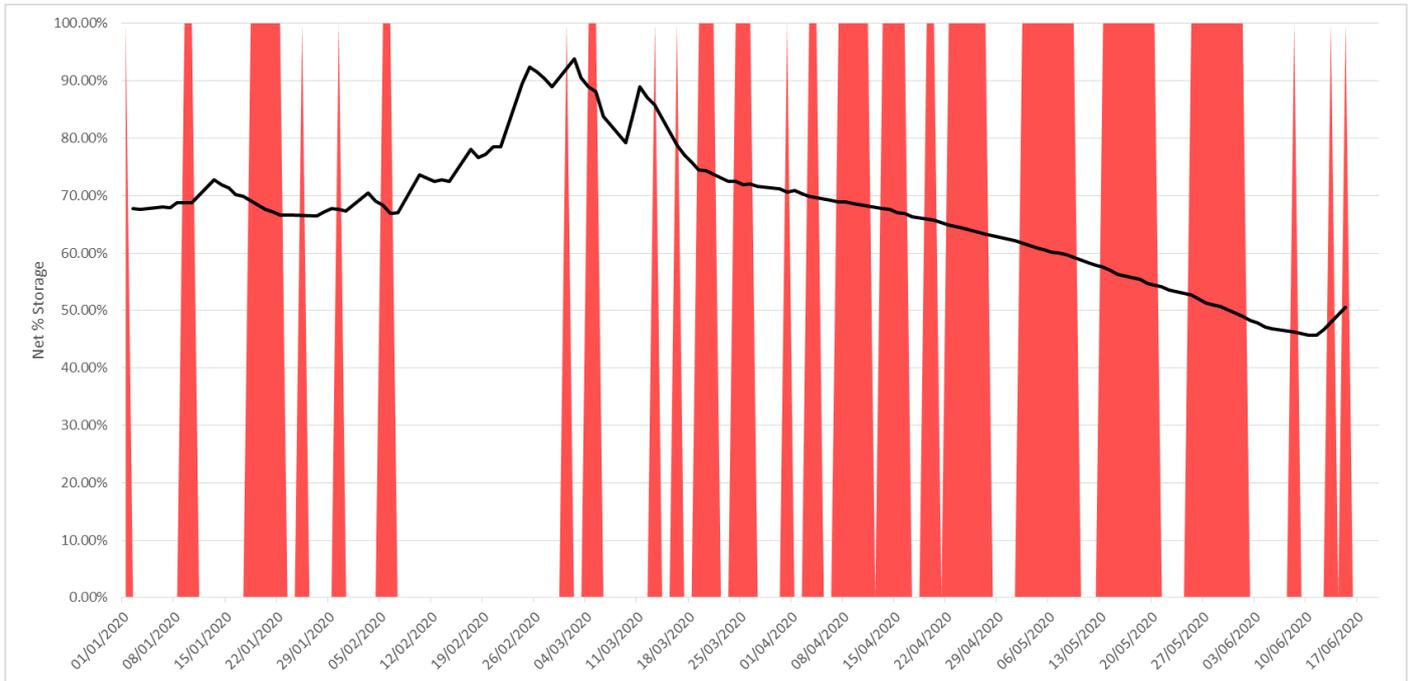


Figure 8 - No rainfall days since 1 January 2020 to 16 June 2020 (Data provided by the EA and the Meteorological Office © Crown Copyright 2020, the Met Office)

5.1.3 Additional analysis

Other relevant climate data, such as temperature (Figure 9), soil moisture deficit (Figure 10) and effective rainfall (the amount of rainfall remaining after evapotranspiration is taken into account) is also collated to support the assessment of dry weather conditions. In each case, recent data for the relevant time period is compared to the

corresponding long term average values to assess the severity of the developing dry conditions.

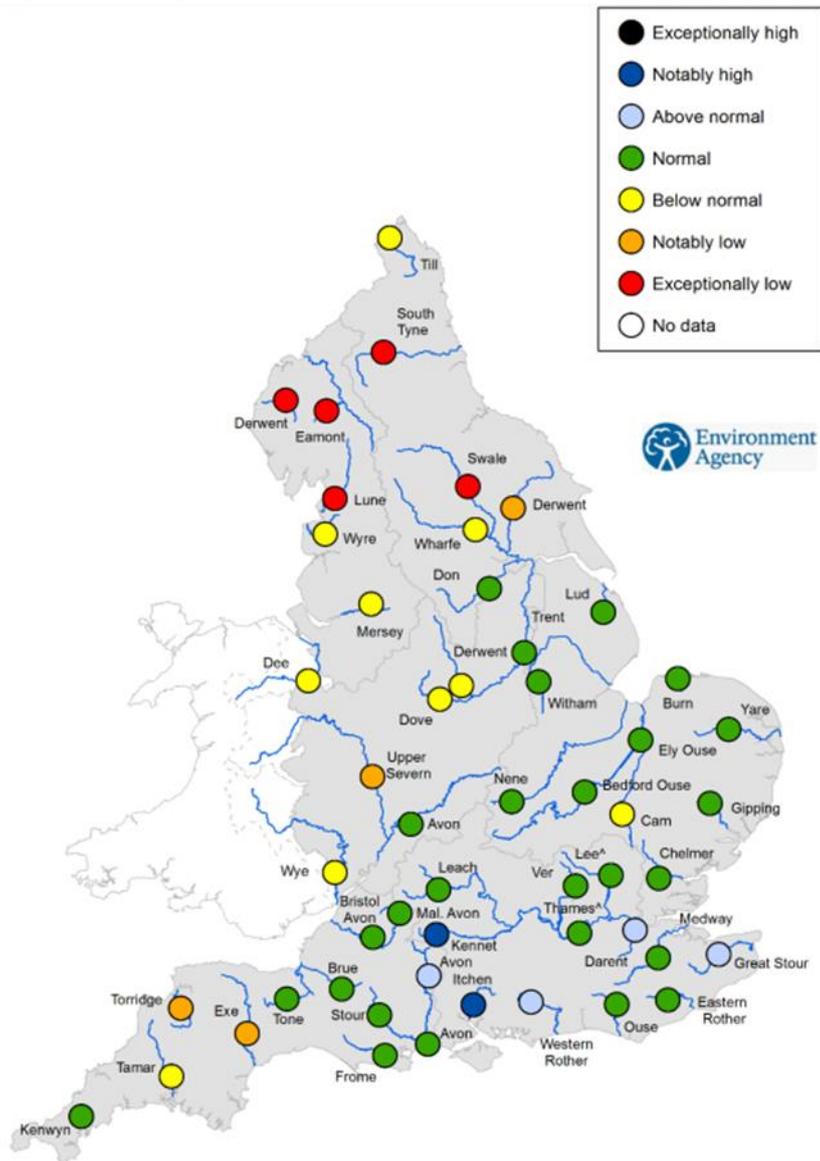


Figure 11) and groundwater levels, or rising soil moisture deficit values; are additional indicators of developing drought conditions.

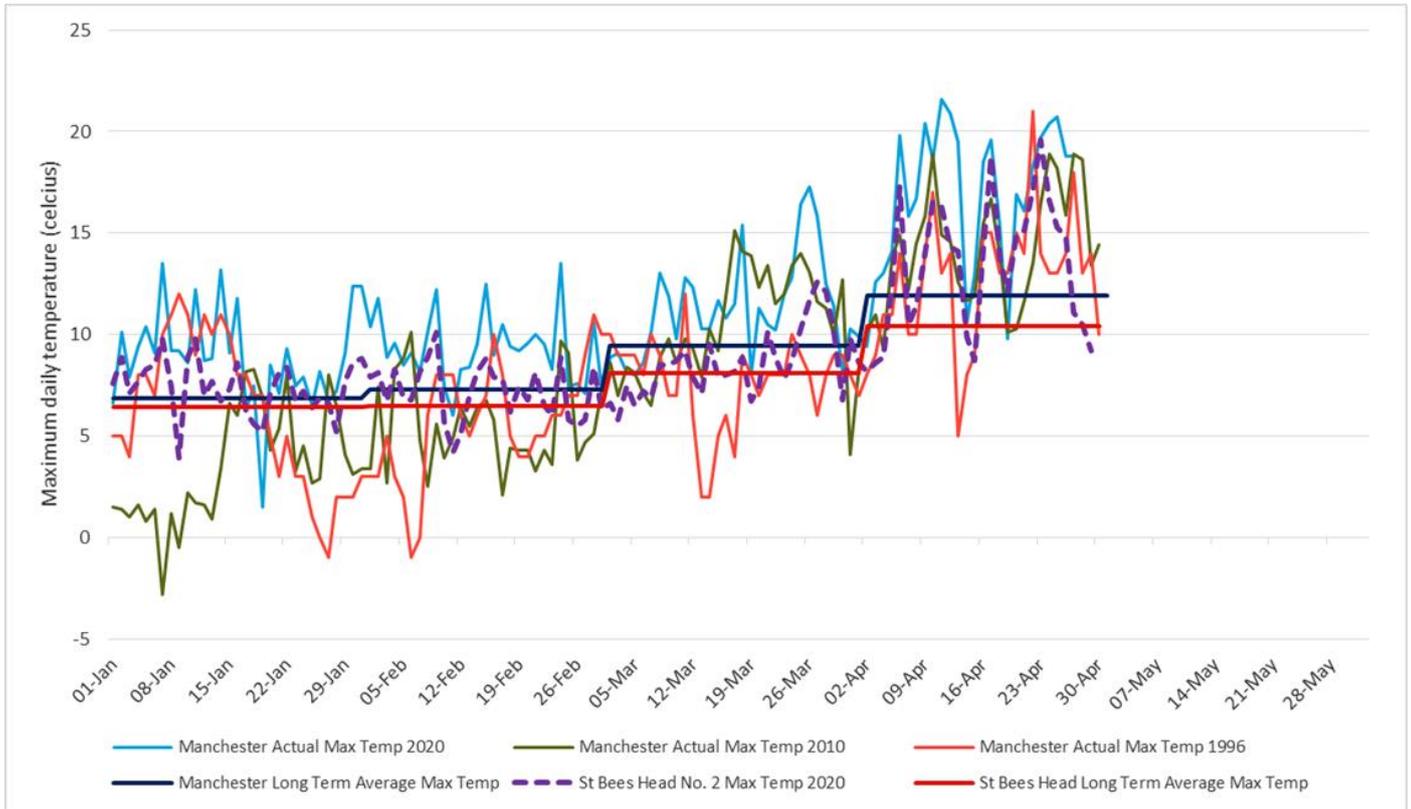


Figure 9 - Temperature analysis for support statement (Data supplied by the Meteorological Office © Crown Copyright. Data for Woodford/Ringway/Rostherne No.2 in Manchester and St Bees Head No.2)

