Monthly water situation report

England

Summary – January 2017

January was wetter than December across much of England, but rainfall totals remain below average in many areas; England as a whole received 81% of long term average (LTA) rainfall for January. Modest soil moisture deficits (SMDs) remain across east and south-east England. River flows and groundwater levels increased at the majority of indicator sites. River flows were below normal or lower for the time of year at almost all sites across England. Groundwater levels were below normal or lower at two thirds of sites. Reservoir stocks increased at two-thirds of reservoirs groups and were normal or lower at all but one reservoir. Overall stocks for England increased marginally compared to the end of December and were 83% of total capacity.

Rainfall

January has been relatively dry across north-east and parts of east England, with some areas receiving less than 40mm of rainfall. Higher rainfall totals were seen across parts of south-east, south-west and north-east England, with more than 100mm received in some areas (Figure 1.1).

Rainfall totals were below the long term average (LTA) for January in two-thirds of the hydrological areas. A number of hydrological areas in north-east England received less than 50% of the LTA rainfall for January, whilst parts of south-east England received more than 110% of the January LTA rainfall. January rainfall totals were classed as normal for the time of year across south-east England, most of central and east England and parts of south-west England. However, across much of north-east, north-west and parts of south-west England, rainfall totals for January were below normal or lower. The 3-month and 6-month accumulations to January show below normal or lower rainfall totals for the majority of hydrological areas across England. The 6-month accumulations were the second driest August to January totals on record since 1910 in three hydrological areas. For the Teign and Torbay, this period was the driest since 1975/6, while for Dee and Upper Wye it was the driest August to January since 1933/4 (Figure 1.2).

January rainfall totals were below average across all geographic regions of England, with the exception of south-east England. Monthly totals ranged from 55% of the LTA in north-east England to 111% in south-east England. Across England as a whole, monthly rainfall totals were 81% of the January LTA (Figure 1.3).

Soil moisture deficit

Soil moisture deficits (SMDs) for January decreased or remained the same across the whole of England compared to December. At the end of the month, SMDs were less than 10mm across the majority of England, with values of zero in parts of north, west and south-west England indicating soils were now saturated in these areas. In parts of east and south-east England, month end values were predominantly between 10 and 40mm. End of month SMDs were close to the long term average (LTA) for January across much of England (Figure 2.1).

At a regional scale, SMDs at the end of January were smaller than at the end of December, with end of month values ranging from less than 1mm (north-west and south-west England) to 11mm (east England) (Figure 2.2).

River flows

Monthly mean flows for January increased at the majority of indicator sites across England compared with December. Almost all sites were classed as below normal or notably low for the time of year. The monthly mean flows were normal for the River Wyre and River Mersey in north-west England and flows were exceptionally low for the time of year for the River Eamont in north west England and the River Wye on the Welsh border (Figure 3.1).

At the regional index sites, monthly mean river flows were below normal for the time of year at 6 sites and notably low at Haydon Bridge (South Tyne) (Figure 3.2).

Groundwater levels

Groundwater levels increased at just over two-thirds of indicator sites during January, including all sites in north-east and north-west England. End of month groundwater levels were below normal or lower for the time of year at two-thirds of indicator sites, including all sites in south-east and south-west England and all but two sites in east England (Figure 4.1).

End of month groundwater levels at the major aquifer index sites ranged from exceptionally low at Chilgrove (Chichester chalk aquifer) to normal for the time of year at Heathlanes (Shropshire Middle Severn sandstone aquifer) and Skirwith (Carlisle Basin and Eden Valley sandstone aquifer) (Figure 4.2).

Reservoir storage

During January, reservoir stocks increased at more than two-thirds of the reservoirs or reservoir groups reported on. Bough Beech reservoir in south-east England experienced the largest increase of 21% and the NCZ Regional group in north-west England experienced the largest decrease of 3%. End of month stocks were classed as normal for the time of year at a quarter of reservoirs and reservoir groups, with the majority of remaining sites being below normal or lower (Figure 5.1).

At a regional scale reservoir stocks decreased slightly in north-east and north-west England, and increased elsewhere by between 3% and 7%. At the end of January, stocks ranged from 66% of total capacity in south-west England to 88% in central England. Overall storage for England increased slightly to 83% of total capacity (Figure 5.2).

Forward look

Weather conditions in February are likely to be mixed, with milder, wetter periods of weather earlier in the month being replaced with largely settled, colder weather later in February, with the possibility of rain and snow showers in some areas. Over the 3 month period February to April, there is broadly equal likelihood of below average and above average precipitation[1].

Projections for river flows at key sites[2]

There is a greater than expected chance of cumulative river flows being below normal or lower at more than three-quarters of the modelled sites at the end of March and September 2017.

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

Projections for groundwater levels in key aquifers[2]

At the end of March 2017, more than three-quarters of modelled sites have a greater than expected chance of below normal or lower groundwater levels for the time of year. At the end of September 2017, just over half of the modelled sites have a greater than expected chance of below normal or lower groundwater levels for the time of year.

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

Authors: E&B Hydrology Team

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

Rainfall

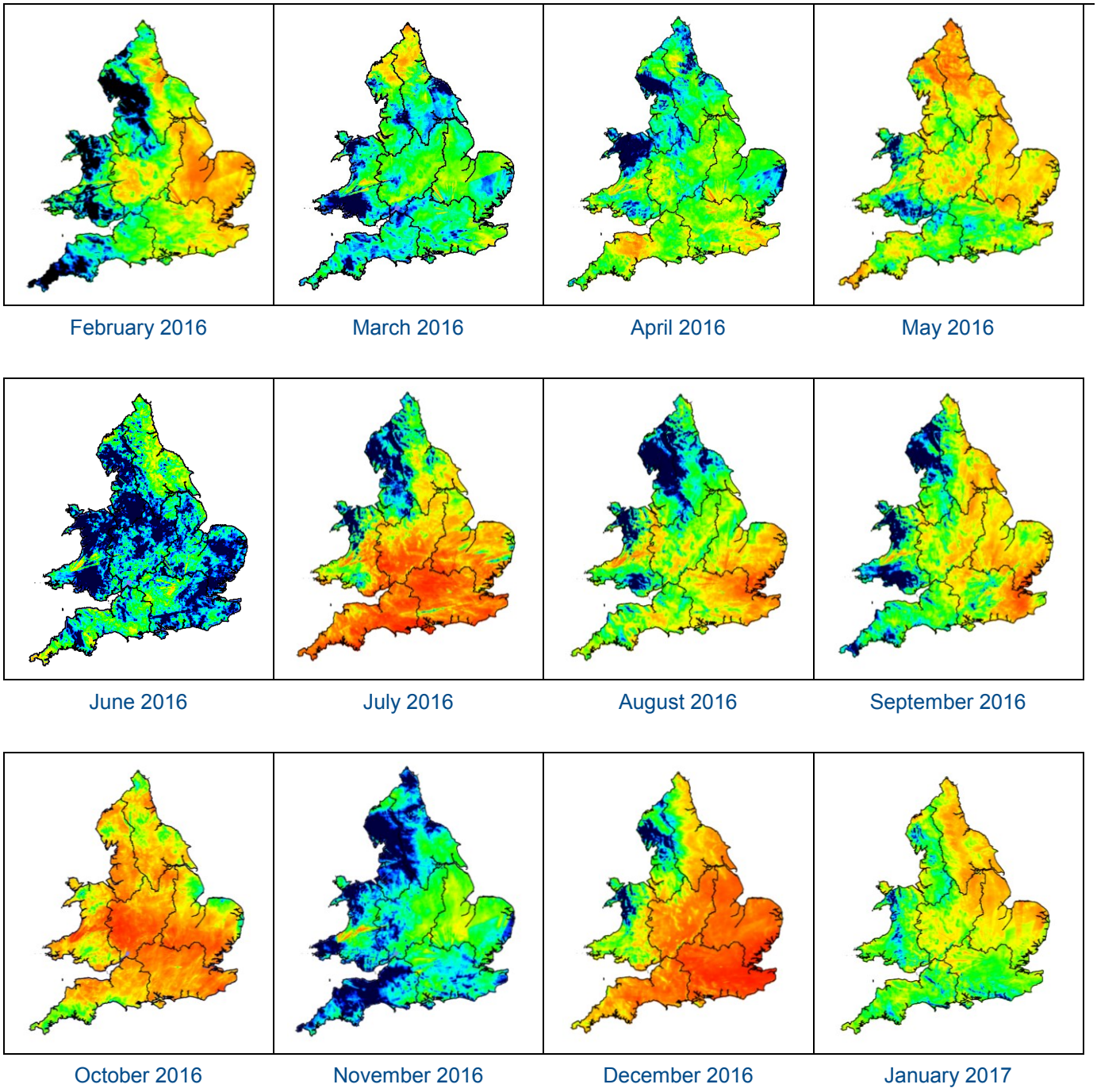


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2017). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100026380, 2017.

