Monthly water situation report: North West England

1 Summary – April 2024

1.1 Rainfall

April was another month where we observed the wet and unsettled weather that has been characteristic of the last 5 months. In particular, the first half of April saw exceptional rainfall, with indicator sites across the North West recording either close to, or above their long term averages (LTA) by the end of the first week. Although the second half of April saw drier weather with high pressure systems dominating, moderate rainfall totals were still recorded, particularly across Cumbria, and in the upland areas of Lancashire and Greater Manchester, Merseyside, and Cheshire (GMC).

Rainfall for North West England as a whole was classed as exceptionally high for April, at 195% of the LTA, and was ranked as the wettest April since 1871 (153 years), with a cumulative rainfall of 138mm, breaking the previous record of 130mm in 1913. Cumbria and Lancashire observed 203% of the LTA, classed as exceptionally high. This was also the wettest April for the area, with a cumulative rainfall of 153mm, breaking the previous record of 152mm in 1947. GMC observed lower totals at 168% of the LTA, but still classed as exceptionally high, and was ranked as the sixth wettest April since 1871.

Rainfall totals were generally higher towards the north of North West England, particularly in Cumbria, than towards the south, however, all hydrological areas were classed as exceptionally high with the exception of:

- the Douglas hydrological area (classed as notably high)
- the Esk (Dumfries) hydrological area (classed as above normal)

The highest rainfall (in terms of the LTA) was observed in the Eden hydrological area (232% of the LTA), classed as exceptionally high, and ranked as the second wettest April since 1871, and the wettest since 1947. The lowest rainfall was recorded in the Esk (Dumfries) hydrological area (147% of the LTA).

April 2024 was also ranked as the wettest April since 1871 for:

- the Esk (Cumbria) hydrological area, with a cumulative rainfall of 203mm, breaking the previous record of 182mm in 1947
- the Kent hydrological area, at 206mm, breaking the previous record of 182mm in 1970

April 2024 was also:

- the second wettest April since 1871 for the Derwent hydrological area;
- the fifth wettest April for the Cheshire Rivers Group, and the Wyre and Lune hydrological areas

The 3-month cumulative rainfall totals reflects the rainfall pattern seen in February, with nearly all hydrological areas classed as exceptionally high, with the exception of:

- the Eden hydrological area which was classed as notably high
- the Esk (Dumfries) hydrological area which was classed as above normal

The 3-month period ending in April was ranked as the wettest since 1871 for:

- North West England, with a cumulative rainfall of 400mm, breaking the previous record of 393mm in 2020
- GMC, which recorded 312mm during this period, breaking the previous record, which was 289mm in 1920
- the Esk (Cumbria) hydrological area, at 590mm, breaking the previous record of 561mm in 1989
- the Cheshire Rivers Group hydrological area, at 285mm, breaking the previous record of 266mm in 1920
- the Kent hydrological area, at 601mm, breaking the previous record of 588mm in 1989
- the Mersey and Irwell hydrological area, at 336mm, breaking the previous record of 323mm in 1970
- the Douglas hydrological area, at 319mm, breaking the previous record of 308mm in 1981

Of note, the 3-month period ending in April was also the second wettest 3-month period since 1871 for:

- Cumbria
- Lancashire
- the Derwent hydrological area
- the Wyre and Lune hydrological area

The 3-month period was also the third wettest for the Ribble hydrological area.

The 6-month cumulative rainfall totals see almost all hydrological areas across the North West England being classed as exceptionally high, with the exception of the Esk (Dumfries) hydrological area, which was classed as above normal.

The 6-month period ending in April was also the wettest since 1871 for:

- GMC at 697mm, breaking the previous record of 671mm in 2016
- the Cheshire Rivers Group hydrological area at 592mm, breaking the previous record of 533mm in 1920 by almost 60mm

In addition, this was the second wettest 6-month period since 1871 for:

- North West England
- Cumbria
- Lancashire
- the Esk (Cumbria) hydrological area
- the Derwent hydrological area
- the Eden hydrological area
- the Kent hydrological area
- the Mersey and Irwell hydrological area
- the Douglas hydrological area
- the Ribble hydrological area
- the Wyre and Lune hydrological area

The 12-month cumulative totals replicate the trend seen in the 6-month cumulative rainfall totals, with all hydrological areas, except for the Esk (Dumfries) which was classed as above normal, being classed as exceptionally high.

The 12-month period ending in April was the wettest since 1871 for:

- North West England with a cumulative rainfall of 1676mm, breaking the previous record of 1587mm in 2016
- Cumbria, at 1971mm breaking the previous record of 1942mm in 2016
- GMC at 1333mm, breaking the previous record of 1229mm in 2020
- Lancashire at 1784mm, breaking the previous record of 1669mm in 1981 by over 100mm
- the Esk (Cumbria) hydrological area at 2328mm, breaking the previous record of 2262mm in 2016
- the Cheshire Rivers Group hydrological area at 1169mm breaking the previous record of 1074mm in 2001
- the Kent hydrological area at 2463mm breaking the previous record of 2261mm in 2016 by more than 200mm
- the Mersey and Irwell hydrological area at 1479mm breaking the previous record of 1381mm in 2020
- the Douglas hydrological area at 1456mm breaking the previous record of 1303mm in 2001 by over 150mm
- the Ribble hydrological area at 1826mm breaking the previous record of 1767mm in 2020
- the Wyre and Lune hydrological area which at 1960mm also broke the previous record which was 1876mm in 2016

Additionally, the 12-month period ending in April was also:

- the second wettest on record for the Eden hydrological area
- the third wettest on record for the Derwent hydrological area

1.2 Soil moisture deficit and recharge

Drier weather observed during the second half of April increased soil moisture deficits (SMD) across the North West compared to levels at the end of March. This is particularly the case for Lancashire and GMC. SMD levels for the end of April across North West England fell within the range of 1 to 24mm. This was either at or slightly higher than expected for the time of year.

1.3 River flows

Monthly mean river flows increased across all catchments in response to the rainfall received during April. River flows in all catchments increased to levels that far exceeded what would be expected for the time of the year. Overall, 20 out of 25 sites were classed as exceptionally high, with the remaining sites classed as notably high. It is also worth noting that 18 out of 25 of the indicator sites recorded monthly mean river flows above 200% of their LTA.

Monthly mean river flows were generally higher in Cumbria, Cheshire, and in the uplands of Lancashire and Greater Manchester than elsewhere, which reflects the rainfall that was received during the month. River flows were highest (in terms of percentage of the LTA) in the Upper Lune catchment at Lunes Bridge (301% of the LTA, classed as exceptionally high), and lowest in the Tame catchment at Portwood (164% of the LTA, classed as notably high).

There were some notable peaks in daily mean flow recorded when rain fell on saturated ground on 8 and 9 April. Daily mean flows above Q1 (this is where mean flow has been exceeded only one percent of the time during the lifespan of the gauging station) were recorded at:

- Ashbrook gauging station on the River Weaver
- Bollington Mill gauging station on the River Bollin
- Bulgill gauging station on the River Ellen
- Sheepmount gauging station on the River Eden
- Kirkby gauging station on the River Alt

1.4 Groundwater levels

Groundwater levels across the North West at the end of April were classed between exceptionally high and normal. Groundwater levels at Skirwith increased from notably high to exceptionally high, and decreased at Bruntwood Hall from exceptionally high to notably high.

All other groundwater indicator sites remained at the same classification with:

- Lea Lane being classed as normal
- Brown Bank Lay-By being classed as above normal
- Richmond Park and Priors Heyes being classed as exceptionally high

Levels at Priors Heyes remain high compared to historic levels because the aquifer is recovering from the effects of historically high abstractions.

1.5 Reservoir storage

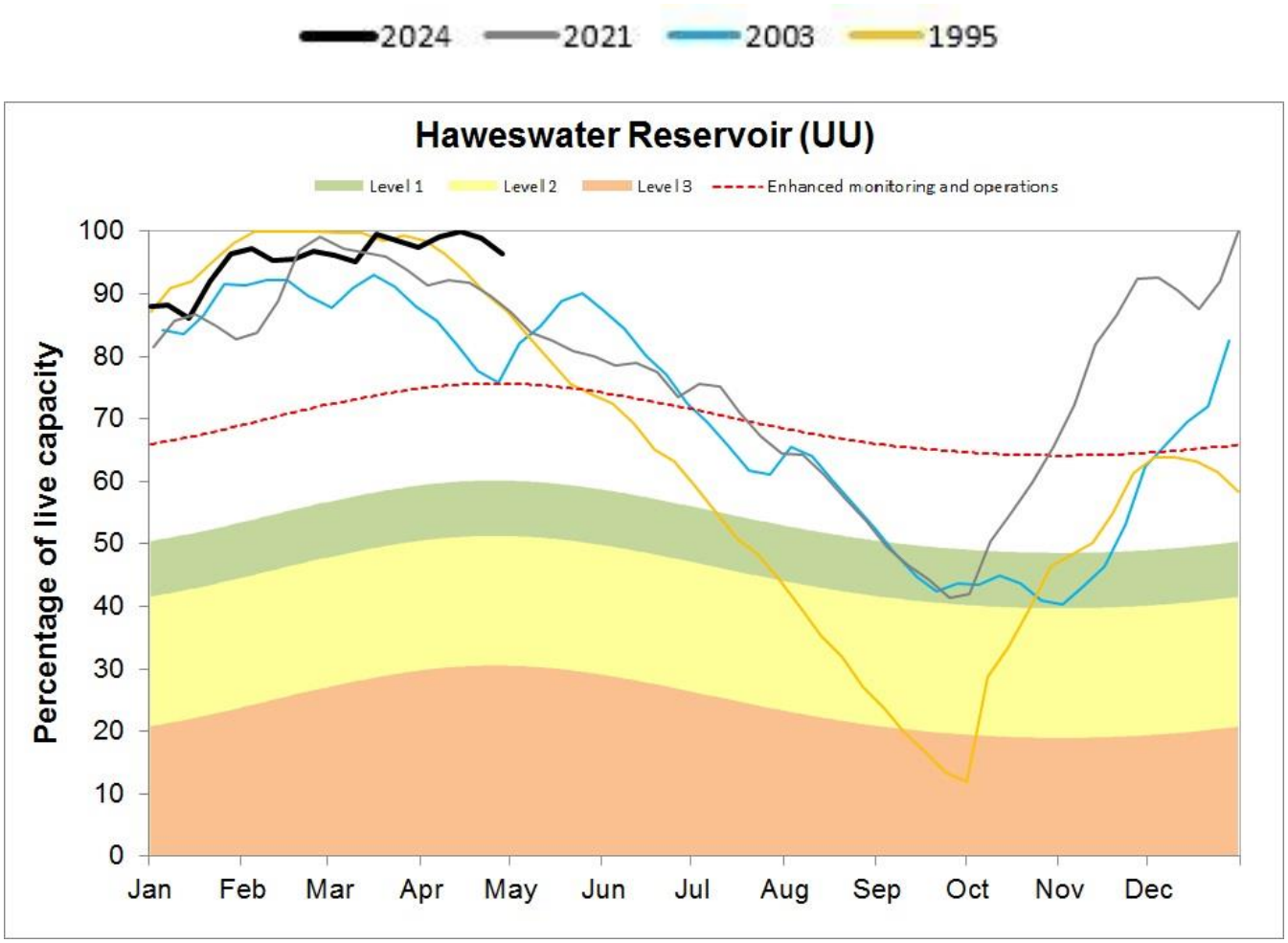
Total reservoir storage for North West England decreased slightly from 93% at the end of March to 92% at the end of April, higher than the average of 90% at this time of the year, but slightly lower than this time last year when total reservoir storage was at 93%.

