

Overview

September 2023 brought heatwaves, heavy rainfall and the first named storm of the season, storm Agnes. Monthly rainfall was above the long-term average for September in most places, wettest in the East and Southwest.

The monthly average river flows for September remained high, with 83% of river flows above the long-term average for September. 55% of lake and turlough monitoring stations observed levels above the long-term normal range for this month.

Average monthly groundwater levels were 52% lower than the previous month, but over half (57%) of monitoring wells had levels above the long-term average for September. Similarly, most monitored spring outflows were above the normal range this time of year.

Rainfall

The majority of monthly rainfall totals were above their 1981-2010 Long-Term Average (LTA). Percentage of monthly rainfall values ranged from 76% (the month's lowest monthly rainfall total of 77.2 mm) at Belmullet, Co Mayo to 225% (monthly rainfall total of 134.1 mm) at Dublin Airport, Co Dublin (its wettest September since 1976). Monthly rainfall totals were as much as 189.3 mm (151% of its LTA) at Valentia Observatory, Co Kerry.

The highest daily rainfall total was 57.9 mm at Mace Head, Co Galway on Sunday 24th. The number of rain days ranged from 16 days at Roche's Point, Co Cork to 24 days at both Sherkin Island, Co Cork and Knock Airport, Co Mayo. The number of wet days ranged from 12 days at Roche's Point, Co Cork to 18 days at both Malin Head, Co Donegal and Johnstown Castle, Co Wexford.

The number of very wet days ranged from 3 days at a few stations to 8 days at Valentia Observatory, Co Kerry. Johnstown Castle, Co Wexford had its wettest September since 1974 with 178.4 mm (203% of its LTA). Both Roches Point, Co Cork with 145.9 mm (172% of its LTA) and Cork Airport with 171.4 mm (181% of its LTA) had their wettest September since 2006. Both Shannon Airport, Co Clare with 113.8 mm (151% of its LTA) and Mullingar, Co Westmeath with 132.9 mm (170% of its LTA) had their wettest September since 2010.

River Flows

The average river flows for September increased at 60% of river monitoring stations compared to average flows observed in August 2023. Analysis of the monthly average flows at 144 river monitoring sites identified 76 (53%) as 'particularly high', 43 (30%) as 'above normal', 22 (15%) as 'normal' and 3 (2%) 'below normal' for this time of year. 'Particularly high' river flows were observed in the southern half of the country.

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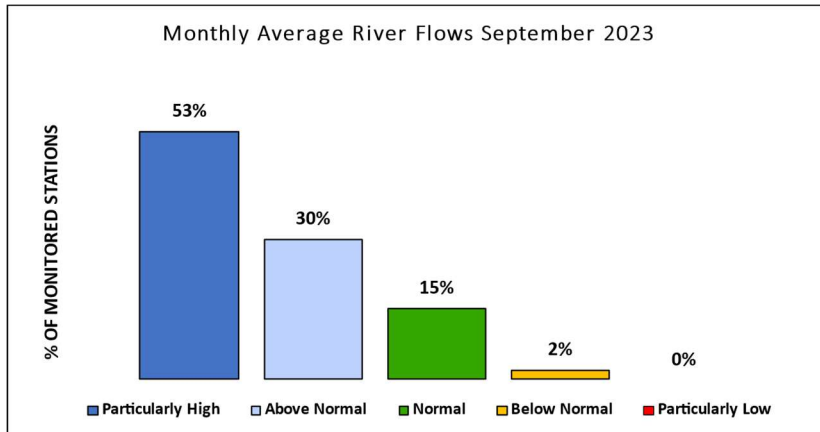


Figure 1: Percentage distribution of river flow monitoring sites within each of the percentile flow categories for September 2023.

Lake and Turlough Levels

Average water levels during September decreased at 94% of monitored lakes compared to average levels observed in August 2023. Monthly average levels at 39 lakes and 3 turloughs were classified as being ‘particularly high’ at 12 (29%), ‘above normal’ at 11 (26%), ‘normal’ at 16 (38%) and ‘below normal’ at 3 (7%) monitoring locations for the month of September.

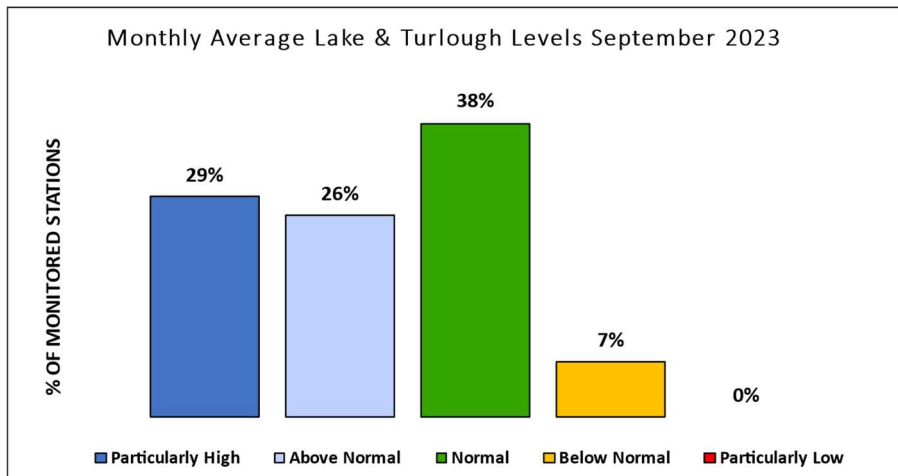


Figure 2: Percentage distribution of lake and turlough level monitoring sites within each of the percentile flow categories for September 2023.

Groundwater Levels and Spring Flows

Average groundwater levels in September were lower at 52% of monitoring wells compared to average levels observed in August 2023. Groundwater levels for September were classified as being ‘particularly high’ at 14 wells (40%) ‘above normal’ at 6 wells (17%), ‘normal’ at 11 wells (32%) and ‘below normal’ at 4 wells (11%) across the country.

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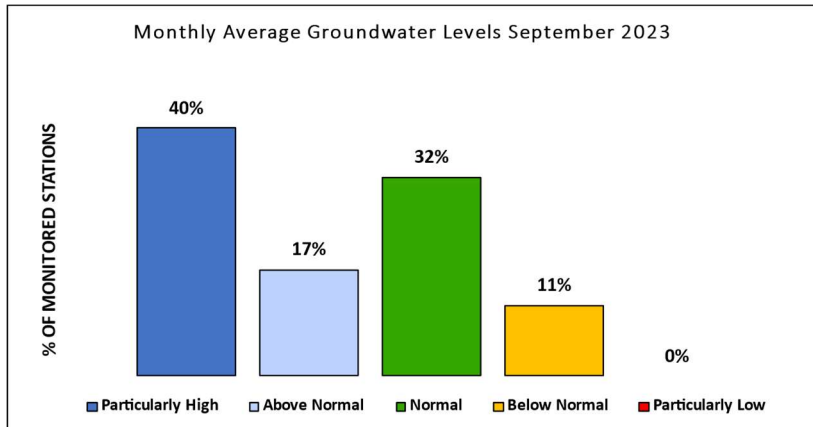


Figure 3: Percentage distribution of groundwater level sites within each of the percentile flow categories for September 2023.

Spring outflows were also monitored at 9 EPA monitoring sites for September. The outflows from these springs were compared to previously recorded September flows and were ‘particularly high’ at 2 locations, ‘above normal’ at 3 locations, ‘normal’ at 3 locations and ‘below normal’ at 1 location [Gortgarrow Spring, Co. Galway], for this time of year.

