REINHOLD ENVIRONMENTAL ®

2023 Reinhold/PCUG Round Table Presentation

Cohosted by Duke Energy and Vistra in The Westin Hotel, Cincinnati, OH on June 26-27, 2023

UCC environmental

Sustainable Solutions for Air, Water and Solids

UCC's Innovative CCR Dewatering

Reinhold Conference
6/26/23

Contacts

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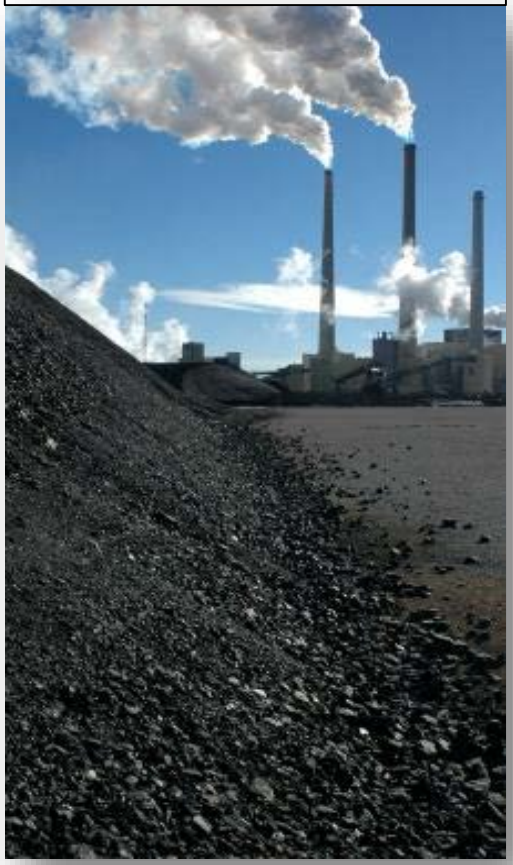
UCC Environmental

Offerings

Solid Material Handling

Air Pollution Control



Wastewater Treatment

Water/Wastewater Management Team

Kevin McDonough
Executive Vice President and Chief Revenue Officer

- Joined UCC in 1999
- BS in Environmental Engineering, Master's in Mining Engineering, Master's in Business Administration
- Executive Sponsorship in Achieving Program and Project Success
- Pre-UCC, worked for Montana Resources (Open Pit Copper Mining and Concentration Operation) as an Environmental Engineer

Andrew Matthews
Vice President of Sales - Americas

- Joined UCC in 2008
- BS in Construction Engineering and Management, PMP Certification
- Began serving Power Generation in 1998 working on EPC Coal Handling Projects coupled with 6+ Yrs UCC Capital Project PM Experience
- Supports the UCC Team on Key Account Management

Kevin Matyas
Director, WWT Ops Planning & Business Development

- Joined UCC in 2005
- BS in Mechanical Engineering, Master's in Project Management, PMP Certification
- Broad UCC Experience including Systems Engineering, Project Management, Global Purchasing Manager, Integration Manager, Strategy
- Passionate in Project Execution and creating Customer Value in Innovative, Regulatory Compliant, Reliable Environmental Solutions

David Donkin
Director, Wastewater Solutions

- Joined UCC in 2019
- BS in Environmental Chemistry, Master's in Business Administration
- Over 3 Decades in Water/Wastewater Treatment
- Experience as Analytical and Treatability Chemist, Applications Engineer, and Sales Professional

Joseph Woodley
Director, Environmental Solutions

- Joined UCC in 2021
- BS in Biology, Master's in Civil and Environmental Engineering
- Involved in the execution of over $1B of Environmental Compliance Projects with Alabama Power and Georgia Power
- Expertise includes Phys/Chem Treatment, Biological Removal of Nitrates and Selenium, Advanced Filtration, and Solids/Liquids Separation

Mark Owens
Senior Water/Wastewater Treatment Sales Manager

- Joined UCC in 2022
- BS in Environmental Engineering, Master's in Civil and Environmental Engineering, Professional Engineer License
- Over 3 Decades in Water/Wastewater Treatment including Plant Management, Consulting, and OEM Technology Supply
- Experience supporting USEPA in the development of new Wastewater Regulations for Industry

Morgan French
Sales Manager, CCR Remediation - Americas

- Joined UCC in 2022
- BS in Environmental Science, Master's in Civil and Construction Engineering
- 14 years in Power Generation leading Environmental Capital Projects and Retrofits (Air, Water, Material Handling, and Ash Pond Closure)
- Led R&D and Emerging Technology Efforts within Water Treatment and CO2 Capture

Jack Ma
Manager of Wastewater Technology

- Joined UCC in 2020
- BS in Chemical Engineering, Master's in Chemical Engineering, PhD in Civil and Environmental Engineering, Professional Engineer License
- Experience in Process Design and Product Development and Management
- Thoroughly Engaged in the Water/Wastewater Treatment Community (Tech Conference Presentations, Panelist, Peer Review, etc)

Brian Geegan
Program Director, Mobile Fleet Solutions

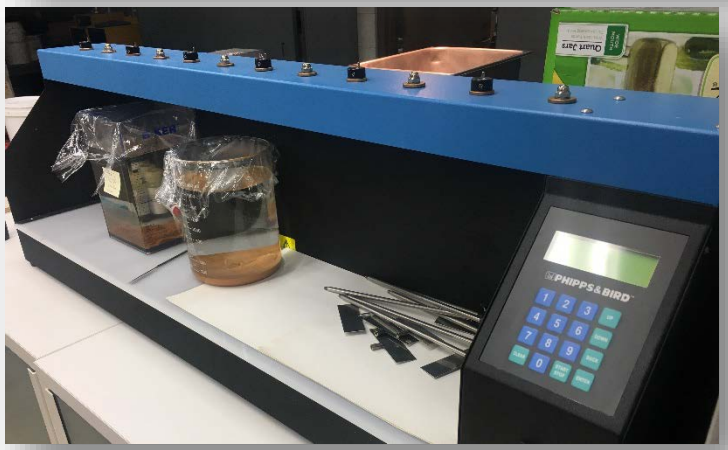
- Joined UCC in 2023
- BS in Mechanical Engineering
- Experience Leading Industrial Water Mobile Solutions and Service in Oil & Gas, Power, Food & Bev, and Petrochemical
- Also Experienced in Turnkey EPC Business Development

