Monthly water situation report

England

Summary – May 2020

It was the driest May on record in England with below average rainfall totals recorded across all parts of the country. Soils were drier than normal for the time of year. Monthly mean river flows decreased at all of the indicator sites we report on, compared to April. All indicator sites in north-west and north-east England and in Devon and Cornwall recorded river flows which were classed as either notably low or exceptionally low for May. However, end of month groundwater levels were classed as normal or higher at nearly all of the reported sites. Reservoir stocks were classed as lower than normal for the time of year at over half of the reservoirs and reservoir groups we report on.

Rainfall

The May rainfall total for England was 10mm, which is only 16% of the 1961 to 1990 long-term average (LTA) (17% of 1981 to 2010 LTA). This, combined with the rainfall totals from March and April, meant that in England it has been the fourth driest spring on record, behind only 1893, 2011 and 1990 (Figure 1.1).

The highest May rainfall totals were in the River Esk and Kent catchments (both located in Cumbria) and in West Cornwall streams; these received 45mm (49% of LTA), 39mm (43% of LTA) and 34mm (54% of LTA) respectively. Other than in the Eastern Rother catchment (East Sussex) and in west Cornwall, the May rainfall totals across every hydrological area in south-west, south-east, east and central England were classed as exceptionally low for the time of year. Rainfall totals in much of north-east and north-west England were also classed as exceptionally low. Despite the unusually dry conditions during spring, the twelve month cumulative rainfall totals were above the LTA across the country and were classed as above normal or higher in most catchments (Figure 1.2).

At a regional scale, May was the third consecutive month of below average rainfall in all regions. Totals ranged from 5mm in east and south-east England (10% and 9% of LTA respectively) to 20mm (27% of LTA) in north-west England. It was the driest May on record (using records from 1891) in east, north-east, central and south-east England (Figure 1.3).

Soil moisture deficit

Soil moisture deficits generally increased through May, with soils drier than average for the time of year across all of England at the end of the month. Deficits across England ranged from 65mm to 136mm, with most areas having a soil moisture deficit of greater than 100mm (Figure 2.1). This is reflected at a regional scale, with much higher than average soil moisture deficits in all regions at the end of May (Figure 2.2).

River flows

Monthly mean river flows decreased at all of the indicator sites we reported on, compared to April. At two-thirds of the sites flows were classed as below normal or lower for the time of year. Higher flows were generally seen in the areas of the country where the geology means that rivers receive larger contributions to baseflow from groundwater. Monthly mean flows were classed as exceptionally low at a fifth of sites. Of these, the River Torridge (Devon), River Till (Northumberland), River Swale and River Derwent (both Yorkshire) all recorded the lowest monthly mean flow for May on record. All indicator sites in north-west and north-east England and in Devon and Cornwall recorded either notably low or exceptionally low monthly mean flows for May (Figure 3.1).

River flows for the regional indicator sites ranged from being classed as normal for the time of year on the Thames at Kingston (naturalised flows) and the Great Stour at Horton (south-east England) to exceptionally low on the South Tyne at Haydon Bridge (north-east England) (Figure 3.2).

Groundwater levels

Groundwater levels fell at all indicator sites we report on during May. Despite this, the end of month groundwater levels were classed as normal or higher at nearly all of the sites. Groundwater levels were classed as exceptionally high at four sites and of these, at Coxmoor (Idle and Torne Sandstone) and Prior Hayes (West

Cheshire sandstone) the highest end of May levels on record were recorded (Figures 4.1 and 4.2) Levels at Priors Heyes remain high, compared to historic levels, because the aquifer is recovering from the effects of historic abstraction.

Groundwater levels at the major aquifer index sites ranged from notably low at Jackaments Bottom (Burford Jurassic Limestone in the Cotswolds) to exceptionally high in the sandstone aquifers recorded 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 almost all of the reservoirs and reservoir groups that we report on during May. A quarter of these saw a reduction in stocks of greater than 10% of storage capacity. The biggest decrease in reservoir stocks, as a proportion of total storage capacity, was seen in the Dee reservoir system (which supplies north-west England); here stocks were at 90% of capacity at the end of April and 73% of capacity at the end of May. Reservoir stocks were classed as notably low or exceptionally low for the end of May at almost a third of reservoirs and reservoir groups we report on (Figure 5.1).

Total reservoir stocks for England were at 81% of capacity at the end of May. At a regional scale, total reservoir stocks were above the LTA for the time of year in east, south-east and south-west England, and below the LTA in central, north-east and north-west England (Figure 5.2).

Forward look

The early part of June is expected to be quite a change from the conditions experienced throughout most of May, with cooler temperatures and showers, as well as longer spells of rain, across much of England. Towards the middle of the month, the driest and brightest conditions are likely to be seen in northern parts of England, with changeable conditions dominant elsewhere. The middle and latter parts of June are likely to see a continuation of these changeable conditions, with a mix of dry and brighter periods interspersed with showers or longer spells of rain.

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

Projections for river flows at key sites[2]

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 September 2020. By the end of March 2021, 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 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]

More than 90% 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 September 2020. By the end of March 2021, nearly two-thirds of the modelled sites have a greater than expected chance of groundwater levels being normal or higher for the time of year, with a third of sites having 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 2021 see 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

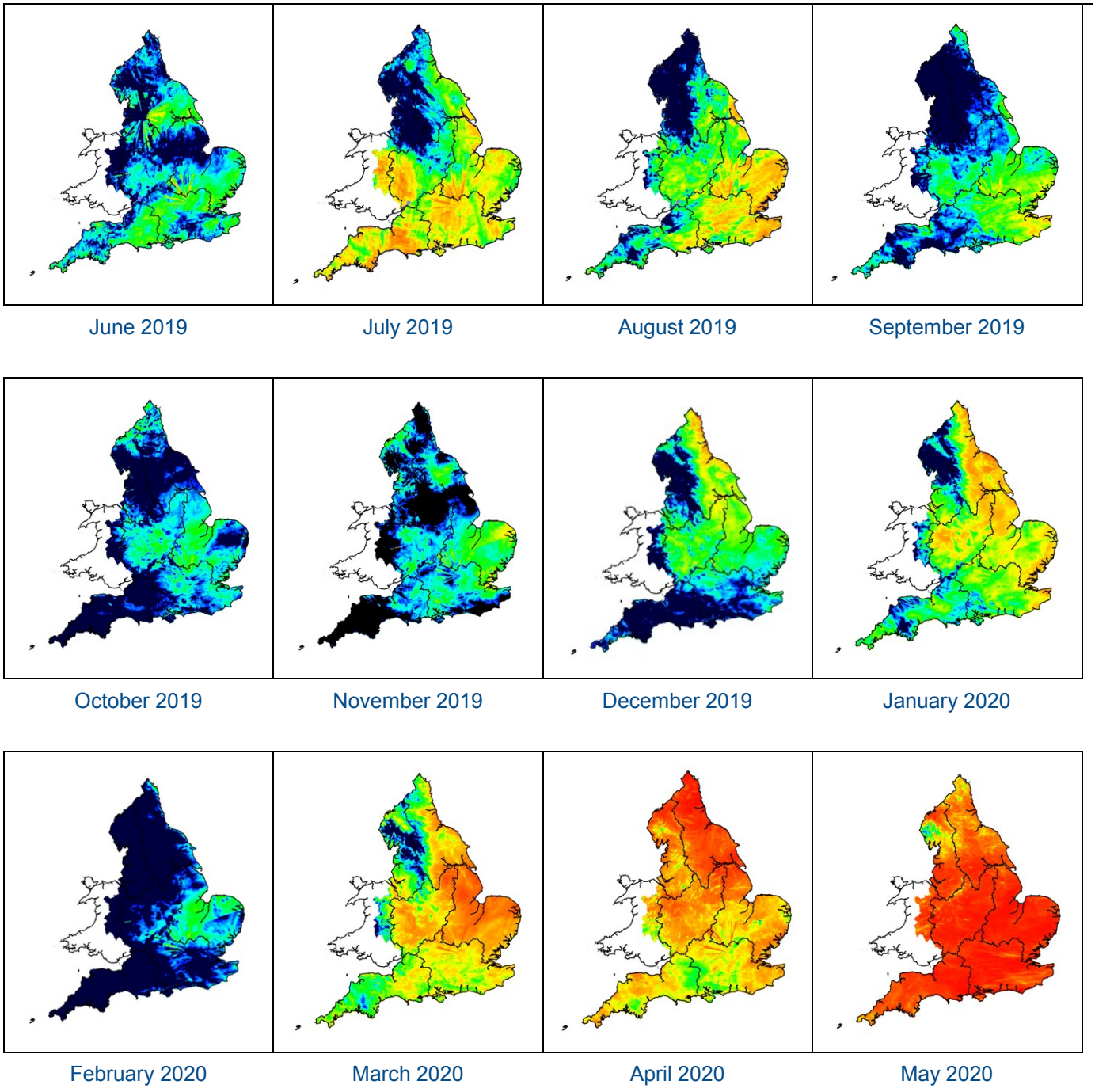
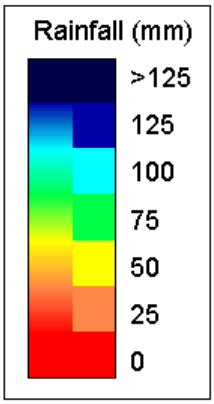


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2020). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.



