KFAG Assessment of some release scenarios using historical data 2015-2025

Aims

By using historical data to get some feeling for:

- The impact of a "no release" case vs current KFAG, ie UU proposal for 1/4/26. Builds on note circulated on 4/1/26.
- Benefits/disbenefits of a limited range of scenarios eg flood risk, overspills, SJB flows, water "lost".
- Peak flows (frequencies?) in SJB and comparison to S20 flows and flows in the UU environmental report supporting licence application.
- The feasibility of scenarios vs the UU view that only FDR will work.

Approach

- Historical 15 minute data from January 2015 to 18th October 2025 used (378,578 x 15 min periods or 3943.5 days).
- All data provided by EA or from Hydrology data explorer website.
- Baseline dataset – measured values from gauges, calculated overspills based on weir rating equations.
- Simply add or subtract water into reservoir volume in each 15 min period to model effect of different storm release regimes, or no storm release at all.
- Allows calculation of a new reservoir volume for each period and hence a new level, trigger release and overspill to create a new input level for the next 15 minute period.
- Builds a full modelled "history" for a release scenario to compare with the baseline.

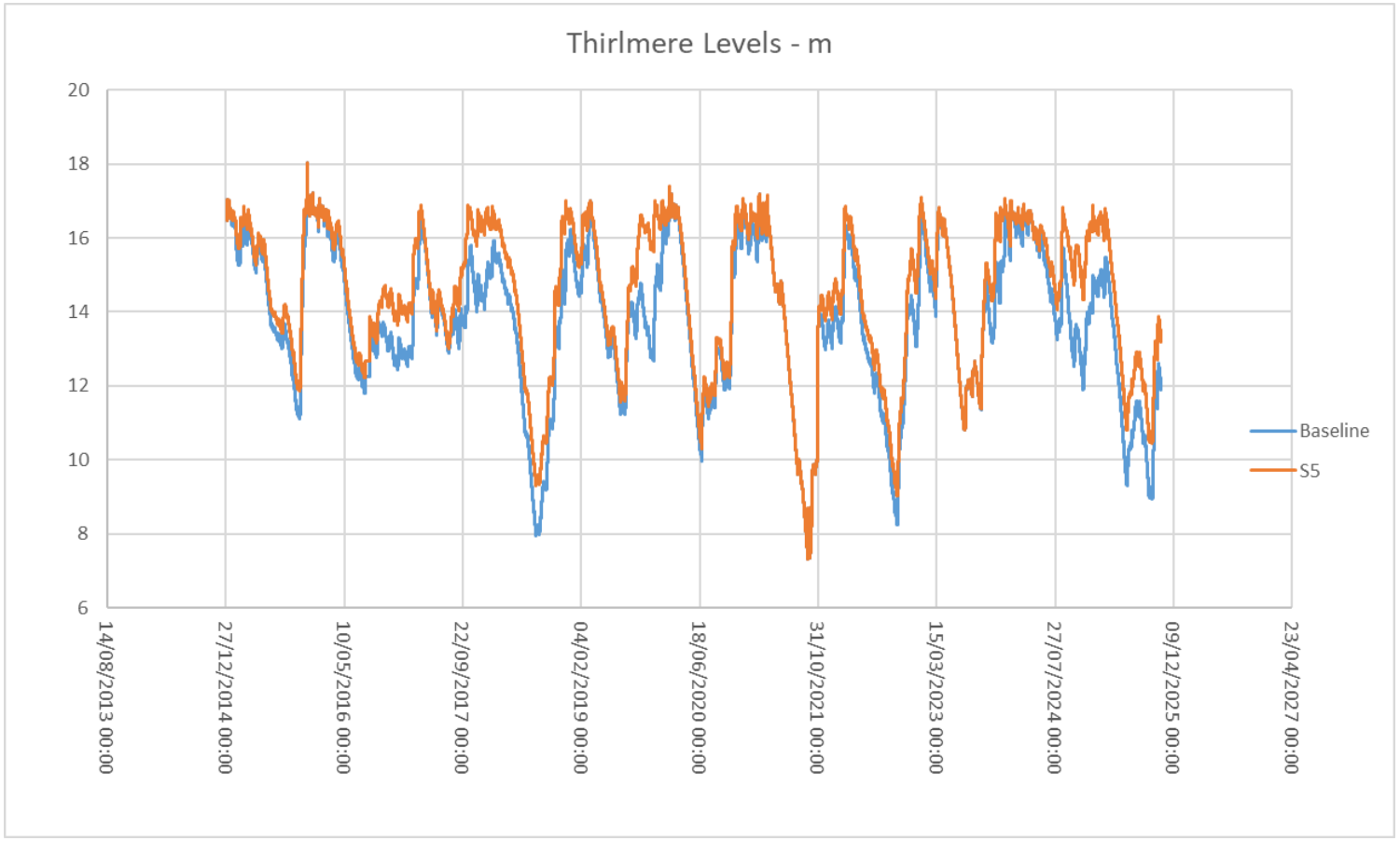
Scenarios

	Storm Release in Ml/d	Trigger levels below weir
Baseline (KFAG)	120	Current KFAG monthly triggers
Scenario 1 (S1)	600	1m June-Feb, 0.5m Mar & May, 0m Apr
Scenario 2 (S2)	1500	1m June-Feb, 0.5m Mar & May, 0m Apr
Scenario 3 (S3)	600	0.5m May-Mar, 0m Apr
Scenario 4 (S4)	1500	0.5m May-Mar, 0m Apr
No release (S5)	0	No trigger levels, no releases

Scenarios chosen to be challenging – higher trigger levels, high release flows.

