# Monthly water situation report

## England

### Summary – July 2017

Rainfall totals for July were above the long term average (LTA) for the month in all parts of the country, and particularly high in parts of north-west, south west and south-east England. For England as a whole, the July rainfall total was 163% of the 1961-90 LTA. Soils were wetter than average for the time of year across most areas of England, but were close to average across central and east England. Monthly mean river flows decreased compared to June at more than three-quarters of the indicator sites, but are classed as normal for the time of year at around half of all sites. Groundwater levels decreased at all except one of the indicator sites during July. Reservoir stocks decreased at the majority of reported reservoirs or reservoir groups. Overall reservoir storage for England decreased slightly during July to 80% of total capacity.

### Rainfall

Rainfall totals for July were above 60mm in all hydrological areas across England. The highest rainfall totals were in north-west, south-west and parts of south-east England where some catchments received more than 125mm. Rainfall totals were above the long term average (LTA) for July across all of the hydrological areas, and some catchments in Hampshire and Dorset received rainfall totals that were more than 250% of the LTA for July (Figure 1.1).

July rainfall totals were classed as normal or higher for the time of year for all of the hydrological areas across England. Across south-east and south-west England, the majority of hydrological areas received rainfall totals that were above normal or notably high for the time of year. The rainfall accumulations for the previous 12-month period are below normal or lower across most parts of central, east, south-east and south-west England and normal for most of north England (Figure 1.2).

Overall, rainfall totals for July ranged from 149% of the LTA in central England to 200% in south-east England. Across England as a whole, monthly rainfall totals were 163% of the 1961-90 LTA for July (153% of the 1981-2010 LTA) (Figure 1.3).

### Soil moisture deficit

Soil moisture deficits (SMDs) decreased in response to above average rainfall across the majority of England during July, although a small increase in SMDs occurred in much of east England, and parts of north-west and south-east England. End of month SMDs were smaller than for June across almost three-quarters of England. SMDs ranged from 0 to 144mm. Soils were wetter than the end of July LTA across nearly three-quarters of England, with notable exceptions in parts of east, south-east and central England where SMDs were greater than the end of July LTA (Figure 2.1).

At a regional scale, soils were drier at the end of July than at the end of June in east England, but wetter elsewhere. End of month SMDs ranged from 23mm in north-west England to 96mm in east England. SMDs were close to average across central and east England, but lower than average elsewhere (Figure 2.2).

### River flows

Compared with June, monthly mean river flows for July decreased at more than three-quarters of the indicator sites across England. River flows were classed as normal for the time of year at around half of all the indicator sites, and below normal or lower at a quarter of the sites (Figure 3.1).

At the regional index sites, monthly mean river flows ranged from notably low for the time of year on the Great Stour at Horton in south-east England to notably high on the Lune at Caton in north-west England (Figure 3.2).

### Groundwater levels

Groundwater levels decreased at all except one of the indicator sites during July compared to the end of June. End of month groundwater levels were below normal or lower at more than half of the indicator sites. End of month

groundwater levels at the major aquifer index sites ranged from exceptionally low for the time of year at Little Bucket (East Kent Stour chalk) to normal for the time of year at Heathlanes (Shropshire sandstone), Dalton Holme (Hull and East Riding chalk) and Skirwith (Carlisle Basin and Eden Valley sandstone) (Figures 4.1 and 4.2).

## Reservoir storage

During July, reservoir stocks decreased or remained the same at all but three of the reported reservoirs or reservoir groups. Notable decreases of greater than 10% occurred at Clywedog, Elan Valley and Clatworthy reservoirs, whereas an increase of more than 10% was seen for the Teesdale Group. End of month stocks were classed as normal or higher for the time of year at almost two-thirds of all reported reservoirs or reservoir groups. The remaining sites were classed as below normal or notably low for the time of year (Figure 5.1).

Compared with the end of June, reservoir stocks decreased in all regions except north-east England where they increased very slightly. The largest decrease of 9% occurred in central England. End of July stocks ranged from 70% of total capacity in south-west England to 88% in east England. Overall storage for England decreased by 4% to 80% of total capacity (Figure 5.2).

## Forward look

The first half of August is likely to be unsettled with heavy showers or prolonged spells of rain affecting most places at times. During the second half of August, a north-west – south-east split in the weather is likely to prevail, with wetter conditions in the north-west and drier, more settled conditions in the south-east. Over the 3 month period August to October, below-average rainfall across the UK as a whole is slightly more probable than above-average rainfall[1].

**Projections for river flows at key sites[2]**

Just under half of the modelled sites have a greater than expected chance of cumulative river flows being below normal or lower by both the end of September 2017 and the end of March 2018.

For scenario based projections of cumulative river flows at key sites by September 2017 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by March 2018 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by September 2017 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by March 2018 see Figure 6.4

**Projections for groundwater levels in key aquifers[2]**

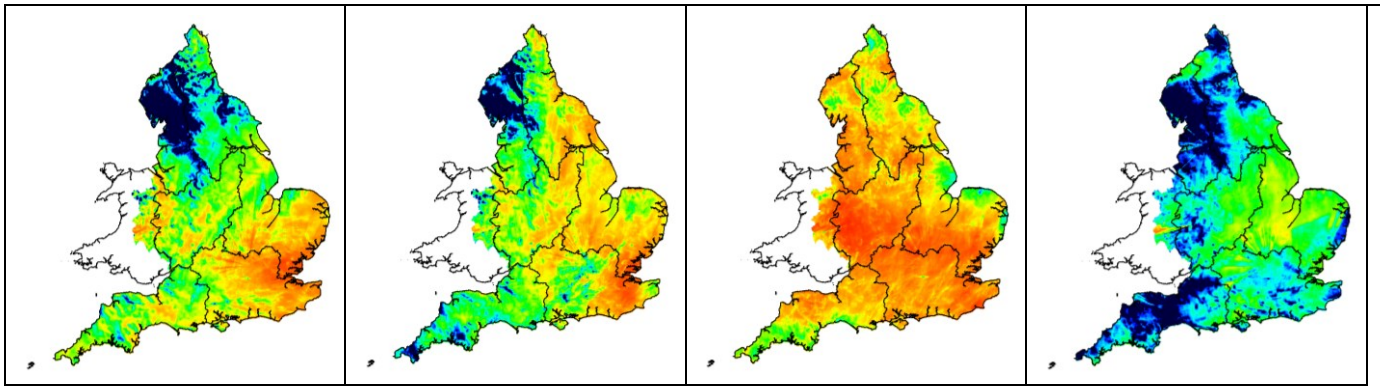
A quarter of modelled sites have a greater than expected chance of notably low or lower groundwater levels for the time of year at the end of September 2017. By March 2018, just over a third of all modelled sites have a greater than expected chance of notably low or lower groundwater levels for the time of year.

For scenario based projections of groundwater levels in key aquifers in September 2017 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in March 2018 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2017 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2018 see Figure 6.8

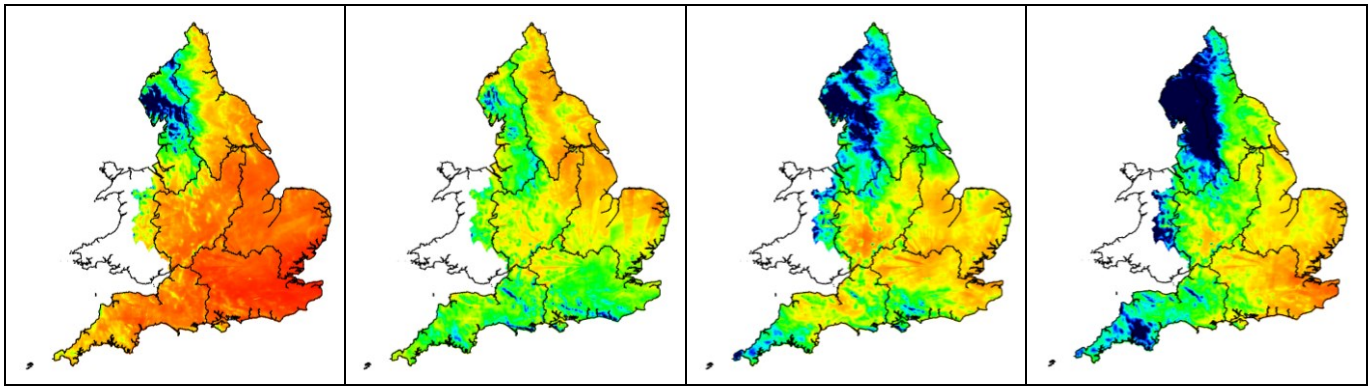
Authors: National Water Resources Hydrology Team

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).

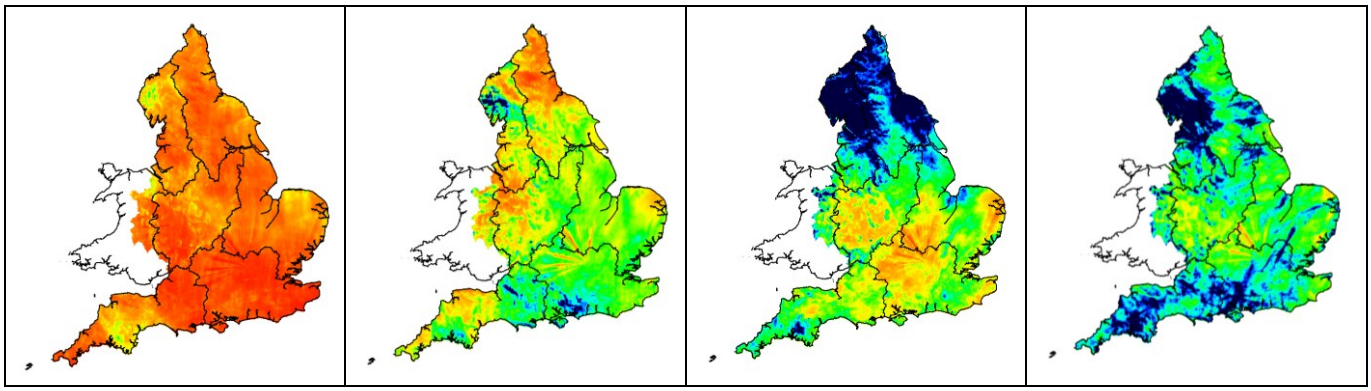
## Rainfall



August 2016 | September 2016 | October 2016 | November 2016



December 2016 | January 2017 | February 2017 | March 2017



April 2017 | May 2017 | June 2017 | July 2017

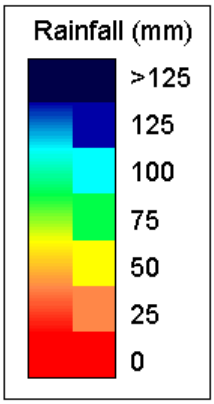



**Figure 1.1**: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2017). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100026380, 2017.

