Monthly water situation report: England

1 Summary - October 2022

Monthly rainfall totals in October were above average in most of the catchments across England. As a result of the rainfall, soil moisture deficits continued to decline across the country, however soils remain drier than would be expected in many places for the time of year. River flows increased in October at the majority of indicator sites and most sites are now classed as normal for the time of year though a third of sites still remain below normal or lower. Groundwater levels continued to decline at all but three indicator sites, and most remain below normal or lower for the time of year. Reservoir stocks in October increased at the majority of reservoirs and reservoir groups we report on however end of month reservoir stocks remain below normal or lower at all but two sites.

1.1 Rainfall

The October rainfall total for England was 99.6mm which represents 130% of the 1961-1990 long term average (LTA) for the time of year (110% of the 1991-2020 LTA). The majority of catchments received above average rainfall during October, with the Witham to Chapel Hill catchment in east England being the wettest part of the country (relative to its LTA) having received 209% of October's LTA rainfall. The Thanet Chalk catchment in south-east England was the driest catchment (relative to its LTA) receiving 53% of LTA rainfall. (Figure 2.1)

October rainfall totals were classed as normal for almost two-thirds of catchments across the country, with the other third being above normal or notably high. At a regional scale, October rainfall totals were normal in all regions, with the exception of north-west and central England which were above normal. England as a whole was normal for the time of year. (Figure 2.2)

England as a whole, has had the seventh driest 12 month period ending in October on record (using records since 1891) and the driest since 1988/89, with south-west England recording the third driest 12 month period ending October on record and the driest since 1933/34. (Figure 2.3)

1.2 Soil moisture deficit

Soil moisture deficits (SMD) continued to decline across the country during October. Soils became wetter in many areas due to above average rainfall and lower temperatures. (Figure 3.1)

With the above average rainfall, the end of October SMDs were below (wetter than) average for the time of year across central and northern England. SMDs remained above (drier than) average for the time of year across southern England, particularly in the far east of the country. Soils in east and south-east England continue to be drier than expected for the time of year. (Figure 3.2)

1.3 River flows

October monthly mean river flows increased at more than four-fifths of the indicator sites we report on, compared to September. The majority of sites were classed as normal for the time of year however over a third of sites remain below normal or lower for the time of year. (Figure 4.1)

At the regional index sites monthly mean flows show a varied picture at the end of October. Most index sites were classed as normal or below normal for the time of year. However monthly mean flows range from above normal at Haydon Bridge on the South Tyne in north-east England to notably low at Thorverton on the Exe and at Horton on the Great Stour, in south-west and south-east England respectively. (Figure 4.2)

1.4 Groundwater levels

At the end of October, groundwater levels decreased at all but three of the reported indicator sites. The majority of end of month groundwater levels were classed as normal or lower, with four sites exceptionally low for the time of year. Only three sites recorded end of month levels higher than would be typically expected for the time of year. (Figure 5.1)

The major aquifer index sites were classed normal or lower for the end of October, with the exception of Skirwith in the Carlisle Basin Sandstone which was above normal for the time of year. End of month groundwater levels at Jackaments Bottom in the Burford Jurassic Limestone of the Cotswolds and Chilgrove in the West Sussex Chalk were classed as exceptionally low. Chilgrove has been classed as exceptionally low for the third consecutive months and has recorded the lowest end of October level on record (record goes back to 1836) (Figure 5.2)

1.5 Reservoir storage

At the end of October reservoir stocks increased at most of the reservoirs and reservoir groups we report on. Eight reservoirs or reservoir groups saw an increase of 10% or more in their stocks in comparison to the end of September. Despite these increases, end of month reservoir stocks were classed as below normal or lower in all except two reservoirs and reservoir groups (Figure 6.1)

At a regional scale, total reservoirs stocks ranged from 27% in south-west England to 68% in north-east England. Total reservoir stocks for England were at 56% of total capacity at the end of October (Figure 6.2)

1.6 Forward look

Early November was dominated by wet weather across most of the country, with periods of heavy rainfall. Temperatures have been mild, with windy conditions in many areas. Conditions are expected to be mixed through the middle of November, with spells of rain and strong winds in the north-west and milder conditions elsewhere. Towards the end of November pressure is expected to build near the UK, bringing drier, cooler weather in many areas.

For the three month period from November to January there is a greater chance of cold and dry conditions than mild and wet.

1.7 Projections for river flows at key sites

By March 2023 more than half of modelled sites have a greater than expected chance of cumulative flows being below normal or lower for the time of year. The exception to this is sites in the north west and north east which have a greater than expected chance of being normal or higher. By September 2023 the majority of sites have a greater than expected chance of cumulative flows being below normal or lower for the time of year, except in the north east where cumulative flows are more likely to be normal for the time of year.

For scenario based projections of cumulative river flows at key sites by March 2023 and September 2023 see Figure 7.1 and Figure 7.2.

For probabilistic ensemble projections of cumulative river flows at key sites by March 2023 and September 2023 see Figure 7.3 and Figure 7.4.

1.8 Projections for groundwater levels in key aquifers

By the end of March 2023 two thirds of modelled sites have a greater than expected chance of groundwater levels being below normal or lower for the time of year, with the exception of the sandstone aquifer sites in the north west which are more likely to be above normal or higher. By the end of September 2023 most sites have a greater than expected chance of being normal or lower for the time of year. Sites, predominately in the chalk in the south east, east and north east have a greater chance of being below normal or lower.

For scenario based projections of groundwater levels in key aquifers in March 2023 and September 2023 see Figure 7.5 and 7.6.

For probabilistic ensemble projections of groundwater levels in key aquifers in March 2023 and September 2023 see Figure 7.7 and 7.8.

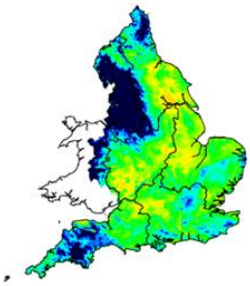
Author: National Water Resources Hydrology Team, NATIONALHYDROLOGY@environment-agency.gov.uk

2 Rainfall

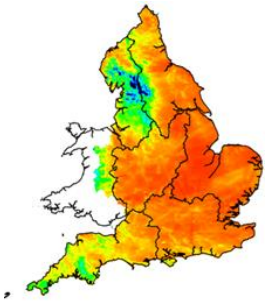
2.1 Rainfall map

Figure 2.1: Monthly rainfall across England and Wales for the past 11 months. UKPP radar data Note: Radar beam blockages in some regions may give anomalous totals in some areas.

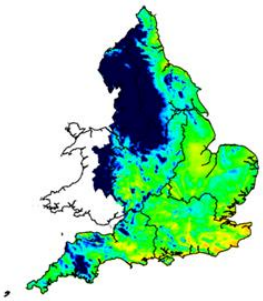
December 2021



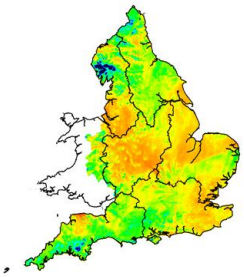
January 2022



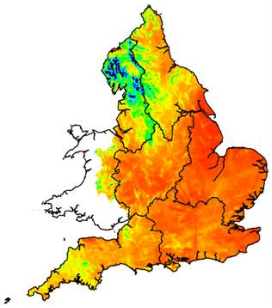
February 2022



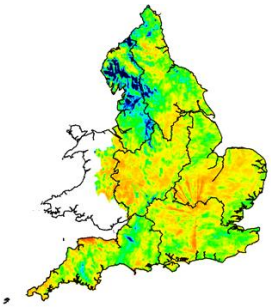
March 2022



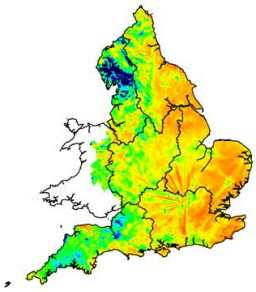
April 2022



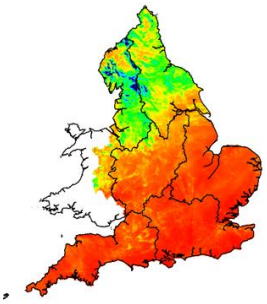
May 2022



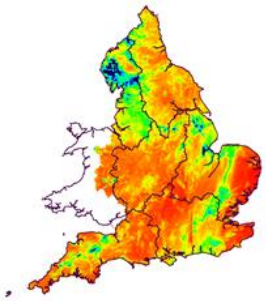
June 2022



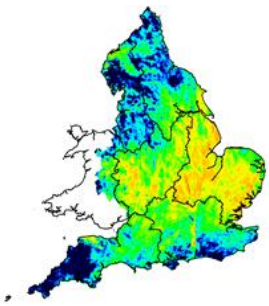
July 2022



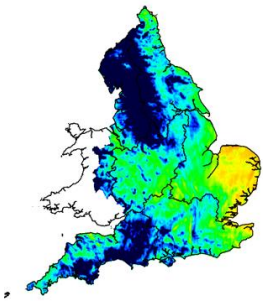
August 2022



September 2022



October 2022



Map Legend

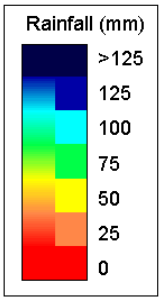
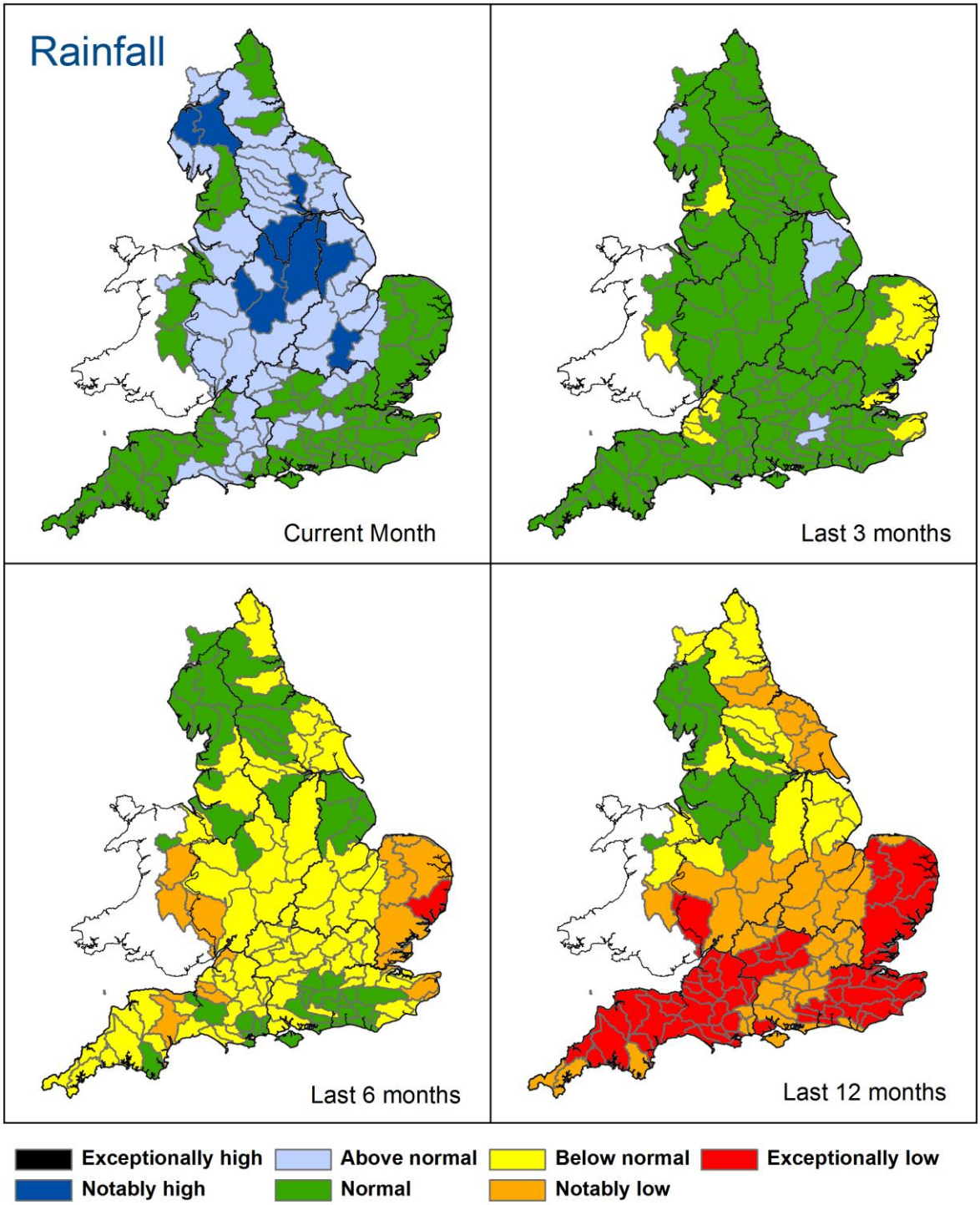


