Monthly water situation report

England

Summary – May 2018

May rainfall totals were below average across England at 78% of the monthly long term average. Rainfall totals were normal or lower for the time of year across nearly all hydrological areas. Soil moisture levels fell across the country. Monthly mean river flows were lower in May than in April at nearly all indicator sites but remained normal or higher for the time of year at most sites. Groundwater recharge declined at the majority of sites during May but remained normal or higher for the time of year at all but one site. Reservoir stocks decreased at most reported reservoirs and reservoir groups but remained normal or higher for the time of year at all but five sites. Overall reservoir storage for England decreased to 91% of total capacity at the end of May.

Rainfall

May rainfall totals were highest across parts of Oxfordshire and Gloucestershire at approximately 80mm, and lowest across parts of Norfolk, Suffolk, Yorkshire and Northumberland at less than 25mm. Rainfall totals were below average in all almost three-quarters of hydrological areas, ranging from 35% of the May long term average (LTA) in the Ribble hydrological area (Lancashire) to 145% in the Upper Cherwell (Oxfordshire) (Figure 1.1)

May rainfall totals were classed as lower than normal for the time of year across over a third of hydrological areas (mainly located in northern England) and normal across most of the rest. Rainfall totals in the Ribble and Aire (Yorkshire) hydrological areas were exceptionally low for the time of year. Rainfall totals in eight hydrological areas across a central band of England were above normal for the time of year. In the Ribble hydrological area it was provisionally the 5th driest May on record (since records began in 1910) and the driest since 2010. It was also provisionally in the top ten driest Mays on record in the Aire, Tyne, Wharfe and Mersey and Irwell hydrological areas. It was provisionally the 2nd wettest spring (March-May) period on record in the West Somerset Streams. It was provisionally the 10th and 11th driest spring on record in the Derwent (NW) and Esk (Dumfries) hydrological areas and the driest over this period since 1984 in both. (Figure 1.2)

At a regional scale, May rainfall totals were above average across central and south-east England but below average elsewhere (north-west and north-east England had close to only 50% of the May LTA). It was provisionally the 6th wettest spring period on record and the wettest since 2000 in south-west England. The spring period was also notable in central and south-east England (9th wettest in both and wettest since 1983 and 2008 respectively). The monthly rainfall total for England was 46mm which was 78% of the 1961-90 LTA (80% of the 1981-10 LTA) (Figure 1.3)

Soil moisture deficit

With the continuation of the warm and dry conditions seen towards the end of April soil moisture deficits (SMDs) continued to increase throughout May – although SMDs did decrease in the final week of May in those parts of the country that saw the largest rainfall totals (mainly central, east and south-east England). At the end of May SMDs were between 41 and 70mm across three-quarters of the country, with slightly larger deficits in north-east England and slightly smaller deficits in parts of central and south-east England (Figure 2.1)

At the end of May, soils were drier than average across most of England, apart from parts of central and south-east England where soils were wetter than average. At a regional scale, soils were slightly drier than average at the end of May in central, east and south-east England and significantly drier than average (by between 20 and 35mm) in south-west, north-east and north-west England, in a marked contrast to the beginning of May (Figure 2.2)

River flows

May monthly mean flows decreased compared to April at all but one (the Great Stour at Horton in Kent) of the indicator sites across England. However monthly mean river flows were classed as lower than normal for the time of year at only one tenth of indicator sites, with two thirds of sites being classed as normal for the time of year. (Figure 3.1)

Flows at the regional index sites in central (River Dove), south-east (River Thames) and south-west (River Exe) England changed from notably high for April to normal for May. In north-east England (River Tyne) flows changed from normal for April to notably low for May. Only two regional index sites in east (River Bedford Ouse) and south-east (River Great Stour) England remained higher than normal for the time of year. (Figure 3.2)

Groundwater levels

The rise in groundwater levels during April only continued at a third of indicatorsites during May, levels decreased at the rest. The rise in groundwater levels was restricted to either slow responding aquifers or those which have benefitted from spring recharge. However end of month groundwater levels were normal or higher for the time of year at all but 1 indicator site: Crossley Hill (Idle Torne sandstone aquifer) remained notably low (although levels have continued to rise here) (Figures 4.1 and 4.2)

End of month levels at the major aquifer index sites were all normal or higher for the time of year.

Reservoir storage

Reservoir stocks decreased at three-quarters of reservoirs and reservoir groups during May. The largest decreases of 12% occurred at the Derwent Valley, NCZ Group and Pennines Group reservoirs – in central and north-west England. Farmoor reservoir in south-east England increased by 7%. However, end of month stocks were classed as normal or higher for the time of year at all but 5 sites: Carsington and Ogston reservoir group and the Dove group in central England, the Teesdale group in north-east England, Grafham Water in east England and the NCZ group in north-west England were classed as below normal (Figure 5.1)

Regional reservoir stocks decreased by 10% in north-west England during May and decreased by up to 6% or remained unchanged elsewhere. End of May stocks ranged from 80% of total capacity in north-west England to 97% in south-east England. Overall storage for England decreased by 4% to 91% of total capacity (Figure 5.2)

Forward look

The mixed weather is expected to continue during June, with thundery showers and spells of heavy rain interspersed with drier and more settled conditions. For the 3-month period June-July-August, below average precipitation is more likely than above average precipitation[1].

Projections for river flows at key sites[2]

Nearly two-thirds of the modelled sites have a greater than expected chance of cumulative river flows being normal or higher for the time of year by the end of September 2018. Three-quarters of the modelled sites have a greater than expected chance of cumulative flows being normal or higher by the end of March 2019.

For scenario based projections of cumulative river flows at key sites by September 2018 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by March 2019 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by September 2018 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by March 2019 see Figure 6.4

Projections for groundwater levels in key aquifers[2]

Just over 90% of the modelled sites have a greater than expected chance of groundwater levels being normal or higher for the time of year at the end of September 2018. Nearly three-quarters of the modelled sites have a greater than expected chance of levels being normal or higher at the end of March 2019.

For scenario based projections of groundwater levels in key aquifers in September 2018 see Figure 6.5.
For scenario based projections of groundwater levels in key aquifers in March 2019 see Figure 6.6.
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2018 see Figure 6.7.
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2019 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

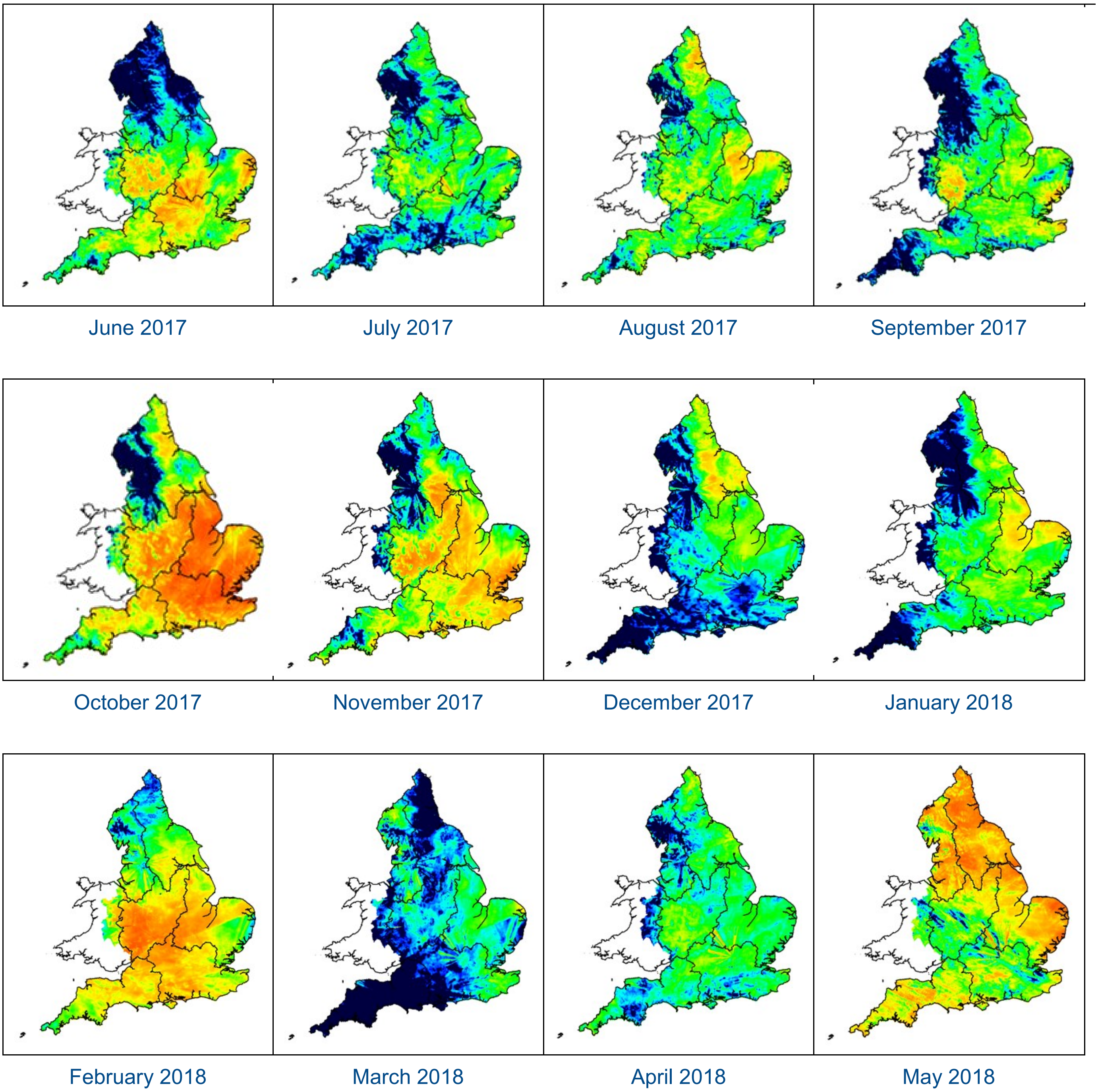
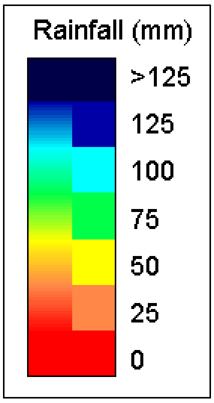


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2018). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100026380, 2018.



