Monthly water situation report

England

Summary – July 2022

It was the driest July across England since 1935 with monthly rainfall totals for the majority of catchments classed as exceptionally low for the time of year. It was also the fifth consecutive month across England with below average rainfall. With low rainfall and high temperatures, soils have continued to get drier across the country with end of July soils much drier than would typically be expected for the time of year. River flows decreased in July at most of the indicator sites we report on and the majority of sites are classed as notably low for the time of year. Groundwater levels also decreased at all sites we report on during July and remain below normal at the majority of sites for the time of year. Reservoir stocks in July decreased at all of the reservoirs and reservoir groups we report on. At the end July stocks in England were 65.2%.

Rainfall

The July rainfall total for England was 23.1mm, the driest July since 1935, being 39% of the 1961-1990 long term average (LTA) (35% of the 1991-2020 LTA). The majority of catchments received exceptionally low rainfall during July, with the lowest monthly totals seen across south-east England. 5 hydrological areas along the south coast received less than 2mm with both the Pevensey Levels in east Sussex and the New Forest receiving only 3% of the LTA. Out of 139 catchments, 39 experienced the driest July on record and 99 were in the top ten driest (using records from 1891). The Wyre and Lune catchment in north-west England was the wettest part of the country receiving 99% of LTA for the time of year. (Figure 1.1)

July rainfall totals were classed as exceptionally low at two-thirds of catchments across the country. The three month cumulative totals show the majority of catchments were classed as notably low. The six month cumulative rainfall totals were classed as below normal and notably low across the majority of England with sixteen catchments in south-east England classed as exceptionally low. Twelve month cumulative totals show that nearly two-thirds of catchments across the country were classed as notably low (Figure 1.2)

At a regional scale, with the exception of north-east and north-west England which were below normal, July rainfall totals across all regions and for England as a whole were classed as exceptionally low. It was the driest July on record across east and south-east England (using records from 1891). (Figure 1.3)

Soil moisture deficit

Soil moisture deficits (SMD) continued to increase (soils became drier) across the country as expected at this time of year due to warmer, at times record breaking temperatures. (Figure 2.1)

End of July soil moisture deficits (SMD) were greater (drier) than the long term average (LTA) for the time of year across England. Soils were drier than would be typically expected for July throughout England. Soil moisture deficits reduced (soils became wetter) in parts of north-west and north-east England towards the end of July due to rainfall at the end of the month. Elsewhere, across other geographic regions of England, end of month SMDs were close to, but not drier than those at the end of July 1976. (Figure 2.2)

River flows

July monthly mean river flows decreased at all but three of the indicator sites we report on compared to the previous month. A quarter of sites across England remain classed as below normal although the majority of sites were classed as notably low for July. More than a quarter were classed as exceptionally low for the time of year. (Figure 3.1)

With the exception of the River Lune in north-west England which remains classed as normal and the Great Stour which is classed as exceptionally low all other regional index site monthly mean flows were classed as below normal or notably low for the time of year (Figure 3.2). July monthly means were the lowest on record on the Ely Ouse at Denver (records start 1970).

Groundwater levels

Groundwater levels at all of the reported indicator sites during July decreased as they continued their seasonal decline. End of month groundwater levels were classed as normal at nearly a third of indicator sites although the majority are now classed as below normal – particularly in the chalk aquifers of southern England. (Figure 4.1)

The major aquifer index sites show a varied picture at the end of July. Index sites in the major aquifers ranged from normal levels in the sandstone aquifers in central England at Weir Farm and north-west England at Skirwith to exceptionally low at Jackaments Bottom in the Burford Jurassic limestone in the Cotswolds. In the southern Chalk levels at Little Bucket and Stonor Park were below normal while Chilgrove was notably low (Figure 4.2).

Reservoir storage

End of July reservoir stocks decreased at all reservoirs and reservoir groups we report on. More than two-thirds of reservoirs or groups recorded a decrease of over 10% of total capacity in comparison to the end of June; Ardingly and Hanningfield reservoirs both had the largest decreases at 21%. (Figure 5.1)

The majority of reservoirs were classed as exceptionally low for the time of year based upon their previous operation. End of month reservoir stocks were classed as normal for the time of year at only 4 of the reported reservoirs. (Figure 5.1)

At a regional scale, total reservoir stocks ranged from 54% in south-west England to 79% in east England. Total reservoir stocks decreased by 12.4% in July which is similar to July 1995 (11.7% decrease) and July 2018 (13% decrease). Total reservoir stocks for England were at 65.2% of total capacity at the end of July (Figure 5.2) their lowest end of July level since end of July 1995.

Forward look

August started much as July had ended, with largely dry conditions and some rainfall in the north of the country. Moving through the month, temperatures are expected to remain above average, with very warm conditions in the south. The north is expected to receive some rainfall, and there is a chance of thunderstorms in the south. Towards the end of the month conditions are likely to become less settled for many, with increasingly unsettled conditions in the north and west. Temperatures will continue to be warm for many, with humid conditions in the south where temperatures are expected to be highest.

For the three month period from August to October for the UK there is an increased chance of warm conditions consistent with an increased westerly flow from warmer than average seas. Any rainfall is likely to follow the typical pattern of wetter conditions in the north-west and drier conditions in the south-east. [1]

Projections for river flows at key sites[2]

By the end of September 2022 more than half of all modelled sites will have a greater than expected chance of cumulative river flows being below normal or lower for the time of year. By the end of March 2023 three quarters of all modelled sites have a greater than expected chance of cumulative river flows being notably low 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 half of all modelled sites will have a greater than expected chance of groundwater levels being below normal for the time of year. By the end of March 2023 the majority of all modelled 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 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

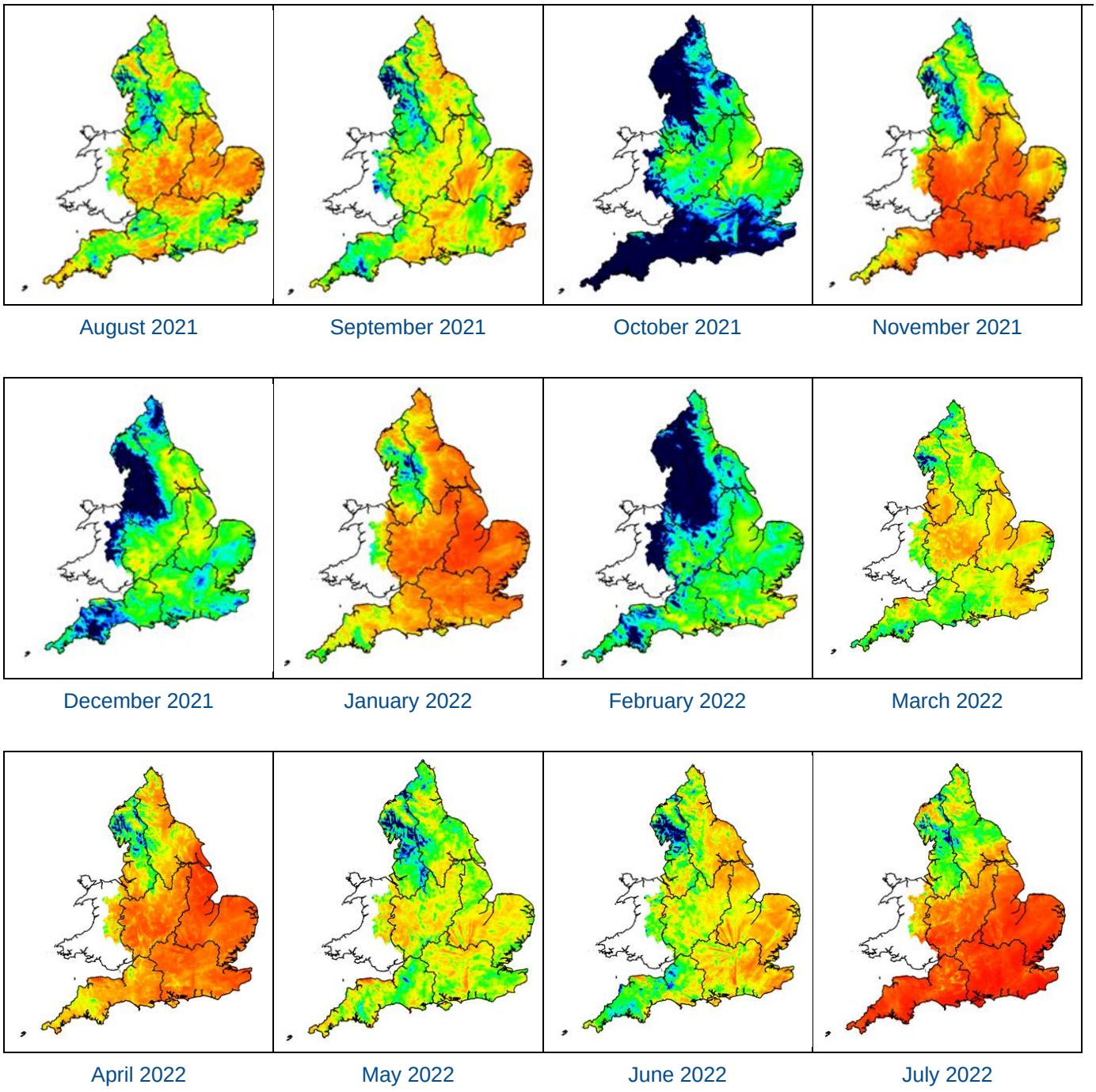


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2022). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.

