Monthly water situation report

England

Summary – September 2020

September rainfall totals were below the long-term average across most of England. As a result, soils got drier across much of the country and river flows decreased at almost all indicator sites. At four-fifths of indicator sites groundwater levels were classed as normal or higher for the time of year. Total reservoir stocks for England were at 78% of capacity at the end of September (down from 83% of capacity at the end of August).

Rainfall

The September rainfall total for England was 45mm, which represents 63% of the 1961 to 1990 long-term average (LTA) (64% of the 1981 to 2010 LTA). The highest monthly rainfall totals were in parts of Cumbria and Norfolk (Figure 1.1).

Monthly rainfall totals across much of central, south-west and south-east England were classed as below normal for the time of year. The Axe, Yeo and Kenn catchments in Somerset received the lowest rainfall totals, as a proportion of the LTA. These were classed as notably low, representing only 33% of LTA. Exceptionally high September rainfall totals, representing over 200% of LTA, were recorded over parts of Norfolk. The six month cumulative rainfall totals, ending in September, highlight that over the past six months much of East and West Sussex and Kent has received notably low or exceptionally low rainfall totals. However, the twelve month cumulative totals are classed as normal or higher in all catchments across England (Figure 1.2).

At a regional scale, September rainfall totals were below the long-term average in all regions, ranging from 45% of LTA (28mm) in central England to 92% of LTA (46mm) in east England (Figure 1.3).

Soil moisture deficit

Soil moisture deficits (SMDs) increased (soils got drier) across most of England during September. However, soils in north Norfolk got wetter during September, reflecting the high rainfall totals in this area. The highest month-end SMD values were in parts of south-east England, where they ended the month at over 160mm. By contrast in parts of north-east and north-west England soils remained at close to saturation at the end of September (SMD of <10mm) (Figure 2.1).

At a regional scale, the end of month SMD values in south-east and south-west England were greater than the end of month September LTA. In all other regions the average SMD was lower than the LTA for the time of year (Figure 2.2).

River flows

River flows decreased at almost all indicator sites, compared to August. One of the few exceptions to this was the at Colney gauging station on the River Yare (Norfolk), where, in response to the high rainfall totals in this area, monthly mean flows were classed as notably low in August but were classed as notably high in September. September monthly mean flows were classed as normal at over four-fifths of indicator sites in England, but notably low flows were recorded on the River Rother at Udiam (East Sussex) and the River Cam at Dernford (Cambridgeshire)
(Figure 3.1)

Monthly mean river flows for the regional indicator sites were classed as normal for the time of year at all gauging stations other than Horton on the Great Stour (Kent) where flows represented 70% of LTA and were classed as below normal (Figure 3.2).

Groundwater levels

Groundwater levels remained in recession at most of the indicator sites we report on during September. At four-fifths of indicator sites ground water levels were classed as normal or higher for the time of year. Levels at Weir Farm (Bridgnorth sandstone), Coxmoor (Idle and Torne sandstone) and Priors Hayes (West Cheshire sandstone) were classed as exceptionally high. These sites recorded the highest end of September levels on record (records go back to 1983, 1970 and 1973 respectively). 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 levels at the major aquifer index sites were classed as notably low at Chilgrove (Chichester chalk) and below normal at Jackaments Bottom (Burford Jurassic) and Redlands Hall (Cam and Ely Ouse Chalk) (Figures 4.1 and 4.2).

Reservoir storage

Reservoir stocks decreased at almost all reservoirs and reservoir groups we report on during September. The biggest decrease, as a proportion of total capacity, was at Ardingly reservoir (West Sussex) where stocks fell from 43% at the end of August to 26% at the end of September, which is classed as exceptionally low for the time of year. At over a quarter of reservoirs and reservoir groups stocks were classed as below normal or lower for the end of September (Figure 5.1).

Total reservoir stocks for England were at 78% of capacity at the end of September (down from 83% of capacity at the end of August), just below the LTA for the time of year. At a regional scale, total reservoir stocks were close to or above the LTA in all parts of England, with the exception of south-west England where total stocks remained below average (Figure 5.2).

Forward look

A very wet start to October is expected for many parts of England, with unsettled conditions likely to continue throughout the first part of the month, with showers and locally heavy rain interspersed with some sunny spells. Towards the middle of the month, many parts of England could see more settled and dry weather, however there is the possibility of further showery conditions in the south and south-east. The end of the month is likely to remain settled and dry across much of England.

For the 3 month period October to December, across the UK, above average precipitation is slightly more likely than below average precipitation[1].

Projections for river flows at key sites[2]

More than two-thirds of the modelled sites 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 2021. By the end of September 2021, more than half of the sites have a greater than expected chance of cumulative river flows being normal or higher for the time of year.

For scenario based projections of cumulative river flows at key sites by March 2021 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by September 2021 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by March 2021 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by September 2021 see Figure 6.4

Projections for groundwater levels in key aquifers[2]

By the end of March 2021, nearly half of all the 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 September 2021, more than two-thirds of the modelled sites have a greater than expected chance of groundwater levels being normal or higher for the time of year.

For scenario based projections of groundwater levels in key aquifers in March 2021 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in September 2021 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2021 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2021 see Figure 6.8

Authors: National Water Resources Hydrology Team

1 Source: Met Office
2 Information produced by the Water Situation Forward Look group led by Environment Agency in partnership with the Centre for Ecology and Hydrology, British Geological Survey, Met Office (www.hydoutuk.net).

Rainfall

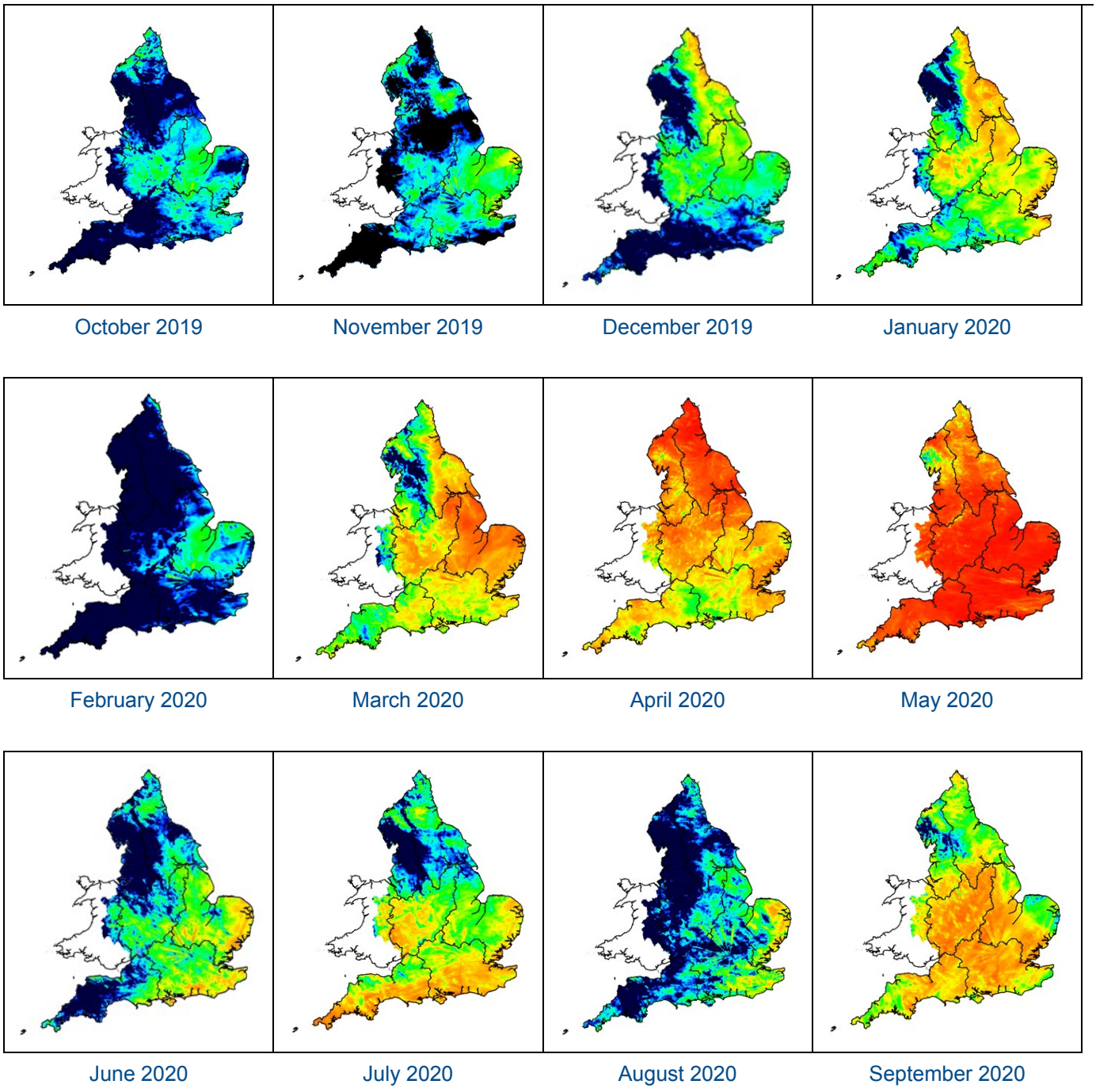
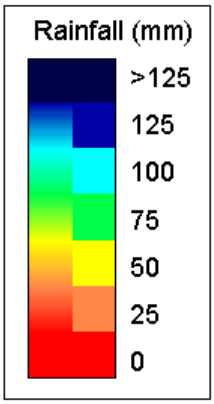


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2020). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.