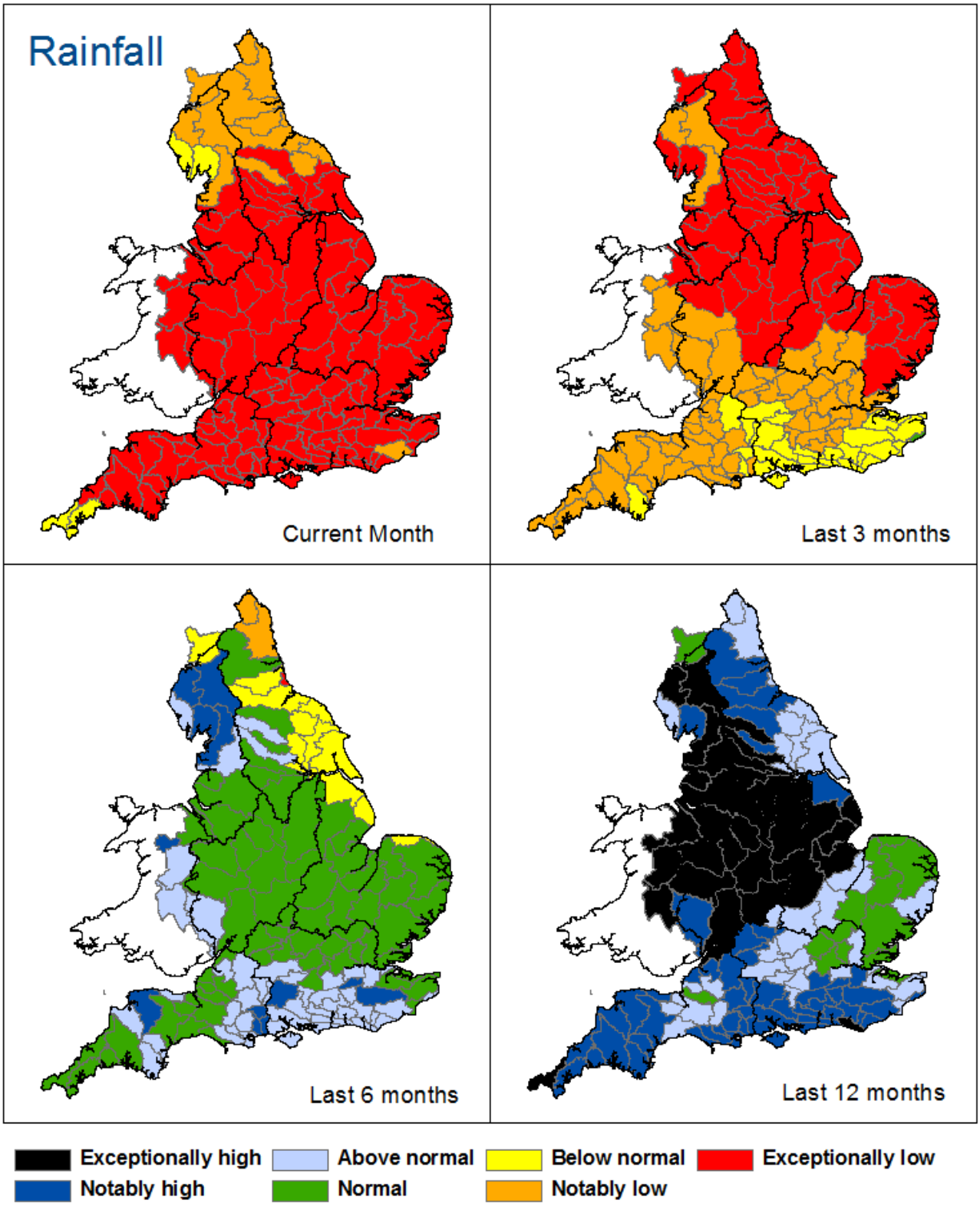


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 May), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived from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

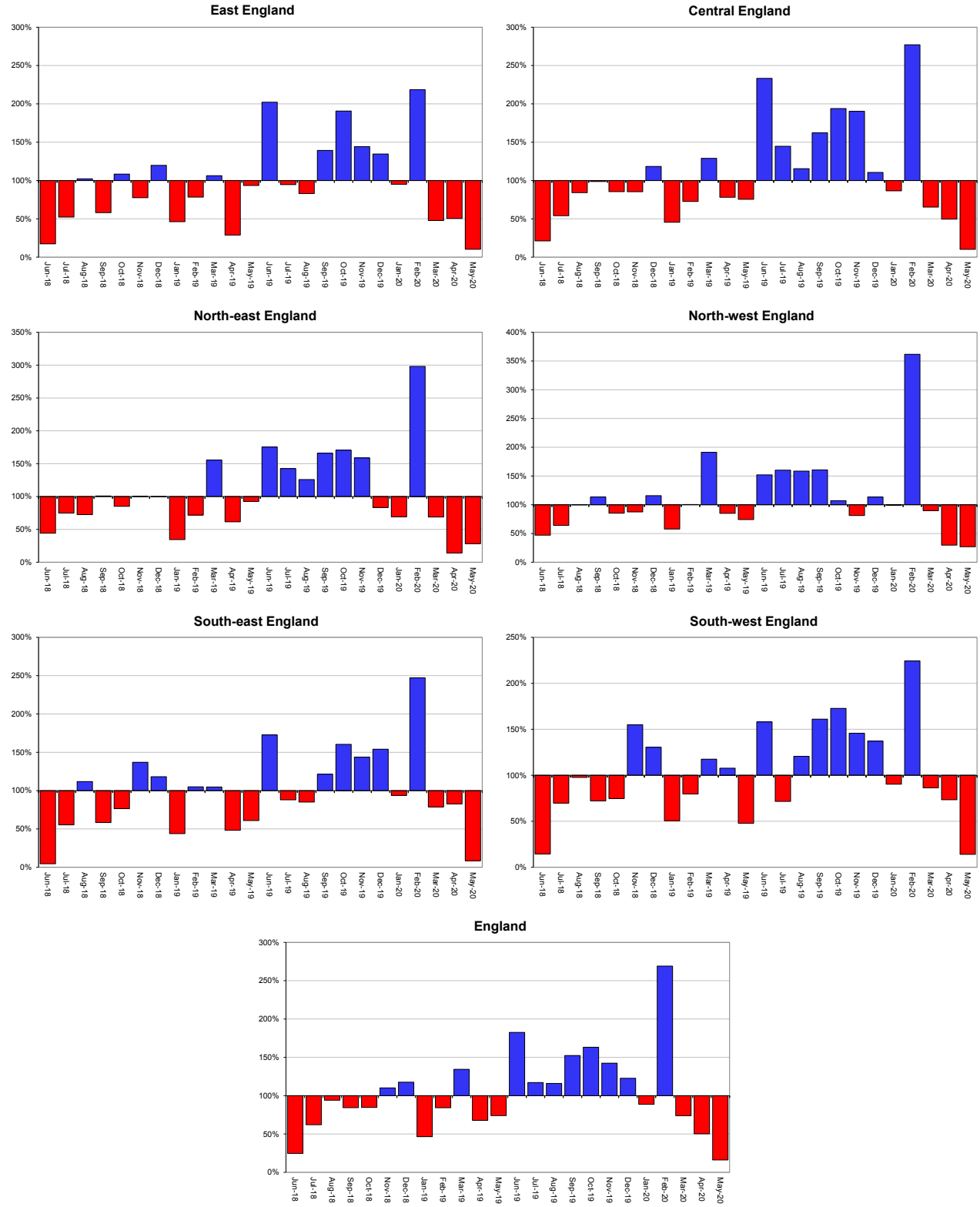


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2020).

Soil moisture deficit

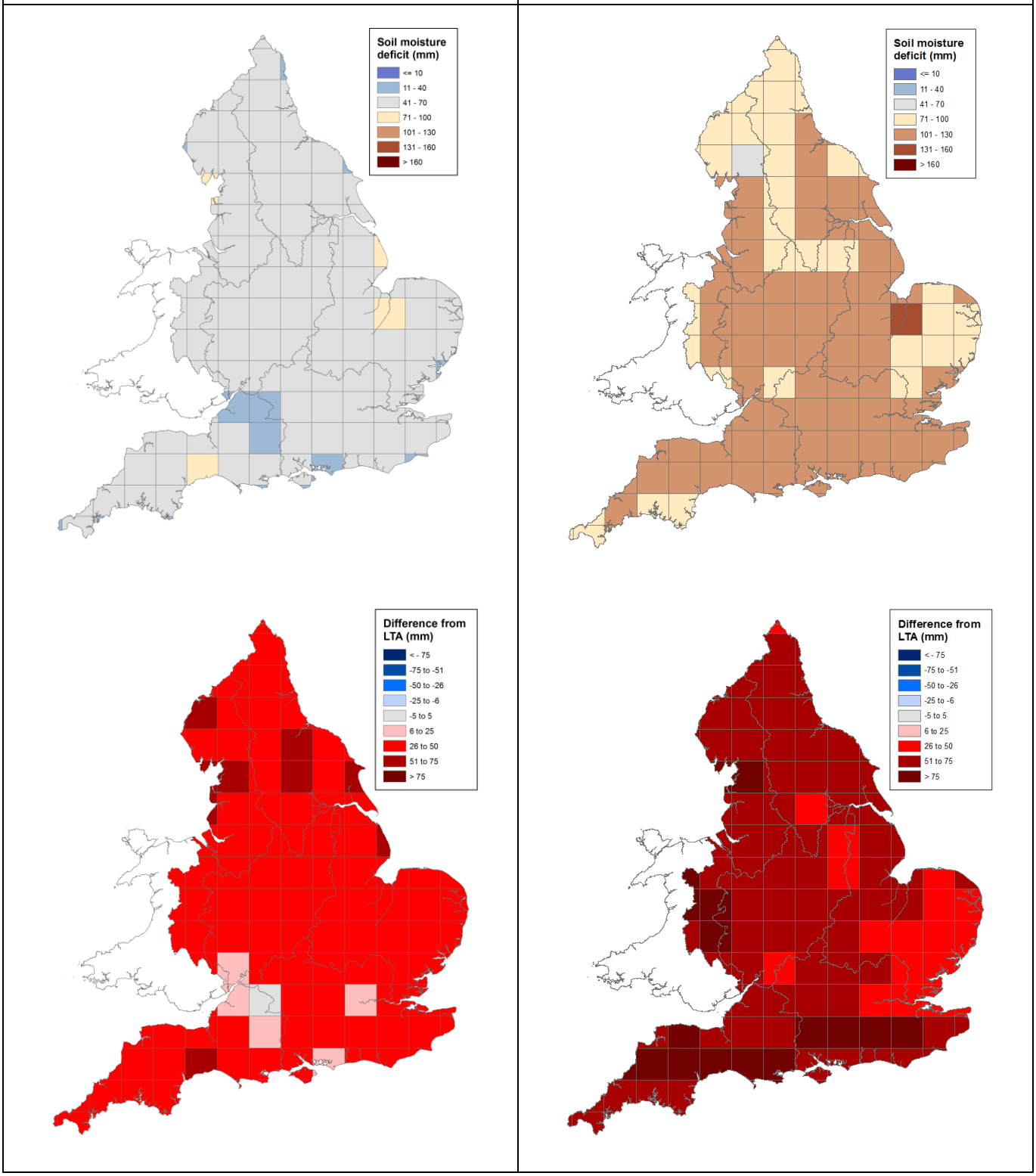
End of April 2020[1]	End of May 2020[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 28 April 2020 [1] (left panel) and 02 June 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