UCC Environmental

Overview

UCC Environmental

Innovation Lab



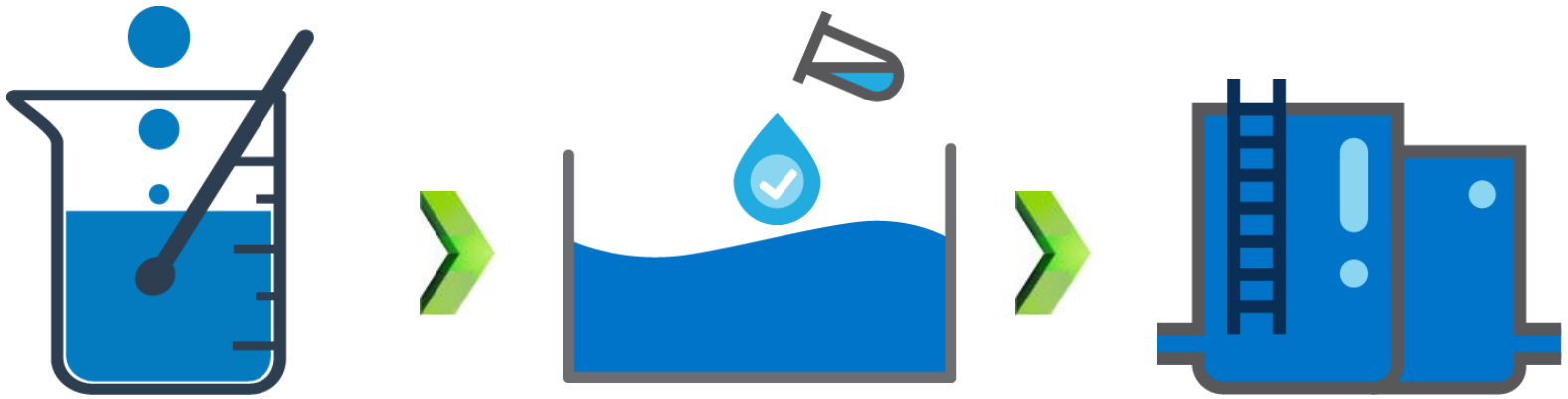
UCC Environmental

Innovation Lab Capabilities

- Prototype Design and Development
- Product Performance Testing and Evaluation
- Material Performance Testing and Analysis
- Failure Analysis
- Metallurgical Analysis
- Pressure, Flow, and Cycle Testing
- Physical Conveying Analysis and Evaluation
- Chemical Analysis
- Bulk Material Property Testing and Flow Analysis
- Wastewater Treatability Testing
- Solids Dewatering Analysis

Project Execution Approach

Risk Mitigation Stepped Approach



Characterization and Treatability Studies

UNDERSTAND THE CHALLENGE

Pilot System Demonstration

TEST THE TECHNOLOGY APPROACH

Full-Scale Permanent System Design/Installation

IMPLEMENT THE SOLUTION

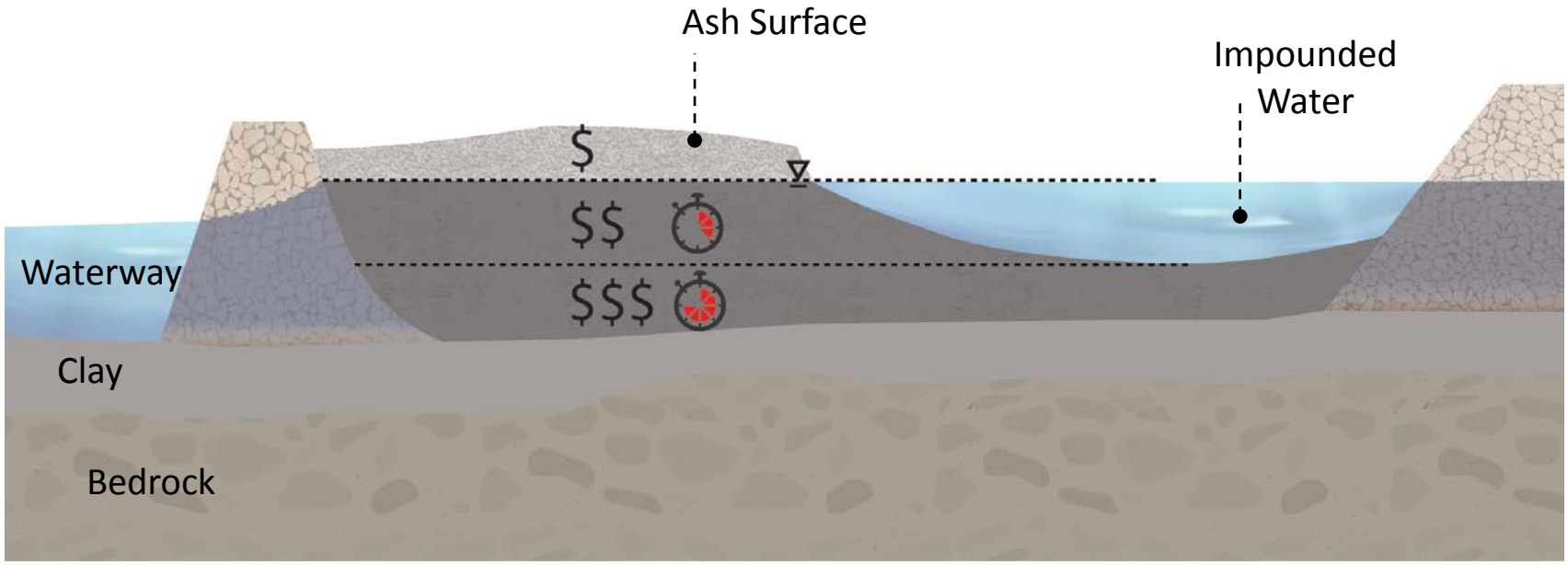
CCR Pond Closure Options

Closure-in-Place
(Cap & Close)

Closure-by-Removal
(Clean Close)

Dewatering + Water Treatment

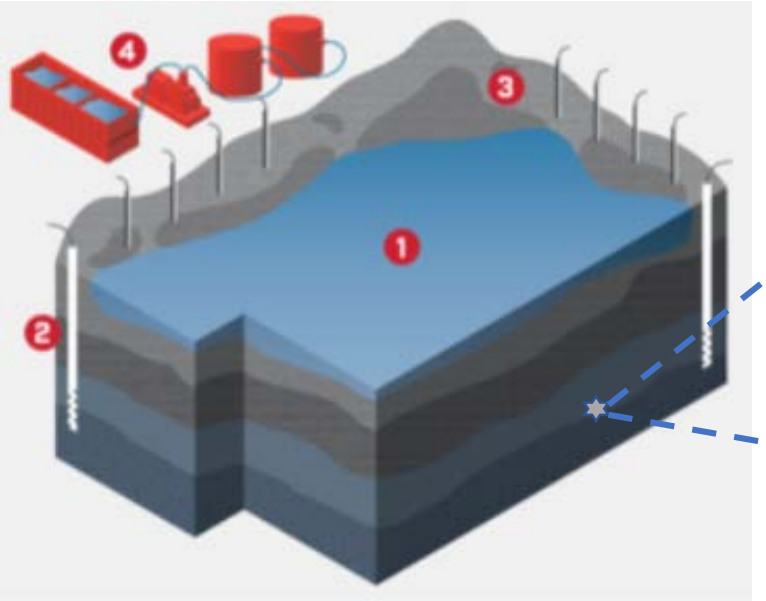
CCR Pond Closure Cost of Removal Pyramid