At the end of April, reservoir storage (in terms of percentage) was highest at Crummock Water and Ennerdale Water, which were both at 100% full. Storage was lowest at Longdendale (78%). The combined storage at Haweswater and Thirlmere was 96%, higher than the average of 87% at this time of year, and higher than the storage level this time last year which was 94%.

Reservoirs kept low for maintenance works include:

- Audenshaw No.1, Torside, and Woodhead (part of the Longdendale system)
- Anglezarke, and High Bullough (part of the Rivington system)
- Dingle, and Jumbles (part of the Bolton supply system)
- Harlock (part of the Poaka Beck system)
- Kitcliffe (part of the Piethorne Valley system)
- Ogden Lower, and Ogden Upper (part of the Ogden (Barley) system)
- Alston No.2 (part of the Longridge system)
- Llyn Celyn (part of the Dee (Celyn and Brenig) system)
- Coldwell Upper (part of the Coldwell system)
- Cragg (part of the Cowpe system),
- Ridegate (part of the Ridegate system)

Figure 1.5: Storage in Haweswater Reservoir, including the drought levels for the reservoir and storage for the current year (2024) and representative years: 1995, 2003 and 2021 (*Source: United Utilities* (UU)).

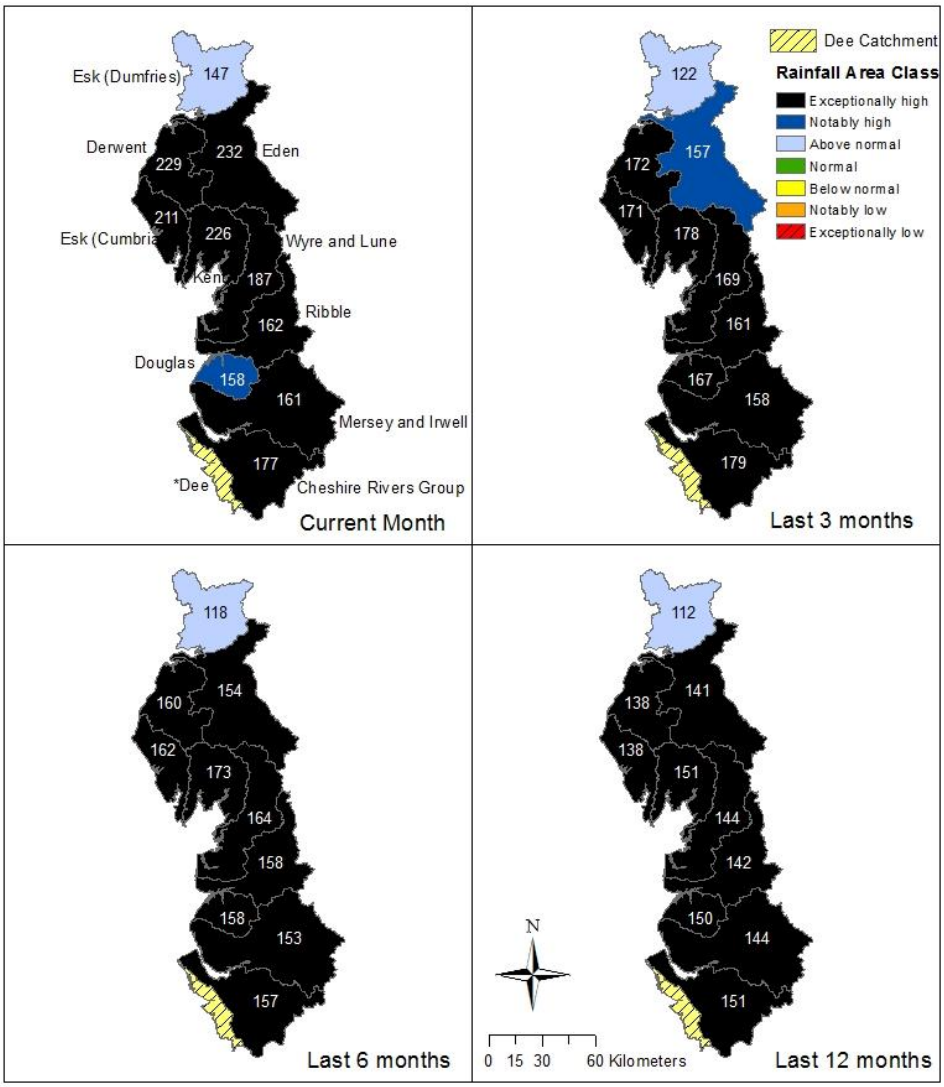


Author: Cumbria and Lancashire Hydrology Team, hydrology.CMBLNC@environment-agency.gov.uk

2 Rainfall

2.1 Rainfall map

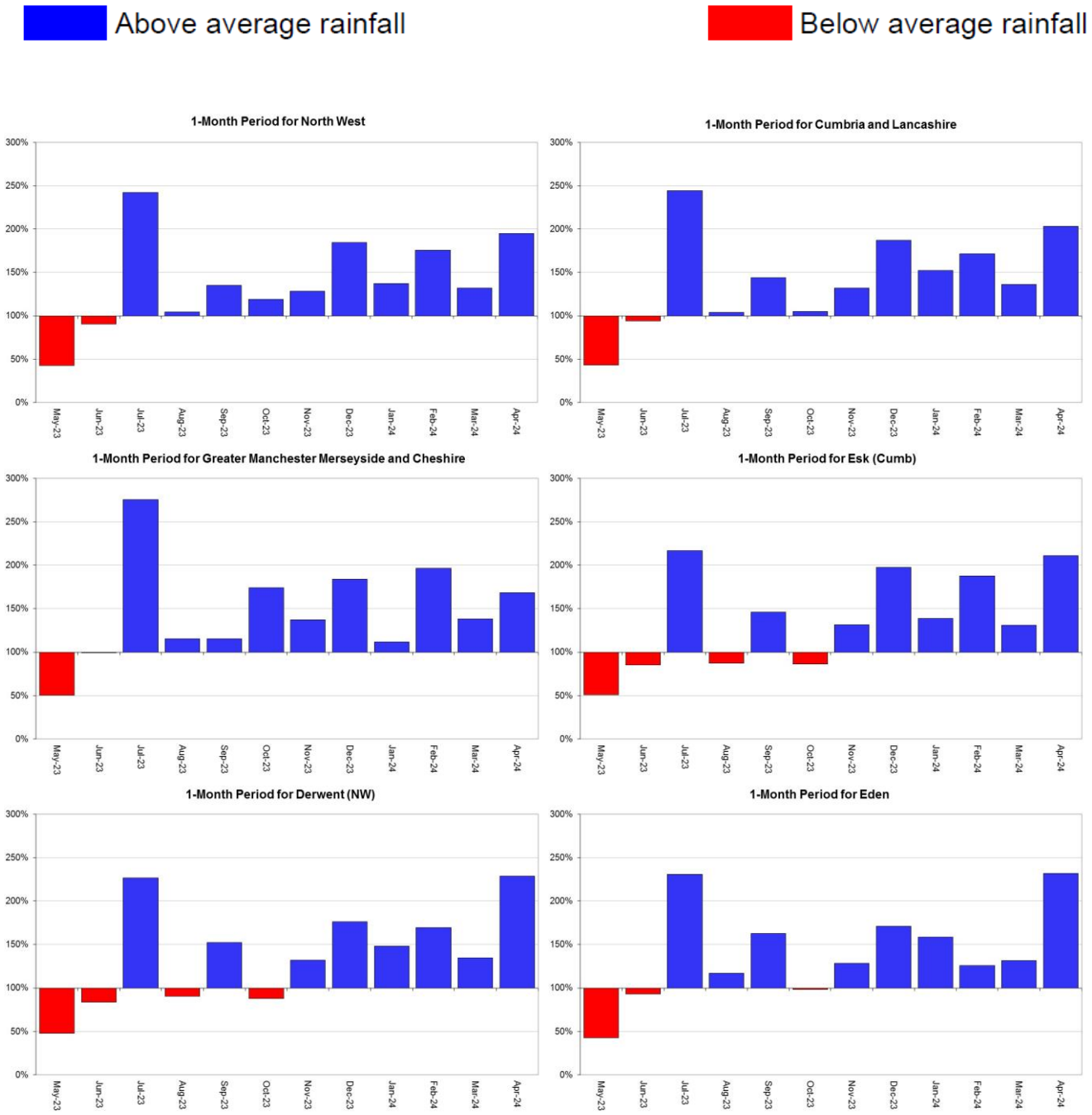
Figure 2.1: Total rainfall (as a percentage) for hydrological areas for the current month (up to 30 April 2024), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Table available in the appendices with detailed information.