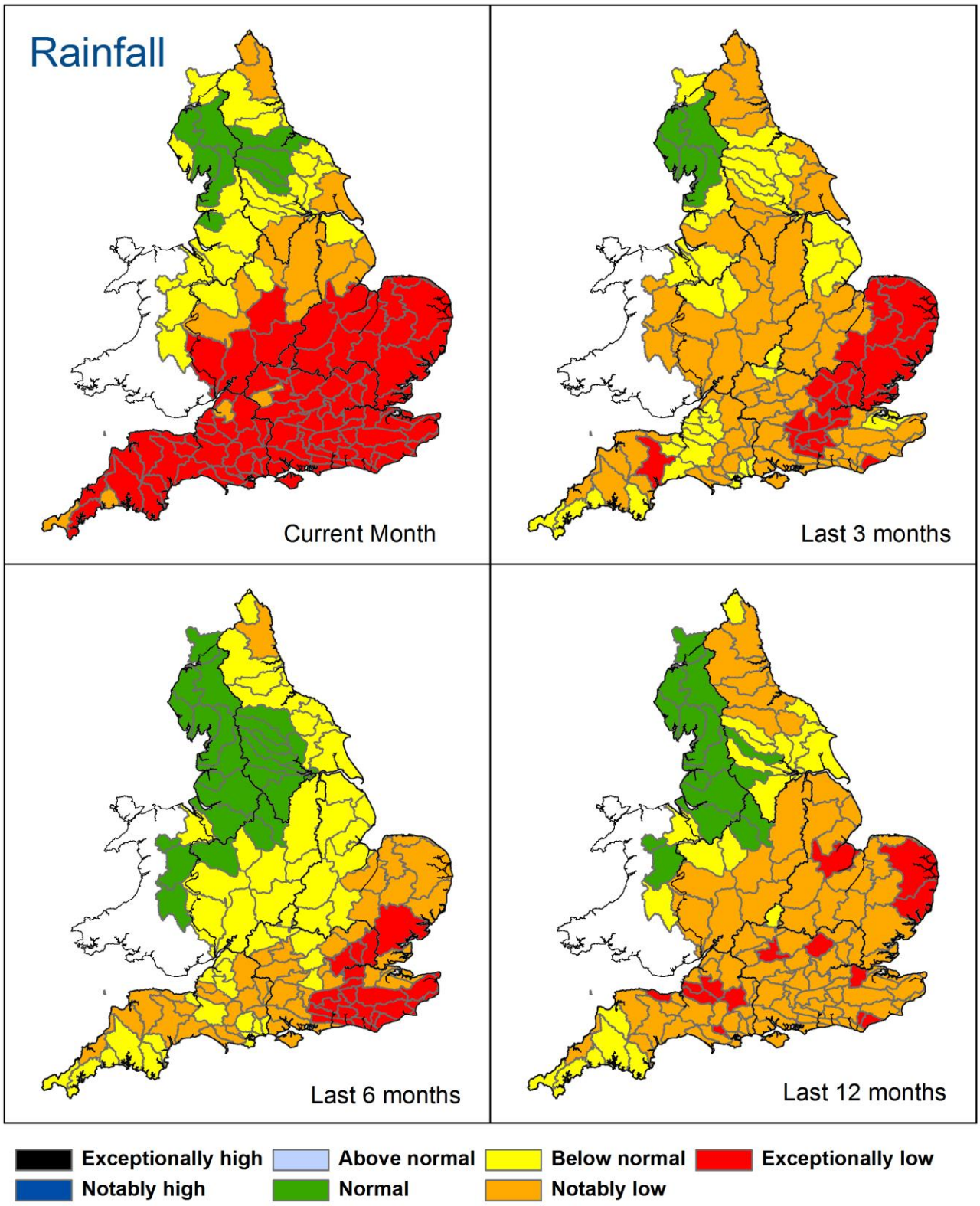


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 July), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived 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

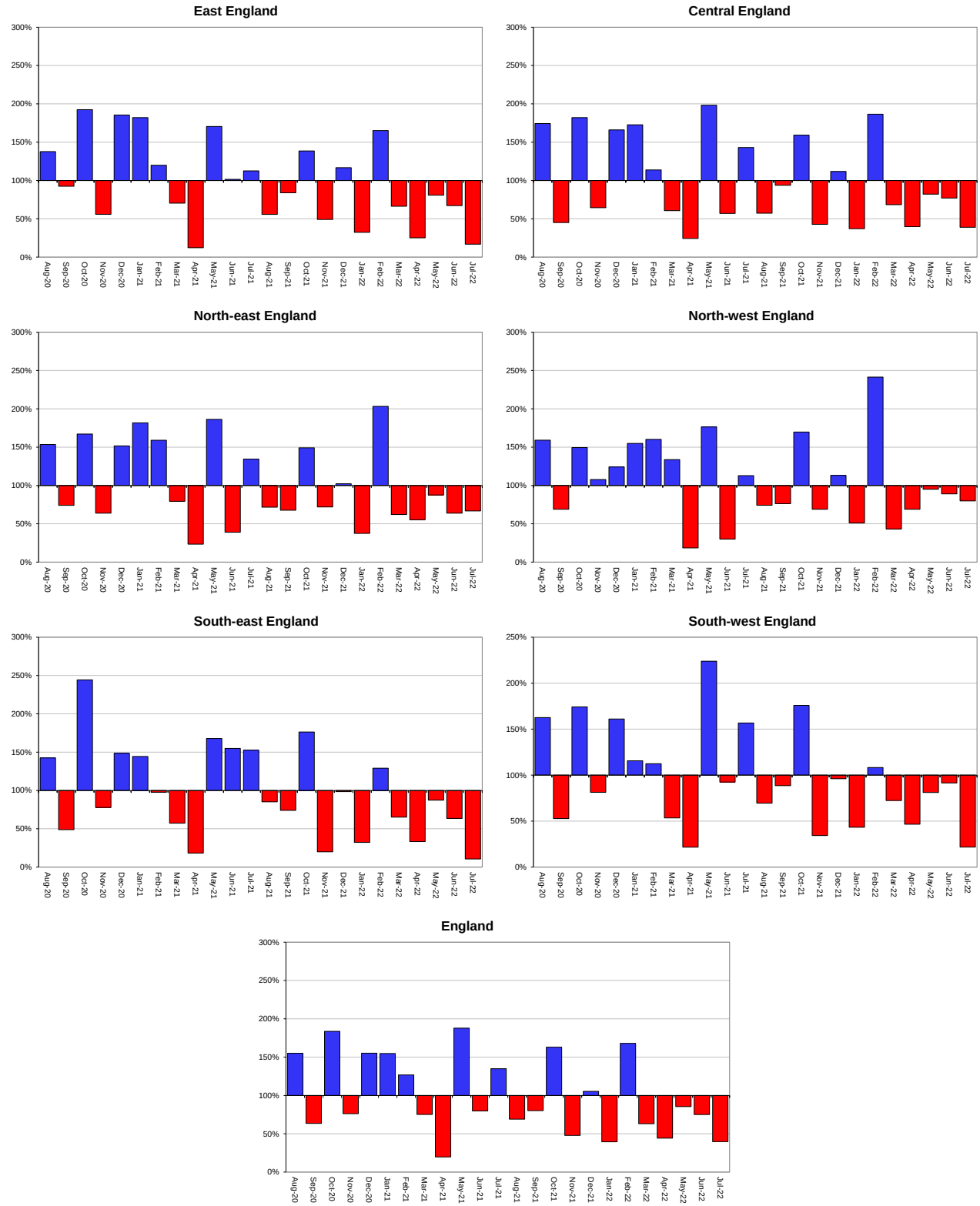


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2022).

Soil moisture deficit

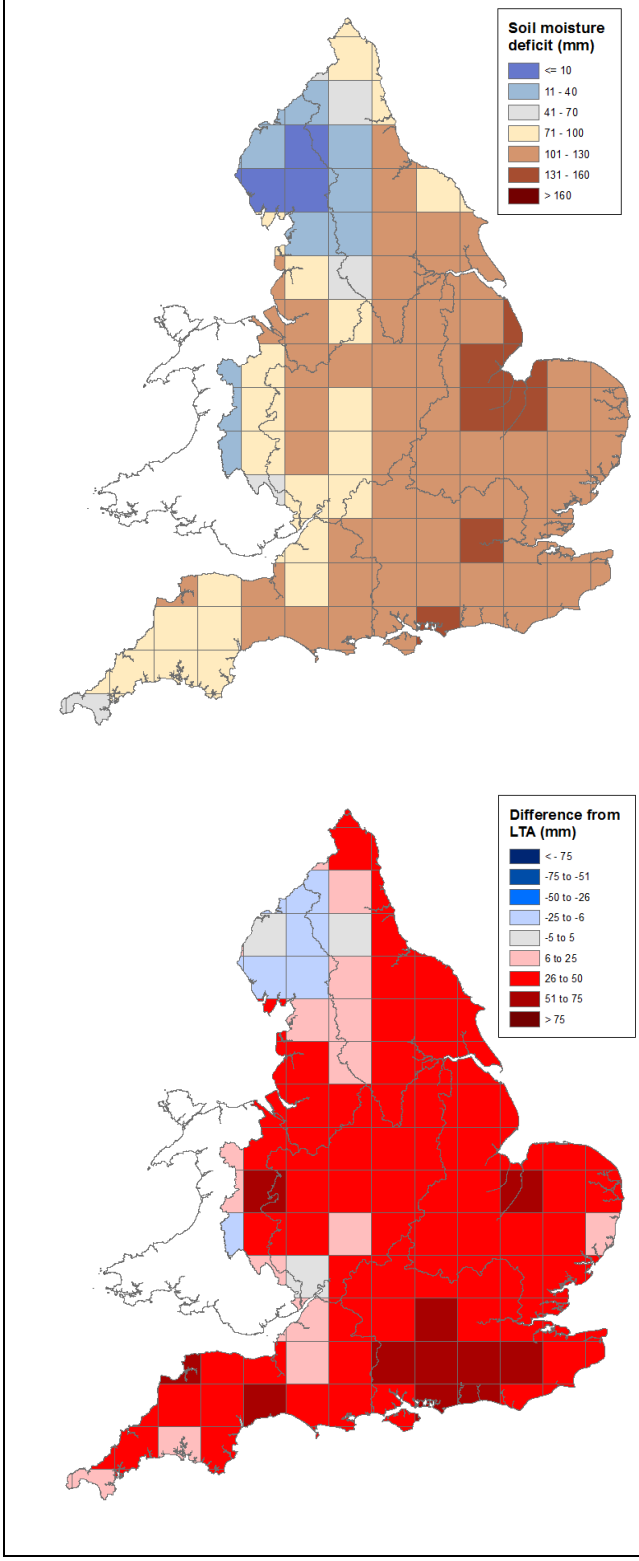
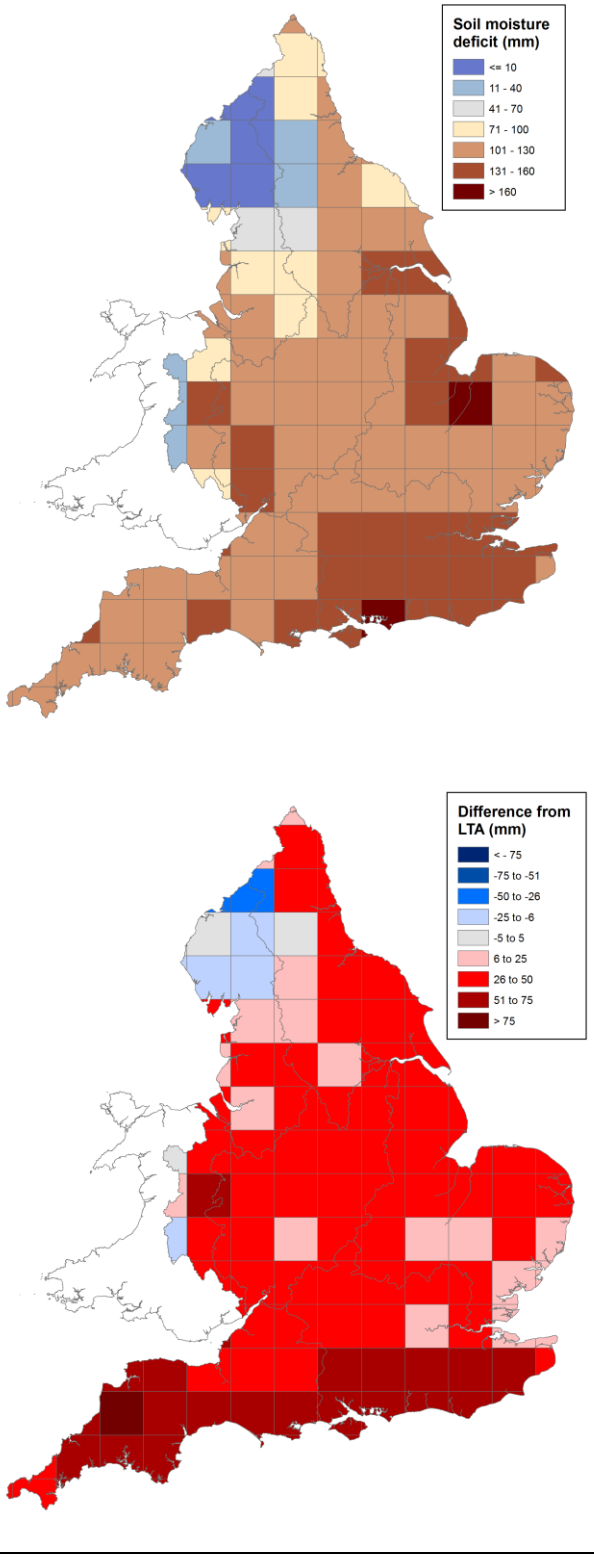
End of June 2022[1]	End of July 2022[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 28 June 2022 [1] (left panel) and 2 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, 2022). Crown copyright. All rights reserved. Environment Agency, 100024198, 2022

