Bacteria Management in Urban Watersheds

URBAN STORMWATER WORKGROUP

SEPTEMBER 18, 2018

Background

Stormwater Forum in February – USWG request for guidance on 3 topics:

➢ Source Analysis Techniques

➢ Land Use Loading Rates

➢ BMP Performance Data

Ad Hoc Team convened to do a literature review and summary report

Team Member	Affiliation
Ted Brown	Biohabitats
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Emerging Science: Source Tracking

Improving How We Target Sources (Microbial Source Tracking)

Polymerase Chain Reactions (PCR)
◦ Presence
◦ Quantity
◦ Source Distribution

Less Dependent Upon "Libraries"

Emerging Science: Source Tracking

➤ Developing New Indicators
  ➤ Bacteriodes HF183

  ➤ Increasing Sensitivity and Selectivity

  ➤ Less cross-reactions

  ➤ Viral markers have potential

  ➤ Non-biological markers

  ➤ Caffeine and acetaminophen have potential but degrade quickly.

Land Use Loading Rates

NSWQD (2005)

- High Data Variability
- Concentrations above RWQC
  - (126 cfu/100mL for E. Coli)

Other important land use predictors

- High Impervious Cover

- High sediment yielding Land Uses

- Low density Residential – septic

	Median Fecal Coliform Concentration (MPN/100mL)
Mixed Residential	11,210
Open Space	7,200
Residential	7,000

Land Use Loading Rates

Selvakumar and Borst, 2006

➢ High Data Variability

➢ Concentrations similar to NSWQD

➢ High Density Residential > Low Density Residential > Commercial

Kelsey et al. 2004

➢ GIS-based regression model

➢ Proximity to septic systems and high impervious cover were strong predictors

➢ Too many confounding variables – proximity to water, residential, etc.

Bacteria BMP Performance

Extrapolating to other BMPs

➢Performance research is limited to just a few types of BMPs

➢Some removal mechanisms may translate

➢Proceed with caution

Bioretention

Field Studies: -197% to 92% removal (average around 80%) for E. Coli

Showed ability to meet RWQC (126 cfu/100mL E. Coli) but not always

Factors influencing performance:

➢ Hydraulic retention time

➢ Temperature

➢ Time

➢ Media Amendments

Constructed Wetlands

Field Studies: 33% to 96% removal for E. Coli

Rarely met RWQC (126cfu/100mL E.Coli)

Factors Influencing Performance

➢Hydraulic Residence Time

➢Design (depth and macrophyte plantings)

➢Storm Intensity

Stormwater Ponds

Field Studies: 0% to 46% removal for E. Coli

Rarely met RWQC (126cfu/100mL E. Coli)

Factors Influencing Performance

➢Pond Depth

➢Contributing Drainage Area

➢Storm Intensity

Other Stormwater BMPs

Not recommended as part of a bacteria management strategy:

➢**Dry Ponds (Detention basins)**

  ➢Highly variable – frequently act as a source

➢**Swales**

  ➢Consistently found to be a bacteria source

Other Stormwater BMPs

BMPs that show some potential:

➢**Buffers/Filter Strips**
  ➢High variability (30-75%)
  ➢Sensitive to soil, vegetation, storm intensity
  ➢Susceptible to re-suspension

➢**Tree Pits**
  ➢Limited study
  ➢High performance (90+%)
 ➢Caution with impacts of media additives and potential nutrient/metal leaching

Takeaways*

➢Not a lot has changed in the past 10 years

➢More studies still needed, especially field-scale

➢We understand FIBs better, but not necessarily how to manage them better

*Takeaways represent the opinions of CSN and not necessarily the ad-hoc group. All rotten tomatoes and fist shaking should be directed accordingly

Takeaways*

➢ Mimicking the Bay TMDL nutrient accounting structure is not yet supported
  ➢ Land Use loading rates and BMP removal efficiencies are highly variable but may still be useful to support decision making

➢ Structural BMPs are not enough to meet RWQC by themselves
  ➢ But some are better than others

➢ Source "sleuthing" is still the most effective approach to management
  ➢ IDDE programs can be leveraged

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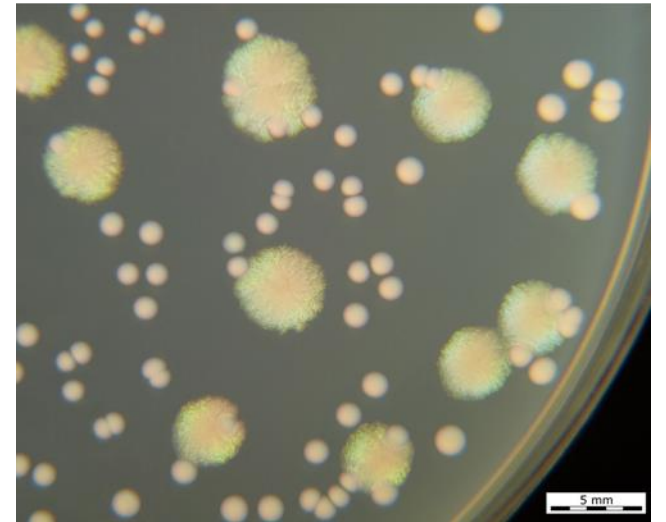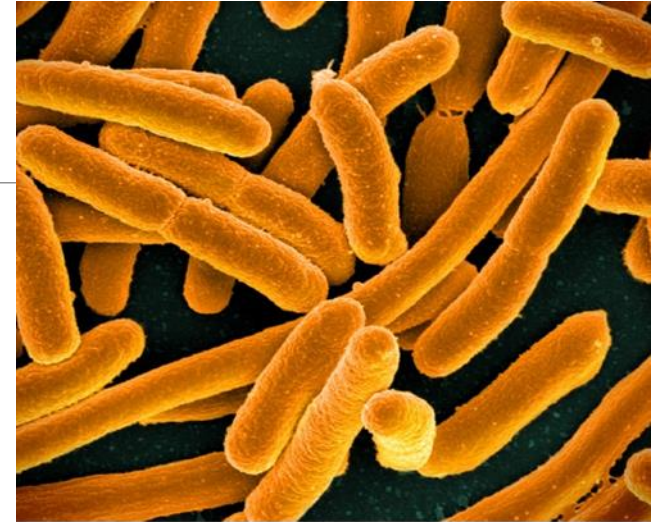
Where Do We Go From Here?

➢Determine how to better quantify bacteria co-benefits of stormwater BMPs

➢Showcase successful bacteria management programs

➢Isolate key design factors that could improve bacteria performance for the next generation of BMPs

➢ "Program focus" - source control, education to reduce health risk, IDDE, etc.

➢Full report and webcast coming soon – including references