

Monthly water situation report: East Anglia

1 Summary - March 2024

Following an extremely wet February, rainfall during March was normal across much of East Anglia with no areas experiencing exceptionally high rainfall as all did last month. Regional SMD [Soil Moisture Deficit] has transitioned from exceptionally low to below normal since February, but soils remain close to field capacity. Monthly river flows were subsequently exceptionally high at several sites due to good responsiveness to the rainfall received. Furthermore, high base flow is likely contributing due to the exceptionally high groundwater levels across the majority of the region, which are still recharging at a number of locations. All reservoirs are at or above their normal levels, with most above their normal operating curves.

1.1 Rainfall

March 2024 rainfall was normal for most hydrological areas, with only the Lower Bedford Ouse, South Essex and Cam receiving above normal rainfall and the Upper Bedford Ouse receiving notably high rainfall. The 3, 6 and 12-month totals for the region are almost entirely dominated by exceptionally high rainfall, with no areas for any total classified as normal or below.

1.2 Soil moisture deficit and recharge

The East Anglia SMD for the end of March in all areas was below 10mm with a regional average of 6mm, which is below normal for the time of year. This has increased both in value and relative to the LTA [Long Term Average] since February for the end of which the SMD was notably low at 2mm. Recharge has stopped at most monitoring boreholes for which we have data, but continues at 7 boreholes which have shown an increase in groundwater levels since February.

1.3 River flows

Monthly average river flows for March have remained exceptionally high for a number of sites in the North and West of the region, with many more being notably high. The only exceptions are the Bure, Yare, Waveney and Gipping in the East, which have above normal flows. Though rainfall this past month was reduced significantly, the high groundwater levels and soil moisture are maintaining these high flows through base flow and high amounts of runoff from the reduced rainfall.

1.4 Groundwater levels

Groundwater levels have stopped rising at all but 7 of the monitoring sites for which we have sufficient data. Despite the reduced rainfall this month, the exceptionally wet past few months have led to significant amounts of recharge which is still seeing a lagged response at these locations. Levels remain exceptionally high at all monitoring sites except for Rook Hall at above normal levels and Therfield Rectory at notably high levels. There is a fair likelihood that that these regional levels will remain above normal at many locations late into the year.

1.5 Reservoir stocks

Reservoir stocks remain at good levels, Grafham at a normal 85% capacity and all others above normal or higher at 90-98% of their capacity. Grafham and Ardeigh are slightly below their normal operating curves for the time of year.

1.6 Forward look

1.6.1 Probabilistic ensemble projections for river flows at key sites

The river flow projections indicate a very high likelihood of normal and above normal flows for June 2024, with a fair likelihood of notably high and exceptionally high flows. The likelihood of notably high and exceptionally high flows is projected to increase for September.

1.6.2 Probabilistic ensemble projections for groundwater levels in key aquifers

Groundwater levels are predicted to have a high likelihood of remaining exceptionally high or notably high at a number of locations by September 2024, and none are projected to fall below normal levels. By March 2025, it is predicted that there is a chance that levels at almost all sites will fall to below normal or notably low levels, but it is more likely that levels will remain normal or above.

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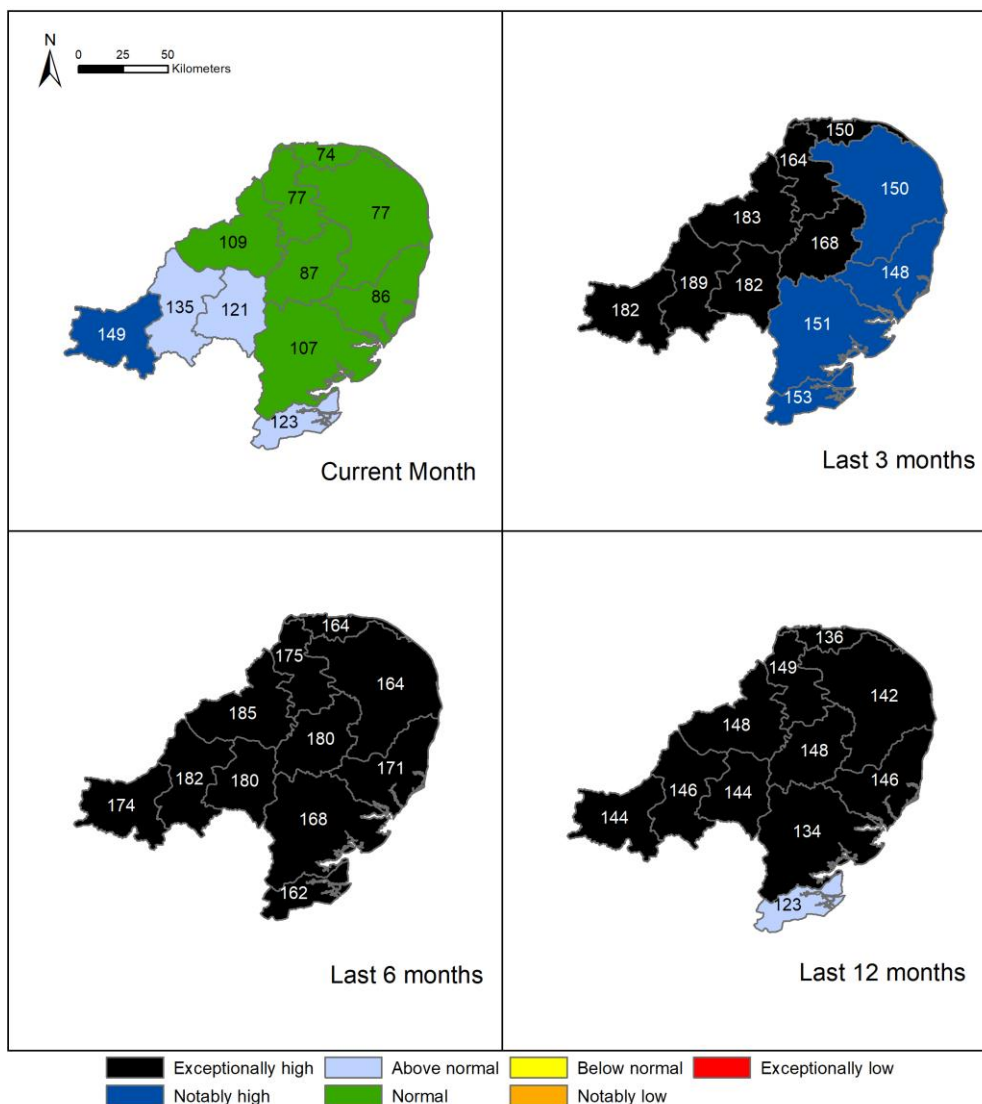
*[SMD]: soil moisture deficits

*[LTA]: long term average

2 Rainfall

2.1 Rainfall map

Figure 2.1: Total rainfall for hydrological areas across East Anglia, expressed as a percentage of long term average rainfall for the current month (up to 31 March 2024), the last 3 months, the last 6 months, and the last 12 months. Category classes are based on an analysis of respective historic totals. Table available in the appendices with detailed information.