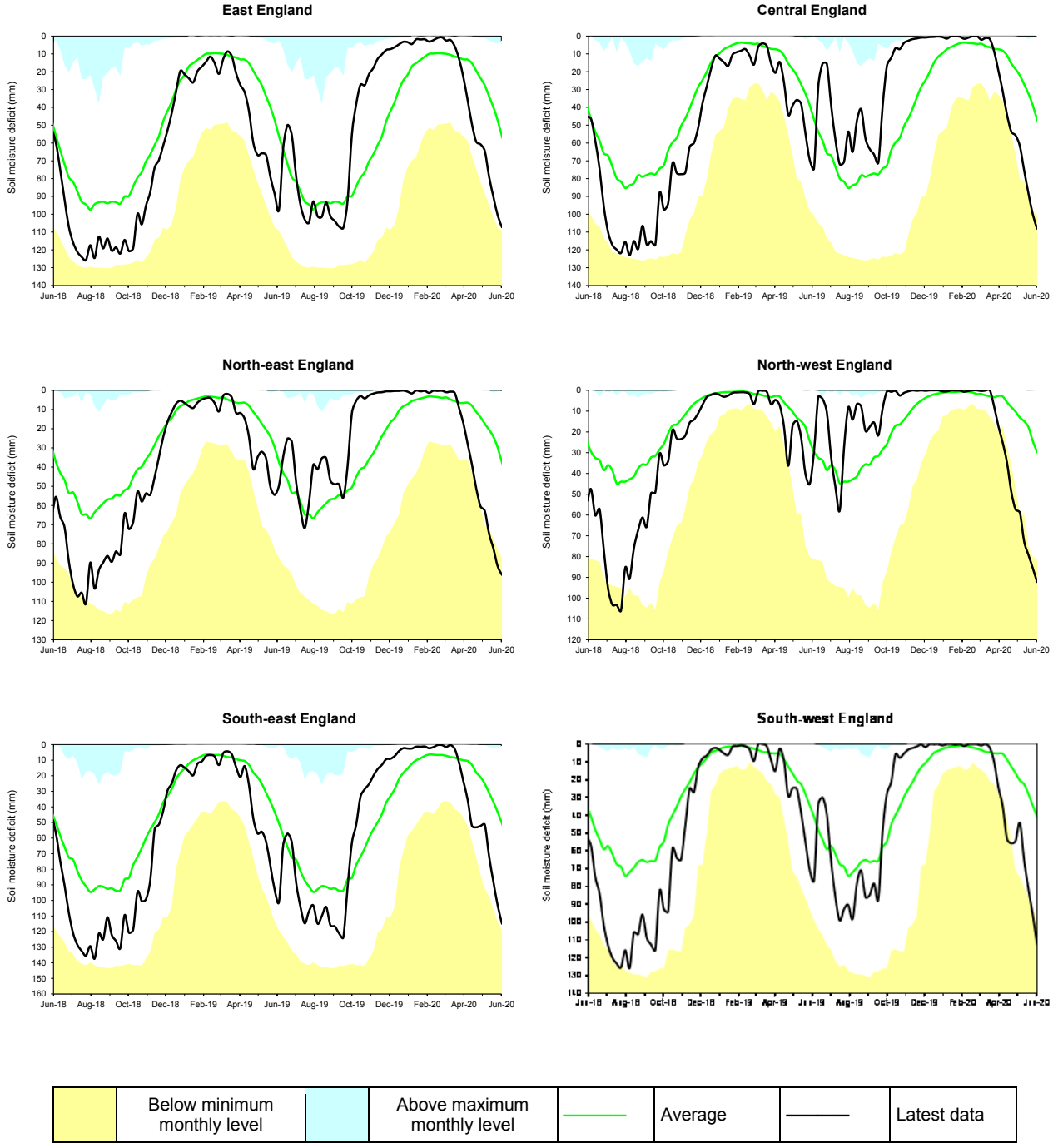
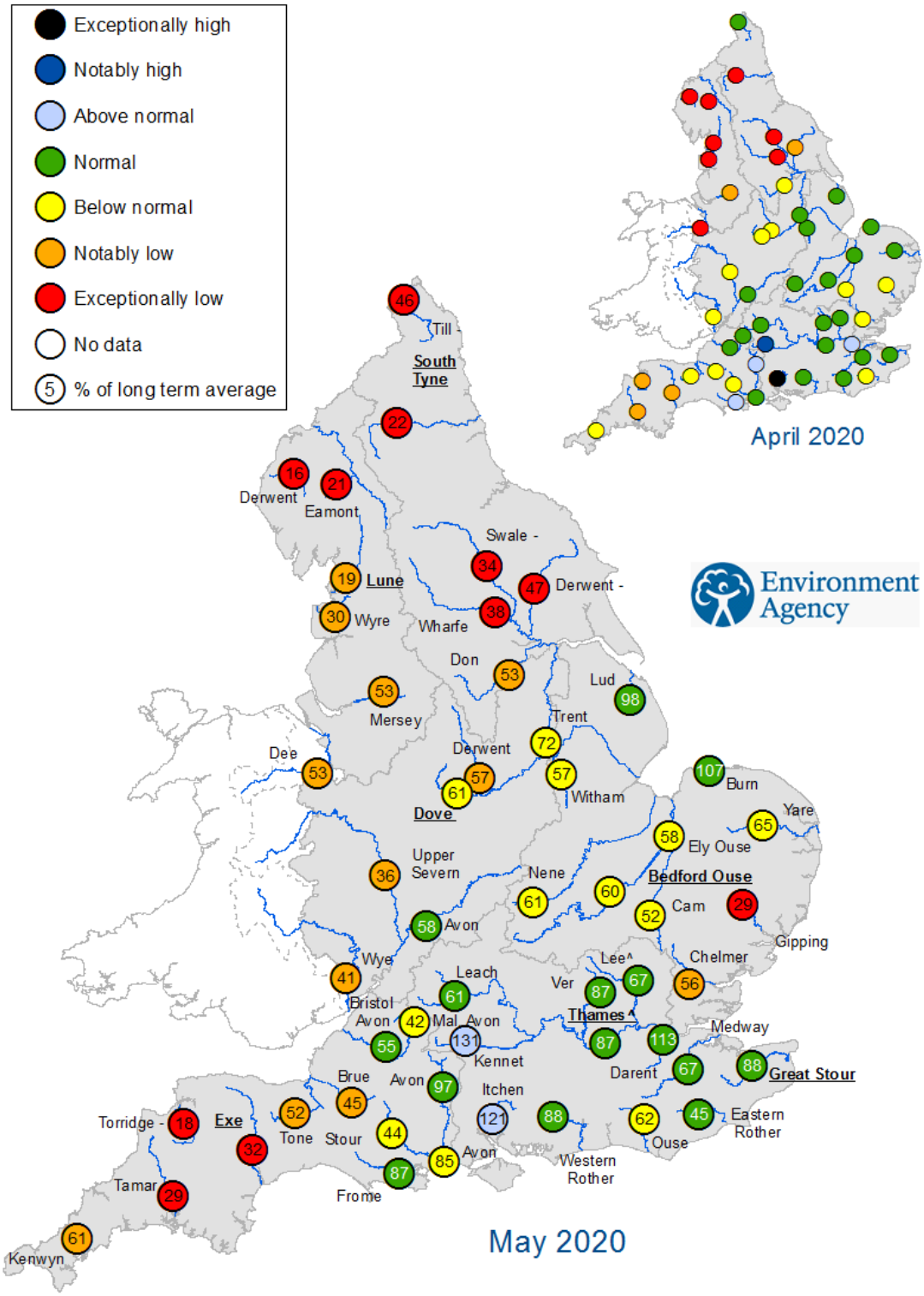


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2020).