Common features – release off when overspill starts and not back on until it stops.

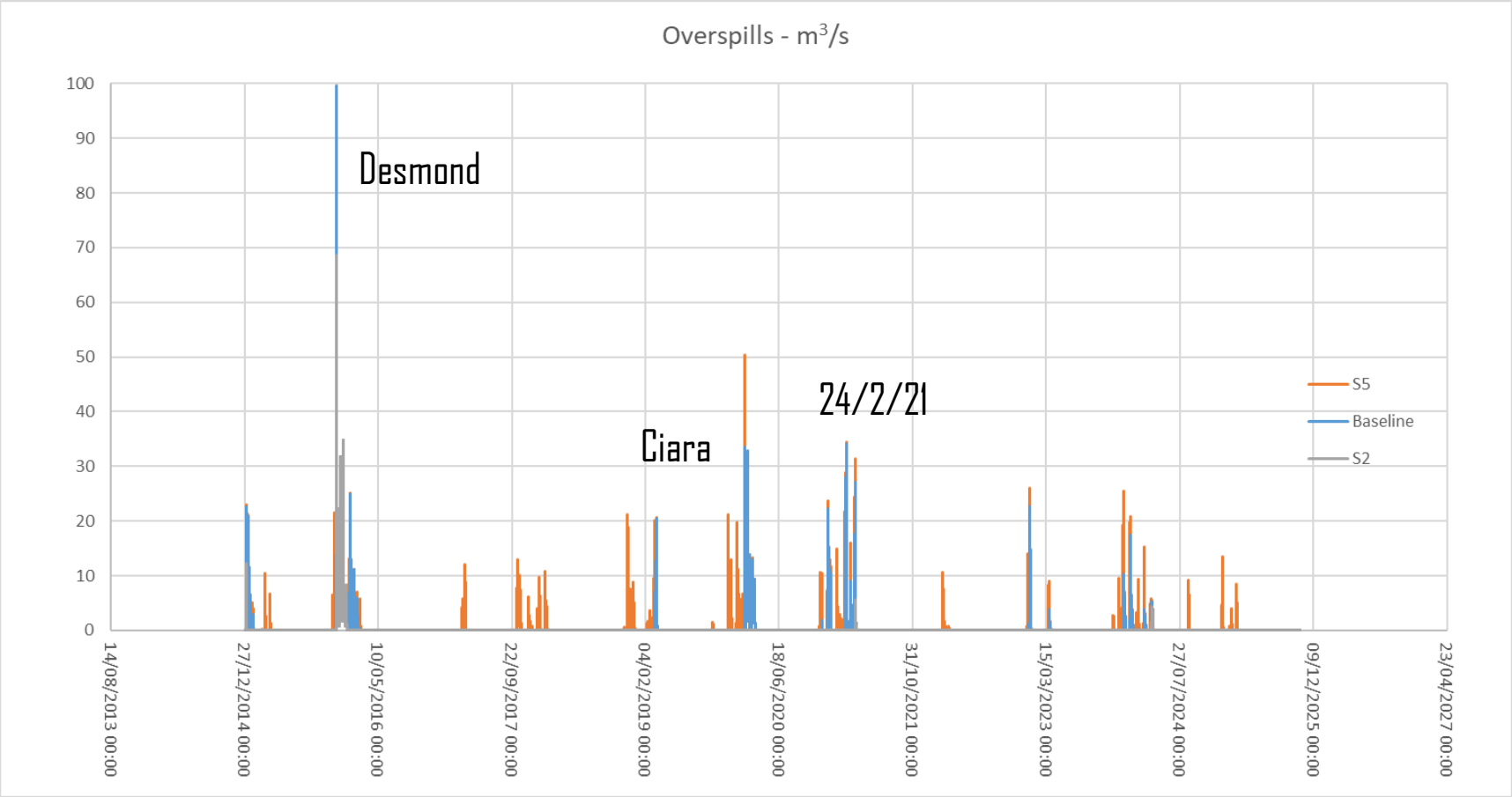
Results – Thirlmere Level



Comparing Baseline with S5 (no release) looks sensible.

Levels come together at overspills and separate when KFAG release is on.

Results – Overspills



3 largest actual overspills in the dataset identified

Flood risk mitigation

Peak overspills – 3 largest peaks in the dataset tabulated below

Peak overspills - m3/s						
	Baseline 2015-2025 KFAG Releases	S1 1m trigger 600Ml/d release	S2 1m trigger 1500Ml/d release	S3 0.5m trigger 600Ml/d release	S4 0.5m trigger 1500Ml/d release	S5 No releases
Desmond	99.6	87.1	68.5	96.4	89.4	99.6
Ciara	33.6	5.5	0.0	24.1	20.2	50.4
24/02/2021	34.1	16.9	0.0	34.1	33.4	34.4

