

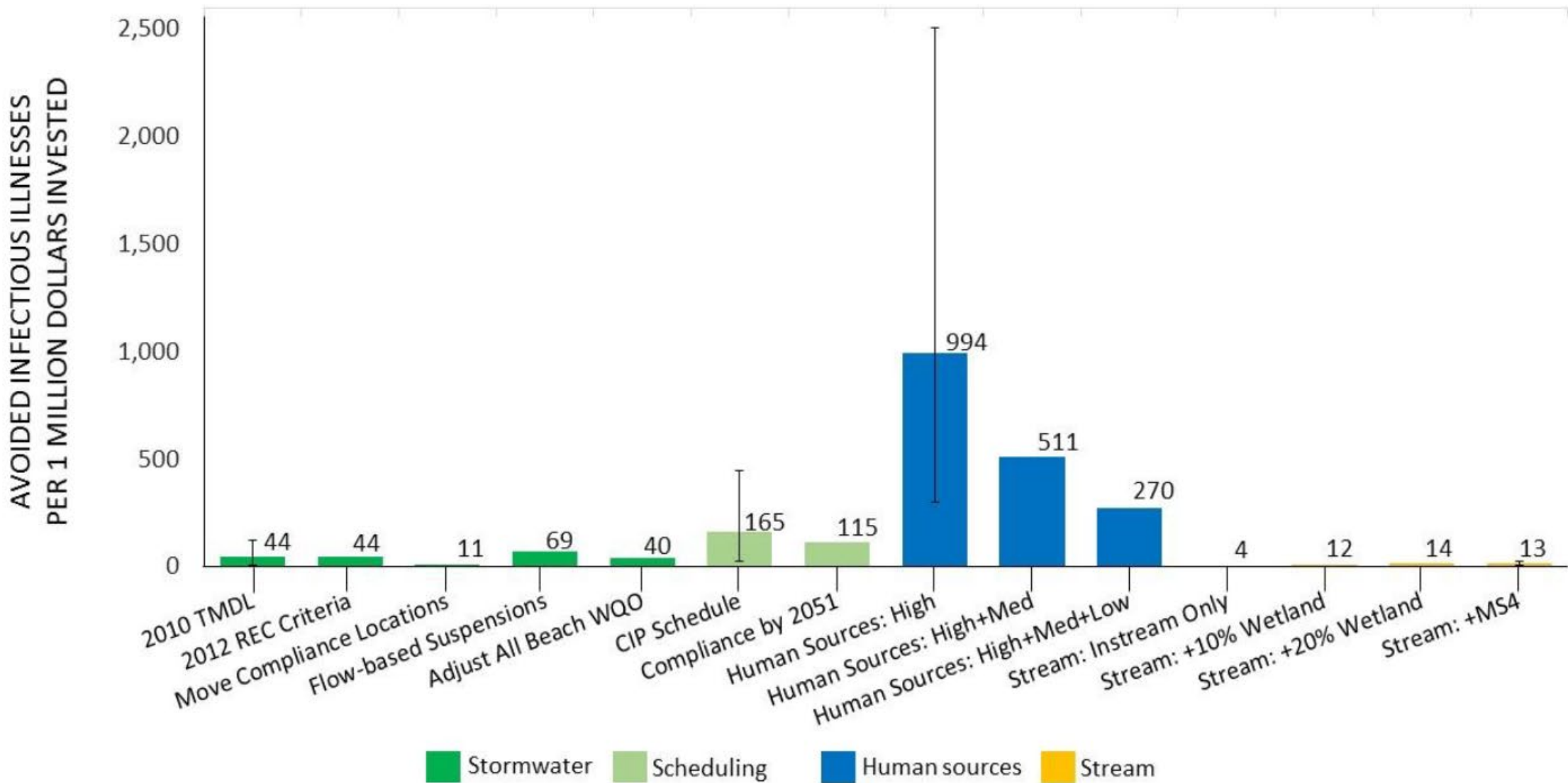
# San Diego Investigative Order (IO): Quantifying Human Fecal Loading to the San Diego River

SCCWRP Commission  
September 6, 2019

# Background

- There is a wet weather bacteria TMDL in San Diego
  - Compliance deadlines begin in 2021
- Wet weather discharges from the San Diego River contain human pathogens as well as fecal indicator bacteria (FIB)
  - The risk of surfer illness increased following wet weather compared to no exposure or dry weather exposure
- Cost of compliance is estimated in the \$billions
  - Reducing human sources of fecal contamination is the most cost effective solution to protect human health

## PUBLIC HEALTH COST-EFFECTIVENESS



# Which Human Source?

- Public Sewer
  - Sanitary sewer overflows
  - Exfiltration
- Sewer Laterals and Septics
- Homeless Populations
- Illicit Connections/Illegal Discharges
  - Recreational Vehicles

# Goals of the IO Conceptual Workplan

- Quantify loading of human fecal contamination from different sources to the San Diego River
  - Focus on wet weather
- Use the loading estimates to compare relative contributions among the sources of human fecal inputs
  - Which is the greatest potential source?
- Identify the factors that might lead to the greatest risk of loading
  - Where and when does the greatest loading occur?