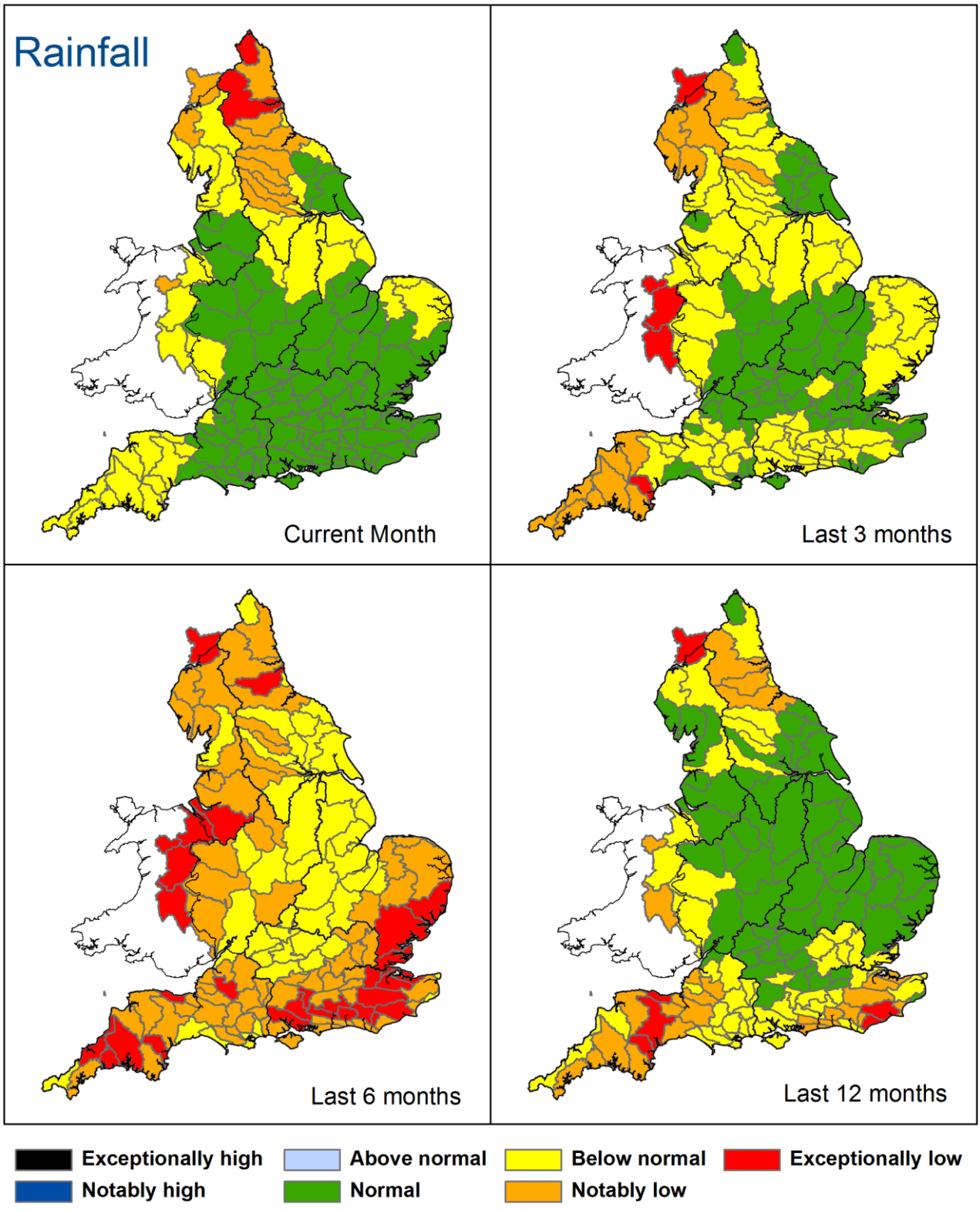


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 January), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Final NCIC (National Climate Information Centre) data based on the Met 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

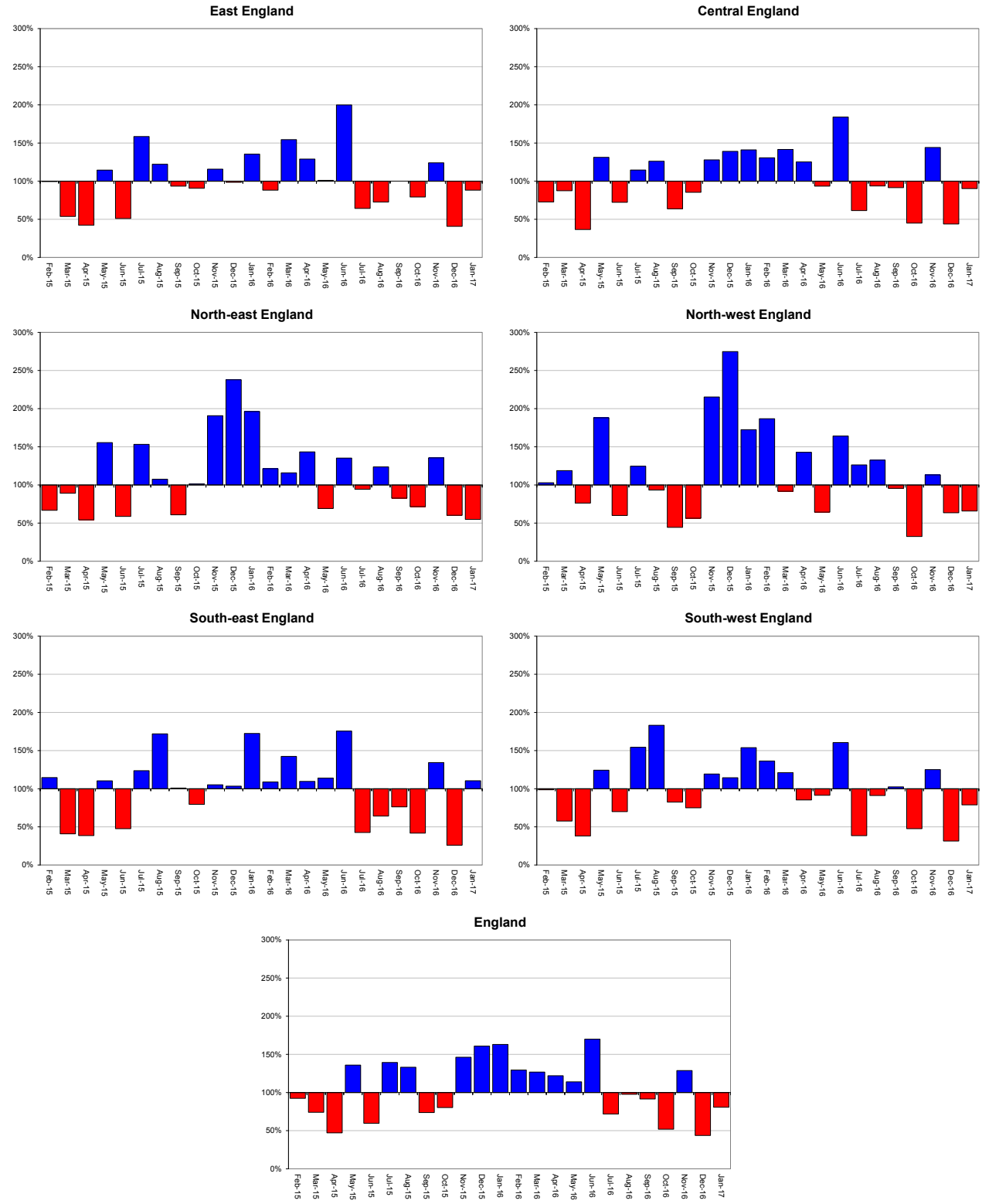


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each region and for England. NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright, 2017).

Soil moisture deficit

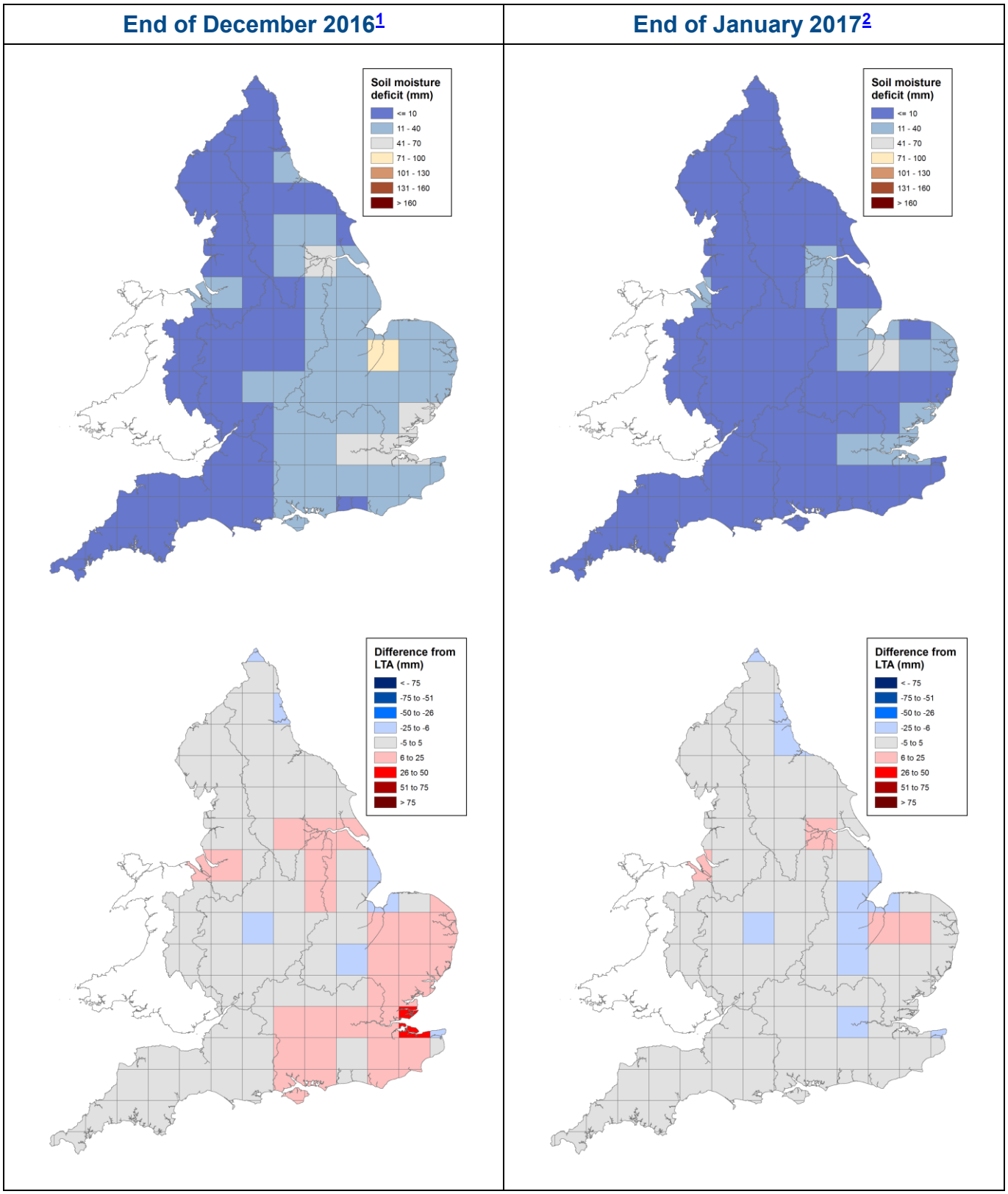


Figure 2.1: Soil moisture deficits for weeks ending 27 December 2016 [1] (left panel) and 31 January 2017 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961-90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2017). Crown copyright. All rights reserved. Environment Agency, 100026380, 2017

