

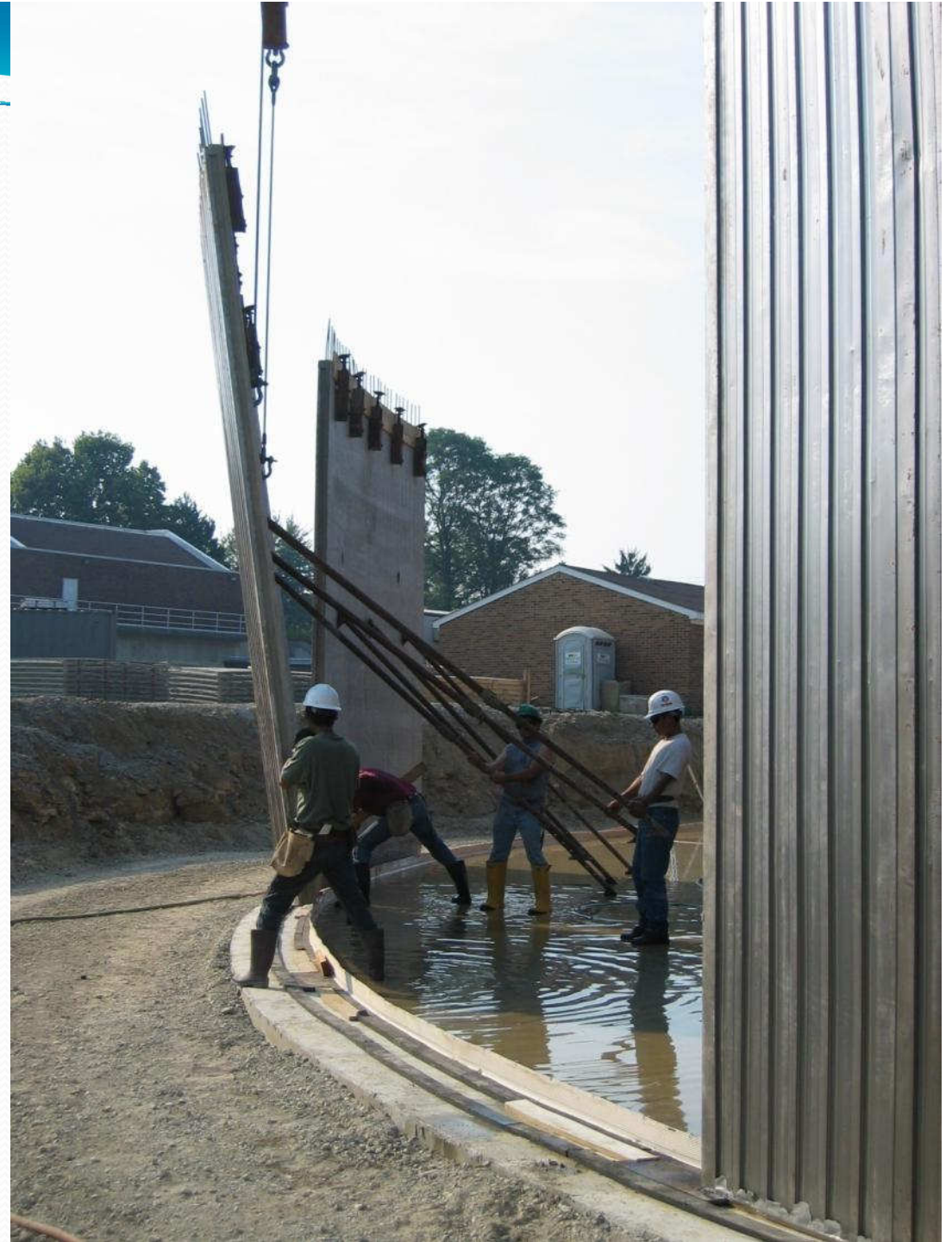


# *Erecting Wall & Dome Panels*





*Wall panels set on the  
flexible floor/wall  
connection*







# AWWA D110 Type III

- Free-Standing, Clear-Span Concrete Dome
  - ✓ Provides Long Term Durability
  - ✓ Eliminates Interior Support Columns





