Presentation
to the

Upper Mississippi River Basin Environmental Management Program Workshop

by

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Engineering Design Handbook

Water Level Management

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Agenda

- Resource Problem
- Backwater Lakes, MSMUs, Green Tree Reservoirs
- Perimeter Levees, Cross Dikes and Overflow Spillways
- Pumps and Wells
- Water Control Structures
- Questions?

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Resource Problem

- UMRS characterized by seasonal flood and drought conditions.
- Navigation system has impacted these natural conditions (low river stages eliminated).
- Large water level management in pools (draw downs) not discussed in this chapter
- Smaller drawdown (backwater areas) are covered.

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History…

- Prior to navigation system, backwater lakes would dry during drought season.
- Drying would encourage growth of emergent aquatic plants.
- Plants provide food, shelter, dissolved oxygen to wildlife.
- Water level control provides temporary seasonal increase or decrease to mimic natural hydrologic regimes over large areas.

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Goals & Objectives

GOALS

- Enhance wetland habitat for migratory waterfowl
- Enhance aquatic habitat

OBJECTIVES

- Increase reliable food source and resting area
- Provide water level control

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The NAMES

- A rose is a rose….
  - Unless it is a backwater lake
- For purposes of the Design Handbook:
  - Backwater Lakes
  - Moist Soil Management Units
  - Green Tree Reservoirs

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Backwater Lakes

- Lakes which generally still exist, but are not operating to create fullest habitat benefits.
- Development, navigation, siltation may have all impacted lakes.

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MSMU

- **Moist soil management units are generally constructed.**
- **Similar to backwater lake, other than they may not have been a lake immediately prior to construction.**
- **Levees containing the area.**
- *Blurry distinction between backwater lakes and MSMUs.*

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Green Tree Reservoirs

- Forested bottomland temporarily flooded though the winter to attract ducks.
- Holds water while trees are dormant.

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Green Tree Reservoir Requirements

- Need dominance of hardwood trees 40 years old.
- 10 acre minimum
- Flat area (flood 1 to 18 inches)
- Soils hold water
- Adequate water supply
- Close proximity to traditional waterfowl wintering grounds and flight paths
- 3 foot deep water table during growing season

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Operation

- Applies to all types of water level management systems (see exceptions for GTR later)
  - Managed for annual drawdown
  - Keep water out in late spring and summer
  - Flood the area in the fall

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Management Plan

Typical Water Level Annual Management Plan		
Month	**Action**	**Purpose**
April to July	Dewater area	Expose and maintain mudflats to allow revegetation
August to November	Gradually increase water levels to correspond with growth of marsh plant community	Provide access to food plants for migratory waterfowl
December to April	Maintain water levels to maximum extent possible and then release water late during early spring	Maintain winter furbearer habitat and then prepare for aquatic plant germination through gradual water release

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Management Plan GTR

- MAKE SURE IT VARIES
- Flood before leaves turn color in fall (vary one month)
- Dewater before new leaves appear in spring (vary three months)
- Leave unflooded one out of every 6-8 years
- Change flooding depths year to year and within season
- Flood an dewater slowly
- Timber Management

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Design Features

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Design Features

- Water containment
  - Perimeter levees
  - Cross dikes
  - Overflow spillways
- Water supply
  - River water (Pump station)
  - Groundwater (Well)
- Water control structures
  - Maintain desired water elevations throughout the year.
  - Varied Designs.