Soil moisture deficit charts

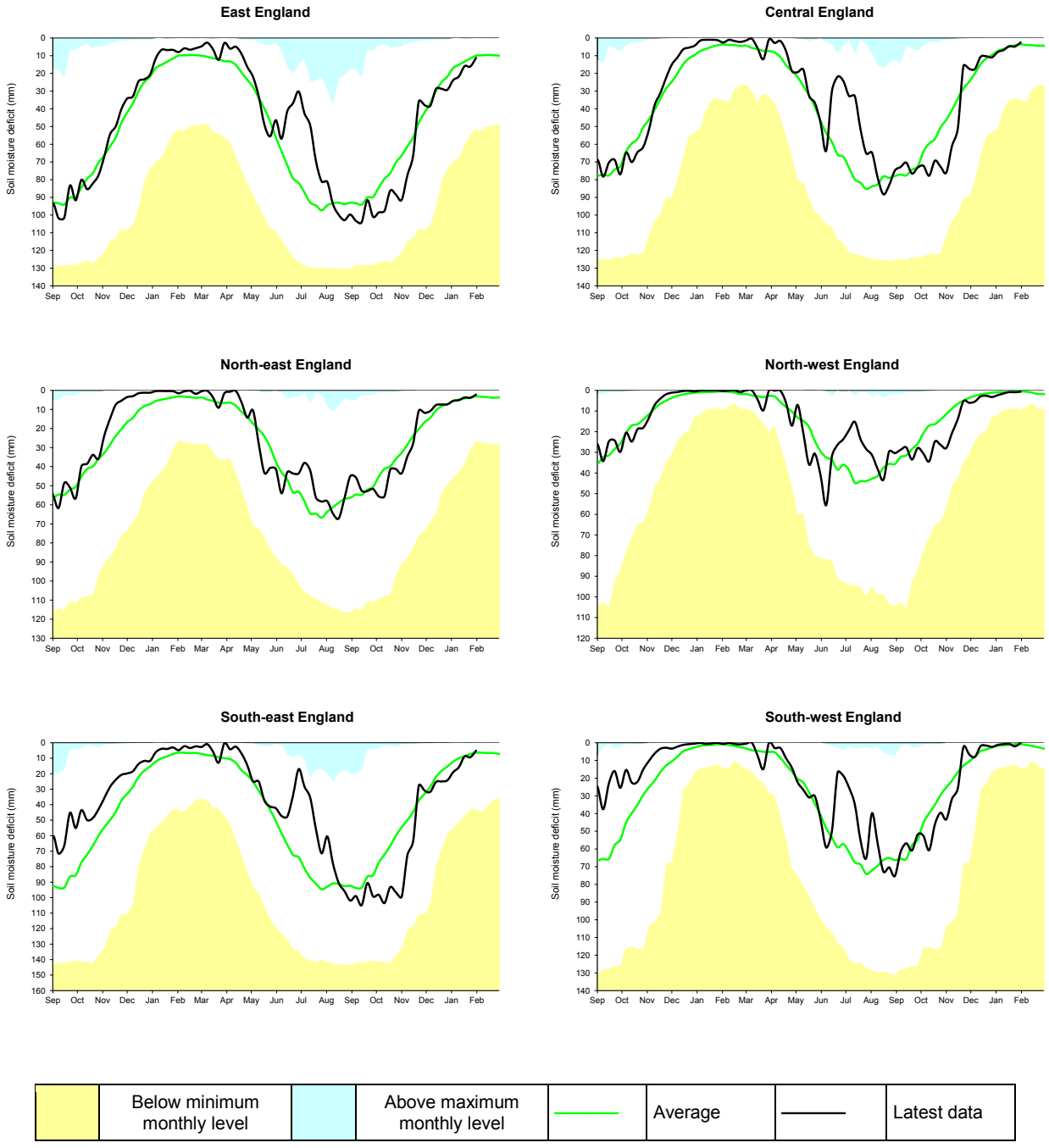
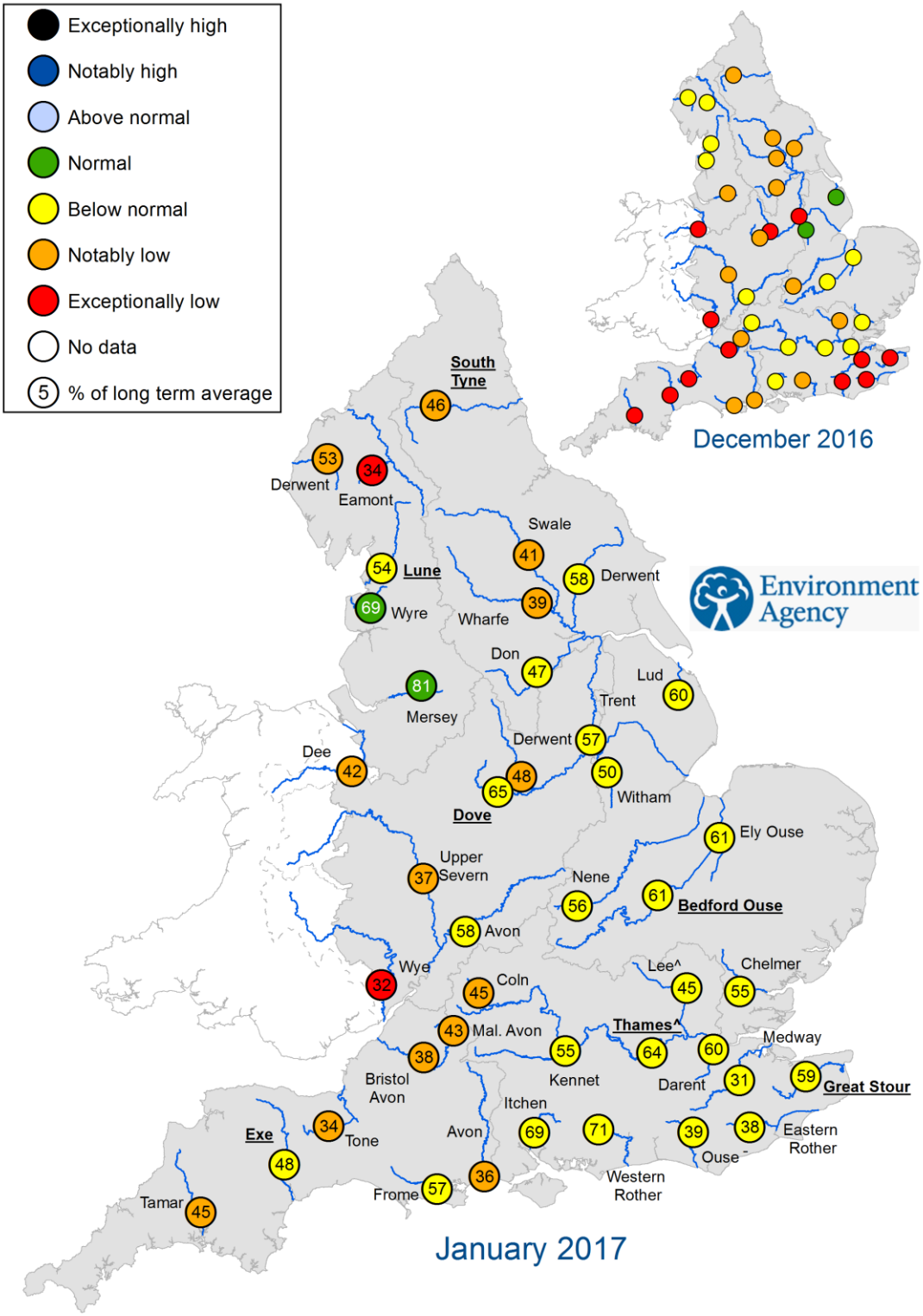


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961-90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2017).

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

Figure 3.1: Monthly mean river flow for indicator sites for December 2016 and January 2017, expressed as a percentage of the respective long term average and classed relative to an analysis of historic December and January monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100026380, 2017.

