Non-compliance with Environment Agency "heavy rainfall" methodology suggests 80%-90% of untreated sewage discharge is illegal

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WASP: Windrush Against Sewage Pollution, revised August 3rd 2026

In 2021, the Environment Agency (EA) used a definition of "heavy rainfall" unchallenged in a criminal case against Southern Water when it pleaded guilty to unlawful sewage pollution. The EA used an explicit level of "heavy rainfall" of 25-30 mm rainfall in 24 hrs for sewage spills to be compliant. A senior EA investigator provided a supporting document to WASP which said of its future usage:

This methodology was not disputed by Southern Water and was therefore accepted by the court. It is the opinion of the investigators that it is robust enough to use in defining rainfall levels that constitute a storm and should be used to assess permit compliance for WwTW's, CSO's, and relevant WwPS's.

The EA hasn't used this approach since 2021. WASP has applied it to sewage spills from 570 storm overflows and identified widespread non-compliance rates and potential illegality in 2024 and 2025.

Main findings for non-compliance with EA "heavy rainfall" methodology in 2024 and 2025

F1) In 2024 and 2025, non-compliance of 80%-90% was found across water companies operating 482 storm overflows at sites serving a population equivalent of 41.6 million in England, Scotland and Wales.

F2) In 2025, all spills from 18 Thames Water STWs, serving 7 million, were non-compliant.

F3) In 2025, non-compliance across 64 Thames Water STWs, serving 16 million, was 95.5%.

F4) In England, the wet year 2024 involved lower non-compliance for many individual overflows but the overall non-compliance for the sites considered was much the same (87.2%) as the drier 2025 (86.5%).

F5) Areas of high rainfall, such as the Lake District, may have lower but persistent rates of non-compliance.

F6) Non-compliance doesn't reflect EA star rating e.g., Thames (1*) and Severn Trent (4*) had similar rates.

F7) In 2024, the non-compliance of 64 overflows analysed in Wales was similar to that in England.

F8) Non-compliance for Scottish Water (26 STWs; 2 CSOs) and 8 PFI operated STWs, serving 3 million, was 87% in 2024 across all 36 overflows and 88% in 2025 for the 26 Scottish Water sites.[1]

F9) Lower "heavy rainfall" thresholds for dry and higher thresholds for wet regions result in minor variation, but the overall non-compliance of 80% to 90% persists.

Ofwat's enforcement actions against water companies typically reported failure to demonstrate that *"spills resulted from exceptional circumstances, or that it would have been excessively costly to address the spills from these storm overflows. Indeed, the information that we assessed showed that at the majority of its highest spilling storm overflows, operational and asset maintenance issues were identified as the reason for the high spill"*.

In 5 of 7 actions, Ofwat has cited WASP's published analysis of illegal discharges of untreated sewage[2].

[1] An appeal 1 year ago to the Scottish Information Commissioner for data withheld by Scottish Water is ongoing.
[2] https://www.peter-hammond.com/sewage_pollution.html

UPDATES and CONSEQUENCES

25/07/2026	Addition of Anglian Water start-stop times for 2025 spills from EA update.
	The overall Anglian non-compliance for 2025 is 91%.
	The overall 2025 non-compliance for England sites is now 86.5%.
03/08/2026	Addition of 89 Yorkshire Water sites for 2024 in River Aire/Leeds area.
	The overall Yorkshire non-compliance for 2024 changed from 93% to 90%.
	The overall 2024 non-compliance for England sites is now 87.2%.

BACKGROUND

The European Urban Waste Water Treatment Directive of 1991 required sewage treatment works to be

> "*designed, constructed, operated, and maintained to ensure sufficient performance under all normal local climatic conditions*".

After Brexit, the UK retained the UWWTD directive (SI No. 2841/1994 2025) but is not subject to the new, tighter EU requirements introduced in 2025. The UK Government's recent **New Vision for Water** White Paper is committed to look at the underpinning legislation and "***see whether it can be stripped back***", according to **Paul Kissock**, Permanent Secretary at DEFRA, in a Public Accounts Committee hearing. Thus, the UK is on the brink of a major deviation from EU environmental legislation used to regulate untreated sewage discharges.

ILLEGAL UNTREATED SEWAGE DISCHARGE

In 2024, the Office for Environment Protection (OEP) accused DEFRA of failing to fulfil its duties in respect of *"untreated sewage discharge by sewerage undertakers via network Combined Sewer Overflows"*. A primary issue in the OEP's detailed legal argument was that a spill or discharge of untreated sewage is only permitted in *"exceptional circumstances, **such as during unusually heavy rainfall**. This is unless an assessment of the CSO concludes that the costs to address the issue would be disproportionate to the benefits gained."*.

For decades, the Environment Agency (EA) has permitted discharge of untreated sewage (spills) provided it is due to "rainfall (or snowmelt)" and does not occur when treatment at STWs or flow from pumping stations is below capacity. There has been **no** reference to the exceptional nature of the rainfall in any of its permits to discharge sewage to inland or coastal waters.

Generally, the EA has a conservative "dry day" approach to spills being "potentially" illegal if they occur on days with extraordinarily low rainfall (< 0.25 mm). It now appears that the EA has used a methodology defining rainfall that is sufficiently "heavy" (broadly 25-30 mm in 24 hr period) to permit spills. Southern Water did not challenge the EA's use of the "heavy rainfall" methodology when it pleaded guilty to 51 charges of environmental law breaches in court in 2021 and was fined £90 million.

The "dry day" approach is overcautious and overlooks most spill non-compliance. The "heavy rainfall" approach can test compliance hourly to determine the % of annual spill hours that are potentially unlawful. Why has the EA not used the "heavy rainfall" approach to prosecute more water companies?

In this study, the EA's "heavy rainfall" methodology was applied to 482 overflows in England, Scotland and Wales, primarily at STWs but also sewage pumping stations and CSOs on the sewerage network. **The analysis suggests most untreated sewage discharge (80%-90%) is non-compliant with respect to "heavy rainfall"** compared to 5%-10% of days with spills that a "dry spill day" approach identifies.

SEPA, the environmental regulator in Scotland, has yet to declare its own definition of "heavy rainfall". NRW, the Welsh environmental regulator, appears to favour a similar, but stricter definition which results in even greater non-compliance and potential illegality than that used in the EA methodology[3].

[3] https://afonyddcymru.org/welsh-water-overflows-in-2025/

ENVIRONMENT AGENCY "DRY SPILL DAY" AND "HEAVY RAINFALL" METHODOLOGIES

The following Defra and EA "definitions" of a "dry day/dry day spill" are pertinent to this report.

DEFRA https://deframedia.blog.gov.uk/2023/09/05/government-response-to-bbc-reporting-on-storm-overflows/
A 'dry spill' is when a storm overflow is used on a 'dry day' – which is defined as no rainfall above 0.25mm on that day and the preceding day (24 hours). However, there are exceptions which must also be considered, such as in very large catchments with long drain down times.

Environment Agency (Chair: Alan Lovell, 11th March 2026, in email exchanges with WASP)
*A dry day spill is when a storm overflow is used on a 'dry day' – which is defined as a 24-hour period, (from midnight to midnight) with **less** than 0.25 mm total rainfall on that day and the preceding 24 hours.*

- *We allow the first dry day after rainfall ceases as a drain down allowance (min 24hrs/max 47hrs 45mins depending upon when rain stops).*
- *If an overflow discharge starts or continues after the one dry calendar day drain down time, it should be reported to the Environment Agency as an incident.*

The reports we received show that over 14,700 dry day spill incidents occurred in 2025 for all water and sewerage companies.

The 14,700 "dry day" spill incidents in 2025 are about 5% of the 291,492 spills reported.

An exchange of emails with a senior EA investigator resulted in the following agreed definition of "heavy rainfall" for determining compliance of untreated sewage discharges (for brevity "spill" is used):

a spill is compliant at time t with respect to rainfall if and only if
total rainfall between t-48 hrs and t-24 hrs is at least 25 mm OR
total rainfall between t-24 hrs and t is at least 25 mm OR
rainfall per hr in any hr between t-24 hrs and t is at least 4 mm

The "dry day spill" approach uses a daily rainfall threshold of 0.25 to identify unpermitted spills. The "heavy rainfall" approach, loosely speaking, uses a 25 mm threshold for 24 hrs of rainfall to permit a spill. The simple diagram below illustrates how "heavy rainfall" detects more unpermitted spills.

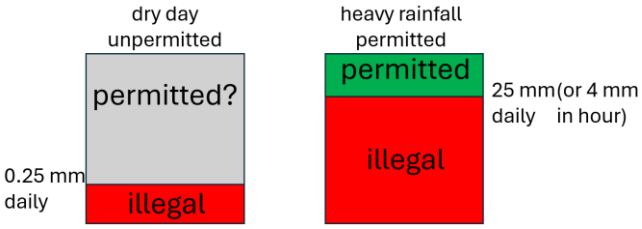


Figure 1: simple comparison of the two EA methodologies used to investigate dry spilling using rainfall thresholds

A short document (see Appendix A) was provided by a senior EA investigator which explained the background Met Office justification for the 25-30 mm and 4mm hourly thresholds used in the Southern Water prosecution. It ends with the following comment on its future usage:

> *This methodology was not disputed by Southern Water and was therefore accepted by the court. It is the opinion of the investigators that it is robust enough to use in defining rainfall levels that constitute a storm and should be used to assess permit compliance for WwTW's, CSO's, and relevant WwPS's*. "Storm rainfall definition and use". See Appendix A.

In responses to WASP and to the BBC, Philip Duffy (Environment Agency CEO) and Defra agreed that a "heavy rainfall" definition had been used in the Southern Water prosecution of 2021. WASP has tested a range of thresholds between 20 mm for drier eastern regions and 45 mm for the wettest western regions) and the overall 80% to 90% non-compliance persists.

An illustrative example of applying "dry spill day" and "heavy rainfall" methodologies

Figure 2 shows a chart for Cirencester STW in Feb 2024. Sewage treatment is represented by the brown curve, hourly rainfall by the green curve and spill intervals by the black, horizontal segments. The letter **D** denotes "dry day" spilling on 3 of the 29 days (about 10%) when spilling is unpermitted. The blue horizontal segments denote hours when rainfall is sufficiently heavy, according to the EA methodology, to permit spilling on parts of 4 days. The remainder, about 90%, is unpermitted and hence illegal.

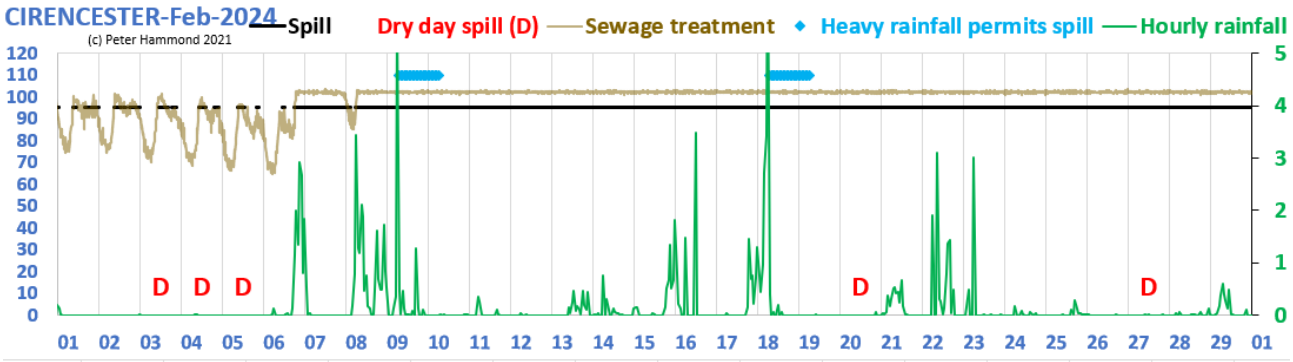


Figure 2: Feb 2024 chart for Cirencester STW where a "dry day" approach highlights about 10% of days with spills as illegal whereas a "heavy rainfall" approach permits 10% and hence 90% is non-compliant

Data sources and application of the EA "heavy rainfall" methodology

The untreated sewage discharge (spill) data were retrieved from water company websites or obtained via EIR request. Recent spill data for Thames Water was obtained via an API using Dr Alex Lipp's Poopy environment which is the basis for the website www.sewagemap.co.uk. For 2025, Southern Water has provided unusable block spill data; Anglian Water mixed unlabelled overflow data that was unusable; DCWW and Northumbrian have yet to provide detailed spill data. Hourly rainfall data at storm overflow locations was purchased from www.visualcrossing.com.

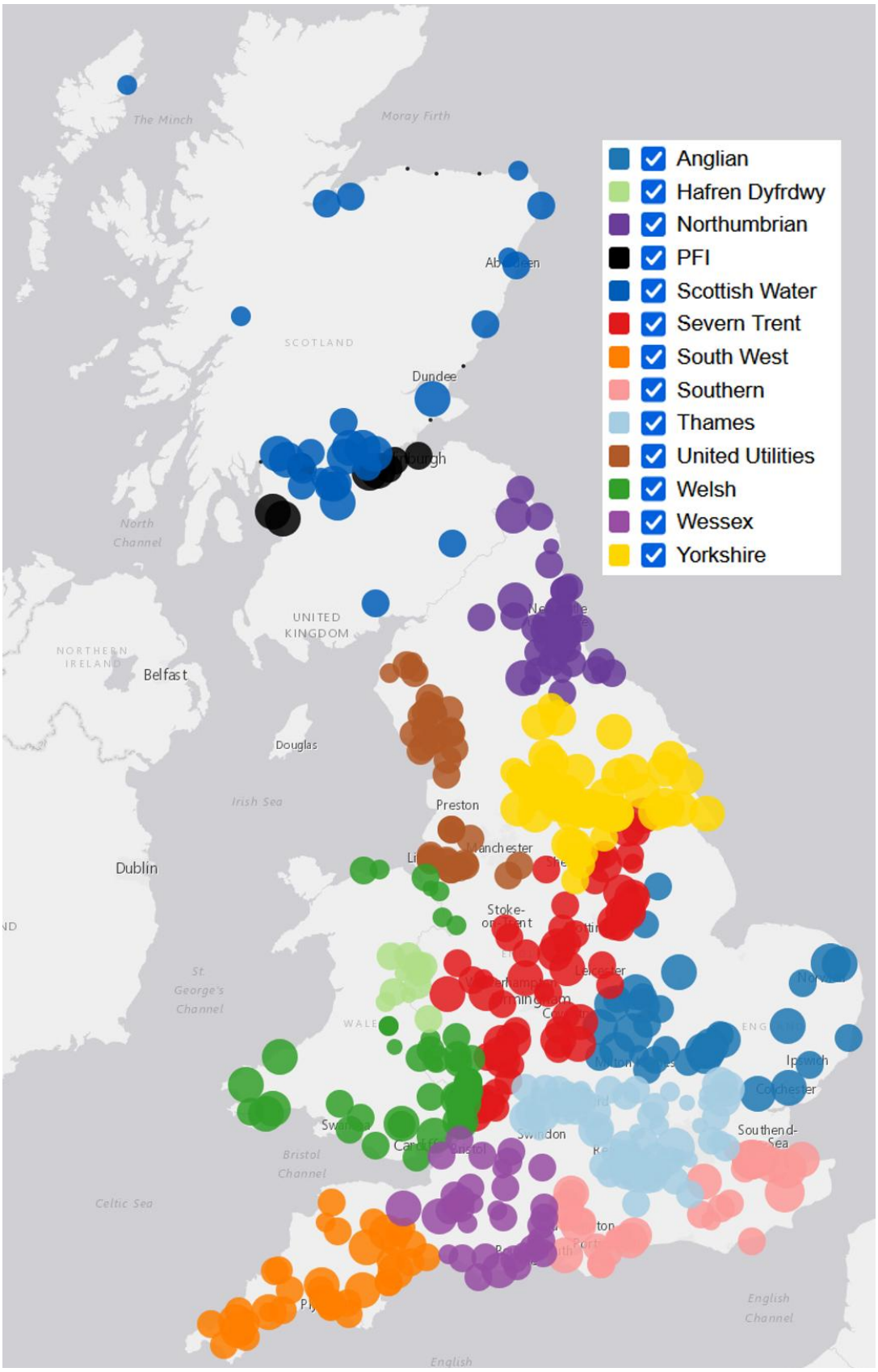
The "heavy rainfall" compliance definition described above was applied to every hour where a spill occurred along with hourly rainfall data. For each overflow and for each year, the number of hours when spilling was non-compliant was divided by the total number of spill hours to give a non-compliance/potential illegality rate (%) for an overflow for that year. For a collection of overflows, the total number of non-compliant spill hours in a specific year was divided by the total number of spill hours to give an overall annual non-compliance/potential illegality rate.

In addition, plots were provided for annual spill hours vs non-compliance rate. This was to demonstrate that non-compliance could be high for both low and high numbers of annual spill hours.