*Dome panels set on temporary shoring*



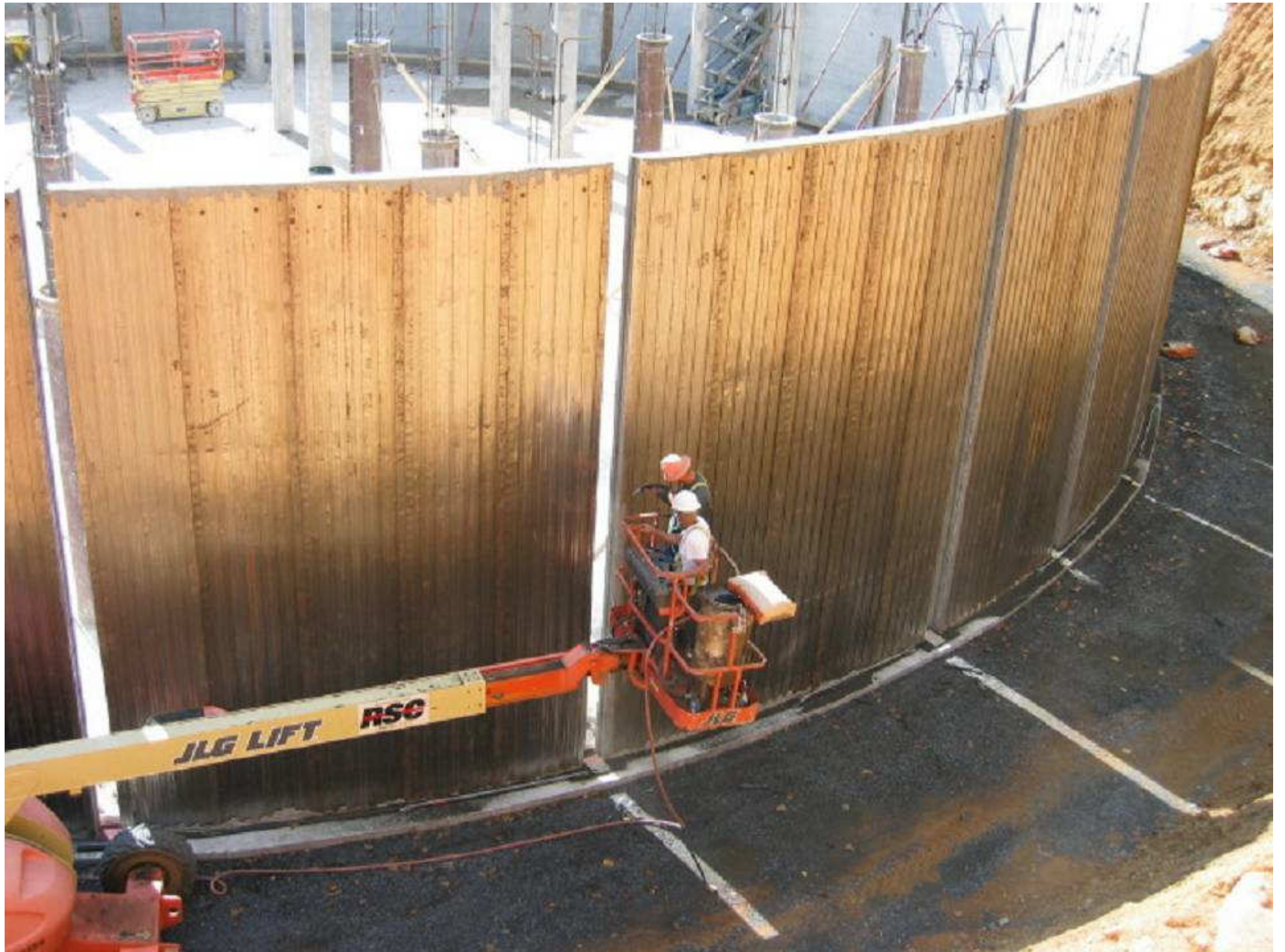








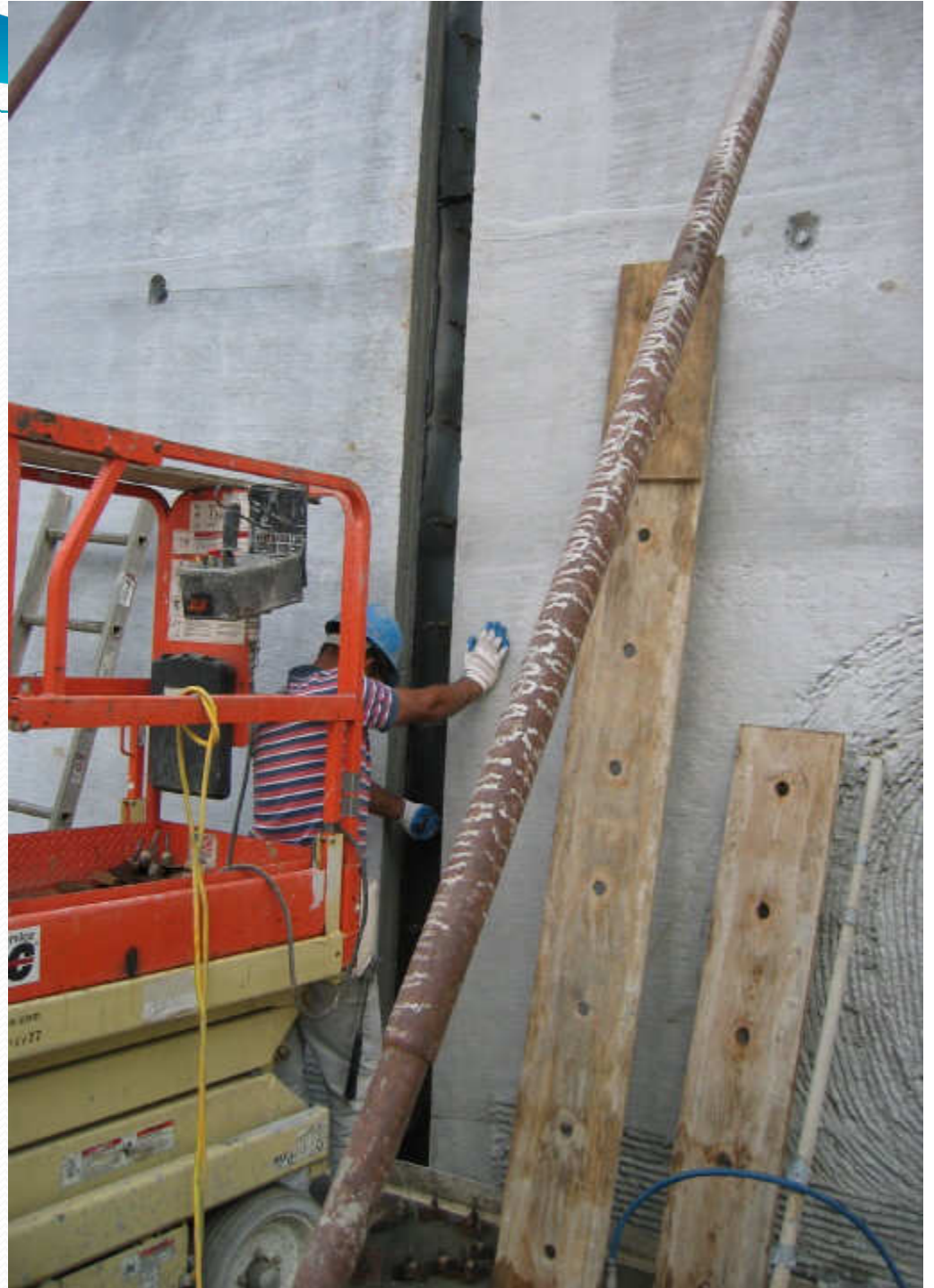




# 3



*Wall slot  
10 gauge Steel plate  
with threaded inserts  
installation*









# AWWA D110 Type III

- Flexible Floor/Wall Connection
  - ✓ Minimizes Vertical Bending Moments
  - ✓ Eliminates Tension Cracks