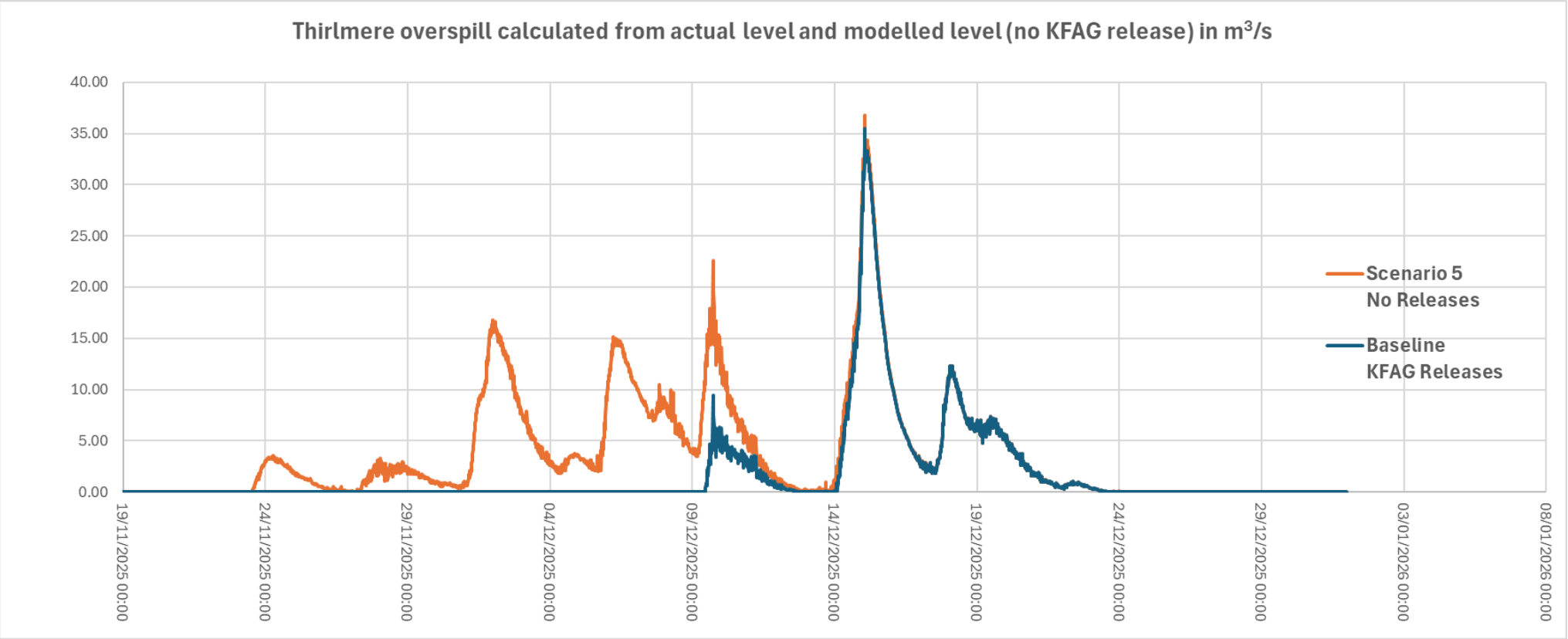
Trigger value of 1m (ie more storm space) of S1 and S2 shows even Desmond can be reduced. Other events virtually eliminated.
Even at 0.5m trigger there is some benefit over the baseline. No release is worst case for flood mitigation.

Peak SJB flows - m3/s						
	Baseline 2015-2025 KFAG Releases	S1 1m trigger 600Ml/d release	S2 1m trigger 1500Ml/d release	S3 0.5m trigger 600Ml/d release	S4 0.5m trigger 1500Ml/d release	S5 No releases
Desmond	110.2	97.8	80.5	107.1	100.1	110.3
Ciara	38.0	14.0	24.4	28.7	24.3	55.0
24/02/2021	35.2	17.9	21.1	35.3	34.7	35.5

Some events the effect is to swap out overspill for release (eg Ciara and 24/2/21 in S2) where overspill is eliminated but SJB flow is reduced by ~1/3 – good for flooding. But maintains high flow for environment.

Common feature of all 3 events – either were overspilling (baseline) or would have had significant overspills immediately before the main event if no KFAG releases (S5).

Outside date range, but recent overspill in Dec 2025 is good example of this and is fresh in the memory.



KFAG have expressed their concerns over FDR scheme as currently proposed by UU, and exemplified with some early modelling based on Desmond (email 16/10/25)

Would EA/UU really do a FDR in these circumstances?

Overspills and SJB Flows

Days with a peak overspill and SJB flow above a given value tabulated for each scenario

- 550Ml/d – Spate release flow in S20 (also max of LSVs)
- 1450Ml/d – to catch all1500Ml/d releases (ie max of both LSVs and USVs)
- 2000Ml/d – natural small flood flow in S20

For baseline, S4 and S5 have also looked at peak flows of:

- 1600Ml/d - flow measure in SJB on 23/1/24 that EA has agreed performed the function of a small flood flow.
- 1750Ml/d – small flood flow release in S20 (not currently possible).

Effect of scenarios on overspills – Days within the ~11 year dataset with a peak above a threshold

Number of days with an overspill above a given flow - m3/s (Ml/d)						
Flow	Baseline 2015-2025 KFAG Releases	S1 1m trigger 600Ml/d release	S2 1m trigger 1500Ml/d release	S3 0.5m trigger 600Ml/d release	S4 0.5m trigger 1500Ml/d release	S5 No releases
6.37 (550)	32	18	7	28	12	66
16.78 (1450)	18	12	5	15	9	26
23.15 (2000)	9	5	3	8	6	13

Overspills can be greatly reduced.

