Monthly water situation report

England

Summary – August 2022

August was the sixth consecutive month with below average rainfall across England. Monthly rainfall totals for the majority of catchments were classed as notably low for the time of year. As expected for the time of year, soil moisture deficits have continued to increase across the country with end of August soils much drier than would typically be expected for the time of year. River flows decreased in August at the majority of indicator sites we report on and most sites were classed as below normal for the time of year. Groundwater levels also decreased at the vast majority of the sites we report on during August and remained below normal at the majority of sites for the time of year. Reservoir stocks in August decreased at all the reservoirs and reservoir groups we report on.

Rainfall

The August rainfall total for England was 38.4mm which represents 49% of the 1961-1990 long term average (LTA) (47% of the 1991-2020 LTA). The majority of catchments received notably low rainfall during August. The Lower Lee catchment in south-east England was the wettest part of the country relative to its LTA, receiving 127% of LTA for the time of year. The Thanet Chalk catchment also in south-east England was the driest receiving 14% of LTA. (Figure 1.1)

August rainfall totals were classed as notably low or below normal at over two-thirds of catchments across the country. The three month cumulative totals for summer show the majority of catchments were classed as exceptionally low. Six hydrological areas had their driest summer on records from 1891.The six month cumulative rainfall totals were classed as either notably low or exceptionally low at all but one catchment. Twelve month cumulative totals show that more than half of catchments across England were classed as notably low (Figure 1.2)

At a regional scale August rainfall totals across all regions and for England as a whole were classed as notably low, with the exception of east England which was below normal. For south-west England the ten month rainfall accumulations to August have been the second driest since 1891 (Figure 1.3)

Soil moisture deficit

Soil moisture deficits (SMD) continued to increase across the country as expected during August due to warmer temperatures and drier conditions; although within the month did becoming slightly wetter in places in response to local rainfall, particularly toward the end of the month. (Figure 2.1)

End of August soil moisture deficits (SMD) were greater than the long term average (LTA) for the time of year across England; soils were much drier than would be typically expected for August and for much of the country are close to driest ever values for the end of August (dataset from 1961). (Figure 2.2)

River flows

August monthly mean river flows decreased at over two-thirds of the indicator sites we report on compared to the previous month. The majority of sites were classed as below normal for August however over half the sites were classed as either notably low or exceptionally low for the time of year. (Figure 3.1)

The lowest monthly mean August flows on record were recorded on the River Yare at Colney (records since 1970), the Ely Ouse at Denver (records since 1971), the River Till at Heaton Mill (records since 2002) and the Great Stour at Horton (records since 1964).

With the exception of the Great Stour which was classed as exceptionally low all the other regional index sites monthly mean flows were classed as below normal or notably low for the time of year. (Figure 3.2)

Groundwater levels

Groundwater levels during August decreased at all but two of the reported indicator sites. The majority of end of month groundwater levels were classed as below normal and a quarter of sites were classed as normal. (Figures 4.1)

The major aquifer index sites show a more varied picture at the end of August. Index sites in the major aquifers ranged from normal levels in the Brignorth sandstone aquifer in central England at Weir Farm and in north-west England in the Carlisle Basin sandstone at Skirwith to exceptionally low at Jackaments Bottom in the Burford Jurassic limestone and Chilgrove in the West Sussex Chalk. (Figures 4.2).

Reservoir storage

End of August reservoir stocks decreased at all reservoirs and reservoir groups we report on. More than half of reservoirs or groups recorded a decrease of over 10% of total capacity in comparison to the end of July, Ardingly reservoir recording the largest decrease at 20%. (Figure 5.1).

End of month reservoir stocks were classed as normal for the time of year at only one of the reported reservoirs. Nearly half of reservoirs were classed as exceptionally low for the time of year. (Figure 5.1) Stithians, Colliford, Wimbleball, Ardingly and the Derwent Valley are their lowest on record for end of August.

At a regional scale, total reservoir stocks ranged from 42% in south-west England to 69% in east England. Total reservoir stocks for England were at 55% of total capacity at the end of August, for south-west England and all England these numbers are the lowest ever on record for the end of August (records start 1988) (Figure 5.2)

Forward look

September started with wet conditions across much of the country, with the south west already receiving more than half the expected rainfall for the month. The middle of the month is likely to be dry for many, although there is a chance of rain spreading across the north. High pressure is likely to break down, bringing more unsettled conditions. Towards the end of the month rain is likely in the west and northwest, while the south and east are likely to be drier with chances of fog and mist. Temperatures are likely to remain warm for many.

For the three month period from September to November, there is a chance of warmer than average conditions although near average temperatures are most likely. Dry conditions are expected to continue in the south and east, while impacts from higher rainfall totals are more likely than usual in western and north-western parts of the country. [1]

Projections for river flows at key sites[2]

By the end of September 2022 almost all modelled sites have a greater than expected chance of cumulative river flows being notably low or lower for the time of year. By the end of March 2023, the majority of sites have a greater than expected chance of cumulative river flows being below normal or lower for the time of year.

For scenario based projections of cumulative river flows at key sites by September 2022 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by March 2023 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by September 2022 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by March 2023 see Figure 6.4

Projections for groundwater levels in key aquifers[2]

By the end of September 2022 more than two thirds of all modelled sites have a greater than expected chance of groundwater levels being below normal or lower for the time of year. By the end of March 2023 three quarters of modelled sites have a greater than expected chance of groundwater levels being below normal or lower for the time of year.

For scenario based projections of groundwater levels in key aquifers in September 2022 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in March 2023 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2022 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2023 see Figure 6.8

Authors: National Water Resources Hydrology Team

1 Source: Met Office
2 Information produced by the Hydrological Outlook, a partnership between UK Centre for Ecology and Hydrology, British Geological Survey, Met Office, Environment Agency and other devolved agencies.

Rainfall

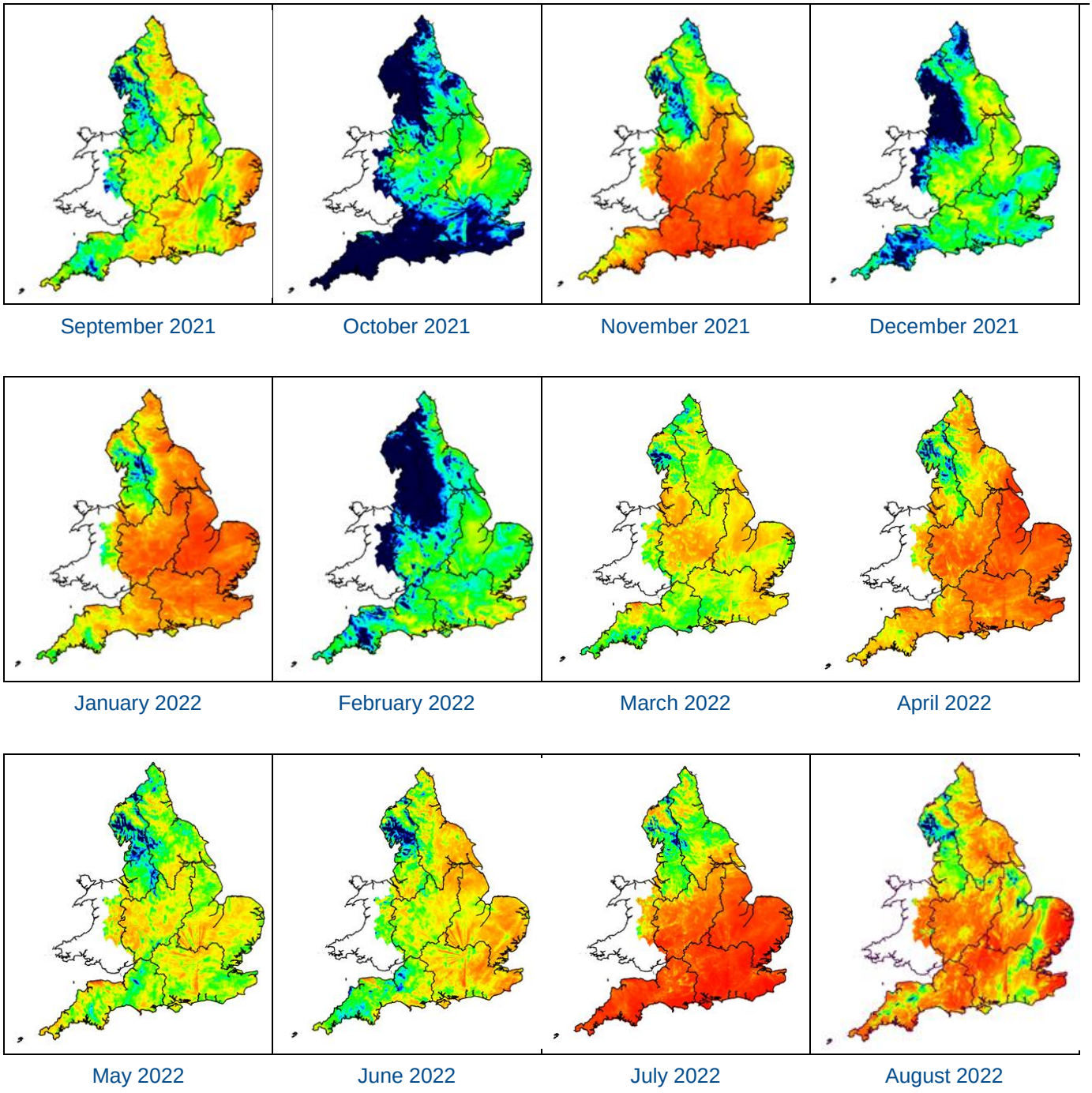


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2022). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.

