Monthly water situation report

England

Summary – April 2017

It has been the driest April across England for 6 years and rainfall was well below average at 34% of the long term average. Soil moisture deficits increased during April. Deficits ranged between 10 and 100mm and soils were significantly drier than the long term average for the time of year. Monthly mean river flows decreased compared to March and are below normal or lower for the time of year at the majority of indicator sites. Groundwater levels decreased during the month at nearly two-thirds of indicator sites with end of month groundwater levels being below normal or lower at just over half of sites. Overall reservoir stocks for England stocks decreased to 89% of total capacity.

Rainfall

Cumulative rainfall totals for April were highest in south-west England where parts of Devon, north Cornwall and west Somerset received between 30 and 50mm, where much of this rain occurred on the last day of the month. Rainfall totals were lowest in the south and east, where many catchments received less than 10mm. Rainfall totals were well below the long term average (LTA) for April across all hydrological areas in England. For hydrological areas in Devon, rainfall totals were between 50 and 75% of the LTA. Elsewhere, just under half of the hydrological areas had rainfall totals that were 25% or less than the LTA (Figure 1.1).

April rainfall totals for three quarters of hydrological areas across England were classed as notably low. The rainfall accumulations over the previous 6-month and 12-month periods are below normal or notably low across most parts of England, particularly in the south and east. Accumulations from October (the start of the UK water year), to April have been the second driest 7-month period on record (starting in 1910) in 4 hydrological areas (in parts of Kent and Sussex and in the Scottish borders), and third driest in a further 5 hydrological areas (in parts of Kent, Sussex, Surrey and Hertfordshire). In all but the Scottish border catchment this is the driest 7 month period in these areas starting October since 1975/76 (Figure 1.2).

Overall, April rainfall totals ranged from 19% of the LTA in the south-east of England to 44% in south-west England. Across England as a whole, monthly rainfall totals were well below the 1961-90 LTA for April at 34% (32% of the 1981-2010 LTA (Figure 1.3).

Soil moisture deficit

Soil moisture deficits (SMDs) increased across England during April. At the end of the month SMDs ranged from 10 to 100mm, with soils in the north-west, west and south-west remaining slightly wetter than in other parts of England. SMDs were significantly drier than the end of April LTA across almost all parts of England, but particularly in the east and south-east of the country (Figure 2.1).

At a regional scale, soils were drier at the end of April than at the end of March, with end of month SMDs ranging from approximately 30mm in north-west England to 65mm in south-east England. Soils were drier than average across all regions. Soils in south-east England are as dry as they would typically be in the middle of June (Figure 2.2).

River flows

Compared with March, monthly mean flows for April decreased at all of the indicator sites across England. River flows were classed as below normal or lower for the time of year at four fifths of the indicator sites. The remaining sites, which are mainly located in the west of England, were normal for the time of year (Figure 3.1). At the regional index sites, monthly mean river flows ranged from normal on the Exe at Thorverton in south-west England to exceptionally low for the time of year on the Great Stour at Horton in south-east England (Figure 3.2).

Groundwater levels

Groundwater levels decreased at nearly two-thirds of indicator sites during April compared to the end of March. End of month groundwater levels were normal or lower for the time of year at almost all indicator sites. Just over half of sites were below normal or lower for the time of year. These sites are predominantly in the chalk and Jurassic limestone aquifers (Figure 4.1).

End of month groundwater levels at the major aquifer index sites were notably low for the time of year at Jackaments (Burford Jurassic limestone), below normal at Redlands Hall (Cam and Ely Ouse chalk), Little Bucket (East Kent Stour chalk) and Stonor Park (South West Chilterns chalk) and normal at the remaining 5 index sites (Figure 4.2)

Reservoir storage

During April, reservoir stocks decreased at almost two thirds of all the reported reservoirs or reservoir groups. Notable decreases of 10% or greater occurred at Derwent Valley, the Teesdale Group, the NCZ Regional reservoir group and the Pennines reservoir group. The remaining third of reservoirs or reservoir groups saw no change or small increases in storage of less than 5%. End of month stocks were classed as normal or higher for the time of year at more than half of all reported reservoirs or reservoir groups. The remaining sites were classed as below normal or lower for the time of year (Figure 5.1).

Reservoir stocks remained unchanged or decreased in all regions compared with the end of March. The largest decrease of 11% occurred in north-east England. End of April stocks ranged from 86% of total capacity in north-east and south-west England to 94% in east England. Overall storage for England decreased by 6% to 89% of total capacity (Figure 5.2).

Forward look

During May, below average rainfall totals are more probable than above average. The beginning of the month is likely to remain dry, with south-east England seeing the driest weather. Towards the middle of May, it is possible that more unsettled conditions will occur, with outbreaks of rain or showers possible across England. The latter part of May could see a return to drier than average conditions, but there is still the possibility of occasional wetter interludes. Over the 3 month period May to July, above average precipitation is considered slightly more probable than below average[1].

Projections for river flows at key sites[2]

Approximately four-fifths of the modelled sites have a greater than expected chance of cumulative river flows being notably low 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 2017see 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]

Nearly two-thirds of the 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. Nearly two-thirds of the modelled sites have a greater than expected chance of notably low or lower groundwater levels for the time of year at the end of March 2018.

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 2017see 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

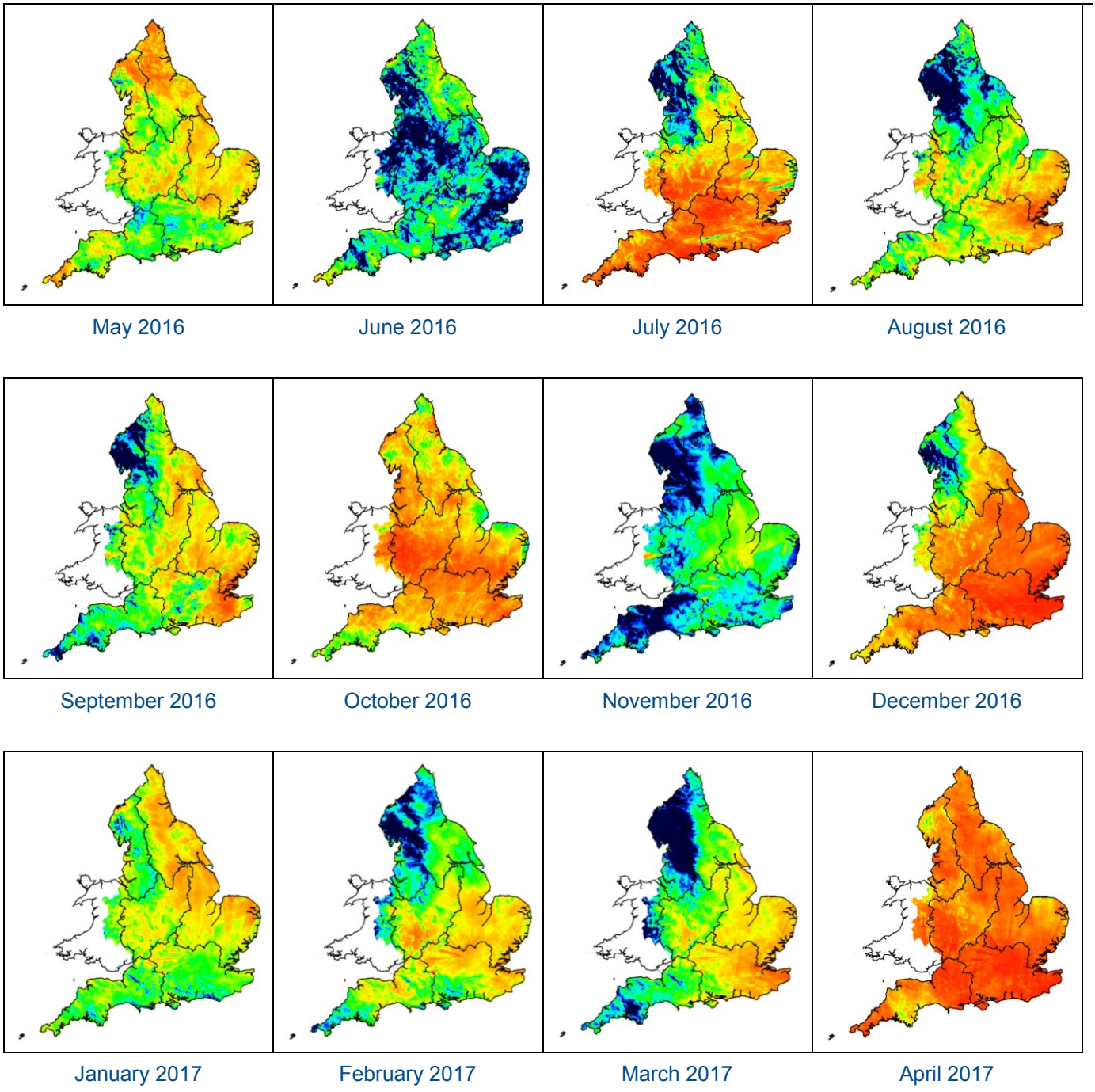


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2017). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100026380, 2017.