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Water Containment

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Perimeter Levees, Cross Dikes, and Overflow Spillways (Levees…)

- General Design Criteria
  - Construct reliable levee
  - Provide adequate flood protection to meet management goals
  - Locate borrow sites in areas which would improve habitat
- Prevent interior sedimentation
- Protect against loss of water control during floods)

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Levees…

- Next to major river?
  - Consider sloping to allow for gradual overtopping during floods
- Top widths?
  - Wide enough for access
- Slopes?
  - Reduce erosion
  - Reduce rodent problems

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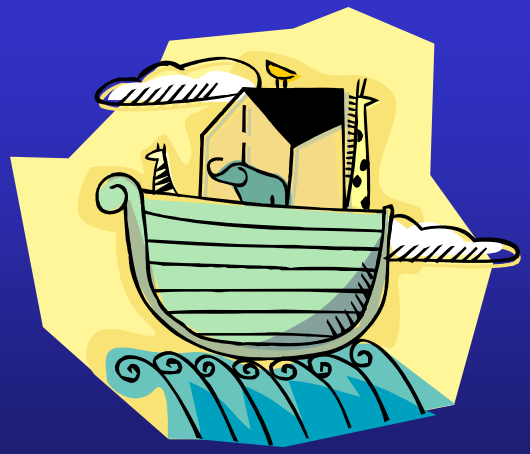
Levees…

- Height
  - (Perimeter) Compare level of protection (flood elevation) to cost and benefits of that protection.
  - Cross Dikes: Provide freeboard above ponding depth.



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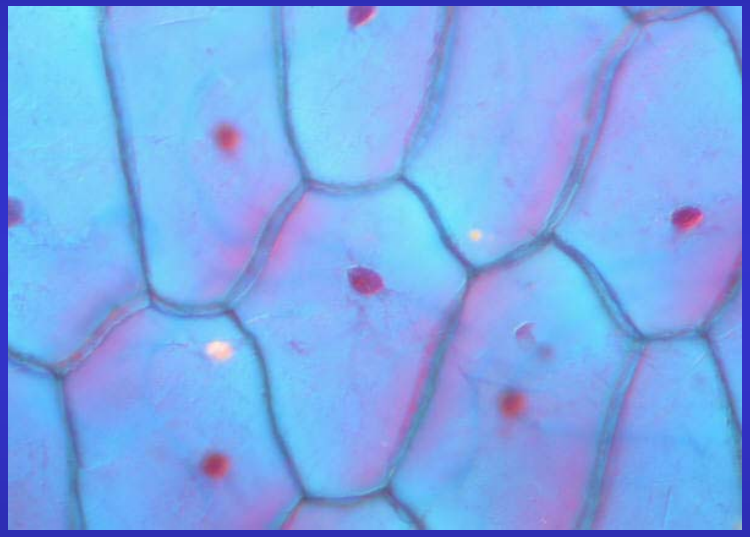
Levees…

- Cells
  - Single cell
    - ♦ Good for flat terrain
  - Multiple cells
    - ♦ Management flexibility
    - ♦ Maximize ideal water depth for unleveled terrain



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Spillway

- Overflow spillways
  - Downstream end of site
  - Elevation lower than perimeter levee.
  - Provides overtopping at a lesser flood event.

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Levees… Borrow

- **Borrow**
  - On site material (if suitable).
  - Converts cropland to non-forested wetland.
  - Make large and shallow to increase benefits (potholes)

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Levees… Maintenance

- Inspections (annual or following flood events
- Look for:
  - Settlement, slough, or loss of section
  - Wave wash and scouring
  - Overtopping erosion
  - Inadequate vegetative cover
  - Unauthorized grazing or traffic
  - Encroachments
  - Unfavorable vegetative growth
  - Seepage Distress

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Water Source

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Pump Stations and Wells

- Several options to consider including:
  - Structure
  - Pump Direction
  - Fuel Source
  - Maintenance

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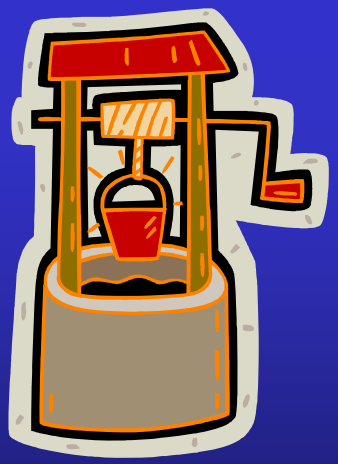
Pump vs. Well

