

Monthly water situation report: East Anglia

1 Summary - June 2023

Following on from the high pressure weather dominating East Anglia in late May, the dry conditions have persisted and very little rainfall has fallen throughout June. River flows had already receded to their baseflows, and remain at these levels with only short flow increases coinciding with what little precipitation fell. The lack of significant groundwater recharge continues to cause groundwater levels to recede at most locations.

1.1 Rainfall

This June has been particularly dry compared to previous years, falling just short from half of the month's long term average [LTA]. Rainfall events occurred on the 18th, 19th, 22nd and 28th, totalling 25mm of precipitation overall.

1.2 Soil moisture deficit and recharge

The soil moisture deficits [SMD] continued to rapidly increase following on from the dry weather in late May. In response to the rainfall events, the deficit was reduced for a few days, but soon began to rapidly increase again afterwards.

1.3 River flows

Many sites saw a slight response to the rainfall events that occurred, with exception to the more baseflow driven sites in the north and northwest. Besides this, rivers have been reduced to baseflow due to the continuous dry weather.

1.4 Groundwater levels

By the end of June, groundwater levels at all indicator boreholes had begun to decline, as expected at this time of year with little groundwater recharge occurring.

1.5 Reservoir stocks

All reservoirs stocks have now stopped increasing and have now either stabilised or slowly begun to decline. Rutland, Covenham, Alton, Ardleigh and Hanningfield have all fallen noticeably below their operational control curves. Grafham is also below the control curve, but is close and not currently declining.

1.6 Environmental impact

June has marked the beginning of the operational support season. Snailwell, Dungate farm and Chippenham from the Lodes-Granta scheme have all been receiving varying degrees of support, and the Ely Ouse to Essex Transfer Scheme is continuing to pump at a low rate.

Multiple fish deaths have been reported to have occurred in the River Cam during June. Though the reason is not certain, algal blooms caused by the hot weather and subsequent hypoxic conditions may be the cause.

1.7 Forward look: Probabilistic ensemble projections for groundwater levels in key aquifers

For September 2023, most sites are showing an increased probability of normal levels. The only exception is Bircham Newton which shows increased probability of below normal flows.

For March 2024, most sites show an increased probability of normal levels and above. Notably, Newmarket, Smeetham and Therfield all show an increased probability of above normal levels. Kenninghall, Bury St Edmonds and Bircham Newton show an increased probability of lower than normal levels. Redlands Hall shows an increased probability of normal flows.

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*[SMD]: soil moisture deficits

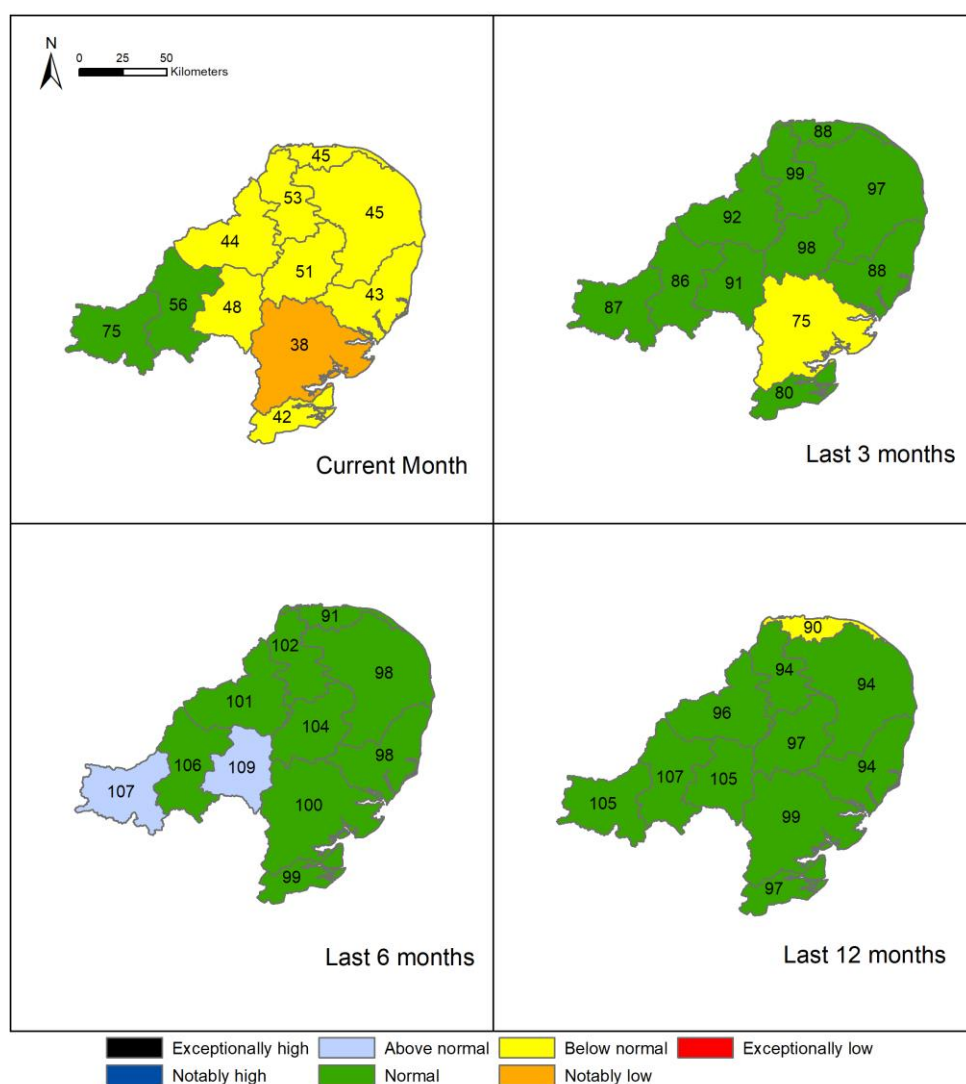
*[LTA]: long term average

Contact Details: 03708 506 506

2 Rainfall

2.1 Rainfall map

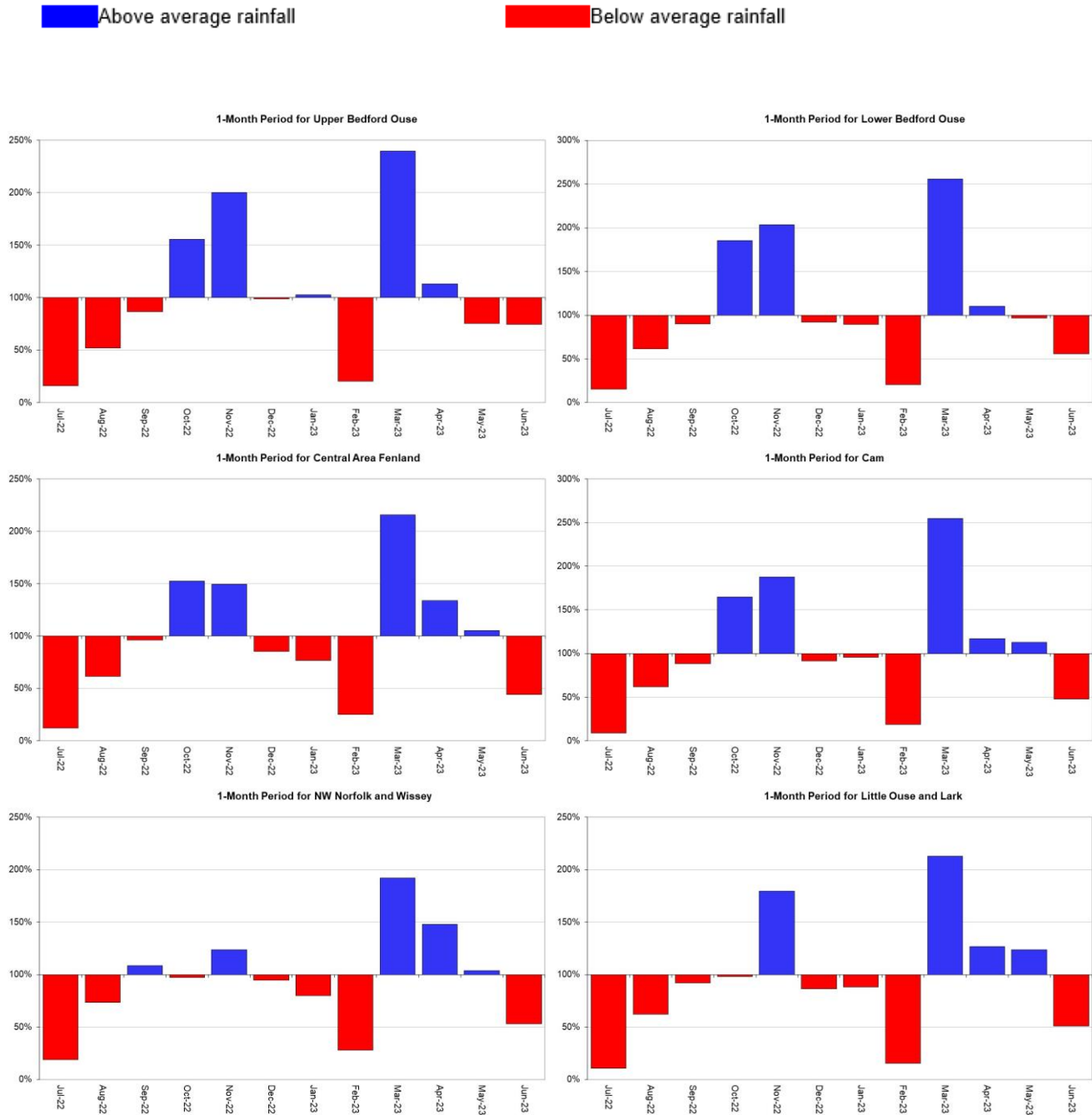
Figure 2.1: Total rainfall for hydrological areas across East Anglia, expressed as a percentage of long term average rainfall for the current month (up to 30 June 2023), the last 3 months, the last 6 months, and the last 12 months. Category classes are based on an analysis of respective historic totals. Table available in the appendices with detailed information.

