Water Exclosure Treatment System (WETs) to Minimize Beach Closings

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Madison Beaches were Closed ~120 days/year or ~10 days/year/beach
Motivations

Findings:
- Ocean and not freshwater
- Safety concerns

Harbor Island Beach, NY
82% Reduction *E. coli*

Calumet Beach, Chicago, IL
No Reduction

Passive

Active

Top View

Curtain Filter

Cross Section

Beach

Swimming Water

Ebb Tide

Flood Tide

Harbor Island Beach, NY
82% Reduction *E. coli*

Calumet Beach, Chicago, IL
No Reduction

Findings:
- Ocean and not freshwater
- Safety concerns
Research Objectives

• Develop **active** approach for minimizing **beach closings** within freshwater.

• **Sustainable** solution

![Diagram showing social, environment, and economic aspects]
Alternatives for Active Approach

Interceptor

Deflector

Exclosure

BACTERIA

ALGAE
Water Exclosure Treatment System (WETs)

Contaminant

Outlet Location

Intake Location

Study Site

Brittingham Beach

Beach

Chlorination

Intake Location

Outlet Location

Intake Pipe

Outlet Pipe

Treatment

Backwash to Sanitary Collection System

Kilometers

North
Modeling Approach

1. Hydrodynamic model
   • Spatial resolution: 1 meter
   • Vertical resolution: 0.5 cm

Model Setup
   • Locations
     ○ 3 Intakes
     ○ 3 Filtered Outlets
Modeling Approach

1. Hydrodynamic model

2. Particle Transport Model

How much time?
**Water Renewal Times**

**Residence Time**
- Time at each water parcel:
  - 20 hr
  - 15 hr
  - 10 hr
  - 5 hr
  - 1 hr

**Spatial Domain**

**Flushing Time**
- Time for ~2/3 of particles to leave

- Inflow
- Outflow, Q
Water Treatment Design Criteria

Flushing Time

Inlet Shallow: 3.92
Inlet Middle: 1.52
Inlet Deep: 4.15
Outlet Shallow: 4.05
Outlet Middle: 4.35
Outlet Deep: 2.50
Treatment System
WETs Implementation

Friends of Monona Bay

Section A-A

97°
Algae Species Monitoring

Cylindrospermopsis (colonies/mL)

07/26 08/05 08/15 08/25 09/04 09/14

0 0.5 1 1.5 2 x 10^4

Site1 Site2 Site3 Site4

Limnothrix (colonies/mL)

0 0.5 1 1.5 2 x 10^4

Site1 Site2 Site3 Site4
Recall: Research Objective

- Develop **active** approach for minimizing **beach closings** within freshwater.

**Sustainable & Innovative** WETs

- **Portable**
- **Community**
- Approx. ~ $5 per day

Brittingham (2011)

Bernie’s (2012-Present)
QUESTIONS ?

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