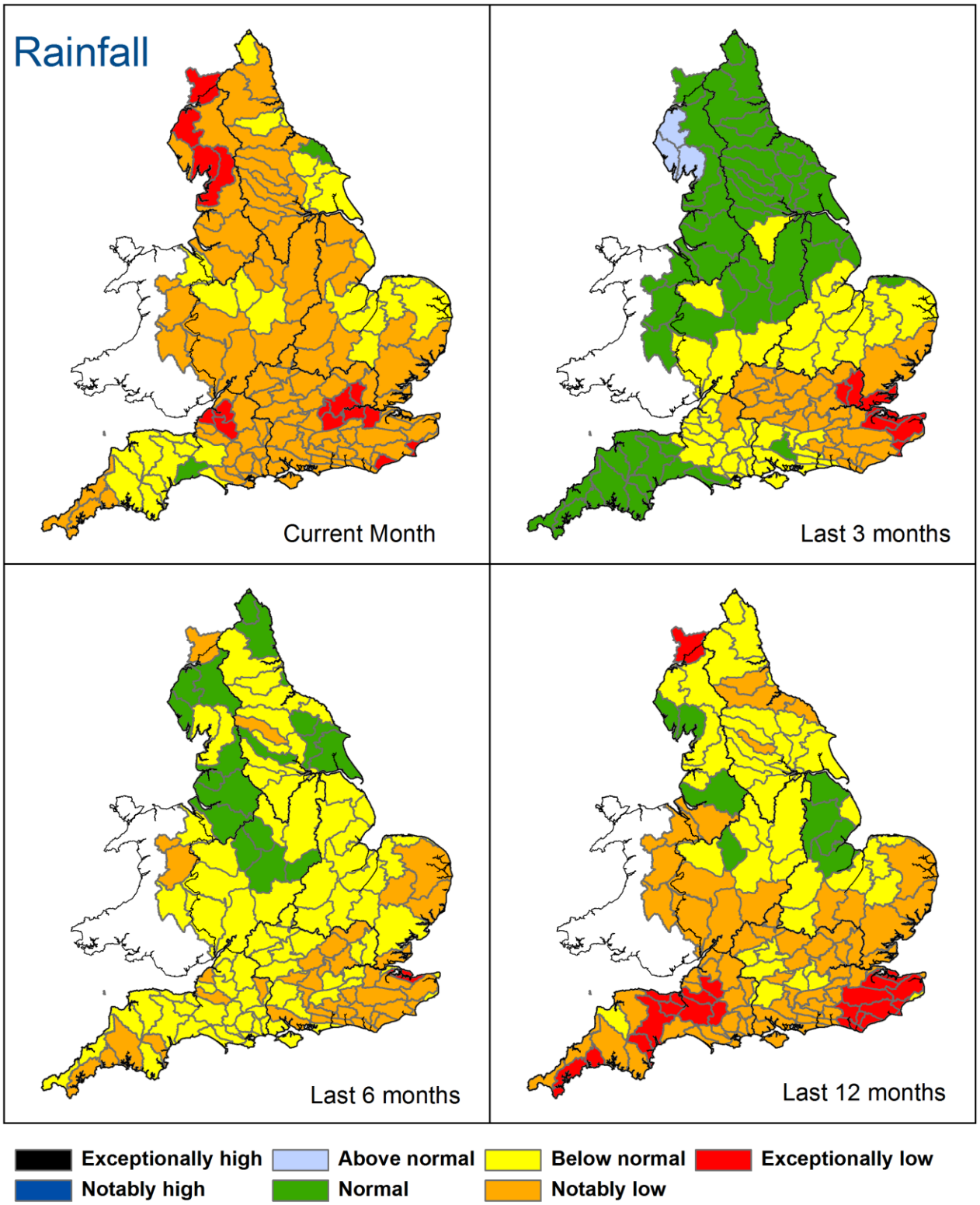


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 30 April), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Final NCIC (National Climate Information Centre) data based on the Met 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

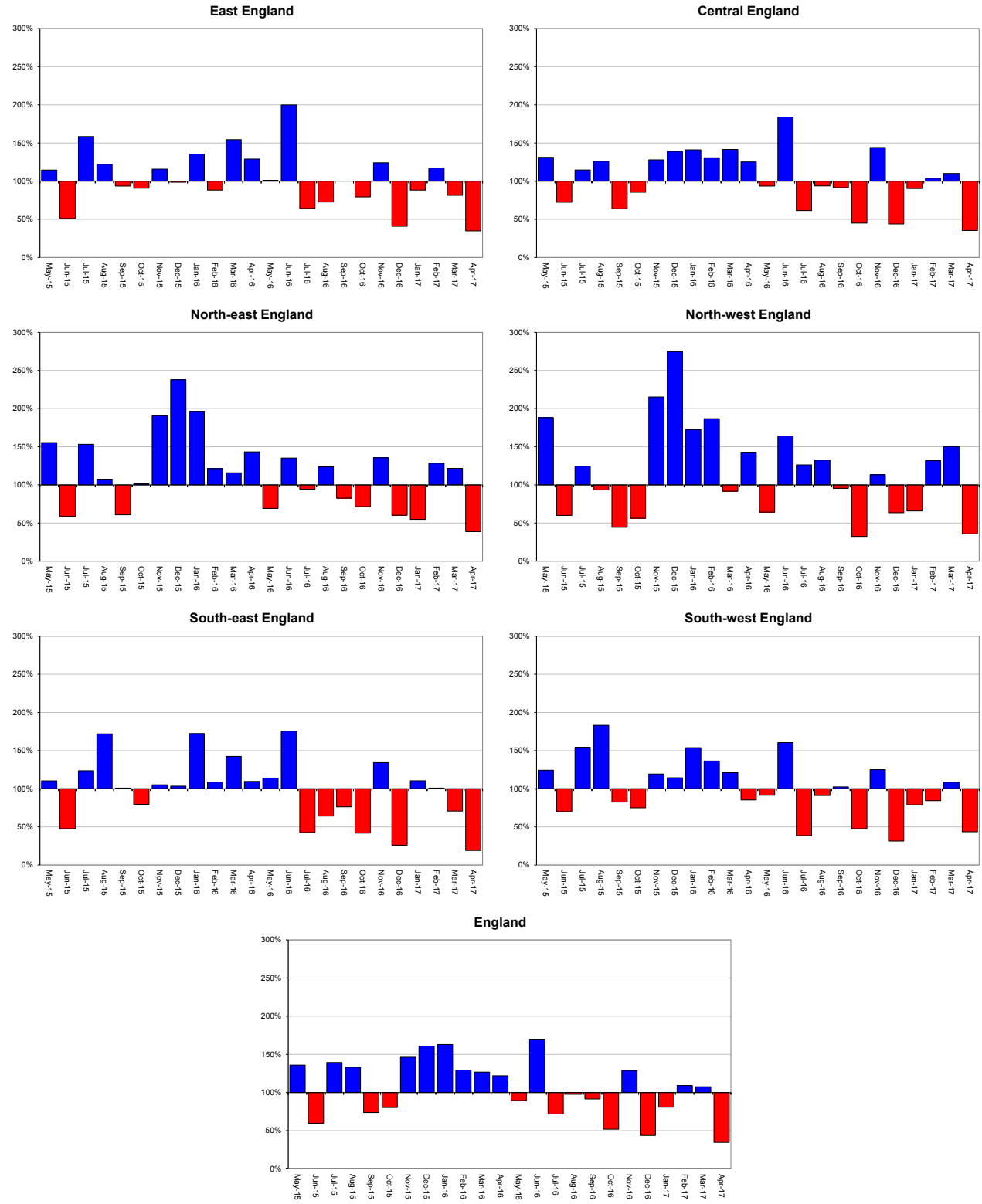


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each region and for England. NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright, 2017).

Soil moisture deficit

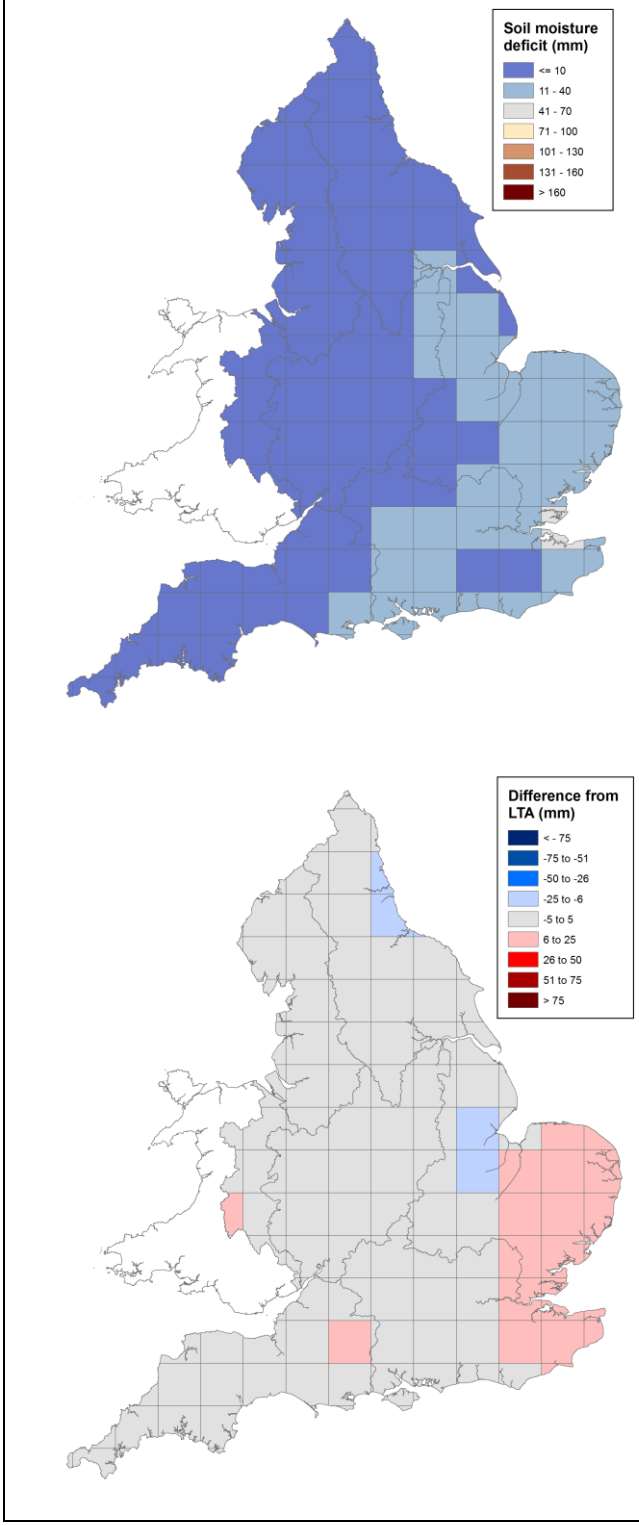
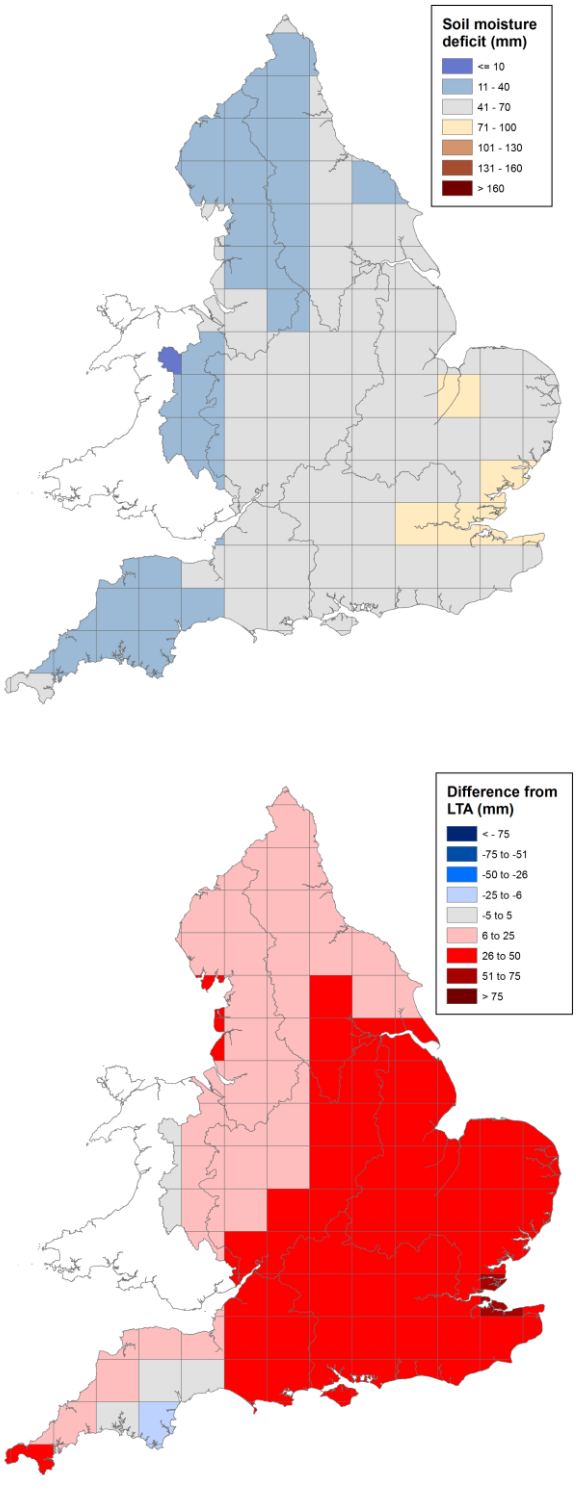
End of March 2017[1]	End of April 2017[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 28 March 2017 [1] (left panel) and 2 May 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