FINDINGS ARISING FROM APPLICATION OF THE EA's "HEAVY RAINFALL" METHODOLOGY

F1) In 2024 and 2025, non-compliance of 80%-90% was found across water companies operating 570 storm overflows serving a total population of 41.6 million in England, Scotland and Wales.

The overall annual spill non-compliance/illegality rate in 2024 across 471 overflows in England, serving a population equivalent of 36.7 million, was 87.2%. In 2025, the overall non-compliance for 269 overflows in England was 86.5%. Using the EA methodology, similar spill non-compliance rates were found for 64 overflows in Wales (serving 1.9 million) and 36 overflows in Scotland (serving 3 million). Figure 3 shows the location of the sites with markers coloured to reflect the overflow operator.



www.peter-hammond.com/sewage_pollution.html

Figure 3: 482 overflow locations coloured by water company with size reflecting 2024 non-compliance

PFI = private company under contract from Scottish Water (treating 38% of sewage in Scotland)

(most treated sewage discharge by volume in Scotland is to coastal waters or river estuaries;
most treated sewage discharge by volume in England and Wales is to inland waters)

F2) In 2025, all spills from 18 Thames Water STWs, serving 7 million, were non-compliant.

The spill non-compliance/potential illegality rate in 2025 was 100% for 18 overflows at STWs operated by Thames Water. Seven are highlighted as being STWs where Thames Water deferred upgrades and used the allocated funds to cover the company's day-to-day shortfall in cash flow – as admitted by its Chaiman, Sir Adrian Montague, to the EFRA Select Committee in 2025.

Berkhamsted	**Guilford**	Long Reach	Riverside
Chesham	**Hatfield Heath**	**Luton East Hyde**	Rye Meads
Crawley	**Hogsmill**	**Maple Lodge**	**Slough**
Deephams	Little Marlow	Mogden	Weybridge
Dorking			Widford & Wareside

F3) In 2025, non-compliance across 64 Thames Water STWs, serving 16 million, was 95.5%.

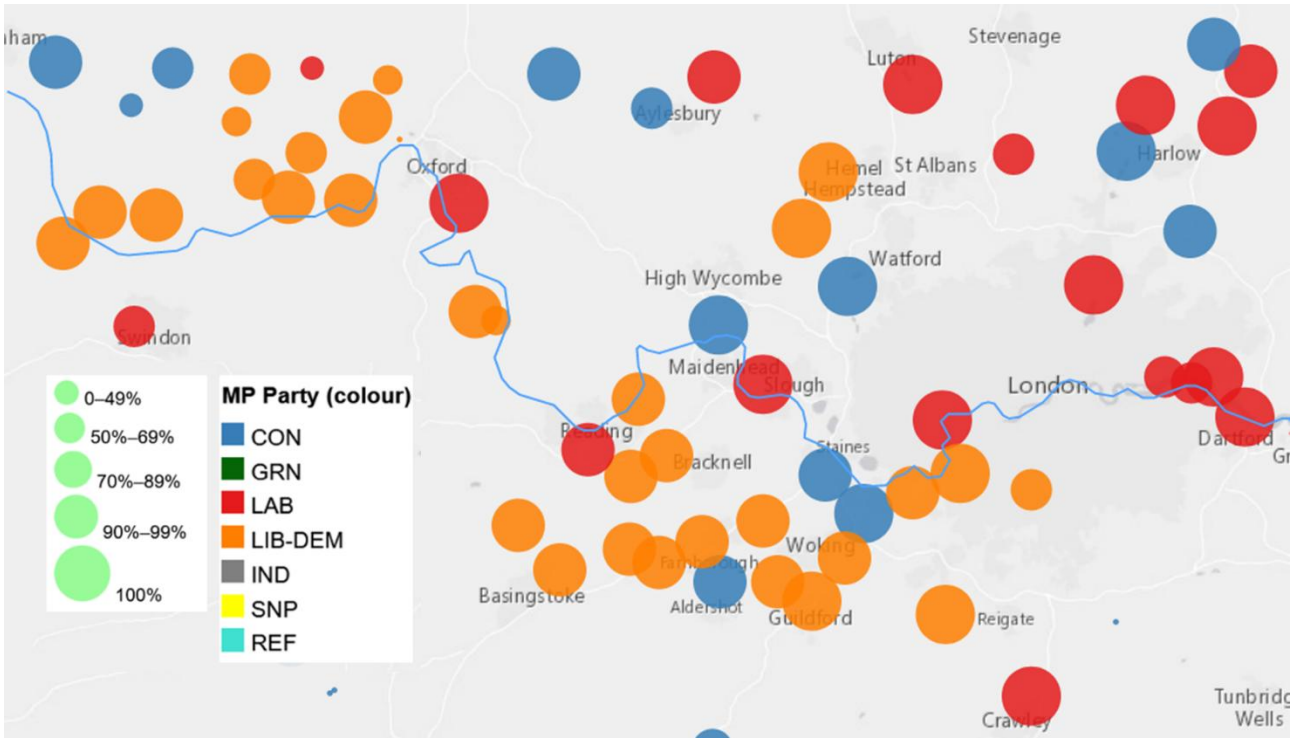


Figure 4: 64 Thames Water STWs with overall non-compliance of 95.6% in 2025
(colour coding reflects party affiliation of Westminster MP at the location of an overflow)

Thames Water has been on the brink of insolvency for some time and serious consideration has been given to placing the company in Special Administration. London & Valley Water (L&VW), a consortium of Thames Water's creditors, has proposed a £10 billion rescue package made up of £3.35 billion equity injection, up to £6.55 billion in new debt, and a massive debt write-down. In return, L&VW is seeking a 5-year waiver on fines from regulators. The UK Government and Environment Secretary have strongly pushed back against the proposal.

WASP's analysis of Thames Water's widespread and continuing non-compliance shows that the L&VW demand for leniency is totally unacceptable. and the company must be placed in Special Administration.

F4) In England, the wet year 2024 involved lower non-compliance for many individual overflows but the overall non-compliance for the sites considered was much the same (87.2%) as the drier 2025 (86.5%).

2025 was drier than 2024 producing lower annual spill hours. The higher rainfall in 2024 meant more spills were compliant so some individual overflow non-compliance was lower. To avoid equating non-compliance for different annual spill hours, the charts below plot spill hours vs non-compliance rate.

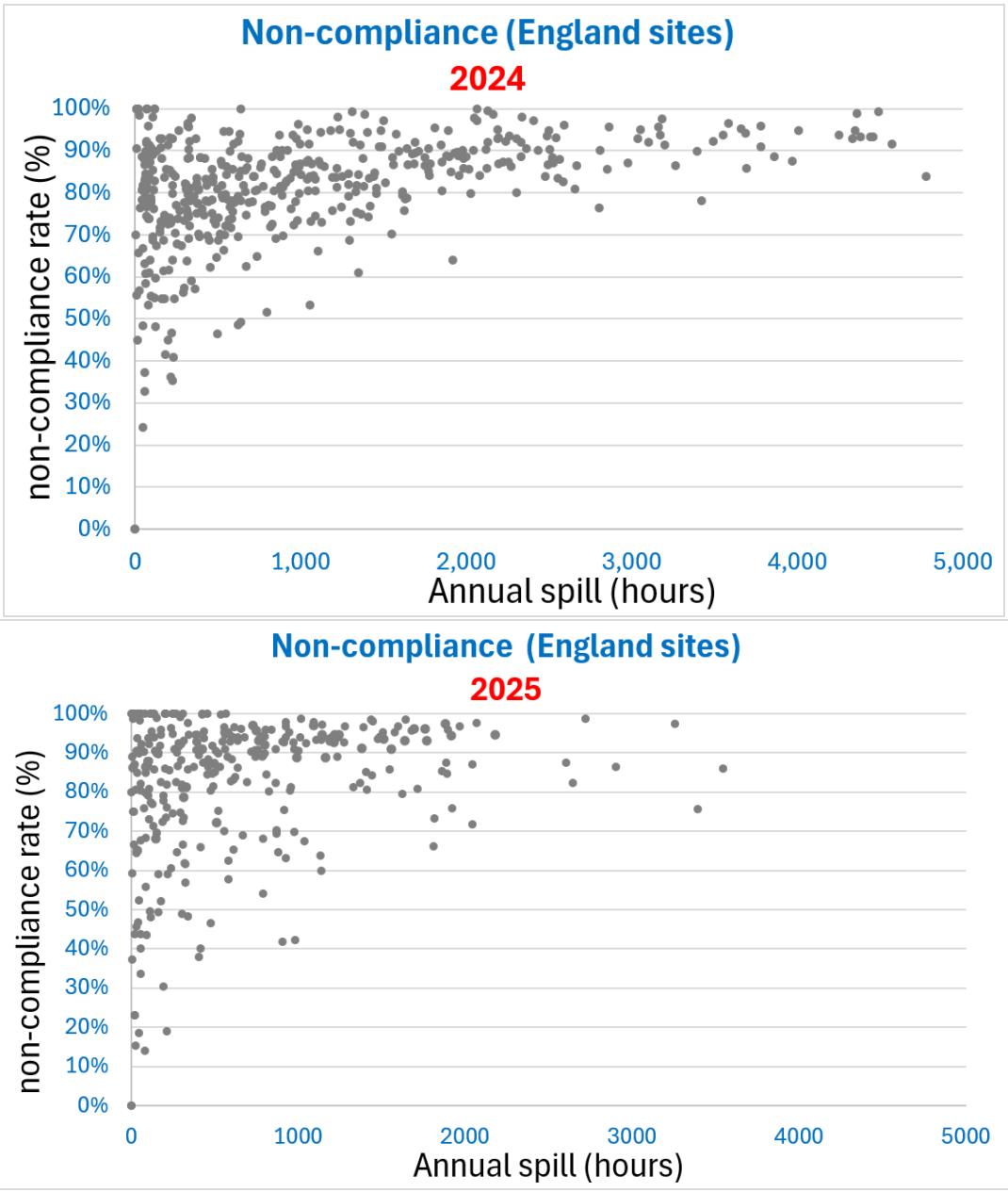


Figure 5: annual spill hours vs illegality rate for England for 2024 (n=382) and 2025 (n=269)
Data was unavailable or unreliable in 2025 for Northumbrian Water, DCWW and Southern Water[4]

The charts demonstrate that although annual spill hours are reduced in 2025, a drier year than 2024, the overall distribution is shifted upwards reflecting increased non-compliance. Many overflows with high annual spill hours continue to have high non-compliance rates even in a drier year.

[4] Southern Water provided only block spill data. Anglian Water mixed unlabelled overflow data. DCWW and Northumbrian have yet to provide 2025 detailed spill data.

F5) Overflows in areas of high rainfall, such as Lake Windermere, may have lower but persistent rates of non-compliance/illegality.

Given the greater rainfall in the Lake District, often with intense, short bursts of rainfall even in the summer months, it is not surprising to see lower illegality rates for the 6 sites discharging untreated sewage into Lake Windermere.

Nationally, 2025 was drier than 2024 and non-compliance rates were higher for individual overflows but Lake Windermere had periods of intense rainfall in the summer of 2025 which resulted in more permitted spilling.

The table below shows non-compliance rates with respect to "heavy rainfall" at thresholds ranging from 35 mm to 45 mm which are more realistic given local weather conditions

	2024 Heavy rainfall threshold (mm)			2025 Heavy rainfall threshold (mm)		
	35	40	45	35	40	45
Ambleside	56.7%	59.5%	61.2%	58.2%	63.0%	67.5%
Elterwater	65.2%	68.3%	69.6%	48.7%	53.1%	60.2%
Glebe Road SPS	57.1%	57.9%	59.6%	41.3%	48.1%	55.6%
Grasmere	82.9%	83.5%	84.1%	54.8%	60.6%	66.2%
Hawkshead	88.8%	89.3%	89.8%	77.8%	81.1%	83.4%
Near Sawrey	86.8%	87.0%	87.7%	76.9%	83.6%	85.1%
overall	82.9%	83.6%	84.4%	68.3%	73.2%	76.5%

Figure 6: non-compliance in 2024 and 2025 for 6 overflows to Lake Windermere and feeder rivers/becks

Ambleside and Grasmere STWs appear to be the only storm overflows which have had a significant reduction in non-compliance rate since 2021. There remains a persistent high non-compliance rate for Hawkshead SPS and Near Sawrey STW.

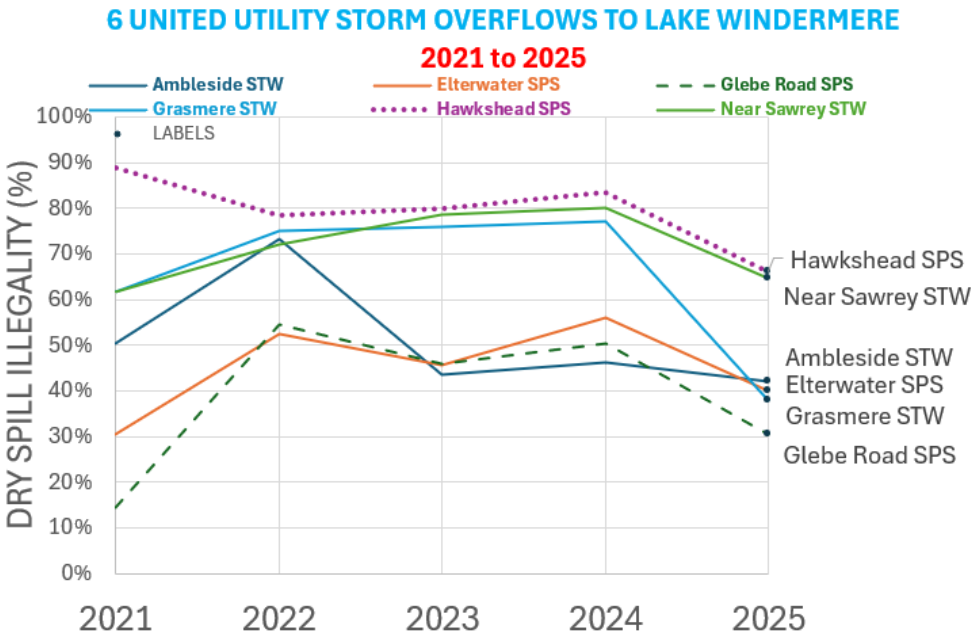


Figure 7: 5 year comparison of non-compliance for 6 overflows to Lake Windermere & feeder rivers/becks using a 25 mm threshold

F6) Non-compliance doesn't reflect EA star rating e.g., Thames (1*) and Severn Trent (4*) had similar rates.

In England, there is no correlation between the existing EA star rating of WaSCs and annual non-compliance as can be seen from Table 1 where a 25 mm heavy rainfall threshold is used throughout.

TABLE 1 Population served	# sites	ENGLAND OPERATOR	2024 spill hrs	% hrs illegal	EA stars	2025 spill hrs	% hrs illegal	EA stars
1,892,987	33	Anglian	56,980	92%	2	11,897	91%	2
2,980,721	40	Northumbrian	40,252	86%	3	data unavailable		2
5,348,908	62	Severn Trent	84,219	90%	4	36,609	93%	4
797,592	40	South West	64,181	86%	2	47,402	79%	2
2,312,336	30	Southern	37,270	90%	2	data unavailable		2
16,051,144	64	Thames	75,303	84%	2	25,068	96%	1
1,668,706	43	United Utilities	51,128	82%	4	31,026	74%	2
2,209,919	36	Wessex	37,774	82%	4	16,029	87%	2
1,022,562	123	Yorkshire	82,210	93%	2	34,976	93%	2
34,284,876	**471**	**TOTAL**	**529,317**	**87%**		**203,007**	**86%**	

The spill non-compliance of 64 Thames Water and 62 Severn Trent Water storm overflows are compared for 2024 and 2025 in **Fig**. 8. The higher levels for 2024 for Severn Trent Water are surprising given its 4* status compared to Thames Water's 2*/1* status in the 2024/2025 Environmental Performance Assessment (EPA). Non-compliance of untreated sewage discharge is not yet an EPA metric.