ROUGH BROOM  
FINISH

ANCHOR ROD AND  
THREADED INSERT

BASE PAD

SPONGE FILLER  
PAD

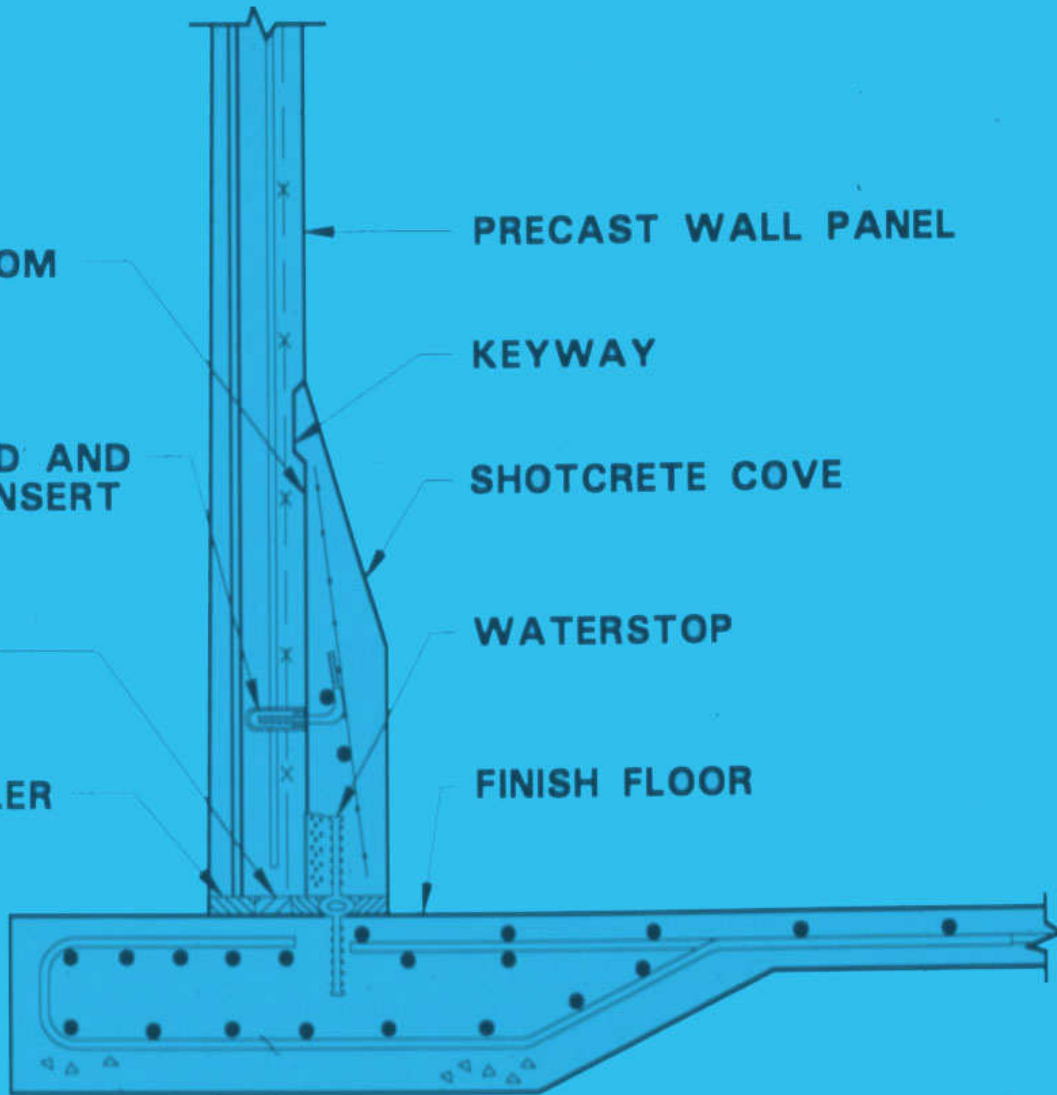
PRECAST WALL PANEL

KEYWAY

SHOTCRETE COVE

WATERSTOP

FINISH FLOOR



WALL/FLOOR CONNECTION





**DOME RING PRESTRESS  
WIRE AND SHOTCRETE  
COVER**

**DOME RING REINFORCING**

**ROUGH BROOM  
FINISH**

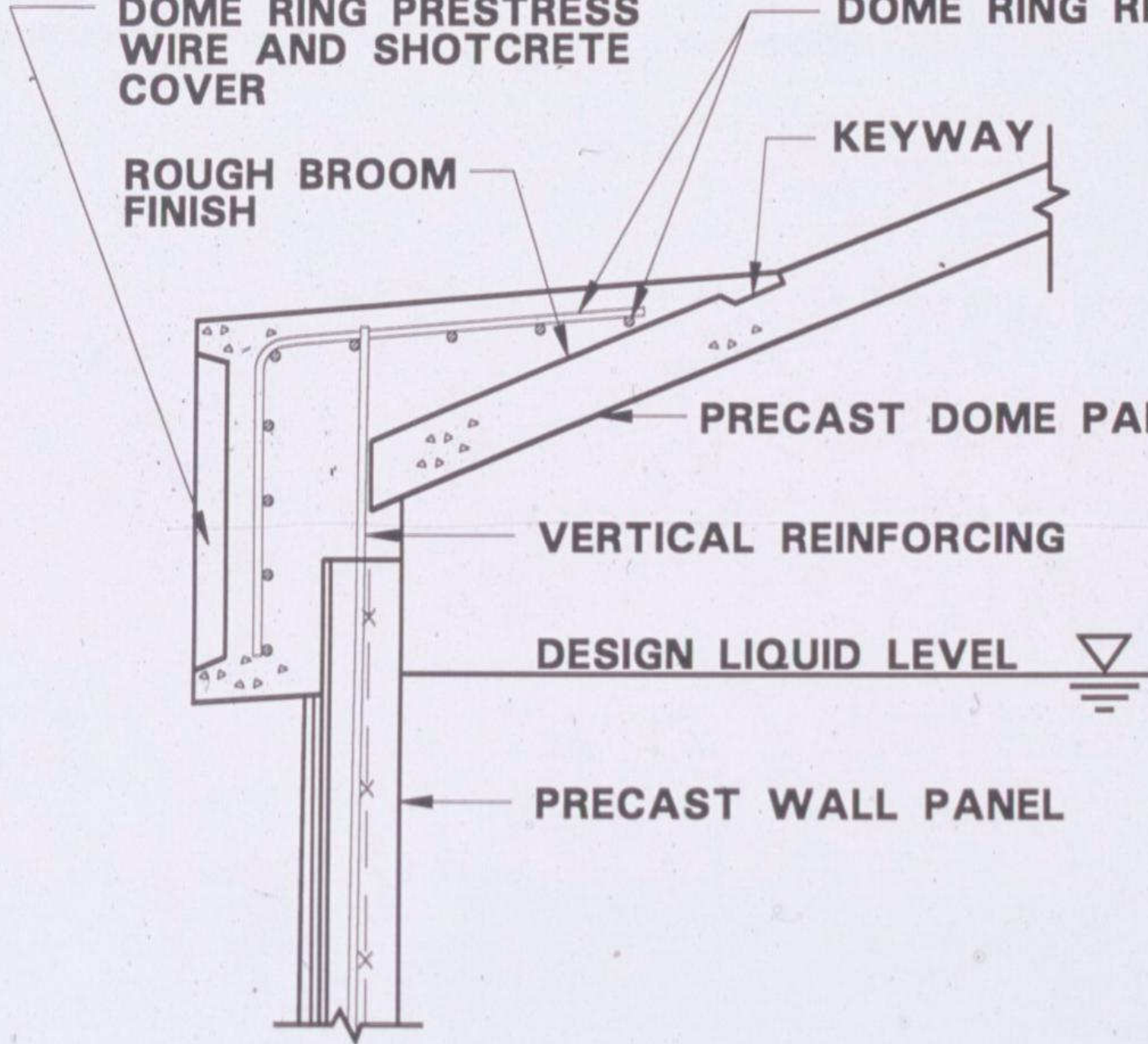
**KEYWAY**

**PRECAST DOME PANEL**

**VERTICAL REINFORCING**

**DESIGN LIQUID LEVEL**

**PRECAST WALL PANEL**











# AWWA D110 Type III

- **Wire-wound Prestressing**
  - ✓ Locks Tank Wall in Compression
  - ✓ Eliminates Tension in Wall

Wirewinding is the most time-proven, conservative method.

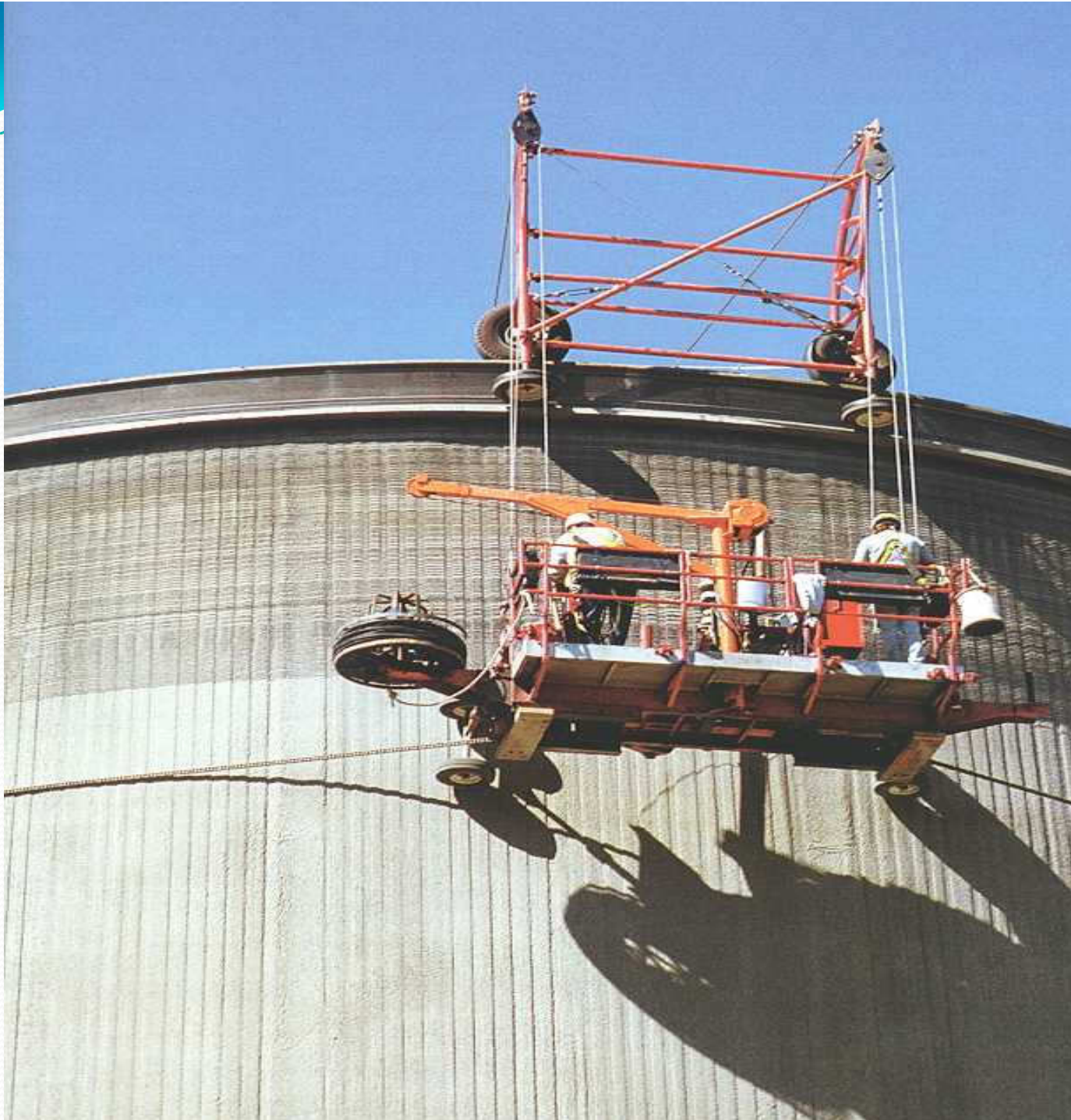




# *Prestressing Operation*









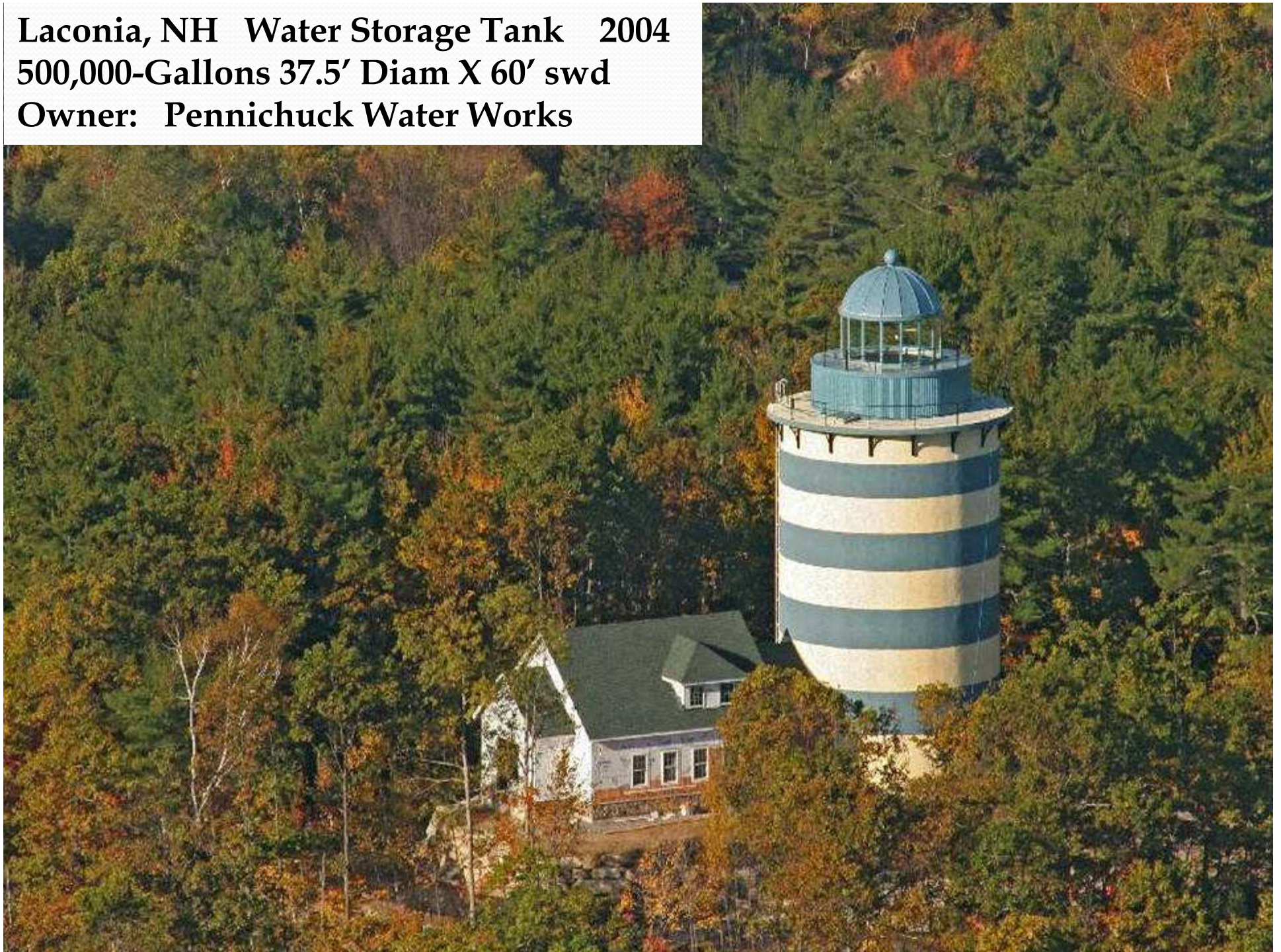
*Tank Completion*



# *Architectural Treatments*



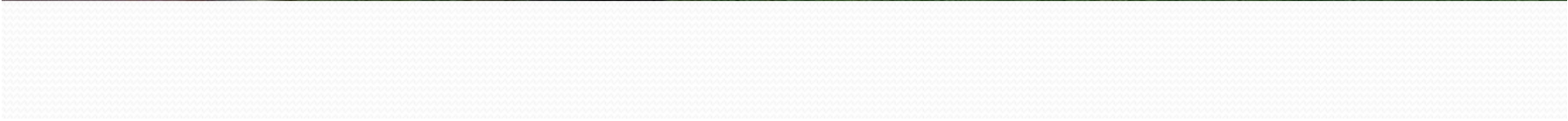
**Laconia, NH Water Storage Tank 2004**  
**500,000-Gallons 37.5' Diam X 60' swd**  
**Owner: Pennichuck Water Works**













