



Tracing Sources of Water Pollution With DNA Tools

Collection System Investigation Microbial Source Tracking (CSI-MST) is a highly sensitive method that uses molecular markers to identify sewer infrastructure issues. By distinguishing human from non-human contamination, it overcomes the limitations of traditional fecal indicator bacteria (FIB) like *E. coli* and enterococci, which are nonspecific and can persist in the environment.

Hampton Roads Sanitation District (HRSD) combines MST with system knowledge to proactively detect compromised pipes. When conventional methods like smoke testing, dye testing, or CCTV are inefficient, CSI-MST narrows the search area, enabling more targeted, cost-effective investigations and repairs.



REDUCE



REGENERATE



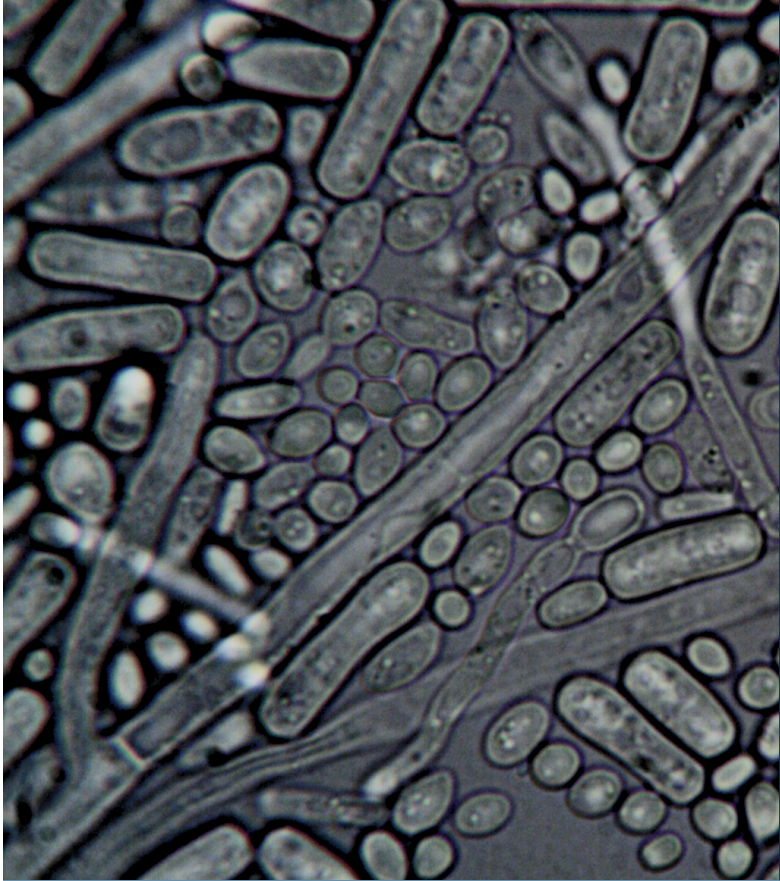
HAMPTON ROADS, VIRGINIA, USA



WASTEWATER



STORMWATER



CHALLENGES FACED

HRSD faced several challenges in its operations, including coordinating efforts among stakeholders and managing complexity of data interpretation and mapping. Tracing contamination upstream involved logistical hurdles, contributing to extended project timelines. When results are unclear, repeated sampling and iterative repairs may be necessary. These repairs are carried out by the localities that own the infrastructure.

TECHNOLOGIES & SOLUTIONS USED

Microbial Source Tracking identifies chronic sewage leaks into stormwater system and surface waters by detecting the human-specific HF183 marker during dry weather. Sampling starts downstream and follows the contamination gradient upstream. Using droplet digital PCR (ddPCR), a molecular technique, HF183 is accurately quantified even at low concentrations. Results are mapped with GIS to pinpoint potential sewer defects, which are then targeted for further inspection. Multiple sampling rounds increase confidence in findings.

IMPACT & INSIGHTS



Since 2014, MST has been applied across 120+ square miles, covering 24+ watersheds in 7 localities. This approach improved the efficiency and effectiveness of contamination detection.

Key Highlights:

- Inspection needs reduced by as much as 90%, allowing teams to focus resources on critical defects.
- Repairs based on MST data achieved 90%-99% reductions in HF183, demonstrating successful elimination of chronic contamination sources.

LESSONS LEARNED



The majority of the regional collection system is managed by local governments, making interagency and cross-department coordination essential. Regular Teams calls, shared GIS tools, and site visits help maintain engagement over long timelines. Initial skepticism about detecting exfiltration using HF183 was overcome by sharing case studies and showing HF183 concentration drops post-repair. As results proved reliable, confidence grew.

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Treat MST as a decision-support tool to prioritize collection system maintenance. Focus on demonstrating clear environmental and operational benefits to gain buy-in and create support for corrective action.

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