Monthly water situation report

England

Summary – August 2020

Rainfall totals across much of England were above normal or notably high for August, with a small number of catchments recording exceptionally high totals for the time of year. Soil moisture deficits decreased across many parts of England, with soil in most areas wetter than average for the end of August. River flows increased at nearly three-quarters of sites, compared to July, and across England monthly mean flows were classed as normal or higher at the majority of sites. End of month groundwater levels were classed as normal or higher at more than three-quarters of the indicator sites. Total reservoir stocks for England were at 83% of capacity at the end of August, just below the long term average for the time of year.

Rainfall

The August rainfall total for England was 109mm, which is 153% of the 1961 to 1990 long-term average (LTA) (158% of the 1981 to 2010 LTA). The highest rainfall totals for August were seen in parts of north-west and south-west England (Figure 1.1).

The majority of hydrological areas across England received above normal or higher rainfall totals for August, with five catchments seeing exceptionally high totals for the time of year. This includes the Lee Chalk (in Hertfordshire) which received the highest rainfall total as a proportion of the LTA, with 128mm of rainfall during August, representing 233% of the LTA. The Lower Wye, Upper Dee, Avon, Dart and Erme and Cotswold East catchments also received exceptionally high rainfall totals for August. Normal rainfall totals were recorded in around a third of the hydrological areas, mainly in coastal areas of Norfolk and Suffolk, and across Kent and Sussex. A below normal rainfall total for August was recorded in the Thanet Chalk catchment (in Kent) with 30mm, representing 65% of the long-term average (Figure 1.2).

At a regional scale, August rainfall totals ranged from 76mm (137% of LTA) in east England to 171mm (159% of LTA) in north-west England. The three month period ending in August this year has been the third wettest June-July-August period on record for north-west England (records go back to 1891) (Figure 1.3).

Soil moisture deficit

Soil moisture deficits (SMDs) decreased (soils got wetter) across the majority of England during August, with the exception of parts of north-west England where soils became slightly drier compared with the end of July, although deficits remain small here (<10mm). In contrast, despite a reduction in SMDs through August, soils in parts of south-east and east England continue to have SMDs greater than 100mm. By the end of August, soils were wetter than average across most of England, with the exception of parts of south-east England (Figure 2.1).

At a regional scale, soil moisture deficits have decreased across all regions through August. Soils were wetter than the LTA for the time of year in all regions except south-east England, where soils were slightly drier than the LTA for the end of August (Figure 2.2).

River flows

River flows increased at around three-quarters of the indicator sites, compared to July. Across England, monthly mean flows at all but three sites, were classed as normal or higher for the time of year. Almost half of the indicator sites were classed as normal, and in general these sites were located in south-east, east and parts of south-west England. Indicator sites located in north-west, north-east and parts of south-west England were generally classed as above normal or higher for the time of year. Three sites were classed as notably low: the Eastern Rother at Udiam in south-east England, and the Yare at Colney and Cam at Dernford in east England. The Dee at Manley Hall (Wales) had exceptionally high monthly mean flows for August (Figure 3.1).

Monthly mean river flows for the regional indicator sites were classed as normal for the time of year at three sites: the Bedford Ouse at Offord (east England), the Thames at Kingston and Great Stour at Horton in south-east England. The remaining regional sites were classed as above normal or notably high (Figure 3.2).

Groundwater levels

As generally expected for the time of year, groundwater levels continued to recede during August at nearly all of the indicator sites reported on. End of month groundwater levels were classed as normal or higher at more than three-quarters of indicator sites. Levels at Coxmoor (Idle and Torne Sandstone) and Priors Hayes (West Cheshire sandstone) were classed as exceptionally high. These sites recorded the highest end of August levels on record (records go back to 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. Four chalk aquifer sites recorded below normal or lower groundwater levels for the time of year, including Redlands Hall (Cam and Ely Ouse Chalk), Tilshead (Upper Hampshire Avon chalk), Woodyates (Upper Dorset Stour chalk) and Chilgrove (Chichester Chalk). Jackaments Bottom in the Burford Jurassic limestone aquifer also recorded below normal groundwater levels for the time of year (Figure 4.1).

End of month groundwater levels at the major aquifer index sites ranged from notably low at Chilgrove (Chichester chalk) to notably high in the sandstone aquifers at Weir Farm (Bridgnorth sandstone) and Skirwith (Carlisle Basin and Eden Valley sandstone) (Figures 4.1 and 4.2).

Reservoir storage

Reservoir stocks decreased at just under two-thirds of the reservoirs and reservoir groups reported on during August. At Abberton (east England), Ardingly, Bewl and Bough Beech (south-east England) and Stithians (south-west England) reservoir stocks reduced by more than 10% of total storage capacity. The biggest decrease was at Abberton reservoir, where stocks fell from 86% of capacity at the end of July, to 61% of capacity at the end of August. The Haweswater and Thirlmere reservoir group (north-west England) and Vyrnwy reservoir (Wales) recorded the largest increases in reservoir stocks of more than 10% of total capacity. Reservoir stocks were classed as normal or higher at two-thirds of the sites reported on at the end of August (Figure 5.1).

Total reservoir stocks for England were at 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 remain below average (Figure 5.2).

Forward look

Some changeable weather conditions are expected in early September, particularly in northern England. Towards the middle of the month a shift to more settled conditions is expected. Warmer than average temperatures are expected in the south of England at times, with the chance of some thundery activity during this period. It is not clear how long this settled spell will last but changeable weather in the second half of September is most likely. For the 3 month period September to November, across the UK, above average precipitation is slightly more likely than below average precipitation[1].

Projections for river flows at key sites[2]

Over four-fifths of the modelled sites have a greater than expected chance of cumulative river flows being normal or higher for the time of year by the end of September 2020. By the end of March 2021, a fifth of 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 2020 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by March 2021 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by September 2020 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by March 2021 see Figure 6.4

Projections for groundwater levels in key aquifers[2]

By the end of September 2020, almost four-fifths of all the modelled sites have a greater than expected chance of groundwater levels being normal or higher for the time of year. By the end of March 2021, over a third of the 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 2020 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in March 2021see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2020 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in March 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

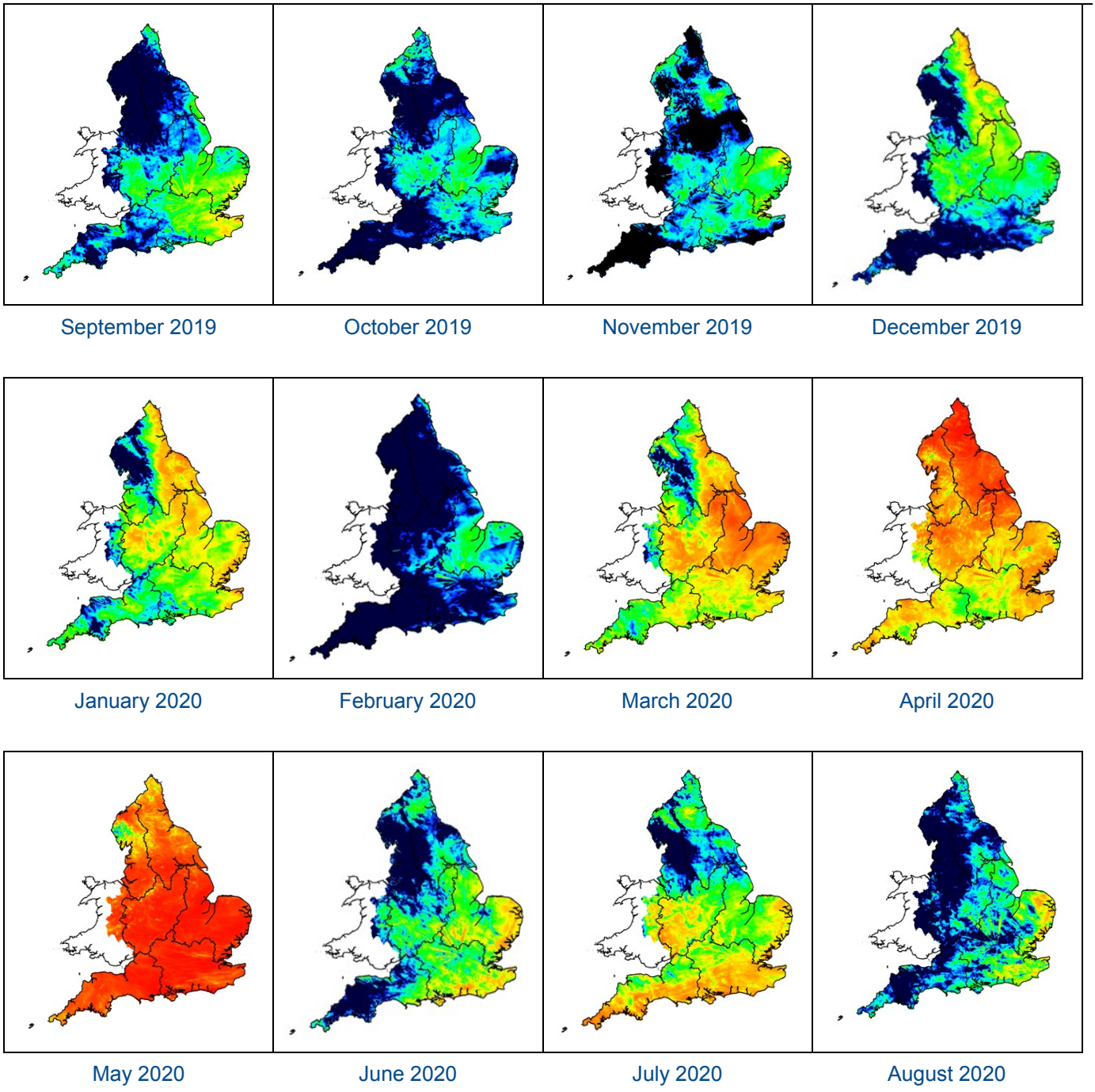


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2020). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