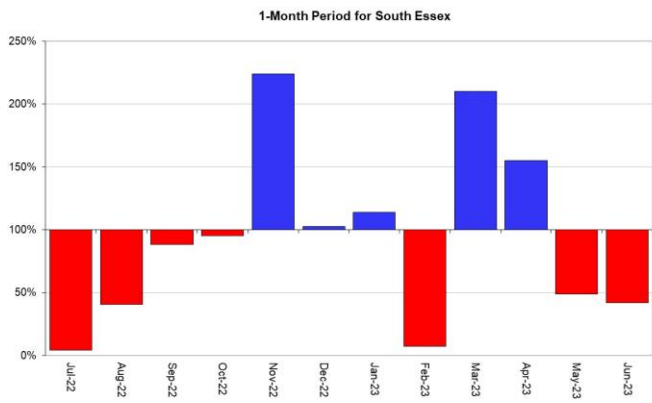
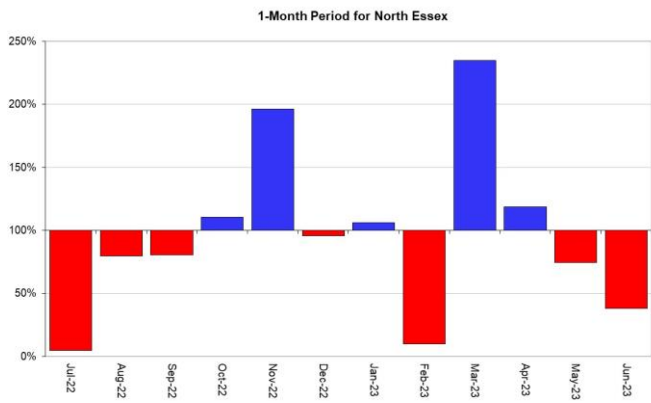
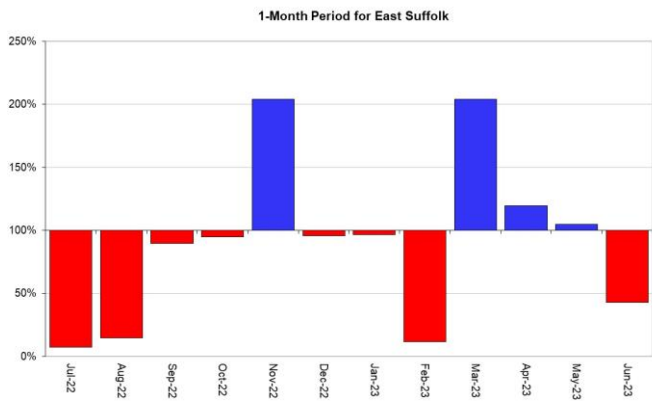
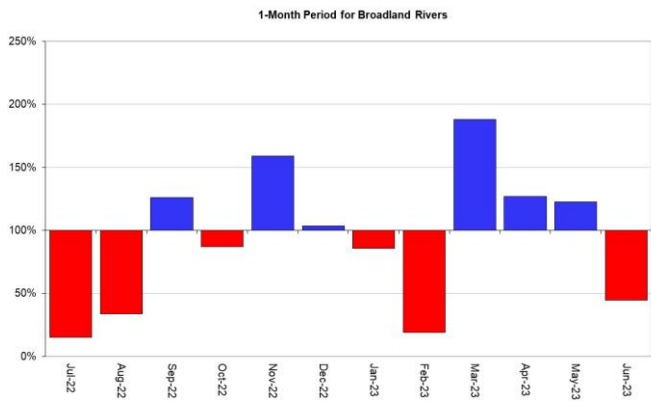
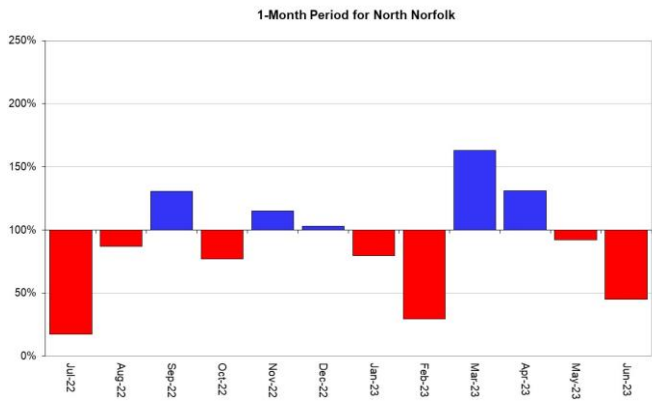


HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges (Source: Met Office. Crown copyright, 2023). Provisional data based on Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. Crown copyright. All rights reserved. Environment Agency, 100024198, 2023.

2.2 Rainfall charts

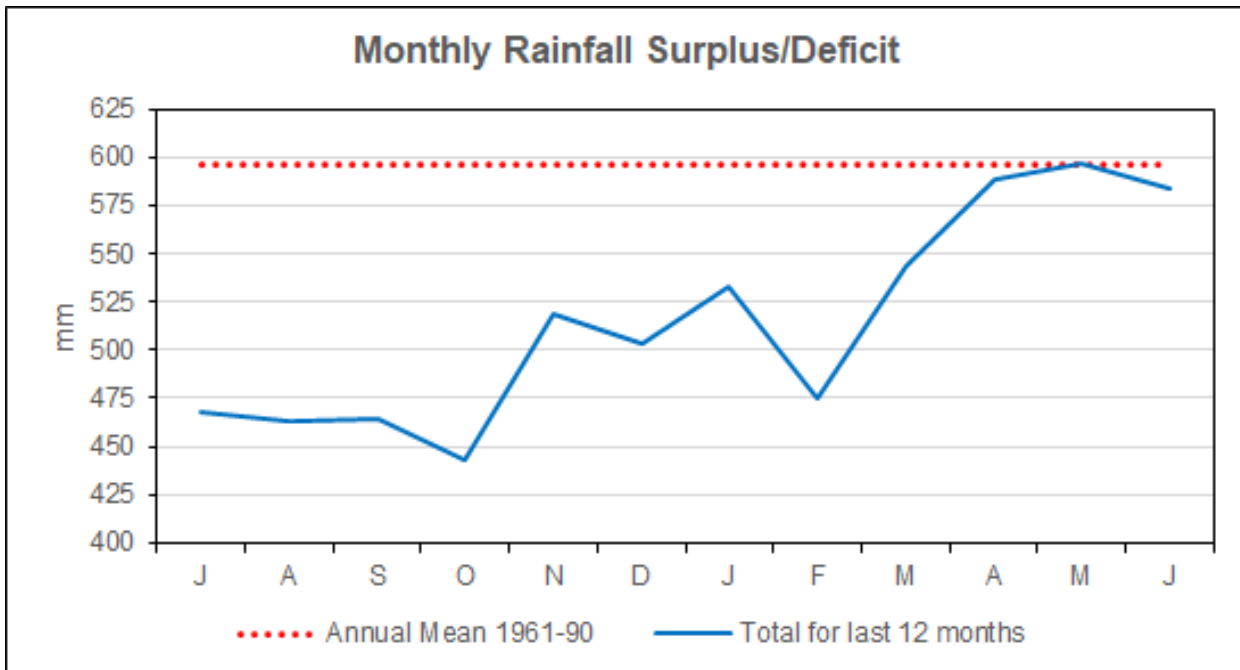
Figure 2.2: Monthly rainfall totals for the past 12 months as a percentage of the 1961 to 1990 long term average for each region and for England.





HadUK rainfall data. (Source: Met Office. Crown copyright, 2023).

2.3 Monthly rainfall surplus deficit chart

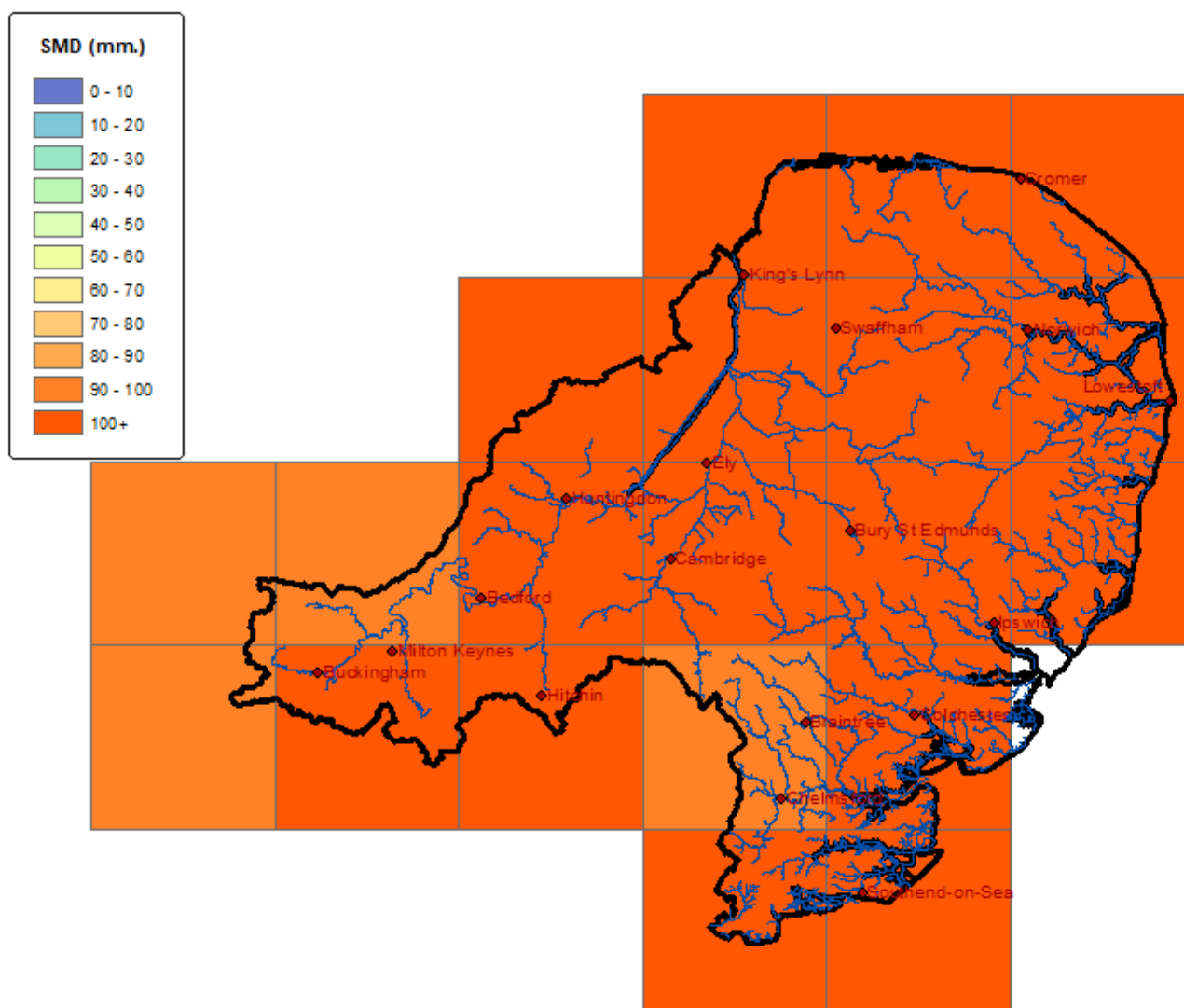


HadUK rainfall data. (Source: Met Office. Crown copyright, 2023).