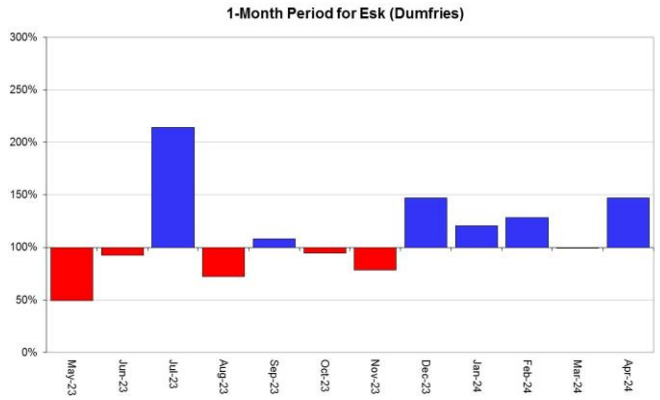


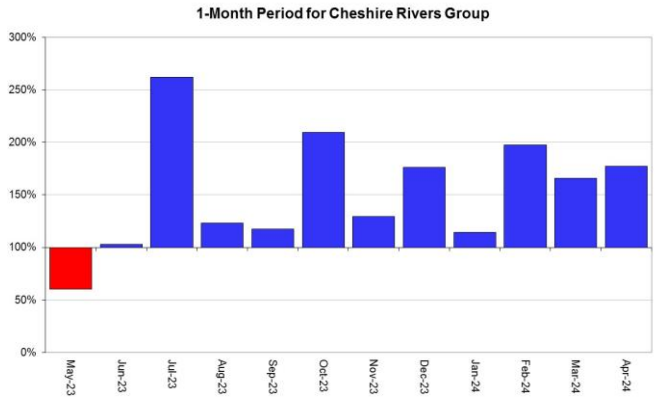
Rainfall data for 2024, extracted from Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. (Source: Environment Agency. Crown Copyright, 100024198, 2024). Rainfall data prior to 2023, extracted from Met Office HadUK 1km gridded rainfall dataset derived from registered rain gauges (Source: Met Office. Crown copyright, 2024).

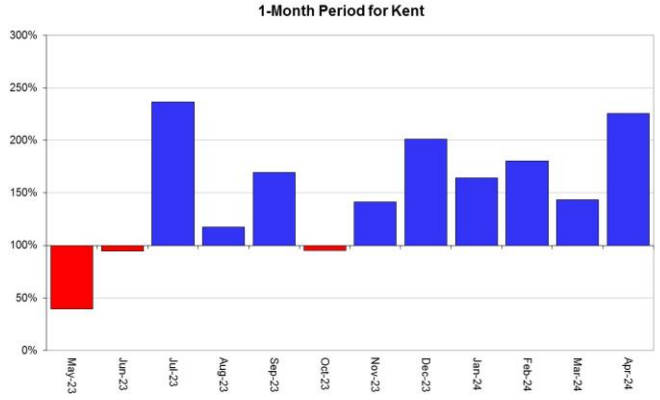
2.2 Rainfall charts

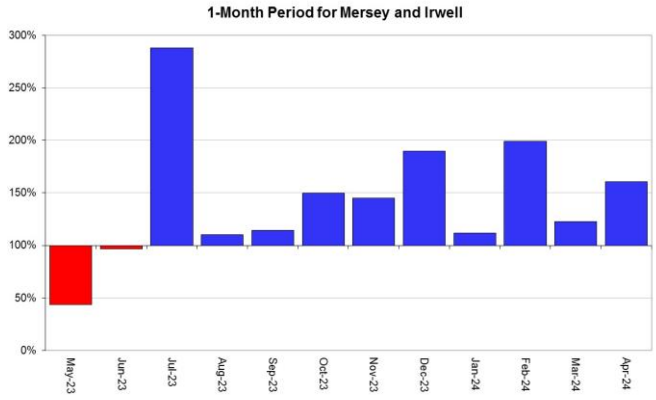
Figure 2.2: Monthly rainfall totals for the past 12 months expressed as a percentage of the 1961 to 1990 long term average for North-west England and its hydrological areas.

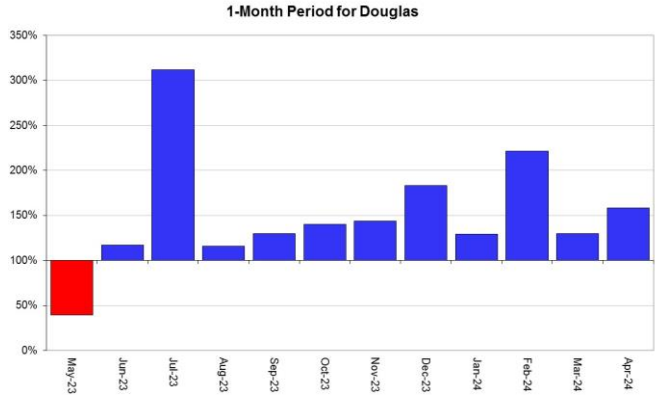


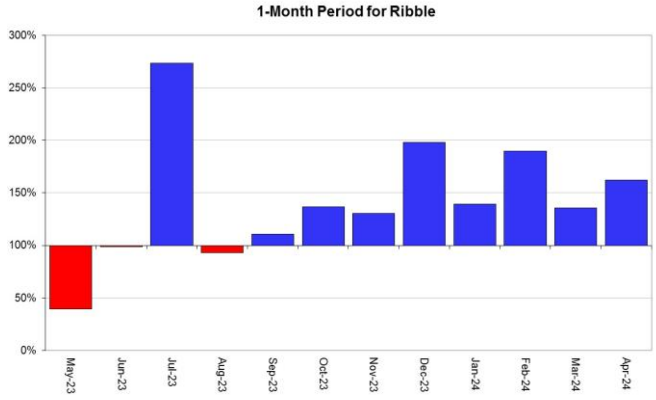

1-Month Period for Esk (Dumfries)
300%
250%
200%
150%
100%
50%
0%
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24

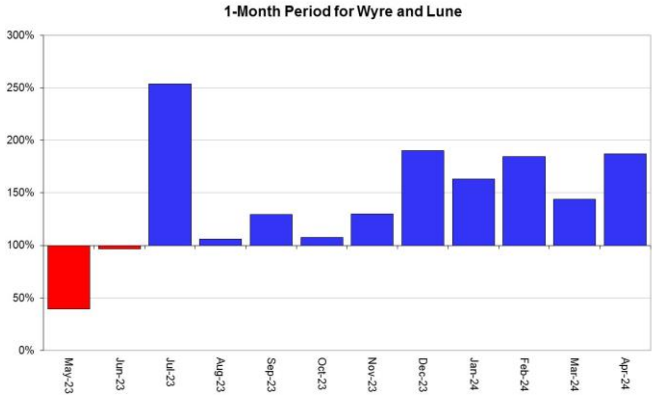

1-Month Period for Cheshire Rivers Group
300%
250%
200%
150%
100%
50%
0%
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24


1-Month Period for Kent
300%
250%
200%
150%
100%
50%
0%
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24


1-Month Period for Mersey and Irwell
300%
250%
200%
150%
100%
50%
0%
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24


1-Month Period for Douglas
350%
300%
250%
200%
150%
100%
50%
0%
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24


1-Month Period for Ribble
300%
250%
200%
150%
100%
50%
0%
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24

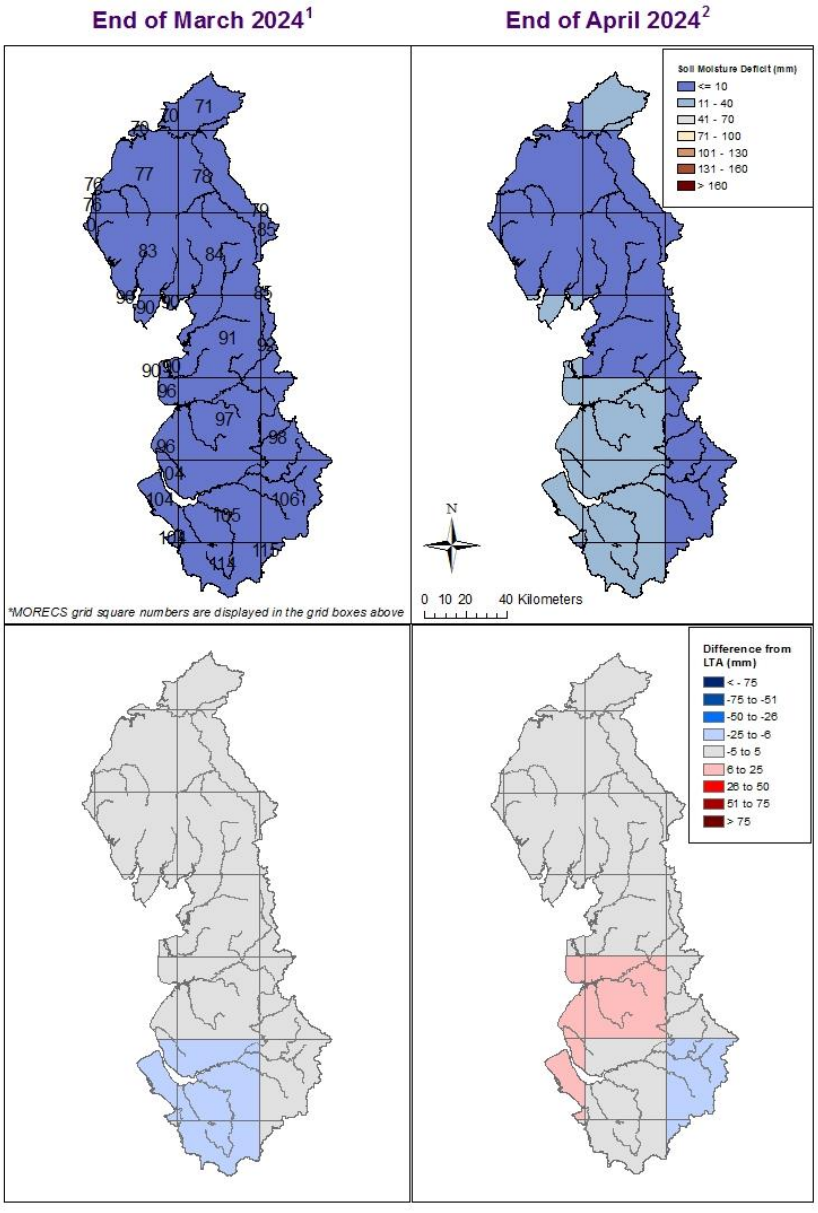


Rainfall data for 2024, extracted from Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. (Source: Environment Agency. Crown Copyright, 100024198, 2024). Rainfall data prior to 2023, extracted from Met Office HadUK 1km gridded rainfall dataset derived from registered rain gauges (Source: Met Office. Crown copyright, 2024).