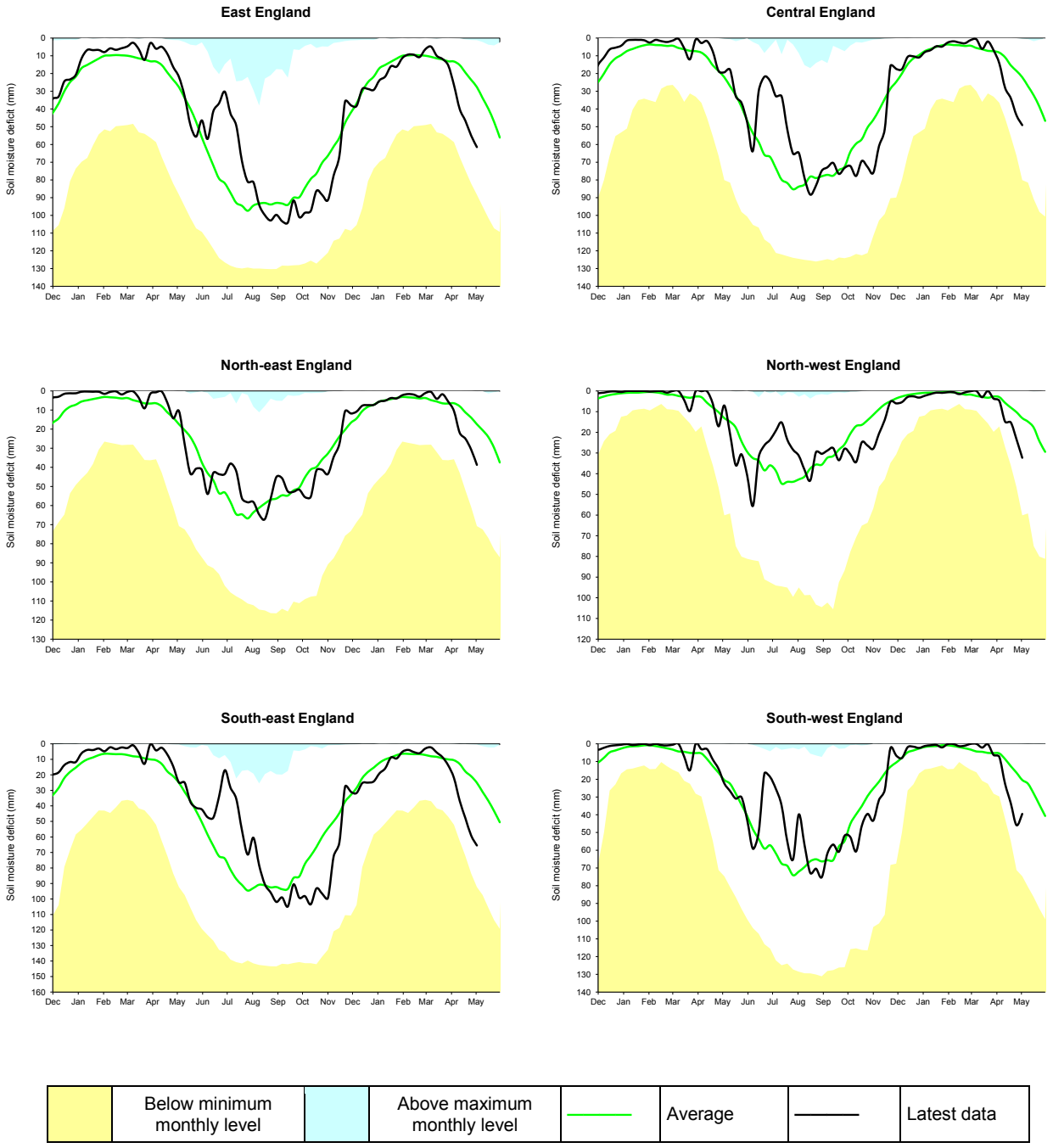
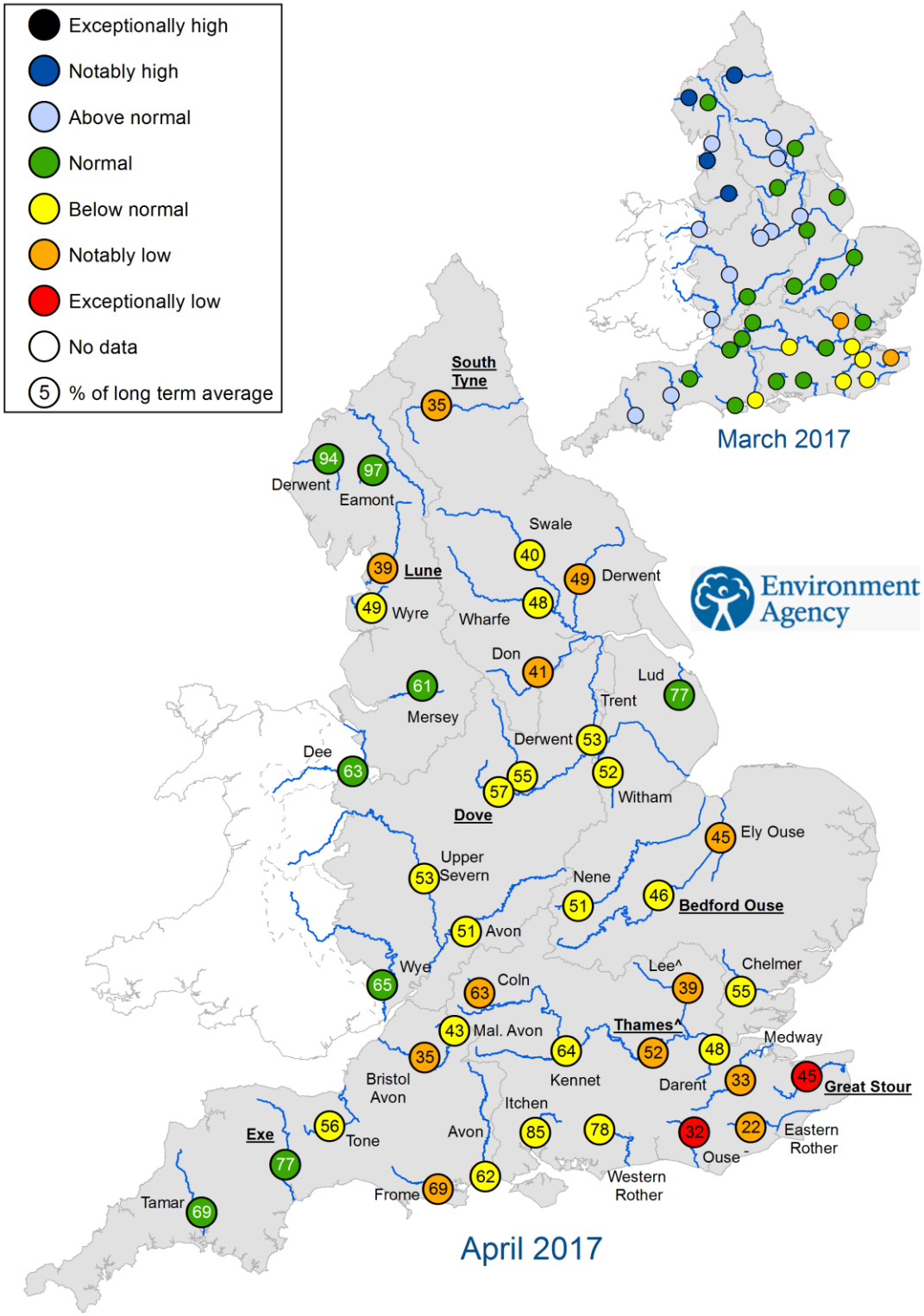


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961-90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2017).