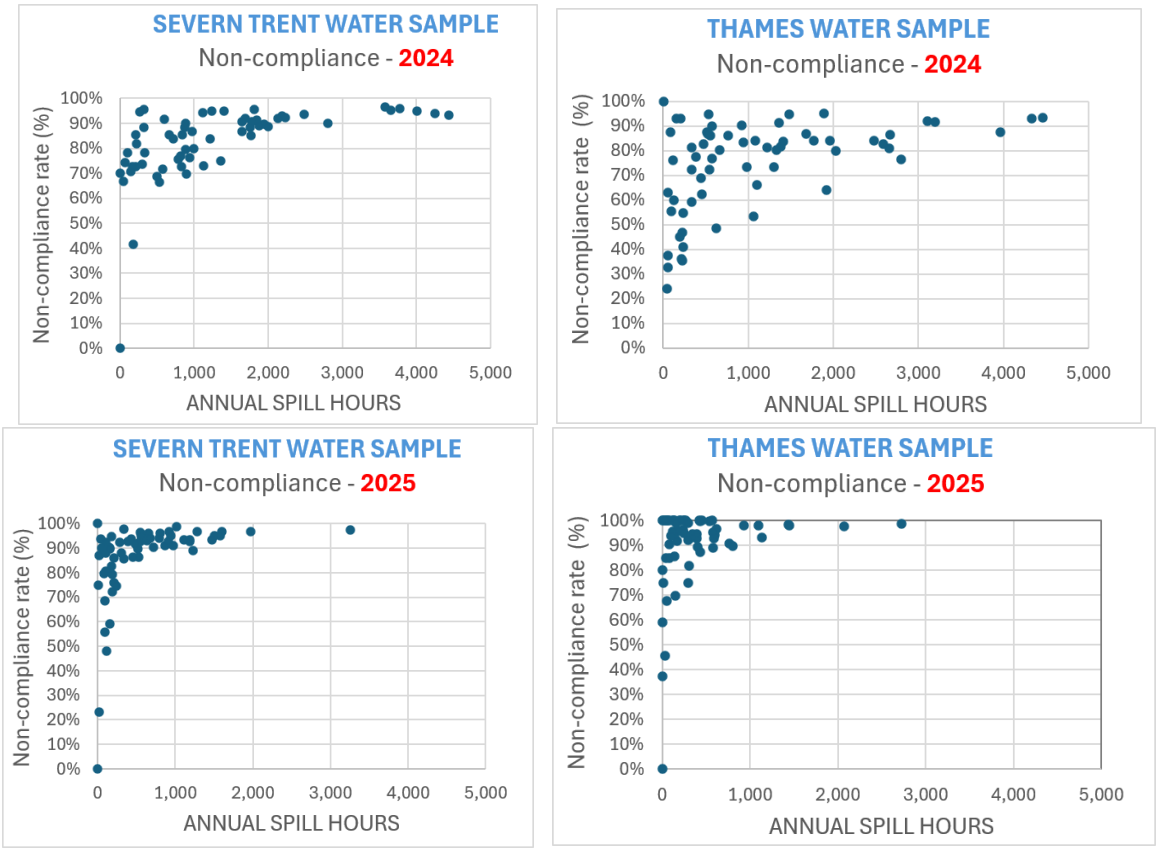


Figure 8: annual spill hours vs non-compliance for 2024 and 2025 for 62 SvT sites and 64 Thames sites

The non-compliance is lower at some sites with fewer annual spill hours. But there is an uncomfortable number of sites with high non-compliance and high annual hours.

F7) In 2024, the non-compliance of 50 overflows analysed in Wales was similar to that in England.

For historical reasons, the EA monitors and regulates some storm overflows in Wales involving sewage treatment and transport that are operated by Dwr Cymru Welsh Water (DCWW). A similar situation has occurred for storm overflows in England overseen by NRW (Natural Resources Wales).

NRW has recently been using a Welsh government approved definition of "heavy rainfall" which uses one clause of the EA definition, namely "4mm of hourly rainfall in any of the preceding 24 hours". Thus, NRW's determination of spill non-compliance will always be higher than the EA's for a given site/spill.

Having different definitions of spill non-compliance is potentially a problem for rivers (such as the Wye) which meander across the England-Wales border or overflows which discharge to a river that forms the border. For the moment, we simply use the EA methodology.

DCWW is a "not-for-profit" company whereas Hafren Dyfrdwy, which also undertakes sewerage operations in Wales, is a subsidiary of Severn Trent Water, a listed and privatised company in England.

TABLE 2 Population served	# sites	WALES OPERATOR	2024 spill hrs	% hrs illegal	2025 spill hrs	% hrs illegal
1,901,515	51	Dwr Cymru Welsh Water	50,667	85.5%	DATA UNAVAILABLE	
33,063	13	Hafren Dyfrdwy/Severn Trent	11,865	81.1%	5,900	79.0%
1,934,577	64	**TOTAL**	62,531	84.7%		

F8) Non-compliance for Scottish Water (26 STWs; 2 CSOs) and 8 PFI operated STWs, serving 3 million, was 87% in 2024 across all 36 overflow and 88% in 2025 for Scottish Water.[5]

Although described as a "nationalised" company and fully owned by the Scottish Government, Scottish Water has ongoing, inherited PFI contracts. Indeed, 38% of sewage in Scotland is still treated under contract by private companies such as Veolia, Saur and AES (a subsidiary of Northumbrian Water). These PFI contracts will not disappear completely until 2041. Moreover, 75% of treated sewage is discharged via outfalls directly into the sea or indirectly via river estuaries. By comparison, the corresponding figure is 25% for both England and Wales. So, in Scotland the inland waters appear to receive less of a "hit" from both treated and untreated sewage than their counterparts in England.

Because Scottish Water has withheld data from WASP and SEPA (Scottish Environmental Protection Agency) collects little data, WASP's analysis of Scotland is more limited than is possible for England and Wales. That said, the 36 storm overflows analysed in Scotland (8 operated under PFI and 28 directly by Scottish Water) involve a population equivalent of over 3 million - more than half Scotland's population.

TABLE 3 Population served	# sites	SCOTLAND OPERATOR	2024 spill hrs	% hrs illegal	2025 spill hrs	% hrs illegal
1,198,637	28	Scottish Water	44,224	87.0%	**34,267**	**87.7**
1,833,818	8	PFI	7,824	88.2%		
3,032,455	36	**OVERALL**	52,048	87.2%		

[5] Data withheld by Scottish Water is under appeal to the Scottish Information Commissioner

For the storm overflows that WASP has analysed for Wales and Scotland, the charts for annual spill hours vs annual non-compliance for 100 overflows is shown in **Fig**. 9 for 2024 and 2025.

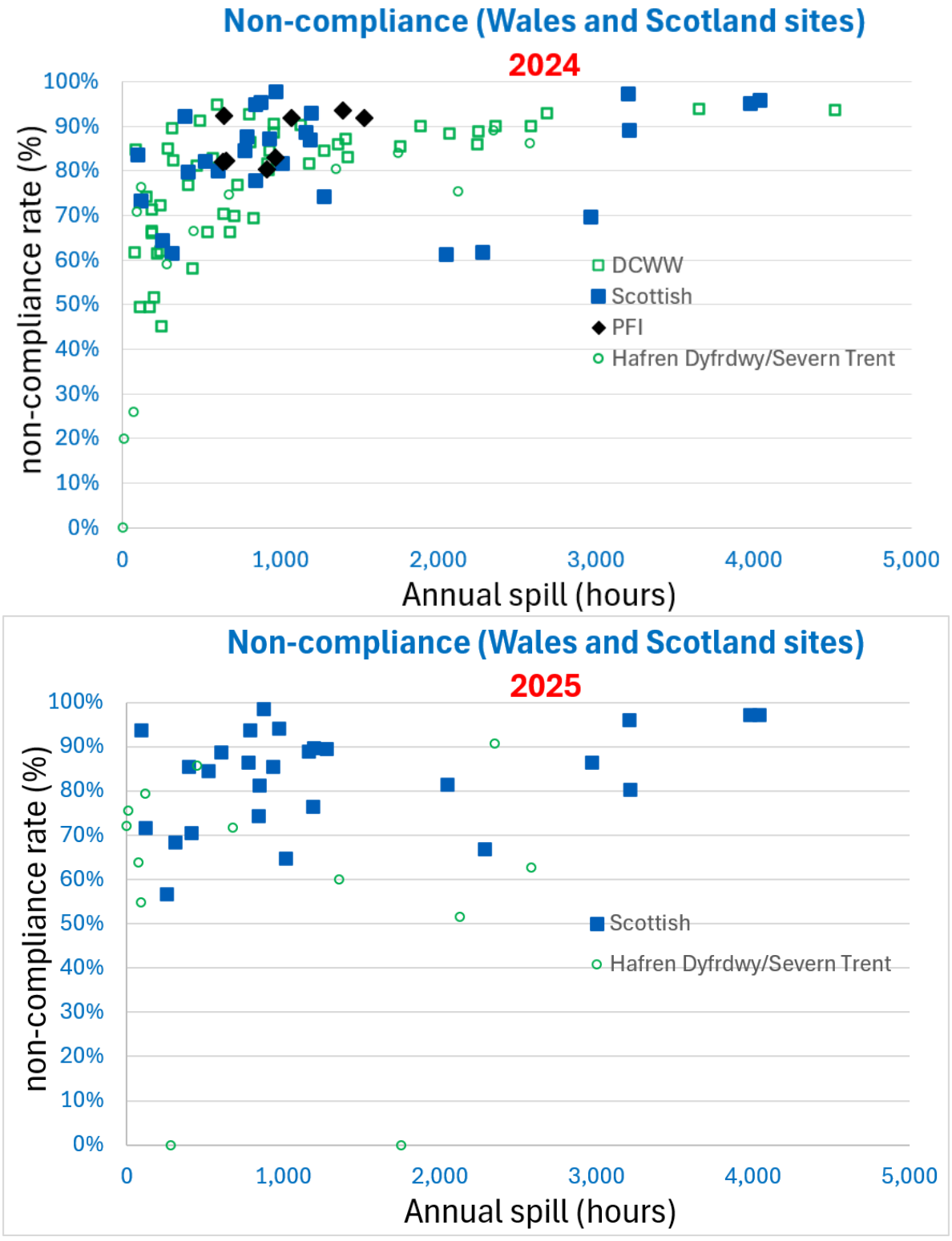


Figure 9: annual spill non-compliance for 100 storm overflows in Scotland and Wales

After more than a year, the Scottish Information Commissioner has yet to make a decision on WASP's appeal on the withholding of data by Scottish Water, the least co-operative and transparent of all British water companies.

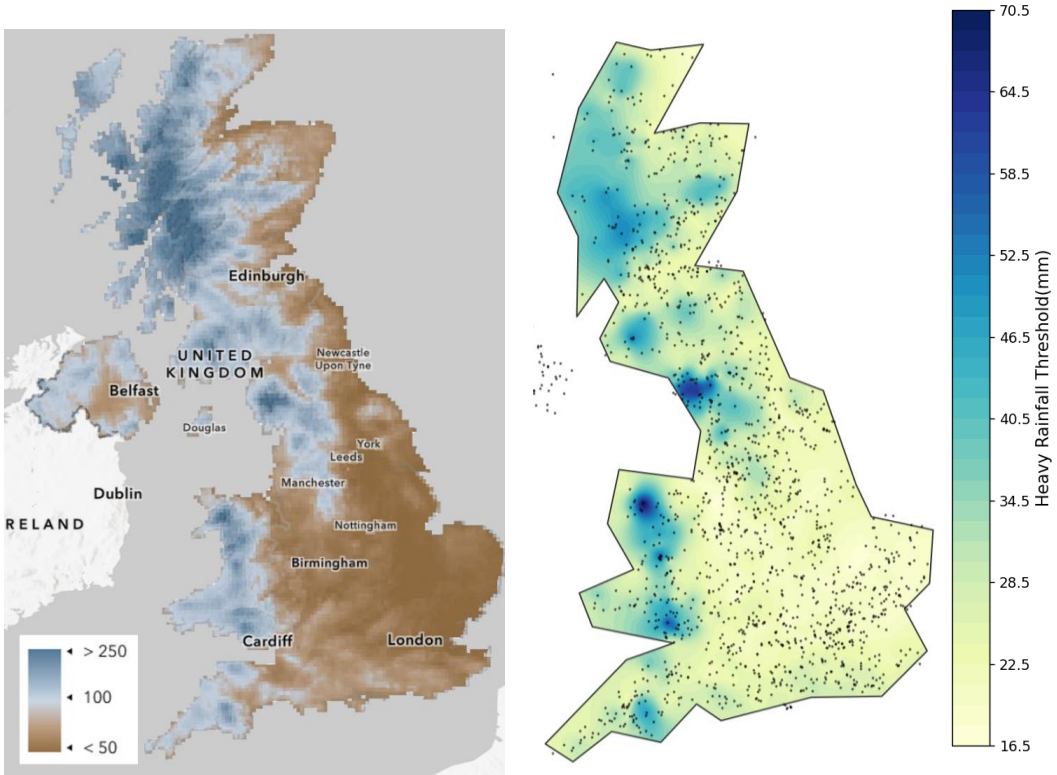
F9) Lower "Heavy rainfall" thresholds for dry and higher for wet regions result in minor variation, but the overall non-compliance of 80% to 90% persists.

The European Urban Waste Water Treatment Directive of 1991 required STWs to be

> "*designed, constructed, operated, and maintained to ensure sufficient performance under all normal local climatic conditions*".

WASP initially used a 25 mm "heavy rainfall" threshold, as suggested by an EA senior investigator, across all overflows regardless of location. The non-compliance rates for untreated sewage discharges (spills) for each set of water company overflows varied between 80% and 90%.

Clearly, in the UK, there is considerable climatic variation with wetter regions in the west and drier regions in the east, as confirmed by the Met Office average monthly rainfall map in **Fig.** 10a. Hence, it is reasonable to assume that some variation in the "heavy rainfall" threshold might be applied to reflect local weather conditions.



a) UK Average Monthly Rainfall (1991-2020) Met Office

b) Heavy rainfall threshold derived by WASP from daily rainfall data at 1600 NRA gauge stations

Figure 10: variation in rainfall across England, Wales and Scotland

Non-compliance using fixed thresholds for each water company region

Fixed regional thresholds were tested by WASP ranging from 15mm to 20mm for Anglian Water to 30mm to 35mm for United Utilities and as high as 45mm for overflows discharging to Lake Windermere in Cumbria, an area that can receive extreme rainfall even in summer months. Clearly, a lower threshold reduces non-compliance and a higher threshold increases non-compliance. The table below summarises the non-compliance rates obtained using a variety of thresholds for 2024.

	2024 "heavy rainfall" threshold (mm)						
Non-compliance (%)	**15**	**20**	**25**	**30**	**35**	**40**	**45**
Anglian	83.2	89.6	92.2				
Northumbrian			85.6				
Severn Trent		86.2	89.5				
South West			86.7				
Southern			90.4				
Thames		81.3	83.7				
United Utilities			82.4	87.4	88.9		
Wessex			81.6				
Yorkshire			92.6				
6 Windermere overflows				80.3	82.9	83.6	84.4

Irrespective of the "heavy rainfall" threshold applied, the overall non-compliance for each set of water company overflows was persistently between 80% and 90% for 2024.

Non-compliance using "amount quantile" approach and rainfall data from 1600 gauge stations

WASP used an "amount quantile" approach[6] to classify daily rainfall on a scale 0 to 9 relative to decades of rainfall records from 1,600 gauge stations operated by the National Rivers Authority. This approach involves the following for each station and series of daily rainfall totals:

1. rank wet-day rainfall totals from smallest to largest;
2. accumulate the rainfall amounts;
3. define nine thresholds at 10%, 20%, ..., 90% of the total rainfall
4. assign every wet day to one of the ten **amount quantiles**.

Thus, the lightest quantile contains many days, while the heaviest quantile contains only a few extreme events, but each quantile contributes the same fraction (10%) of the long-term rainfall total.

Fig. 10b shows the variation at, and interpolation between, the gauge station locations. As expected, it is strongly correlated with the average monthly rainfall shown in **Fig**. 10a. Each storm overflow considered in the study was allocated the grade 9 threshold value at the nearest gauge station. The average of thresholds for the set of overflows operated by the same water company is shown the table below

WaSC	90% threshold	WaSC	90% threshold
Anglian	20 mm	Wessex	24 mm
Northumbrian	25 mm	Yorkshire	24 mm
Severn Trent	21 mm	PFI	27 mm
South West	30 mm	Scottish Water	27 mm
Southern	**25 mm**	Welsh	25 mm
Thames	22 mm	Hafren Dyfrdwy	30 mm
United Utilities	35 mm		

Interestingly, the average 90% threshold for the overflows operated by 9 of the water companies was between 25 mm and 30 mm with 25 mm for Southern Water.

[6] Osborn, T. J., Hulme, M., Jones, P. D. & Basnett, T. A. (2000). ***Observed trends in the daily intensity of United Kingdom precipitation***. Int J Climatology, 20(4), 347–364

APPENDIX A Storm rainfall definition and use – provided by the Environment Agency

A process for defining storm rainfall in the context of storm discharges made from a wastewater treatment works

Background

During the course of the investigation into storm discharges from SWS WwTW it was necessary to overtly define a level of rainfall that would lead to FFT flows meeting the requirement to allow a storm discharge to be made.

How this was assessed

This was calculated for most sites in the investigation as being between 25-30mm of rainfall within a 24hr period prior to or during a discharge. Taking the lower boundary of 25mm corresponds to a conservative value for analysis.