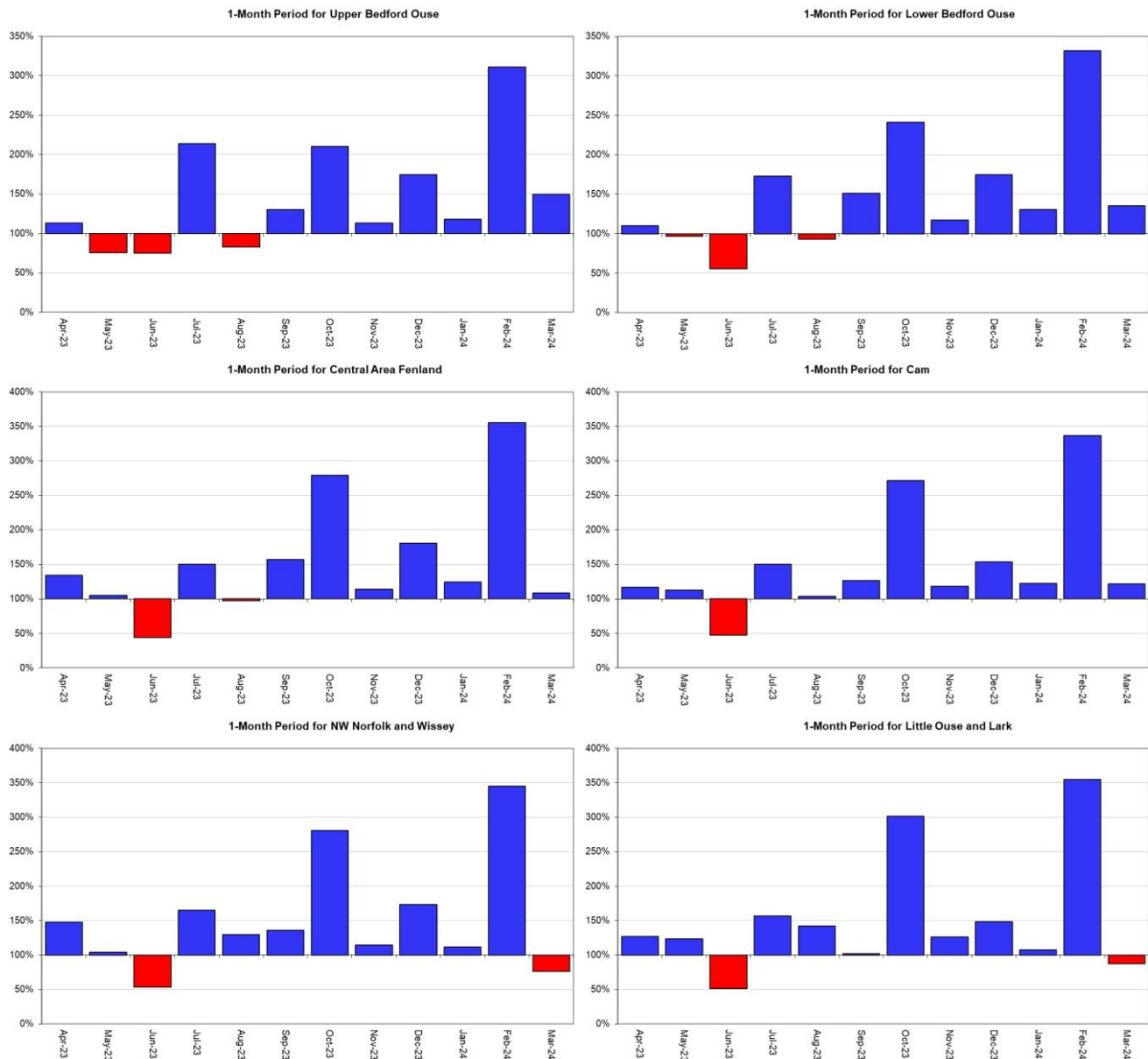


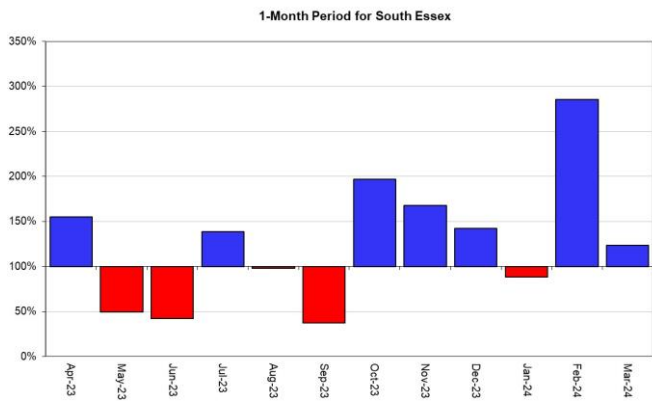
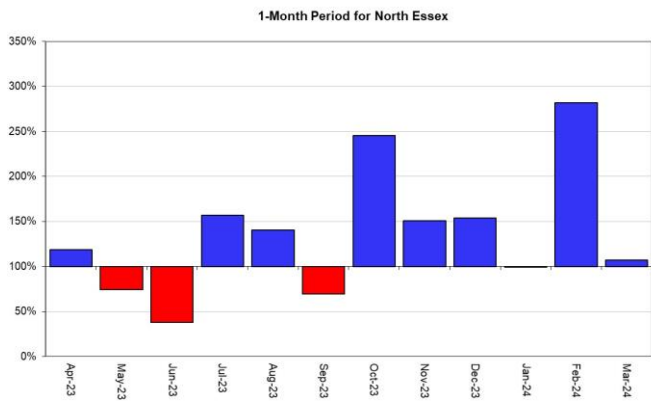
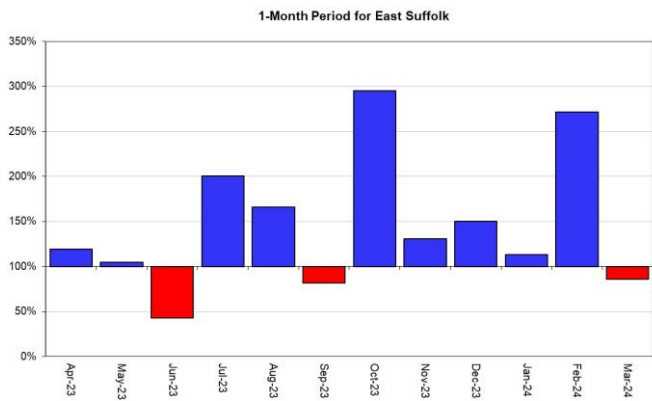
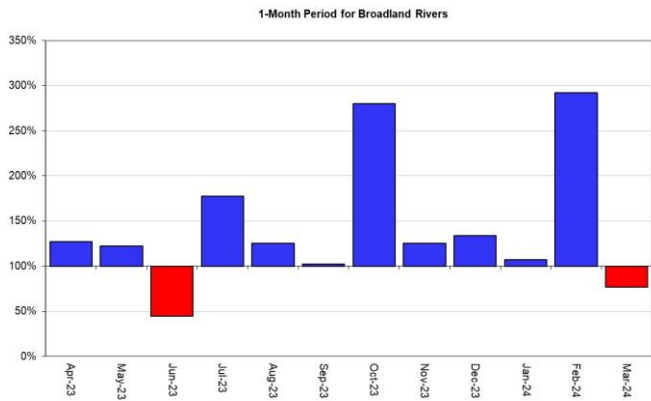
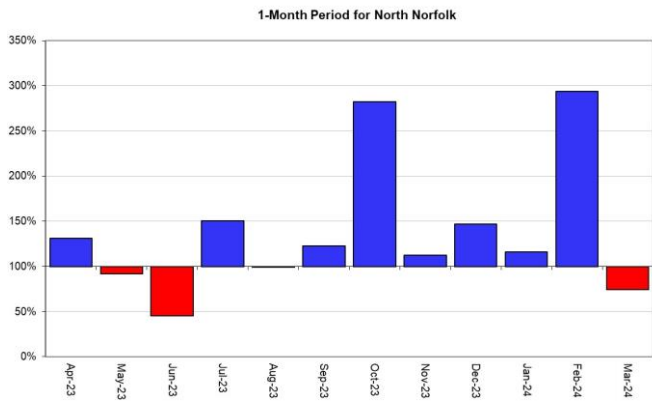
HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges (Source: Met Office. Crown copyright, 2024). Provisional data based on Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. Crown copyright. All rights reserved. Environment Agency, 100024198, 2024.

2.2 Rainfall charts

Figure 2.2: Monthly rainfall totals for the past 12 months as a percentage of the 1961 to 1990 long term average for each region and for England.

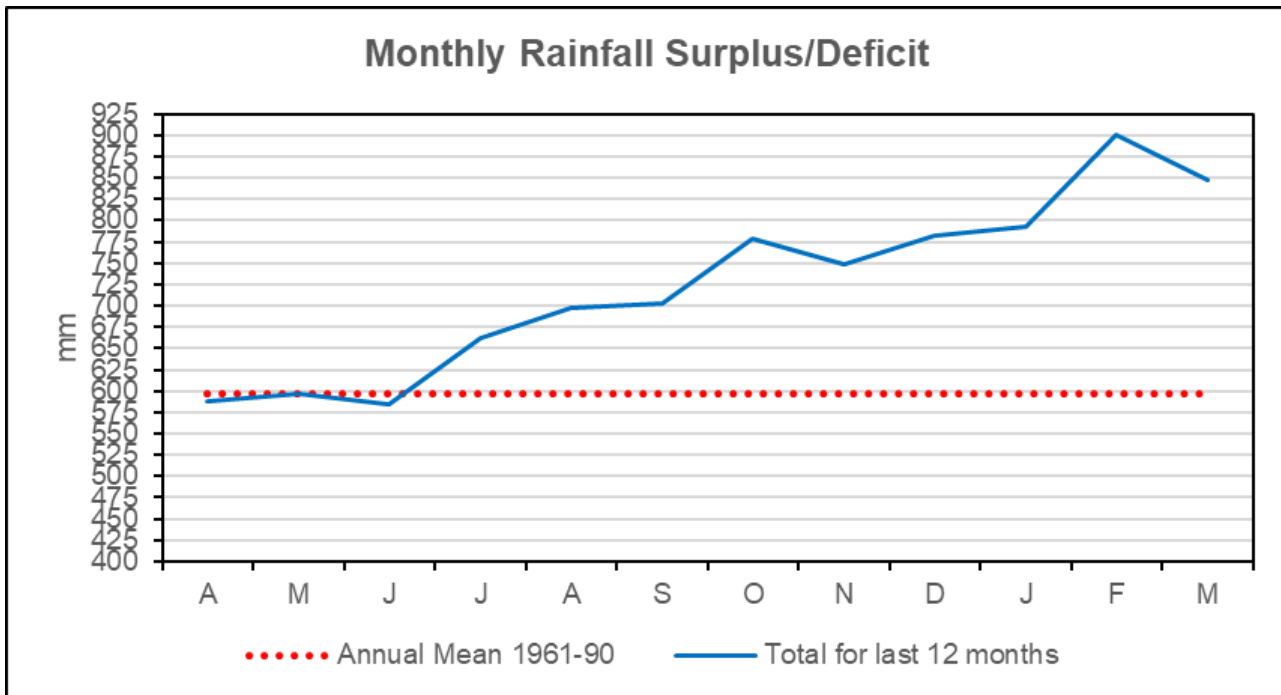
■ Above average rainfall ■ Below average rainfall





HadUK rainfall data. (Source: Met Office. Crown copyright, 2024).

2.3 Monthly rainfall surplus deficit chart

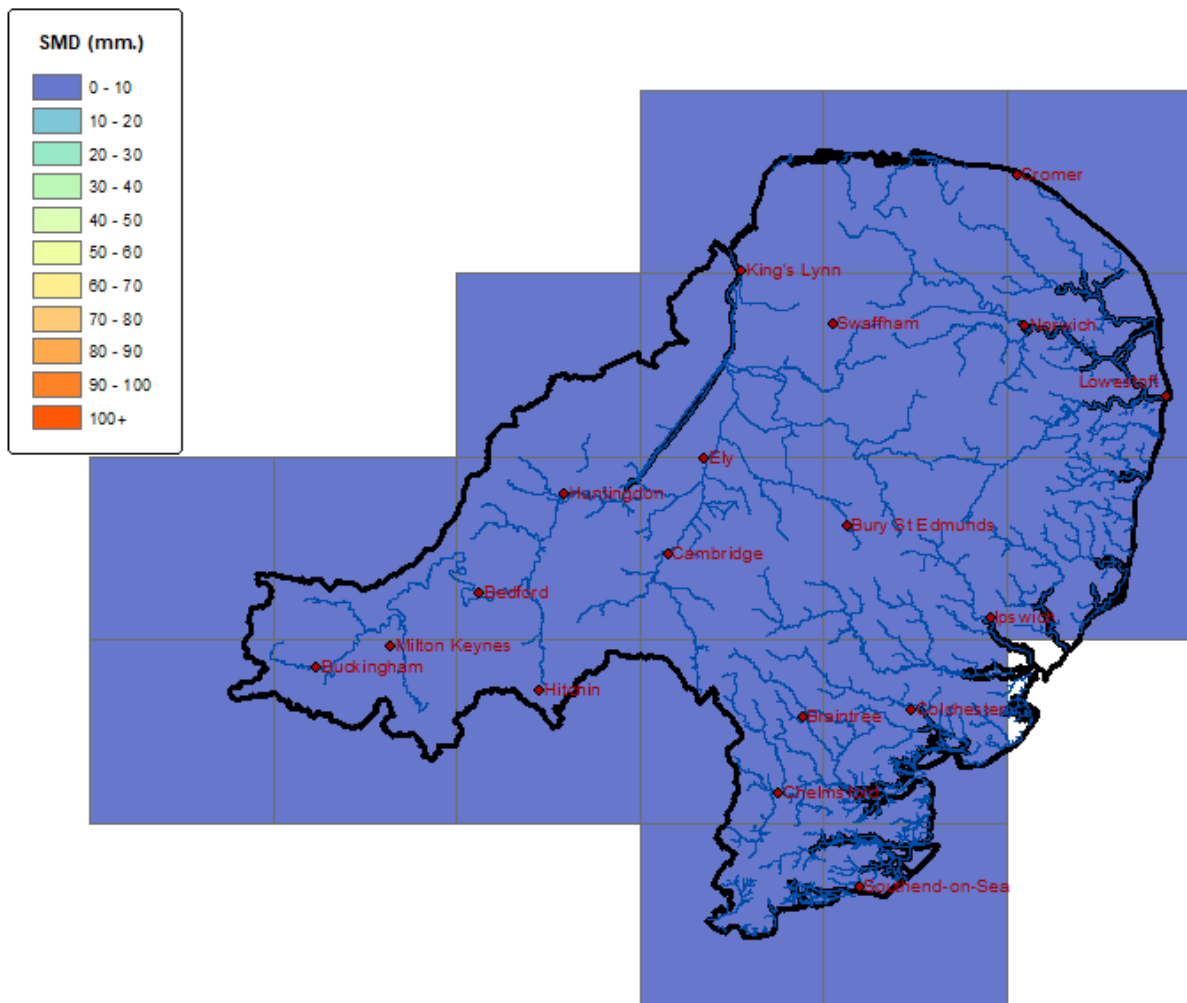


HadUK rainfall data. (Source: Met Office. Crown copyright, 2024).