- **Pump**
  - Uses surface water (desirable)
- **Well**
  - Limited capacity



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Electric Pumps

- Advantages
  - Quieter
  - Easier automation
  - Less routine maintenance
  - Submergible
  - Require less time to operate
- Disadvantages
  - Must be protected from flooding
  - Require available utility power
  - Larger structures required to house electrical equipment

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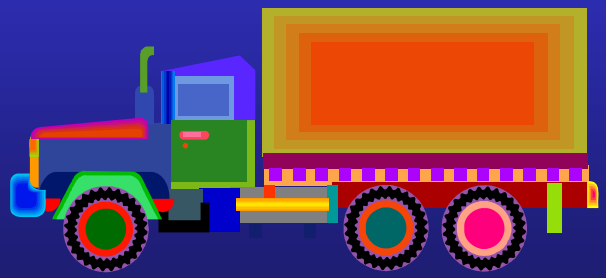
Diesel Pumps

- Advantages
  - Suited if utility power is unavailable
  - Trailer mounted to reduce threat of flooding
  - Flexible drive arrangements (direct, belt, hydraulic)
- Disadvantages
  - Noisy
  - Require more routine maintenance
  - Capacity and availability of on site fuel can be restrictive
  - Difficult to automate



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Pump Station Maintenance

- Inspections (annual and after flood event)
  - Structural Steel
  - Structural concrete
  - Displaced Missing Riprap
  - Electrical lighting/standby generator
  - Discharge pipe
  - Sump
  - Hydraulic Pump

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Water Control Structures

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Types of Water Control Structures

- Stoplog
- Sluice Gate
- Tainter Gate
- Overflow Weir
- Fuse Plug

Multiple Bay Concrete Stoplog Structure with Four 5’ Weirs

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Bay Island HREP
Pool 22

Single Bay Concrete Stoplog Structure with Two 5’ Weirs

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Princeton Refuge HREP
Pool 14

Single Bay Concrete Stoplog Structure with One 5’ Weir

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Spring Lake HREP
Pool 13

Concrete/CMP Stoplog Structure

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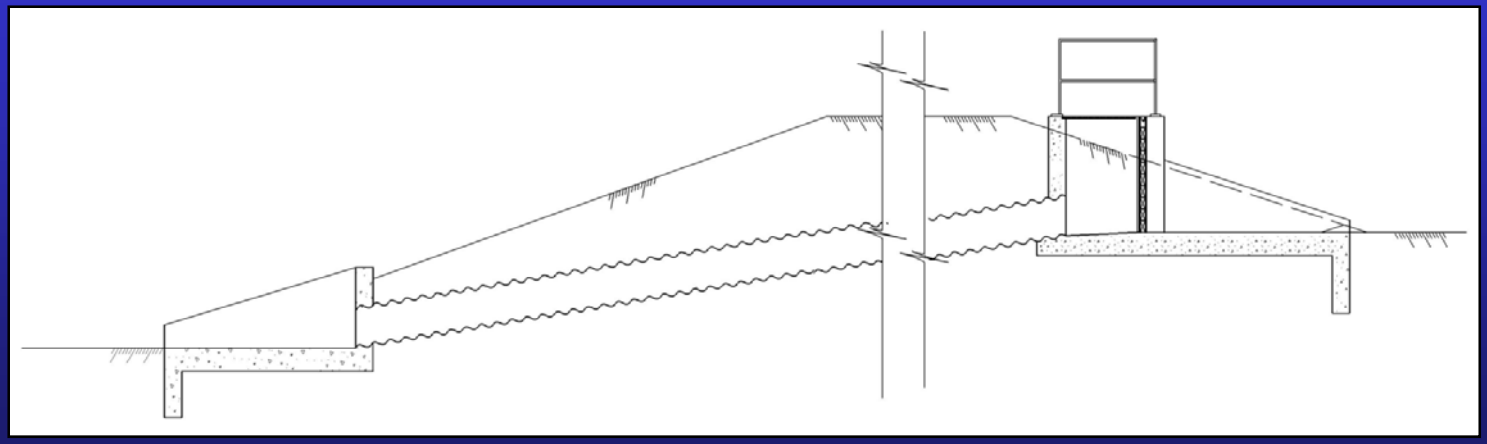
- Outlet