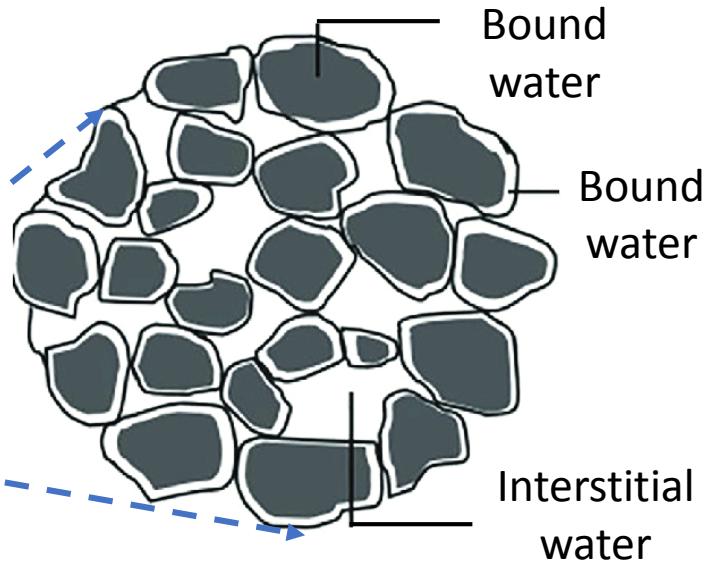


CCR Pond Closure Safety

Safety First, Unstable Surfaces = Unsafe Conditions

CCR Ash Dewatering – Traditional Way





① Pump & treat free surface water

② Deep wells, or well points

③ Shallow wickpoints to drain ash

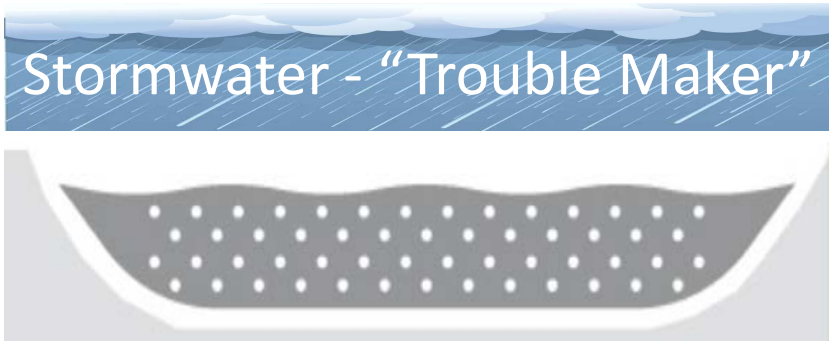
④ Water treatment

Challenges:

1. Dewatering efficiency ↓↓↓ over time
2. Deep bed dewatering performance ???
3. Complex process – hundreds of well points
4. Prolonged schedule of completion

CCR Ash Dewatering – Traditional Way

Cont.



UCC Dewatering Approach

Patent Pending

Dredging Ash Slurry → **Scalping** → **Thickening** → **Dewatering**

Ash

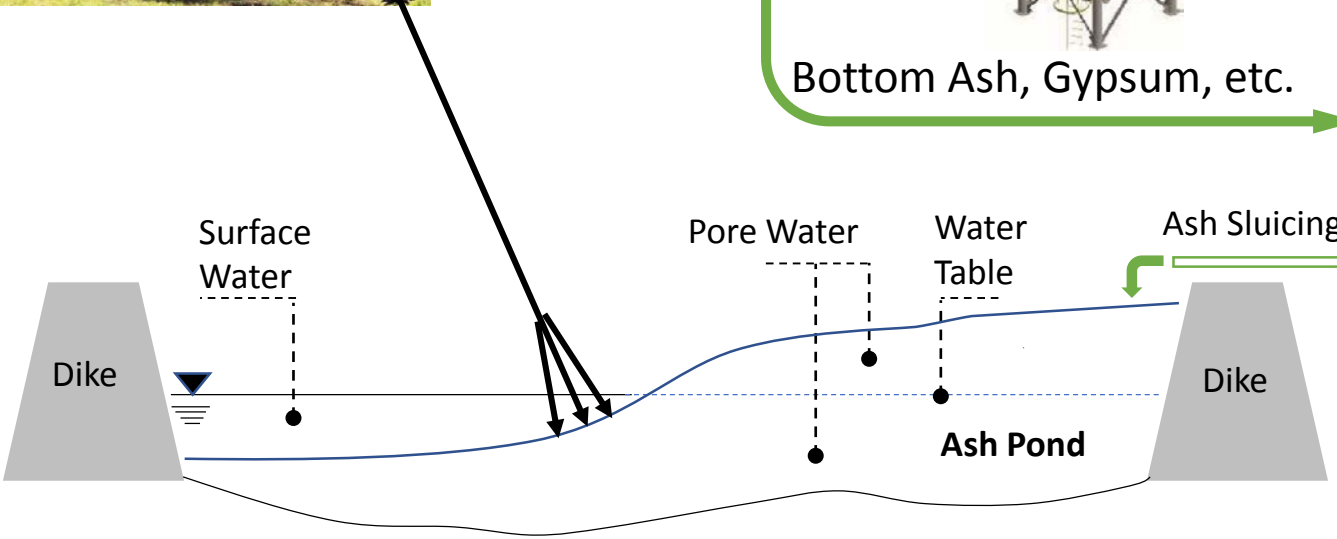
Bottom Ash, Gypsum etc.

Ash

Ash

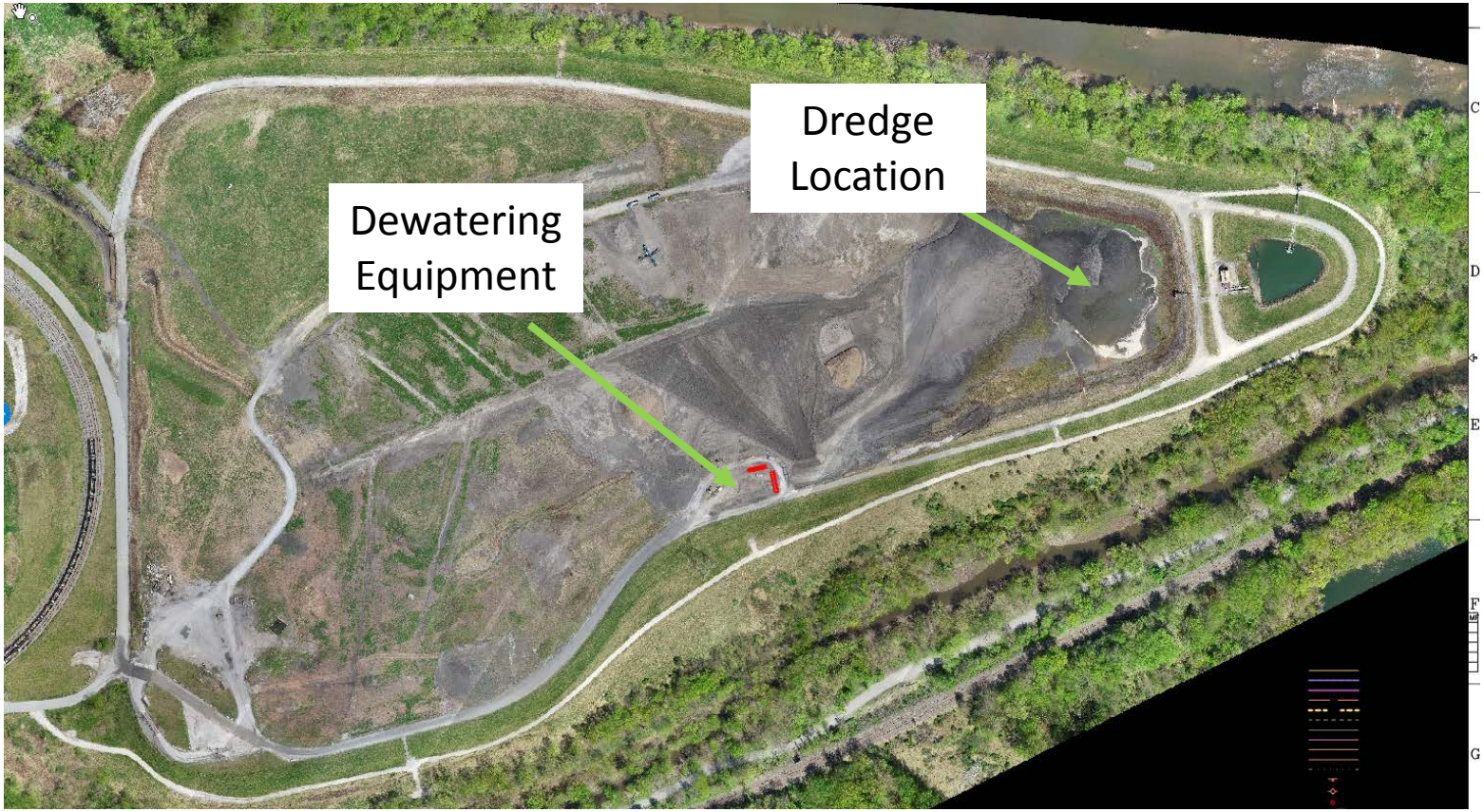
Bottom Ash, Gypsum, etc.