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# Wastewater Tank Showcase





**Georgetown (Possum Run), OH**

**2011**

**800,000-Gallon EQ Baswin**

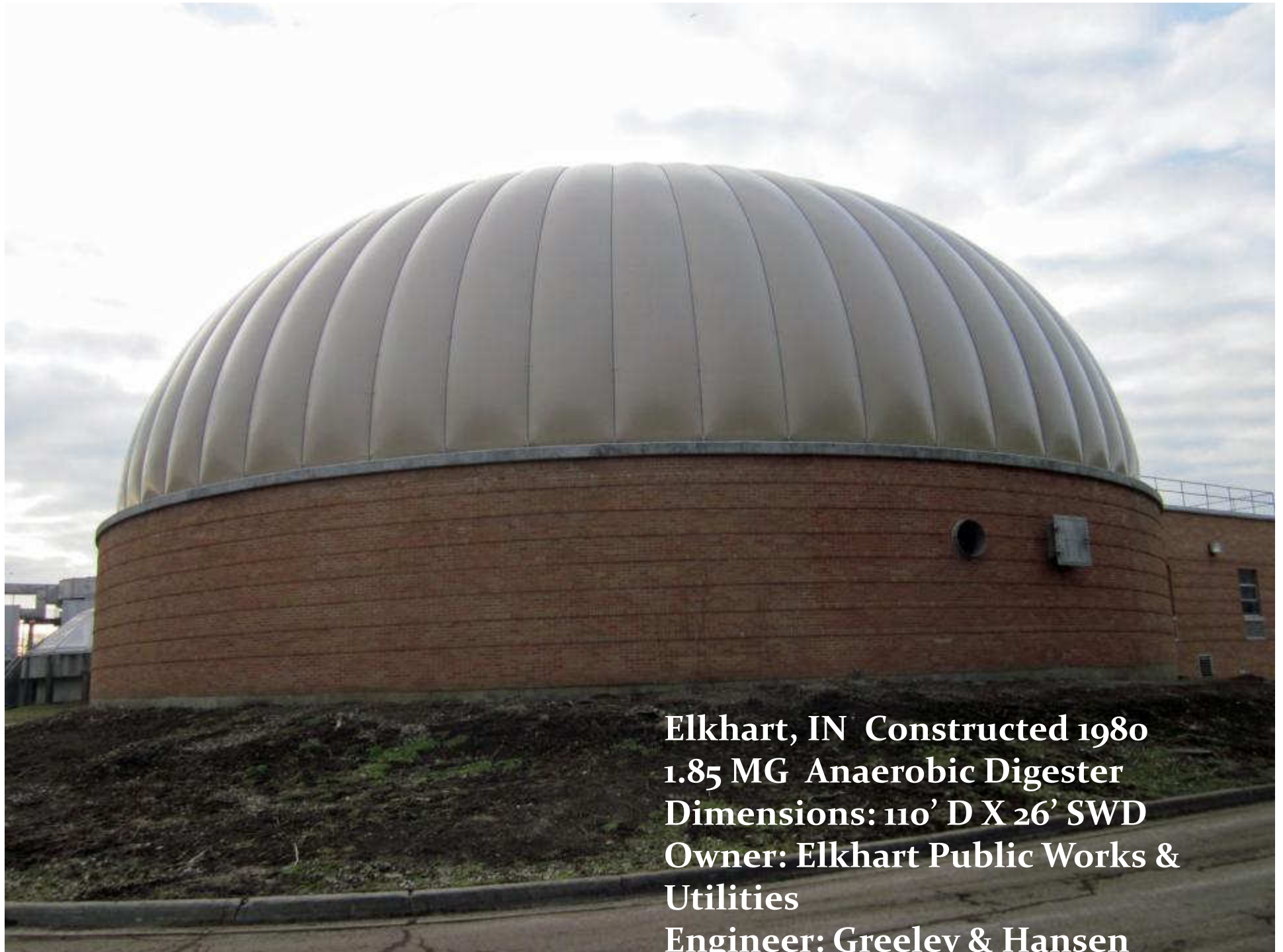
**70' D X 28' SWD**

**Owner: Village of Georgetown**

**Engineer: Jones & Henry**

**Georgetown (Town Run), OH - UNDER  
CONSTRUCTION in 2013  
2.0 MG EQ Storage Tank - 70' D X 28' SWD  
Owner: Village of Georgetown  
Engineer: Jones & Henry**





**Elkhart, IN Constructed 1980  
1.85 MG Anaerobic Digester  
Dimensions: 110' D X 26' SWD  
Owner: Elkhart Public Works &  
Utilities  
Engineer: Greeley & Hansen**



Indianapolis, IN

1.35MG E<sup>2</sup>

Basin







Dayton, OH Light 2.0110

# Clarifiers





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Akron Canton Airport  
Canton, OH

Two 0.75mg Glycol  
Storage Tanks





OH

Baldwin Plant

1.18MG Equalization  
Storage Tank





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COLUMBUS INTERNATIONAL  
AIRPORT, OH