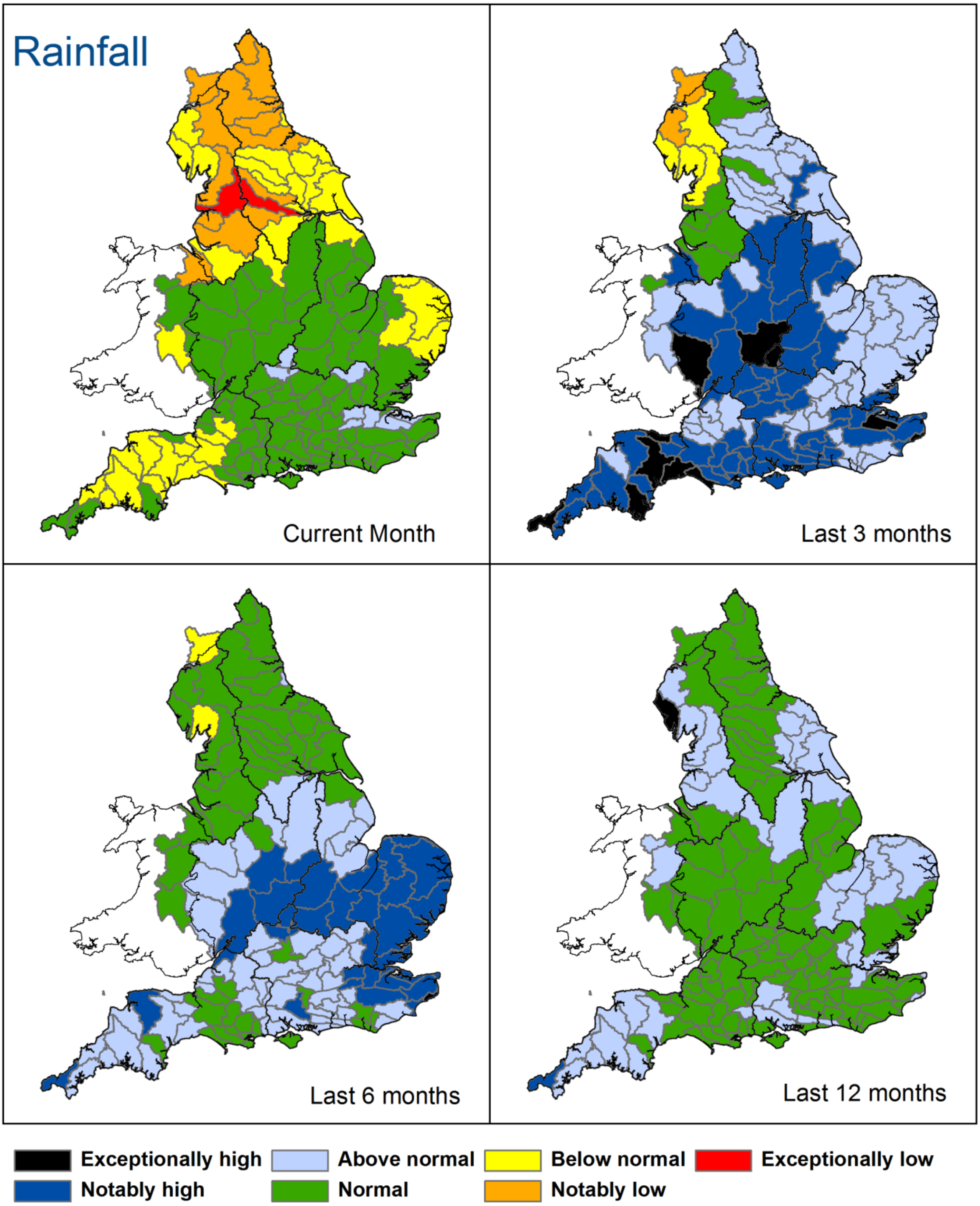


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 May), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Final NCIC (National Climate Information Centre) data based on the Met Office 5km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2018).* 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, 2018.

Rainfall charts

Above average rainfall

Below average rainfall

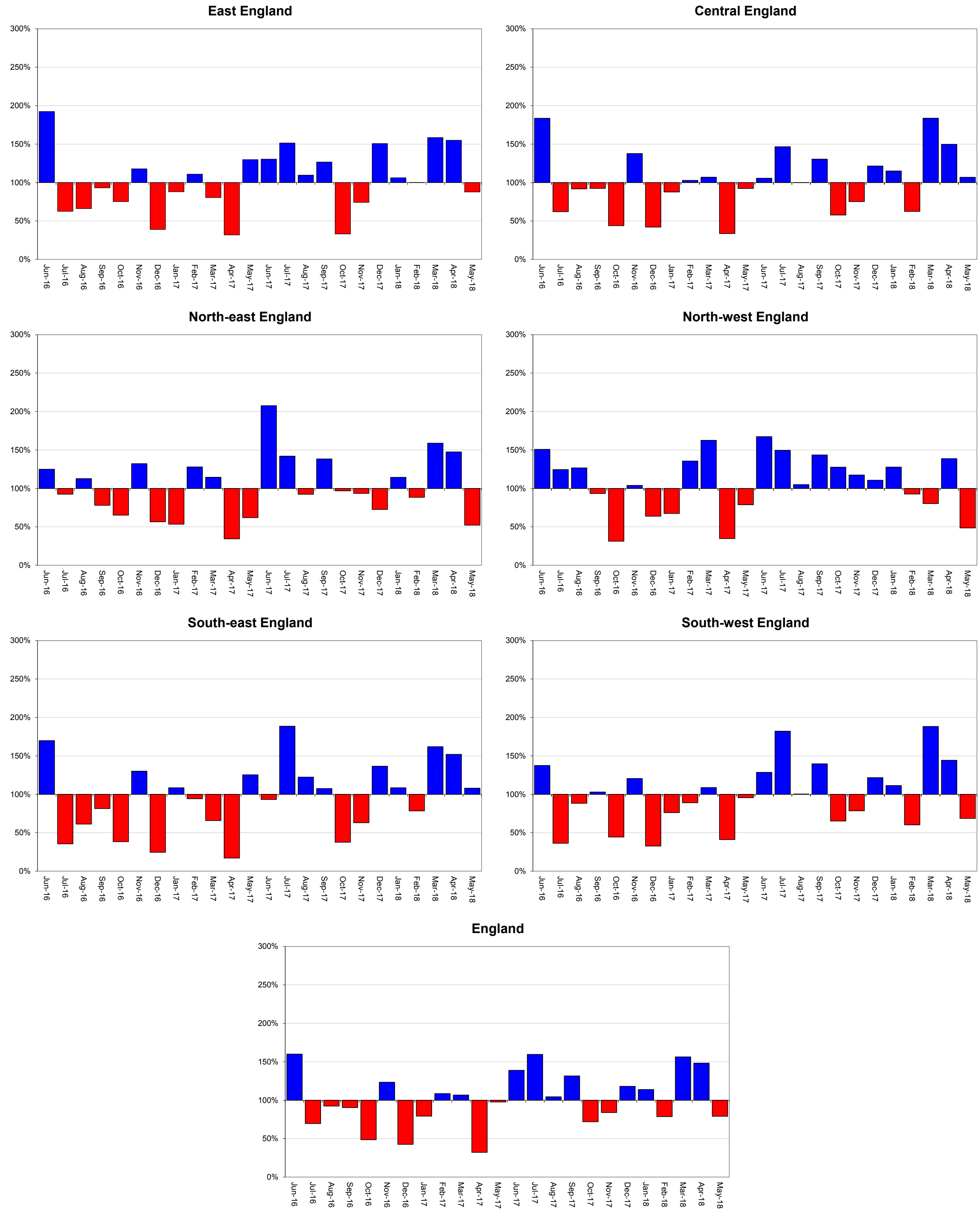


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each region and for England. NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright, 2018).

Soil moisture deficit

End of April 2018[1]	End of May 2018[2]

