
POLK COUNTY NORTH CENTRAL
LANDFILL CONSTRUCTED
WETLANDS LEACHATE
TREATMENT SYSTEM



OUTLINE

- Background and Motivations
- System Overview
- Design and Performance



BACKGROUND AND MOTIVATIONS

- Leachate treatment at \$0.20 /gal
>\$3,000,000/yr
- Vertical integration of operations
- Decrease reliance on external parties for treatment



Exploring Leachate Treatment Options

- Partnered with University of Florida to examine options
- Constructed wetlands well documented for wastewater treatment
 - Low-energy
 - Reduced maintenance needs
 - Comparatively large land requirements
- Reclaimed phosphate mining land available on-site



Polk County North Central Landfill

SYSTEM OVERVIEW

Zero Discharge
Industrial
Wastewater
Pond

Mixing
Basin

Vertical Flow
Wetland Cells

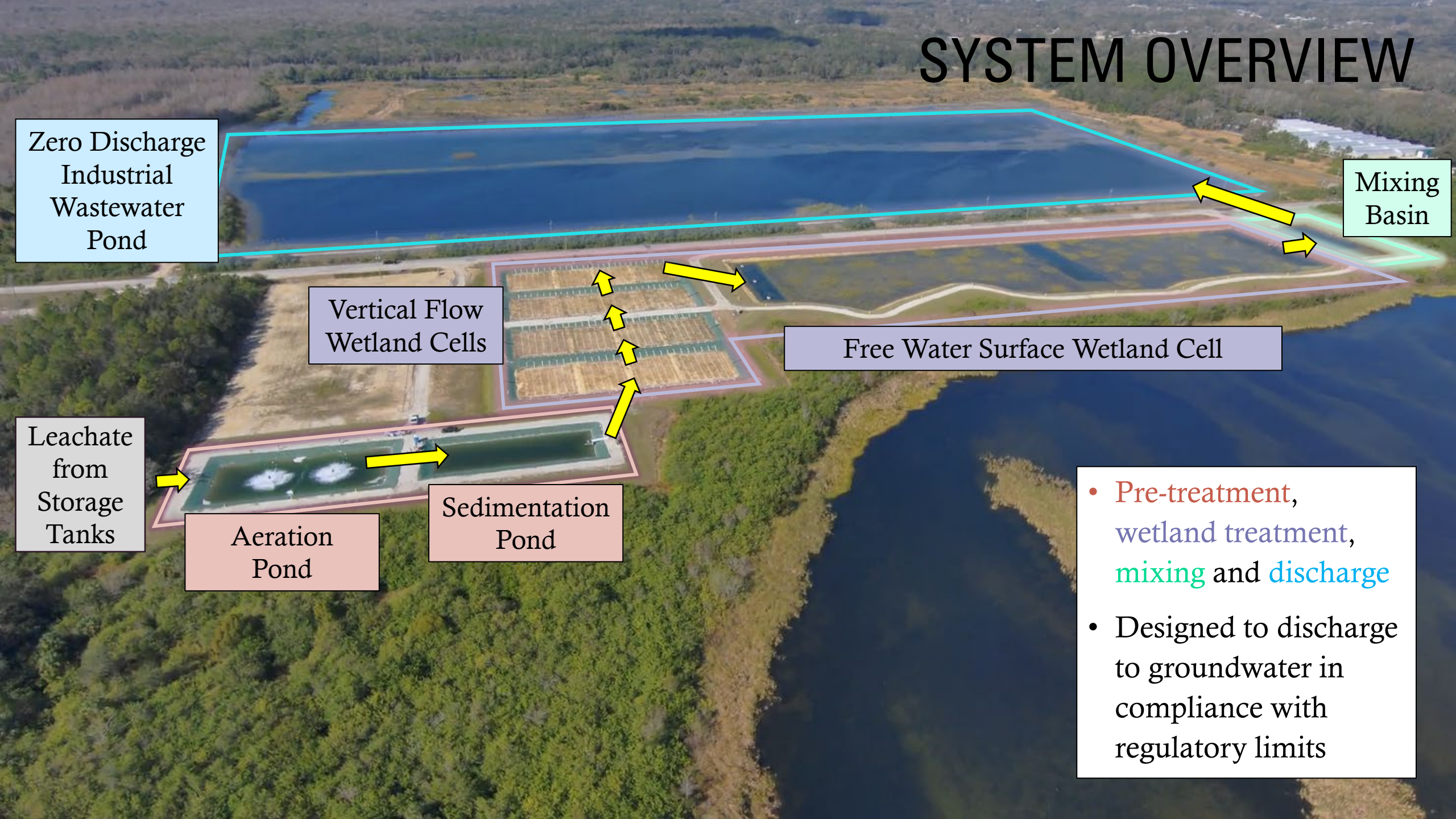
Free Water Surface
Wetland Cell

Leachate
from
Storage
Tanks

Aeration
Pond

Sedimentation
Pond

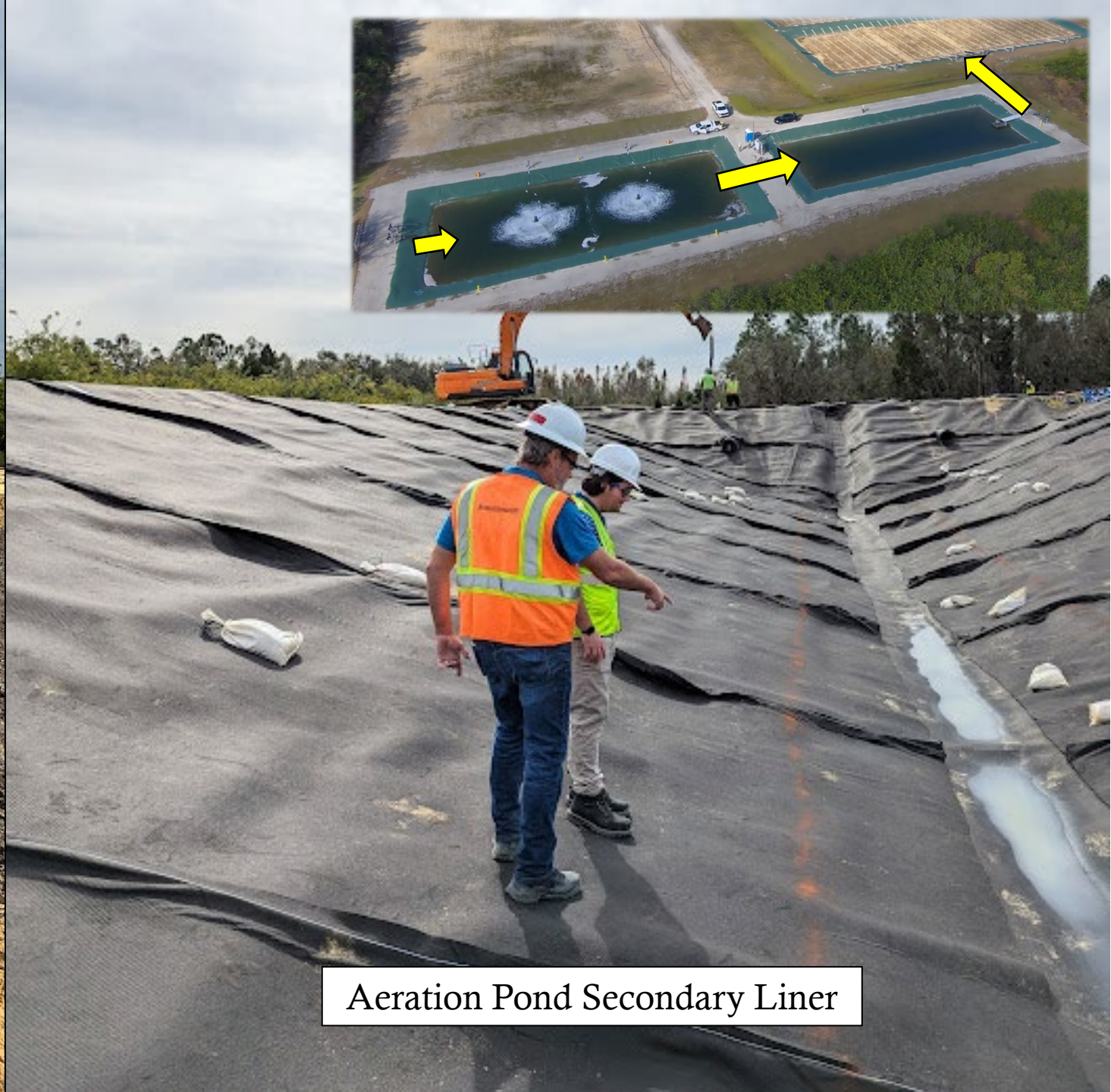
- Pre-treatment, wetland treatment, mixing and discharge
- Designed to discharge to groundwater in compliance with regulatory limits



