Report to Gouthwaite Board of Management

Hydrological Conditions of the Nidd Catchment – 2022 to March 2023

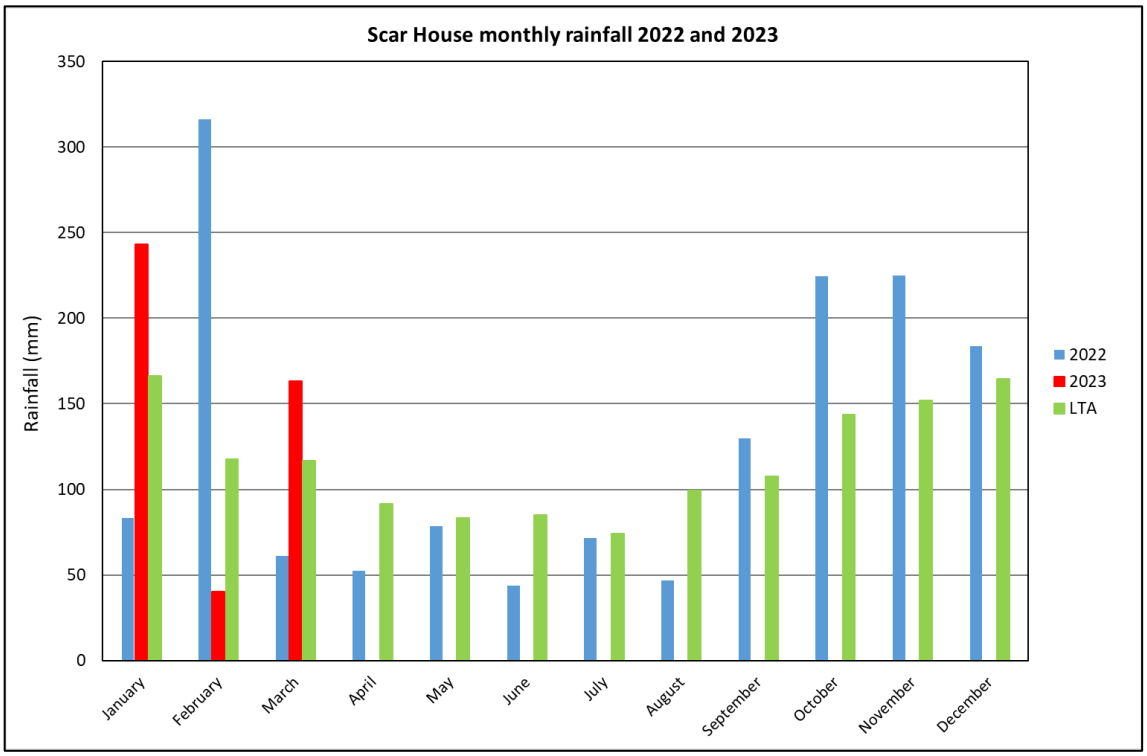
Rainfall

Two contrasting statistics:

For the Nidd catchment as a whole, 2022 had the third wettest February in a record commencing in 1891, ranked after 2020 and 2002.

Then, it experienced the fifth driest March to August period in this same record, which is the Met Office Had-UK Grid data set.