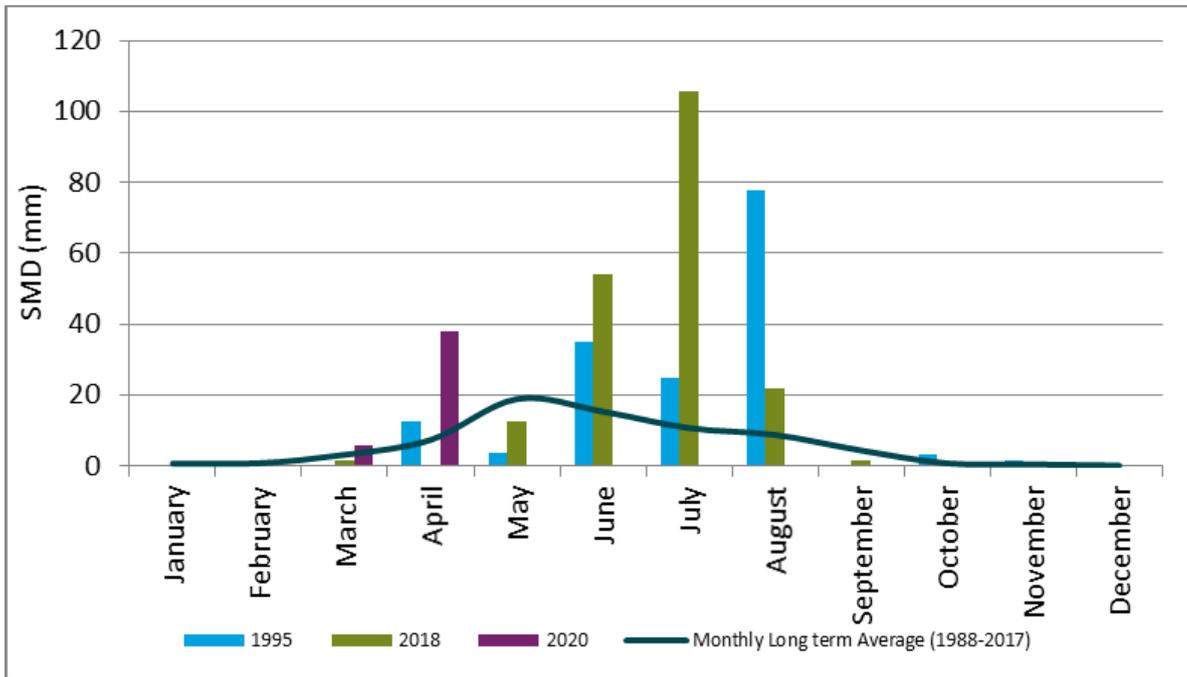


Figure 10 - Soil Moisture Deficit (SMD) analysis for support statement (Data supplied by the Meteorological Office © Crown Copyright)

6 Summary of environmental studies

6.1 Strategic Resource Zone

Option Name: Delph Reservoir drought permit: reduce compensation flow from 3.7 to 1.0 MI/d

Trigger/previous action	If appropriate, implementation from Drought level 2 (Strategic Resource Zone). Preceding actions could include rezoning of water supplies; bringing water sources online; customer communication actions and demand restrictions
Deployable Output of action MI/day. Include how this is calculated	The drought option would reduce the compensation flow requirement from 3.7 MI/d to 1 MI/d. This would result in a temporary reduction in the flow from Delph reservoir to Delph Brook. The precise reduction would be discussed fully with the Environment Agency and would depend upon the need for additional water, time of year and current environmental circumstances. The benefit to deployable output of the reservoir would be c.2.5 MI/d, based on the compensation flow reduction. Previous Hydro-Logic® Aquator modelling has shown that compensation flow reductions of this type have a 1:1 benefit on source yield. Benefits to the wider zone are drought event specific
Location Area affected or whole supply zone	Local impact in Bolton area. Benefit to Strategic Resource Zone due to conservation of reservoir storage in Delph reservoir, resulting in reduced need to support the area from other local and regional water sources
Implementation timetable	Commencement of drought permit preparation from Drought level 1 Application of drought permit from Drought level 2 Implementation of drought permit from Drought level 2 Drought permit could be effective at all times of the year Drought permits are valid for up to 6 months and can be extended for a further 6 months
Permissions required and constraints	Approval of the application
Risks associated with option	That the application, as applied for, is not approved

Summary of environmental assessment: Delph Reservoir drought permit: reduce compensation flow from 3.7 to 1.0 MI/d

Overall environmental impact (minor, moderate, major or uncertain)	Overall minor (moderate impacts on brown trout spawning and egg incubation if implemented in the period October-February, minor or negligible impacts on all other receptors at all other times) Environmental assessment report completed in 2021
Level of confidence (H, M, L)	Medium – environmental assessment report completed in 2021 which identifies the level of confidence for each receptor
Summary of likely environmental impacts	No designated sites impacted by this drought permit The environmental study identified a moderate adverse environmental impact on brown trout spawning and egg incubation if implemented in the period October-February, and impacts at all other times and to all other features were concluded to be minor or negligible. Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites

Information used to understand conditions before drought or any drought actions are implemented	The environmental study used historical data on river flow, reservoir level, ecological monitoring and water quality. In addition river cross-section measurements were taken throughout the study area to enable hydraulic modelling to translate flow changes in to habitat parameter changes (e.g. depth, velocity).	
Environmental Monitoring Plan for sensitive features	Baseline monitoring	Fish - quantitative surveys on the Delph Brook (undertaken in 2014, 2015 and 2016)
	Pre- and during drought permit monitoring	Walkover surveys - During drought permit implementation weekly walkover surveys, looking for signs of fish in distress or other unforeseen effects. Water quality – spot sampling at two sites and spot measurements using hand held probe during walkover surveys
	Post- drought permit monitoring	Fish - repeat baseline fish monitoring survey in year following implementation then review
Summary of mitigation measures	We will use Eagley borehole (deployable output of 1.43 MI/d) to help sustain flows in Eagley Brook (into which Delph Brook flows) and to help mitigate the reduction in Delph reservoir's compensation flow from 3.7 MI/d to 1.0 MI/d. The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including; a temporary or permanent return to the statutory compensation flow, fish rescue and relocation, habitat modification to concentrate remaining flow within the stream channel, installation of fish refugia within the watercourse and/or provision of appropriate assistance and/ or funding of appropriate reasonable measures (e.g. habitat restoration).	
Permits/approvals needs for mitigation measures	Dependent on measures identified by monitoring undertaken time of implementation. May include consent from the EA for fish rescue or an environmental permit and landowner consent for instream works (if required).	
Impact on other activities e.g. fisheries, industry etc.	No significant impacts on other activities identified.	

Option Name: Dovestone Reservoir drought permit: reduce compensation flow from 15.9 to 10.0 or 5.0 MI/d

Trigger/previous action	If appropriate, implementation from Drought level 2 (Strategic Resource Zone). Preceding actions could include rezoning of water supplies; bringing water sources online; customer communication actions and demand restrictions.
Deployable Output of action MI/day. Include how this is calculated	The drought option would reduce the compensation flow requirement from 15.9 MI/d to between 10 MI/d and 5 MI/d. This would result in a temporary reduction in the flow from Dovestone reservoir to Chew Brook. The precise reduction would be discussed fully with the Environment Agency and would depend upon the need for additional water, time of year and current environmental circumstances. The benefit to deployable output of Greenfield, Yeoman Hey and Dovestone reservoirs would be between c.3.6 MI/d to 7.5 MI/d depending on the magnitude of the compensation flow reduction applied for, or this water could be conserved in the reservoirs to protect the compensation flow. Benefits to the wider zone are drought event specific.
Location Area affected or whole supply zone	Local impact in Tameside and Oldham areas. Benefit to Strategic Resource Zone due to conservation of reservoir storage in Dovestone reservoir, resulting in reduced need to support the area from other local and regional water sources
Implementation timetable	Commencement of drought permit preparation from Drought level 1 Application of drought permit from Drought level 2 Implementation of drought permit from Drought level 2 Drought permit could be effective at all times of the year Drought permits are valid for up to 6 months and can be extended for a further 6 months
Permissions required and constraints	Approval of the application
Risks associated with option	That the application, as applied for, is not approved. In 1995, one objection was made to the proposed compensation flow reduction at Dovestone reservoir due to concern about the impact on fisheries and ecology in Chew Brook and the River Tame. A local public hearing was held, but the Inspector recommended that the permit be granted

Summary of environmental assessment: Dovestone Reservoir drought permit: reduce compensation flow from 15.9 to 10.0 or 5.0 MI/d

