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Sanitary Sewer Overflow Consent Decree – Water Quality Monitoring

21 November 2019

Agenda

- Consent Decree
- Anacostia Sewer Basins
- Water Quality Monitoring
- New Analytical Methods
- Results and Trends

SSO Consent Decree

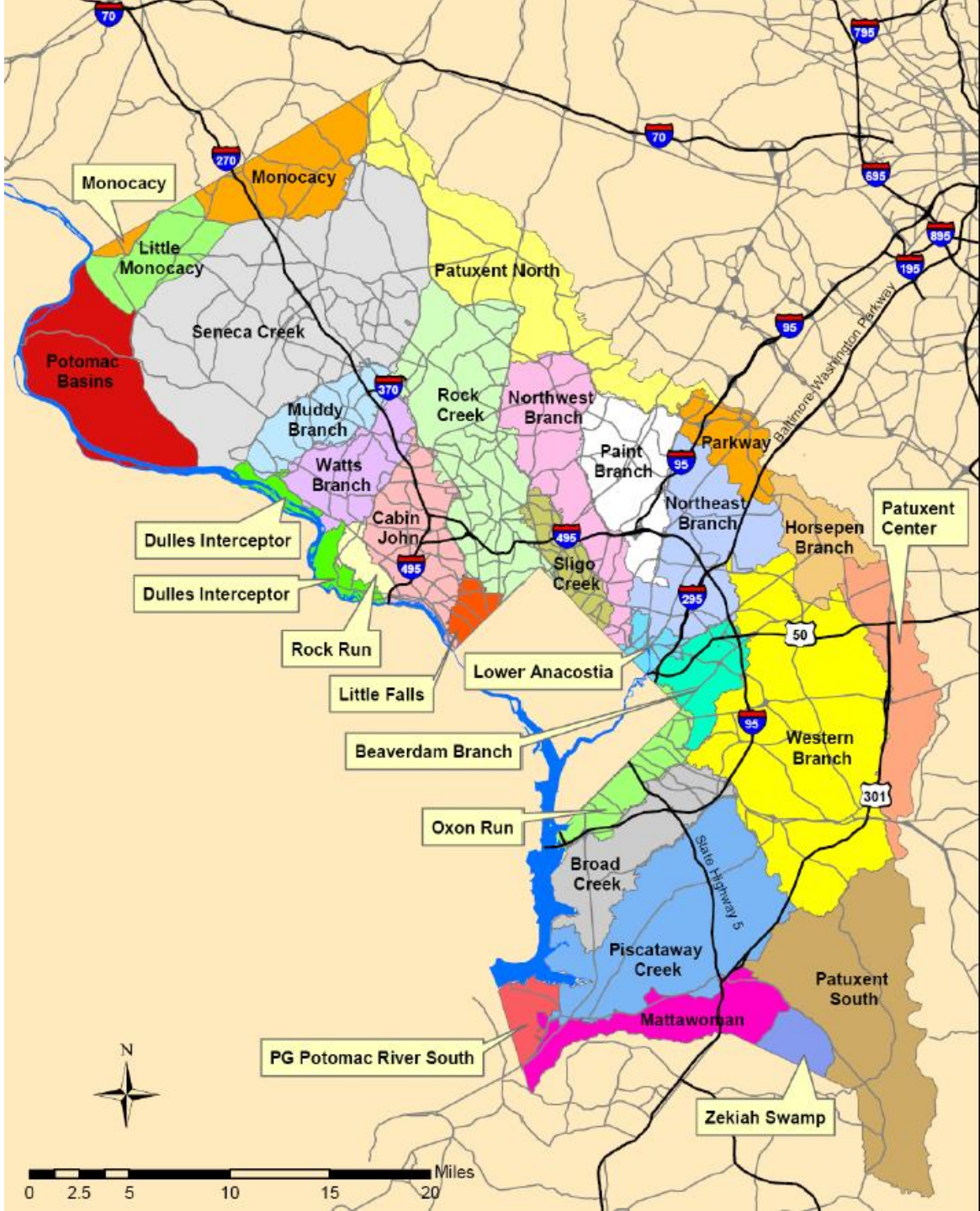
- Article II, Section 5
- Semi-annual sampling (microbial [“bacterial”] source tracking and fecal indicator bacteria testing) – approved 2006
- Identify human microbial sources and determine whether sewer improvements are reflected in surface water quality