3 Soil moisture deficit

3.1 Soil moisture deficit map

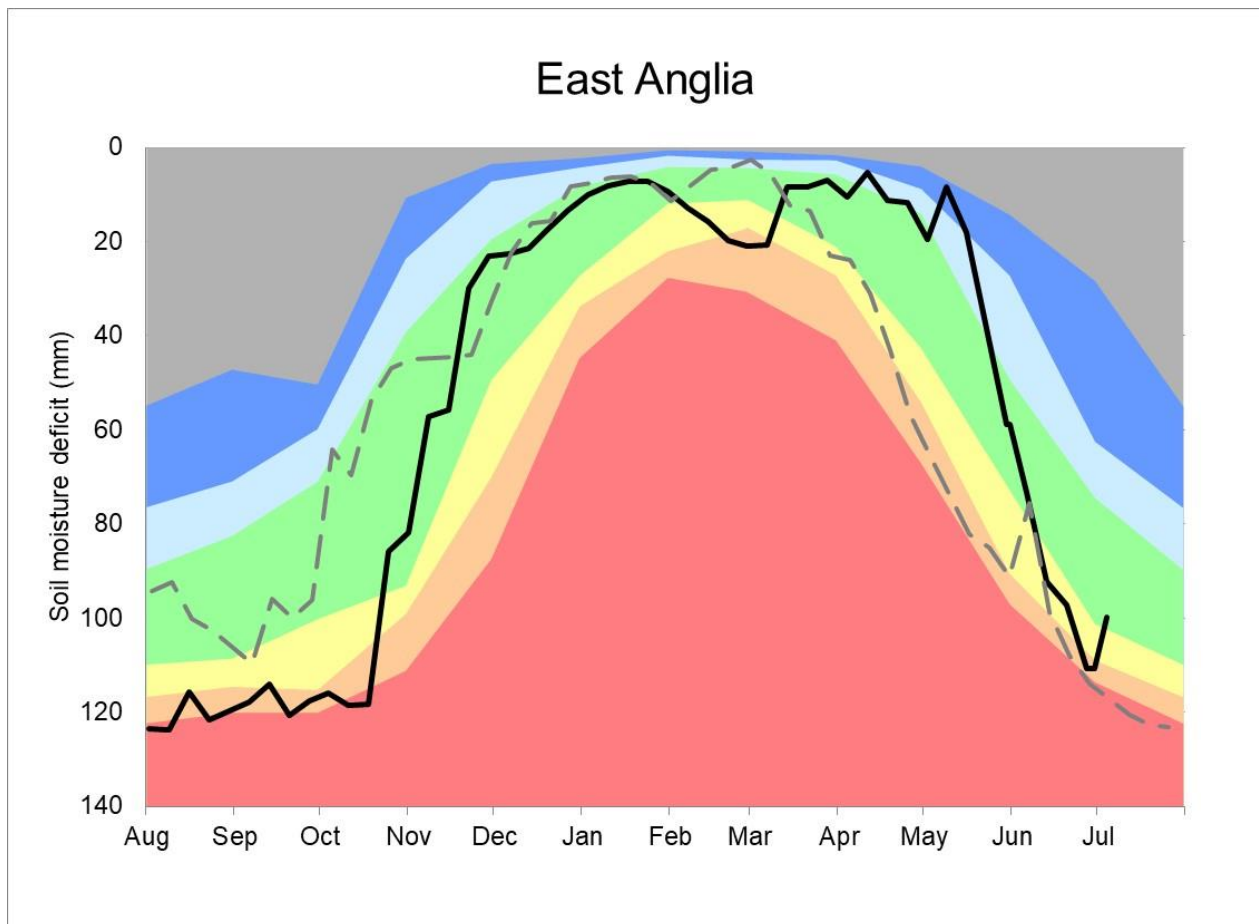
Figure 3.1: Soil moisture deficit values for 30 June 2023. Values based on the weekly MORECS data for real land use.



(Source: Met Office. Crown copyright, 2023). All rights reserved. Environment Agency, 100024198, 2023.

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.

