Quantifying Human Fecal Loading from Public Sewer Exfiltration

Presentation to SCCWRP Commission
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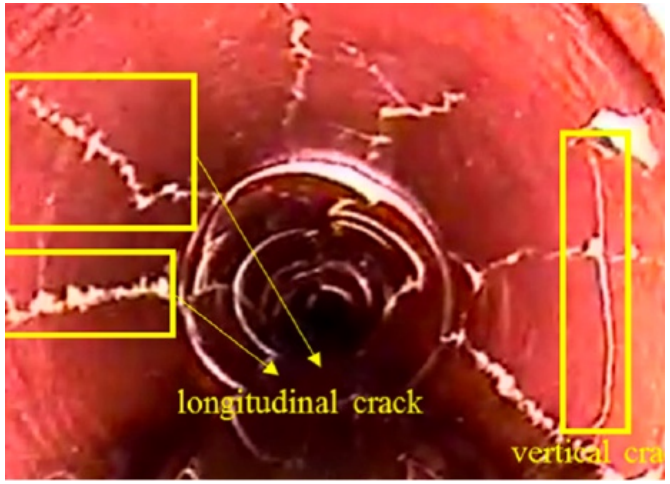
Joshua Steele

Background

- Regulators have prioritized human sources
- We can differentiate human from non-human sources
  - Source ID methods have advanced and found their way into management actions
- When we look, we find widespread human sources
- No longer a question of if, but a question of which
  - Management actions will be different with different sources

Which Human Source?



Exfiltration

Laterals

Direct Deposit

Sewer Overflows

Septic Systems

Illicit Discharge

Statement of the Problem

- Human Marker (HF183) doesn’t distinguish between human sources
- Each source requires a different solution
  - Different organizations or agencies will be involved
- No widely applied techniques available to distinguish sources

Goals

Quantify the contribution from the sewer collection system

I: Develop techniques to assess potential contribution of human fecal contamination from sewers

II: Apply these techniques in San Diego County

Two Approaches for Detecting and Measuring Public Sewer Exfiltration

- Utilize DNA signature of bacterial biofilm found in sewer pipes to detect exfiltration and SSOs in receiving waters