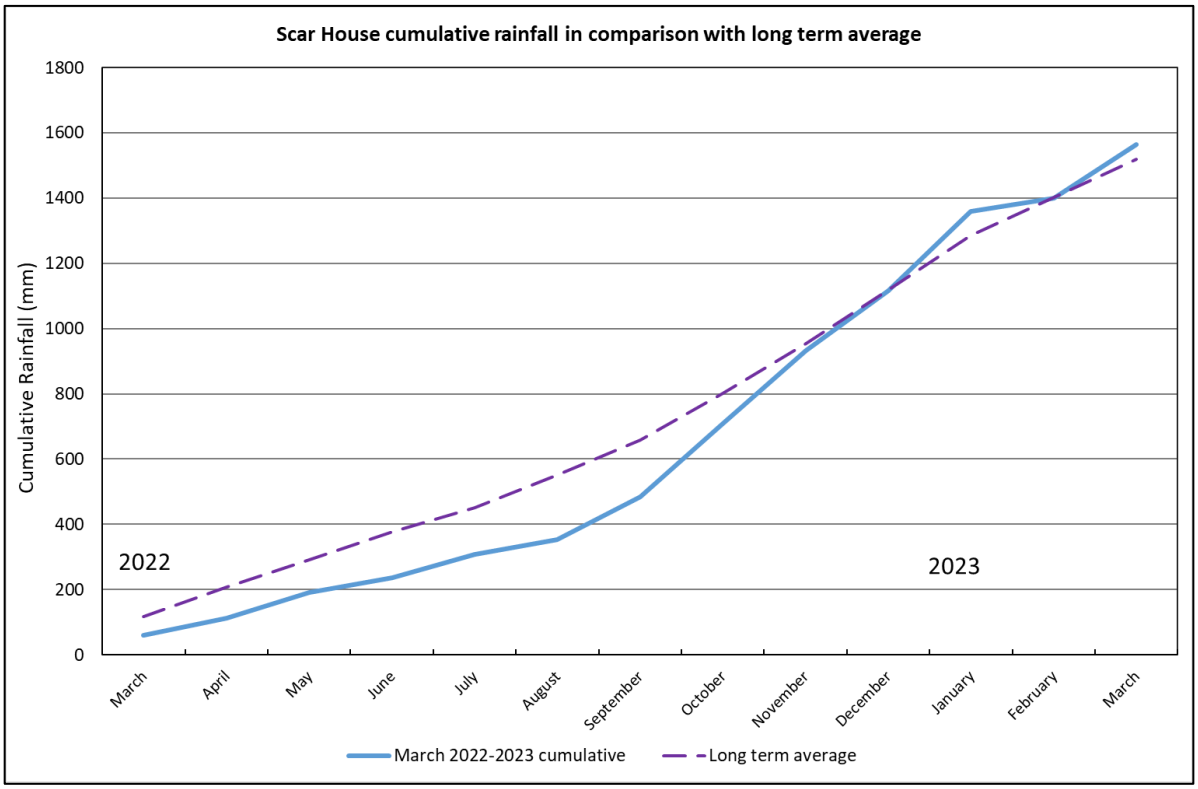
More locally for the Gouthwaite Reservoir catchment, Graph 1 shows monthly rainfall totals at Scar House rain gauge in comparison with the 1981-2010 long term average (LTA). January 2022 continued from November and December 2021 in having well below average rainfall. February, as noted above, was exceptionally wet; at least 225% of the monthly LTA rainfall was recorded at Scar House. The tipping bucket rain gauge (TBR) indicated 269% of the LTA but comparison with check gauges suggests that the TBR reading may have been affected by snowfall or the potential for TBRs to over-record during heavy storms.



Graph 1: Monthly rainfall totals at Scar House Reservoir compared with the LTA for 2022 to March 2023

The next six months all recorded below average rainfall; in particular March, April, June and August combined received just over half the normal amount. Graph 2 overleaf illustrates the rainfall deficit that built up over the spring and summer, reaching almost 200mm by the end of August. More widely in Yorkshire, the impacts of the dry weather on water resources were increased by periods of high temperature and prolonged periods of high evaporation. Unusually dry soils extended through the upper Pennine river and reservoir catchments by late August.