TWO 4.0 MG GLYCOL  
STORAGE TANKS





PORTLAND INTERNATIONAL  
AIRPORT, OR

TWO 7.25 MG GLYCOL  
STORAGE TANKS

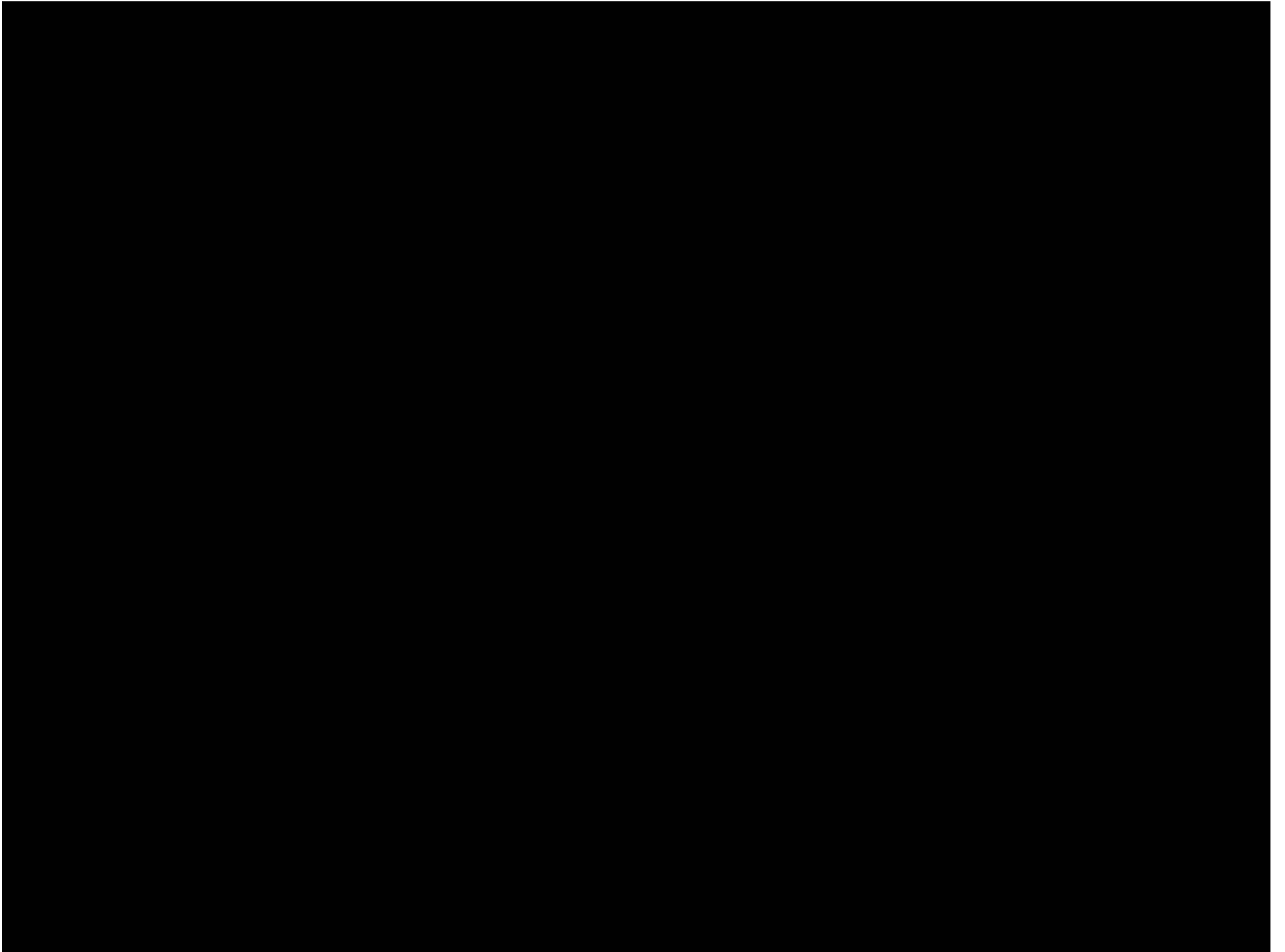




Roselle, IL  
Basin

2.83mg EC





# Inspection and Rehabilitation of Wastewater Tanks





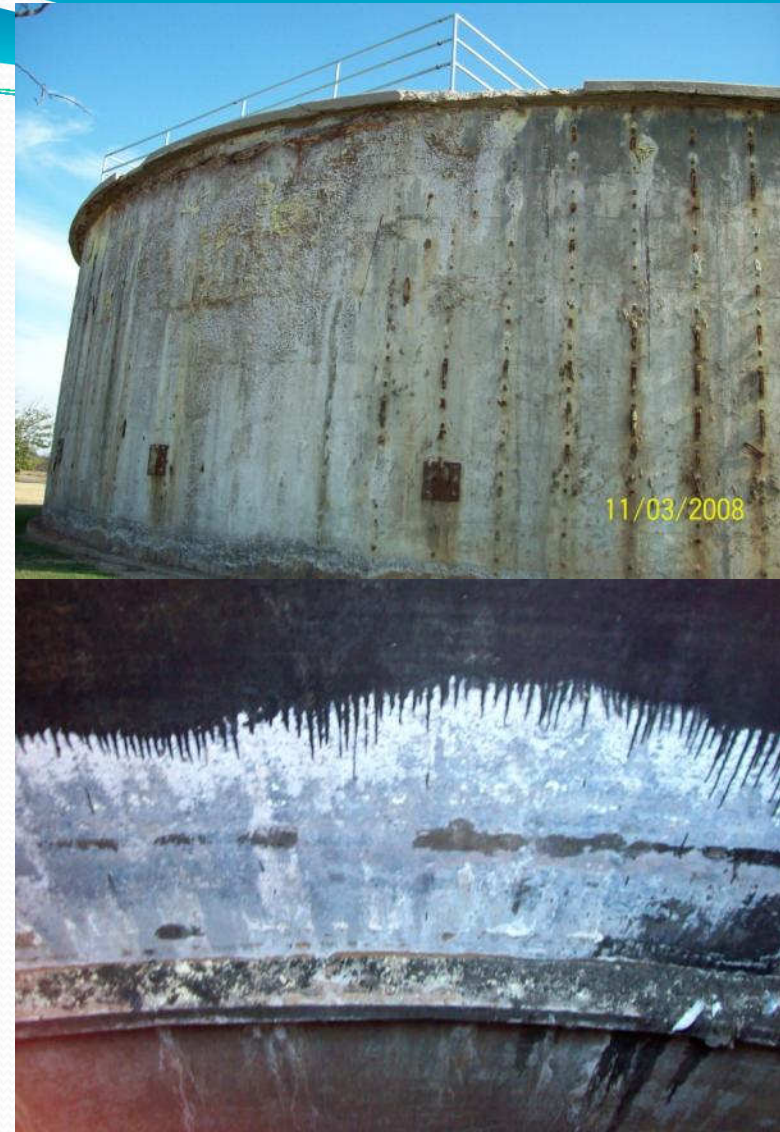
# Inspection Types

- Routine-daily/weekly
- Periodic-monthly/quarterly
- Comprehensive-3-5 years



# Wastewater Tank Issues

- Deteriorated Concrete
- Failed Liners
- Piping Modifications
- Replacement of Dome or Roof



# Maintenance – Tank interior

## ➤ Construction Joints



# Digester Retrofit & Rehab

- Installed wall manway to improve access



# Digester Retrofit & Rehab

- Installed air lines to facilitate operations



# Digester Retrofit & Rehab

- Repaired concrete wall cap to allow installation of new fabric cover



# Wastewater Tank Liners

- Failed liners can lead to an increased exposure of concrete to harmful chemicals
- Can lead to structural and contamination issues



# Wastewater Tank Liners

- Solutions
  - Removal of failed liner
  - Restoration of concrete
  - Installation of new elastomeric, chemical resistant coating





# Digester Exterior Rehabilitation

- Remove deteriorated concrete
- Restore concrete surface
- New architectural finish



# Elkhart, IN Digester

- Owner: City of Elkhart
- Engineer: DLZ Indiana, LLC
- 1.85 MG Prestressed Concrete Tank  
Built by DN Tanks in 1980



# Reason for Retrofit

- Abandoned the existing floating steel top, and installed a new fabric dome.
- The old steel top had access hatches.
- The new fabric dome did not have access hatches.
- Still needed access to the tank interior for maintenance or inspections.



# Elkhart, IN Digester

- Install Pipes Through Tank Wall
  - 1" air pressure line pipe.
  - 3" liquid level indicator pipe.
  - 8" overflow pipe.