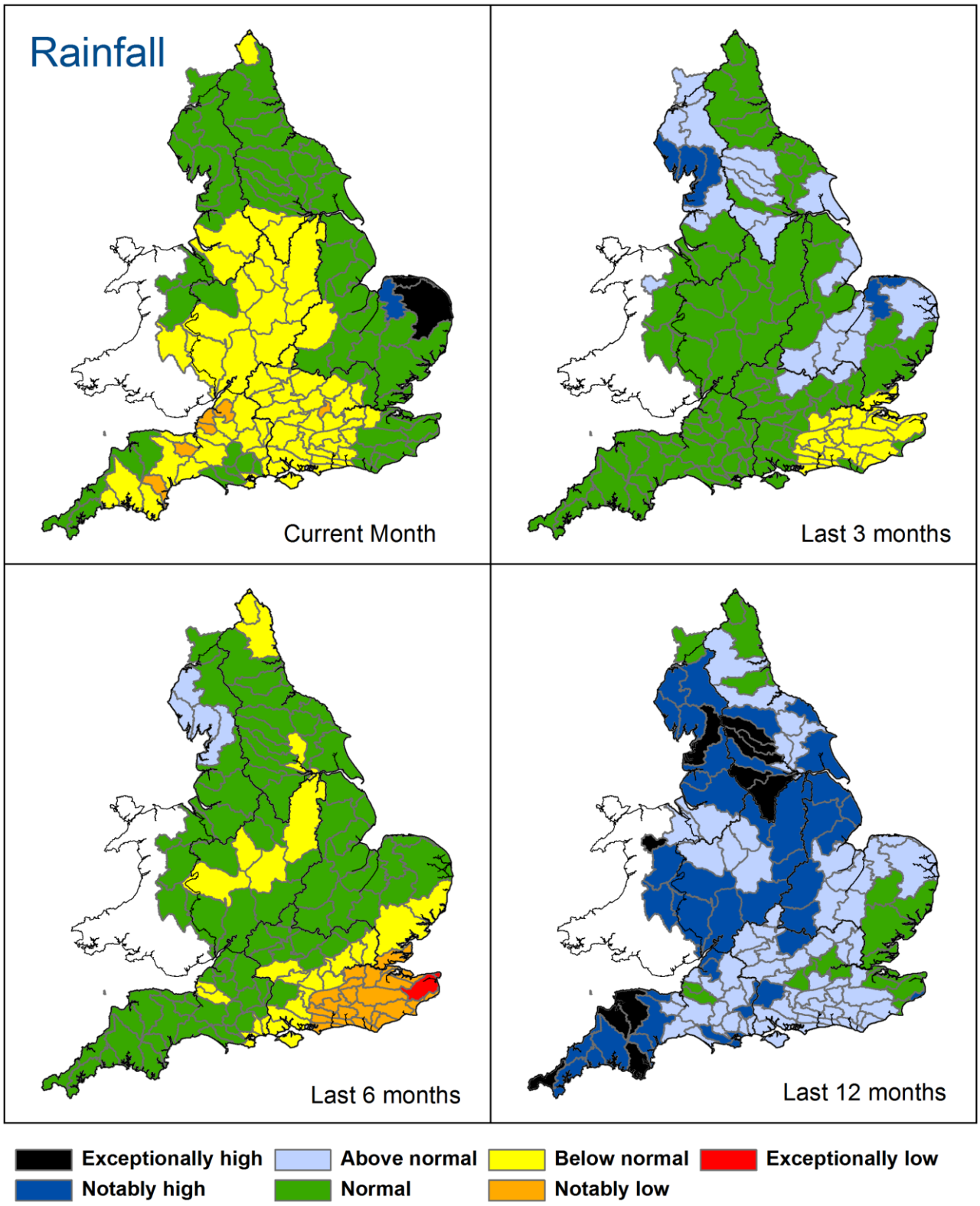


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 30 September), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2020)*. 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, 2020.

Rainfall charts

Above average rainfall

Below average rainfall

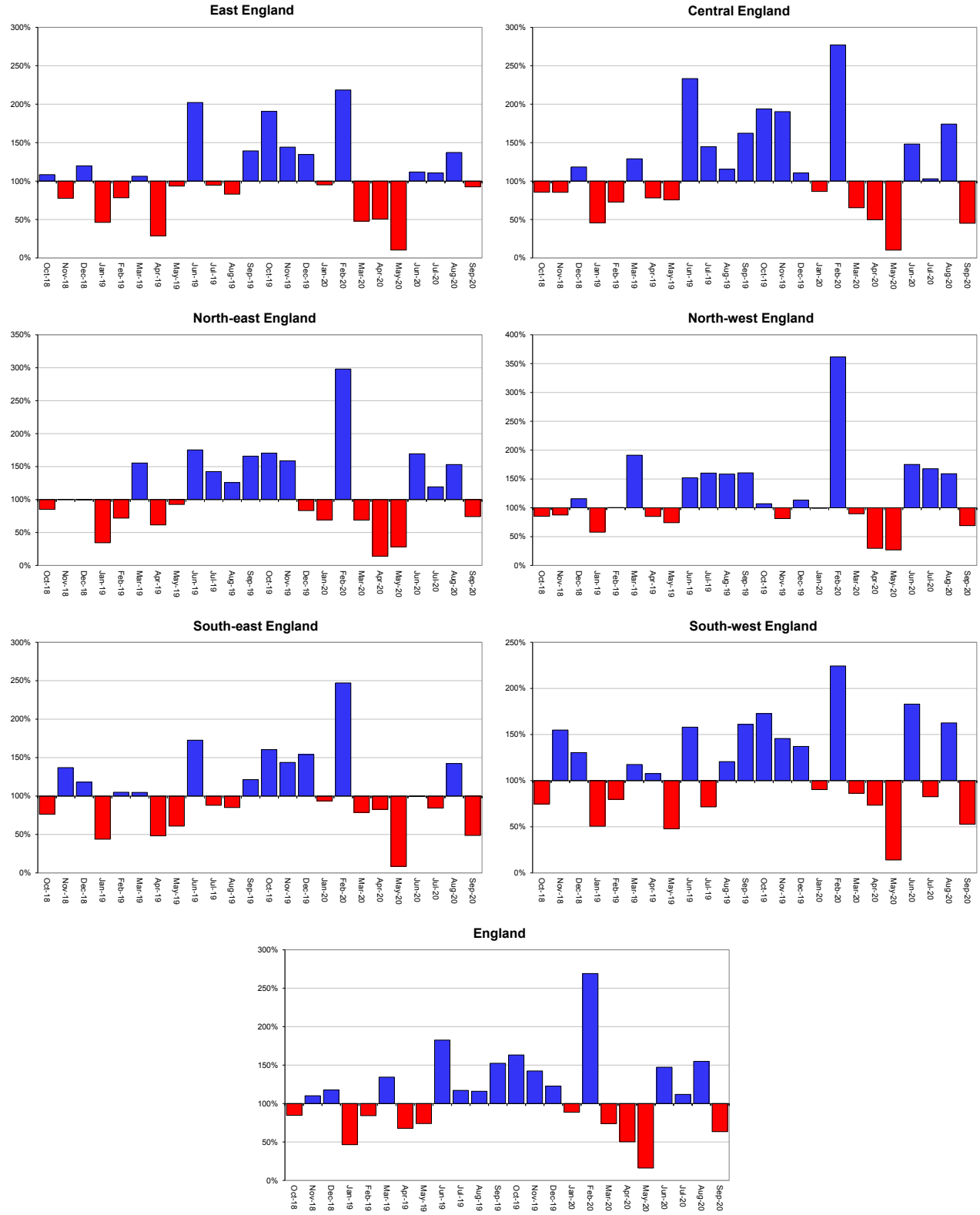


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2020).

Soil moisture deficit

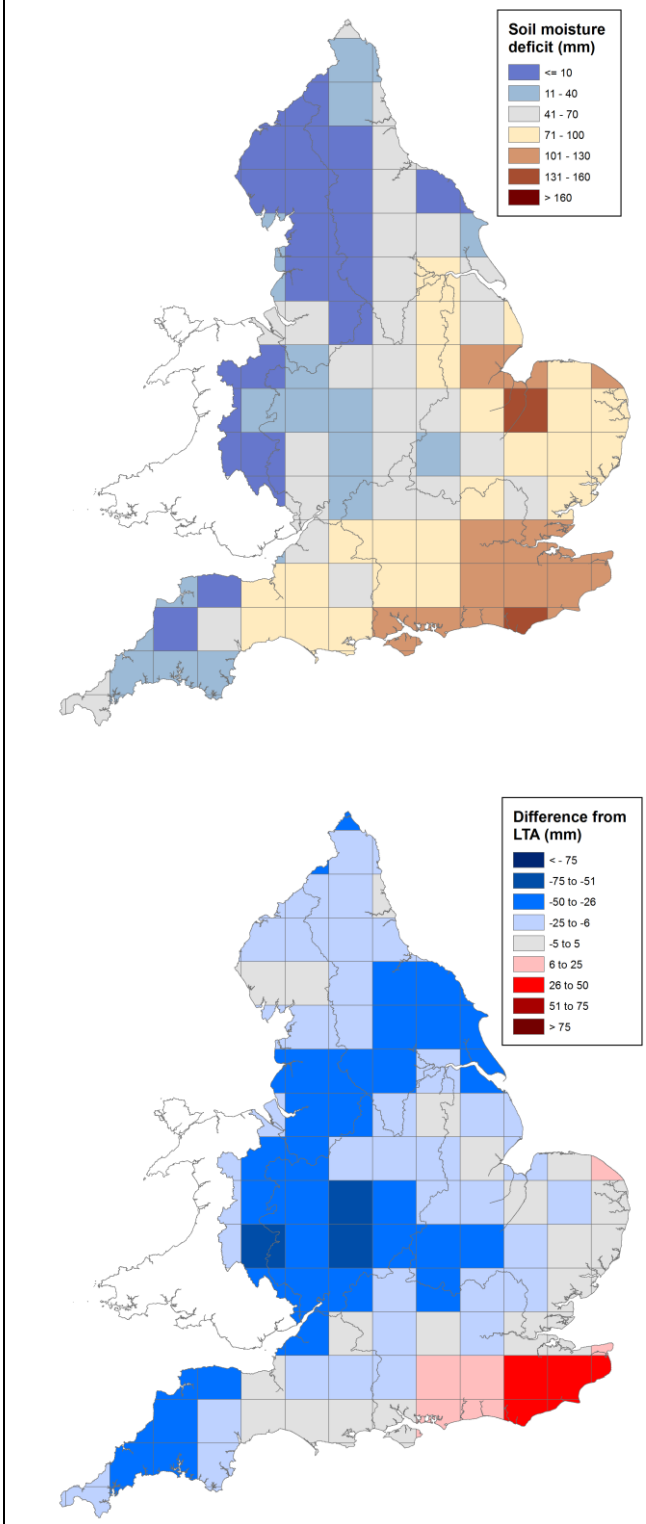
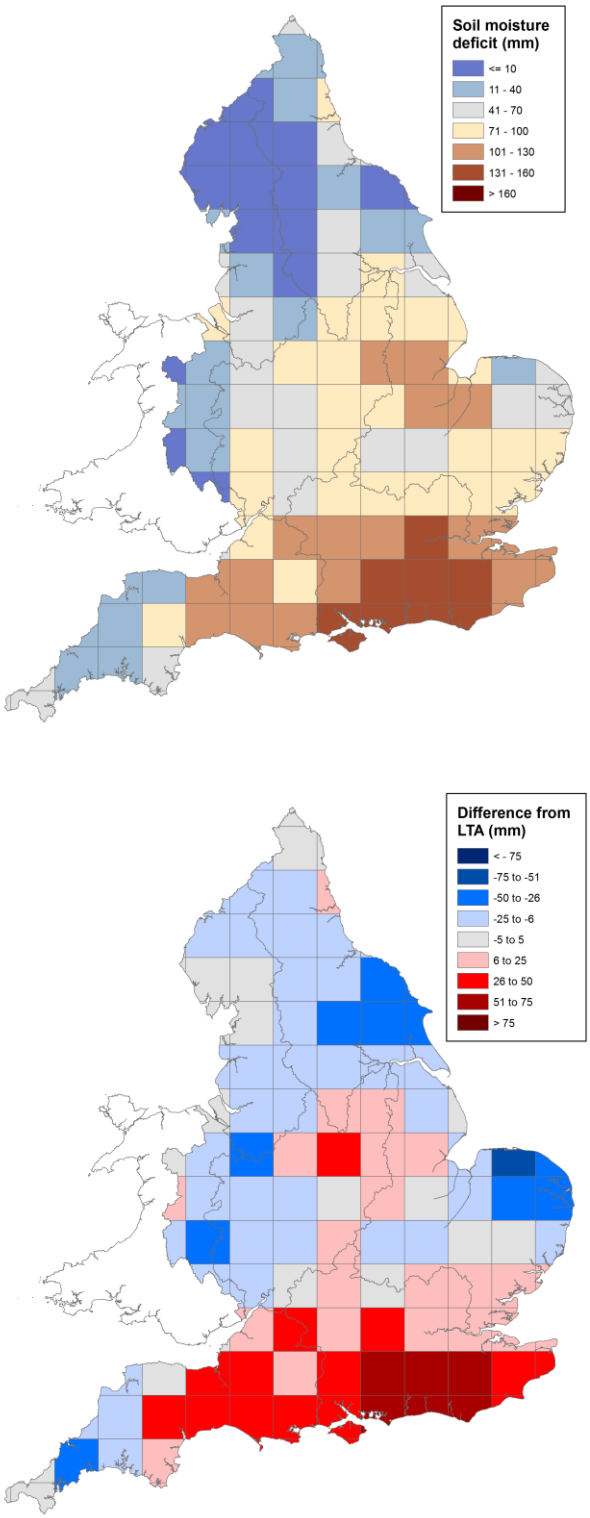
End of August 2020[1]	End of September 2020[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 1 September 2020 [1] (left panel) and 29 September 2020 [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, 2020). Crown copyright. All rights reserved. Environment Agency, 100024198, 2020