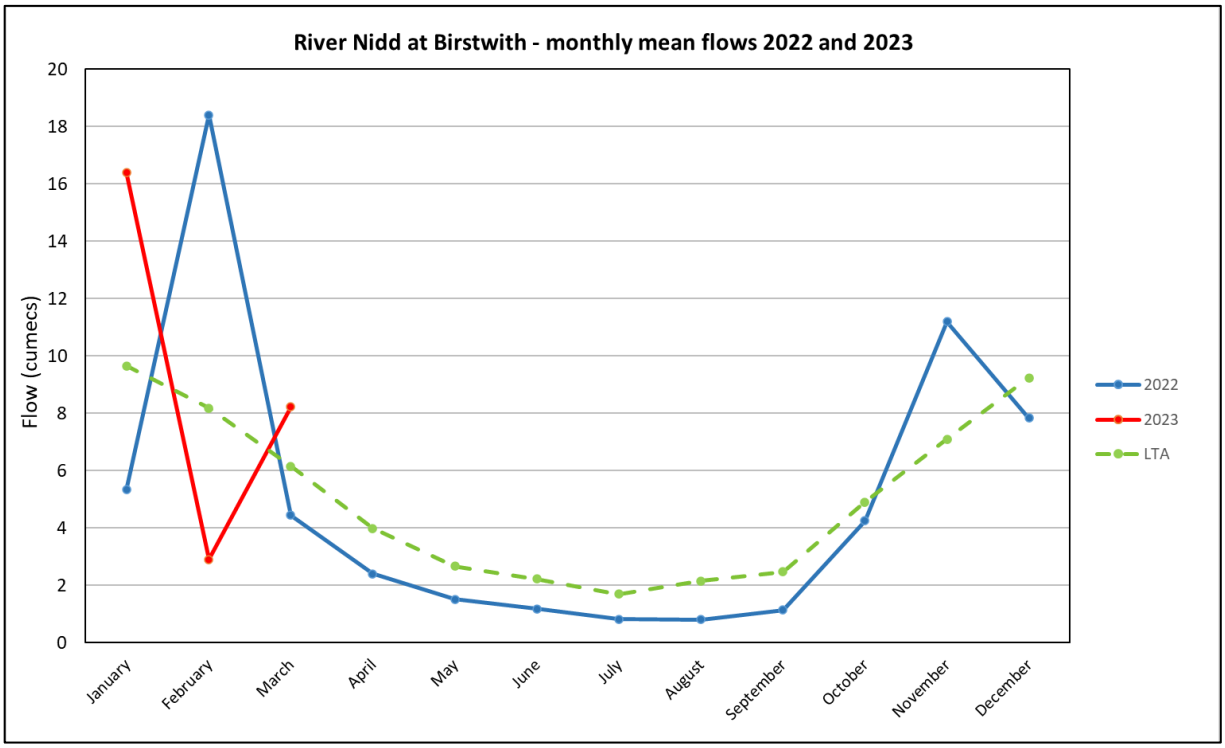
A wet second half of autumn followed. At Scar House, September to December all had above average monthly rainfall totals, although not exceptionally so. January 2023 had 170% of LTA rainfall but this was concentrated in the first half of the month. Late January and February were very dry with high pressure weather conditions dominating. Only 34% of LTA rainfall was recorded at Scar House in February. Wetter conditions returned from mid-March and the total at the time of writing to 28th March represented 140% of the LTA.



Graph 2. Cumulative rainfall to show deficit from long term average during summer 2022

River Flow

Graph 3 shows the monthly mean flows recorded at Birstwith gauging station on the River Nidd for 2022 and early 2023. They are compared with the LTA from the preceding record of 1975-2021.



Graph 3: River Nidd monthly mean flow at Birstwith for 2022 to March 2023, compared with the LTA