Soil moisture deficit charts

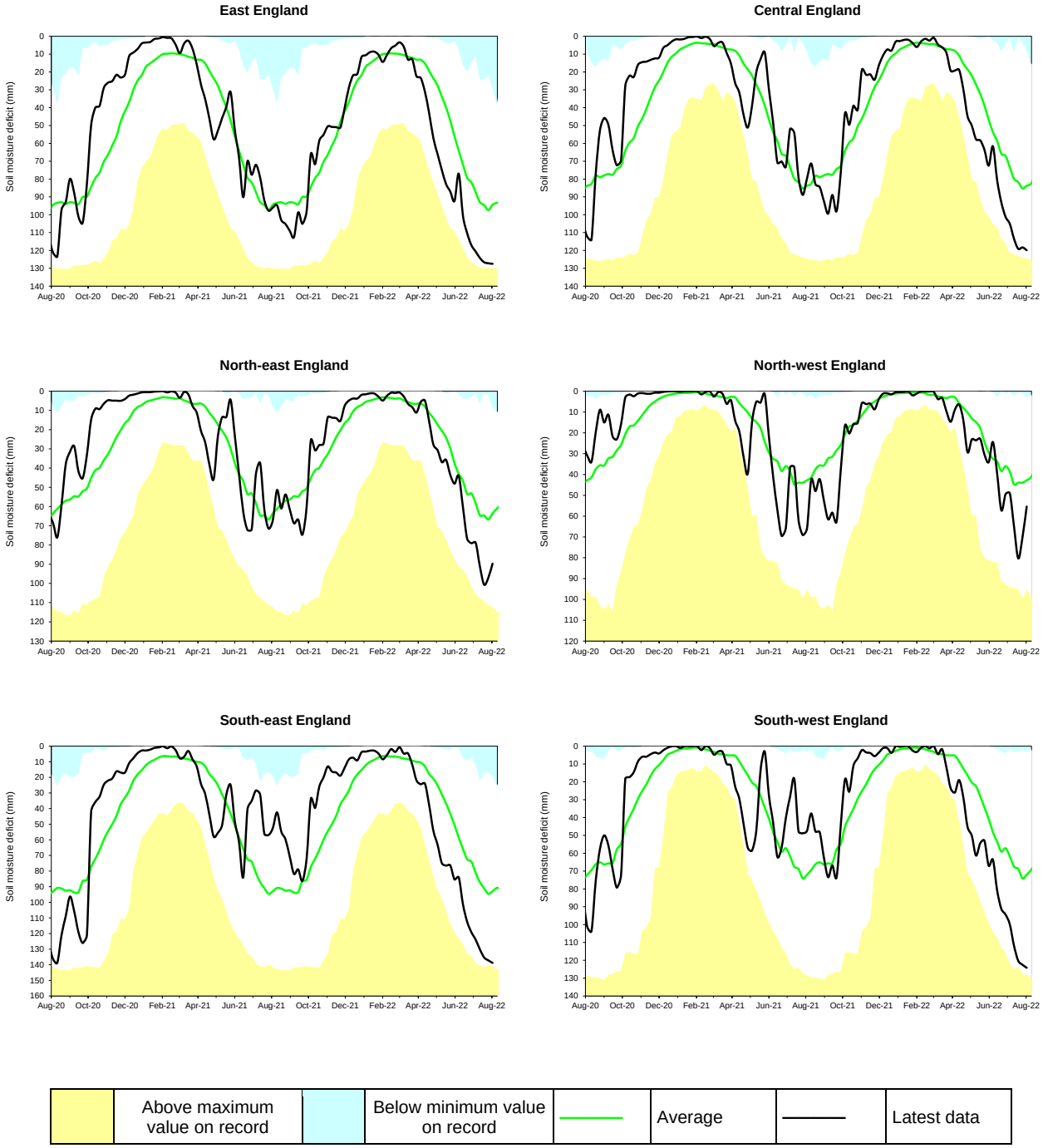
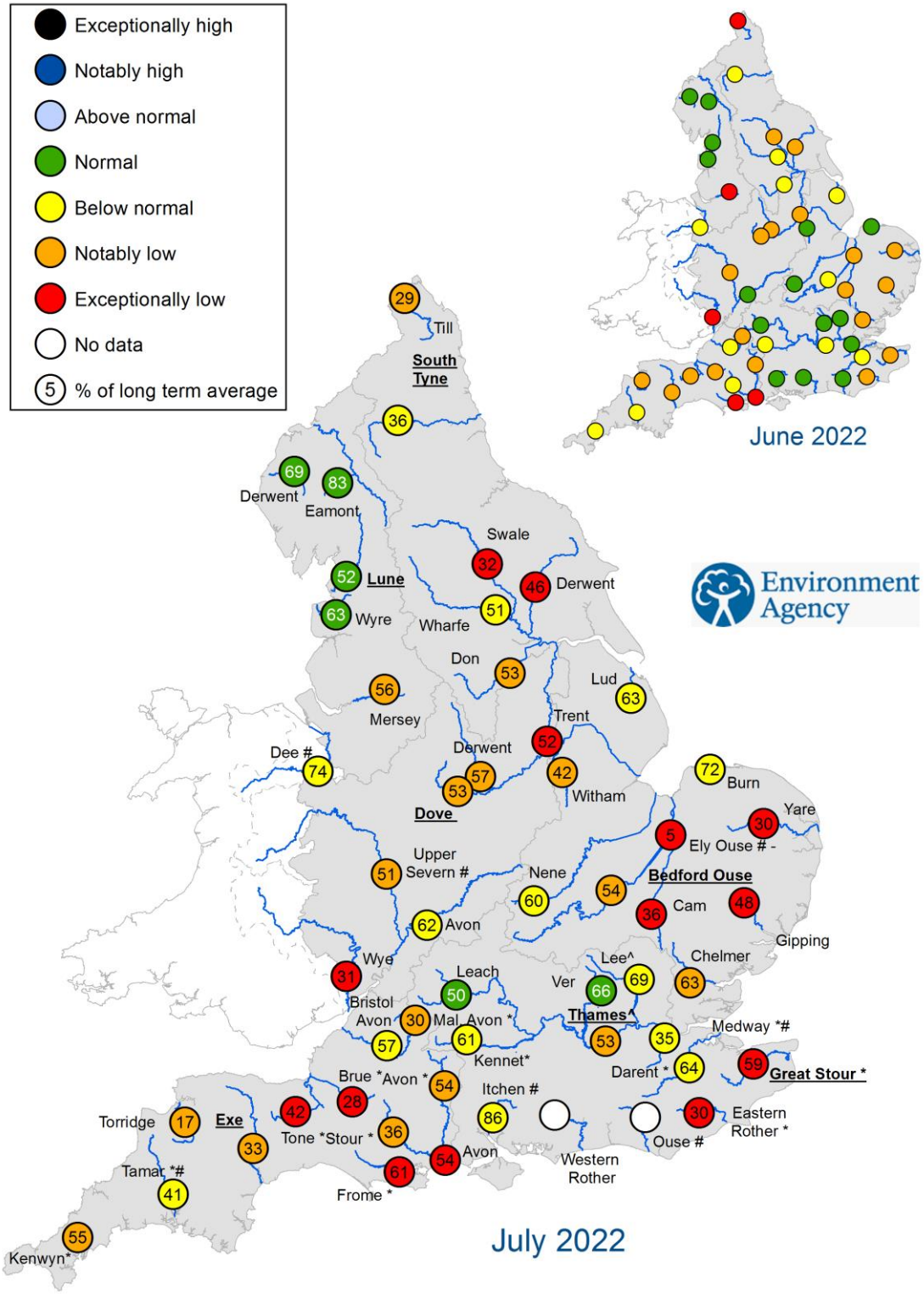


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2022).