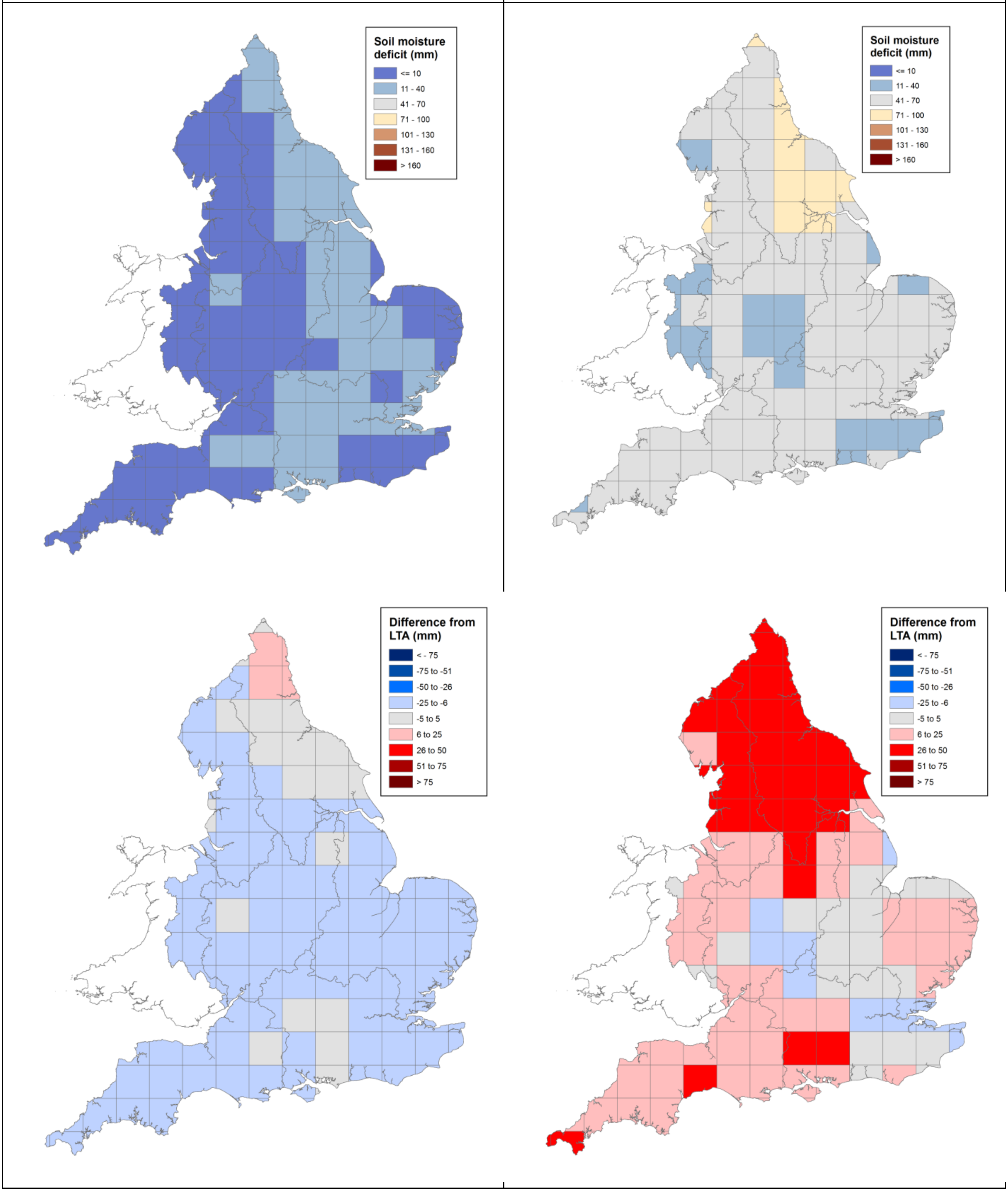
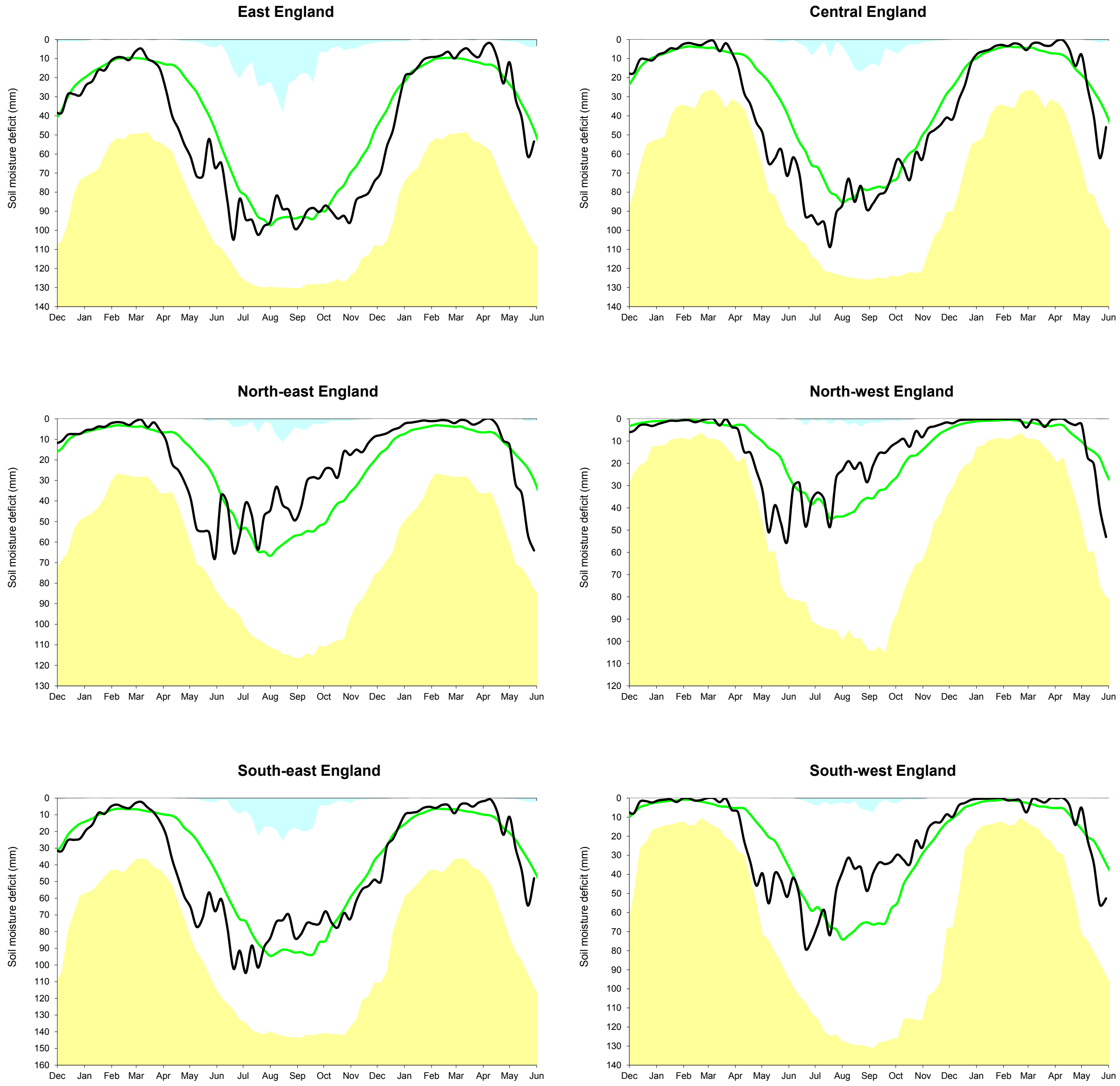


Figure 2.1: Soil moisture deficits for weeks ending 1 May 2018 [1] (left panel) and 29 May 2018 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961-90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2018). Crown copyright. All rights reserved. Environment Agency, 100026380, 2018.

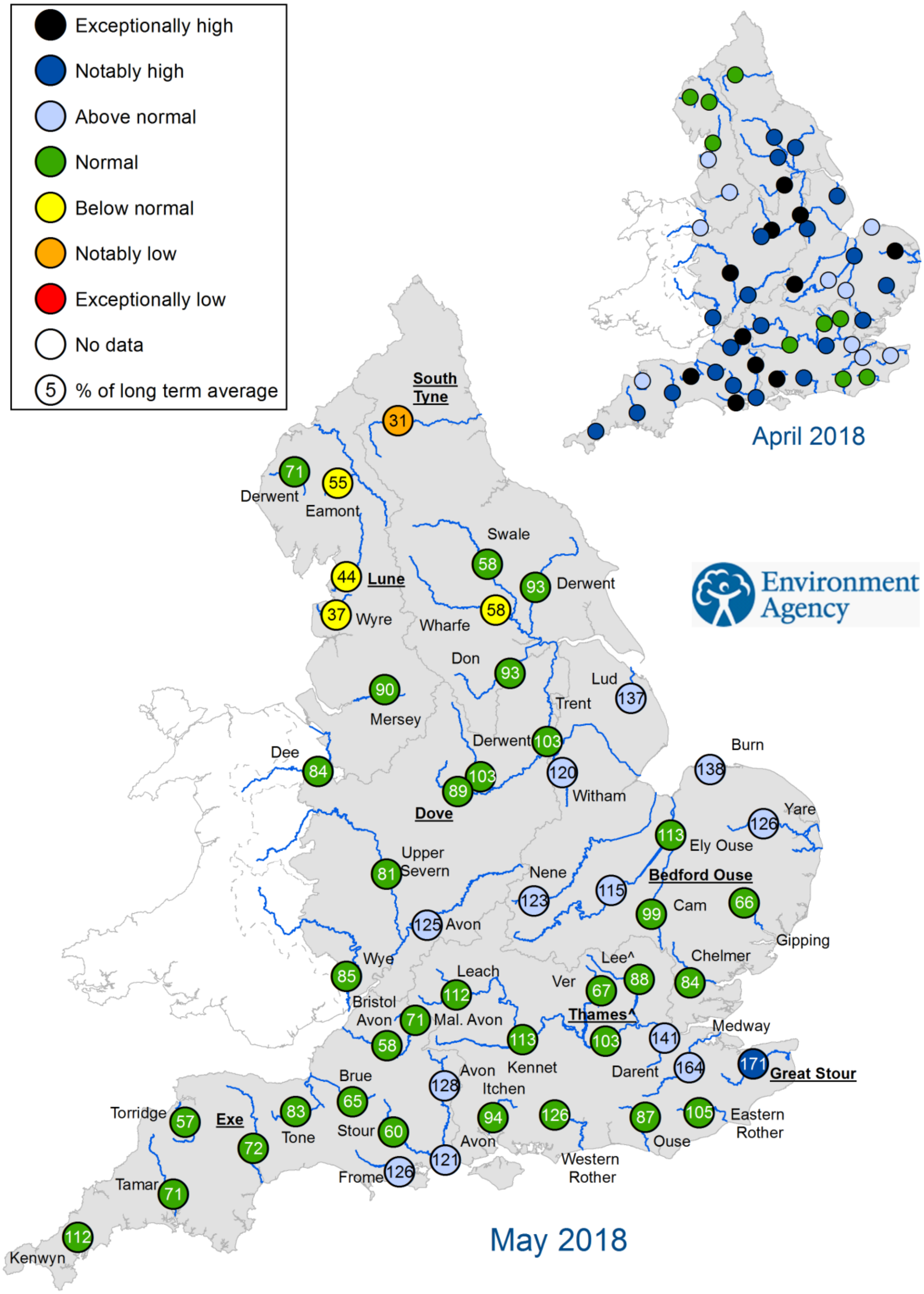
Soil moisture deficit charts



	Below minimum monthly level		Above maximum monthly level		Average		Latest data

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, 2018).

River flows



^ “Naturalised” flows are provided for the River Thames at Kingston and the River 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 April and May 2018, 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, 100026380, 2018.