- Inlet

Potters Marsh HREP Pool 13



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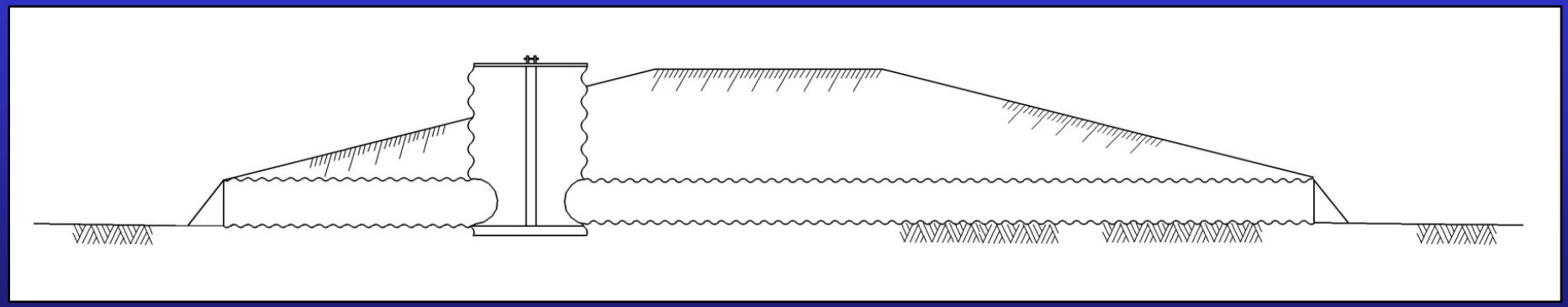
CMP Stoplog Structures



Banner Marsh HREP LaGrange Pool

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PVC Stoplog Structure

Agri Drain Inline Water Level Control Structure™

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Steel Stoplog Structure

Andalusia
Small
Boat
Harbor
Pool 16

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Maintenance Issues

- Sills, inlets, and outlets filling with sediment

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Maintenance Issues

- Degrading concrete or steel

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Maintenance Issues

- Erosion, seepage, encroachments occurring adjacent to the structure
- Displaced or missing riprap

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Maintenance Issues

- Trash and other debris accumulating around the structure

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Operational Issues

- Installation & Removal
- Stoplog Material
- Lifting Devices
- Storage
- Security
- Safety

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Installation & Removal

- Site managers prefer a one-person operation
- Difficult with:
  - high head
  - heavy stoplogs
  - bulky lifting device

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Installation & Removal

- Proper placement of stoplogs

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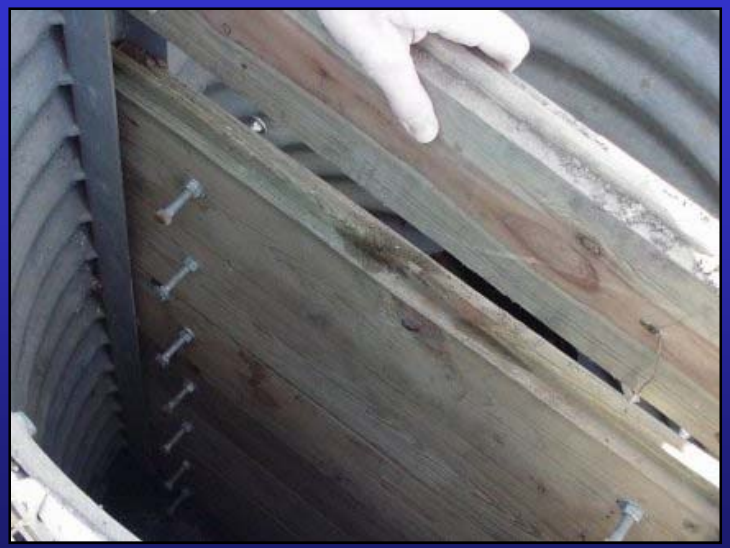
Stoplog Material