5. Water Quality Monitoring (“WQM”) Plan WSSC shall develop and submit a WQM Plan to EPA, MDE and the Citizens Groups for review and comment no later than 120 days after the Date of Entry. WSSC shall begin implementation of the WQM Plan 60 days after receiving EPA and MDE approval.

a. The WQM Plan shall include semi-annual bacteria source tracking (BST) and fecal coliform testing at two locations in each of the following Sewer Basins:

Anacostia Sewer Basins

- Northwest Branch
- Sligo Creek
- Paint Branch
- Lower Anacostia
- Beaverdam Branch
- Oxon Run
- Northeast Branch:
  - Indian Creek
  - Upper Beaverdam Creek
  - Lower Northeast Branch



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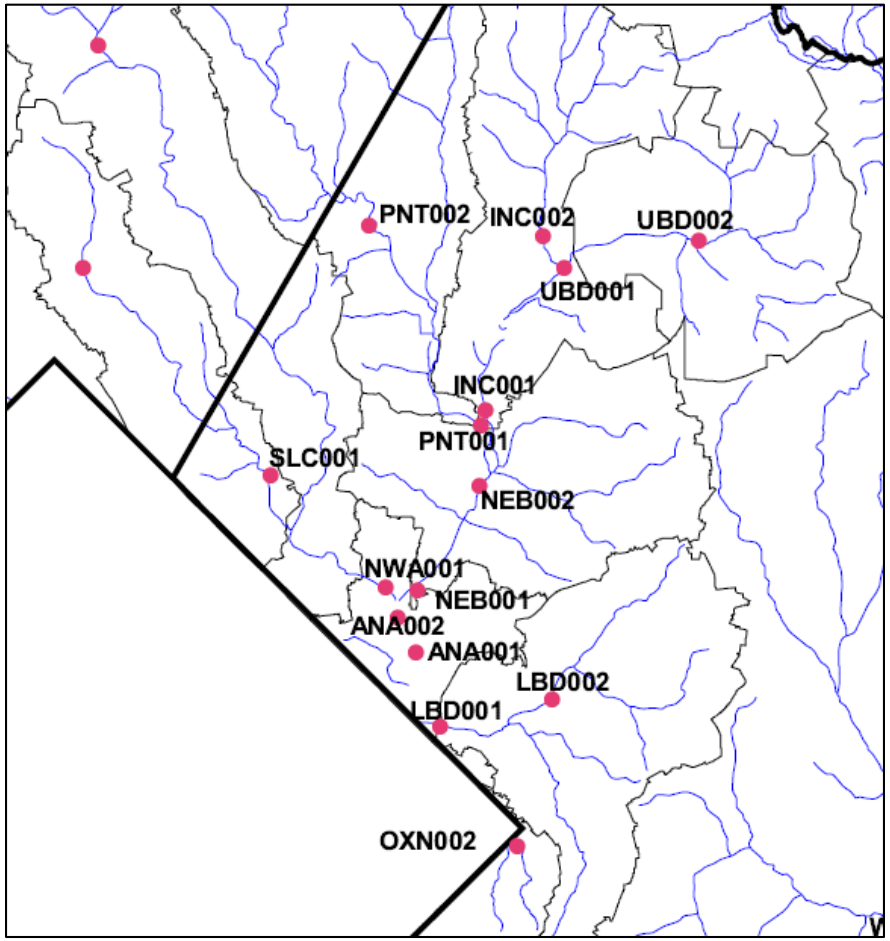
Water Quality Monitoring (WQM) Plan

- 2 locations per sewer basin (18 sample points in 9 basins)
- Typ. one downstream near discharge from basin; one upstream
- Publicly accessible sampling points (bridges etc.)
- Large differences in scale (NW Branch >> Lwr Anacostia)