A further measure was used from the Met Office definitions to try to account for shorter but intense showers. A conservative value was achieved at 4mm/hr as the threshold for moderate to heavy rainfall from the Met Office definitions for synoptic rainfall. The extracted definition from the Met Office is copied below:

> ***'For synoptic purposes, rain (other than showers) is classed as 'slight', moderate', 'or heavy' for rates of accumulation less the 0.5mm/hr, 0.5-4mm/hr, and greater than 4mm/hr, respectively.'*** Factsheet_3 Water In The Atmosphere v02 p 18.

Using this 4mm/hr reading negates the need for analysis of summer storm type 'showers' using the Met Office showers definitions:

> ***'For synoptic purposes, rain showers are classed as 'slight', moderate', 'heavy', or 'violent' for rates of accumulation of about 0 to 2mm/hr, 2 to 10mm/hr, 10mm/hr to 50mm/hr, or greater than 50mm/hr, respectively.'***

How it was used

Where the 15 minute FFT (flow to full treatment) averages were below the permitted requirement (taking into account the 8% MCERTS tolerance for calibrated flow measuring apparatus) there is no requirement to assess rainfall as well as the condition has been breached.

Where the 15 minute FFT averages were above, or fluctuated above and below permitted requirement (taking into account the 8% MCERTS tolerance for calibrated flow measuring apparatus) there is a requirement to assess rainfall as well to satisfy the remainder of the condition.

Method

The start and end time of a discharge made via the storm, formula A or preliminary treated storm sewage routes were collated. The recorded rainfall accumulations (captured in the nearest gauges to the site) were then added to the analysis.

Two reviews were undertaken. 1. 25-30mm rainfall 24hrs immediately prior to the discharge commencing, 2. 25-30mm rainfall 24-48hrs prior to discharge. The second review takes account of unusual catchment drain down characteristics, i.e. a larger shallower catchment would normally drain down over a longer period. If this rainfall element was met that discharge was considered a genuine storm discharge.

Conversely, where no rainfall, or rainfall below 25-30mm in the assessment periods, was recorded then the "…due to rainfall.." element of the permit condition was not achieved.

Some local assessment and further review may be required where sudden bursts of rainfall in the 24hr period prior to discharge exceed the 4mm/hr level and then the duration of the discharge vs the duration of rainfall must be assessed taking into account storm tank volume and fill time. These discharges to storm are therefore not in accordance with the permit condition

Future Usage

This methodology was not disputed by Southern Water and was therefore accepted by the court. It is the opinion of the investigators that it is robust enough to use in defining rainfall levels that constitute a storm and should be used to assess permit compliance for WwTW's, CSO's, and relevant WwPS's.

EXAMPLES OF ANALYSIS

THAMES WATER

CIRENCESTER STW
CRAWLEY STW
CROSSNESS STW
EPPING (Fiddler's Hamlet) STW
HATFIELD HEATH STW
LUDGERSHALL STW

UNITED UTILITIES

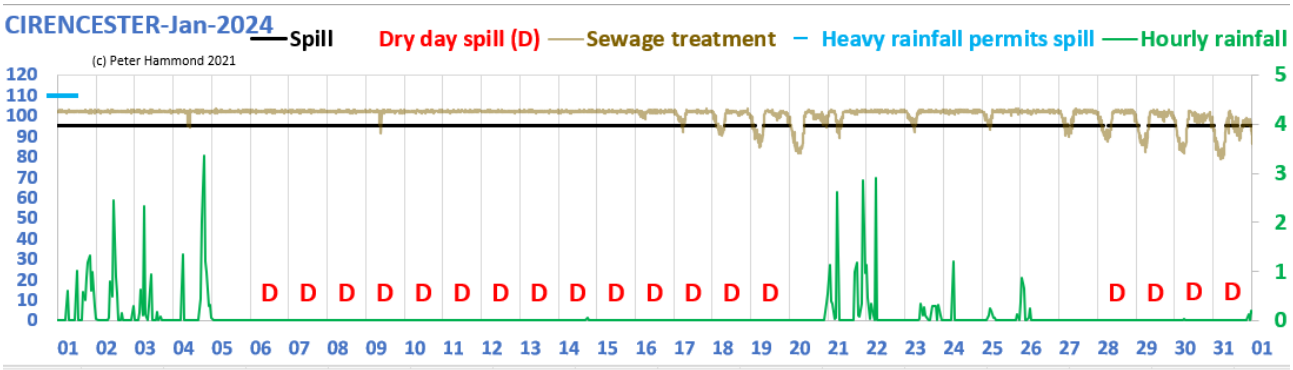
AMBLESIDE STW
ELTERWATER SPS AND LANGDALE STW
GLEBE ROAD SPS
GRASMERE STW
HAWKSHEAD SPS
NEAR SAWREY
WARRINGTON SOUTH
LIVERPOOL STW

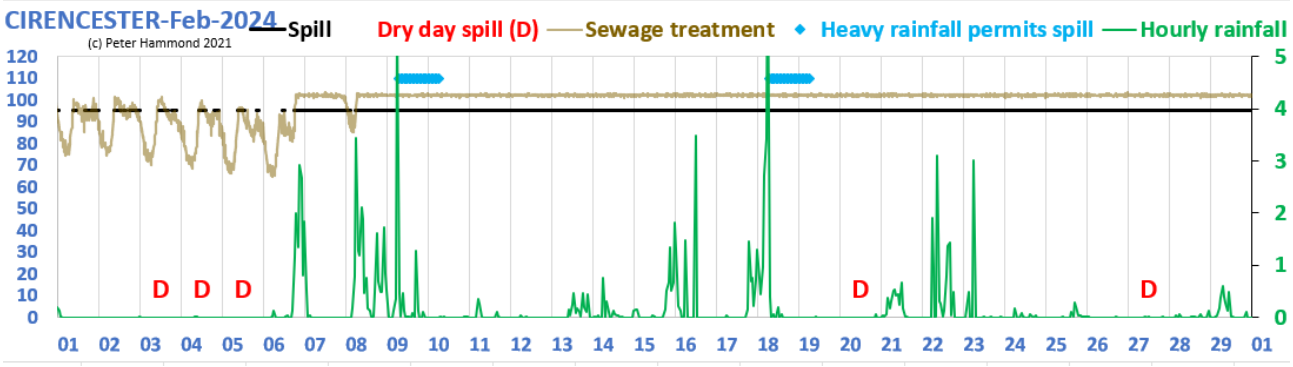
THAMES WATER

CIRENCESTER STW

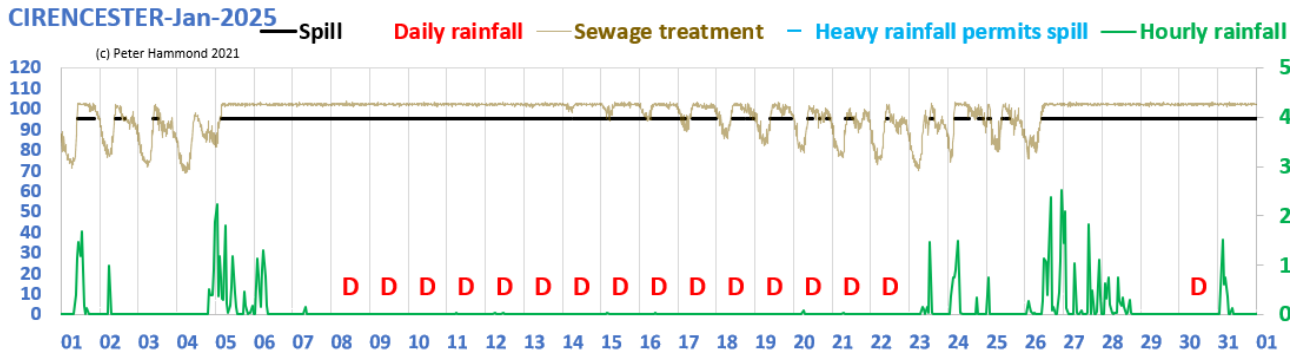
Using the EA classic “dry-day” definition, there were 66 ”dry-day” untreated sewage discharges in 2024 (28.8% of spill days) and 45 in 2025 (36.3% of 124 spill days). According to “heavy rainfall review” for 2024 and 2025 the non-compliance rates were 93.3% and 97.7% respectively.

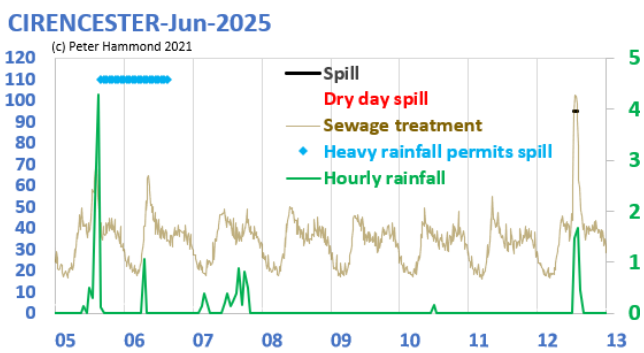
2024 examples

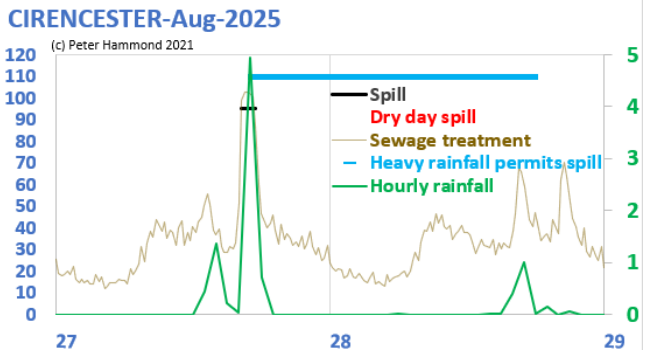




2025 examples



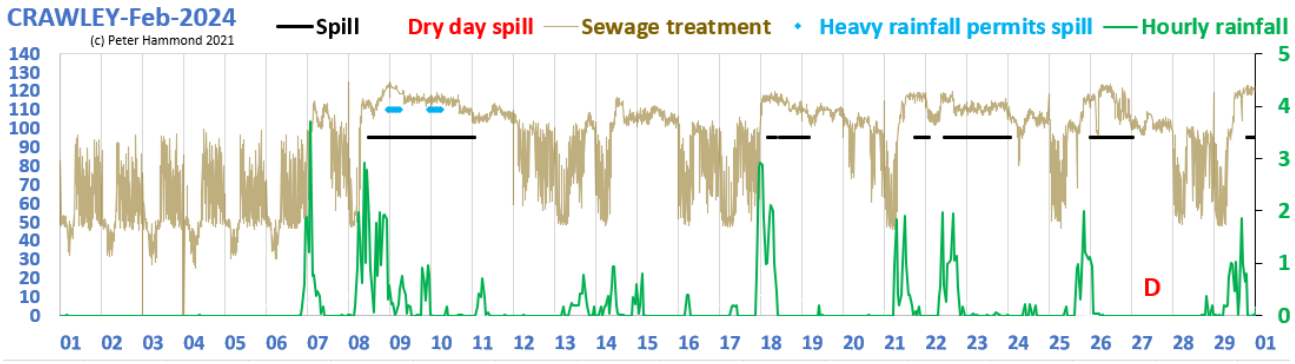


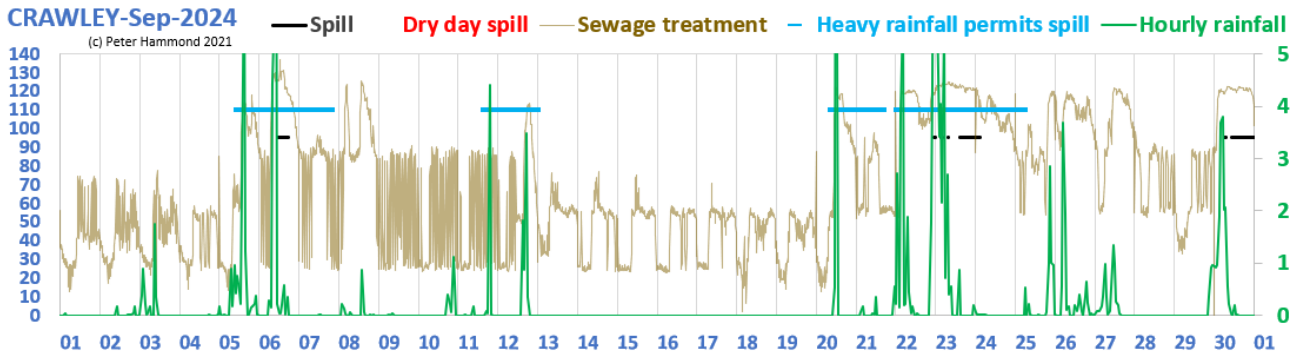


CRAWLEY STW

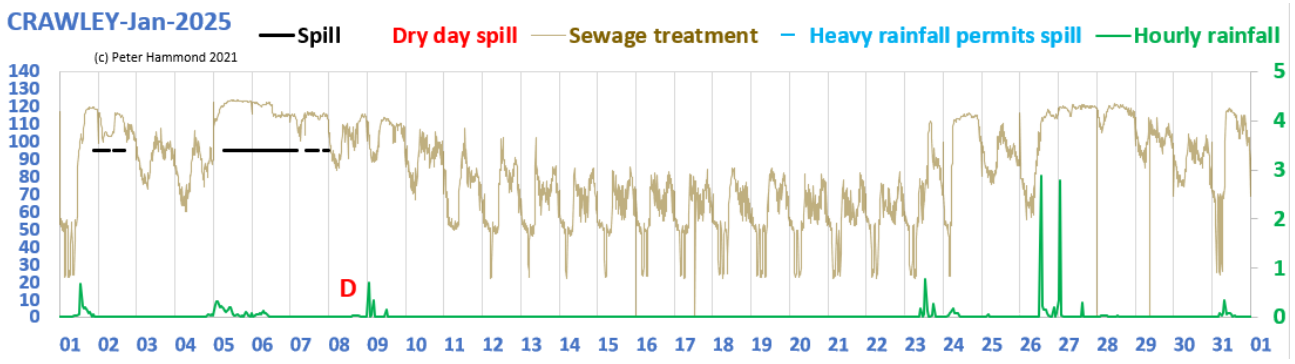
Using the EA classic “dry-day” definition, there were 5 ”dry-day” untreated sewage discharges in 2024 (10.6% of 47 spill days) and 1 in 2025 (4.2% of 24 spill days). According to “heavy rainfall review” for 2024 and 2025 the non-compliance rates were 72.2% and 100% respectively.