River flow charts

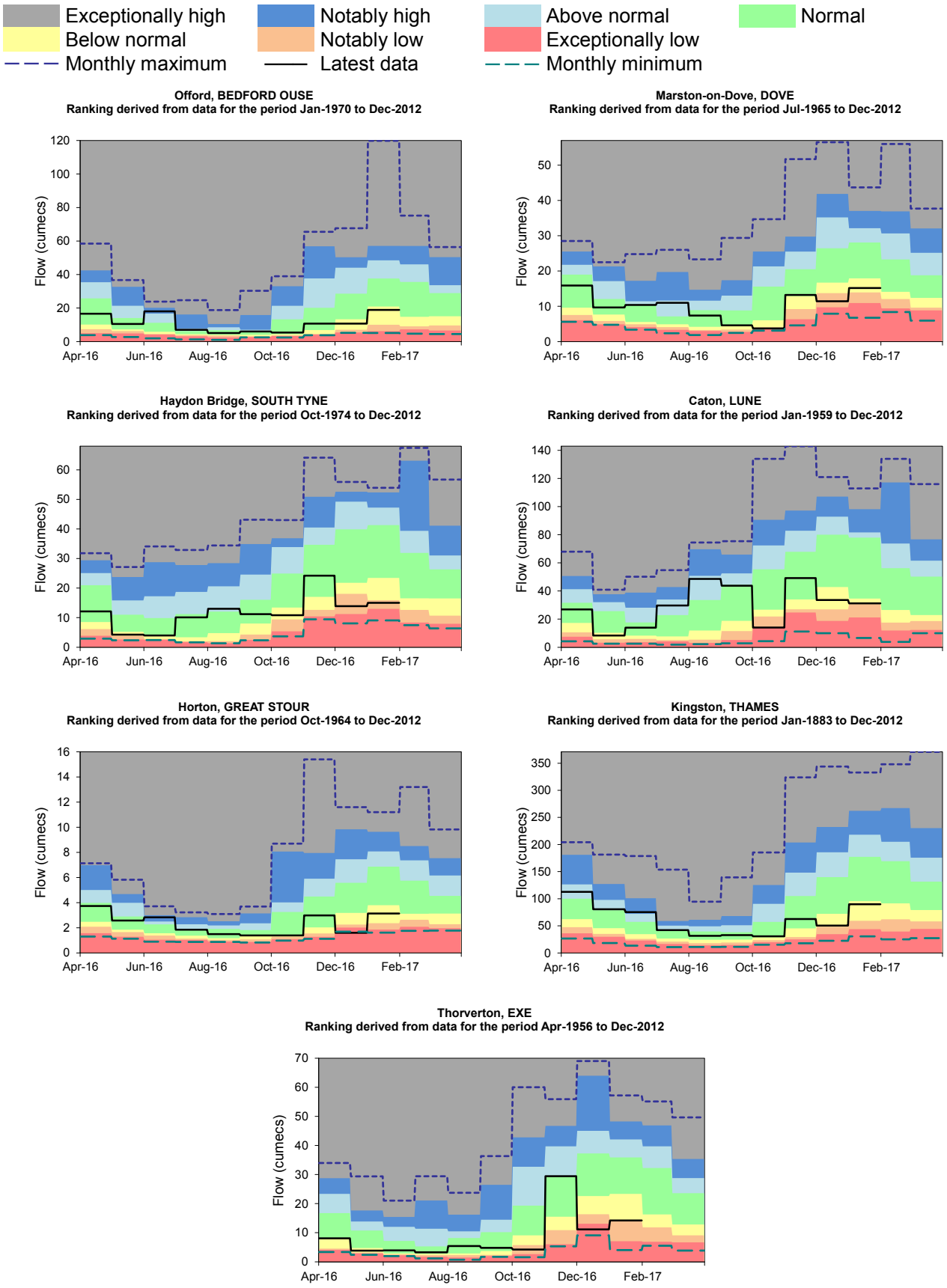
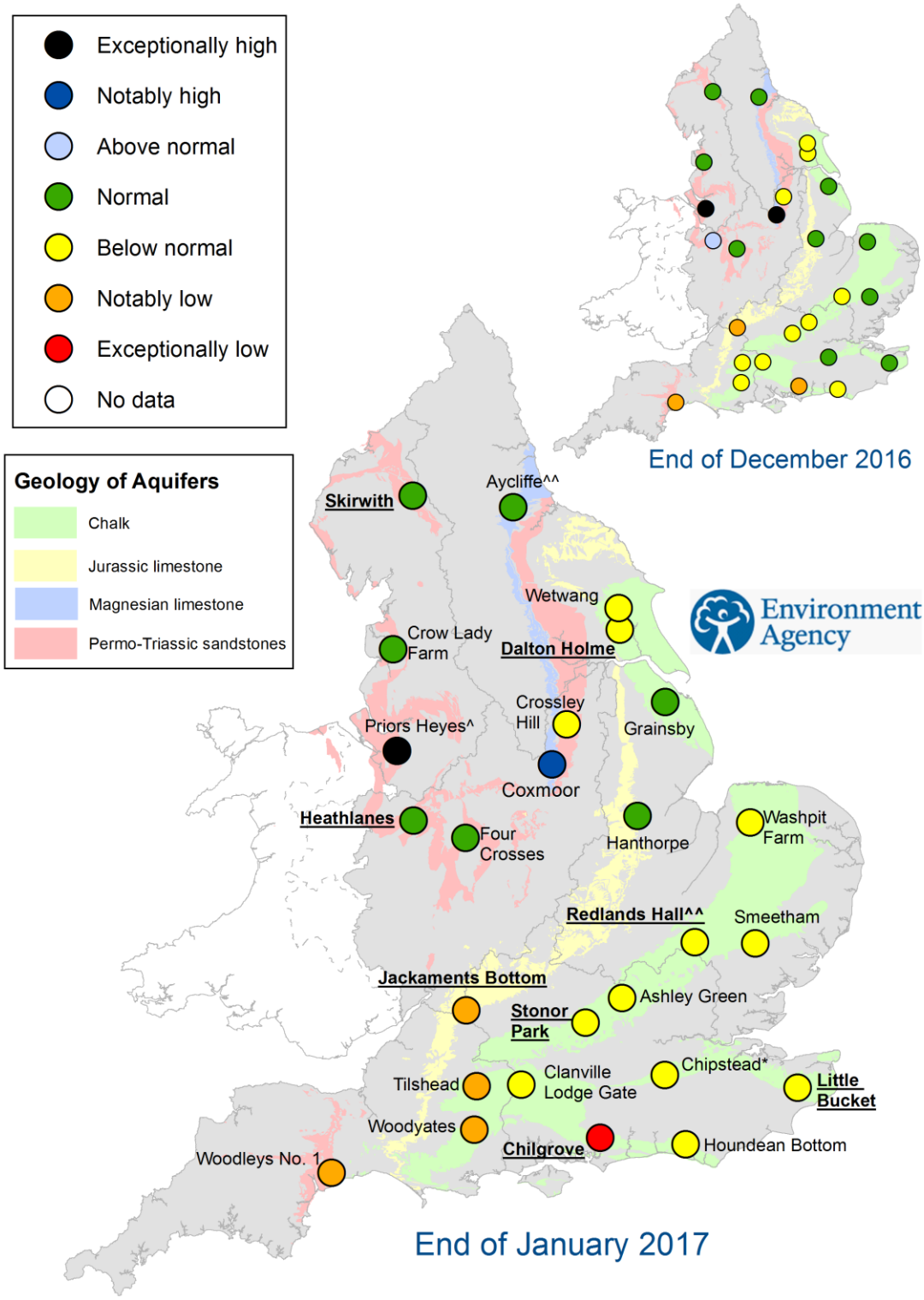


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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 December 2016 and January 2017, classed relative to an analysis of respective historic December and January 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