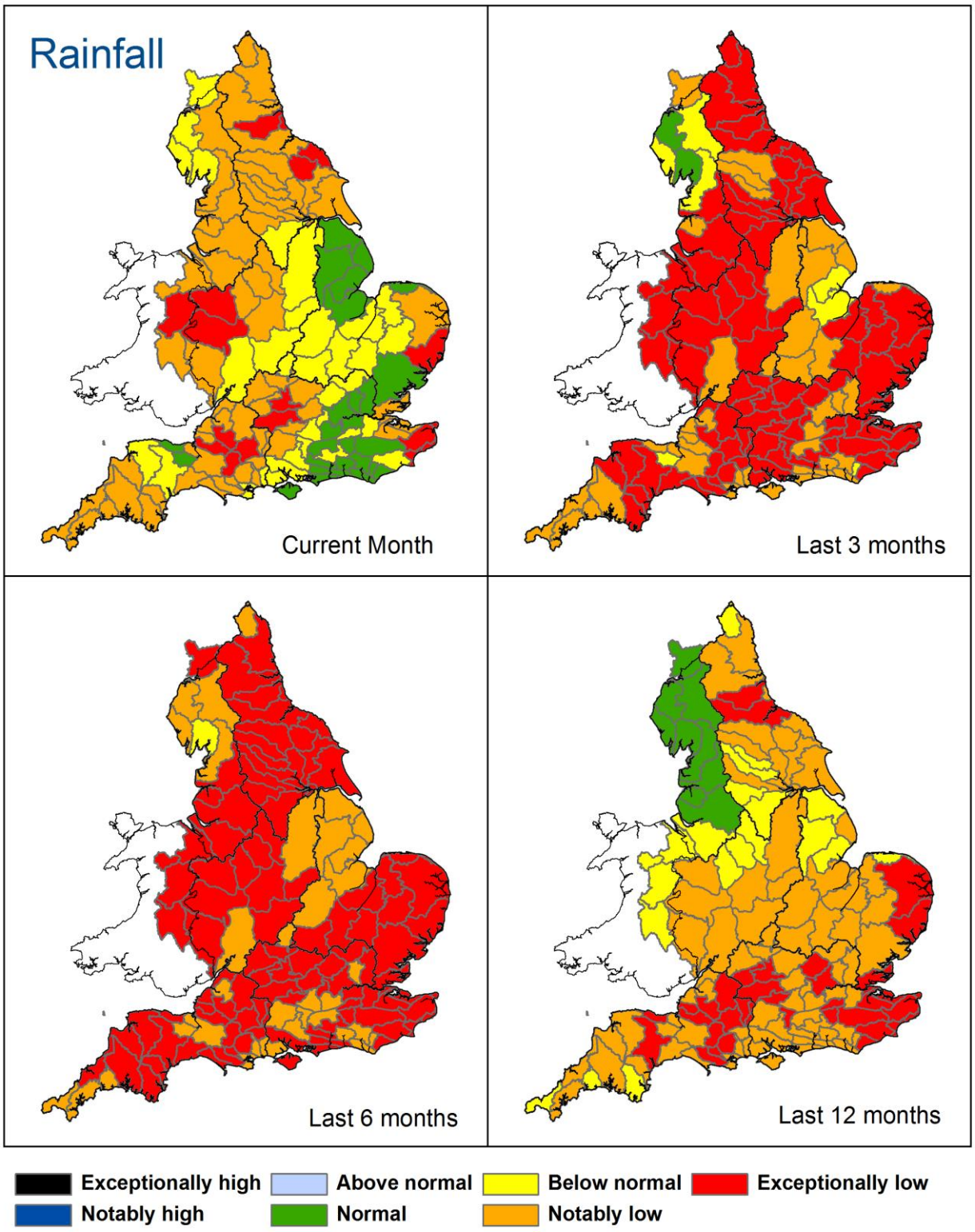


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 August), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2022).* Provisional data based on Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.

Rainfall charts

Above average rainfall

Below average rainfall

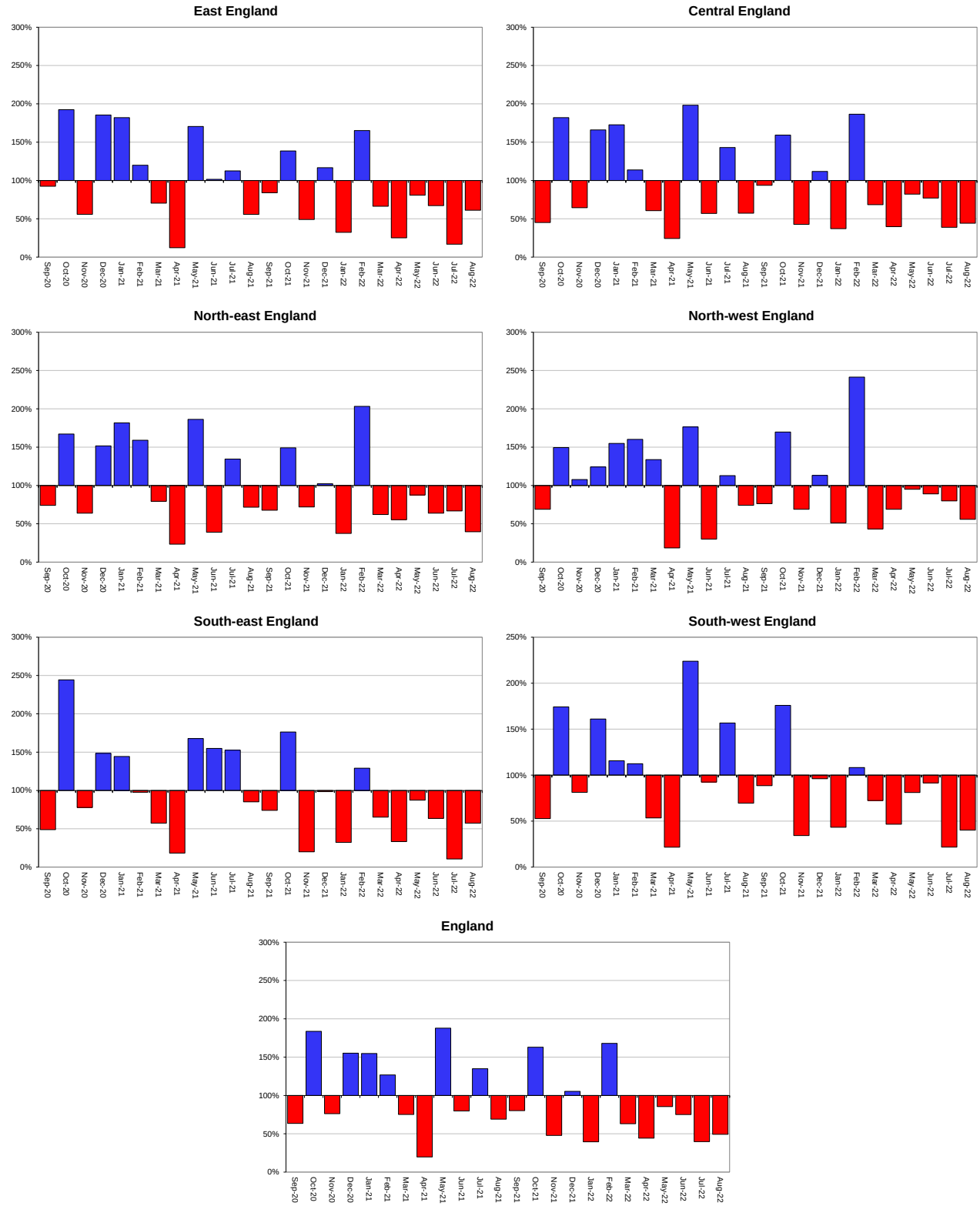


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2022).

Soil moisture deficit

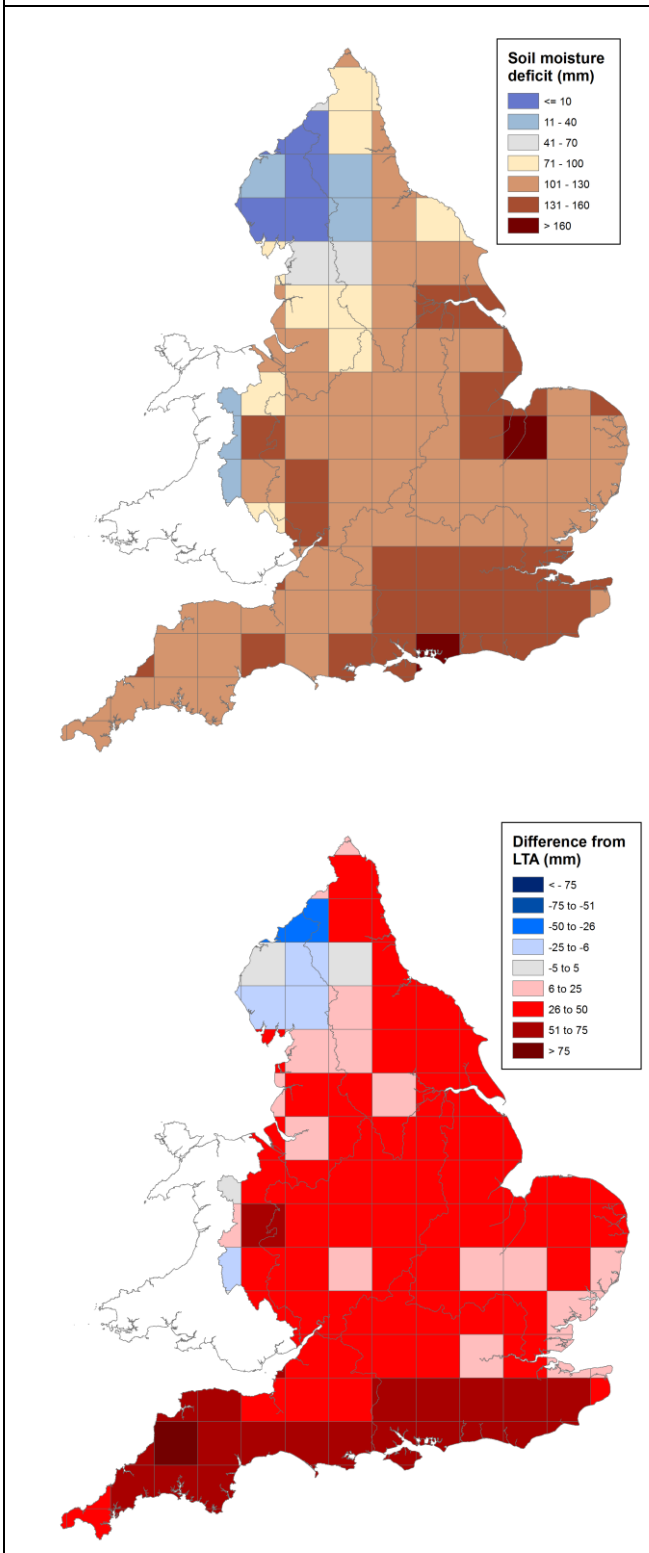
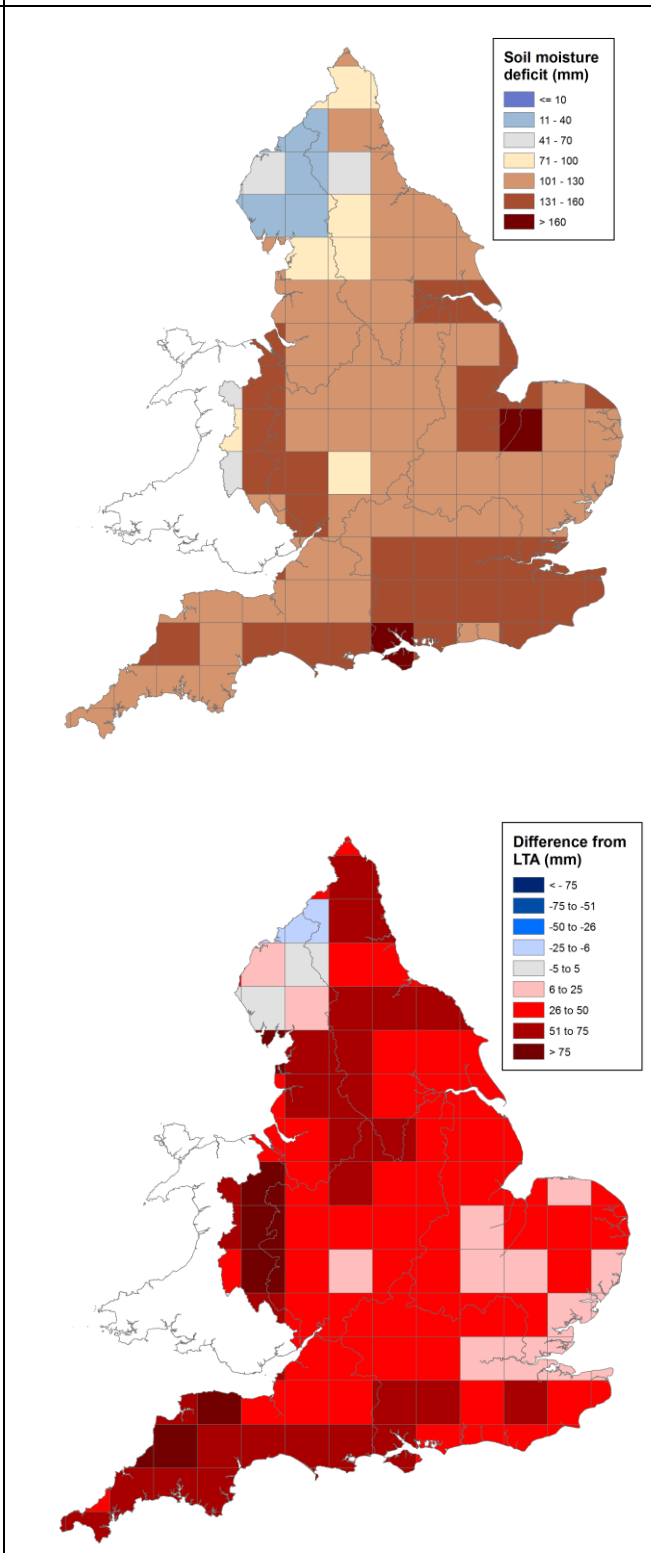
End of July 2022[1]	End of August 2022[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 2 August 2022 [1] (left panel) and 30 August 2022 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961 to 90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 20212. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022