River flow charts

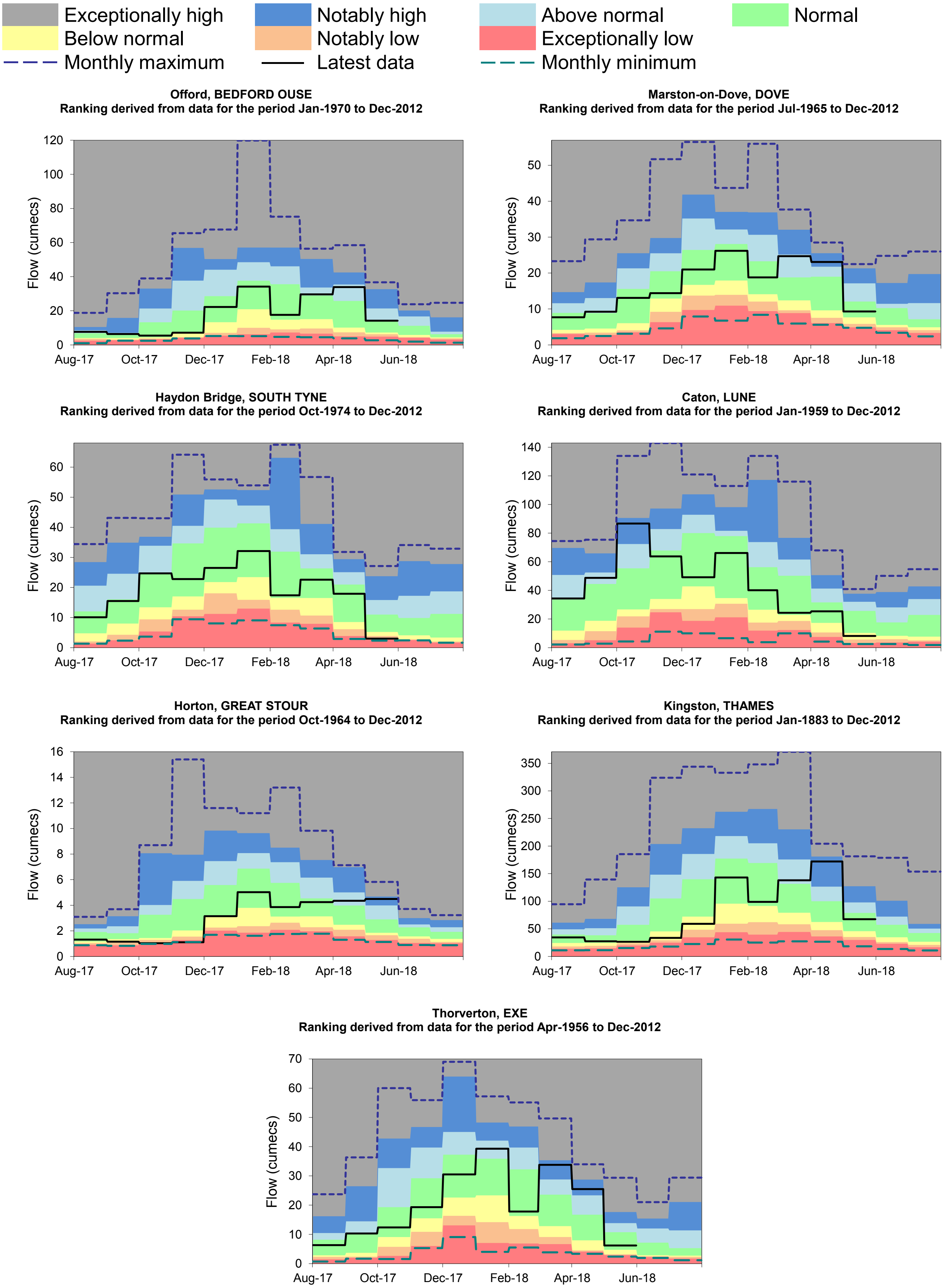
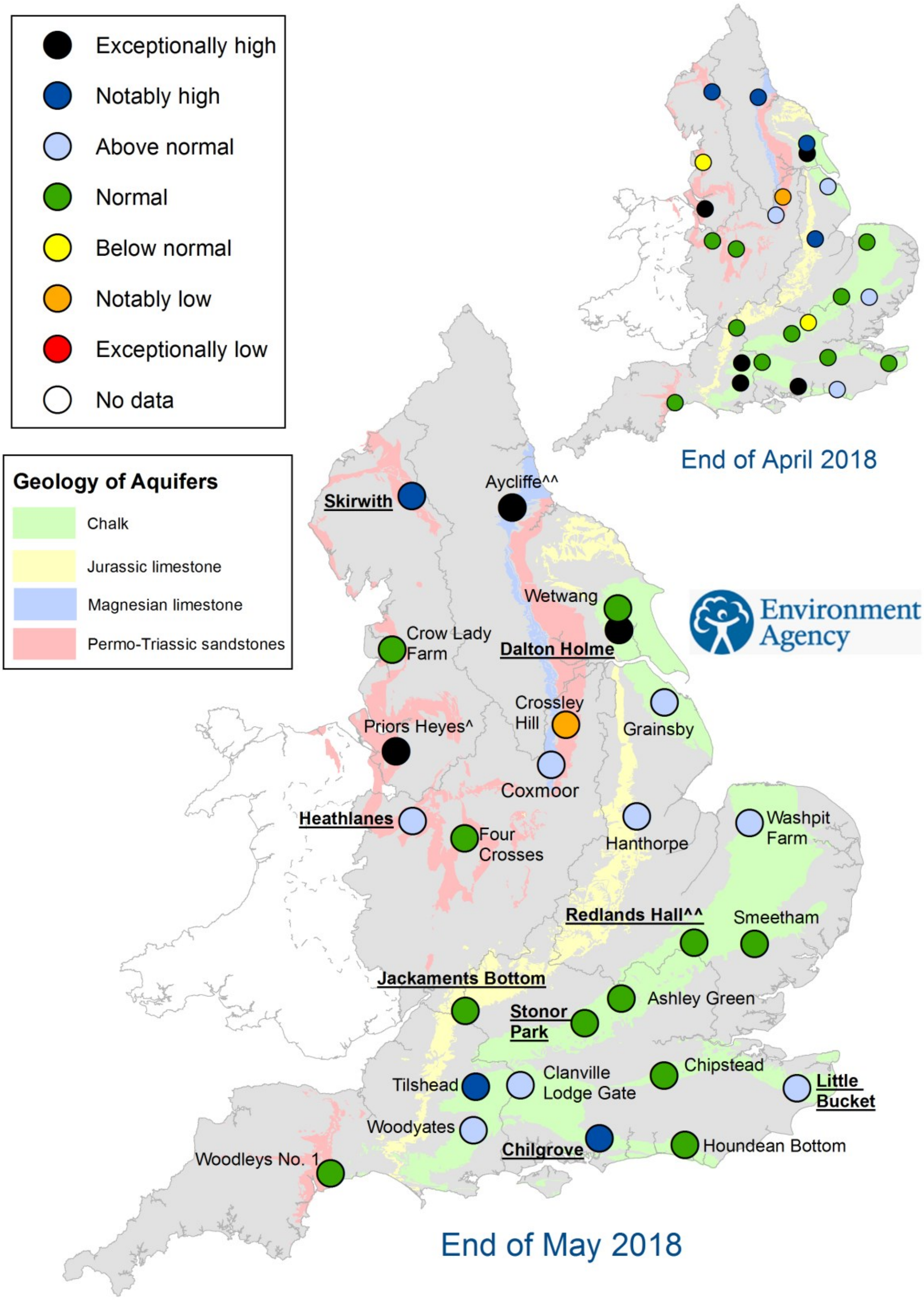


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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 April and May 2018, 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, 100026380, 2018.