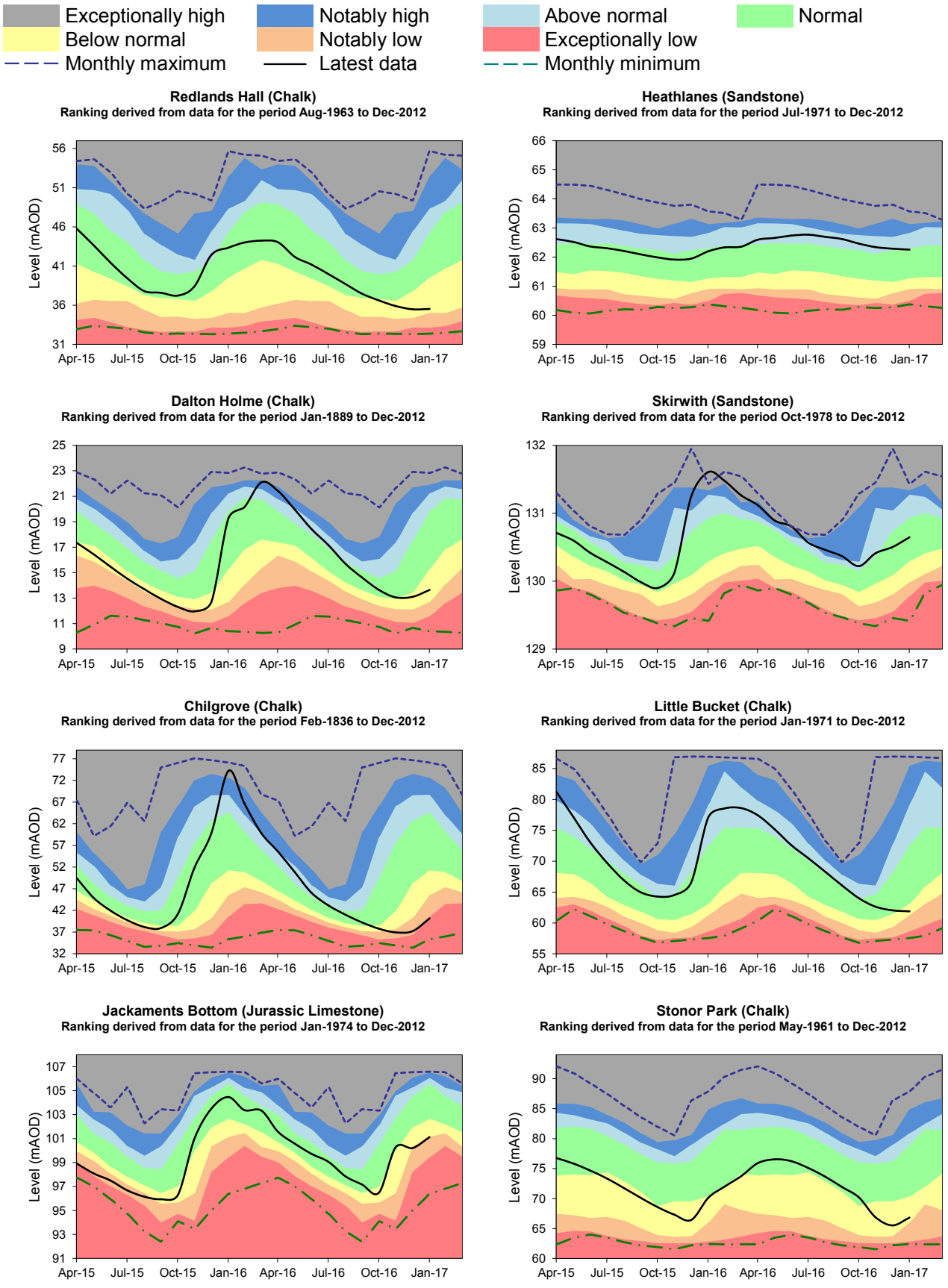
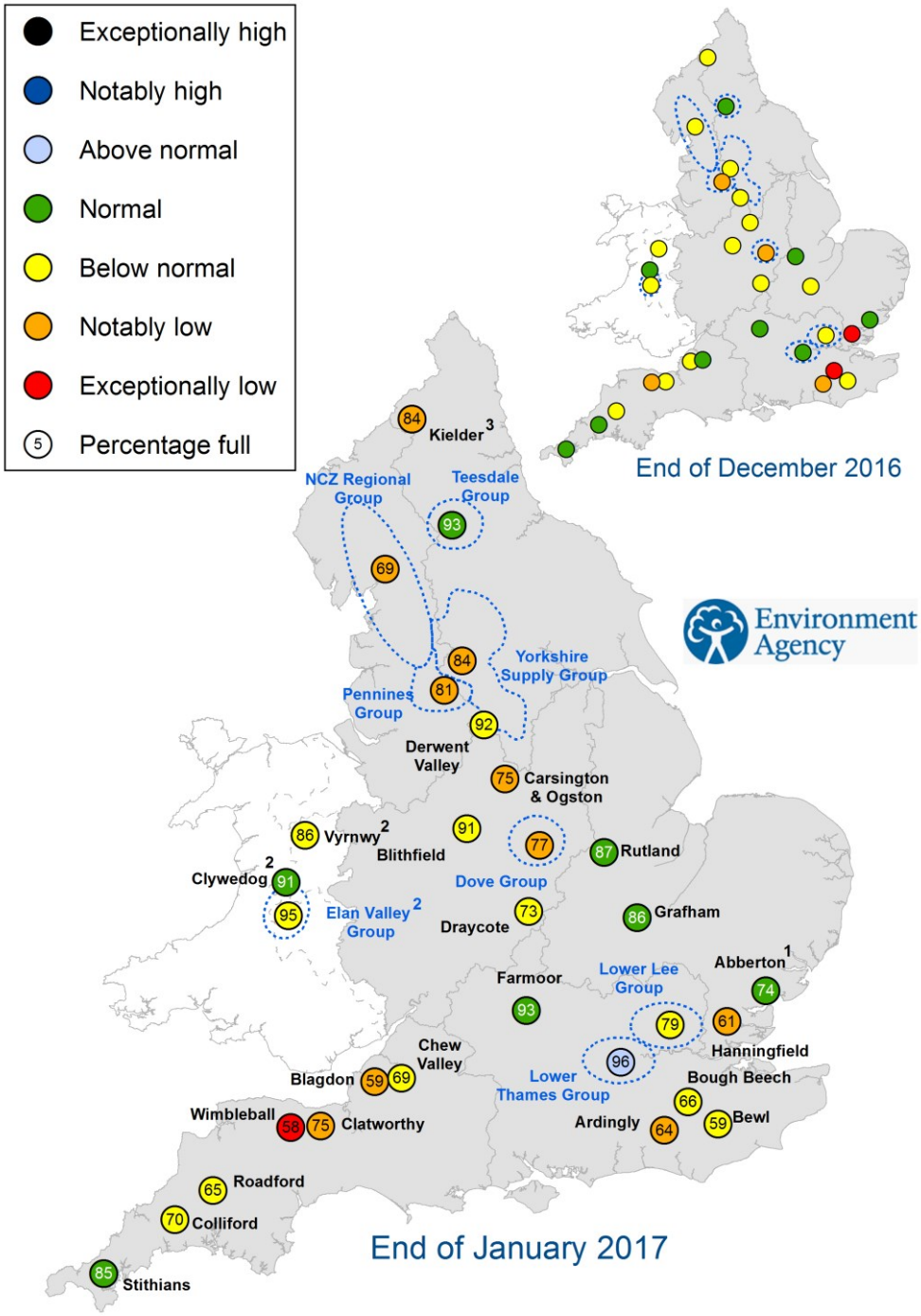


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2017).

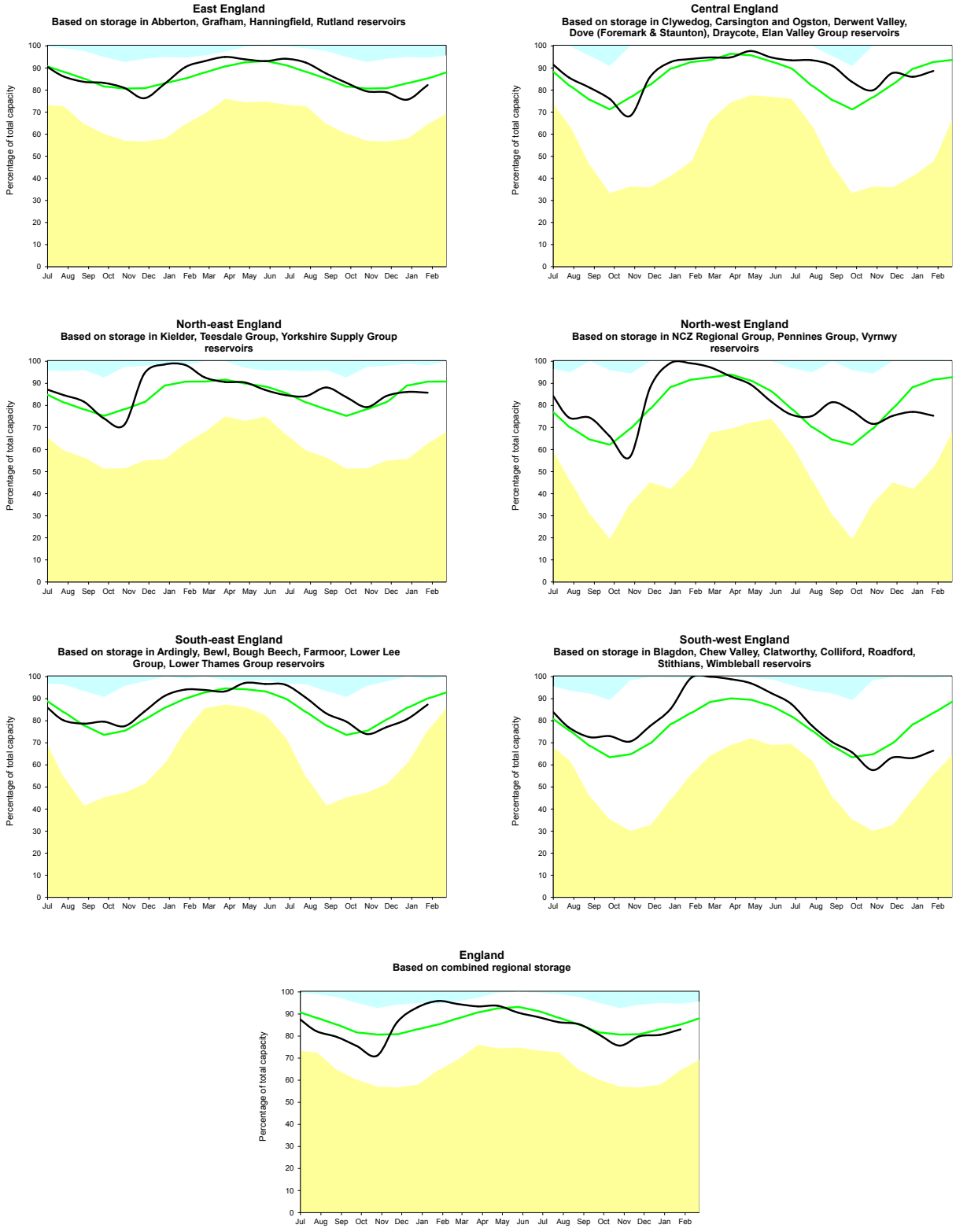
Reservoir storage



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 December 2016 and January 2017 as a percentage of total capacity and classed relative to an analysis of historic December and January values respectively (Source: Water Companies). Note: Classes shown may not necessarily relate to control curves or triggers for drought actions. As well as for public water supply, some reservoirs are drawn down to provide flood storage, river compensation flows or for reservoir safety inspections. In some cases current reservoir operating rules may differ from historic ones.