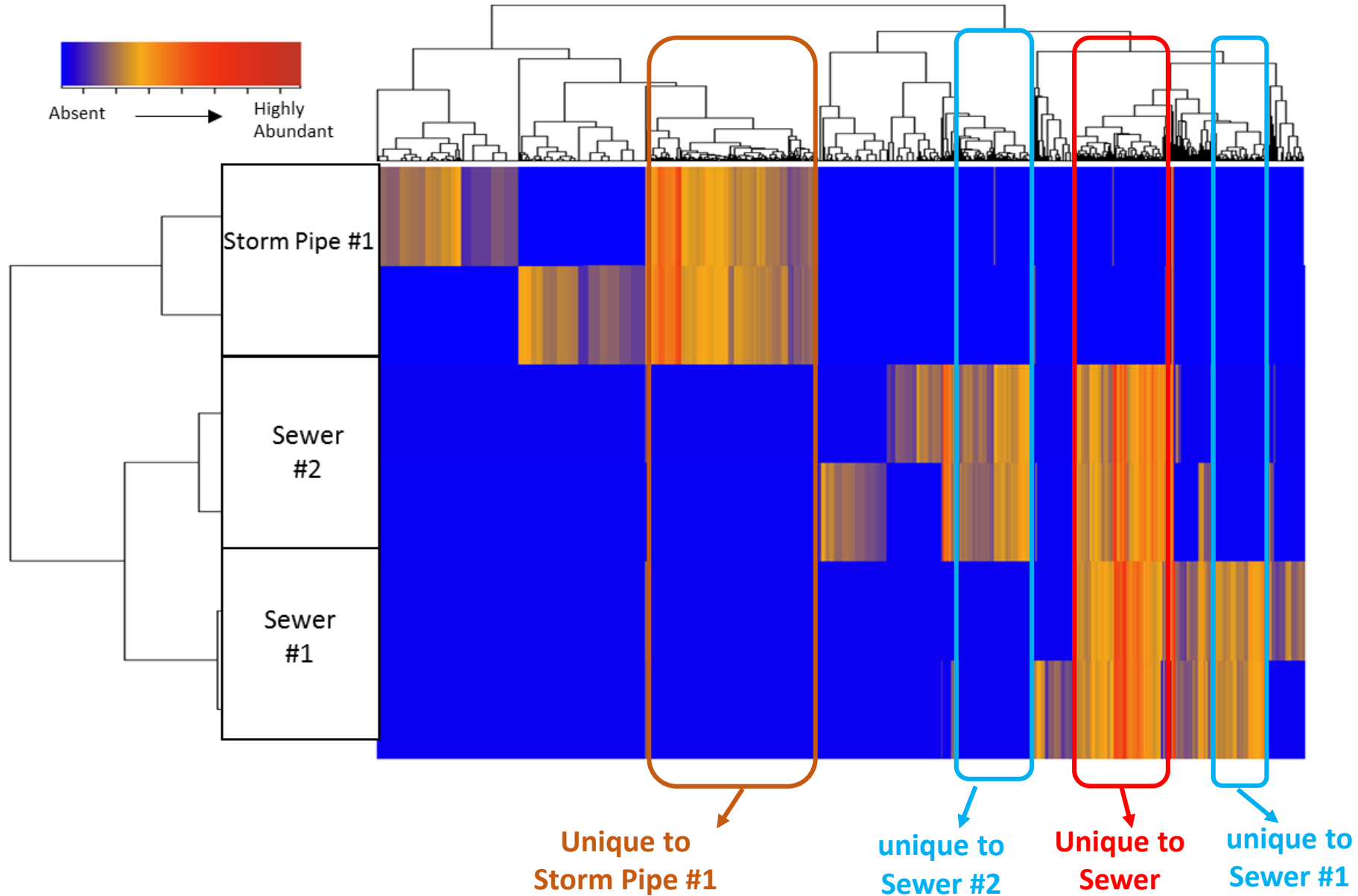
# Two Approaches for Detecting and Measuring Public Sewer Exfiltration