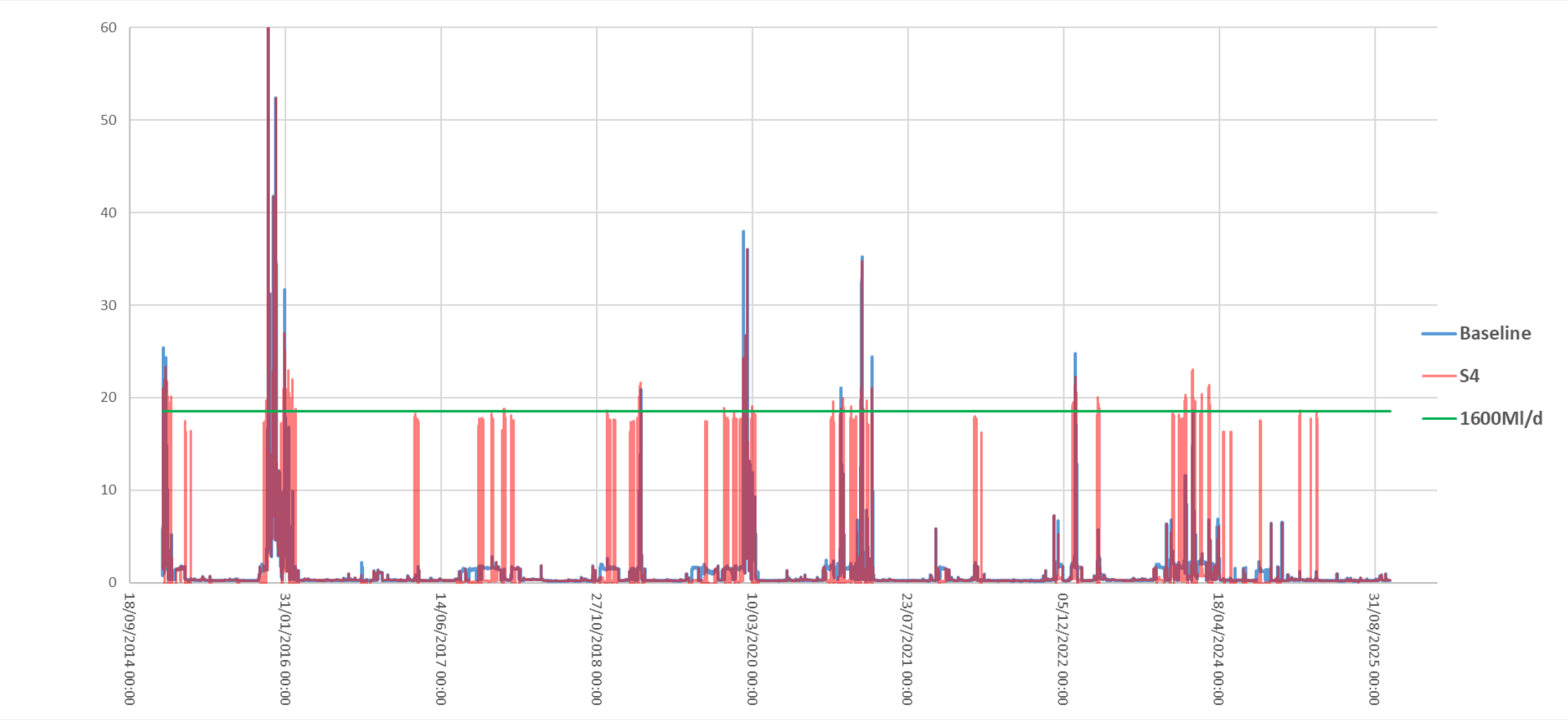
Effect on SJB flow peaks – Days within the ~11 year dataset with a peak above a threshold

Number of days with an SJB peak above a given flow - m3/s (Ml/d)						
	Baseline 2015-2025 KFAG Releases	S1 1m trigger 600Ml/d release	S2 1m trigger 1500Ml/d release	S3 0.5m trigger 600Ml/d release	S4 0.5m trigger 1500Ml/d release	S5 No releases
6.37 (550)	38	81	82	98	89	66
16.78 (1450)	21	11	78	14	84	30
23.15 (2000)	15	7	11	10	12	19

More flows over1450Ml/d (S2 and S4) and can be flexible. At 2000Ml/d number is reduced.

What is key for SJB health?

Distribution of days with high SJB flow is far more even than baseline



No 2 year period without a flow peak >1500Ml/d

All flow thresholds in Table 2-1 of the Environ Report can be met

Number of days with SJB peak an SJB peak above given flow (Ml/d)			
Flow - Ml/d	Baseline 2015-2025 KFAG Releases	S4 0.5m trigger 1500Ml/d release	S5 No releases
550	38	89	66
1450	21	84	30
1600	19	50	28
1750	19	30	27
2000	15	12	19

S4 offers more days with peak flows >1750Ml/d (SFF release target from S20) than S5 (no releases). This is in contrast to page 4 of UU Env Report which says this flow can't be achieved without overspill.

