



***SUSTAINABLE REMEDIATION USING
ENGINEERED NATURAL SYSTEMS
TECHNOLOGIES***

**6th International
Phytotechnologies Conference**

December 3, 2009

Presented by:

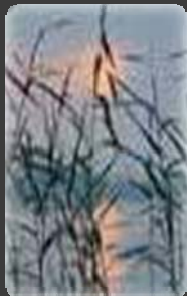
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Principal Hydrologist/VP**

Roux Associates, Inc.

ROUX

Presentation Summary



- Site Background
- Overview of Constructed Treatment Wetland (CTW) System
- Description of CTW and Landfill Area Improvements
- Lessons Learned
- Other Current Systems

Site Background



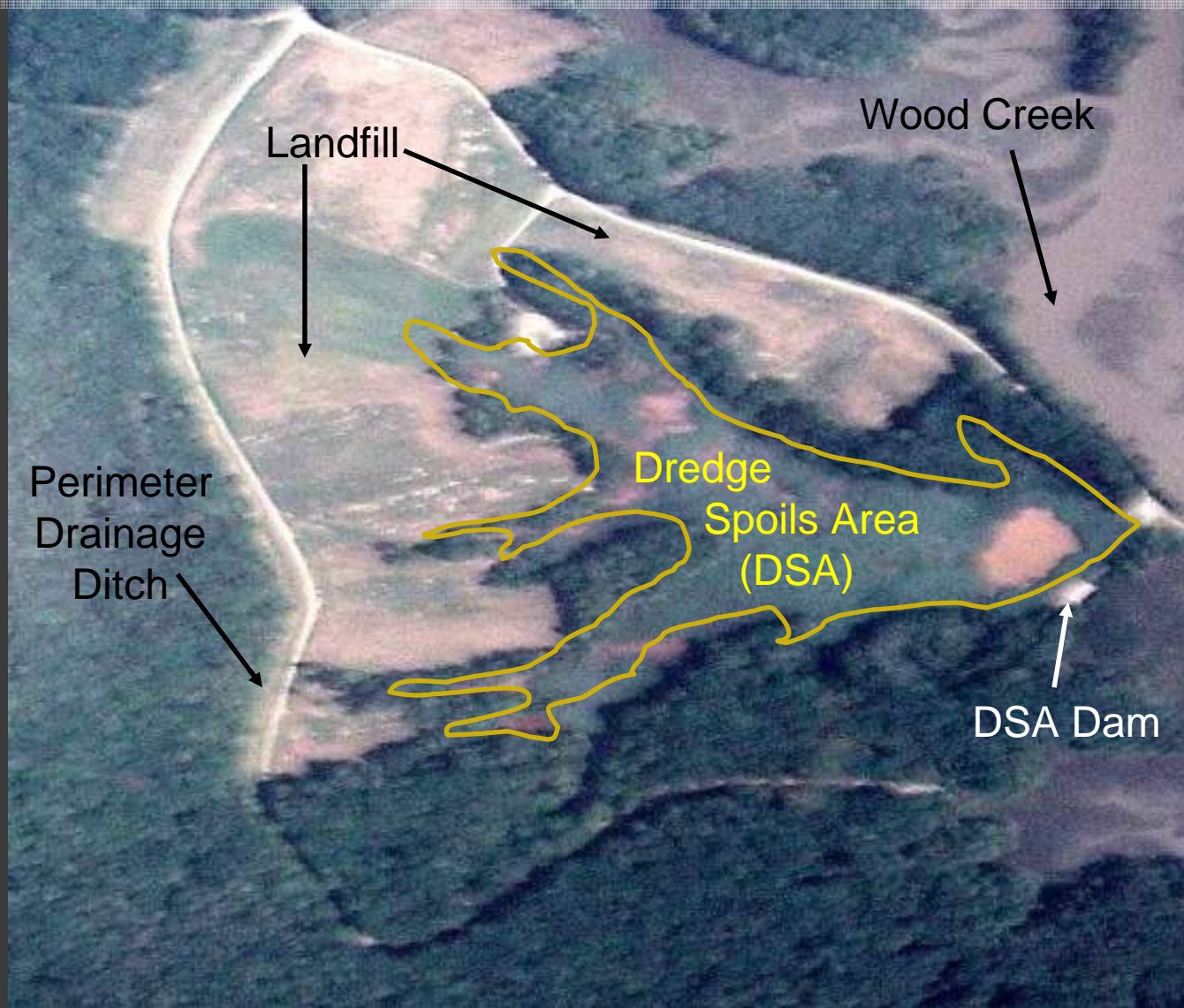
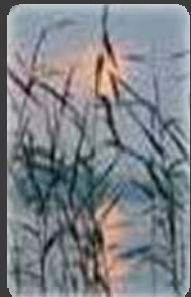
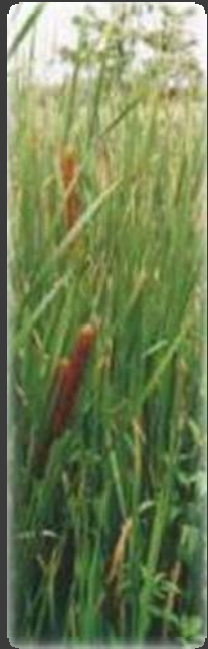
- 700-acre former fibers plant
- Inactive 32-acre ISW Landfill
- Operated from 1958 to 1980
- Repository for manufacturing wastes
- Grass cap with low-permeability soils