- Direct measurements of volumetric loss to quantify exfiltration

Using Biofilms as a Tracer for Sanitary Sewers

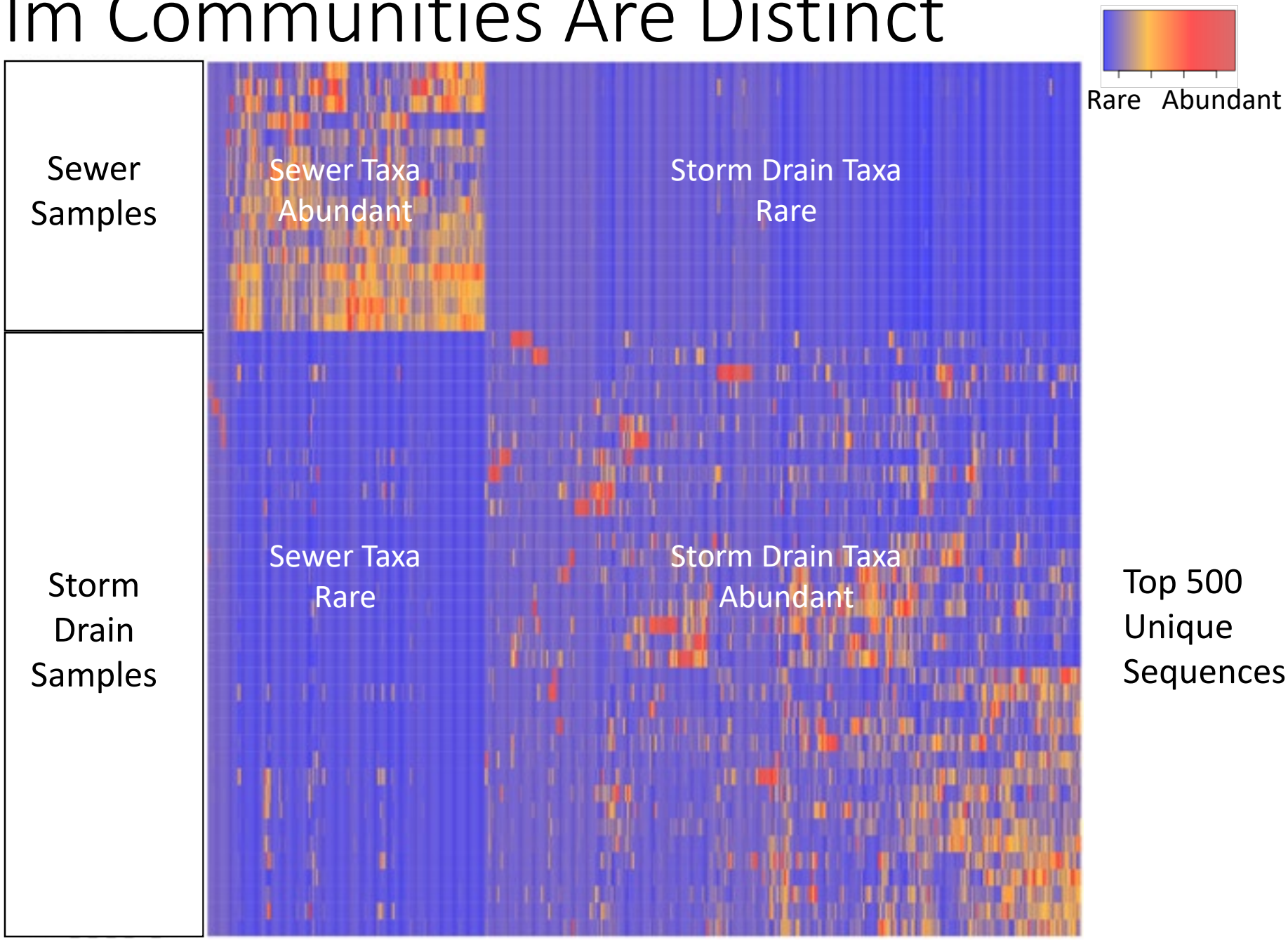
- Sewer pipes are a unique environment which promotes growth of a specific bacterial biofilm community
- Biofilm continuously sloughs off and can be used as a tracer
  - Takes advantage of advances in DNA sequencing
- SCCWRP is adapting biofilm detection for use in identifying sewer exfiltration

Biofilms Tracer Study Phases

- Profile biofilm communities in sewers and storm drains
- Sensitivity testing
- Wet weather implementation

Biofilm Collection

Biofilm Communities Are Distinct



Next Steps

- We’re 70% of the way done with the initial phase
  - We have 26 re-visit samples
- We will apply the method in stormwater samples next year

Two Approaches for Detecting and Measuring Public Sewer Exfiltration

- Utilize DNA signature of bacterial biofilm found in sewer pipes to detect exfiltration and SSOs in receiving waters

