

Case Studies of Zebra Mussel Control at Raw Water Intakes

Presenter:
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Agenda

- Control of Mussels at Raw Water Intakes
- Three Case Studies
 - Milford Municipal Utilities
 - City of Spirit Lake
 - DNR Fish Hatchery in Spirit Lake

Control vs. Prevention

- Few natural controls (limited predators)
- Once found, likely there to stay
- Prevention techniques have varying success rates



Water Systems – Raw Water Intakes

- Intake screens
 - Copper
 - Brass
 - Galvanized steel
 - Z-Alloy™ material



JOHNSON SCREENS® Passive Intake Screen Z-Alloy (CuNi) to avoid zebra mussel growth

Water Systems – Raw Water Intakes

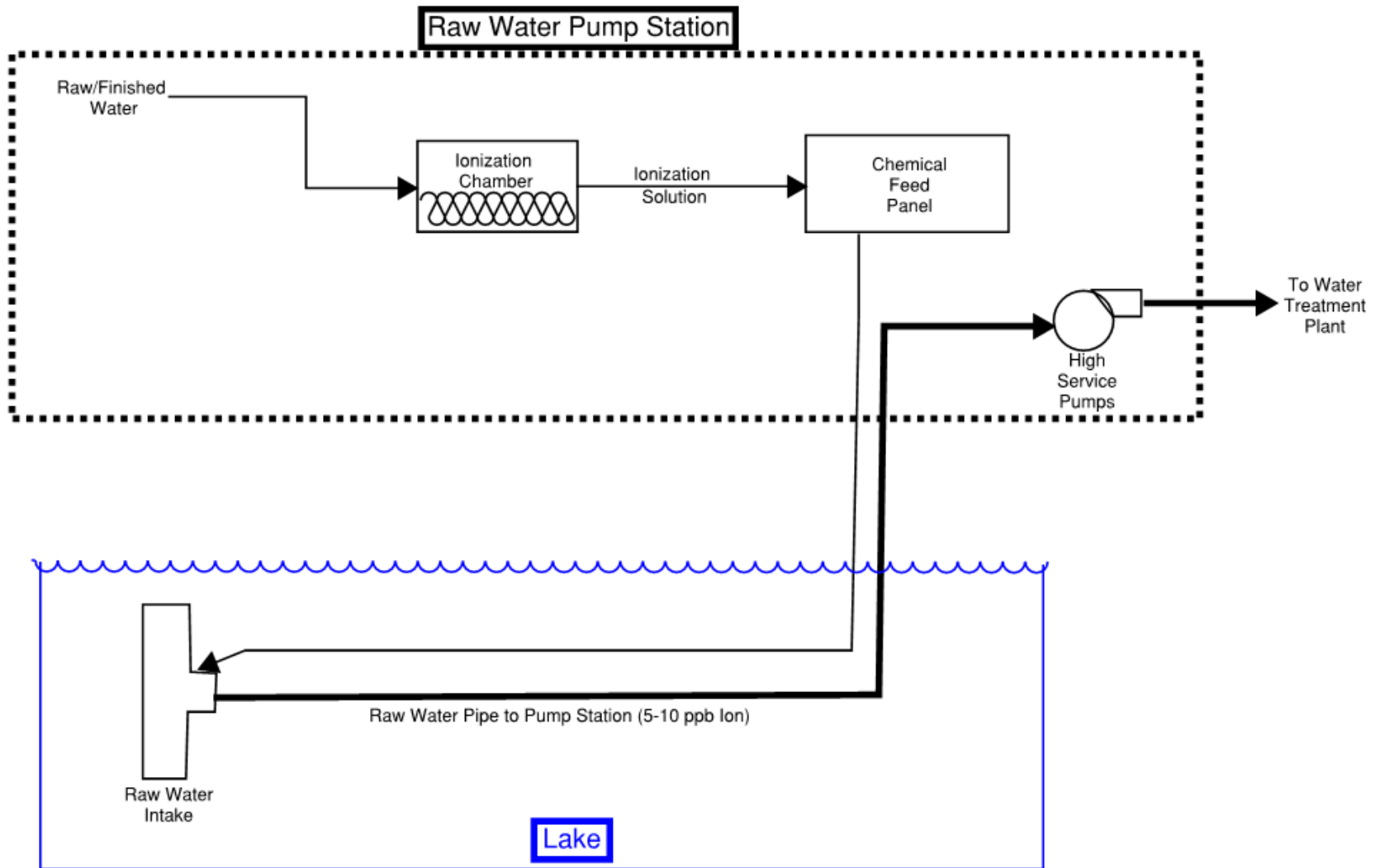
- Intake piping
 - Chemical
 - Chlorine, various forms (oxidant)
 - Permanganate (oxidant)
 - Ozone (oxidant)
 - Bromine (oxidant)
 - Hydrogen Peroxide (oxidant)
 - Free Copper Ion/Aluminum/Aluminum Hydroxide (nonoxidizing)
 - Quaternary ammonium compounds (nonoxidizing)
 - Aromatic hydrocarbons (nonoxidizing)
 - Endothall (nonoxidizing)
 - Potassium/potash/potassium chloride (nonoxidizing)
 - Physical
 - Permeable Barrier
 - Mechanical Cleaning
 - Mechanical Filtration
 - Light Sources
 - UV Radiation
- US Army Corps of Engineers Guide
 - Sprecher, S. L., and Getsinger, K. D. (2000). “Zebra mussel chemical control guide,” ERDC/EL TR-00-1, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Free copper ion solution technology

