Summary – October 2019
A persistently wet month with well above average rainfall across the area. River flows were in the exceptionally or notably high range and new record monthly mean flows for October were set on many rivers. Soils became saturated across the area by month end. Groundwater levels increased in all aquifers, with a turnaround in conditions from previously below average to above average levels for the time of year in the Magnesian Limestone, Corallian Limestone and the northern part of the Chalk aquifer. Reservoirs were at close to full capacity throughout the month.

Rainfall
October was a persistently wet month as a series of depressions crossed the country. Yorkshire experienced frequent rainfall for the first two to three weeks of October. This was followed by a somewhat drier spell from 19th to 23rd in most areas, and then large rainfall totals accumulated over the 25th to 26th of the month when over 24 hours of near constant rainfall occurred. The Don catchment in particular received 64% of the monthly Long Term Average (LTA) rainfall over the 25th to 26th of October.

Using the Met Office National Climate Information Centre (NCIC) data set, the Ure catchment received 158% of the LTA rainfall, classed as above normal. All other catchments in Yorkshire received between 175% and 245% of LTA rainfall over the month, classed as notably high or exceptionally high. The NCIC data set extends back to 1891 and, in comparison with this record, September to October 2019 has been the 2nd wettest 2-month period ending October in the Don catchment; the 3rd wettest 2-month period ending October in the Ouse catchment; the 4th wettest 2-month period ending October in the Derwent and the Calder catchments and the 5th wettest 2-month period ending October in the Swale, Nidd, Wharfe, Rye, Aire and Hull catchments.

In contrast to previous months, the wet conditions in the last few days of September and throughout October extended to the north central and eastern catchments, namely the Rye, Derwent, Esk, Hull and Humber, each receiving more than twice the LTA rainfall. This was reflected in river flow and groundwater level response as described in sections below.

Soil Moisture Deficit (SMD)
At the start of October, soil moisture deficits were zero along the western Pennine ridge and in the southern most parts of Yorkshire. During the first half of the month the saturated area extended further east and south, covering all but the areas bordering the Humber estuary, lower Ouse and Lower Aire. During the final week of October, SMD was reduced to zero or marginally above across all of Yorkshire area, so that by month end all catchment soils were classified as wet.

River Flows
River flows during October were in the exceptionally high or notably high range across Yorkshire. The highest October monthly mean flows on record were achieved at locations in the Swale, Nidd, Ouse, Foss, Aire, Calder, Don, Went, Rother and Derwent catchments. Monthly mean flows ranged from 175% of the LTA on the upper Wharfe to more than 450% of the LTA on the Foss and Went.

In the Pennine fed catchments the month commenced with high flows, peaking on the 1st or 2nd. Several further flow peaks occurred in response to rainfall until mid-month, followed by a brief period of recession. A further large peak occurred on the 26th to 27th October in response to over 24 hours of persistent rainfall. This peak was most significant within the Went, Rother, lower Dearne and middle to lower Don catchments, which received the heaviest rainfall. Peak water levels were the second highest on record on the River Went, and third or fourth highest at selected locations on the rivers Don, Dearne and Rother when using the peaks over threshold series. In the lower Don a rising high tide contributed to the high recorded water levels.
In the Rye and Derwent catchments, flows were in the notably or exceptionally high range all month, fluctuating with a series of multiple peaks. A sustained high flow peak occurred on the Derwent from the 26th to the end of the month.

In the River Hull in the east of the area, flows increased quickly in response to rising groundwater levels in the Chalk, from the normal flow range at the start of the month to notably high by the 11th and exceptionally high from the 14th onwards. Flows in Mires Beck and the River Foulness showed a more fluctuating pattern in response to rainfall events, with a large peak on the 26th to 27th of the month.

**Groundwater Levels**
There has been rise in groundwater levels throughout the area due to the large rainfall totals experienced over the last two months.

**Magnesian Limestone**
The groundwater level at Brick House Farm rose to just above average for the time of year.

**Millstone Grit**
The groundwater level at Hill Top Farm rose to well above average for the time of year.

**Sherwood Sandstone**
Groundwater levels in the Sherwood Sandstone, measured at both Great Ouseburn and Riccal Approach, increased this month and were above average for the time of year.

**Corallian Limestone**
The groundwater levels at Sproxton & East Ness increased sharply during October, from below average to above average for the time of year.

**Chalk**
The groundwater level in the northern area of the aquifer, as monitored at Wetwang, increased sharply from below average to well above average for the time of year. At Dalton Estate in the south of the aquifer the groundwater level increased to an average level for the time of year.

**Reservoir Storage**
Reservoir stocks were at almost full capacity; they increased slightly during the first half of the month and remained essentially steady thereafter. Overall reservoir stocks were well above the LTA and equal to the historic maximum for the time of year (based on records from 1990).

**Environmental Impact**
No Hands off Flow stop notices were in force by the end of October. One advance warning of low flows in the Hull catchment was sent out during the first week of the month, although the licence holder was still able to abstract.

