Report on the counts of faecal indicator bacteria in a Cam Valley Forum sample of effluent discharging from Haslingfield STW during a storm overflow,

3 March 2022

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Haslingfield STW site observations and sampling

Rainfall on 28 February to 2 March amounted to 11mm (Cambridge University DTG) and 15mm (Trumpington garden) which prompted a visit to Haslingfield STW on the morning of 3 March to check the state of the storm tanks. **An overflow from both storm tanks into the River Rhee was in progress.** Comparing the relative flows of the treated final-effluent and overflow before they were mixed was very difficult. The proportion of overflow in the total discharge was a minimum of 10% and probably closer to 15%.

On 3 March, a sample of pure final-effluent was taken from the outfall in the bank of the Rhee to analyse for bacteria, and also from river water 80m upstream of the outfall. The results were as follows:

8 March 2022 Haslingfield: sample of STW discharging effluent, a ~15:85 mixture of overflow from storm tanks and treated final-effluent and a sample of river water*				
South east Water lab certificate number		*E. coli* (MPN/100ml	Total coliforms (MPN/100ml	Enterococci (CFU/100ml)
944130-1	River water	2,851	12,033	600
944131-1	Effluent (outfall)	>241,960	>241,960	>10,000

***A reporting upper limit on the counts was imposed by the method used. **The actual counts were higher than the 'greater than' values reported.**

This is CVF's first bacterial count of bacteria in pure effluent during a storm overflow. The result from this single sample when compared to data previously collected on treated final-effluent shows that **the mixture of overflow liquid with treated final-effluent seemed to have a markedly higher bacterial count than treated effluent alone**. Counts in CVF's samples taken on 4 June and 24 August 2021 from treated final-effluent are shown in the Table below and were similar one to the other, but only 16% of the March count at most.

The river water count of *E. coli* taken 80m upstream of the outfall was 2,851 MPN/100ml and all three bacterial counts were in the same ball park as the counts at the same site on 19 January. No counts are available for the treated final-effluent on 19 January, when there was no overflow operating.

Conversion of effluent counts to 'river water' counts

Conversions rely on the use of values of river flow and flow through the STW at the time of sampling. From these, the value of the dilutive capacity of the river flow can be calculated. The river flow at the Burnt Mill EA Flow (Stage) Gauge on 3 March was rising and was at the highest level since February 2021 (as yet, EA-'unchecked' data).

Effluent flow at the outfall was estimated using Flow to Full Treatment (FFT) for treated effluent added to which was the estimated flow of discharged untreated sewage liquid.

Based on the figures, the concentration of anything in the effluent after it was mixed with river water was estimated to be 1/60th of the original. However, the river flow value was the day's average and as the river was still rising rapidly after the time of sampling, the flow at the time of sampling would have been less than the day's mean, and application of an adjusted flow provided a more realistic dilution rate of 53. Using this dilution rate, conversions of the effluent counts to 'river water' counts were then calculated. Note that no sample was actually taken from the river water by the outfall.

The table shows counts in the pure effluent and after conversion to 'river water' counts.

Haslingfield effluent at outfall		**Counts / 100ml**		
		E. coli	**Total Coliforms**	**Enterococci**
Batch 1, 4 June 2021	Actual pure effluent	38,700	155,300	6,200
Converted to river count (dilution rate=11)		*2,167*	*8,696*	*347*
Batch 2, 24 August	Actual pure effluent	38,700	129,970	3,000
Converted to river count (dilution rate=18)		*3,495*	*11,730*	*271*
Sample 3 March	Actual pure effluent	>241,960	>241,960	>10,000
Converted to river count (dilution rate=53)		*>4,565*	*>4,565*	*>189*

There is no reason not to expect an overflow event in high summer to allow the discharge of effluent with a similar concentration of indicator bacteria. Summer flows have been low for some years, and indicator bacteria and associated disease organisms will be diluted far less during the summer. Using the 3 March effluent counts, if similar counts were to be assumed during the overflow that actually occurred on 21 October 2021, the counts after the effluent became mixed with the river water would have been much higher, for *E. coli* the **converted 'river count' would have been over 18,000 MPN/100ml.**

Another concern which is related to variation in bacterial counts and safety to river users is the proportion of STW effluent in the Cam at Cambridge. A crude estimate for this was made in the CVF Batch 1 Report, which suggested that 40% of the river volume at Sheep's Green, Cambridge (a prime site for a Bathing Water) was effluent from the several STWs upstream on the Rhee. This estimate was made for 27 August 2019, in a period of particularly low flows. Others have suggested an even higher figure for the proportion.

Conclusions

1. Regarding Haslingfield STW, Cam Valley Forum has shown previously that treated final-effluent contains sufficient faecal indicator bacteria to create a health risk (from various organisms including enterococci, some of which are opportunistic pathogens) to river users downriver (following EA Bathing Water standards). The risk declines over distance, but not at a constant rate, and so far from our monitoring the risk seems to be lower during the summer months (June and August 2021) than in winter (January 2022).
2. During periods of higher inflows into the sewer system due to rainfall events, greater volumes of surface drainage water, etc (notwithstanding variations in amounts of domestic discharge flows) should reduce numbers of indicator bacteria simply by dilution. *E. coli* for instance, is closely linked to the intestinal tract of most mammalian species including humans, and bird species, rather than from surface water draining from roads, etc. It is clear, however, that despite this dilution factor the sample on 3 March from mixed effluent showed massively raised counts.
3. River "summer" low-flows (often extending into autumn/early winter) do not have the capacity to dilute organisms in effluent nearly so much as flows in late winter. The risk to the health of river users downstream, particularly swimmers, has to be increased when an overflow occurs in low-flow conditions.
4. A model to predict the extent of the 'plume of influence' of Haslingfield STW and other STWs further upstream continues to be constructed.