- Utilize DNA signature of bacterial biofilm found in sewer pipes to detect exfiltration of 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 has been used as a tracer for CSO's and SSO's in the mid-west
  - Takes advantage of advances in DNA sequencing
- SCCWRP is adapting biofilm detection for use in identifying sewer exfiltration

# Preliminary Results: Microbial Community Analysis





# Direct Measurement of Exfiltration

- Isolate a section of sanitary sewer pipe
  - Artificially create wet weather flows using pumps and flow sensors
  - Measure volumetric loss over time
- Designing and constructing prototype sampling device now
  - Start with bench top system for proof of concept
  - Already identified a site for field testing
- Factorial design will enable extrapolation to the rest of the watershed
  - Based on combinations of risk factors
- Volume loss is only part of the equation
  - Use KBr as a tracer to quantify transport to receiving waters

# Exfiltration Risk Factors

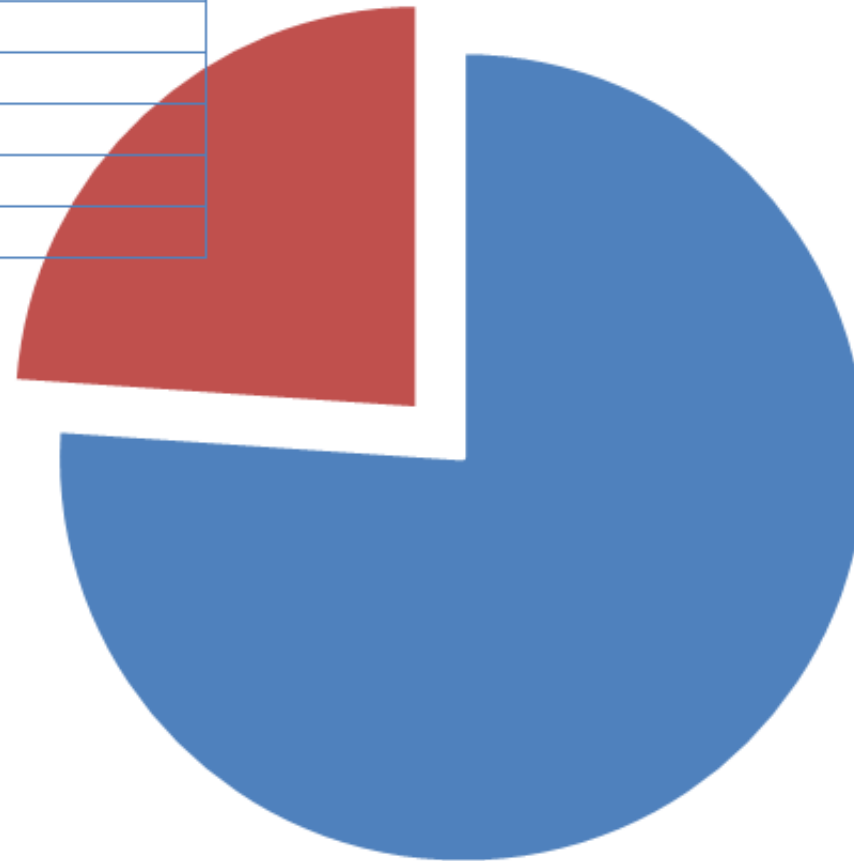
- **Materials of construction (clay, concrete, PVC, CIP lining)**
- **Age (<10, 10-25, >25 years)**
- Condition scores (no action, maintenance required, repair/replace)
- High frequency cleaning list
- Groundwater height
- Soil type
- Land use
- Flow rate
- Depth of pipe relative to storm drain
- Proximity to surface water

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# City of El Cajon Inspection Program (2009-2018)