Soil moisture deficit charts

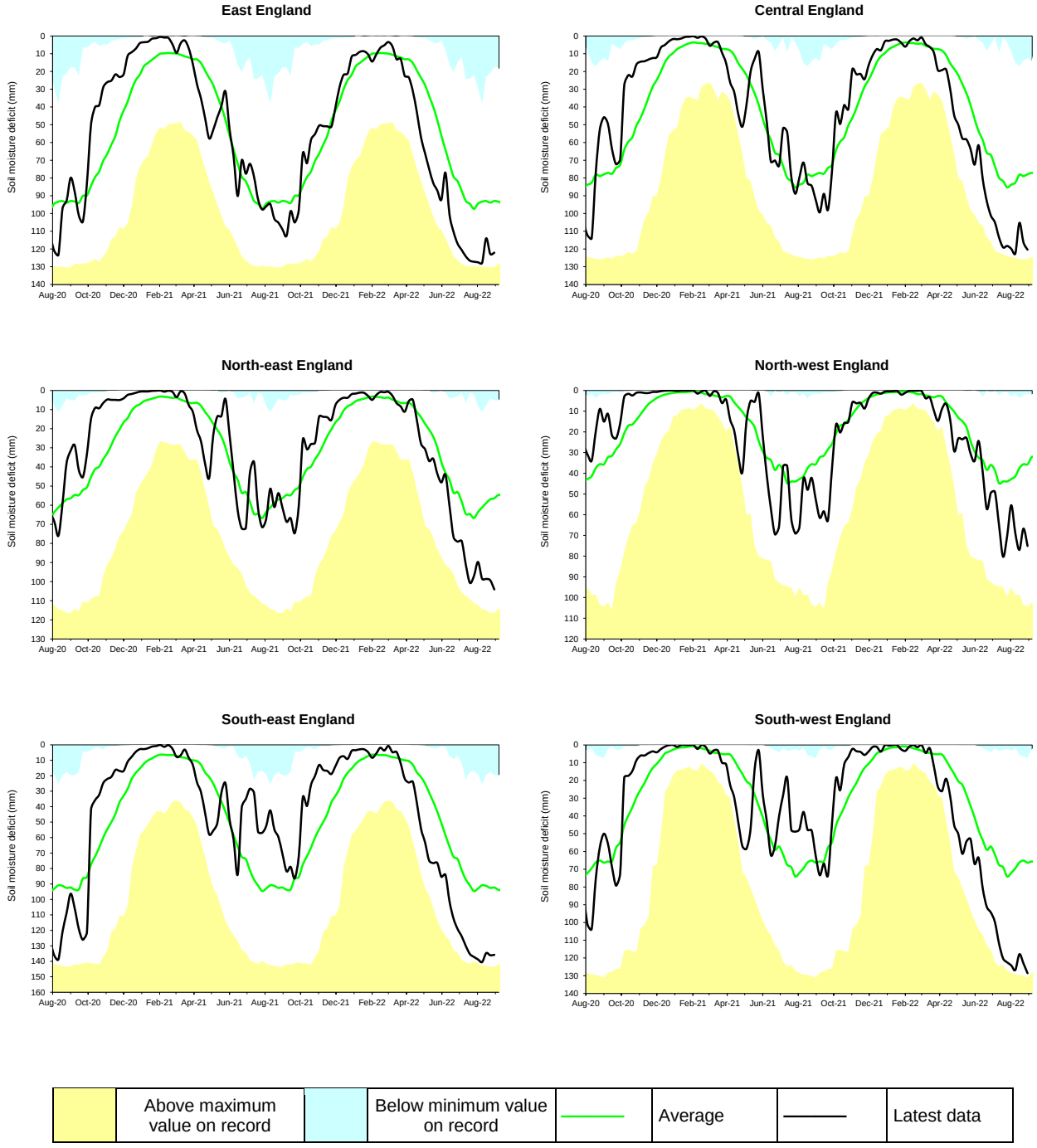
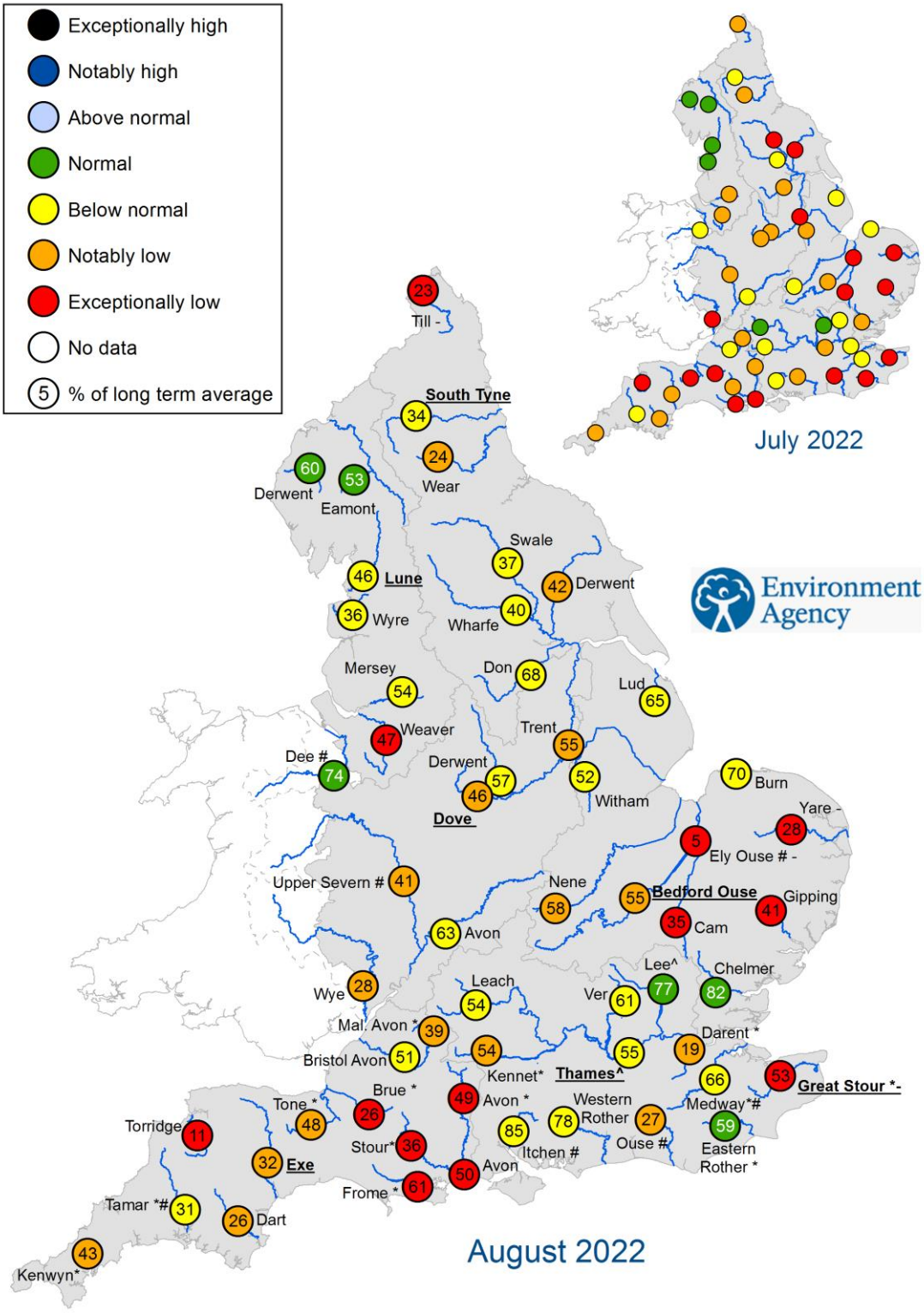


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2022).