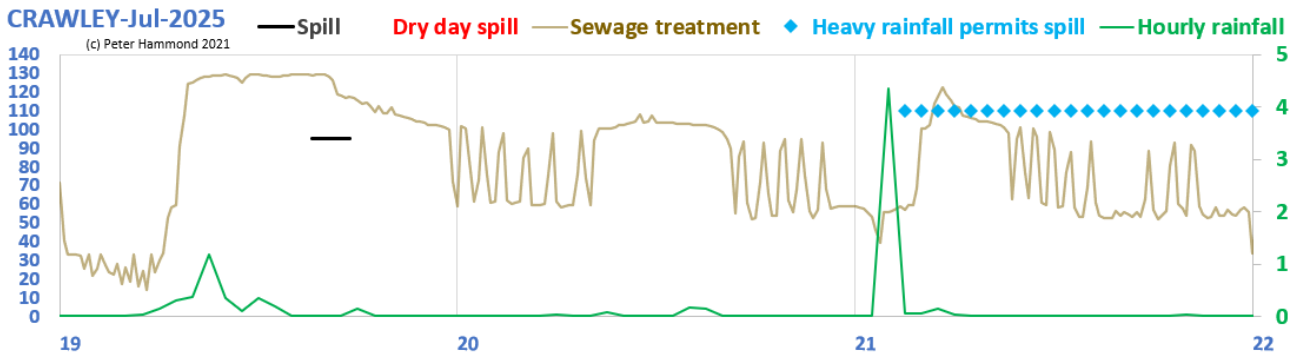
2024 examples





2025 examples

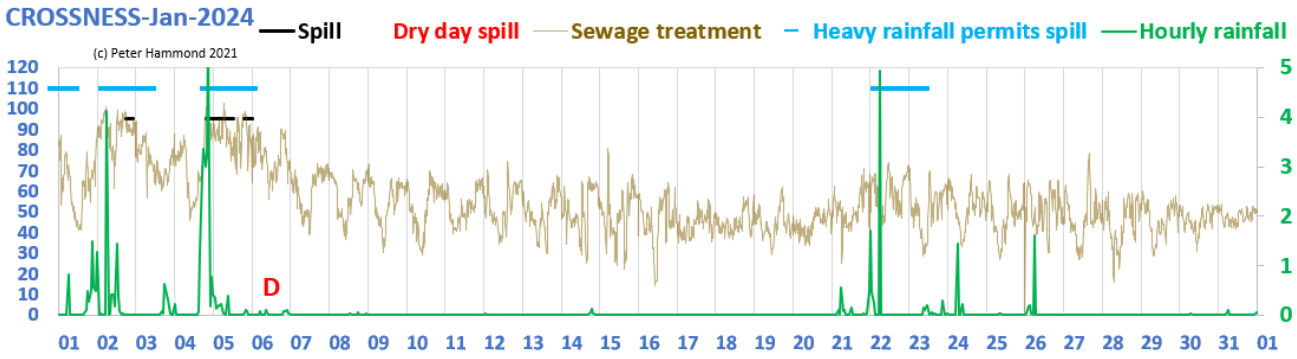


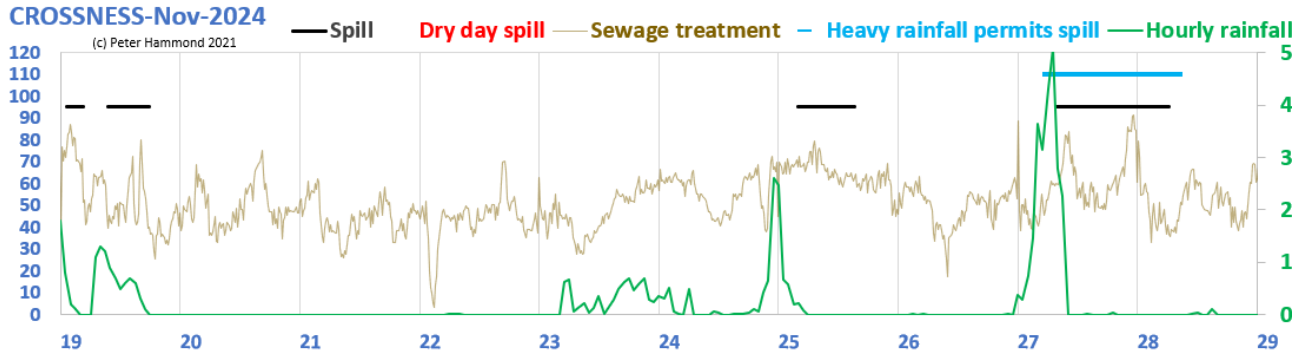


CROSSNESS STW

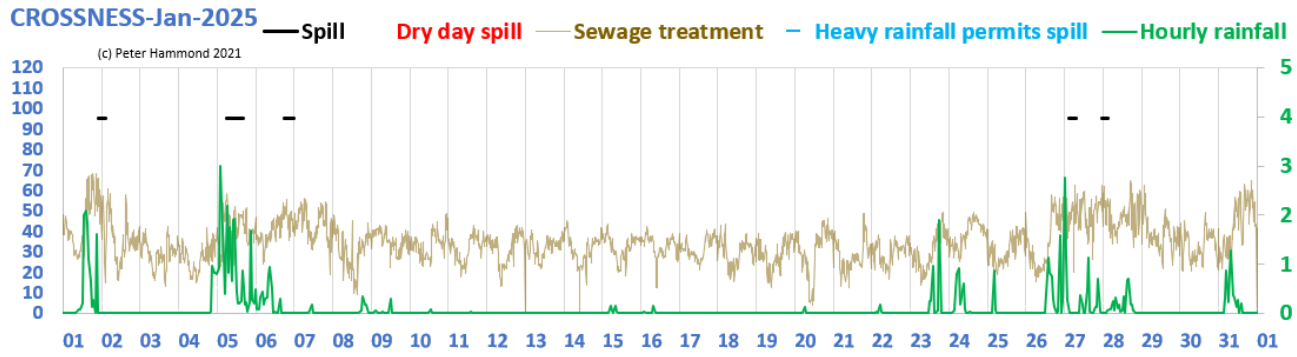
Using the EA classic “dry-day” definition, there were 2 ”dry-day” untreated sewage discharges in 2024 (5.6% of 36 spill days) and 0 in 2025 (0% of 14 spill days). According to “heavy rainfall review” for 2024 and 2025 the non-compliance rates were 54.7% and 84.9% respectively.

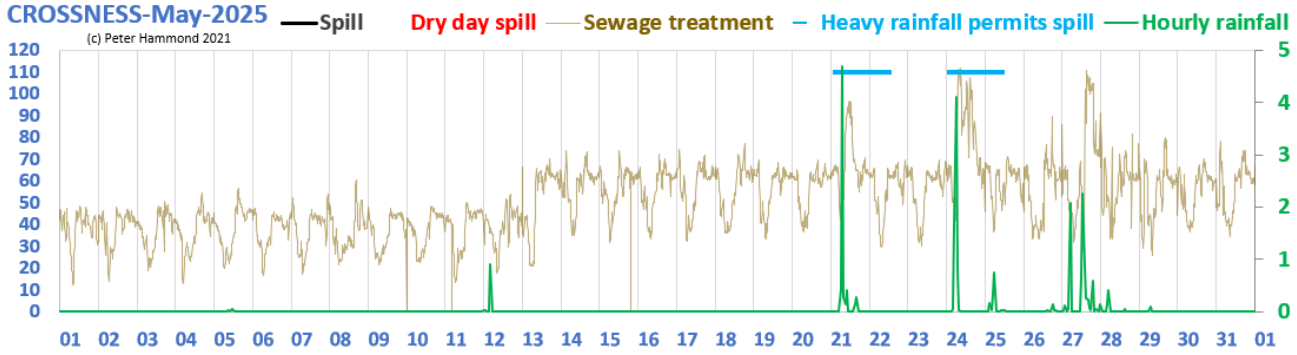
2024 examples





2025 examples

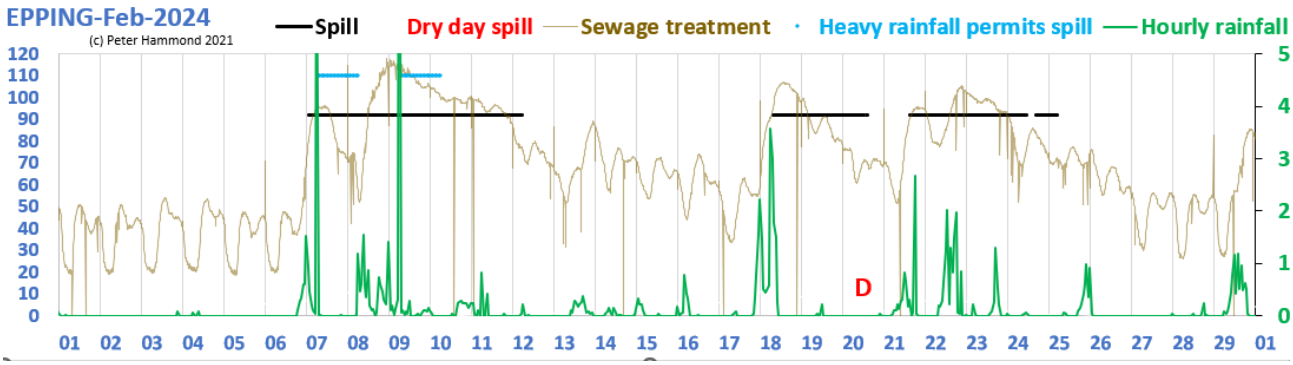


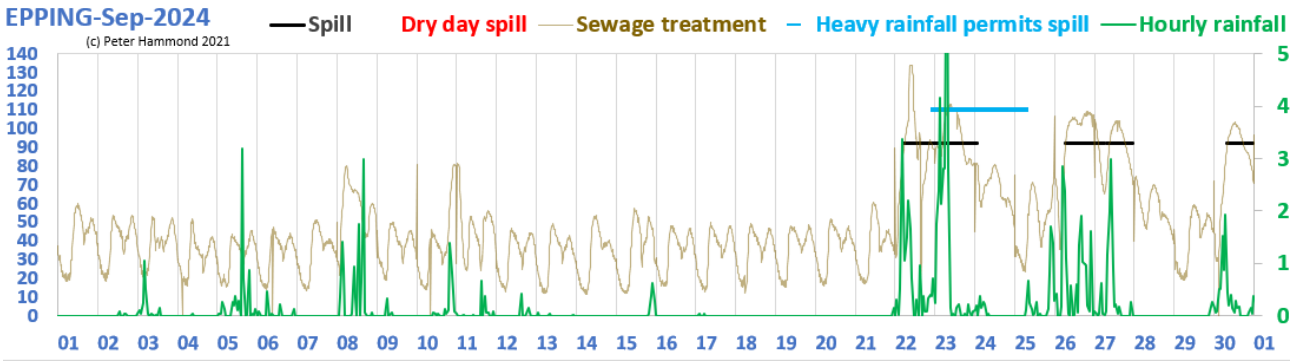


EPPING (Fiddler's Hamlet) STW

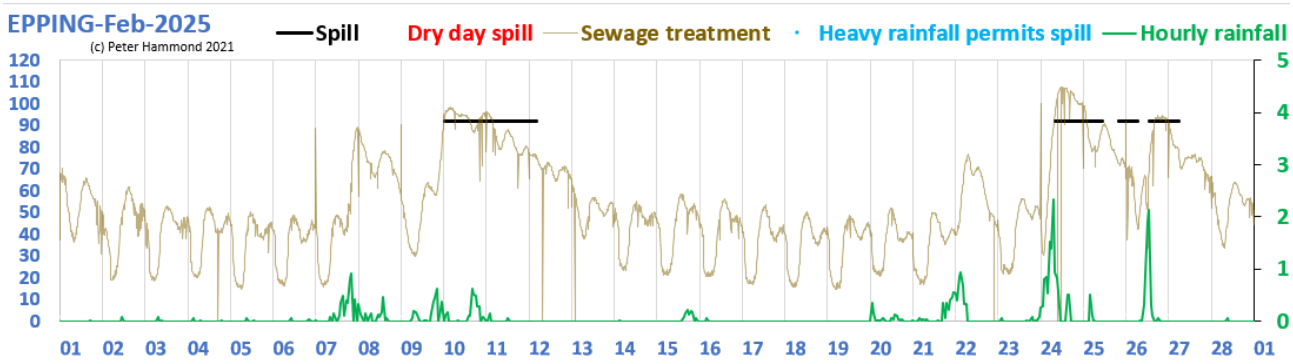
Using the EA classic "dry-day" definition, there were 6 "dry-day" untreated sewage discharges in 2024 (8.5% of 71 spill days) and 2 in 2025 (3.7% of 54 spill days). According to "heavy rainfall review" for 2024 and 2025 the non-compliance rates were 96.6% and 94.1% respectively.

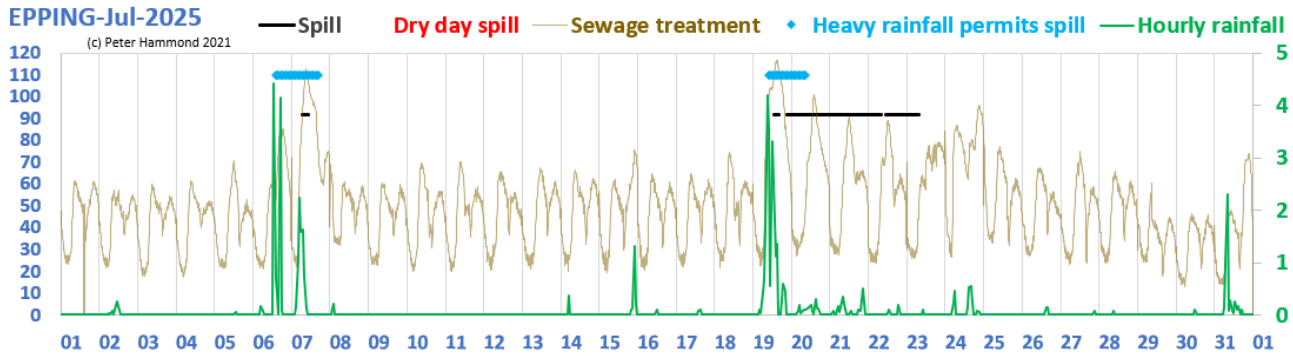
2024 examples





2025 examples

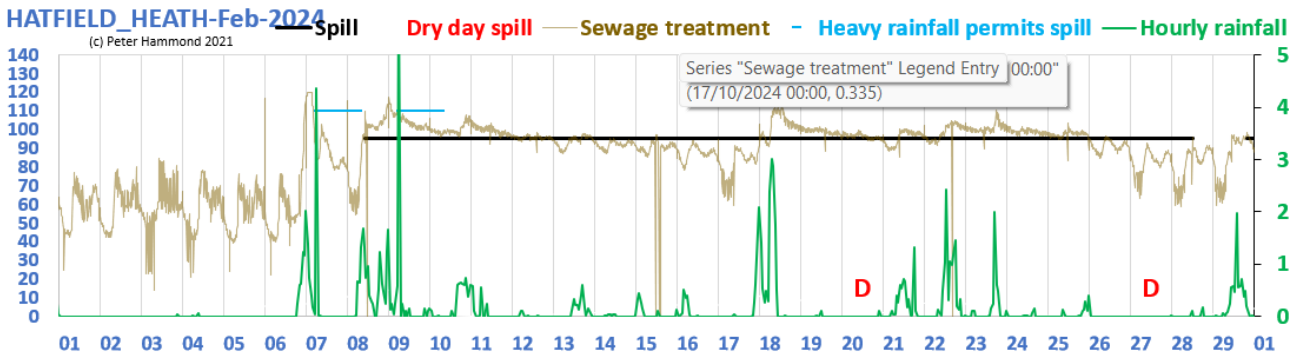


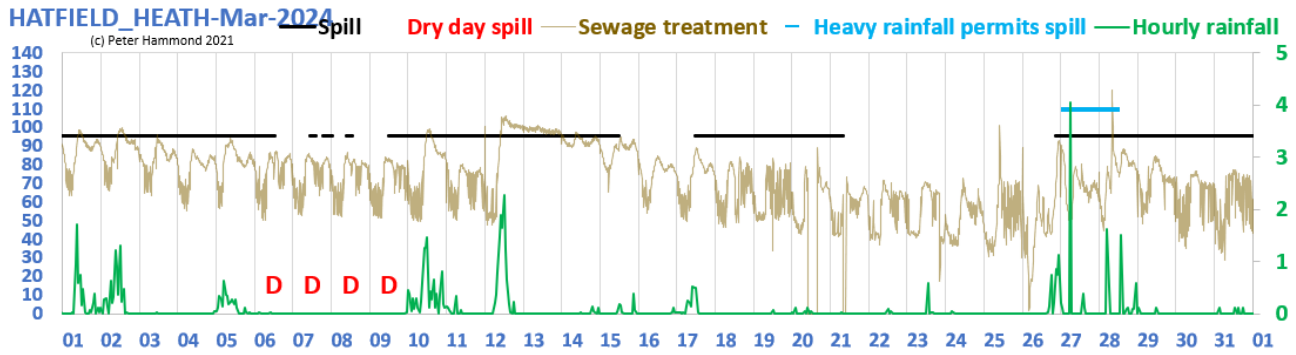


HATFIELD HEATH STW

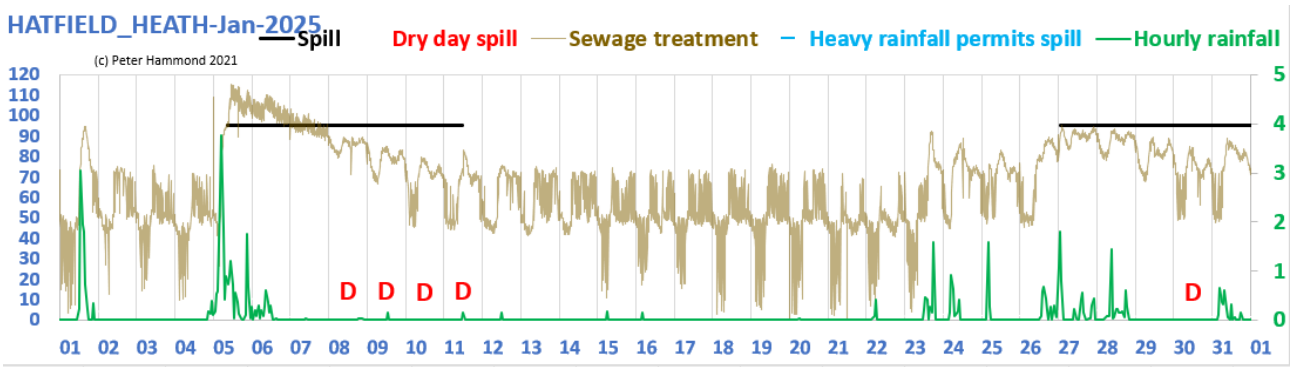
Using the EA classic “dry-day” definition, there were 15 ”dry-day” untreated sewage discharges in 2024 (15.5% of 97 spill days) and 11 in 2025 (37.9% of 29 spill days). According to “heavy rainfall review” for 2024 and 2025 the non-compliance rates were 94.9% and 100.0% respectively.