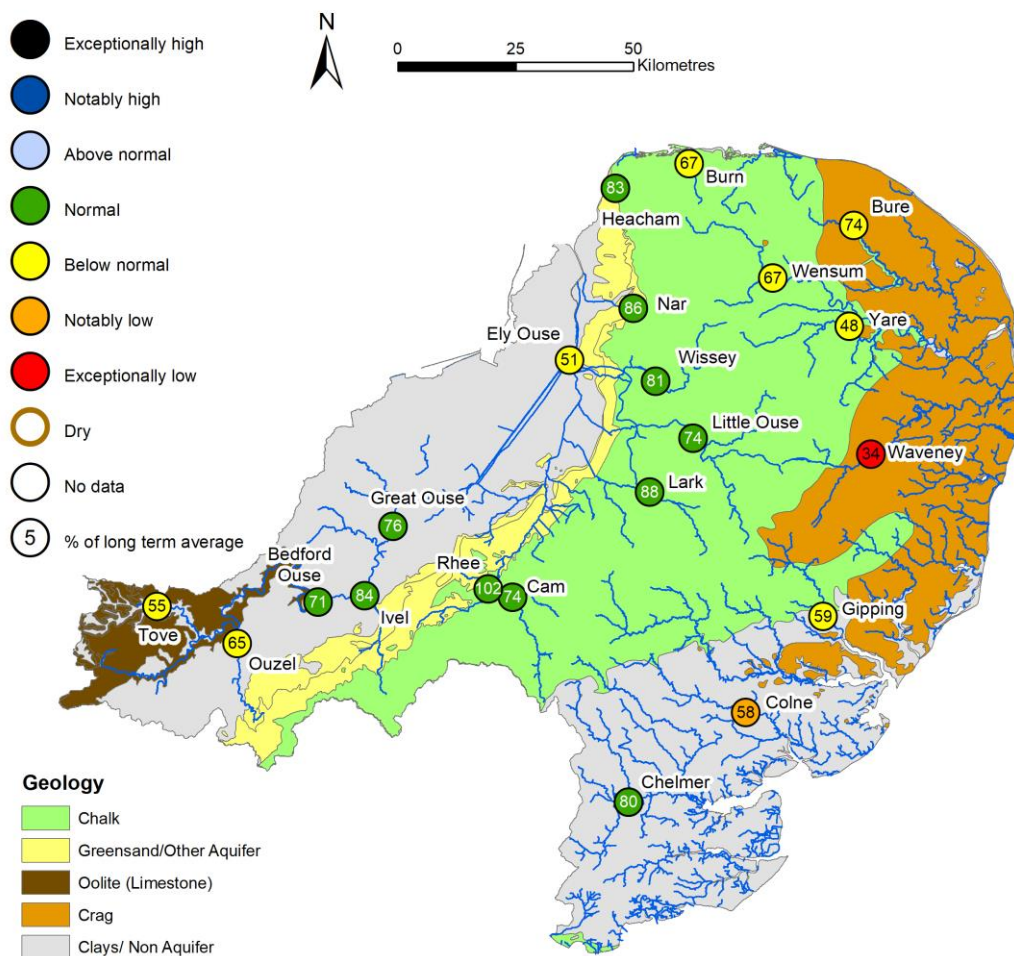


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4 River flows

4.1 River flows map

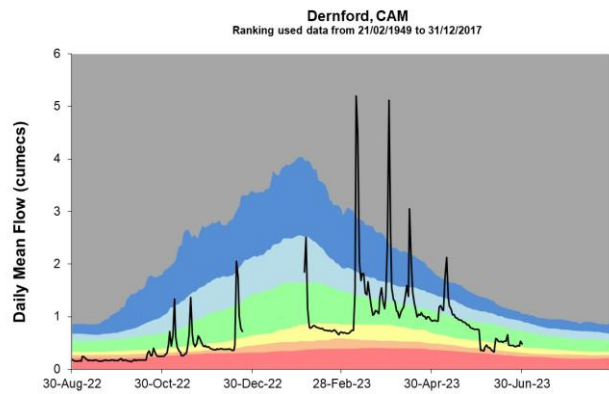
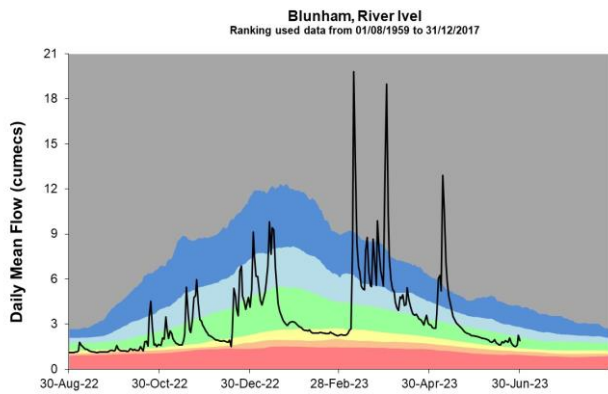
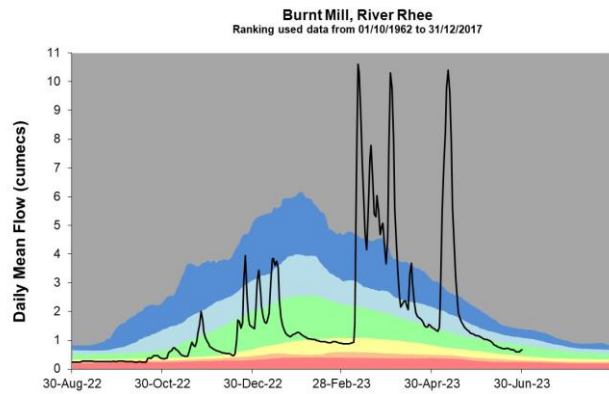
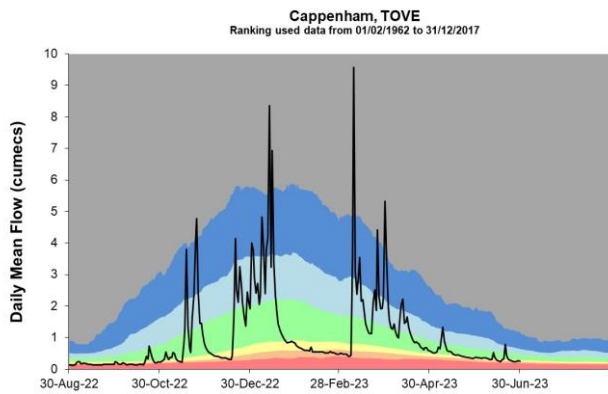
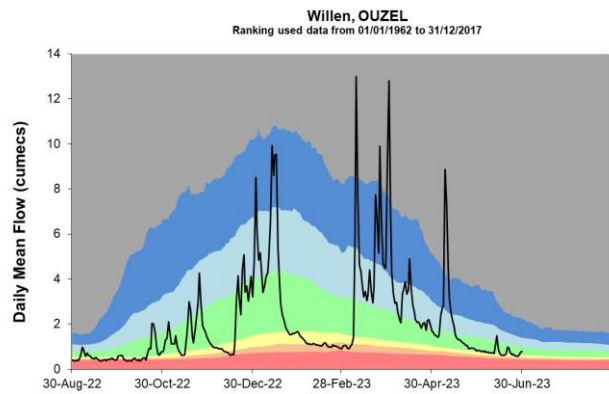
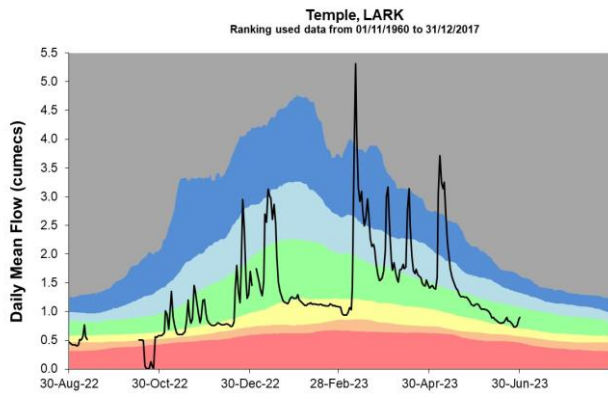
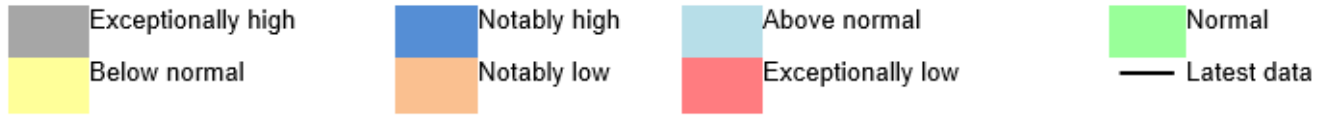
Figure 4.1: Monthly mean river flow for indicator sites for June 2023, expressed as a percentage of the respective long term average and classed relative to an analysis of historic June monthly means Table available in the appendices with detailed information.



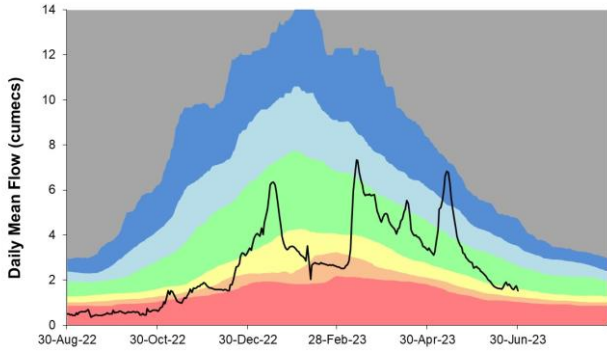
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4.2 River flow charts

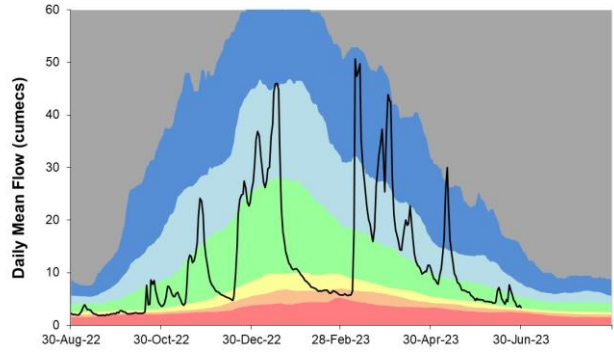
Figure 4.2: Daily mean river flow for index sites over the past year, compared to an analysis of historic daily mean flows, and long term maximum and minimum flows.



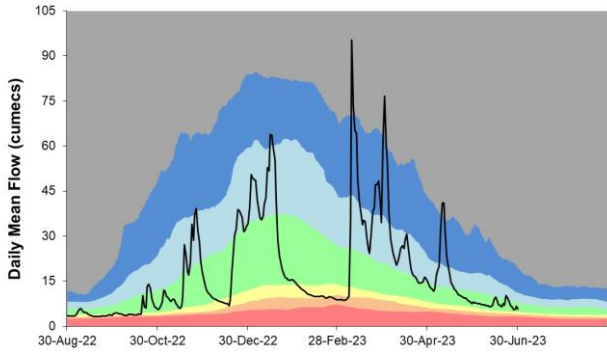
Abbey Heath, LITTLE OUSE
Ranking used data from 01/06/1968 to 31/12/2017



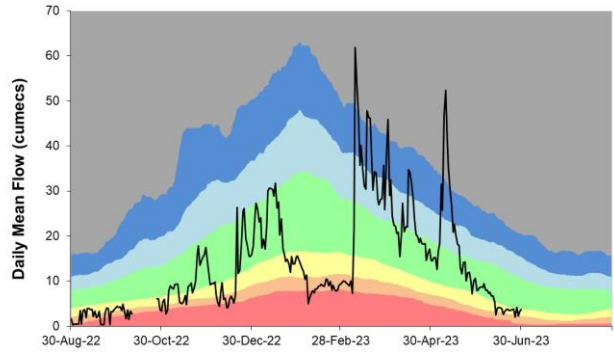
Roxton, GREAT OUSE
Ranking used data from 23/10/1972 to 31/12/2017



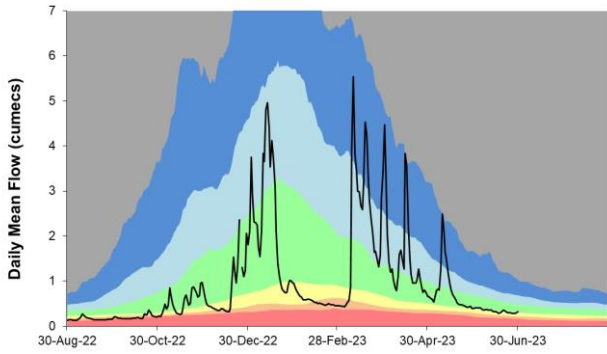
Offord (Gross flows), GREAT OUSE
Ranking used data from 01/01/1972 to 31/12/2017



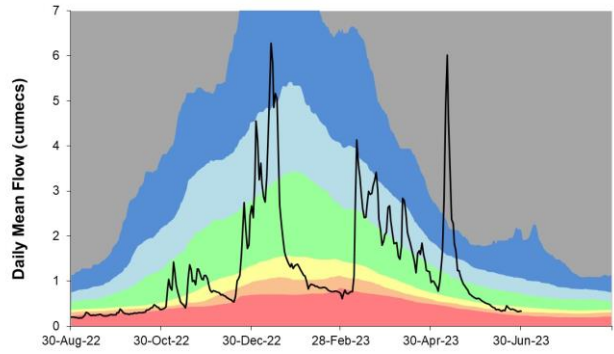
Denver, ELY OUSE
Ranking used data from 01/11/1971 to 31/12/2017



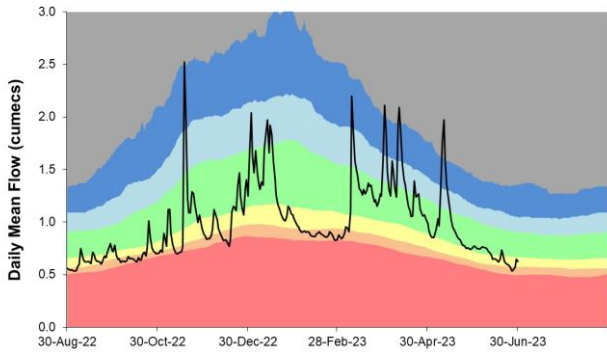
Bramford, Gipping
Ranking used data from 01/07/1969 to 31/12/2017



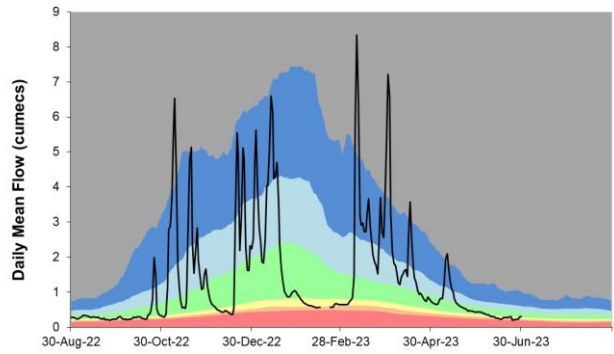
COLNEY, River Yare
Ranking used data from 01/01/1970 to 31/12/2017