Overall environmental impact (minor, moderate, major or uncertain)	Overall minor (moderate impacts on brown trout spawning and egg incubation if implemented in the period October-February, moderate impact on bullhead spawning and egg incubation in March to June, minor or negligible impacts on all other receptors at all other times) Environmental assessment report completed in 2021
Level of confidence (H, M, L)	Medium – environmental assessment report completed in 2021 which identifies the level of confidence for each receptor
Summary of likely environmental impacts	No designated sites impacted by this drought permit The environmental study identified a moderate adverse environmental impact on brown trout spawning and egg incubation if implemented in the period October-February, moderate impact on bullhead spawning and egg incubation in March to June and impacts at all other times and to all other features were concluded to be minor or negligible. Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites
Information used to understand conditions before drought or any drought actions are implemented	The environmental study used historical data on river flow, reservoir level, ecological monitoring and water quality. In addition river cross-section measurements were taken throughout the study area to enable hydraulic modelling to translate flow changes in to habitat parameter changes (e.g. depth, velocity).
Environmental Monitoring Plan for sensitive features	Baseline monitoring Hydrodynamics - cross-section surveys on River Tame, River Mersey, Chew Brook undertaken in 2014
	Pre- and during drought permit monitoring Hydrodynamics cross-section surveys on River Tame, River Mersey, Chew Brook Once, within two weeks of drought permit implementation, then review Walkover surveys - During drought permit implementation weekly walkover surveys, looking for signs of fish in distress or other unforeseen effects. Water quality – spot measurements using hand held probe at specific sites identified in the environmental assessment and during walkover surveys
	Post- drought permit monitoring None identified
Summary of mitigation measures	The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including: a temporary or permanent return to the statutory compensation flow, fish rescue and relocation, habitat modification to concentrate remaining flow within the stream channel and/or installation of fish refugia within the watercourse
Permits/approvals needs for mitigation measures	Dependent on measures identified by monitoring undertaken at time of implementation. May include consent from the EA for fish rescue or an environmental permit and landowner consent for instream works (if required).
Impact on other activities e.g. fisheries, industry etc.	No significant impacts on other activities identified.

Option Name: Fernilee Reservoir drought permit: reduce maintained flow from 13.63 MI/d to 6.8 MI/d

Trigger/previous action	If appropriate, implementation from Drought level 2 (Strategic Resource Zone). Preceding actions could include rezoning of water supplies; bringing water sources online; customer communication actions and demand restrictions
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Deployable Output of action MI/day. Include how this is calculated	The drought option would reduce the maintained flow requirement from 13.63 MI/d to 6.8 MI/d. This would result in a temporary reduction in the flow from Fernilee reservoir to the River Goyt. The precise reduction would be discussed fully with the Environment Agency and would depend upon the need for additional water, time of year and current environmental circumstances. The benefit to deployable output of the source would be c.3.8 MI/d. Aquator modelling has shown that compensation flow reductions of this type have a 1:1 benefit on source yield. Benefits to the wider zone are drought event specific
Location Area affected or whole supply zone	Local impact in Stockport area. Benefit to Strategic Resource Zone due to conservation of reservoir storage in the Wybersley system, resulting in reduced need to support the area from other local and regional water sources
Implementation timetable	Commencement of drought permit preparation from Drought level 1 Application of drought permit from Drought level 2 Implementation of drought permit from Drought level 2 Drought permit could be effective at all times of the year Drought permits are valid for up to 6 months and can be extended for a further 6 months
Permissions required and constraints	Approval of the application
Risks associated with option	That the application, as applied for, is not approved

Summary of environmental assessments: Fernilee Reservoir drought permit: reduce maintained flow from 13.63 MI/d to 6.8 MI/d

Overall environmental impact (minor, moderate, major or uncertain)	Moderate; impacts on fish species (juvenile brown trout, bullhead and lamprey throughout the year) and minor/negligible impacts on all other receptors. Environmental assessment report completed in 2021						
Level of confidence (H, M, L)	Medium – environmental assessment report completed in 2021 which identifies the level of confidence for each receptor						
Summary of likely environmental impacts	No designated sites impacted by this drought permit Moderate negative effects on juvenile brown trout, juvenile bullhead and lamprey in the River Goyt and minor negative or negligible impacts on all other receptors. Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites.						
Information used to understand conditions before drought or any drought actions are implemented	The environmental study used historical data on river flow, reservoir level, ecological monitoring and water quality. In addition river cross-section measurements were taken throughout the study area to enable hydraulic modelling to translate flow changes in to habitat parameter changes (e.g. depth, velocity).						
Environmental Monitoring Plan for sensitive features	<table border="1"> <tr> <td>Baseline monitoring</td> <td>Fish - Baseline quantitative electric fishing survey at existing monitoring sites, three years, then review</td> </tr> <tr> <td>Pre- and during drought permit monitoring</td> <td>Hydrodynamics – cross-section surveys – one event pre-implementation and during implementation fortnightly. Walkover surveys - During drought permit weekly walkover surveys, looking for signs of fish in distress or other unforeseen effects, including water quality spot measurements using hand held probe.</td> </tr> <tr> <td>Post- drought permit monitoring</td> <td>Fish – Repeat baseline quantitative electric fishing survey at existing monitoring sites, in year following drought permit implementation</td> </tr> </table>	Baseline monitoring	Fish - Baseline quantitative electric fishing survey at existing monitoring sites, three years, then review	Pre- and during drought permit monitoring	Hydrodynamics – cross-section surveys – one event pre-implementation and during implementation fortnightly. Walkover surveys - During drought permit weekly walkover surveys, looking for signs of fish in distress or other unforeseen effects, including water quality spot measurements using hand held probe.	Post- drought permit monitoring	Fish – Repeat baseline quantitative electric fishing survey at existing monitoring sites, in year following drought permit implementation
Baseline monitoring	Fish - Baseline quantitative electric fishing survey at existing monitoring sites, three years, then review						
Pre- and during drought permit monitoring	Hydrodynamics – cross-section surveys – one event pre-implementation and during implementation fortnightly. Walkover surveys - During drought permit weekly walkover surveys, looking for signs of fish in distress or other unforeseen effects, including water quality spot measurements using hand held probe.						
Post- drought permit monitoring	Fish – Repeat baseline quantitative electric fishing survey at existing monitoring sites, in year following drought permit implementation						
Summary of mitigation measures	The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including; a temporary or permanent return to the statutory compensation flow, fish rescue and relocation, habitat modification to concentrate remaining flow within the stream channel, installation of fish refugia within the watercourse and/or provision of appropriate assistance and/ or funding of appropriate reasonable measures (e.g. habitat restoration).						

Permits/approvals needs for mitigation measures	Dependent on measures identified by monitoring undertaken at time of implementation. May include consent from the EA for fish rescue or an environmental permit and landowner consent for instream works (if required).
Impact on other activities e.g. fisheries, industry etc.	No significant impacts on other activities identified.

Option Name: Jumbles Reservoir drought permit: reduce compensation flow from 19.9 to 12.0 or 6.0 MI/d

Trigger/previous action	If appropriate, implementation from Drought level 2 (Strategic Resource Zone). Preceding actions could include rezoning of water supplies; bringing water sources online; customer communication actions and demand restrictions
Deployable Output of action MI/day. Include how this is calculated	The drought option would reduce the compensation flow requirement from 19.9 MI/d to between 12 MI/d and 6 MI/d. This would result in a temporary reduction in the flow from Jumbles reservoir to Bradshaw Brook. The precise reduction would be discussed fully with the Environment Agency and would depend upon the need for additional water, time of year and current environmental circumstances. The benefit to deployable output of the associated supply reservoirs of Wayoh and Entwistle would be between c.7.5 MI/d to 15.5 MI/d depending on the magnitude of the compensation flow reduction applied for. Benefits to the wider zone are drought event specific
Location Area affected or whole supply zone	Local impact in Bolton area. Benefit to Strategic Resource Zone due to conservation of reservoir storage in Jumbles reservoir for the purpose of providing a compensation flow release to Bradshaw Brook, resulting in reduced need to support the area from other local and regional water sources
Implementation timetable	Commencement of drought permit preparation from Drought level 1 Application of drought permit from Drought level 2 Implementation of drought permit from Drought level 2 Drought permit could be effective at all times of the year Drought permits are valid for up to 6 months and can be extended for a further 6 months
Permissions required and constraints	Approval of the application
Risks associated with option	That the application, as applied for, is not approved

Summary of environmental assessment: Jumbles Reservoir drought permit: reduce compensation flow from 19.9 to 12.0 or 6.0 MI/d

Overall environmental impact (minor, moderate, major or uncertain)	12MI/d - Minor (minor or negligible impacts on all receptors at all other times) 6MI/d – Moderate (moderate impacts on fish species, minor or negligible impacts on all other receptors) Environmental assessment report completed in 2021
Level of confidence (H, M, L)	Medium – environmental assessment report completed in 2021 which identifies the level of confidence for each receptor
Summary of likely environmental impacts	No designated sites impacted by this drought permit The environmental study identified minor/negligible impacts of the compensation flow reduction to 12MI/d drought permit option on all receptors. The 6MI/d option is predicted to result in moderate impacts to fish species including trout and bullhead. The environmental study identified minor/negligible impacts of the compensation flow reduction to 12MI/d drought permit option on all receptors. The 6MI/d option is predicted to result in moderate impacts to fish species including trout and bullhead. Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites

Information used to understand conditions before drought or any drought actions are implemented		The environmental study used historical data on river flow, reservoir level, ecological monitoring and water quality. In addition river cross-section measurements were taken throughout the study area to enable hydraulic modelling to translate flow changes in to habitat parameter changes (e.g. depth, velocity).
Environmental Monitoring Plan for sensitive features	Baseline monitoring	Hydrodynamics cross-section surveys on Bradshaw Brook and River Irwell undertaken in 2014-2015
	Pre- and during drought permit monitoring	Hydrodynamics - cross-section surveys on River Tame, River Mersey, Chew Brook one event pre-implementation and during implementation. Walkover surveys - During drought permit implementation weekly walkover surveys, looking for signs of fish in distress or other unforeseen effects. Water quality – spot measurements using hand held probe at specific sites identified in the environmental assessment and during walkover surveys
	Post- drought permit monitoring	None identified
Summary of mitigation measures		The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including; a temporary or permanent return to the statutory compensation flow, fish rescue and relocation, habitat modification to concentrate remaining flow within the stream channel, installation of fish refugia within the watercourse and/or provision of appropriate assistance and/ or funding of appropriate reasonable measures (e.g. habitat restoration).
Permits/approvals needs for mitigation measures		Dependent on measures identified by monitoring undertaken at time of implementation. May include consent from the EA for fish rescue or an environmental permit and landowner consent for instream works (if required).
Impact on other activities e.g. fisheries, industry etc.		No significant impacts on other activities identified.