# Elkhart, IN Digester

- Install 31" diameter circular manway
- Install 30" by 36" rectangular manway



# Elkhart, IN Digester

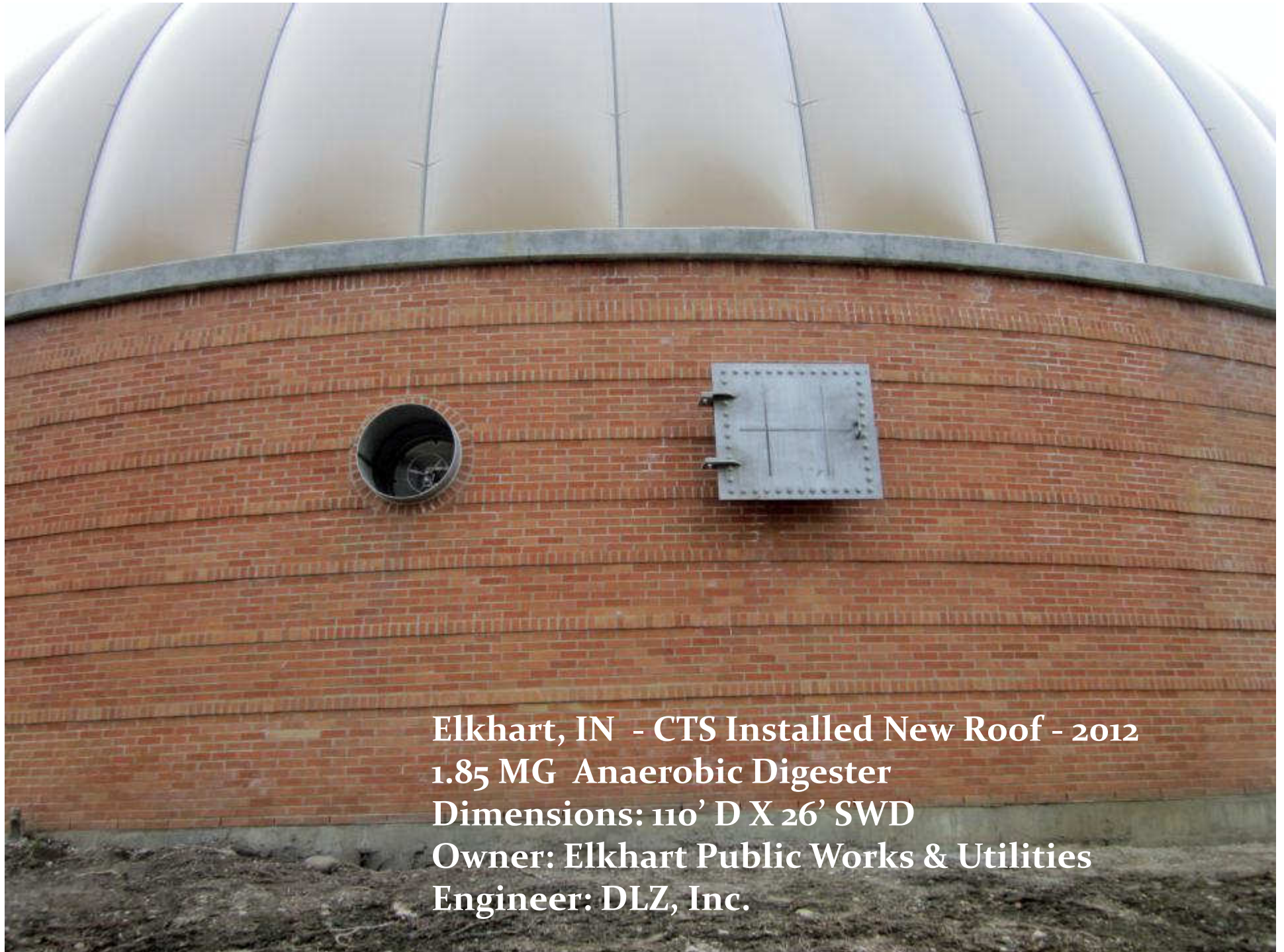


# Elkhart, IN Digester



- Poured interior concrete encasements around both manways



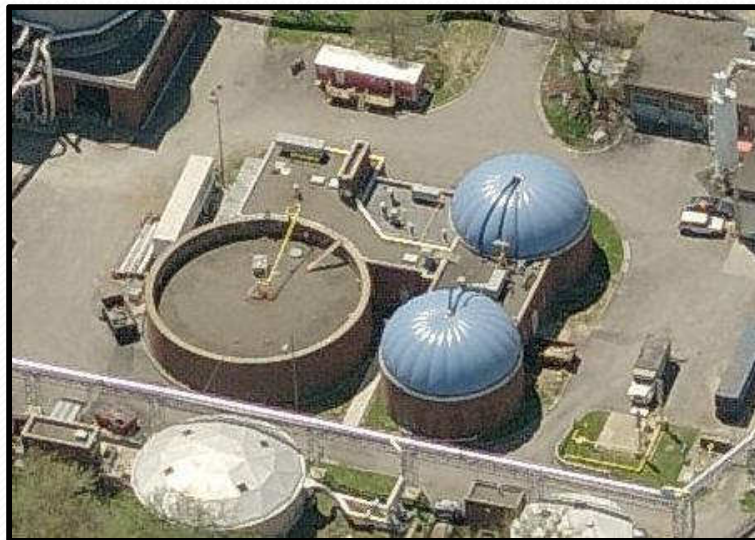


**Elkhart, IN - CTS Installed New Roof - 2012**  
**1.85 MG Anaerobic Digester**  
**Dimensions: 110' D X 26' SWD**  
**Owner: Elkhart Public Works & Utilities**  
**Engineer: DLZ, Inc.**



# Benefits of Utilizing CTS

- A comprehensive inspection and preventive maintenance program can extend the life of an existing tank indefinitely
- Waste water tanks require special attention to maintain integrity of structure
- Existing infrastructure can be rehabilitated and retrofitted to ensure proper long term operation.

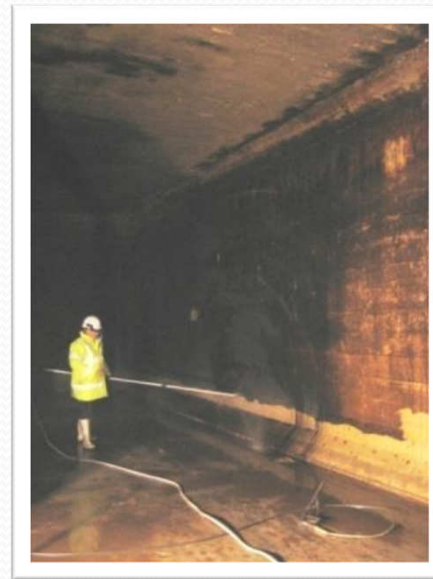




# Solutions for Water Quality Issues in Your Water Storage Tank

# Water Quality Issues

- Physical
  - Sediment Buildup
    - Causes staining and discoloration
    - Water flow increase can stir up sediment, causing discoloration
    - Creates an environment for bacterial growth



# Water Quality Issues

- Chemical

- Disinfection by-products (DBP)
  - Reaction between disinfectant (typically chlorine) and organic matter in water creates certain acids.
  - These acids can reduce the pH in the water, causing the effectiveness of the chlorine to decrease.
- Chlorine Residual Levels
  - High vs. Low
  - Taste & Odor



# Solutions

## Baffle Walls

- Fabric and/or Concrete

## Mixing Systems

- Hydrodynamic vs Mechanical

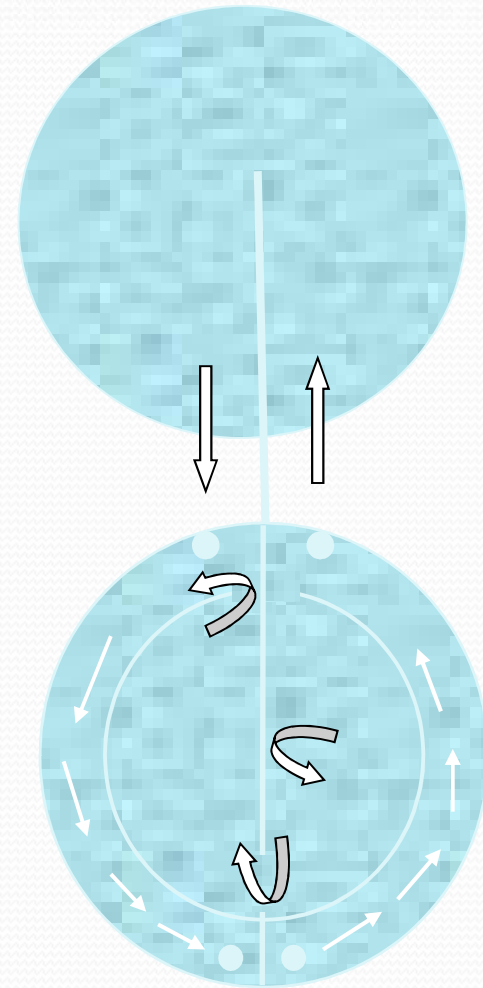
## Cleaning

- Chemical Application & Chlorine Disinfection

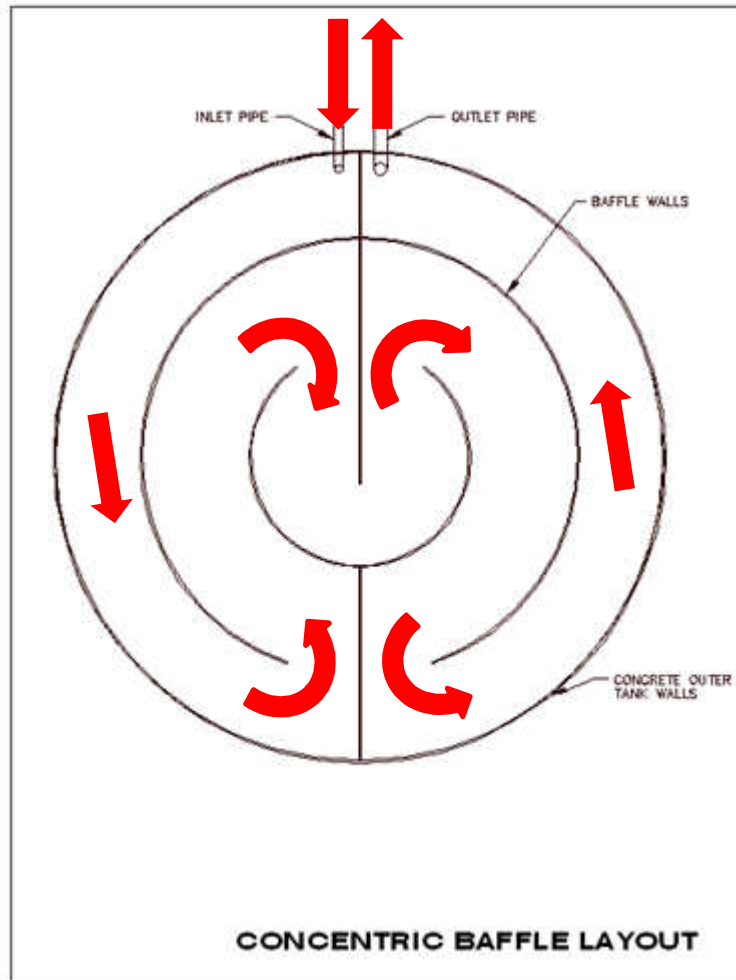


# Baffle Walls

- Provides specific contact time ( $C_t$ ) for water in tank
- Increases the efficiency of the tank (Plug Flow)
- Increases the path that the water travels from inlet to outlet
- Minimizes contact between entering water and water already in tank



# Fabric & Concrete Concentric C Baffles



# Hydrodynamic Mixing Systems

- Provides complete mixing of water in tank. Not plug flow.
- Eliminates stagnant water areas in tank
- Can be installed horizontally or vertically