River flows



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

\- Monthly mean flow is lowest 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 April 2020 and May 2020, expressed as a percentage of the respective long term average and classed relative to an analysis of historic April and May monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

River flow charts

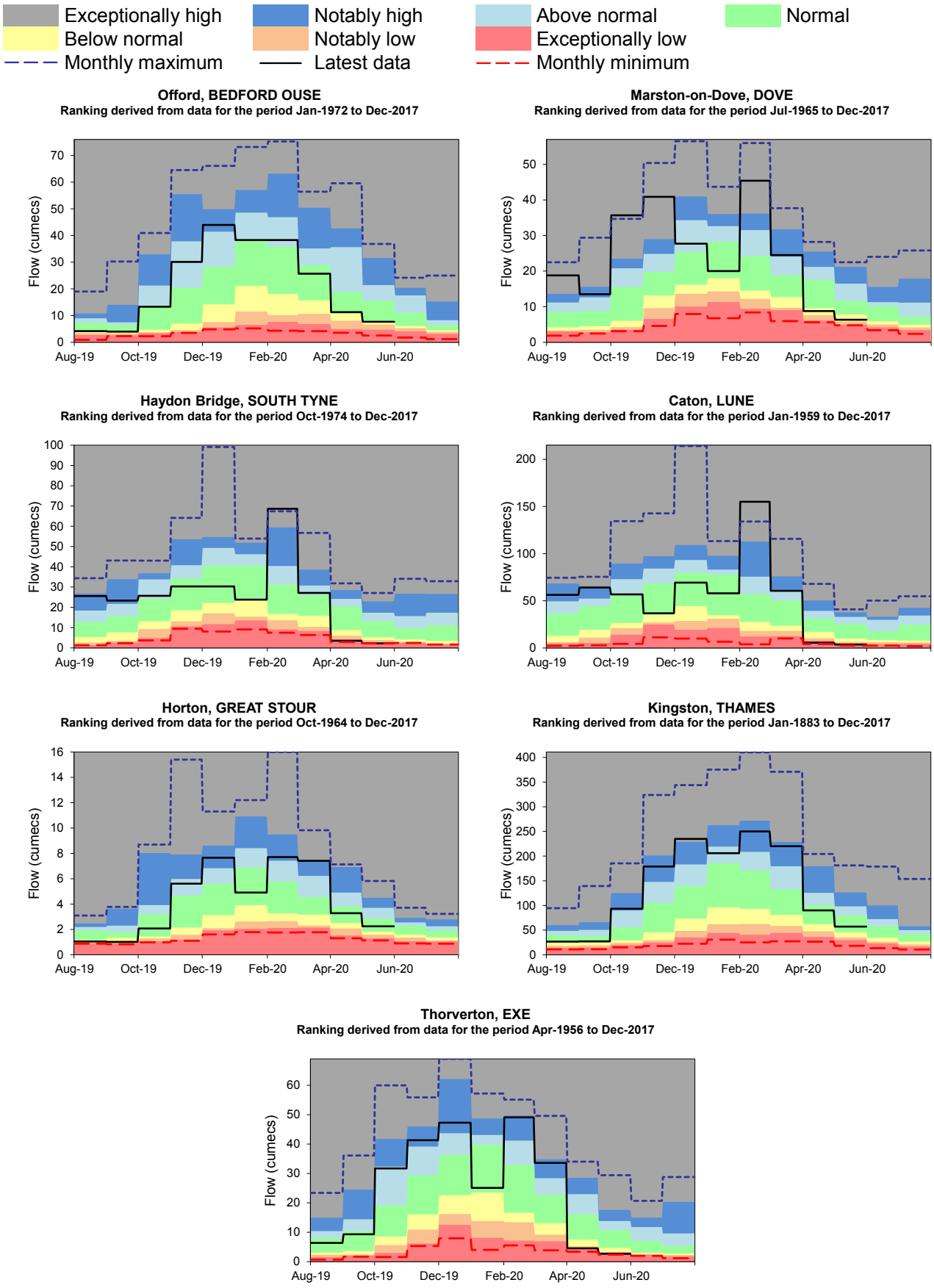
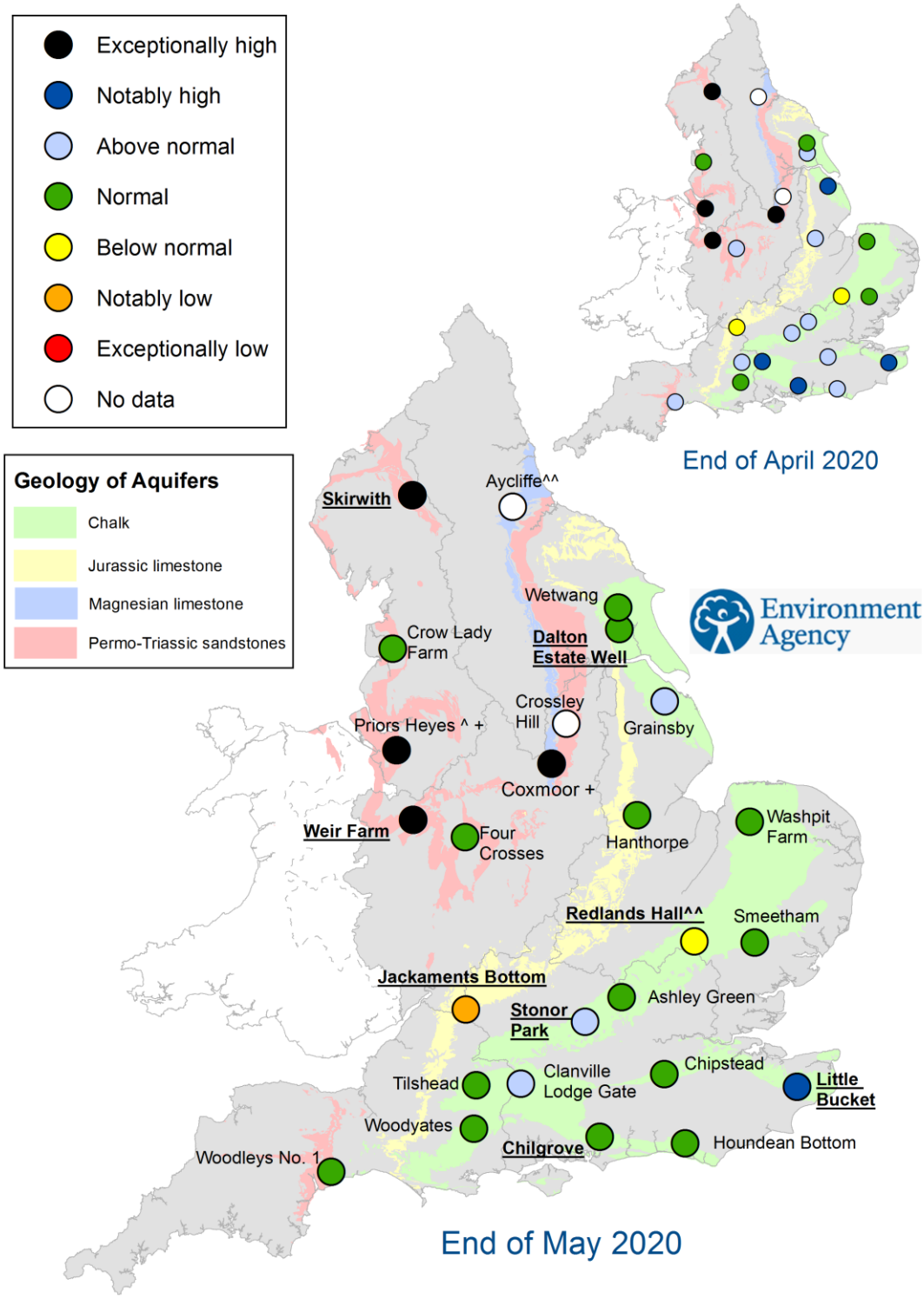


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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
Data is not available at some sites owing to current COVID-19 restrictions.

Figure 4.1: Groundwater levels for indicator sites at the end of April 2020 and May 2020, classed relative to an analysis of respective historic April and May 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