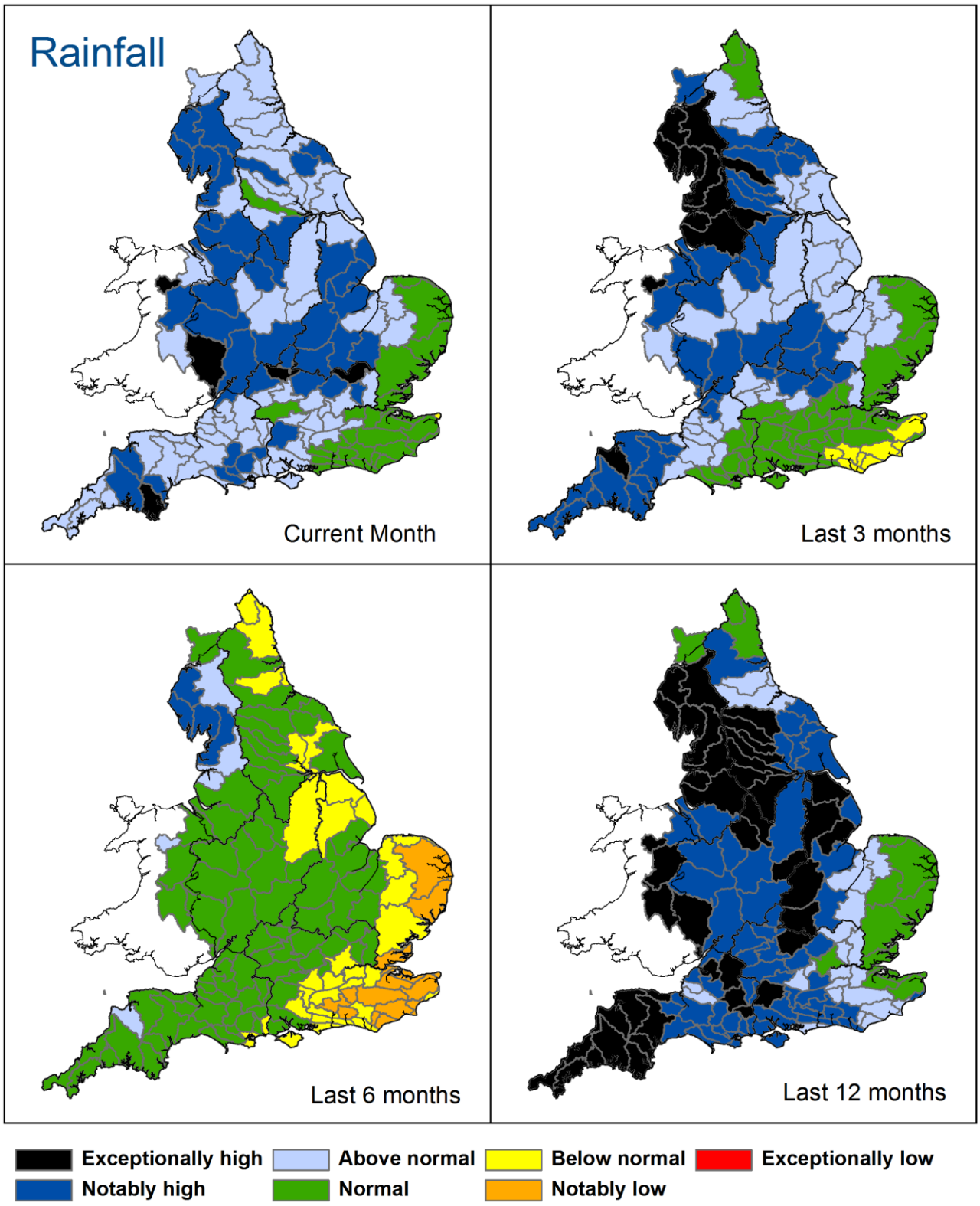


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 August), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived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

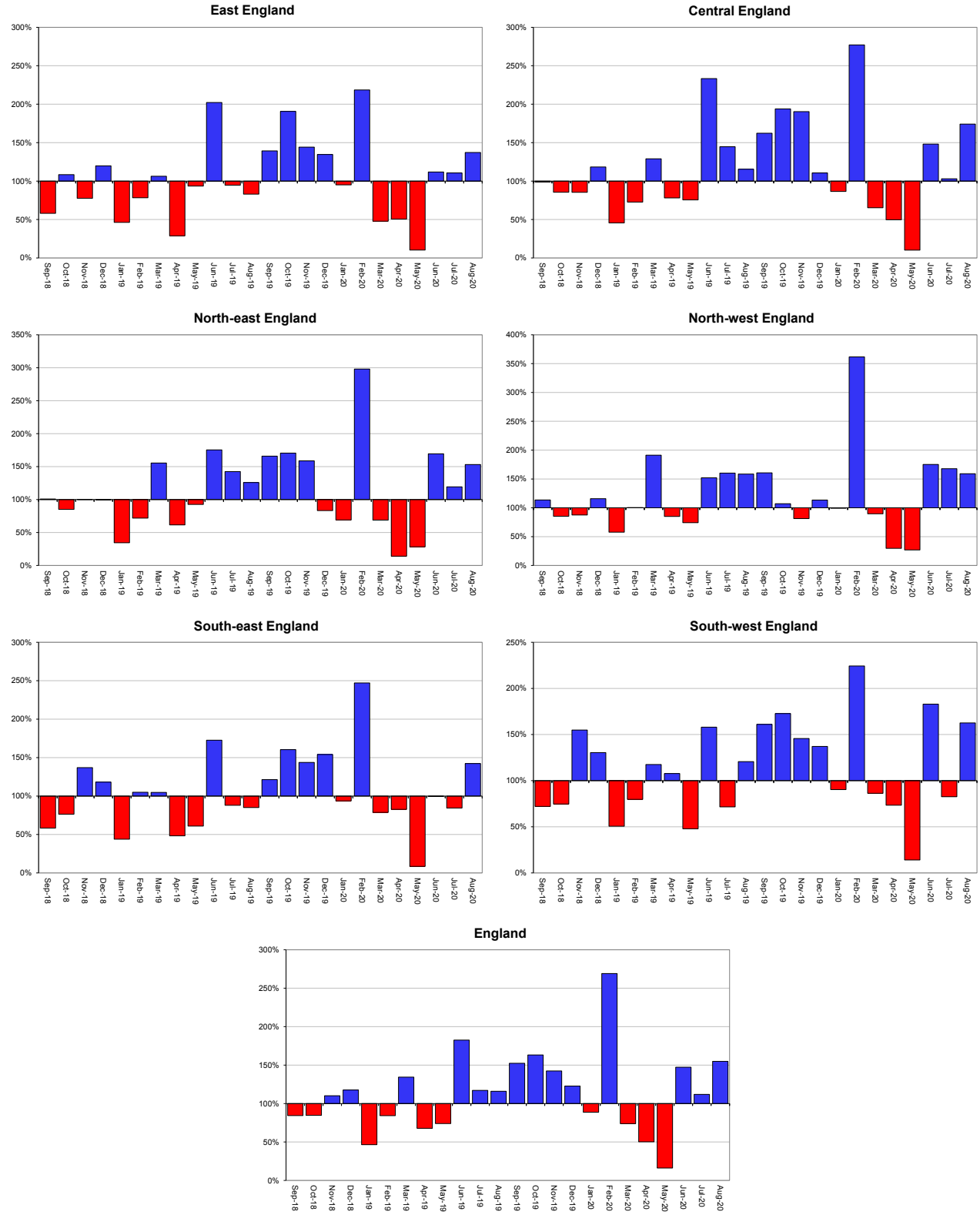


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2020).

