



Florida Department of Environmental Protection

Office of Communications

Wastewater Treatment Study: design and preliminary results

05/16/2017



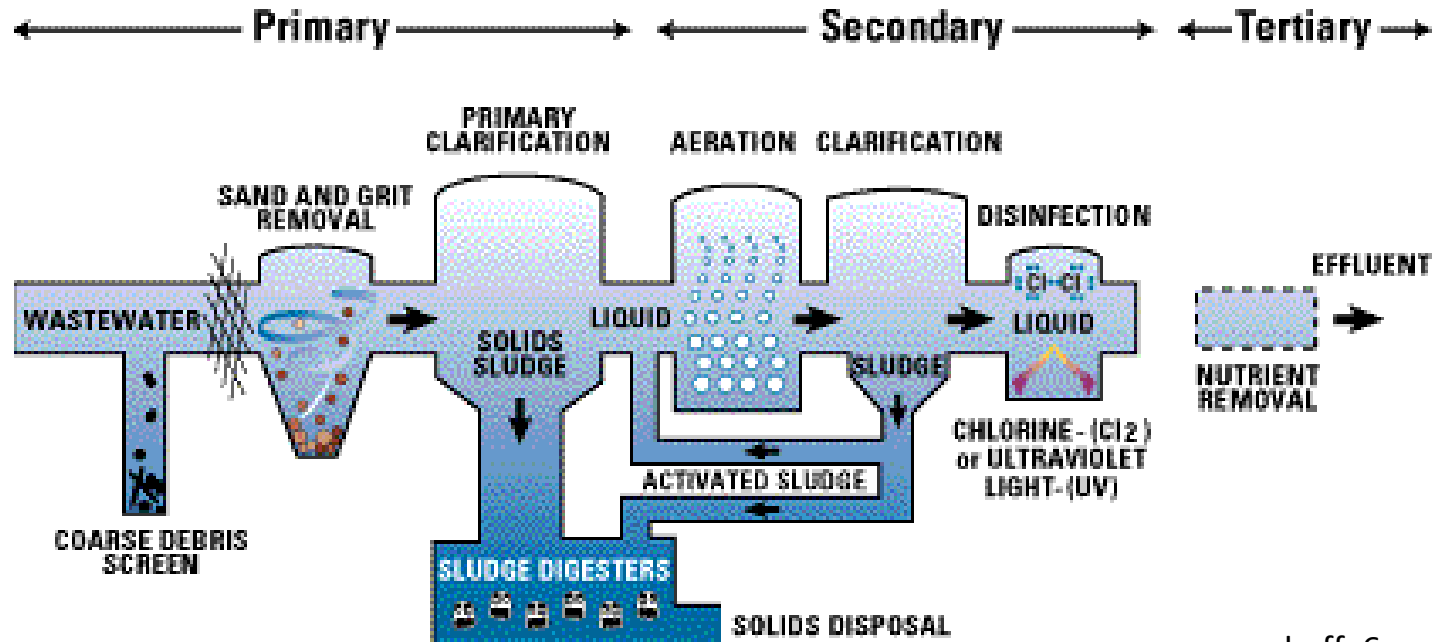


Microbial Source Tracking





Wastewater Treatment



sheffy6marketing.com

Routinely monitored:

- Total nitrogen (TN)
- Total phosphorus (TP)
- Fecal coliforms (FC)

Less known:

- Molecular markers
- Pharmaceuticals
- Pesticides



- # Depends on:
- Region
 - Properties of drug
 - Treatment process
 - Capacity
 - Microbial environment
 - Temperature
 - Precipitation
 - pH





Wastewater Characterization Study

- Effluent from WWTPs globally contaminates ~25% of rivers and lakes (Subedi and Loganathan, 2016)



Study Questions:

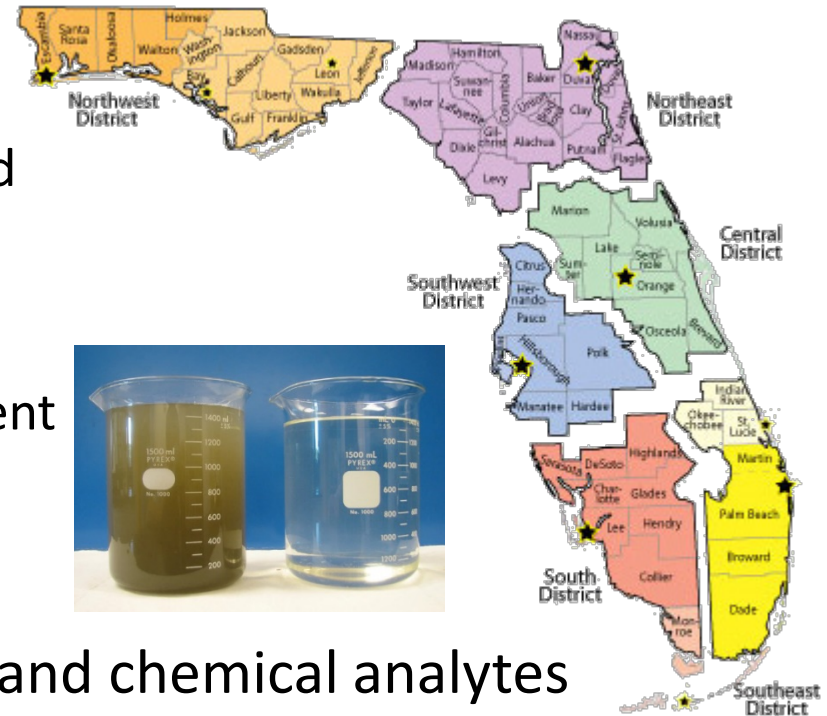
- How to differentiate wastewater contamination from other sources of fecal contamination?
- Distinguish between raw and treated?
- Relevant to Florida?

Goal: Improve the interpretation of potential wastewater contamination indicators in Florida surface waters to prioritize restoration for ones that pose greatest human health risk



Study Design

- 25 facilities selected based on:
 - DEP districts
 - treatment type: secondary or advanced
 - disinfection type: chlorine or UV
- Collect samples
 - primary settled influent and final effluent
- 2 sampling events per facility
 - 1 dry event, 1 rainfall event
- Measure concentrations of biological and chemical analytes in influents and effluents to:
 - Identify amount of degradation that occurs during treatment process
 - Determine which analytes may help characterize potential wastewater contamination and amount of contamination