Site Background



- ◎ Dredge Spoils Area (DSA)
 - 16-acre wetland area
 - Created in 1967
 - 150,000 cubic yards of Dredge Spoils
- ◎ DSA /Landfill Project Area = 53-acre drainage area
 - COCs include Zinc, Iron, Acidity and low pH
- ◎ Runoff/leachate to on-site WWTP
 - DSA Operated as “Zero Discharge” Facility

Project Area: Pre-Construction



0 400 FT

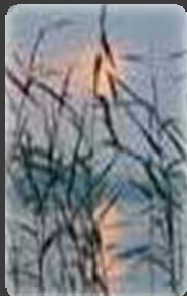
Site Background

Water Balance:

- Receives runoff, landfill leachate and direct precipitation

Parameter	Value (Average Annual)
Precipitation	45.22 Inches
Evapotranspiration (ET)	33.02 Inches
Runoff	13.21 Inches
Infiltration	3.5 inches

- Average Daily Runoff = 41,500 gpd
- Average Leachate Influent = 5,000 gpd

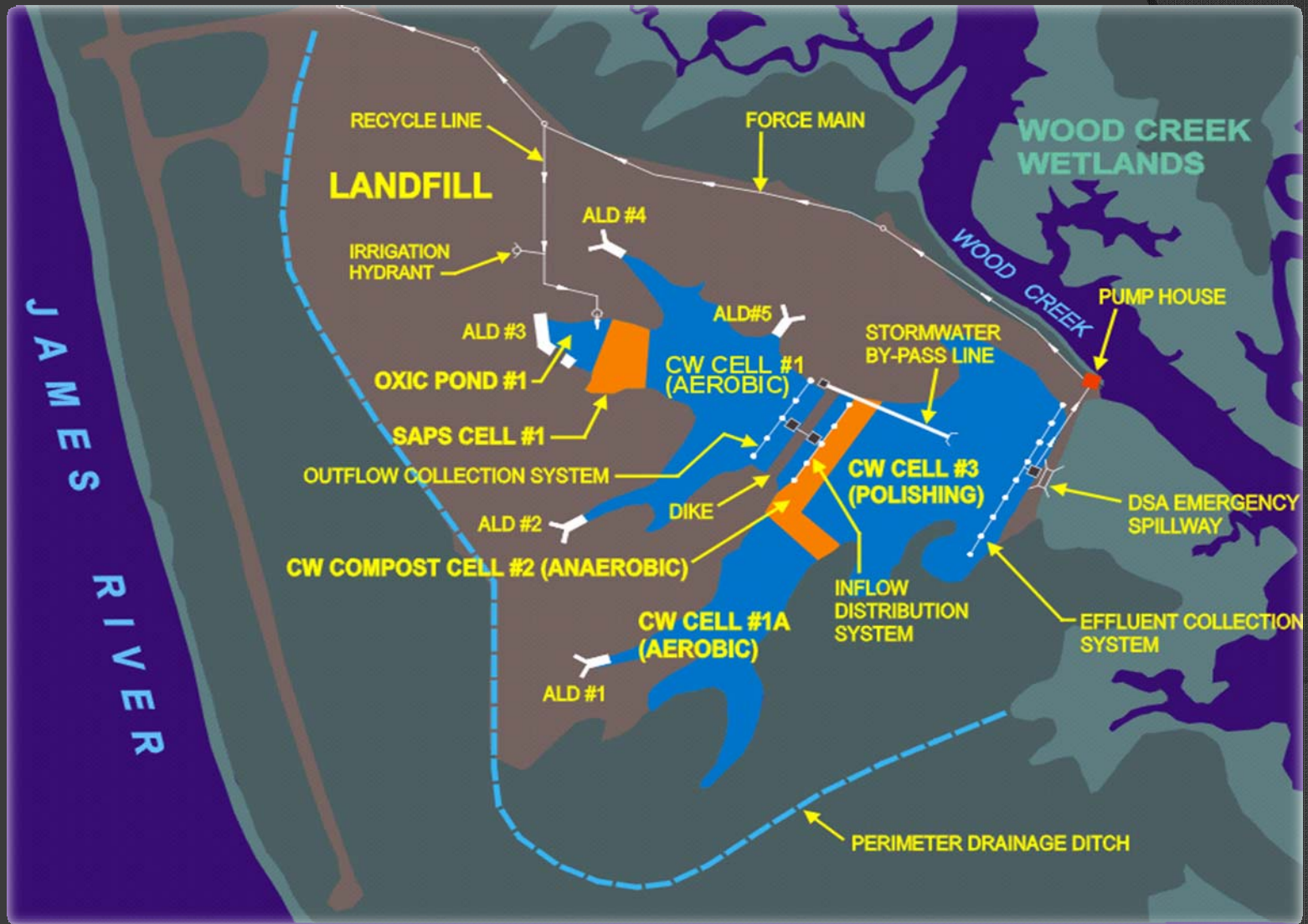
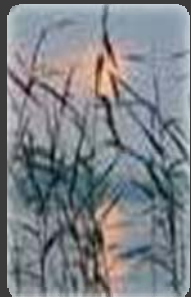
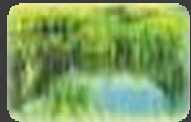


CTW System Overview

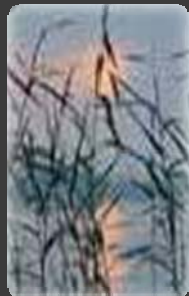
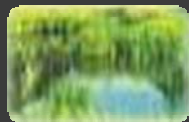


- Purpose: Eliminate on-Site WWTP
- Installed in 1999
- Retrofit into existing DSA footprint
- Effluent conveyed to local POTW
- 5-year storm bypass
- Operated as a “Zero-Discharge” system

CTW System Overview



CTW System Overview



← Leachate Influent



Leachate Effluent →

CTW/Landfill System Improvements



- ⦿ Performed to enhance system operation and minimize stormwater runoff
- ⦿ Landfill Enhancements
 - Stormwater Diversions
 - Phytotechnology Plot Installation
- ⦿ CTW Enhancements
 - Conveyance Modifications
 - Compost Cell Reconfiguration/Repair