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 March 2017 and April 2017, expressed as a percentage of the respective long term average and classed relative to an analysis of historic March and April monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100026380, 2017.

River flow charts

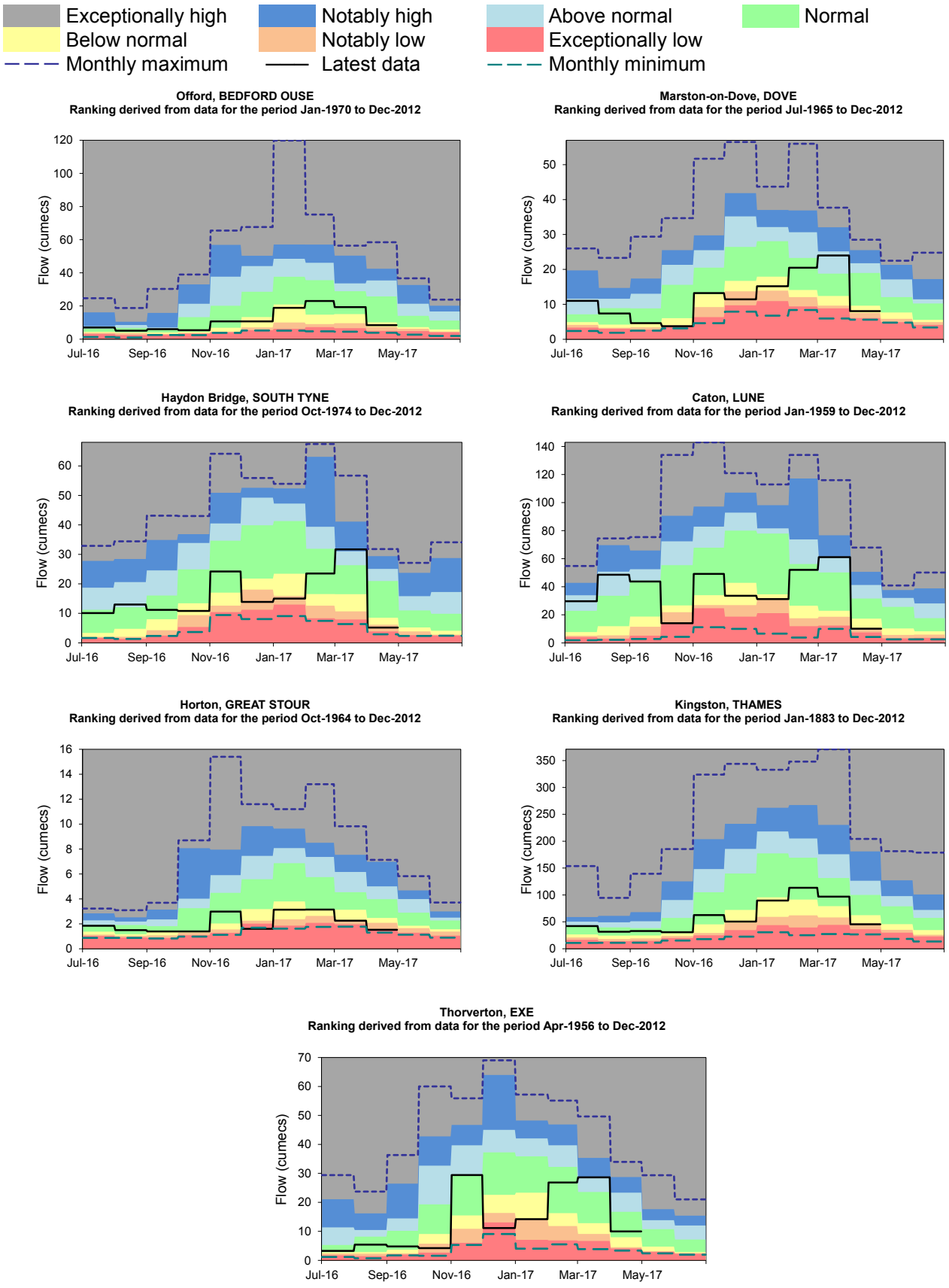
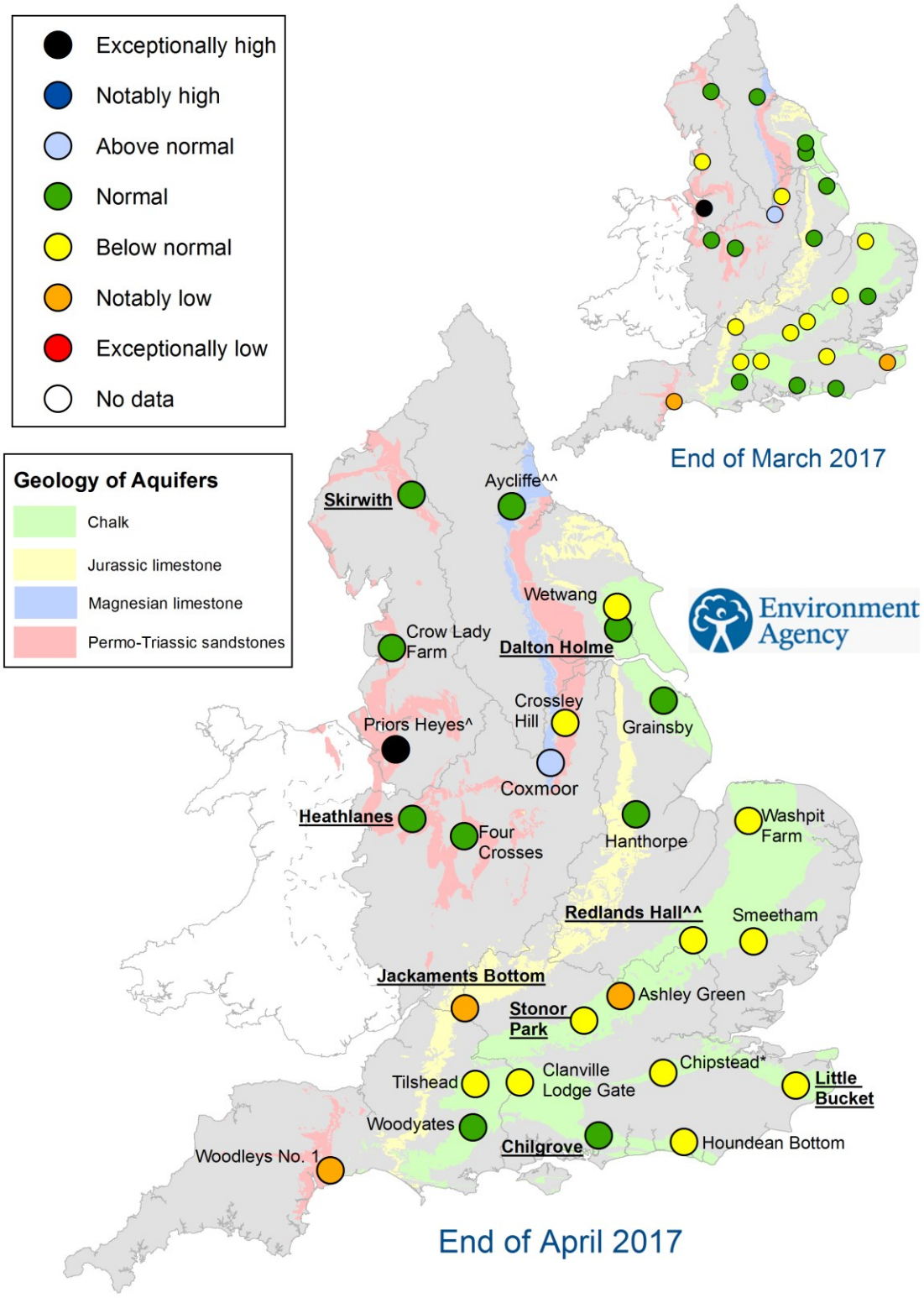


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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 March 2017 and April 2017, classed relative to an analysis of respective historic March and April 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