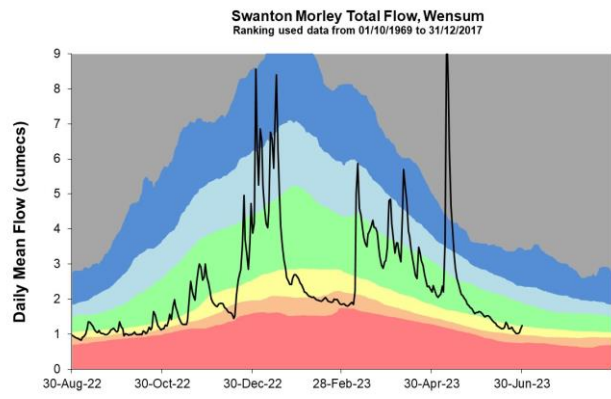
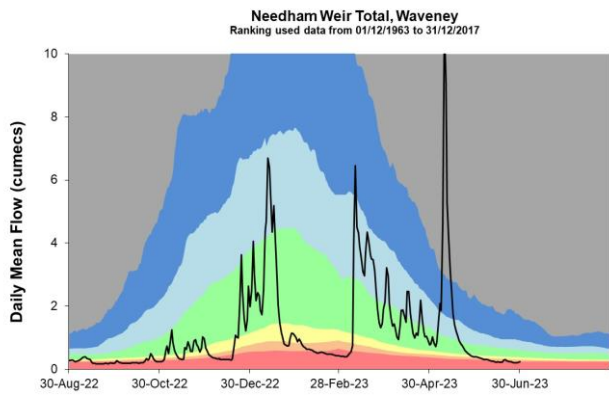
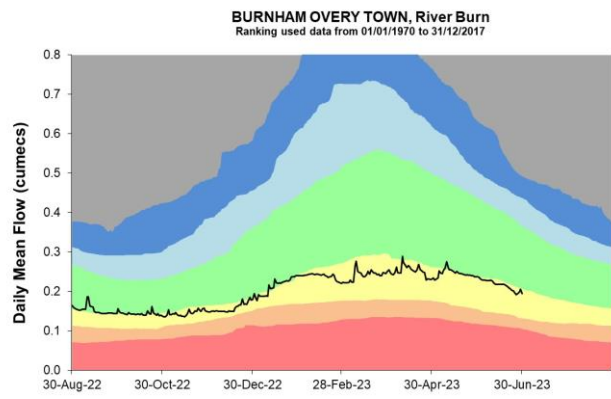
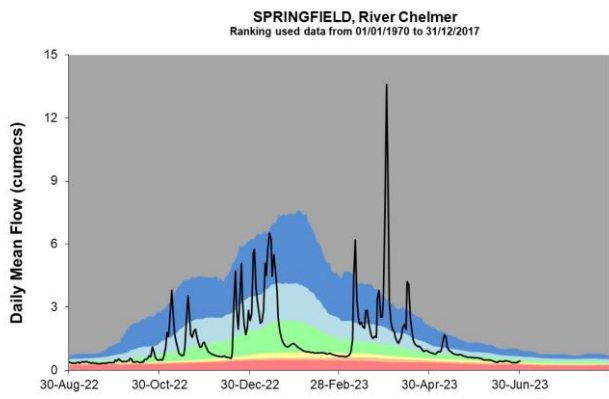


Ingworth, Bure
Ranking used data from 01/06/1959 to 31/12/2017



Lexden, Colne
Ranking used data from 01/10/1959 to 31/12/2017



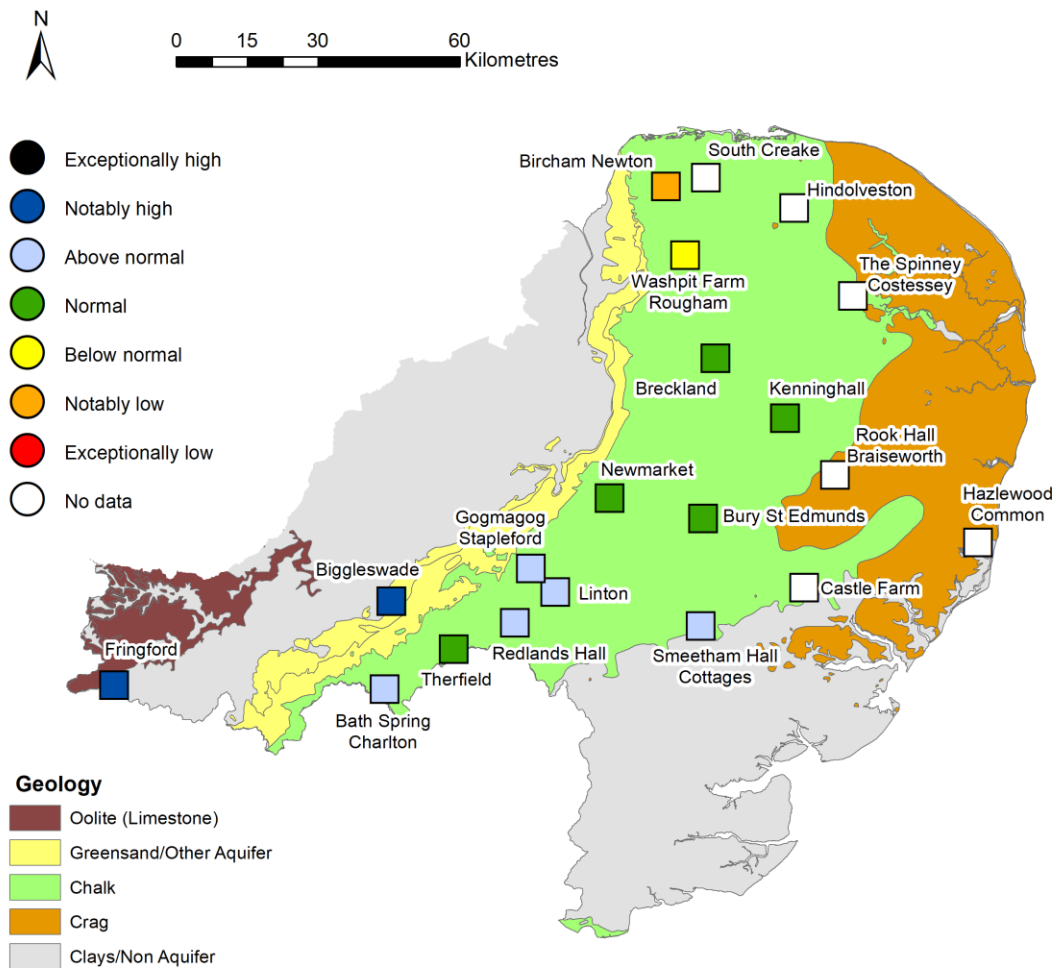


Source: Environment Agency.

5 Groundwater levels

5.1 Groundwater levels map

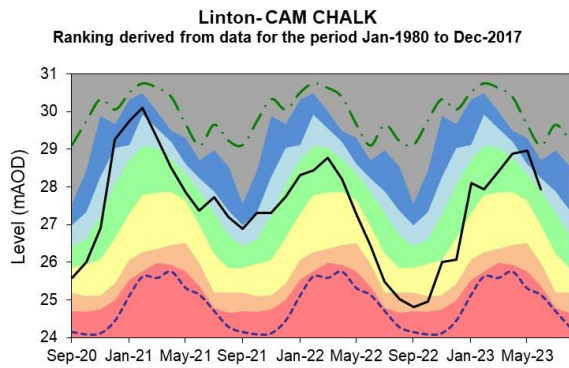
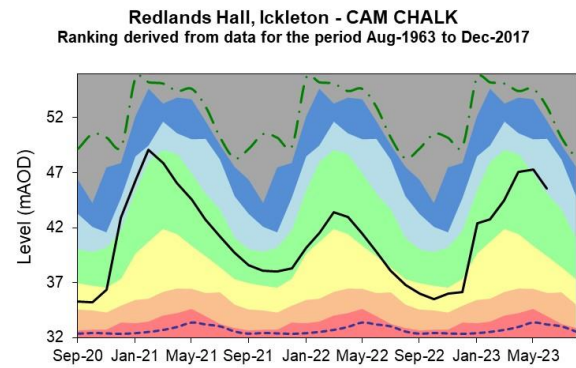
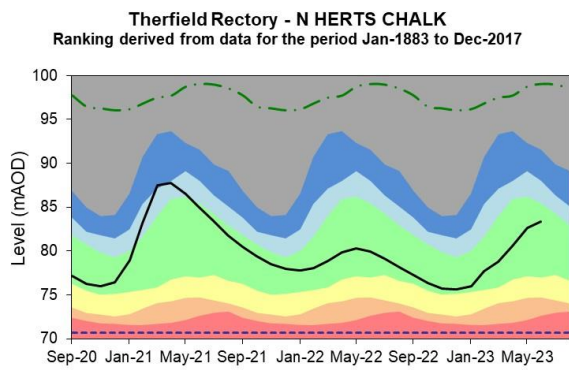
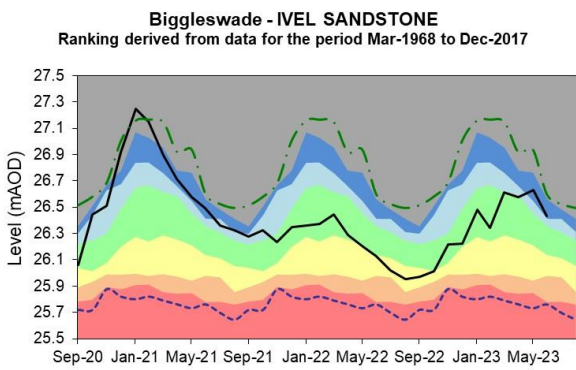
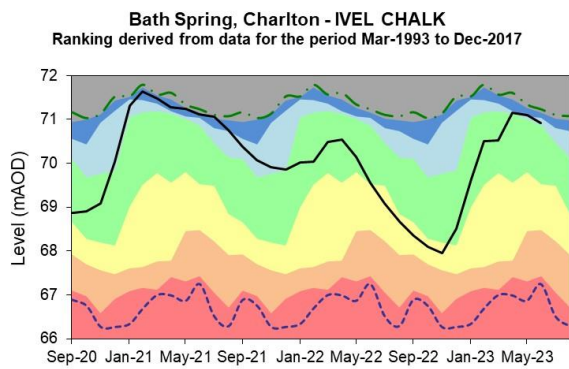
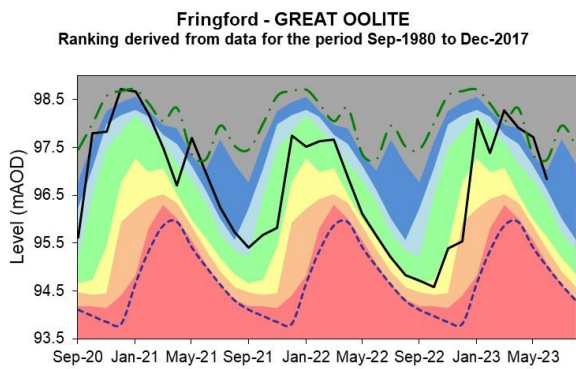
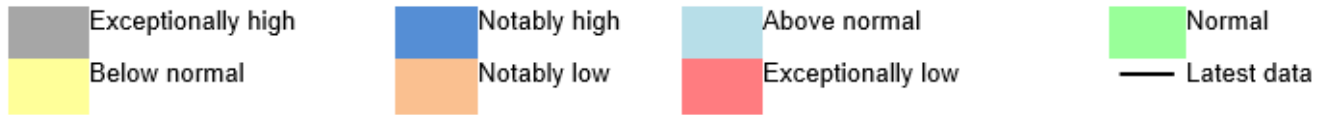
Figure 5.1: Groundwater levels for indicator sites at the end of June 2023, classed relative to an analysis of respective historic June levels. Table available in the appendices with detailed information.