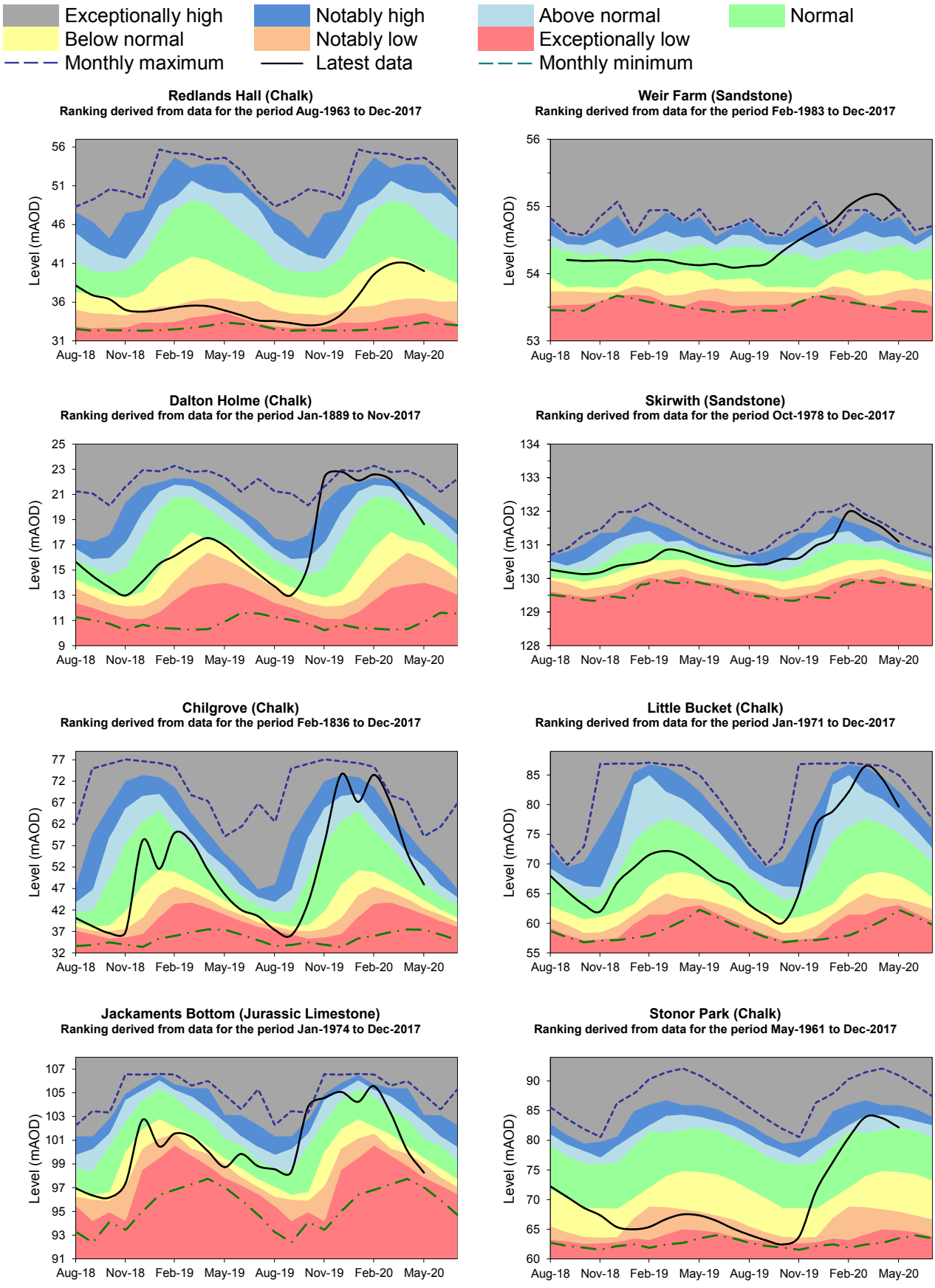
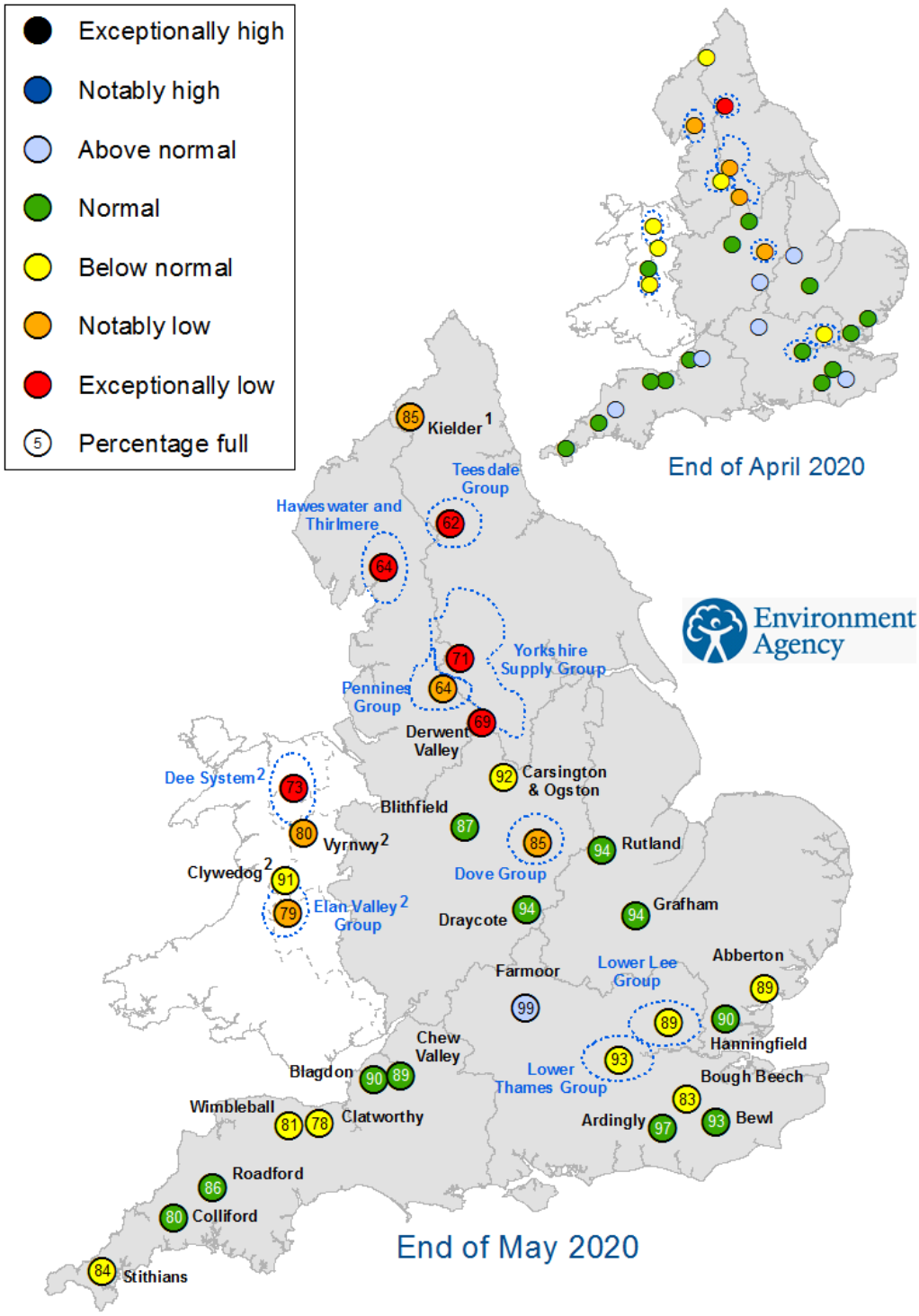


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2020).

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 April 2020 and May 2020 as a percentage of total capacity and classed relative to an analysis of historic April and May 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