Ash

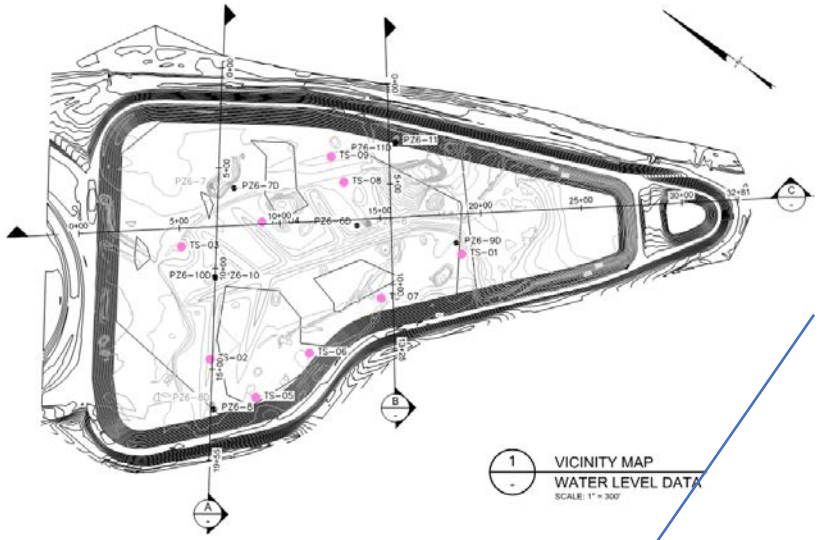


Product passing paint filter test or other requirements

Dewatering Plant Location



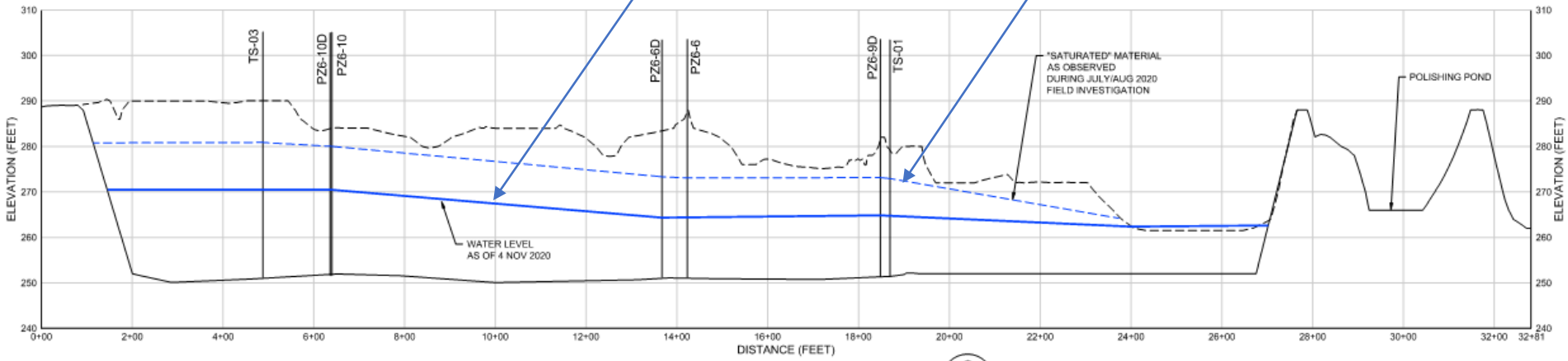
Water Level and Saturated Ash Level



1 VICINITY MAP
WATER LEVEL DATA
SCALE: 1" = 300'

Water Level

Saturated Ash Level



C SECTION
WATER LEVEL DATA
SCALE: HOR. 1" = 150'
VER. 1" = 100'