3 Soil moisture deficit

3.1 Soil moisture deficit map

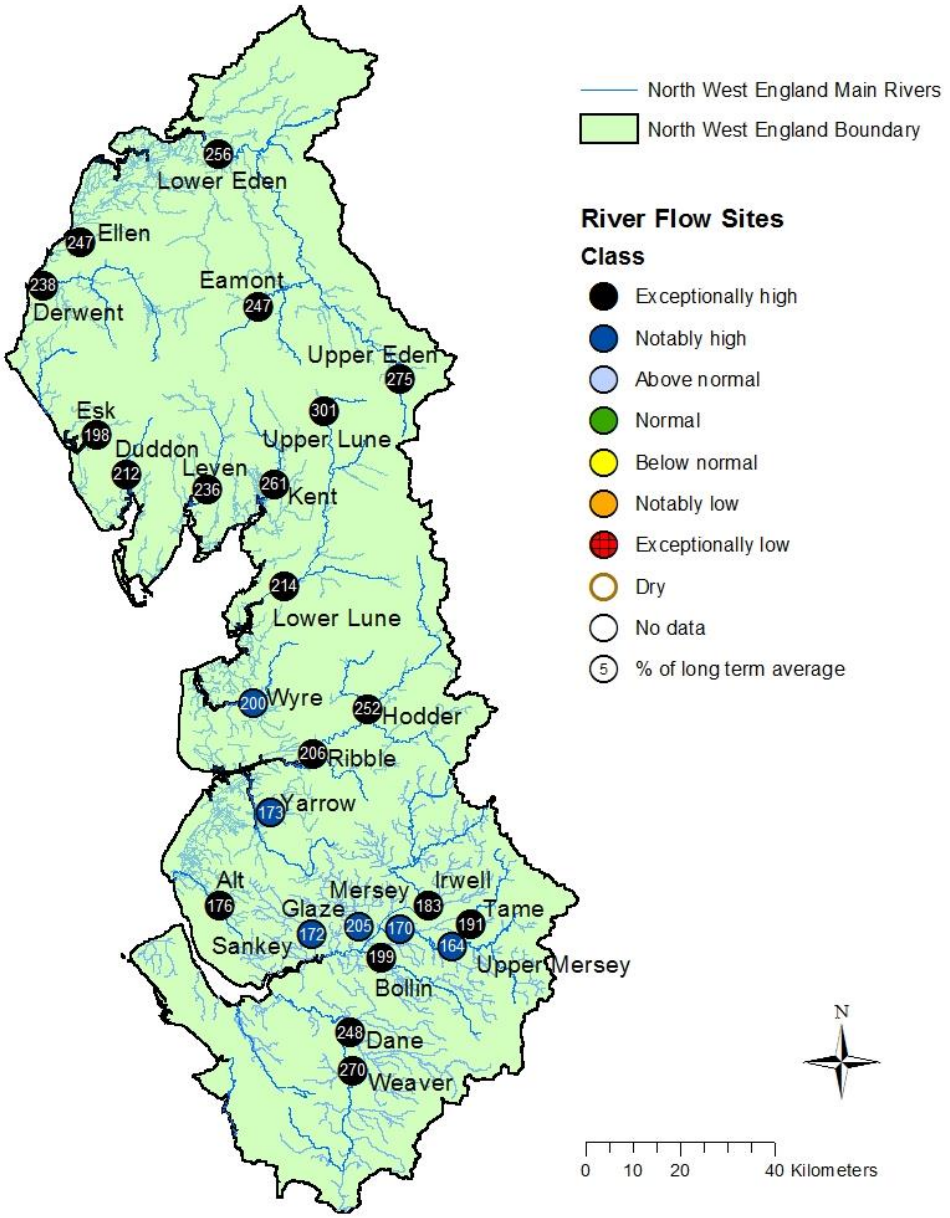
Figure 3.1: Soil moisture deficits for weeks ending 27 March 2024[1] (left panel) and 30 April 2024[2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961-90 long term average soil moisture deficits. MORECS data for real land use.



4 River flows

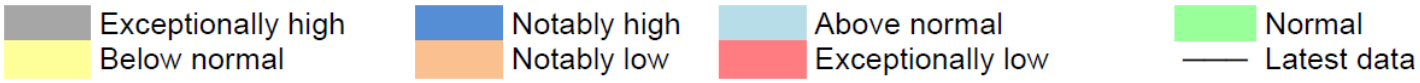
4.1 River flows map

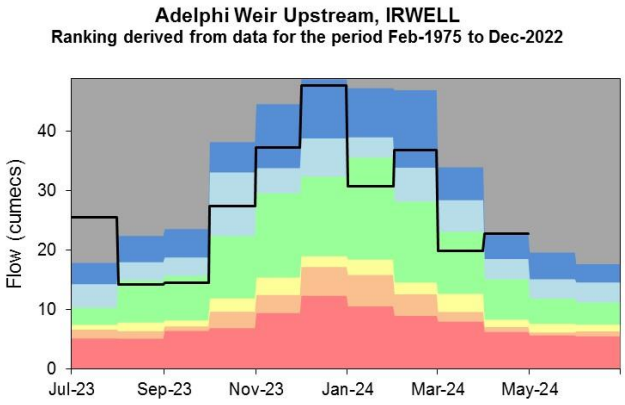
Figure 4.1: Monthly mean river flow for indicator sites for April 2024, expressed as a percentage of the respective long term average and classed relative to an analysis of historic April monthly means. Table available in the appendices with detailed information.

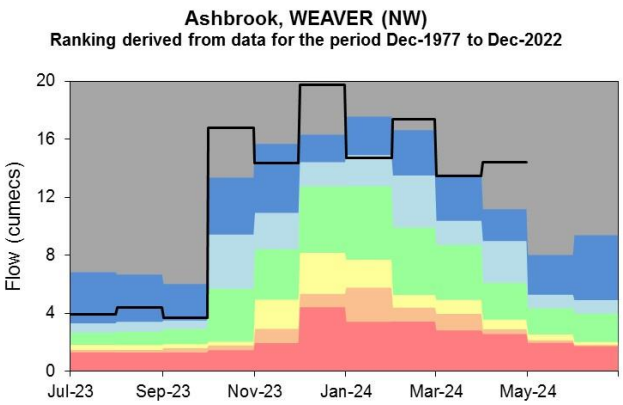


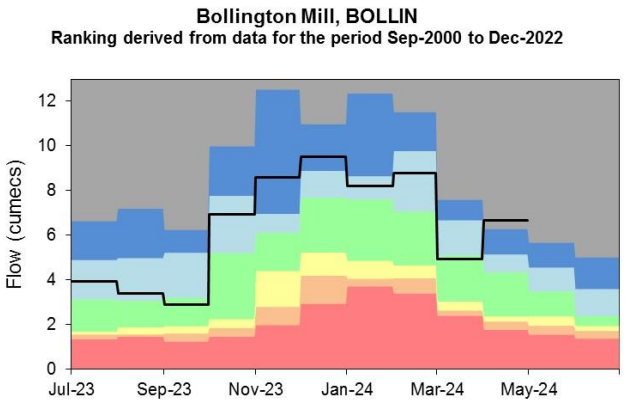
4.2 River flow charts

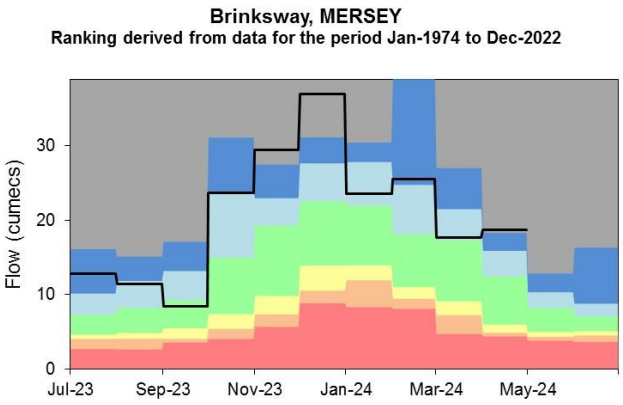
Figure 4.2: Monthly mean river flow for index sites over the past year, compared to an analysis of historic monthly mean flows.