Aeration & Sedimentation Ponds



Excavation of Aeration and Sedimentation Ponds



Aeration Pond Secondary Liner

Aeration & Sedimentation Ponds



Aeration Pond Leak Detection Piping

Aeration & Sedimentation Ponds



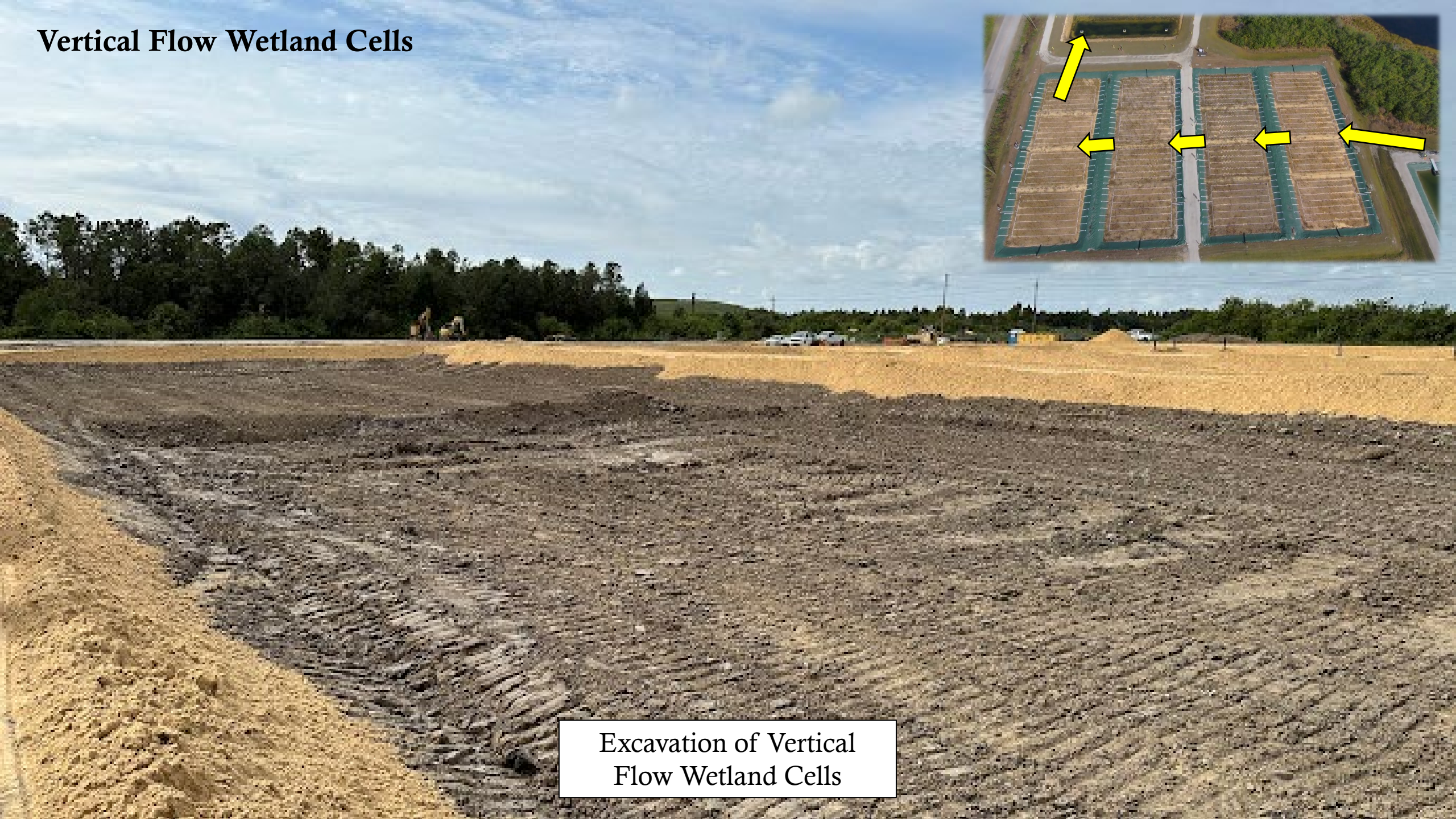
Aeration Pond

Aeration & Sedimentation Ponds