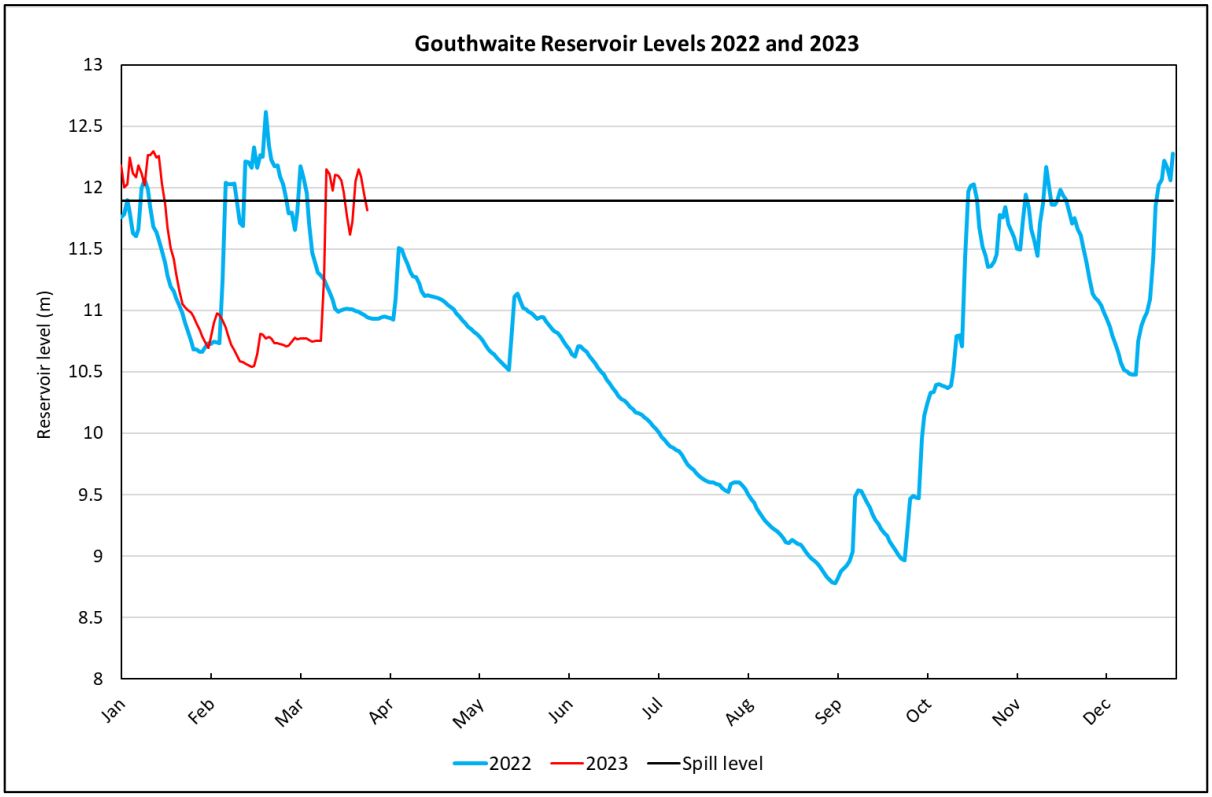
Flows were only 55% of the LTA in January 2022. The very wet February included a series of storms and spates on the River Nidd. In particular, on 20th February 2022 Storm Franklin produced the third highest flood peak in the 46 year record at Birstwith, ranked after October 2000 and February 2020. The monthly mean flow was 225% of the LTA, less extreme than in 2020.

Flows receded rapidly in late February. As Graph 3 shows, river flows were considerably below average from March right through to September, although they only reached what we would consider to be summer low flow values from late June onwards. By July and August monthly mean flows were 49% and 38% of the LTA respectively. Similar conditions were recorded on many of Yorkshire's rivers. The Environment Agency declared drought status in Yorkshire on the 15th August, and this status was retained until mid-January 2023.

Flows at Birstwith began to recover during October although the monthly mean was still slightly below the LTA. November had above average flows (158% of LTA) but the first half of December again featured some notably low flows for the time of year. Following the wet late December and early January, monthly mean flow for January 2023 was 170% of the LTA. In the very dry February monthly mean flows fell to 35% of the LTA. Flows stepped up from mid-March and the monthly mean was around 133% of the LTA.

Reservoir Level

Graph 4 shows Gouthwaite Reservoir levels during 2022 and early 2023 relative to the spill level of 11.89m. After a brief spill in early January 2022 reservoir levels declined through application of the control rules. Levels rose sharply with February rainfall and spills occurred for a total of 23 days in this period up to early March.