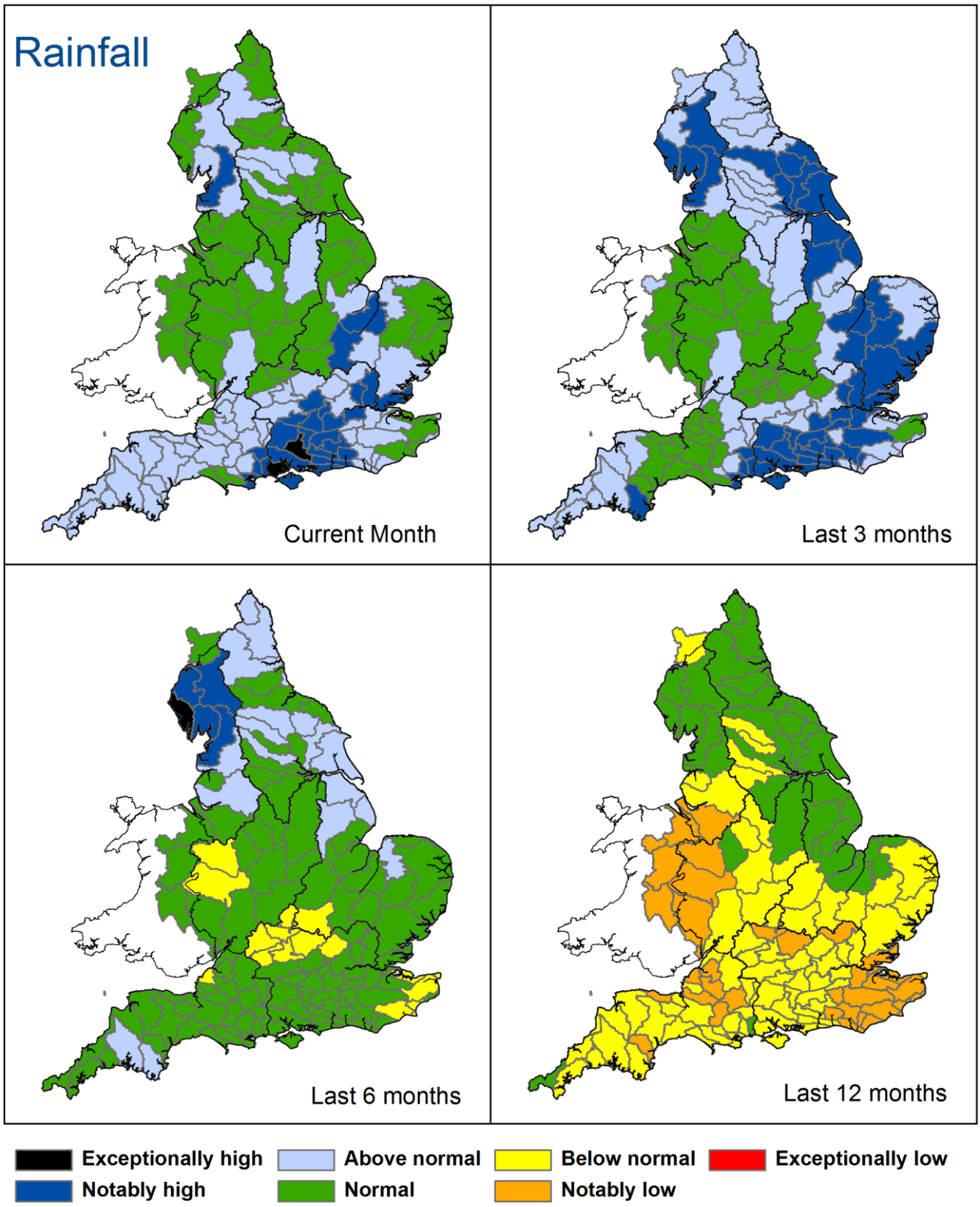



**Figure 1.2**: Total rainfall for hydrological areas across England for the current month (up to 31 July), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Final NCIC (National Climate Information Centre) data based on the Met Office 5km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2017).* Provisional data based on Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. Crown copyright. All rights reserved. Environment Agency, 100026380, 2017.

## Rainfall charts

Above average rainfall

Below average rainfall

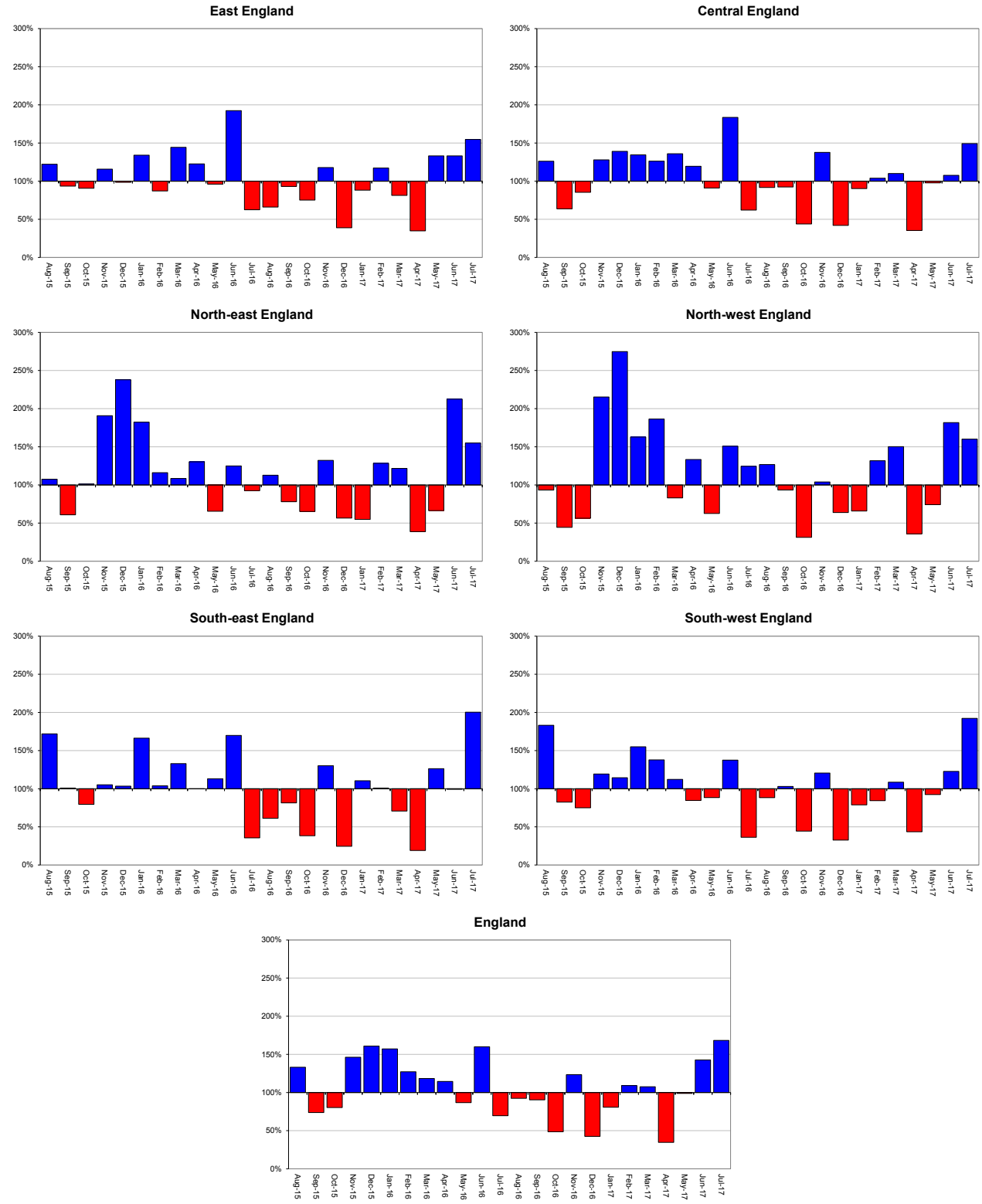



**Figure 1.3**: Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each region and for England. NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright, 2017).