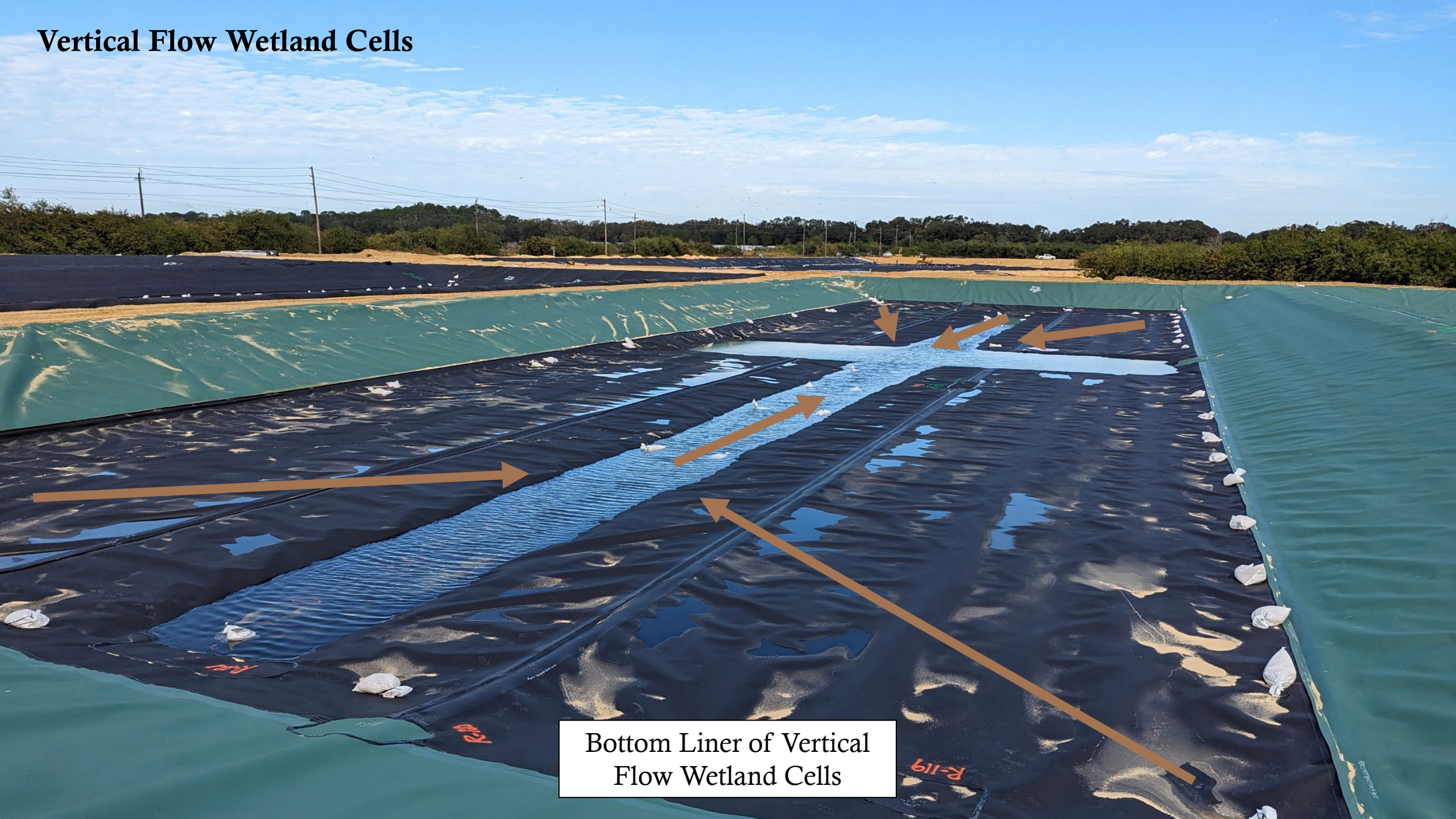
Sedimentation Pond

Vertical Flow Wetland Cells



Excavation of Vertical Flow Wetland Cells

Vertical Flow Wetland Cells



Bottom Liner of Vertical Flow Wetland Cells

Vertical Flow Wetland Cells



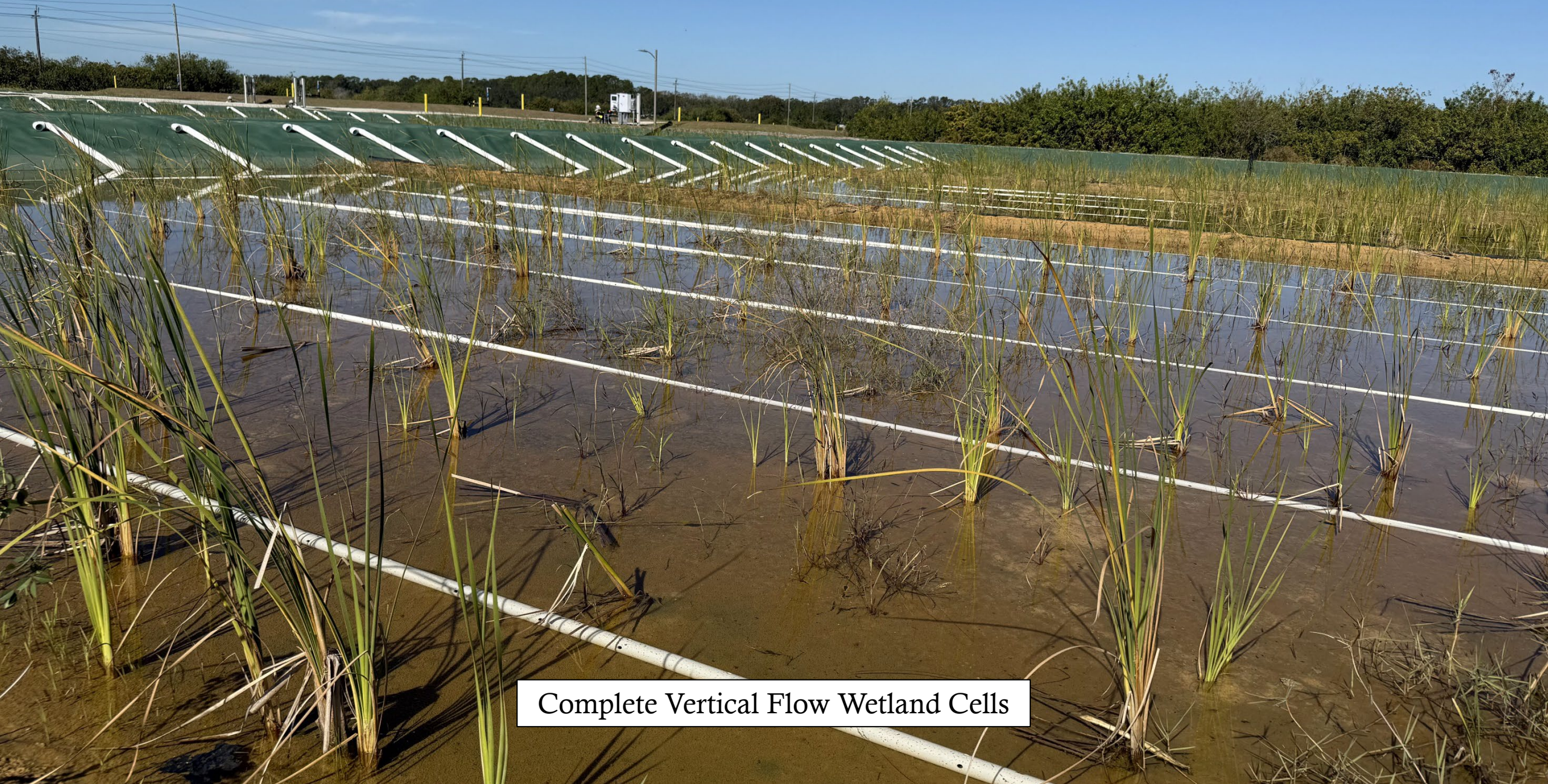
Bottom Gravel Layer of Vertical Flow Wetland Cells