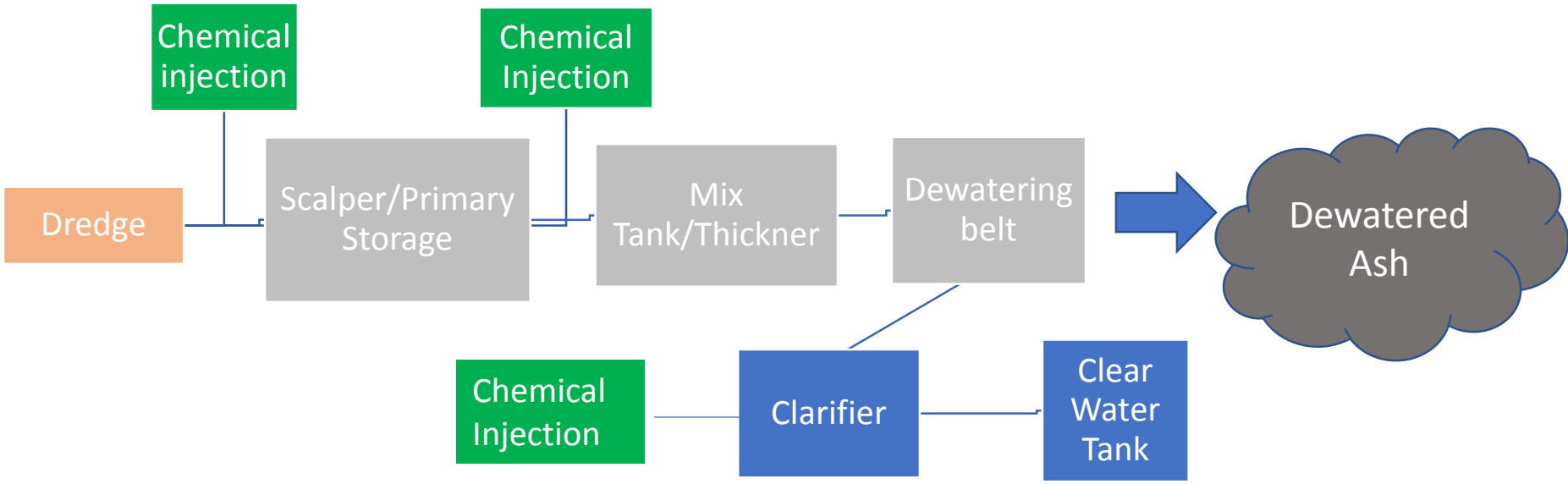
Amphibious Equipment

Material Handling Equipment

Dredge Head

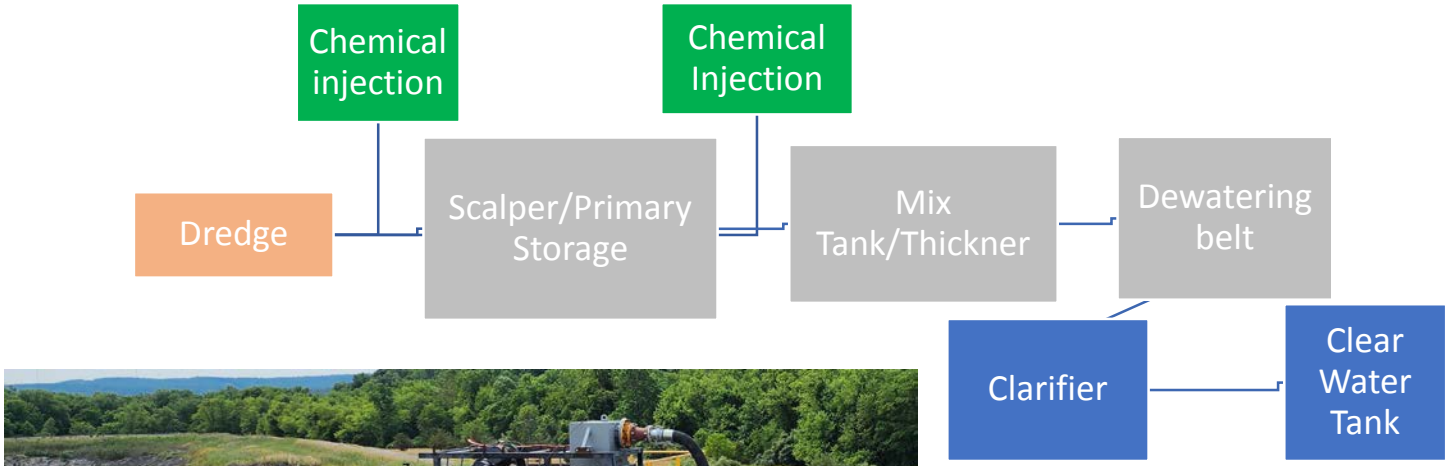
- Capable of 20-60% solids pumping
- Approx. 1000gpm
- More flexible and mobile than traditional floating dredge

Dewatering Process Flow Diagram



Mobile Dewatering Equipment Overview

Pictorial Walkthrough of Dewatering Equipment



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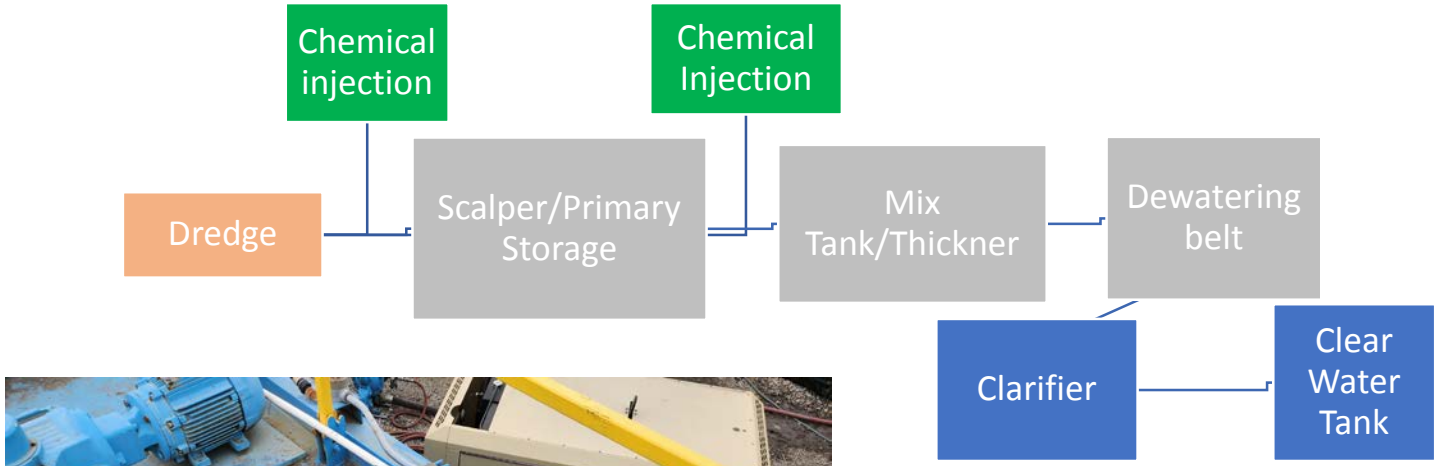

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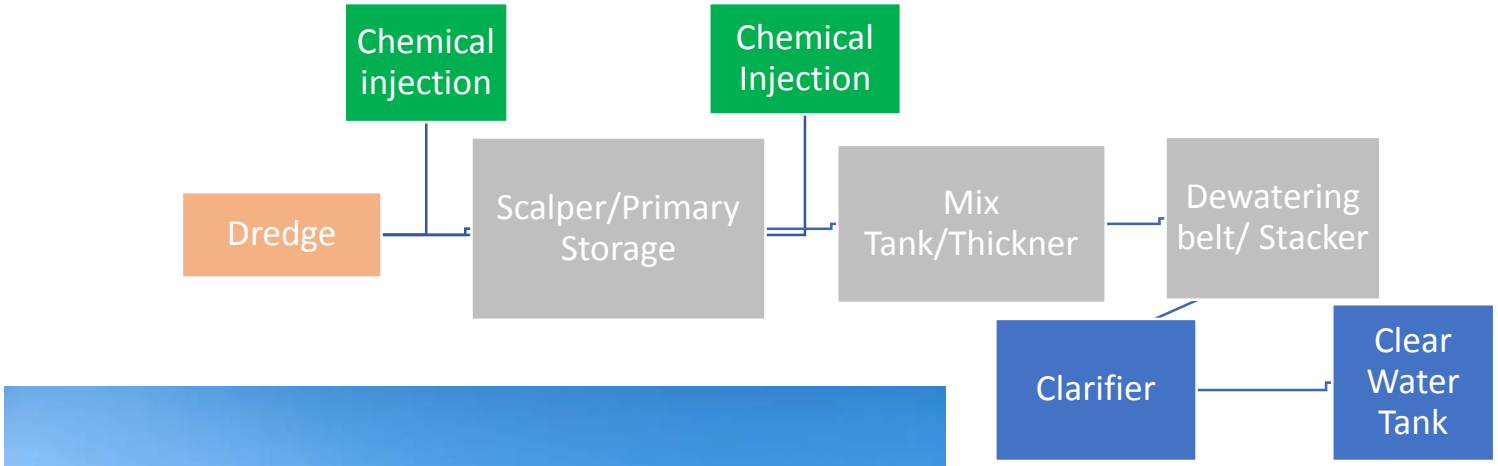