Groundwater level charts

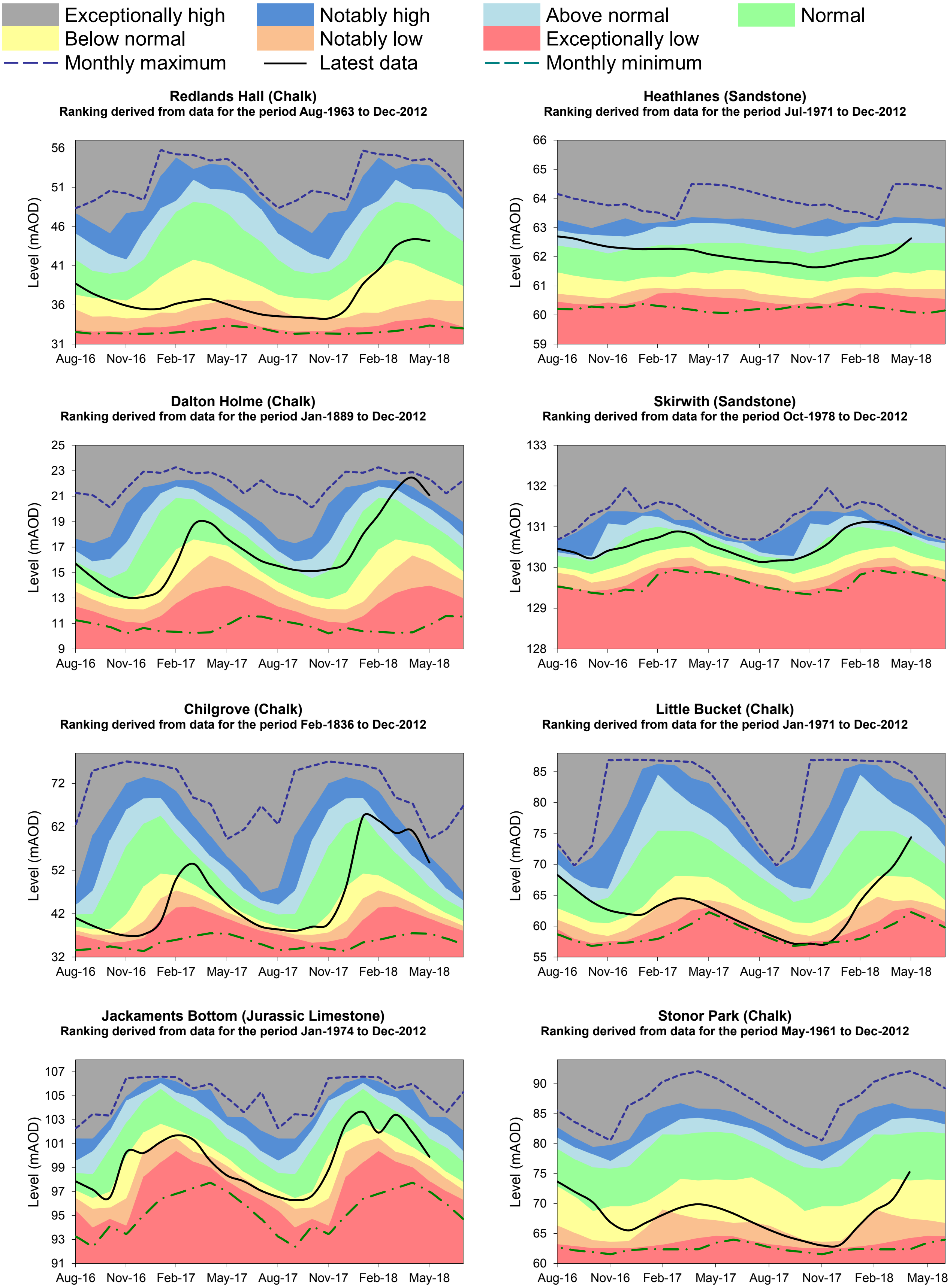
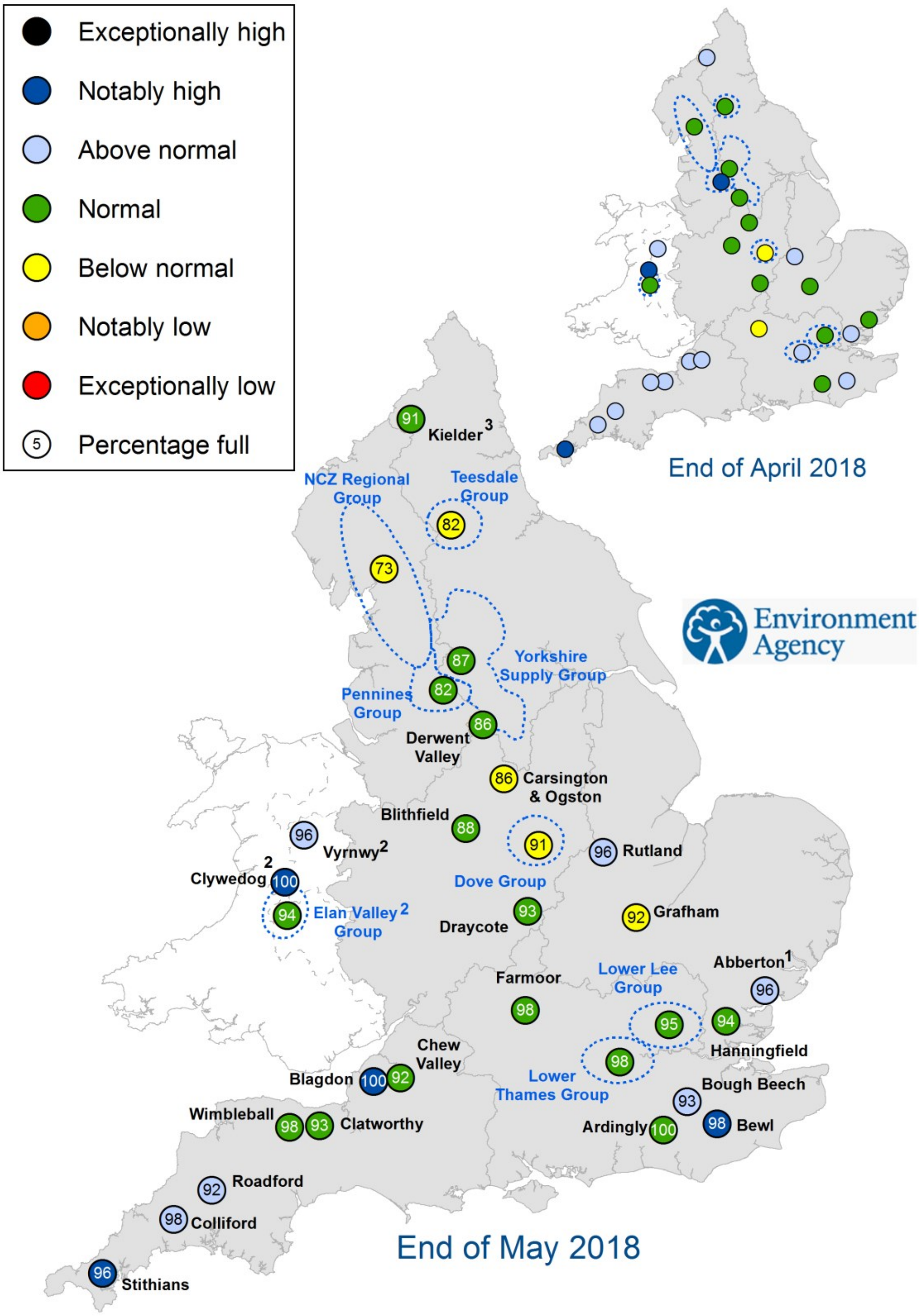


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2018).

Reservoir storage

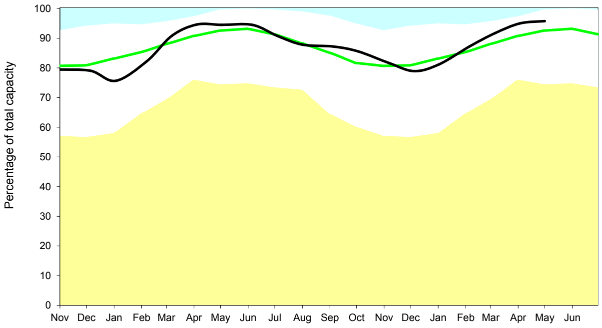


1. Current levels at Abberton Reservoir in east England are relative to increased capacity
2. Vyrnwy, Clywedog and Elan Valley reservoirs are located in Wales but provide a water resource to Central and north-west England
3. Current levels at Kielder are lower than historical levels due to the implementation of a new flood alleviation control curve

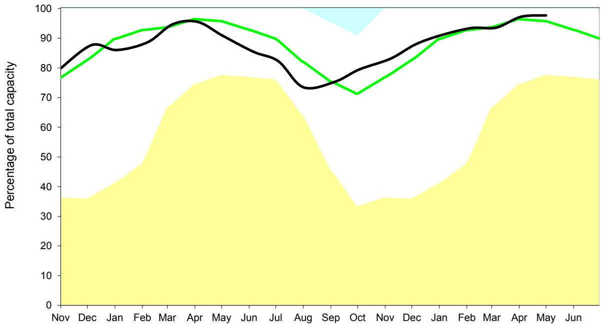
Figure 5.1: Reservoir stocks at key individual and groups of reservoirs at the end of April and May 2018 as a percentage of total capacity and classed relative to an analysis of historic April and May values respectively (Source: Water Companies). Note: Classes shown may not necessarily relate to control 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. Crown copyright. All rights reserved. Environment Agency, 100026380, 2018.

Reservoir storage charts

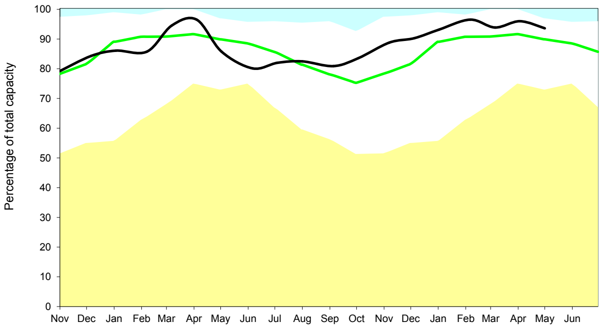
East England
Based on storage in Abberton, Grafham, Hanningfield, Rutland reservoirs



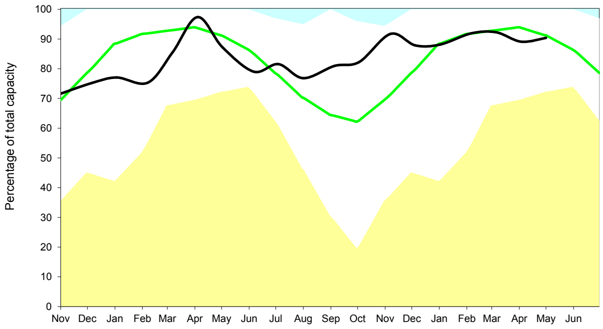
Central England
Based on storage in Clywedog, Carsington and Ogston, Derwent Valley, Dove (Foremark & Staunton), Draycote, Elan Valley Group reservoirs



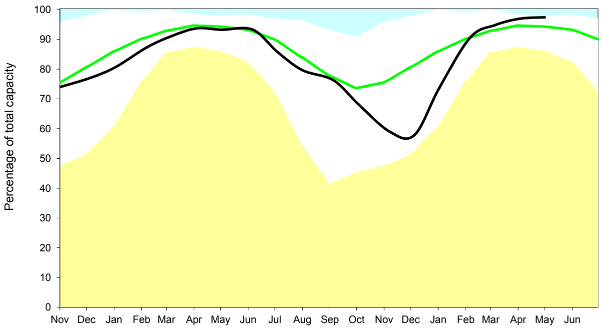
North-east England
Based on storage in Kielder, Teesdale Group, Yorkshire Supply Group reservoirs



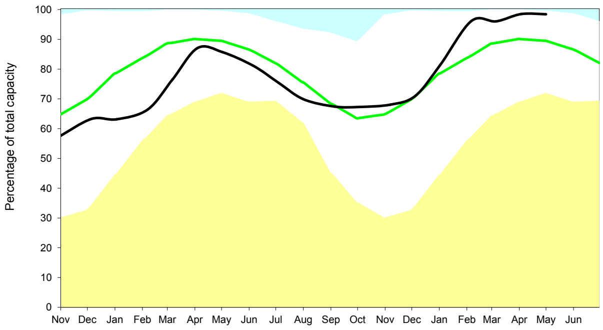
North-west England
Based on storage in NCZ Regional Group, Pennines Group, Vyrnwy reservoirs



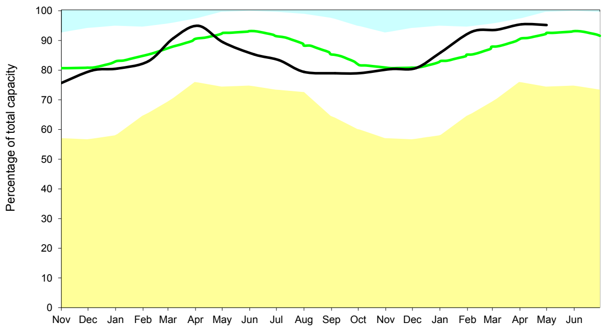
South-east England
Based on storage in Ardingly, Bewl, Bough Beech, Farmoor, Lower Lee Group, Lower Thames Group reservoirs



South-west England
Based on storage in Blagdon, Chew Valley, Clatworthy, Colliford, Roadford, Stithians, Wimbleball reservoirs