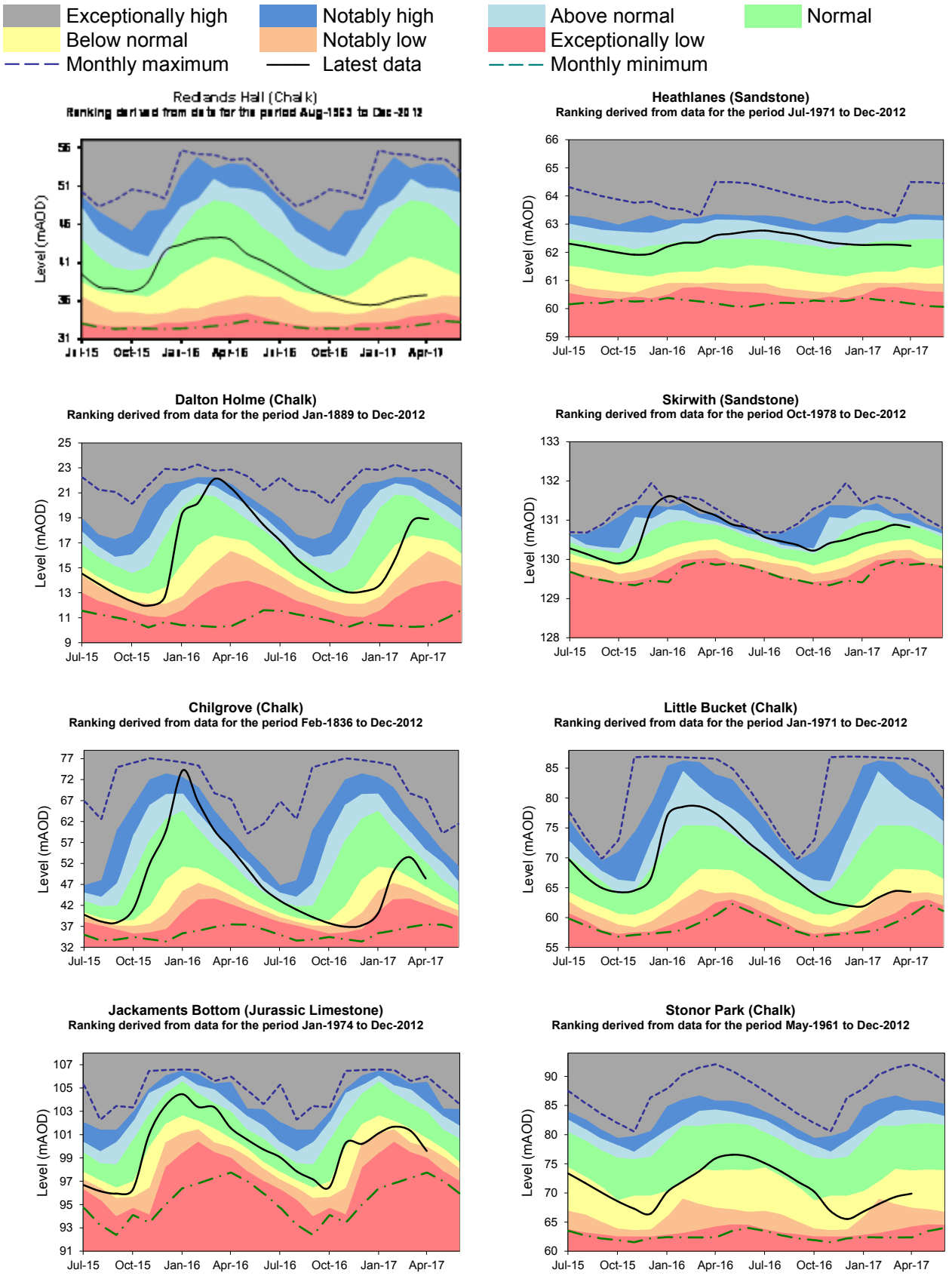
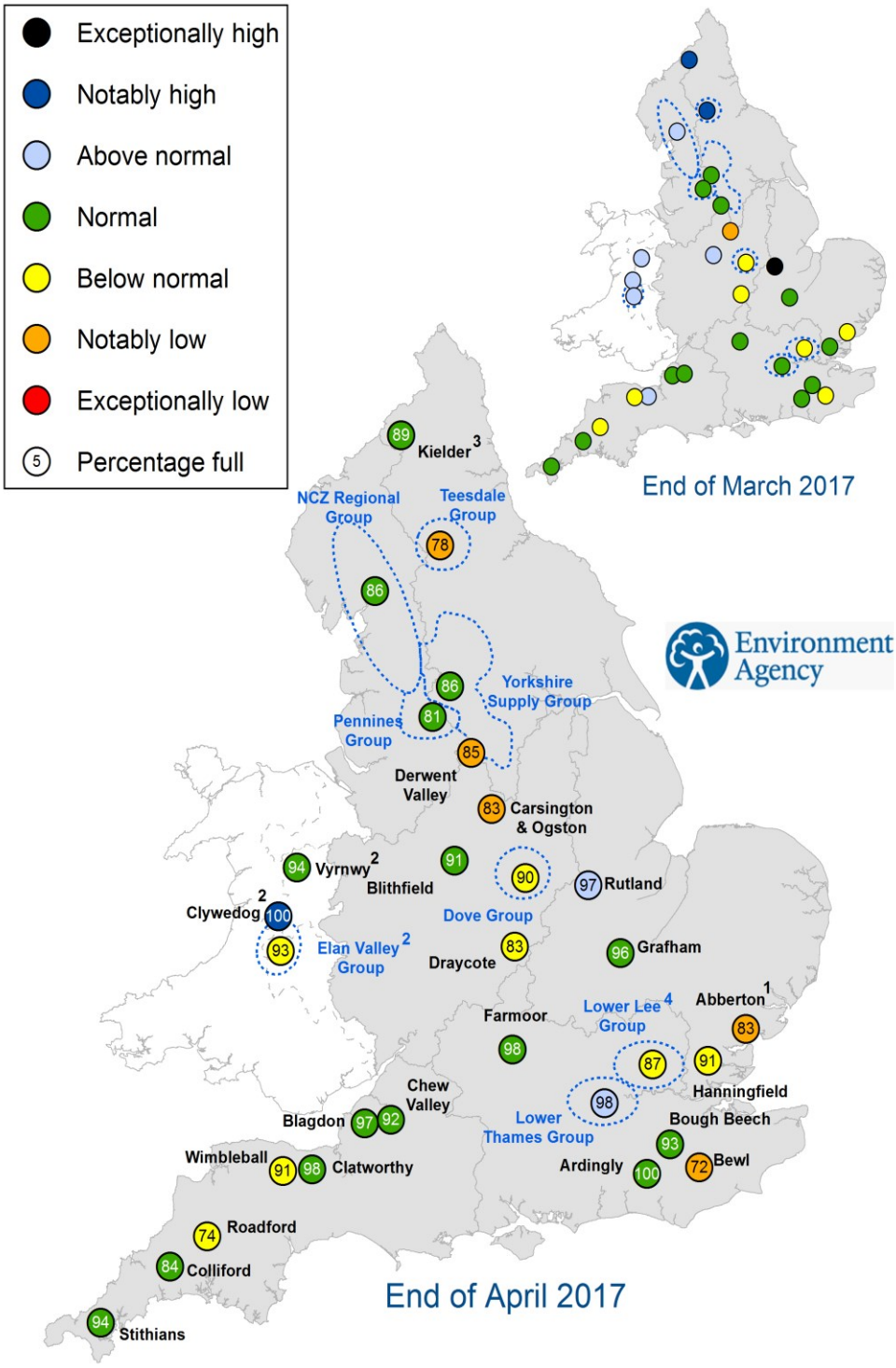


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2017).

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 March 2017 and April 2017 as a percentage of total capacity and classed relative to an analysis of historic March and April 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