# Soil moisture deficit

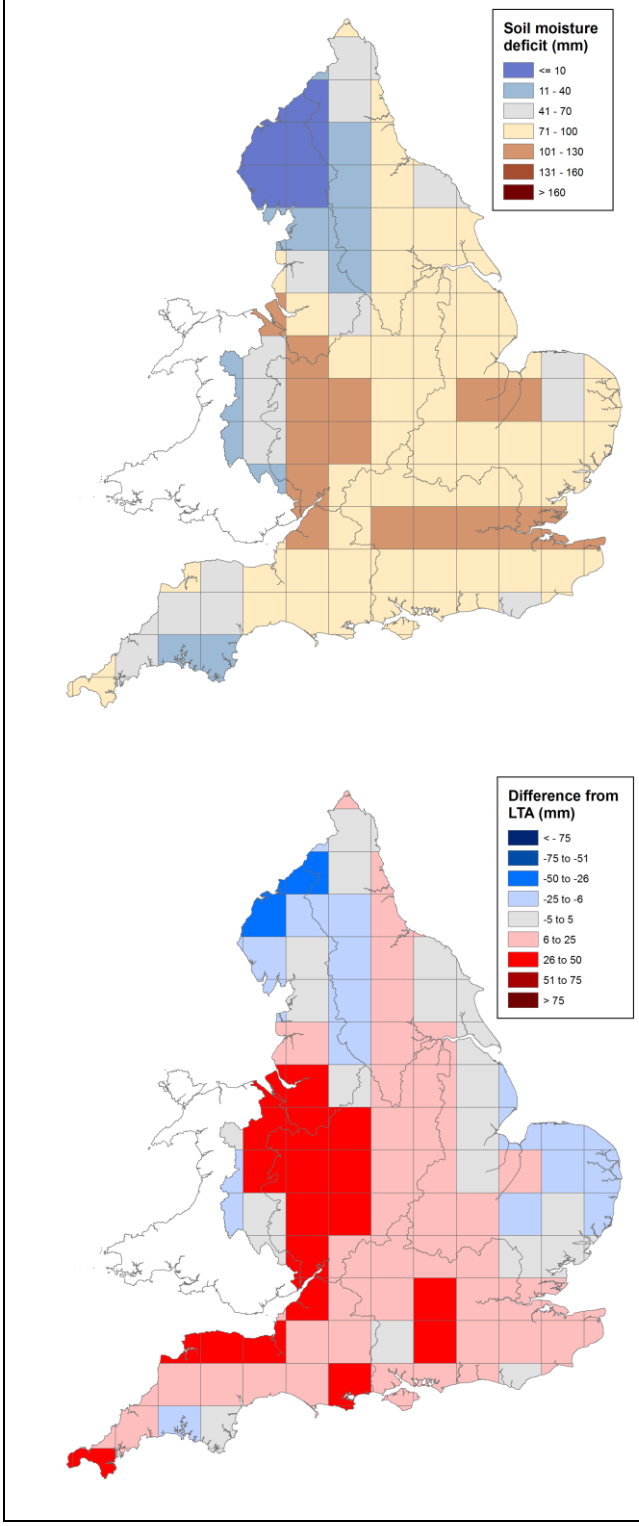
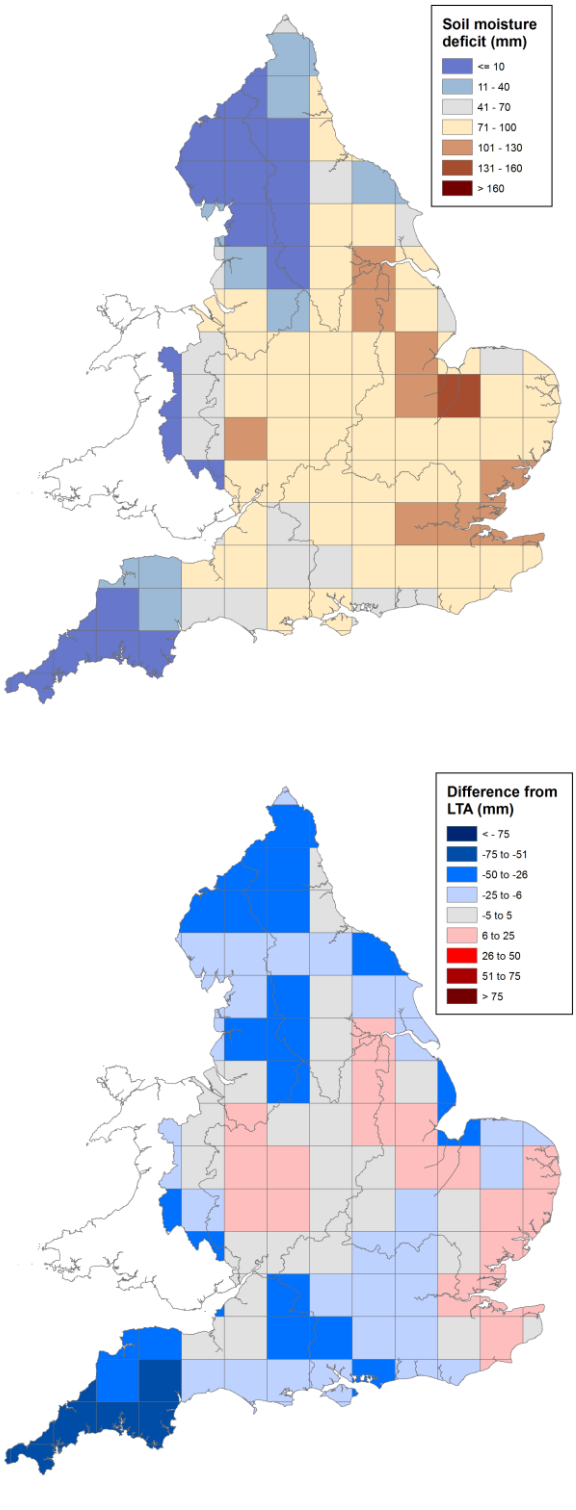
| End of June 2017[1] | End of July 2017[2] |
|---|---|
|  |  |



**Figure 2.1**: Soil moisture deficits for weeks ending 27 June 2017 [1] (left panel) and 1 August 2017 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961-90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2017). Crown copyright. All rights reserved. Environment Agency, 100026380, 2017

# Soil moisture deficit charts

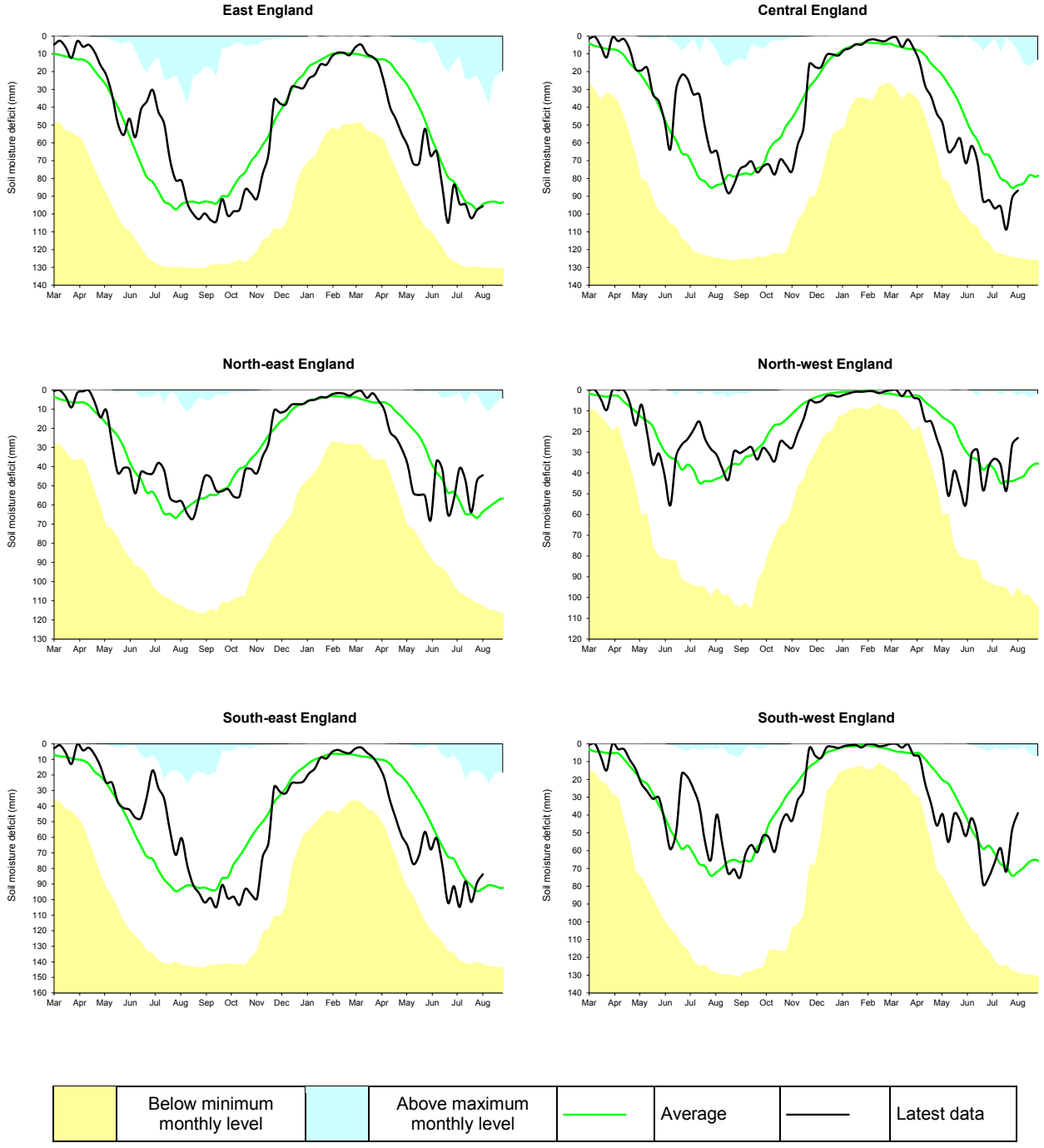
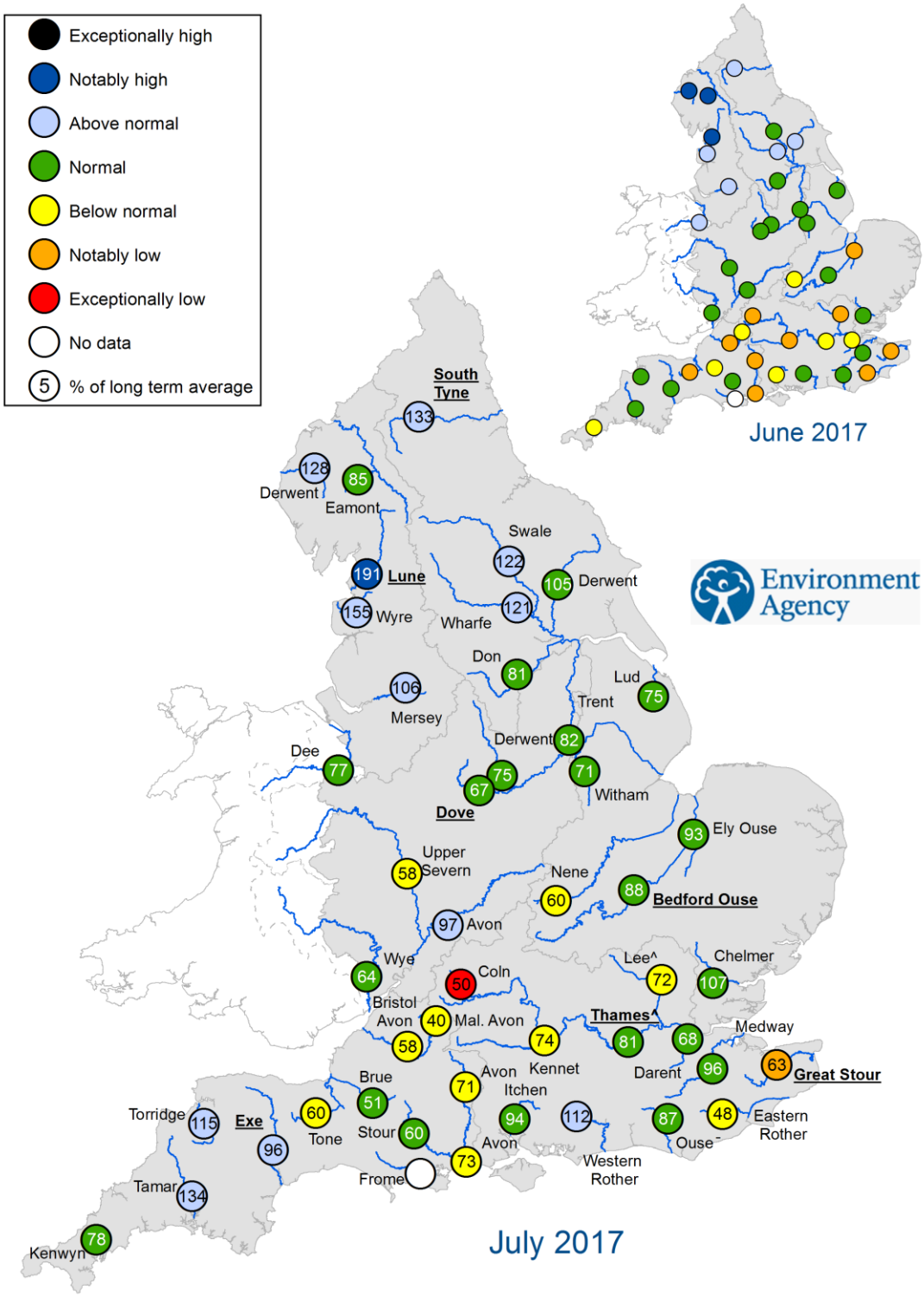



**Figure 2.2**: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961-90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2017).