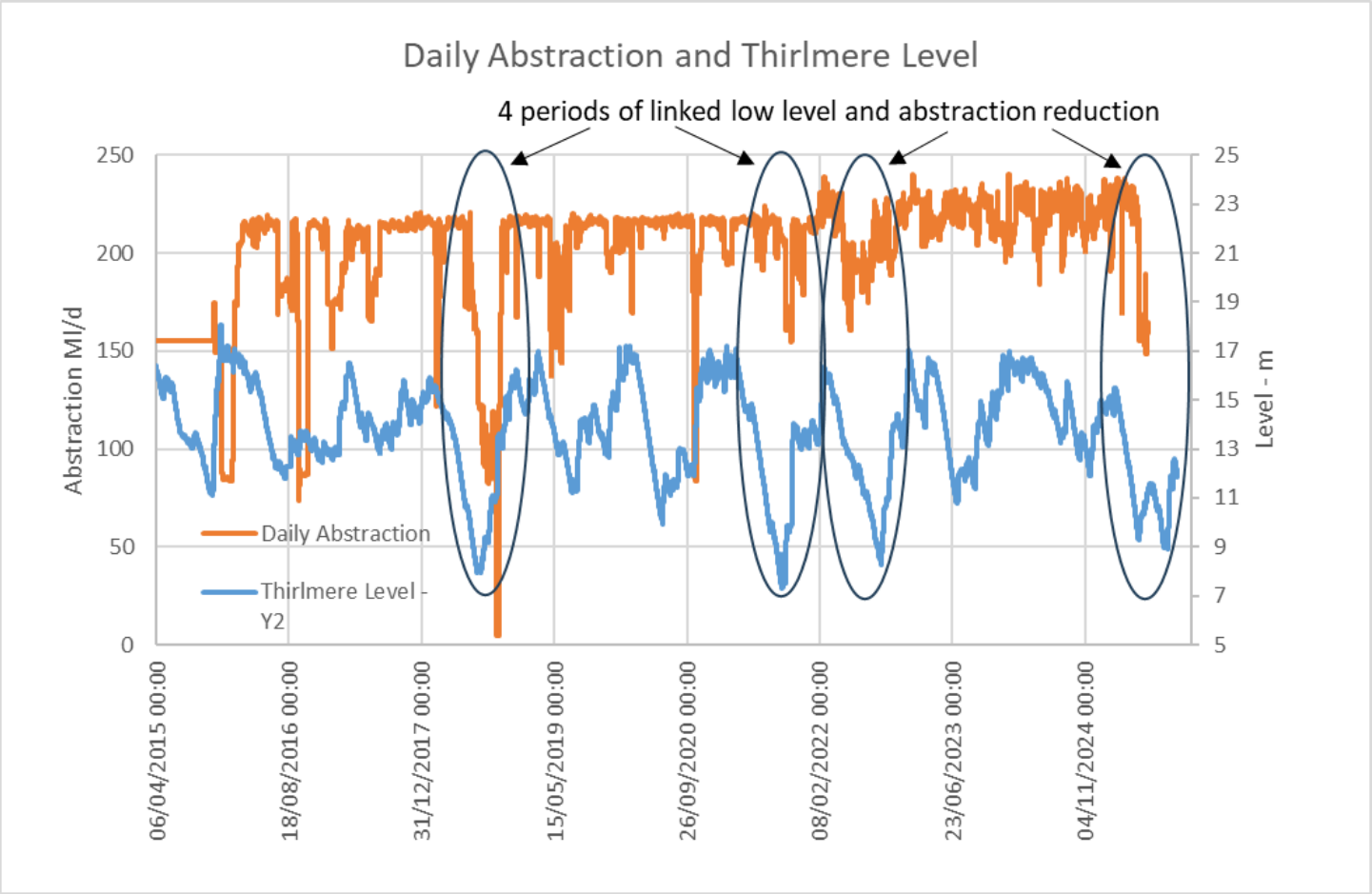
Baseline numbers do not agree with Page 19 Fig 2-4 or Page 32 Physical Environment (removing releases, ie assessment case, restores >1750Ml/d to 1/3 of years).

Baseline (2015-2025) >1750 >1750	Fig 2-4 basecase >1750	Fig 2-4 assessment case >1750 >1750
19 in ~11 years ie ~1.7 per year per year	~18% of years ie <1 every 5 years every 5 years	~33% of years, ie 1 in every 3 years every 3 years

Having the USVs in play gives flexibility over release flows and hence SJB flows. However, at 2000Ml/d or above number of days is reduced but not eliminated.

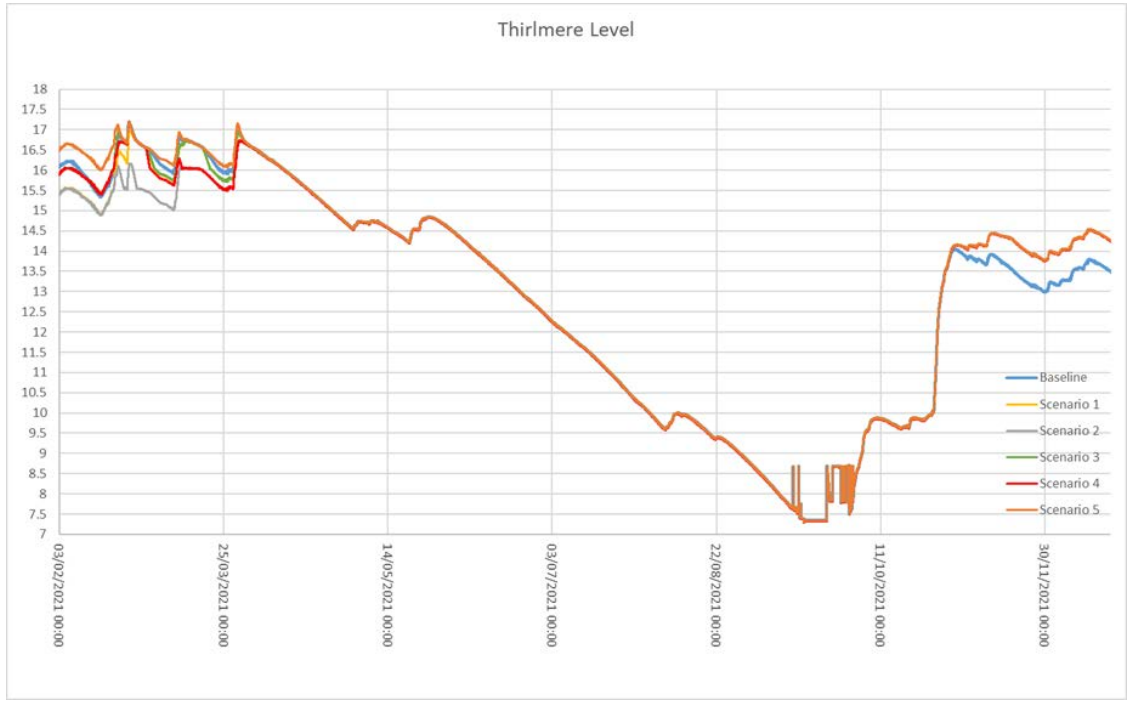
Impact on Abstraction

Assumption - Water resource is only lost if low level necessitates a cut in abstraction.
There appear to be 4 such periods in the historical dataset (2015 onwards).