England
Based on combined regional storage



	Below minimum monthly level		Above maximum monthly level		Average		Latest data

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

Forward look – river flow

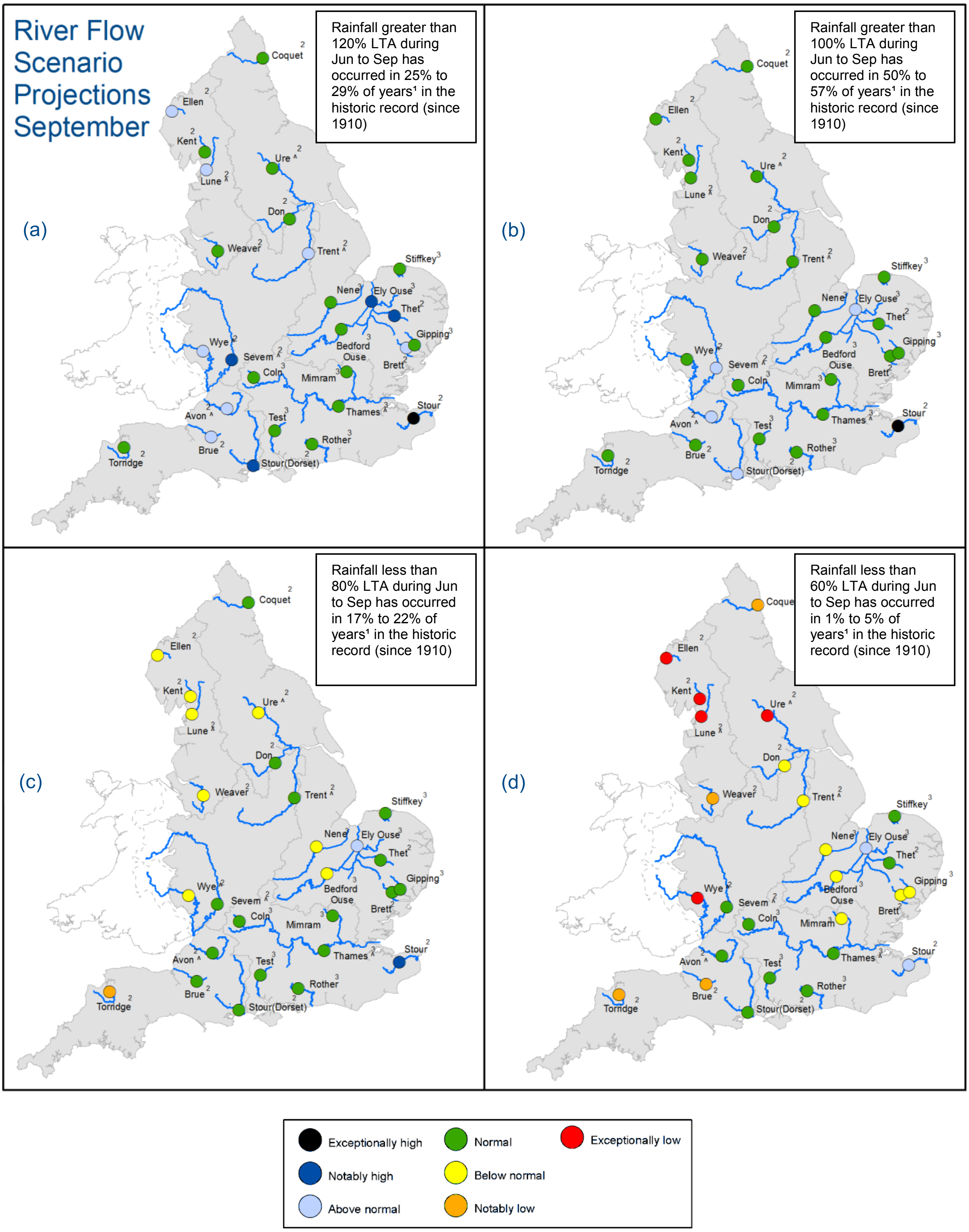


Figure 6.1: Projected river flows at key indicator sites up until the end of September 2018. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June and September 2018 (Source: Centre for Ecology and Hydrology, Environment Agency).

[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*

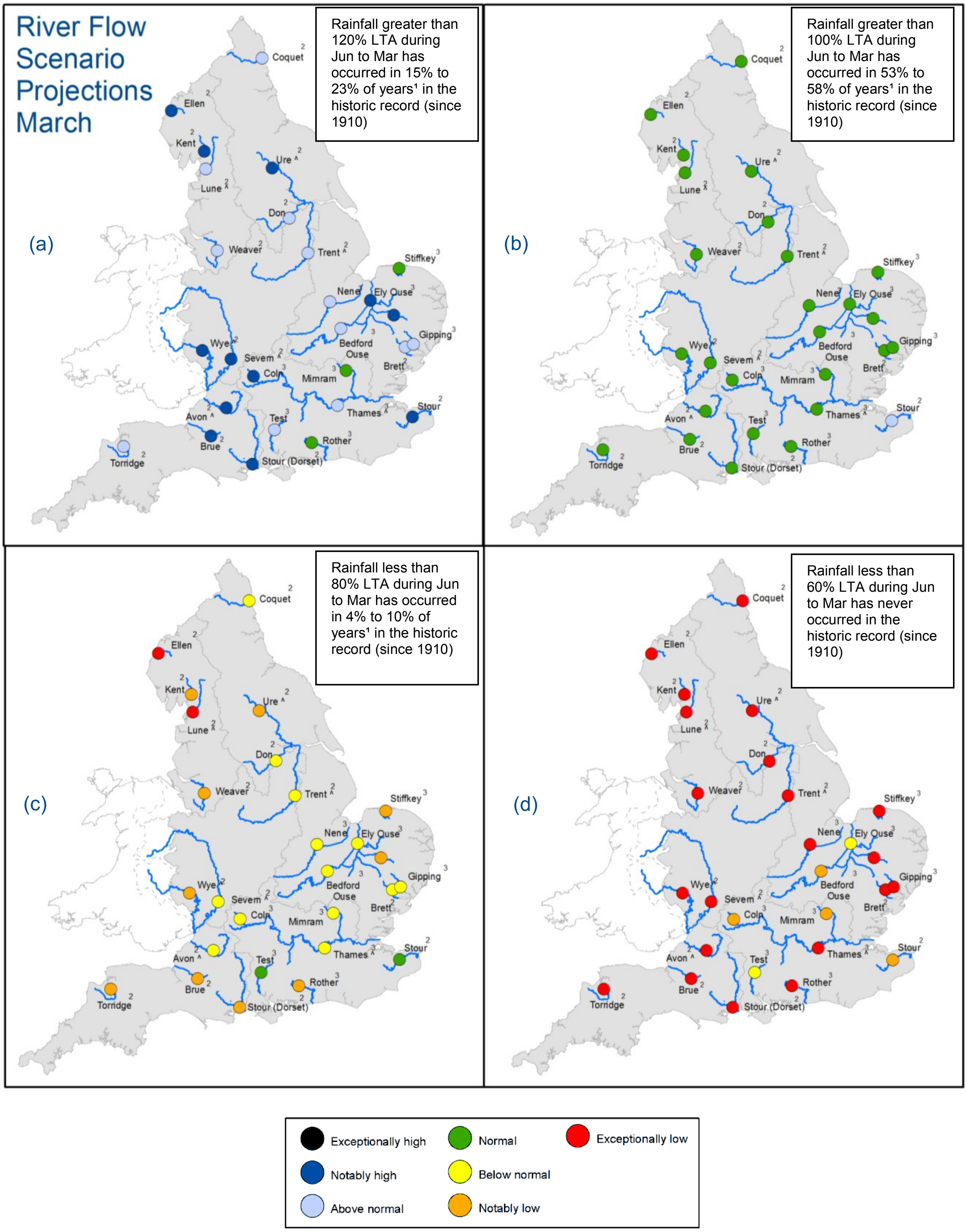


Figure 6.2: Projected river flows at key indicator sites up until the end of March 2019. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2018 and March 2019 (Source: Centre for Ecology and Hydrology, Environment Agency).

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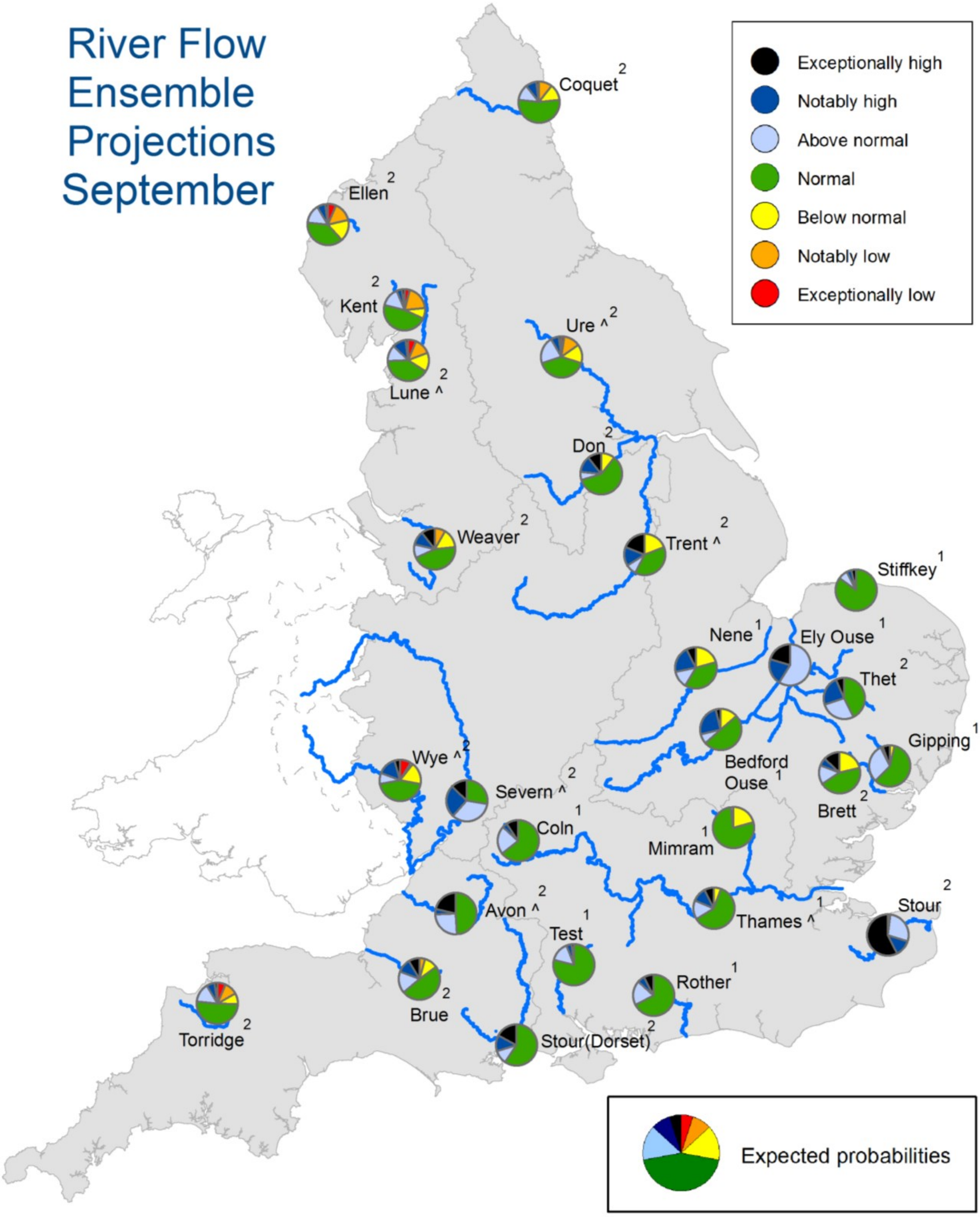