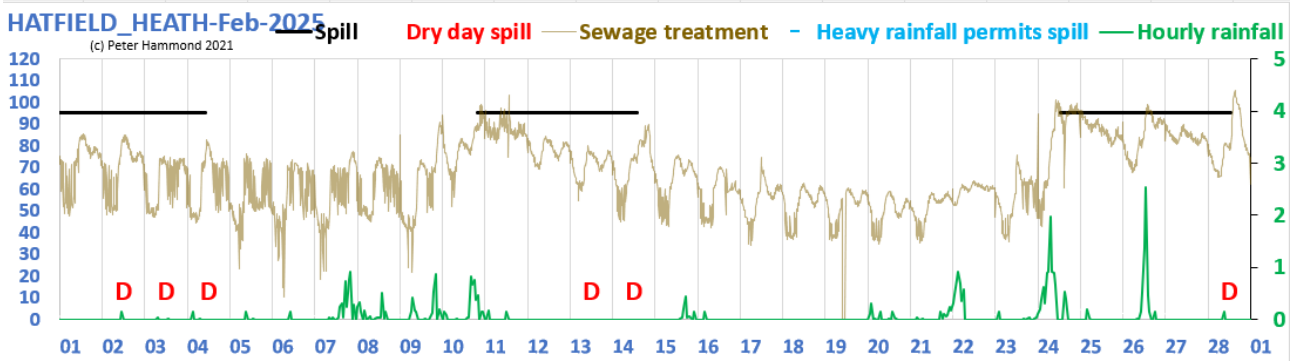
2024 examples





2025 examples

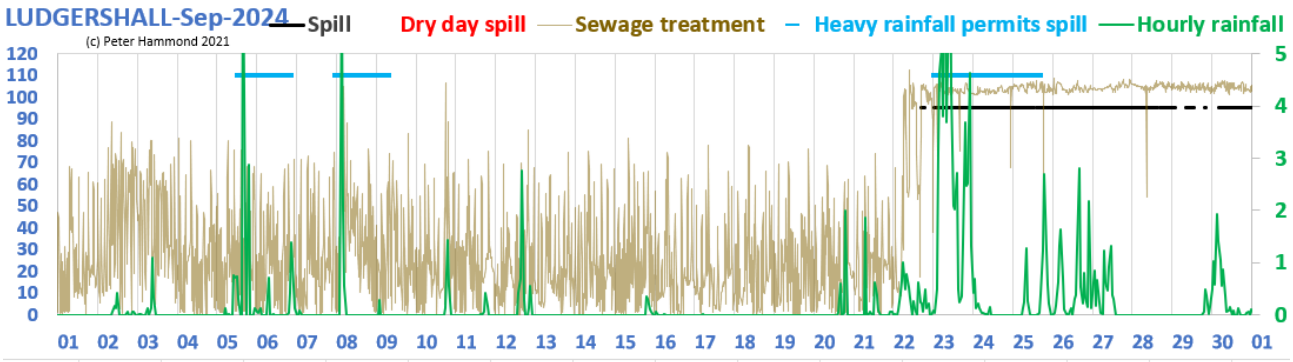


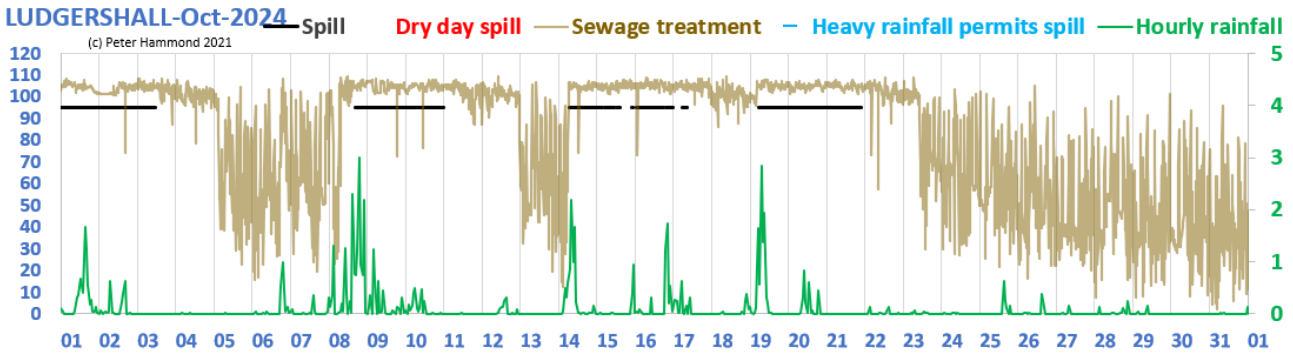


LUDGERSHALL STW

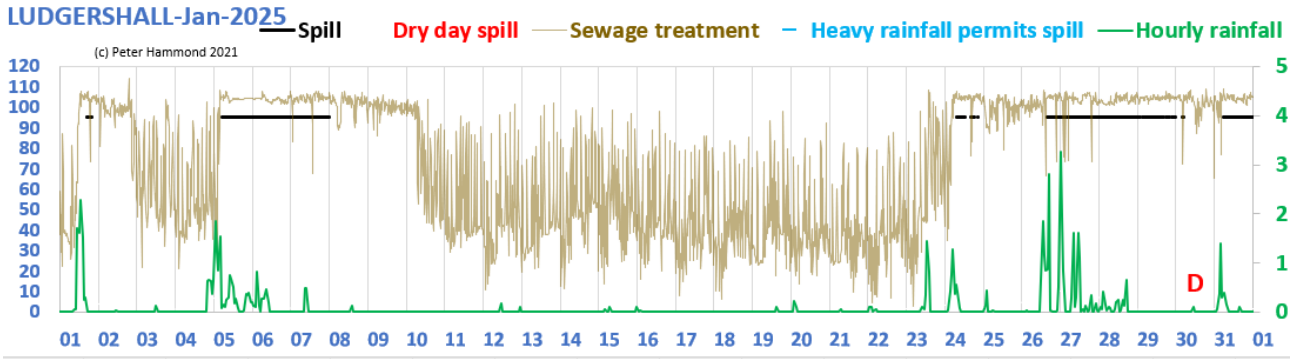
Using the EA classic “dry-day” definition, there were 5 ”dry-day” untreated sewage discharges in 2024 (5.3% of 94 spill days) and 4 in 2025 (8.2% of 49 spill days). According to “heavy rainfall review” for 2024 and 2025 the non-compliance rates were 83.5% and 96.5% respectively.

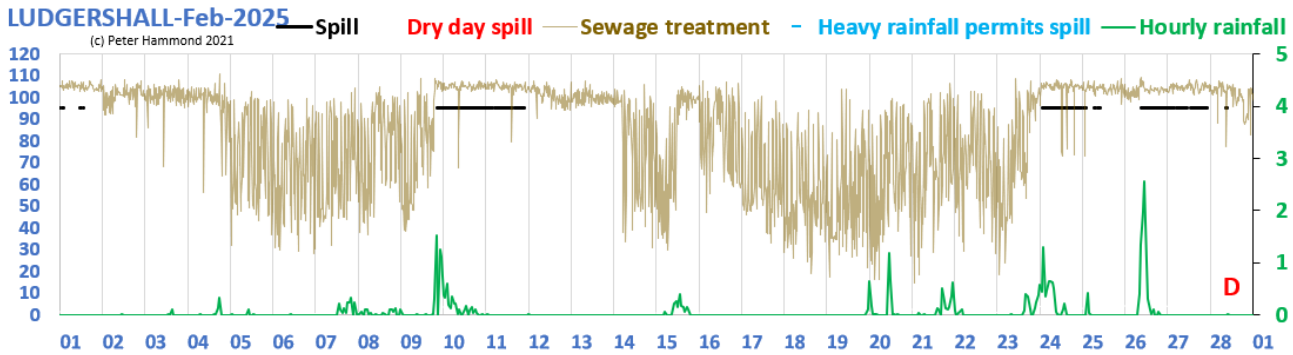
2024 examples





2025 examples



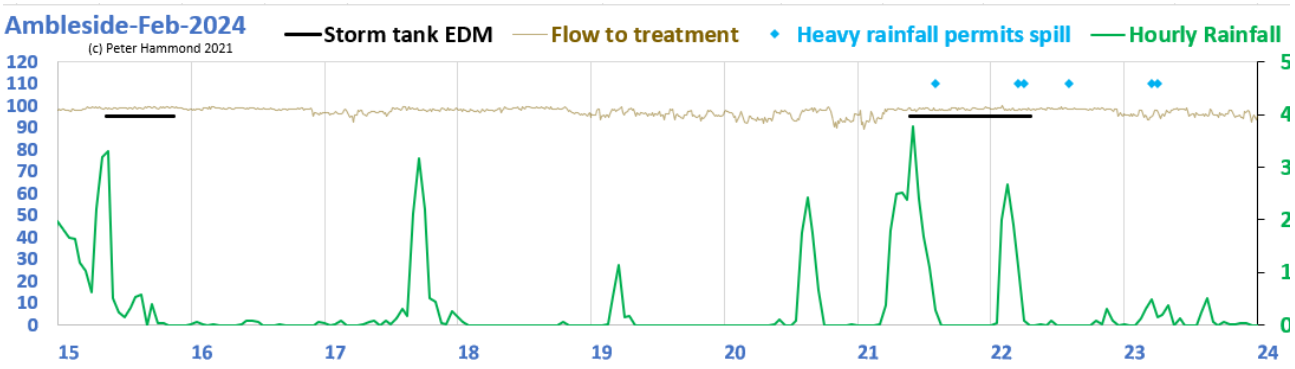


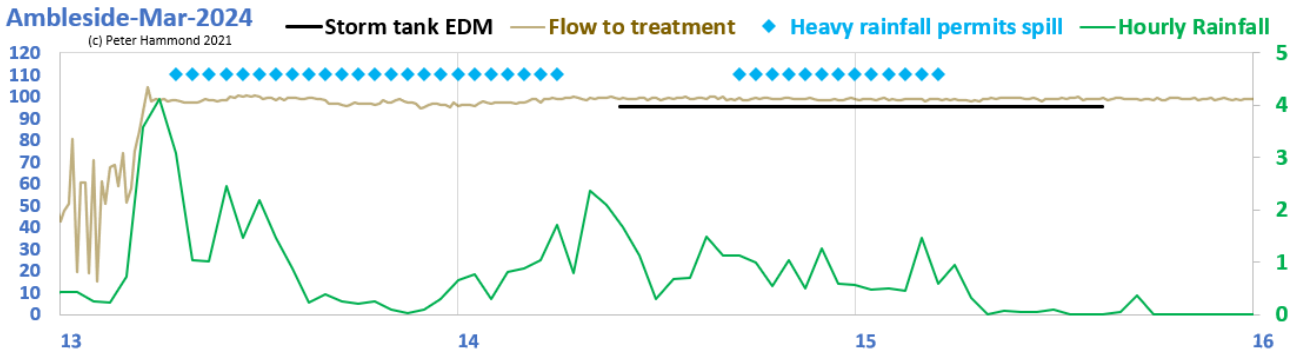
UNITED UTILITIES

AMBLESIDE STW

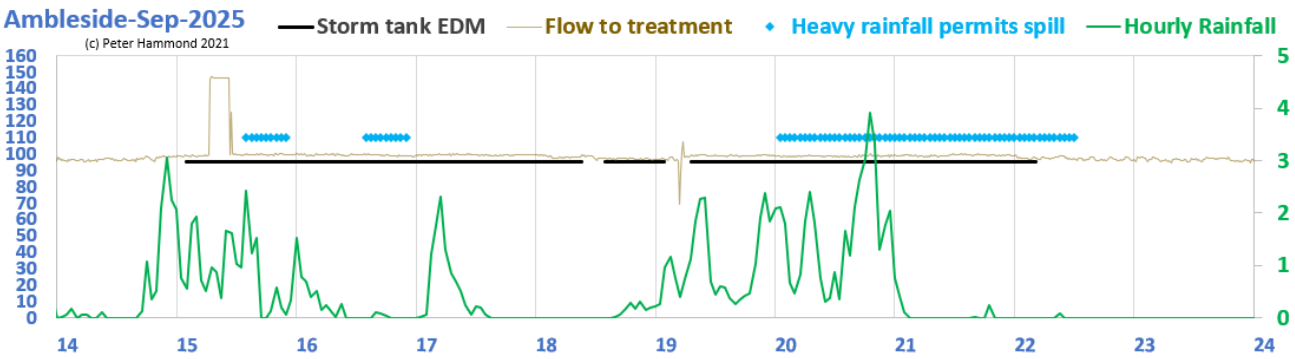
Using the EA classic definition, there were no “dry-day” discharges in both 2024 and 2025. According to “Heavy hourly rainfall review” for 2024 and 2025 the dry spill non-compliance rates for a 25 mm threshold were 46.4% and 42.2% respectively.

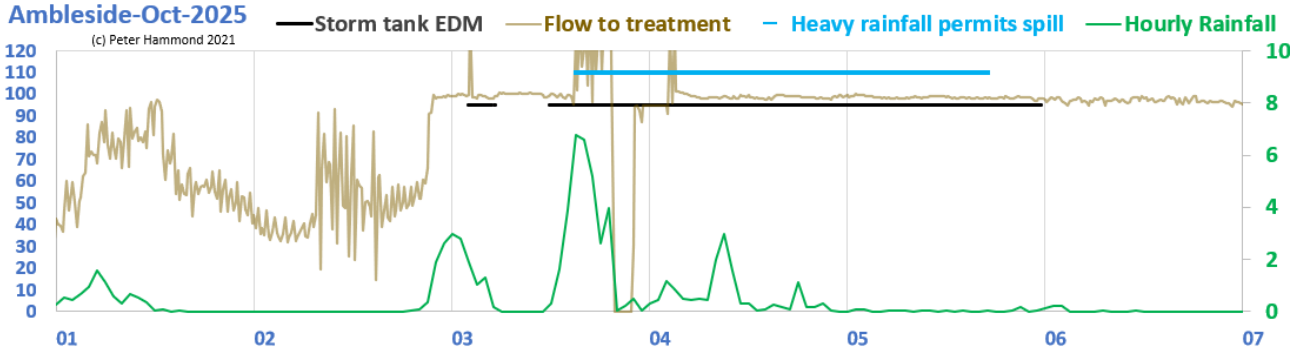
2024 examples





2025 examples





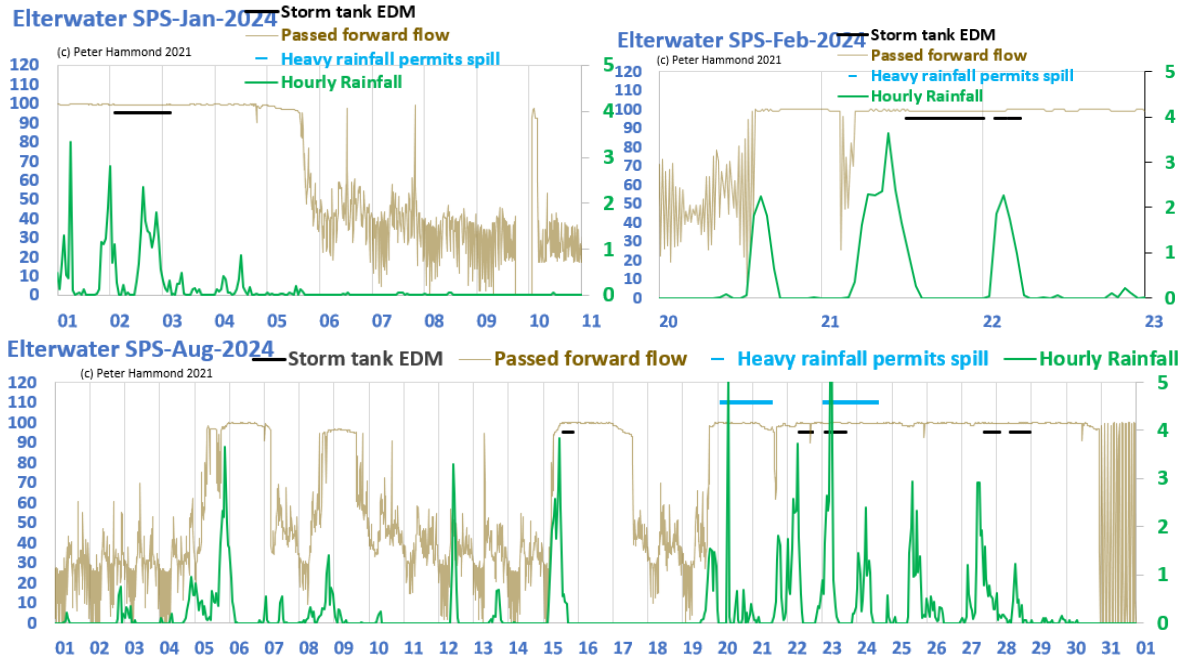
ELTERWATER SPS AND LANGDALE STW

Using the EA classic definition, there were 3 (9.1%) "dry-day" discharges in 2024 and none in 2025.