Reservoir storage charts



	Below minimum monthly level		Above maximum monthly level		Average		Latest data

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

Forward look – river flow

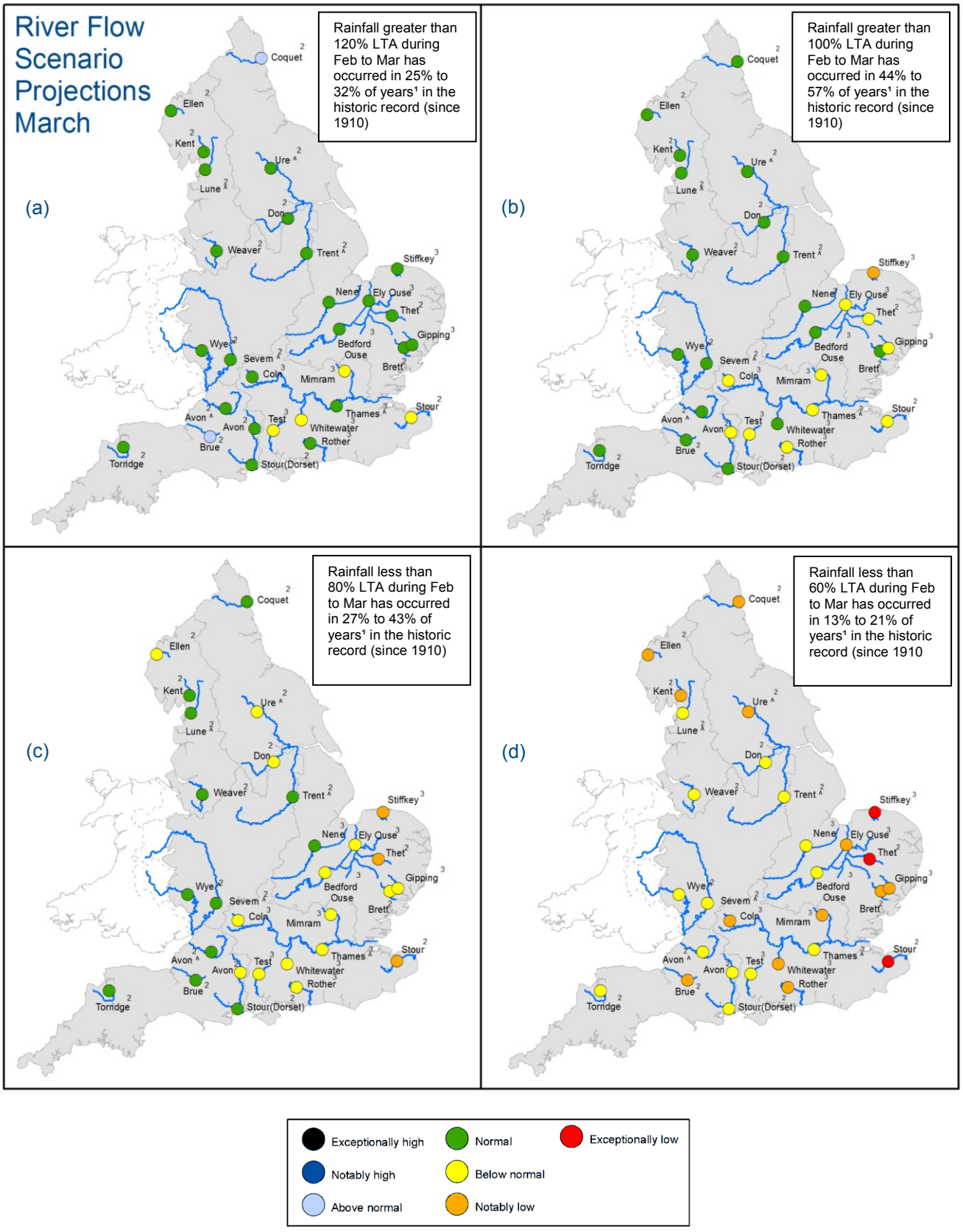
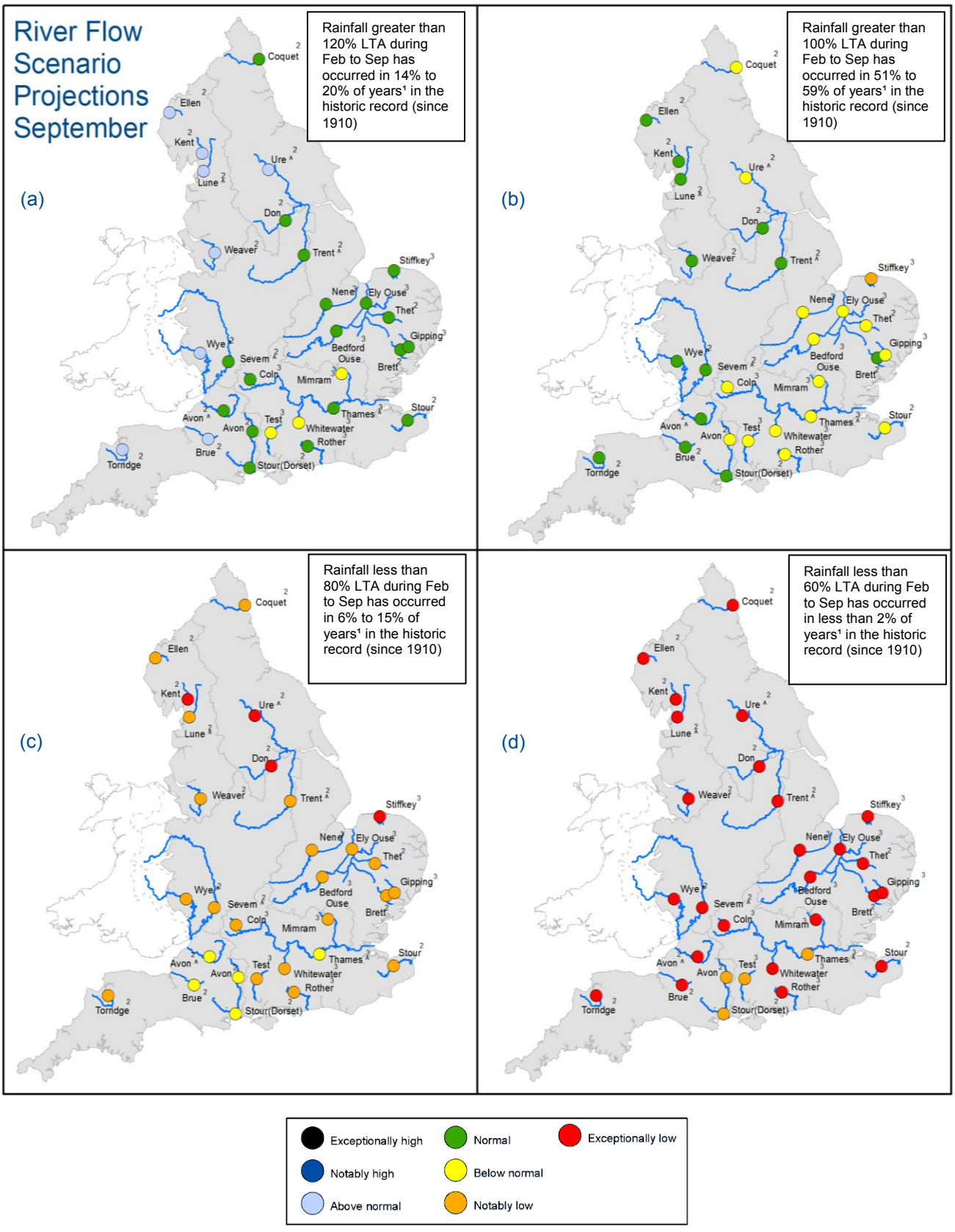


Figure 6.1: Projected river flows at key indicator sites up until the end of March 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February and March 2017 (Source: Centre for Ecology and Hydrology, Environment Agency).

[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*



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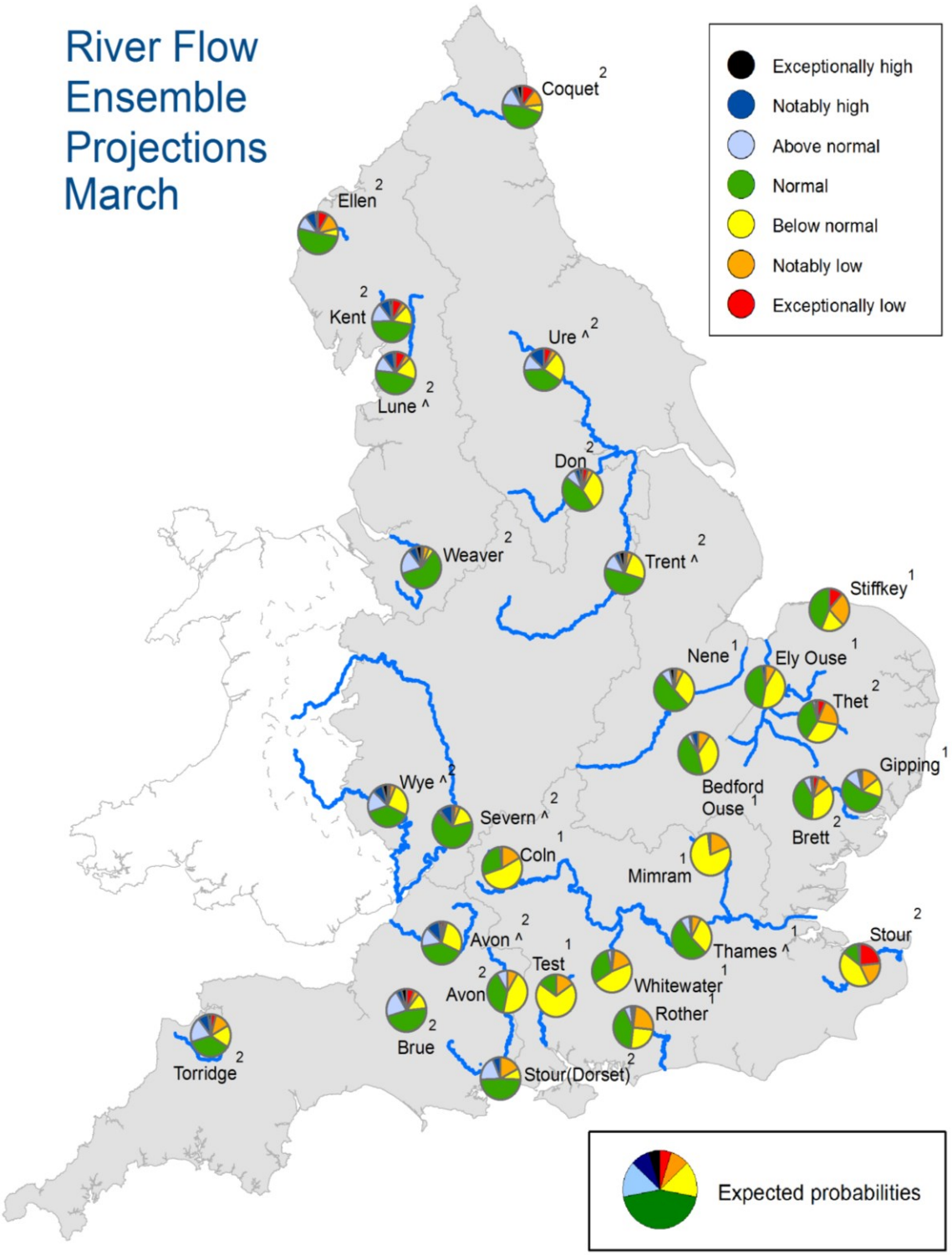