- Wood vs. Aluminum
  - weight
  - cost
  - durability



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Stoplog Material

- Effective seal with aluminum stoplogs

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Stoplog Material

- Effective seal with wood stoplogs

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Lifting Devices

- Transporting and handling

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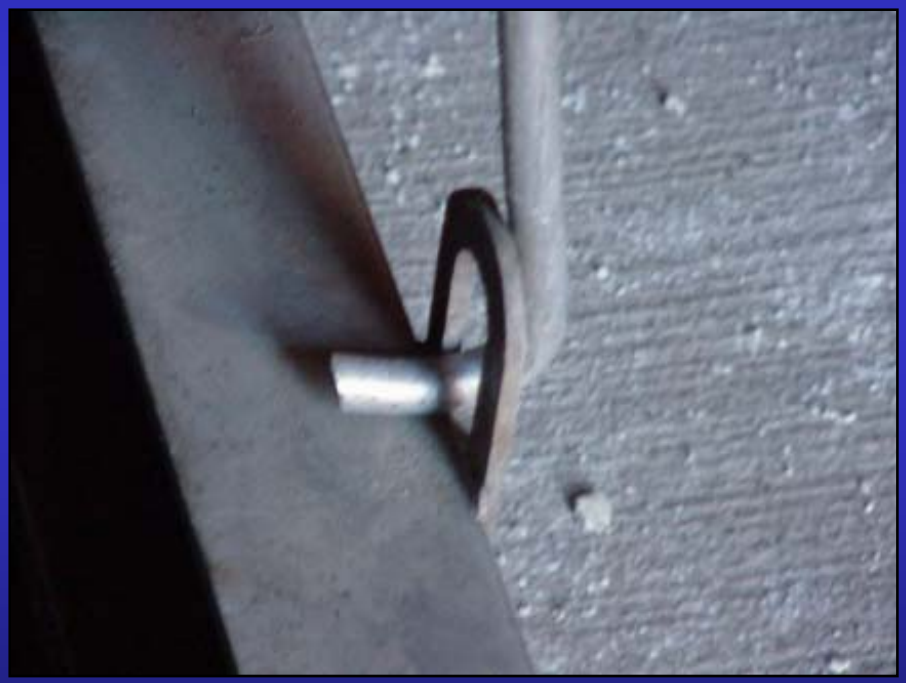
Lifting Devices

- Hooking stoplogs with high flows



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Lifting Devices

Spring Lake HREP Pool 13

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Lifting Devices

Princeton
Refuge HREP
Pool 14

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Storage

- On-Site
  - pump house
- Off-Site
  - maintenance shop

Princeton
Refuge HREP
Pool 14

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Storage

- Manual hoist with jib crane

Andalusia Refuge HREP Pool 16

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Security

- Vandalism
- Theft
- Unauthorized use

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Security

Spring Lake HREP Pool 13

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Safety

- Padlocks

- Inlet / outlet guards

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Safety

- Ladders

- Guardrails

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Questions for YOU

- How many people operate water level management unit?
- How close is the in field operation to that expected in the design?
- How is habitat responding?
- What are some of the best things built for you?
- What are some of the hardest things to operate or maintain?

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More Questions for YOU

- How does the facility respond to a flood or drought?
- Would you build another identical facility?
- What would you change?
- What other features in an water level management unit did we not mention?
- What features should we expand upon?
- Would the Chapter Description in the Design Handbook help a PDT start the design process?

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One Team: Relevant, Ready, Responsive and Reliable