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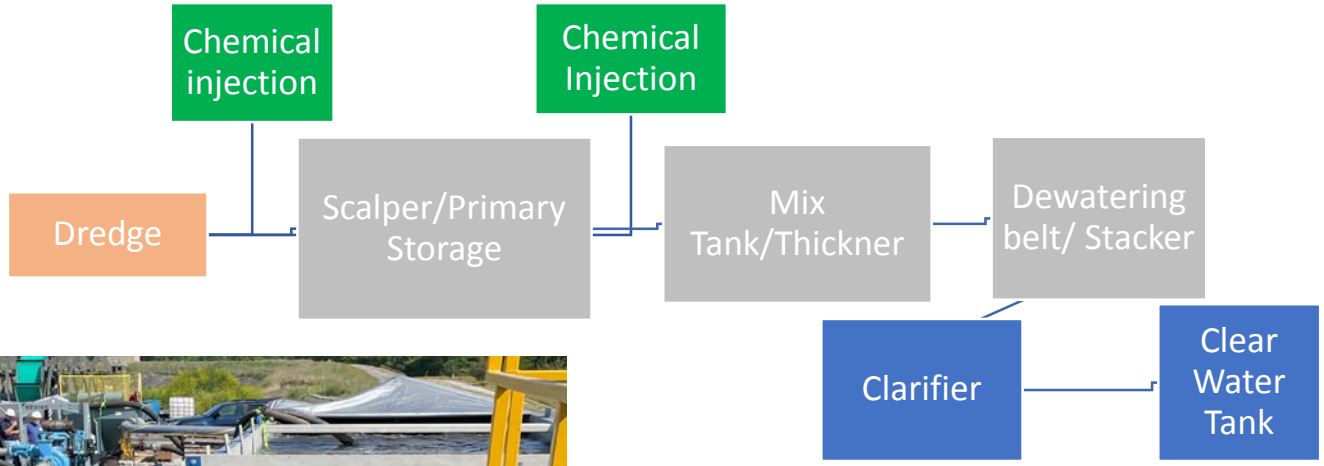

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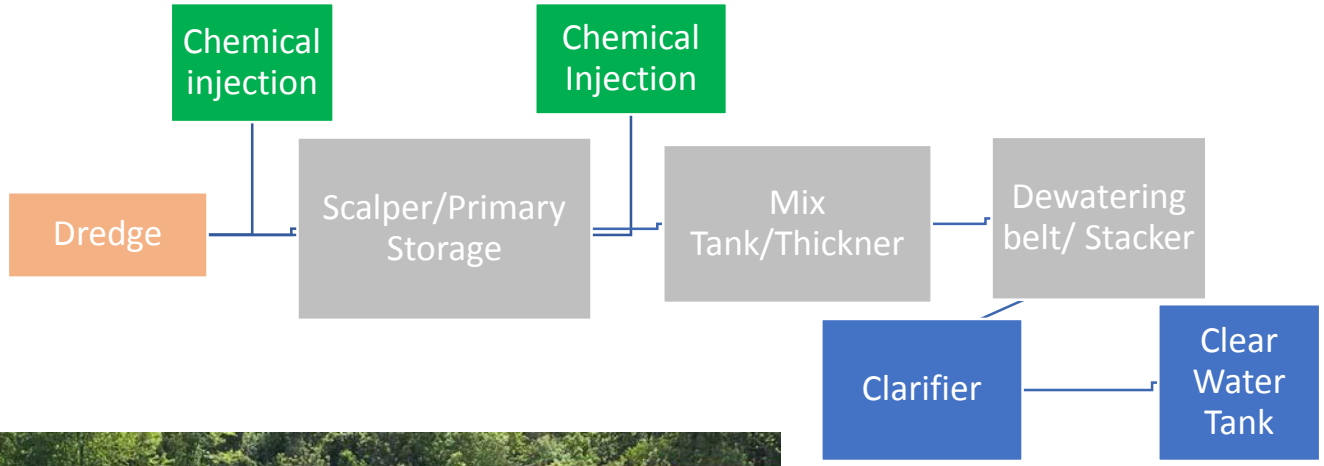

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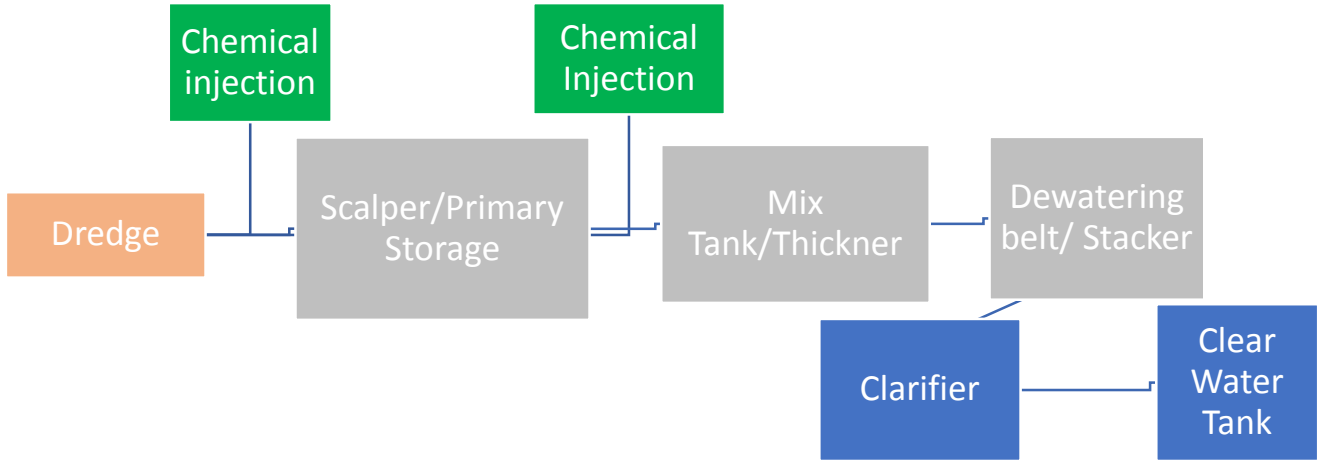
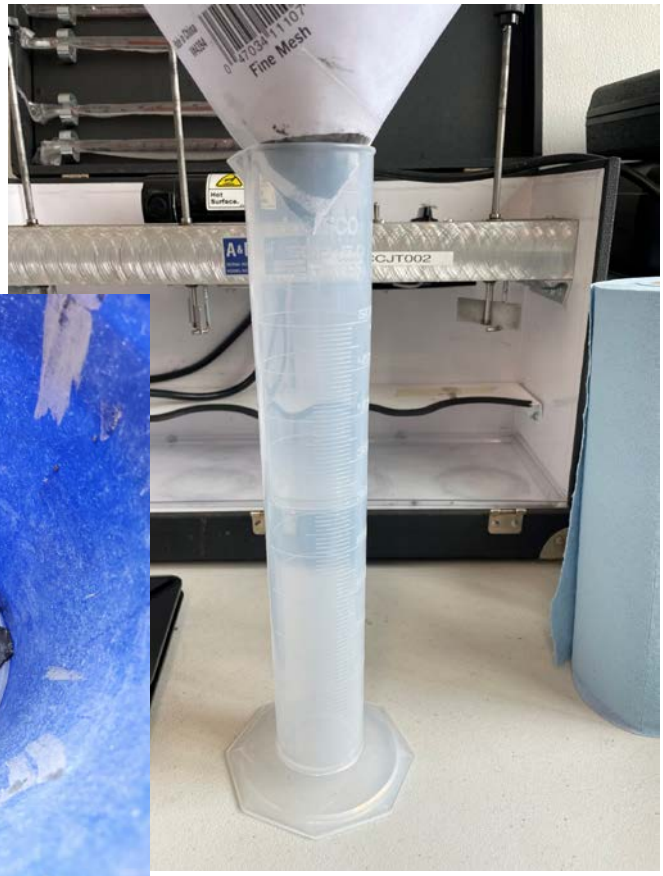