3 Soil moisture deficit

3.1 Soil moisture deficit map

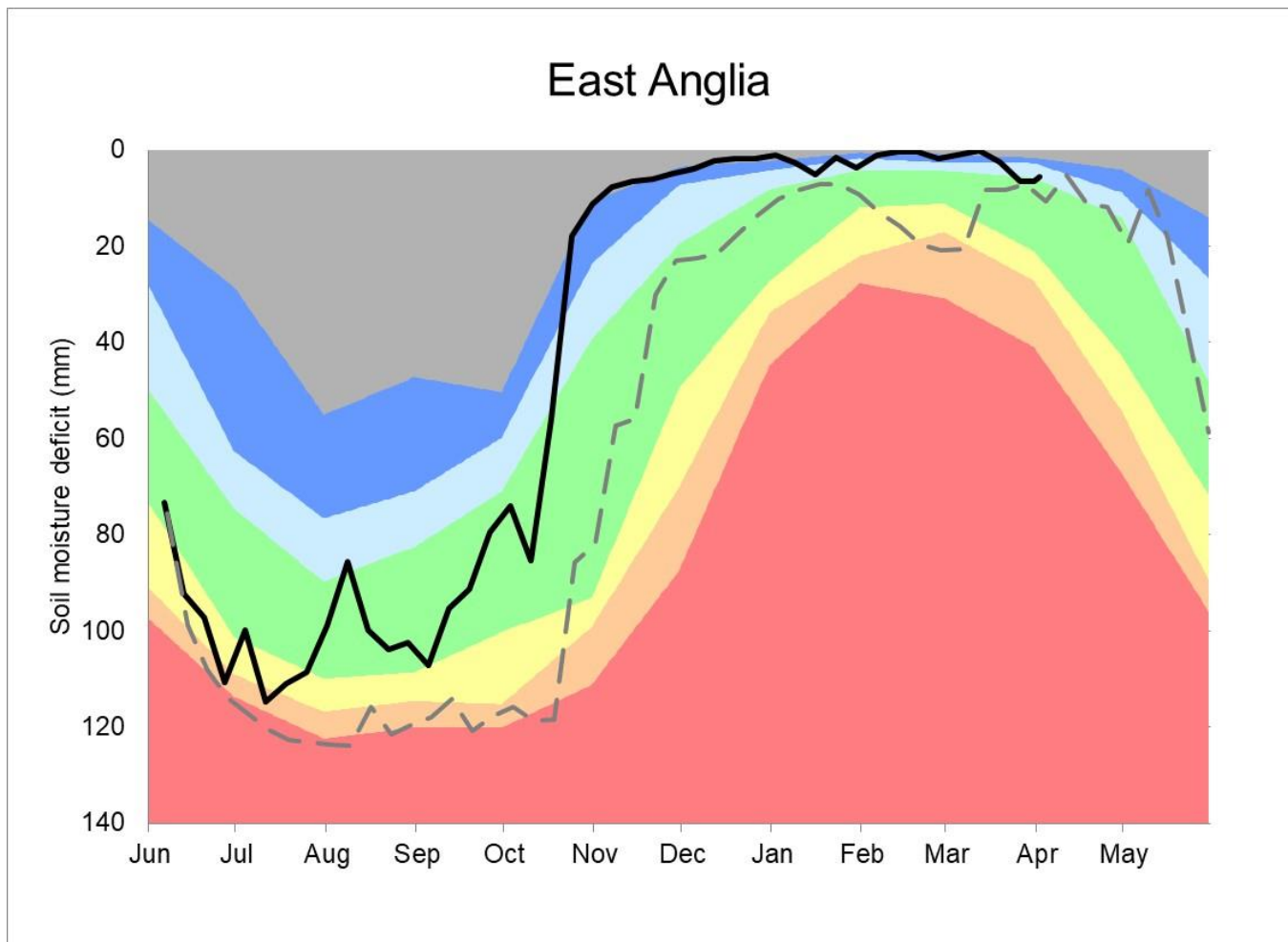
Figure 3.1: Soil moisture deficit values for 31 March 2024. Values based on the weekly MORECS data for real land use.



(Source: Met Office. Crown copyright, 2024). All rights reserved. Environment Agency, 100024198, 2024.

3.2 Soil moisture deficit charts

Figure 3.2: Latest soil moisture deficit compared to an analysis of historic 1961 to 1990 long term data set. Weekly MORECS data for real land use.

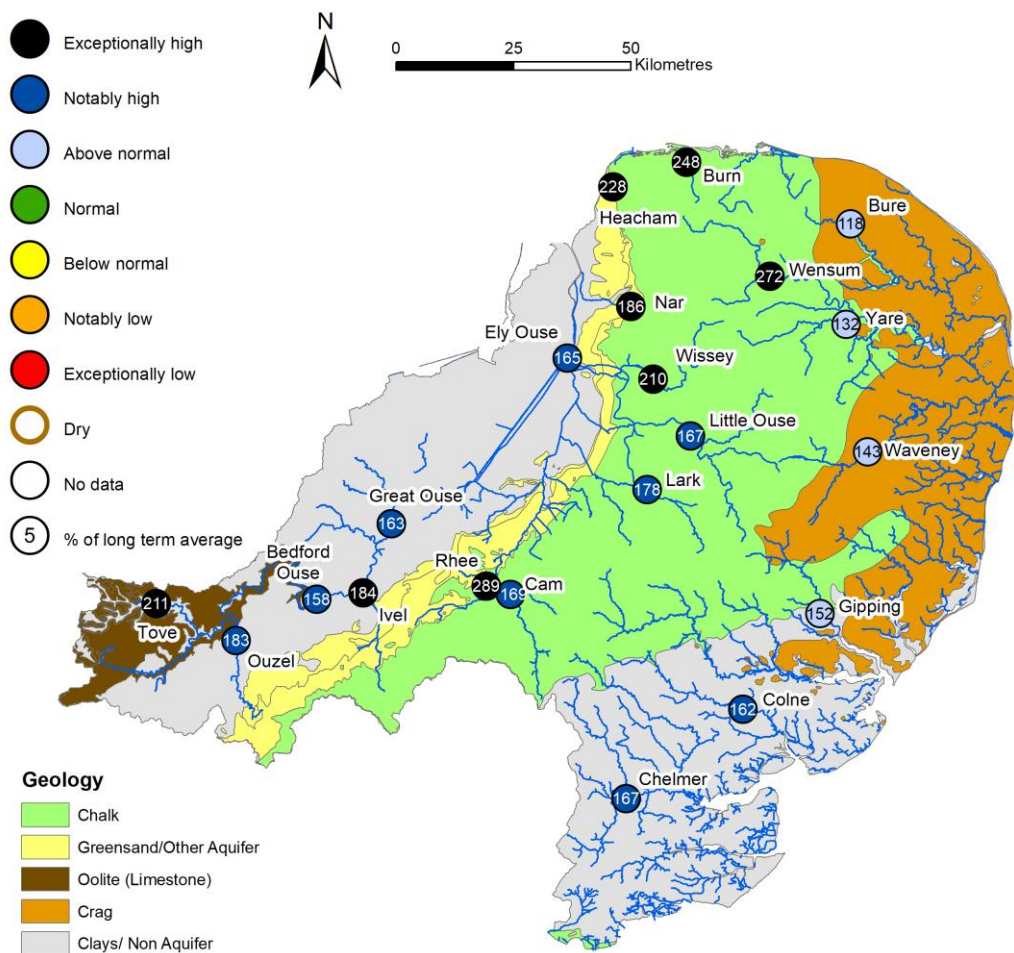


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4 River flows

4.1 River flows map

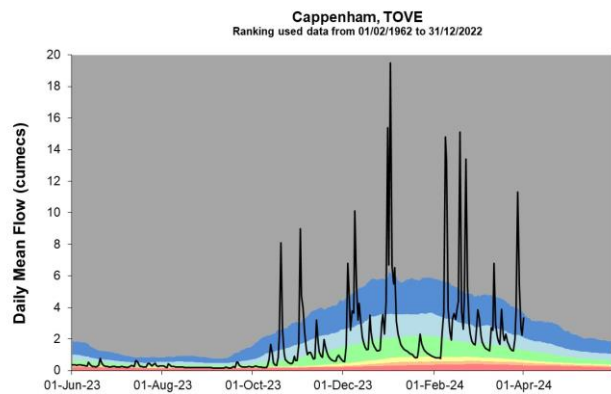
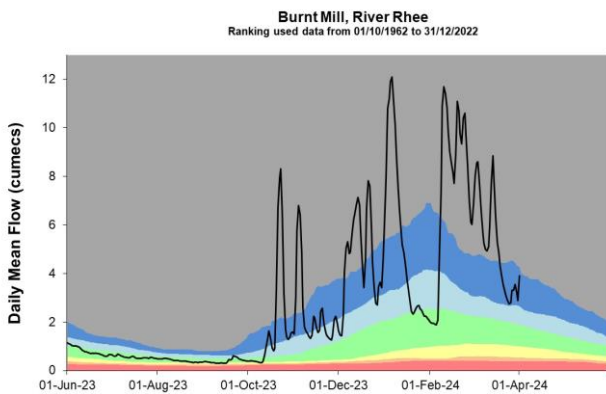
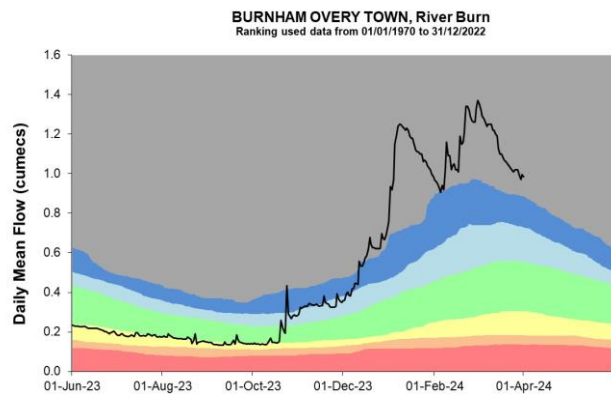
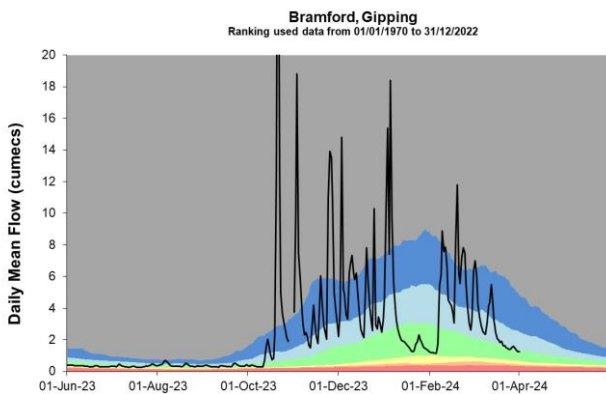
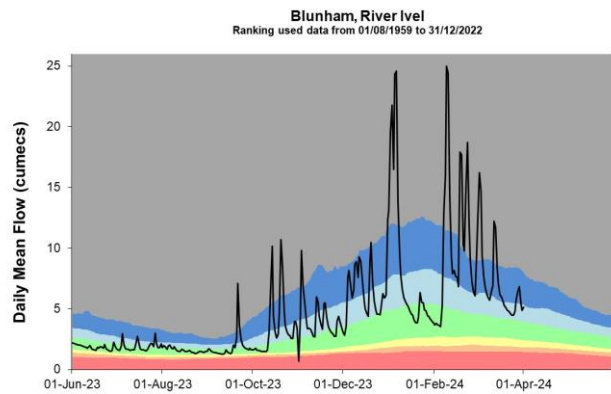
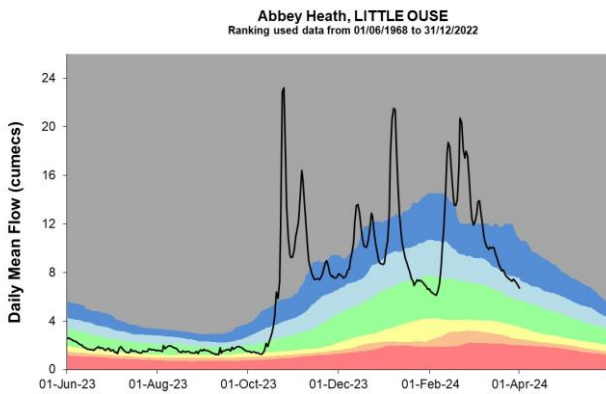
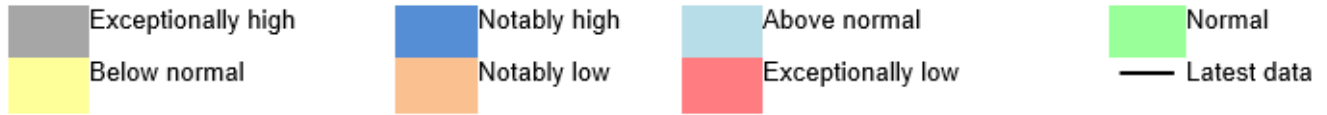
Figure 4.1: Monthly mean river flow for indicator sites for March 2024, expressed as a percentage of the respective long term average and classed relative to an analysis of historic March monthly means Table available in the appendices with detailed information.