# River flows




^ "Naturalised" flows are provided for the 'Thames at Kingston' and the 'Lee at Feildes Weir'
Underlined sites are regional index sites and are shown on the hydrographs in Figure 3.2

* Data unavailable for the Frome at East Stoke due to a technical problem at the site

**Figure 3.1**: Monthly mean river flow for indicator sites for June 2017 and July 2017, 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, 100026380, 2017.

## River flow charts

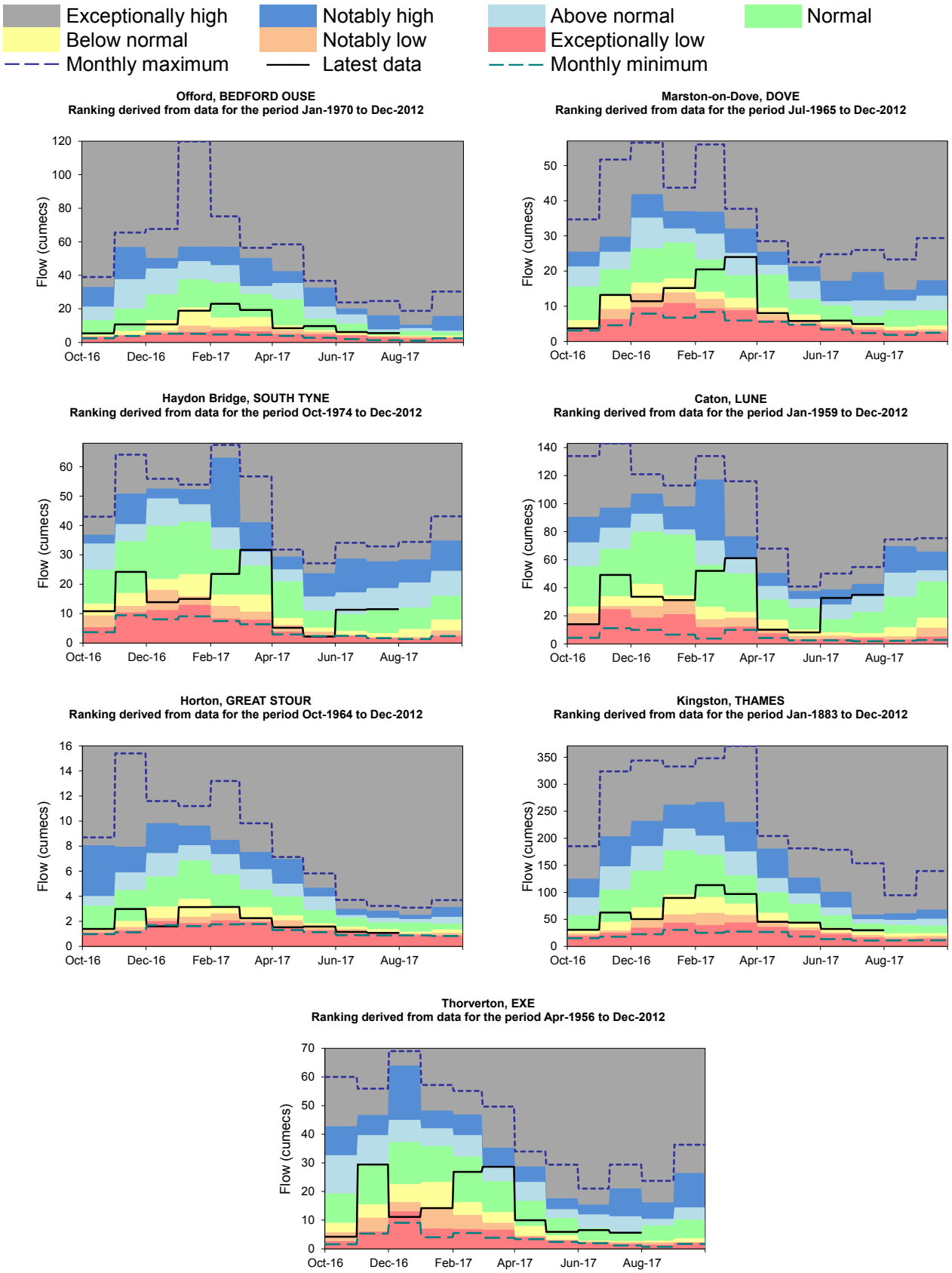
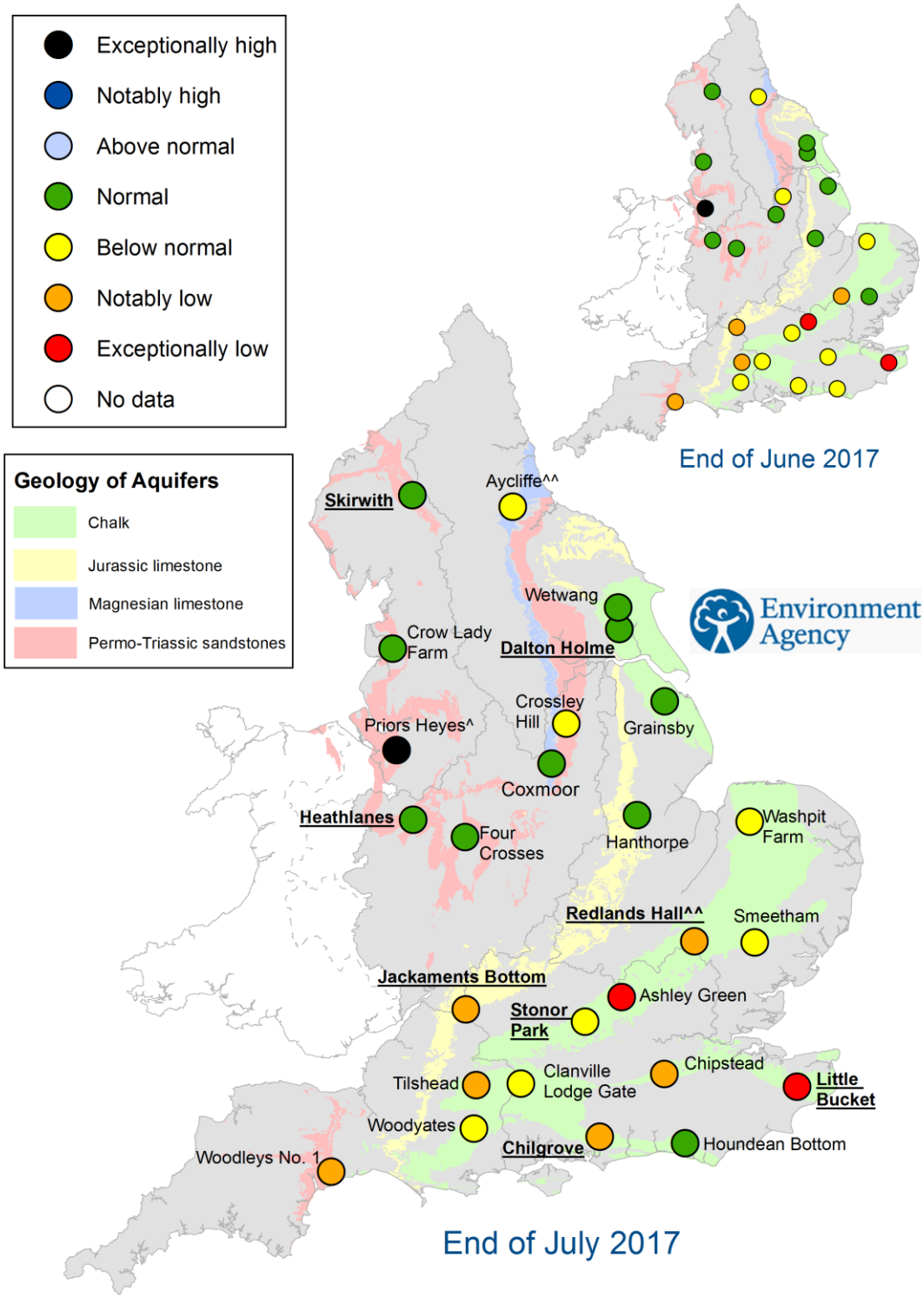



**Figure 3.2**: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

# 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
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 2017 and July 2017, 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, 100026380, 2017.