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Rainfall

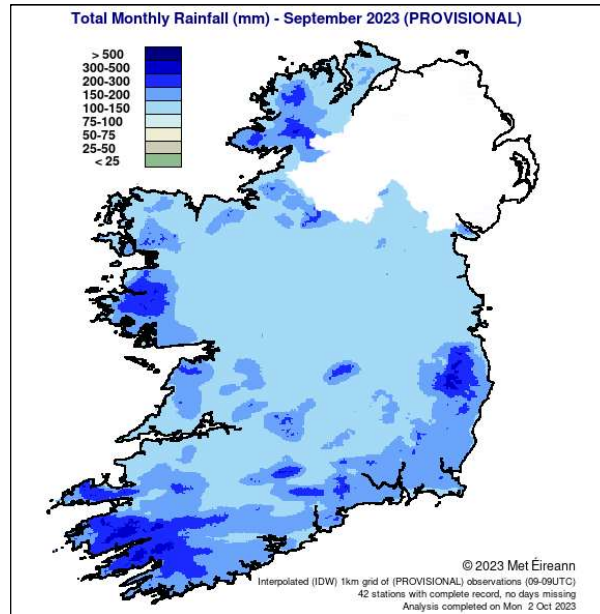


Figure 4: Rainfall map for Ireland September 2023 (Source: Met Éireann.ie).

September 2023

Based on Data from 1- 30 September 2023 on whole month basis

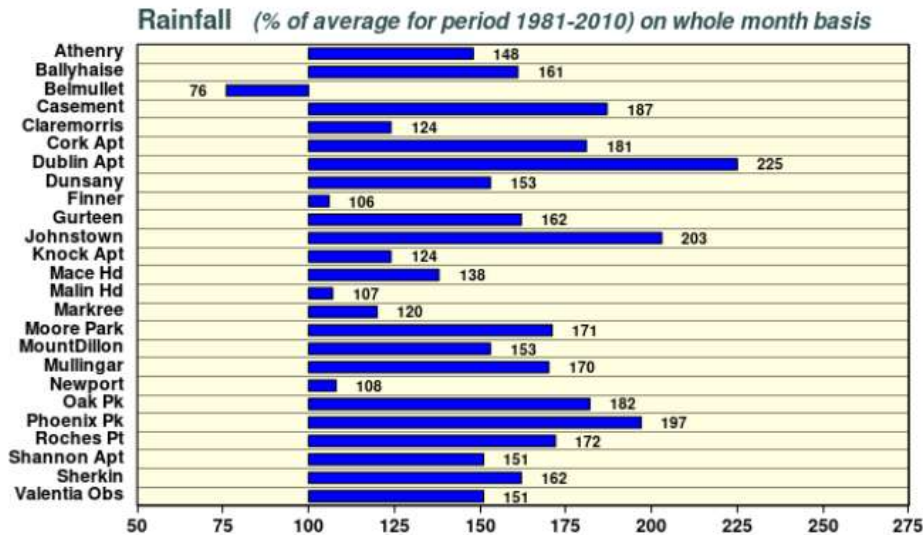


Figure 5: Summary of rainfall at synoptic stations for September 2023, figures indicate the percentage difference from the Long-Term Average rainfall for this month (Source: Met Éireann.ie).

River Flows

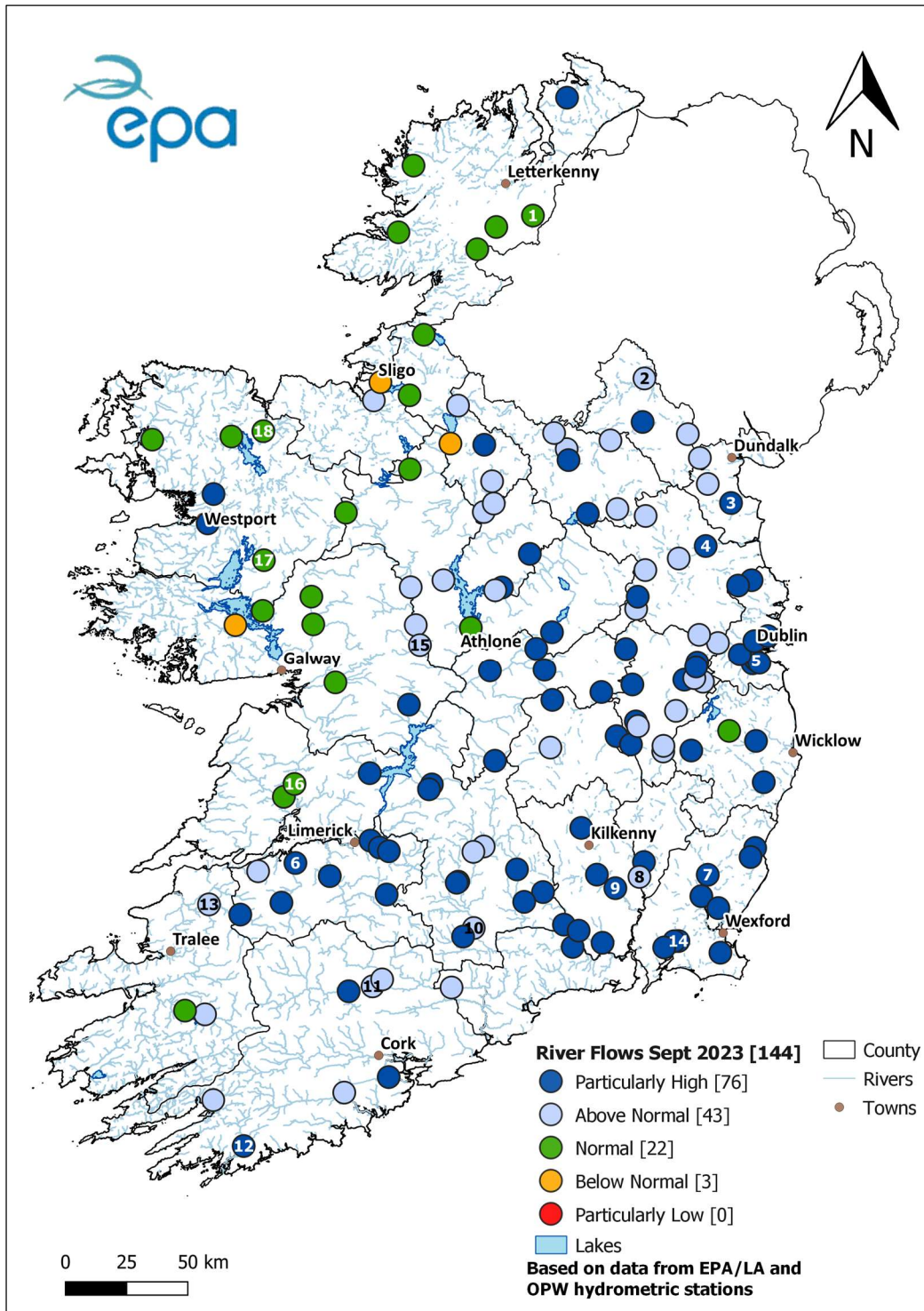


Figure 6: Monthly average river flows for September 2023 relative to historic monthly average flows expressed as percentile of the long-term values of monthly flow. Numbered sites are represented in the hydrographs below. All data are provisional and may be subject to revision (Source: EPA, OPW).