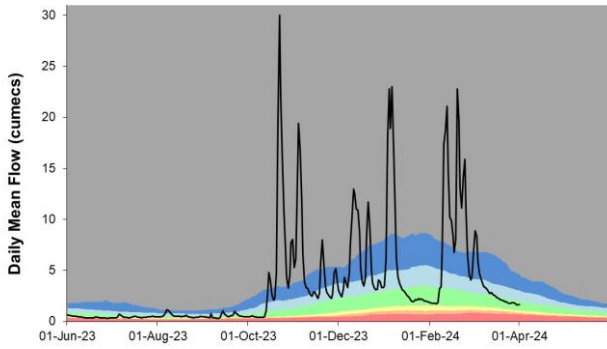
(Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS copyright NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2024.

4.2 River flow charts

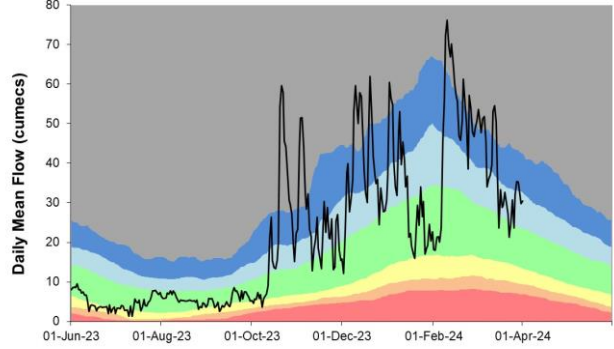
Figure 4.2: Daily mean river flow for index sites over the past year, compared to an analysis of historic daily mean flows, and long term maximum and minimum flows.



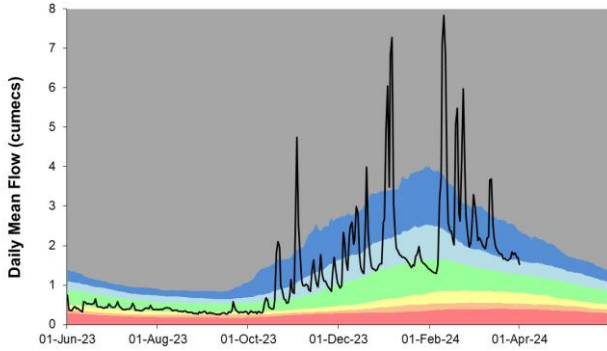
COLNEY, River Yare
Ranking used data from 01/01/1970 to 31/12/2022



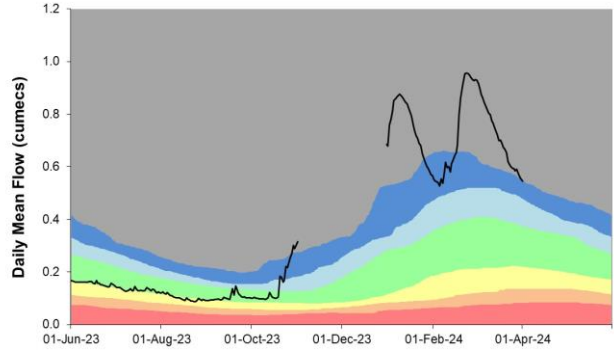
Denver, ELY OUSE
Ranking used data from 01/11/1971 to 31/12/2022



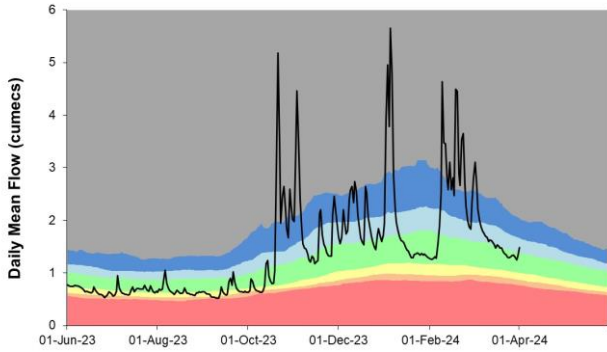
Dernford, CAM
Ranking used data from 21/02/1949 to 23/12/2022



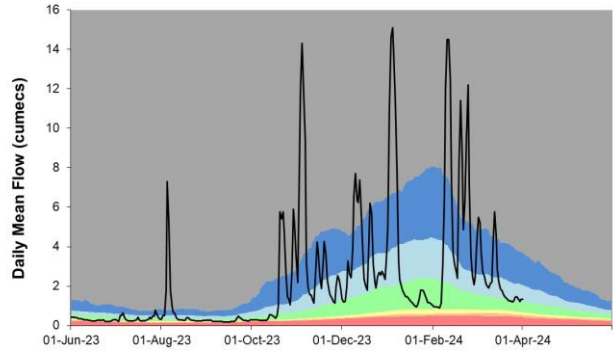
Heacham, HEACHAM
Ranking used data from 01/11/1965 to 31/12/2022



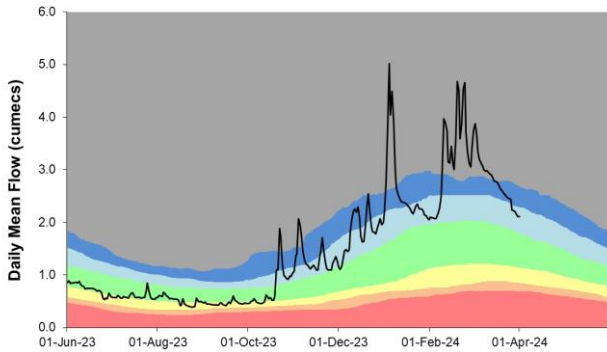
Ingworth, Bure
Ranking used data from 01/01/1970 to 31/12/2022



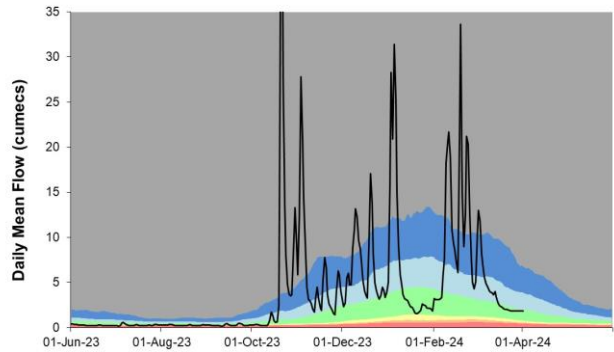
Lexden, Colne
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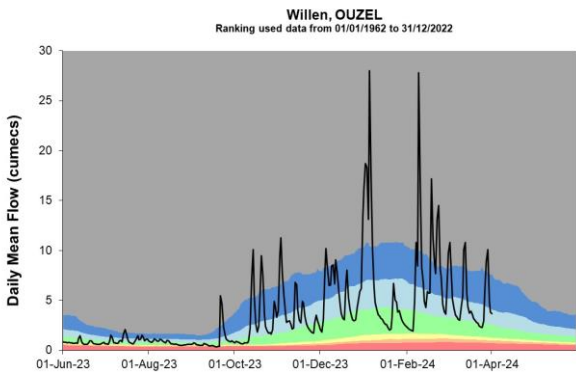
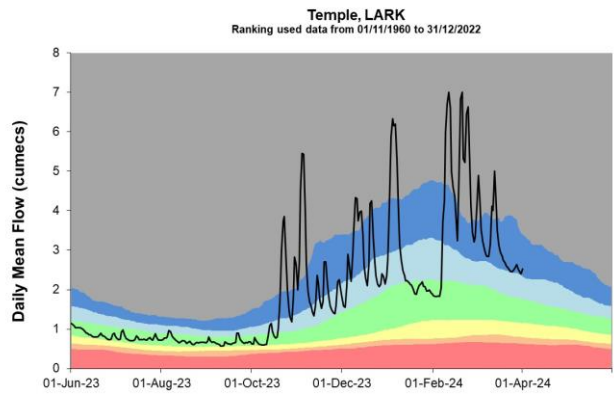
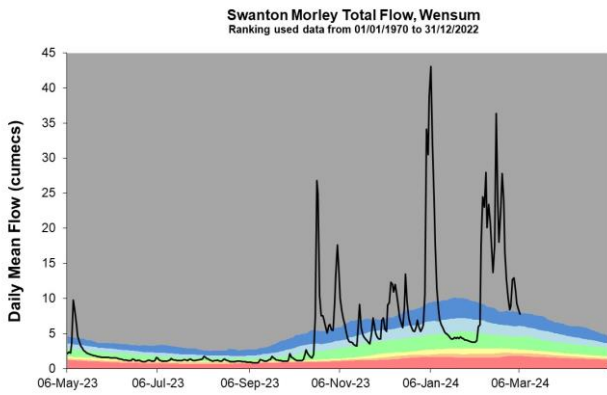
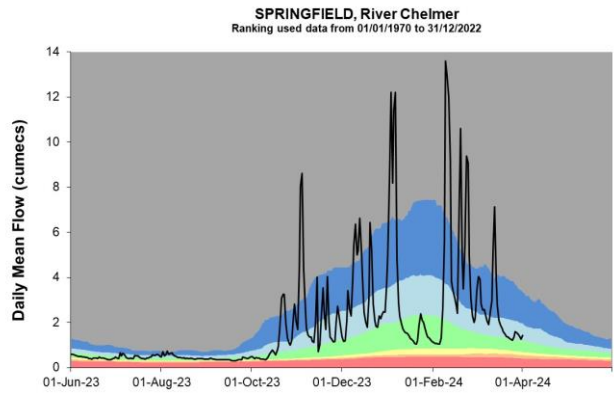
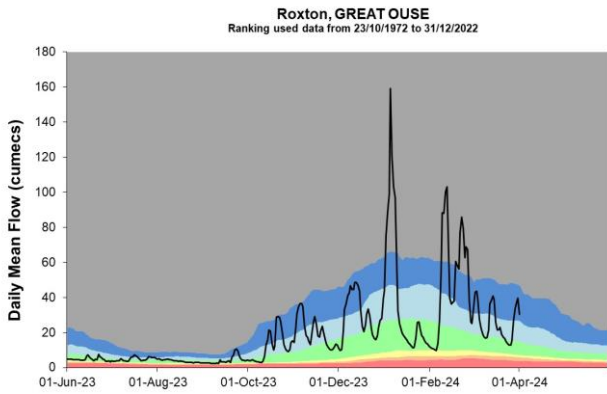
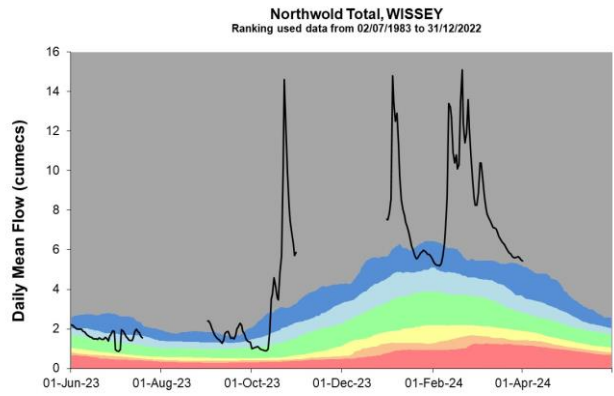
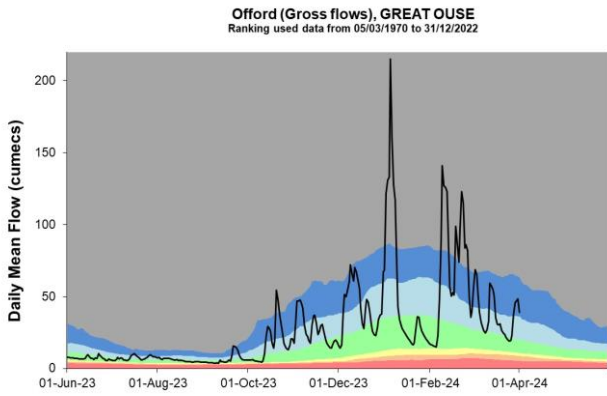