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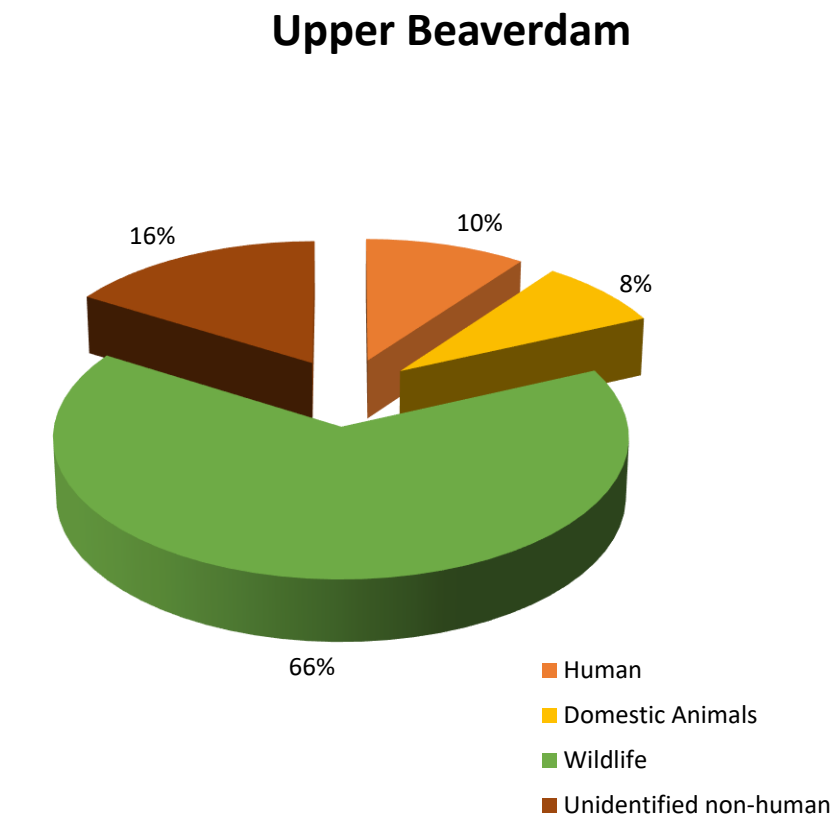
Analytical Methods

2007-2016

- BOX-PCR developed at Virginia Tech now obsolete, no longer supported
- Reported % human and other MST sources (domestic animals, wildlife, unidentified non-human)
- Known source library, regional specificity, maintenance needs
- False positives (<10% human not reliable, often zero)



Geomean Enterococcus = **141** CFU/100mL

Analytical Methods

2016-2019

- Since 2017, new droplet digital qPCR methods at University of North Carolina
- Library independent
- Genetic “markers” specific to selected microbial sources (human, avian, ruminant, canine)
- No false positives (absent/present); relative abundances reported
- Toolbox approach includes confirmatory test for human adenovirus

Analytical Methods

Units of Measurement

- 2007-2016
  - Enterococcus (CFU/100 mL) EPA Method 1600 (MF) – values can be related to MDE Bacteriological WQ Standards
  - MST (% human, % domestic animals, % wildlife etc.)

- 2016-2019
  - Enterococcus (CCE/100 mL) EPA Method 1609.1 (qPCR) – no equivalence to MDE WQ Standards
  - MST (gene copies / 100 mL)
  - Relative abundance:
    - 10^4 – 10^8 copies: probable sewage sources
    - $<10^4$ copies: human source present, substantial dilution

