

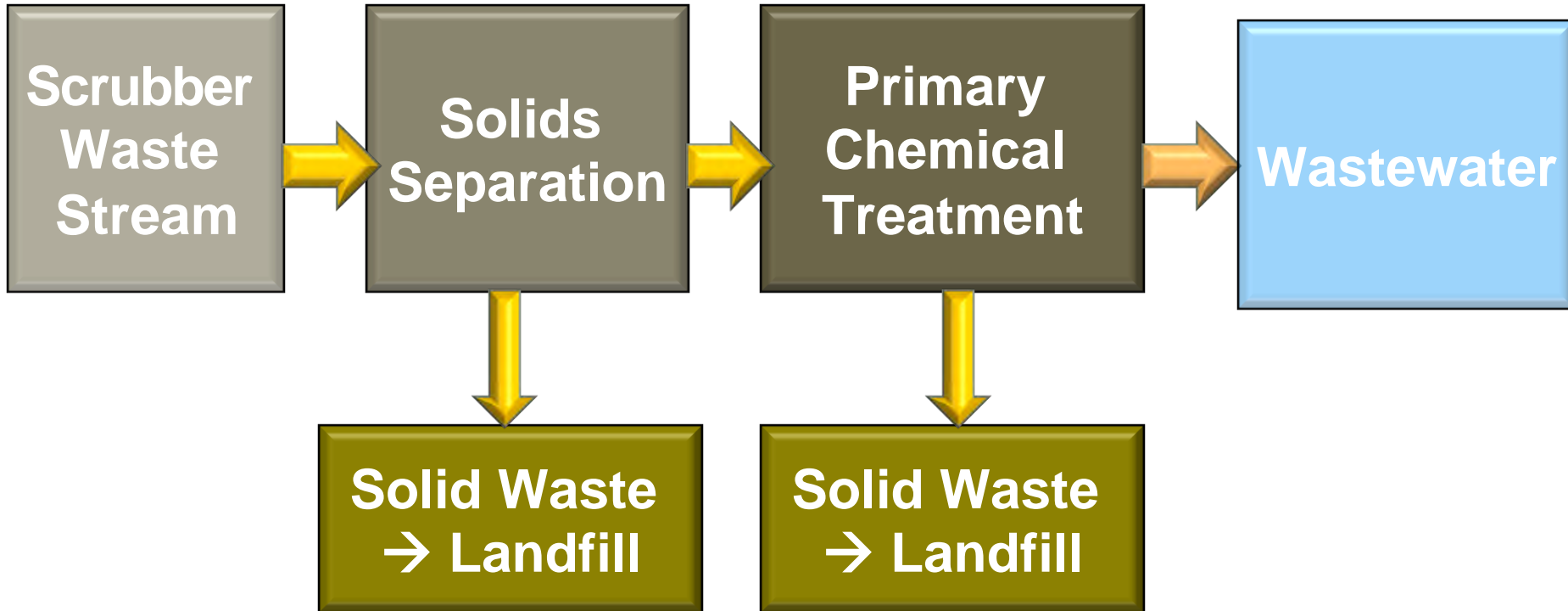


Wastewater and Wetlands: A Green Solution

Jeffrey Energy Center



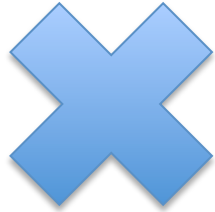
The Problem: Wastewater



The Problem: Contaminants

Key contaminants: chloride, boron, manganese, selenium, sulfate, and fluoride

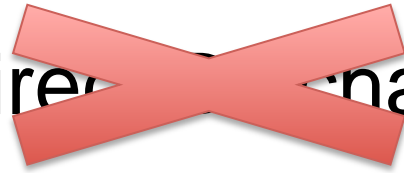
The Problem: Volume



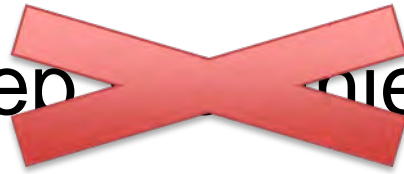
2
million

The Solution

Option 1: Direct charge



Option 2: Deep injection

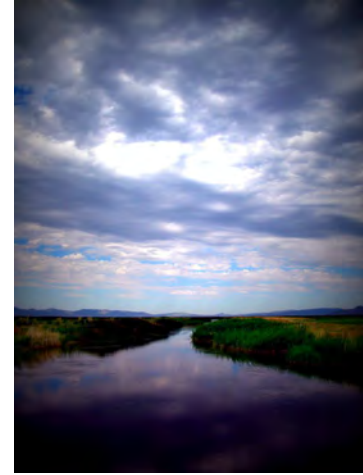
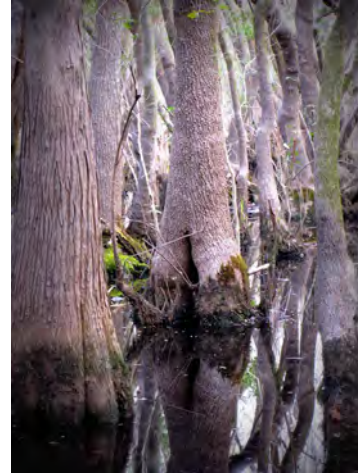
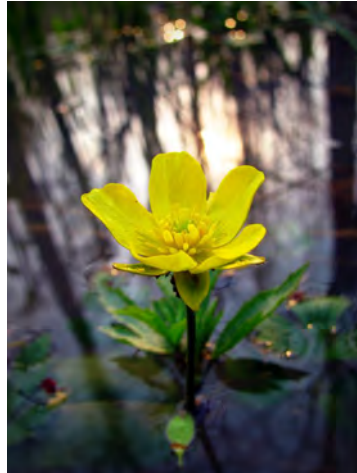


Option 3: Zero liability charge (reverse osmosiserator)



The Green Solution

Wetlands are natural filters.