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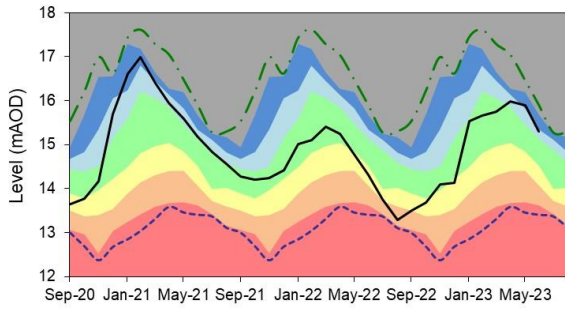
5.2 Groundwater level charts

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.



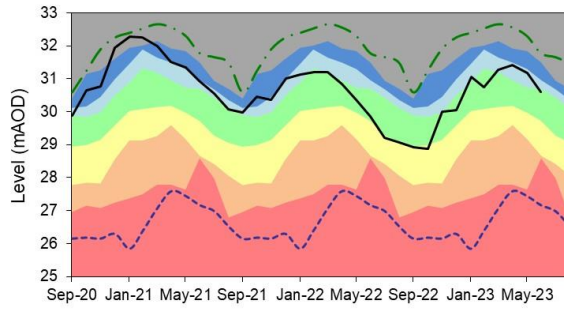
Gog Magog, Stapleford - CAM CHALK

Ranking derived from data for the period Jan-1980 to Dec-2017



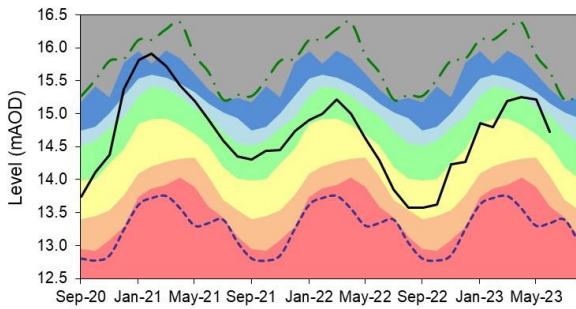
Bury St Edmunds - UPPER LARK CHALK

Ranking derived from data for the period May-1983 to Dec-2017



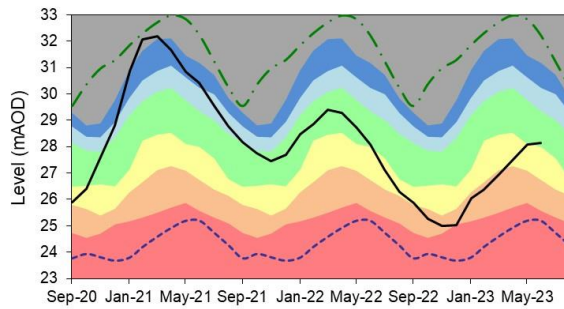
Newmarket - SNAIL CHALK

Ranking derived from data for the period Feb-1983 to Dec-2017



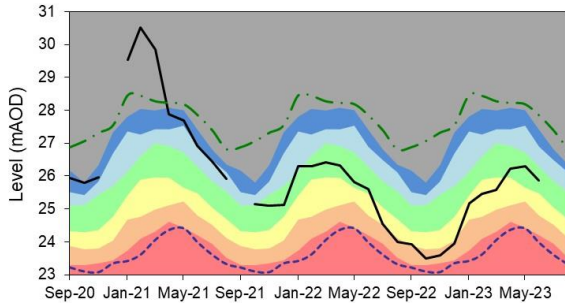
Kenninghall - LITTLE OUSE CHALK

Ranking derived from data for the period Aug-1973 to Dec-2017



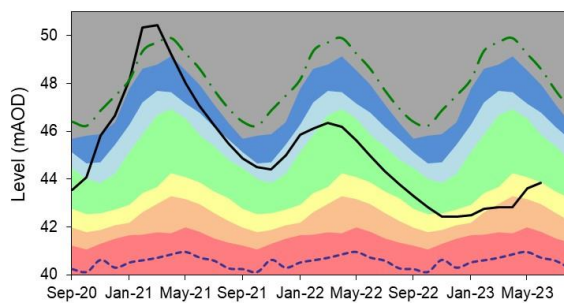
Breckland - WISSEY CHALK

Ranking derived from data for the period Jan-1971 to Nov-2017



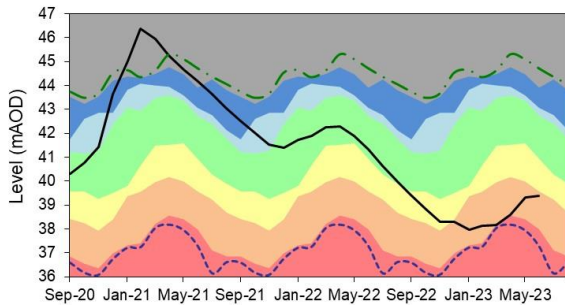
Washpit Farm, Rougham - NW NORFOLK CHALK

Ranking derived from data for the period May-1950 to Dec-2017



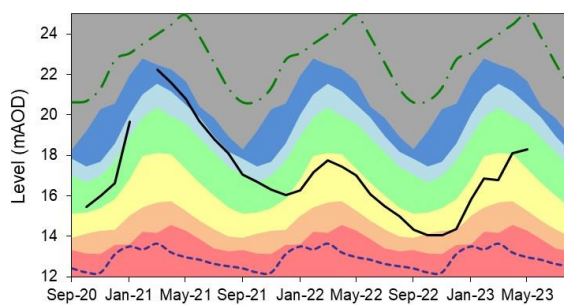
Bircham Newton - NW NORFOLK CHALK

Ranking derived from data for the period Mar-1995 to Sep-2017

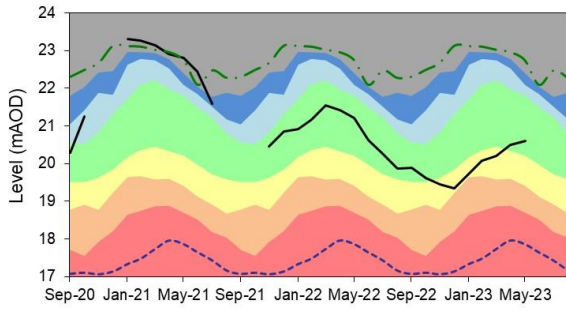


Castle Farm, Offton - MID SUFFOLK CHALK

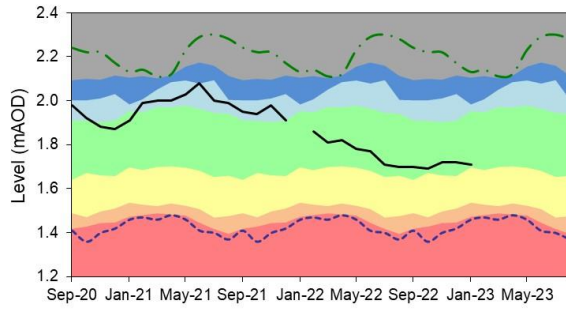
Ranking derived from data for the period Mar-1967 to Dec-2017



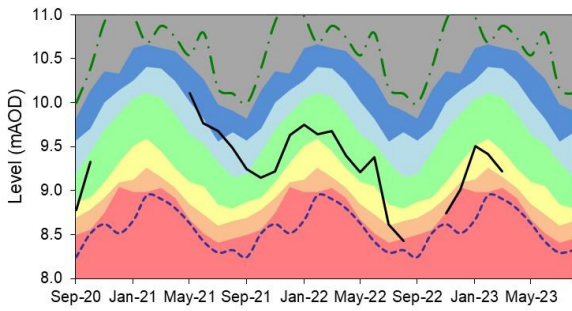
Old Primary School, South Creake, NORFOLK CHALK
 Ranking derived from data for the period Oct-1971 to Dec-2017



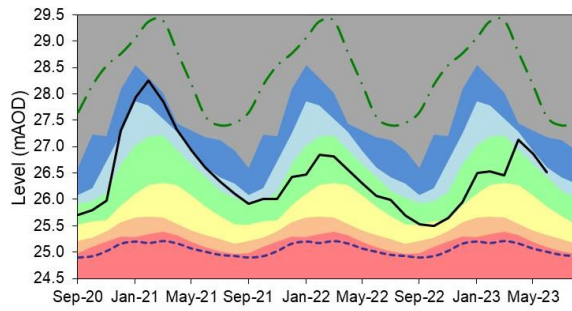
Hazlewood Common - SUFFOLK CRAG
 Ranking derived from data for the period Oct-1988 to Feb-2020