Water Quality Monitoring Results

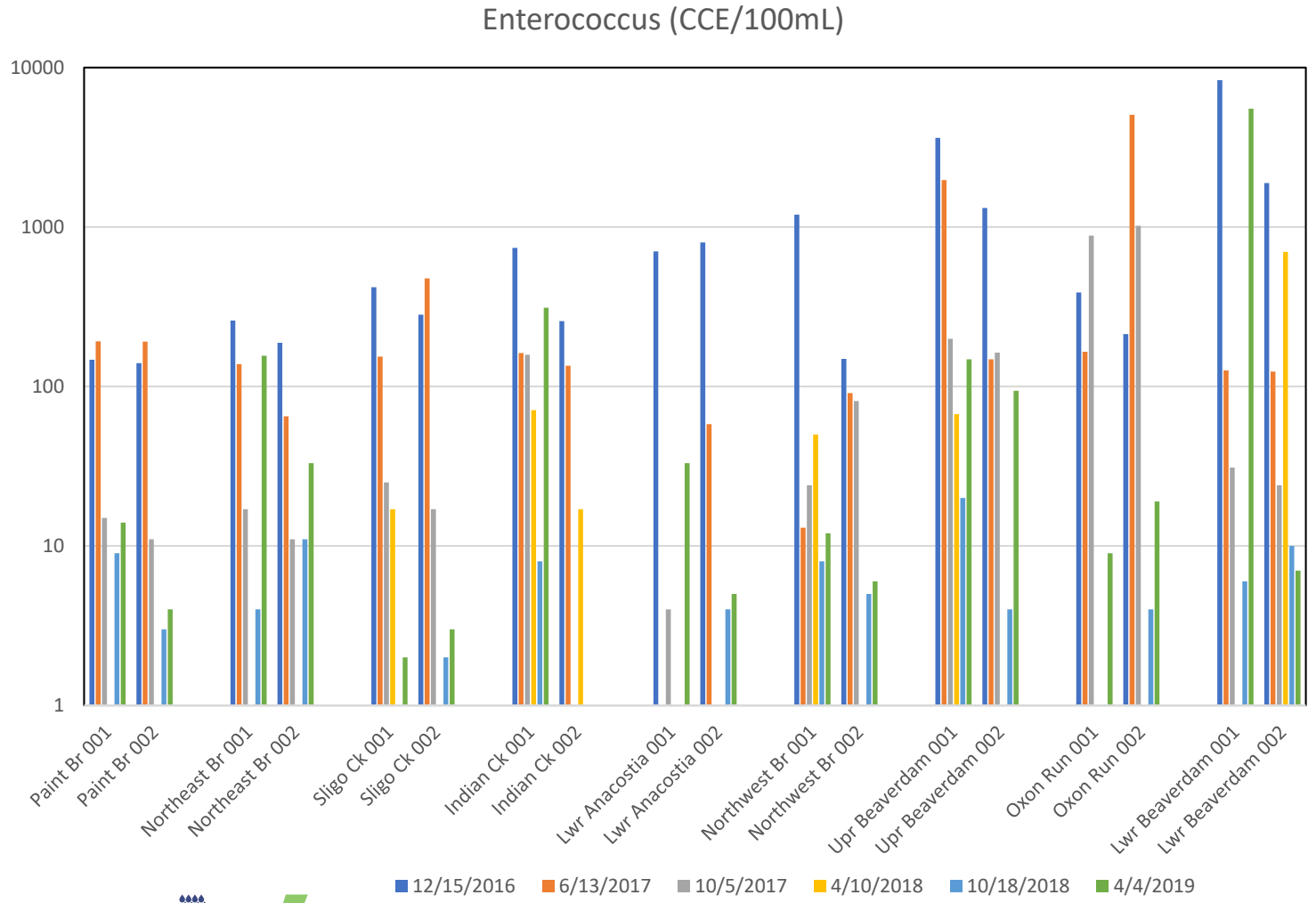
- Twenty-six sampling rounds completed in past 13 years (2007-2019)
- Quarterly sampling in Lower Anacostia, Sligo Creek, Northeast and Northwest Branch (4 year trial basis)
- Not Consent Decree required; discontinued due to lack of statistically significant difference from semi-annual sampling
- Monitoring to c.2016 established typical range of background or “baseline” human source microbial occurrence
- Since 2017, human and avian only (canine and ruminant markers perform poorly)

Water Quality Monitoring Results

- Seven sampling rounds using new qPCR methods (2016-2019)
  - December 2016: different lab used different human source markers
  - Since June 2017 (UNC): one primary human marker (HF183) and two secondary markers (adenovirus and BacHum); one avian marker (Gull2)
  - More reliable canine and ruminant markers under development
- Enterococcus still represents bacteria from ALL environmental sources
  - Relative concentrations are meaningful for trend assessment

Water Quality Monitoring Results

- Enterococcus Trends
  - Note log scale (order of magnitude differences)
  - Need >10 samples or >5 years for statistically significant trend assessment