Option Name: Longdendale Reservoirs drought permit: reduce compensation flow from 45.5 to 22.5 or 15 MI/d

Trigger/previous action	If appropriate, implementation from Drought level 2 (Strategic Resource Zone). Preceding actions could include rezoning of water supplies; bringing water sources online; customer communication actions and demand restrictions
Deployable Output of action MI/day. Include how this is calculated	The drought option would reduce the compensation flow requirement from 45.5 MI/d to 22.5 MI/d or 15 MI/d. This would result in a temporary reduction in flow from the Longdendale reservoirs to the River Etherow. The precise reduction would be discussed fully with the Environment Agency and would depend upon the need for additional water, time of year and current environmental circumstances. The benefit to deployable output of the source would be c.11.4 MI/d depending on the magnitude of the compensation flow reduction applied for. Benefits to the wider zone are drought event specific
Location Area affected or whole supply zone	Strategic Resource Zone
Implementation timetable	Commencement of drought permit preparation from Drought level 1 Application of drought permit from Drought level 2 Implementation of drought permit from Drought level 2 Drought permit could be effective at all times of the year

	Drought permits are valid for up to 6 months and can be extended for a further 6 months	
Permissions required and constraints	Approval of the application	
Risks associated with option	That the application, as applied for, is not approved	
Summary of environmental assessment: Longdendale Reservoirs drought permit: reduce compensation flow from 45.5 to 22.5 or 15 MI/d		
Overall environmental impact (minor, moderate, major or uncertain)	22.5MI/d - Moderate (moderate impacts on fish species, minor or negligible impacts on all other receptors) 15MI/d – Moderate (moderate impacts on fish species, minor or negligible impacts on all other receptors) Environmental assessment report completed in 2021	
Level of confidence (H, M, L)	Medium – environmental assessment report completed in 2021 which identifies the level of confidence for each receptor	
Summary of likely environmental impacts	No designated sites impacted by this drought permit. The Longdendale reservoirs are located just within the Peak District National Park, however the downstream watercourse (River Etherow) is outside the boundary. The environmental study identified moderate impacts of the both of compensation flow reductions options (22.5MI/d and 15MI/d) on fish species including trout and bullhead in the River Etherow at any time of year. Impacts on all other receptors were concluded as minor or negligible. Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites.	
Information used to understand conditions before drought or any drought actions are implemented	The environmental study used historical data on river flow, reservoir level, ecological monitoring and water quality. In addition river cross-section measurements were taken throughout the study area to enable hydraulic modelling to translate flow changes in to habitat parameter changes (e.g. depth, velocity).	
Environmental Monitoring Plan for sensitive features	Baseline monitoring	Hydrodynamics - cross-section surveys on River Etherow, River Goyt and River Mersey, undertaken in 2014 Fish - quantitative surveys on River Etherow, and lamprey surveys on River Etherow and River Goyt (undertaken in 2014, 2015 and 2016) Wet woodland/fen habitat - baseline survey of species composition and water level preferences 2 sites in SSSI (undertaken in 2014)
	Pre- and during drought permit monitoring	Hydrodynamics - cross-section surveys, one event pre-implementation then fortnightly and review. Walkover surveys - During drought permit implementation weekly walkover surveys, looking for signs of fish in distress or other unforeseen effects. Water quality – spot measurements using hand held probe at specific sites identified in the environmental assessment and during walkover surveys
	Post- drought permit monitoring	Fish and lamprey – Repeat baseline quantitative electric fishing survey at existing monitoring sites, in year following drought permit implementation then review
Summary of mitigation measures	The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be implemented to mitigate the moderate/major adverse environmental impacts outlined above, including a return to the statutory compensation flow, a temporary increase in discharge or freshet flow releases	

Permits/approvals needs for mitigation measures	The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including; a temporary or permanent return to the statutory compensation flow, fish rescue and relocation, habitat modification to concentrate remaining flow within the stream channel, installation of fish refugia within the watercourse and/or provision of appropriate assistance and/ or funding of appropriate reasonable measures (e.g. habitat restoration).
Impact on other activities e.g. fisheries, industry etc.	No significant impacts on other activities identified.

Option Name: River Lune LCUS drought permit: reduce prescribed flow from 365 to a minimum of 200 MI/d

Trigger/previous action	If appropriate, implementation from Drought level 2 (Strategic Resource Zone). Preceding actions could include rezoning of water supplies; bringing water sources online; customer communication actions and demand restrictions
Deployable Output of action MI/day. Include how this is calculated	<p>The drought option would reduce the prescribed flow requirement at Skerton Weir from 365 MI/d to a minimum of 200 MI/d. This would allow us to abstract from the River Lune (part of the Lancashire Conjunctive Use Scheme, LCUS) at lower river flows than normal. This would result in a temporary reduction in the flow in the River Lune. The precise reduction would be discussed fully with the Environment Agency and would depend upon the need for additional water, time of year and current environmental circumstances</p> <p>The potential benefit of drought powers at River Lune (LCUS) is dependent upon the exact scope of the application and the pattern of weather conditions. Drought powers to allow increased abstraction from the River Lune (LCUS) will reduce demand on the Lake District and Pennine reservoirs. The benefits of drought powers would be greatest over a dry winter to aid refill of reservoirs. For this reason, the Deployable Output based on Aquator modelling of historic drought conditions is small, however, greater benefits are likely to be realised under prolonged or multiple-season drought events that are more severe than historically experienced (and to supplement resources elsewhere in the zone to reduce risks). To indicate the material benefit that may be realised in a multiple-season drought event, analysis of historic flow data in the 1995/96 drought has indicated the drought permit could provide up to 27.4 MI/d additional yield over the course of the event</p>
Location Area affected or whole supply zone	Strategic Resource Zone
Implementation timetable	<p>Commencement of drought permit preparation from Drought level 1</p> <p>Application of drought permit from Drought level 2</p> <p>Implementation of drought permit from Drought level 2</p> <p>Drought permit could be effective at all times of the year</p> <p>Drought permits are valid for up to 6 months and can be extended for a further 6 months</p>
Permissions required and constraints	Approval of the application
Risks associated with option	That the application, as applied for, is not approved

Summary of environmental assessment: River Lune LCUS drought permit: reduce prescribed flow from 365 to a minimum of 200 MI/d

Overall environmental impact (minor, moderate, major or uncertain)	<p>Minor</p> <p>Environmental study completed in 2021</p>
Level of confidence (H, M, L)	Medium – environmental assessment report completed in 2021 which identifies the level of confidence for each receptor

Summary of likely environmental impacts		<p>No designated sites impacted by this drought permit (including the downstream Morecambe Bay SAC/SPA/Ramsar/SSSI The LCUS abstraction site is located just within the Forest of Bowland AONB, however the downstream watercourse (River Lune) is outside the boundary.</p> <p>The prescribed flow reduction would result in reduced river flows in the lower stretches of the River Lune. In drought conditions, the flow in the River Lune will naturally be lower than normal and the drought permit provisions will not result in any significant further reduction to low flows (as a prescribed flow, albeit lower, will still be in place to govern abstraction) although it could increase the number of days at lower flows. Impacts on all receptors were concluded to be minor or negligible.</p> <p>Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites</p>
Information used to understand conditions before drought or any drought actions are implemented		<p>The environmental study used historical data on river flow, ecological monitoring and water quality. In addition river cross-section measurements were taken to enable hydraulic modelling to translate flow changes into habitat parameter changes (e.g. depth, velocity). An extreme high tide occurred on 29 September 2015 (the highest predicted until 2035) and we used this to collect salinity measurements close to third party abstraction intakes (near Skerton weir). A walkover survey to map habitat was completed. Discussions were held with the Lancaster Port Commission to understand potential impacts near Glasson Dock and they made their historic reports and hard copy maps of their bathymetric mapping of the low flow channel of the approach to the port available to us.</p> <p>In 1995, following a public hearing, an application to reduce the prescribed flow to 200 MI/d over the winter months was refused on grounds of adverse impacts on a specific genetic strain of spring salmon. Following this refusal, the Environment Agency and us commissioned an independent report from environmental consultants APEM to assess the spring salmon issues and the impacts of winter River Lune drought powers. The final report by APEM (1999) concluded that a reduction to the prescribed flow from 365 MI/d to 200 MI/d during winter months would have little or no impact on spring salmon migration in the River Lune.</p>
Environmental Monitoring Plan for sensitive features	Baseline monitoring	Salinity – monitoring to identify saline incursion that may affect industrial users. Undertaken in 2015.
	Pre- and during drought permit monitoring	Salinity - Single survey to be conducted should an overtopping event (spring tides greater than MHWS) be predicted during drought permit implementation Walkover surveys - During drought permit implementation weekly walkover surveys, looking for signs of fish in distress or other unforeseen effects. Industrial abstractors - routine consultation with abstractors during drought permit operation for evidence of cavitation
	Post- drought permit monitoring	None required
Summary of mitigation measures		<p>The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including: a temporary cessation of abstraction, fish rescue and relocation or aeration, installation of fish refugia within the watercourse and/or provision of appropriate assistance and/ or funding of appropriate reasonable measures (e.g. habitat restoration).</p> <p>In the event of saline incursion negatively impacting upon industrial abstractions (which is not predicted to occur), it may be feasible to cease abstractions for short periods of time to facilitate dilution and flushing of salt water from the river or to provide temporary supply</p>
Permits/approvals needs for mitigation measures		Dependent on measures identified by monitoring undertaken at time of implementation. May include consent from the EA for fish rescue or an environmental permit and landowner consent for instream works (if required).
Impact on other activities e.g. fisheries, industry etc.		No significant impacts on other activities identified (other abstractors discussed above).