Landfill Enhancements



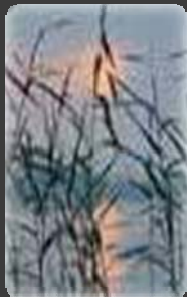
- ◎ Stormwater Diversion
 - Regrading of Existing Swales
 - Installation of Berms and Culverts
- ◎ Removal of 10 acres of contributing drainage area
- ◎ Allowed for storage of the 100-year Storm

Landfill Enhancements



- ◎ Phytotechnology Plot installation
 - 3.2-acre pilot-scale plot in 2002
 - 15-acre full-scale plot in 2003
 - 17,000 total plantings
 - OP-367 Hybrid Poplars and Indigenous Species
- ◎ Runoff reductions projected at 40%
- ◎ Lowered landfill groundwater table

Phytotechnology Plot Installation

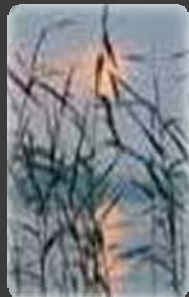


← Year 1



Year 2 →

Phytotechnology Plot Installation



← Year 3



Year 4 →

Phytotechnology Plot Installation



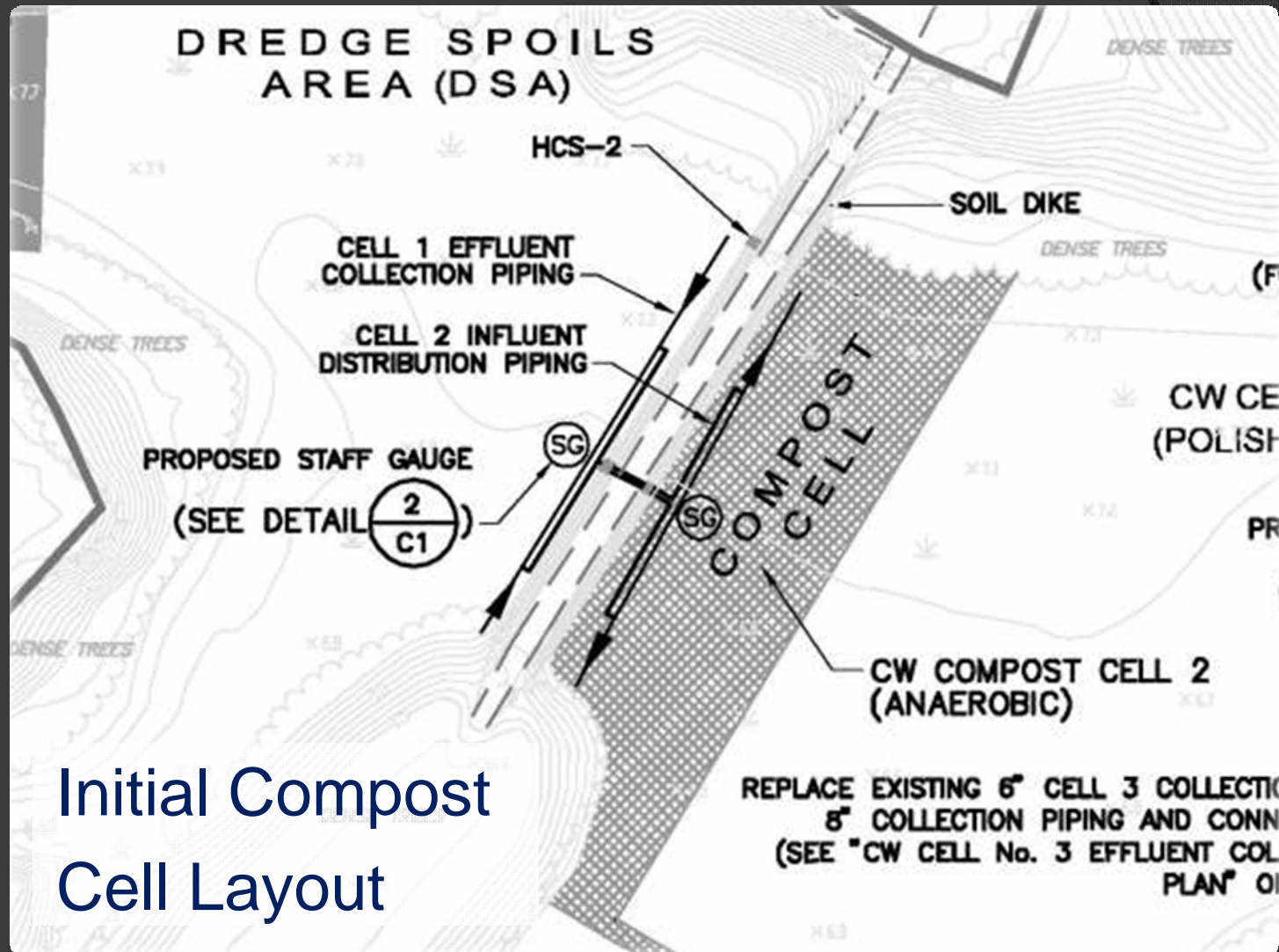
Year 5

CTW Enhancements



- ⦿ Conveyance System Modifications
 - Additional collection piping
 - Pump Installation
- ⦿ Compost Cell Reconfiguration/Repair
 - Removal of the compost cell
 - Fresh compost addition and amendment
 - Installation of stone berms
 - Replacement of collection and distribution piping