Biological Markers

Microbiology

E. Coli
Enterococci
Fecal Coliforms

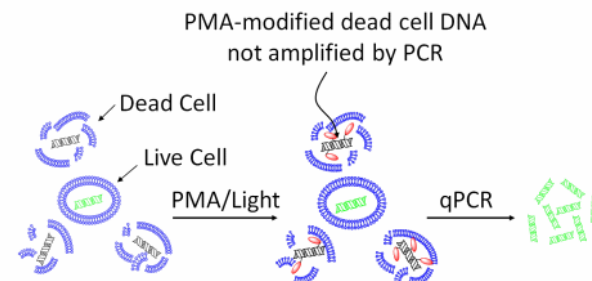
Molecular Markers

Human source

- HF183

Live vs. dead cells

- HF183 PMA



biotium.com



Chemical Tracers

Artificial Sweetener

Sucralose

Pharmaceuticals

Pain Reliever

- Acetaminophen

Anticonvulsant

- Carbamazepine
- Primidone

Pesticides

Herbicide

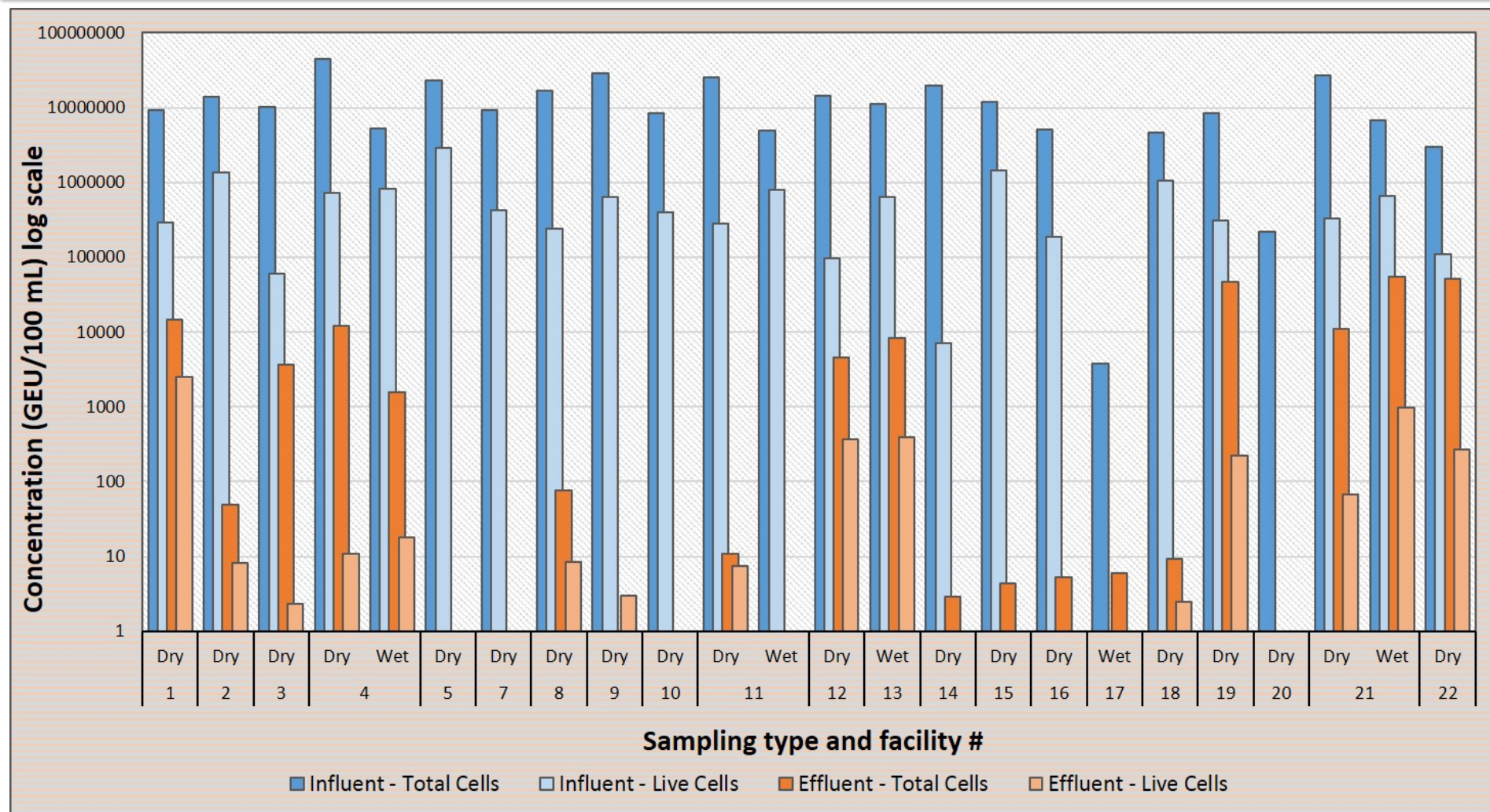
- Fluridone
- Diuron
- Fenuron
- Linuron