Option Name: Rivington Reservoir – Brinscall Brook drought permit: reduce compensation flow from 3.9 to 2.0 MI/d

Trigger/previous action	If appropriate, implementation from Drought level 2 (Strategic Resource Zone). Preceding actions could include rezoning of water supplies; bringing water sources online; customer communication actions and demand restrictions
Deployable Output of action MI/day. Include how this is calculated	The drought option would reduce the compensation flow requirement from 3.9 MI/d to 2 MI/d. This would result in a temporary reduction in the flow from The Goit (a man-made channel linking Rake Brook and Anglezarke reservoirs) to Brinscall Lodge. The precise reduction would be discussed fully with the Environment Agency and would depend upon the need

	for additional water, time of year and current environmental circumstances. The benefit to deployable output of the source would be c.2.0 MI/d. Benefits to the wider zone are drought event specific
Location Area affected or whole supply zone	Local impact in Wigan area
Implementation timetable	Commencement of drought permit preparation from Drought level 1 Application of drought permit from Drought level 2 Implementation of drought permit from Drought level 2 Drought permit could be effective at all times of the year Drought permits are valid for up to 6 months and can be extended for a further 6 months
Permissions required and constraints	Approval of the application
Risks associated with option	That the application, as applied for, is not approved

Summary of environmental assessment: Rivington Reservoir – Brinscall Brook drought permit: reduce compensation flow from 3.9 to 2.0 MI/d

Overall environmental impact (minor, moderate, major or uncertain)	Moderate Environmental study completed in 2021 (draft at drought plan submission). The assessment assumes that both Brinscall Brook and White Coppice drought permits would be applied for and implemented at the same time.
Level of confidence (H, M, L)	Medium – environmental assessment report completed in 2021 which identifies the level of confidence for each receptor.
Summary of likely environmental impacts	No designated sites impacted by this drought permit. The environmental study identified moderate impacts on fish species including trout and bullhead at any time of year. Impacts on all other receptors were concluded as minor or negligible. Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites.
Information used to understand conditions before drought or any drought actions are implemented	The environmental study used historical data on river flow, reservoir level, ecological monitoring and water quality. In addition river cross-section measurements were taken throughout the study area to enable hydraulic modelling to translate flow changes into habitat parameter changes (e.g. depth, velocity).
Environmental Monitoring Plan for sensitive features	Baseline monitoring Lamprey - surveys of the River Yarrow and Black Brook (carried out in 2014, 2015 and 2016)
	Pre- and during drought permit monitoring Walkover surveys - During drought permit implementation weekly walkover surveys, looking for signs of fish in distress or other unforeseen effects. Water quality – spot measurements using hand held probe during walkover surveys
	Post- drought permit monitoring Lamprey – repeat baseline survey at existing monitoring sites, in year following drought permit implementation then review.

Summary of mitigation measures	The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including: a temporary or permanent return to the statutory compensation flow, fish rescue and relocation, habitat modification to concentrate remaining flow within the stream channel, installation of fish refugia within the watercourse and/or provision of appropriate assistance and/ or funding of appropriate reasonable measures (e.g. habitat restoration).
Permits/approvals needs for mitigation measures	Dependent on measures identified by monitoring undertaken at time of implementation. May include consent from the EA for fish rescue or an environmental permit and landowner consent for instream works (if required).
Impact on other activities e.g. fisheries, industry etc.	No significant impacts on other activities identified.

Option Name: Rivington Reservoir – White Coppice drought permit: reduce compensation flow from 4.9 to 2.0 MI/d

Trigger/previous action	If appropriate, implementation from Drought level 2 (Strategic Resource Zone). Preceding actions could include rezoning of water supplies; bringing water sources online; customer communication actions and demand restrictions
Deployable Output of action MI/day. Include how this is calculated	The drought option would reduce the compensation flow requirement from 4.9 MI/d to 2 MI/d. This would result in a temporary reduction in the flow from The Goit (a man-made channel linking Rake Brook and Anglezarke reservoirs) to White Coppice Lodge. The precise reduction would be discussed fully with the Environment Agency and would depend upon the need for additional water, time of year and current environmental circumstances. The benefit to deployable output of the source would be c.2.9 MI/d. Benefits to the wider zone are drought event specific
Location Area affected or whole supply zone	Local impact in Wigan area
Implementation timetable	Commencement of drought permit preparation from Drought level 1 Application of drought permit from Drought level 2 Implementation of drought permit from Drought level 2 Drought permit could be effective at all times of the year Drought permits are valid for up to 6 months and can be extended for a further 6 months
Permissions required and constraints	Approval of the application
Risks associated with option	That the application, as applied for, is not approved

Summary of environmental assessment: Rivington Reservoir – White Coppice drought permit: reduce compensation flow from 4.9 to 2.0 MI/d

Overall environmental impact (minor, moderate, major or uncertain)	Moderate Environmental study completed in 2021 (draft at drought plan submission). The assessment assumes that both Brinscall Brook and White Coppice drought permits would be applied for and implemented at the same time.
Level of confidence (H, M, L)	Medium – environmental assessment report completed in 2021 which identifies the level of confidence for each receptor
Summary of likely environmental impacts	No designated sites impacted by this drought permit.

		<p>The environmental study identified moderate impacts on fish species including trout and bullhead at any time of year. Impacts on all other receptors were concluded as minor or negligible.</p> <p>Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites.</p>
Information used to understand conditions before drought or any drought actions are implemented		The environmental study used historical data on river flow, reservoir level, ecological monitoring and water quality. In addition river cross-section measurements were taken throughout the study area to enable hydraulic modelling to translate flow changes into habitat parameter changes (e.g. depth, velocity).
Environmental Monitoring Plan for sensitive features	Baseline monitoring	Lamprey - surveys of the River Yarrow and Black Brook (carried out in 2014, 2015 and 2016)
	Pre- and during drought permit monitoring	Walkover surveys - During drought permit implementation weekly walkover surveys, looking for signs of fish in distress or other unforeseen effects. Water quality – spot measurements using hand held probe during walkover surveys.
	Post- drought permit monitoring	Lamprey – repeat baseline survey at existing monitoring sites, in year following drought permit implementation then review.
Summary of mitigation measures		The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including: a temporary or permanent return to the statutory compensation flow, fish rescue and relocation, habitat modification to concentrate remaining flow within the stream channel, installation of fish refugia within the watercourse and/or provision of appropriate assistance and/ or funding of appropriate reasonable measures (e.g. habitat restoration).
Permits/approvals needs for mitigation measures		Dependent on measures identified by monitoring undertaken at time of implementation. May include consent from the EA for fish rescue or an environmental permit and landowner consent for instream works (if required).
Impact on other activities e.g. fisheries, industry etc.		No significant impacts on other activities identified.

Option Name: Ullswater drought permit: reduce hands-off flow and relax 12-month rolling abstraction licence limit

Trigger/previous action	If appropriate, implementation from Drought level 2 (Strategic Resource Zone). Preceding actions could include rezoning of water supplies; bringing water sources online; customer communication actions and demand restrictions
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<p>Deployable Output of action MI/day. Include how this is calculated</p>	<p>Drought powers could cover the following aspects to allow us to continue abstracting:</p> <ul style="list-style-type: none"> Reduce hands-off flow in the River Eamont at Pooley Bridge to a minimum of 175 MI/d (the statutory prescribed flow varies throughout the year from January to December: 386 MI/d, 386 MI/d, 350 MI/d, 273 MI/d, 273 MI/d, 195 MI/d, 195 MI/d, 195 MI/d, 195 MI/d, 195 MI/d, 232 MI/d, 232 MI/d) Relax 12-month rolling abstraction licence limit (45,634 MI/yr) <p>The scope of required powers would be discussed fully with the Environment Agency and Natural England and will depend upon the need for additional water, time of year and current environmental circumstances. The benefit to deployable output depends on the extent of the drought powers applied for and the pattern of weather conditions. Based on the 'design' 1995-96 two-season drought event the Deployable Output benefit is 30.3 MI/d (derived using our Aquator models). During such events, winter refill is particularly critical to protect against a subsequent risk of a dry summer the following year.</p>
<p>Location Area affected or whole supply zone</p>	<p>Strategic Resource Zone</p>
<p>Implementation timetable</p>	<p>Commencement of drought permit preparation from Drought level 1 Application of drought permit from Drought level 2 Implementation of drought permit from Drought level 2 Drought permit could be effective at the beginning of the year Drought permits are valid for up to 6 months and can be extended for a further 6 months</p>
<p>Permissions required and constraints</p>	<p>Approval of the application</p>
<p>Risks associated with option</p>	<p>That the application, as applied for, is not approved</p>