Vertical Flow Wetland Cells



Intermediate Gravel Layers of Vertical Flow Wetland Cells

Vertical Flow Wetland Cells



Complete Vertical Flow Wetland Cells

Free Water Surface Wetland Cell



Excavation of Free Water Surface Wetland Cell

Free Water Surface Wetland Cell



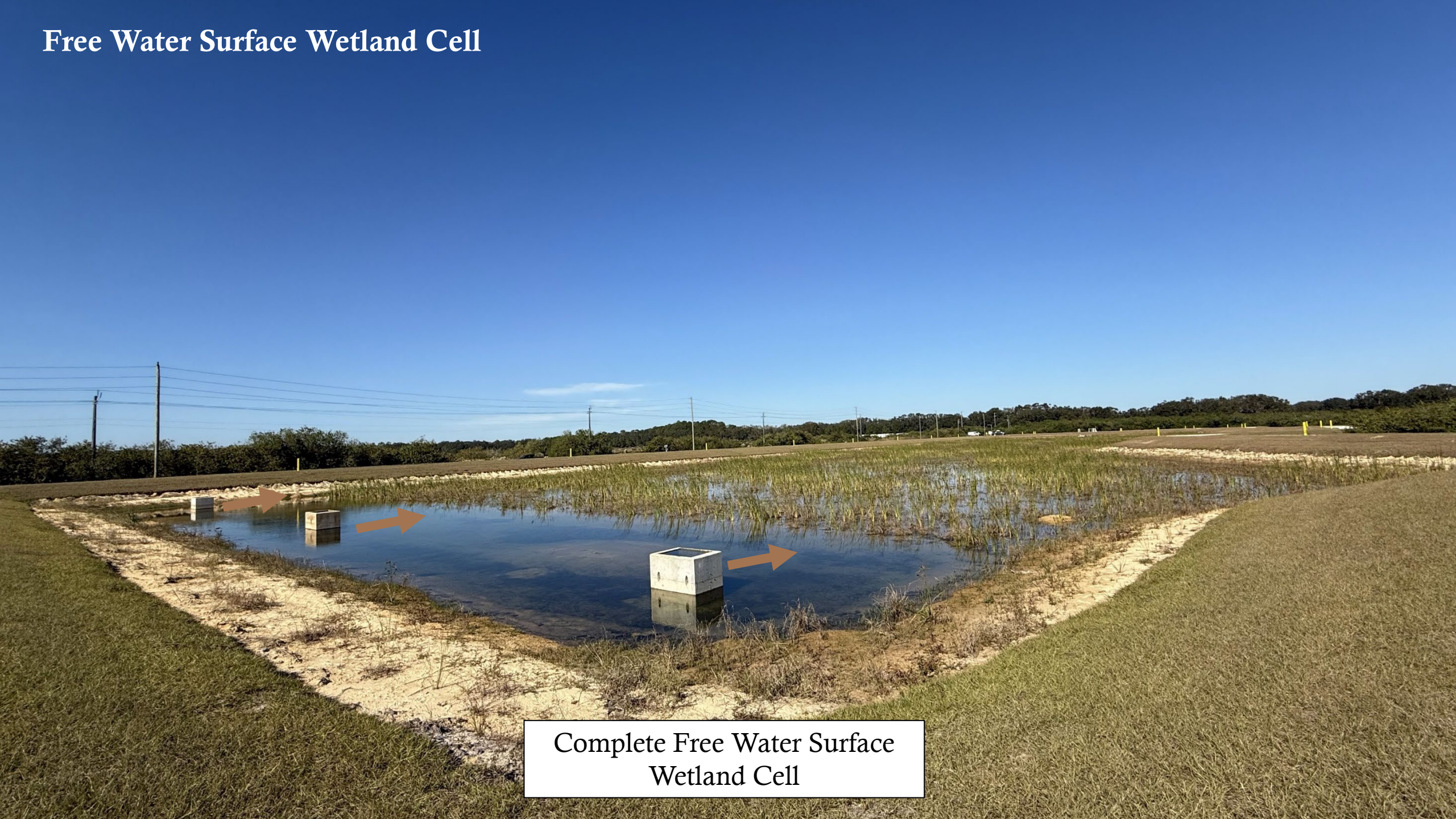
Bottom Liner of Free Water Surface Wetland Cell

Free Water Surface Wetland Cell



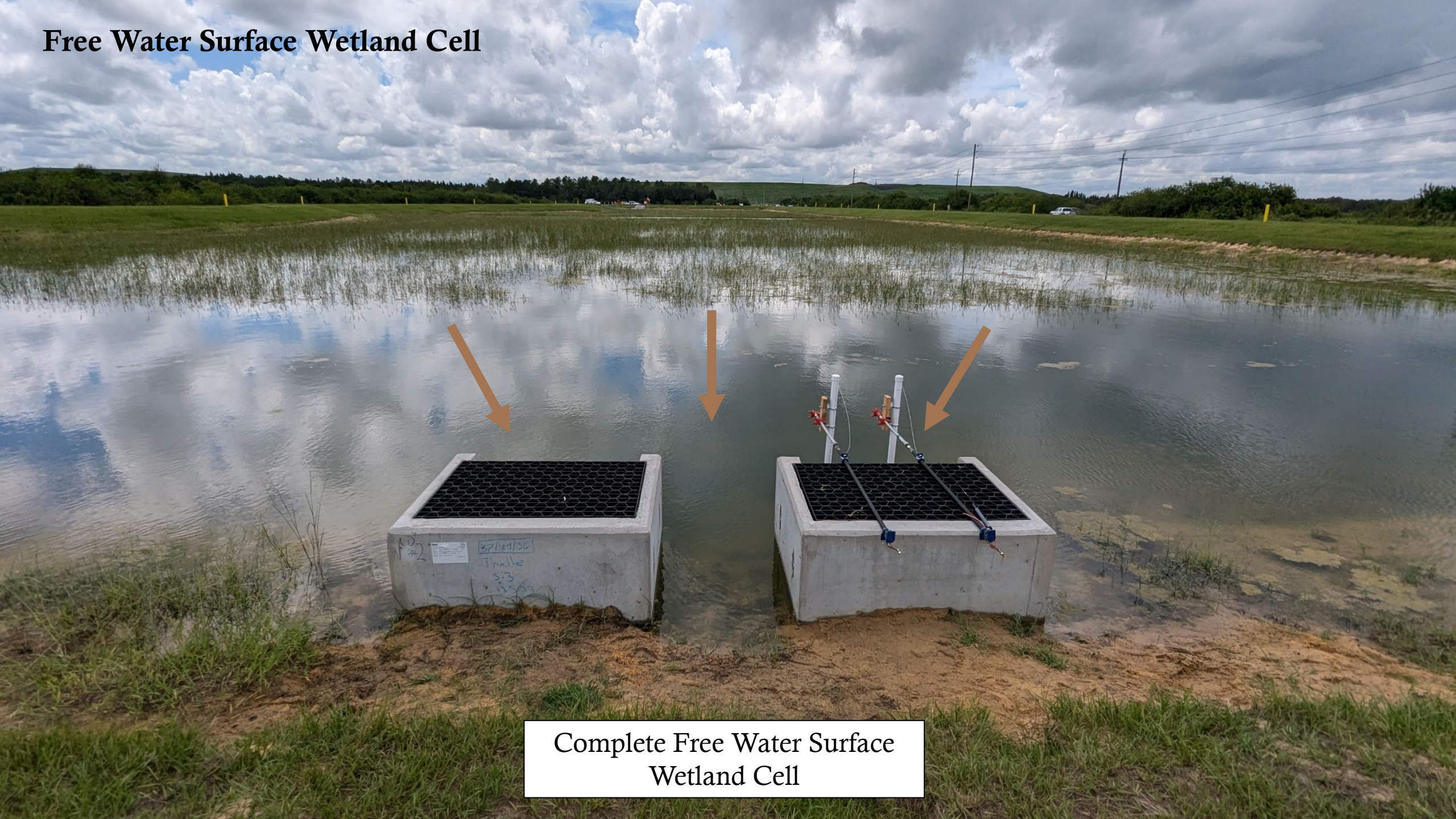
Sand Layer of Free Water
Surface Wetland Cell