Marham, River Nar
Ranking used data from 01/09/1953 to 31/12/2022



Needham Weir Total, Waveney
Ranking used data from 01/01/1970 to 31/12/2022



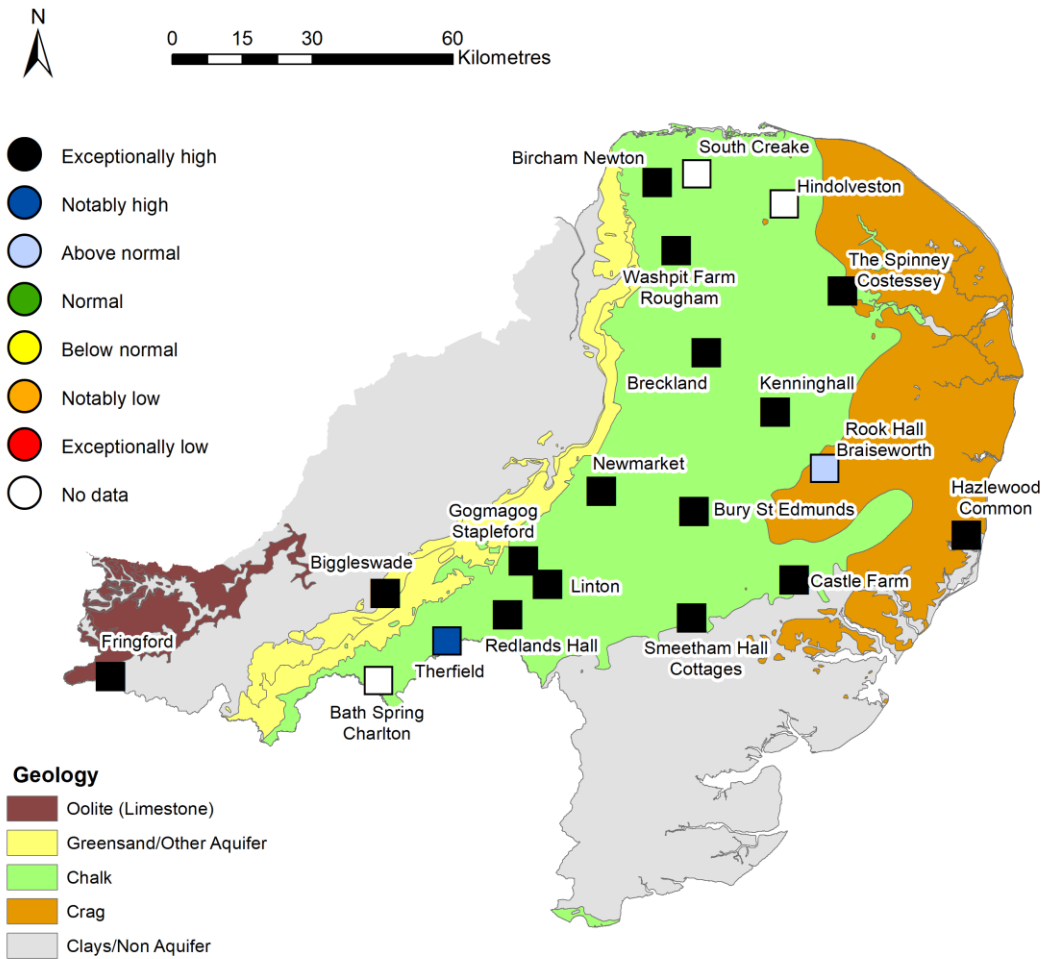


Source: Environment Agency.

5 Groundwater levels

5.1 Groundwater levels map

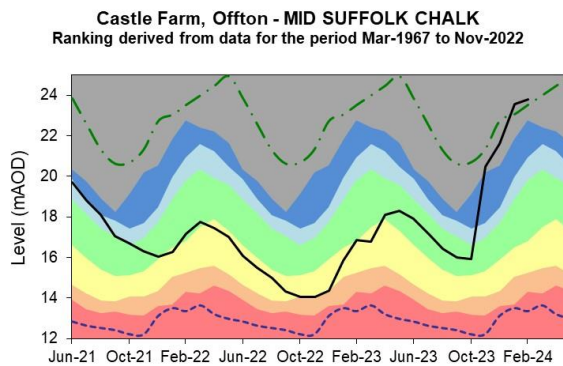
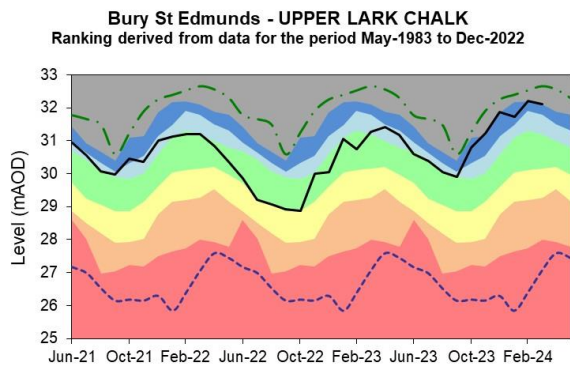
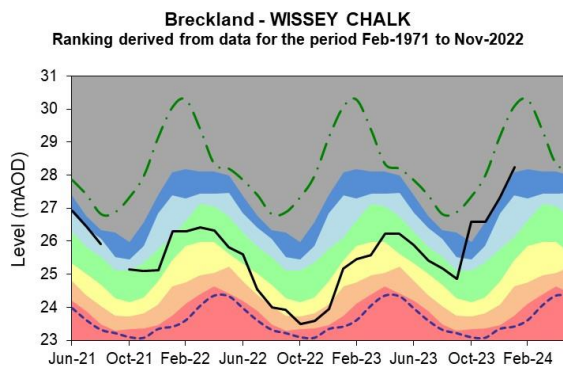
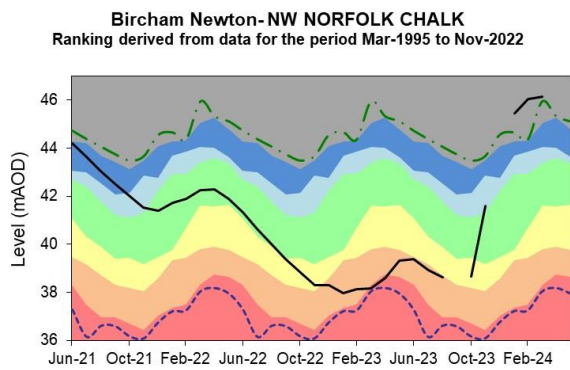
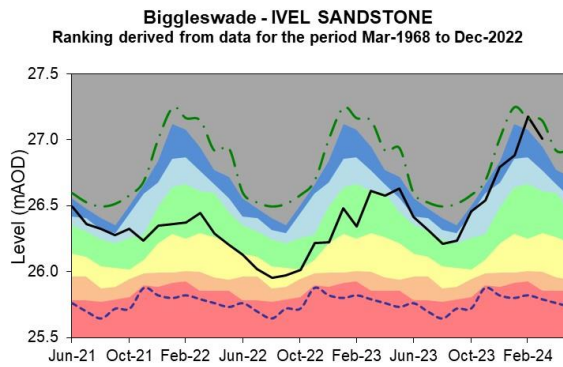
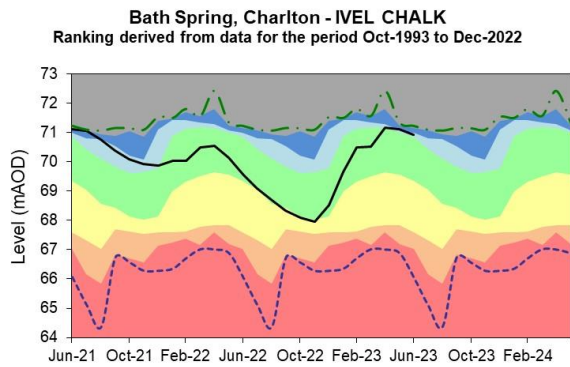
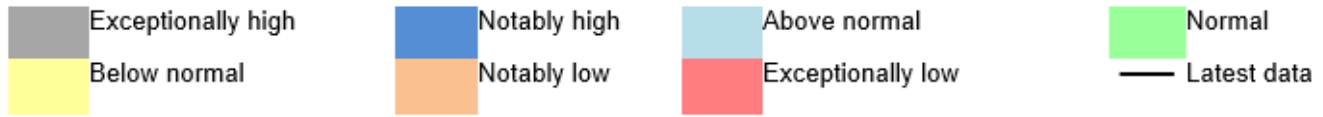
Figure 5.1: Groundwater levels for indicator sites at the end of March 2024, classed relative to an analysis of respective historic March levels. Table available in the appendices with detailed information.



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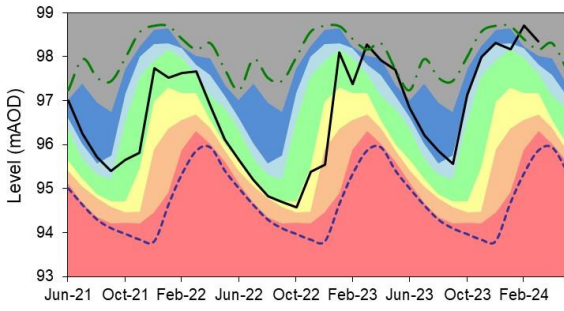
5.2 Groundwater level charts

Figure 5.2: End of month groundwater levels at index groundwater level sites for major aquifers. 22 months compared to an analysis of historic end of month levels and long term maximum and minimum levels.