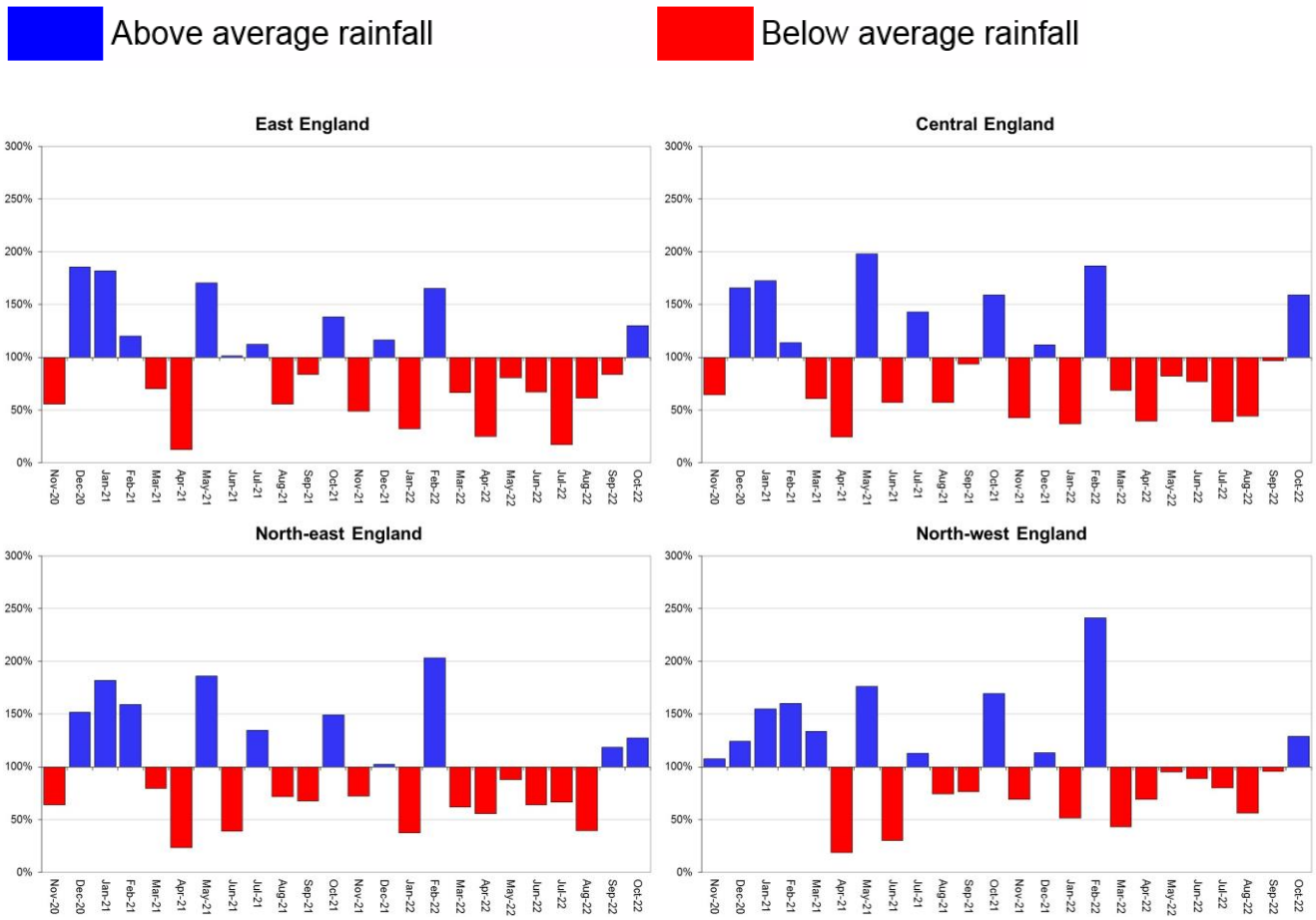
Figure 2.2: Total rainfall for hydrological areas across England for the current month (up to 31 October 2022), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals.

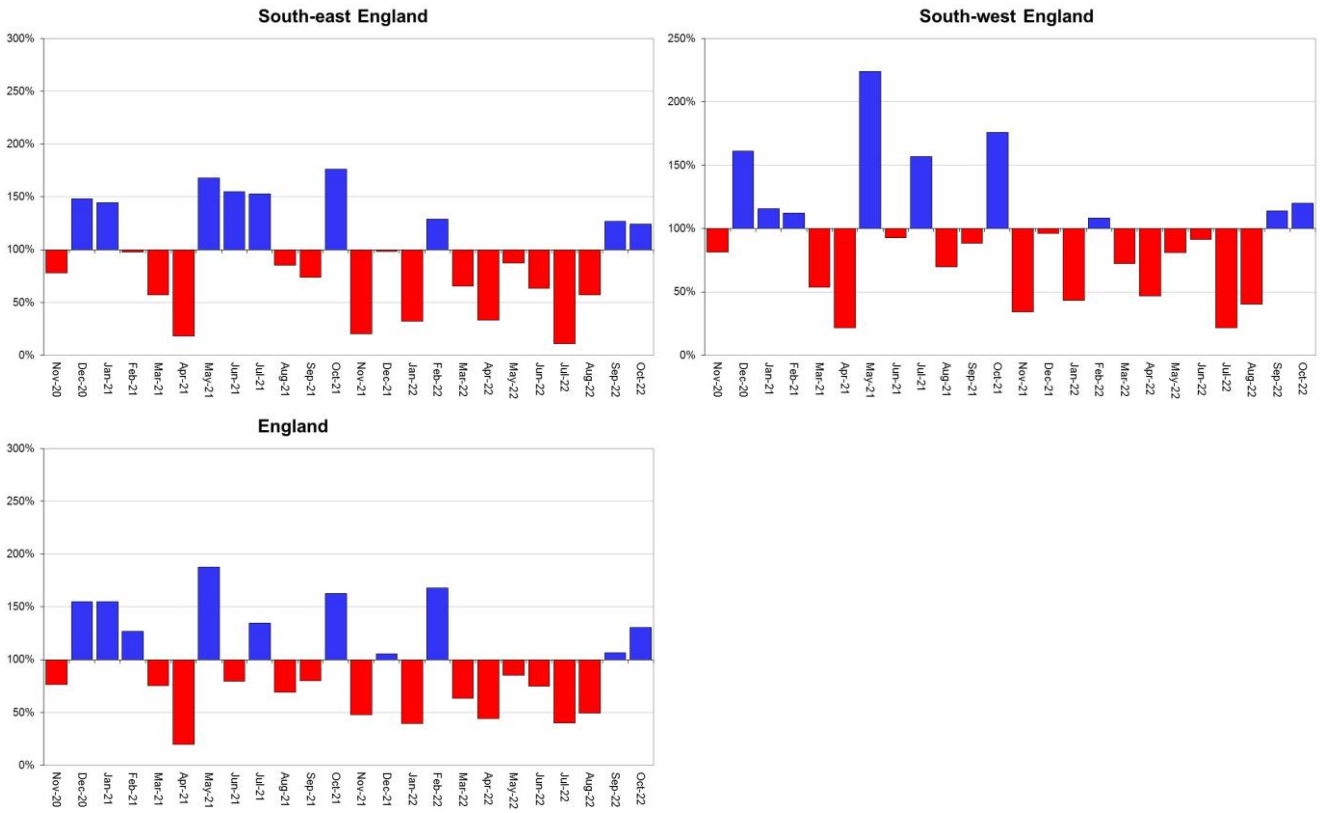


Provisional data based on Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges (Source: Met Office. Crown copyright, 2025). Crown copyright. All rights reserved. Environment Agency, 100024198, 2025.

2.2 Rainfall charts

Figure 2.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England.





HadUK rainfall data. (Source: Met Office. Crown copyright, 2025).

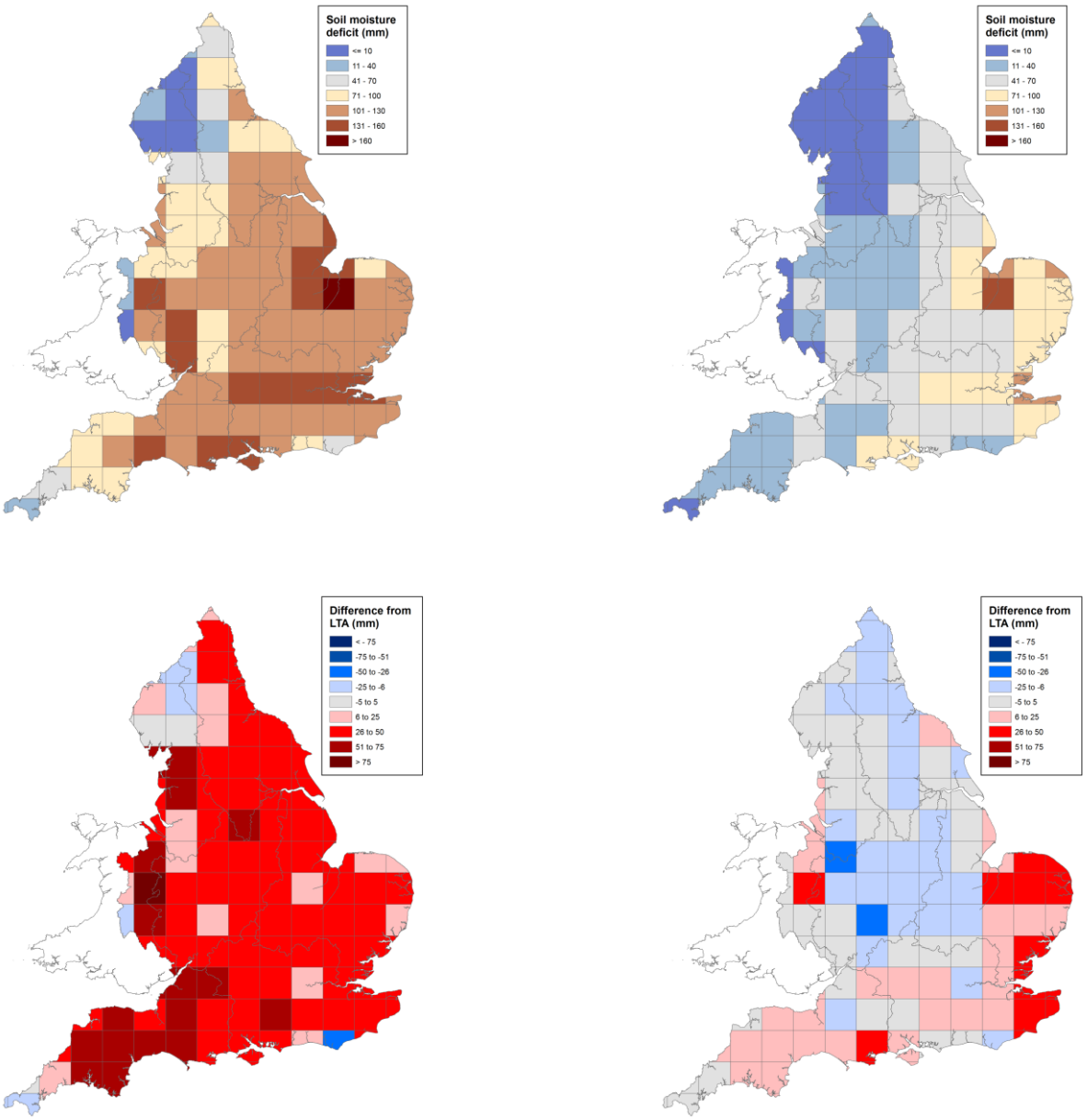
3 Soil moisture deficit

3.1 Soil moisture deficit map

Figure 3.1: Soil moisture deficits for weeks ending, 28 September 2022 (left panel) and 02 November 2022 (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961 to 1990 long term average soil moisture deficits. MORECS data for real land use.