River flows



^ "Naturalised" flows are provided for the River Thames at Kingston and the River Lee at Feildes Weir

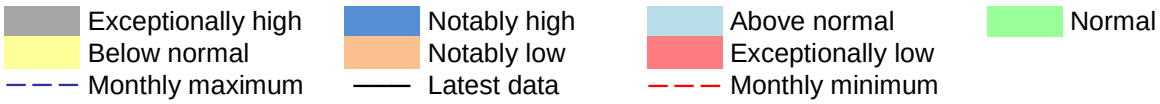
+/- Monthly mean flow is the highest/lowest on record for the current month (note that record length varies between sites)

* Flows may be overestimated at these sites – data should be treated with caution

Underlined sites are regional index sites and are shown on the hydrographs in Figure 3.2

Figure 3.1: Monthly mean river flow for indicator sites for July 2022 and August 2022, expressed as a percentage of the respective long term average and classed relative to an analysis of historic July and August monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.

River flow charts



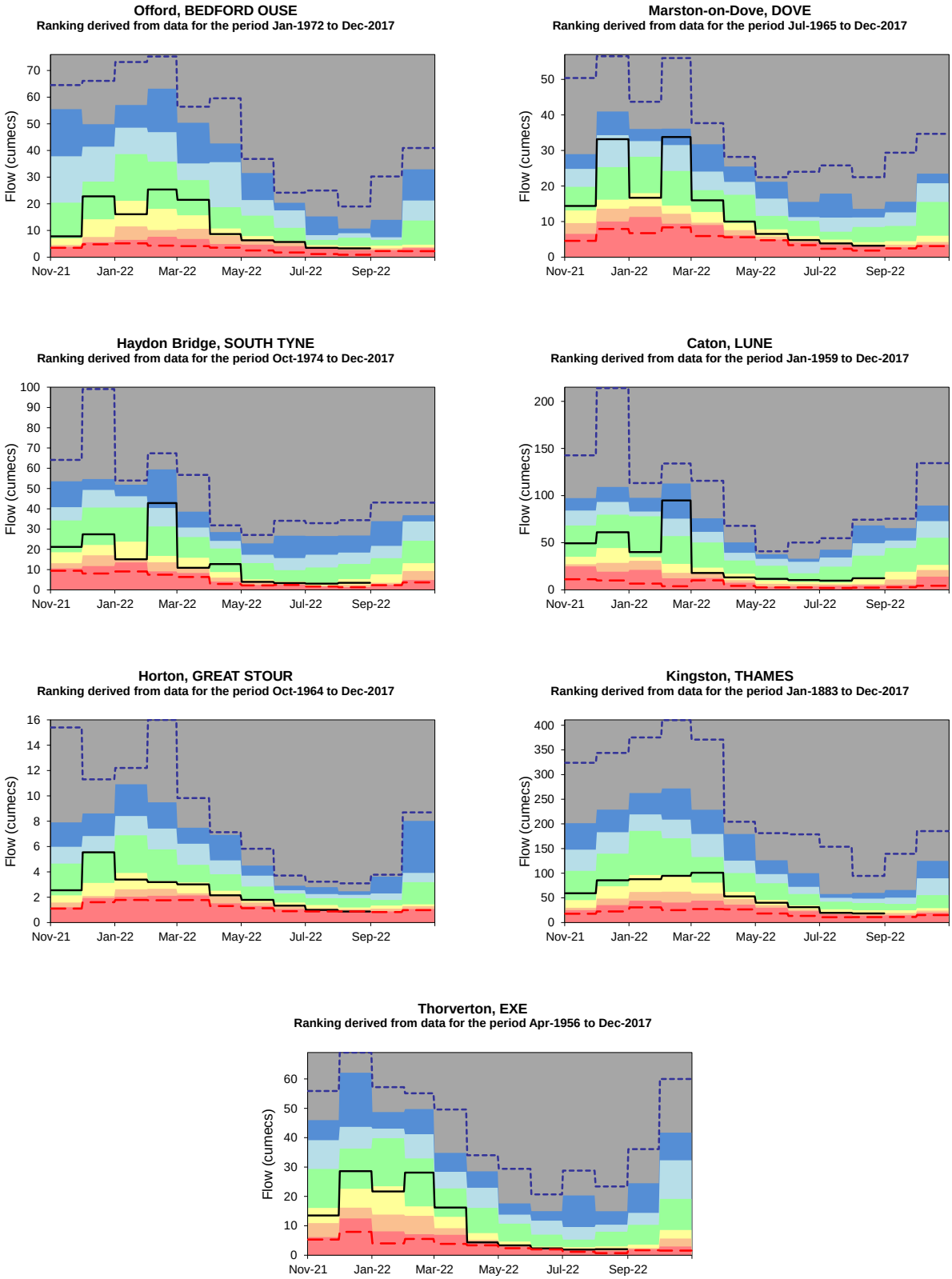
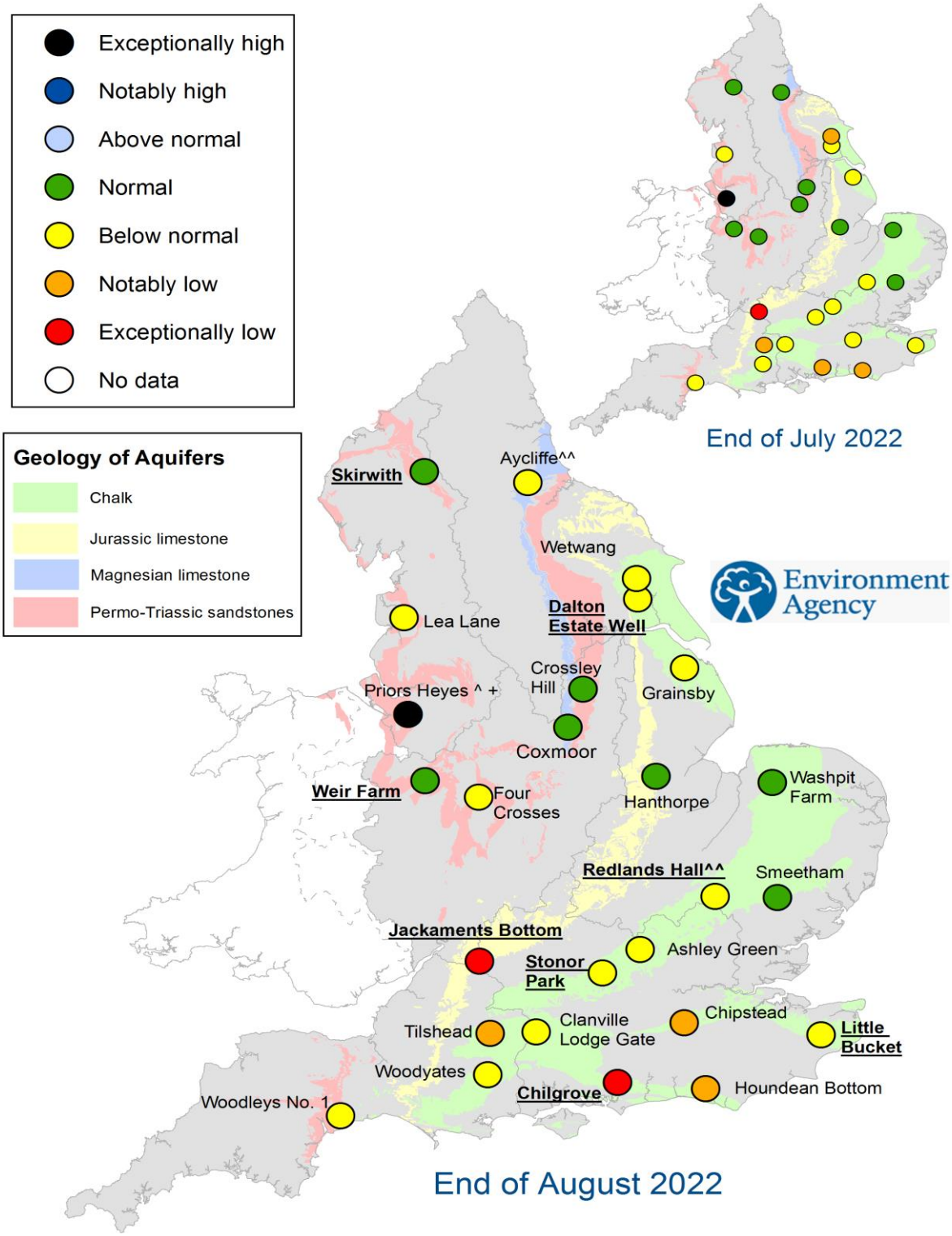


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

Groundwater levels



^ The level at Priors Heyes remains high compared to historic levels because the aquifer is recovering from the effects of historic abstraction
^^ Sites are manually dipped at different times during the month. They may not be fully representative of levels at the month end
+/- End of month groundwater level is the highest/lowest on record for the current month (note that record length varies between sites). Underlined sites are major aquifer index sites and are shown in the groundwater level charts in Figure 4.2

Figure 4.1: Groundwater levels for indicator sites at the end of July 2022 and August 2022, classed relative to an analysis of respective historic July and August levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.