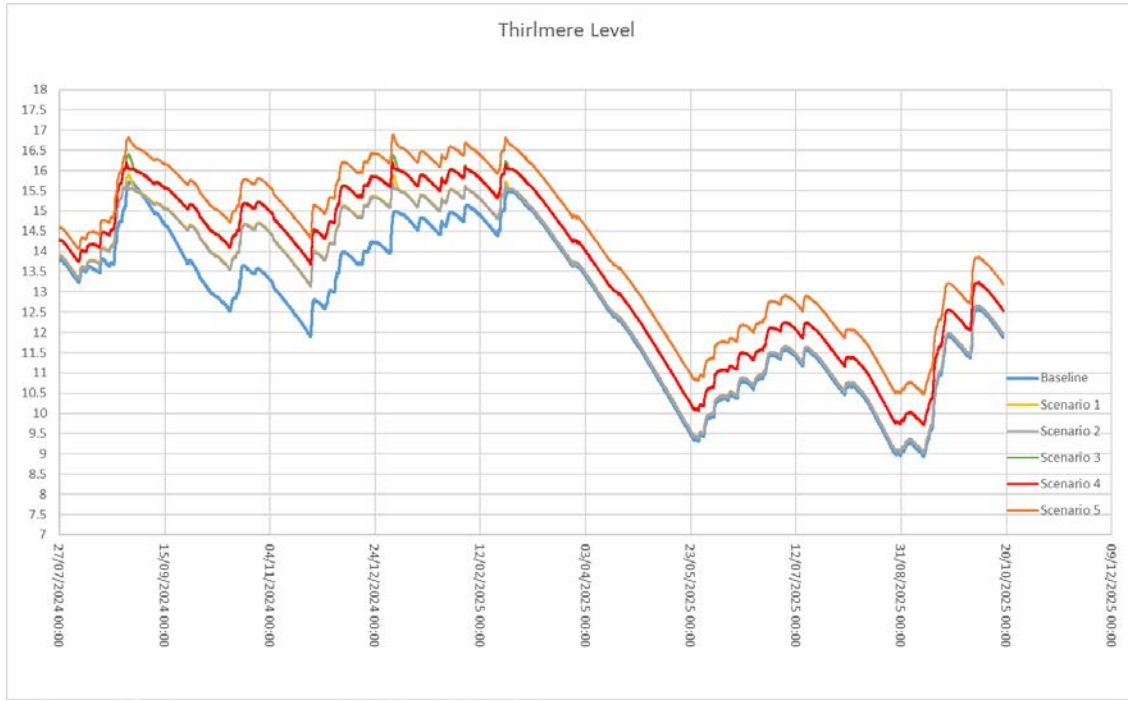


2021 and 2024-2025 Low level Periods

Precursor conditions are key as to whether storm releases impact on later periods of low level