Dewatered Material Results

Lab Results

- 100% success passing EPA 9095B Paint filter test
- Percent moisture on dewatered material allowed for direct transfer to belt and/or truck
- Mobile equipment averaged 18-22TPH
- Clarifier treating filtrate for clear water process re-use and fines removal
    - Clarifier discharge average turbidity 15-20ntu



Lessons Learned

- Chemistry is king
  - » Getting the chemistry correct is directly related to ability to dewater and settle solids
- Optimization of the dewatering belt is not set it and forget it
- VFD motors on mix tanks would allow for more controlled mixing
- Thickeners vs Mix tank discussion
  - » Dredge flow and solids percentage directly influence need for thickener vs mix tank

Lessons Learned

CCR Materials Dewatering

Prior to Tuning

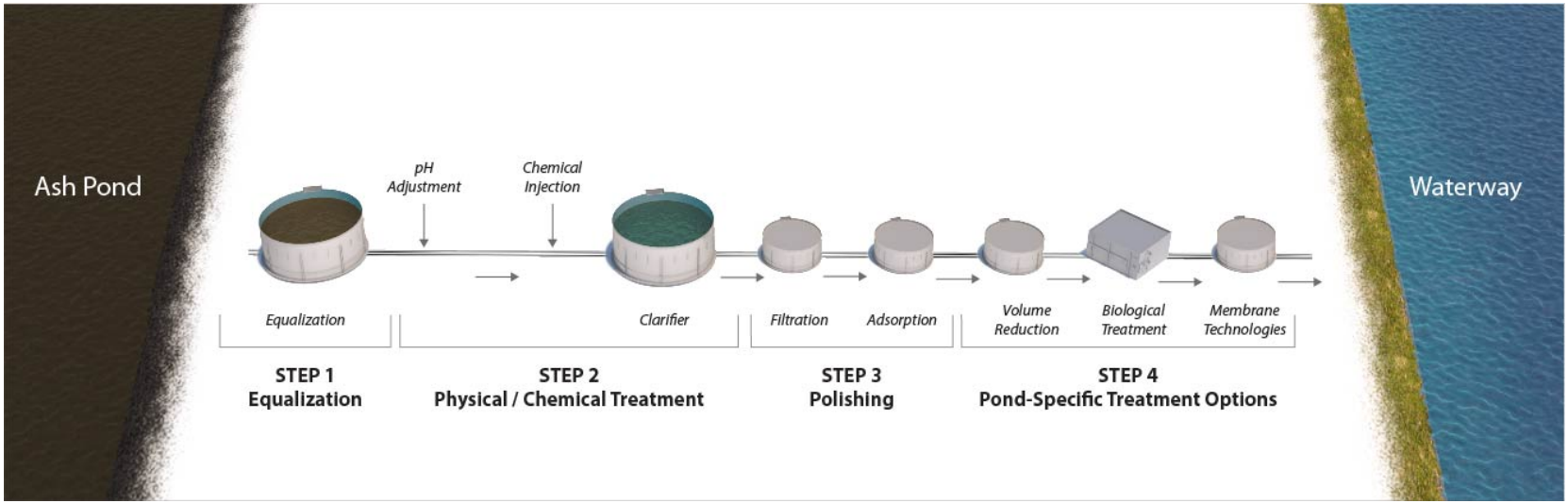
After Tuning

Advantages of Direct Dewatering on Ponds

- **Safe**
  - Only dredge contacts ash pond
- **Flexible**
  - Works on multiple materials i.e. Ash, Gypsum, water treatment sludge, etc.
- **Efficient**
  - Instant-On: Ash removal & dewatering at ONE time
  - Not Batch Operation: Continuous production and treatment
  - Not a Guess Game: See DRY ash cake after dewatering
- **Cost Effective**
  - Less # of operators
  - Shorter completion schedule
- **Proven Concept**
  - Lake restoration, dredge mining, etc
  - Site-specific design of dewatering equipment
- **Scalable and Mobile/Temporary**
  - Mobile/Temporary options for short term areas of concern
  - Full scale “permanent” installation with 100-300+TPH trains (multi train system designs available)

CCR Surface Impoundment Remediation

Challenge



- UCC Environmental offers a full complement of wastewater treatment technologies
- As each project has unique and changing influent wastewater characteristics, a customized approach to the design is required, and UCC will deploy and integrate the required technologies to meet the owner's treatment and financial goals.

Reference Highlights

CCR Surface Impoundment Wastewater Treatment Case Study

PROJECT OVERVIEW

- Southeast USA, Closed Coal Fired Plant
- Year Executed: 2021-2030 (9 Year Contract)
- Solution Type: Design and Operations (with Consumables) of CCR Pond Closure Wastewater Treatment Systems

CUSTOMER CHALLENGE

The turnkey general contractor required wastewater treatment expertise to assist in the closure of three CCR ponds. An existing, but mothballed system required improvements and start-up services and new wastewater treatment systems to treat TSS and arsenic were required for the two additional CCR ponds.

SOLUTION

UCC mobilized five full-time on-site resources to analyze the existing system, design and implement improvements, start-up, and provide operational and maintenance support for the nine-year duration of the effort. UCC managed all consumable purchases, lab testing subcontracts, and compliance reporting.

RESULTS

In less than 30 days, UCC submitted official plans and mobilized. The system was successfully improved and commissioned. To date, there have been no treatment compliance issues. As of May 31st, approximately 90,000,000 gallons have been treated and discharged.

SCOPE OF WORK

- Total process design
- Design & engineering
- Rental equipment supply
- Project management
- Construction & installation
- Supply of chemicals and other consumables
- Startup & commissioning
- Operation & maintenance
- On and off-Site lab testing and reporting management

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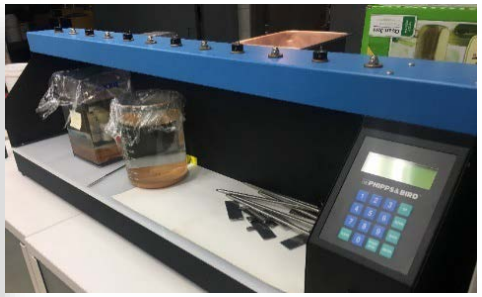
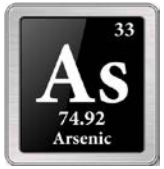
Questions