Free Water Surface Wetland Cell



Complete Free Water Surface
Wetland Cell

Free Water Surface Wetland Cell



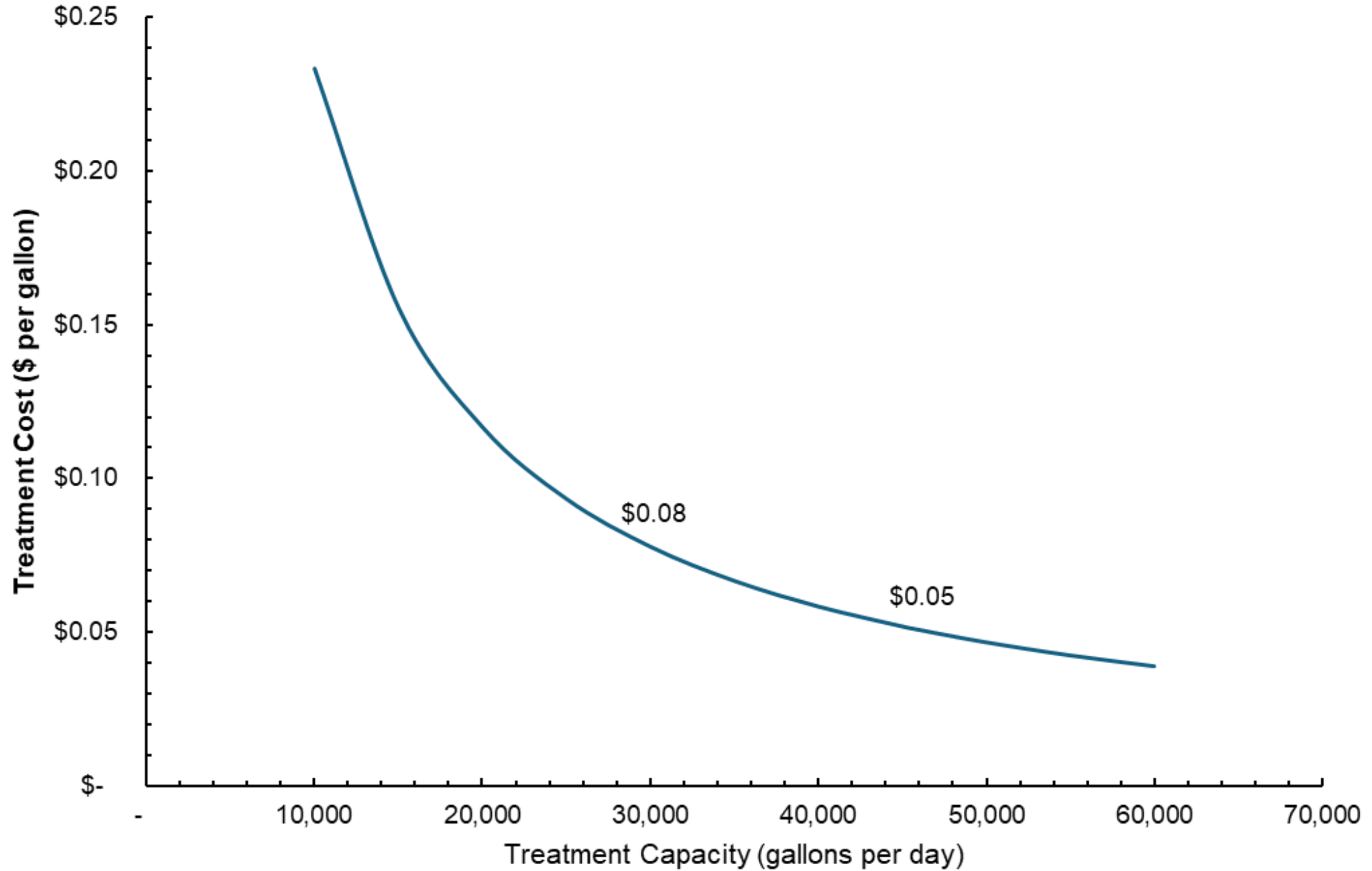
Complete Free Water Surface
Wetland Cell