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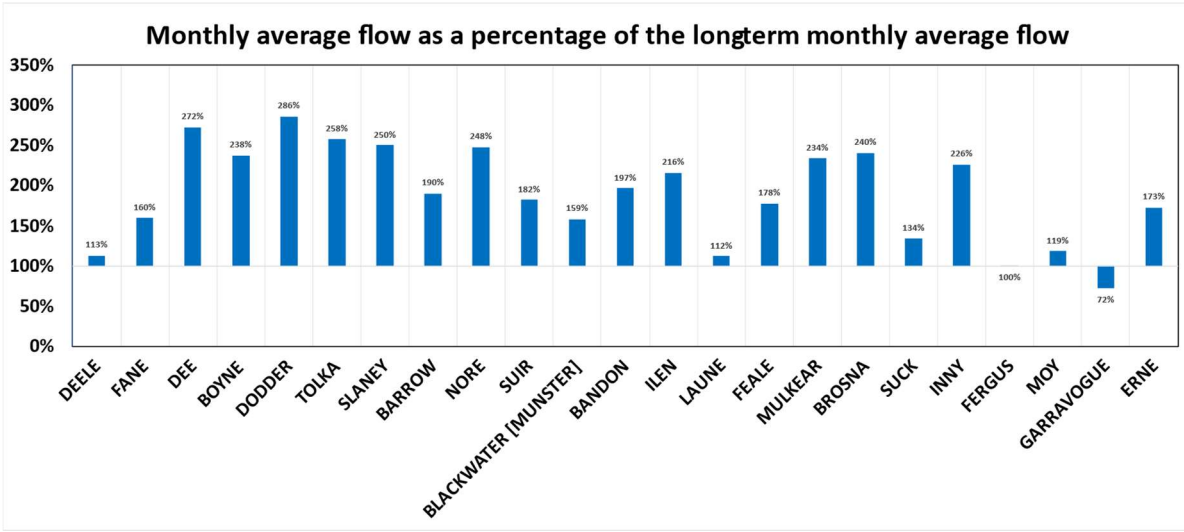
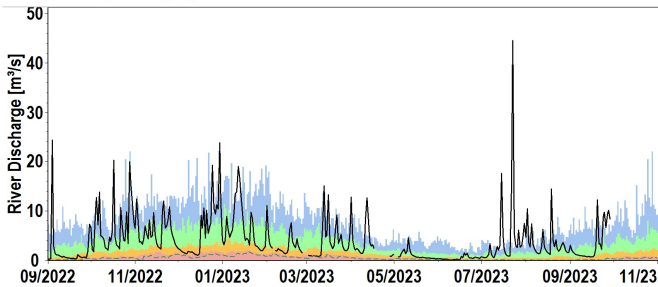


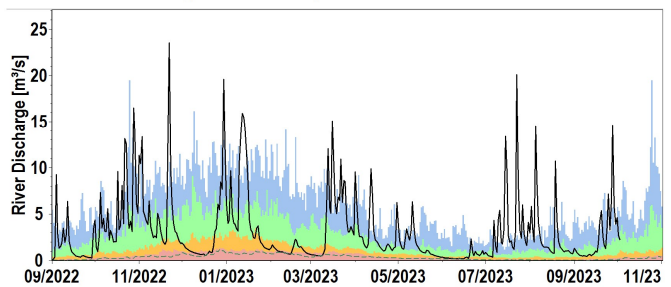
Figure 7: September 2023 average flows as a percentage of the long-term monthly average flow for this month at a selected number of stations. All data are provisional and may be subject to revision (Source: EPA, OPW).

Flow hydrographs for selected rivers

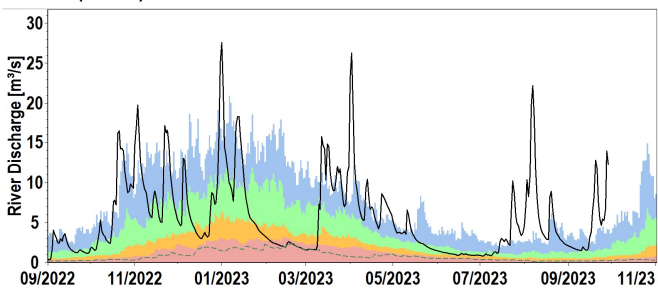
1. DEELE (Donegal)



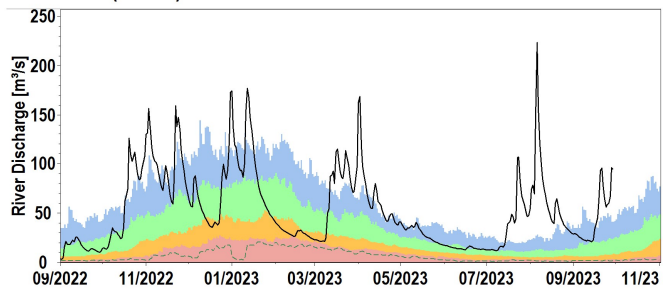
2. BLACKWATER [MONAGHAN]



3. DEE (Louth)

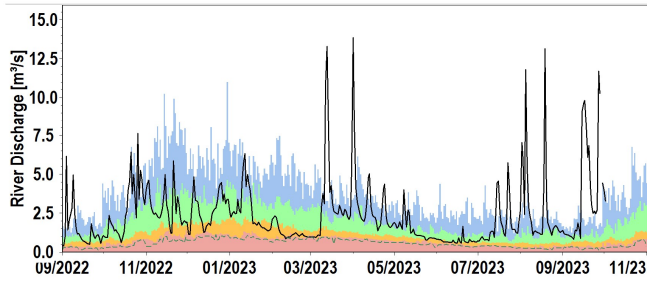


4. BOYNE (Meath)

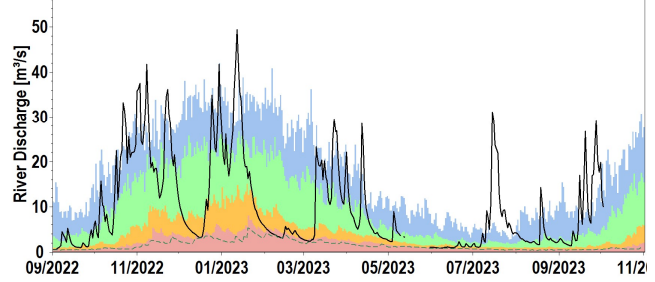


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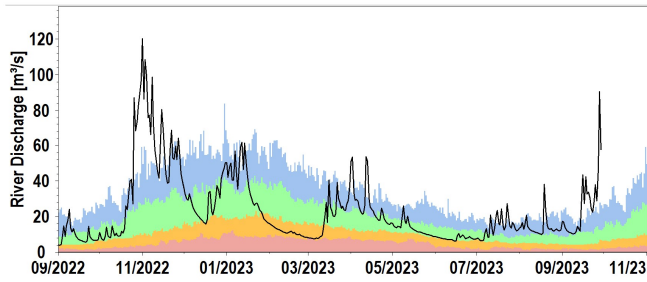
5. DODDER (Dublin)



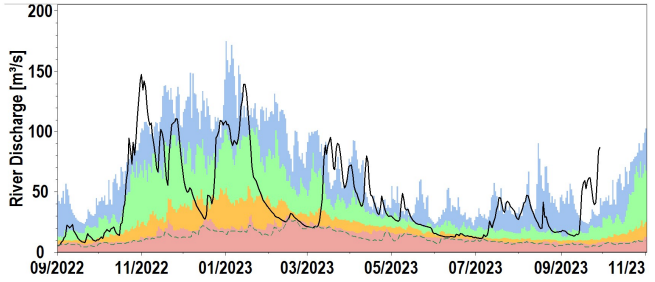
6. DEEL (Limerick)



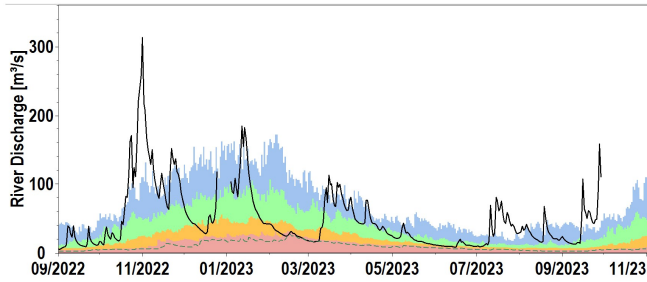
7. SLANEY (Wexford)