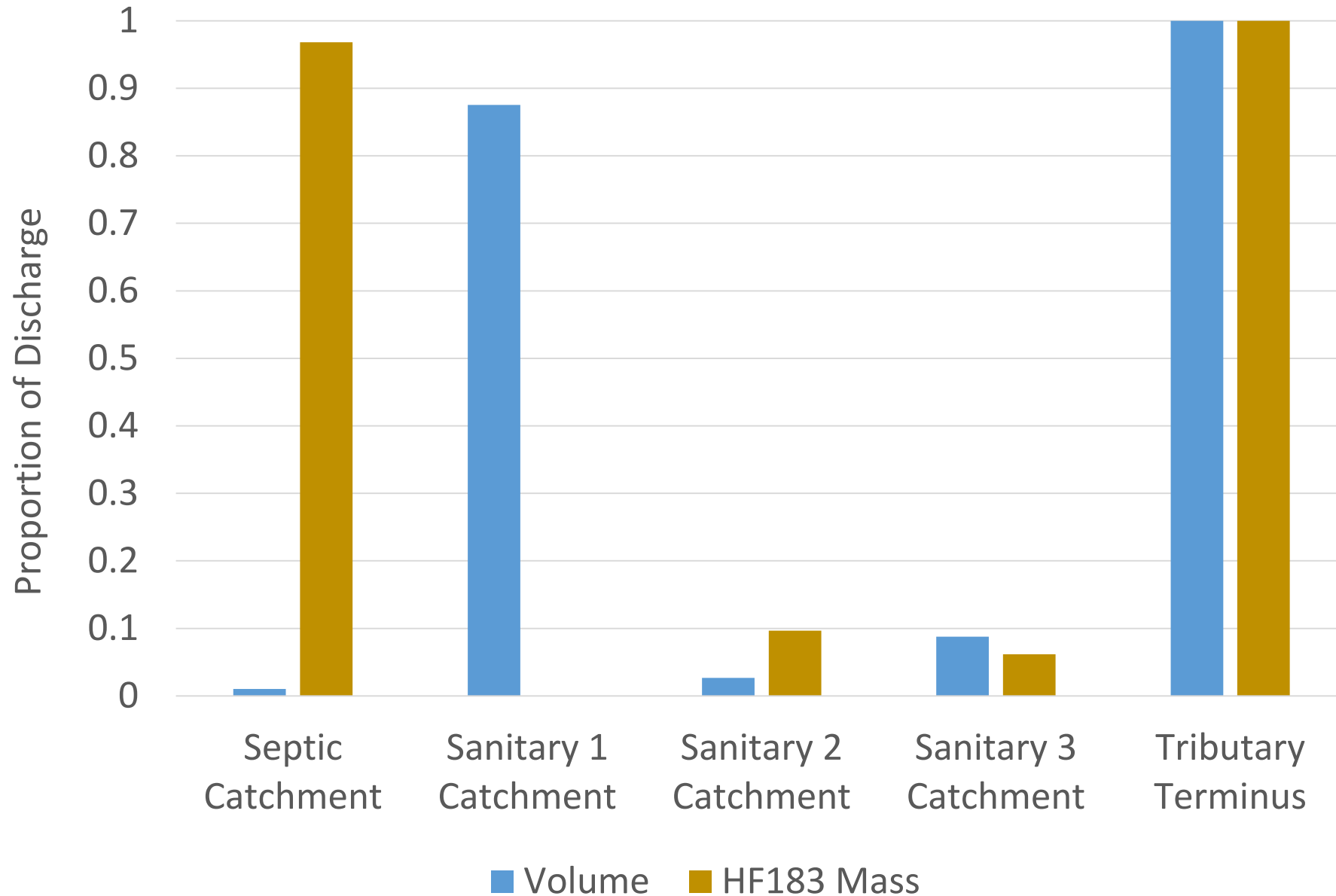
Type of Repair	% of Laterals That Needed Repair
Root intrusion	32
Build Up	22
Broken Pipe	22
Offset	12
Sag	2
Corrosion	4
Outdated Plumbing	2



Number of Homes  
(N=548)

- No Repair Needed (417)
- Needing Repair (131)

# Volume and HF183 Human Marker Loading by Catchment Source



# Approach for Lateral and Septic System Contributions

- First step is to assess potential for leakage rates
  - Stratified random design for inspections
- Laterals will use the same direct exfiltration measurement strategy as used for public sanitary sewer
- Septic contributions will be measured using unique tracers
  - Examples: dyes, DNA markers, non-targeted chemical markers
- Stratified random design will be used for extrapolating to watershed

# Approach for Estimating Contributions from Homelessness

- Census and survey of homelessness
  - How many potential contributors? Where? When?
  - What are their sanitary habits (direct vs indirect deposit)?
- Confirming homelessness contribution estimates
  - Upstream-downstream sampling design
- Washoff experiments for boosting empirical confidence
  - Contribution from streambank latrines during wet weather

# Current Status

- Final Workplan due by Dec 12, 2019
- Assembled a Steering Committee
  - City, County, RWQCB
  - Other named parties
  - Coastkeeper and Riverpark Foundation
- Currently assembling an external Technical Review Committee of national experts
  - We encouraged independent technical oversight
- Being approached for similar projects in other counties