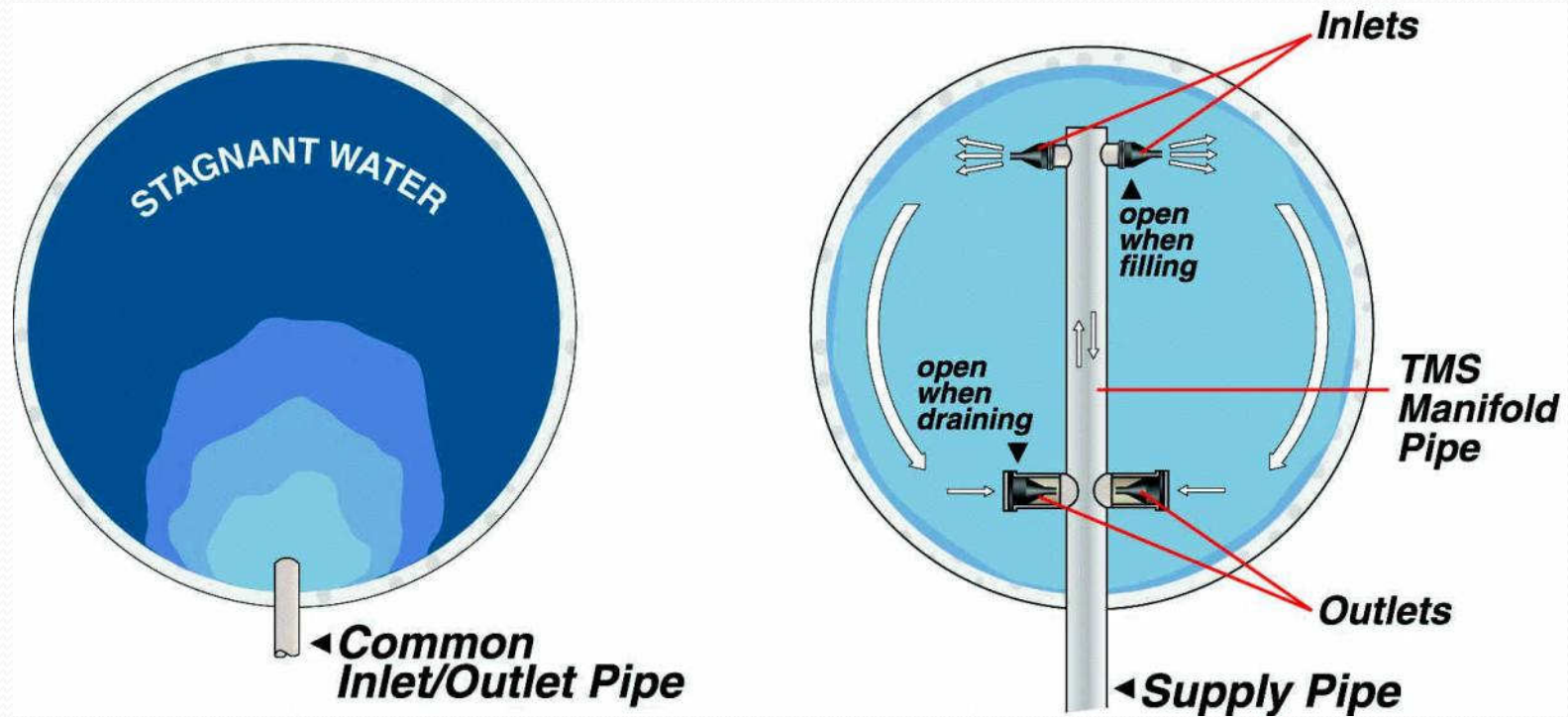


Tideflex Technologies





# Hydrodynamic Mixing Systems



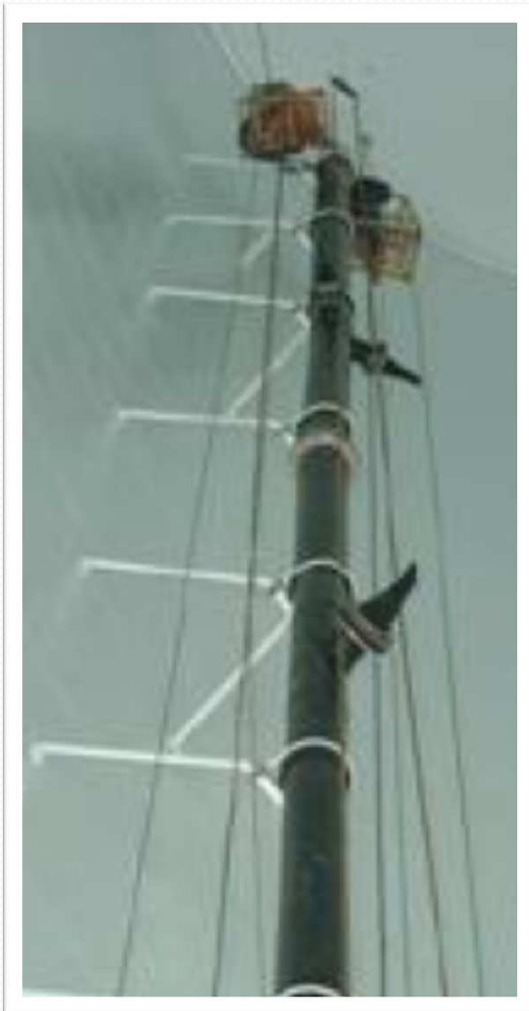
Tideflex Technologies



# Hydrodynamic Mixing System Across Floor



# Vertical Hydrodynamic Mixing System

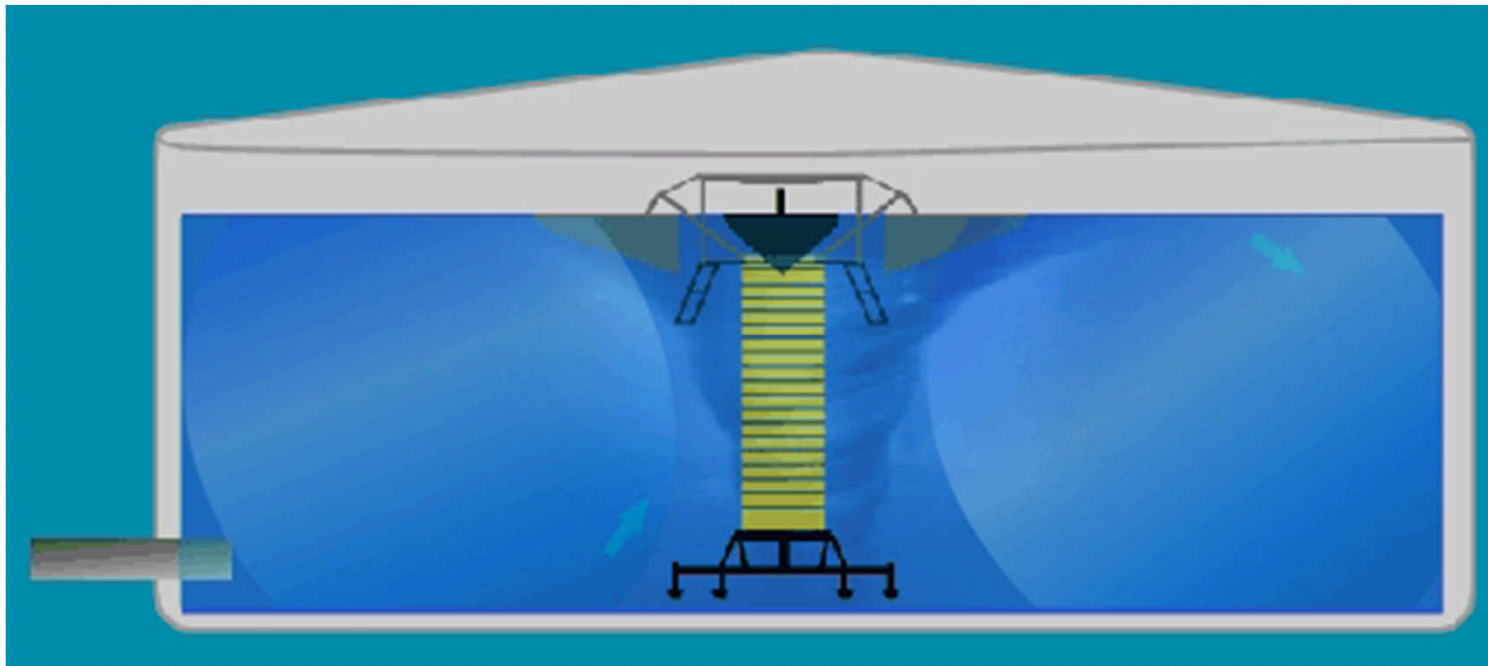


Tideflex Technologies



# Mechanical Mixing System

- Prevents stagnation, thermal stratification, nitrification and short circuiting.
- Provides complete mixing of influent and outflow.
- Can be solar powered.

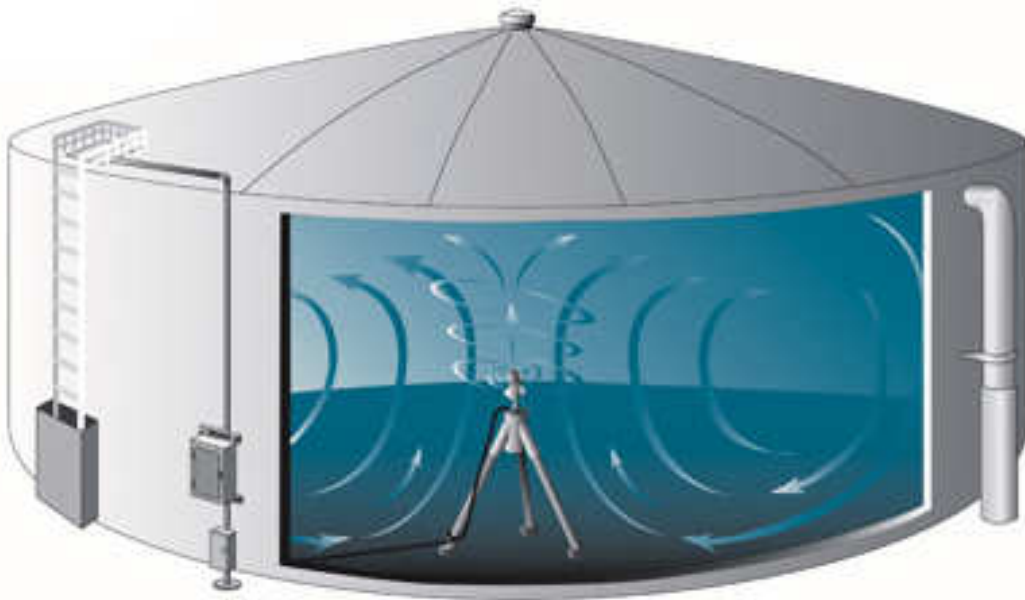


Solarbee, Inc.