Soil moisture deficit

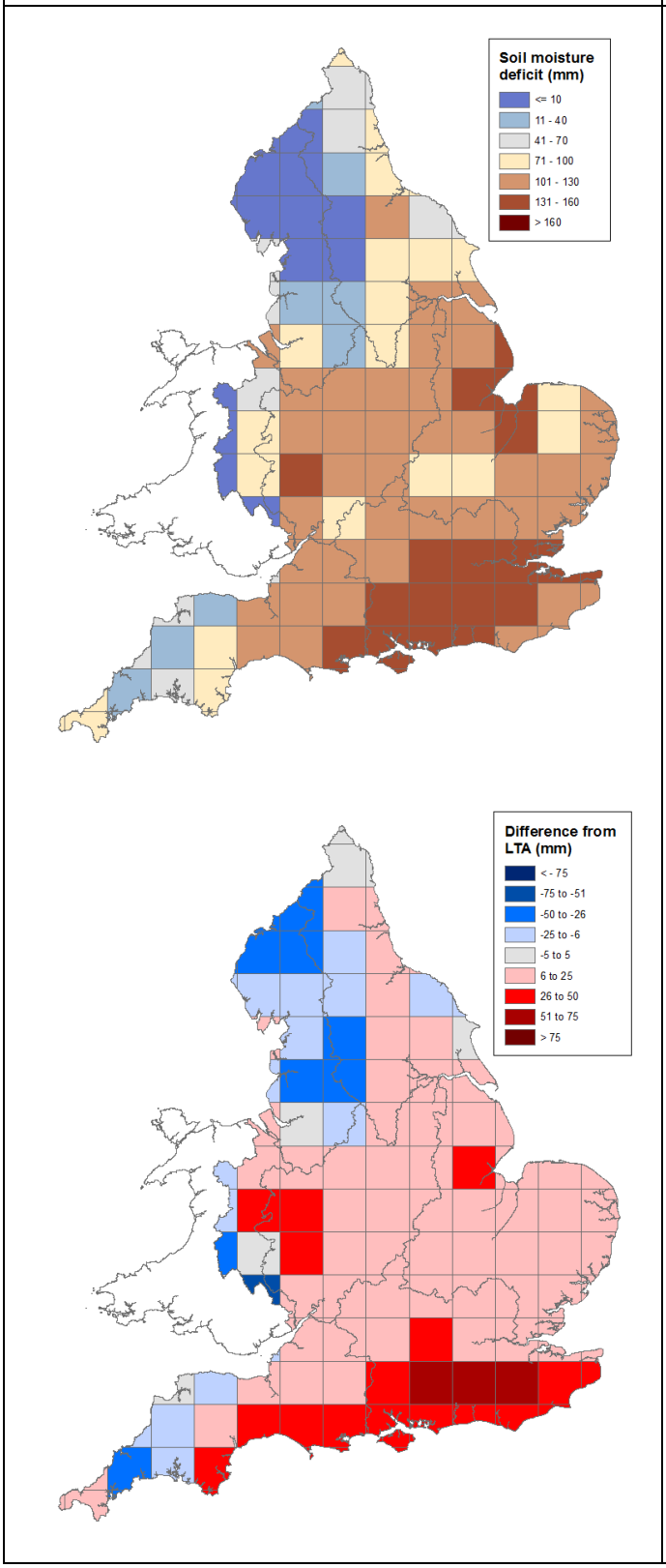
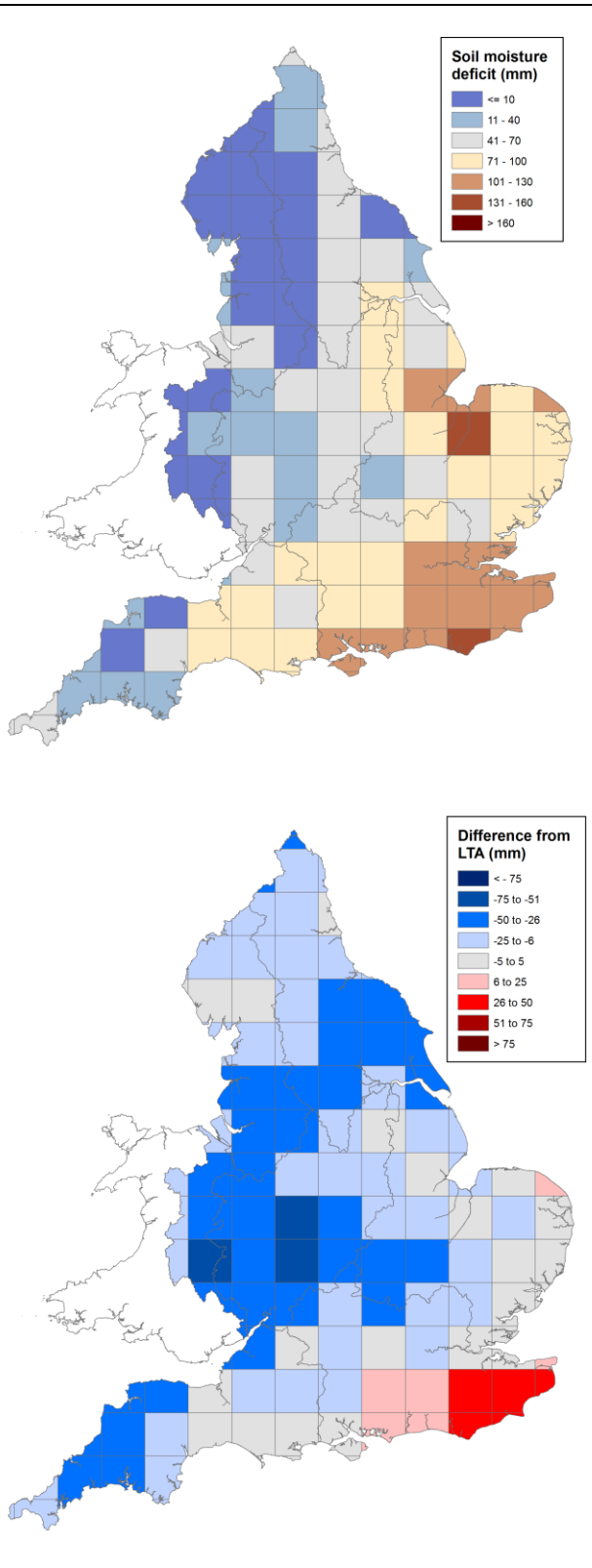
End of July 2020[1]	End of August 2020[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 28 July 2020 [1] (left panel) and 01 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

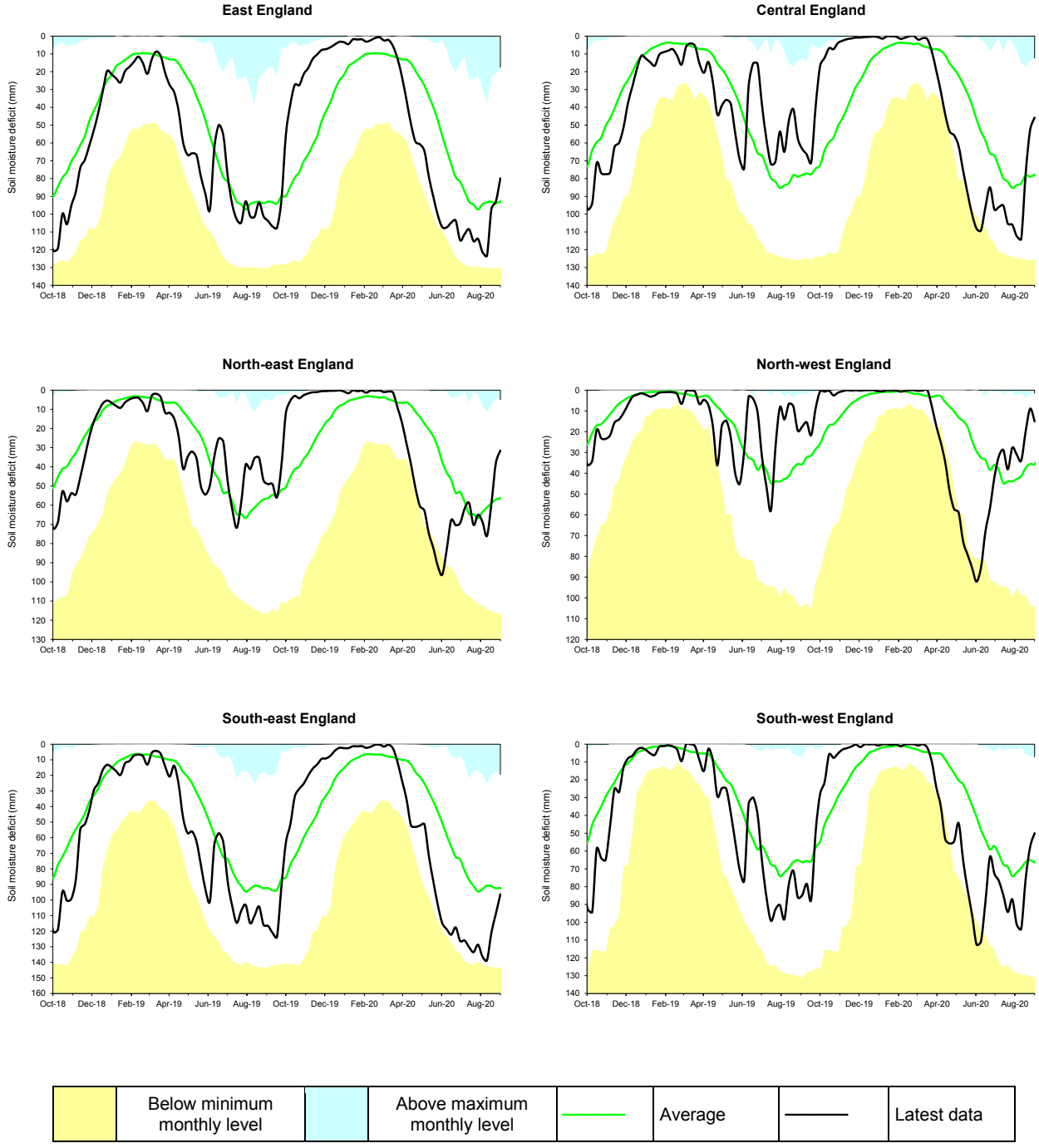
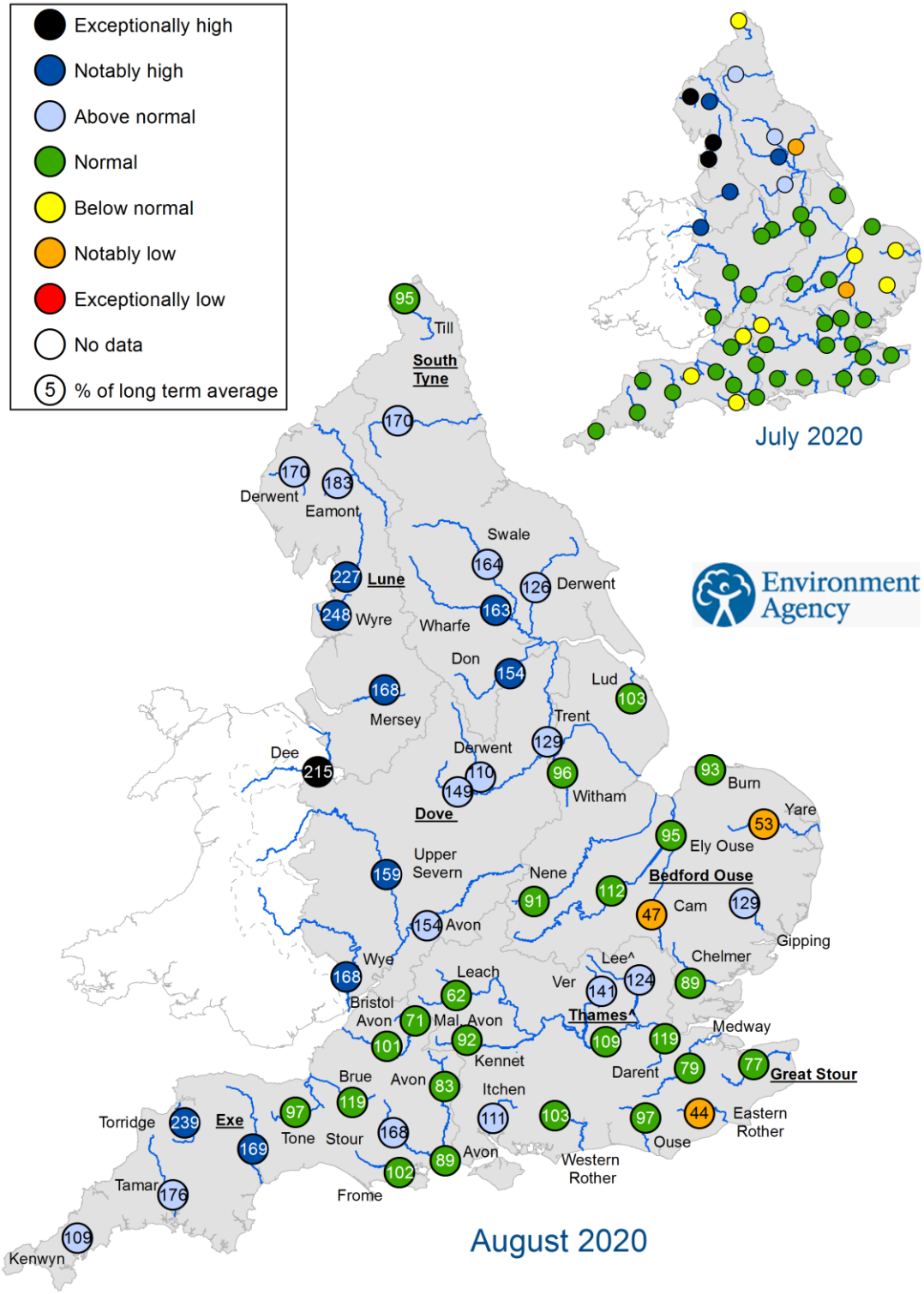


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2020).