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)

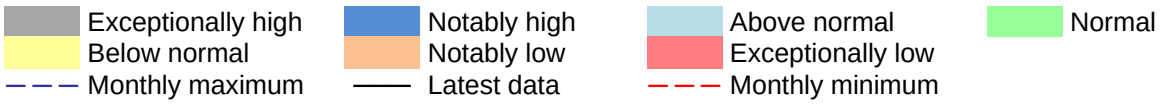
* Flows may be overestimated at these sites – data should be treated with caution

\# Flows may be impacted at these sites by water releases from upstream reservoirs

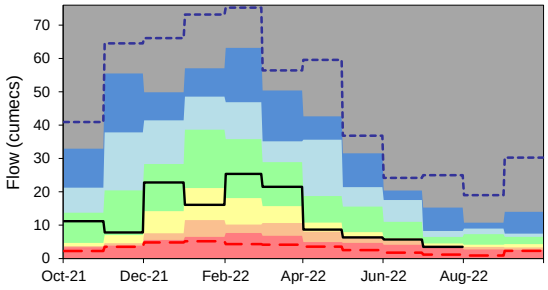
Underlined sites are regional index sites and are shown on the hydrographs in Figure 3.2

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

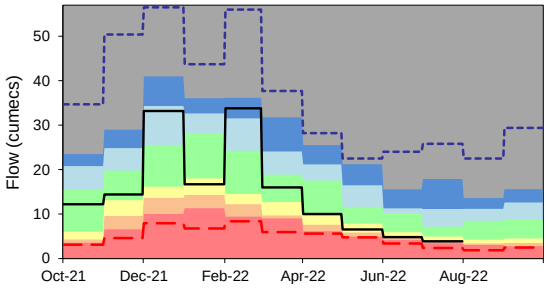
River flow charts



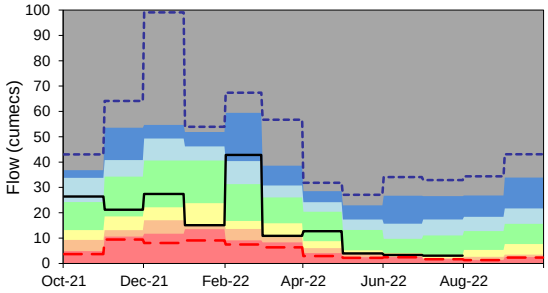
Offord, BEDFORD OUSE
Ranking derived from data for the period Jan-1972 to Dec-2017



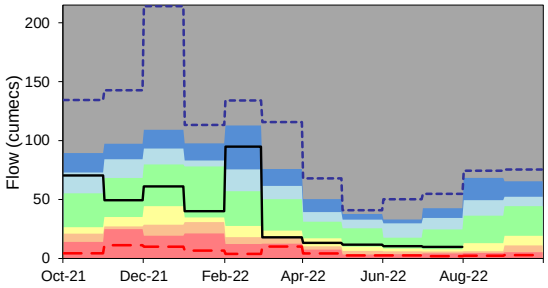
Marston-on-Dove, DOVE
Ranking derived from data for the period Jul-1965 to Dec-2017



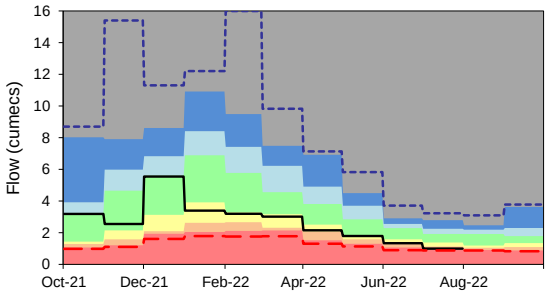
Haydon Bridge, SOUTH TYNE
Ranking derived from data for the period Oct-1974 to Dec-2017



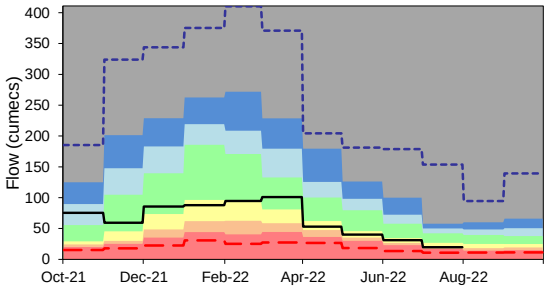
Caton, LUNE
Ranking derived from data for the period Jan-1959 to Dec-2017



Horton, GREAT STOUR
Ranking derived from data for the period Oct-1964 to Dec-2017



Kingston, THAMES
Ranking derived from data for the period Jan-1883 to Dec-2017



Thorverton, EXE
Ranking derived from data for the period Apr-1956 to Dec-2017

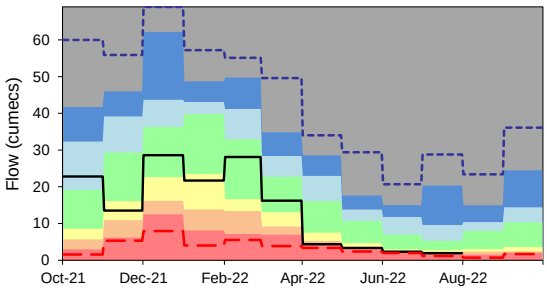
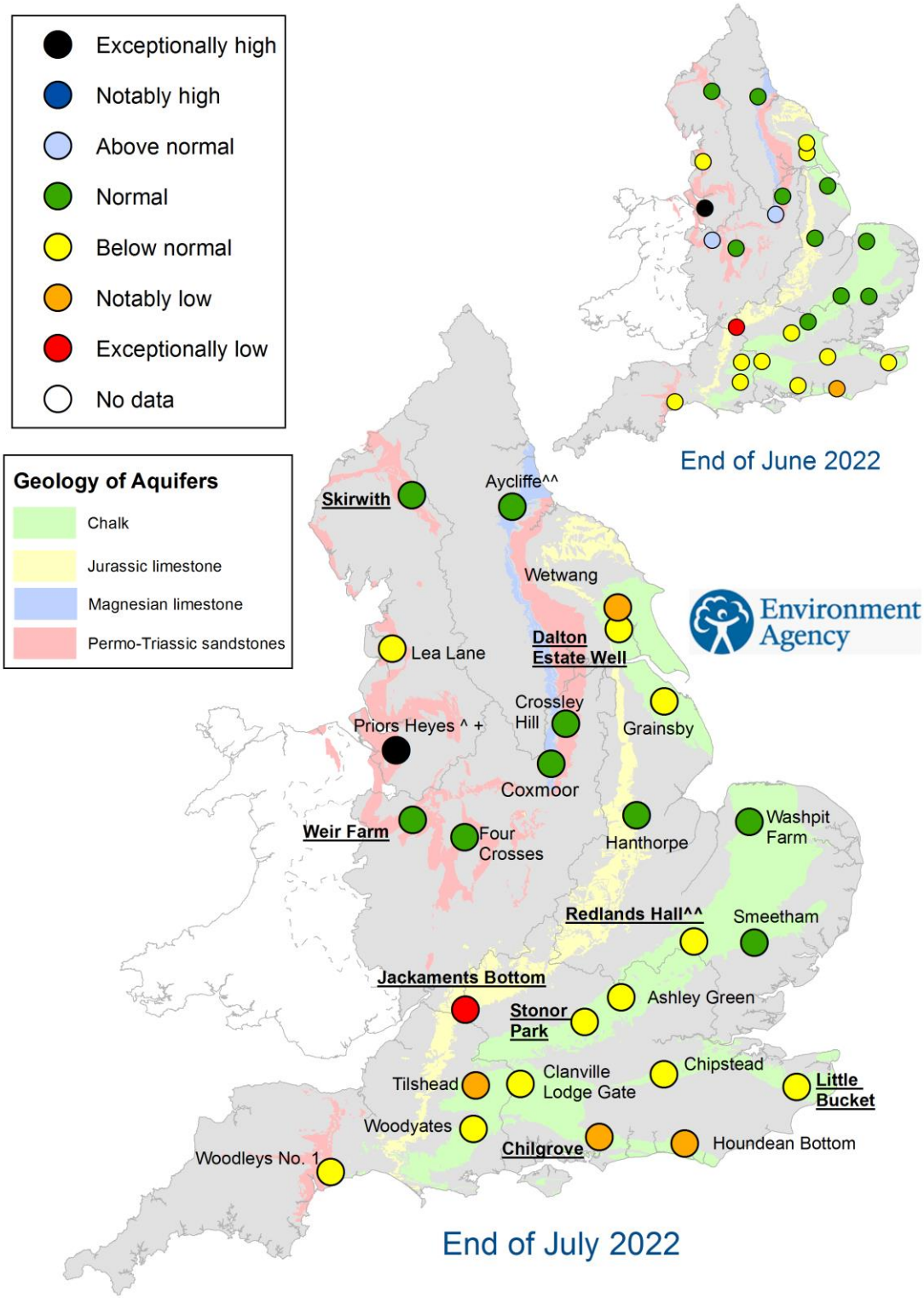


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

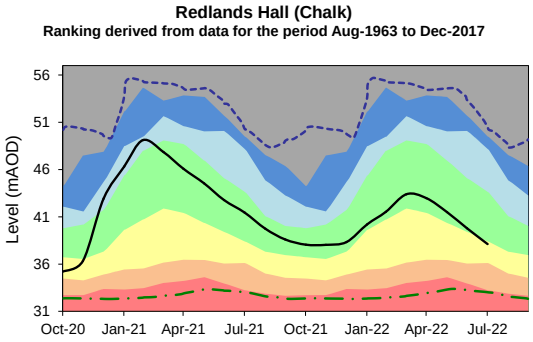
Groundwater levels

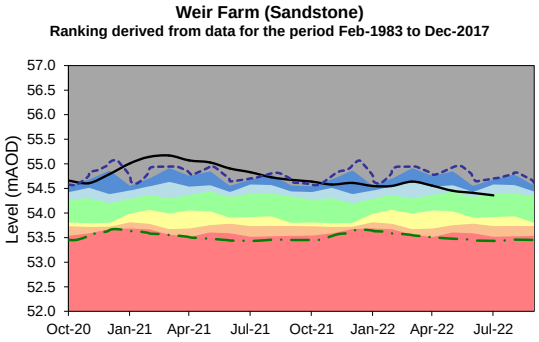


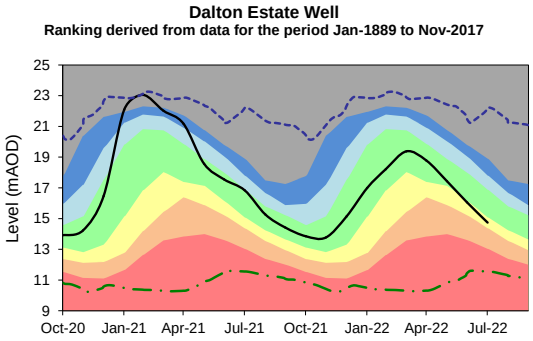
^ The level at Priors Heyes remains high compared to historic levels because the aquifer is recovering from the effects of historic abstraction
^^ Sites are manually dipped at different times during the month. They may not be fully representative of levels at the month end
+/- End of month groundwater 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