Soil moisture deficit charts

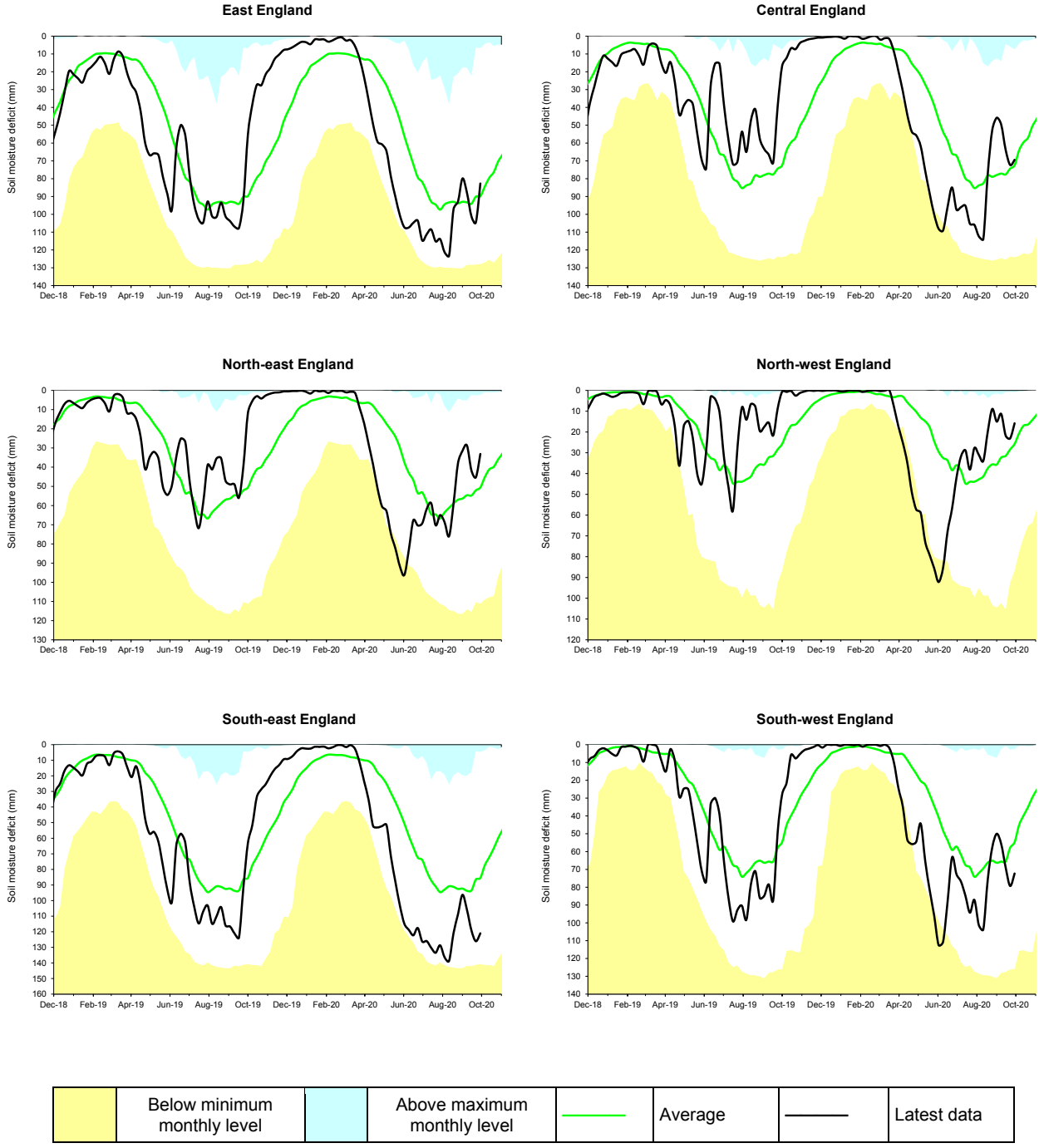
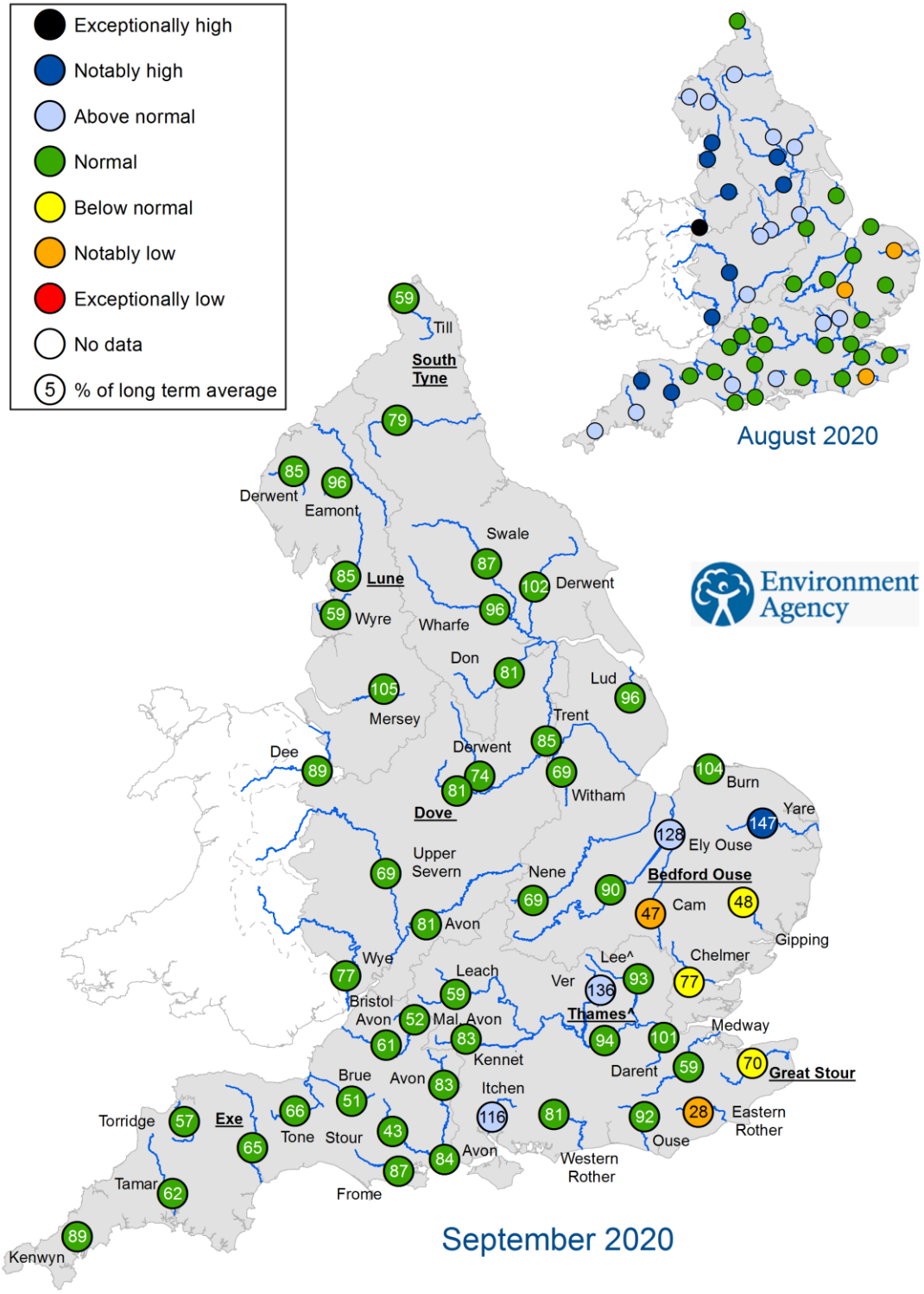


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2020).