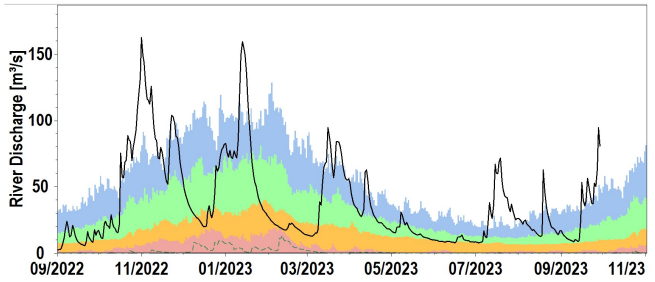
8. BARROW (Carlow)



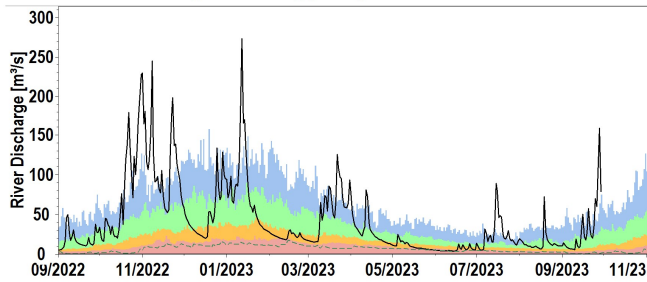
9. NORE (Kilkenny)



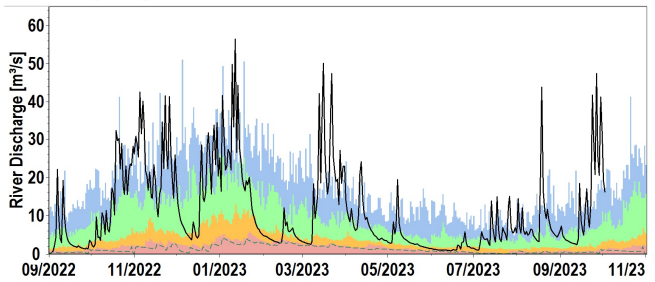
10. SUIR (Tipperary)



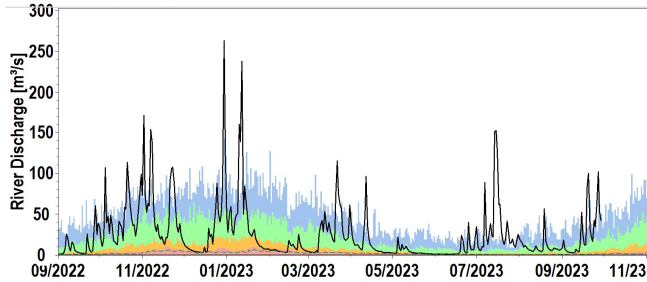
11. BLACKWATER [MUNSTER] (Cork)



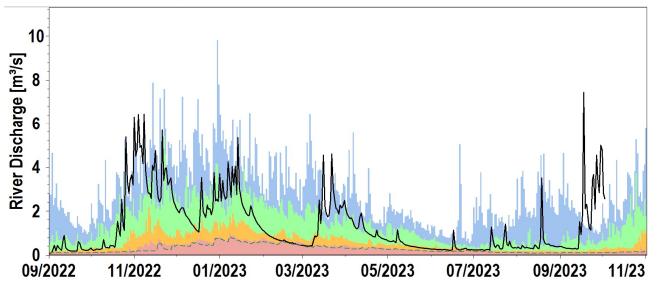
12. ILEN (Cork)



13. FEALE (Kerry)

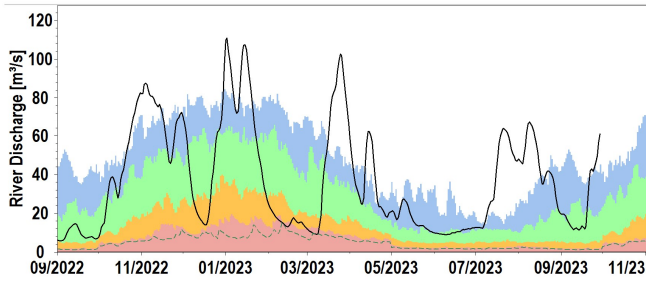


14. MULMONTRY (Wexford)

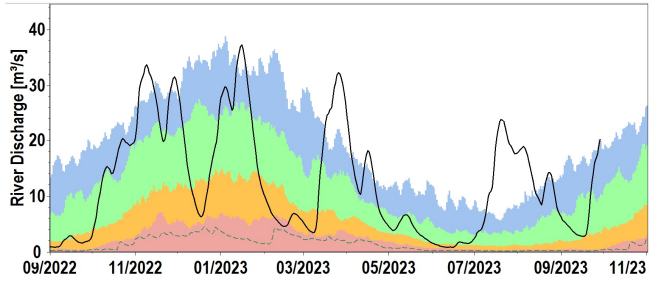


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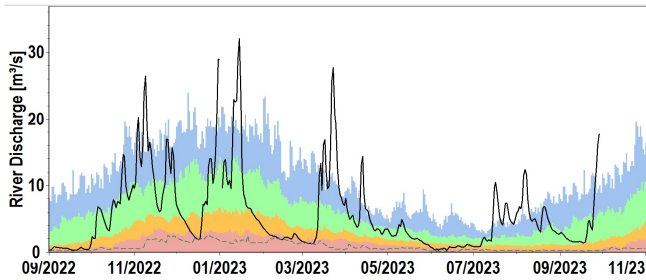
15. SUCK (Roscommon)



16. FERGUS (Clare)



17. ROBE (Mayo)



18. MOY (Mayo)

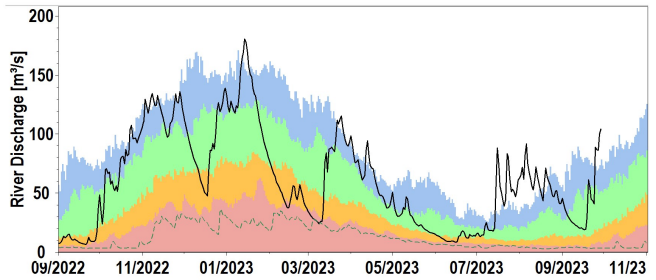




Figure 8: Daily average river flows measured in cubic metres per second relative to historic daily average flows expressed as percentile of the long-term values of each day and long-term minimum flows. All data are provisional and may be subject to revision (Source: EPA, OPW).

Explanation - Classes						
Particularly Low	Below Normal	Normal	Above Normal	Particularly High	Daily Mean Flow	Lowest Daily Mean Flow
<95%tile daily average flow	>95%tile <70%tile daily average flow	>70 %tile <30%tile daily average flow	>30%tile 10%tile daily average flow	>10%tile daily average flow		