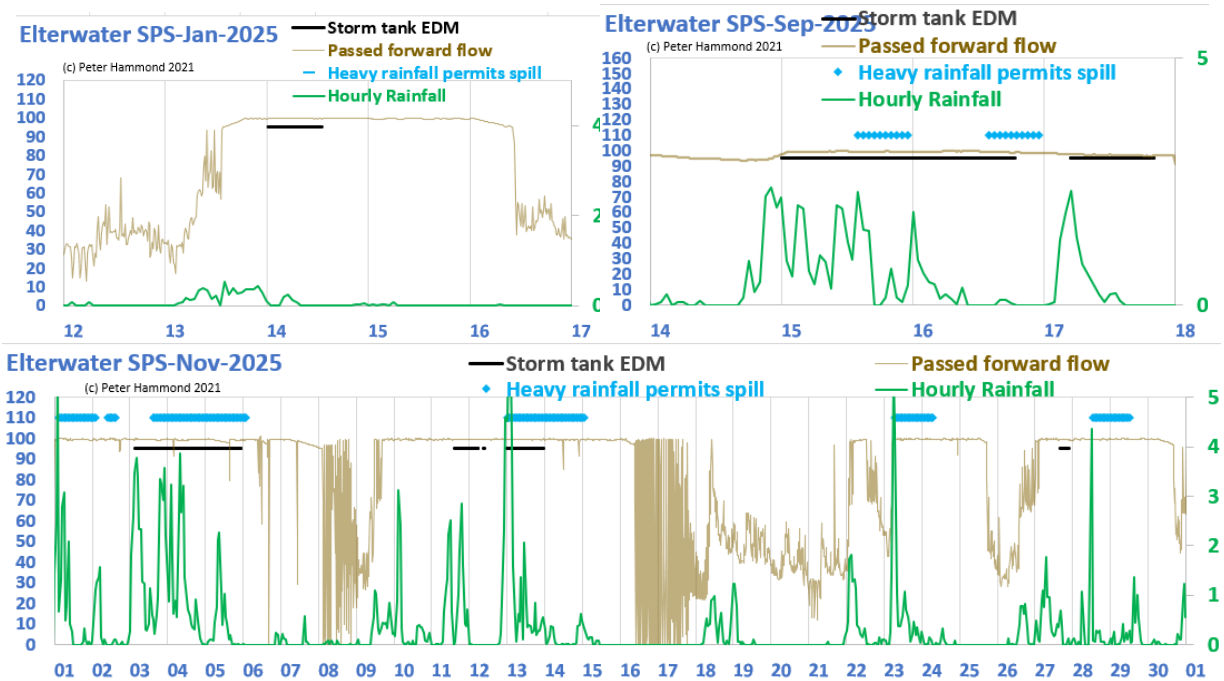
The EA's review of the period **2nd of June 2024 to the 2nd of June 2025** is documented in CAR Report NW_01LAK0025_SI_S-567881_20250602 and is summarised as *No non-compliances have been identified during this compliance assessment.*

According to "Heavy hourly rainfall review" for 2024 and 2025 the dry spill non-compliance rates were 56.2% and 40.0% respectively even with a 25 mm threshold. The rates are much higher at more reasonable thresholds of 35 mm and 40 mm.

2024 examples



2025 examples

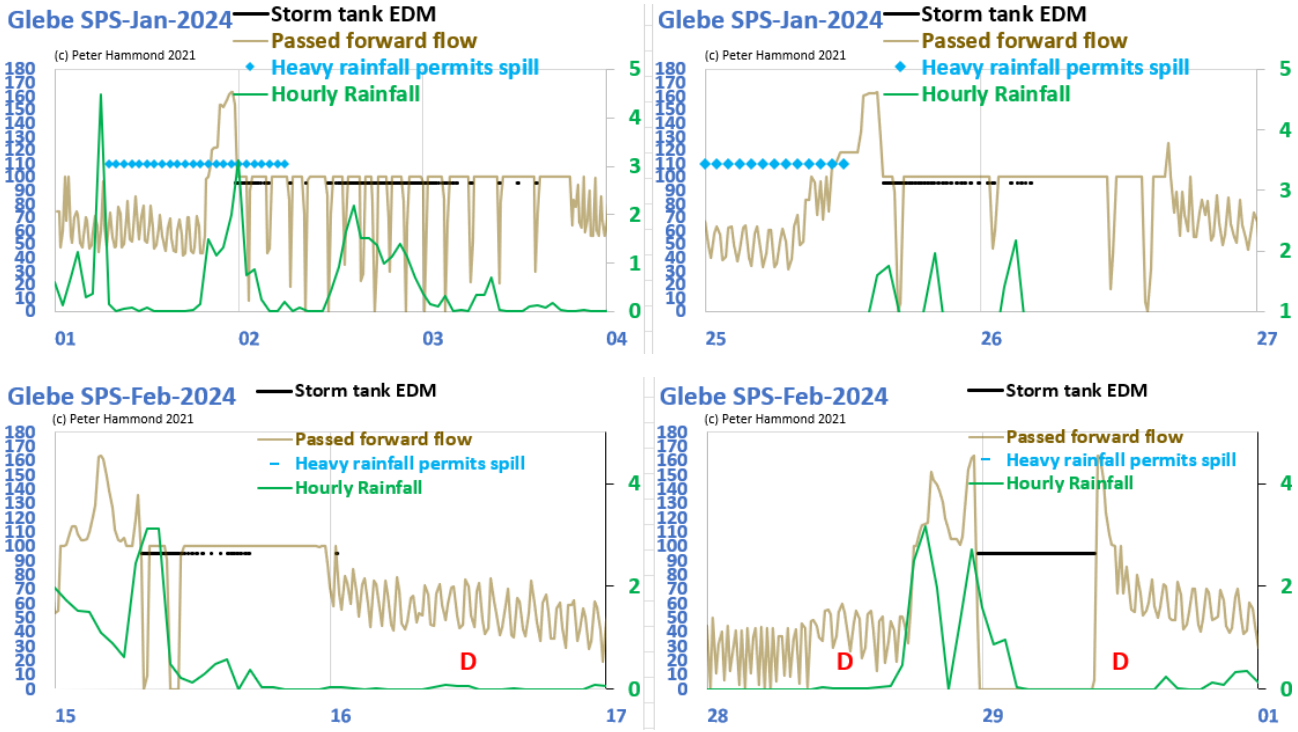


GLEBE ROAD SPS

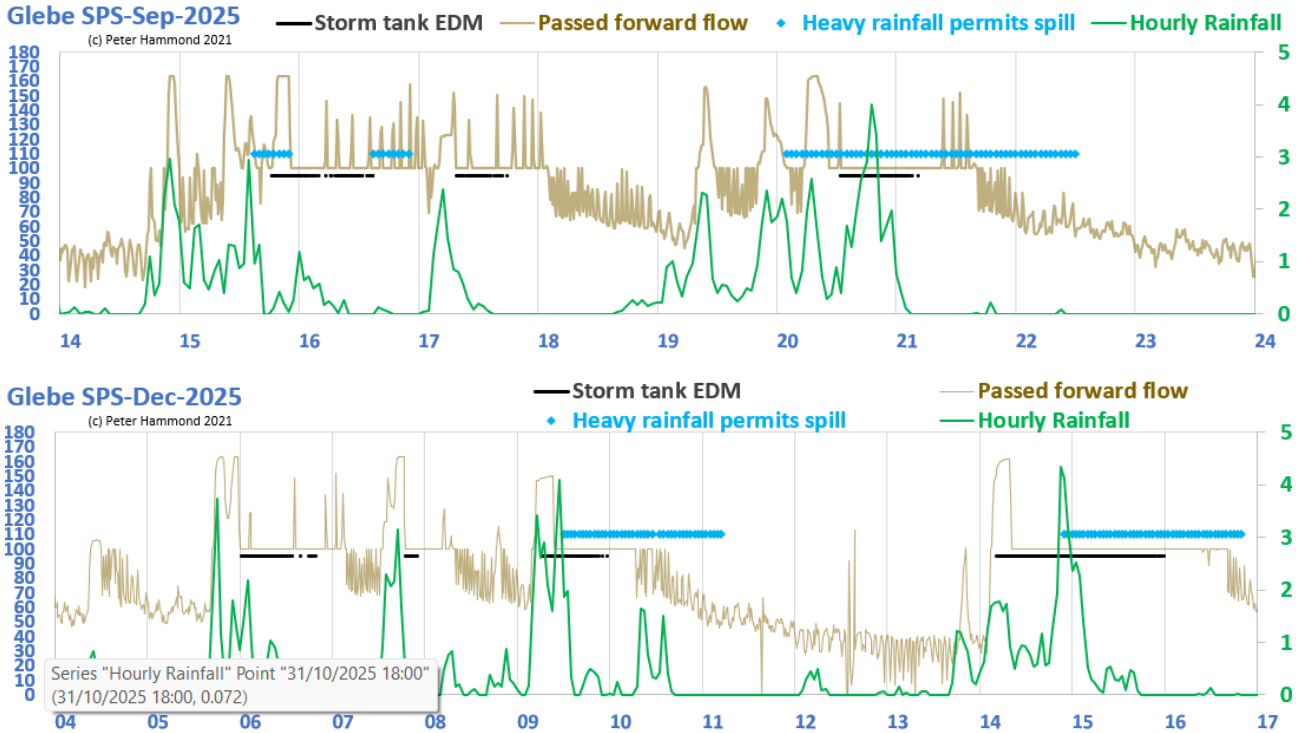
Using the EA classic definition, there were 9 “dry-day” discharges in 2024 and none in 2025.

According to “Heavy hourly rainfall” analysis, in 2024 and 2025 untreated sewage discharges were non-compliant 50.4% and 30.4% of the time respectively at a 25 mm threshold. In addition, the passed forward flow was often over 160% of the permitted capacity.

2024 examples



2025 examples



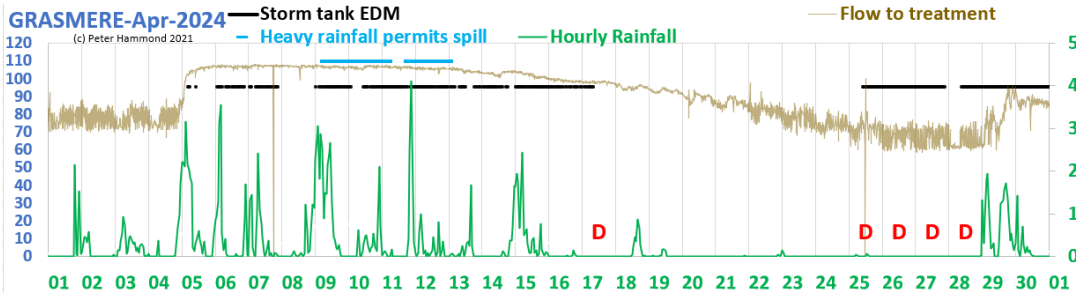
GRASMERE STW

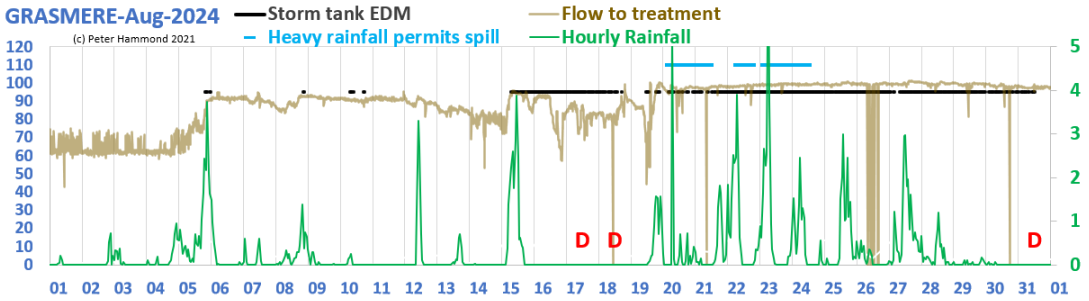
Using the EA classic definition, there were 10 (9.9%) "dry-day" discharges of untreated sewage in 2024 and none in 2025 (days labelled with **D**).

According to "Heavy hourly rainfall" analysis, in 2024 and 2025 untreated sewage discharges were non-compliant 77.2% and 37.9% of the time respectively at a 25 mm threshold.

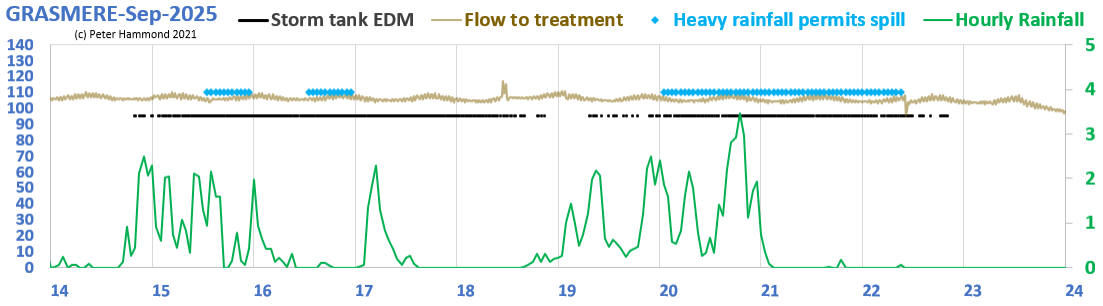
2024 Examples

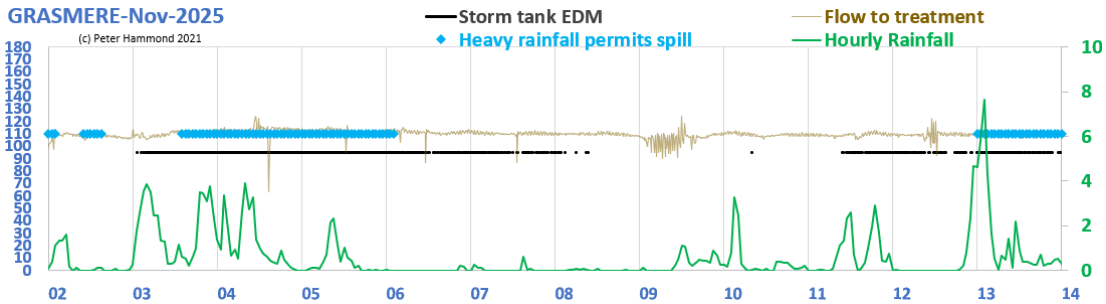
The EA issued a CAR report **NW_017370027_SI_S-545353_20250226-1** on Feb 26th 2025 about various dry day spill in 24 at Grasmere STW. Some are shown in the two charts below and labelled by a **D**. These dry spill days account for less than 10% of the all days involving spills. In contrast, analysis of the hourly rainfall patterns shows that 77% of the total annual spilling is illegal as the rainfall is not sufficiently heavy to permit untreated sewage discharges.





2025 examples



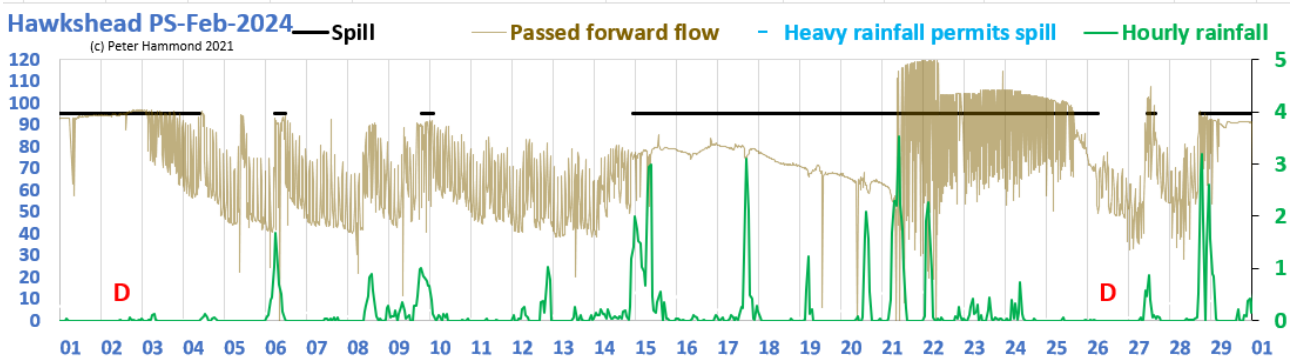


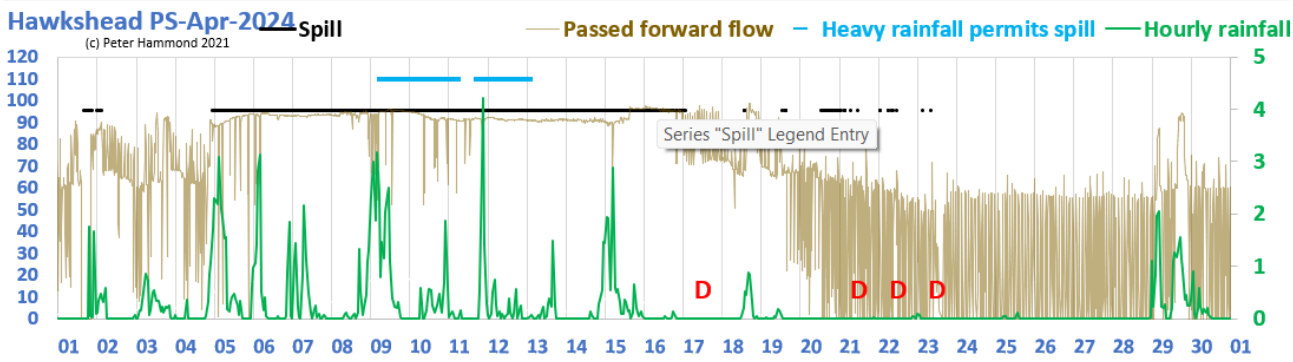
HAWKSHEAD SPS

Using the EA classic definition, there were 8 (5.2% of spill days) “dry-day” discharges of untreated sewage (labelled **D**) in 2024 and 1 (0.9% of spill days) in 2025.