Treatability Testing – Project Specific



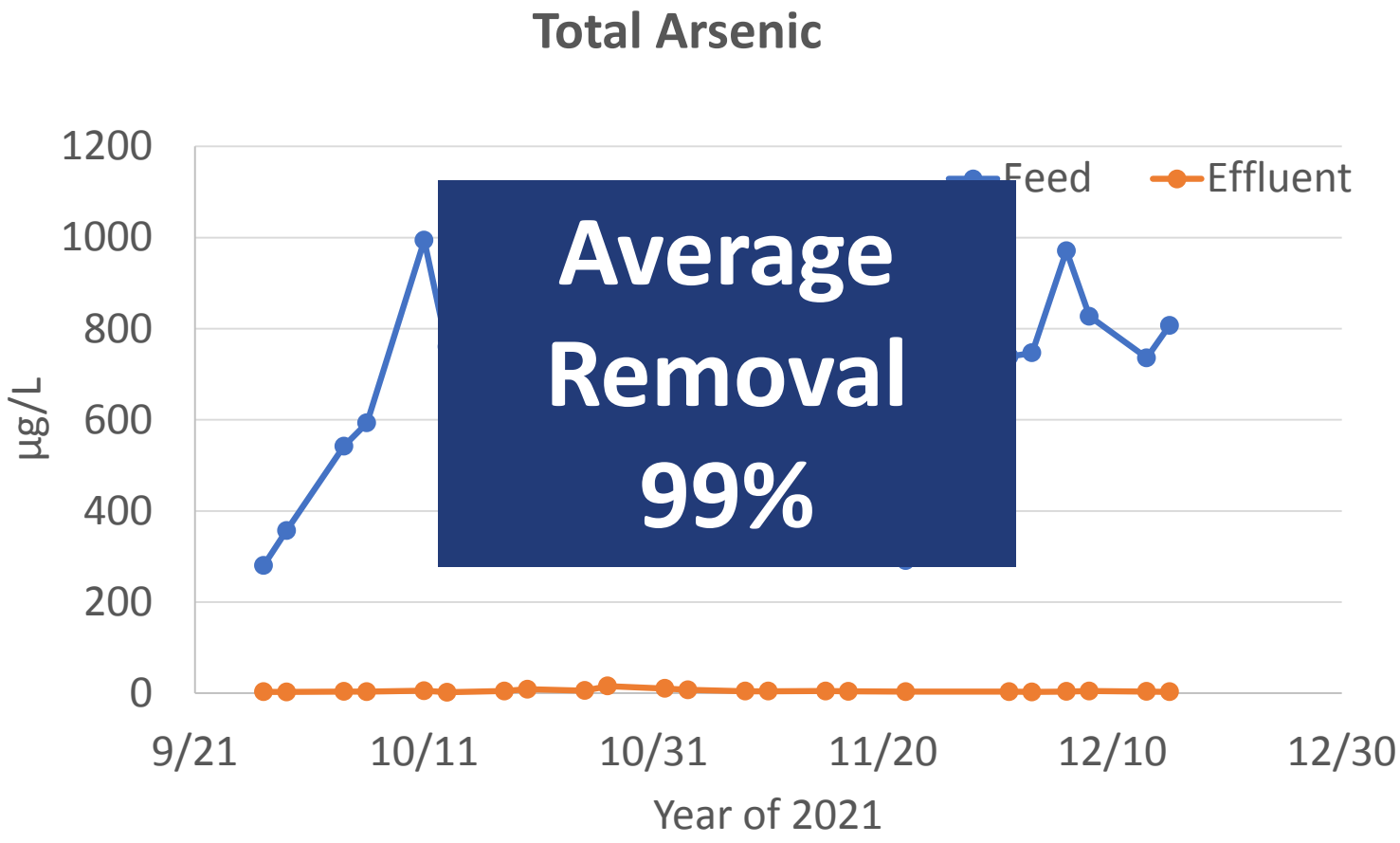
Example: 

Removal

Treatment Step	Removal %
pH adjustment, Coagulation, Clarification	80% ± 10%
Filtration	30% ± 10%
Activated Alumina Adsorption	95% ± 5%

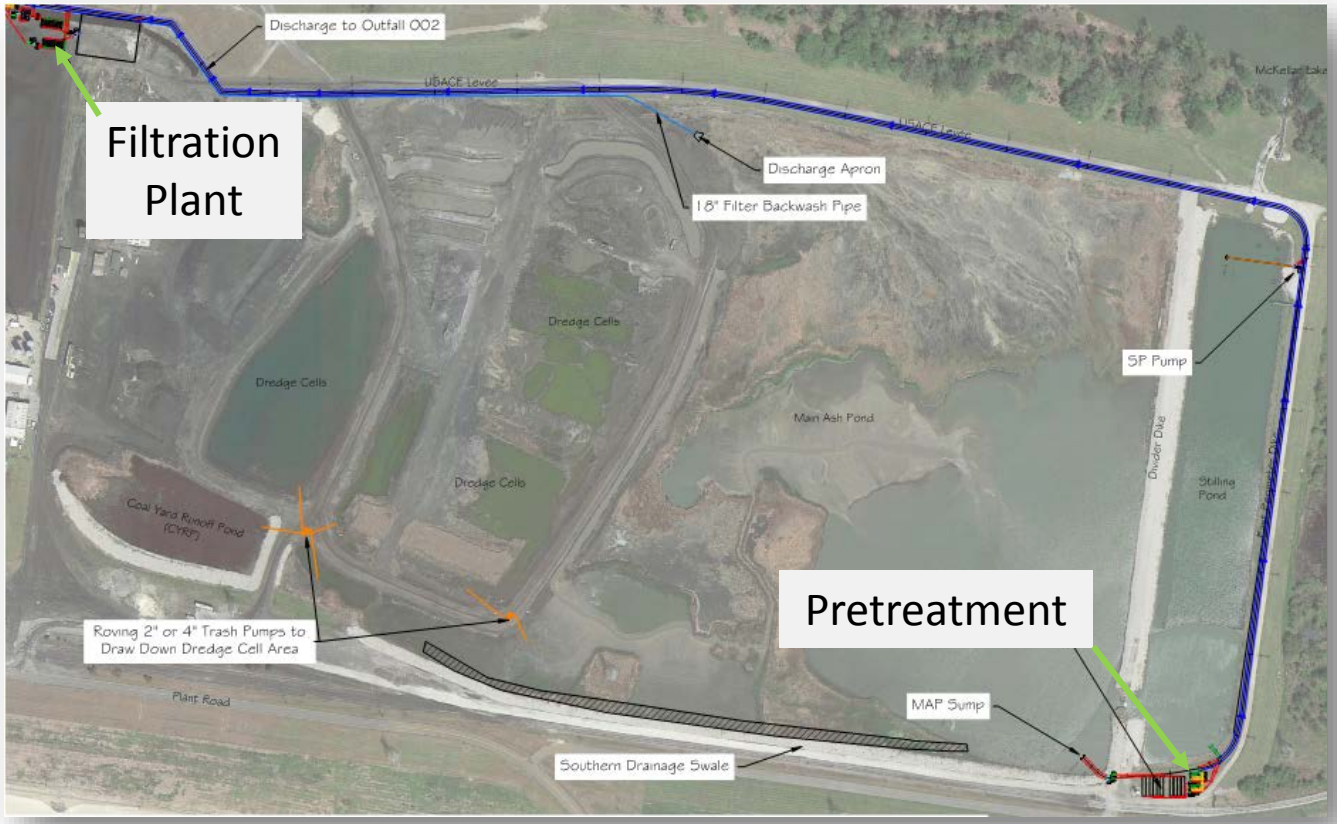
>98% Arsenic Removal Anticipated for WTS

Results



Improvement Thoughts (1)

Decentralized vs. Centralized Treatment



- Existing de-centralized operations are miles apart
- Safety concern arises if single person is stationed on either location

Results