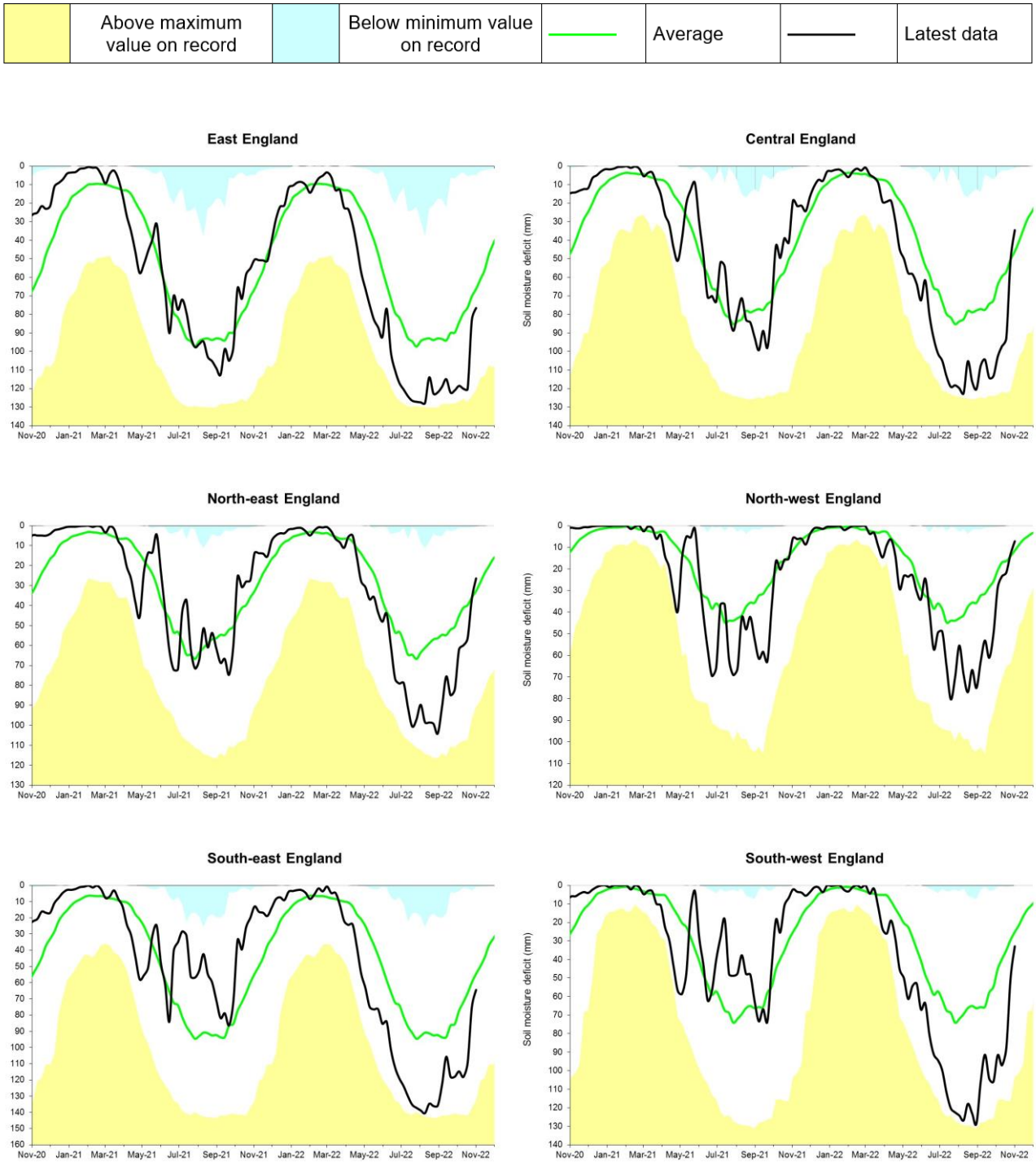
End of September 2022

End of October 2022



3.2 Soil moisture deficit charts

Figure 3.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 1990 long term average. Weekly MORECS data for real land use.



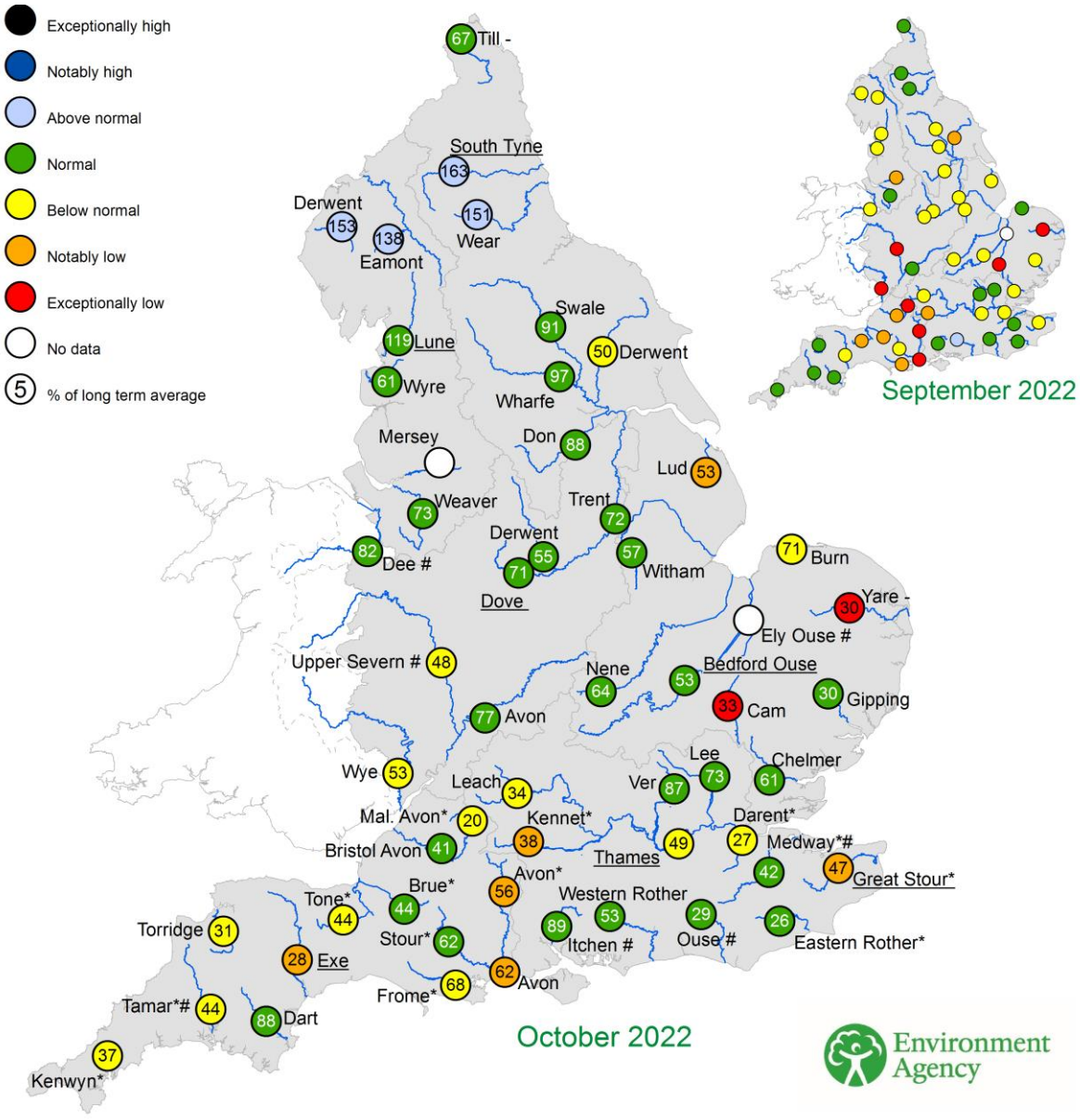
(Source: Met Office. Crown copyright, 2025).

4 River flows

4.1 River flow map

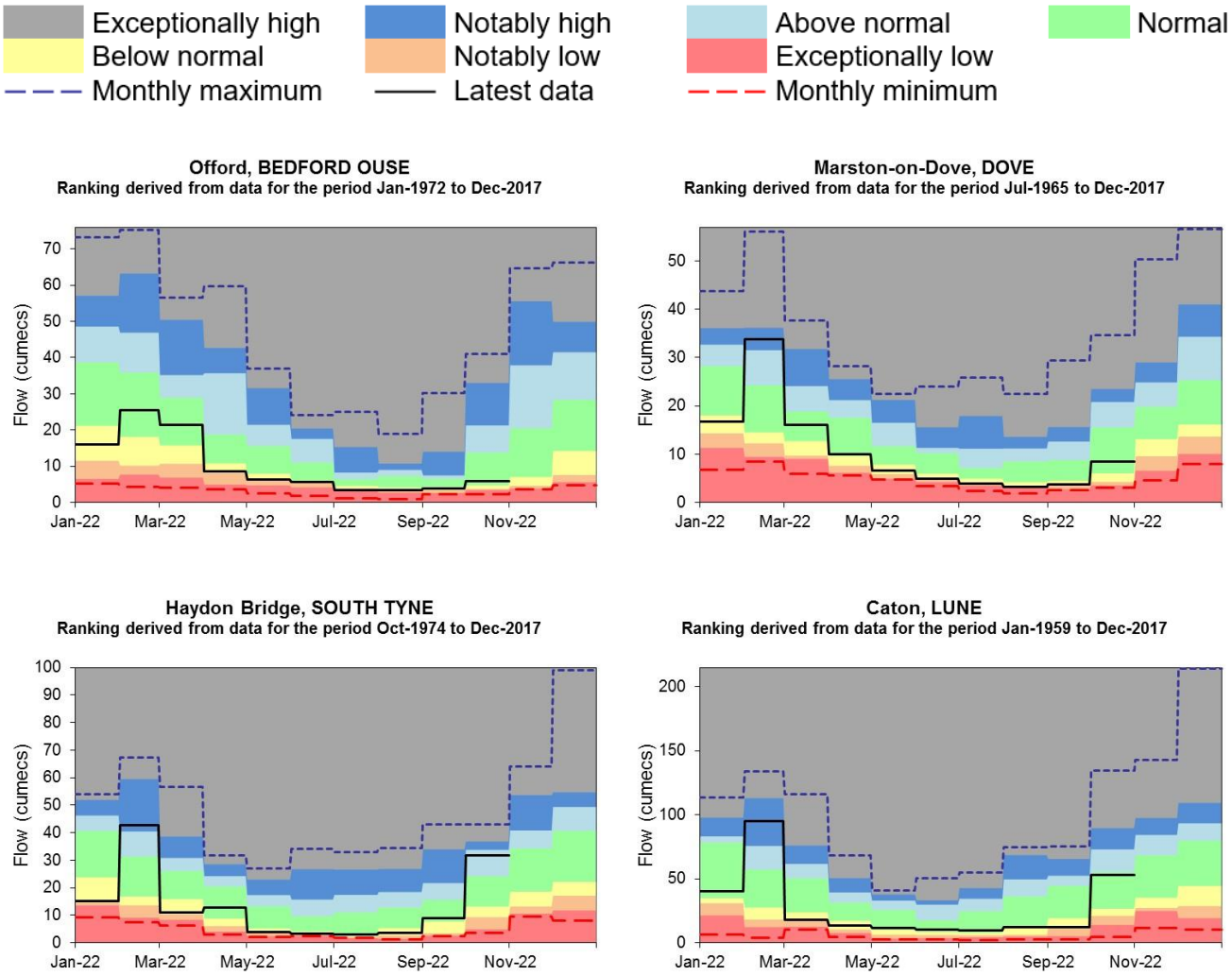
Figure 4.1: Monthly mean river flow for indicator sites for September 2022 and October 2022, expressed as a percentage of the respective long term average and classed relative to an analysis of historic September and October monthly means. Table available in the appendices with detailed information. Regional index sites are underlined and shown in the hydrographs in Figure 4.2.

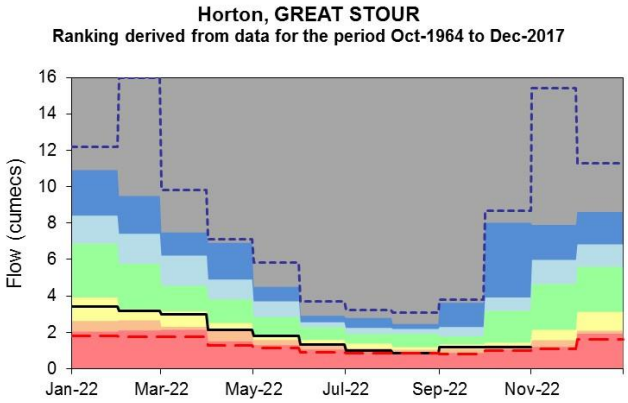
Naturalised flows are provided for the River Thames and the River Lee. +/- Monthly mean flow is the highest/lowest on record for the current month (note that record length varies between sites). * Flows may be overestimated at these sites – data should be treated with caution.
Flows may be impacted at these sites by water releases from upstream reservoirs.

