## Worrying about wastewater in the Wharfe: the role of citizen science

**Rick Battarbee** 

Addingham Environment Group, Ilkley Clean River Group University College London

CIWEM, Birmingham, November 9<sup>th</sup>, 2022



# Ilkley STW Storm Overflow

Steve Fairbourn, 23<sup>rd</sup> March 2016

100

# Causing severe organic pollution of the river, including "solids", nutrients, and faecal bacteria

Steve Fairbourn, 23<sup>rd</sup> March 2016

## Risks to human health

Untreated sewage contains exceptionally high concentrations of viruses and bacteria that can cause severe human health problems



#### Cromwheel

#### **Beanlands Island**



In the early summer of 2018 at the instigation of Karen Shackleton several of us decided it was time for action and formed the **Ilkley Clean River Group** under the leadership of Becky Malby



## Faecal bacteria sampling





# Registering samples at the ALS lab in Wakefield before overnight delivery to Coventry



## Ilkley STW: first sampling sites (2019)



# High flow and a spill (take 1000 cfu/100 ml as the fail boundary)



Funding: Ilkley Town Council, WNS and the Rivers Trust

### Low Flow



# Treated effluent: organic matter removed but contains high concentration of faecal bacteria, and it flows continuously



Addingham tap water

0 cfu

Ilkley STW final effluent

500,000 cfu

## Concluded so far on behalf of residents:

- *E. coli* concentrations are very high downstream in wet weather during and after a storm overflow event
- They are high in dry weather owing to continuous discharge from the final effluent outfall
- Bathers downstream are always at risk from faecal bacteria
- E. coli concentrations upstream can be high in wet weather
- But are usually low in dry weather
- Bathing in dry weather upstream is relatively safe

Ilkley Clean River Group town meeting (November 2019) John Grogan MP recommended applying for **Bathing Water Status** 



## Upstream sources ?

What are the sources of high faecal coliform numbers arriving in Ilkley? Do they come from people or livestock, or both?



- Sewage Treatment Works
- Combined Sewer Overflows
- Private STW
- Septic Tanks



- Cows
- Sheep
- Dogs
- Birds
- Other wildlife



# The storm overflow tanks at the Addingham Pumping Station frequently spill into the old mill race and thence into the Wharfe at Low Mill



Pictures from Steve Fairbourn

November 2019

#### Evidence of a spill from Addingham Pumping Station causing high values in Ilkley



# River Wharfe: Bolton Abbey

Photo: Jonathan White

But agricultural sources are also important in wet weather, especially after a long dry period







# Characterising sources of faecal pollution using molecular microbial methods in freshwaters: Ilkley case study

### Dr. Isabel Douterelo<sup>1</sup> & Prof. Rick Battarbee<sup>2</sup>

<sup>1</sup>Dept. Civil & Structural Engineering, The University of Sheffield <sup>2</sup>Environmental Change Research Centre, University College London



YorkshireWater











### Using molecular methods to identify faecal bacteria from different sources





Lab filtration

**DNA Sequencing** 

qPCR

Large water samples

## Quantification of host-specific genes (qPCR)

(anthropogenic vs. zoogenic faecal pollution)



Douterolo and Battarbee, 2022, unpublished

### Microbial Fingerprint (DNA Sequencing): % phyla



Douterolo and Battarbee, 2022, unpublished

### Microbial Fingerprint (DNA Sequencing): % most abundant species



Species of bacteria found in nutrient rich water, in ruminant faeces and in human faeces including some pathogens and many non-pathogenic organisms





"Improving water quality on the River Wharfe from Oughtershaw to the Ouse: a citizen science project"

**The River Wharfe Big Health Check** 

Monday 24<sup>th</sup> August, 2020



#### Faecal bacteria concentrations at 50 sites along the Wharfe from Swarthghyll to Cawood



# iWharfe\_Upper *E. coli* data: April, June and July 2021 *Very low flow!*



Diagram: Malcolm Secrett

Funding: YDNPA

## Conclusions

1. Public health is threatened not only by faecal bacteria from intermittent storm overflows but by discharges from **continuously flowing treated effluent** 

2. Faecal bacteria also enter the main river from **agricultural land** mainly from farm animals although rural **septic tanks, private sewage treatment plants and surface water runoff** may also be important

**3.** Sources and source strength vary strongly with weather conditions and river flow. Wet weather mobilises bacteria from agricultural land and can cause storm overflows to spill (often in non-exceptional situations)

**4. Molecular methods** using both qPCR and DNA sequencing can differentiate between sources and be used to identify a full range of pathogenic organisms

**5. Die off rates** appear to be more rapid than expected from the literature. Can these be better simulated in models?

6. Citizen science has a key role to play not only in field sampling but also in raising awareness and increasing public understanding of water quality problems and river ecology

7. Our current citizen science work in the Wharfe is focussing on the **ecological impact of storm overflows** 

#### iWharfe Eco-Ashlands Project (2022) HUNDER Chemistry Rishaw **Diatoms** Addingham Sunket Warren **Faecal bacteria** Bore Hill CSO **Filamentous algae** Denton Macro-invertebrates Microplastics Ilkley FF Weston Estate Burley in Wharfeda **Ukley** Moor Garnett Wharfe Funded by Ilkley Town Council and Wharfedale Naturalists Society Otley

Earnley

Gailows

Cambridge

Estate

Menston

Collaboration between Ilkley Clean River Group, Addingham Environment Group and Yorkshire Dales Rivers Trust

What are the adverse ecological impacts of untreated sewage discharges?



## Diatoms and nutrient chemistry

The shift in phytobenthos occurs immediately downstream of the final effluent outfall and is not associated with the storm overflow

The organic pollution from the storm overflow appears to have little ecological impact - at this site



#### Thanks to Ilkley Clean River Group, Addingham Environment Group and Yorkshire Dales Rivers Trust