River flows



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

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 August 2020 and September 2020, expressed as a percentage of the respective long term average and classed relative to an analysis of historic August and September monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

River flow charts

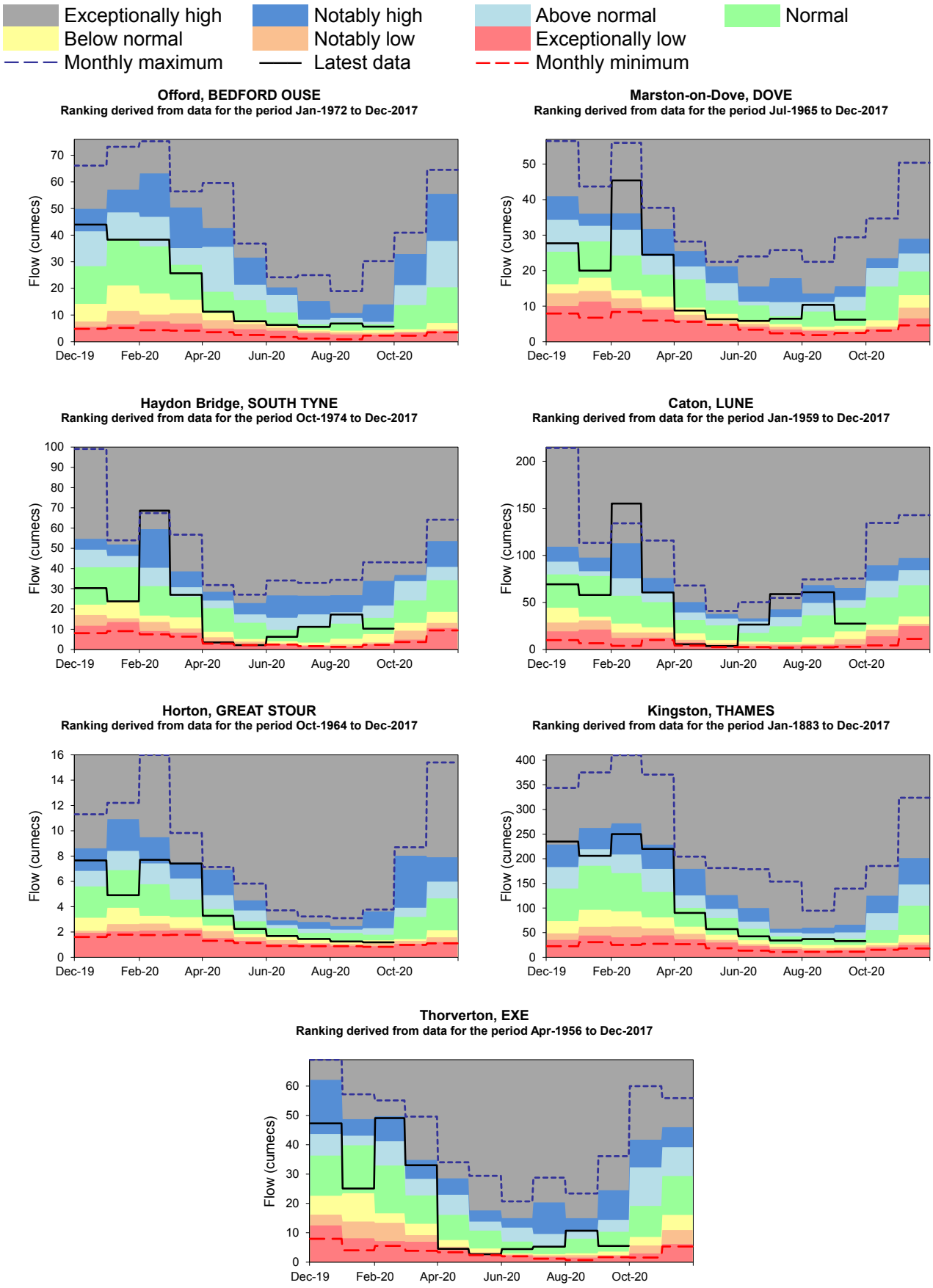
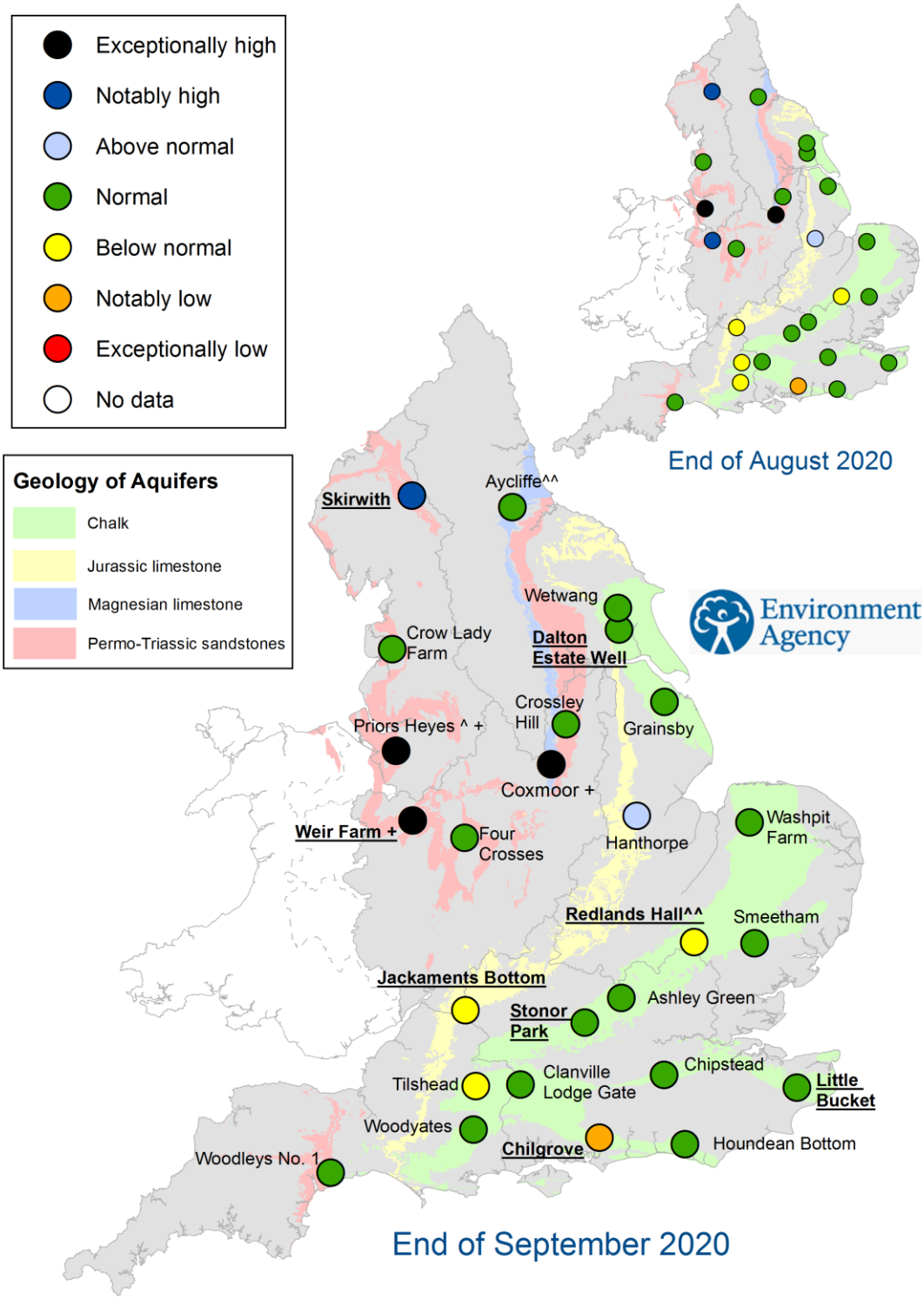


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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 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 August 2020 and September 2020, classed relative to an analysis of respective historic August and September levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