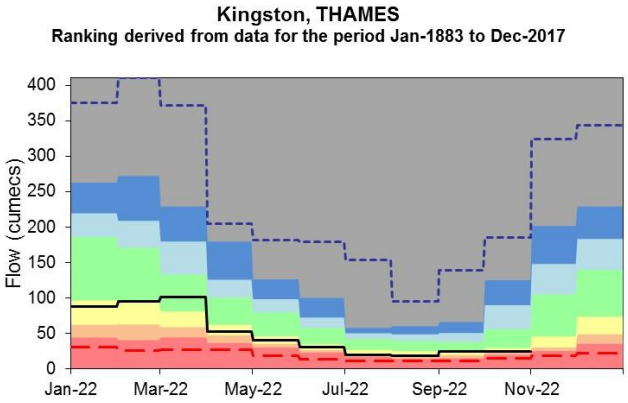


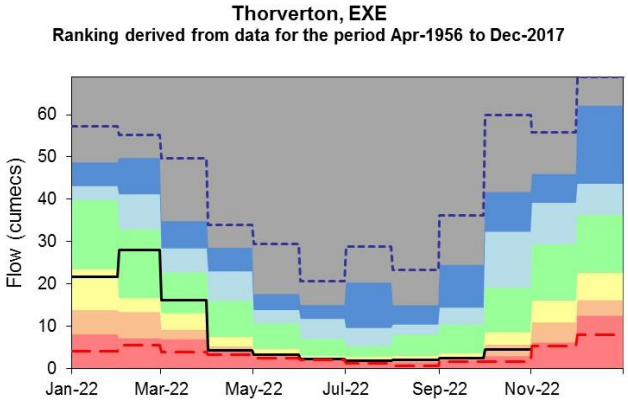
4.2 River flow charts

Figure 4.2: Monthly mean river flow for index sites over the past year for each geographic region, compared to an analysis of historic monthly mean flows, and long term maximum and minimum flows.









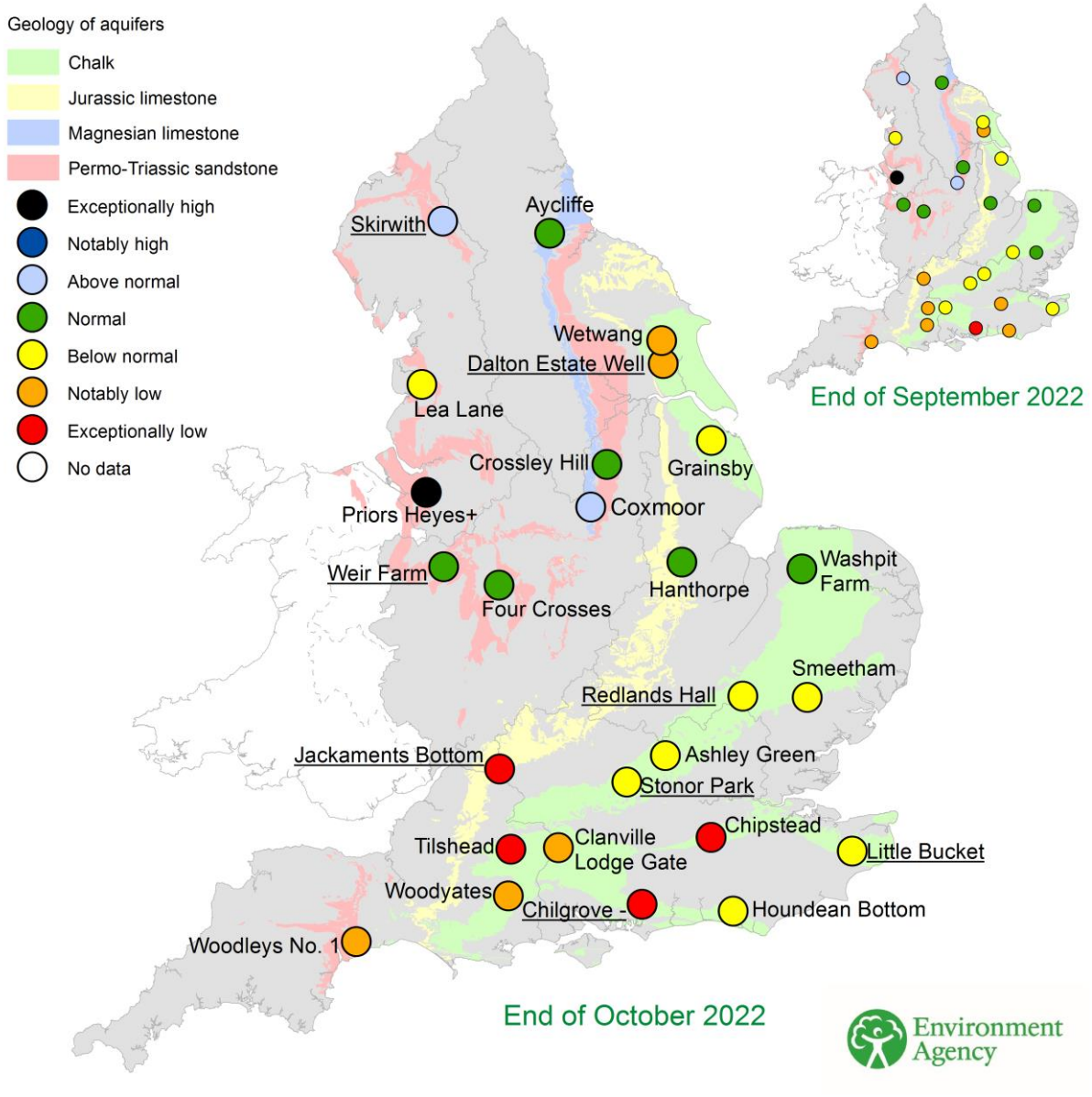
(Source: Environment Agency).

5 Groundwater levels

5.1 Groundwater levels map

Figure 5.1: Groundwater levels for indicator sites at the end of September 2022 and October 2022, classed relative to an analysis of respective historic September and October levels. Major aquifer index sites are underlined and shown in groundwater level charts in Figure 5.2.

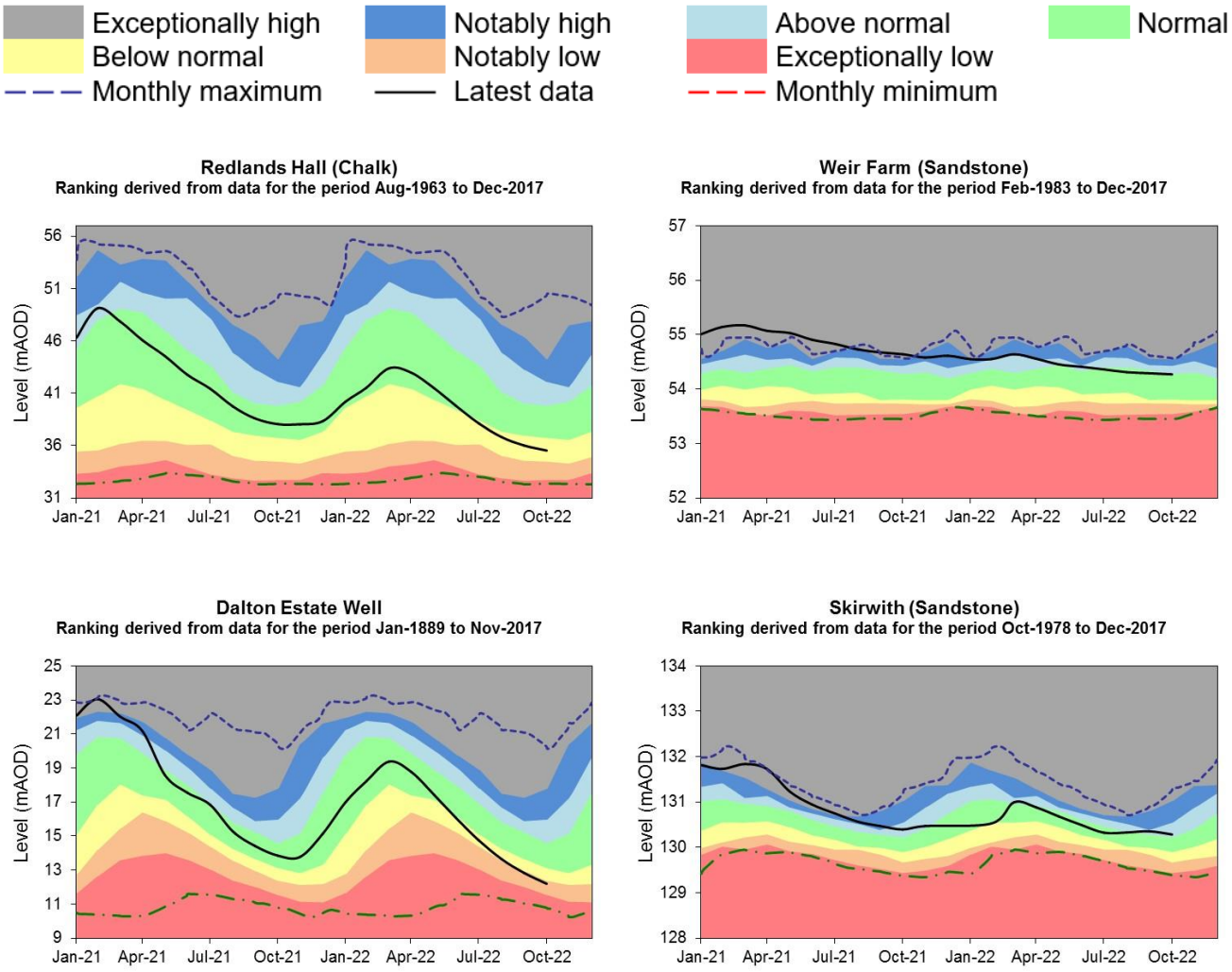
Redlands Hall and Aycliffe are manually dipped at different times during the month and so may not be fully representative of month end levels. Levels at Priors Heyes remain high compared to historic levels because the aquifer is recovering from the effects of historic abstraction. +/- End of month groundwater level is the highest/lowest on record for the current month (note that record length varies between sites).

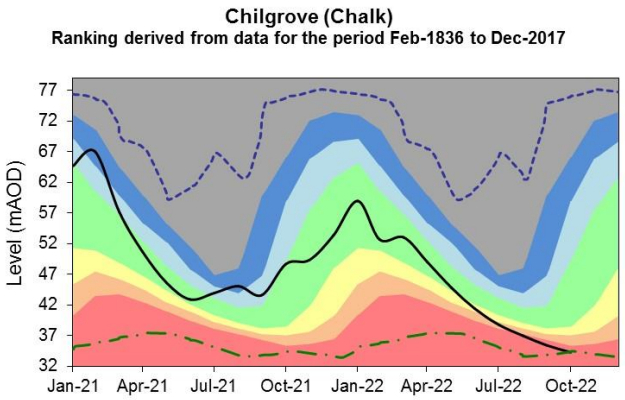


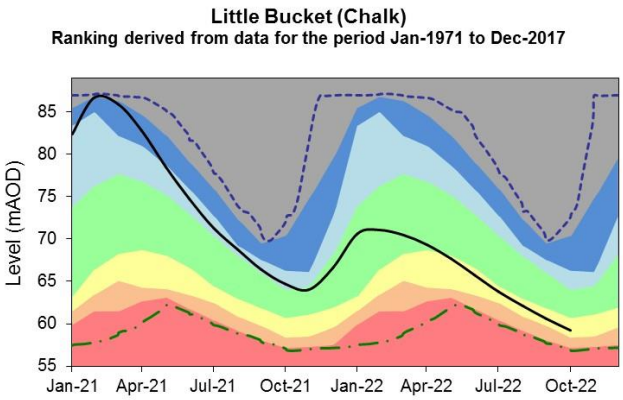
(Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS copyright NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2025.

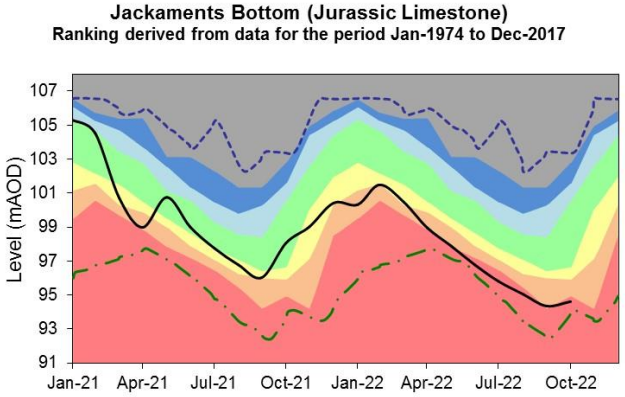
5.2 Groundwater level charts

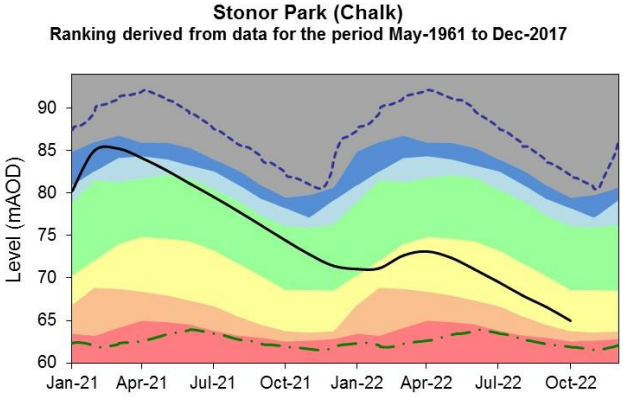
Figure 5.2: End of month groundwater levels at index groundwater level sites for major aquifers. Past 22 months compared to an analysis of historic end of month levels and long term maximum and minimum levels.