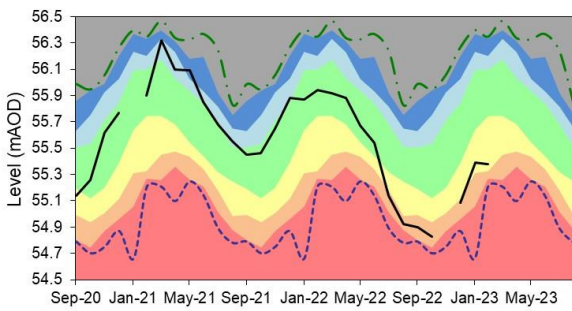
The Spinney, Costessey- WENSUM CHALK
 Ranking derived from data for the period Oct-1971 to Dec-2017



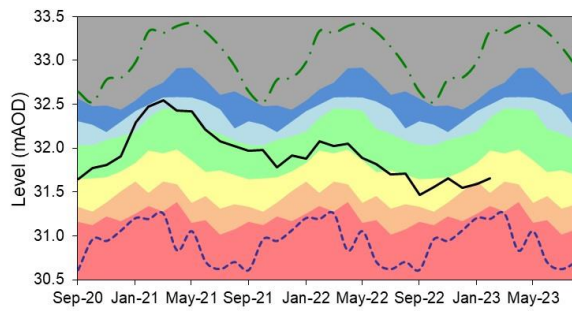
Smeetham Hall Cottages, Bulmer - ESSEX CHALK
 Ranking derived from data for the period Jan-1964 to Dec-2017



Hindolveston - NORFOLK CHALK
 Ranking derived from data for the period Sep-1984 to Nov-2017



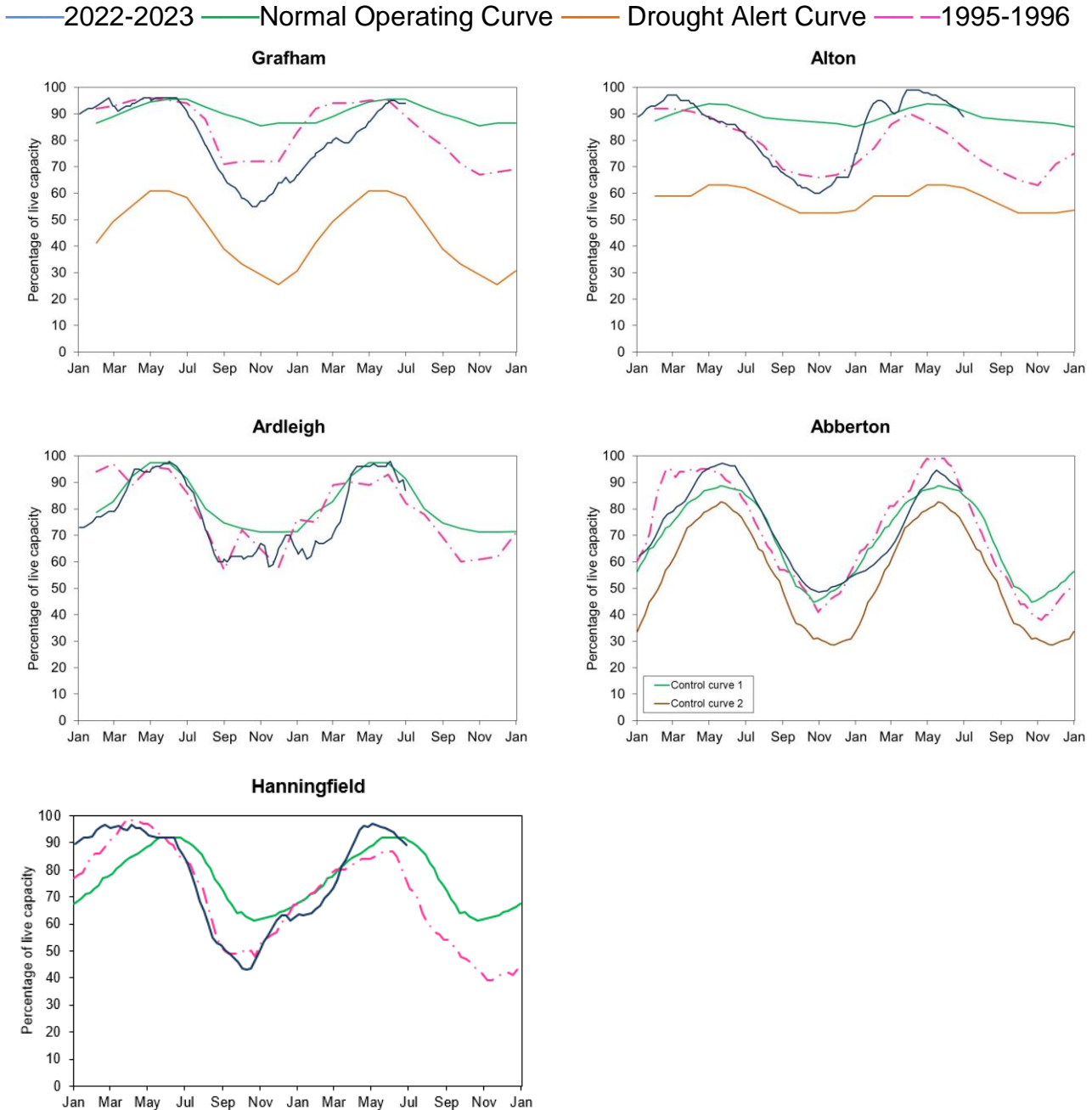
Rook Hall, Braiseworth-SUFFOLK CHALK
 Ranking derived from data for the period Jan-1980 to Dec-2017



Source: Environment Agency, 2023.

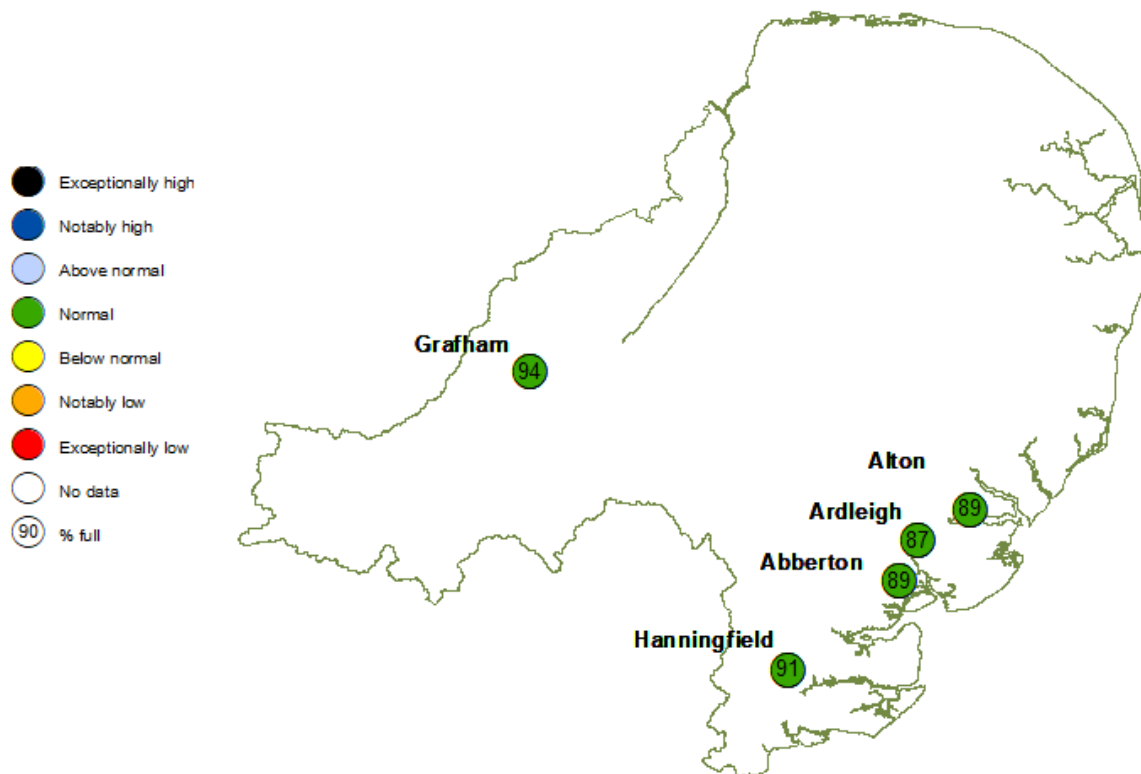
6 Reservoir stocks

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.



(Source: water companies).