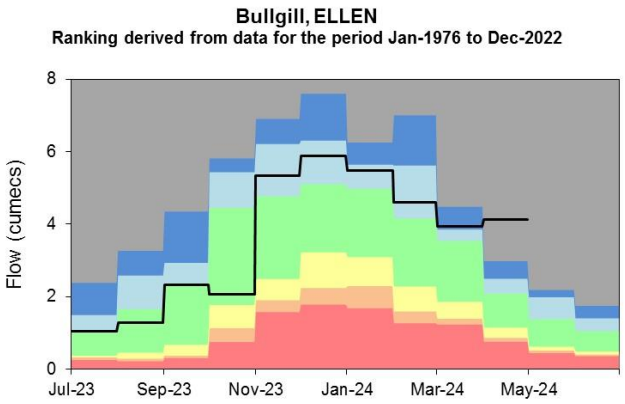


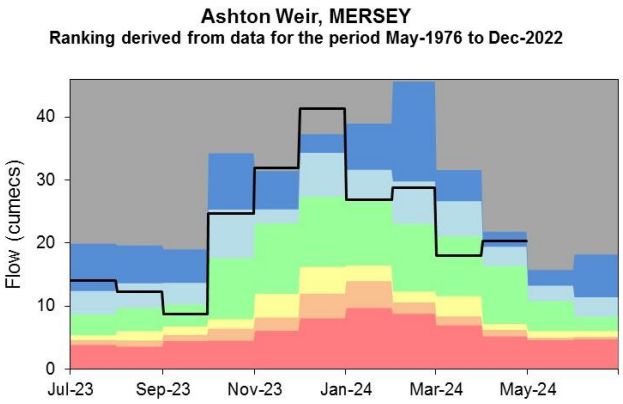




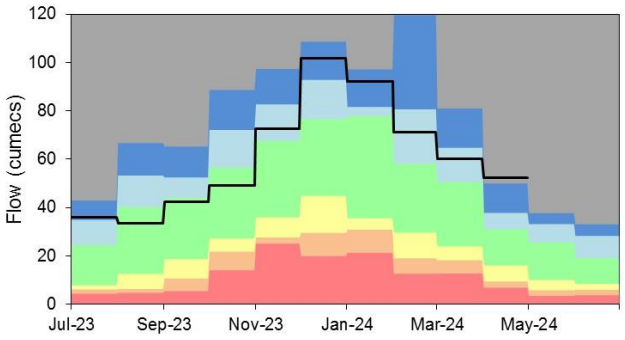




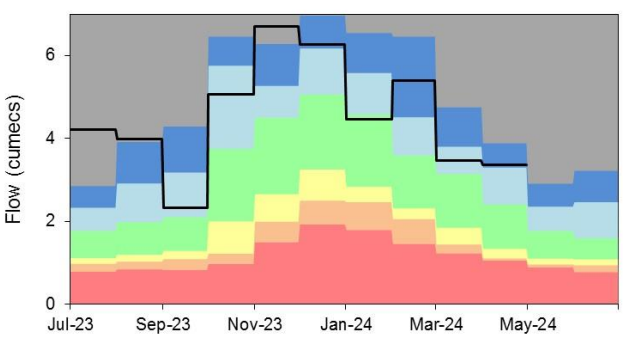




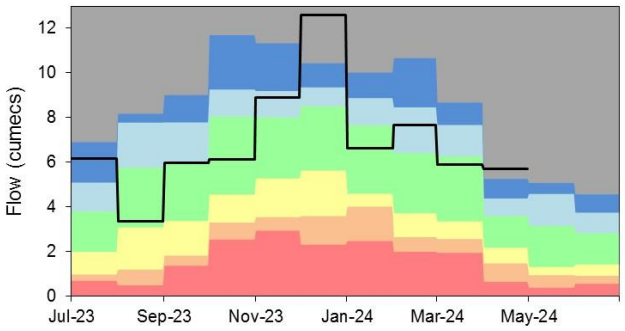
Caton, LUNE
Ranking derived from data for the period Jan-1959 to Dec-2022



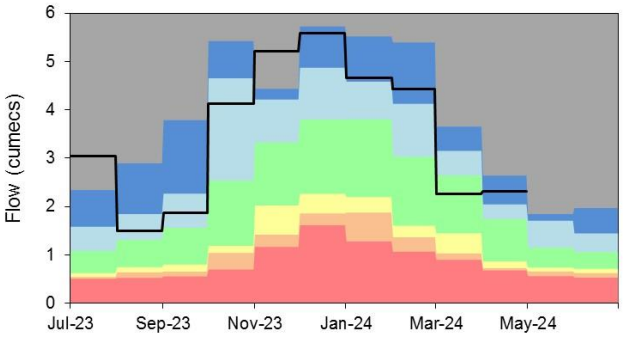
Causey Bridges, SANKEY
Ranking derived from data for the period Jan-1977 to Dec-2022



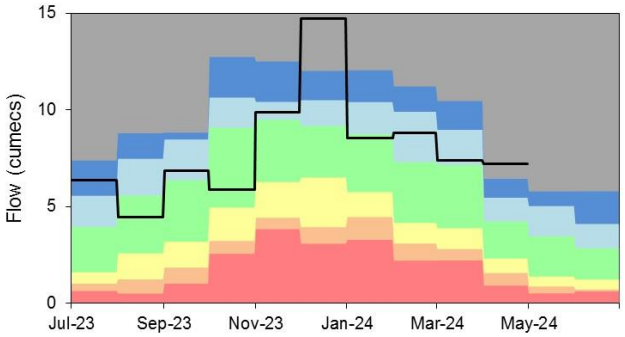
Cropple How, ESK (NW)
Ranking derived from data for the period Jan-1976 to Dec-2022



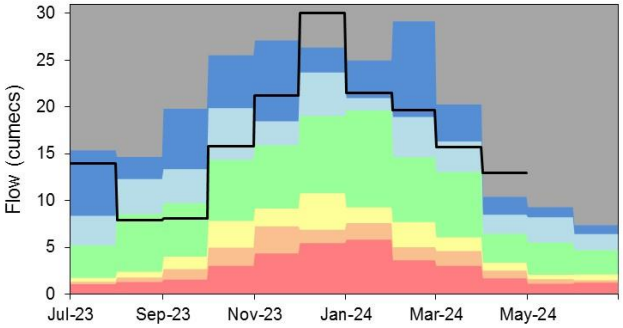
Croston, YARROW
Ranking derived from data for the period Jan-1976 to Dec-2022



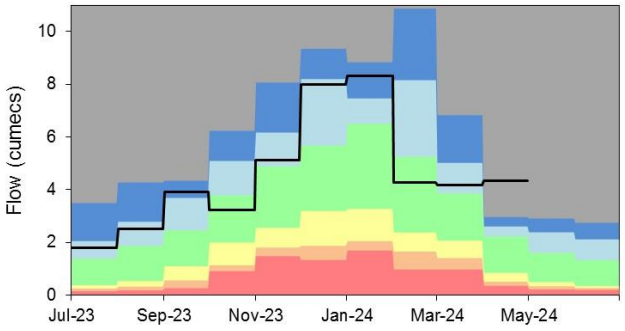
Duddon Hall, DUDDON
Ranking derived from data for the period Mar-1968 to Dec-2022



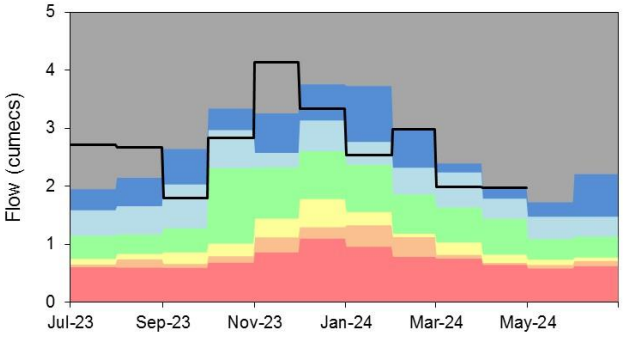
Hodder Place, HODDER
Ranking derived from data for the period Jan-1976 to Dec-2022



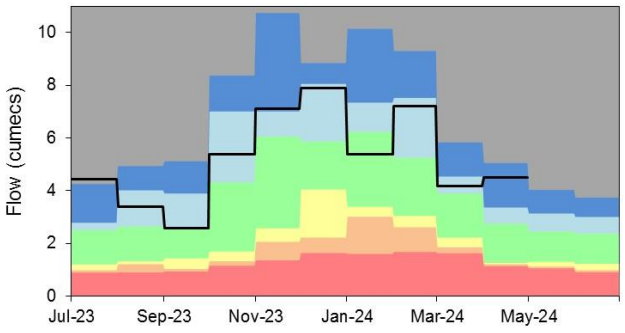
Kirkby Stephen, EDEN (NW)
Ranking derived from data for the period Oct-1971 to Dec-2022



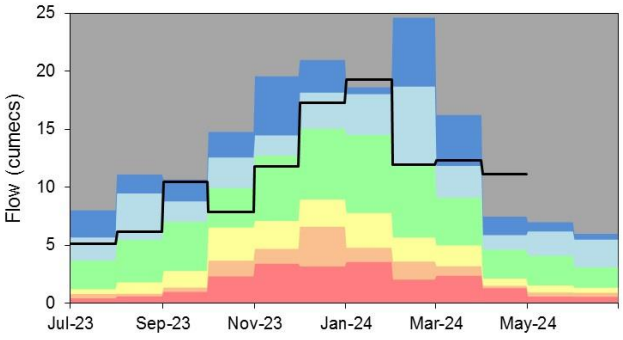
Kirkby, ALT
Ranking derived from data for the period Oct-1977 to Dec-2022



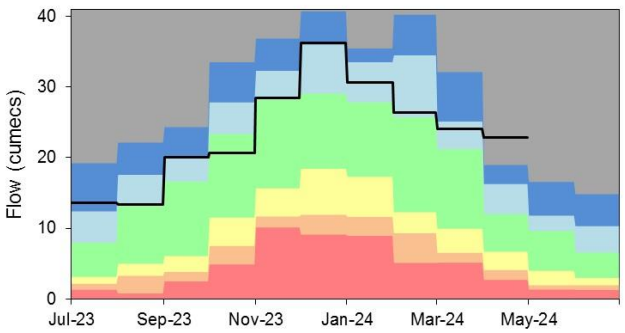
Little Woolden Hall Ultrasonic, GLAZE
Ranking derived from data for the period Jul-1995 to Dec-2022



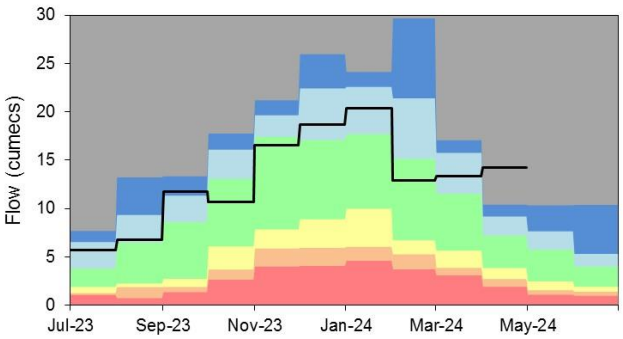
Lunes Bridge, LUNE
Ranking derived from data for the period Dec-1979 to Dec-2022



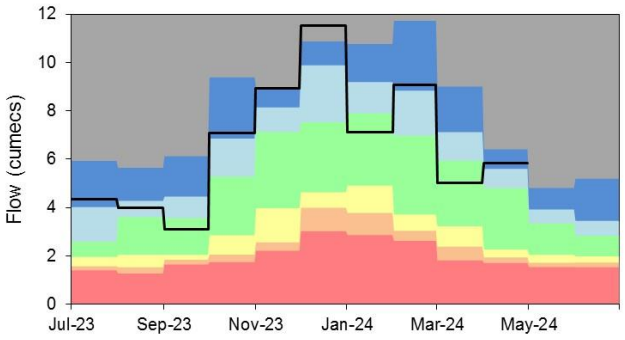
Newby Bridge FMS, LEVEN (NW)
Ranking derived from data for the period Jan-1972 to Dec-2022