Lake and Turlough Levels

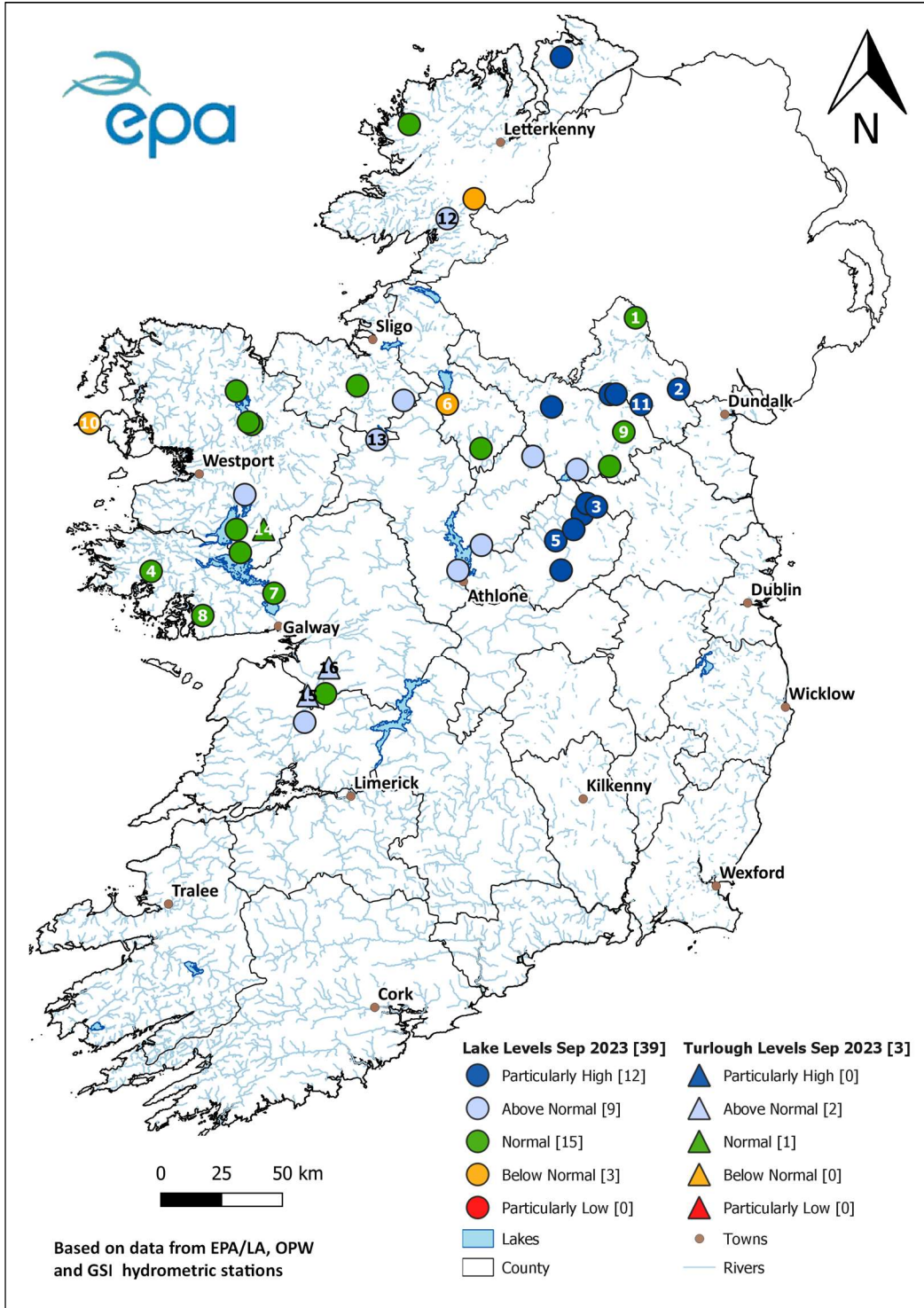
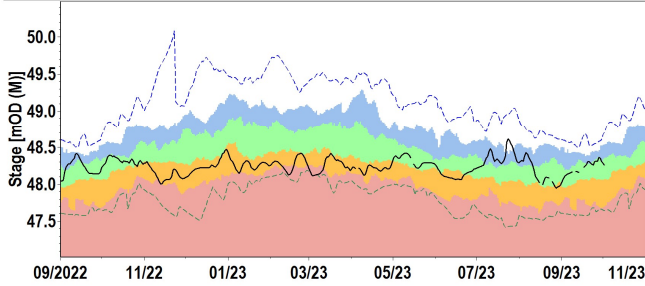


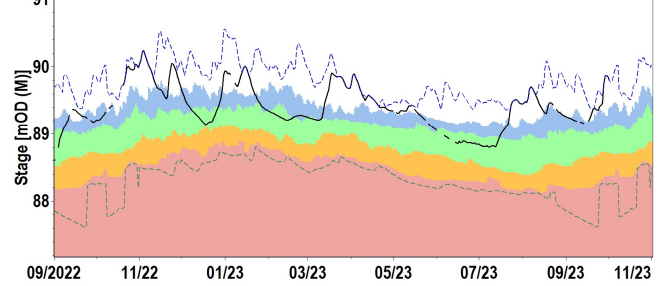
Figure 9: Monthly average lake & turlough levels for September 2023 relative to historic monthly average levels expressed as percentile of the long-term values for this month. Numbered sites are represented in the hydrographs below. All data are provisional and may be subject to revision (Source: EPA, OPW and GSI).

Water level hydrographs for selected lakes and turloughs

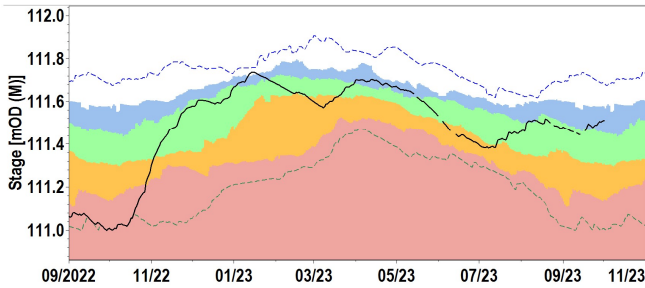
1. EMY LOUGH (Monaghan)



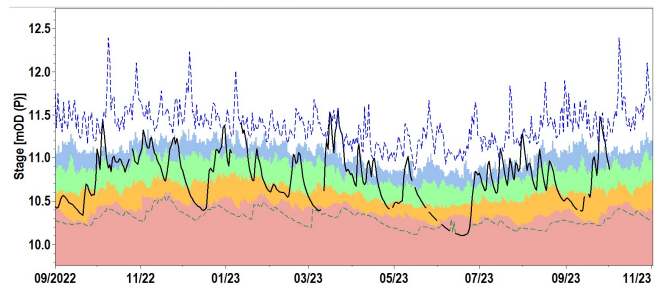
2. L. MUCKNO (Monaghan)



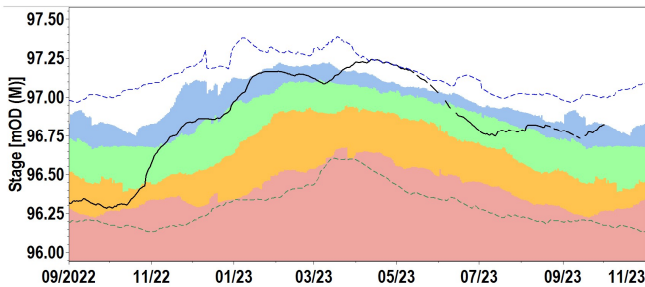
3. L. BANE (Meath)



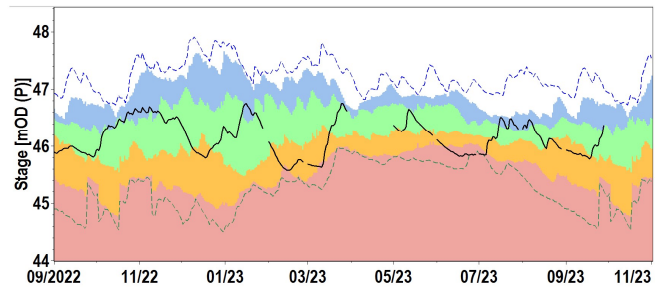
4. DERRYCLARE L. (Galway)



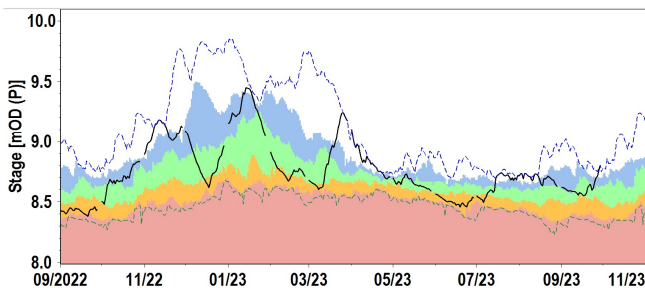
5. L. OWEL (Westmeath)