River flows



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

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

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 and August 2020, 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, 2020.

River flow charts

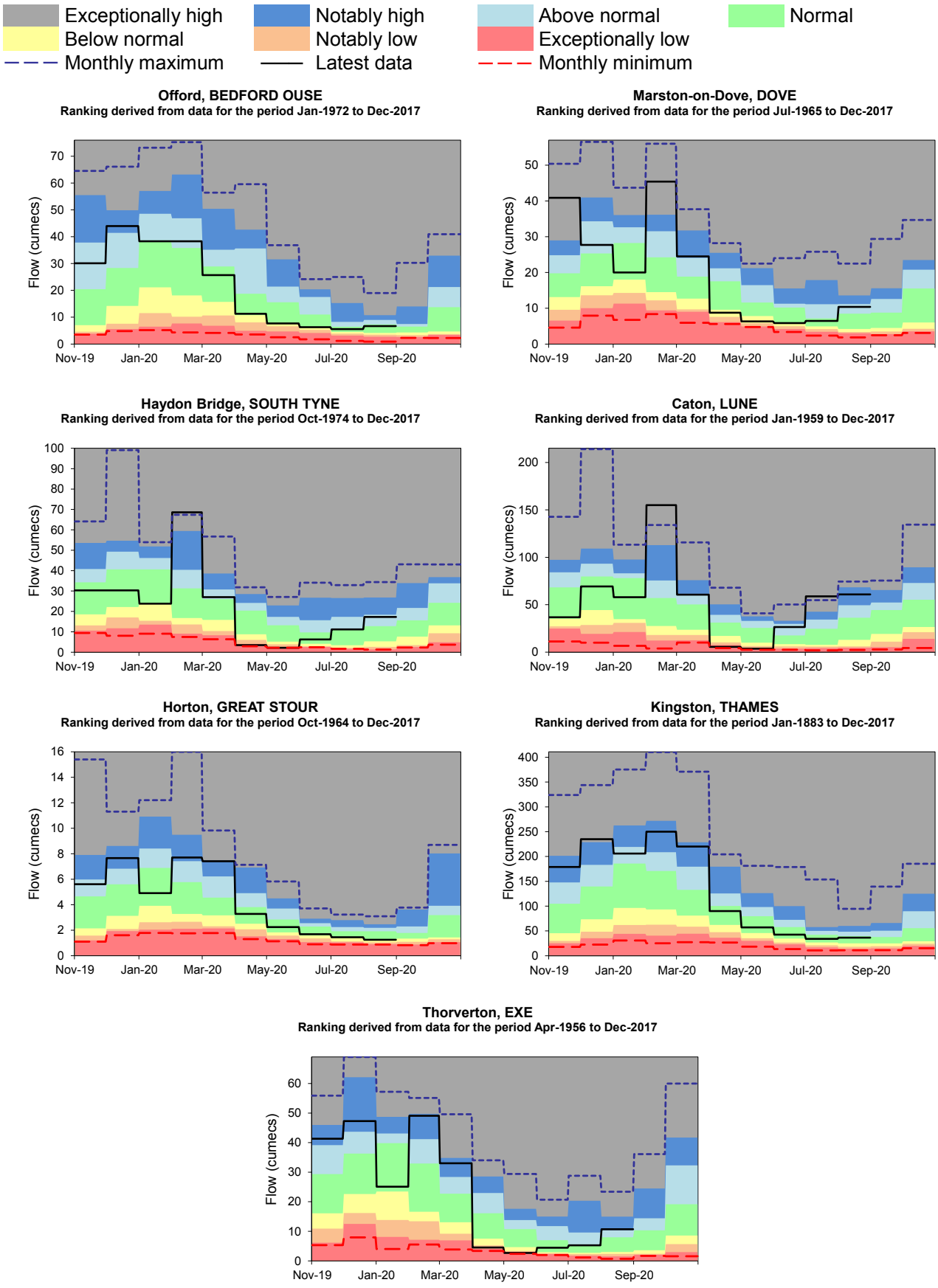
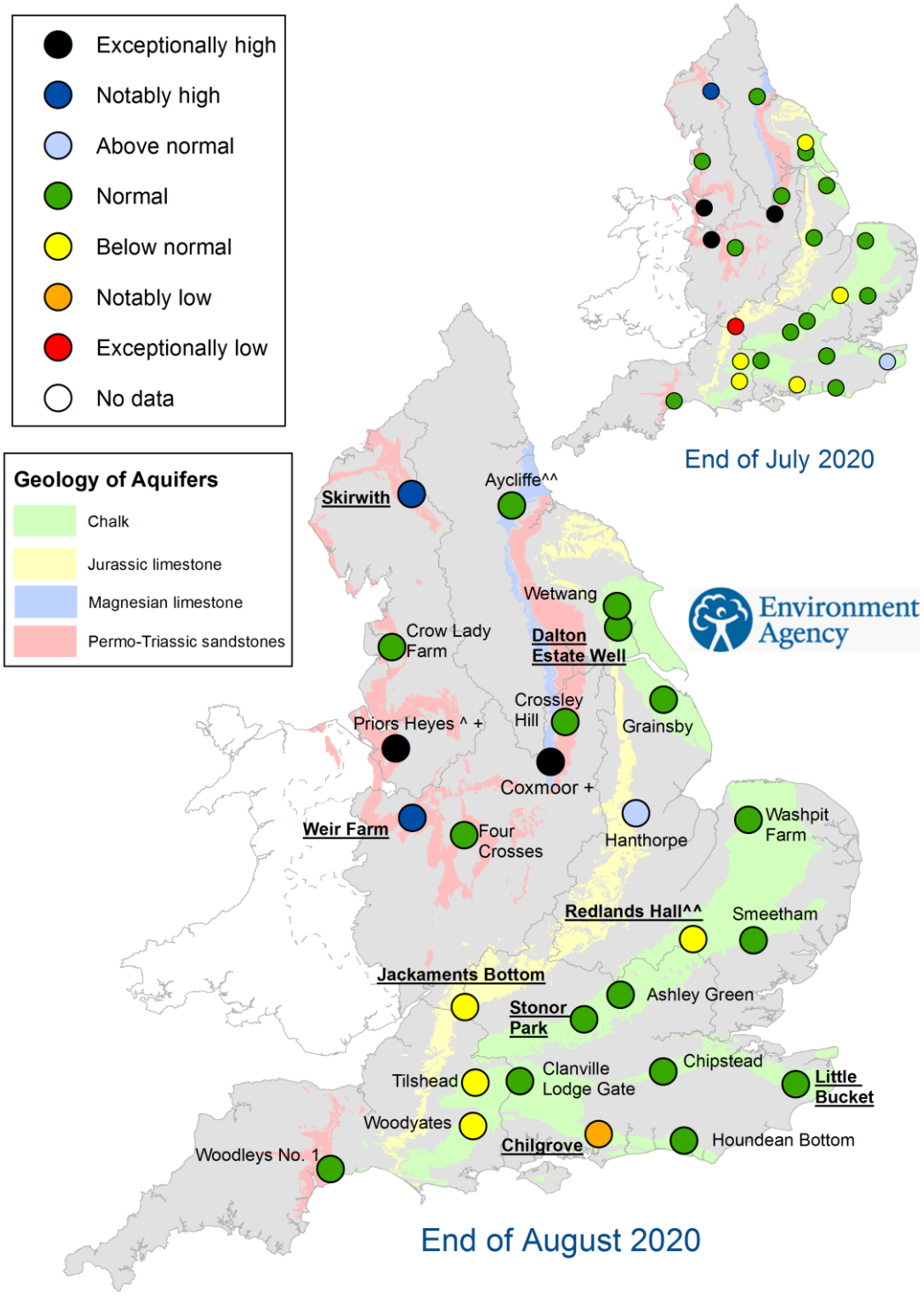


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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 July and August 2020, 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, 2020.