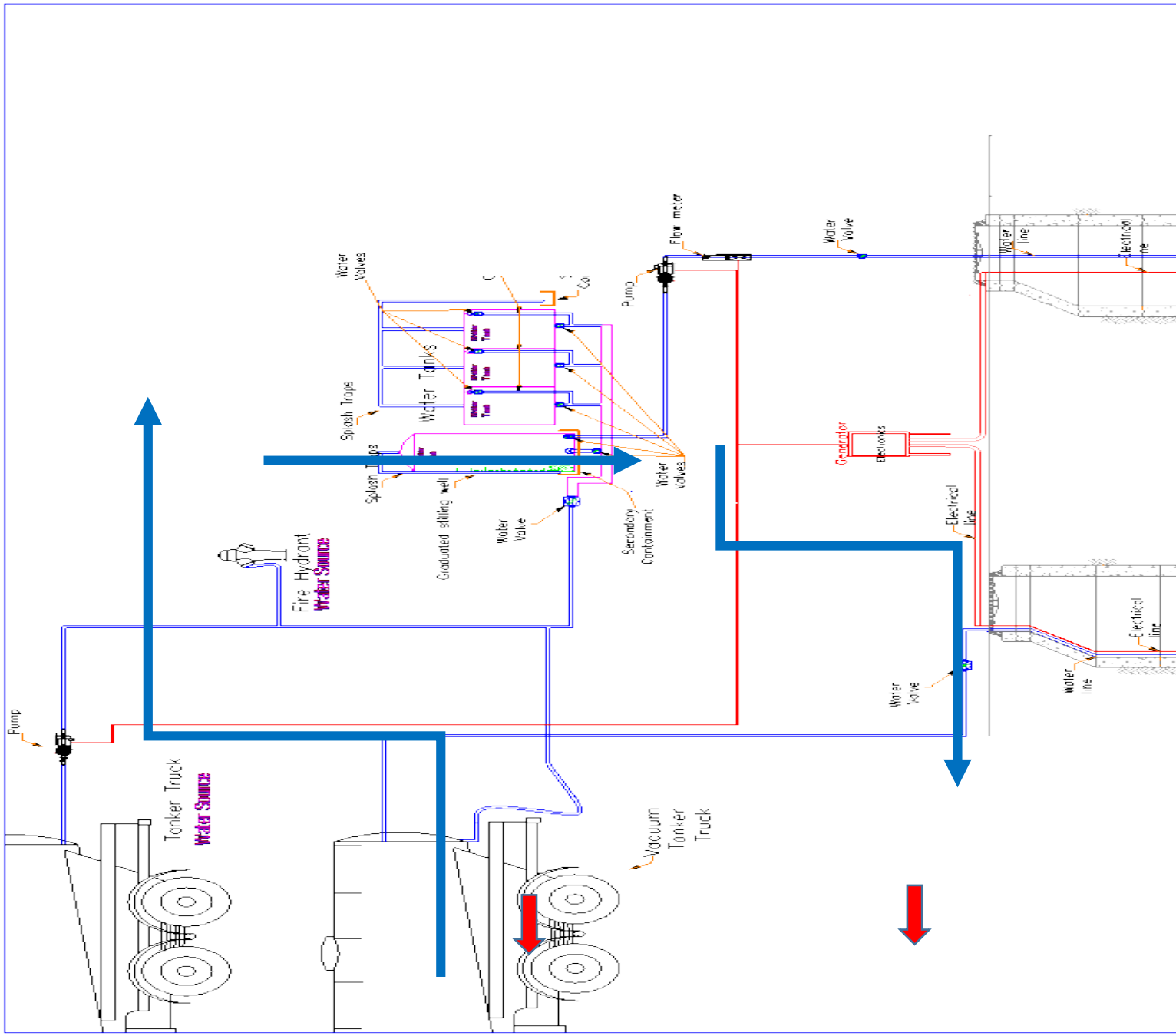
- Direct measurements of volumetric loss to quantify exfiltration

Direct Measurement of Volume Loss Phases

- Design
  - Exfiltration sampler design and prototype testing
- Implementation
  - Measure in multiple sewer pipes with different risk factors
- Link to storm drain system
  - Track from sewer pipe to storm drain

Design Process

- Benchtop prototype
  - Smaller scale ~ 200 Gallons
- Increased scale and performed field test
  - ~1200 gallons
- Refined design to increase sensitivity and performed second field test
  - High precision and sensitivity with large volumes over 1,200 gallons

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Pilot Field Test

- Pump in 1000 gallons into a typical sewer pipe and see if we can recover it.
  - Mimic realistic conditions

- Test how consistently can we recover the 1000 gallons.

Pilot Field Test Results

- Does it work? YES
- We consistently recovered 99.9% of water volume
  - We measured a consistent loss of ~1.3 gallons
- Across 6 runs, our variability was 0.035%
  - We are statistically powered to detect exfiltration as low as 1/3 gallon.

Next Steps

- Begin experimental exfiltration measurements at more sites
- Move forward to implementation phase
  - Summer 2021