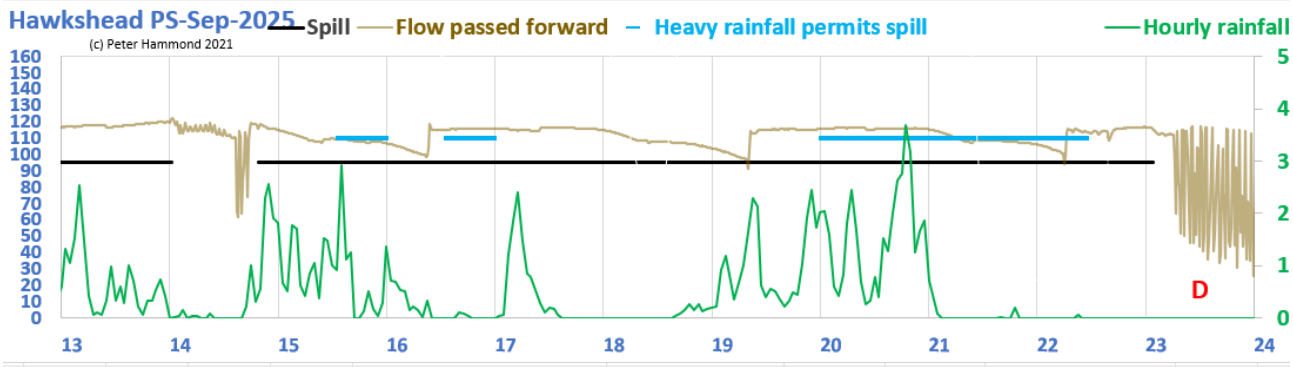
Using a “Heavy rainfall” threshold of 25mm, in 2024 and 2025 untreated sewage discharges were non-compliant 83% and 66% of the time respectively at a 25 mm threshold.

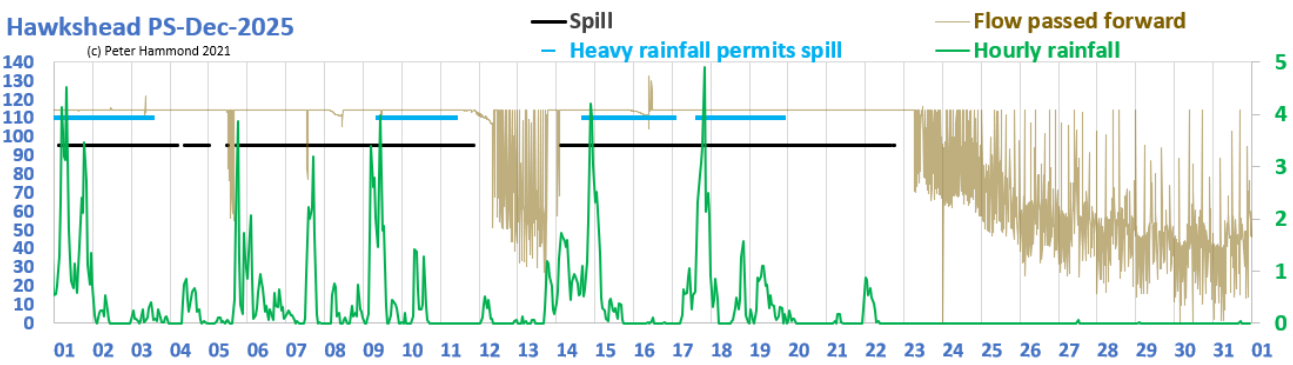
2024 Examples





2025 Examples

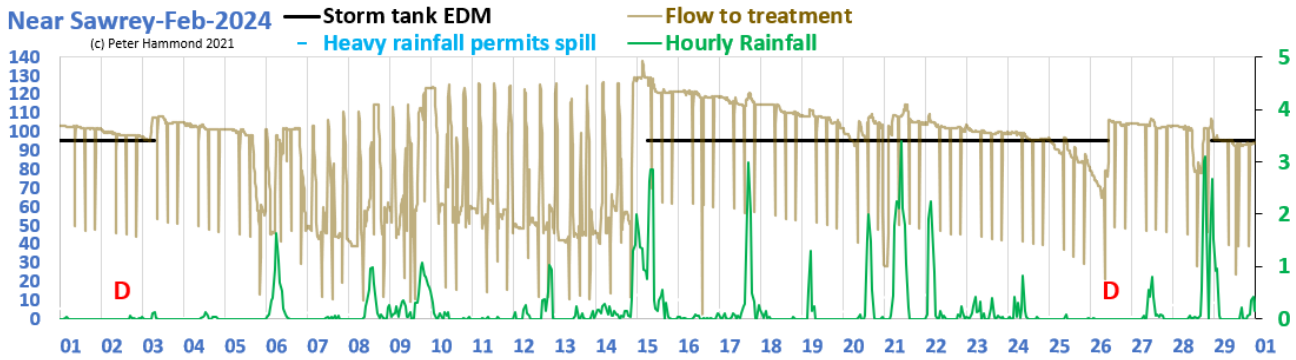


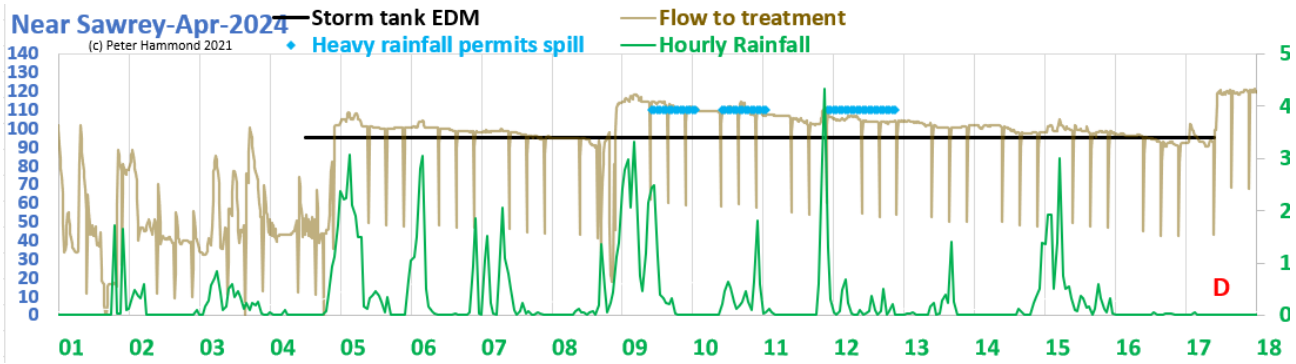


NEAR SAWREY

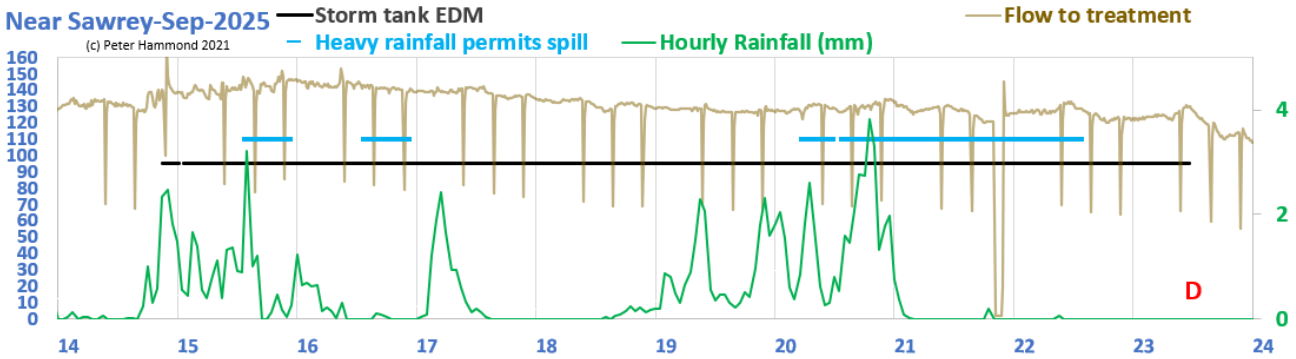
Using the EA definition, there were 4 (4.8% of spill days) “dry-day” discharges of untreated sewage (labelled **D)** in 2024 and 2 (3.8% of spill days) in 2025. According to “Heavy rainfall” analysis, in 2024 and 2025 untreated sewage discharges were non-compliant 80% and 65% of the time respectively at a 25 mm threshold.

2024 Examples

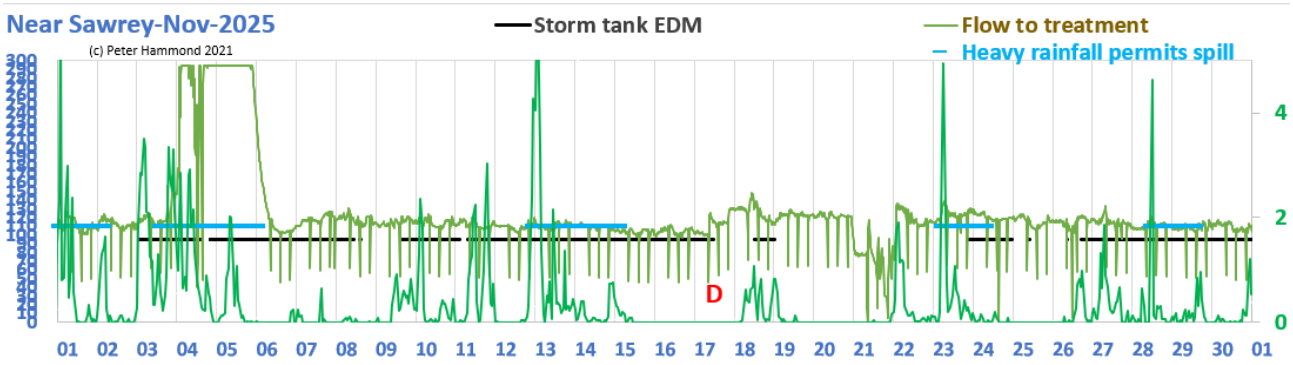




2025 Examples



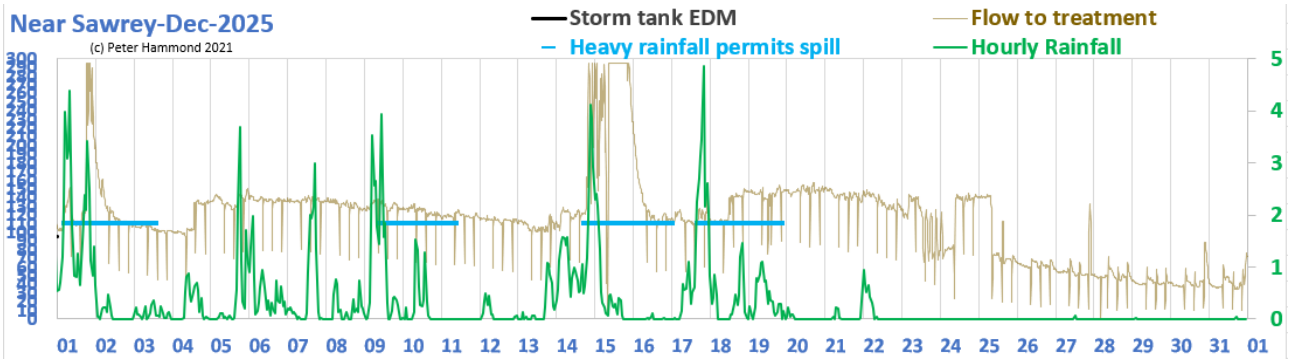
The dry day spill approach for September just picks up 1 day. The “heavy rainfall” picks up at least 140 hours to be unpermitted.



Just 1 dry-day spill.

But over 60% of the 446 hours of spilling are illegal according to the heavy hourly rainfall approach.

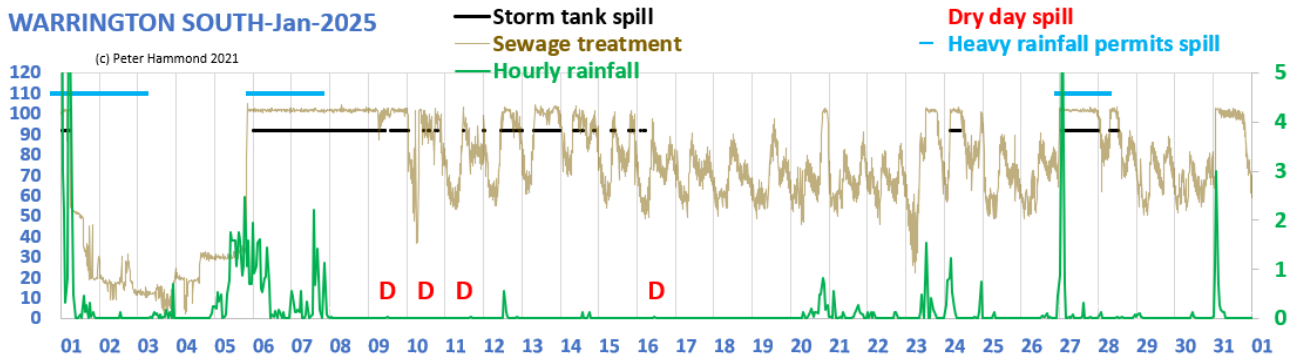
Also, there is 300% of FFT throughput on Nov 4/5!!! Would any treatment have occurred?

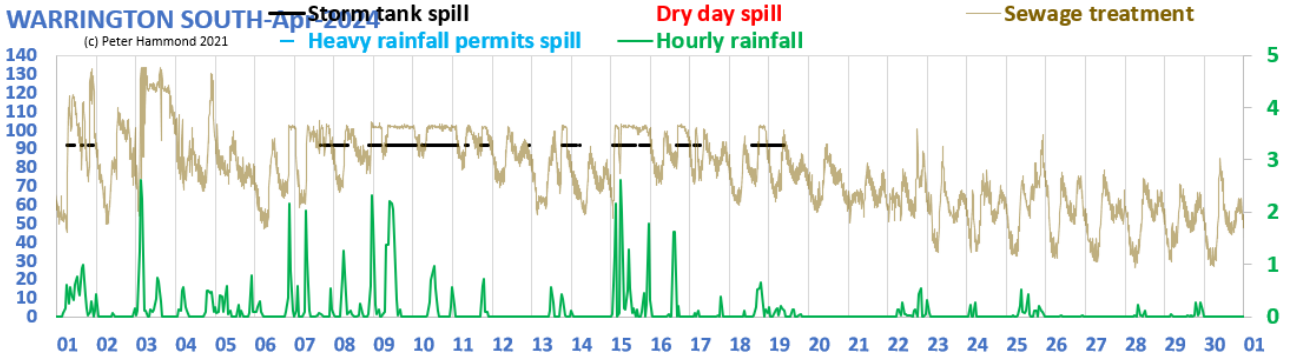


Heavy hourly rainfall approach justifies spilling but instead treatment is pushed to 300% of FFT.

Which is worse? Spill 200% of “diluted” FFT (as UU would likely claim) vs under treated at a flow rate 300% of the site capacity.

WARRINGTON SOUTH





Report ID: S/551803

Primary settlement tanks weirs had significant sludge build up and some vegetation growing on the surface near the weir overspills (see photos 9 & 10). ACTION: to address the maintenance of the scum hopper in the primary settlement tank which has vegetation in it, due by 16th June 2025.

Photograph 9

Photograph 10