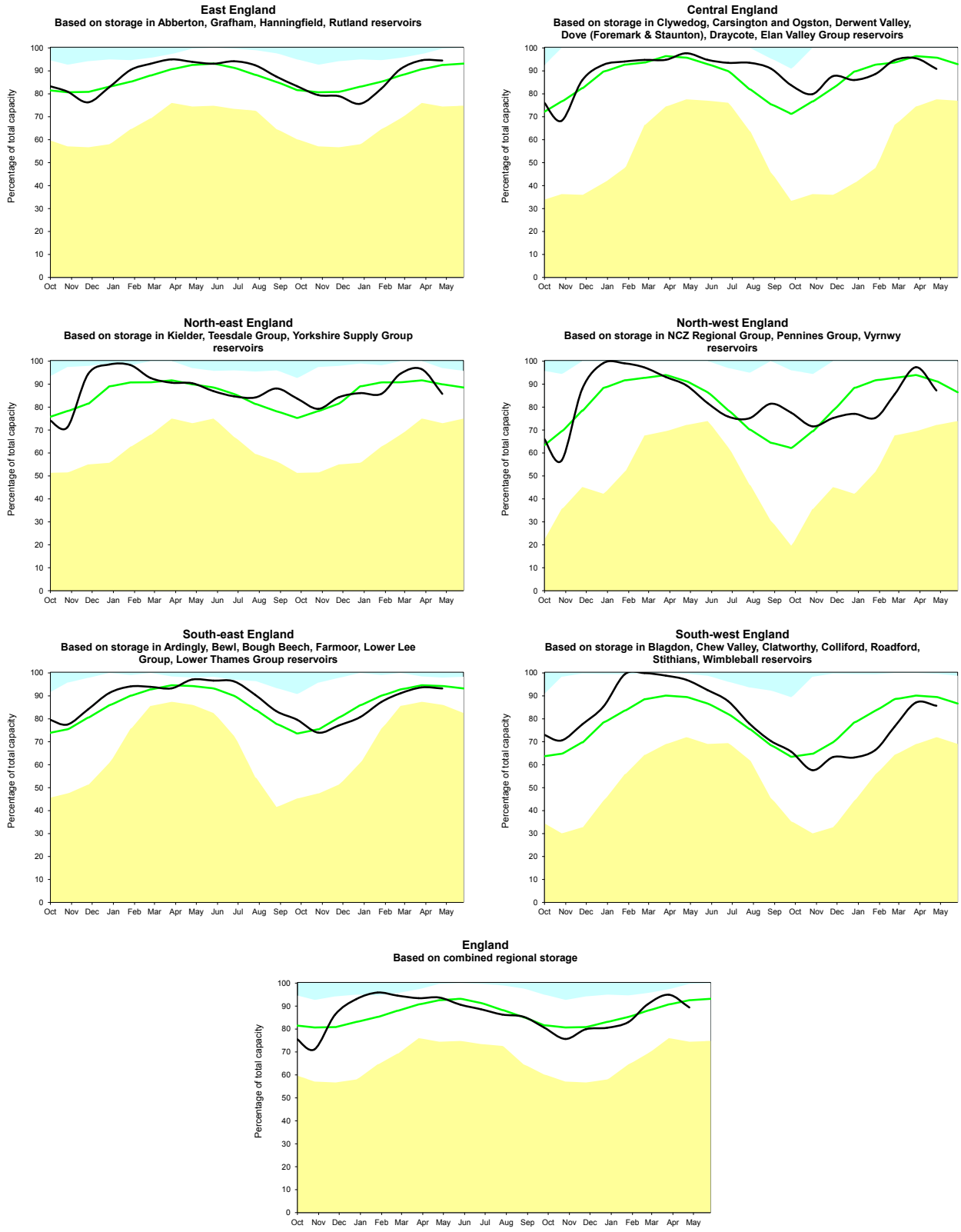


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look – river flow

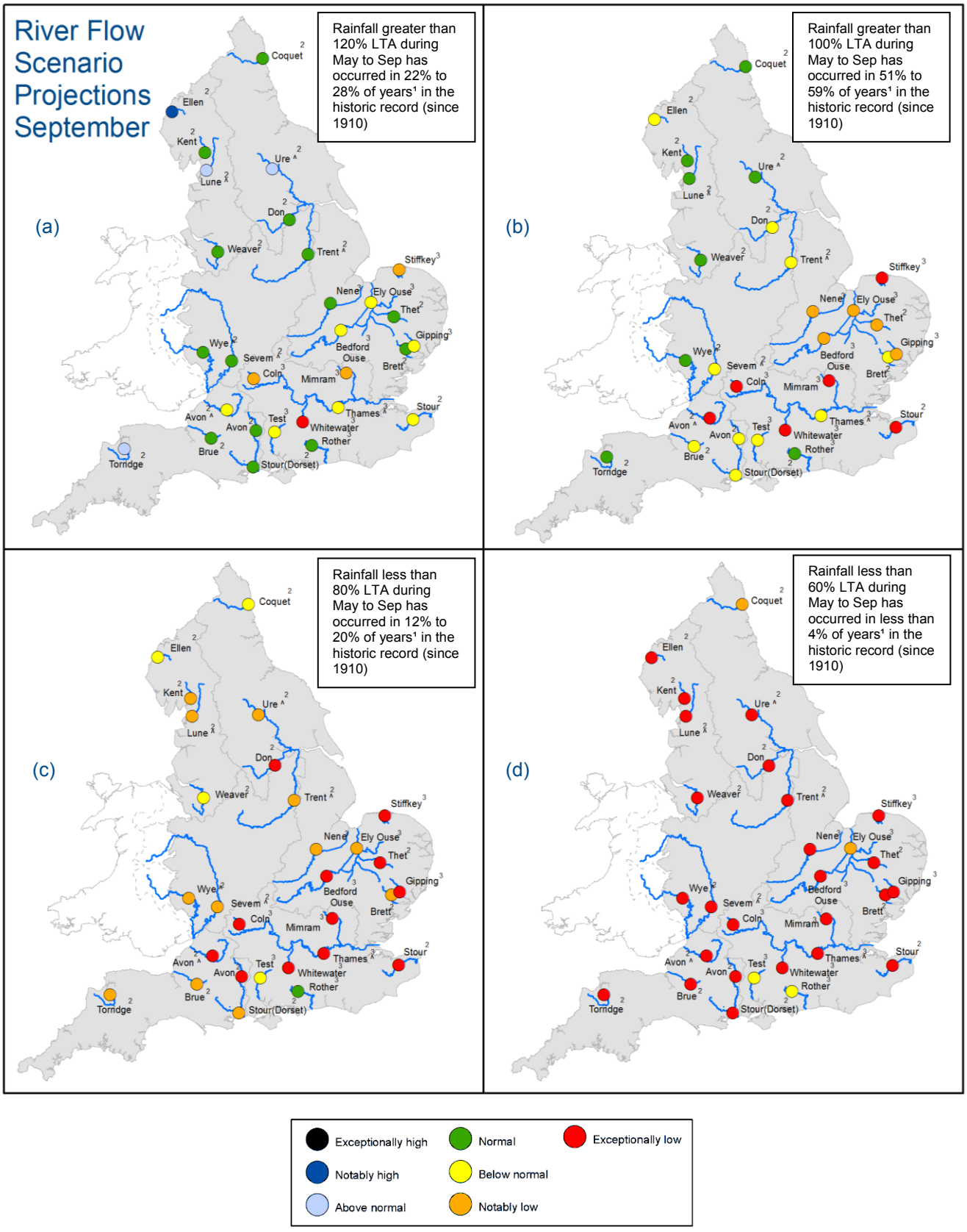
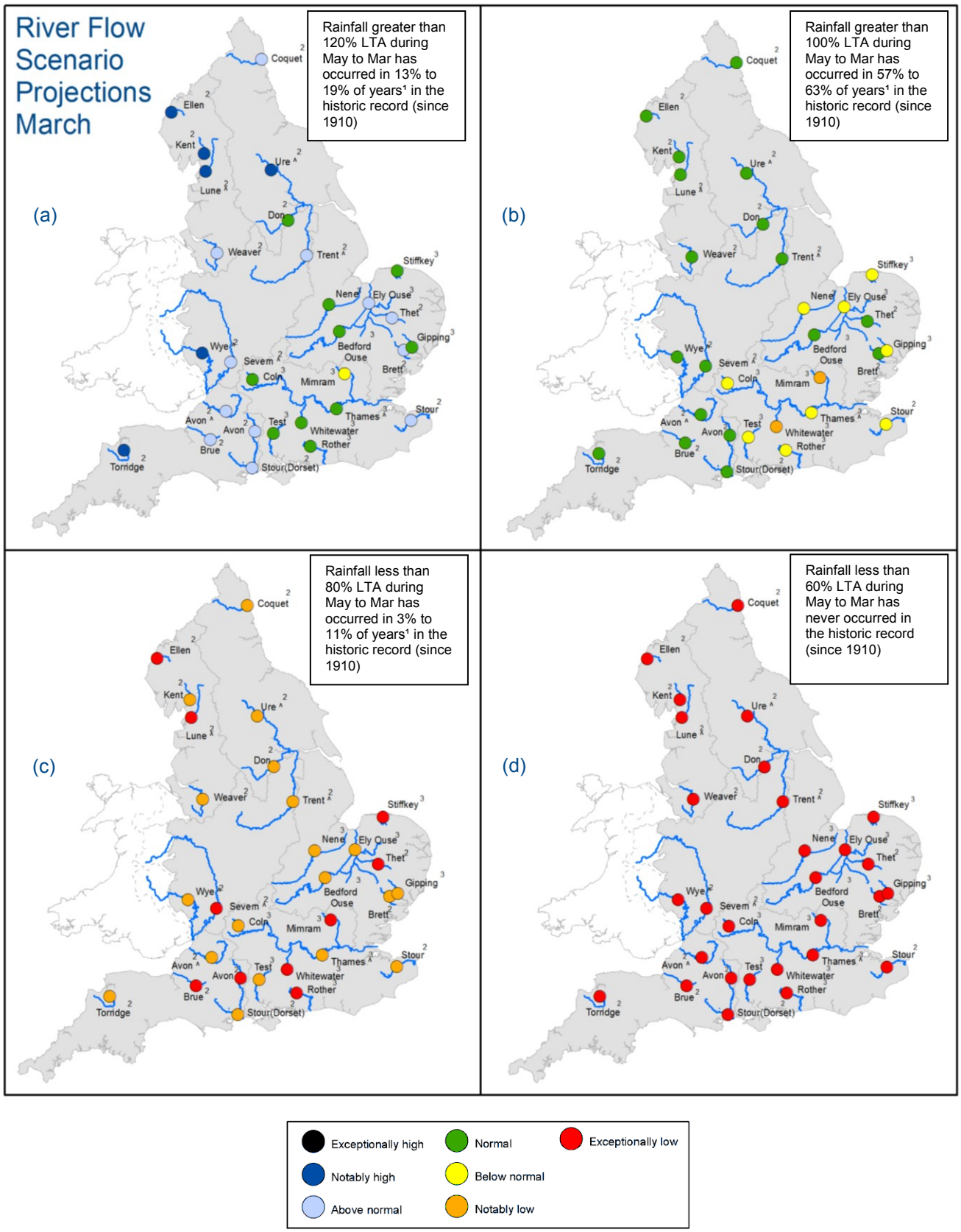


Figure 6.1: Projected river flows at key indicator sites up until the end of September 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between May and September 2017 (Source: Centre for Ecology and Hydrology, Environment Agency).

[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*



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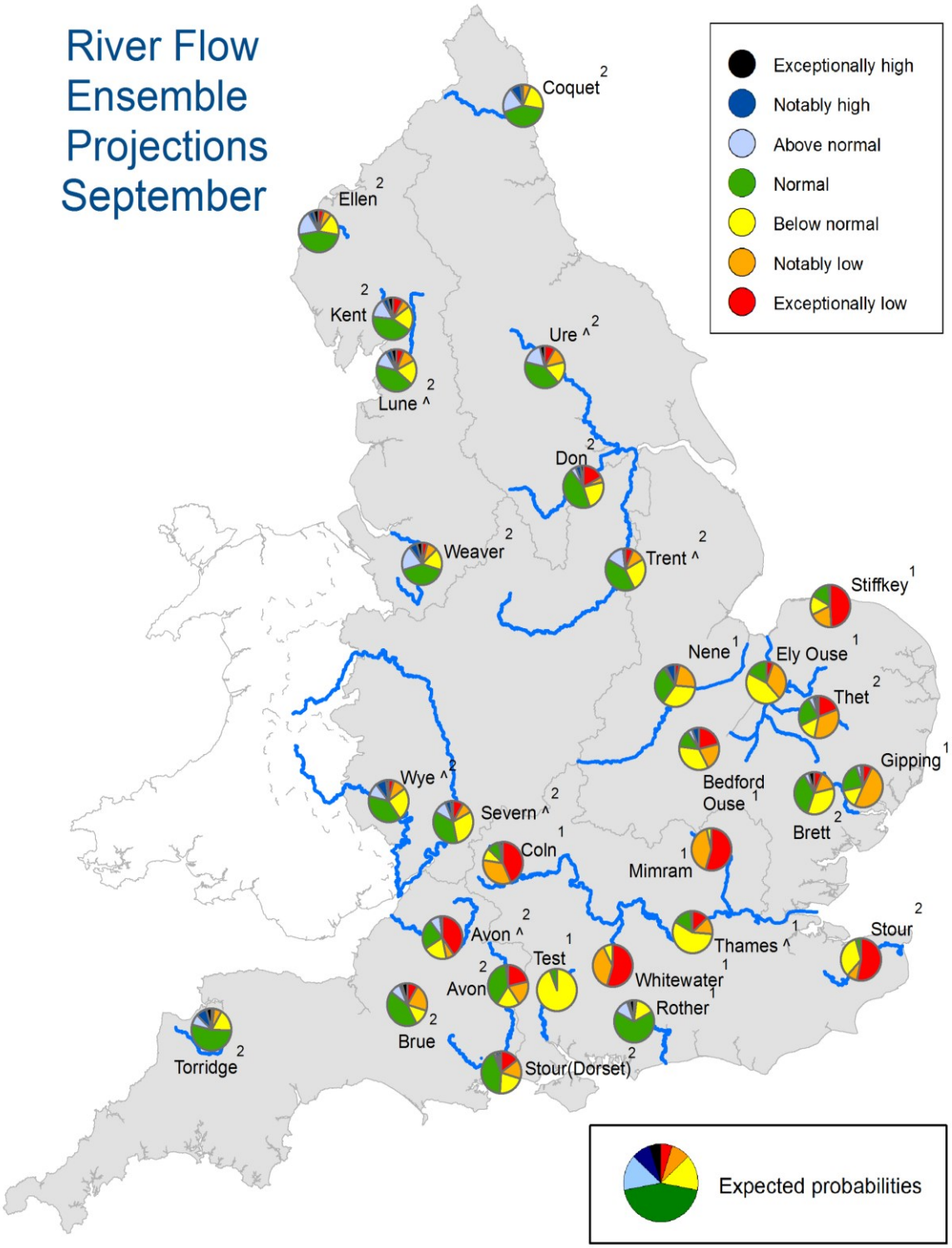