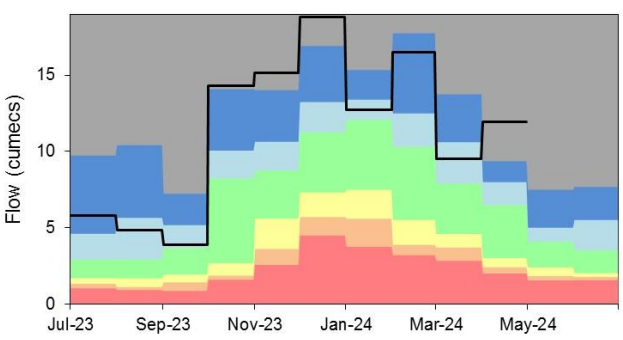
Pooley Bridge, EAMONT
Ranking derived from data for the period Jul-1970 to Dec-2022



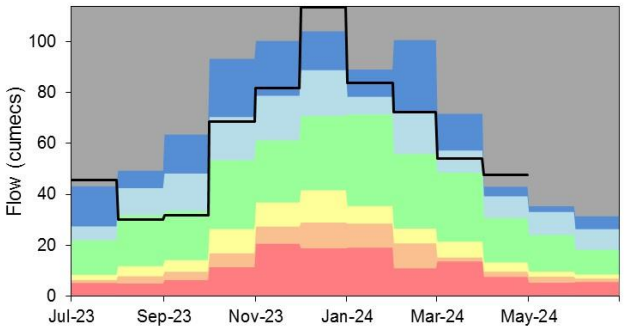
Portwood, TAME
Ranking derived from data for the period Jan-1976 to Dec-2022



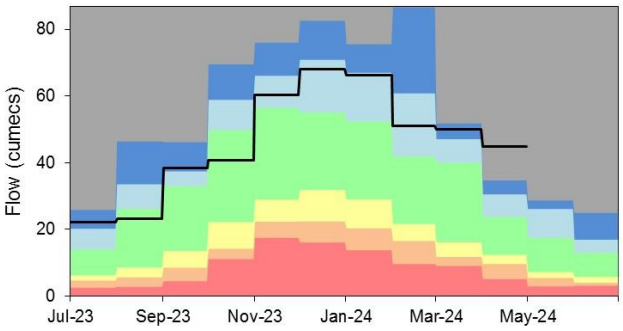
Rudheath, DANE
Ranking derived from data for the period Jan-1976 to Dec-2022



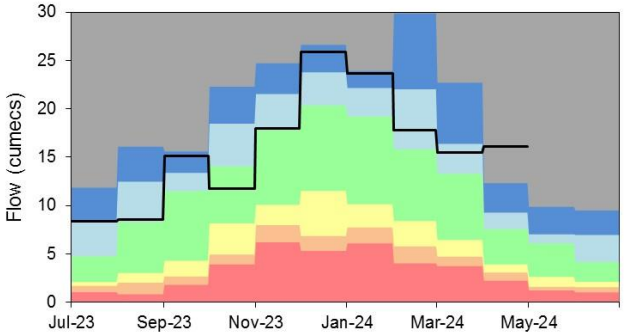
Samlesbury Pgs, RIBBLE (NW)
Ranking derived from data for the period May-1960 to Dec-2022



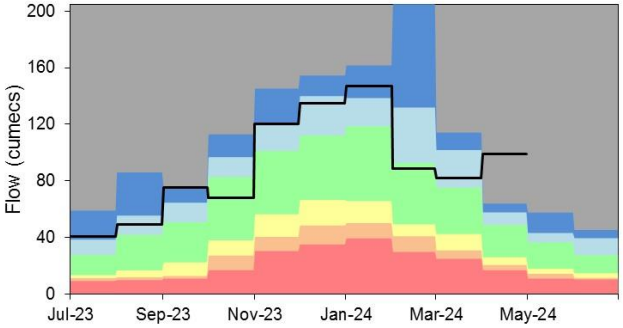
Seaton Mill, DERWENT (NW)
Ranking derived from data for the period Sep-1960 to Dec-2022

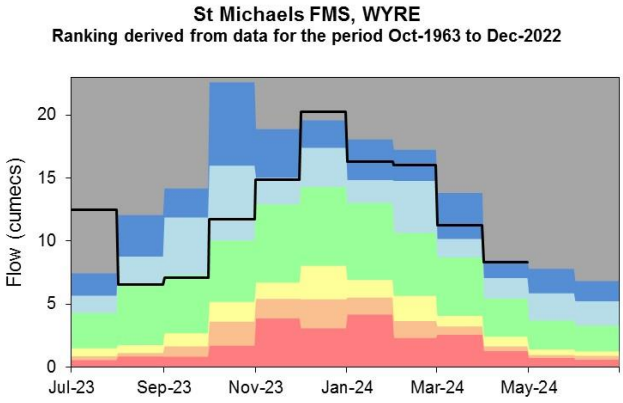


Sedgwick, KENT
Ranking derived from data for the period Nov-1968 to Dec-2022



Sheepmount, EDEN (NW)
Ranking derived from data for the period Oct-1967 to Dec-2022



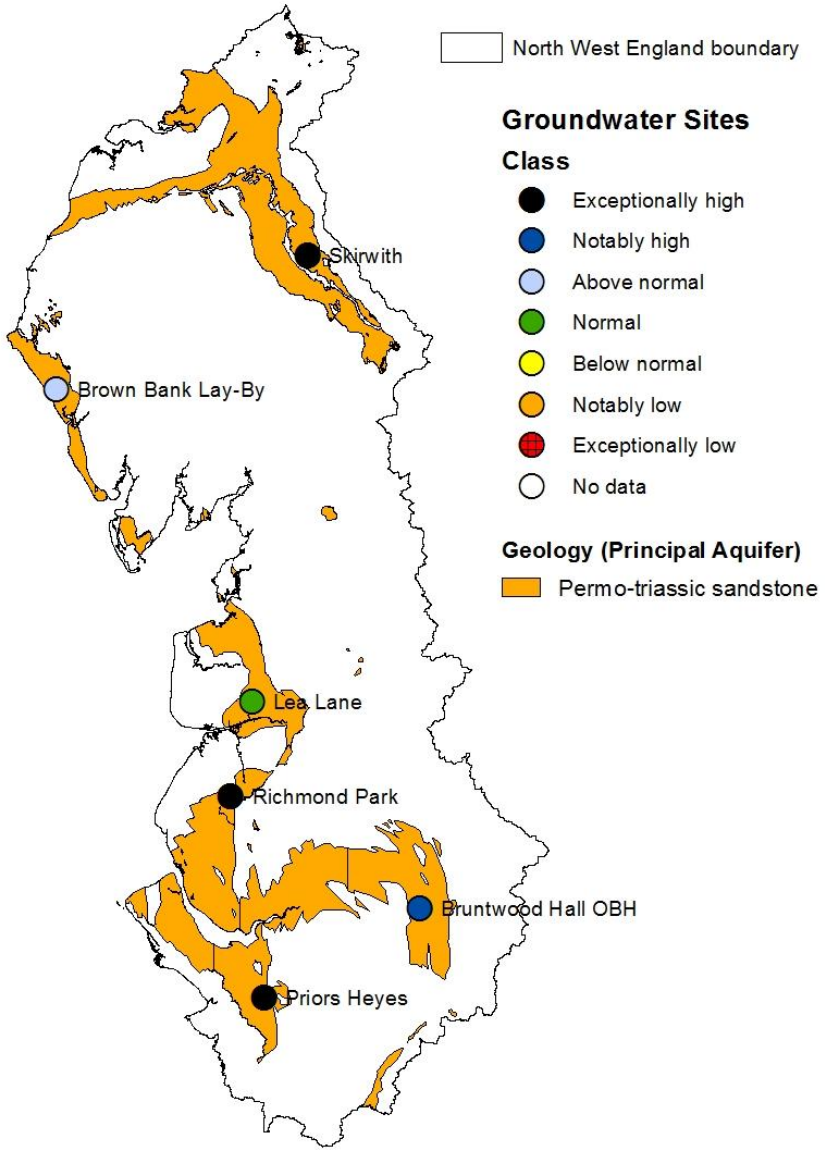


Source: Environment Agency.