Photos from my graduate research in Indiana and Georgia.
My laboratory demonstrated that all of these wetlands significantly improved water quality.

Constructed Wetlands

- Municipal waste
- Livestock waste
- Acid mine drainage remediation
- Stormwater runoff



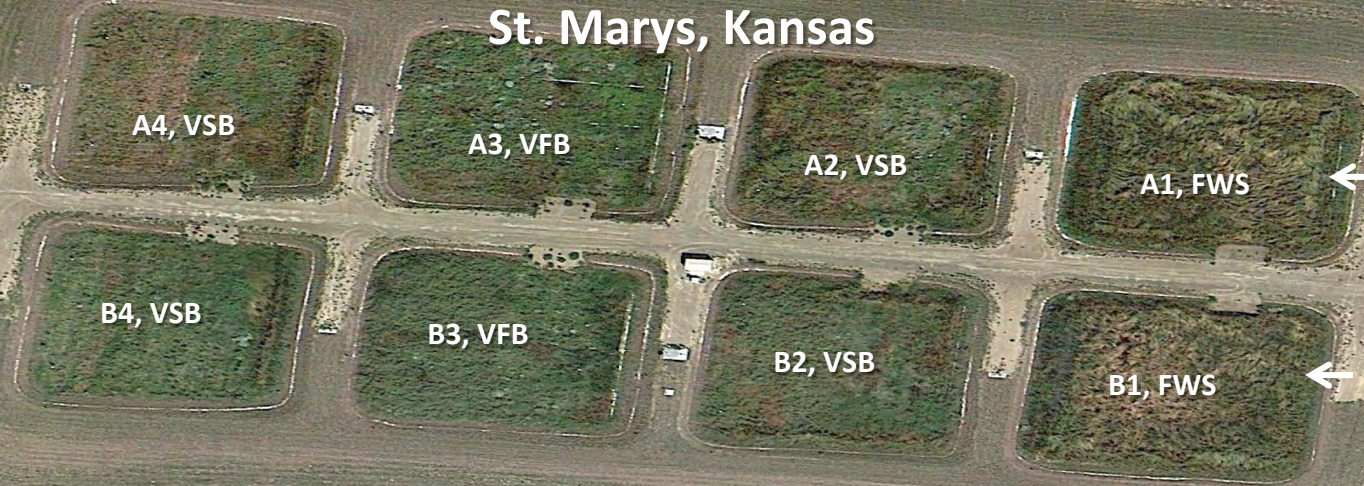
<http://bucknell.edu>

The Experiment

- Two-year pilot study
- Three types of wetland cells
- Two Kansas State graduate students
- Soil, water, and vegetation monitoring



**Westar Energy – Jeffrey Energy
Center
Pilot Constructed Wetland Project
St. Marys, Kansas**



Wetland Cell Types

- FWS – Free Water Surface
- VSB – Vegetated Submerged Bed
- VFB – Vertical Flow Bed
- ← – Direction of Flow

Photo Date: September 2, 2012

Results

- Significant contaminant reduction
- Move ahead with construction on full scale system (20-plus acres)



Ground view of pilot study wetlands.

Construction Begins



Success

- Operational in August 2014
- Estimated \$40 million saved over 15 years
- Edison Award (Edison Electric Institute)
- Water Award (POWER Magazine)



Photo of Jeffrey Energy Center featured in POWER Magazine

Final Product



04/28/2013

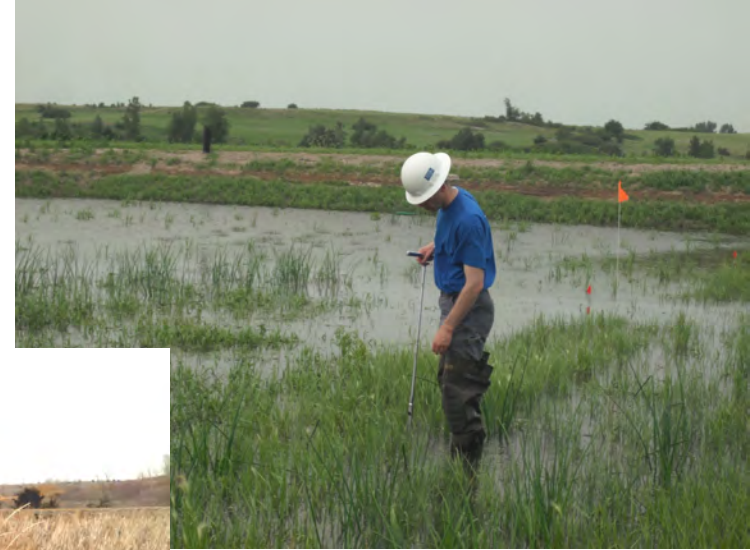


04/28/2013

Wetland Scientists at Work



(I'm in here)





QUESTIONS?