Zero Discharge Industrial Wastewater Pond

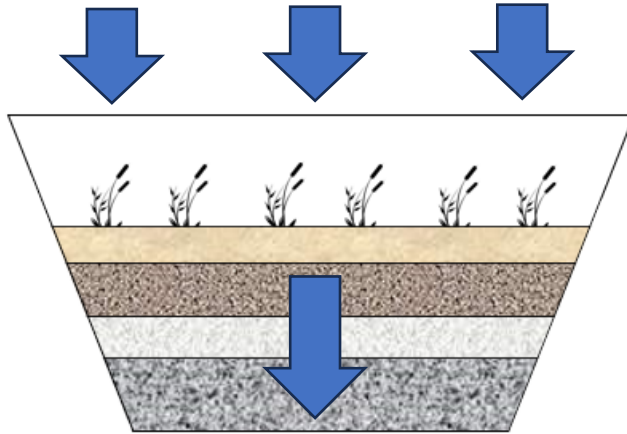


Complete Zero Discharge
Industrial Wastewater Pond

Polk County CWTS Unit Cost vs. Treatment Capacity

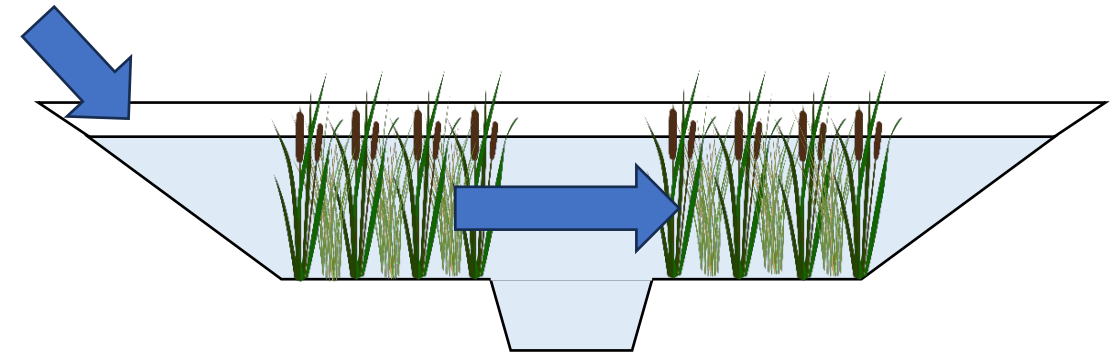


Design and Performance



Vertical Flow Wetlands

- Subsurface Flow
- Aerobic (nitrification)



Free Water Surface Wetlands

- Surface Flow
- Anaerobic (denitrification)

Nitrification: $\text{NH}_3\text{-N} \rightarrow \text{NO}_3^-$

Denitrification: $\text{NO}_3^- \rightarrow \text{N}_2$

Leachate Treatment

Leachate
Tanks



1

Pretreatment



2

Vertical Flow Wetland Cells



3

Free Water Surface
Wetland Cell



4

Mixing
Basin



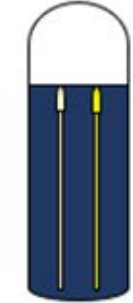
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Zero
Discharge
Industrial
Wastewater
Pond