Groundwater level charts

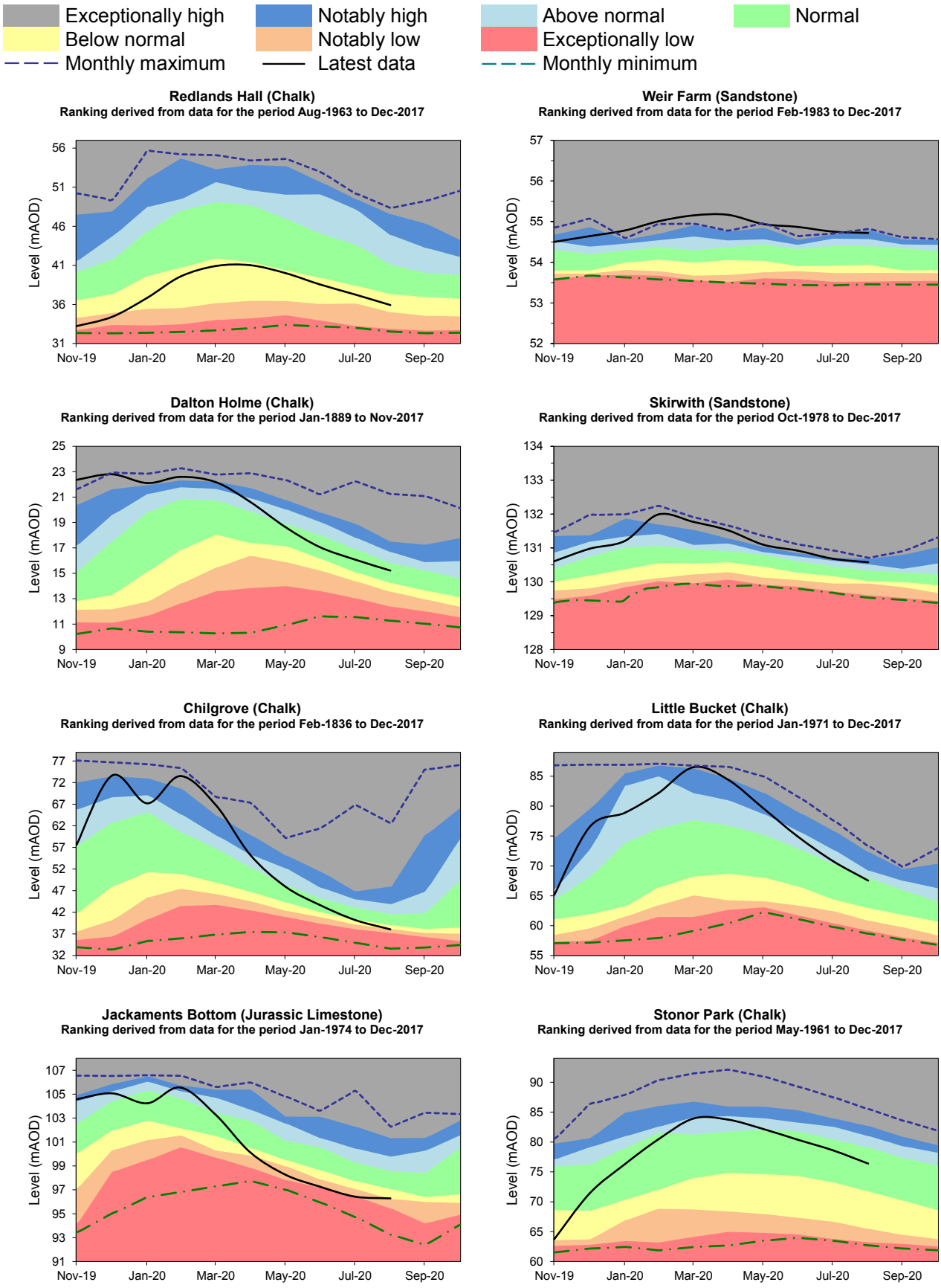
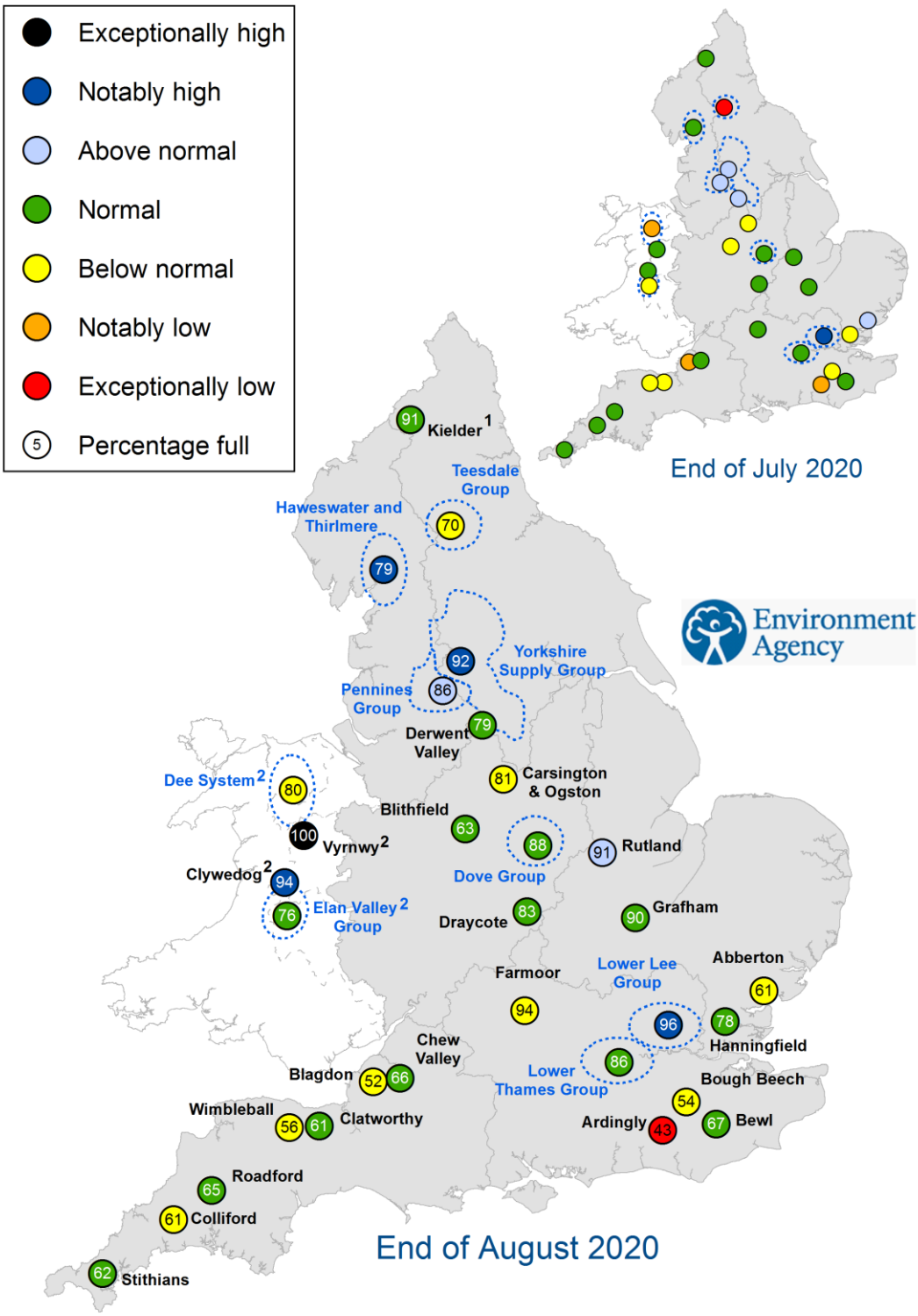


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2020).

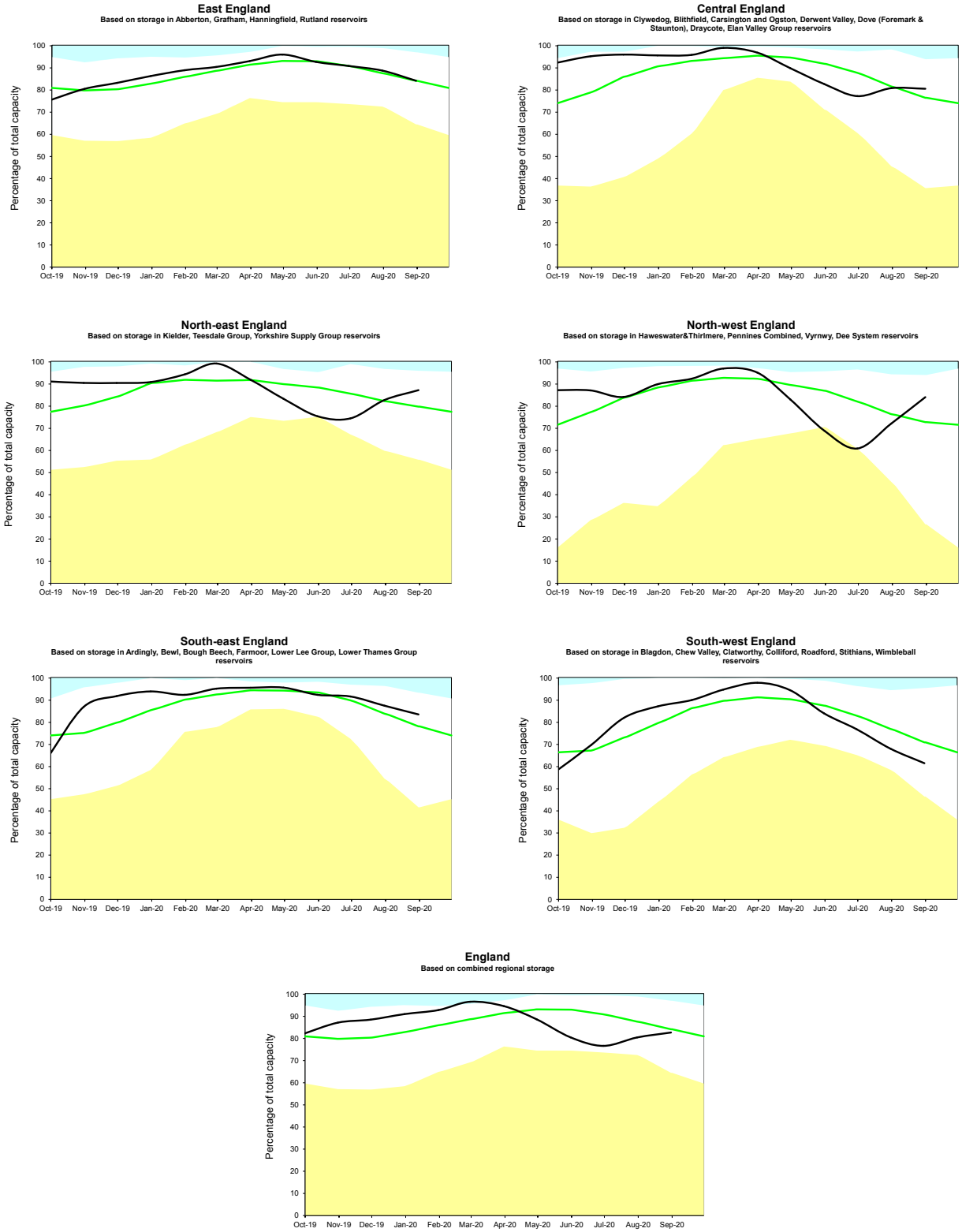
Reservoir storage



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 July and August 2020 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. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