Summary of environmental assessment: Ullswater drought permit: reduce hands-off flow and relax 12-month rolling abstraction licence limit

<p>Overall environmental impact (minor, moderate, major or uncertain)</p>	<p>Negligible Environmental study completed in 2021</p>
<p>Level of confidence (H, M, L)</p>	<p>Medium</p>
<p>Summary of likely environmental impacts</p>	<p>Ullswater and the River Eamont are within the River Eden SAC which is designated primarily for its oligotrophic to mesotrophic standing water habitats, water courses of plain to montane levels and alluvial forest habitats. The primary designated species are white-clawed crayfish, sea/brook/river lamprey, Atlantic salmon, bullhead and otter. The River Eden and Tributaries is also a SSSI. Ullswater is located within the Lake District National Park.</p> <p>The environmental study concluded that the drought permit would have negligible hydrological and water quality impacts and resulting impacts implementation on all sensitive features would be negligible including on designated sites including the River Eden SAC.</p> <p>Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites and that Appropriate Assessment would not be required.</p>
<p>Information used to understand conditions before drought or any drought actions are implemented</p>	<p>The environmental study used historical data on river flow, lake level, ecological monitoring and water quality. Water resources modelling was also undertaken and information from walkover surveys in 2010 and 2018.</p>
<p>Baseline monitoring</p>	<p>Walkover surveys – identify and map vulnerable areas. Undertaken in 2013 and 2018</p>

Environmental Monitoring Plan for sensitive features	Pre- and during drought permit monitoring	Walkover surveys - During drought permit implementation fortnightly (initially) walkover surveys to monitor any unforeseen effects.
	Post- drought permit monitoring	None
Summary of mitigation measures	The environmental study concluded that the impacts of drought permit implementation would be negligible. Consequently, no mitigation measures are considered necessary	
Permits/approvals needs for mitigation measures	None	
Impact on other activities e.g. fisheries, industry etc.	None identified	

Option Name: Lake Vyrnwy drought permit: reduce compensation flow from 45 to 25 MI/d

Trigger/previous action	If appropriate, implementation from Drought level 2 (Strategic Resource Zone). Preceding actions could include rezoning of water supplies; bringing water sources online; customer communication actions and demand restrictions
Deployable Output of action MI/day. Include how this is calculated	Reducing the compensation flow from 45 MI/d to 25 MI/d would result in a temporary reduction in flow from Lake Vyrnwy to the Afon Vyrnwy. The precise reduction would be discussed fully with the Environment Agency and Natural Resources Wales and would depend upon the need for additional water, time of year and current environmental circumstances. The benefit to deployable output of the reservoir would be c.7.2 MI/d, however benefits to the wider zone are drought event specific.
Location Area affected or whole supply zone	Strategic Resource Zone: supports Liverpool area and Manchester via West-East link
Implementation timetable	Commencement of drought permit preparation from Drought level 1 Application of drought permit from Drought level 2 Implementation of drought permit from Drought level 2 Drought permit could be effective at all times of the year Drought permits are valid for up to 6 months and can be extended for a further 6 months
Permissions required and constraints	Approval of application
Risks associated with option	That the application, as applied for, is not approved or that the application conflicts with a drought order application by the Environment Agency to temporarily increase the Vyrnwy water bank releases to the River Severn system

Summary of environmental assessment: Lake Vyrnwy drought permit: reduce compensation flow from 45 to 25 MI/d

Overall environmental impact (minor, moderate, major or uncertain)	Minor Environmental study completed in 2020
Level of confidence (H, M, L)	Medium

Summary of likely environmental impacts		<p>The Severn Estuary SAC/SPA/Ramsar, Berwyn SPA, and the Berwyn and South Clwyd Mountains SAC designated sites are within the locality of Lake Vyrnwy. Coed Copi'r Graig SSSI is on the Afon Vyrnwy downstream. The environmental study concluded no adverse impacts on these protected sites.</p> <p>The environmental study identified minor or negligible impacts on all receptors.</p> <p>Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites.</p>
Information used to understand conditions before drought or any drought actions are implemented		<p>The environmental study used historical data on river flow, reservoir level, ecological monitoring and water quality. In addition river cross-section measurements were taken throughout the study area to enable hydraulic modelling to translate flow changes into habitat parameter changes (e.g. depth, velocity).</p> <p>The Environment Agency and Natural Resources Wales, working with relevant water companies and stakeholders, manage the River Severn regulation system. The Environment Agency is responsible for applying for a River Severn drought order. This reduces the prescribed flow at Bewdley to prolong storage in Llyn Clywedog, enabling regulation to continue supporting the environment and public water supply needs for as long as possible during a severe drought. The Environment Agency and Natural Resources Wales reviewed the process for such applications in 2013, in consultation with all relevant water companies, stakeholders and the public. This ensures that water company drought plans and the Environment Agency's plans are aligned. One of the actions in the Environment Agency's River Severn Drought Order Environmental Assessment report (https://www.gov.uk/government/publications/river-severn-drought-order-environmental-report) is to discuss an overdraft of the Lake Vyrnwy water bank but notes that the feasibility of this will depend on whether there is sufficient excess storage in Lake Vyrnwy, and if we are able to spare the water at low risk to public water supplies. During drought conditions, we will liaise with the Environment Agency to discuss potential management actions for the River Severn system</p>
Environmental Monitoring Plan for sensitive features	Baseline monitoring	<p>Hydrodynamics - cross-section surveys, undertaken 2014</p> <p>Fish and lamprey - surveys at six sites, undertaken in 2014, 2015 and 2016</p> <p>Macroinvertebrate - surveys at three sites, undertaken in 2014, 2015 and 2016</p>
	Pre- and during drought permit monitoring	<p>Hydrodynamics - cross-sections and gauging, photographic survey and sediment inspection, one event pre-implementation then repeat once during implementation.</p> <p>In-stream habitat walkover survey – single pre-implementation survey including Coed Copi'r Graig SSSI and sensitive reach 2km downstream of Dolanog Falls</p> <p>Walkover surveys - During drought permit implementation fortnightly walkover surveys, looking for signs of fish in distress and any other unforeseen effects.</p> <p>Water quality – spot measurements using hand held probe during walkover surveys</p> <p>Consultations and engagement with downstream hydroelectric power operators</p>
	Post- drought permit monitoring	<p>Photographic survey and sediment inspection – repeat in year following drought permit implementation.</p>
Summary of mitigation measures		<p>The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including: a temporary or permanent return to the statutory compensation flow, fish rescue and relocation, habitat modification to concentrate remaining flow within the stream channel, installation of fish refugia within the watercourse and/or provision of appropriate assistance and/ or funding of appropriate reasonable measures (e.g. habitat restoration).</p> <p>During implementation liaison will be made with downstream hydroelectric power operators to ensure a full understanding of any impact on their operations.</p>
Permits/approvals needs for mitigation measures		<p>Dependent on measures identified by monitoring undertaken at time of implementation. May include consent from the NRW for fish rescue or an environmental permit and landowner consent for instream works (if required).</p>
Impact on other activities e.g. fisheries, industry etc.		<p>The environmental study identified potential for a minor adverse impact on downstream hydroelectric power station operators. No significant impacts on other activities identified.</p> <p>Lake Vyrnwy can release water to the River Severn to support the river flow. This is important to the Canal and River Trust for both navigation on the River Severn and abstraction of water to the Gloucester and Sharpness Canal (from which Bristol Water abstracts). The Canal and River Trust will be consulted if drought powers at Vyrnwy are being considered</p>

Option Name: Lake Windermere drought permit: reduce hands-off flow and relax 12-month rolling abstraction licence limit

Trigger/previous action	If appropriate, implementation from Drought level 2 (Strategic Resource Zone). Preceding actions could include rezoning of water supplies; bringing water sources online; customer communication actions and demand restrictions
Deployable Output of action MI/day. Include how this is calculated	<p>Drought powers at Windermere could cover either or both of the following aspects to allow us to continue abstracting:</p> <ul style="list-style-type: none"> Reduce hands-off flow conditions in the River Leven at Newby Bridge to a minimum of 95 MI/d (the statutory prescribed flow varies throughout the year: 273 MI/d in May to September and 136 MI/d in October to April) Relax 12-month rolling abstraction licence limit (36,504 MI/yr) <p>The scope of required powers would be discussed fully with the Environment Agency and will depend upon the need for additional water, time of year and current environmental circumstances. The benefit to deployable output depends on the extent of the drought powers applied for and the pattern of weather conditions. Based on the 'design' 1995-96 two-season drought event the Deployable Output benefit is 53.5 MI/d (using our Aquator models). During such events, winter refill is particularly critical to protect against a subsequent risk of a dry summer the following year. For example, it was estimated that the 2003 drought permit would give an abstraction benefit of up to 50 MI/d in dry conditions over the period December to March inclusive</p>
Location Area affected or whole supply zone	Strategic Resource Zone
Implementation timetable	<p>Commencement of drought permit preparation from Drought level 1</p> <p>Application of drought permit from Drought level 2</p> <p>Implementation of drought permit from Drought level 2</p> <p>Drought permit could be effective at all times of the year</p> <p>Drought permits are valid for up to 6 months and can be extended for a further 6 months</p>
Permissions required and constraints	Approval of the application
Risks associated with option	That the application, as applied for, is not approved

Summary of environmental assessment: Lake Windermere drought permit: reduce hands-off flow and relax 12-month rolling abstraction licence limit