Compost Cell Reconfiguration



Initial Compost Cell Layout

Compost Cell Reconfiguration



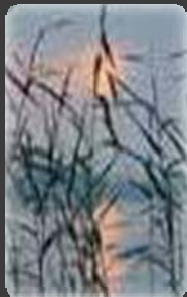
Compost Cell Reconfiguration



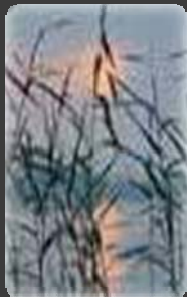
Compost Cell Reconfiguration



Compost Cell Reconfiguration



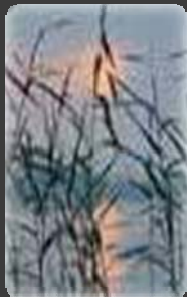
Compost Cell Reconfiguration



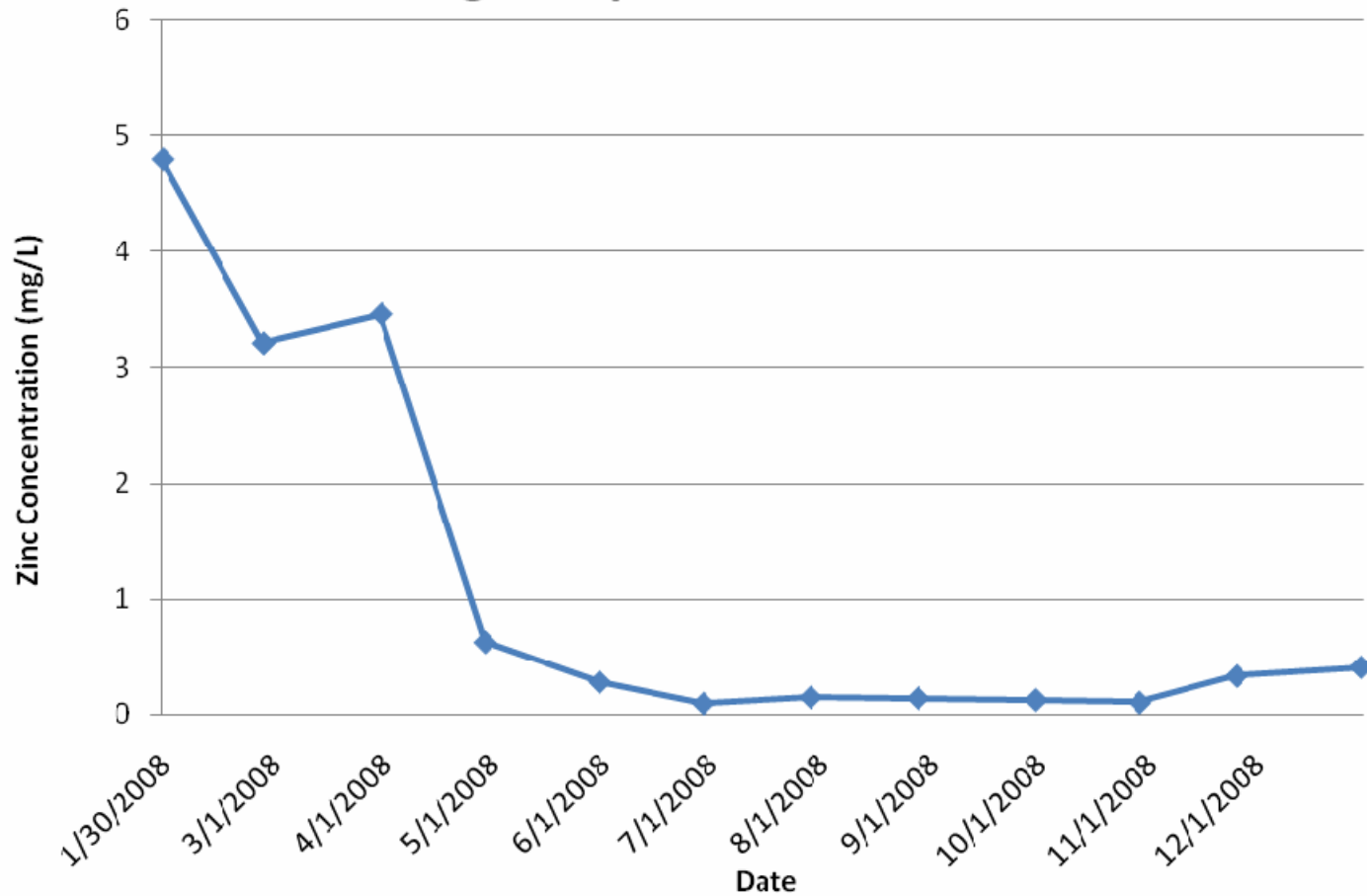
Compost Cell Reconfiguration

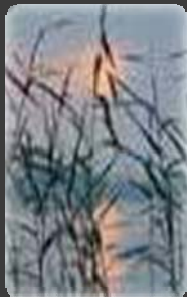


Compost Cell Reconfiguration



Zinc Concentration at the DSA Spillway vs. Time Following Compost Cell Rehabilitation





Lessons Learned

“It’s Hydrology Stupid!!!”

-W.Eifert

Lessons Learned



- Management of Contributing Hydrology Essential
 - Understand water budget
 - Eliminate clean inputs
 - Design for environmental extremes
- Integration of Multiple Management Techniques
 - Reduce variability/seasonality
- Maintain System Hydraulics and Retention Time

Tropical Storm Ida...



- ◎ 8.57" of rain
- ◎ 40-50 mph winds
- ◎ Successfully retained storm
 - Maintained Design Flow Through the System
 - Treating zinc to permit-specified levels
 - Actively discharging 200,000 gpd
- ◎ No release and no NOV triggered

Summary



- The use of natural, passive treatment systems are a sustainable and low cost alternative to traditional treatment systems
- Traditional Alternative = \$30 Million+
 - RCRA capping
 - Sediment removal
 - Leachate collection/treatment

Other Current ENS Technologies



- ◎ Enhanced CTW Aeration
 - Sanitary/High BOD
 - Decrease Footprint
 - Consistent Performance
- ◎ Natural Media Filtration
 - PCB Removal