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

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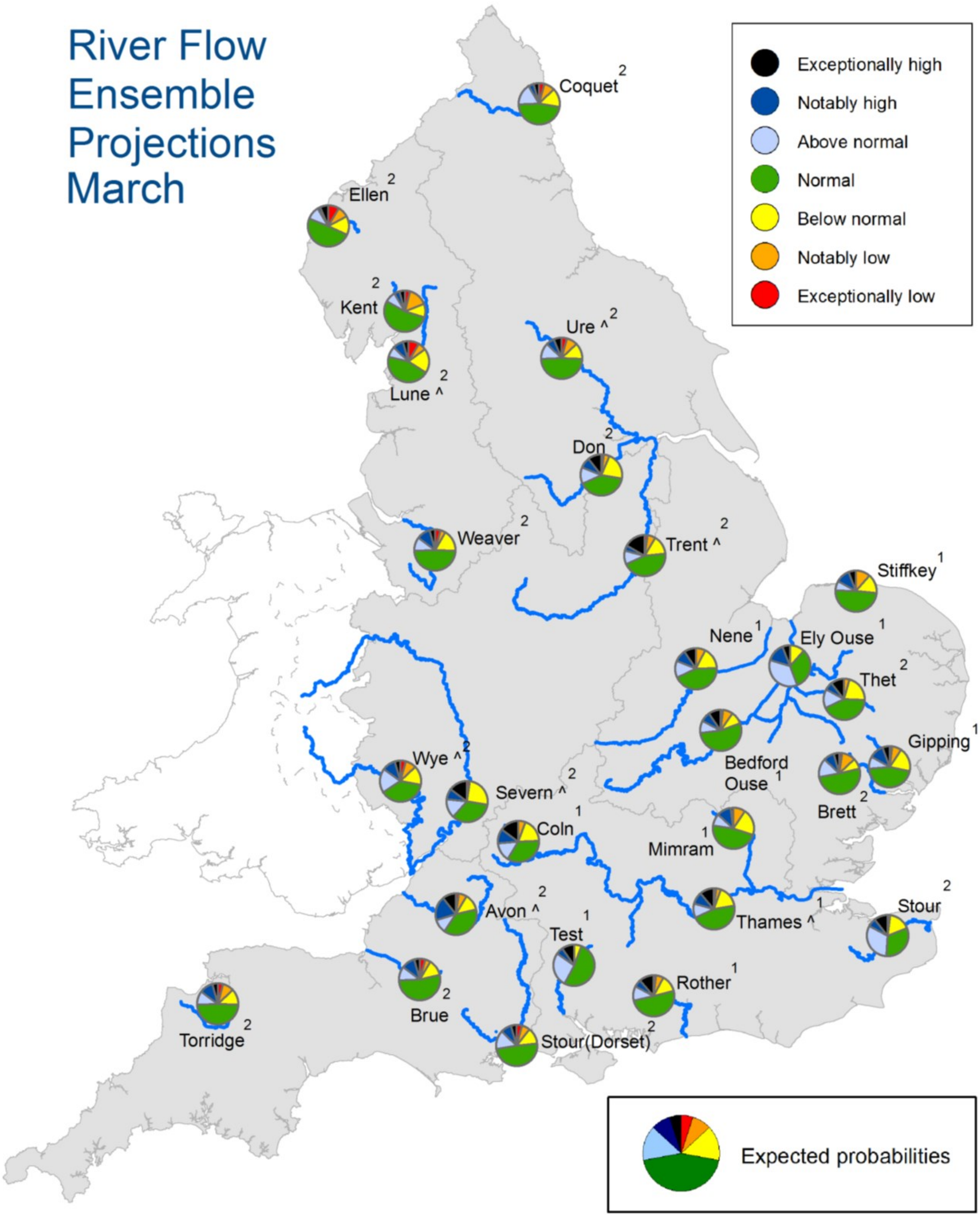
[2] Projections for these sites are produced by CEH
^"Naturalised" flows are projected for these sites



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 2019. 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

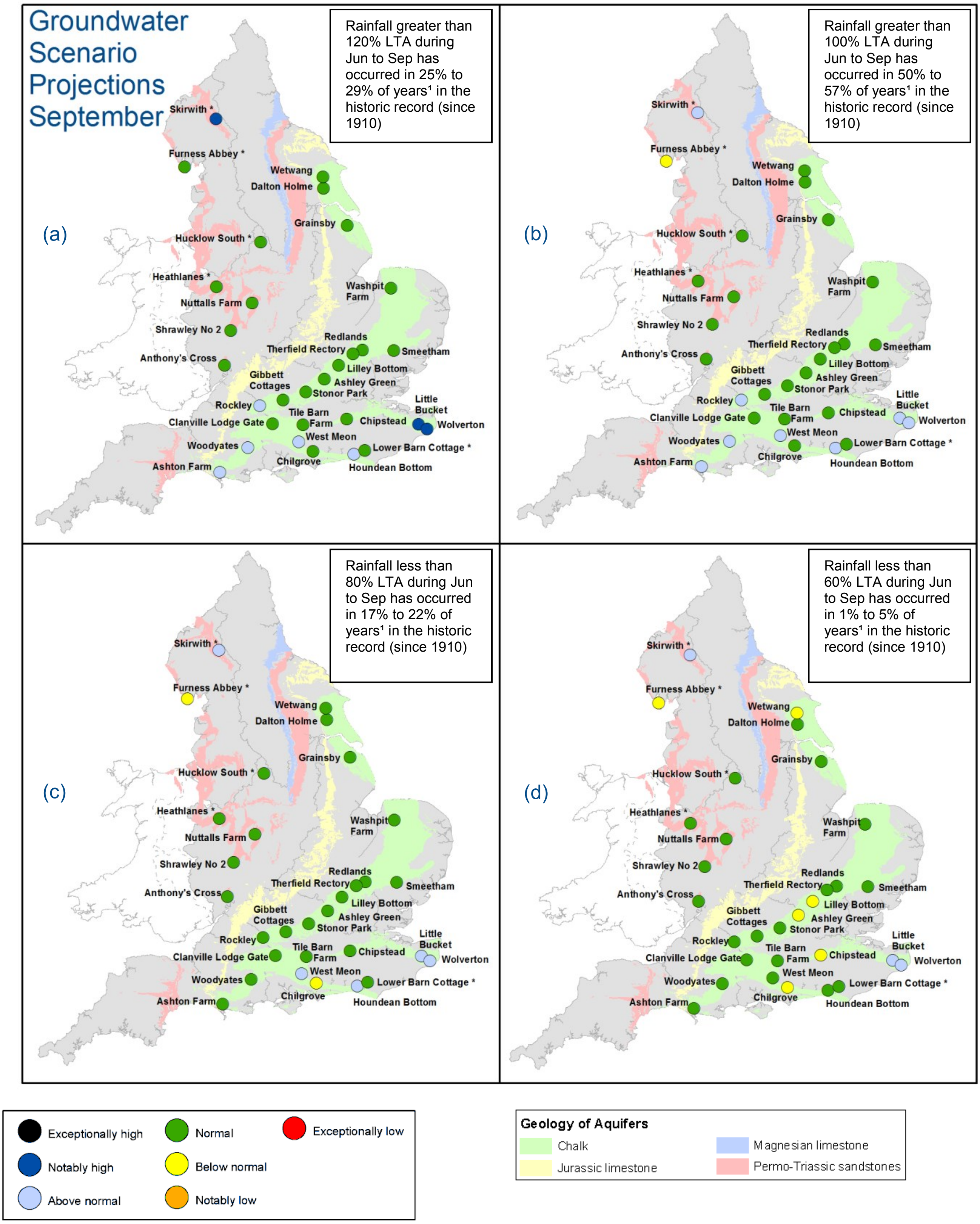


Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2018. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June and September 2018 (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100026380, 2018.