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

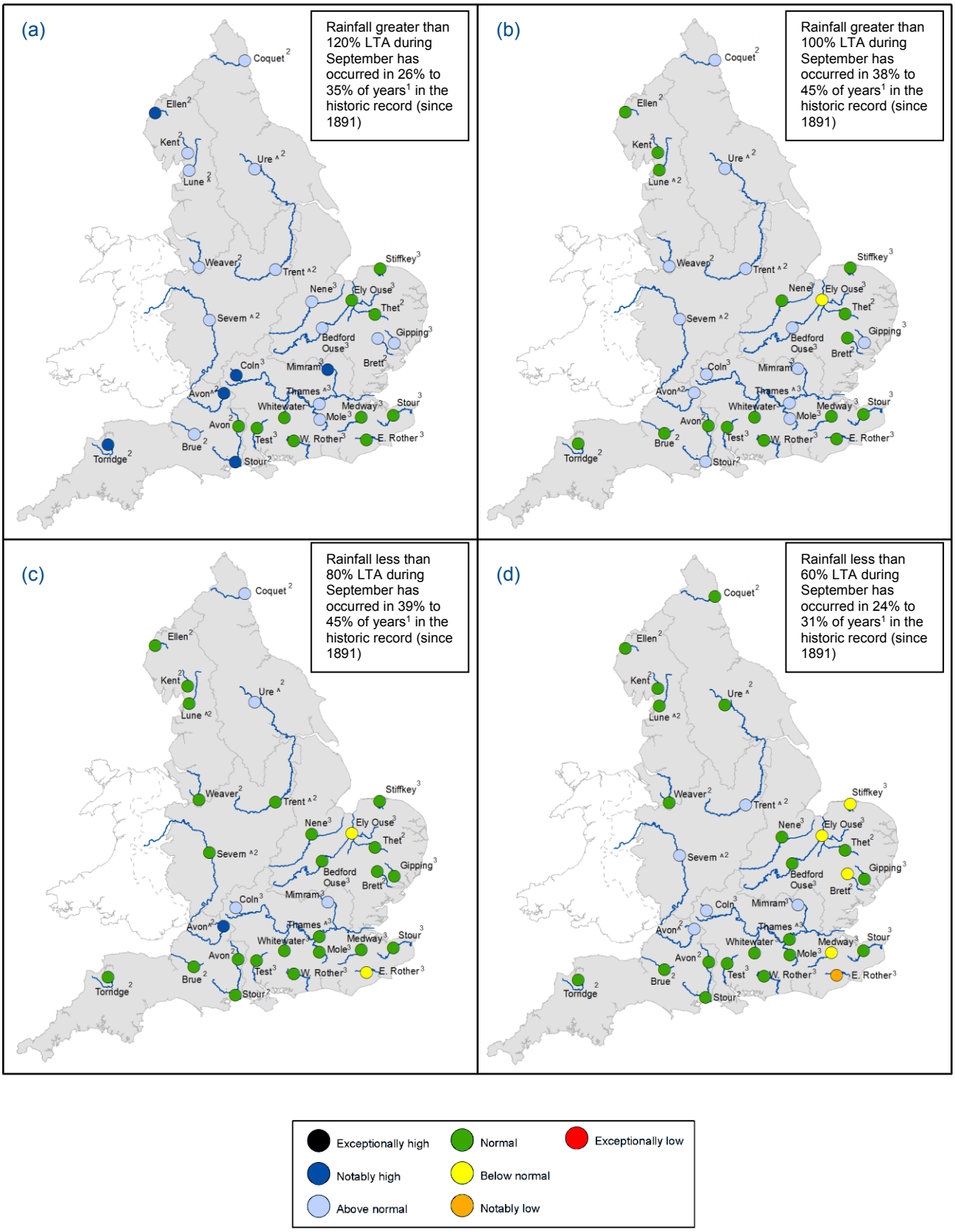


Figure 6.1: Projected river flows at key indicator sites up until the end of September 2020. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2020 and September 2020 (Source: Centre for Ecology and Hydrology, Environment Agency)

[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*

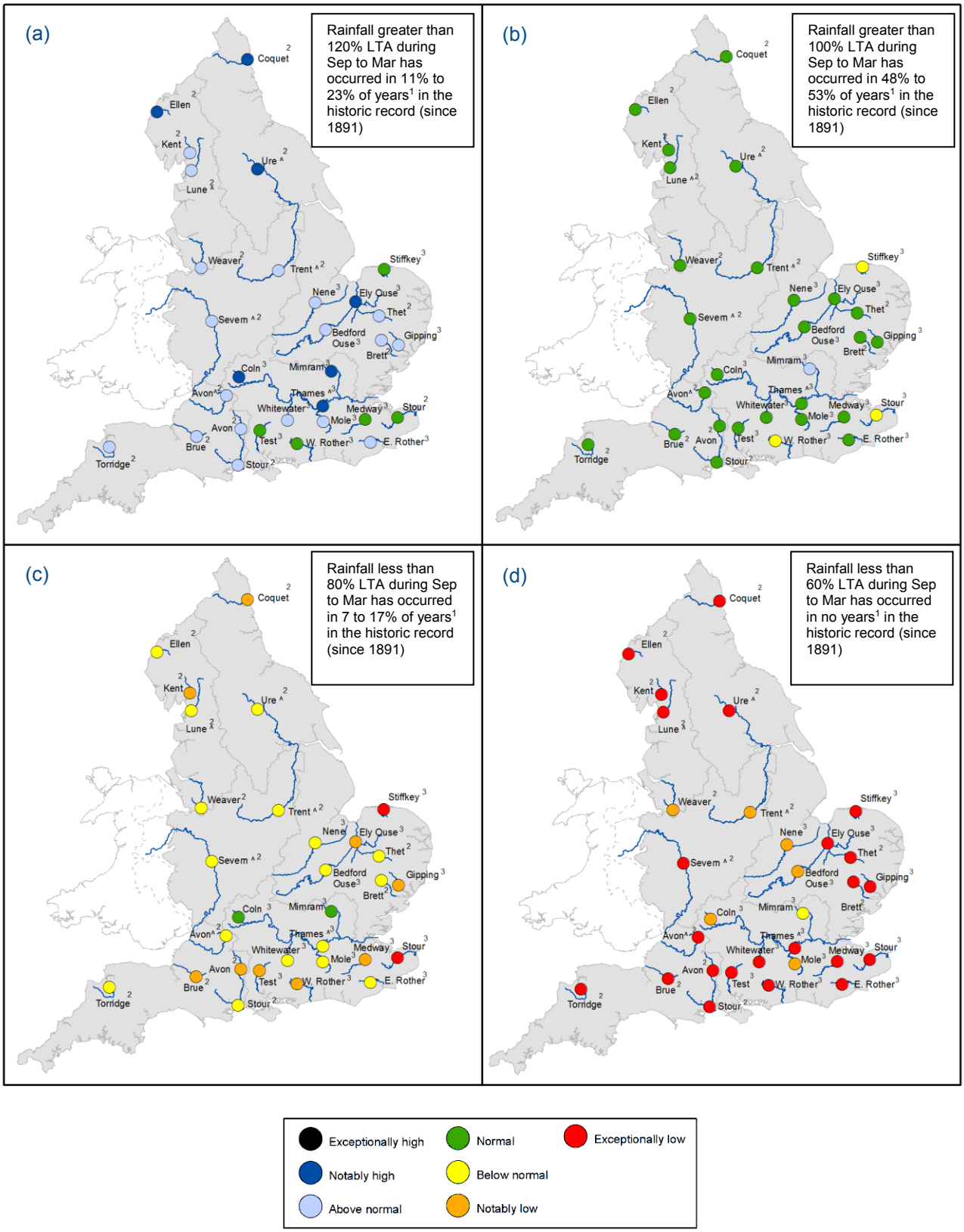


Figure 6.2: Projected river flows at key indicator sites up until the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2020 and March 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

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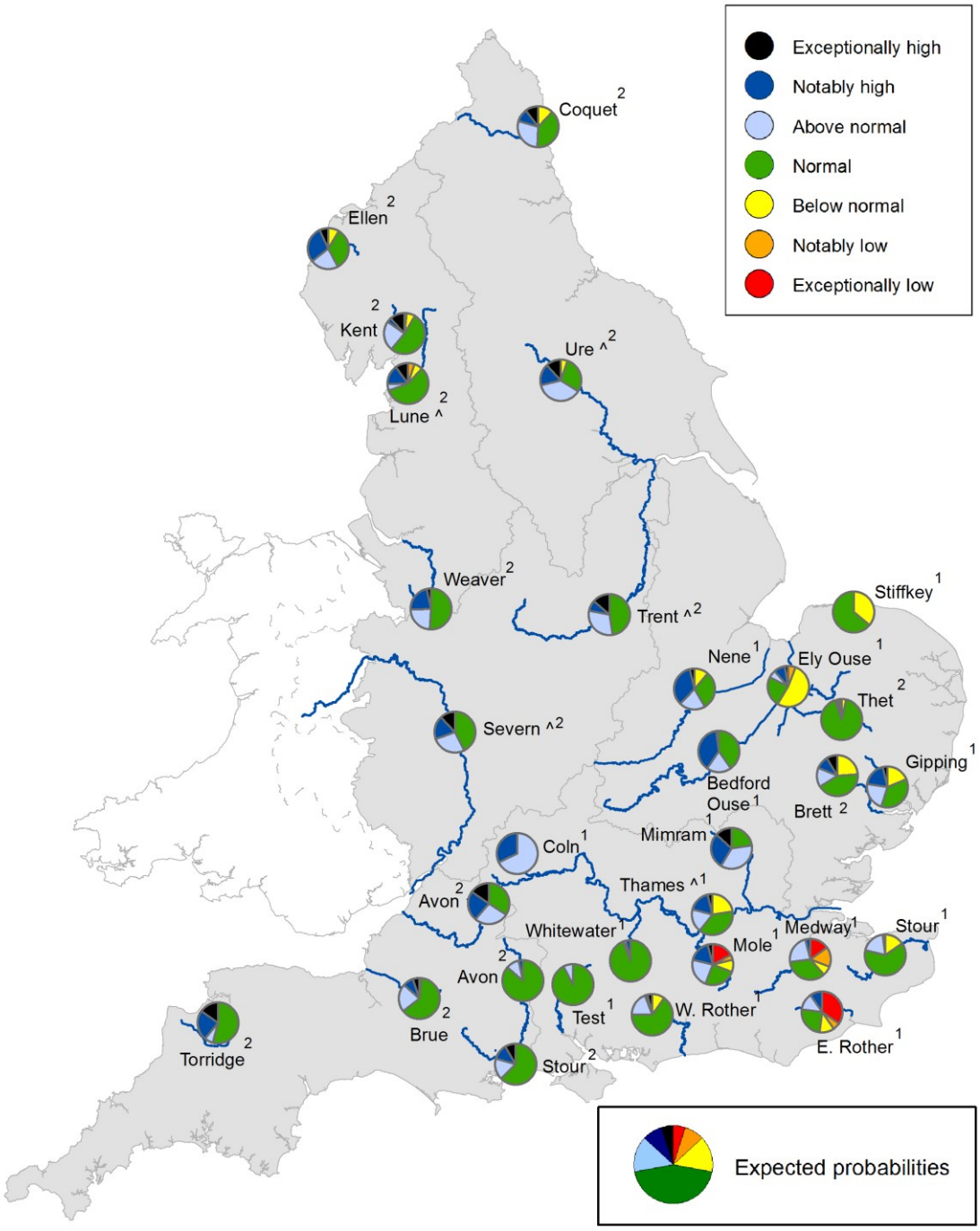