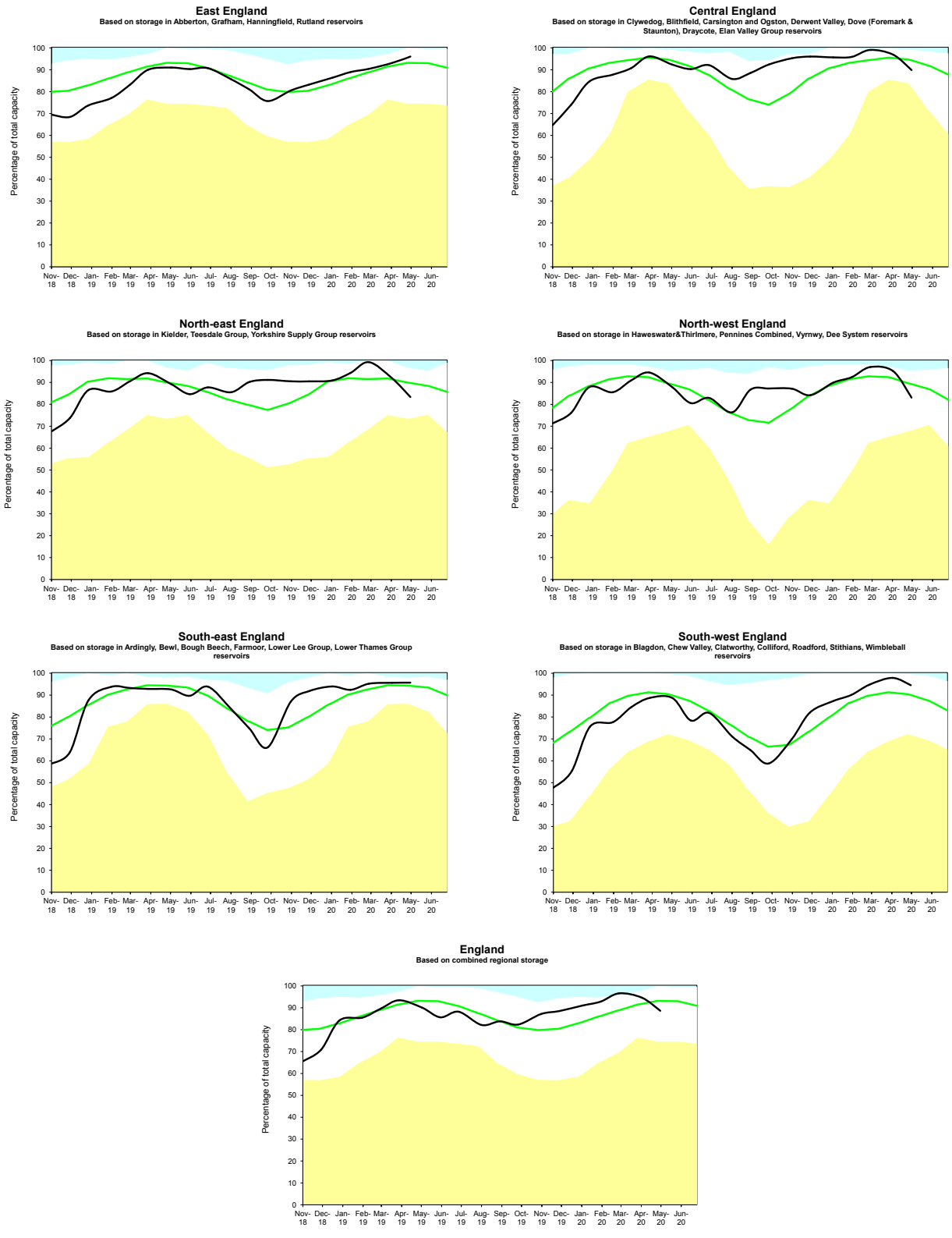


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look: river flow

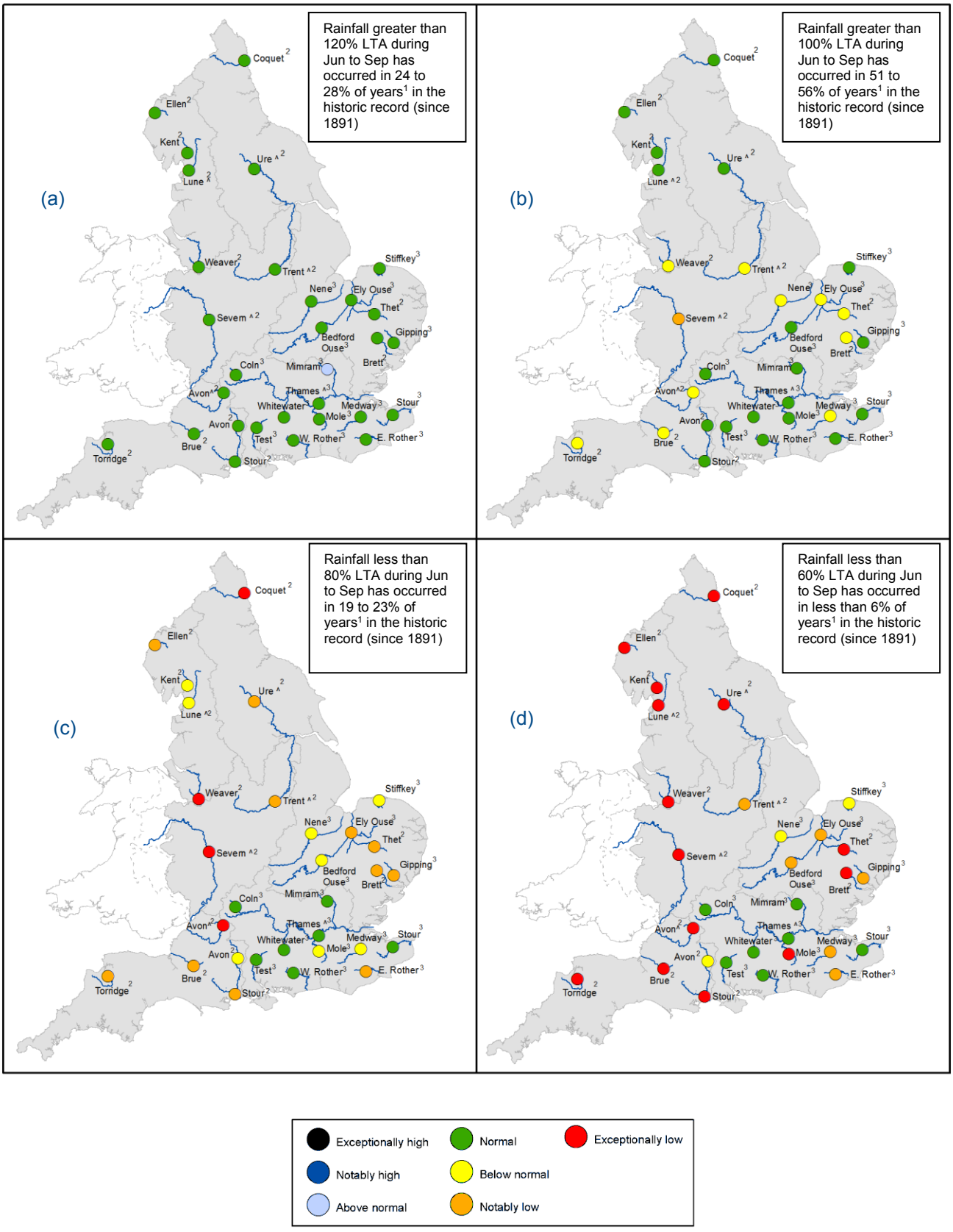


Figure 6.1: Projected river flows at key indicator sites up until the end of September 2020. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2020 and September 2020 (Source: Centre for Ecology and Hydrology, Environment Agency)

[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*

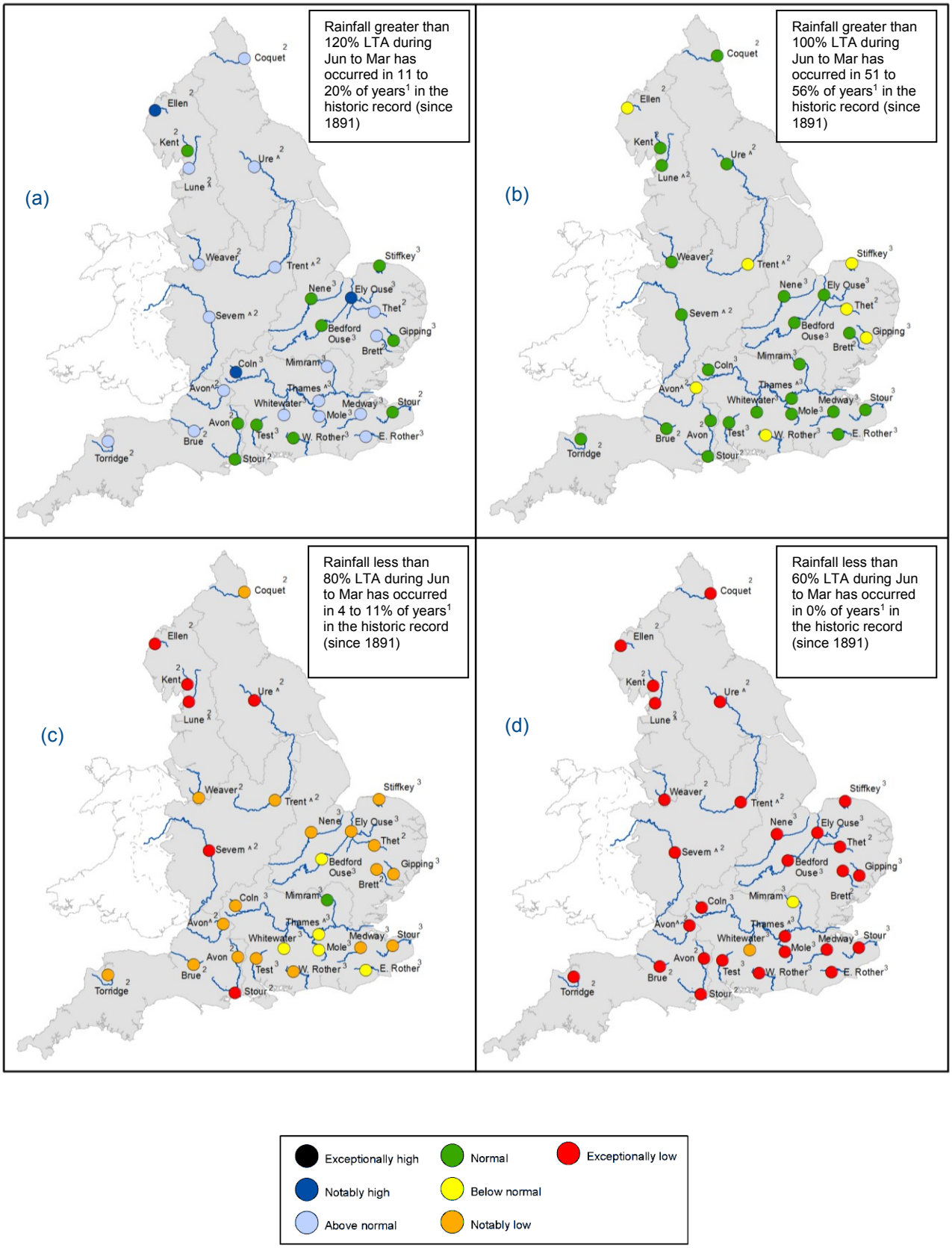


Figure 6.2: Projected river flows at key indicator sites up until the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2020 and March 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

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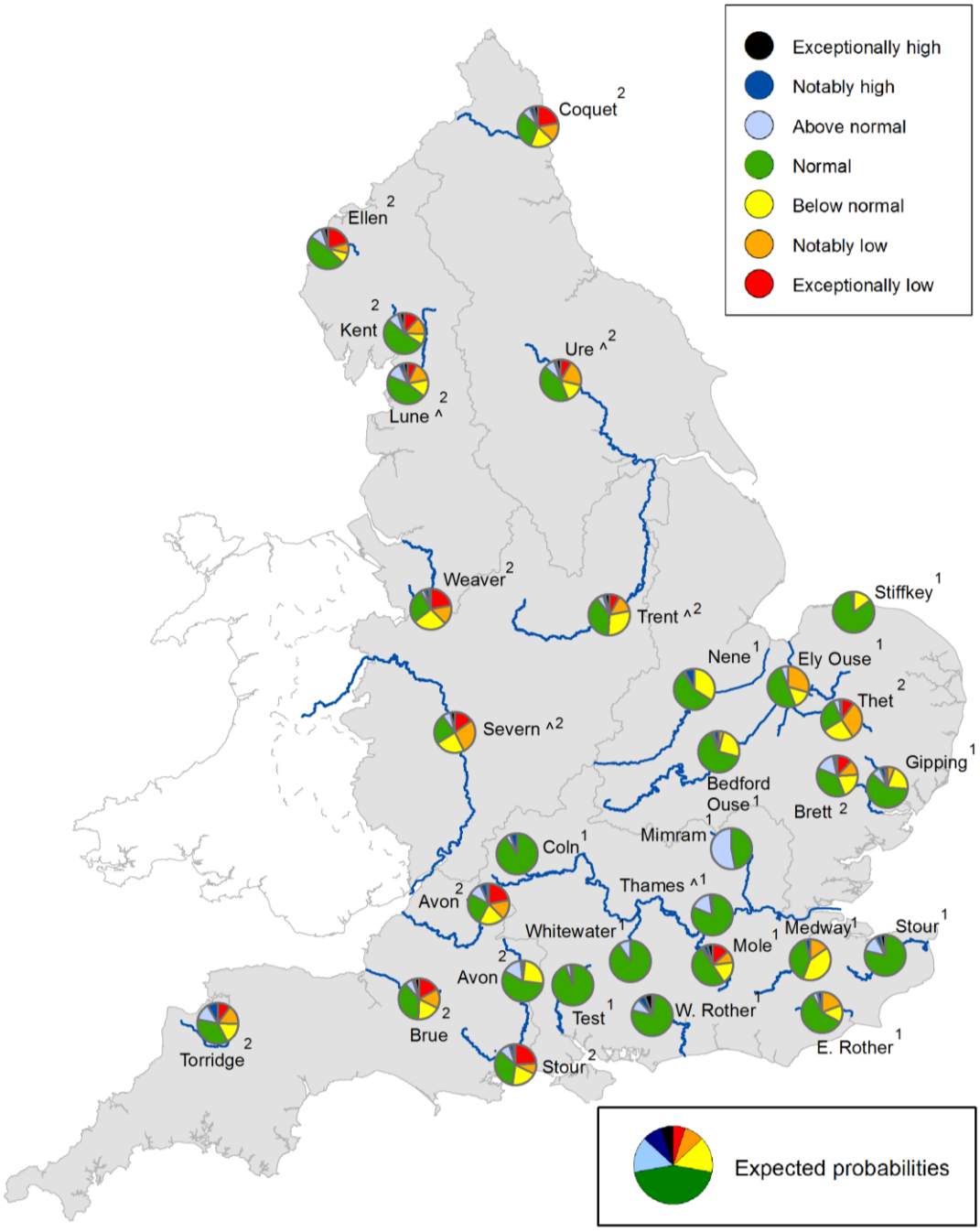