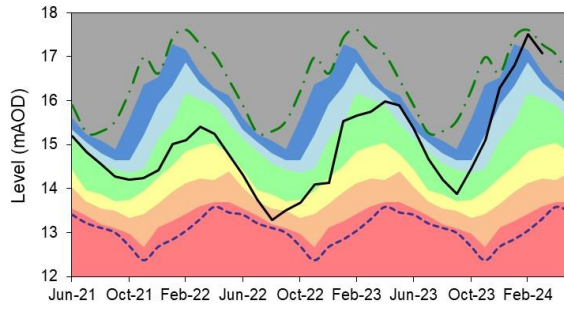
Fringford - GREAT OOLITE

Ranking derived from data for the period Sep-1980 to Dec-2022



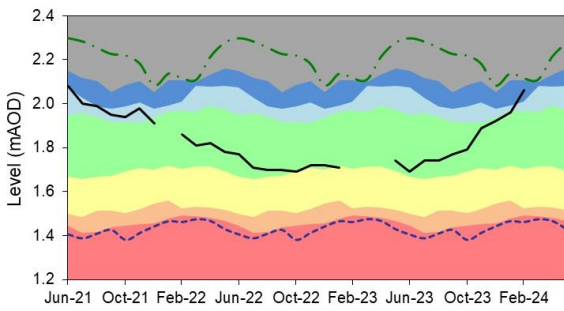
Gog Magog, Stapleford - CAM CHALK

Ranking derived from data for the period Jan-1980 to Dec-2022



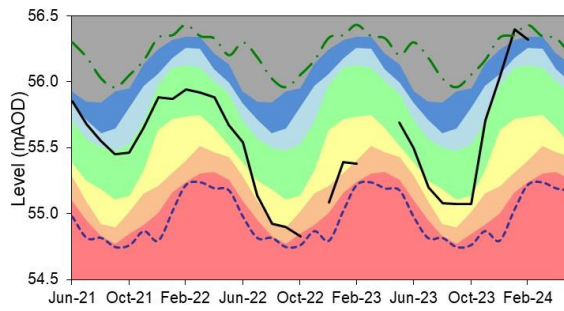
Hazlewood Common - SUFFOLK CRAG

Ranking derived from data for the period Oct-1988 to Nov-2022



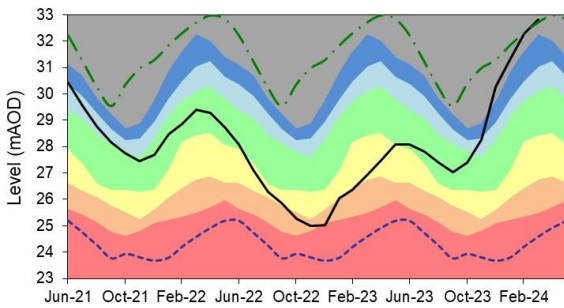
Hindolveston - NORFOLK CHALK

Ranking derived from data for the period Sep-1984 to Nov-2022



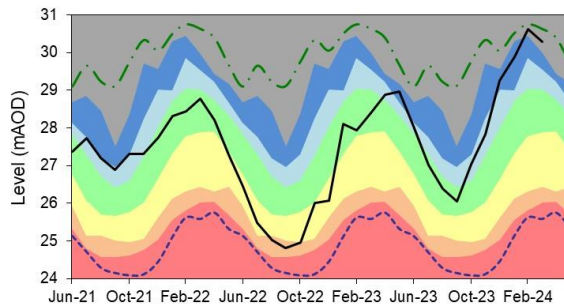
Kenninghall - LITTLE OUSE CHALK

Ranking derived from data for the period Aug-1973 to Dec-2022



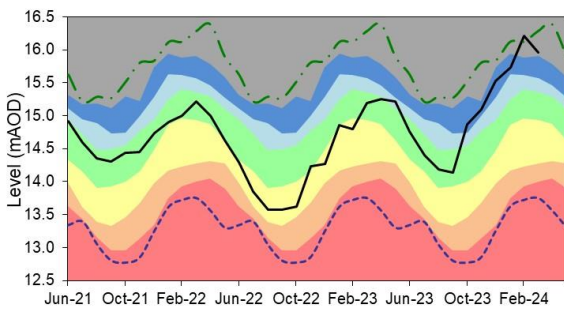
Linton - CAM CHALK

Ranking derived from data for the period Jan-1980 to Dec-2022



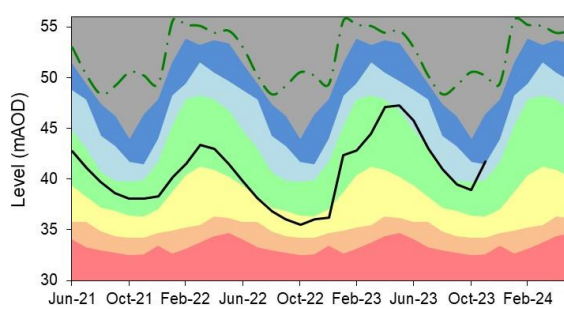
Newmarket - SNAIL CHALK

Ranking derived from data for the period Feb-1983 to Dec-2022

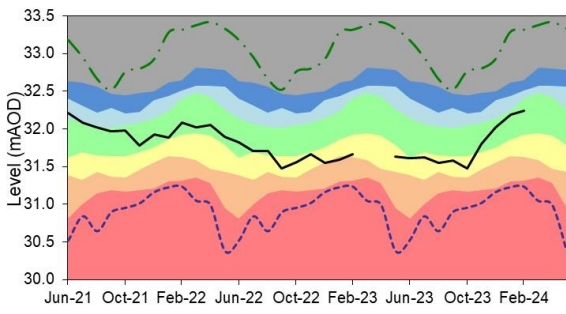


Redlands Hall, Ickleton - CAM CHALK

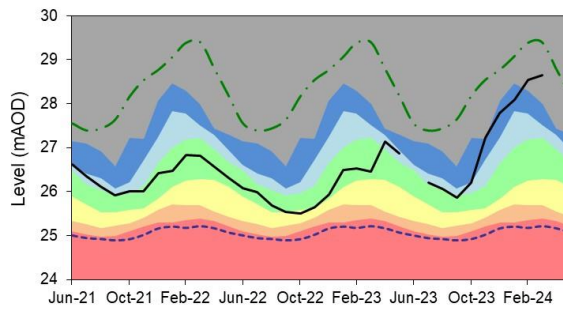
Ranking derived from data for the period Aug-1963 to Dec-2022



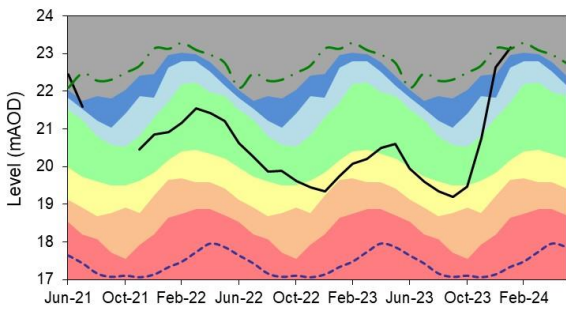
Rook Hall, Braiseworth-SUFFOLK CHALK
 Ranking derived from data for the period Jan-1980 to Nov-2022



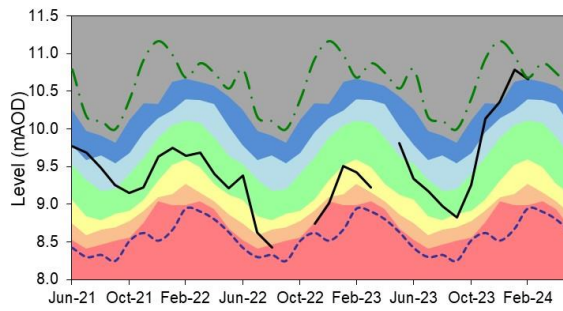
Smeetham Hall Cottages, Bulmer - ESSEX CHALK
 Ranking derived from data for the period Jan-1964 to Jul-2022



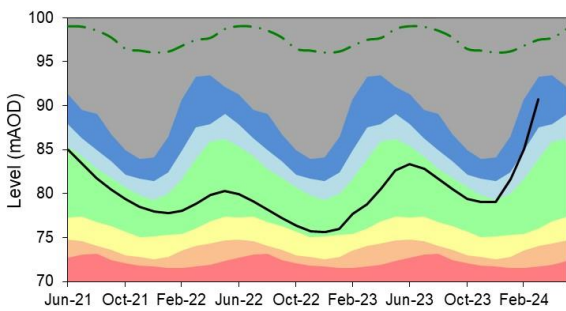
Old Primary School, South Creake, NORFOLK CHALK
 Ranking derived from data for the period Oct-1971 to Aug-2021



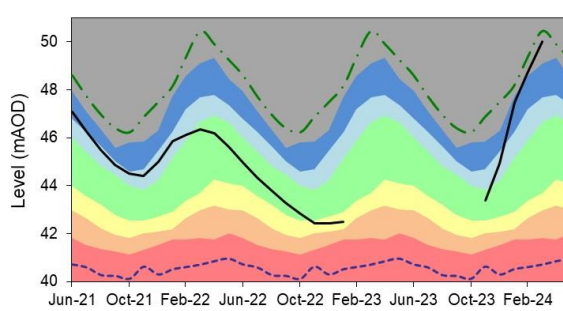
The Spinney, Costessey- WENSUM CHALK
 Ranking derived from data for the period Oct-1971 to Nov-2022



Therfield Rectory - N HERTS CHALK
 Ranking derived from data for the period Jan-1883 to Nov-2022



Washpit Farm, Rougham - NW NORFOLK CHALK
 Ranking derived from data for the period May-1950 to Dec-2022

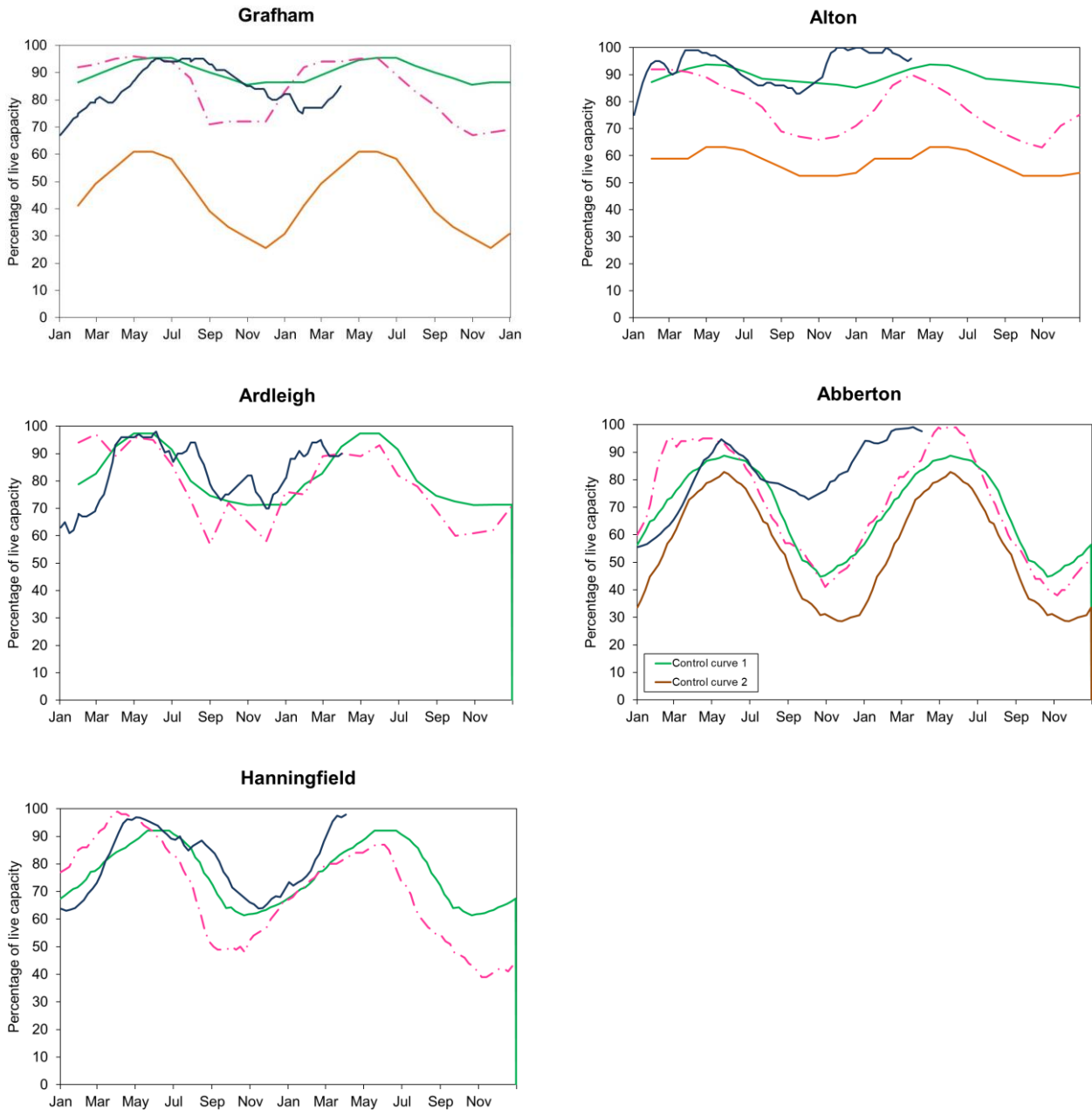


Source: Environment Agency, 2024.