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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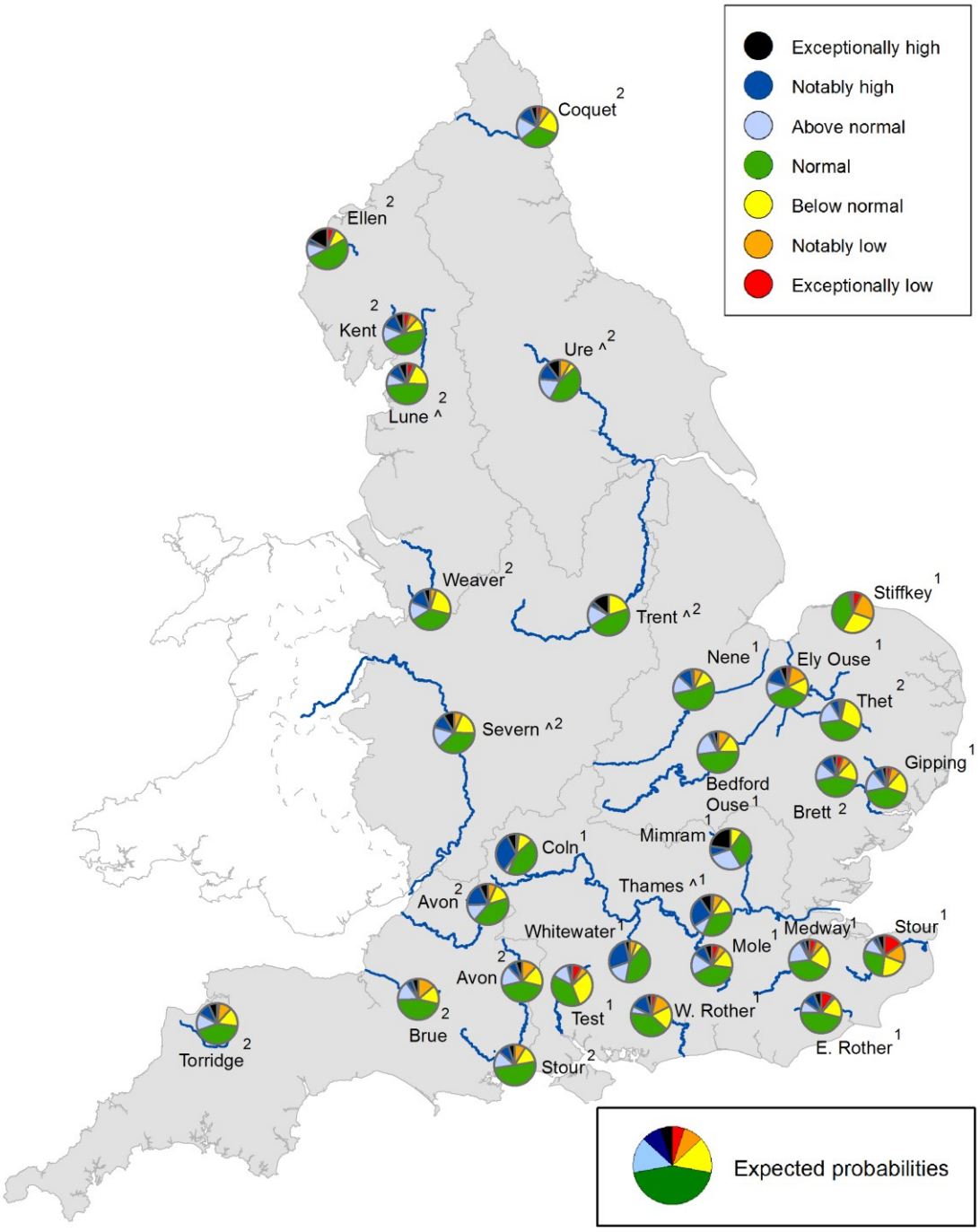

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of March 2021. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. (Source: Centre for Ecology and Hydrology, Environment Agency).

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[2] Projections for these sites are produced by CEH
^"Naturalised" flows are projected for these sites

Forward look: groundwater

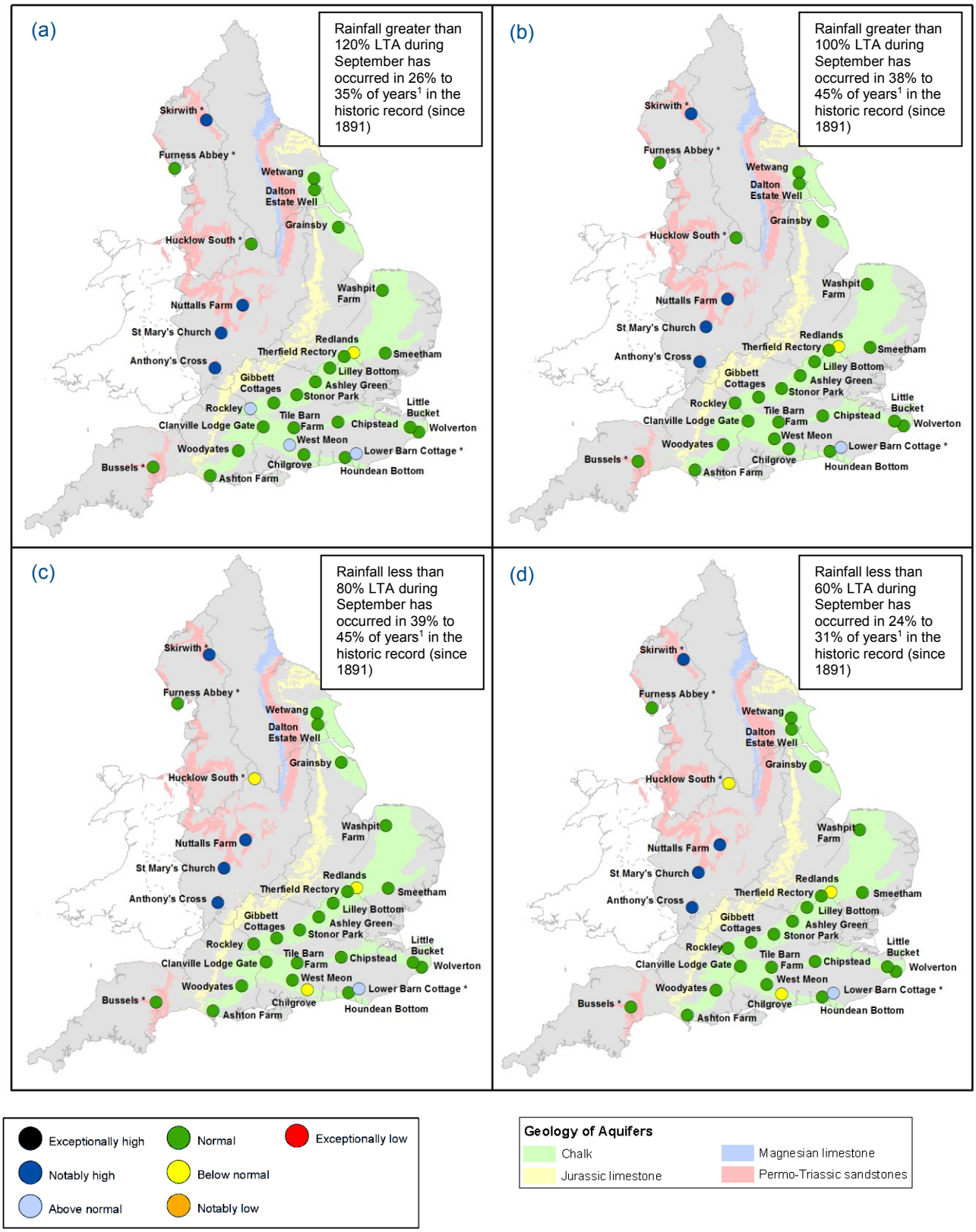

Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2020. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2020 and September 2020 (Source: Environment Agency) Geological map reproduced with kind 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