Leachate Treatment

Leachate
Tanks



1

Pretreatment



2

Vertical Flow Wetland Cells



3

Free Water Surface
Wetland Cell



4

Mixing
Basin



5

Zero
Discharge
Industrial
Wastewater
Pond

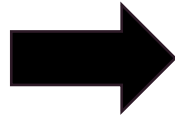


Ammonia

BOD

Iron

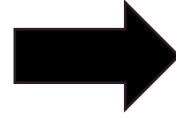
Salts



Ammonia

BOD

Salts

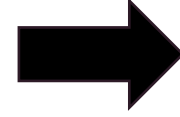


Ammonia

BOD

Nitrate,
Nitrite

Salts



Salts



Salts

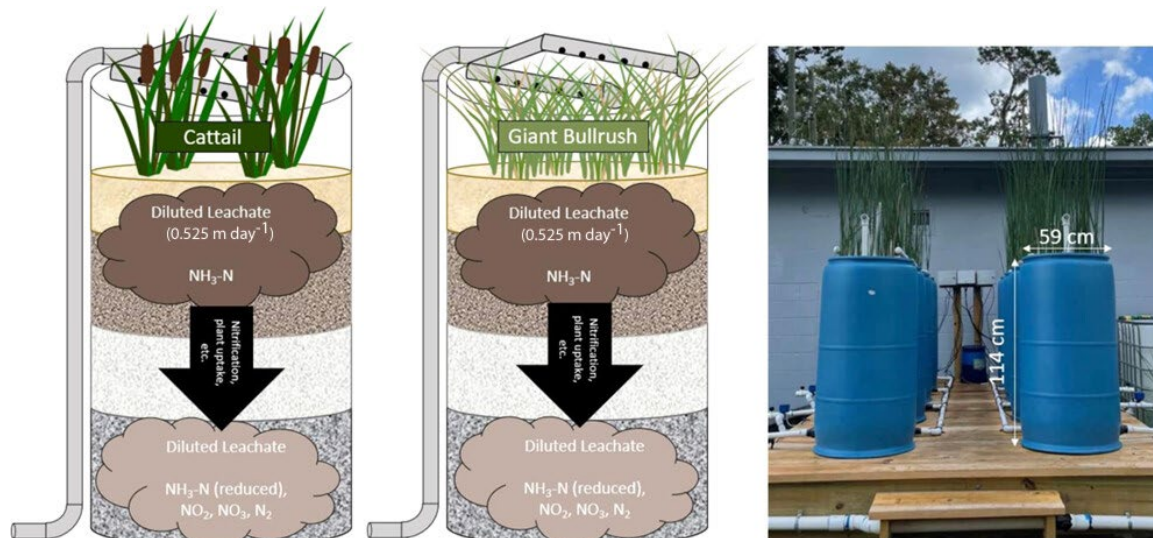
Pilot Study



Leachate Treatment Literature

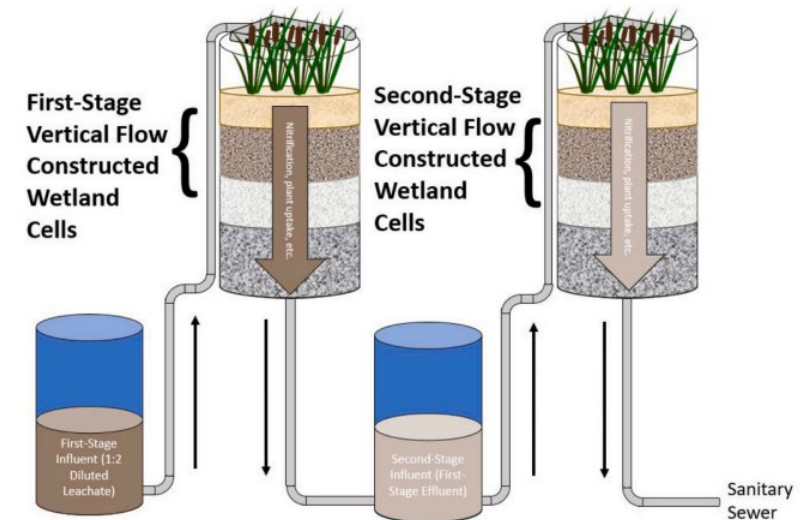
Effect of Loading Frequency on Ammonia-Nitrogen Removal Kinetics in Early-Stage Pilot-Scale Vertical Flow Constructed Wetlands Treating Landfill Leachate

Dreyton J. Lott, Nicole M. Robey, Steven Laux, and Timothy G. Townsend*



Analysis of ammonia-nitrogen removal kinetics by stage in pilot scale vertical flow wetlands treating landfill leachate in series

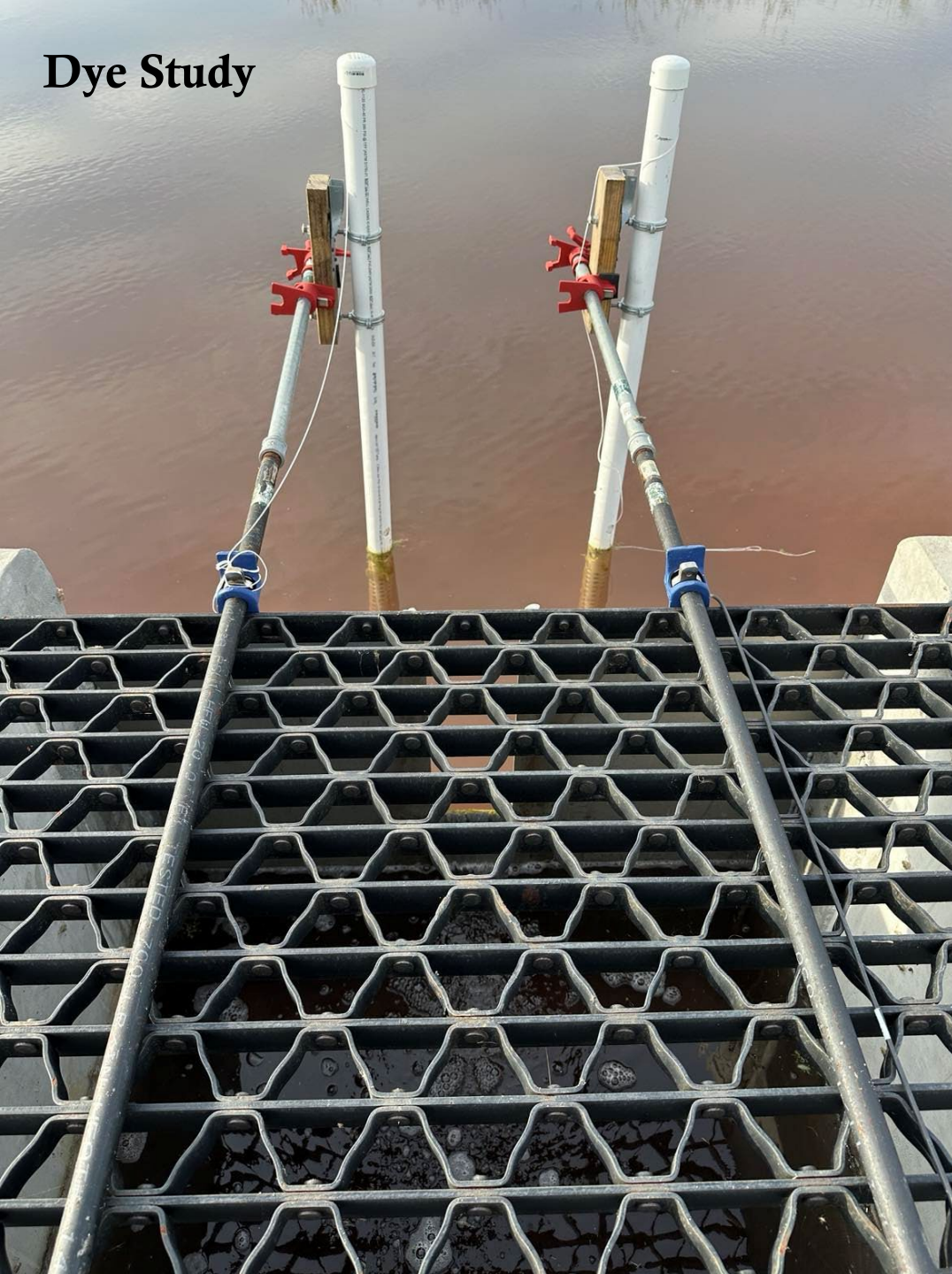
Dreyton J. Lott, Steven J. Laux, Timothy G. Townsend*



Dye Study



Dye Study



Leachate Introduction



QUESTIONS?