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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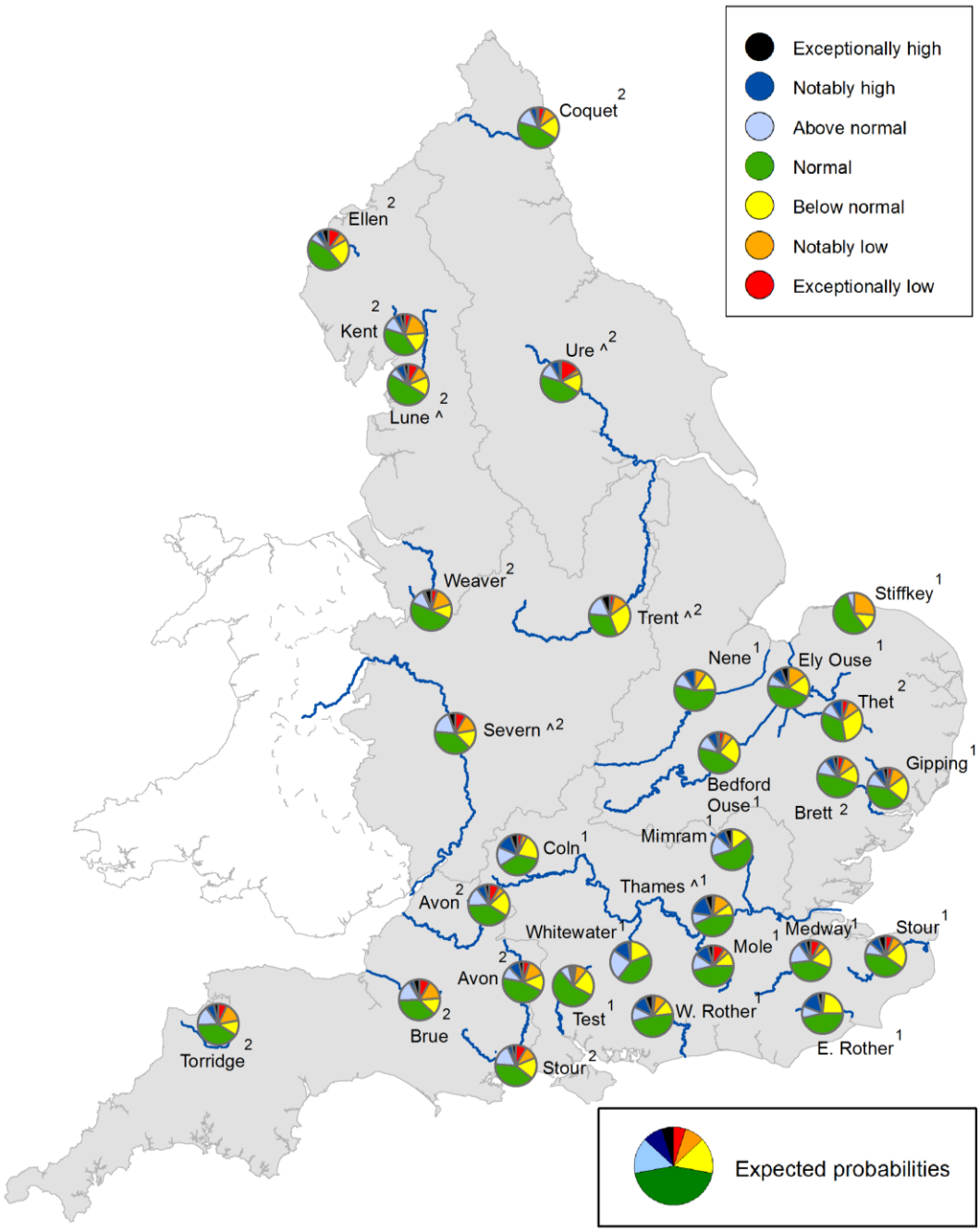

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

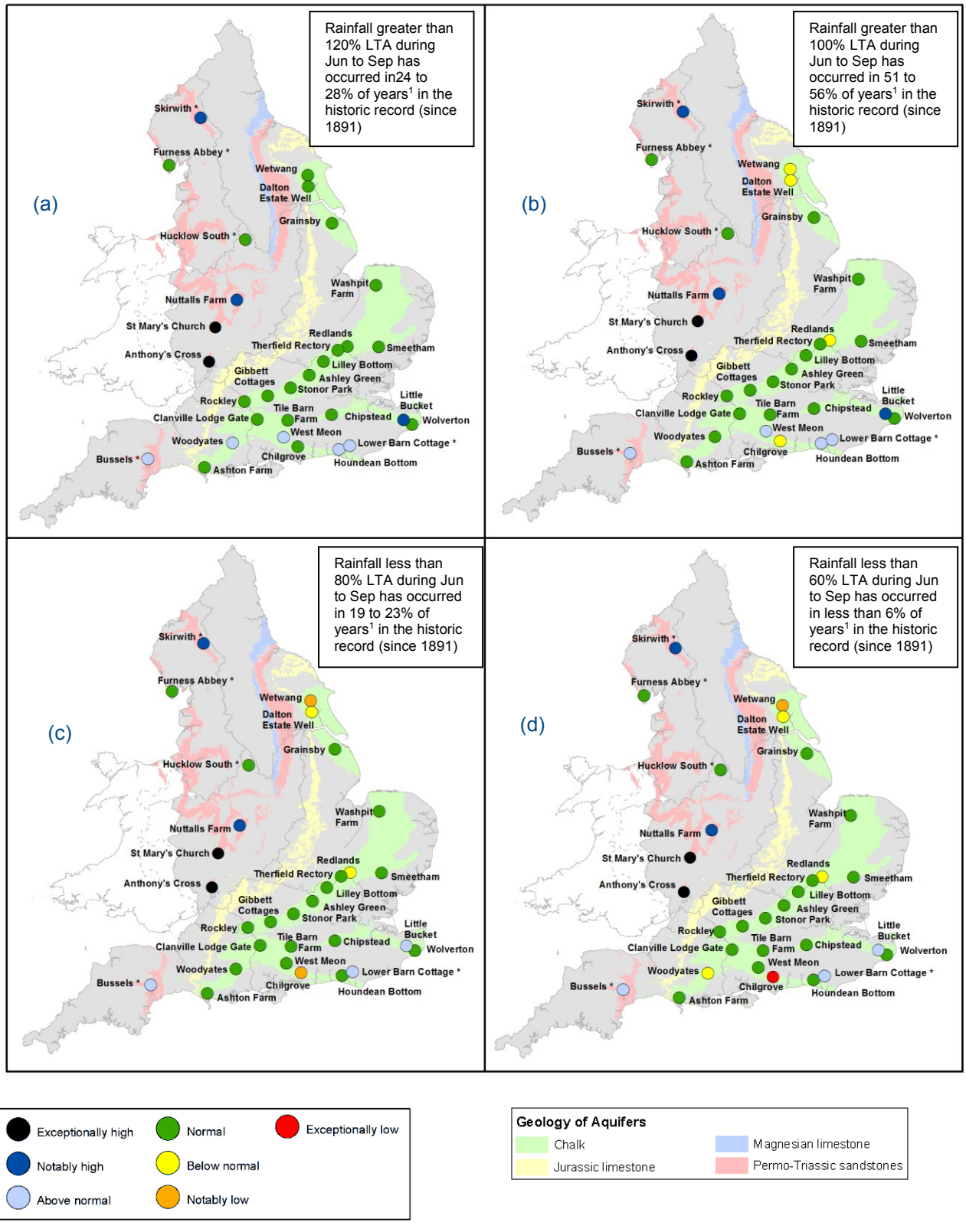

Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2020. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2020 and September 2020 (Source: Environment Agency) Geological map reproduced with kind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