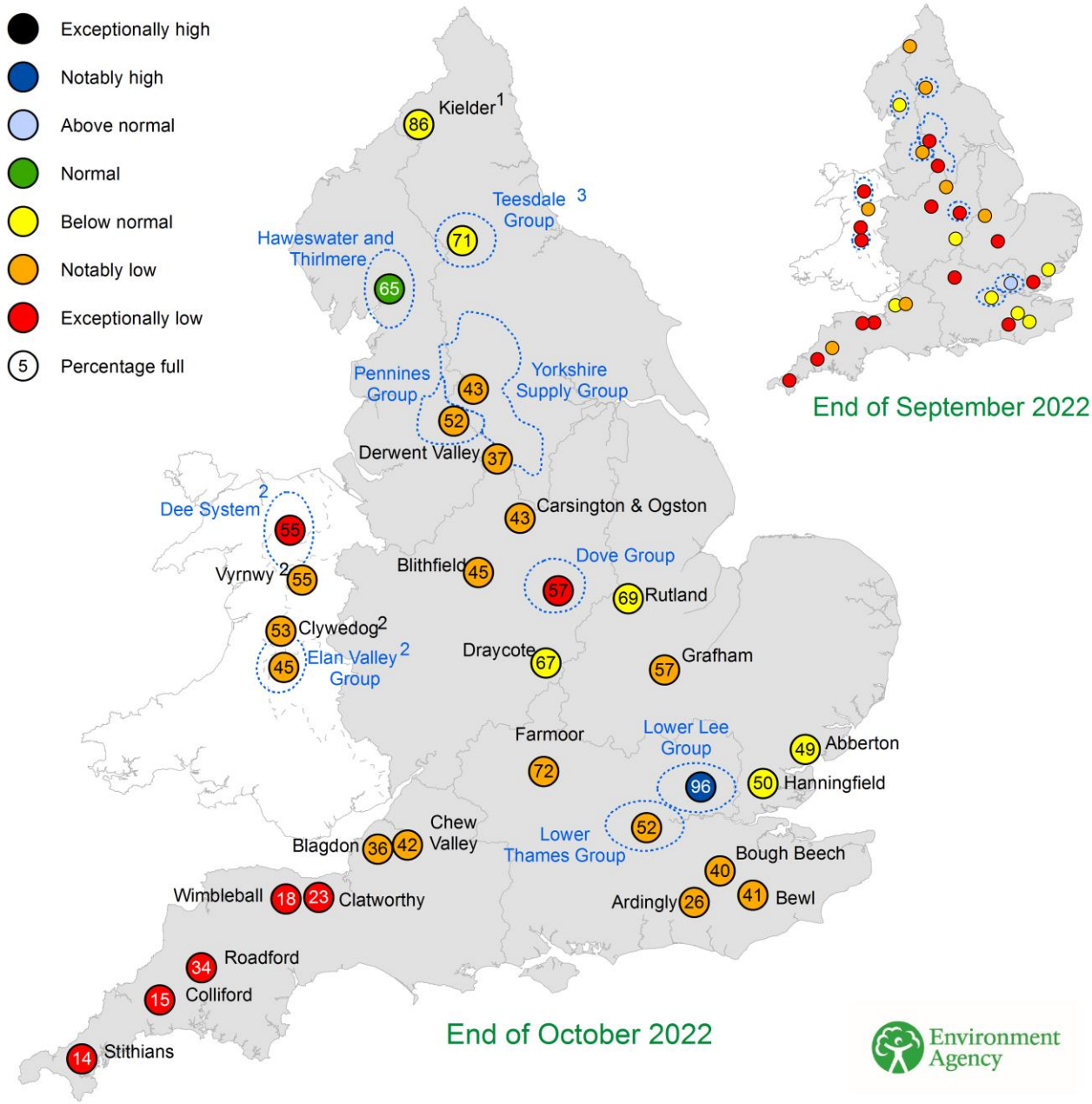


(Source: Environment Agency, 2025)

6 Reservoir storage

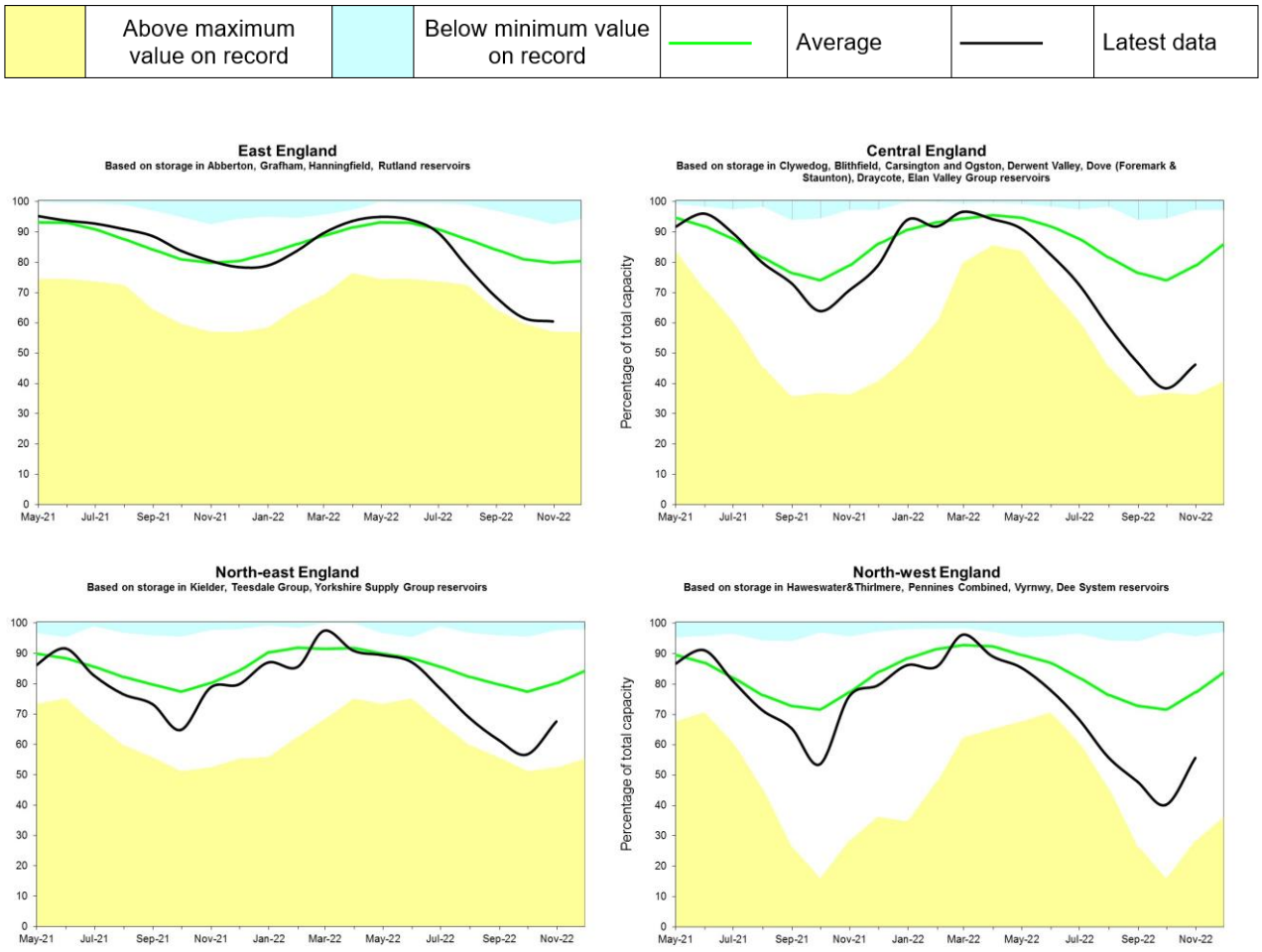
6.1 Reservoir storage map

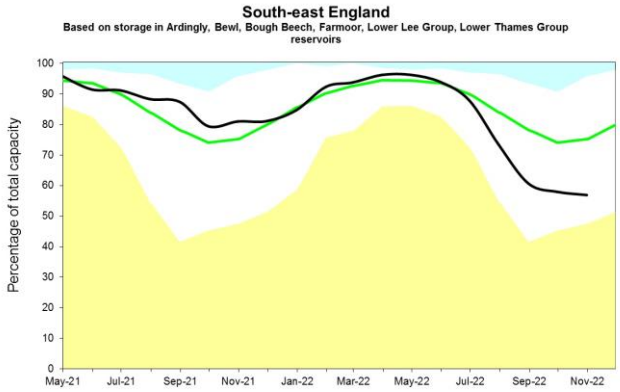
Figure 6.1: Reservoir stocks at key individual and groups of reservoirs at the end of September 2022 and October 2022 as a percentage of total capacity and classed relative to an analysis of historic September and October values respectively. Note: Classes shown may not necessarily relate to control curves or triggers for drought actions. As well as for public water supply, some reservoirs are drawn down to provide flood storage, river compensation flows or for reservoir safety inspections. In some cases current reservoir operating rules may differ from historic ones.

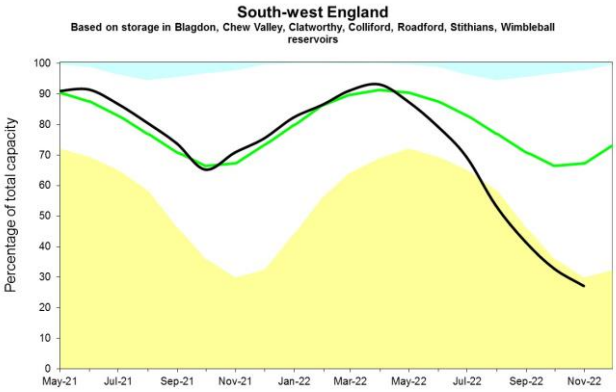


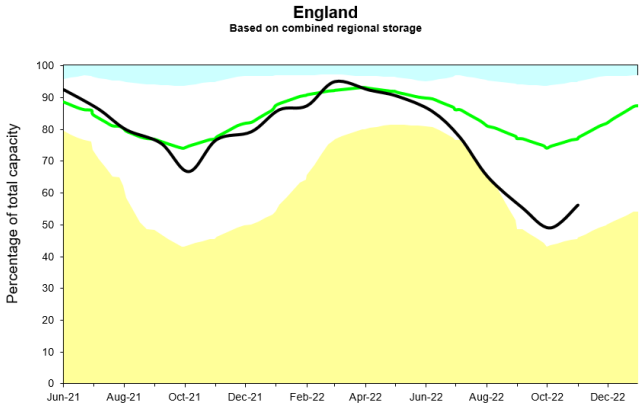
6.2 Reservoir storage charts

Figure 6.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks. Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.