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

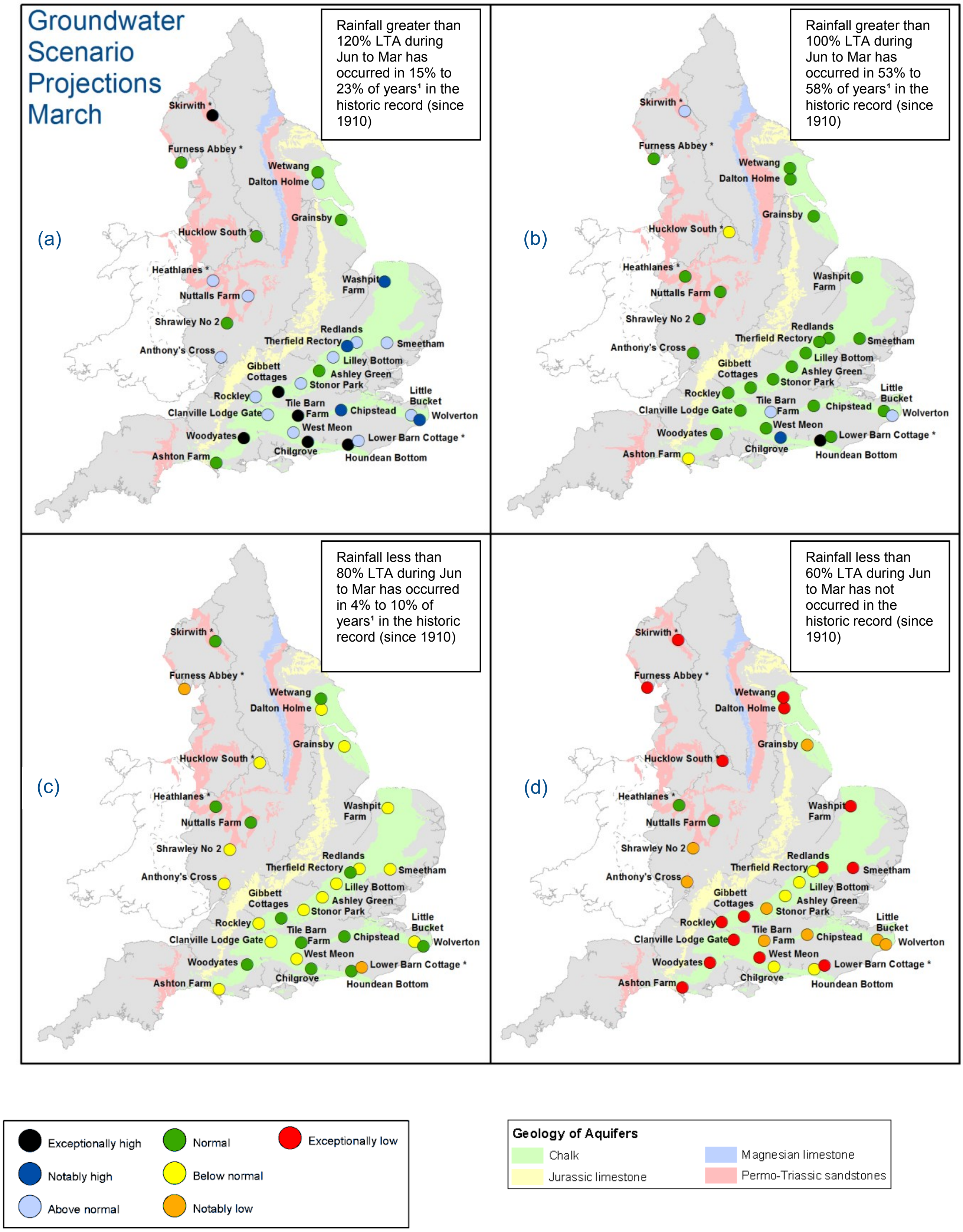
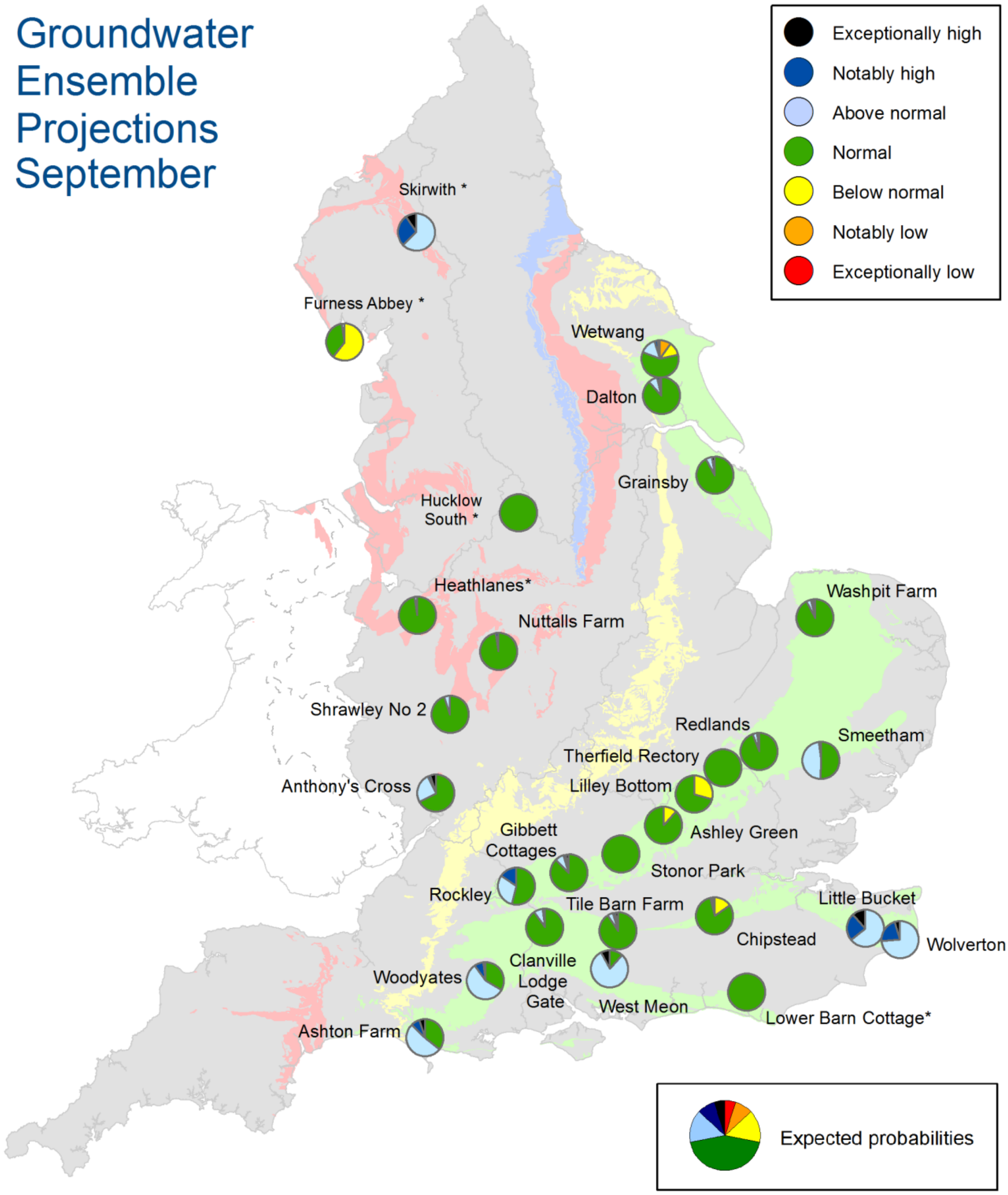


Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2019. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2018 and March 2019 (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100026380 2018.

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

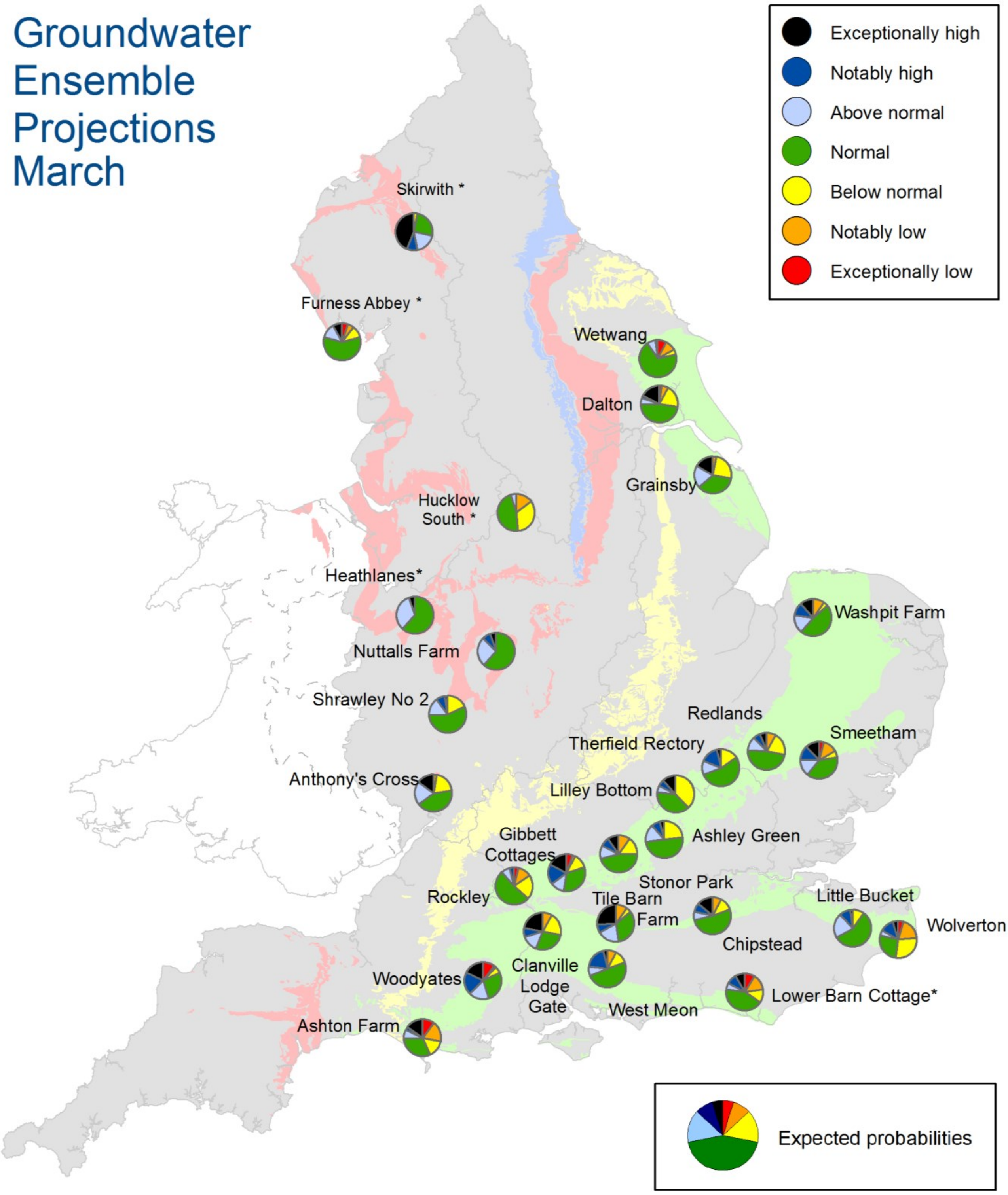
Groundwater Ensemble Projections September



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 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, 2018.

** 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 2019. 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, 2018.

* 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