Groundwater level charts

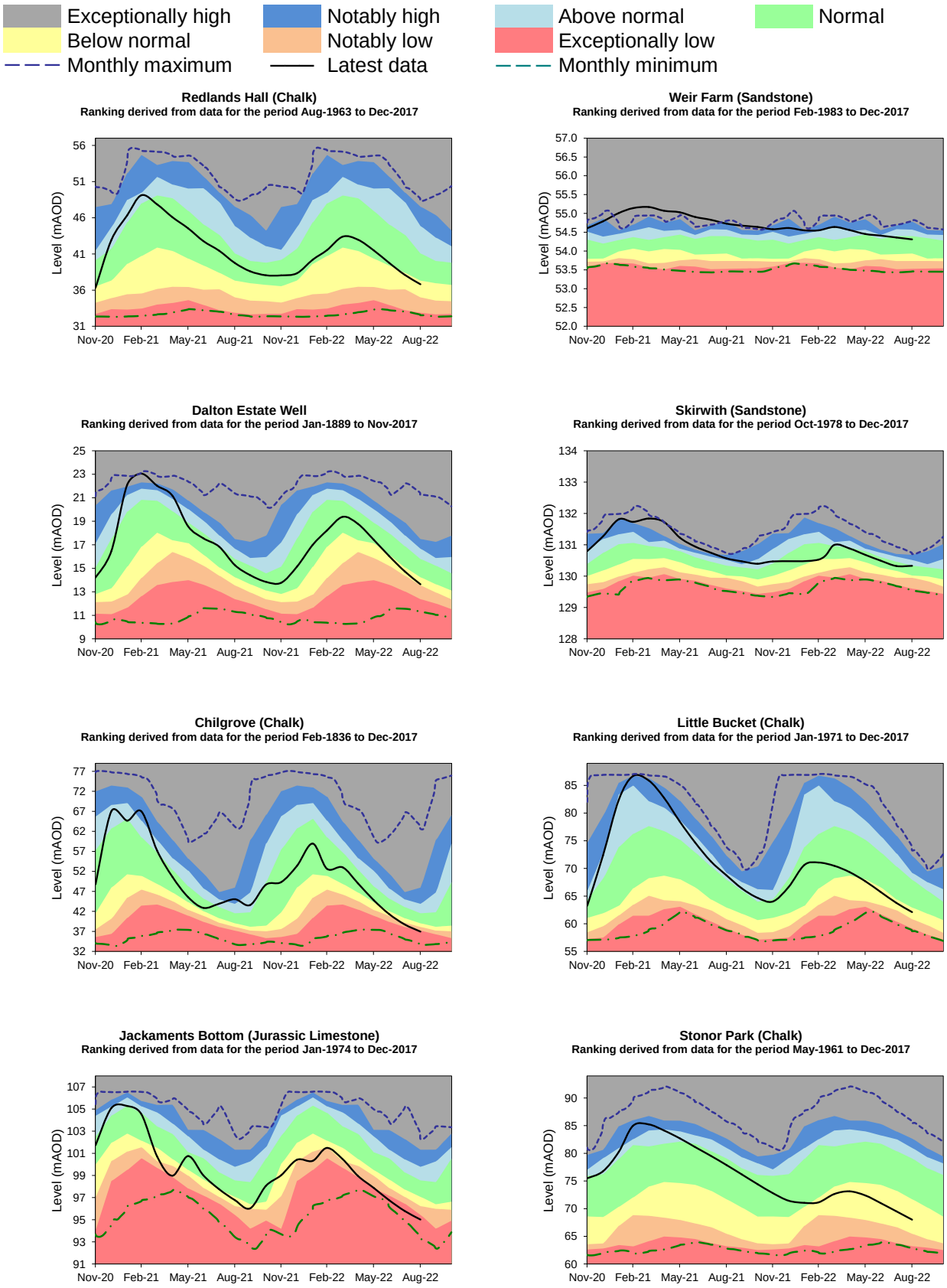
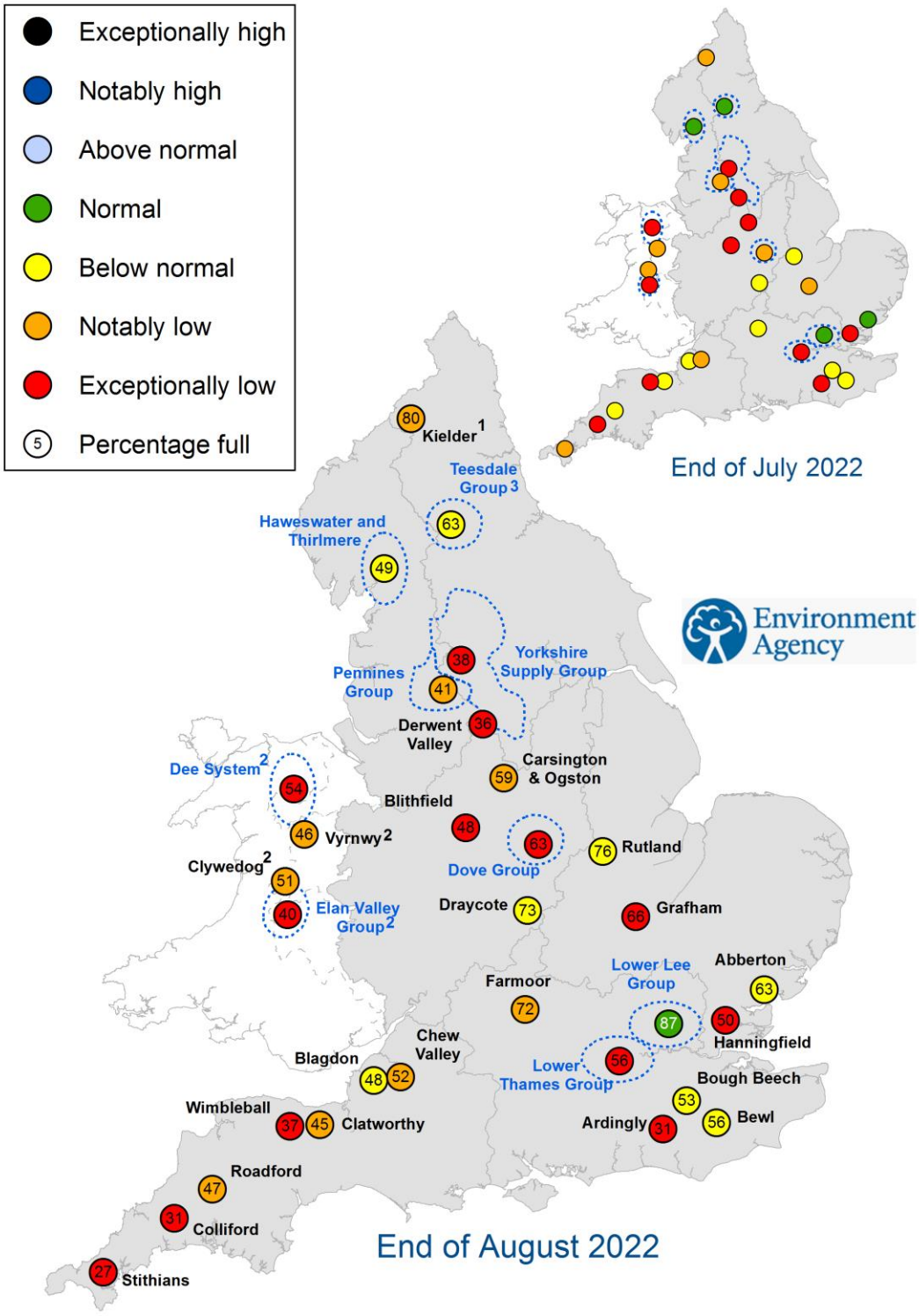


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2022.

Reservoir storage



1. Current levels at Kielder are lower than historical levels due to the implementation of a new flood alleviation control curve
2. Vyrnwy, Clywedog and Elan Valley reservoirs are located in Wales but provide a water resource to Central and north-west England

Figure 5.1: Reservoir stocks at key individual and groups of reservoirs at the end of July 2022 and August 2022 as a percentage of total capacity and classed relative to an analysis of historic July and August values respectively (Source: Water Companies). 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.