Insecticide

- Imidacloprid



Preliminary results: Live cells

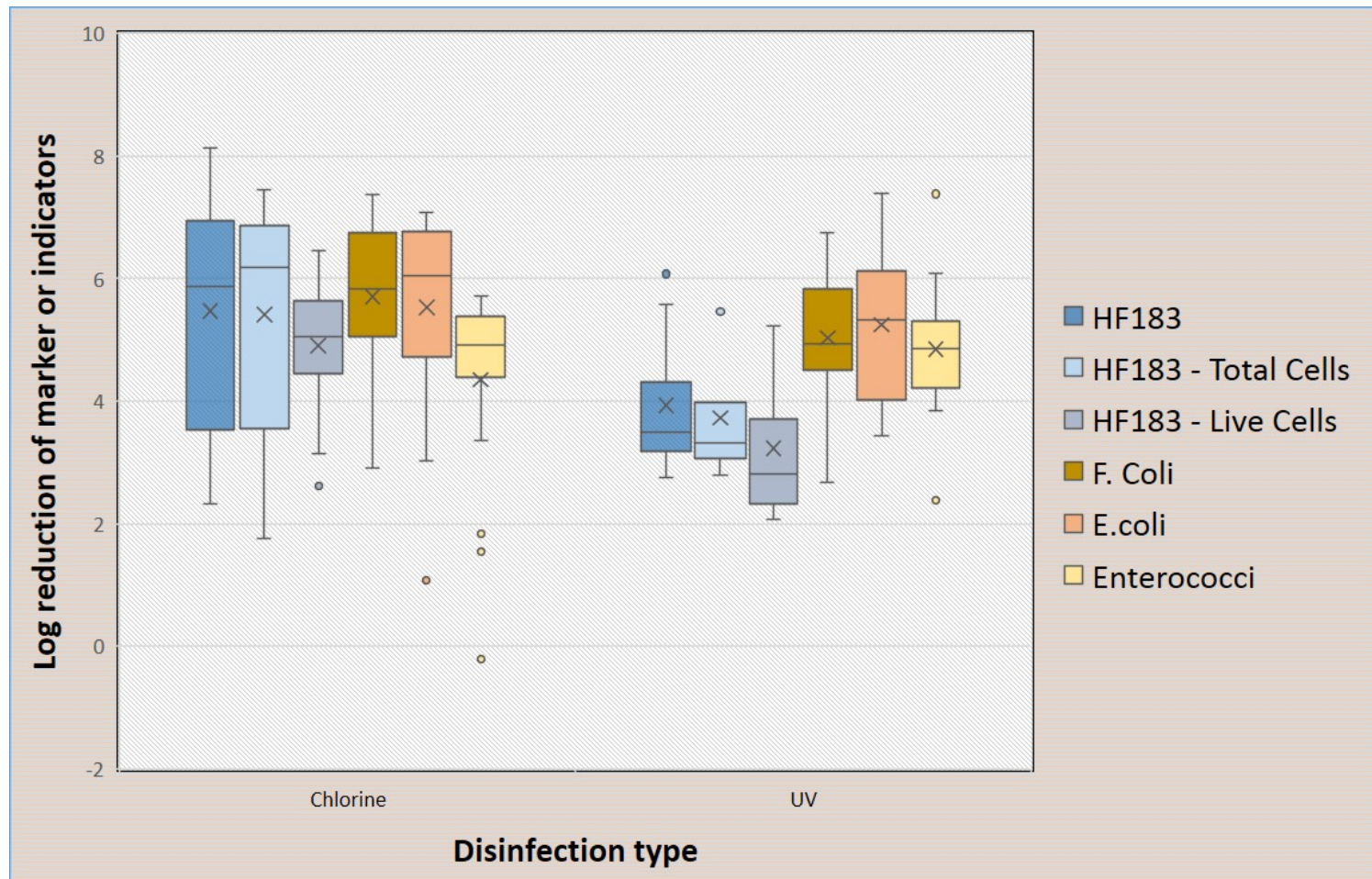


- Influent: ~10 million GEU/100 mL; up to 23% live cells
- Effluent: more variability; some non detects