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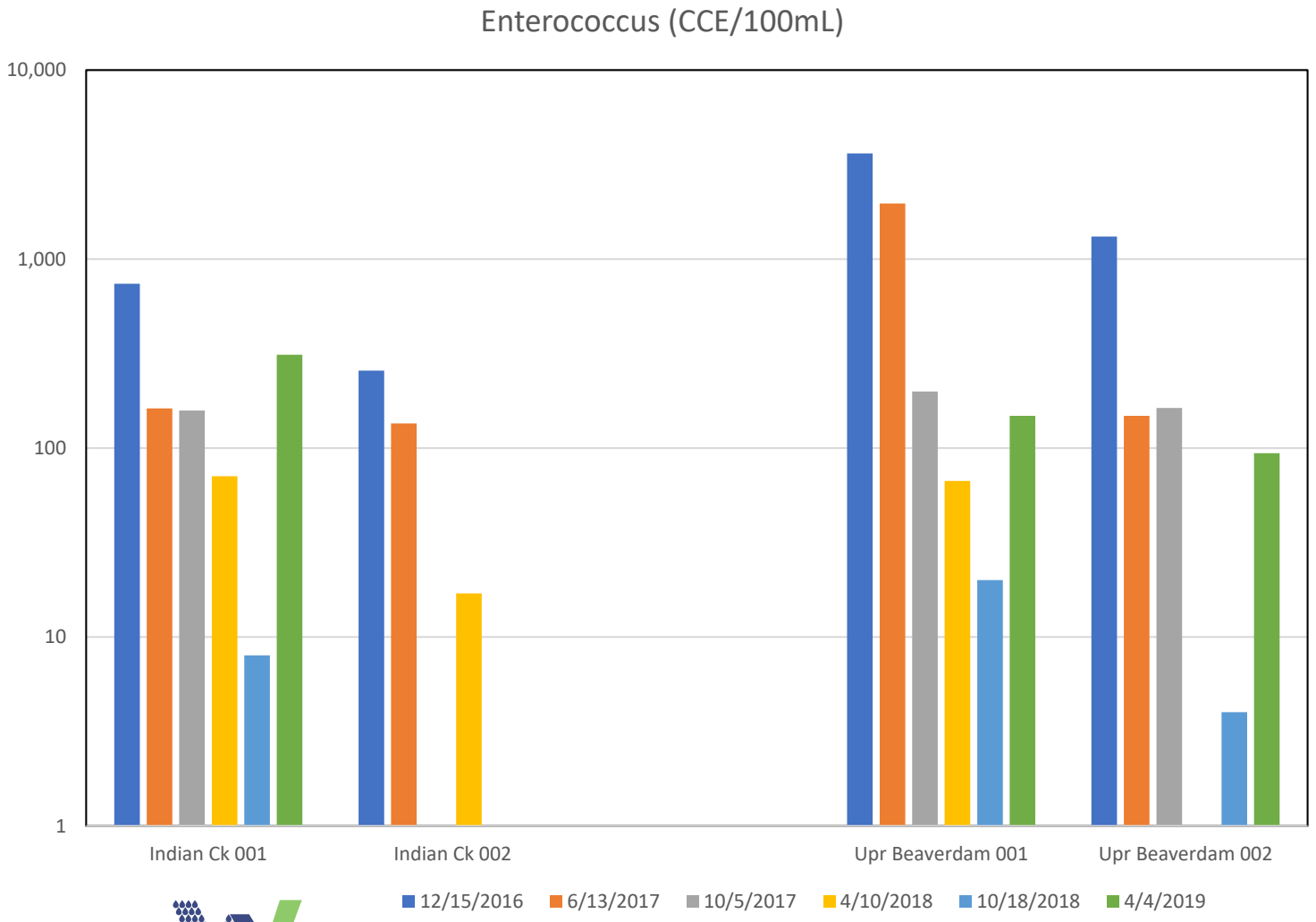
Water Quality Monitoring Results

- Enterococcus Trends
  - Preliminary qualitative downward trend?
  - Does this indicate a successful outcome from collection system rehabilitation?