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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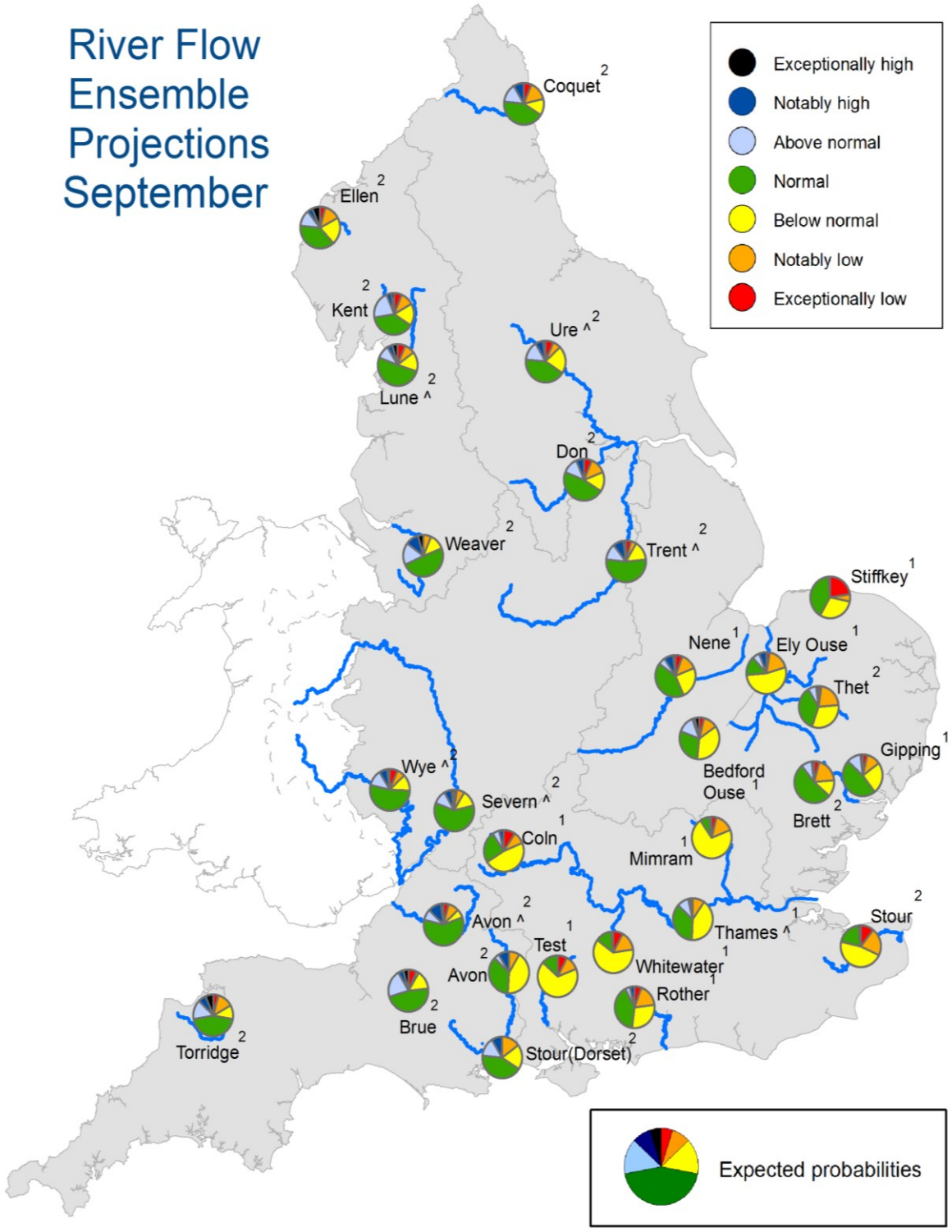

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2017. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. (Source: Centre for Ecology and Hydrology, Environment Agency).

[1] Projections for these sites are produced by the Environment Agency
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Forward look - groundwater

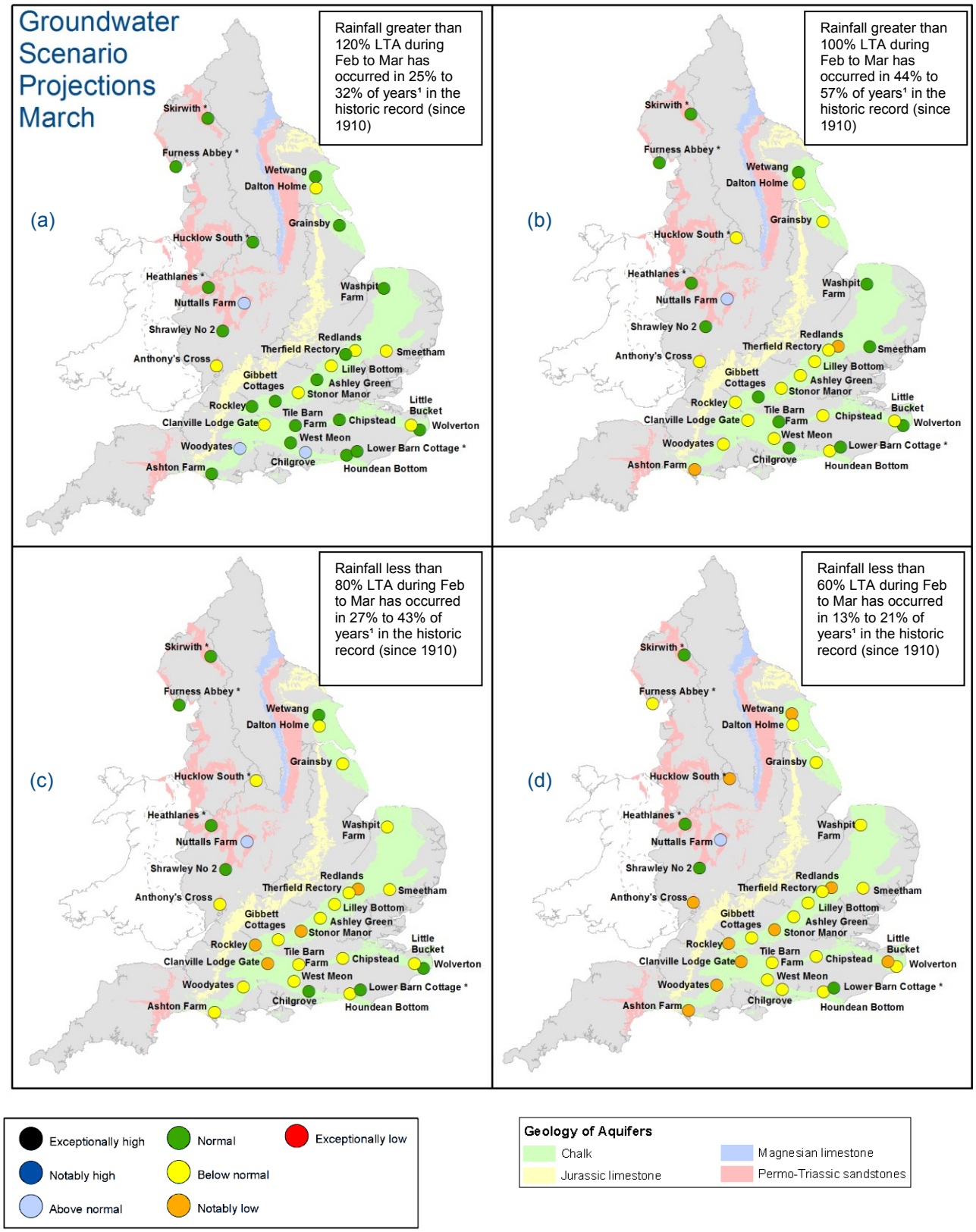

Figure 6.5: Projected groundwater levels at key indicator sites at the end of March 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February 2017 and March 2017 (Source: Environment Agency) Geological map reproduced with kind permission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

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[1] This range of probabilities is a regional analysis