MDL: 12 GEU/100 mL



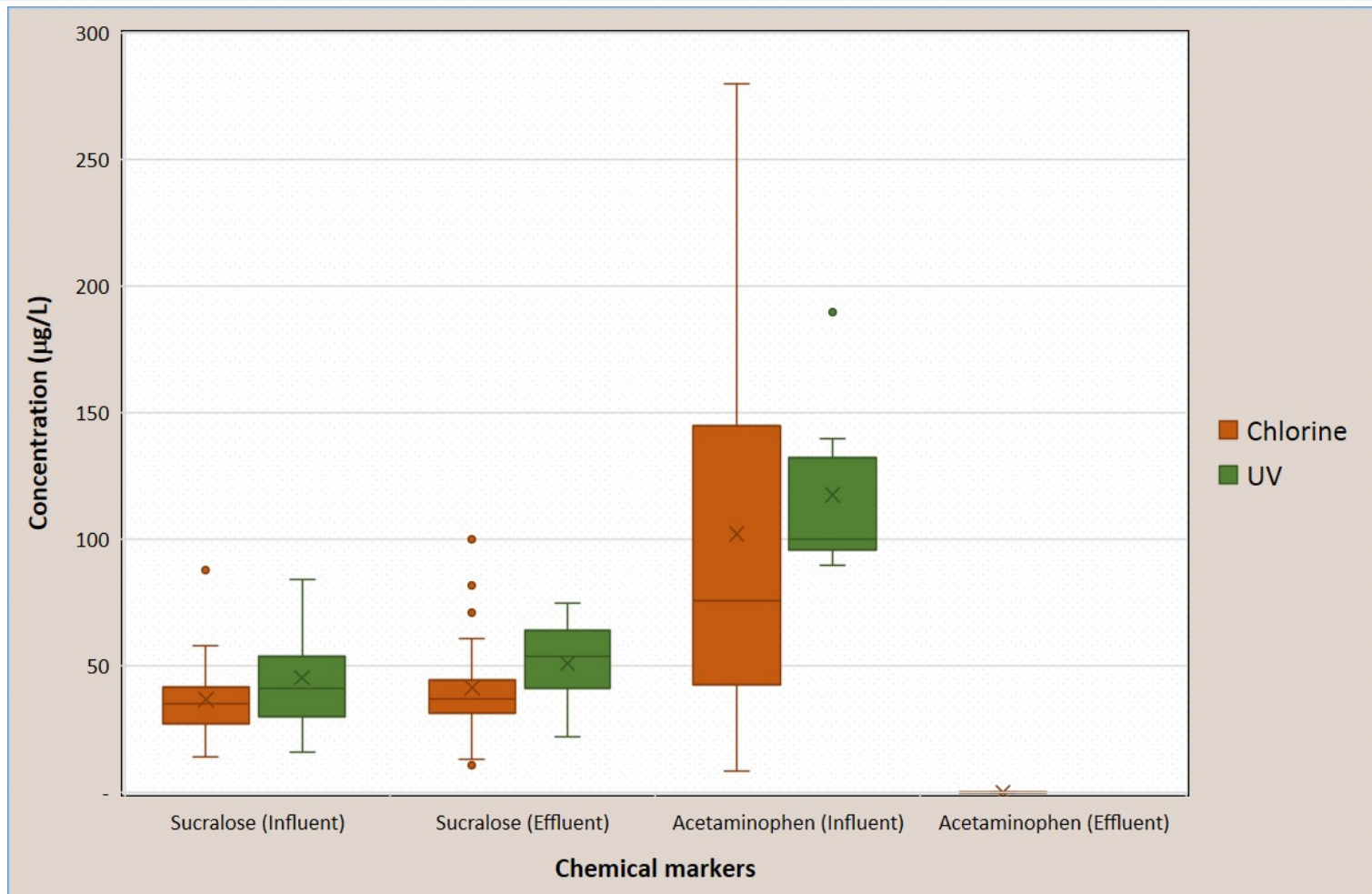
Preliminary results: Biological markers



- ~5 log reduction in molecular and microbiological indicators
- Greater mean log reduction for HF183 with chlorine treatment
- Reduction of microbiological indicators does not vary with disinfection type



