Escherichia coli and total coliform concentrations around a sanitary sewer overflow in Trout Brook in West Hartford, CT

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Background

- The presence of *E. coli* in streams in urban areas is often caused by point source pollution from sewage outflows, as well as runoff from impervious surfaces with animal waste (Bannerman et al., 1993; Cinotto, 2005; Petersen et al., 2005).
- Hartford is a post-industrial city with an outdated sewer system
- Sanitary Sewer Overflows (SSOs) prevent the wastewater treatment plants from being overwhelmed during high flow events
- During heavy flow events, wastewater and untreated sewage are released into Trout Brook

Study Site

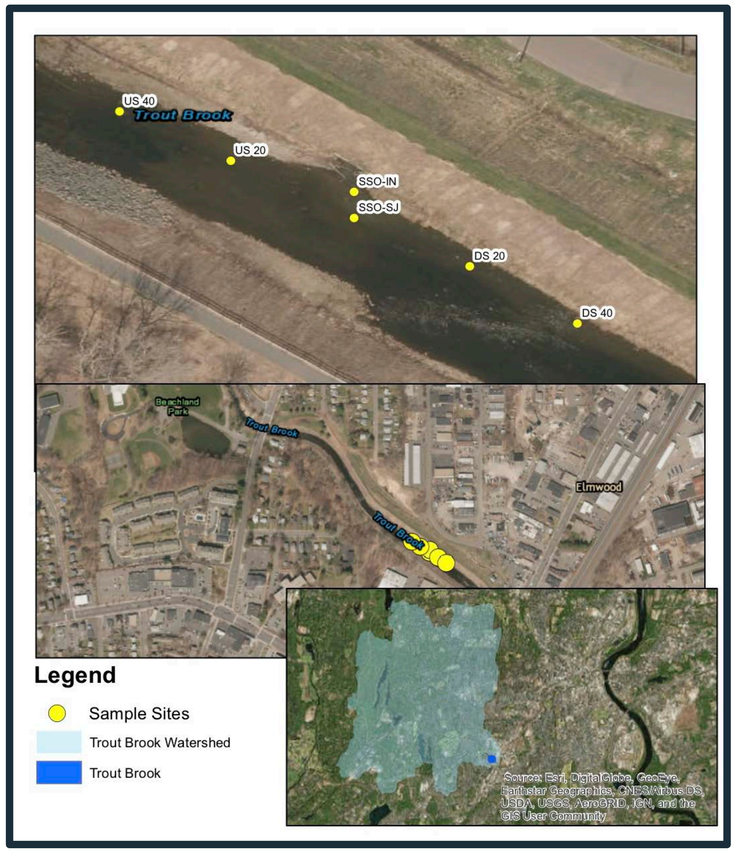

Figure 1: Sample region of Trout Brook at different scales. SSO-IN is the storm sewer overflow, and SSO-SJ is where the outfall meets the stream. All sites are 20 m apart. US=upstream and DS=downstream.

Acknowledgements

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Methods

Field Sampling Methods

- We ran a preliminary indicator test to detect the presence of *E. coli* in Trout Brook and our results were positive
- We collected 2 samples at each of the 6 study sites (Fig.1)
- We measured stream flow and temperature at Sites US40, SSO, and DS40

Lab Methods: HACH Method

Diagram above shows the HACH method for measuring bacteria concentrations. Images taken from HACH.

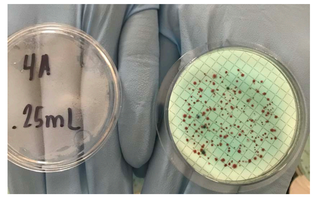

Image above is a plate from the SSO-SJ, red colonies are total coliform and blue are *E. coli.*

Equation below was used to calculate bacteria concentration.

$$\frac{\#\ colonies}{mL\ sample} * 100 = cfu/100mL$$

Conclusions and Recommendations

- The West Hartford SSO is a point source for *E. coli* and total coliform pollution in Trout Brook.
- *E. coli* concentrations exceeded the EPA threshold on multiple days across multiple sites and there was a strong correlation between increasing bacteria concentration and increasing stream temperature.
- Bacteria presence upstream of SSO and in the pond suggests upstream pollution, possibly from non point sources like animal feces (Bannerman et al., 1993; Cinotto, 2005; Petersen et al., 2005)
- Upstream and downstream concentrations were statistically similar, suggesting bacteria is rapidly dispersing and/or binding to stream sediments (Garzio-Hadzick et al., 2010; Packepsky and Shelton, 2011)
- There is a clear public health crisis in Trout Brook, especially during summer months. More immediate action must be taken before the MDC removes all SSOs by 2023.

Recommendations:

- Year round monitoring of *E. coli* and total coliform concentrations throughout Trout Brook, especially around rain events
- Public health notices to warn residents who use Trout Brook for recreation

Results

Bacteria Concentrations Across Sites and Days

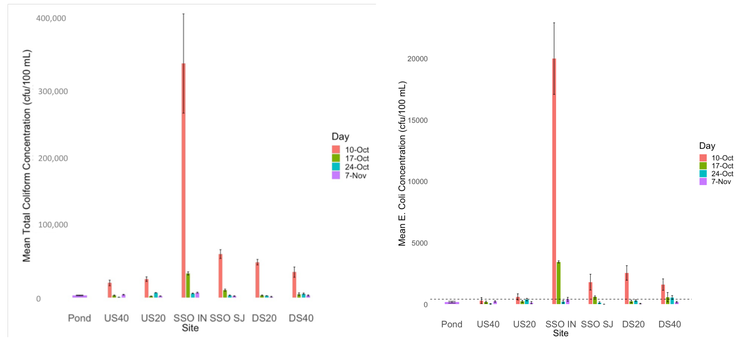

Figure 2: *E. coli* and total coliform concentrations across all sites and days. The threshold line of 410 cfu/100mL sample for *E. coli* represents the safety threshold for non-designated swimming Class A water.

- In the SSO, mean (± SE) *E. coli* (8800 ± 2400 cfu/100mL) and total coliform (95000 ± 39000 cfu/100mL) concentrations were significantly greater than any other site on all sample days (*E. coli*: F = 10., df = 6, p < 0.001, Total coliform: F = 4.3, df = 6, p = 0.0068).
- October 10 had the highest mean (± SE) *E. coli* (4500 ± 1100 cfu/100mL) and total coliform (71000 ± 189000 cfu/100mL) concentrations (*E. coli*: F = 6.2, df = 3, p < 0.001, Total coliform: F = 8.7, df = 3, p < 0.001).
- There were no significant differences in *E. coli* and total coliform concentration among sites excluding inside the SSO or among days excluding October 10.

Correlations

- There were strong positive correlations between bacteria concentration and temperature for *E. coli* In SSO and at SSO SJ and for total coliform at US40 and at SSO SJ
- There was no significant correlations between stream flow and bacteria concentration

Works Cited

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