Author: Yorkshire Hydrology
Above average rainfall

Below average rainfall

1-Month Period for Aire

1-Month Period for Calder

1-Month Period for Don

1-Month Period for Hull and Humber

Soil Moisture Deficit

Environment Agency - Yorkshire Area

Monthly MORECS SMD Levels

October 2019

SMD Conditions
- Wet
- Normal
- Dry
- Very Dry
River Flow

Exceptionally high
Notably high
Above normal
Normal
Below normal
Notably low
Exceptionally low
Dry
No data
% of long term average
Main river network

Addingham, WHARFE
Ranking derived from data for the period Dec-1973 to Dec-2017

Birstwith, NIDD
Ranking derived from data for the period Dec-1976 to Dec-2017

Data source: Environment Agency.
Crown copyright: All rights reserved.
Environment Agency, 100026353, [2019].
**Briggswath, ESK**
Ranking derived from data for the period Jan-1993 to Dec-2017

**Buttercrambe, DERWENT**
Ranking derived from data for the period Sep-1973 to Dec-2017

**Crakehill Topcliffe, SWALE**
Ranking derived from data for the period Jun-1980 to Dec-2017

**Doncaster, DON**
Ranking derived from data for the period Jul-1959 to Dec-2017

**Elland, CALDER**
Ranking derived from data for the period Jul-1971 to Dec-2017

**Hunsingore, NIDD**
Ranking derived from data for the period Oct-1968 to Dec-2017

**Kildwick, AIRE**
Ranking derived from data for the period Aug-1971 to Dec-2017

**Kilgram Bridge, URE**
Ranking derived from data for the period Aug-1971 to Dec-2017
Ness, RYE
Ranking derived from data for the period Sep-1974 to Dec-2017

Skelton, OUSE
Ranking derived from data for the period Sep-1969 to Dec-2017

Tadcaster, WHARFE
Ranking derived from data for the period Jul-1991 to Dec-2017

Walden Stubbs, WENT
Ranking derived from data for the period Oct-1979 to Dec-2017

Wansford Snakeholm Lock - West Beck, WEST BECK
Ranking derived from data for the period Nov-1988 to Dec-2017

Whittington, ROTHER
Ranking derived from data for the period Nov-1979 to Dec-2017
Groundwater Levels

Groundwater site
Class

- Exceptionally high
- Notably high
- Above normal
- Normal
- Below normal
- Notably low
- Exceptionally low
- No data

Brick House Farm
Ranking derived from data for the period Oct-1979 to Nov-2017

Level (m AOD)

Jan-17 May-17 Sep-17 Jan-18 May-18 Sep-18 Jan-19 May-19 Sep-19

Dalton Estate Well
Ranking derived from data for the period Jan-1980 to Nov-2017

Level (m AOD)

Jan-17 May-17 Sep-17 Jan-18 May-18 Sep-18 Jan-19 May-19 Sep-19

Customer service line 03708 506 506
Incident hotline 0800 80 70 60
Floodline 0345 988 1188
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Reservoir Stocks – Data from Water Company

This graph is produced from Yorkshire Water © Crown Copyright data.
# Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquifer</td>
<td>A geological formation able to store and transmit water.</td>
</tr>
<tr>
<td>Areal average rainfall</td>
<td>The estimated average depth of rainfall over a defined area. Expressed in depth of water (mm).</td>
</tr>
<tr>
<td>Artesian</td>
<td>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.</td>
</tr>
<tr>
<td>Artesian borehole</td>
<td>Borehole where the level of groundwater is above the top of the borehole and groundwater flows out of the borehole when unsealed.</td>
</tr>
<tr>
<td>Cumecs</td>
<td>Cubic metres per second (m³s⁻¹)</td>
</tr>
<tr>
<td>Effective rainfall</td>
<td>The rainfall available to percolate into the soil or produce river flow. Expressed in depth of water (mm).</td>
</tr>
<tr>
<td>Flood Alert/Flood Warning</td>
<td>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.</td>
</tr>
<tr>
<td>Groundwater</td>
<td>The water found in an aquifer.</td>
</tr>
<tr>
<td>Long term average (LTA)</td>
<td>The arithmetic mean calculated from the historic record, usually based on the period 1961-1990. However, the period used may vary by parameter being reported on (see figure captions for details).</td>
</tr>
<tr>
<td>mAOD</td>
<td>Metres Above Ordnance Datum (mean sea level at Newlyn Cornwall).</td>
</tr>
<tr>
<td>MORECS</td>
<td>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.</td>
</tr>
<tr>
<td>Naturalised flow</td>
<td>River flow with the impacts of artificial influences removed. Artificial influences may include abstractions, discharges, transfers, augmentation and impoundments.</td>
</tr>
<tr>
<td>NCIC</td>
<td>National Climate Information Centre. NCIC area monthly rainfall totals are derived using the Met Office 5 km gridded dataset, which uses rain gauge observations.</td>
</tr>
<tr>
<td>Recharge</td>
<td>The process of increasing the water stored in the saturated zone of an aquifer. Expressed in depth of water (mm).</td>
</tr>
<tr>
<td>Reservoir gross capacity</td>
<td>The total capacity of a reservoir.</td>
</tr>
<tr>
<td>Reservoir live capacity</td>
<td>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.</td>
</tr>
<tr>
<td>Soil moisture deficit (SMD)</td>
<td>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).</td>
</tr>
</tbody>
</table>

## 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