## Groundwater level charts

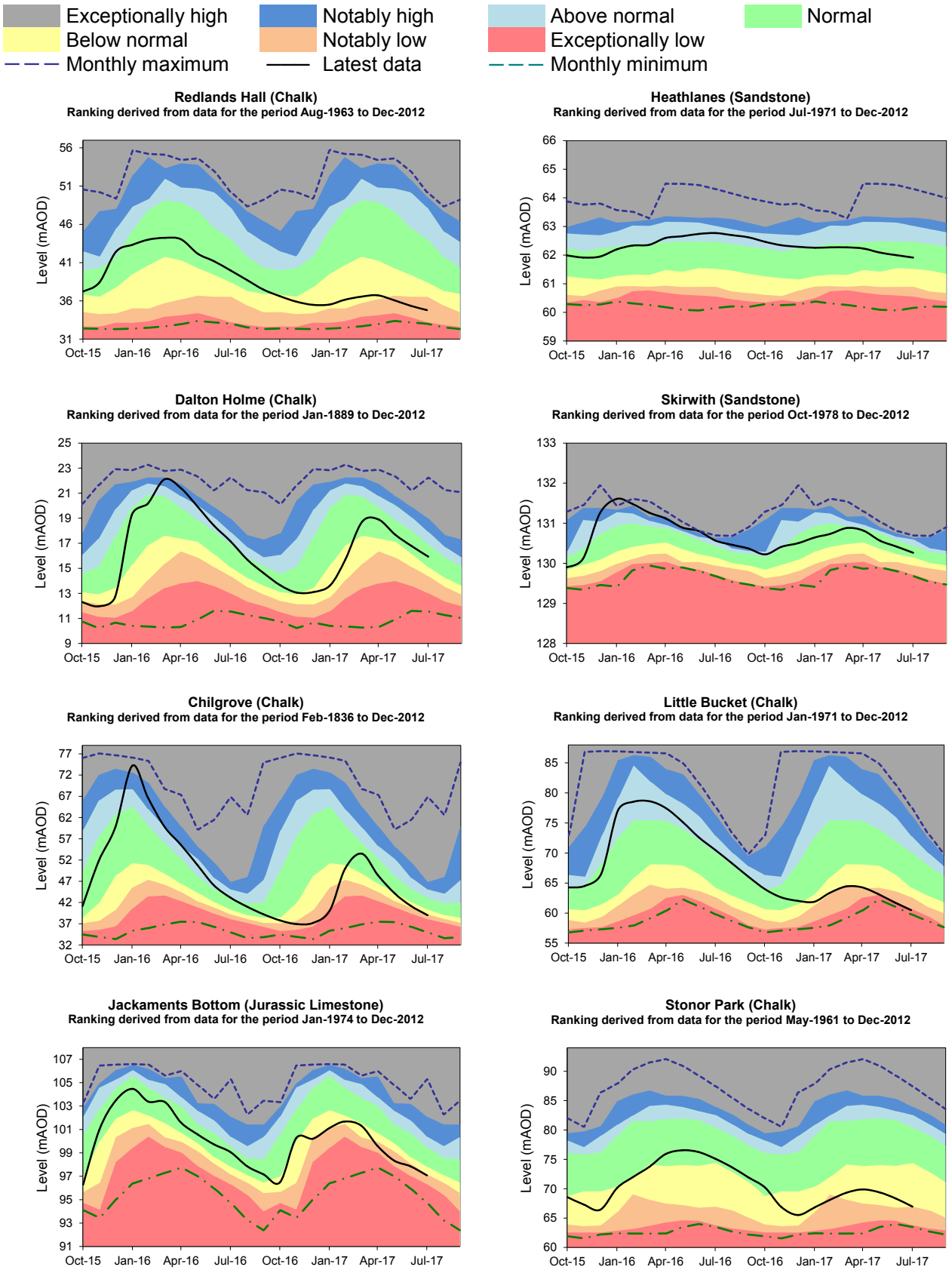
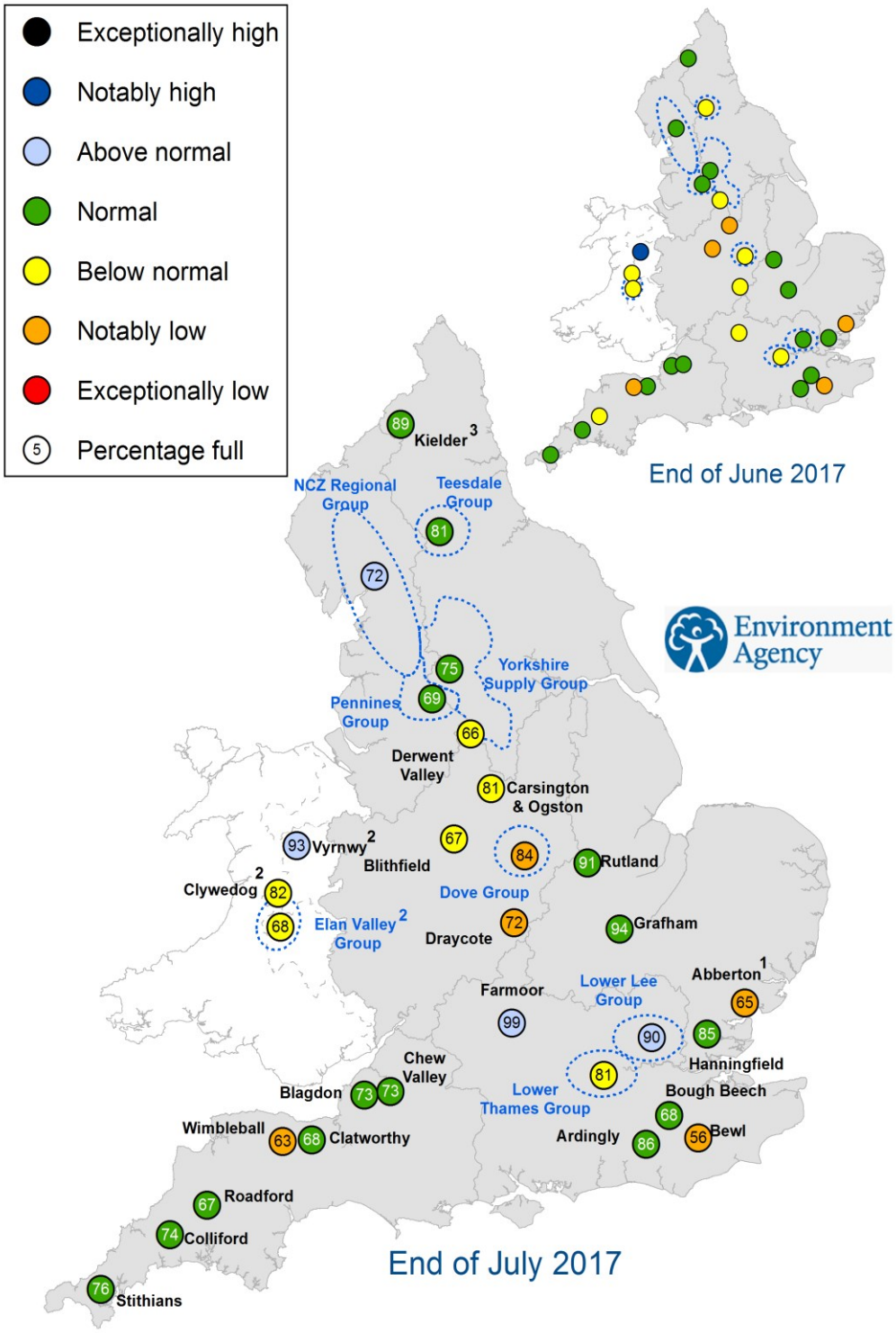



**Figure 4.2**: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2017).

# Reservoir storage




1. Engineering work at Abberton Reservoir in east England to increase capacity has been completed
2. Vyrnwy, Clywedog and Elan Valley reservoirs are located in Wales but provide a water resource to Central and north-west England
3. Current levels at Kielder will be deliberately lower than historical levels during a trial of a new flood alleviation control curve

**Figure 5.1**: Reservoir stocks at key individual and groups of reservoirs at the end of June2017 and July 2017 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