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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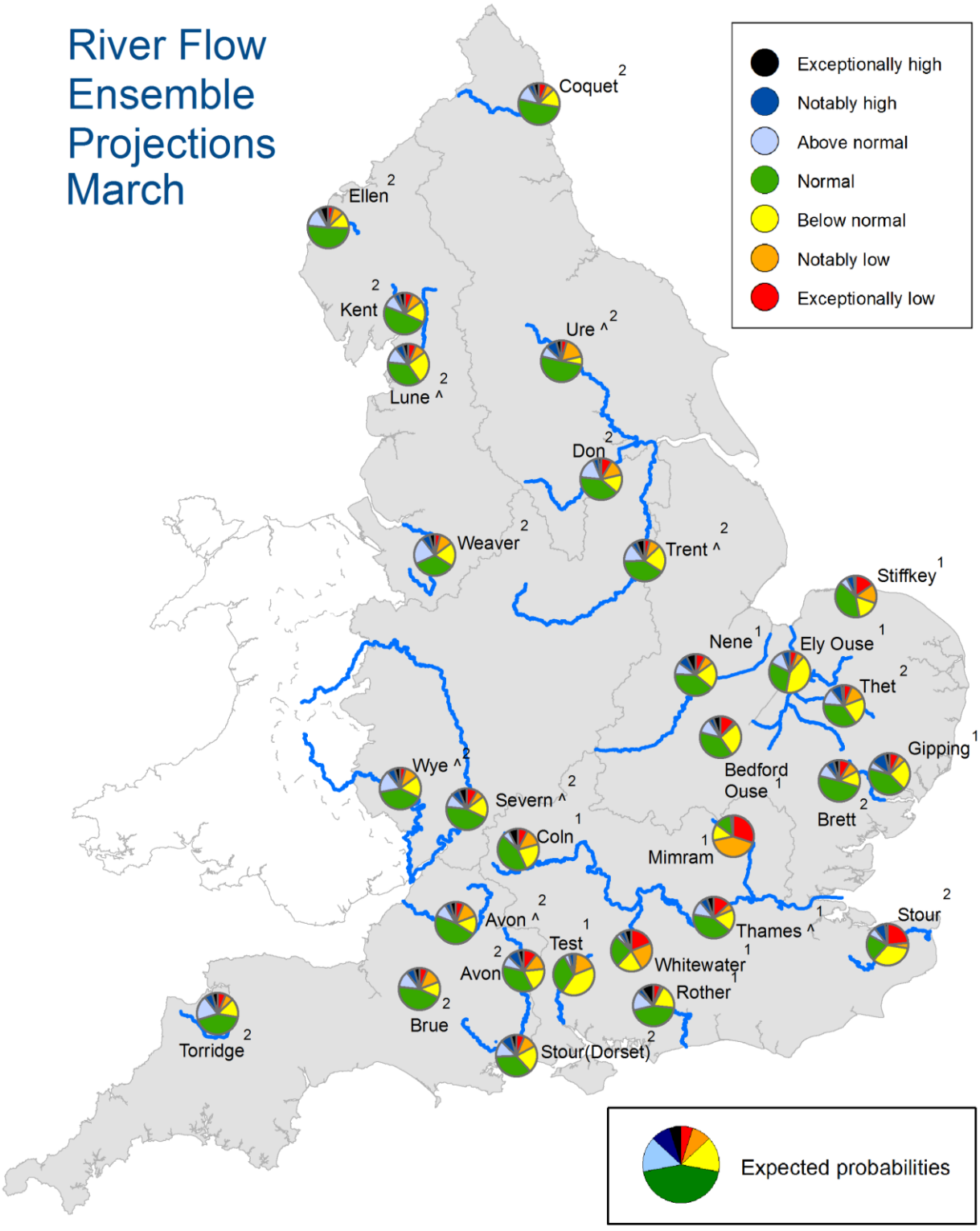

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of March 2018. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the 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

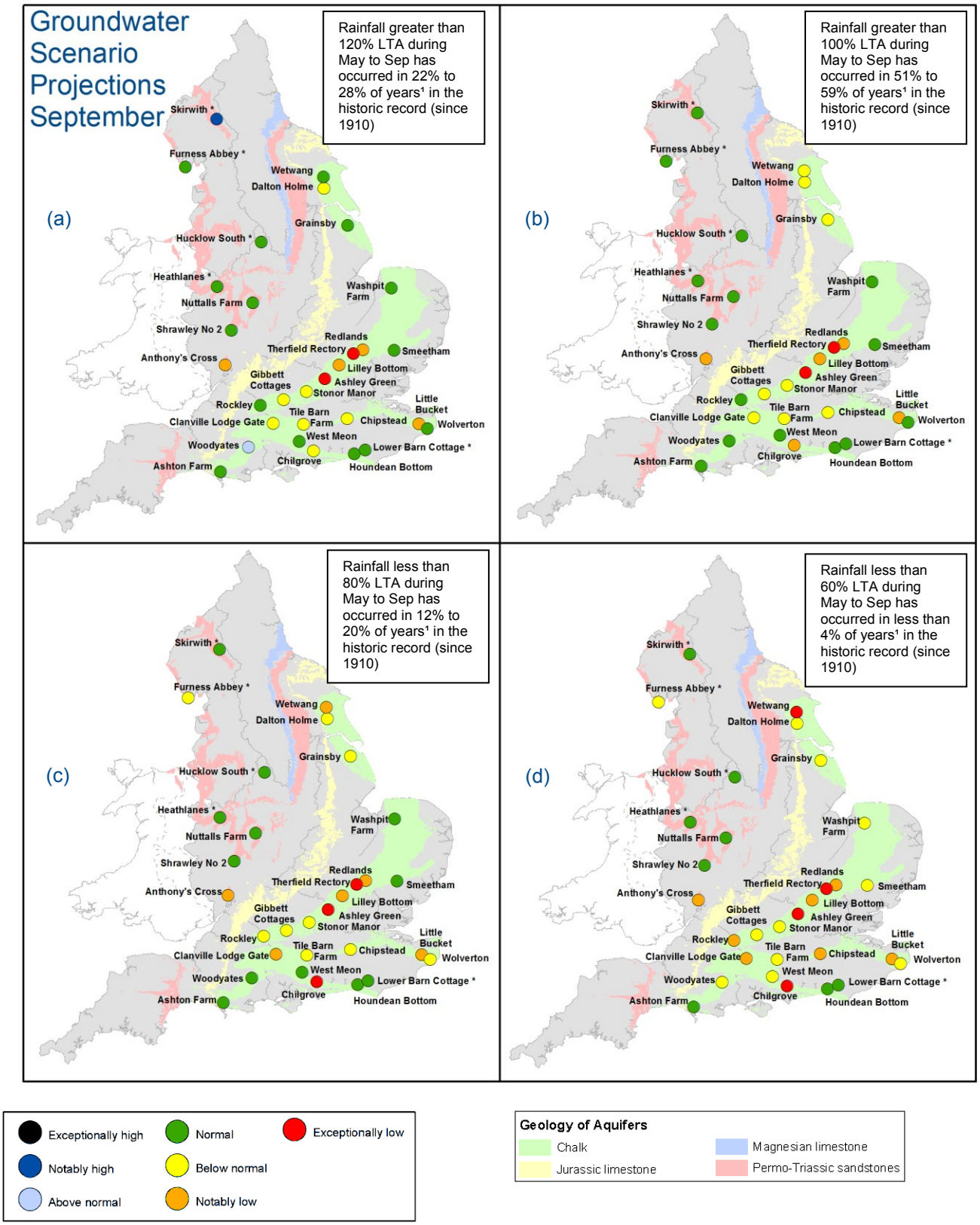

Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between May and September 2017 (Source: Environment Agency) Geological map reproduced with kind permission 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