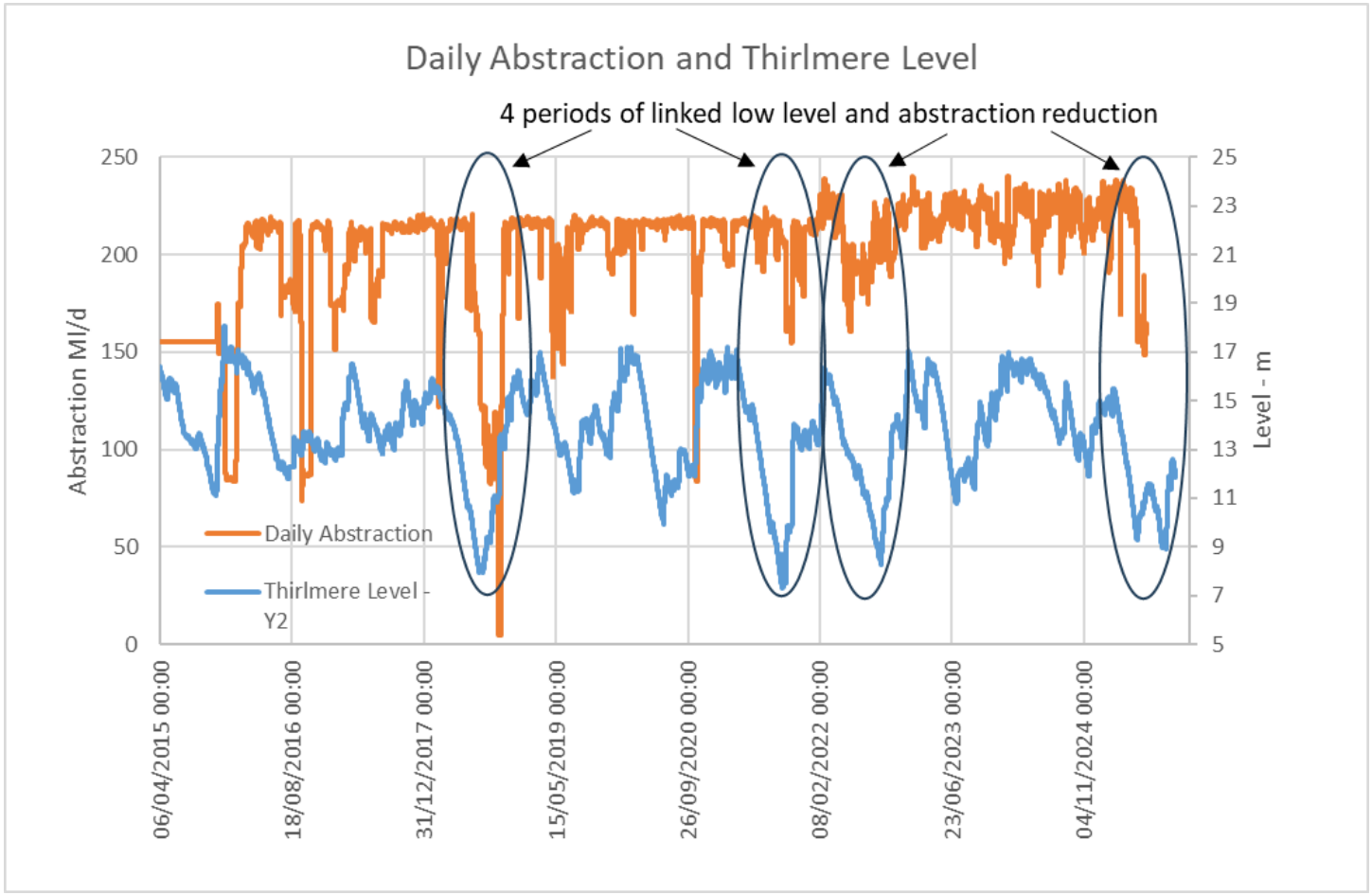


2021 overspill in late March means releases have no impact



2024-2025 releases in Sep-Nov 2024 mean scenario levels separate and do impact level in summer 2025

Impact on Abstraction



For each of the 4 periods the difference in reservoir volume at the lowest points for each scenario relative to the baseline gives an estimate of the impact on abstraction of each scenario.

Volume difference from Baseline in Ml					
	S1 1m trigger 600Ml/d release	S2 1m trigger 1500Ml/d release	S3 0.5m trigger 600Ml/d release	S4 0.5m trigger 1500Ml/d release	S5 No releases
15/08/2018	-457	-482	1,263	1,237	3,252
24/09/2021	-7	-37	-7	-38	3
04/10/2022	-1,711	-1,772	-29	-54	1,853
11/09/2025	204	204	1,923	1,923	3,886
Net	-1,971	-2,087	3,150	3,069	8,995

1m trigger in S1 and S2 does result in lower reservoir volume in 3 out of 4 periods and a net loss over the 11 year period compared to baseline.

0.5m trigger in S3 and S4 gives significant increased reservoir volume in 2 periods and a significant saving of water over the 11 year period compared to baseline.

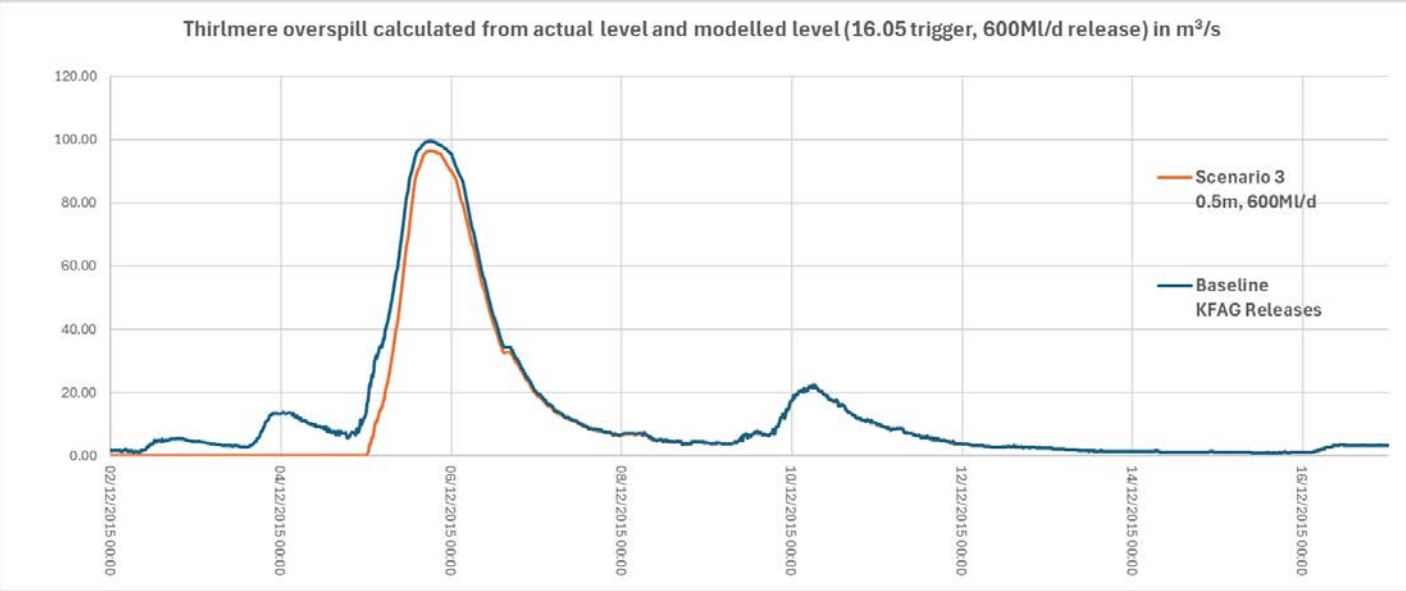
No releases (S5) represents best possible case and does give largest increase. This is at a cost of no flood mitigation at all at Thirlmere.