Reservoir storage charts

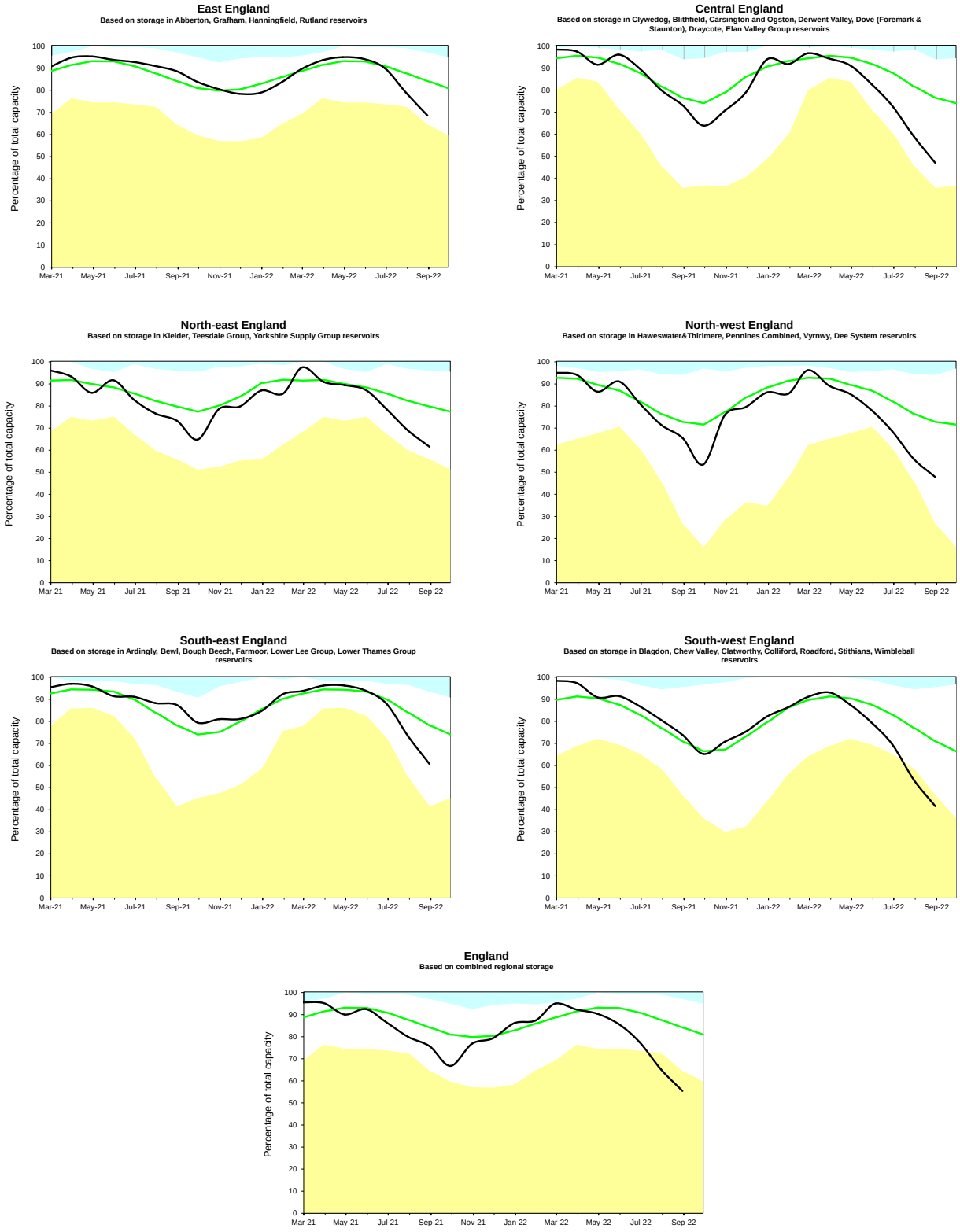


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look: river flow

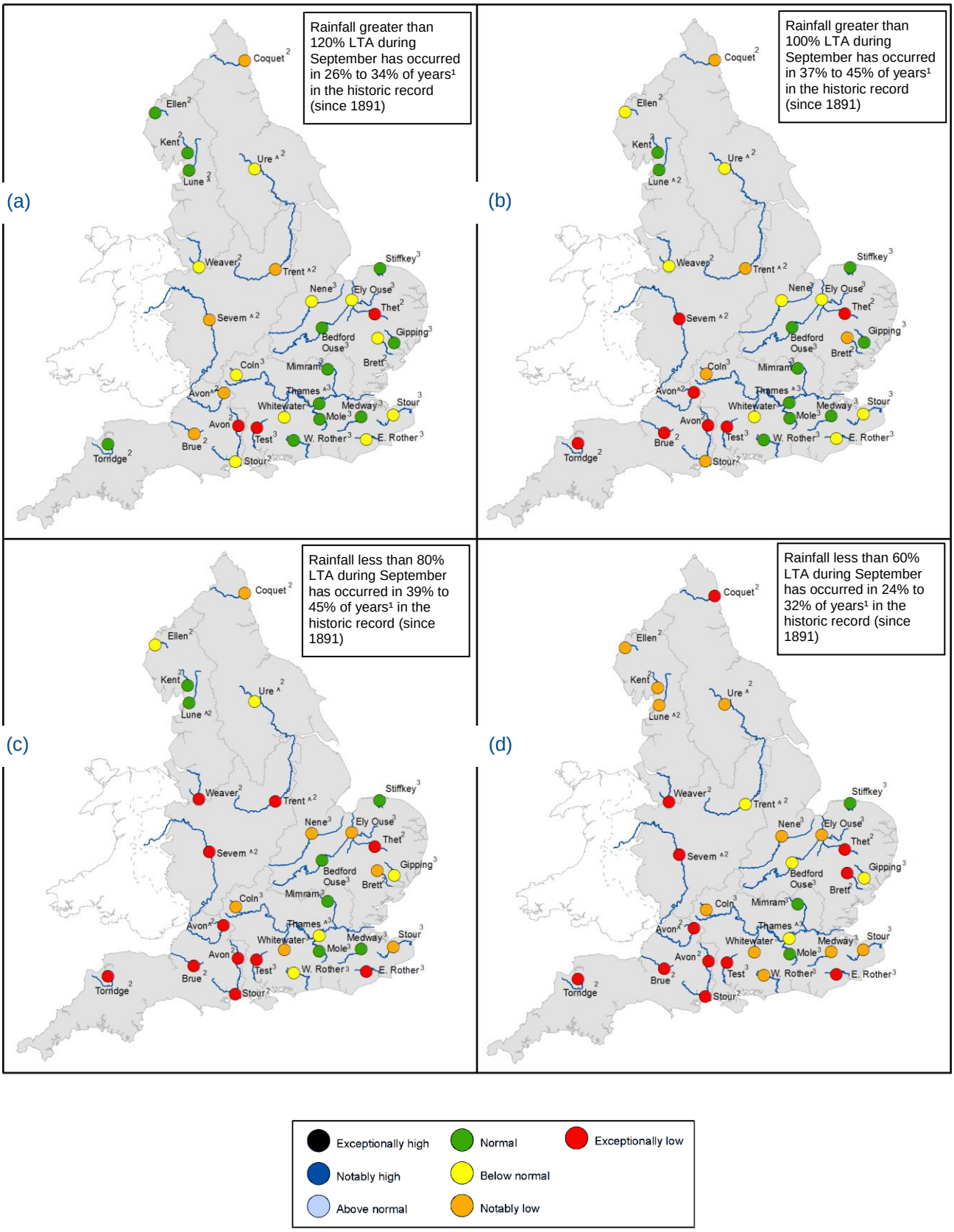


Figure 6.1: Projected river flows at key indicator sites up until the end of September 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall during September 2022 (Source: UK Centre for Ecology and Hydrology, Environment Agency)

[1] This range of probabilities is a regional analysis
[2] Projections for these sites are produced by UK CEH
[3] Projections for these sites are produced by the Environment Agency
^ *"Naturalised" flows are projected for these sites*

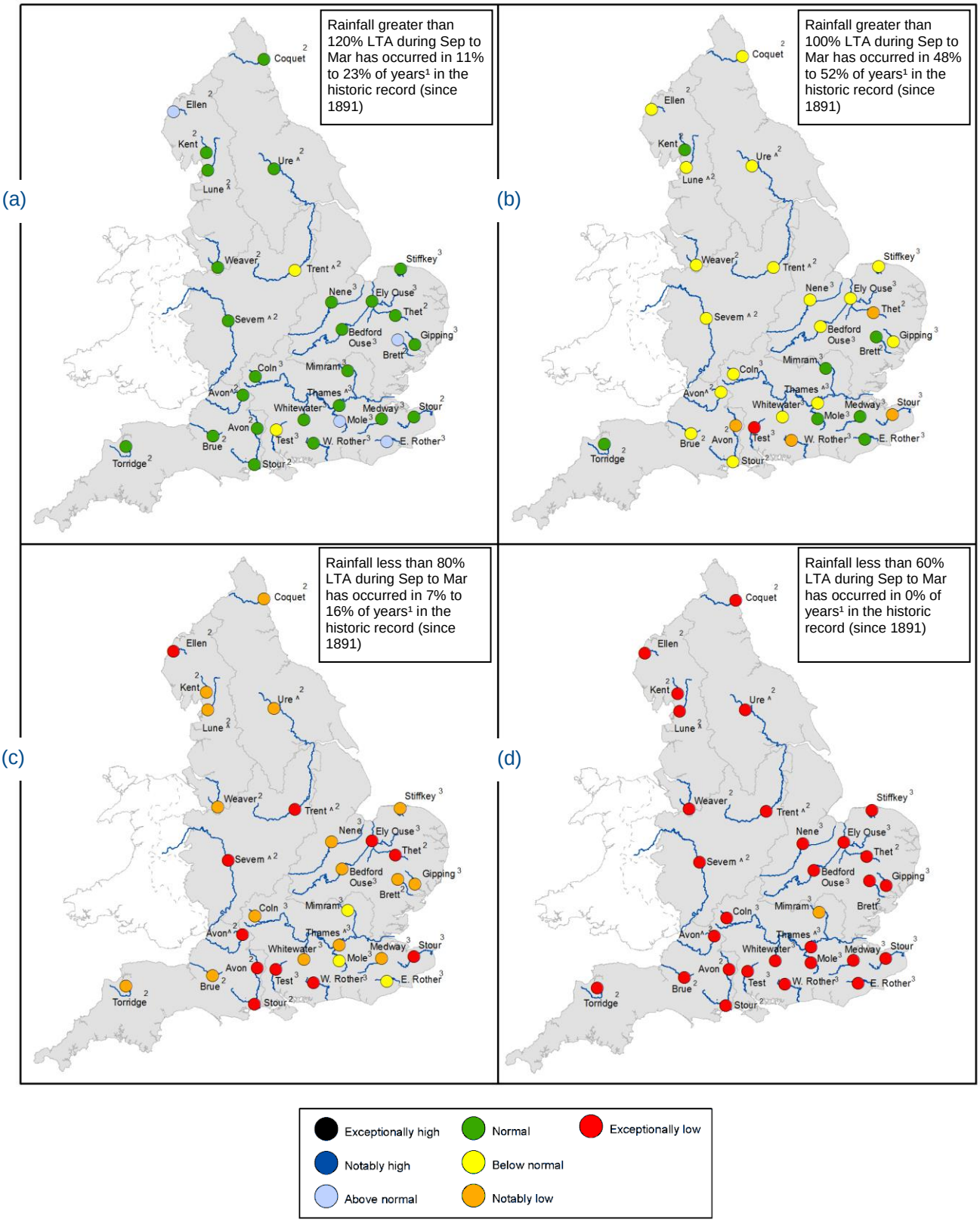


Figure 6.2: Projected river flows at key indicator sites up until the end of March 2023. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between September 2022 and March 2023 (Source: UK Centre for Ecology and Hydrology, Environment Agency)

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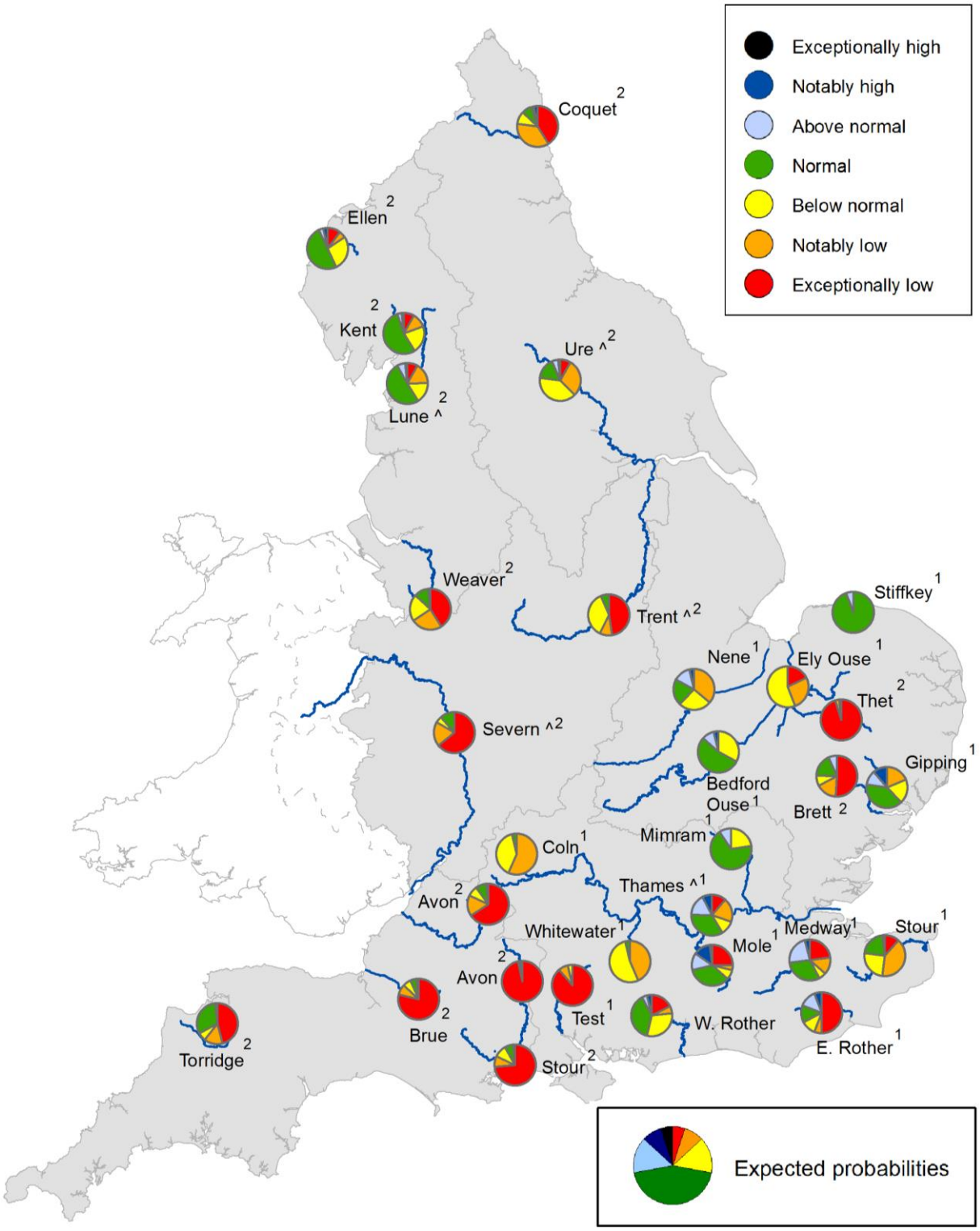

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.