6 Reservoir stocks

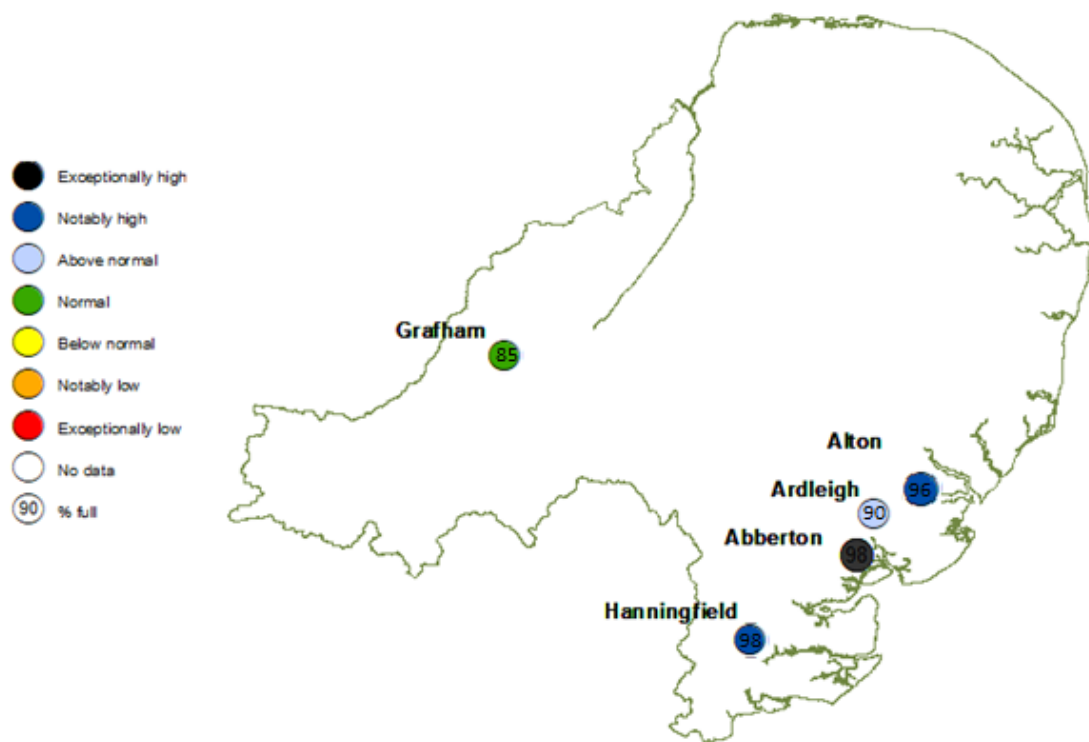
Figure 6.1: End of month regional reservoir stocks compared to the normal operating curve, drought curve and dry 1995-1996 stocks. Note: Historic records of individual reservoirs and reservoir groups making up the regional values vary in length.

— 2023-2024 — Normal Operating Curve — Drought Alert Curve - - 1995-1996



(Source: water companies).

6.1 Reservoir stocks map

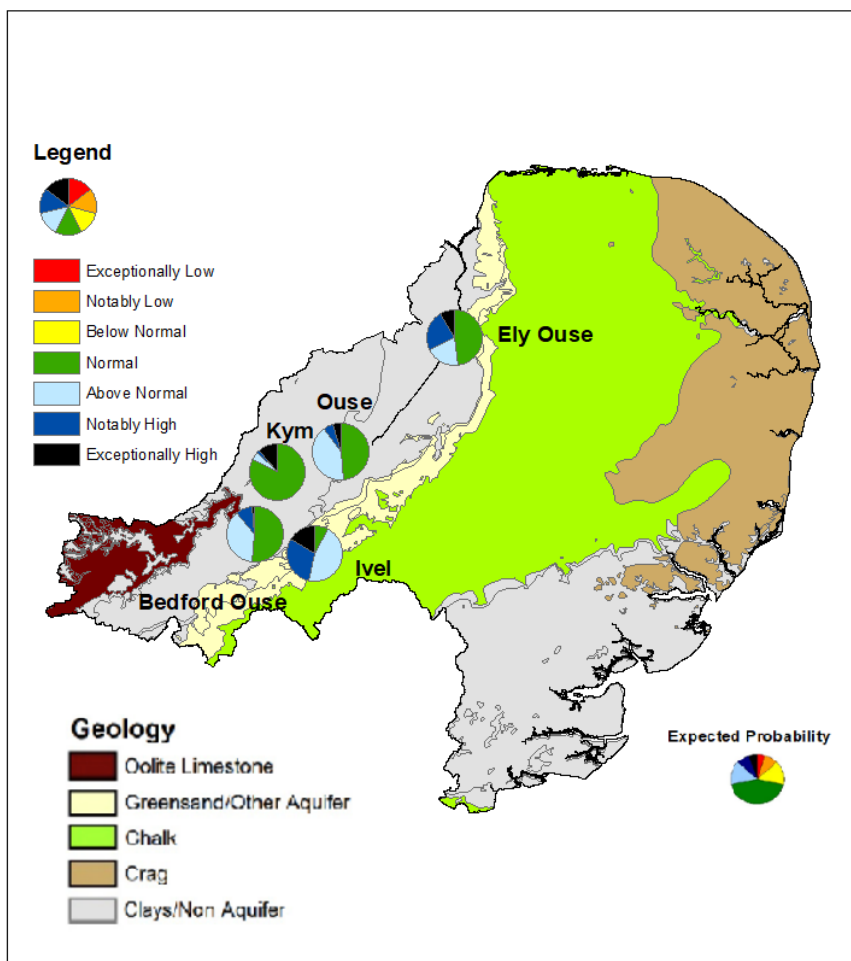


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7 Forward look

7.1 Probabilistic ensemble projection of river flows at key sites in June 2024

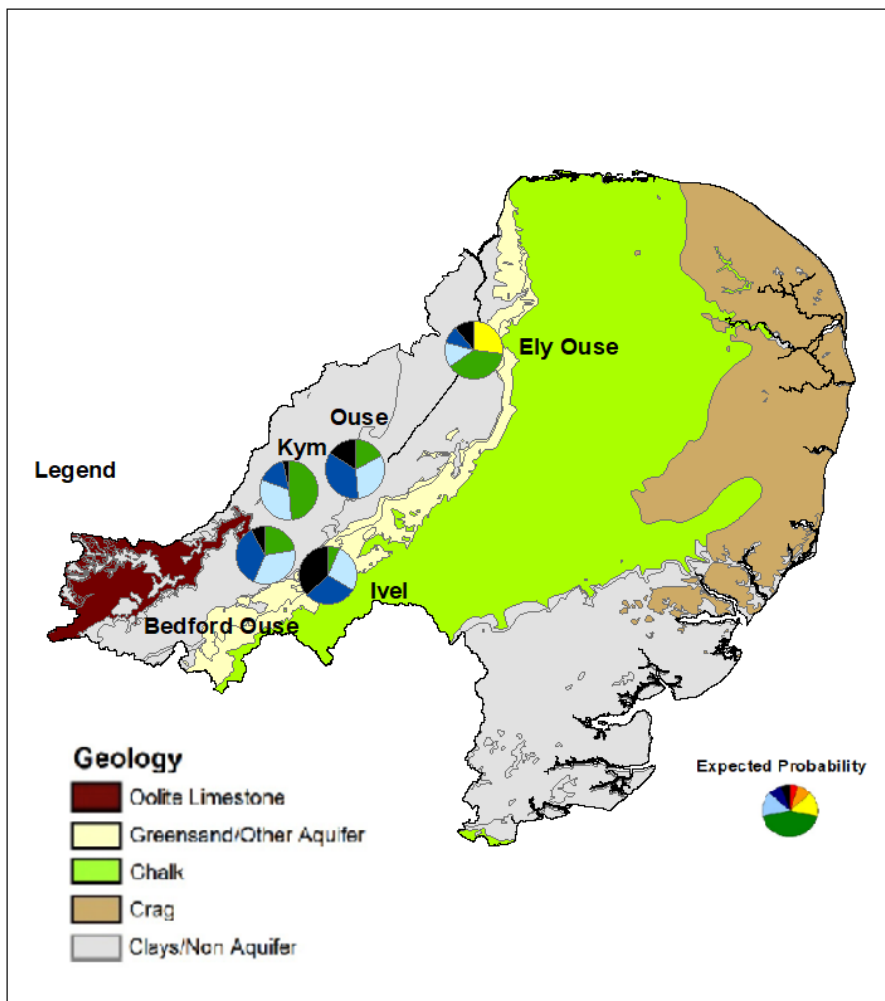
Table available in the appendices with detailed information. exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.



Pie charts indicate probability, based on climatology, of the surface water flow at each site being, for example, exceptionally low for the time of year. (Source: Centre for Ecology and Hydrology, Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100026380, 2024.

7.2 Probabilistic ensemble projection of river flows at key sites in September 2024

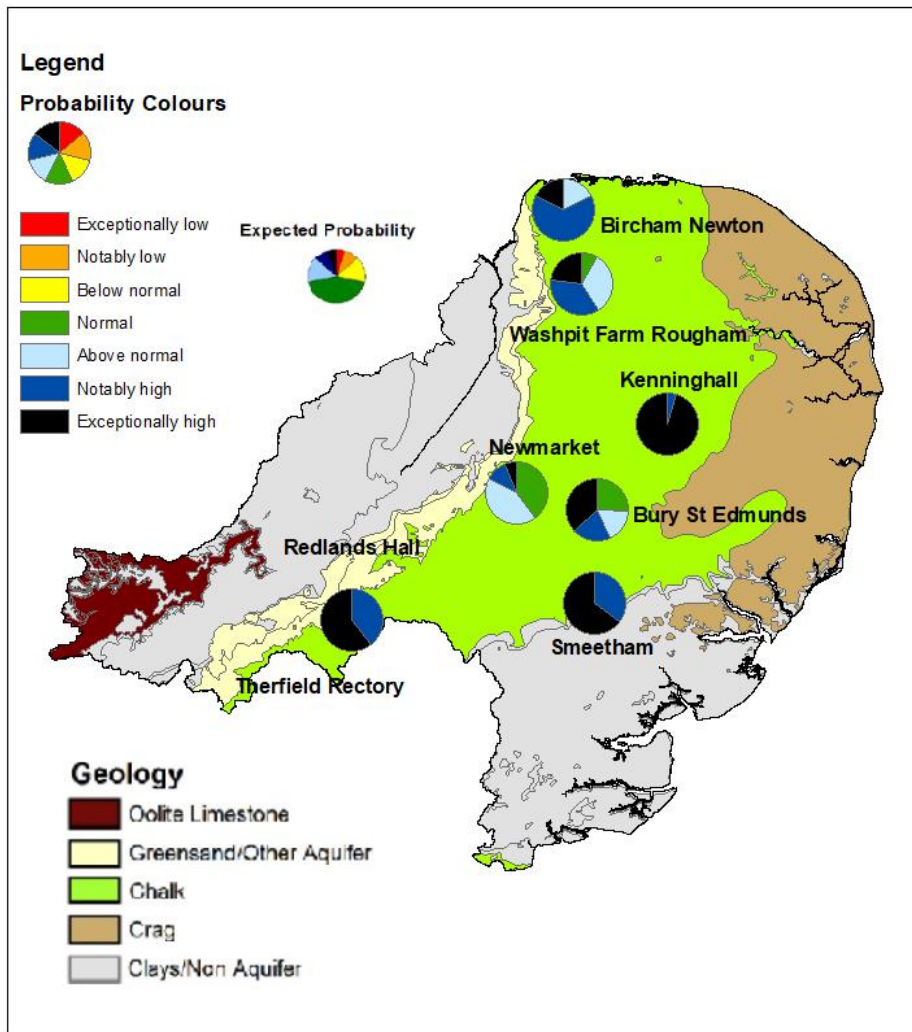
Table available in the appendices with detailed information. exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.