Graph 4: Gouthwaite Reservoir levels 2022 to March 2023

The graph shows the decline in reservoir levels as the drought developed, with only short-lived increases in early April and mid-May. The remaining volume represented 65% of full capacity by the end of June and 45% of capacity by the first week of September. For comparison, levels declined to 49% full in September 2018.

Sustained recovery in the reservoir water levels began at the very end of September. Only three weeks later the reservoir was spilling for a few days, aided by 53mm of rainfall over the 19th to 20th October as recorded at Scar House. Water levels fluctuated close to the spill level during

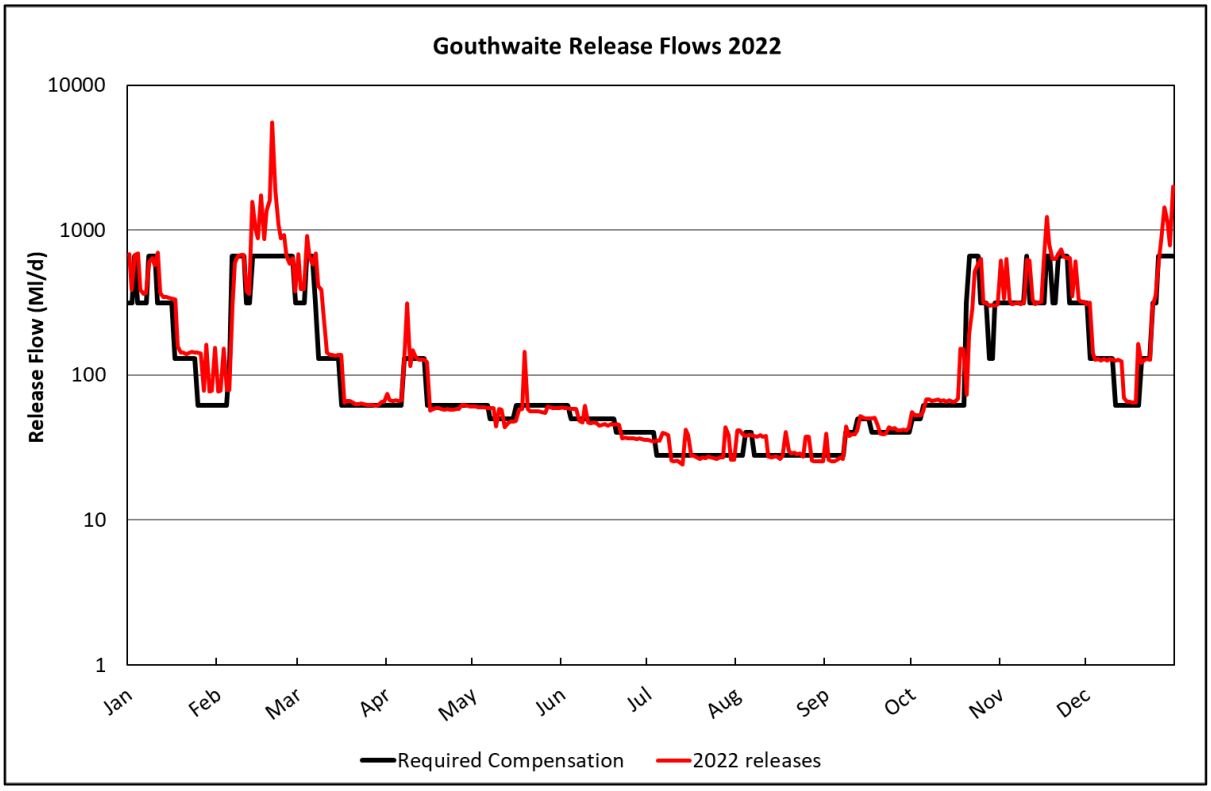
November, then were drawn down through compensation releases in the first half of December, to around 70% full. Reservoir levels increased with late December rainfall and spills occurred for three weeks at the turn of the year. Levels then fell and remained fairly steady during the dry February and early March of 2023. They recovered to full capacity and a week of spills in mid-March, following 65mm of rainfall over four days.