Groundwater level charts

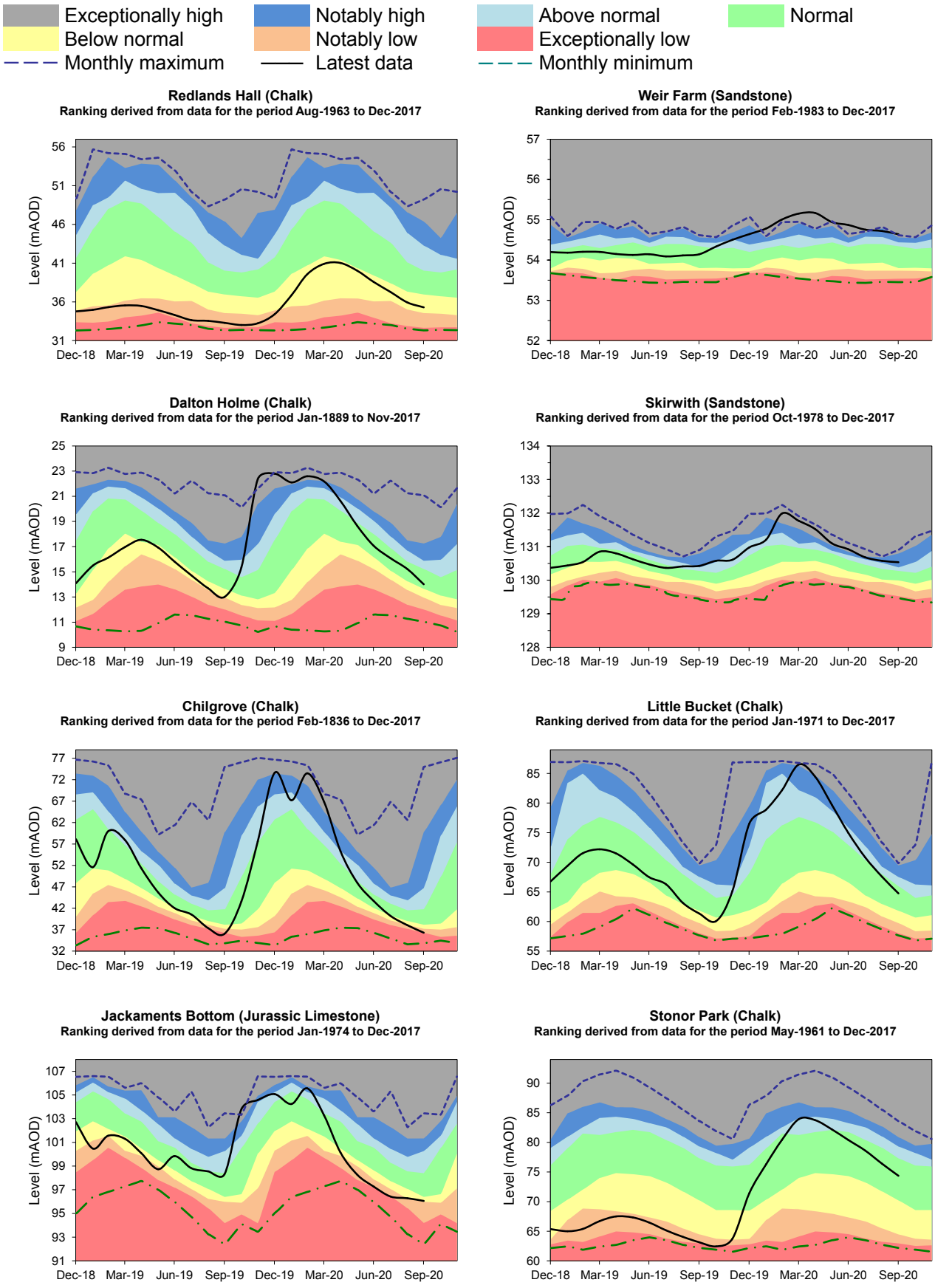
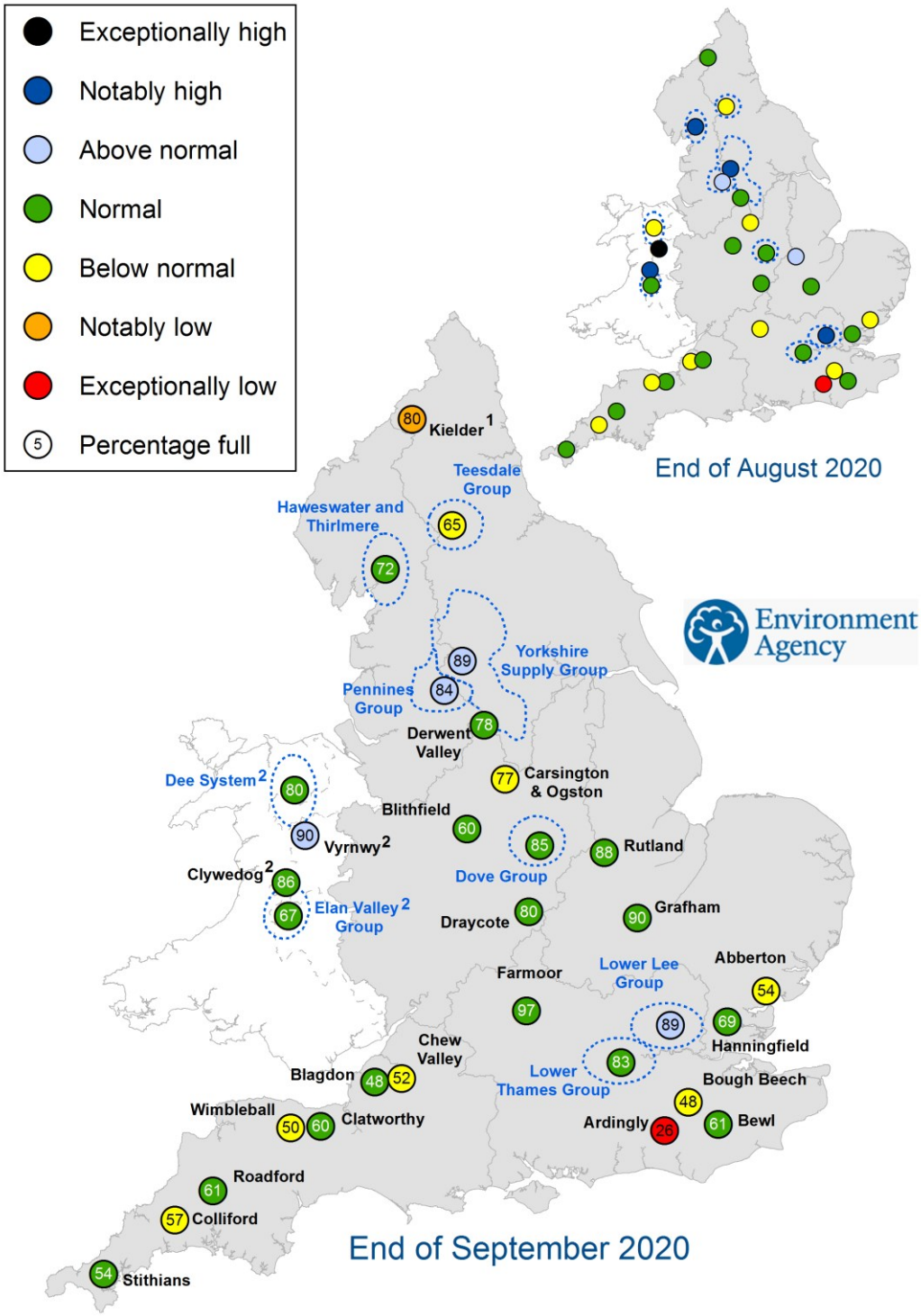


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2020).

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 August 2020 and September 2020 as a percentage of total capacity and classed relative to an analysis of historic August and September 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. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