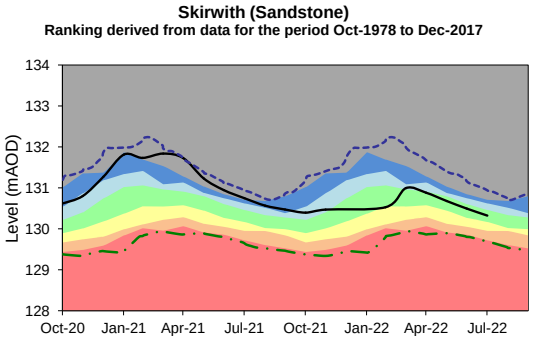
Figure 4.1: Groundwater levels for indicator sites at the end of June 2022 and July 2022, classed relative to an analysis of respective historic June and July levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All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

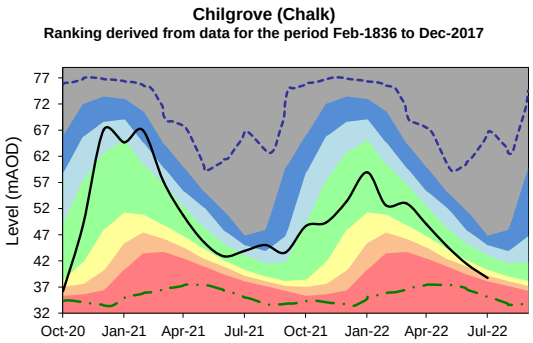
Groundwater level charts

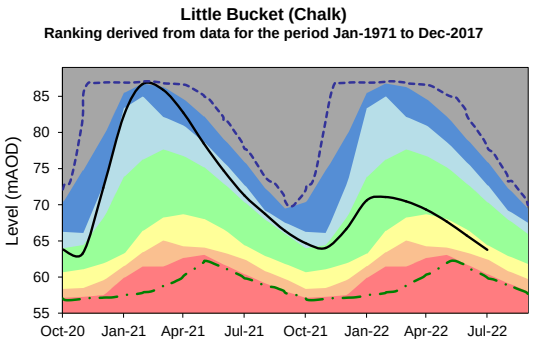


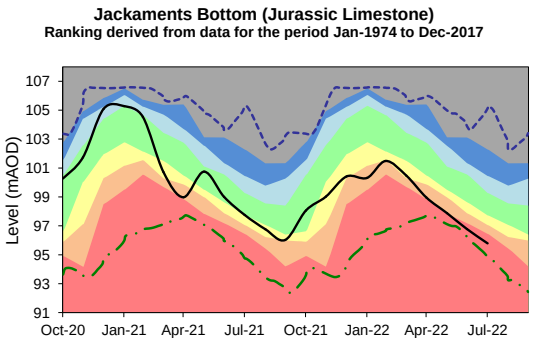












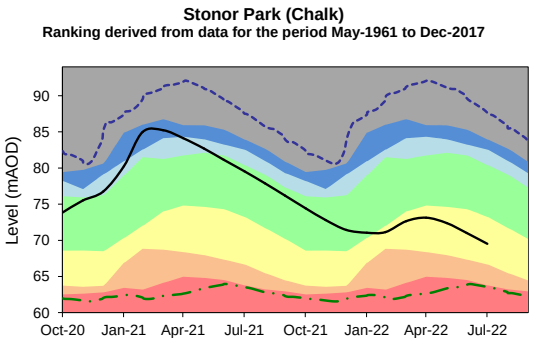
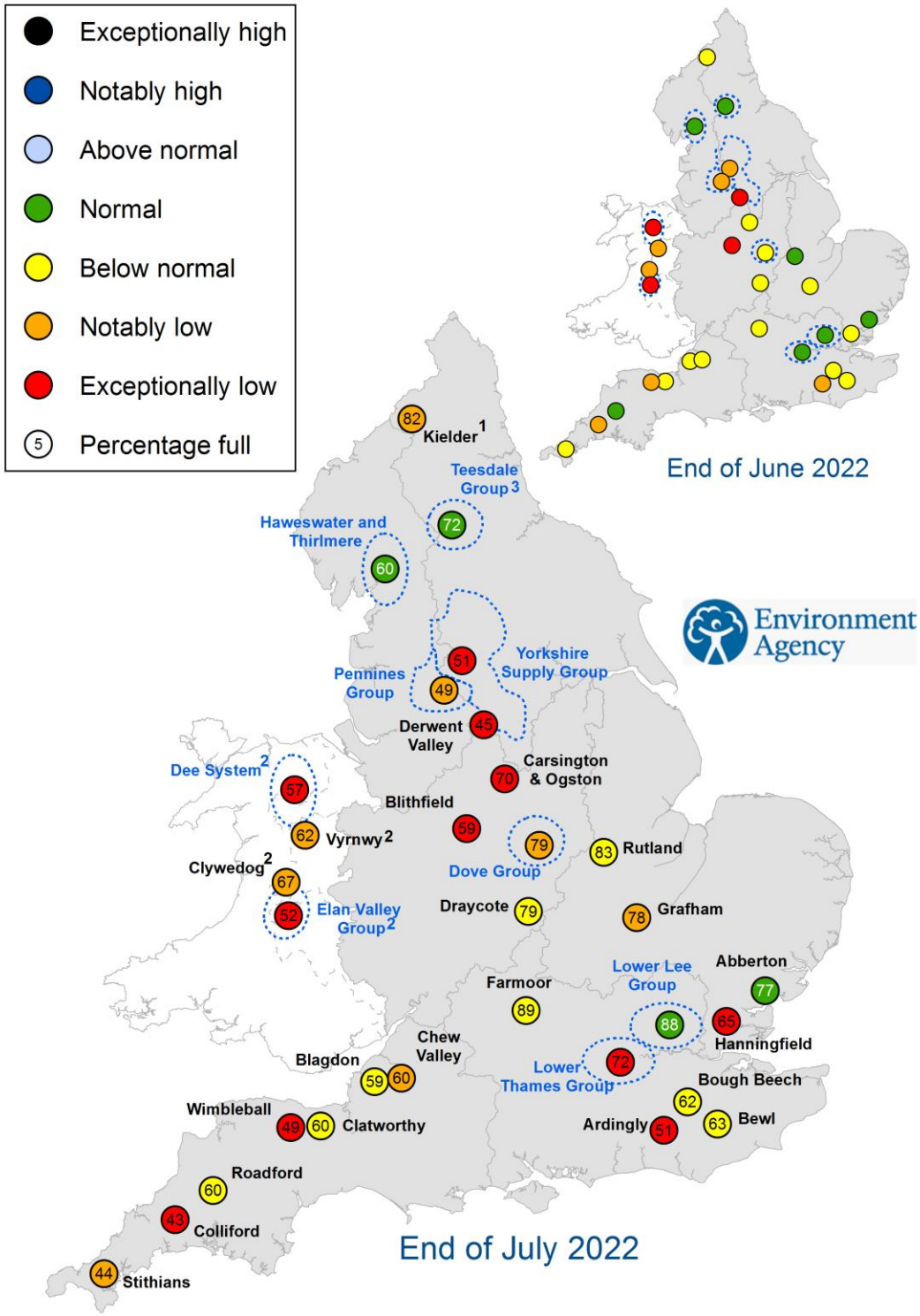


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2022).

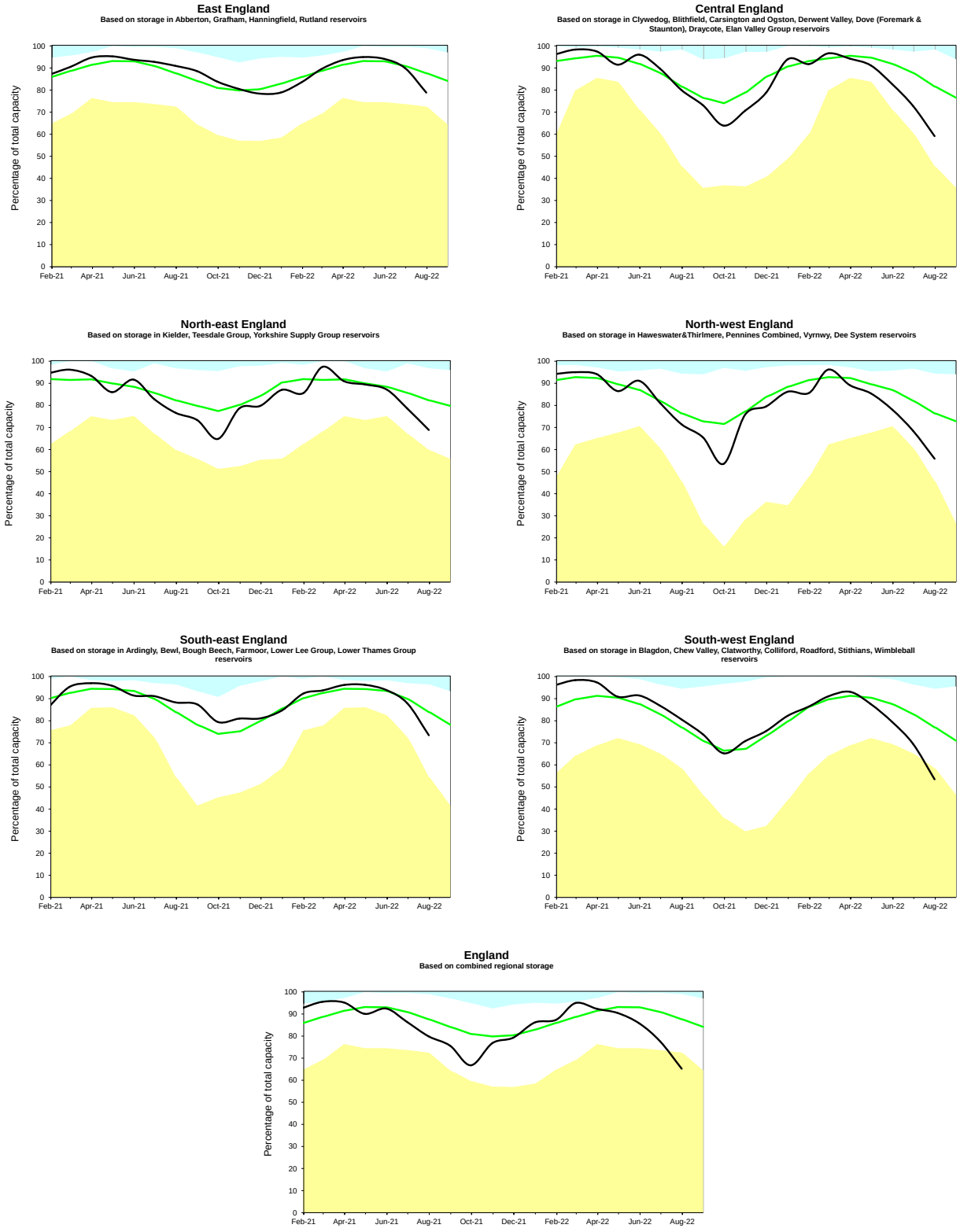
Reservoir storage



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 June 2022 and July 2022 as a percentage of total capacity and classed relative to an analysis of historic June and July 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