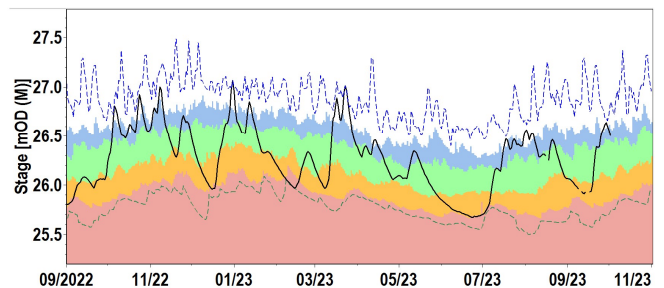
6. L. ALLEN (Leitrim)



7. L. CORRIB (Galway)

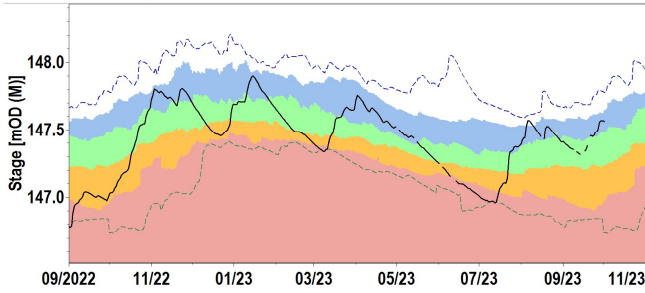


8. GLENICMURRIN LAKE (Galway)

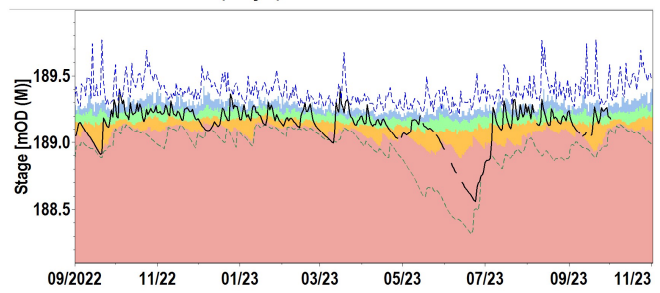


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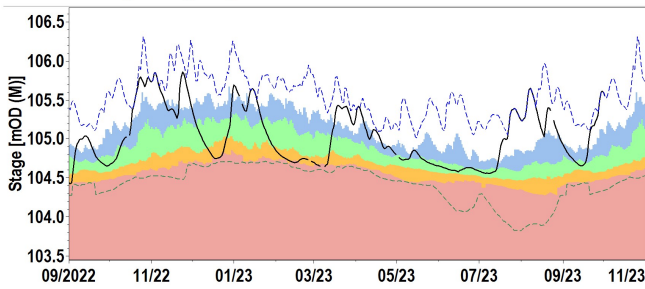
9. SKEAGH L. (Cavan)



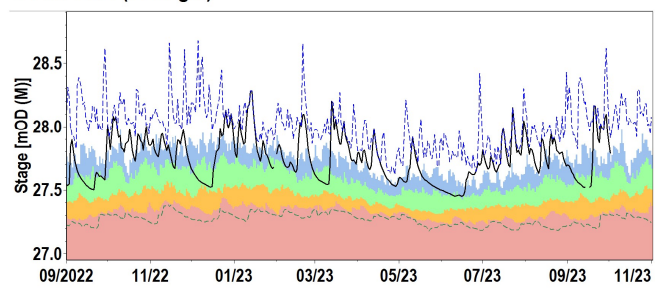
10. L. ACCORMORE (Mayo)



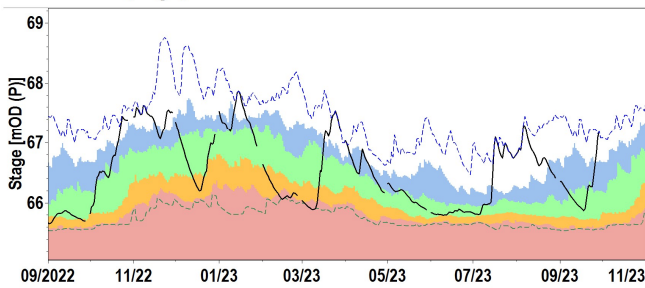
11. L. BAWN (Monaghan)



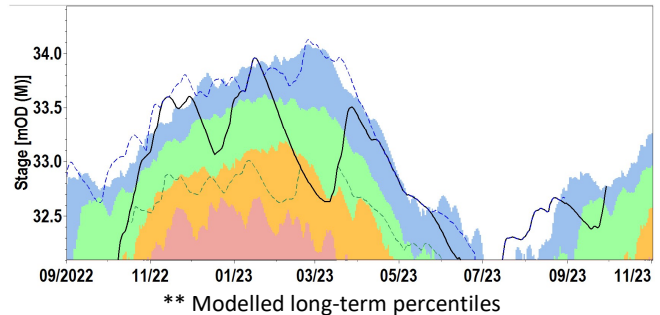
12. L. ESKE (Donegal)



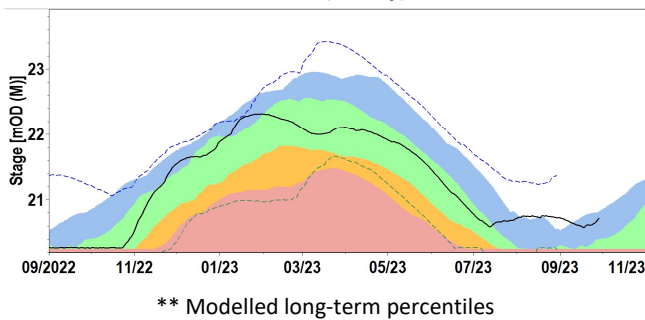
13. L. GARA (Sligo)



14. SKEALOGHAN TURLOUGH (Mayo)



15. TERMON SOUTH TURLOUGH (Galway)



16. BLACKROCK TURLOUGH (Galway)

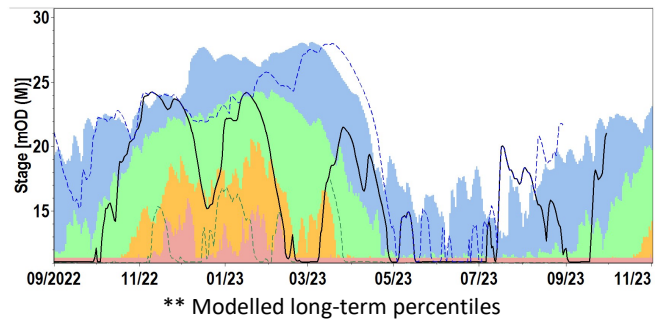
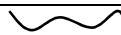




Figure 10: Observed daily mean lake and turlough levels (black trace) measured in meters above ordnance datum compared to the 10%tile, 30%tile, 70%tile and 95%tile for each month for the period of record and observed long-term maximum and minimum levels. Note historic percentiles for turloughs are based on modelled data. All data are provisional and may be subject to revision (Source: EPA, OPW, GSI, TCD, IT Carlow).