Reservoir storage charts

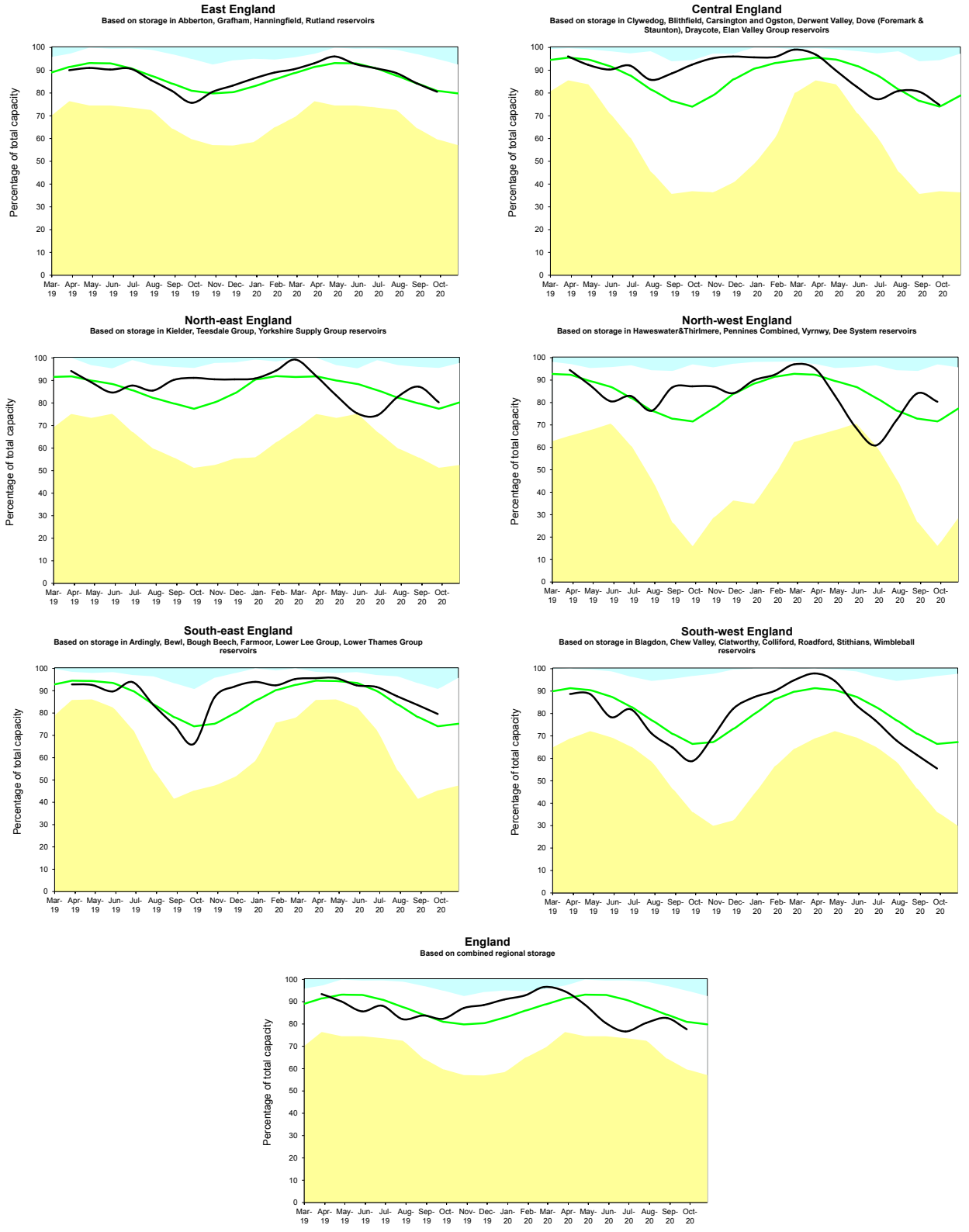


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look: river flow

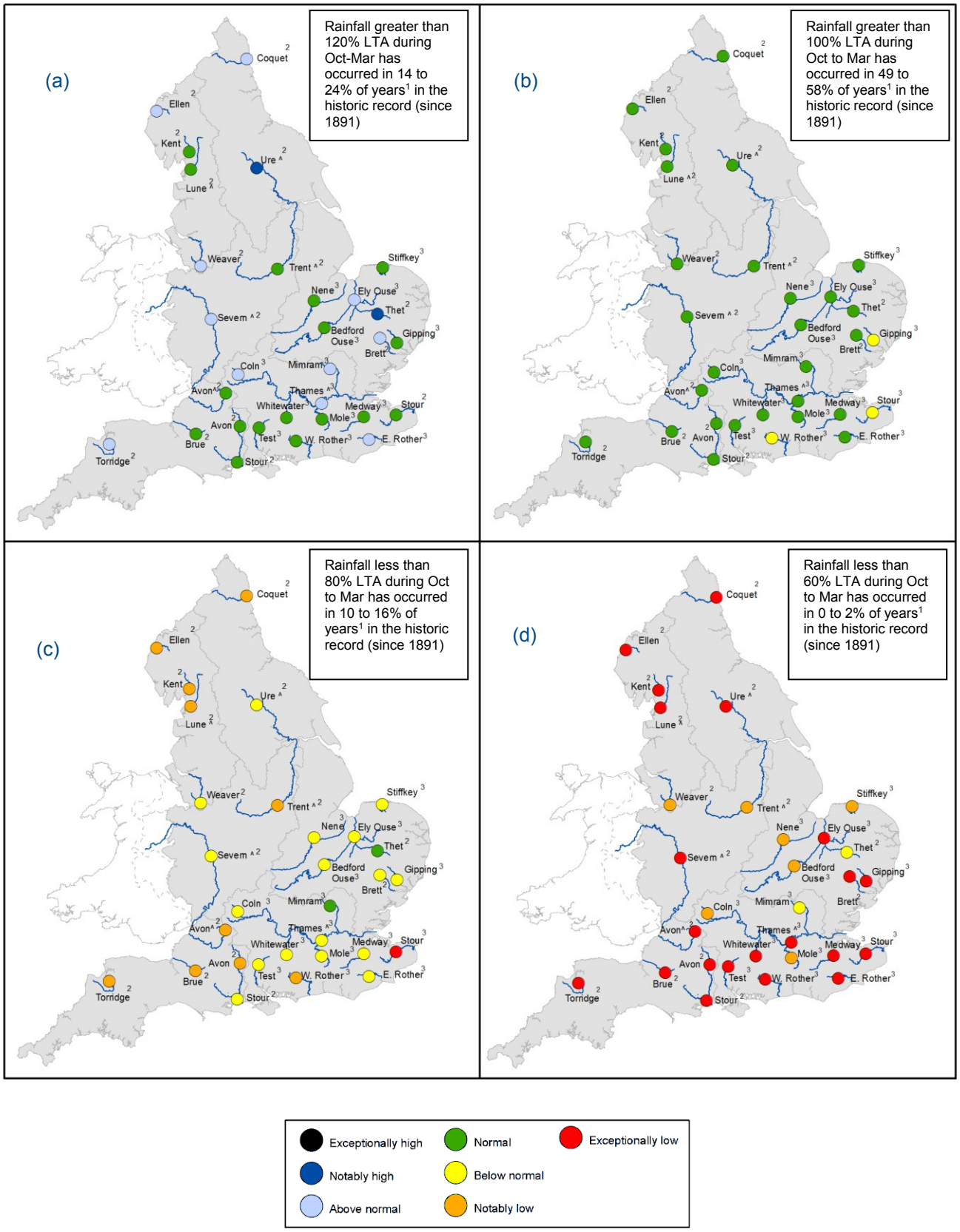
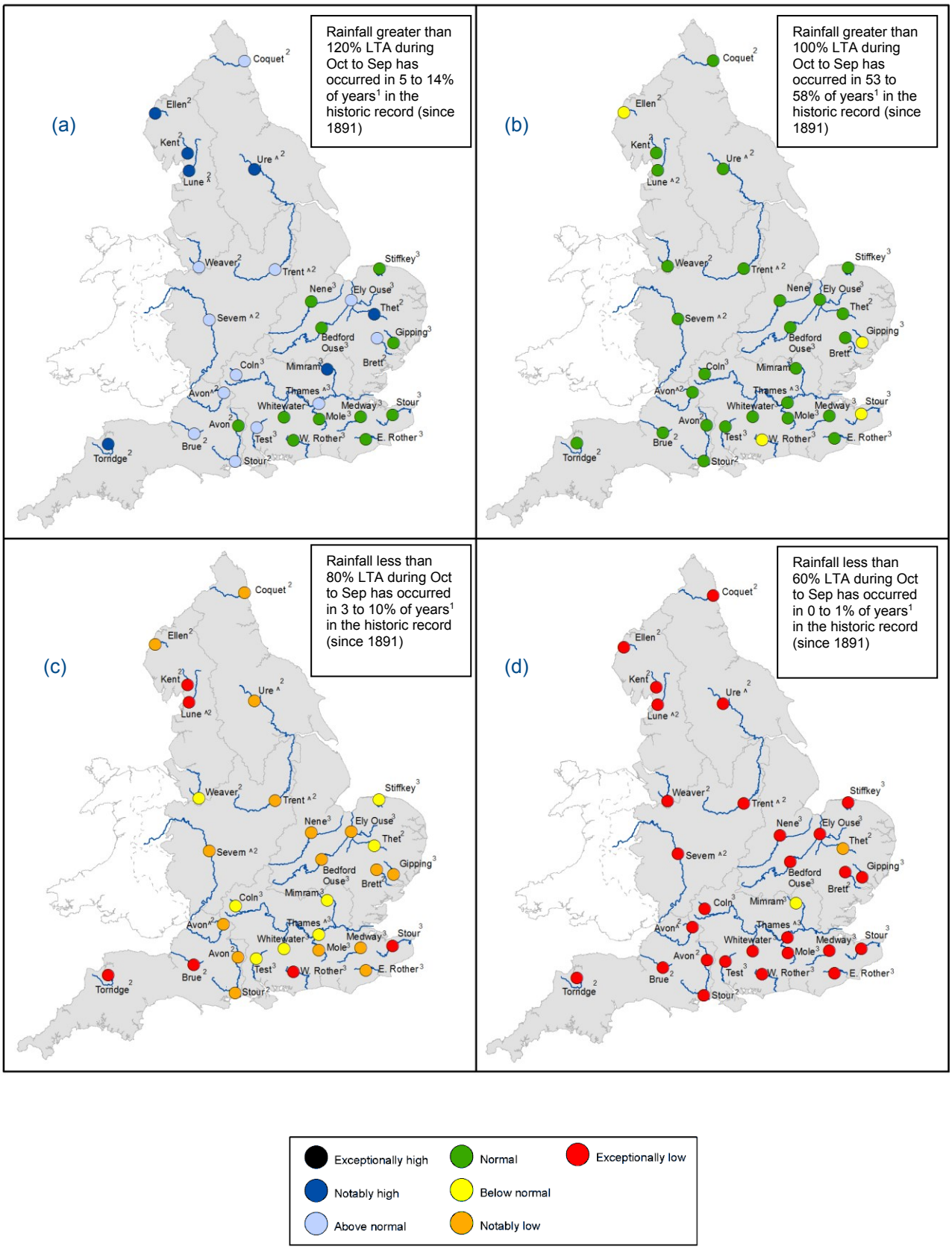


Figure 6.1: Projected river flows at key indicator sites up until the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between October 2020 and March 2021 (Source: Centre for Ecology and Hydrology, Environment Agency).

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



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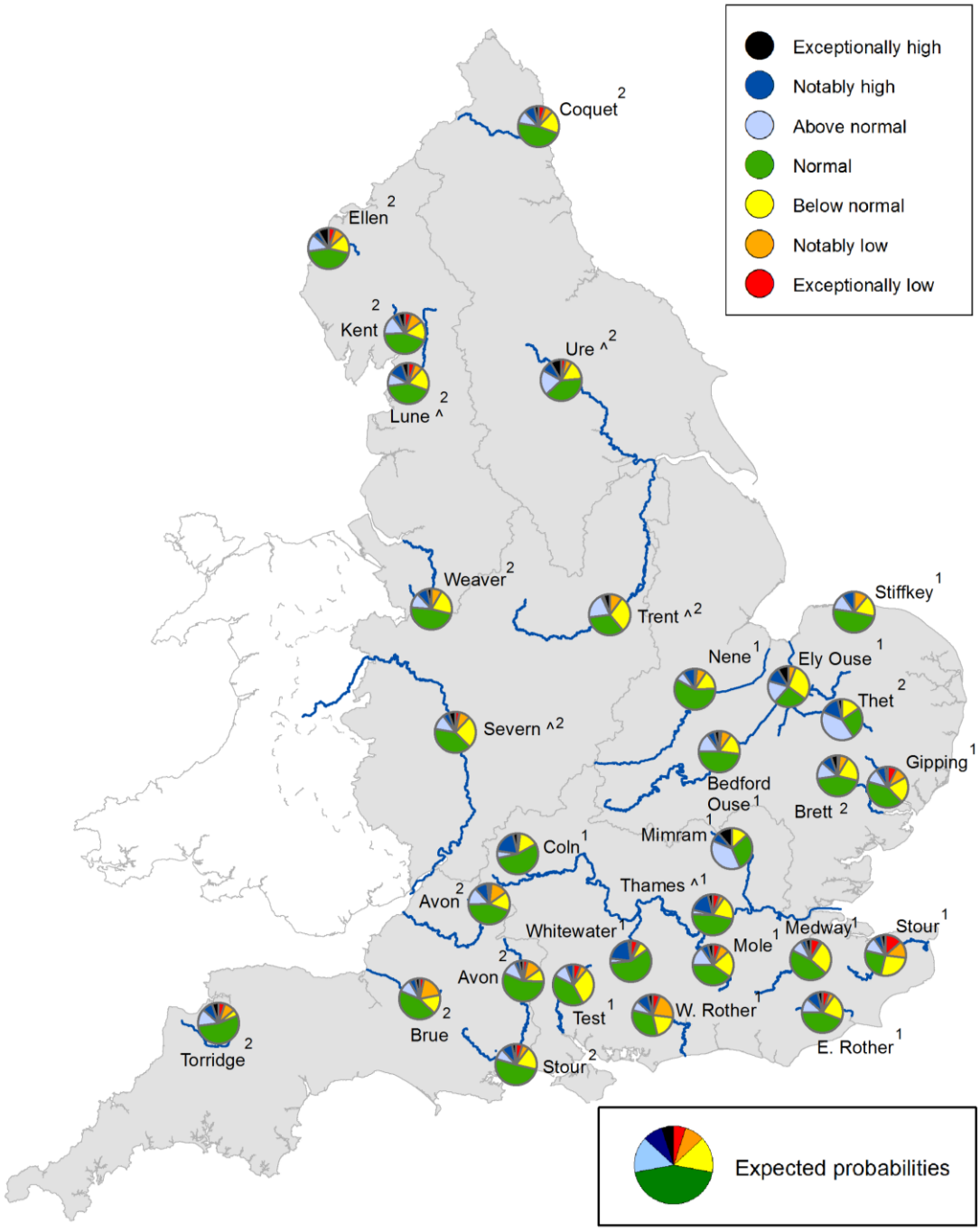

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 March 2021. 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: Centre for Ecology and Hydrology, Environment Agency).