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7.3 Probabilistic ensemble projection of groundwater levels at key sites in September 2024

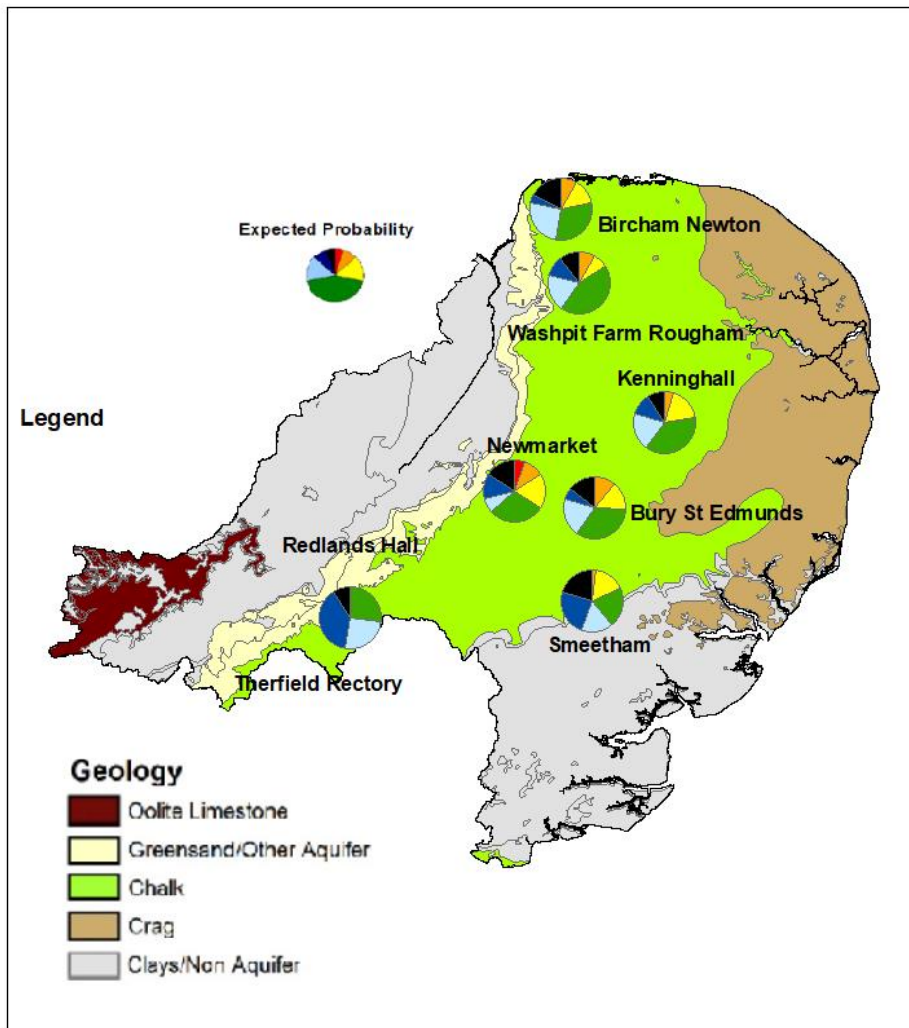
Table available in the appendices with detailed information. exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.



Pie charts indicate probability, based on climatology, of the groundwater level at each site being, for example, 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, 2024

7.4 Probabilistic ensemble projection of groundwater levels at key sites in March 2025

Table available in the appendices with detailed information. 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.



Pie charts indicate probability, based on climatology, of the groundwater level at each site being, for example, 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, 2024

8 Glossary

8.1 Terminology

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 and 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 to 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 by 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 (for example, 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).

8.2 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.

9 Appendices

9.1 Rainfall table

Hydrological area	Mar 2024 rainfall % of long term average 1961 to 1990	Mar 2024 band	Jan 2024 to March cumulative band	Oct 2023 to March cumulative band	Apr 2023 to March cumulative band
Broadland Rivers	77	Normal	Notably high	exceptionally high	exceptionally high
Cam	121	above Normal	exceptionally high	exceptionally high	exceptionally high
Central Area Fenland	109	Normal	exceptionally high	exceptionally high	exceptionally high
East Suffolk	86	Normal	Notably high	exceptionally high	exceptionally high
Little Ouse And Lark	87	Normal	exceptionally high	exceptionally high	exceptionally high
Lower Bedford Ouse	135	above Normal	exceptionally high	exceptionally high	exceptionally high
North Essex	107	Normal	Notably high	exceptionally high	exceptionally high
North Norfolk	74	Normal	exceptionally high	exceptionally high	exceptionally high
Nw Norfolk And Wissey	77	Normal	exceptionally high	exceptionally high	exceptionally high

South Essex	123	above Normal	Notably high	exceptionally high	above normal
Upper Bedford Ouse	149	Notably High	exceptionally high	exceptionally high	exceptionally high

9.2 River flows table

Site name	River	Catchment	Mar 2024 band	Feb 2024 band
Abbey Heath	Little Ouse	Little Ouse	Notably high	exceptionally high
Blunham	Ivel	Ivel	exceptionally high	exceptionally high
Bramford	Gipping	Gipping	above normal	Notably high
Burnham Overy	Burn	Burn	exceptionally high	exceptionally high
Burnt Mill	Rhee	Rhee	exceptionally high	exceptionally high
Cappenham	Tove	Tove	exceptionally high	exceptionally high
Colney	Yare	Yare	above normal	exceptionally high
Denver	Ely Ouse	Cutoff and Renew Channel	Notably high	Notably high
Dernford	Cam	Cam	Notably high	exceptionally high
Heacham	Heacham	Heacham	exceptionally high	exceptionally high
Ingworth	Bure	Bure	above normal	exceptionally high

Lexden	Colne	Colne Essex	Notably high	exceptionally high
Marham	Nar	Nar	exceptionally high	exceptionally high
Needham Weir Total	Waveney (lower)	Waveney	above normal	exceptionally high
Northwold Total	Wissey	Wissey	exceptionally high	
Offord (gross Flows)	Great Ouse	Ouse Beds	Notably high	exceptionally high
Roxton	Great Ouse	Ivel	Notably high	exceptionally high
Springfield	Chelmer	Chelmer Upper	Notably high	exceptionally high
Swanton Morley Total	Wensum	Wensum	exceptionally high	exceptionally high
Temple	Lark	Lark	Notably high	exceptionally high
Willen	Ouzel	Ouzel	Notably high	exceptionally high

9.3 Groundwater table

Site name	Aquifer	End of Mar 2024 band	End of Feb 2024 band
Biggleswade	Ivel Woburn Sands	exceptionally high	exceptionally high
Bircham Newton	North West Norfolk Chalk	exceptionally high	exceptionally high
Breckland	Wissey Chalk		
Bury St Edmunds	Upper Lark Chalk	exceptionally high	exceptionally high
Castle Farm, Offton	East Suffolk Chalk		exceptionally high
Gog Magog, Stapleford	Cam Chalk	exceptionally high	exceptionally high
Hazlewood Common	East Suffolk Crag		Notably high
Hindolveston	Norfolk Chalk		Notably high
Kenninghall	Little Ouse Chalk	exceptionally high	exceptionally high
Linton	Cam Chalk	exceptionally high	exceptionally high
Newmarket	Snail Chalk	exceptionally high	exceptionally high

Old Primary School, South Creake	North Norfolk Chalk		
Redlands Hall, Ickleton	Cam Chalk		
Rook Hall, Braiseworth	East Suffolk Chalk		Normal
Smeetham Hall Cottages, Bulmer	North Essex Chalk	exceptionally high	exceptionally high
The Spinney, Costessey	Wensum Chalk		Notably high
Washpit Farm, Rougham	North West Norfolk Chalk	exceptionally high	exceptionally high
Therfield Rectory	Upper Lee Chalk	Notably high	Notably high
Fringford P.s.	Upper Bedford Ouse Oolitic Limestone (great)	exceptionally high	exceptionally high

9.4 Ensemble projections tables

9.4.1 Probabilistic ensemble projection of river flows at key sites in June 2024

Percentage of pie chart for each band

Site	Bedford Ouse	Kym	Ivel	Ouse	Ely Ouse
exceptionally low	0	0	0	0	0
Notably low	0	0	0	0	0
below normal	0	0	0	0	0
Normal	52	82	8	48	48
above normal	37	5	45	42	20
Notably high	10	2	31	5	23
exceptionally high	2	11	16	5	9

9.4.2 Probabilistic ensemble projection of river flows at key sites in September 2024

Percentage of pie chart for each band

Site	Bedford Ouse	Kym	Ivel	Ouse	Ely Ouse
exceptionally low	0	0	0	0	0
Notably low	0	0	0	0	0
below normal	0	0	0	0	27
Normal	23	48	6	18	39
above normal	34	32	27	31	14
Notably high	35	16	29	35	9
exceptionally high	8	3	37	16	11

9.4.3 Probabilistic ensemble projection of groundwater levels at key sites in September 2024

Percentage of pie chart for each band

Site	Therfield Rectory	Newmarket	Washpit Farm	Bircham Newton	Kenninghall	Bury St Edmunds	Smeetham
exceptionally low	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Notably low	0.0	0.0	0.0	0.0	0.0	0.0	0.0
below normal	0.0	0.0	87.5	0.0	0.0	0.0	0.0
Normal	0.0	51.3	12.5	0.0	0.0	46.2	0.0
above normal	0.0	35.9	0.0	59.3	0.0	20.5	0.0
Notably high	39.3	7.7	0.0	29.6	2.0	10.3	46.6
exceptionally high	60.7	5.1	0.0	11.1	98.0	23.1	53.4

9.4.4 Probabilistic ensemble projection of groundwater levels at key sites in March 2025

Percentage of pie chart for each band

Site	Therfield Rectory	Newmarket	Washpit Farm	Bircham Newton	Kenninghall	Bury St Edmunds	Smeetham
exceptionally low	0.0	7.1	0.0	0.0	0.0	0.0	0.0
Notably low	0.0	9.5	12.5	7.4	4.1	12.8	1.7
below normal	0.0	16.7	12.5	14.8	18.4	12.8	17.2
Normal	29.5	28.6	59.4	29.6	36.7	33.3	20.7
above normal	24.6	7.1	3.1	22.2	18.4	17.9	15.5
Notably high	37.7	14.3	9.4	3.7	12.2	5.1	24.1
exceptionally high	8.2	16.7	3.1	22.2	10.2	17.9	20.7