Explanation - Classes							
Particularly Low	Below Normal	Normal	Above Normal	Particularly High			
<95%tile daily average level	>95%tile <70%tile daily average level	>70 %tile <30%tile daily average level	>30%tile <10%tile daily average level	>10%tile daily average level	Daily Mean Level mOD	Highest Daily Mean Level mOD	Lowest Daily Mean Level mOD

Groundwater Levels and Spring Flows

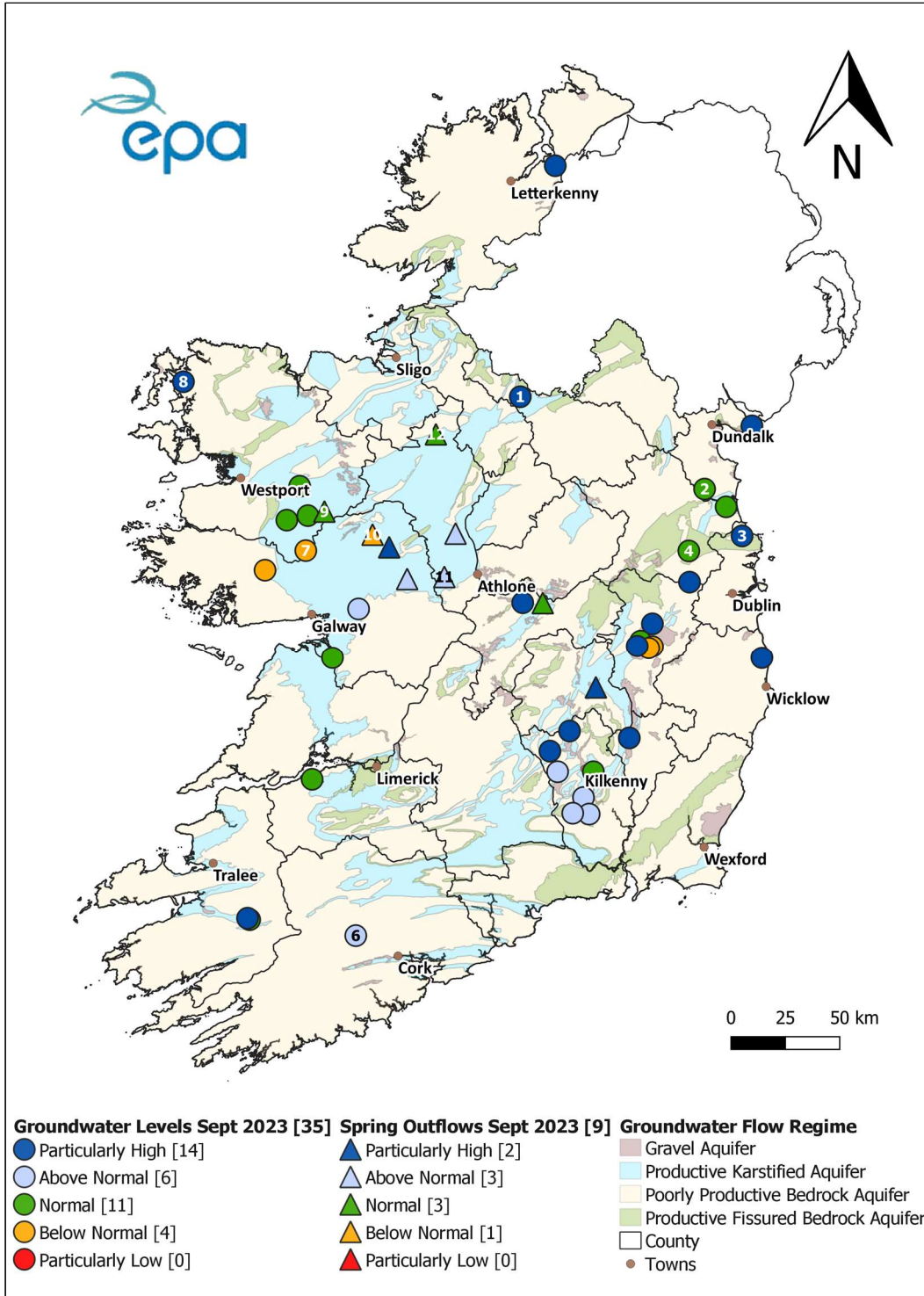
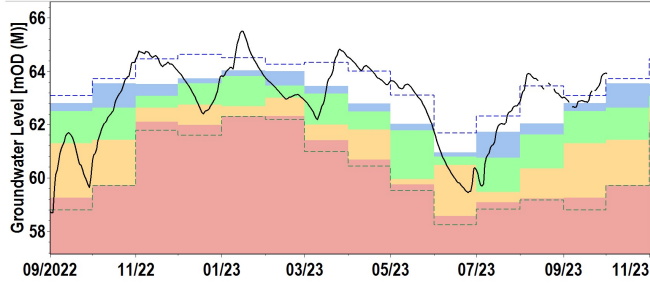


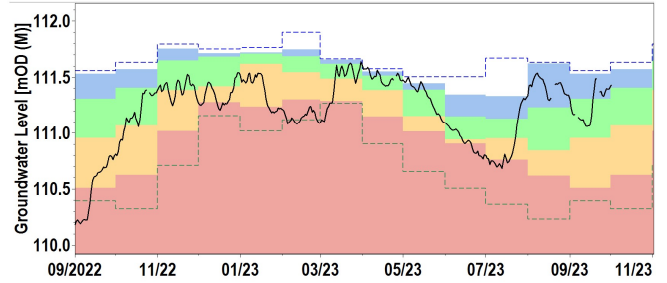
Figure 11: Groundwater level and Spring Flow status for September 2023, relative to historic monthly groundwater levels. Numbered sites are represented in the hydrographs below. All data are provisional and may be subject to revision (Source: EPA).

Groundwater and spring hydrographs

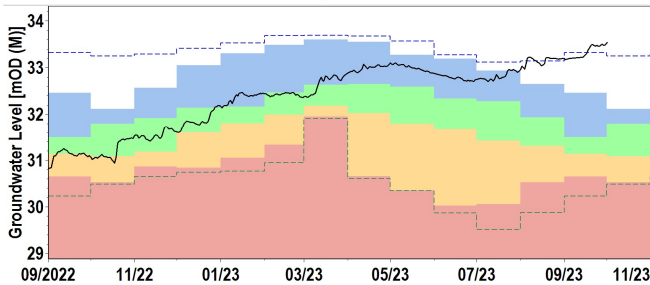
1. BAWN BOY WORKHOUSE (Cavan)



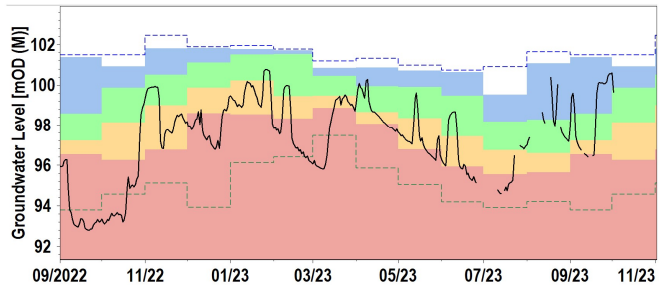
2. Mattock MK1 Deep (Meath)



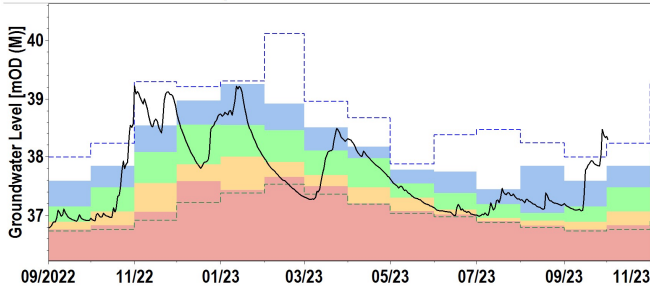
3. BOG OF THE RING OW3D (Fingal)



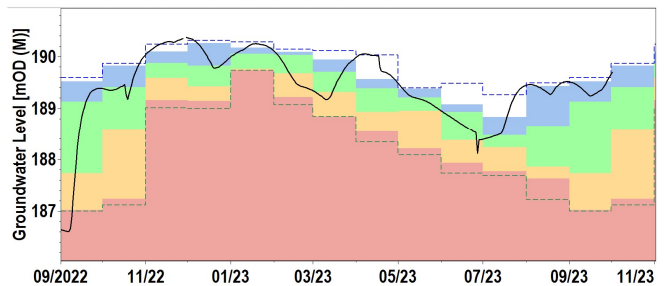
4. DUNSHAUGHLIN PW6 (Meath)



