

# Microbial Source Tracking: Applications and Field Studies

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# Outline

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- **Methods and Initial Approaches**
- **Study Design**
- **Case Study**
- **Recommendations**

# **Water Quality Studies: Methods and Initial Approach**

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- **Sanitary Survey**
- **Watershed mapping, Identification of Potential Fecal Inputs**
- **Indicator Organism Monitoring**

# Results of Initial WQ Investigation

- Indicator Counts (Total coliforms, Fecal Coliforms, *E. coli*, Enterococci, etc.)
- High levels of indicators at most sites
- Almost no relationship between levels of indicators at any given site
- Where do we start?

# MST as a Tool

- **Microbial Source Tracking is a Tool to get you past this step and identify sites of interest**
- **Initially target sites with the highest IO counts**
- **No single perfect method, *but* MST does work and, when applied appropriately, is the most efficient means of identifying sources of indicator organisms in the environment.**
- **Knowledge of watershed is most important factor – but don't rule out what isn't obvious**

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# Keys to successful MST/Water Quality Studies

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- **WELL DEFINED Work Plan/Project Management**
  - **Approach study in a tiered fashion**
  - **Sample during wet and dry events**
  - **Never draw conclusions from single samples**
  - **Don't try to change policy: augment current criteria**
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# Sampling Strategy

- **Collect samples during wet and dry events**
- **Target the sampling effort around points of interest**
- **Collect excess water samples for indicator analyses then decide where to concentrate source tracking efforts**
- **Collect water and sediment samples where applicable (Sediment can be a source)**

# MST Approach

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- **Target Human fecal pollution first**
  - **Multi-Method approach**
    - *Enterococcus esp* gene (Dr. Rose's work)
    - *Bacteroidales* markers (Dr. Field's work)
    - **Human Polyomaviruses**
    - **Appropriate QC on Field samples**
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# Case Study

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- **High Indicator Counts in Urban Creeks**
- **All on Impaired List – 125 sampling stations**
- **Culprit – Local Utility is blamed for 100% of failures and is given a directive: Pay a fine or fund a study**

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# Sampling Plan

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- **Water samples are collected at least monthly for 12 months during wet and dry events**
  - **Sampling begins in June (rainy season) and leads into 2004 hurricane season, which complicates issues**
  - **After hurricanes, residual from flooded lift stations, etc. is very short lived**
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# Results – Case Study

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- **Stations are analyzed for Total coliforms, fecal coliforms, enterococci, esp gene, Bacteroidales human marker, human viruses**
  - **Of 125 sampling stations, only 15 contain evidence of chronic human fecal pollution**
  - **Two of the sites are of particular interest**
    - **High counts and human signature in rural “negative control” site**
    - **High counts and human signature in creek receiving water strictly from storm drains**
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# **Results - Case Study**

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- **Rural site is investigated by team of utility managers and city engineer**
  - **Large homeless camp is discovered**
- **Storm drain is smoke tested and inspected with a video camera**
  - **A septic system is found illegally connected to the storm drain**

# Overall Benefits

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- **MST was successfully used to make a large WQ study significantly more manageable**
- **Follow-up studies will likely seek to identify additional sources of fecal indicators although this was not the objective of the original study**

# The Future of MST

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- **We need more host-specific markers**
  - **Quantification of molecular markers is now possible with appropriate QC and data analysis – quantitative PCR**
  - **Appropriate expectations of the technology must be established prior to undertaking a large (or small) investigation**
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## Finally...

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- **When outsourcing MST analyses, be sure to utilize the expertise and consulting resources of the analytical laboratory**
  - **MST is not a “send a sample/get a report” technology. Results should be carefully interpreted by experienced personnel**
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