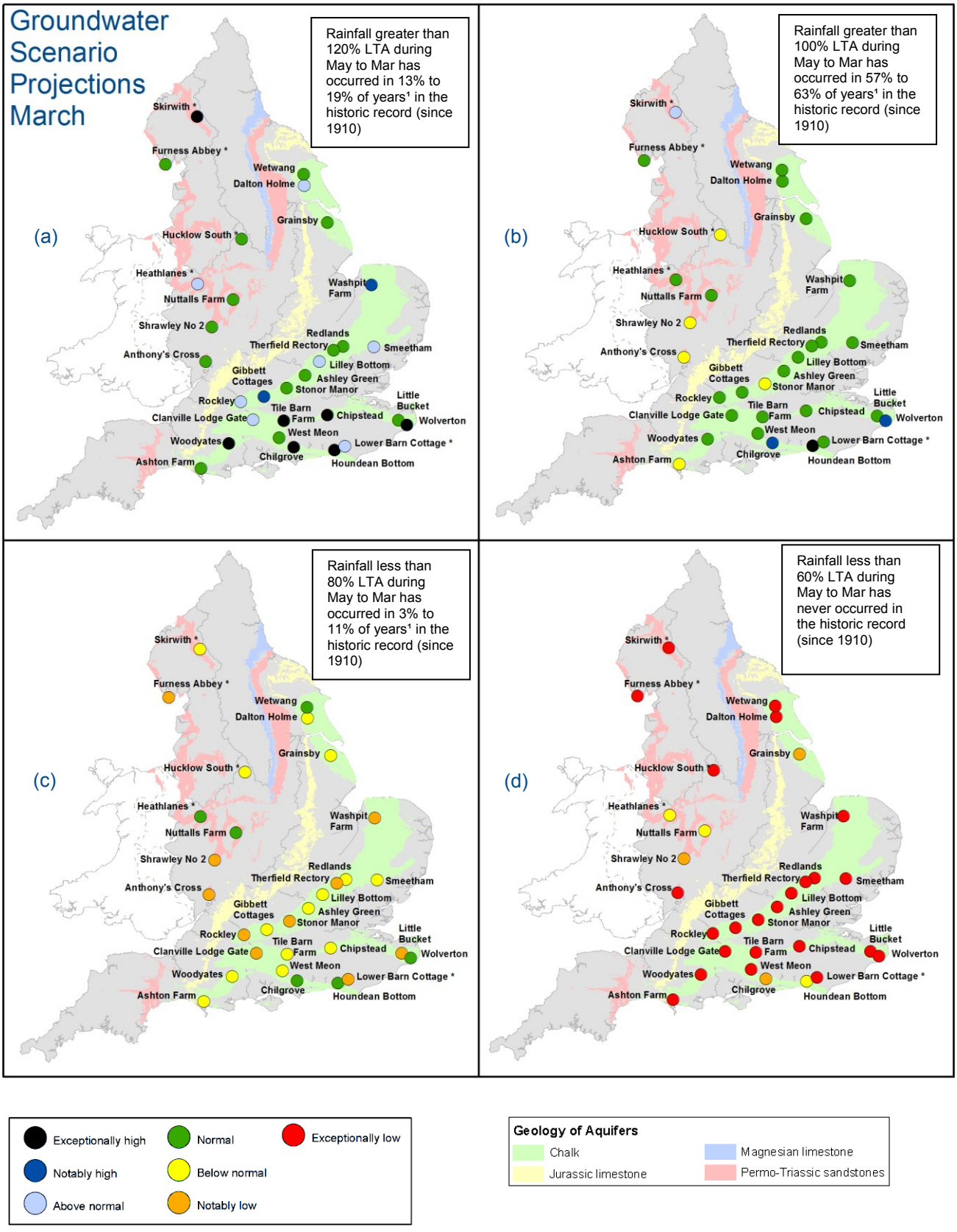

Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2018. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between May 2017 and March 2018 (Source: Environment Agency). Geological map reproduced with kind permission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

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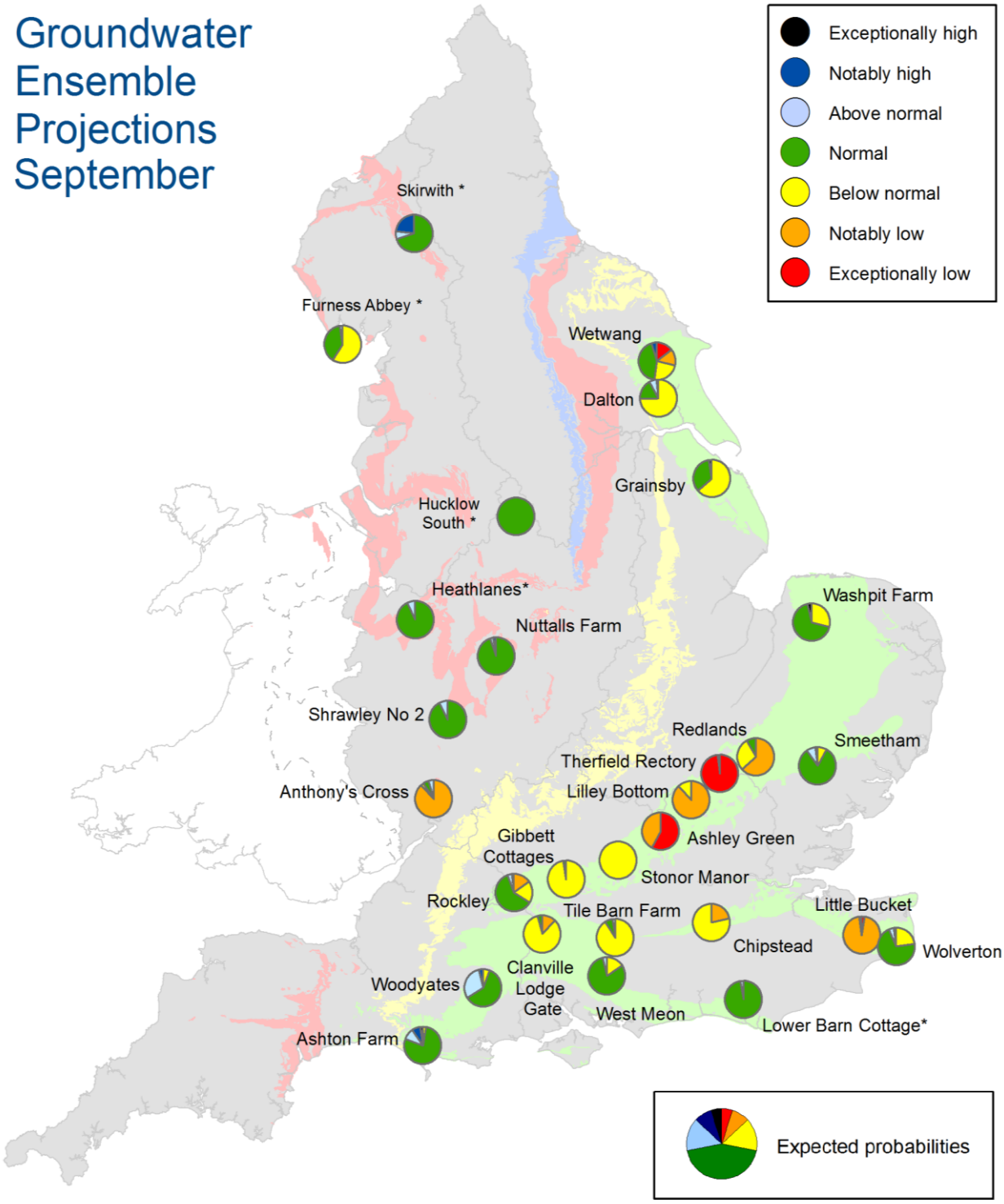

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

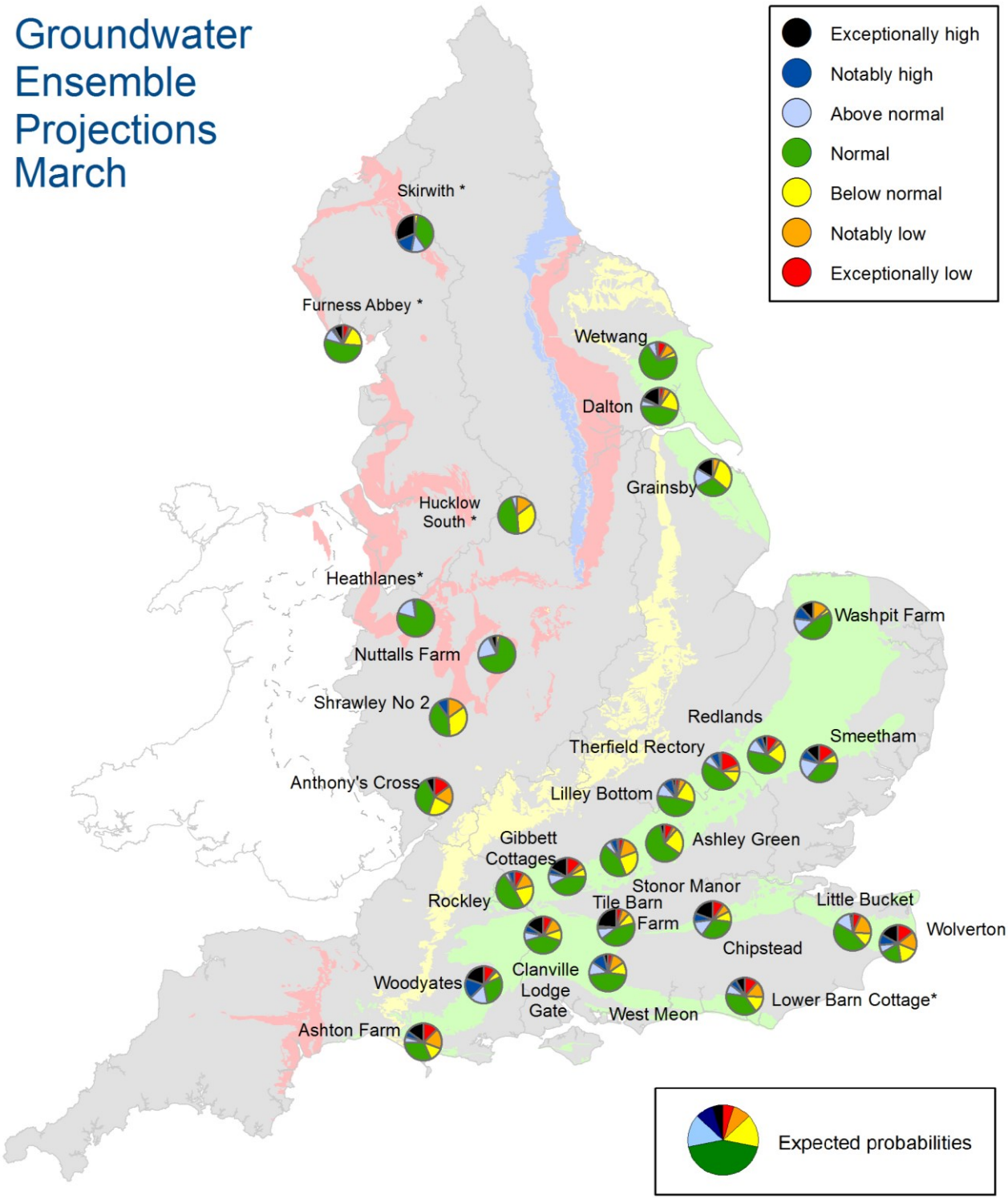

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Figure 6.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of March 2018. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for the time of year. (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. 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 (m3s-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).
Water (or hydrological) year	The 12 month period of the hydrological cycle, starting on 1st October, when typically rainfall increases and starts to recharge soils, aquifers and reservoirs.

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