# Mechanical Mixing System

- Can require a small amount of power to operate
- Fast, cost efficient installation



PAX Water Technologies



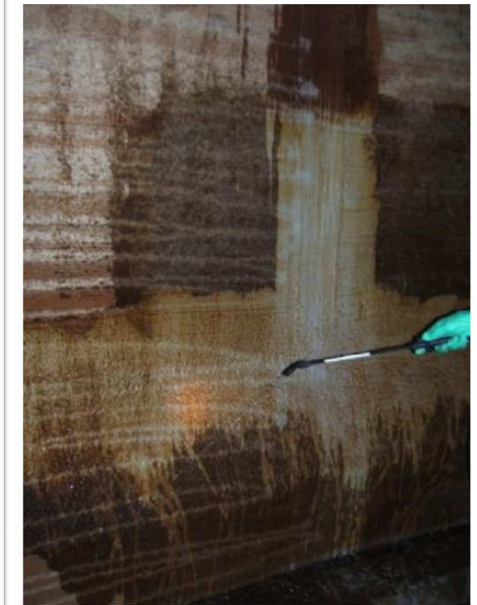
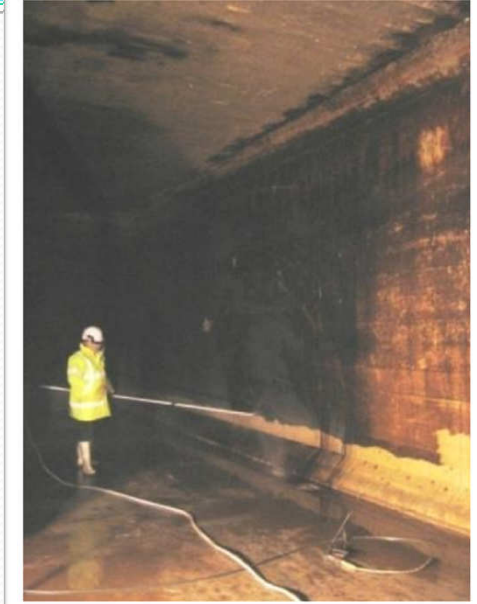
# Hydrodynamic vs. Mechanical Mixing

- Hydrodynamic Mixing
  - Advantage: Zero Maintenance
    - No moving parts
  - Disadvantage: May require longer fill cycle for proper mixing (Inflow Dependent)
- Mechanical Mixing
  - Advantage: Length of fill cycle is not a factor
    - Constantly mixing
  - Disadvantage: Requires maintenance and power source



# Tank Cleaning

- Chlorine Disinfection
  - Interior Chlorine Rinse
  - Routine testing and cleaning can prevent bacteria growth and potential health hazards
- Chemical Cleaning
  - Iron & Manganese Removal
    - Fe & Mg may be present in groundwater
  - Removes Biofouling
  - Chlorine Alternative – Less Harmful

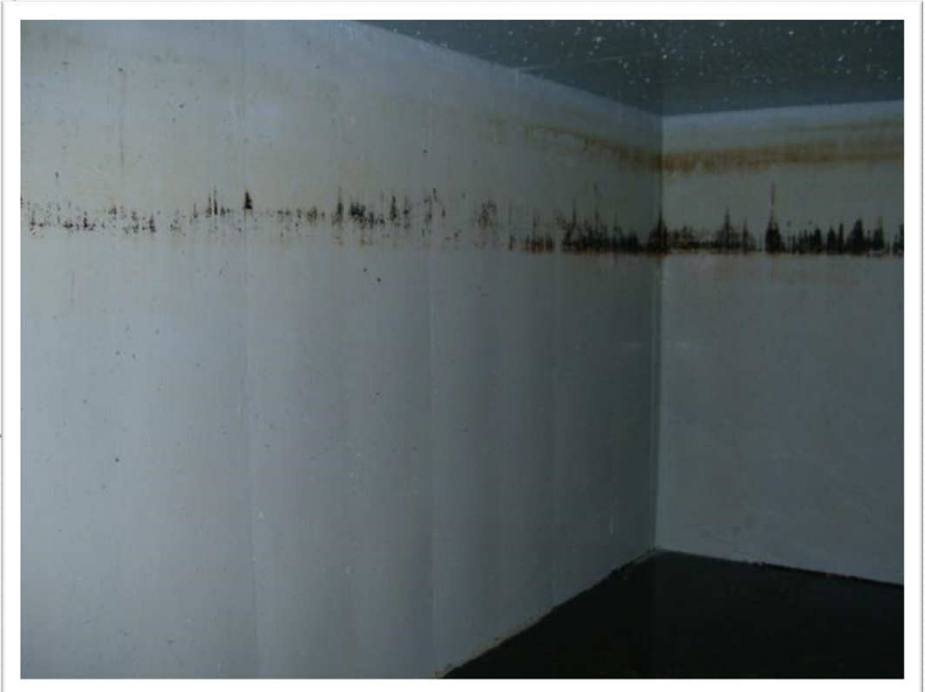
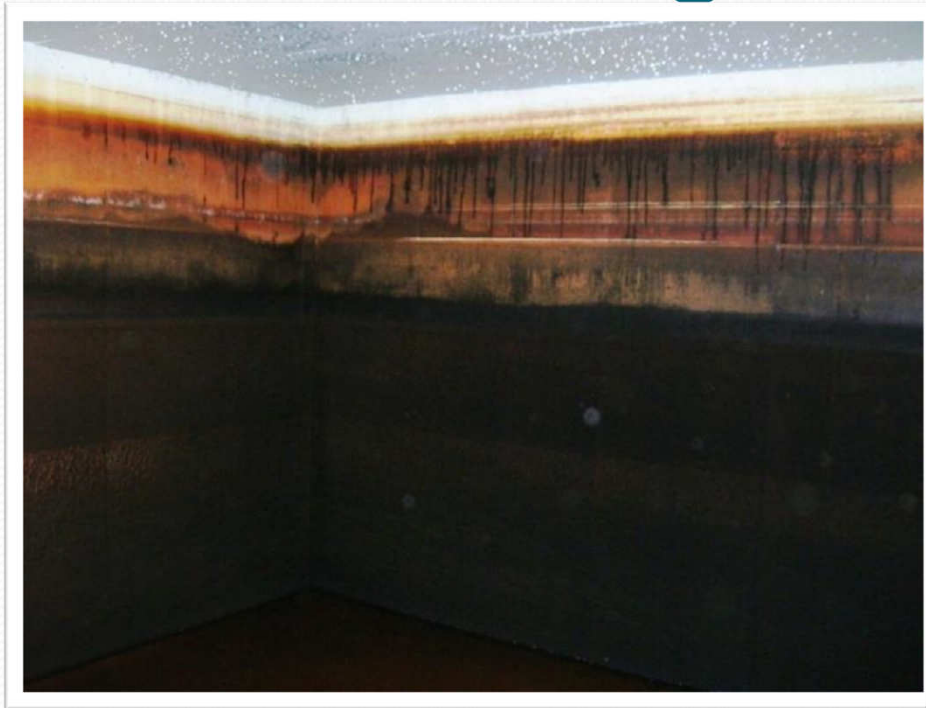


# Wet Well with Iron & Manganese Encrustation





# Clearwell with Heavy Iron & Manganese Buildup



# Biofouling and Iron & Manganese Buildup



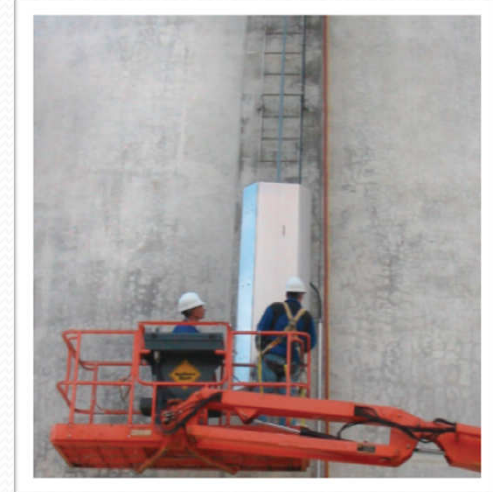
# Preventing Potential Issues

- Perform routine self inspections
  - Identify potential issues before they become major problems
- Professional Inspection every 5 years
  - Interior/Exterior
  - Should include inspection report sealed by a Professional Engineer



# Preventing Potential Issues

- Self Inspection Checklists
  - Screens intact and tight
    - All vents and overflows
  - Cracks in tank structure
  - Coating Failure
  - Wet or Damp areas
  - Concrete spalling
  - Ladders and safety climbs
  - Hatch functionality
    - lock and hinges



# Retrofitting Existing Tanks

- It's never too late to retrofit a tank
  - Regulatory changes
  - Changing needs of a community
  - Water quality issues
  - Safety, Security and Resilience



# AWWA D110 Type III

- Peace of Mind

- ✓ Decades of Reliability
- ✓ No Routine Maintenance



# AWWA D110 Type III

- Single Source Responsibility Contractor

- ✓ Designs
- ✓ Builds
- ✓ Stands Behind Entire Tank