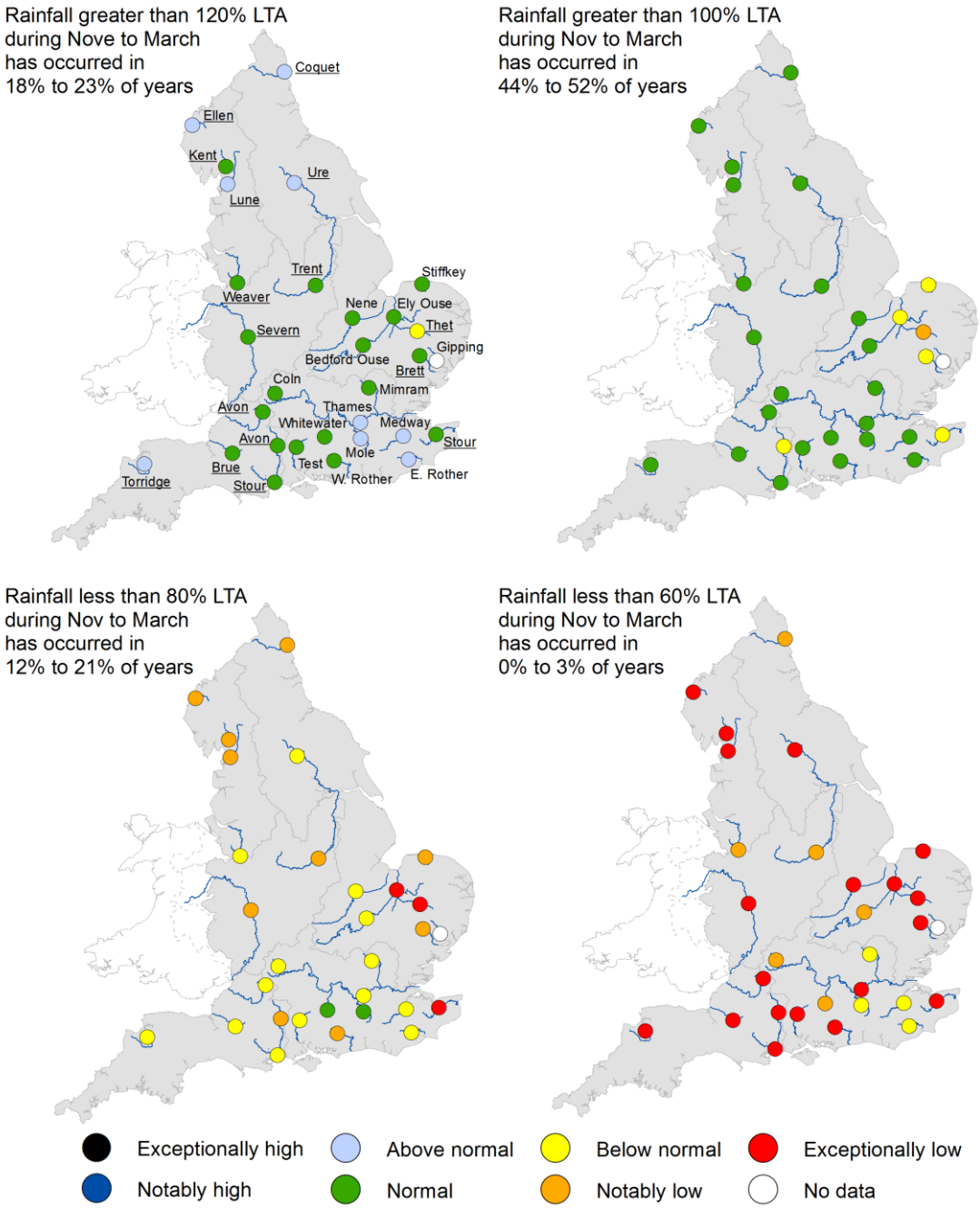


(Source: Water Companies).

7 Forward look

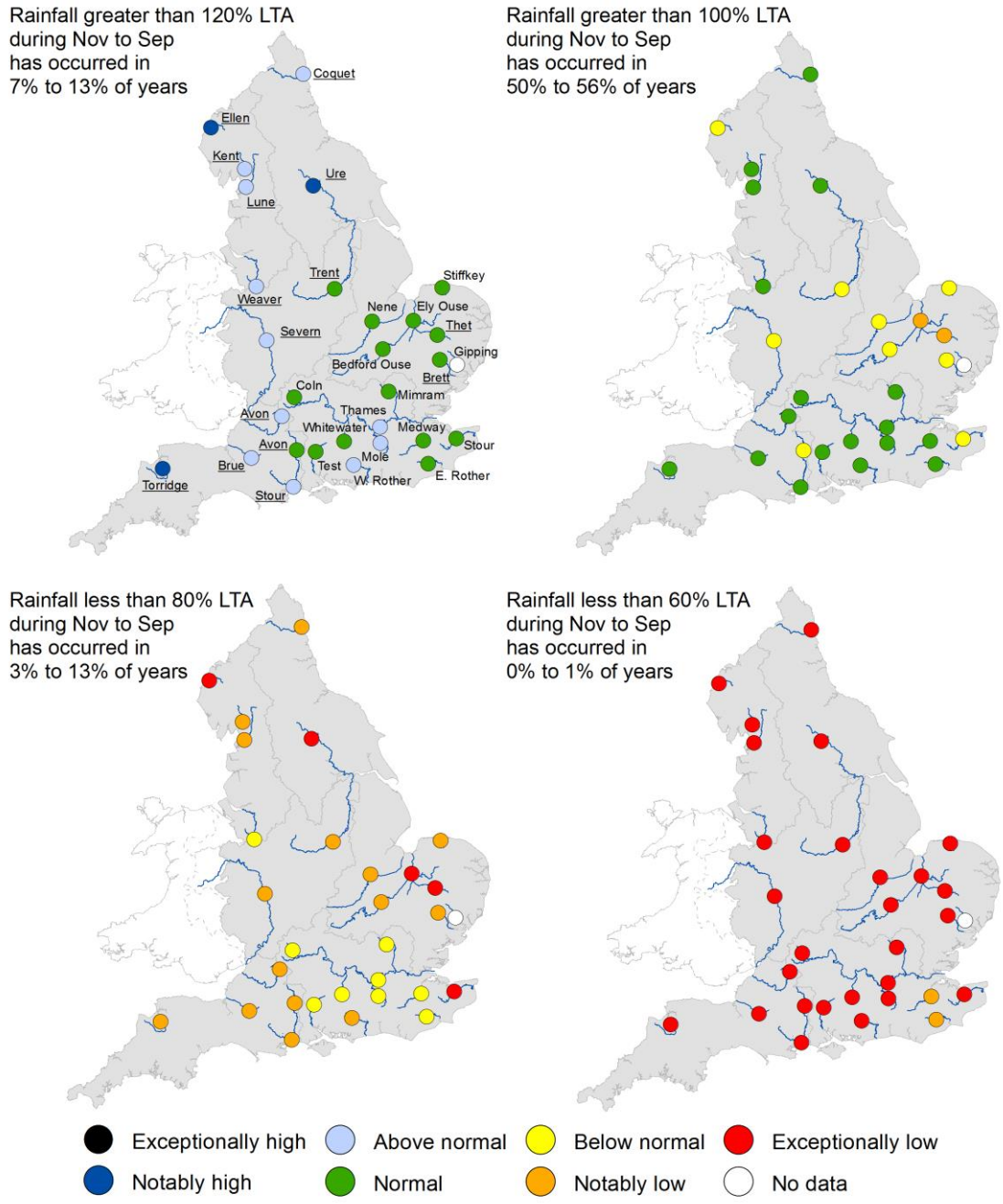
7.1 River flow

Figure 7.1: Projected river flows at key indicator sites up until the end of March 2023. Projections based on four scenarios: 120%, 100%, 80% and 60% of long term average rainfall between November 2022 and March 2023. Rainfall statistics based on occurrence in the historic record since 1891. Projections for underlined sites produced by UKCEH.



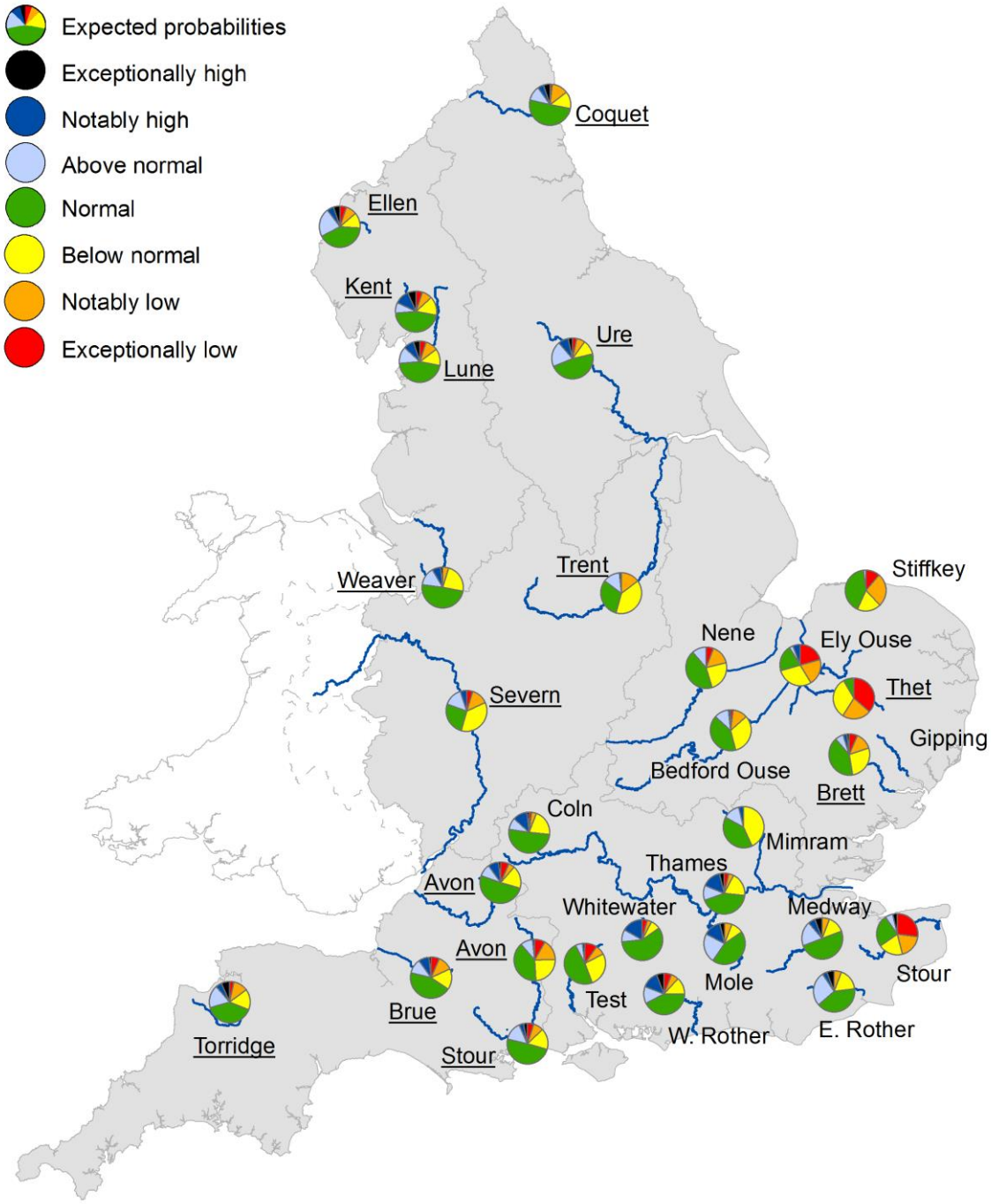
(Source: UK Centre for Ecology and Hydrology, Environment Agency).

Figure 7.2: Projected river flows at key indicator sites up until the end of September 2023. Projections based on four scenarios: 120%, 100%, 80% and 60% of long term average rainfall between November 2022 and September 2023. Rainfall statistics based on occurrence in the historic record since 1891. Projections for underlined sites produced by UKCEH.