	Below minimum monthly level		Above maximum monthly level		Average		Latest data

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

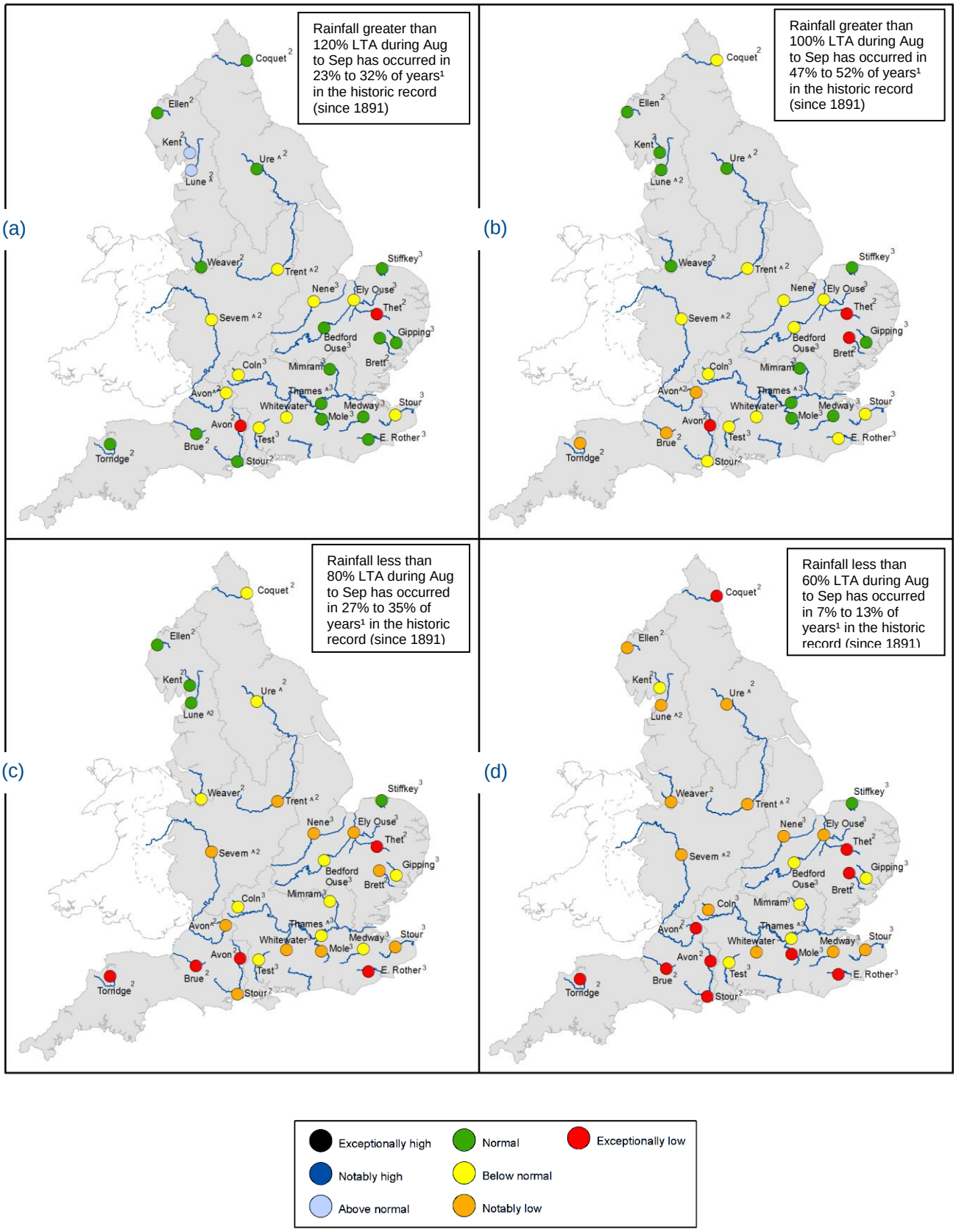


Figure 6.1: Projected river flows at key indicator sites up until the end of September 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2022 and September 2022 (Source: UK Centre for Ecology and Hydrology, Environment Agency)

[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*

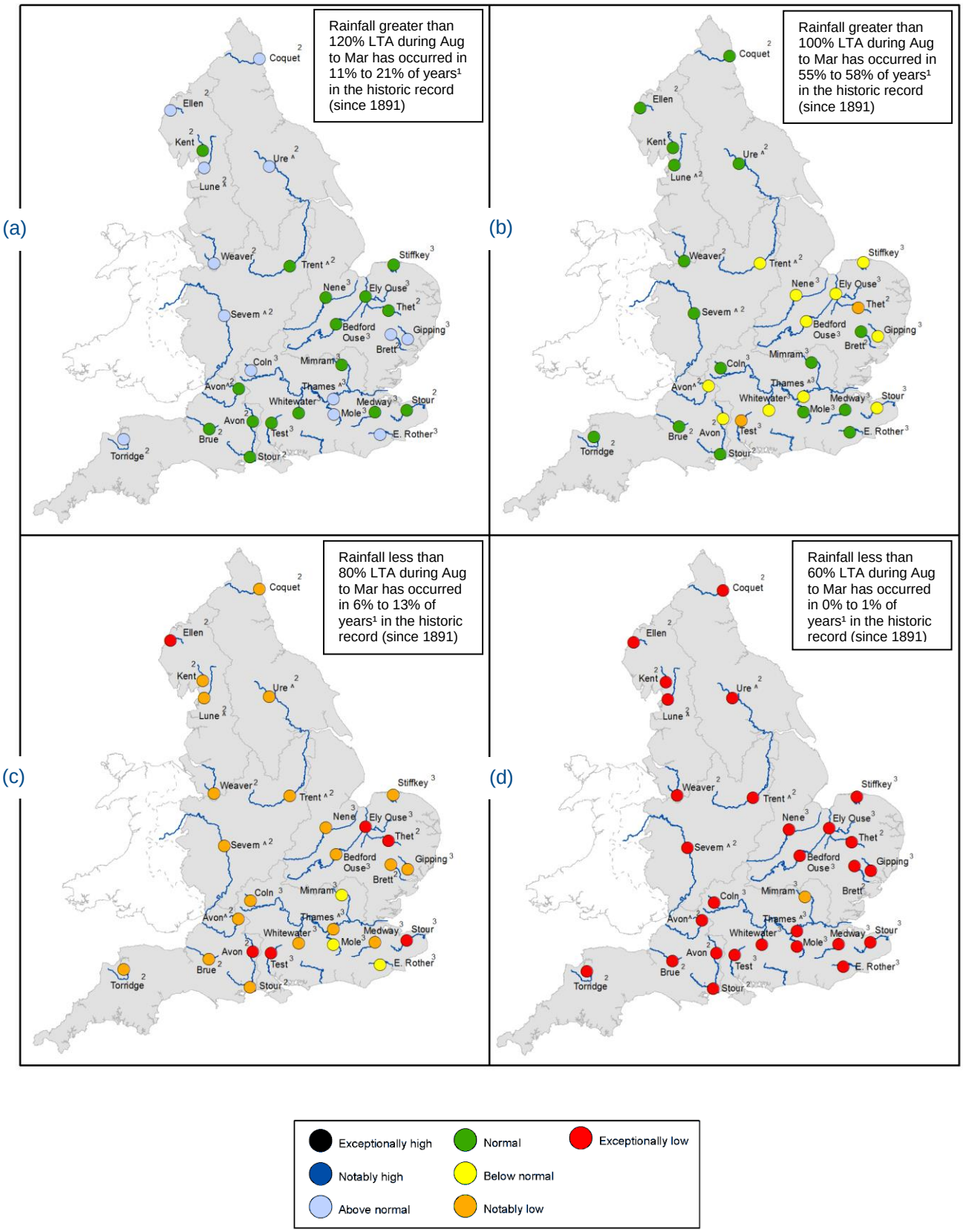


Figure 6.2: Projected river flows at key indicator sites up until the end of March 2023. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2022 and March 2023 (Source: UK Centre for Ecology and Hydrology, Environment Agency)