Figure 6.3: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2022. 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. (Source: UK Centre for Ecology and Hydrology, Environment Agency).

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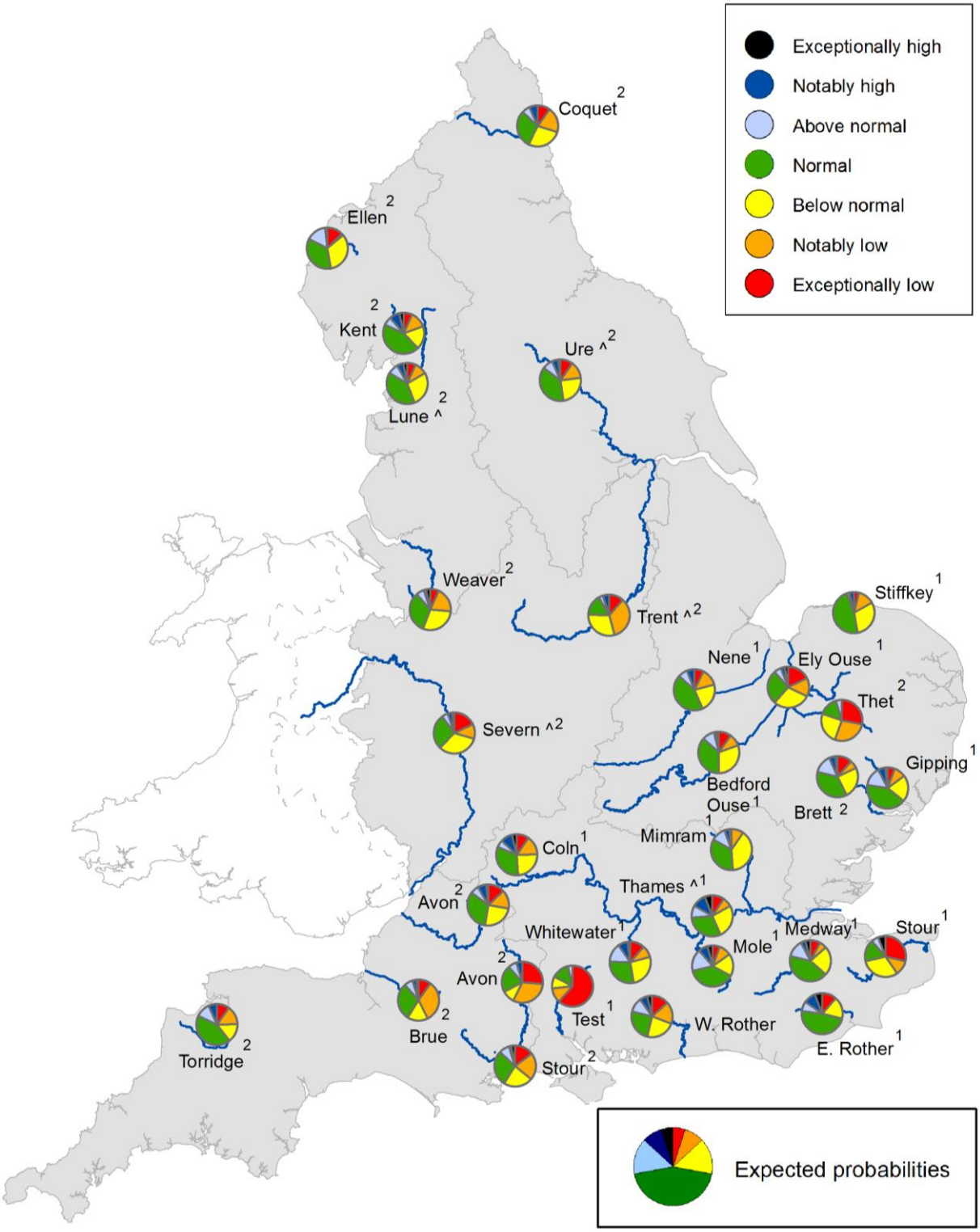

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of March 2023. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. (Source: UK Centre for Ecology and Hydrology, Environment Agency).

[1] Projections for these sites are produced by the Environment Agency
[2] Projections for these sites are produced by UK CEH
^"Naturalised" flows are projected for these sites

Forward look: groundwater

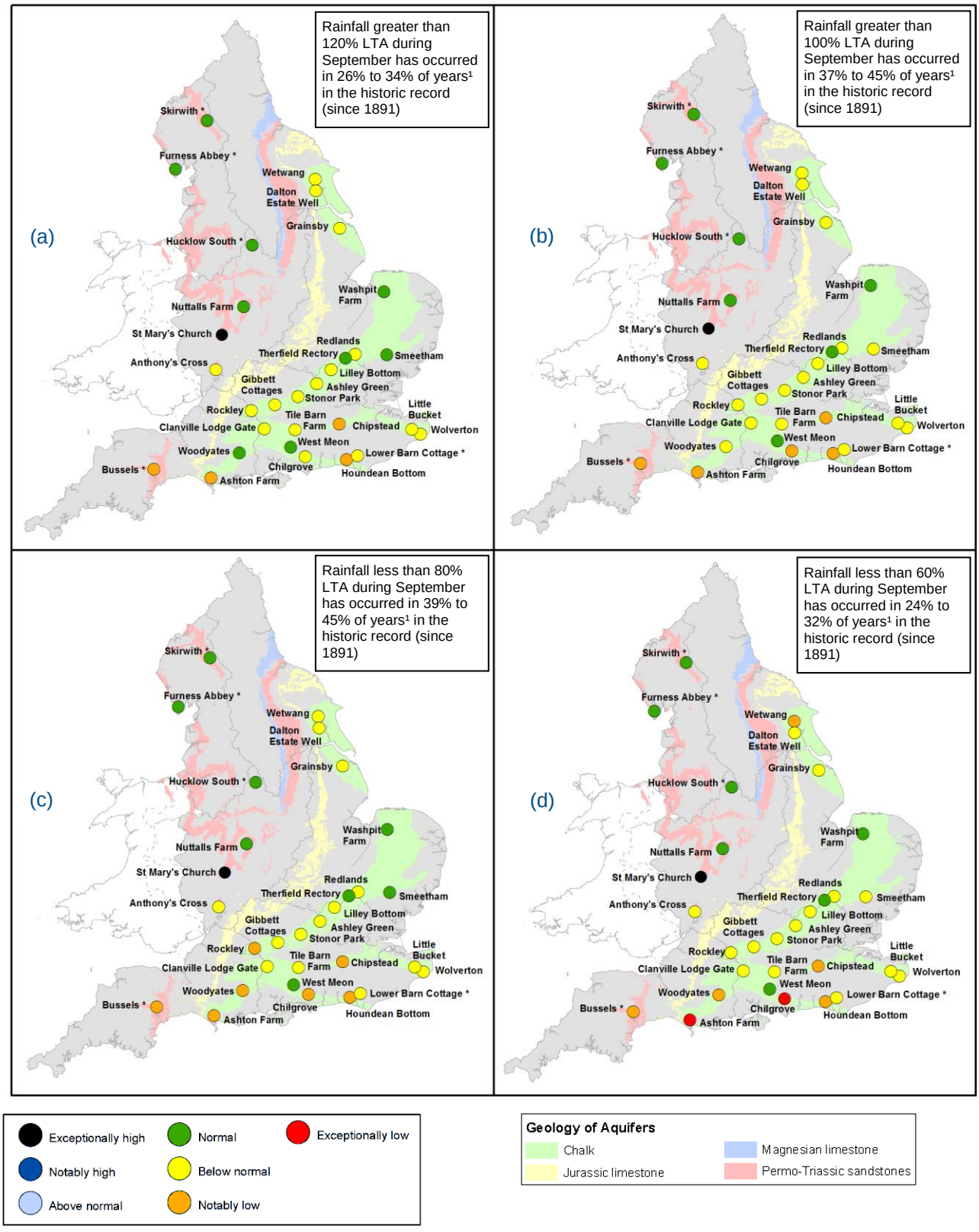

Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall during September 2022 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100024198, 2022.