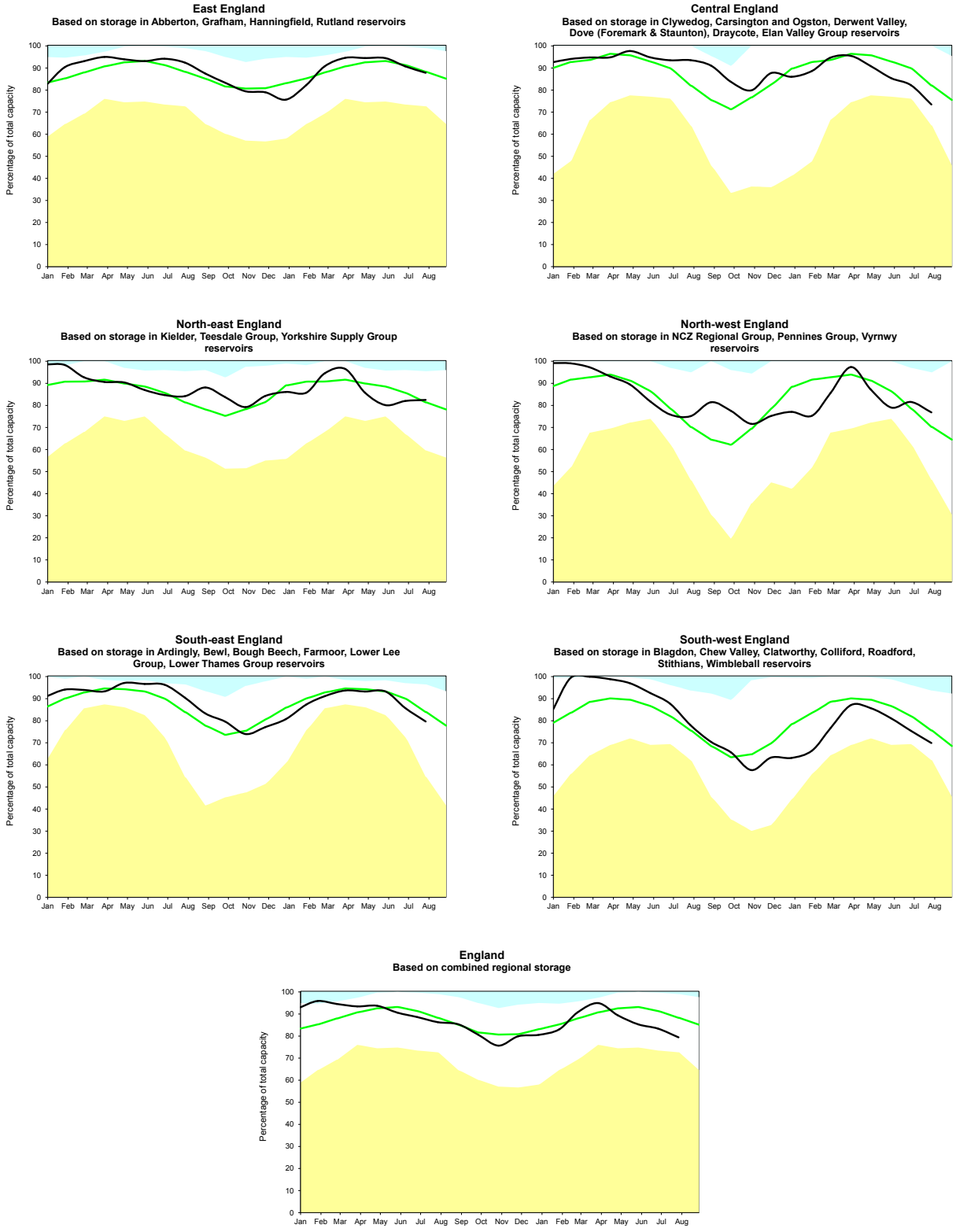



**Figure 5.2**: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

# Forward look – river flow

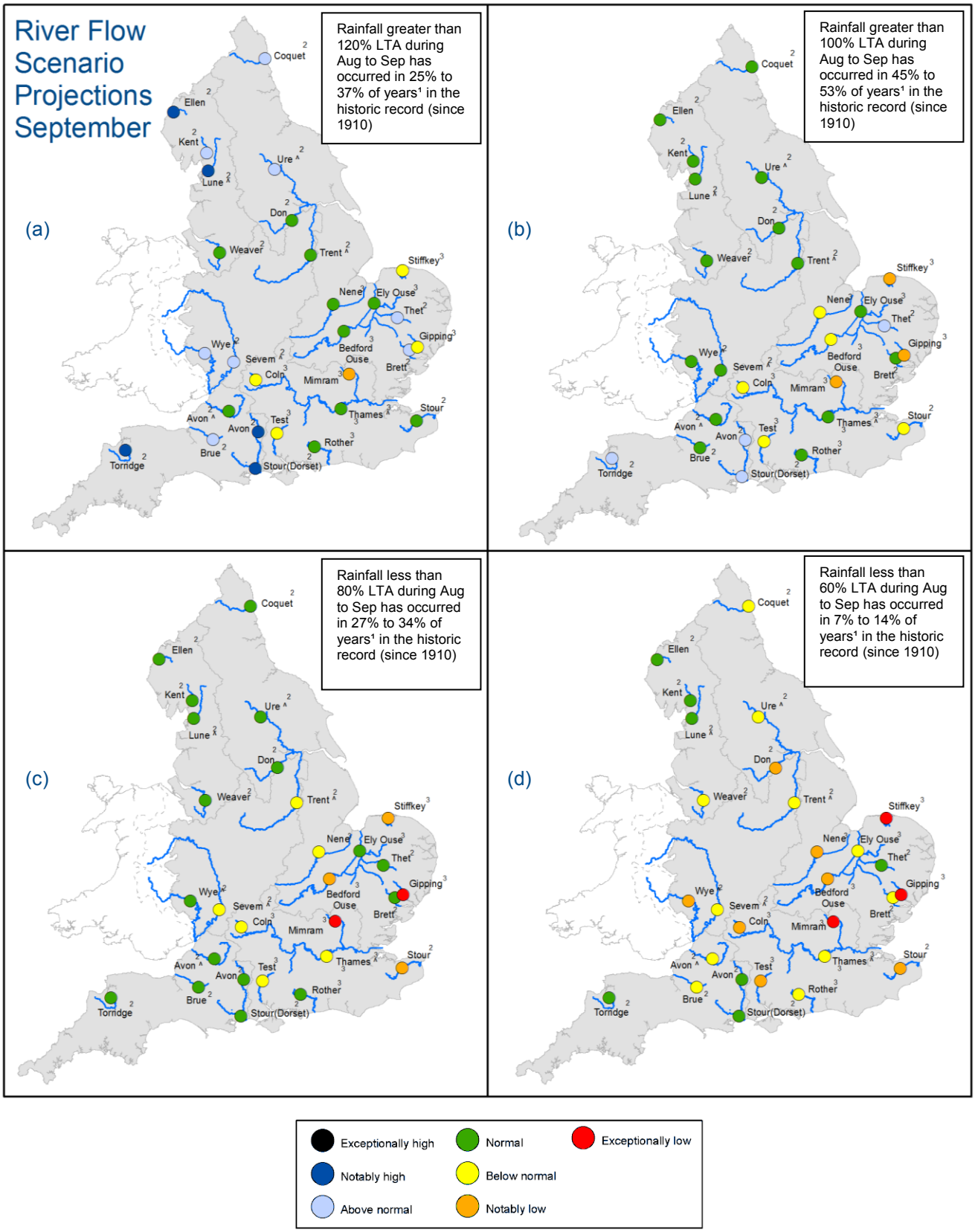



**Figure 6.1**: Projected river flows at key indicator sites up until the end of September 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August and September 2017 (Source: Centre for Ecology and Hydrology, Environment Agency).

[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*

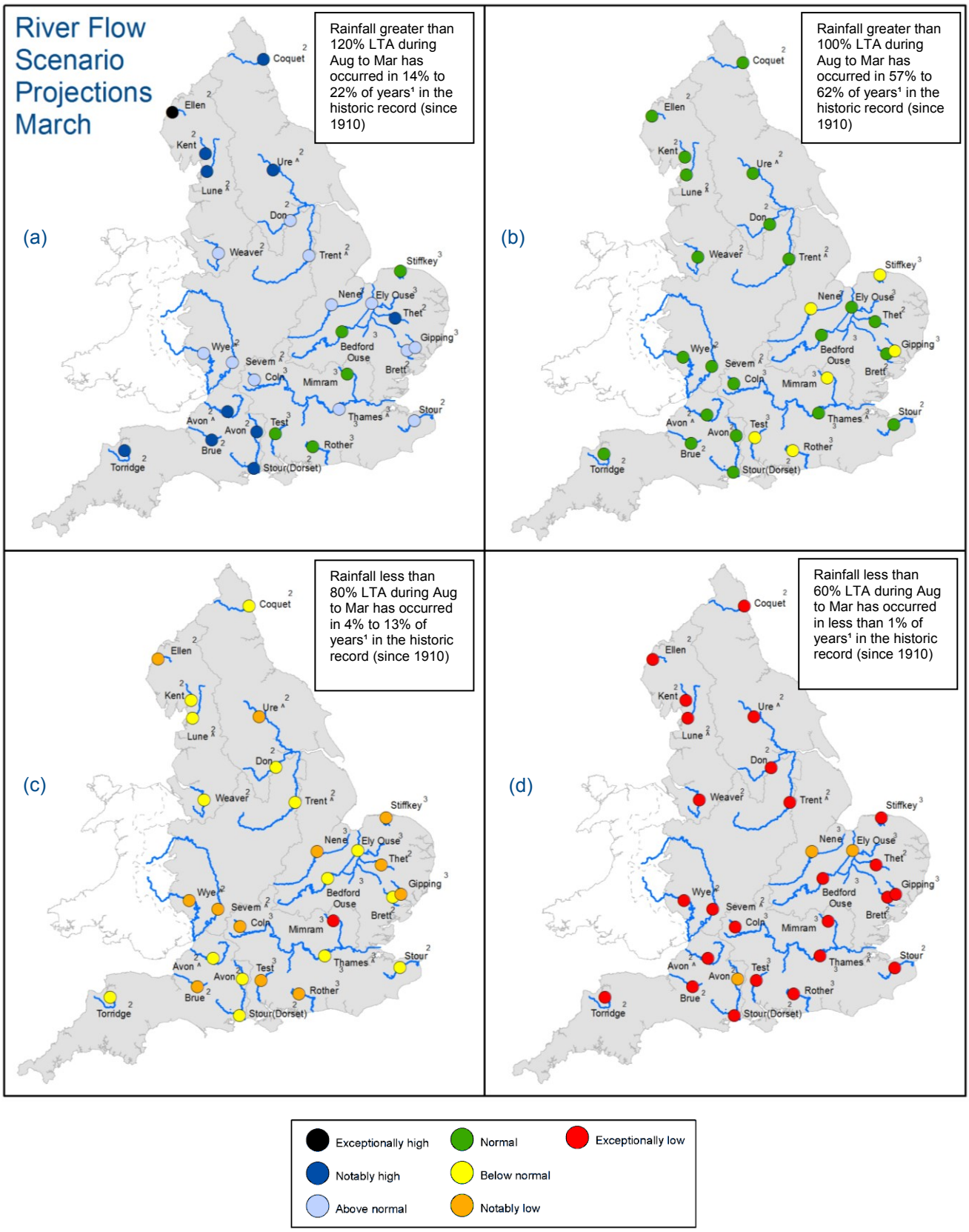



**Figure 6.2**: Projected river flows at key indicator sites up until the end of March 2018. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2017 and March 2018 (Source: Centre for Ecology and Hydrology, Environment Agency).

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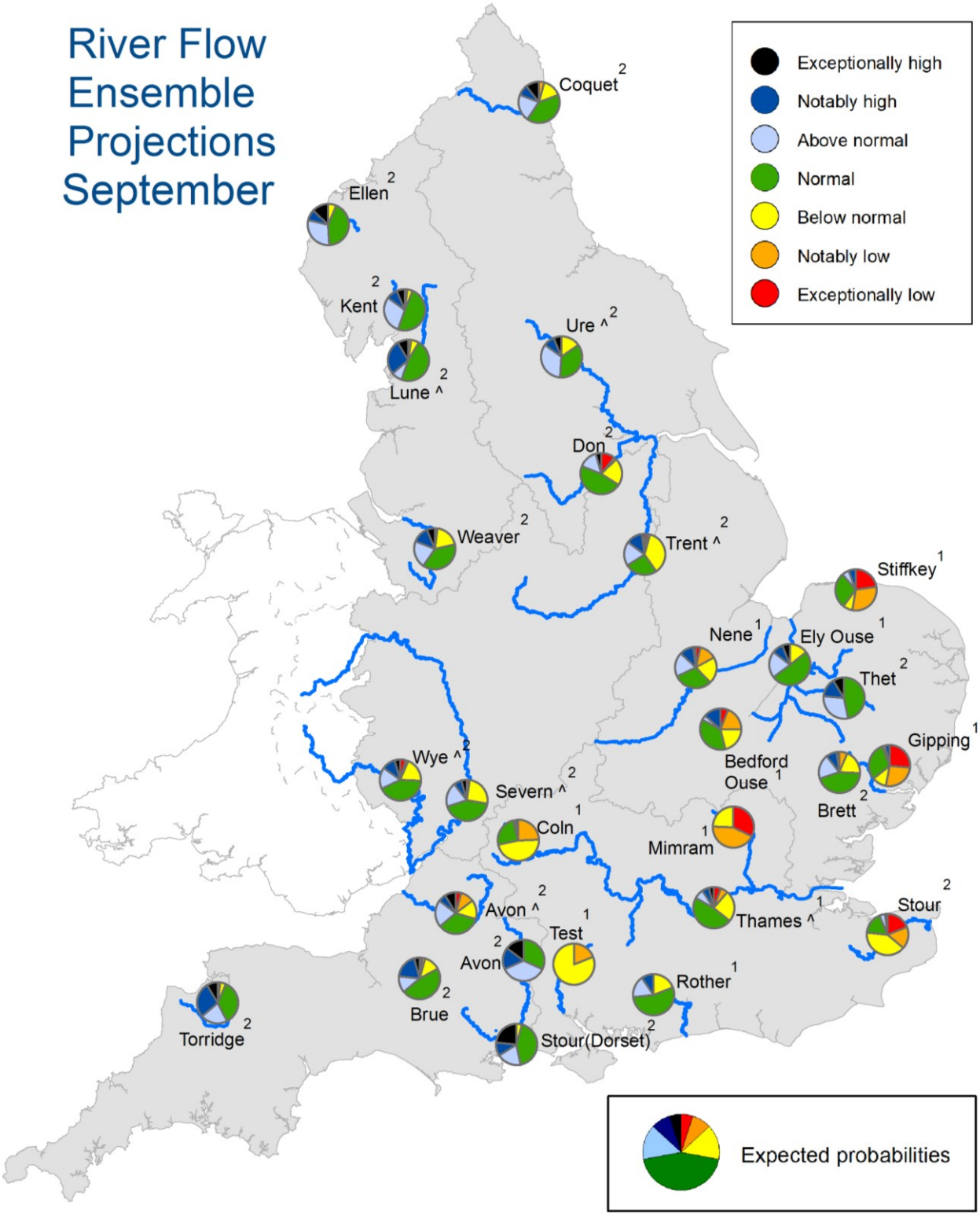


*Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels 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 2017. 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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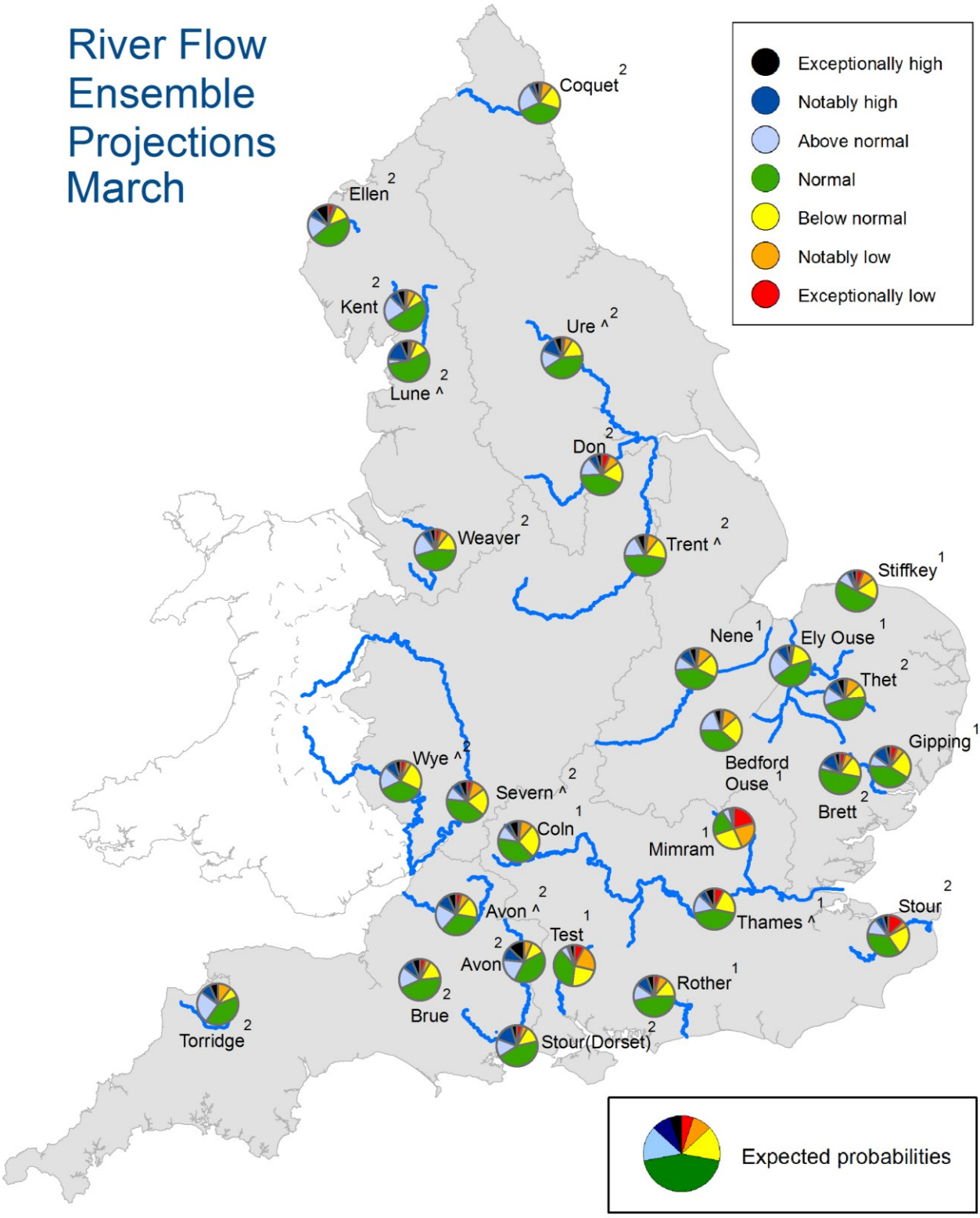
[2] Projections for these sites are produced by CEH
^"Naturalised" flows are projected for these sites




*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 2018. 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

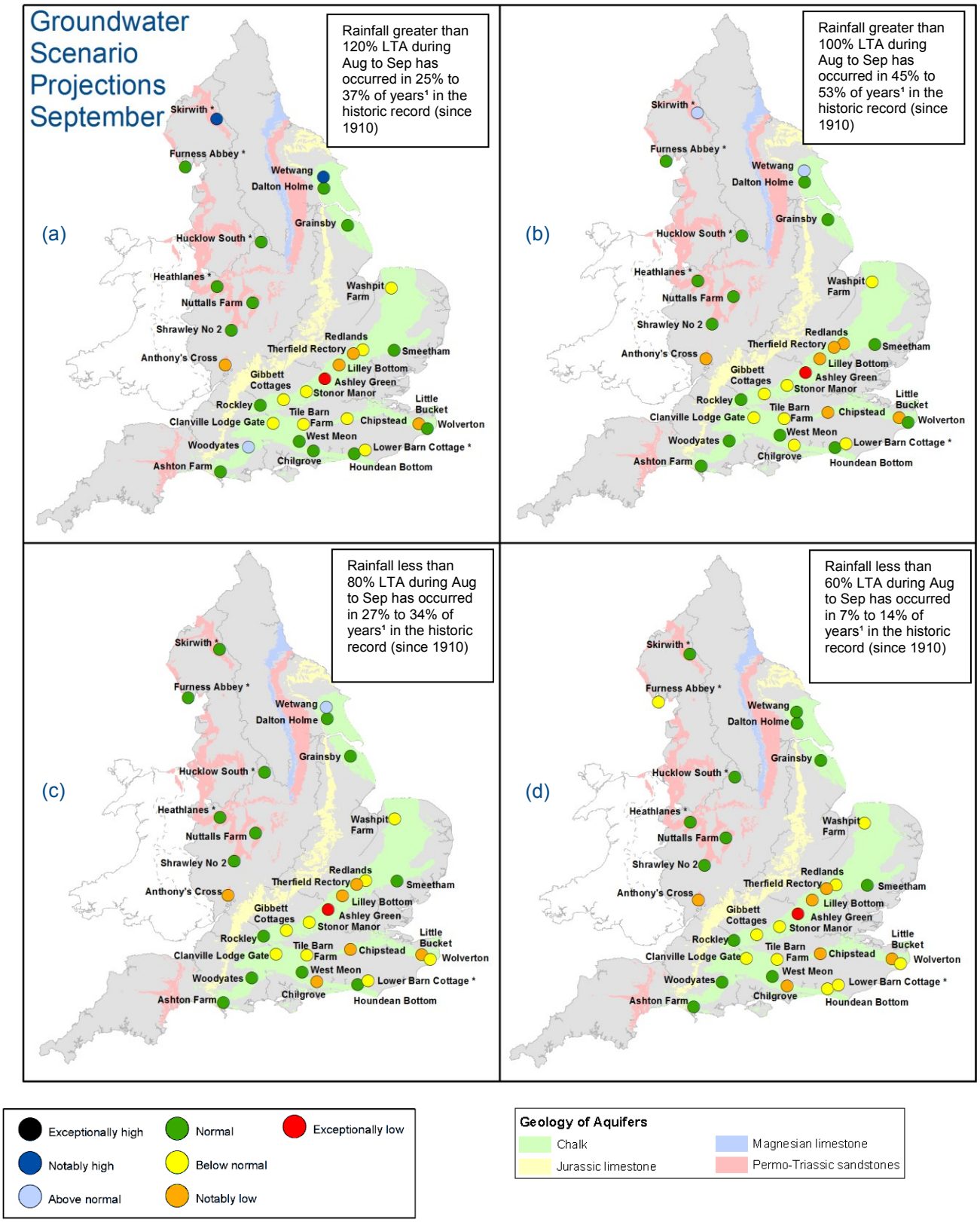



**Figure 6.5**: Projected groundwater levels at key indicator sites at the end of September 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August and September 2017 (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100026380, 2017.