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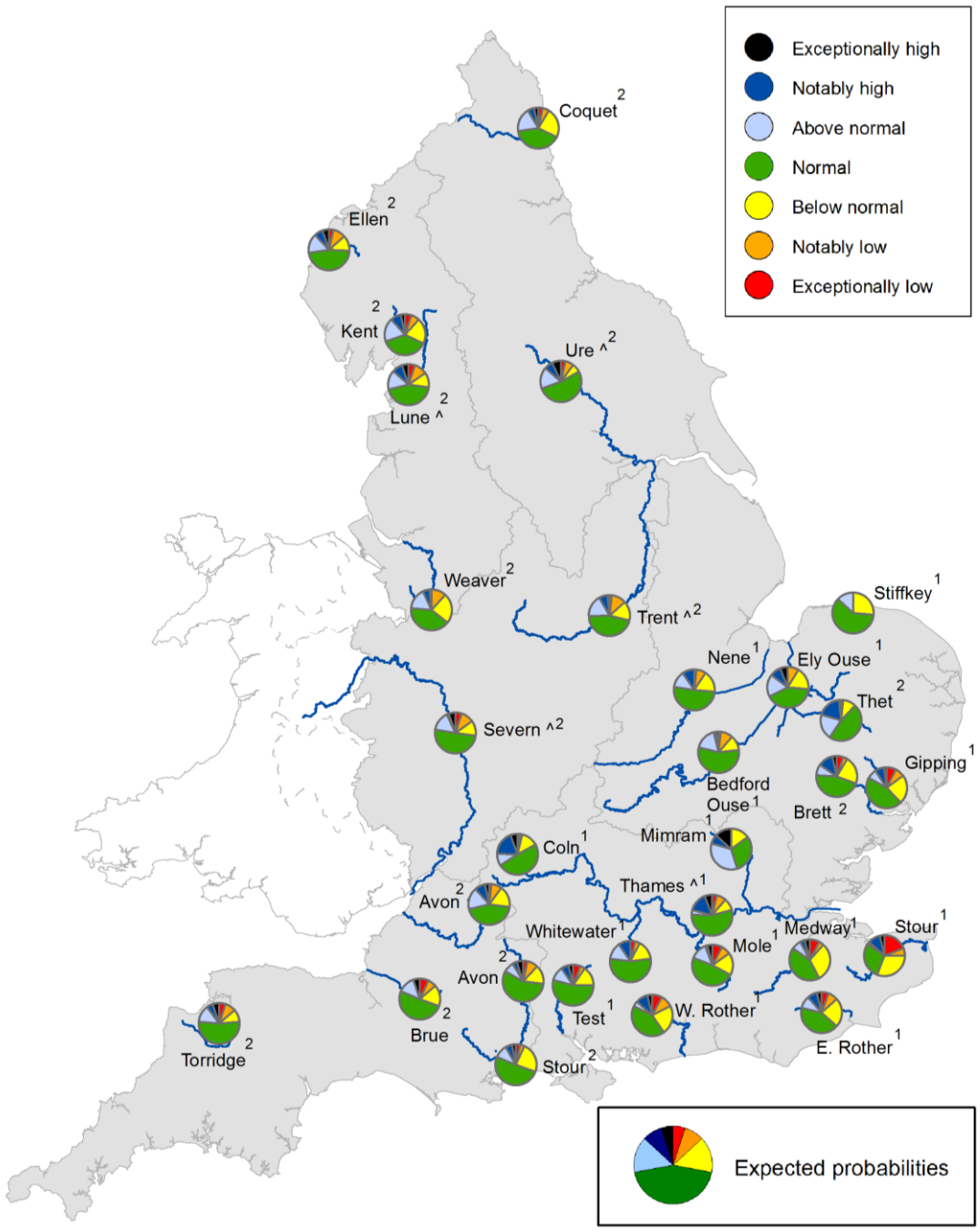
^"Naturalised" flows are projected for these sites



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 September 2021. 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: 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 CEH
^"Naturalised" flows are projected for these sites

Forward look: groundwater

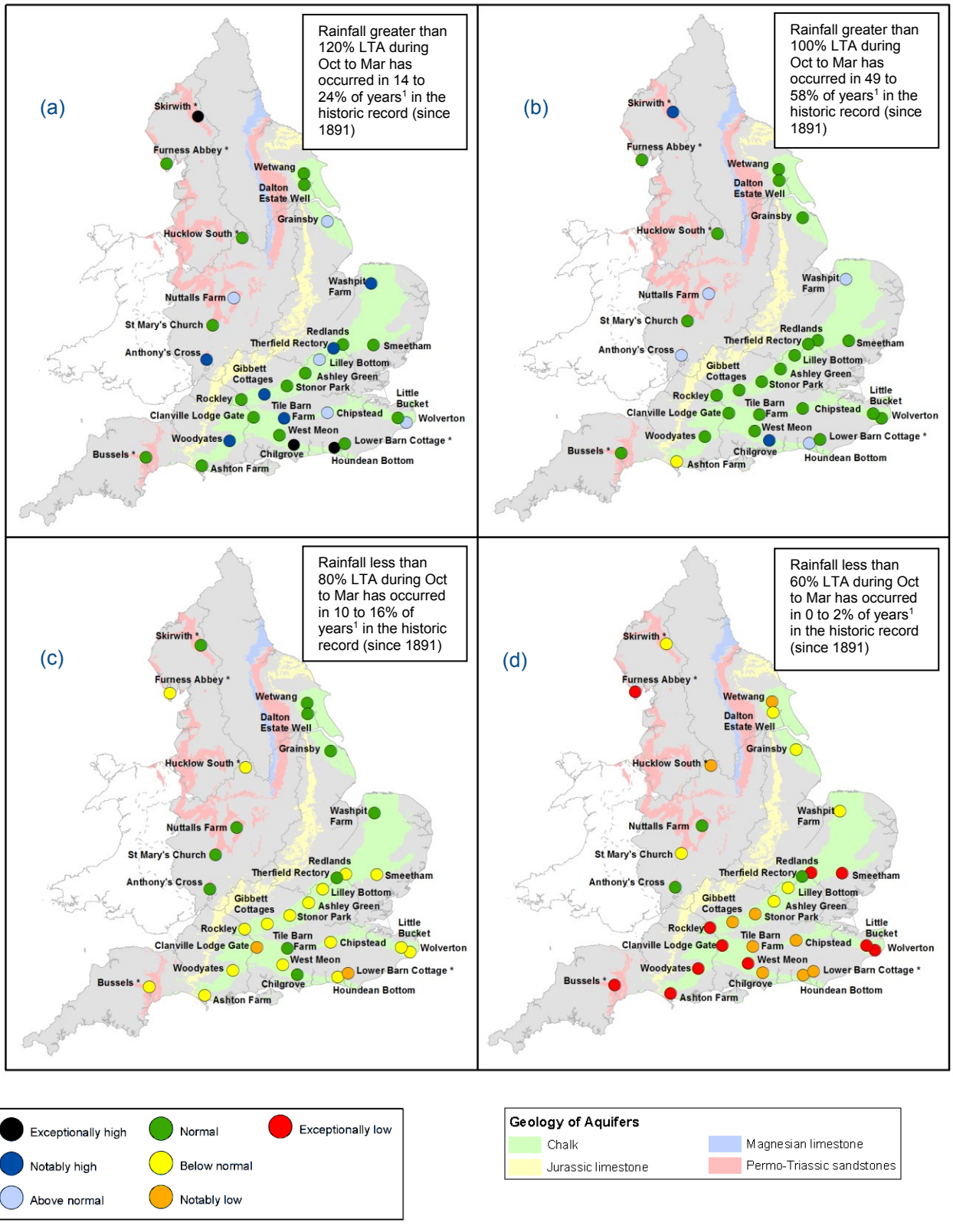


Figure 6.5: Projected groundwater levels at key indicator sites at the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between October 2020 and March 2021 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100024198, 2020.