Enhanced CTW Sanitary System



- Subsurface Flow CTW aeration system
- Footprint reduction

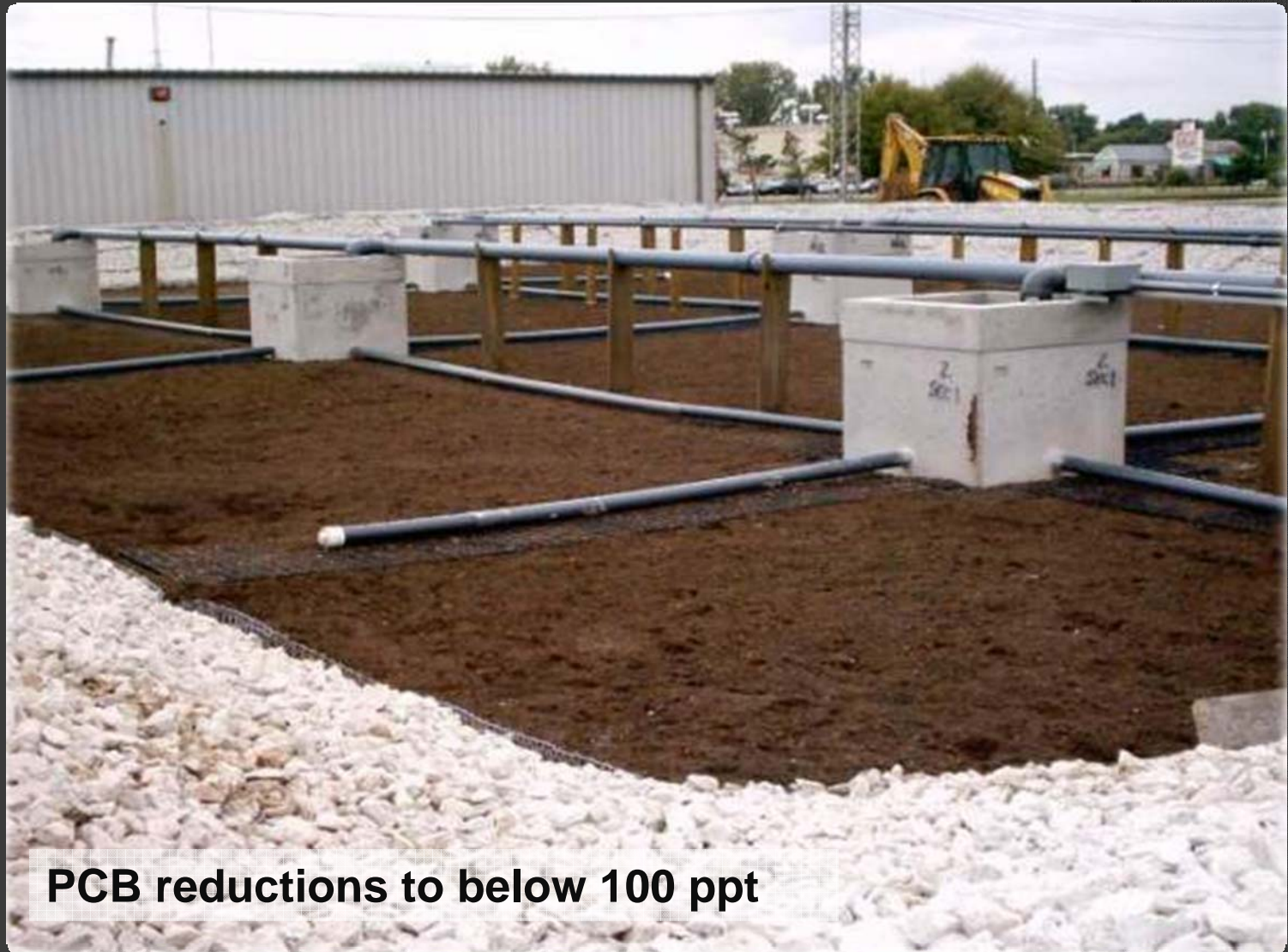
Enhanced CTW Sanitary System



Enhanced CTW Sanitary System



Natural Media Filtration System



PCB reductions to below 100 ppt



VS