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

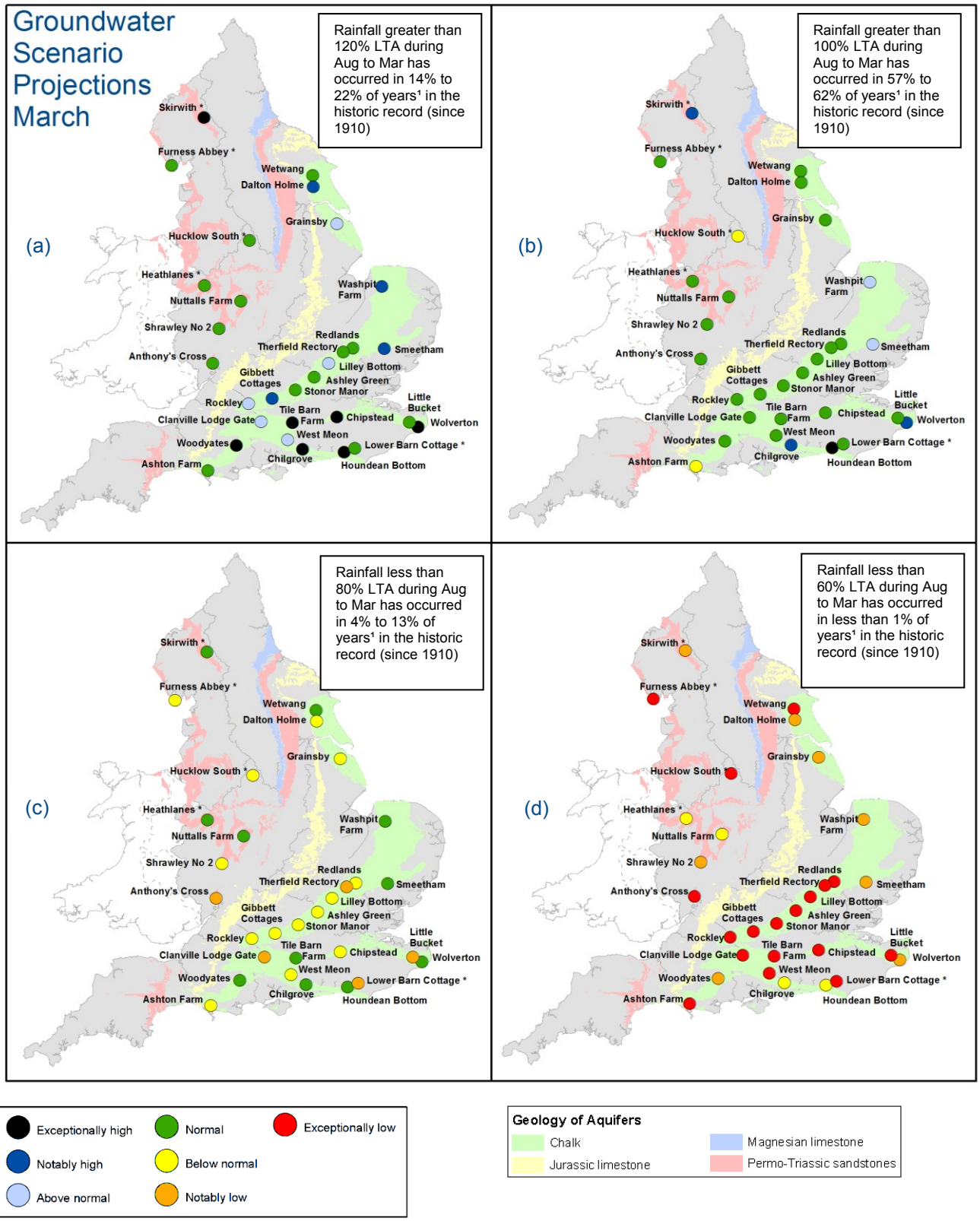
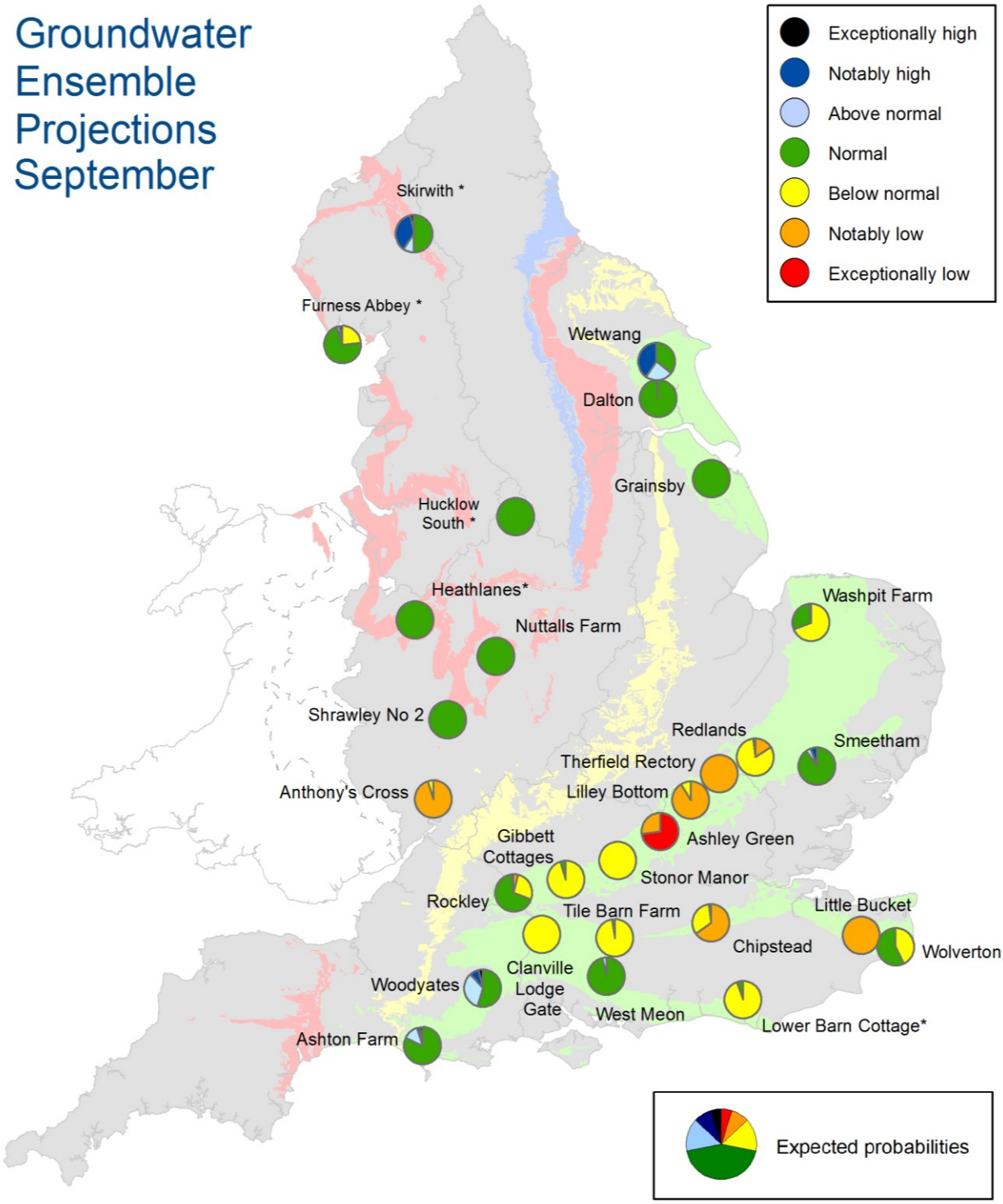



**Figure 6.6**: Projected groundwater levels at key indicator sites at the end of March 2018. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2017 and March 2018 (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100026380 2017.

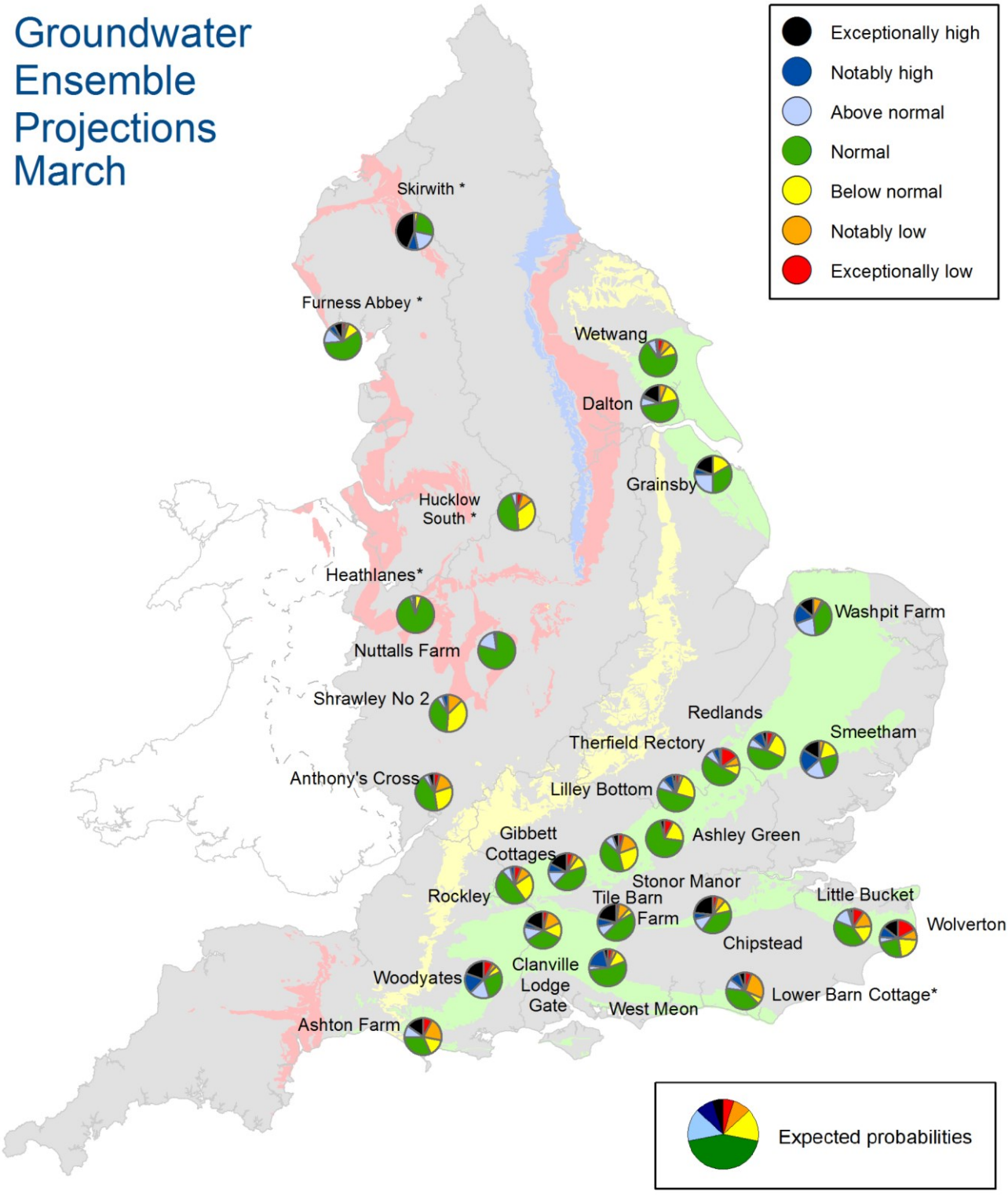
* Projections for these sites are produced by BGS
[1] This range of probabilities is a regional analysis




*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 2017. 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, 100026380, 2017.

** 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 2018. 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. 

* 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 1961-1990, 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 |