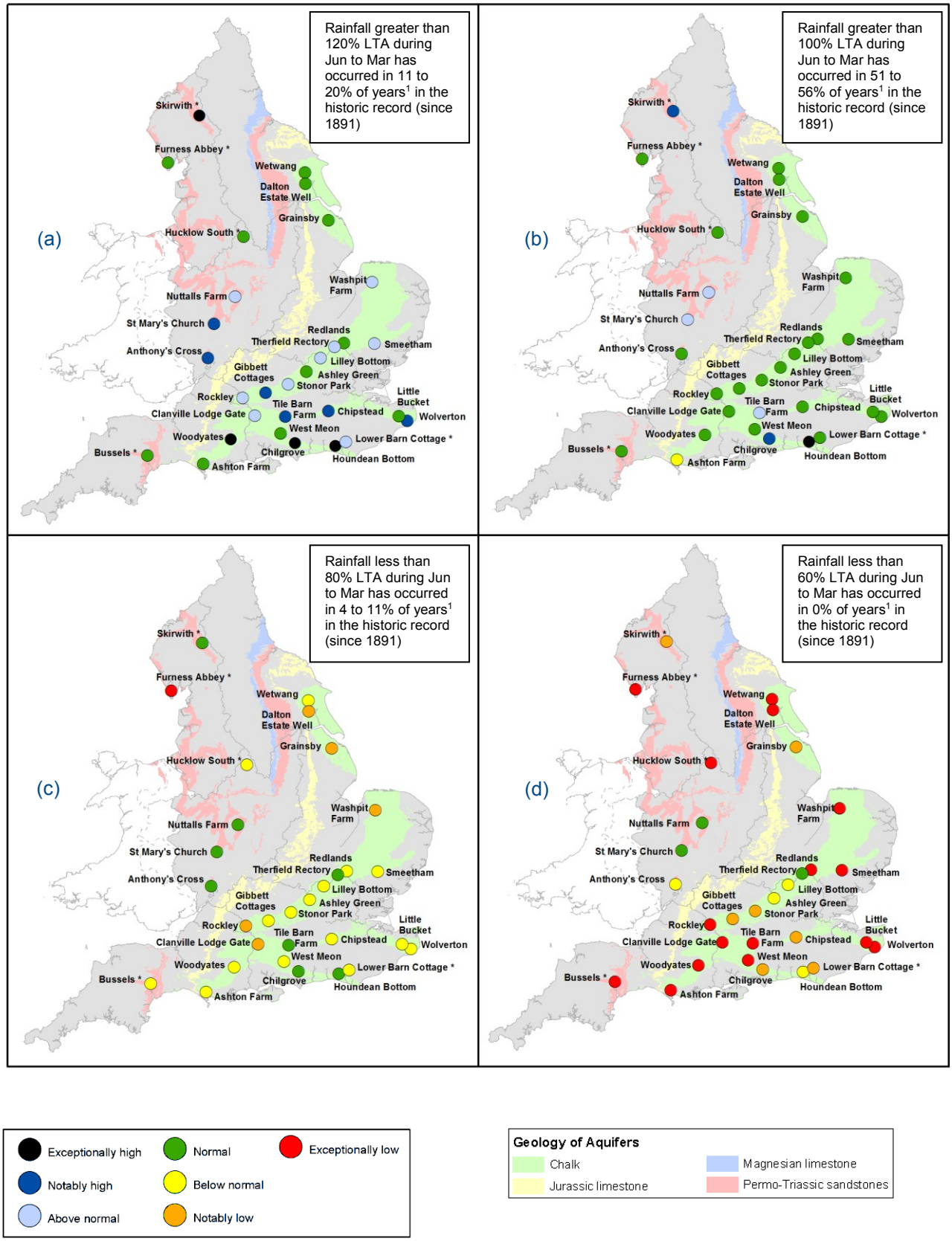

Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2020 and March 2021 (Source: Environment Agency) Geological map reproduced with kind permission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

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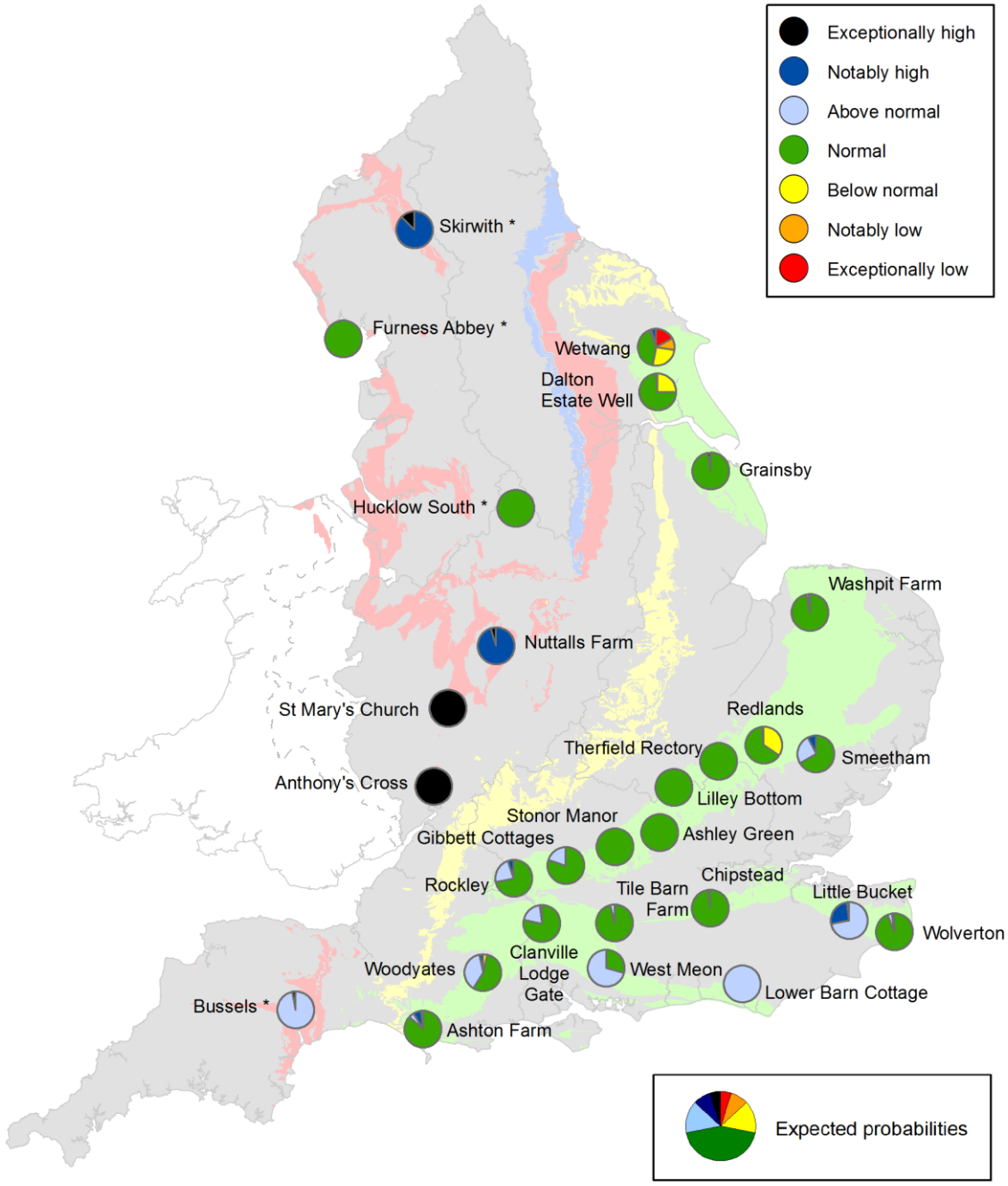
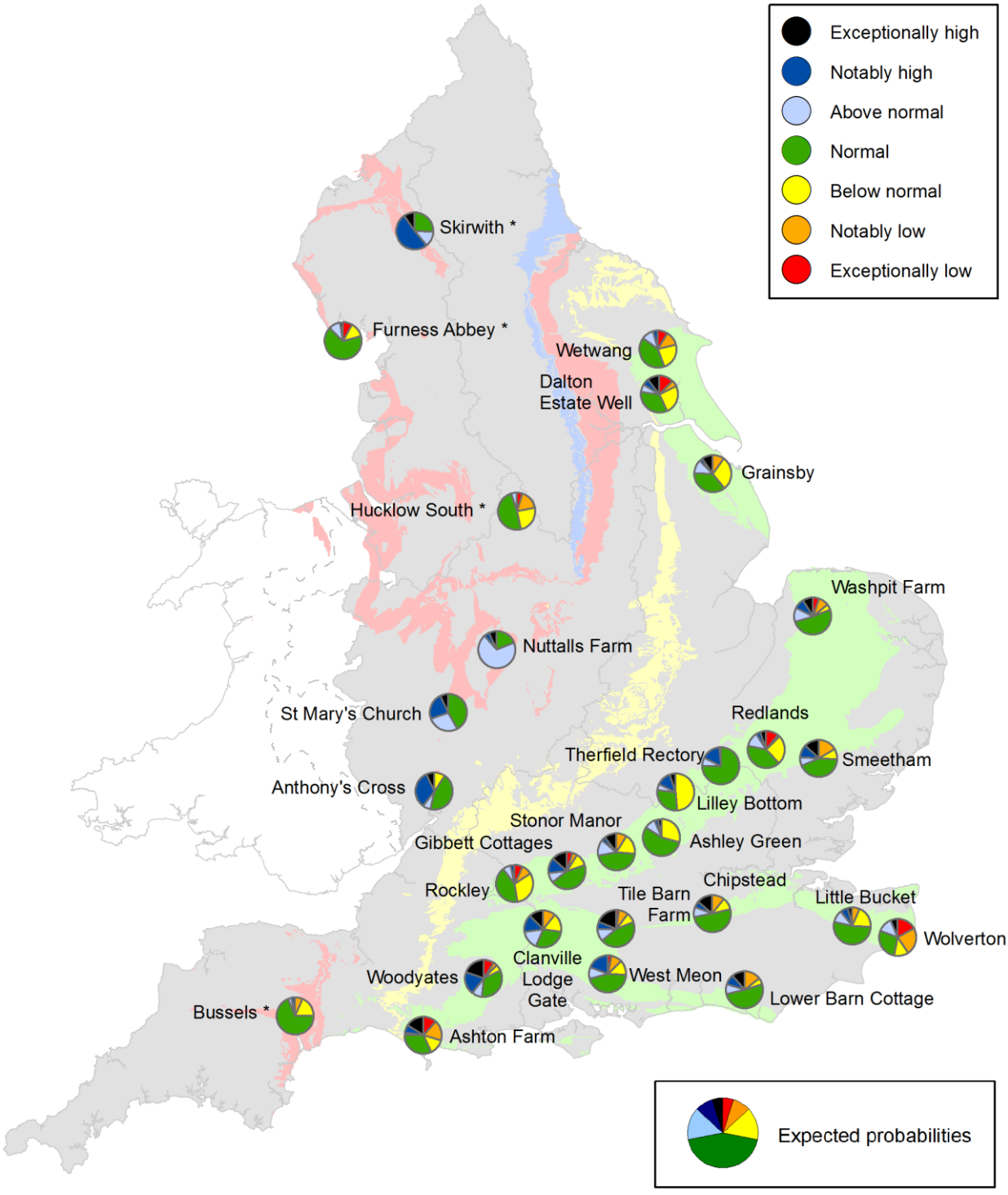


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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



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 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