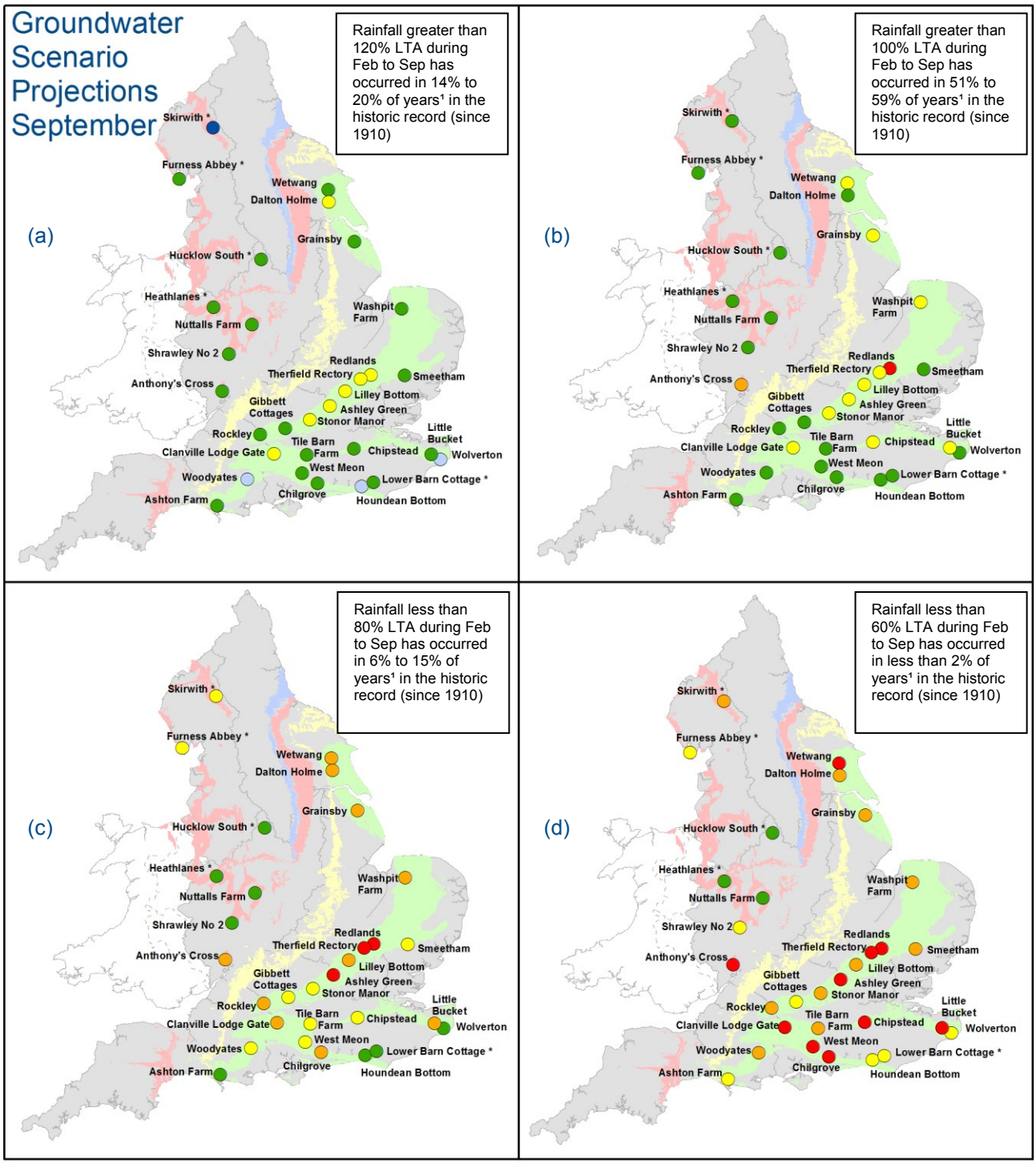

Figure 6.6: Projected groundwater levels at key indicator sites at the end of September 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February 2017 and September 2017 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100026380 2016.

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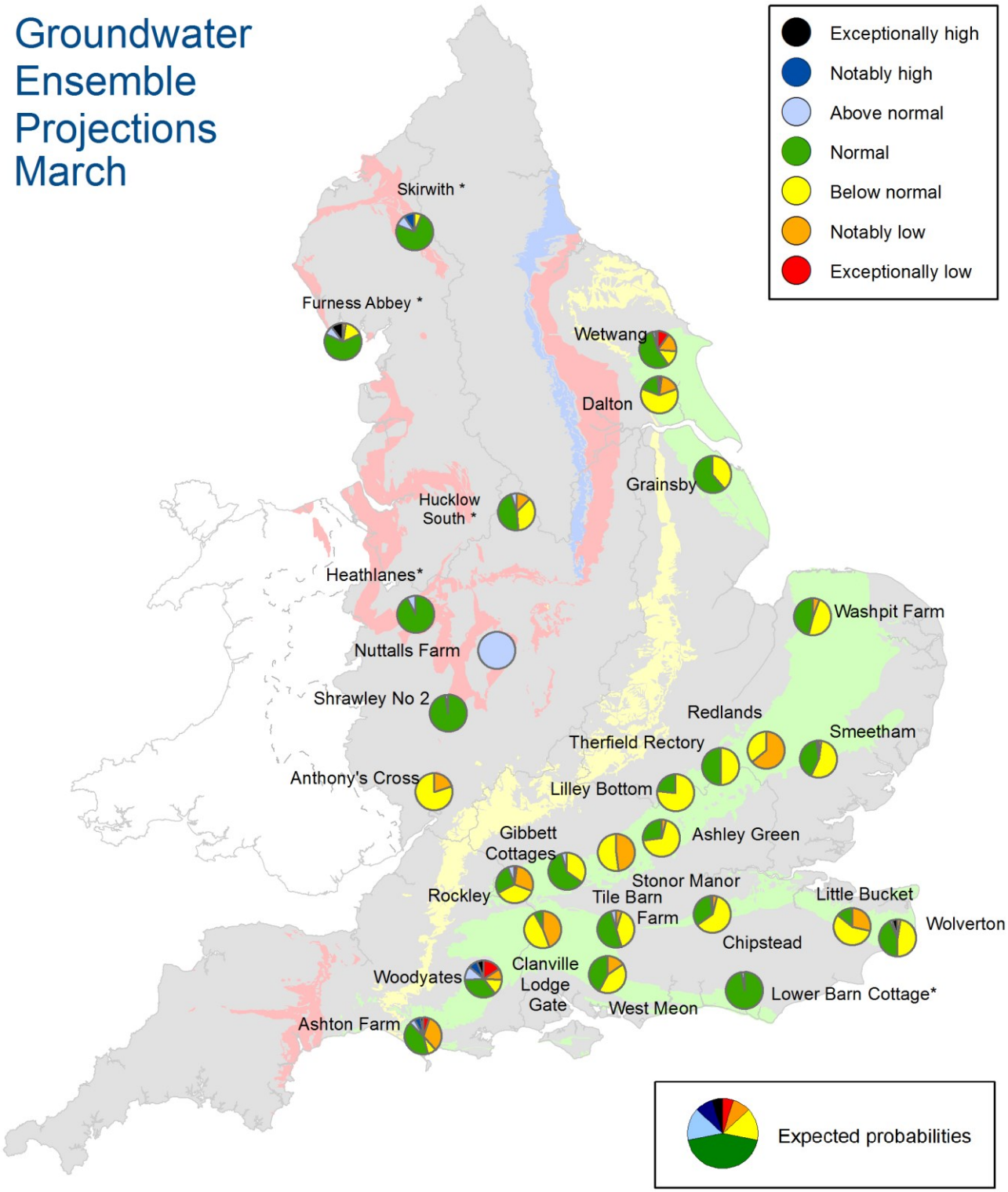

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

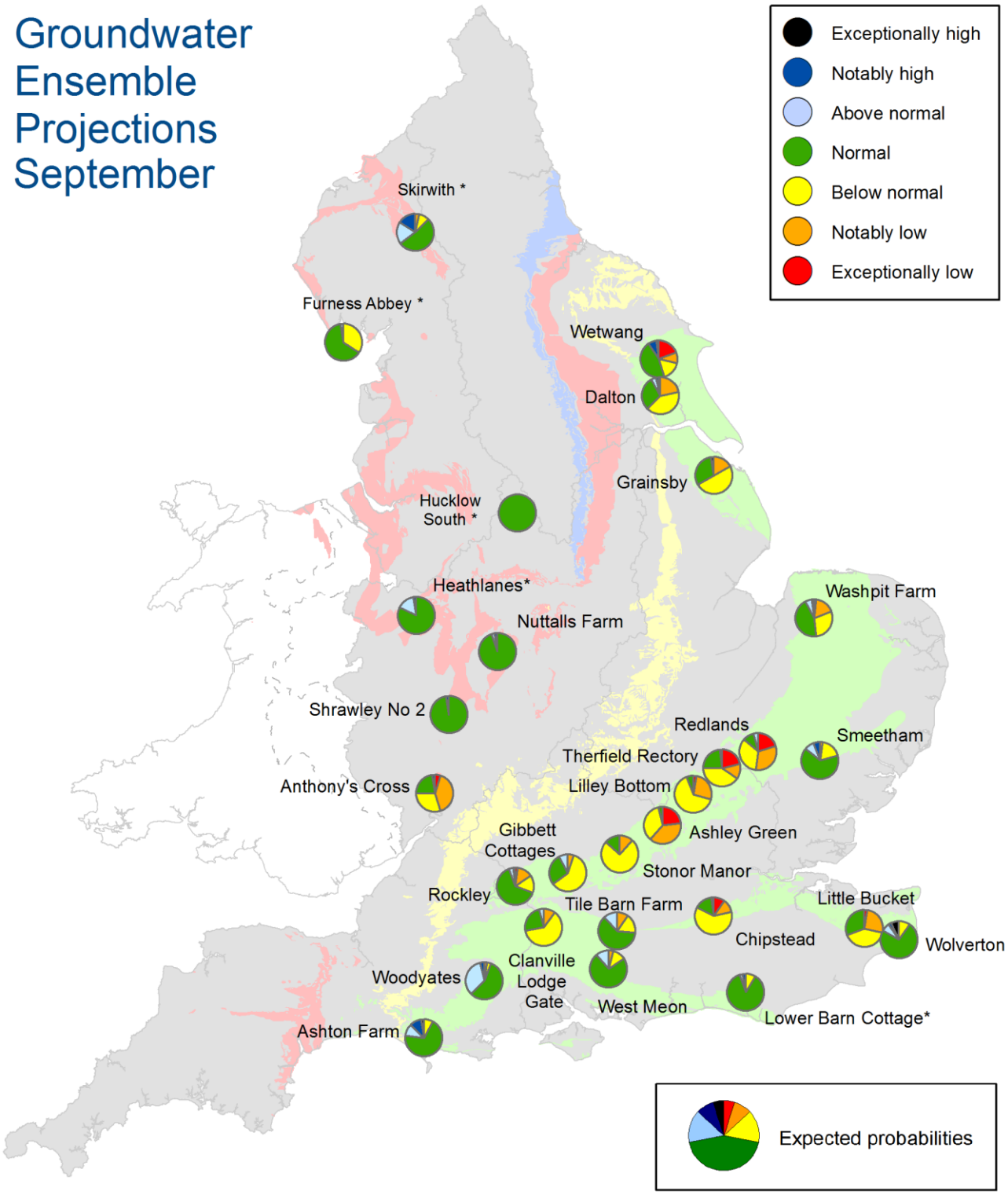

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Figure 6.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of September 2017. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for 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

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, usually based on the period 1961-1990. However, the period used may vary by parameter being reported on (see figure captions for details).
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