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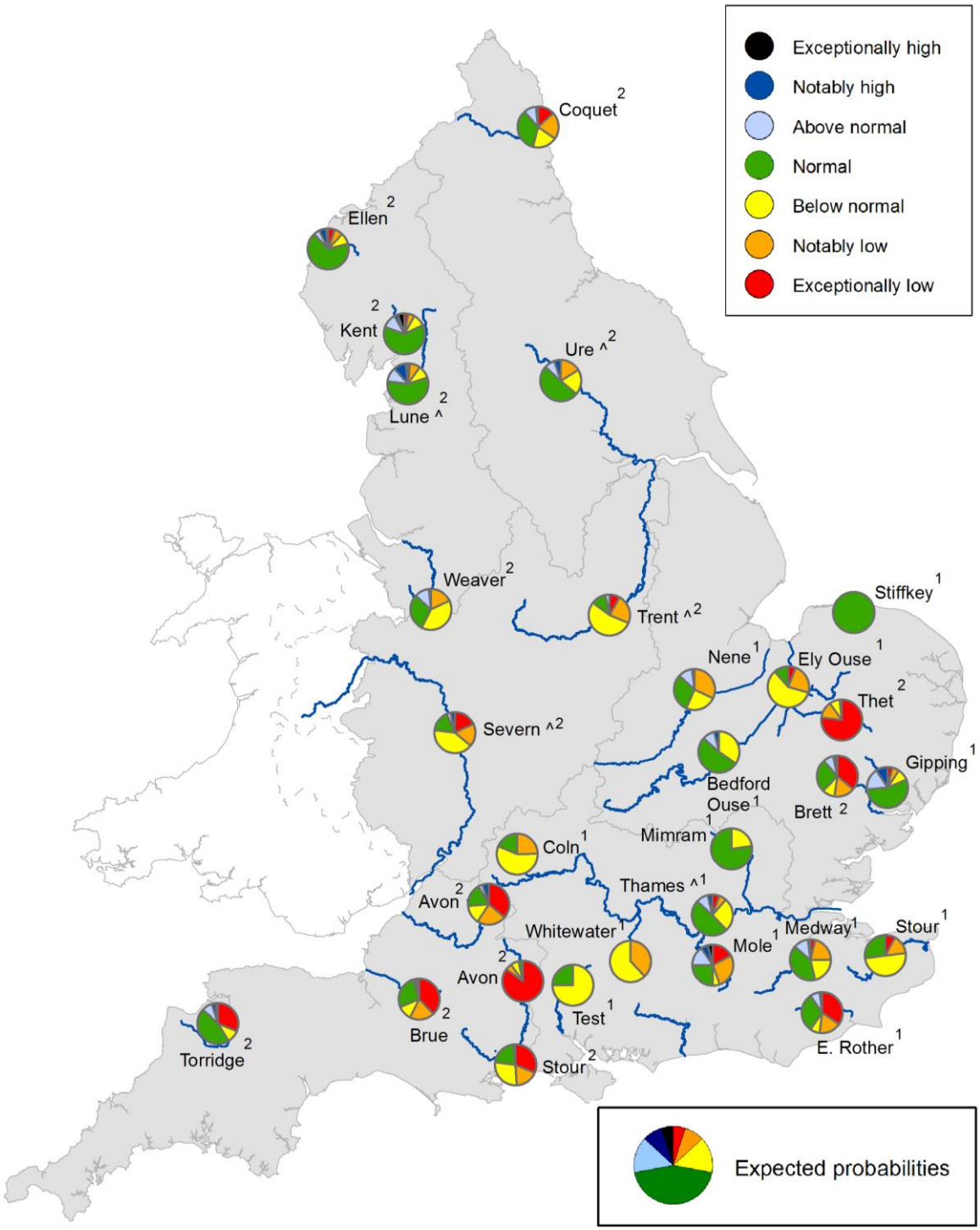
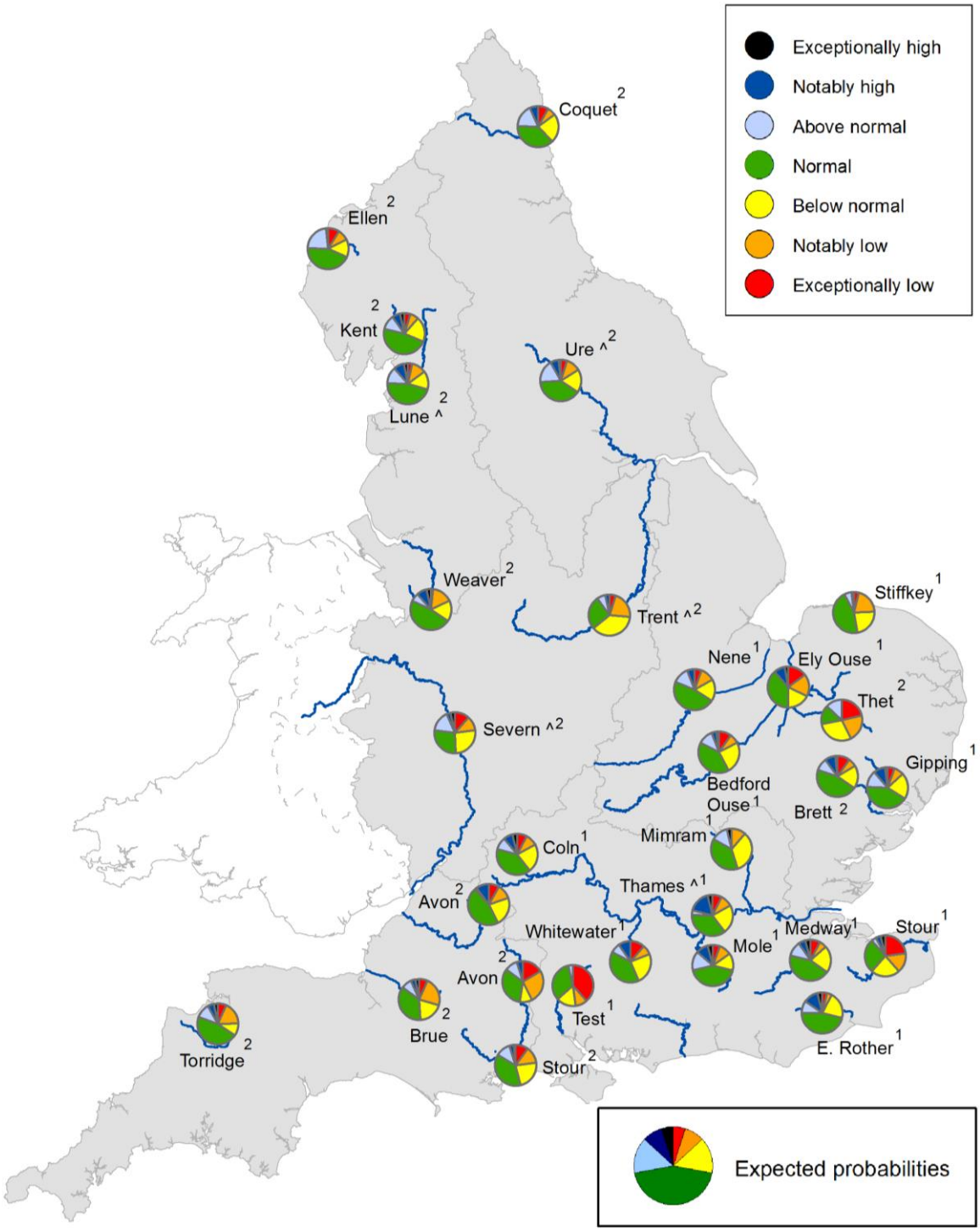


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

[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



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 6.4: 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
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^"Naturalised" flows are projected for these sites

Forward look: groundwater

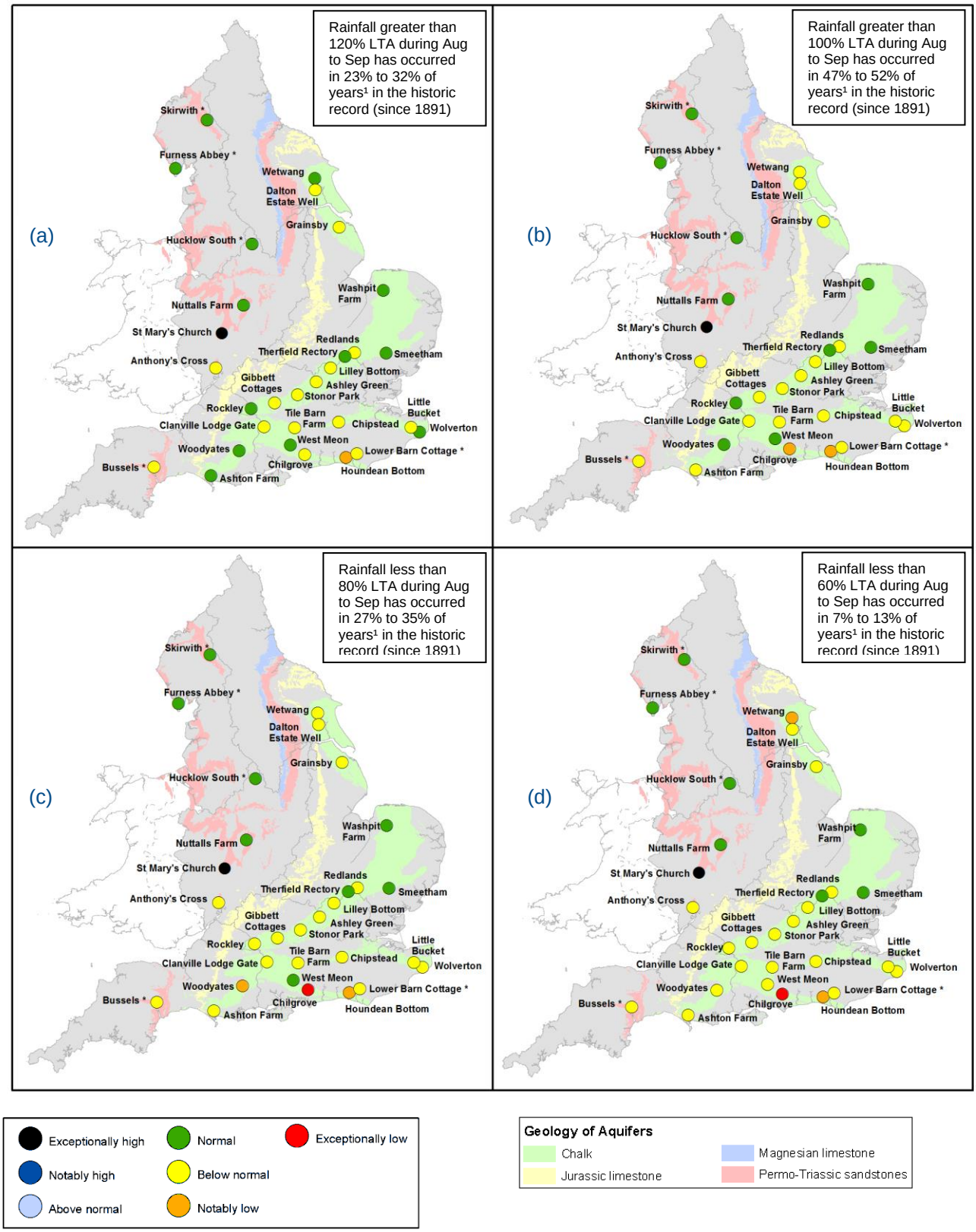


Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2022 and September 2022 (Source: Environment Agency) Geological map reproduced with kind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