* Projections for these sites are produced by BGS
[1] This range of probabilities is a regional analysis

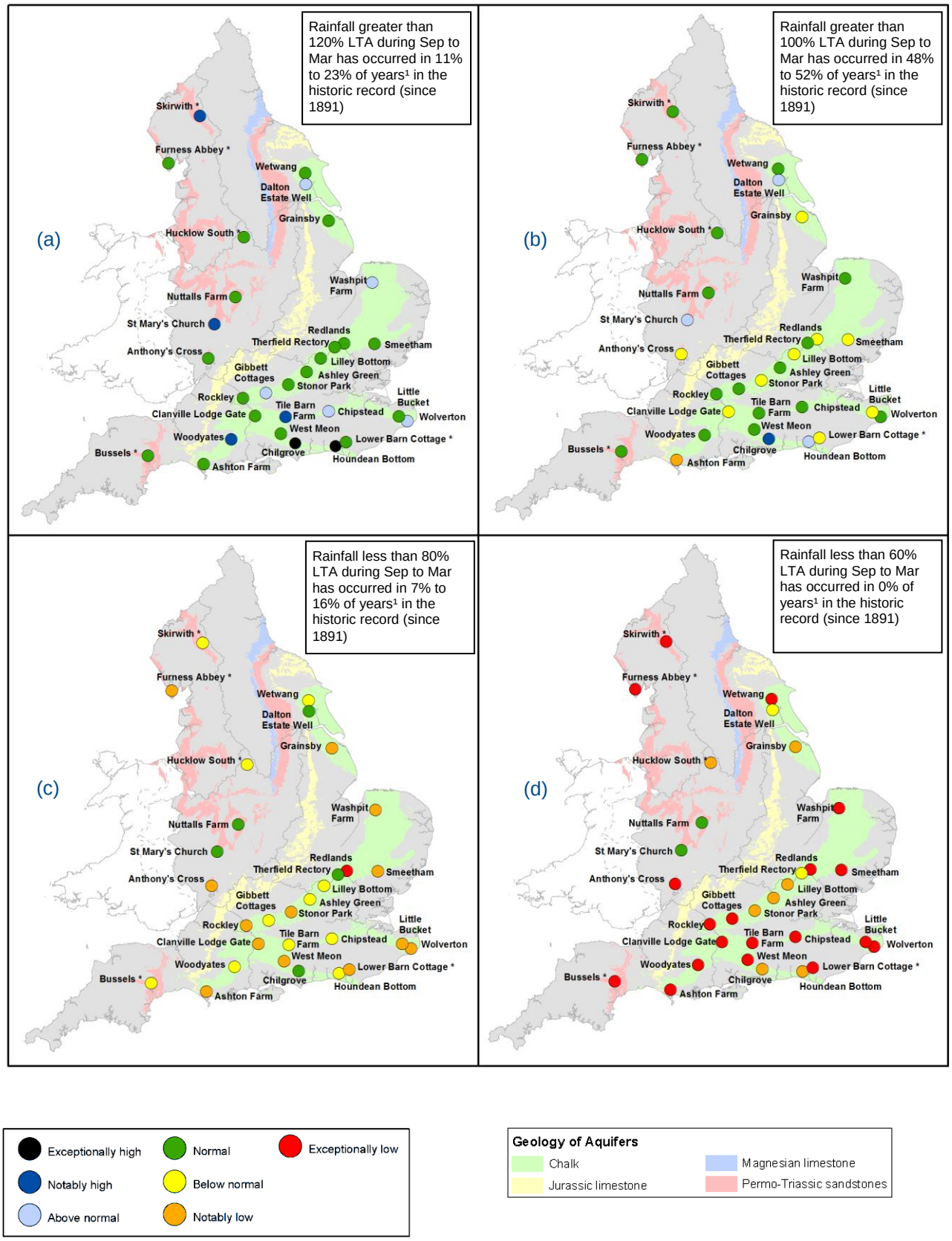

Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2023. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between September 2022 and March 2023 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100024198 2022.

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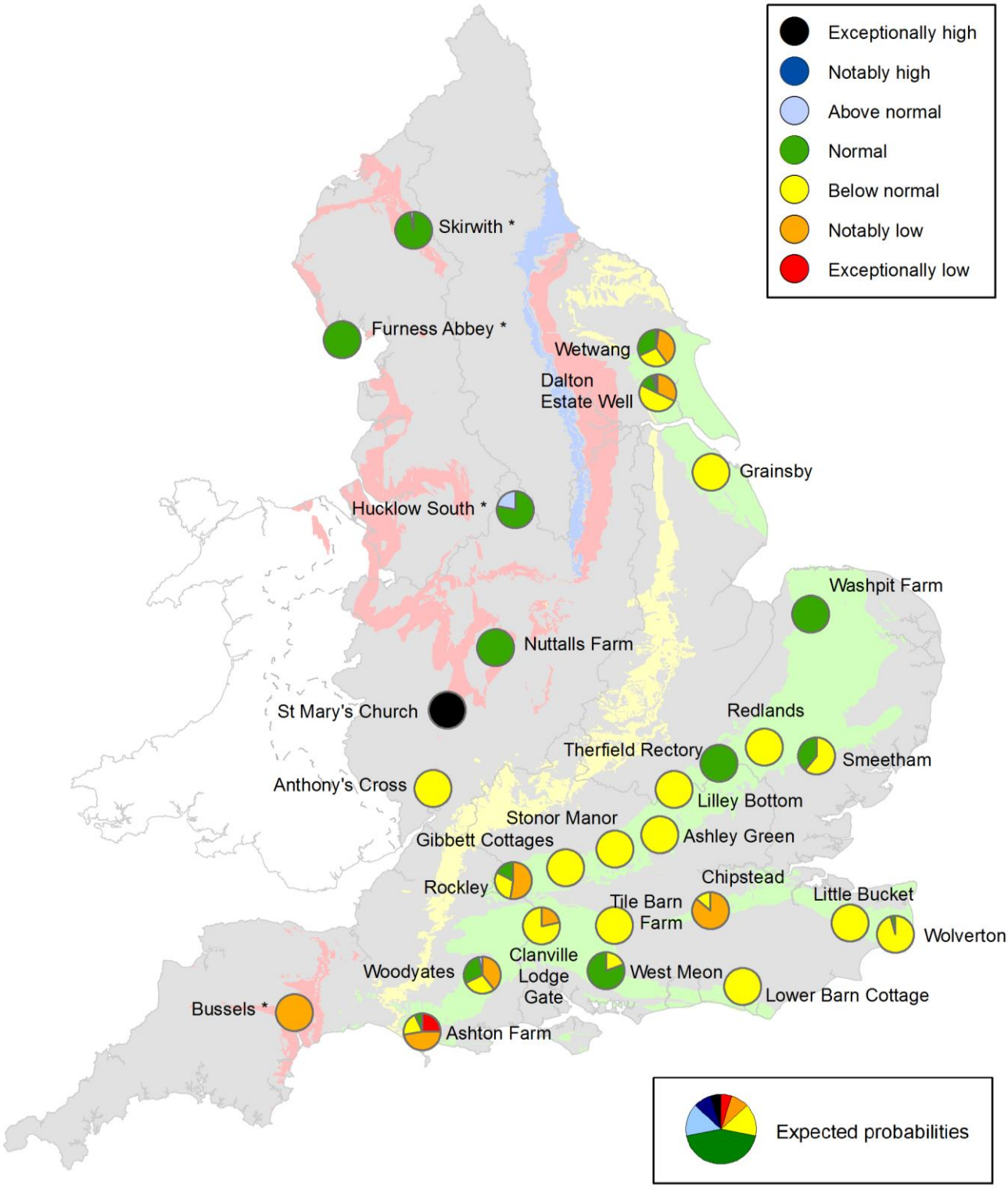

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.

Figure 6.7: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of September 2022. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for the time of year. (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.

** Projections for these sites are produced by BGS*

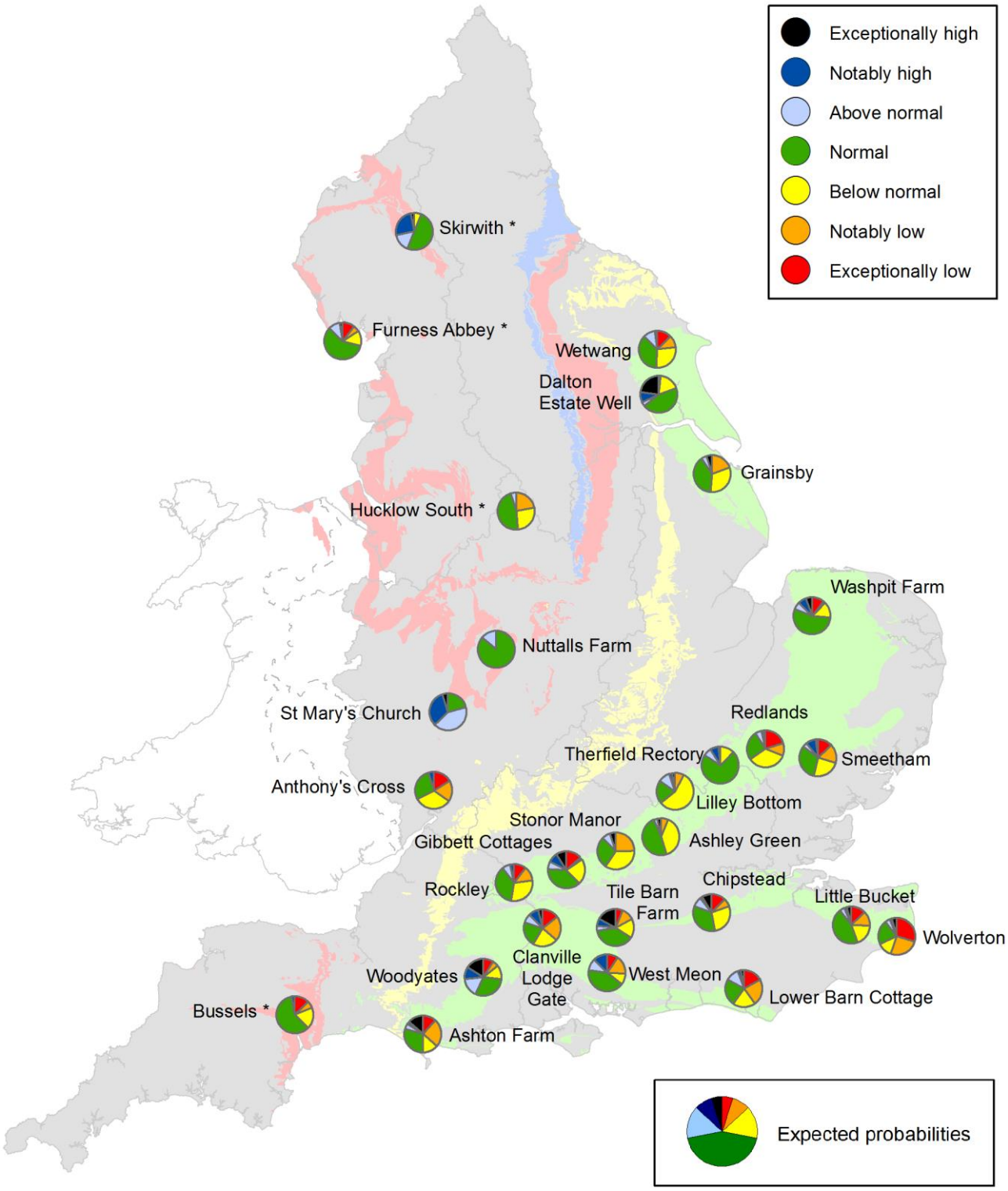

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Figure 6.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of March 2023. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for the time of year. (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.

* Projections for these sites are produced by BGS

Figure 7.1: Geographic regions

Glossary

Term	Definition
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/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. For rainfall and soil moisture deficit, the period refers to 1961 to 1990, unless otherwise stated. For other parameters, the period may vary according to data availability
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).

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