5 Groundwater levels

5.1 Groundwater levels map

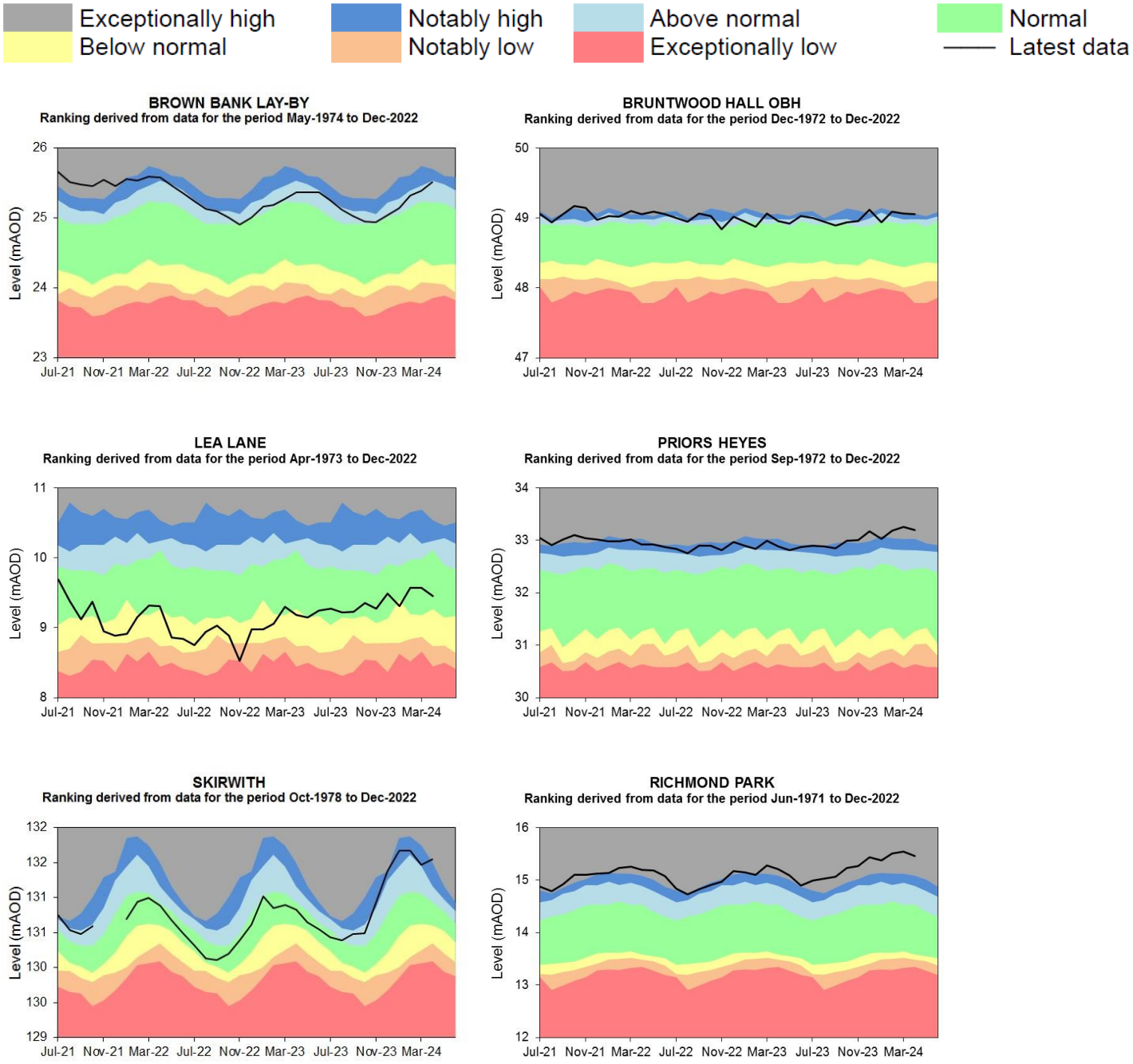
Figure 5.1: Groundwater levels for indicator sites at the end of April 2024, classed relative to an analysis of respective historic April levels. Table available in the appendices with detailed information.



(Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS copyright NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2024.

5.2 Groundwater level charts

Figure 5.2: End of month groundwater levels at index groundwater level sites for major aquifers. 34 months compared to an analysis of historic end of month levels and long term maximum and minimum levels.



Source: Environment Agency, 2024.

6 Reservoir storage

Figure 6.1: The location of reservoirs that comprise the supply districts across North-west England and selected individual reservoirs.

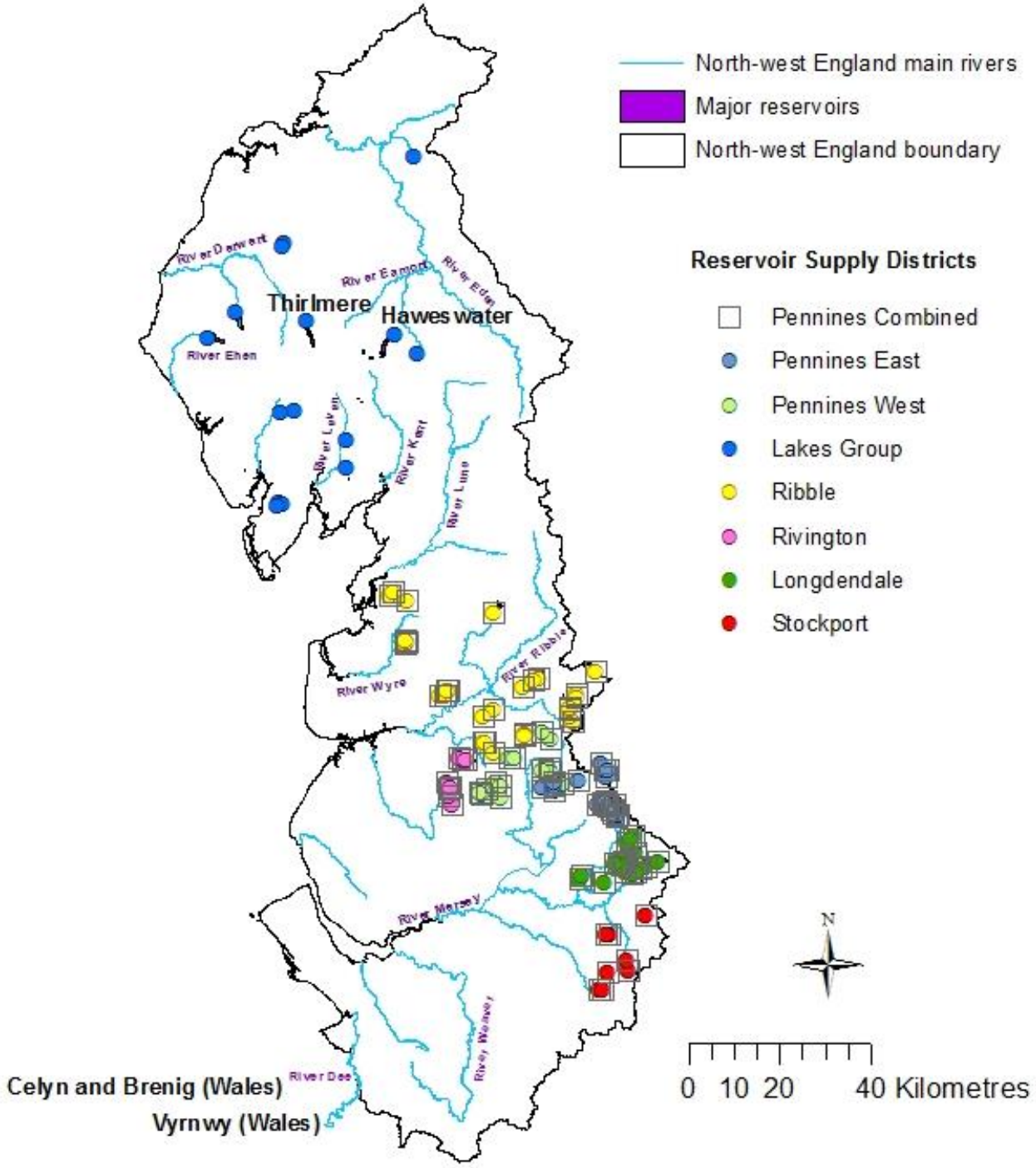
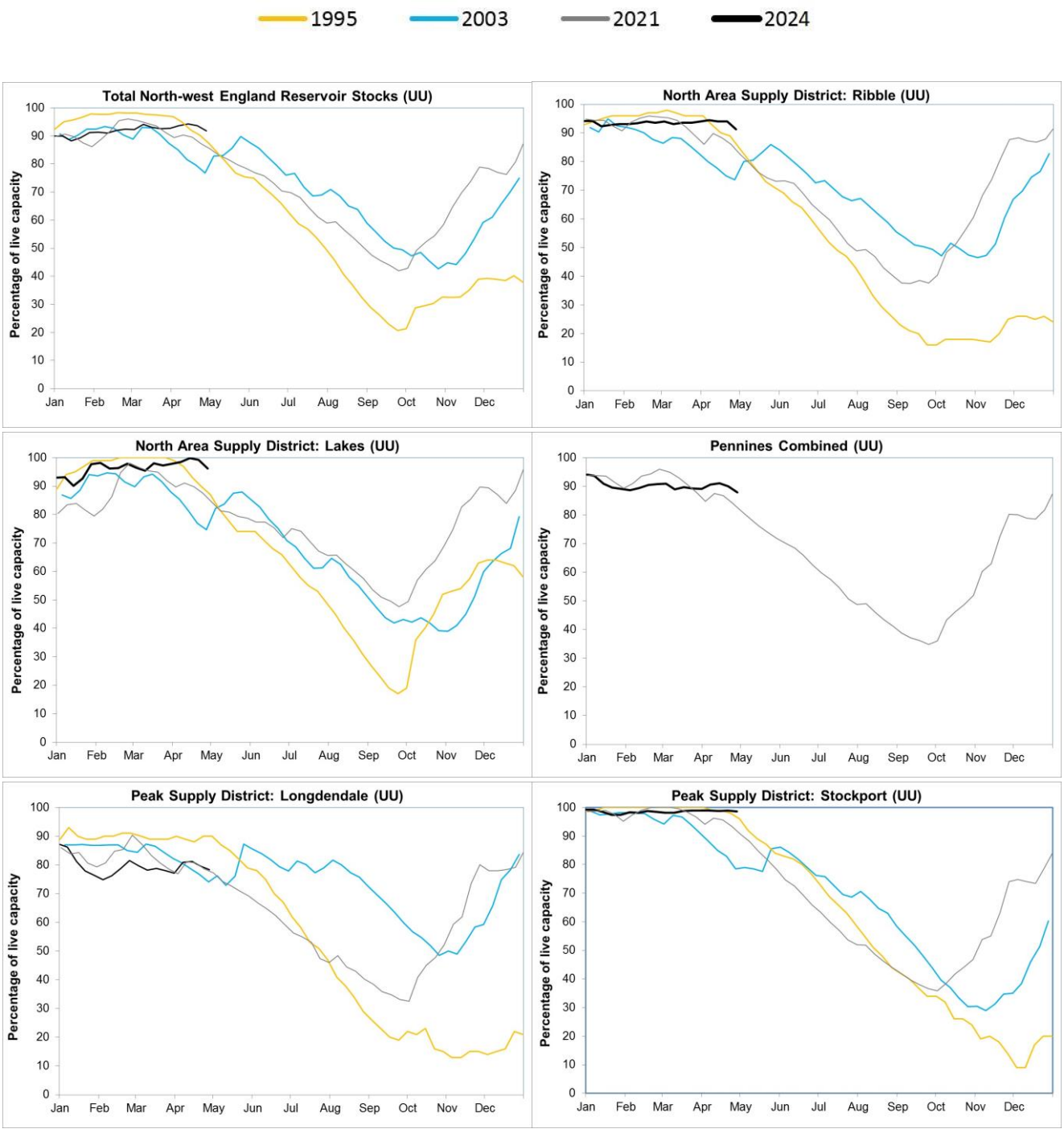
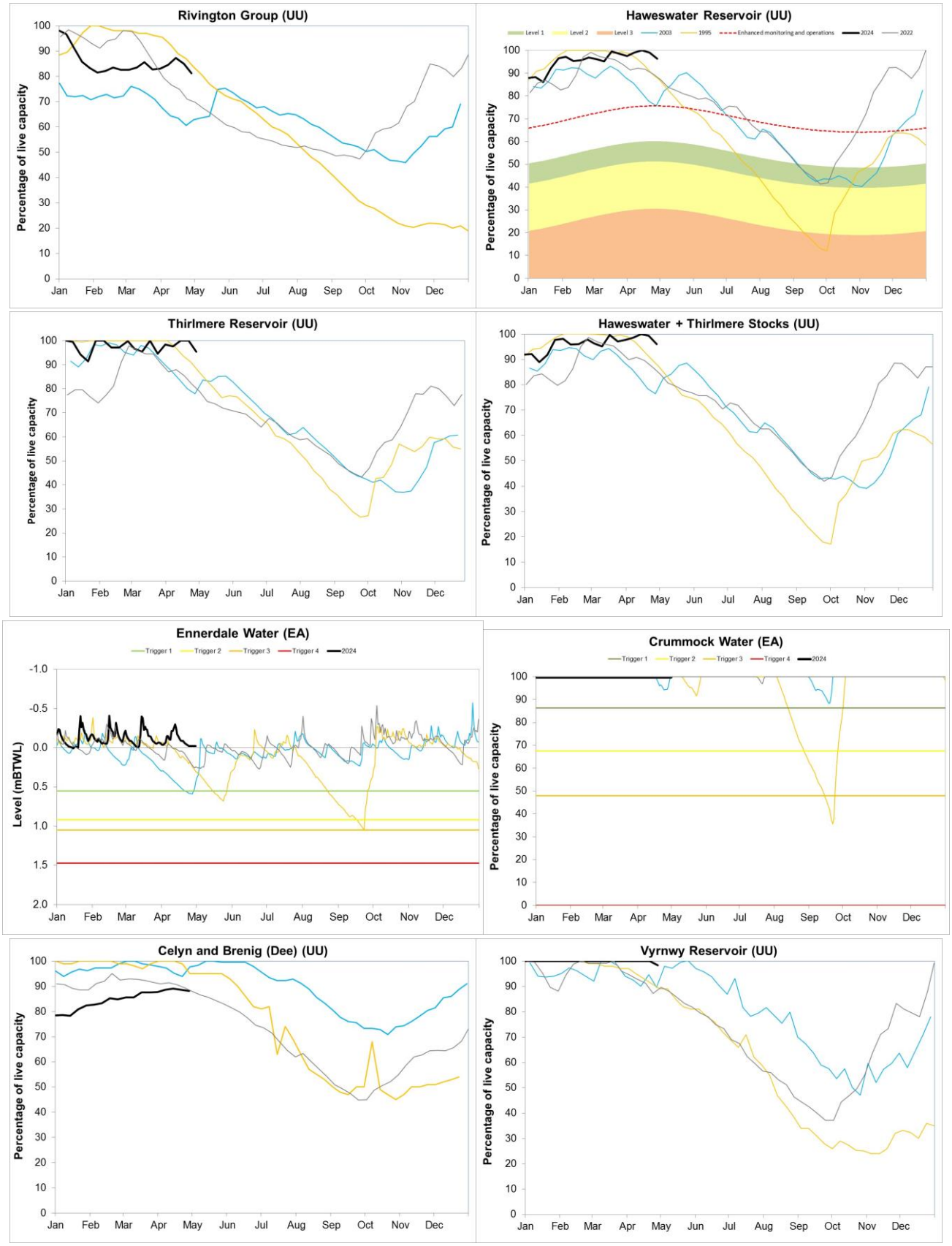


