### Tampons: A Cost - Effective Method to Detect Sanitary Sewer Infiltration in the MS4

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### Overview

- Background
- Problem
  - Detecting sanitary sewer infiltration can be expensive and time consuming.
- Benchmark Testing
  - Minimal detectable limits, proof in concept
- Case Studies
  - Small scale and large scale projects
- Summary

# Background

### • City of Fort Worth

- $\circ$  16<sup>th</sup> Largest City
- ° 2015 population—833,315
- ° 353mi²
- Phase I city
  - NPDES 1996-2005
  - TPDES 2006-present



### Problem

- Why do we care about bacteria monitoring and source tracking?
  - Contact recreation
    - City of Fort Worth has 1 stream listed as impaired for bacteria
  - Assist with identifying trouble spots within an area
  - We have to...

### Problem

- Impaired Waterbodies (bacteria)
  - Sycamore Creek (0806E)
  - Village Creek (0828A)
  - Marine Creek (o8o6D)



## Problem

- 1,308 miles of MS4 lines
  - ° 1905
- 3,336 miles of Water lines
  - ° 1911
- 3,266 miles of Sanitary Sewer lines

   1906



- CCTV the MS4 and find illicit connections • Sure, where's the money going to come from?
- Smoke test the MS4 and wait
   We all know smoke testing is quick...
- Bacteria source tracking (DNA fingerprinting)
   Again, where is that money going to come from?

- Test for optical brighteners
  - Optical brighteners are found in laundry detergent, used to make your whites whiter and your brights brighter
  - Also present in a number of hand soaps
  - Not naturally occurring
  - When optical brighteners are present they will fluoresce under UV light

How do we test?

- Fluorometer
  - Initial cost \$2000
  - Can only analyze grab samples
  - Difficult to involve citizen science groups

How do we test?

- Unbleached cotton sample media (tampons)
  - Cost less than \$0.30/sample
  - Grab or composite sample
  - Involve citizen science groups (or school groups)
  - Need a UV light, like those used for bacteria analysis
  - Readily available

- "Unbleached cotton/rayon sample media utilized for optical brightener collection and analysis"
- If optical brighteners are present, they will glom onto the tampon and cause it to glow under UV light



- Analyze hand soaps and laundry detergents for optical brighteners
- Detectable concentrations
  - Lower limit was approximately 0.1ppm
- Soak time variation
  5min vs. 19hr





#### • 5min soak



### • 19hr soak



- Best results during dry weather time periods
   At least 24hrs after a precipitation event (48hrs ideal)
- Easier to read results if tampon dried for 24hrs after collection
  - Options for drying
    - Unused incubator
    - Drying rack/box

- Series of outfalls with ambiguous sampling results
  - Ammonia-nitrogen was elevated and *E. coli* was less than 2,400MPN/100mL
    - Not necessarily an SSO, could be wildlife
  - Area has infrastructure from the 1920s
  - Area surrounds university











- Break in sanitary line just past lateral connection
- Water Department repaired break
- Outfalls are optical brightener free



- Source tracking for elevated river bacteria levels
- Elevated results not associated with rain events
- Sampled at outfalls discharging into the river







- One outfall had consistent positive optical brightener results
- Tracing back the source



### Summary

- Tampons provide an inexpensive test method for sanitary sewer infiltration in storm drain systems
- Can be used for a grab sample or composite
- Detect optical brighteners at low (0.1ppm) concentrations

### **Questions**?



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