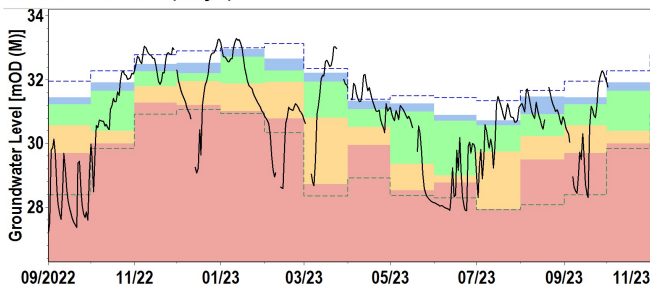
5. RATHDUFF (Kilkenny)



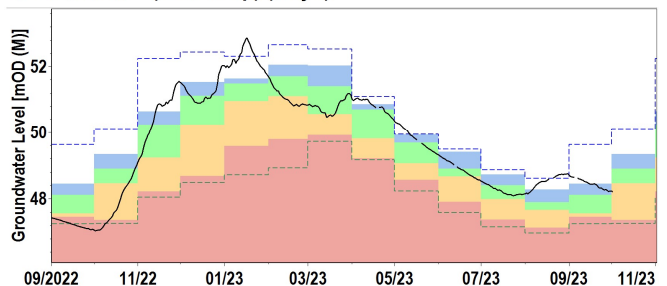
6. DRIPSEY DR1 Deep Upper Site (Cork)



7. SHRULE GWL (Mayo)

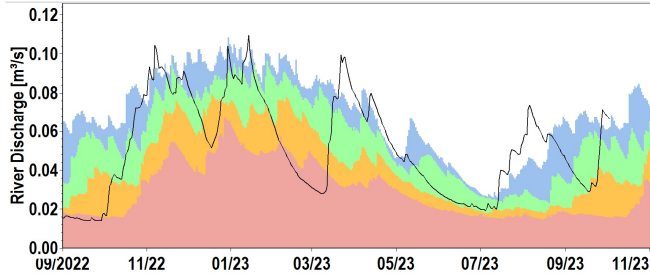


8. Glencastle - (GC1 Deep) (Mayo)

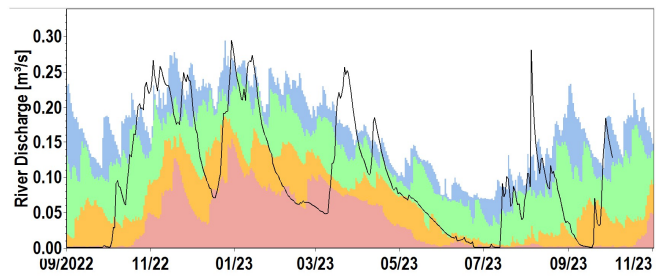


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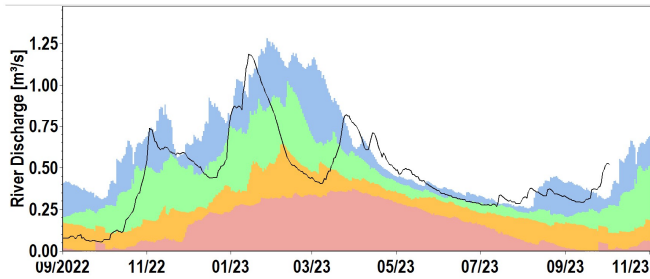
9. BALLINDINE SPRING (Mayo)



10. GORTGARROW SPRING (Galway)



11. KILLEGLAN SPRING (Roscommon)



12. ROCKINGHAM (Roscommon)

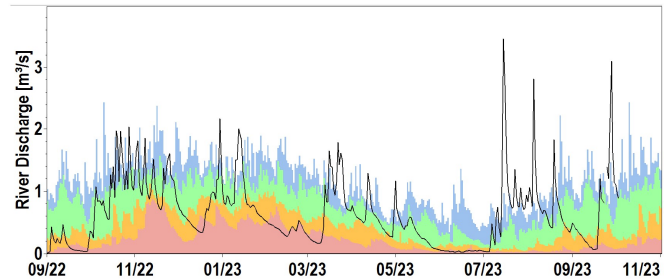


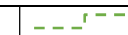


Figure 12: Daily mean groundwater levels (black trace) measured in meters above ordnance datum compared to the 10%tile, 30%tile, 70%tile and 95%tile for each month for the period of record and long-term maximum and minimum levels. All data are provisional and may be subject to revision (Source: EPA).

Explanation - Classes							
Particularly Low	Below Normal	Normal	Above Normal	Particularly High	Daily Mean Level mOD	Highest Month Mean Level mOD	Lowest Month Mean Level mOD
<95%tile monthly average level	>95%tile <70%tile monthly average level	>70 %tile <30%tile monthly average level	>30%tile <10%tile monthly average level	>10%tile monthly average level			

Glossary of terms

Aquifer Type	An aquifer is an underground body of water bearing rock or unconsolidated materials (gravel or sand) from which groundwater can be extracted in useful amounts. For the purposes of this report they have been grouped into four aquifer categories as follows: <ul style="list-style-type: none"> ➤ Karstic (Rk and Lk) aquifers; ➤ Gravel (Rg and Lg) aquifers; ➤ Productive fractured bedrock (Rf and Lm) aquifers; ➤ Poorly productive bedrock (LI, PI and Pu) aquifers.
Dry spell	A dry spell is a period of 15 or more consecutive days to none of which is credited 1.0 mm or more of precipitation (i.e. daily tot < 1.0 mm).
Long term average (LTA)	The arithmetic mean calculated from historic record. For rainfall, the period 1981 to 2010 is used. For other parameters, such as groundwater levels, lake levels and river flow the period may vary according to data availability.
mOD (M or P)	Groundwater levels or lake levels above ordnance datum. In most cases this is relative to mean sea level at Malin (M) but in some cases is relative to Poolbeg (P).
Long-term monthly average	The arithmetic mean calculated from historic record of all monthly averages.
Percentile Level/Flow	Level or flow that is equalled or exceeded the stated percent of the time, e.g. 30%tile is the level or flow that is equalled or exceeded 30 percent of the time.
Very Wet Days	A very wet day is a day with 10.0 mm or more of rainfall.
Wet Days	A wet day is a day with 1.0 mm or more of rainfall.
Dry Spell	A dry spell is a period of 15 or more consecutive days to none of which is credited 1.0mm or more of precipitation (i.e. daily tot < 1.0 mm).
Absolute Drought	An absolute drought is a period of 15 or more consecutive days to none of which is credited 0.2 mm or more of precipitation.
Partial Drought	A partial drought is a period of at least 29 consecutive days, the mean daily rainfall of which does not exceed 0.2 mm

Description of flow and level percentile classifications

Particularly High	>10%tile exceedance	Monthly level or flow that can occur 10% of the time
Above Normal	>30%tile <10%tile exceedance	Monthly level or flow that can occur 20% of the time
Normal	>70%tile <30%tile exceedance	Monthly level or flow that can occur 40% of the time
Below Normal	>95%tile <70%tile exceedance	Monthly level or flow that can occur 20% of the time
Particularly Low	<95%tile exceedance	Monthly level or flow that can occur 5% of the time

Useful links

Access to EPA/LA Hydrometric data on [HydroNet](#)

Access to provisional water level only data from OPW hydrometric stations on [waterLevel.ie](#)

Access to archived water level and flow data from OPW hydrometric stations on [HydroData](#)

Access to turlough and borehole level data from GSI hydrometric stations on [gwlevel.ie](#)

Access to this month's Met Éireann and historic [weather statements](#).