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

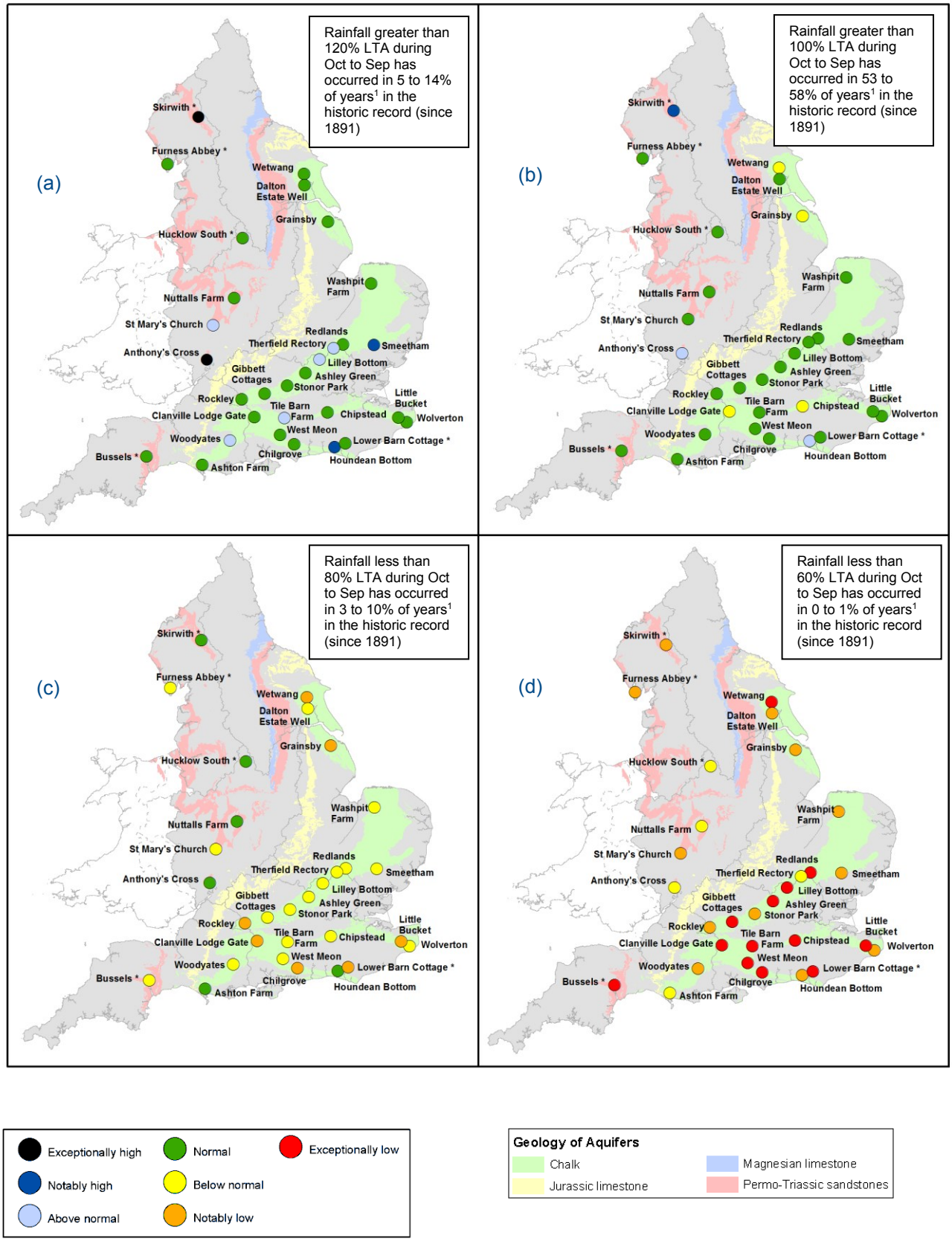


Figure 6.6: Projected groundwater levels at key indicator sites at the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between October 2020 and September 2021 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100024198 2020.

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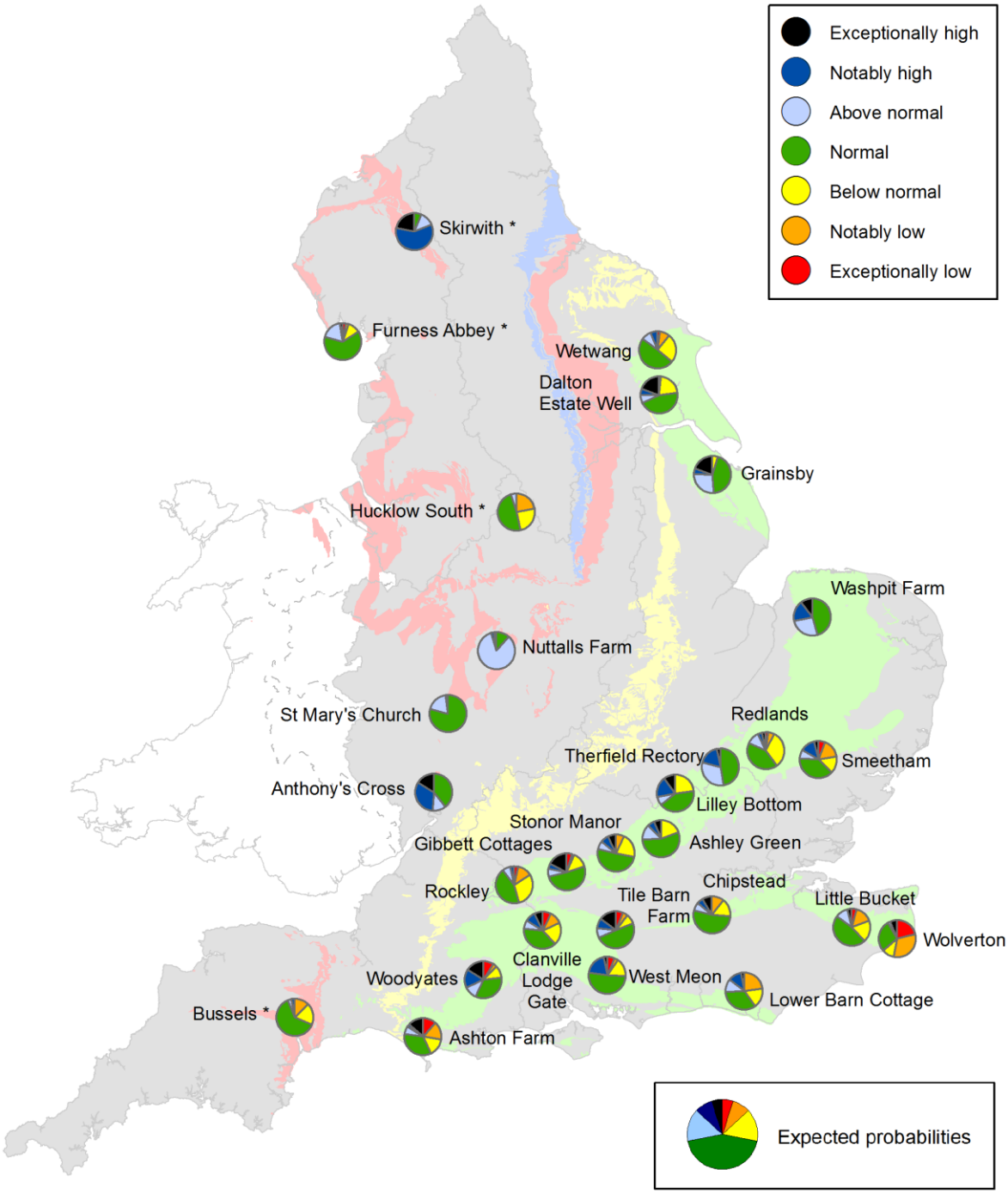
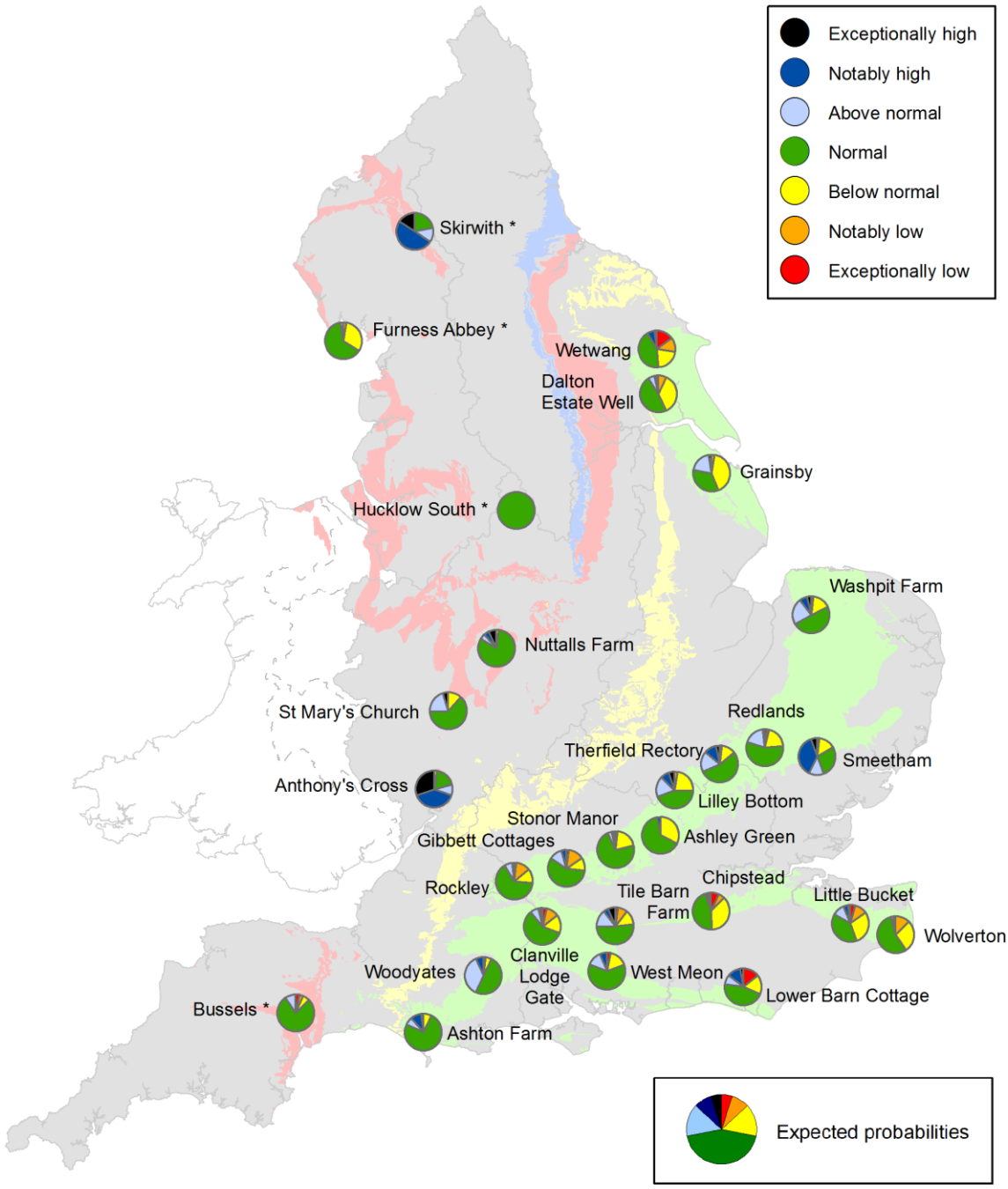


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 March 2021. 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, 2020.

** Projections for these sites are produced by BGS*



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 September 2021. 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, 2020.

* 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