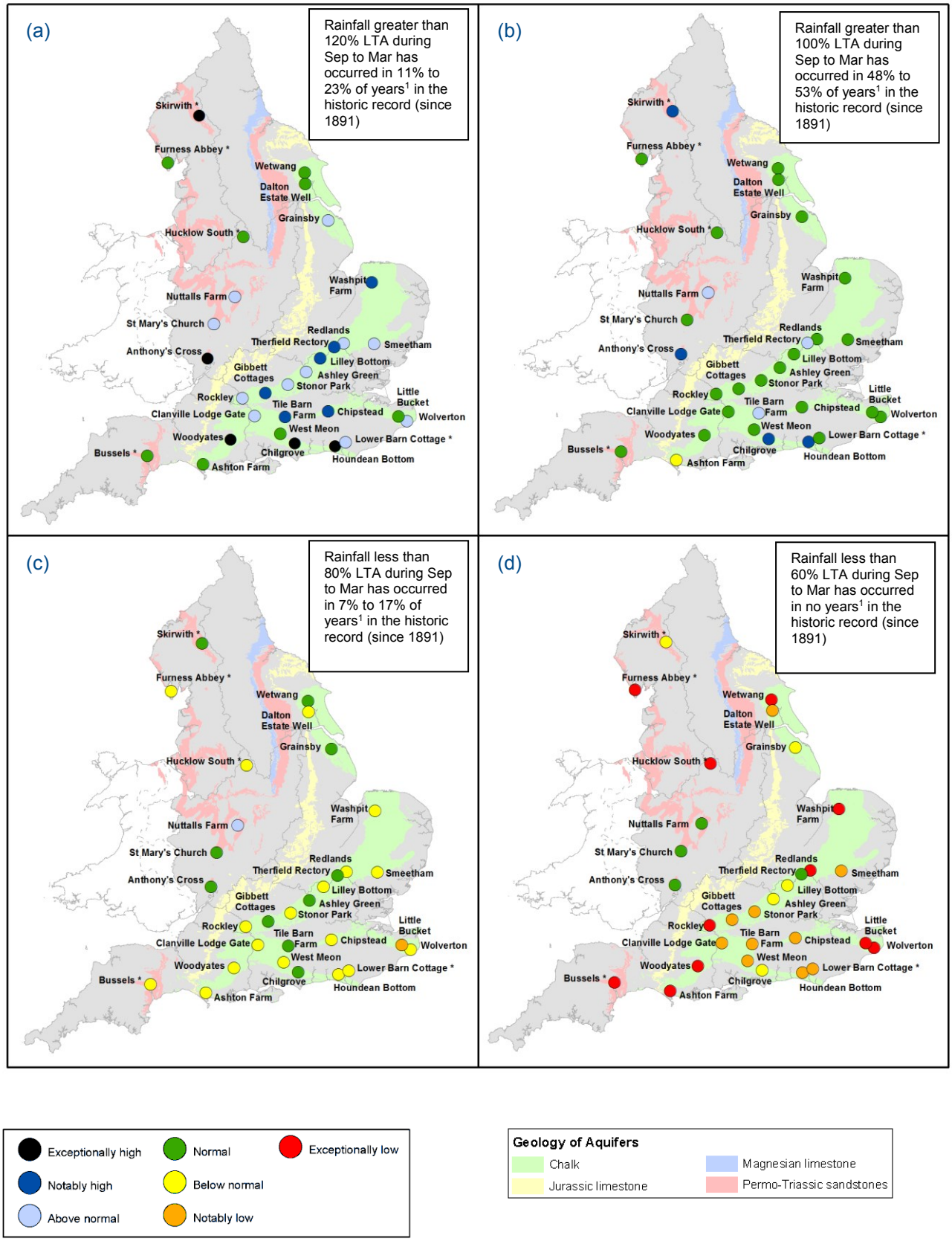

Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2020 and March 2021 (Source: Environment Agency) Geological map reproduced with kind permission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

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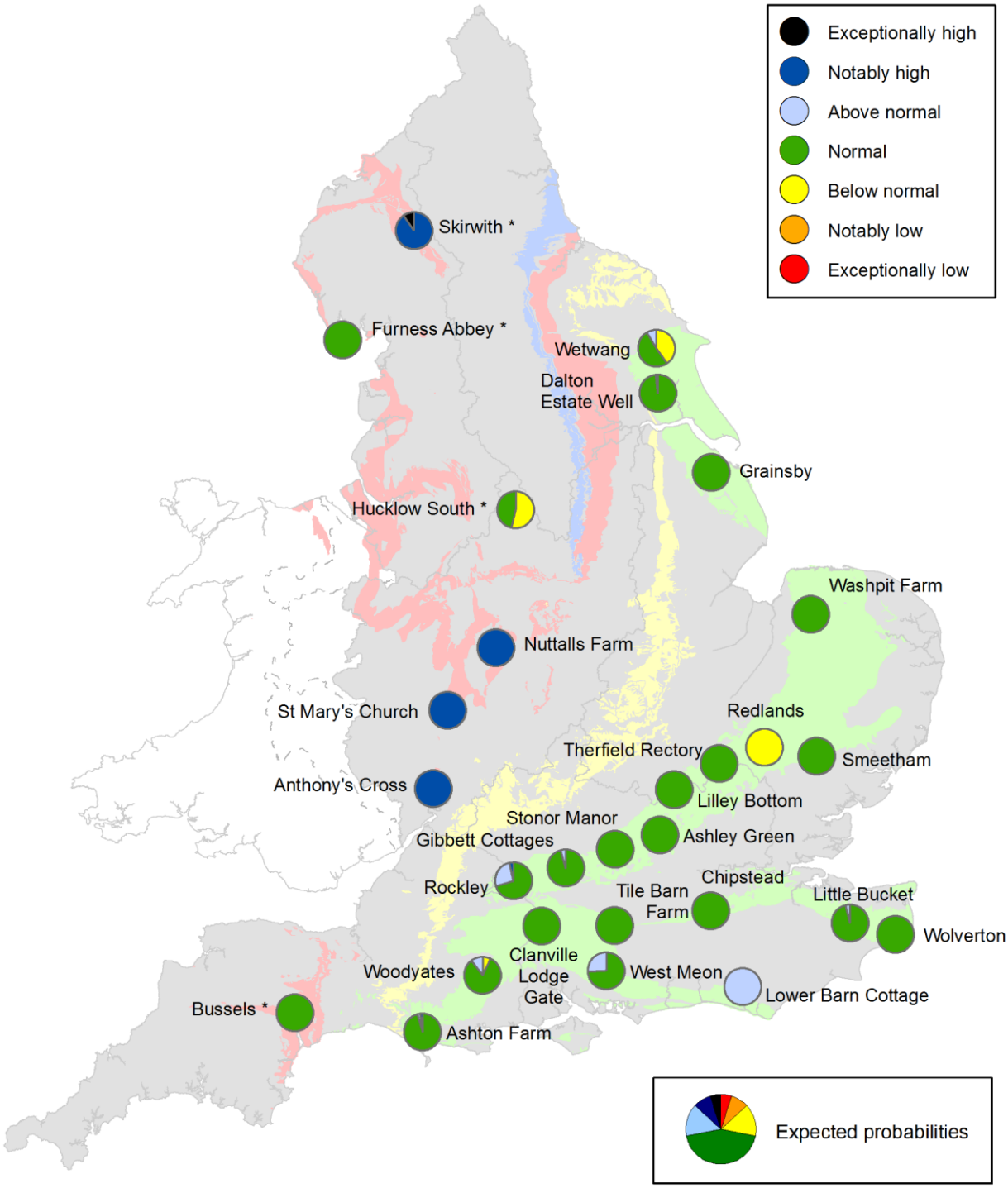

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

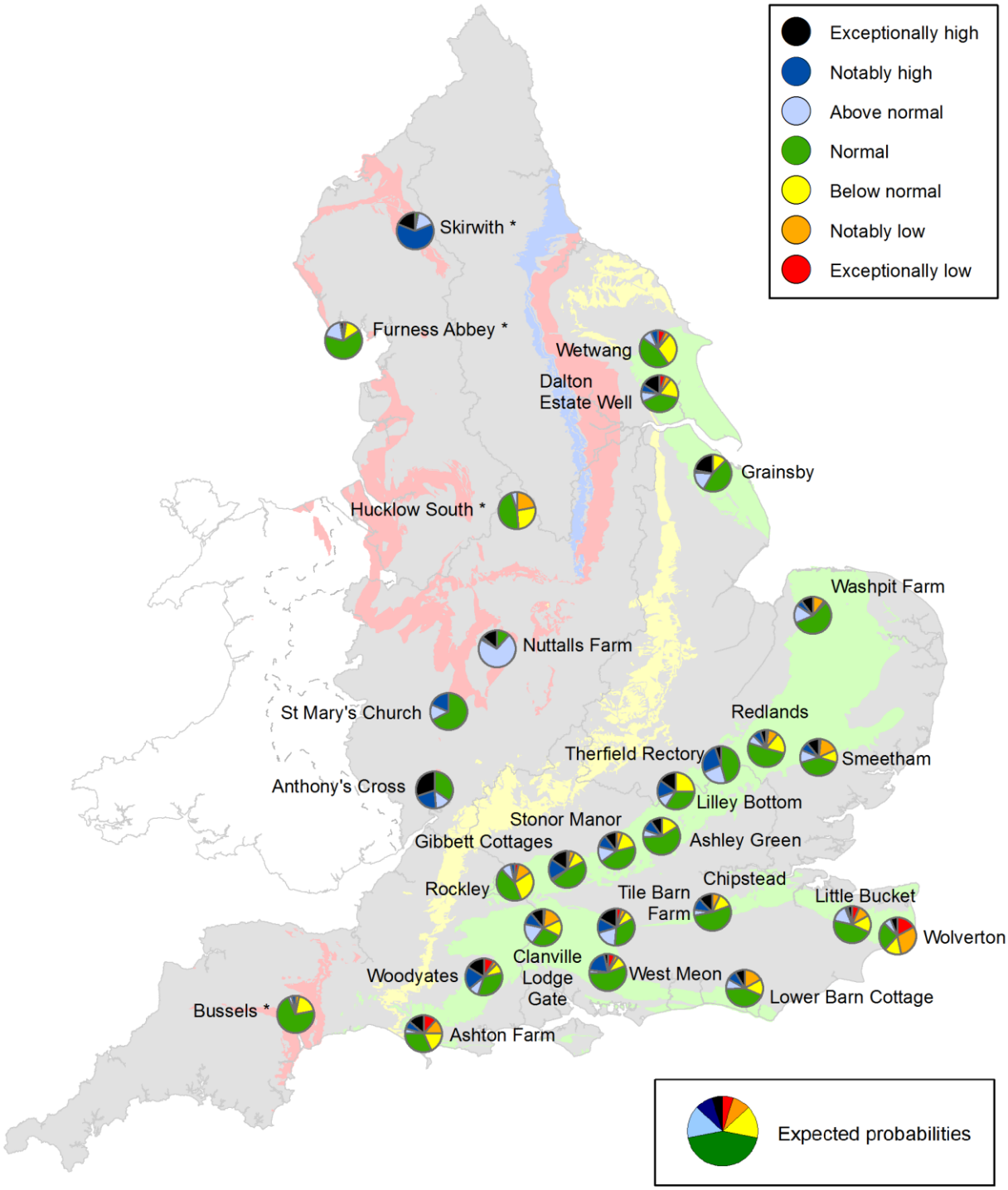

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Figure 6.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of March 2021. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for the 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

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