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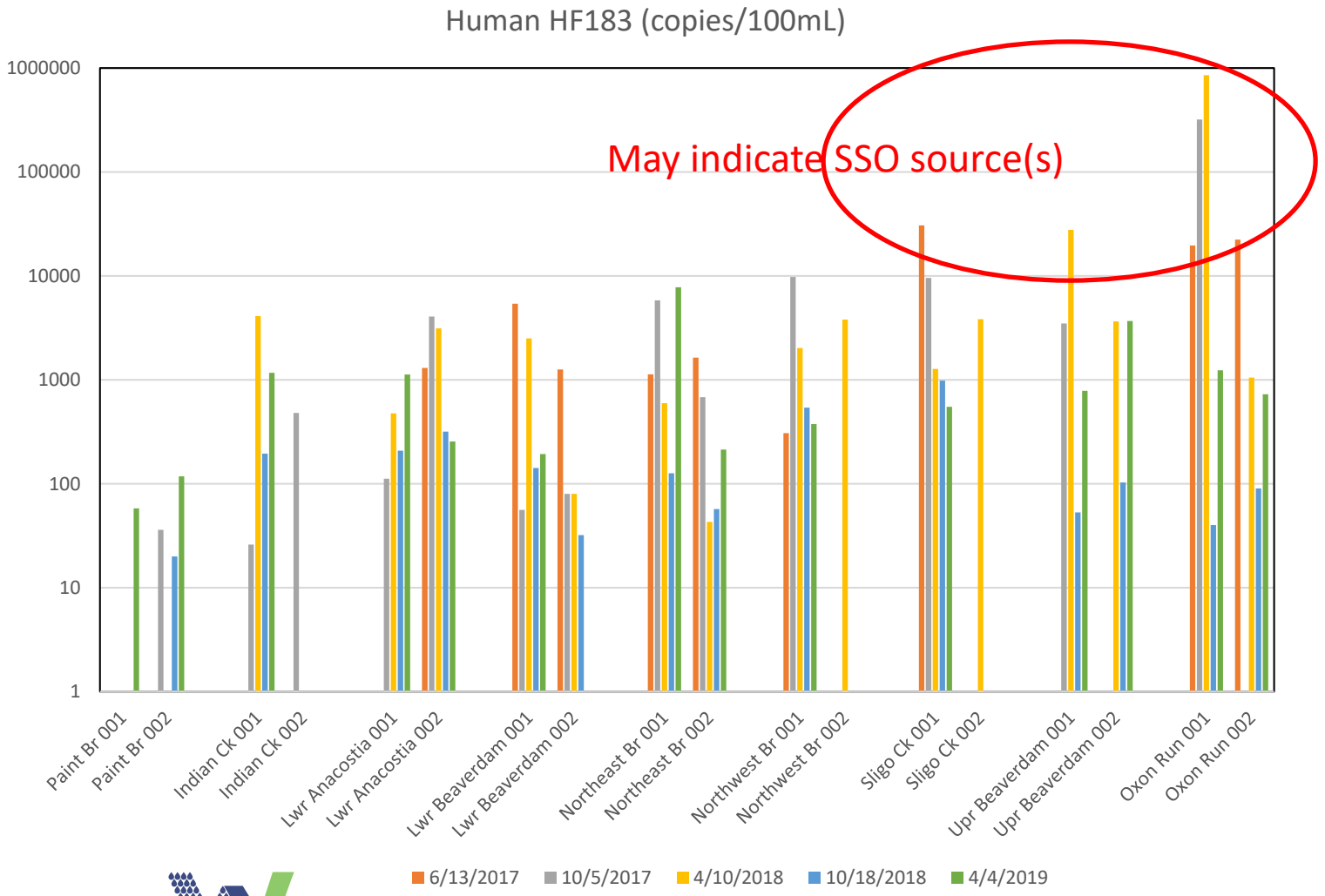
Water Quality Monitoring Results

- Human HF183 Trends
  - Log scale
  - Few samples >10^4 gene copies/100 mL
  - Most sewer basins do not appear to indicate SSO issues (except Sligo, Oxon Run and Upper Beaverdam*)

* [No public sewers in this basin]