Compensation Releases

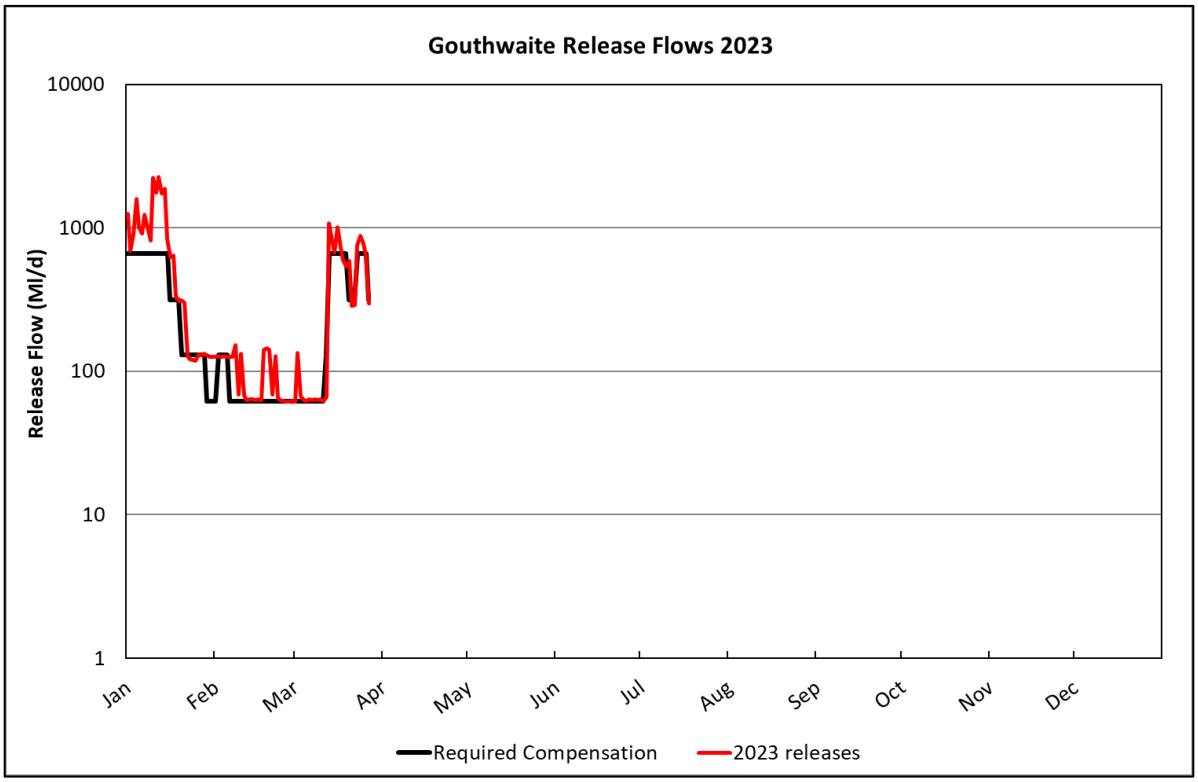
Graphs 5 and 6 show the reservoir release flows, including any spill, for 2022 and early 2023, together with the compensation releases that would be required under the current control rules.

Throughout this period the release flows were well controlled, closely following the required compensation rates. Compensation flows were maintained at the 28 Ml/d or occasionally 40 Ml/d band throughout July and August at the height of the drought. During February 2023 Graph 6 appears to show some short-term releases one band higher than required compensation flow rates. However, this recent data has not yet been validated and the variability may reflect differences in measuring both reservoir level and downstream river level especially under windy conditions.

The reservoir was spilling during periods of high water levels in February 2022, briefly in October and November, for three weeks in late December into January 2023 and for over ten non-consecutive days in a period from mid-March.



Graph 5: Compensation releases 2022



Graph 6: Compensation releases 2023