Overall environmental impact (minor, moderate, major or uncertain)	<p>Minor/moderate</p> <p>Environmental study completed in 2021</p>
Level of confidence (H, M, L)	High – environmental assessment report completed in 2021 which identifies the level of confidence for each receptor
Summary of likely environmental impacts	<p>Lake Windermere is located within the Lake District National Park and is designated as a County Wildlife Site. No designated sites are impacted by implementation of a drought permit. The River Leven, which flows out of Windermere, is one of five major fresh water sources to Morecambe Bay (SAC/SPA/Ramsar/SSSI) which also include the rivers Lune, Kent, Keer and Wyre. Discussions with the Environment Agency and Natural England, as part of the environmental study, ascertained that the impact on Morecambe Bay is likely to be insignificant given the relative volumes of water involved and the large attenuation volumes available in Morecambe Bay. A small proportion of Windermere is within the Low Wray Bay SSSI designated for its preserved sediments. The environmental assessment concluded a drought permit would have negligible impact on this SSSI.</p> <p>The environmental study assessed the impacts of reducing the hands-off flow to 95 MI/d and relaxing the annual licence limit. The study identified moderate impacts on some fish and lamprey lifestages depending on the time of year of implementation. Impacts on all other receptors are predicted to be minor or negligible.</p> <p>Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites.</p>

Information used to understand conditions before drought or any drought actions are implemented		The environmental study used historical data on river flow, lake level, ecological monitoring and water quality. In addition river cross-section measurements were taken throughout the study area to enable hydraulic modelling to translate flow changes in to habitat parameter changes (e.g. depth, velocity). Information from a recent review and assessment of the Windermere abstraction licence was also incorporated.
Environmental Monitoring Plan for sensitive features	Baseline monitoring	Hydrodynamics - flow gauging at four sites on the River Leven.
	Pre- and during drought permit monitoring	Hydrodynamics – repeat flow gauging at four sites on the River Leven. Flows at or below baseline hands-off flows, and at or below 95 MI/d one prior to permit implementation and again during implementation. Walkover surveys - During drought permit implementation fortnightly walkover surveys, looking for signs of fish in distress and any other unforeseen effects. Water quality – spot measurements using hand held probe during walkover surveys Fish – redd mapping, once pre-implementation if implemented in October to December only).
	Post- drought permit monitoring	None identified
Summary of mitigation measures		The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including: release of additional; flow via the Newby Bridge fisheries sluice, installation of fish refugia within the watercourse and/or provision of appropriate assistance and/ or funding of appropriate reasonable measures (e.g. habitat restoration). The new Windermere water bank agreement agreed in December 2012 states that at any time that Windermere is 2.5 cm below weir crest and/or Haweswater storage has crossed Trigger 3, a meeting of the Windermere stakeholder group will be convened to include representatives from the following organisations: United Utilities, Environment Agency, Holker Estates, Windermere Lake User Forum, Windermere Lake Cruises Ltd and Windermere Marina Village Ltd. Through this process the most effective use of the Windermere water bank will be discussed
Permits/approvals needs for mitigation measures		Dependent on measures identified by monitoring undertaken at time of implementation.
Impact on other activities e.g. fisheries, industry etc.		The environmental study identified no adverse impacts of implementation of a drought permit on other activities. The Windermere stakeholder group would be consulted if drought powers at Windermere are being considered

6.2 Carlisle Resource Zone supply side option

Option Name: Castle Carrock: utilisation of reservoir dead water storage

Trigger/previous action	Drought level 2 (Castle Carrock Reservoir). On reaching this trigger we would review the circumstances associated with making this source available for supply and whether it would aid the drought situation. If so, then on crossing this trigger, we would commence actions to enable us to abstract dead water within the reservoir, in line with the implementation timescale outlined below
Deployable Output of action MI/day. Include how this is calculated	The benefit of this option is specific to a given drought event, but is estimated to be up to 6 MI/d. During drought events, the dead water volume of 170.91 MI would provide around an additional 30 days of supply at approximately 6 MI/d.
Location Area affected or whole supply zone	Carlisle Resource Zone
Implementation timetable	Approximately 1 month to implement (this timescale may be extended if a temporary filter plant is required) Available throughout year subject to reservoir storage levels
Permissions required and constraints	This option would seek to utilise dead water (170.7 MI) at the base of the storage reservoir by installation of temporary pumping equipment and associated pipework. Treatment would be through the existing water treatment works
Risks associated with option	Water quality problems at the water treatment works including elevated turbidity and colour We carried out water quality sampling of the dead water in 2016. This did not identify any treatability issues. However this sampling was not carried out under drought conditions therefore there is a risk that additional treatment may be required at the water treatment works (e.g. modifications to add a temporary filter plant at the front of the works, housed within the existing water treatment works site). If this is required the timescale for implementation is likely to be extended to up to 3 months

Summary of environmental assessments: Castle Carrock: utilisation of reservoir dead water storage

Overall environmental impact (minor, moderate, major or uncertain)	Low
Level of confidence (H, M, L)	Medium
Summary of likely environmental impacts	<p>The drought option comprises abstraction of the dead water from Castle Carrock storage reservoir only (i.e. water that is not normally available for abstraction). The reservoir has no compensation flow and no statutory releases would be put at risk. No abstraction licence changes would be required and no reduction to the hands-off flow on the associated River Gelt river sources is proposed.</p> <p>There will be no loss of designated habitat due to the scheme as the construction footprint does not overlap any designated sites. However, given the distance between the drought option site and the North Pennine Moors SAC and River Eden SAC designated sites, there is the potential for impacts from noise, dust or chemical leak. Assuming best practice construction measures, impacts on designated sites will be negligible.</p> <p>The Environment Agency's Review of Consents for the North Pennine Moors SAC and North Pennine Moors SPA concluded that there was no adverse impact of this licence on the integrity of these sites (either alone or in-combination).</p> <p>The River Eden Review of Consents assessed that the River Gelt abstractions alone have an adverse impact on the integrity of the River Eden SAC and changes were made to our abstraction licences in 2015 to address the issue. This drought option involves abstraction of dead water from Castle Carrock storage reservoir only (which is not part of the designated area), and is not dependent on abstraction from the river i.e. the reservoir can be drawn down even if there is no abstraction from the river. As such, there are no impacts on the designated features of the River Eden SAC.</p>

	Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought option on European designated sites WFD waterbody: Castle Carrock (artificial) at good (Cycle 2, 2015). Castle Carrock is classified as an artificial waterbody under the WFD. No risk of deterioration to any surface or groundwater waterbodies associated with this source have been identified (as per the release of data from the Environment Agency, 5 October 2016)
Information used to understand conditions before drought or any drought actions are implemented	Water quality sampling of the dead water in Castle Carrock reservoir was carried out in 2016. This did not identify any water quality issues that would be of concern if we wished to abstract this water, however this sampling was undertaken when the reservoir was full and in a drought, lowered water levels and reduced inflows could result in different conditions to those sampled Habitats Regulations Assessment Screening Report for this drought plan SEA Environmental Report for this drought plan
Summary of additional monitoring required	None required
Summary of mitigation measures	None required
Permits/approvals needs for mitigation measures	None required
Impact on other activities e.g. fisheries, industry etc.	Minor adverse impacts predicted in SEA Environmental Report on: biodiversity (flora/fauna); water; soil, geology and land use Moderate adverse impacts predicted in SEA Environmental Report on: landscape and visual amenity; inter-relationships There may be fish resident in the reservoir, and there may be impacts on this population dependent on the extent of drawdown. It is assumed any impacts on fish populations will be mitigated e.g. through fish rescues. Therefore the impact on biodiversity (flora/fauna) has been assessed as minor adverse. Abstraction of dead water would result in increased drawdown of the reservoir. Therefore the impact on water has been assessed as minor adverse, temporary and reversible. Reservoir drawdown and exposure of shoreline margins may result in minor adverse, temporary and reversible geomorphological impacts. Overall impacts on soil, geology and land use are summarised as minor adverse. Temporary minor adverse effects on landscape and visual amenity are anticipated due to changes in exposure of the reservoir shoreline. The new buildings are relatively small in size and within the existing site area. In view of the fact that the reservoir levels are likely to be at their lowest during peak tourist season and the site is within the North Pennines AONB, the impact of the drought option on landscape and visual amenity is considered to be moderate adverse but temporary. Key inter-relationships between topics include reservoir level impacts on biodiversity, flora and fauna, soil, geology and land use and landscape and visual amenity. Overall these have been summarised as moderate adverse.

6.3 North Eden Resource Zone drought permits

Option Name: Bowscar boreholes drought permit: increase annual licence limit to enable continuation of abstraction at the maximum daily abstraction rate

Trigger/previous action	If appropriate, implementation from Drought level 2 (North Eden boreholes). Preceding actions could include rezoning of water supplies; customer communication actions and demand restrictions.
Deployable Output of action MI/day. Include how this is calculated	The drought option would vary the annual licence limit (618 MI/yr equivalent to an average abstraction rate of 1.69 MI/d) for the Bowscar boreholes to enable the continuation of abstraction at the maximum daily abstraction rate (3.36 MI/d). The drought option would give a benefit of 1.67 MI/d which would help keep abstractions from other sources at sustainable levels, or in isolated supply areas, ensure that essential demands for water would continue to be met. The exact conditions of the application would be discussed fully with the Environment Agency and would depend upon the need for additional water, time of year, the overall condition of the local aquifer and current environmental circumstances
Location Area affected or whole supply zone	Local area supplied by Bowscar boreholes (North Eden Resource Zone)
Implementation timetable	Commencement of drought permit preparation from Drought level 1 Application of permit from Drought level 2 Implementation of drought permit from Drought level 2 Drought permit could be effective at all times of the year Drought permits are valid for up to 6 months and can be extended for a further 6 months
Permissions required and constraints	Approval of the application
Risks associated with option	That the application, as applied for, is not approved

Summary of environmental assessments: Bowscar boreholes drought permit: increase annual licence limit to enable continuation of abstraction at the maximum daily abstraction rate

Overall environmental impact (minor, moderate, major or uncertain)	Minor Environmental study completed in 2021
Level of confidence (H, M, L)	Medium – environmental assessment report completed in 2021 which identifies the level of confidence for each receptor
Summary of likely environmental impacts	The environmental study identified minor or negligible impacts on all receptors. Watercourses in proximity to the Bowscar boreholes are tributaries to the River Eden which is a SAC and SSSI. In addition, the North Pennine Moors SPA is in the locality. The environmental study concluded no impacts of the drought permit on designated sites. Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites
Information used to understand conditions before drought or any drought actions are implemented	The environmental study used historical data on river flow, groundwater level, ecological monitoring and water quality. In addition river cross-section measurements were taken throughout the study area to enable hydraulic modelling to translate flow changes in to habitat parameter changes (e.g. depth, velocity).