Figure 6.2: End of month reservoir storage for supply districts across North-west England and selected individual reservoirs for current year (2023) and representative years: 1995, 2003 and 2021. Note: Historic records of individual reservoirs and reservoir groups making up the regional values vary in length.





Source: (UU) United Utilities, (EA) The Environment Agency.

7 Glossary

7.1 Terminology

Aquifer

A geological formation able to store and transmit water.

Areal average rainfall

The estimated average depth of rainfall over a defined area. Expressed in depth of water (mm).

Artesian

The condition where the groundwater level is above ground surface but is prevented from rising to this level by an overlying continuous low permeability layer, such as clay.

Artesian borehole

Borehole where the level of groundwater is above the top of the borehole and groundwater flows out of the borehole when unsealed.

Cumecs

Cubic metres per second (m^{3s-1}).

Effective rainfall

The rainfall available to percolate into the soil or produce river flow. Expressed in depth of water (mm).

Flood alert and flood warning

Three levels of warnings may be issued by the Environment Agency. Flood alerts indicate flooding is possible. Flood warnings indicate flooding is expected. Severe flood warnings indicate severe flooding.

Groundwater

The water found in an aquifer.

Long term average (LTA)

The arithmetic mean calculated from the historic record, usually based on the period 1961 to 1990. However, the period used may vary by parameter being reported on (see figure captions for details).

mAOD

Metres above ordnance datum (mean sea level at Newlyn Cornwall).

MORECS

Met Office Rainfall and Evaporation Calculation System. Met Office service providing real time calculation of evapotranspiration, soil moisture deficit and effective rainfall on a 40 by 40 km grid.

Naturalised flow

River flow with the impacts of artificial influences removed. Artificial influences may include abstractions, discharges, transfers, augmentation and impoundments.

NCIC

National Climate Information Centre. NCIC area monthly rainfall totals are derived using the Met Office 5 km gridded dataset, which uses rain gauge observations.

Recharge

The process of increasing the water stored in the saturated zone of an aquifer. Expressed in depth of water (mm).

Reservoir gross capacity

The total capacity of a reservoir.

Reservoir live capacity

The capacity of the reservoir that is normally usable for storage to meet established reservoir operating requirements. This excludes any capacity not available for use (for example, storage held back for emergency services, operating agreements or physical restrictions). May also be referred to as ‘net’ or ‘deployable’ capacity.

Soil moisture deficit (SMD)

The difference between the amount of water actually in the soil and the amount of water the soil can hold. Expressed in depth of water (mm).

7.2 Categories

Exceptionally high

Value likely to fall within this band 5% of the time.

Notably high

Value likely to fall within this band 8% of the time.

Above normal

Value likely to fall within this band 15% of the time.

Normal

Value likely to fall within this band 44% of the time.

Below normal

Value likely to fall within this band 15% of the time.

Notably low

Value likely to fall within this band 8% of the time.

Exceptionally low

Value likely to fall within this band 5% of the time.

8 Appendices

8.1 Rainfall table

Hydrological area	Apr 2024 rainfall % of long term average 1961 to 1990	Apr 2024 band	Feb 2024 to April cumulative band	Nov 2023 to April cumulative band	May 2023 to April cumulative band
Cheshire Rivers Group	177	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
Derwent (NW)	229	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
Douglas	158	Notably High	Exceptionally high	Exceptionally high	Exceptionally high
Eden	232	Exceptionally High	Notably high	Exceptionally high	Exceptionally high
Esk (Cumbria)	211	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
Esk (Dumfries)	147	Above Normal	Above normal	Above normal	Above normal
Kent	226	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
Mersey And Irwell	161	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
Ribble	162	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high

Wyre And Lune	187	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
North West	195	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high

8.2 River flows table

Site name	River	Catchment	Apr 2024 band	Mar 2024 band
Adelphi Weir Upstream	Irwell	Irwell (Croal to Irk)	Exceptionally high	Normal
Ashbrook	Weaver (NW)	Weaver Upper	Exceptionally high	Notably high
Ashton Weir	Mersey	Mersey Non Tidal	Notably high	Normal
Bollington Mill	Bollin	Bollin	Exceptionally high	Normal
Brinksway	Mersey	Mersey Non Tidal	Exceptionally high	Above normal
Bullgill	Ellen	Ellen Lower	Exceptionally high	Notably high
Caton	Lune	Lune Lower Tidal	Exceptionally high	Above normal
Causey Bridges	Sankey	Mersey Non Tidal	Notably high	Above normal
Cropple How	Esk (NW)	Esk (South West Lakes)	Exceptionally high	Normal
Croston	Yarrow	Yarrow Lower	Notably high	Normal
Duddon Hall	Duddon	Duddon	Exceptionally high	Above normal
Hodder Place	Hodder	Hodder Lower	Exceptionally high	Above normal
Kirkby	Alt	Alt	Exceptionally high	Above normal
Kirkby Stephen	Eden (NW)	Eden Cumbria Upper	Exceptionally high	Above normal

Little Woolden Hall Ultrasonic	Glaze	Glaze	Notably high	Above normal
Lunes Bridge	Lune	Lune Upper	Exceptionally high	Notably high
Newby Bridge Fms	Leven (NW)	Leven Cumbria	Exceptionally high	Above normal
Pooley Bridge	Eamont	Eamont	Exceptionally high	Above normal
Portwood	Tame	Tame	Notably high	Normal
Rudheath	Dane	Dane	Exceptionally high	Above normal
Samlesbury Pgs	Ribble (NW)	Ribble Lower	Exceptionally high	Above normal
Seaton Mill	Derwent (NW)	Derwent Cumbria Lower	Exceptionally high	Notably high
Sedgwick	Kent	Levens Bridge	Exceptionally high	Above normal
Sheepmount	Eden (NW)	Eden Cumbria Lower	Exceptionally high	Above normal
St Michaels Fms	Wyre	Brock	Notably high	Notably high

8.3 Groundwater table

Site name	Aquifer	End of Apr 2024 band	End of Mar 2024 band
Brown Bank Lay-by	West Cumbria Permo-triassic Sandstone	Above normal	Above normal
Bruntwood Hall Obh	East Cheshire Permo-triassic Sandstone	Notably high	Exceptionally high
Lea Lane	Fylde Permo-triassic Sandstone	Normal	Normal
Priors Heyes	West Cheshire Permo-triassic Sandstone	Exceptionally high	Exceptionally high
Richmond Park	Rufford Permo-triassic Sandstone	Exceptionally high	Exceptionally high
Skirwith	Carlisle Basin Permo-triassic Sandstone	Exceptionally high	Notably high