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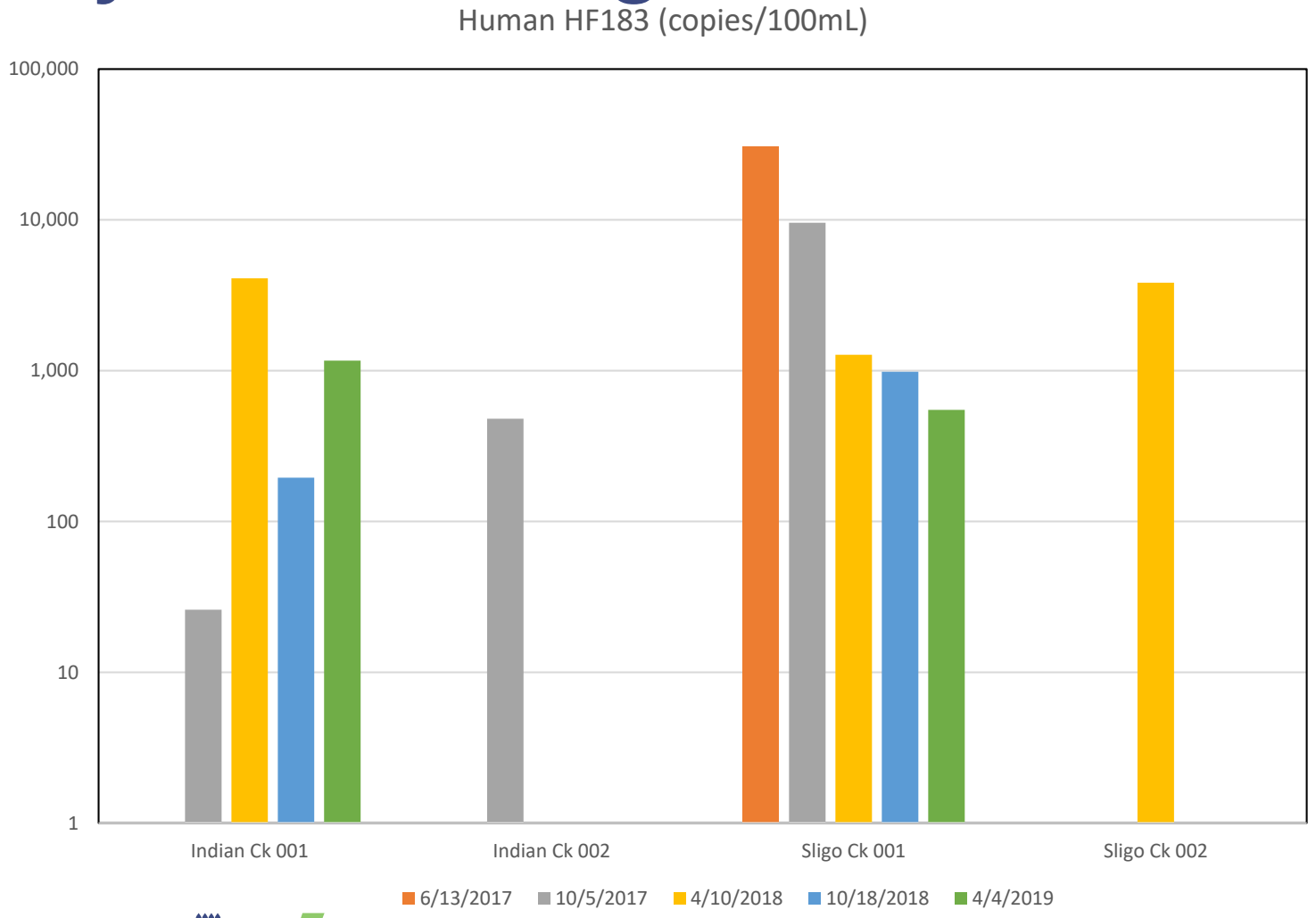
Water Quality Monitoring Results

- Human HF183 Trends
  - Possible decreasing trends
  - Recall that even if human source is present, the total microbial load may be small (Enterococcus Concentrations <100 CCE/100 mL)



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Questions?

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