Environmental Monitoring Plan for sensitive features	Baseline monitoring	Groundwater levels- baseline monitoring of groundwater levels
	Pre- and during drought permit monitoring	Hydrodynamics - Undertake spot gauging and geo-referenced, repeatable assessment of channel wetted width, depth and velocity including field notes and fixed point photographs at two locations specified in the environmental assessment. Relate to ground water level and abstraction volume if possible. One occasion pre-implementation, fortnightly for the first month of implementation then review. Groundwater levels - continue to monitor groundwater levels
	Post- drought permit monitoring	Groundwater levels - continue to monitor groundwater levels
Summary of mitigation measures		The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including: reduce or cease groundwater abstraction, if third party abstractors report impacts, then potential mitigation measures include lowering the pump (if possible), providing an alternative supply (e.g. a temporary bowser), or providing financial compensation, provision of appropriate assistance and/or funding of appropriate reasonable measures (e.g. habitat restoration).
Permits/approvals needs for mitigation measures		Dependent on measures identified by monitoring undertaken at time of implementation. May include an environmental permit and landowner consent for instream works (if required).
Impact on other activities e.g. fisheries, industry etc.		No significant impacts on other activities identified.

Option Name: Gamblesby boreholes drought permit: increase annual licence limit to enable continuation of abstraction at the maximum daily abstraction rate

Trigger/previous action	If appropriate, implementation from Drought level 2 (North Eden boreholes). Preceding actions could include rezoning of water supplies; customer communication actions and demand restrictions.
Deployable Output of action Ml/day. Include how this is calculated	The drought option would vary the annual licence limit (500 Ml/yr equivalent to an average abstraction rate of 1.37 Ml/d) for the Gamblesby boreholes to enable the continuation of abstraction at the maximum daily abstraction rate (1.6 Ml/d). The drought option would give a benefit of 0.23 Ml/d which would help keep abstractions from other sources at sustainable levels, or in isolated supply areas, ensure that essential demands for water would continue to be met. The exact conditions of the application would be discussed fully with the Environment Agency and would depend upon the need for additional water, time of year, the overall condition of the local aquifer and current environmental circumstances
Location Area affected or whole supply zone	Local area supplied by Gamblesby boreholes (North Eden Resource Zone)
Implementation timetable	Commencement of drought permit preparation from Drought level 1 Application of drought permit from Drought level 2 Implementation of drought permit from Drought level 2 Drought permit could be effective at all times of the year Drought permits are valid for up to 6 months and can be extended for a further 6 months
Permissions required and constraints	Approval of the application
Risks associated with option	That the application, as applied for, is not approved

Summary of environmental assessments: Gamblesby boreholes drought permit: increase annual licence limit to enable continuation of abstraction at the maximum daily abstraction rate

Overall environmental impact (minor, moderate, major or uncertain)		Minor Environmental study completed in 2021
Level of confidence (H, M, L)		Medium – environmental assessment report completed in 2021 which identifies the level of confidence for each receptor
Summary of likely environmental impacts		The environmental study identified minor or negligible impacts on all receptors. Watercourses in proximity to the Gamblesby boreholes are tributaries to the River Eden which is a SAC and SSSI. In addition, the North Pennine Moors SPA is in the locality. The site is located within the North Pennines AONB The environmental study concluded no impacts of the drought permit on designated sites. Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites.
Information used to understand conditions before drought or any drought actions are implemented		The environmental study used historical data on river flow, groundwater level, ecological monitoring and water quality. In addition river cross-section measurements were taken throughout the study area to enable hydraulic modelling to translate flow changes into habitat parameter changes (e.g. depth, velocity).
Environmental Monitoring Plan for sensitive features	Baseline monitoring	Groundwater levels- baseline monitoring of groundwater levels
	Pre- and during drought permit monitoring	Hydrodynamics - Undertake spot gauging and geo-referenced, repeatable assessment of channel wetted width, depth and velocity including field notes and fixed point photographs at two locations specified in the environmental assessment. Relate to ground water level and abstraction volume if possible. One occasion pre-implementation, fortnightly for the first month of implementation then review. Groundwater levels - continue to monitor groundwater levels
	Post- drought permit monitoring	Groundwater levels - continue to monitor groundwater levels
Summary of mitigation measures		The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including: reduce or cease groundwater abstraction, if third party abstractors report impacts, then potential mitigation measures include lowering the pump (if possible), providing an alternative supply (e.g. a temporary bowser), or providing financial compensation, provision of appropriate assistance and/or funding of appropriate reasonable measures (e.g. habitat restoration).
Permits/approvals needs for mitigation measures		Dependent on measures identified by monitoring undertaken at time of implementation. May include an environmental permit and landowner consent for instream works (if required).
Impact on other activities e.g. fisheries, industry etc.		No significant impacts on other activities identified.

Option Name: Tarn Wood boreholes drought permit: increase annual licence limit to enable continuation of abstraction at the maximum daily abstraction rate

Trigger/previous action	If appropriate, implementation from Drought level 2 (North Eden boreholes). Preceding actions could include rezoning of water supplies; customer communication actions and demand restrictions.
Deployable Output of action Ml/day. Include how this is calculated	The drought option would vary the annual licence limit (592 Ml/yr equivalent to an average abstraction rate of 1.62 Ml/d) for the Tarn Wood boreholes to enable the continuation of abstraction at the maximum daily abstraction rate (2.37 Ml/d). The drought option would give a benefit of 0.75 Ml/d which would help keep abstractions from other sources at sustainable levels, or in isolated supply areas, ensure that essential demands for water would continue to be met. The exact conditions of the application would be discussed fully with the Environment Agency and would depend upon the need for additional water, time of year, the overall condition of the local aquifer and current environmental circumstances
Location Area affected or whole supply zone	Local area supplied by Tarn Wood boreholes (North Eden Resource Zone)
Implementation timetable	Commencement of drought permit preparation from Drought level 1 Application of drought permit from Drought level 2 Implementation of drought permit from Drought level 2 Drought permit could be effective at all times of the year Drought permits are valid for up to 6 months and can be extended for a further 6 months
Permissions required and constraints	Approval of the application
Risks associated with option	That the application, as applied for, is not approved

Summary of environmental assessments: Tarn Wood boreholes drought permit: increase annual licence limit to enable continuation of abstraction at the maximum daily abstraction rate

Overall environmental impact (minor, moderate, major or uncertain)	Minor Environmental study completed in 2021
Level of confidence (H, M, L)	Medium – environmental assessment report completed in 2021 which identifies the level of confidence for each receptor
Summary of likely environmental impacts	The environmental study identified minor or negligible impacts on all receptors. Watercourses in proximity to the Tarn Wood boreholes are tributaries to the River Eden which is a SAC and SSSI. In addition, the North Pennine Moors SPA is in the locality. The environmental study concluded no impacts of the drought permit on designated sites. Habitats Regulations Assessment Screening for this drought plan concluded no likely significant effects of implementation of this drought permit on European designated sites.
Information used to understand conditions before drought or any drought actions are implemented	The environmental study used historical data on river flow, groundwater level, ecological monitoring and water quality. In addition river cross-section measurements were taken throughout the study area to enable hydraulic modelling to translate flow changes into habitat parameter changes (e.g. depth, velocity).
Baseline monitoring	Groundwater levels- baseline monitoring of groundwater levels

Environmental Monitoring Plan for sensitive features	Pre- and during drought permit monitoring	Hydrodynamics - Undertake spot gauging and geo-referenced, repeatable assessment of channel wetted width, depth and velocity including field notes and fixed point photographs at two locations specified in the environmental assessment. Relate to ground water level and abstraction volume if possible. One occasion pre-implementation, fortnightly for the first month of implementation then review. Groundwater levels - continue to monitor groundwater levels
	Post- drought permit monitoring	Groundwater levels - continue to monitor groundwater levels
Summary of mitigation measures		The environmental study considered mitigation measures. If monitoring during a drought permit indicates that significant impacts are occurring then various measures could be considered for implementation including: reduce or cease groundwater abstraction, if third party abstractors report impacts, then potential mitigation measures include lowering the pump (if possible), providing an alternative supply (e.g. a temporary bowser), or providing financial compensation, provision of appropriate assistance and/or funding of appropriate reasonable measures (e.g. habitat restoration).
Permits/approvals needs for mitigation measures		Dependent on measures identified by monitoring undertaken at time of implementation. May include an environmental permit and landowner consent for instream works (if required).
Impact on other activities e.g. fisheries, industry etc.		No significant impacts on other activities identified.