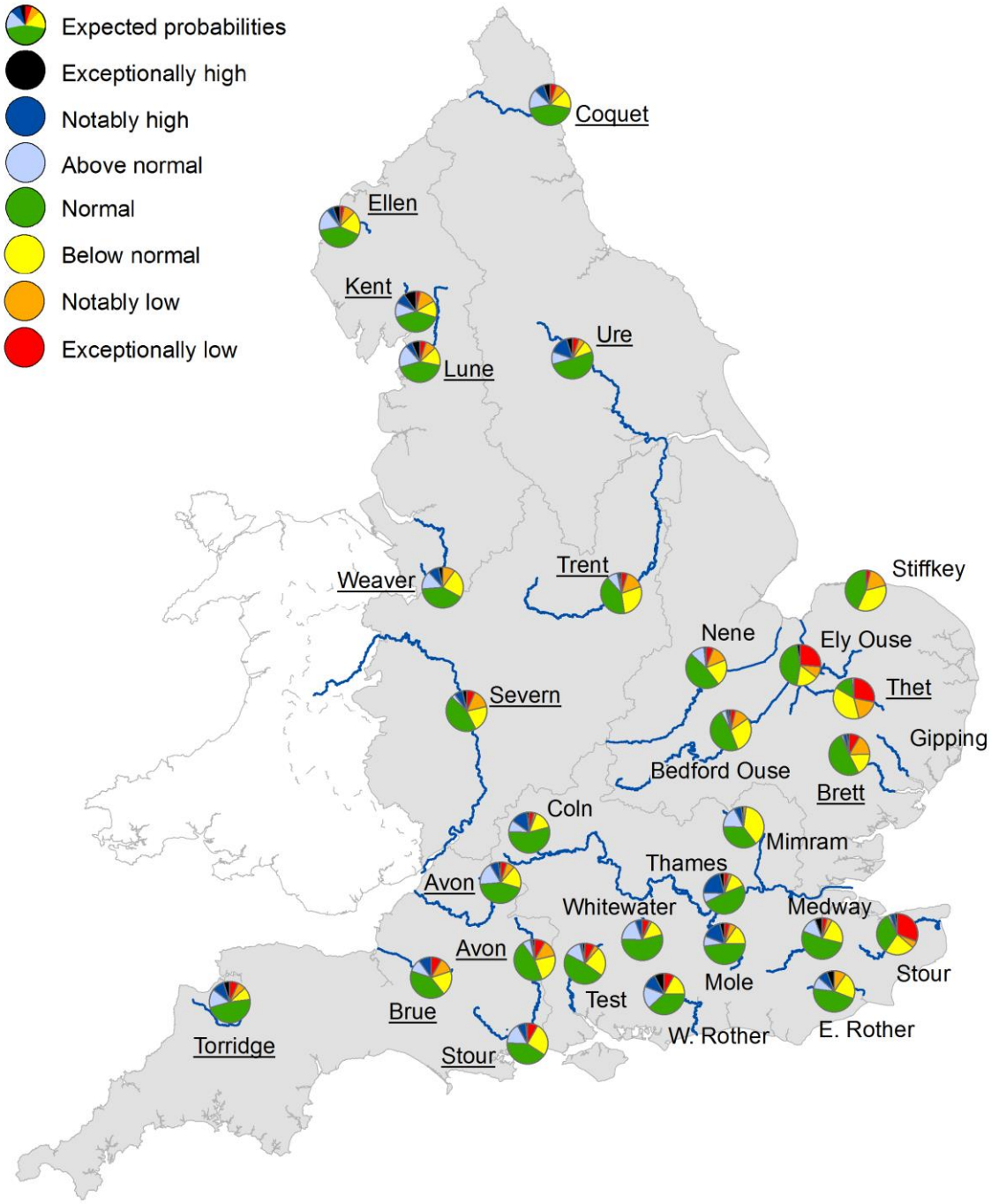
(Source: UK Centre for Ecology and Hydrology, Environment Agency)

Figure 7.3: Probabilistic ensemble projections of river flows at key indicator sites up until the end of March 2023. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. Projections for underlined sites produced by UKCEH.



(Source: UK Centre for Ecology and Hydrology, Environment Agency).

Figure 7.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2023. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. Projections for underlined sites produced by UKCEH.



(Source: UK Centre for Ecology and Hydrology, Environment Agency).

7.2 Groundwater

Figure 7.5: Projected groundwater levels at key indicator sites at the end of March 2023. Projections based on four scenarios: 120%, 100%, 80% and 60% of long term average between November 2022 and March 2023. Rainfall statistics based on occurrence in the historic record since 1891. Projections for underlined sites produced by BGS.

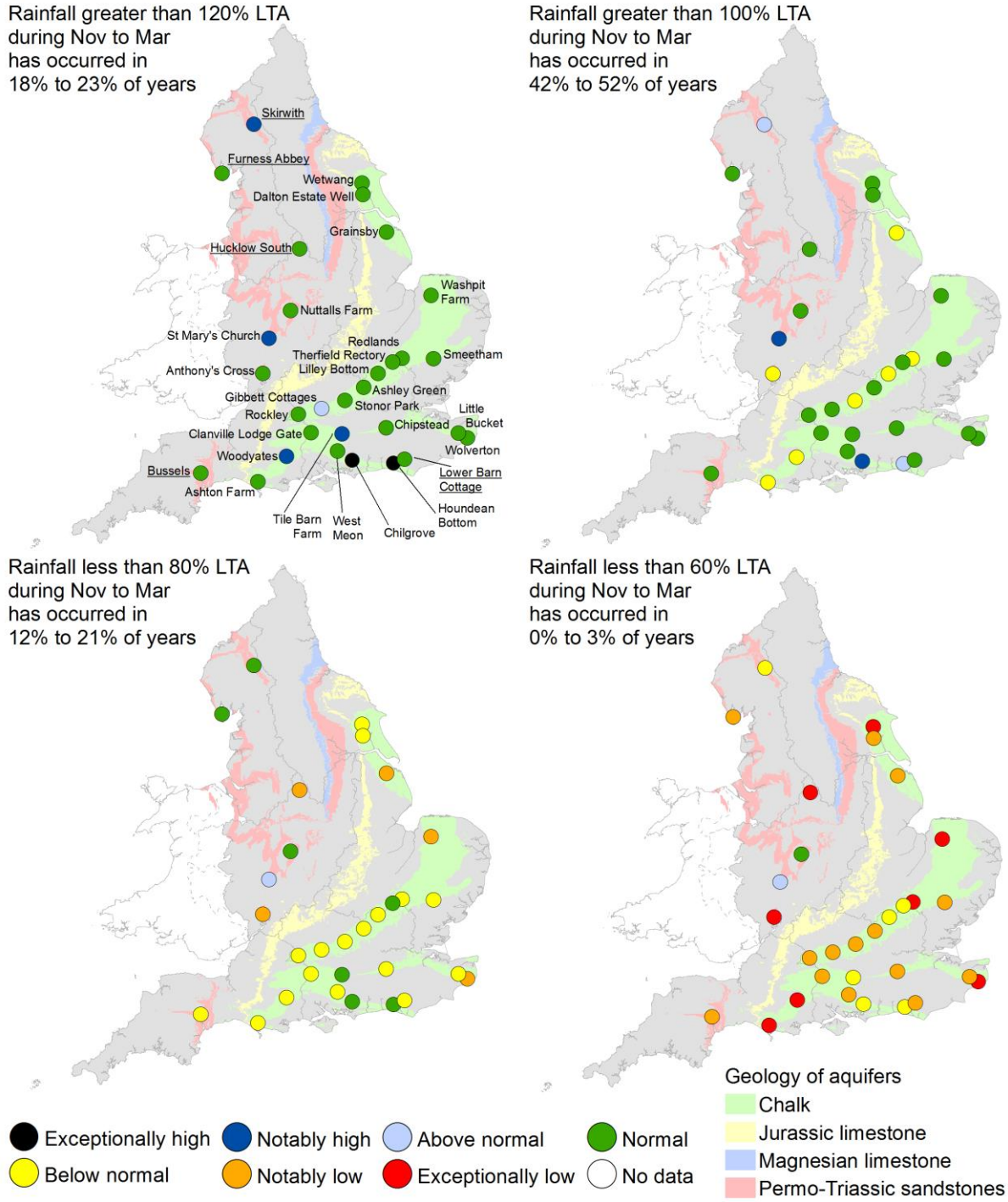


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Figure 7.6: Projected groundwater levels at key indicator sites at the end of September 2023. Projections based on four scenarios: 120%, 100%, 80% and 60% of long term average rainfall between November 2022 and September 2023. Rainfall statistics based on occurrence in the historic record since 1891. Projections for underlined sites produced by BGS.

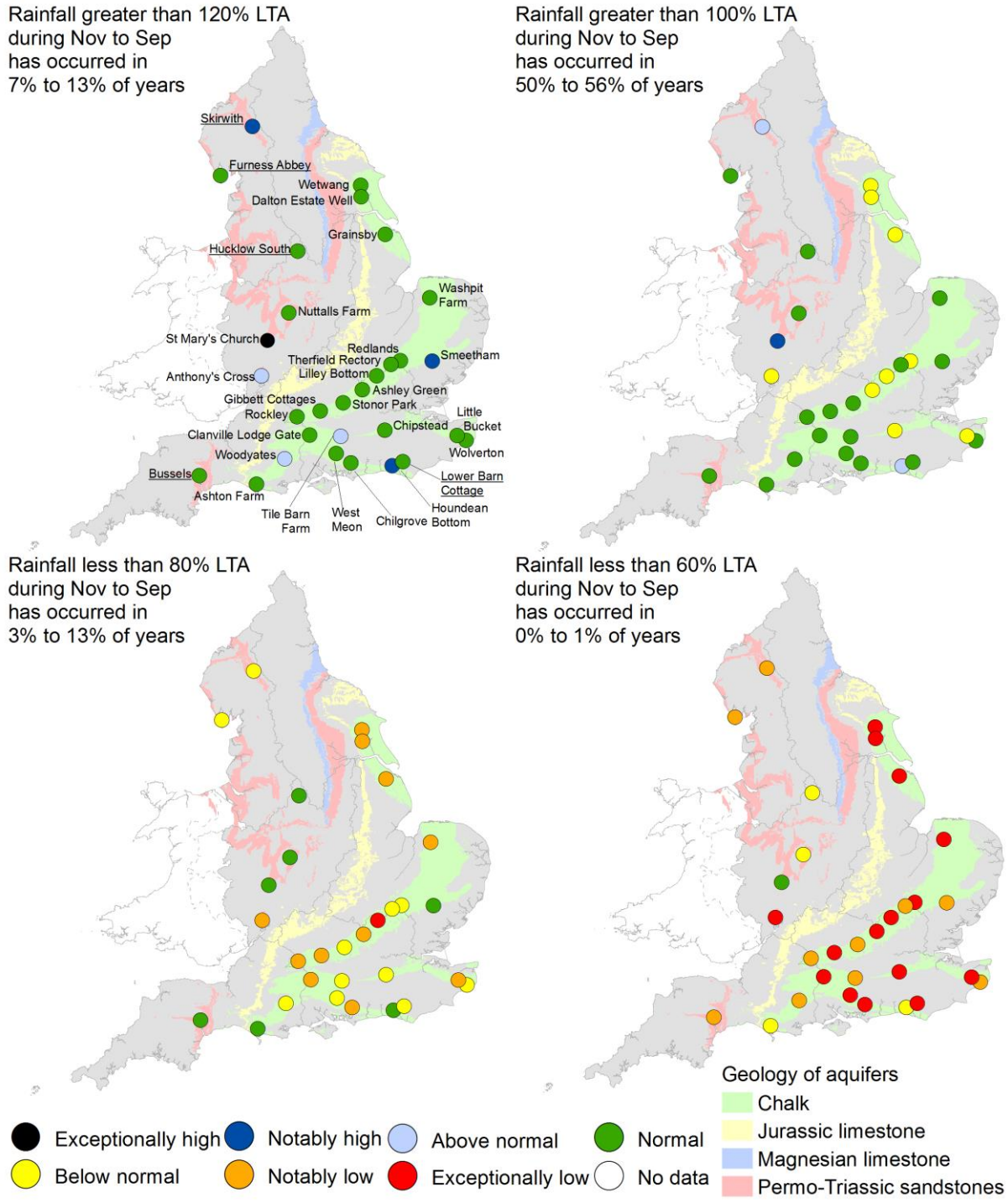

Figure 7.7: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of March 2023. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for the time of year. Projections for underlined sites produced by BGS.