Perspective:

Total water released under baseline (KFAG) is ~103,000Ml so maximum gain of S5 represents only 8.7% of that. Vast majority becomes overspill in S5.

This small impact should have been accounted for in UU WRMPs. Can't find any ref to restrictions due to KFAG releases so presumably it was not flagged as an issue. At same time UU removed Crummock ~20Ml/d.

Example of a combined trigger and forecast driven release (FDR) approach - Desmond



S3, 0.5m trigger, 600Ml/d release offers little benefit over baseline.

Peak overspills of 96.4 and 99.6m^3/s respectively.

However, it does take out the overspill prior to Desmond.

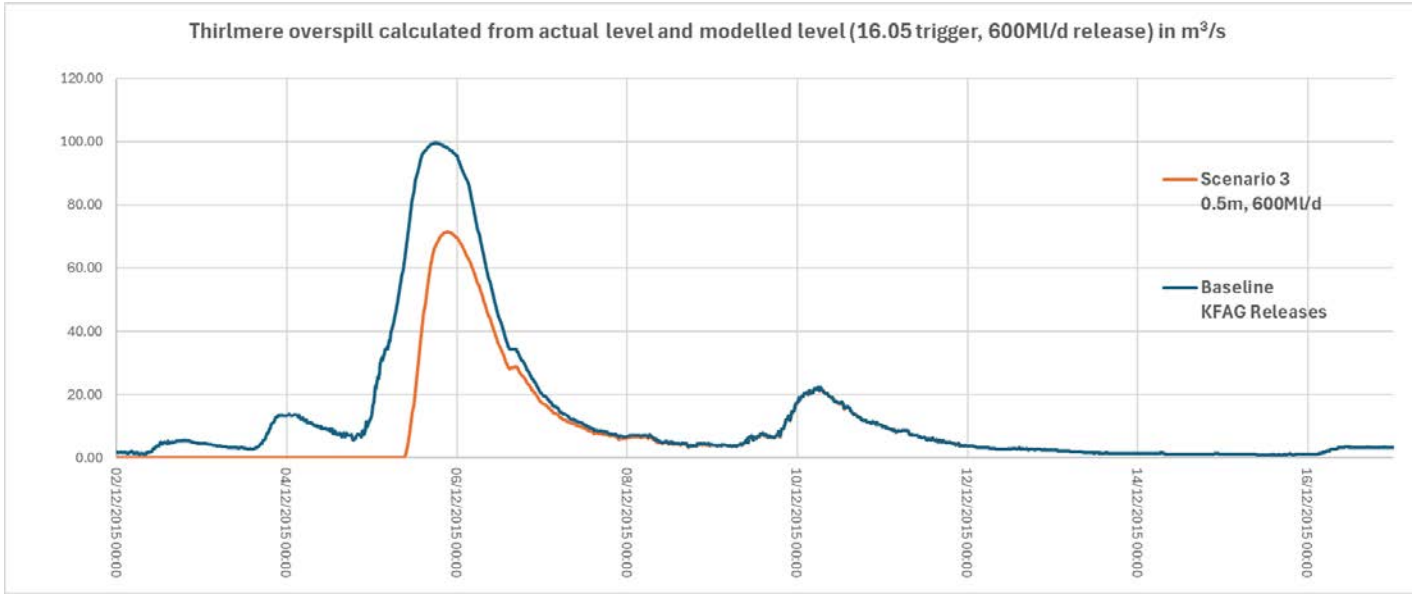
This gives potential for FDR of 1500Ml/d prior to Desmond.

FDR modelled at starting 9:00 on 1/12/15 and stopping 24:00 on 4/12/15, ie 3 days 15 hours.

Reduces peak overspill by 28.2m^3/s to 71.4m^3/s. Flow at Greta bridge reduced by ~7%.

How many properties in Keswick saved?

Booths/Co-op might not flood?



Overall

Conclusion from note on 4/1/26 stands

KFAG does not see anything in the data record from 2015 to 2025, which includes the whole period of the current S20, that can substantiate UU's claim that the KFAG releases have had any detrimental effect for SJB and should be halted as of 1/4/26.

- There are options other than just FDR which seem to meet SJB flow requirements.
- Higher flows available from LSVs (600Ml/d) and USVs (1500Ml/d in combination) would have allowed all flows in S20 and in UU environ doc (Table 2-1) to be met.
- There was a loss to UU of some water during times of reduced level/reduced abstraction (baseline vs S5), but it is small, should be built into resources plans, and could have been reduced if USVs were available.
- Combination of a triggered release with FDR may be optimum in future
- Where is OOG assessments of these types of option?
- After 15 years of data for SJB with KFAG, what environmental issue are you trying to solve?

One suggested way forward

- Continue KFAG release after 1/4/26
- Trial 600Ml/d releases within KFAG system (eg 6hrs at 600, 18 hrs nothing).
- Move towards an interim situation with higher trigger levels and releases up to 600Ml/d.
- Get USVs in play asap
- Move to trial a new scheme which may be a combination of high flows/high triggers and FDR.
- If this proves successful, maybe move to FDR, but only with full confidence from implementation of high release flows and fast response to forecast.