6.1 Reservoir stocks map

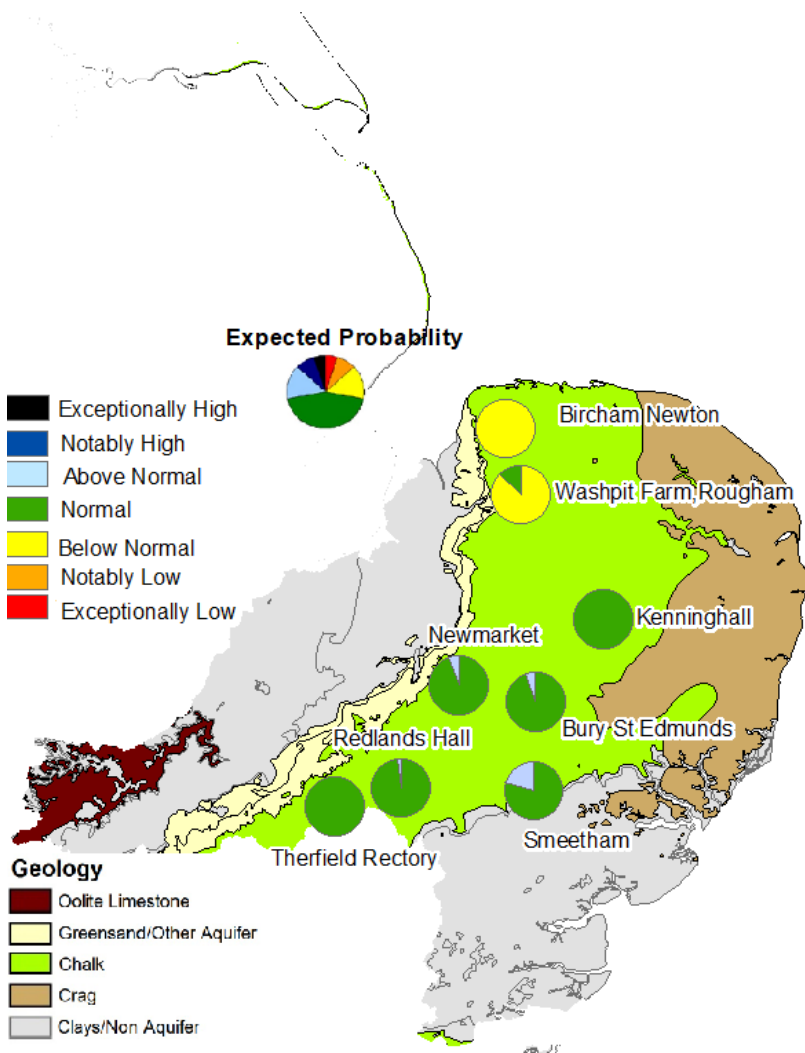


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7 Forward look

7.1 Probabilistic ensemble projection of groundwater levels at key sites in September 2023

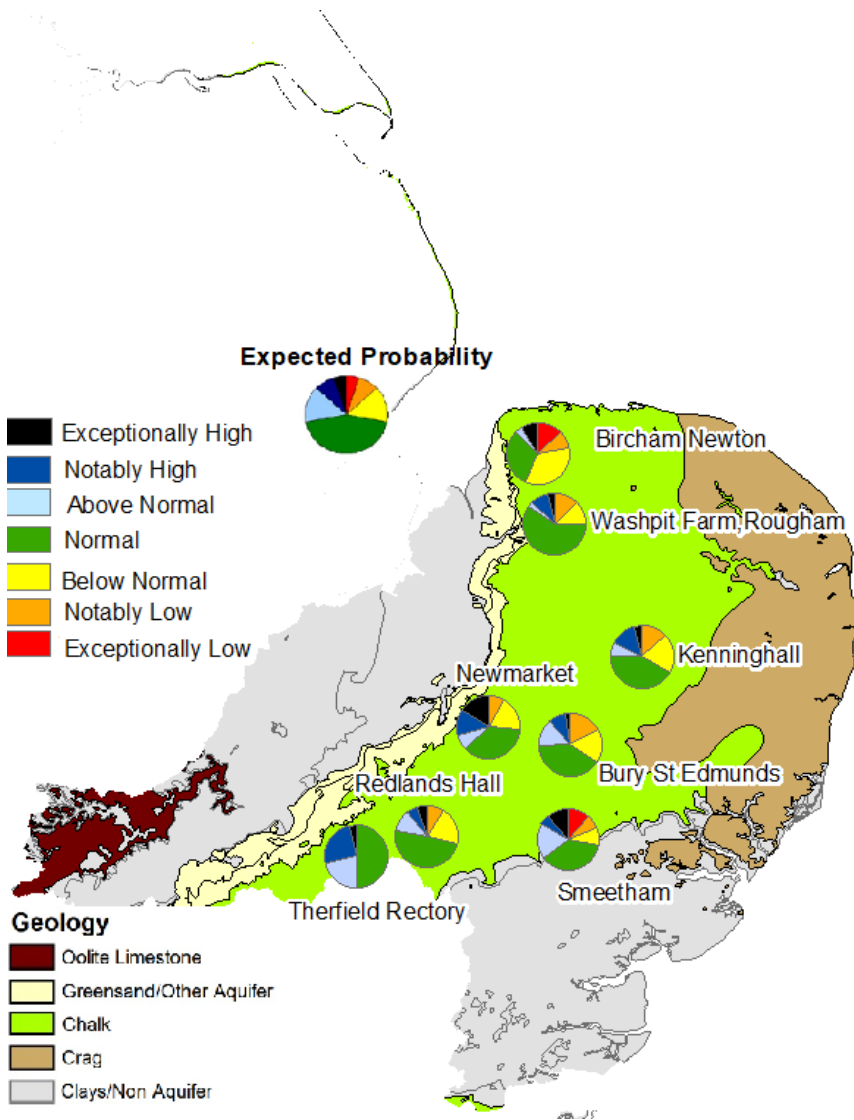
Table available in the appendices with detailed information. Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those 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)
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7.2 Probabilistic ensemble projection of groundwater levels at key sites in March 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)
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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	Jun 2023 rainfall % of long term average 1961 to 1990	Jun 2023 band	Apr 2023 to June cumulative band	Jan 2023 to June cumulative band	Jul 2022 to June cumulative band
Broadland Rivers	45	Below Normal	Normal	Normal	Normal
Cam	48	Below Normal	Normal	Above normal	Normal
Central Area Fenland	44	Below Normal	Normal	Normal	Normal
East Suffolk	43	Below Normal	Normal	Normal	Normal
Little Ouse And Lark	51	Below Normal	Normal	Normal	Normal
Lower Bedford Ouse	56	Normal	Normal	Normal	Normal
North Essex	38	Notably Low	Below normal	Normal	Normal
North Norfolk	45	Below Normal	Normal	Normal	Below normal
Nw Norfolk And Wissey	53	Below Normal	Normal	Normal	Normal

South Essex	42	Below Normal	Normal	Normal	Normal
Upper Bedford Ouse	75	Normal	Normal	Above normal	Normal

9.2 River flows table

Site name	River	Catchment	Jun 2023 band	May 2023 band
Abbey Heath	Little Ouse	Little Ouse	Normal	Above normal
Blunham	Ivel	Ivel	Normal	Above normal
Bramford	Gipping	Gipping	Below normal	Normal
Burnham Overy	Burn	Burn	Below normal	Below normal
Burnt Mill	Rhee	Rhee	Normal	Exceptionally high
Cappenham	Tove	Tove	Below normal	Normal
Colney	Yare	Yare	Below normal	Notably high
Denver	Ely Ouse	Cutoff and Renew Channel	Below normal	Above normal
Dernford	Cam	Cam	Normal	Above normal
Heacham	Heacham	Heacham	Normal	Below normal
Ingworth	Bure	Bure	Below normal	Normal
Lexden	Colne	Colne Essex	Notably low	Above normal
Marham	Nar	Nar	Normal	Normal
Needham Weir Total	Waveney (lower)	Waveney	Exceptionally low	Notably high

Northwold Total	Wissey	Wissey	Above normal	Notably high
Offord (gross Flows)	Great Ouse	Ouse Beds	Normal	Above normal
Roxton	Great Ouse	Ivel	Normal	Normal
Springfield	Chelmer	Chelmer Upper	Normal	Above normal
Swanton Morley Total	Wensum	Wensum	Below normal	Above normal
Temple	Lark	Lark	Normal	Above normal
Willen	Ouzel	Ouzel	Below normal	Above normal

9.3 Groundwater table

Site name	Aquifer	End of Jun 2023 band	End of May 2023 band
Bath Spring, Charlton	Upper Ivel Chalk	Above normal	Notably high
Biggleswade	Ivel Woburn Sands	Notably high	Notably high
Bircham Newton	North West Norfolk Chalk	Notably low	Notably low
Breckland	Wissey Chalk	Normal	Normal
Bury St Edmunds	Upper Lark Chalk	Normal	Above normal
Castle Farm, Offton	East Suffolk Chalk		Normal
Gog Magog, Stapleford	Cam Chalk	Above normal	Notably high
Hazlewood Common	East Suffolk Crag		Normal
Hindolveston	Norfolk Chalk		
Kenninghall	Little Ouse Chalk	Normal	Below normal
Linton	Cam Chalk	Above normal	Notably high
Newmarket	Snail Chalk	Normal	Above normal

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

9.4 Ensemble projections tables

9.4.1 Probabilistic ensemble projection of river flows at key sites in September 2023

Percentage of pie chart for each band

Site	Bedford Ouse	Kym	Ivel	Ouse	Ely Ouse	Stiffkey	Gipping
Exceptionally Low	0.0	0.0	0.0	0.0	0.0	0.0	7.0
Notably Low	0.0	0.0	0.0	0.0	0.0	38.6	5.3
Below Normal	5.4	16.1	0.0	1.8	47.4	35.1	12.3
Normal	51.8	50.0	48.2	53.6	34.2	12.3	43.9
Above Normal	25.0	26.8	16.1	17.9	10.5	14.0	15.8
Notably High	14.3	5.4	16.1	23.2	7.9	0.0	10.5
Exceptionally High	3.6	1.8	19.6	3.6	0.0	0.0	5.3

9.4.2 Probabilistic ensemble projection of river flows at key sites in December 2023

Percentage of pie chart for each band

Site	Bedford Ouse	Kym	Ivel	Ouse	Ely Ouse	Stiffkey	Gipping
Exceptionally Low	1.8	3.6	1.8	1.8	2.6	8.8	7.0
Notably Low	16.1	16.1	0.0	10.7	15.8	22.8	5.3
Below Normal	12.5	17.9	12.5	16.1	28.9	15.8	12.3
Normal	33.9	37.5	32.1	35.7	21.1	29.8	43.9
Above Normal	23.2	12.5	28.6	21.4	15.8	17.5	15.8
Notably High	5.4	7.1	7.1	3.6	0.0	5.3	10.5
Exceptionally High	7.1	5.4	17.9	10.7	15.8	0.0	5.3

9.4.4 Probabilistic ensemble projection of groundwater levels at key sites in March 2024

Percentage of pie chart for each band

Site	Therfield Rectory	Redlands Hall	Newmarket	Washpit Farm	Bircham Newton	Kenninghall	Bury St Edmunds	Smeetham
Exceptionally low	0.0	0.0	0.0	0.0	13.0	0.0	0.0	11.1
Notably low	0.0	9.1	7.9	12.5	8.7	13.3	17.1	7.4
Below normal	0.0	20.0	18.4	12.5	34.8	20.0	17.1	9.3
Normal	50.0	49.1	36.8	59.4	30.4	42.2	40.0	37.0
Above normal	21.4	10.9	7.9	3.1	4.3	6.7	14.3	18.5
Notably high	25.0	5.5	13.2	9.4	0.0	13.3	8.6	5.6
Exceptionally high	3.6	5.5	15.8	3.1	8.7	4.4	2.9	11.1