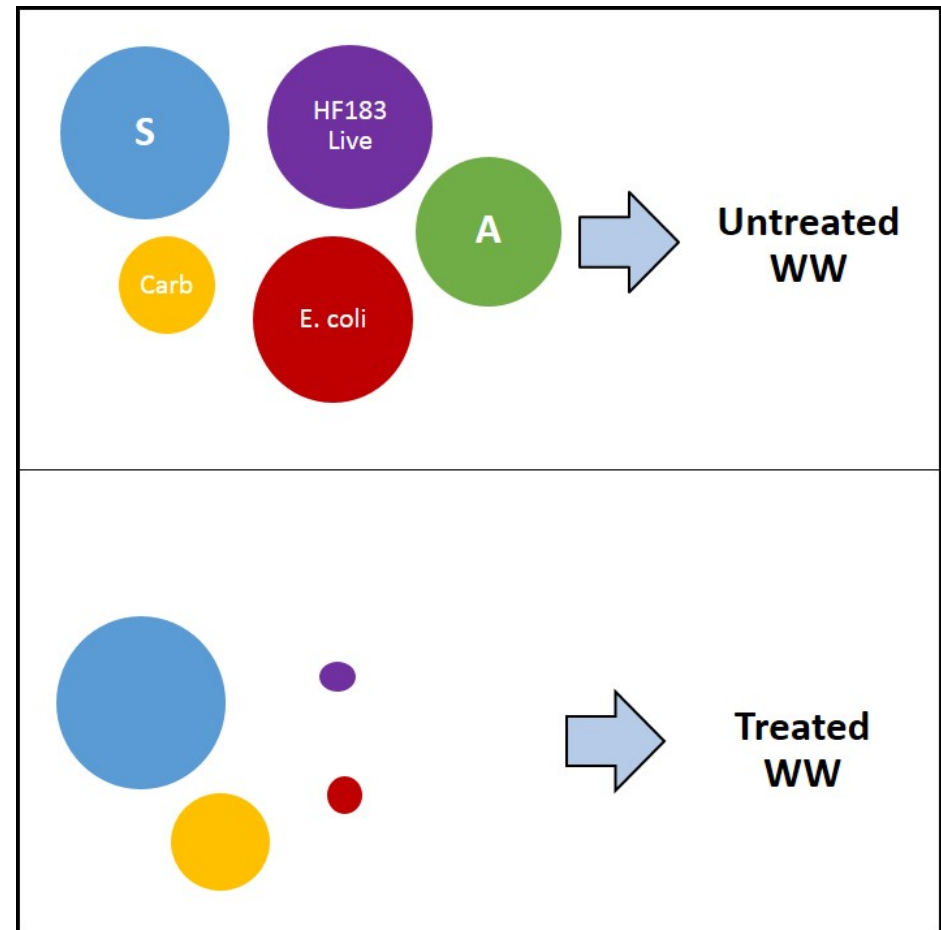
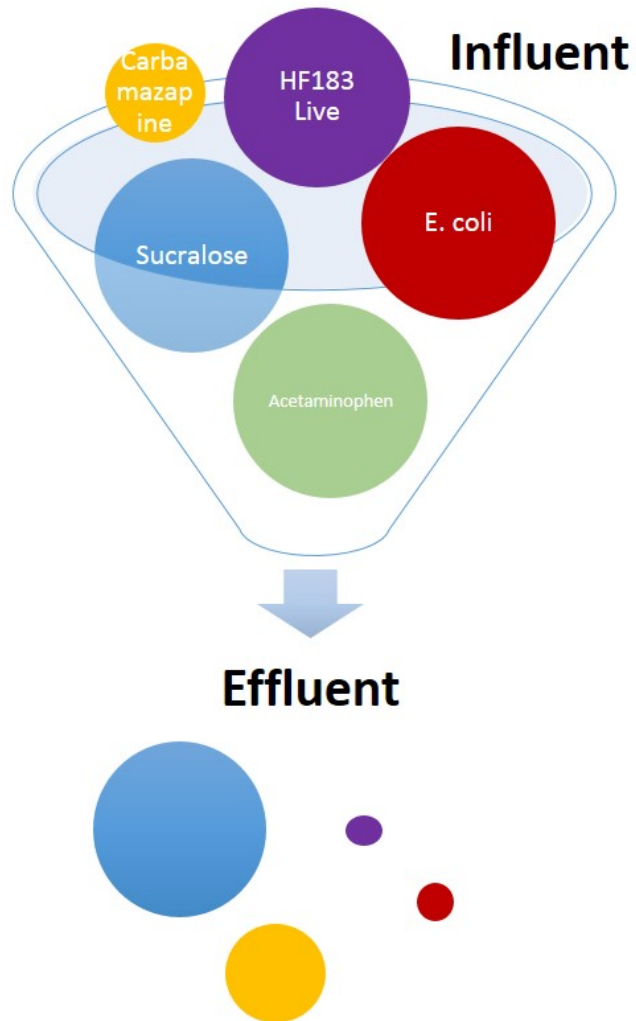
Preliminary results: Chemical tracers



- Sucralose – does not degrade appreciably during wastewater treatment
- Acetaminophen – gets degraded; below detection levels in effluent



Interpreting Results: Potential Model





Next Steps

- Complete sampling by June 2017
 - If weather (rain) cooperates
 - 3 dry and 12 wet events remain
- Analyze results:
 - How do different treatment types compare?
 - How does rainfall affect results?
 - Which combination of markers is most predictive of raw wastewater contamination?
- Validate additional MST markers:
 - Chemistry: Ibuprofen, Naproxen, Duloxetine, Hydriocodone, Metformin, Simvastatin
 - Biology: GFD, BacR, EPA human, EPA cow, EPA dog



Acknowledgments

Sampling team

- Kalina Warren
- Alicia Hogue
- Patrick O'Conner
- Jon Woods
- Corey Anderson
- Chris Green
- Michael Linger
- Natalie Ayala
- Nathan Mulkey
- Pete Wenner
- Brain Davis
- Paul Blair

Biology analysts

- Kim Spencer
- Amelia Rankin
- Jennifer Mihalic
- Brian Cumbie

Chemistry analysts

- Juyoung Kim
- Mohammad Ghaffari



Questions?

Molecular Team

Sarah Menz

Environmental Specialist III

Sarah.Menz@dep.state.fl.us

(850) 245-8857

Daisys Matthews

Environmental Manager

Daisys.Matthews@dep.state.fl.us

(850) 245-8057

Puja Jasrotia

Environmental Consultant

Puja.Jasrotia@dep.state.fl.us

(850) 245-8175

Avril Wood-McGrath

Environmental Specialist I

Avril.Wood-McGrath@dep.state.fl.us

(850) 245-8193