St Mary's Church is currently being monitored due to uncertainty with data

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

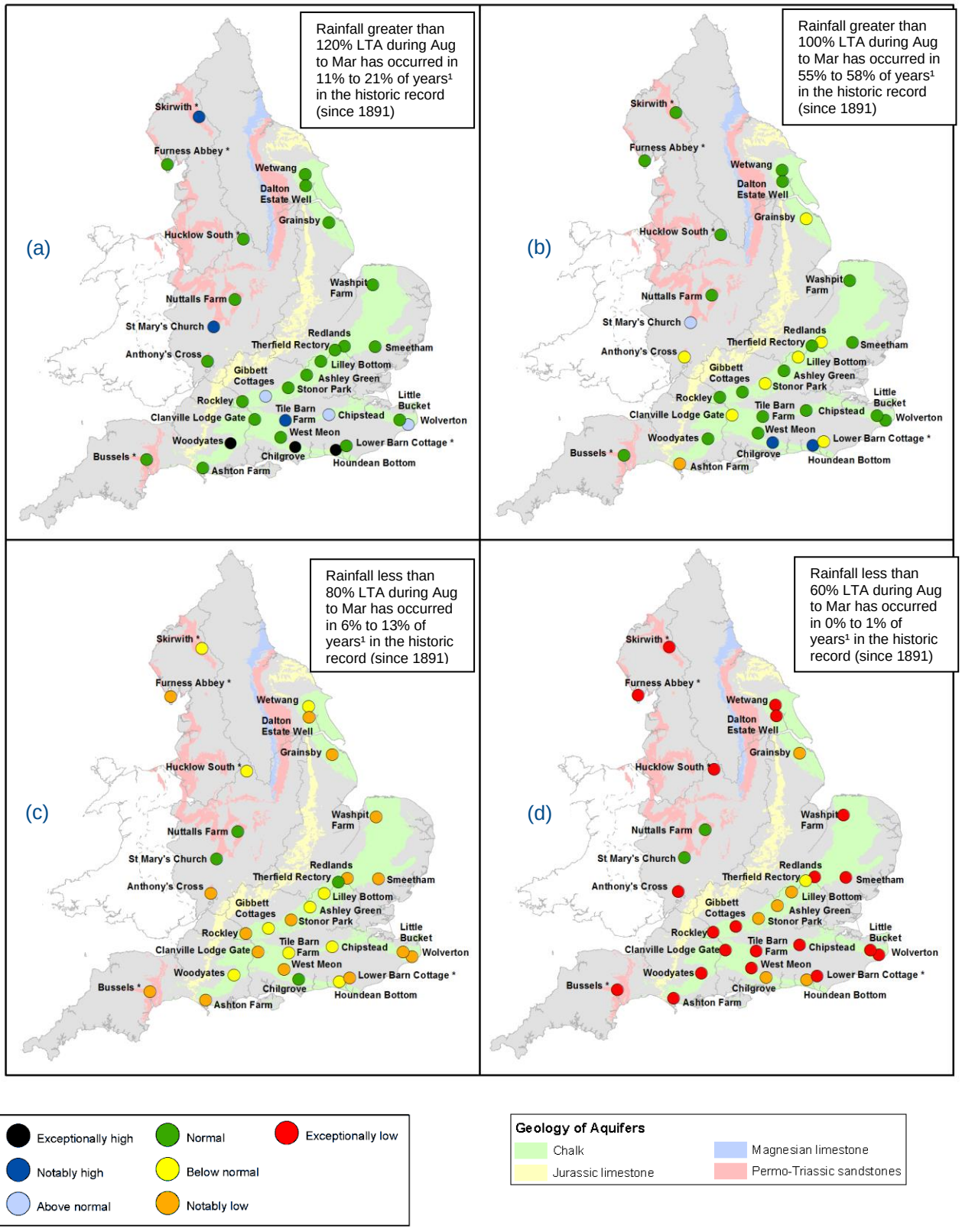
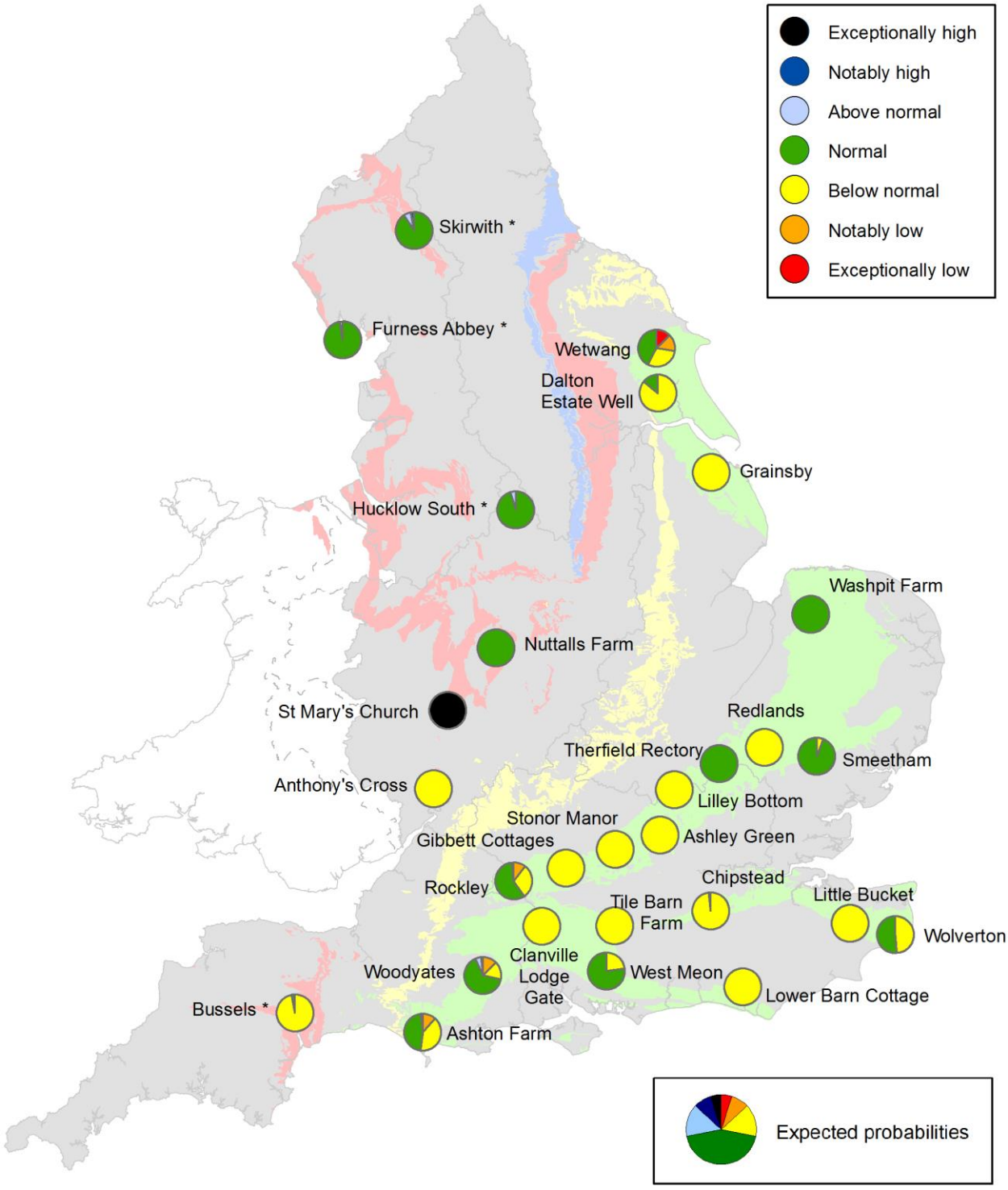


Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2023. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2022 and March 2023 (Source: Environment Agency) Geological map reproduced with kind permission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

St Mary's Church is currently being monitored due to uncertainty with data

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

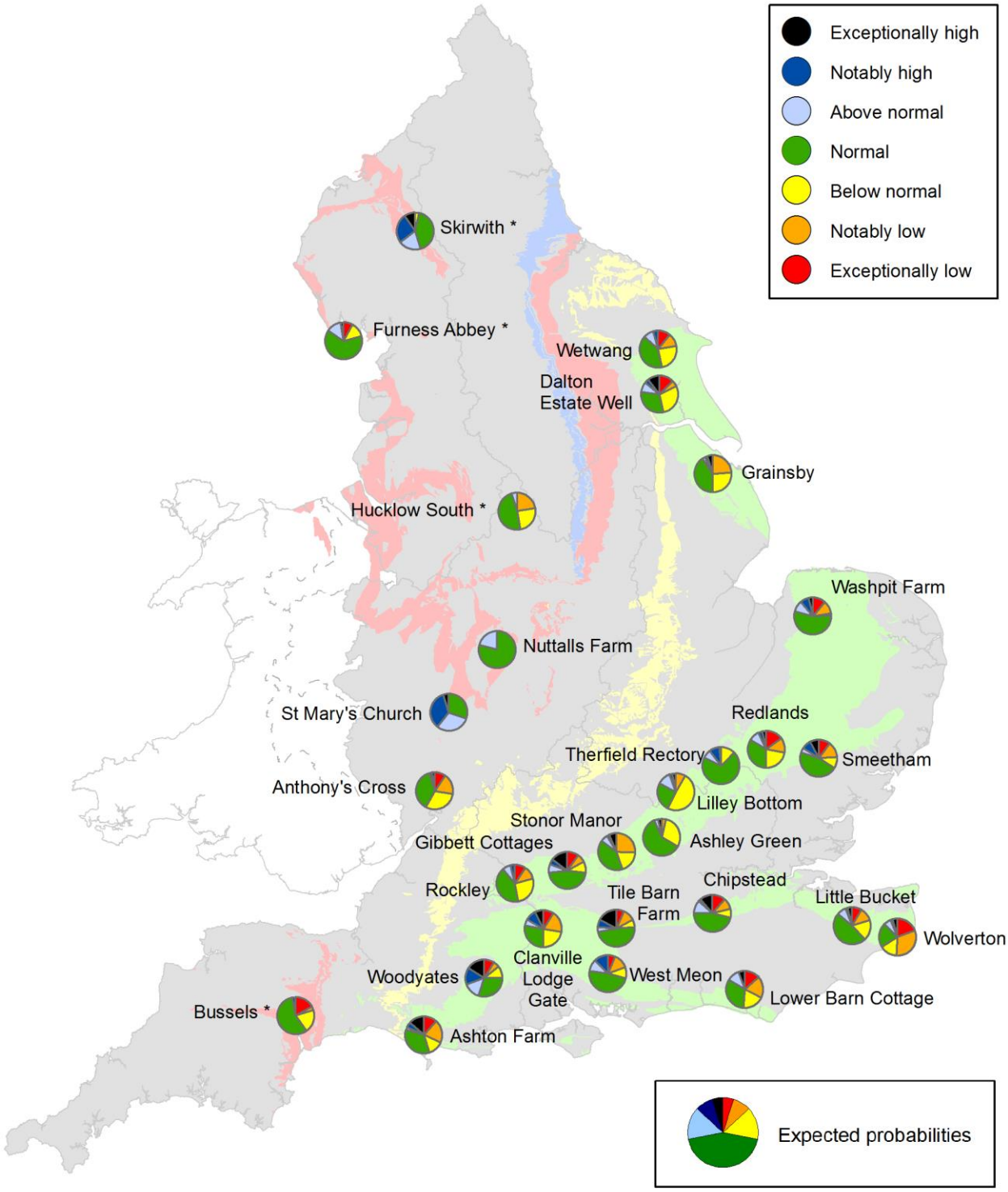


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

St Mary's Church is currently being monitored due to uncertainty with data.



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 6.8: 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

St Mary's Church is currently being monitored due to uncertainty with data.

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