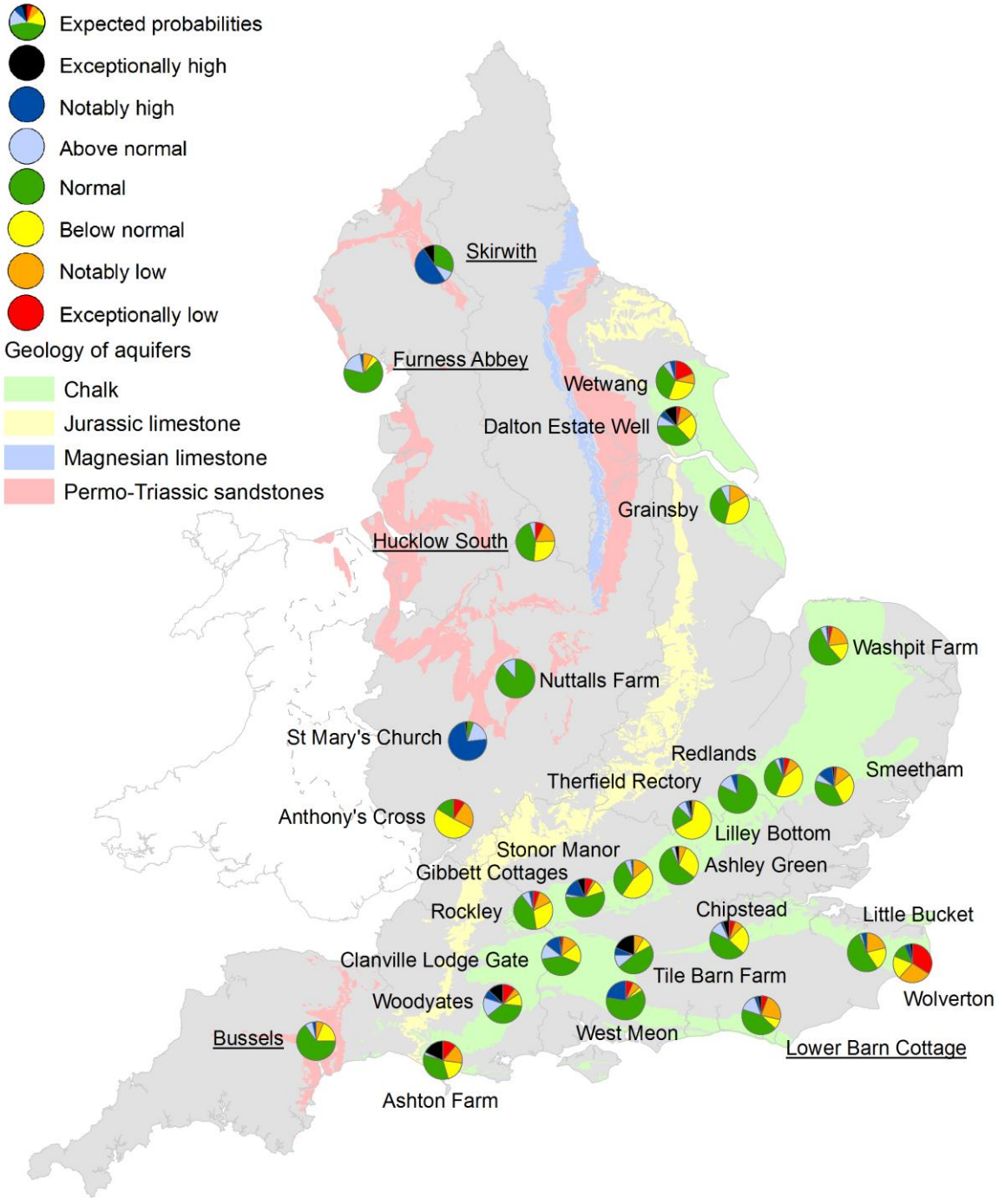

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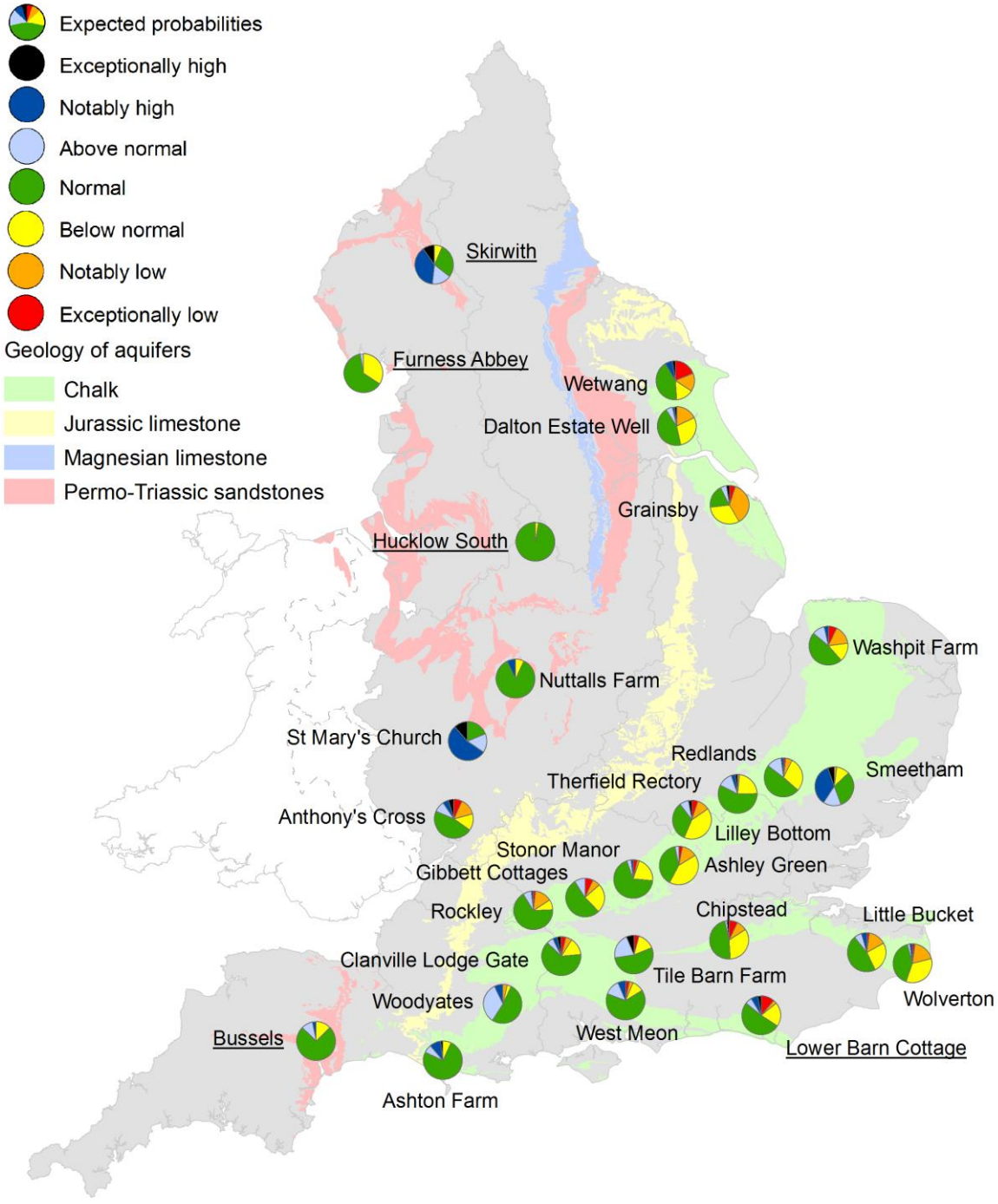
Figure 7.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of September 2023. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for the time of year. Projections for underlined sites produced by BGS.



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8 Glossary

8.1 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} or m^3/s).

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 1961-1990. 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 x 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 (e.g. 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).

8.2 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.

8.3 Geographic regions

Figure 8.1: Geographic regions

9 Appendices

9.1 Rainfall table

Region	Oct 2022 rainfall % of long term average 1961 to 1990	Oct 2022 band	Aug 2022 to October 2022 cumulative band	May 2022 to October 2022 cumulative band	Nov 2021 to October 2022 cumulative band
East England	130	Normal	Normal	Notably low	Exceptionally low
Central England	159	Above Normal	Normal	Below normal	Notably low
North-east England	128	Normal	Normal	Below normal	Notably low
North-west England	129	Above Normal	Normal	Normal	Normal
South-east England	124	Normal	Normal	Below normal	Exceptionally low
South-west England	120	Normal	Normal	Below normal	Exceptionally low
England	130	Normal	Normal	Below normal	Exceptionally low

9.2 River flows table

Geographic area	Site name	River	Oct 2022 band	Sep 2022 band
East	Burnham	Burn	Below normal	Normal
East	Claypole	Upper Witham	Normal	Below normal
East	Colney	Yare	Exceptionally low	Exceptionally low
East	Denver	Ely Ouse	No data	No data
East	Dernford	Cam	Exceptionally low	Exceptionally low
East	Louth Weir	Lud	Notably low	Below normal
East	Offord	Bedford Ouse	Normal	Below normal
East	Springfield	Chelmer	Normal	Below normal
East	Stowmarket	Gipping	Normal	Below normal
East	Upton Mill	Nene	Normal	Below normal
Central	Bewdley	Severn	Below normal	Exceptionally low
Central	Derby St Marys	Derwent	Normal	Below normal
Central	Evesham	Avon	Normal	Normal
Central	Marston-on-dove	Dove	Normal	Below normal
Central	North Muskham	Trent	Normal	Below normal

North East	Buttercrambe	Derwent	Below normal	Notably low
North East	Crakehill Topcliffe	Swale	Normal	Below normal
North East	Heaton Mill	Till	Normal	Normal
North East	Doncaster	Don	Normal	Below normal
North East	Haydon Bridge	South Tyne	Above normal	Normal
North East	Tadcaster	Wharfe	Normal	Below normal
North East	Stanhope	Wear	Above normal	Normal
North West	Ashton Weir	Mersey	No data	Notably low
North West	Caton	Lune	Normal	Below normal
North West	Ouse Bridge	Derwent	Above normal	Below normal
North West	Pooley Bridge	Eamont	Above normal	Below normal
North West	St Michaels	Wyre	Normal	Below normal
North West	Ashbrook	Weaver	Normal	Normal
South East	Allbrook and Highbridge	Itchen	Normal	Normal
South East	Feildes Weir	Lee	Normal	Normal
South East	Hansteads	Ver	Normal	Normal
South East	Hawley	Darent	Below normal	Below normal
South East	Horton	Great Stour	Notably low	Below normal
South East	Kingston	Thames	Below normal	Below normal

South East	Lechlade	Leach	Below normal	Below normal
South East	Teston and Farleigh	Medway	Normal	Normal
South East	Marlborough	Kennet	Notably low	Notably low
South East	Udiam	Rother	Normal	Normal
South East	Ardingley Gs	Ouse	Normal	Normal
South East	Princes Marsh Gs	Rother	Normal	Above normal
South West	Amesbury	Upper Avon	Notably low	Exceptionally low
South West	Bathford	Avon	Normal	Notably low
South West	Bishops Tull	Tone	Below normal	Notably low
South West	East Stoke	Frome	Below normal	Notably low
South West	Great Somerford	Avon	Below normal	Exceptionally low
South West	Gunnislake	Tamar	Below normal	Normal
South West	Hammoon	Middle Stour	Normal	Below normal
South West	Knapp Mill	Avon	Notably low	Exceptionally low
South West	Lovington	Upper Brue	Normal	Notably low
South West	Thorverton	Exe	Notably low	Below normal
South West	Torrington	Torridge	Below normal	Normal
South West	Truro	Kenwyn	Below normal	Normal

South West	Austins Bridge	River Dart	Normal	Normal
Natural Resources Wales	Manley Hall	Dee	Normal	Below normal
Natural Resources Wales	Redbrook	Wye	Below normal	Exceptionally low

9.3 Groundwater table

Geographic area	Site name	Aquifer	End of Oct 2022 band	End of Sep 2022 band
East	Grainsby	Grimsby Ancholme Louth Chalk	Below normal	Below normal
East	Redlands Hall (chalk)	Cam Chalk	Below normal	Below normal
East	Hanthorpe	Cornbrash (South)	Normal	Normal
East	Smeetham Hall Cott.	North Essex Chalk	Below normal	Normal
East	Washpit Farm Rougham	North West Norfolk Chalk	Normal	Normal
Central	Four Crosses	Grimsby Ancholme Louth Limestone	Normal	Normal
Central	Weir Farm (sandstone)	Bridgnorth Sandstone Formation	Normal	Normal
Central	Coxmoor	Permo Triassic Sandstone	Above normal	Above normal
Central	Crossley Hill	Permo Triassic Sandstone	Normal	Normal
North East	Dalton Estate Well	Hull & East Riding Chalk	Notably low	Notably low

North East	Aycliffe Nra2	Skerne Magnesian Limestone	Normal	Normal
North East	Wetwang	Hull & East Riding Chalk	Notably low	Below normal
North West	Priors Heyes	West Cheshire Permo-Triassic Sandstone	Exceptionally high	Exceptionally high
North West	Skirwith (sandstone)	Carlisle Basin Permo-Triassic sandstone	Above normal	Above normal
North West	Lea Lane	Fylde Permo-Triassic Sandstone	Below normal	Below normal
South East	Chilgrove (chalk)	Chichester-Worthing-Portsdown Chalk	Exceptionally low	Exceptionally low
South East	Clanville Gate Gwl	River Test Chalk	Notably low	Below normal
South East	Houndean Bottom Gwl	Brighton Chalk Block	Below normal	Notably low
South East	Little Bucket (chalk)	East Kent Chalk - Stour	Below normal	Below normal
South East	Jackaments Bottom (jurassic Limestone)	Burford Oolitic Limestone (Inferior)	Exceptionally low	Notably low
South East	Ashley Green Stw Obh	Mid-Chilterns Chalk	Below normal	Below normal

South East	Stonor Park (chalk)	South-West Chilterns Chalk	Below normal	Below normal
South East	Chipstead Gwl	Epsom North Downs Chalk	Exceptionally low	Notably low
South West	Tilshead	Upper Hampshire Avon Chalk	Exceptionally low	Notably low
South West	Woodleys No1	Otter Valley Sandstone	Notably low	Notably low
South West	Woodyates	Dorset Stour Chalk	Notably low	Notably low

9.4 Reservoir table

Geographic region	% Full	Average comparison
East England	60	Below average
Central England	46	Below average
North-east England	68	Below average
North-west England	56	Below average
South-east England	57	Below average
South-west England	27	Below average
England	56	Below average