- Free copper ions are a biocide that inhibits mussel and bacterial growth
- Concentrations as low as 1-2 parts per billion (ppb) is effective for zebra mussel control (U.S. Bureau of Reclamation)
- Recommend effective dosing concentrations of 5-10 ppb
- EPA: Copper action level of 1.3 mg/L, or 1,300 ppb

Free copper ion solution technology

- Generation equipment produces copper ion solution
- Equipment inputs:
 - Raw or Finished carrier water stream (10-20 gallons per minute)
 - Electrical current (5A, 120VAC)
 - Copper anodes (replaceable)
 - Control inputs
- Equipment outputs:
 - Copper ion solution in carrier water stream, 1 part per million (ppm) concentration
- Copper Ion Solution injected into bulk raw water flowstream, blending down total effective copper concentration to 5-10 ppb

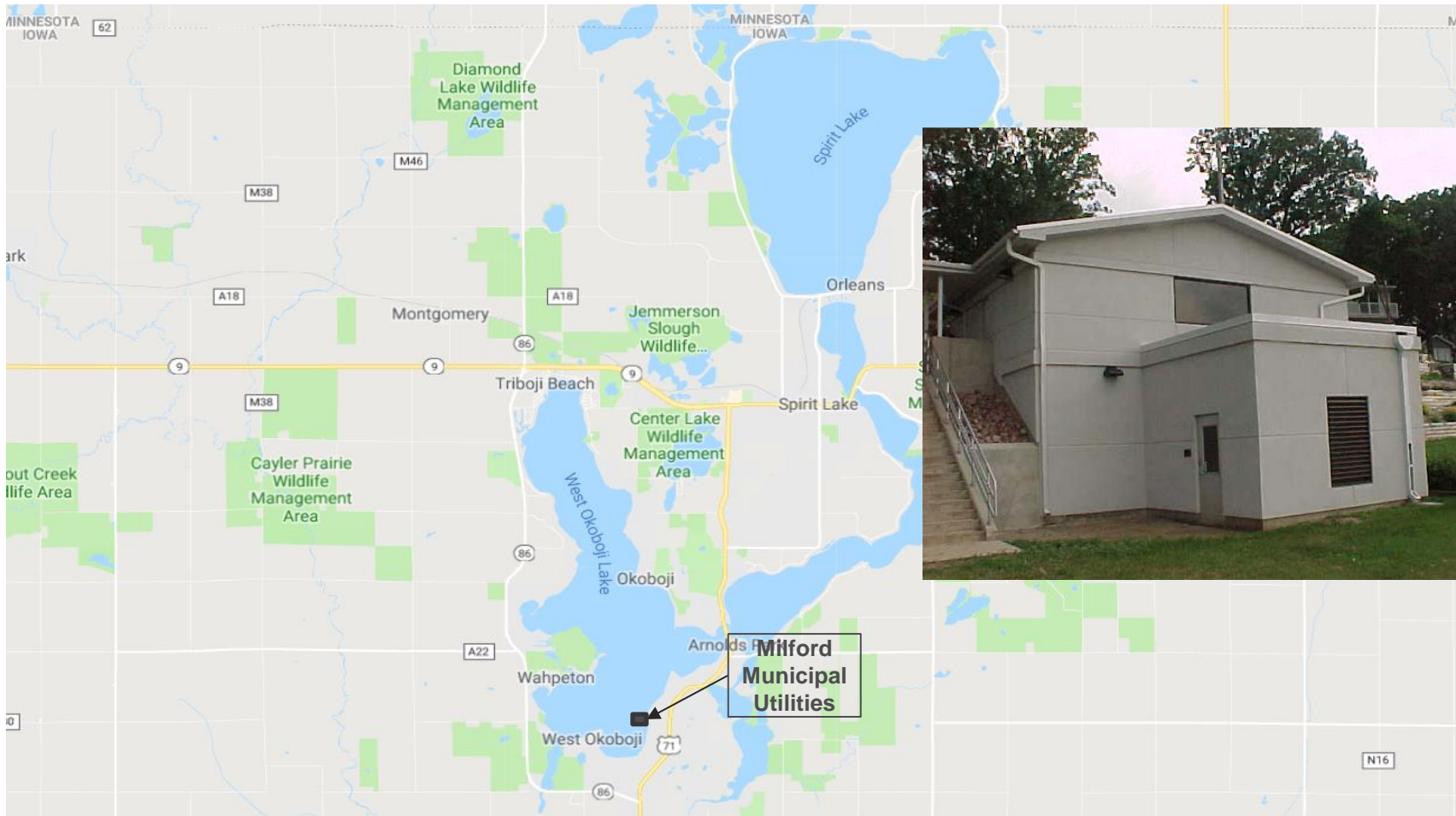


NEW ANODES

ORIGINAL ANODES (22 MONTHS)



Case Study #1 – Milford Municipal Utilities, Milford Iowa



Project Highlights

- Utilized ZM-1 equipment by MacroTech, Inc.
- Milford was the first installation in Iowa on a public water system
- Iowa DNR required 12-month pilot study
- New screen on existing intake
- New intake piping and screen installed on ice during winter
- Chemical feed system added with no building addition



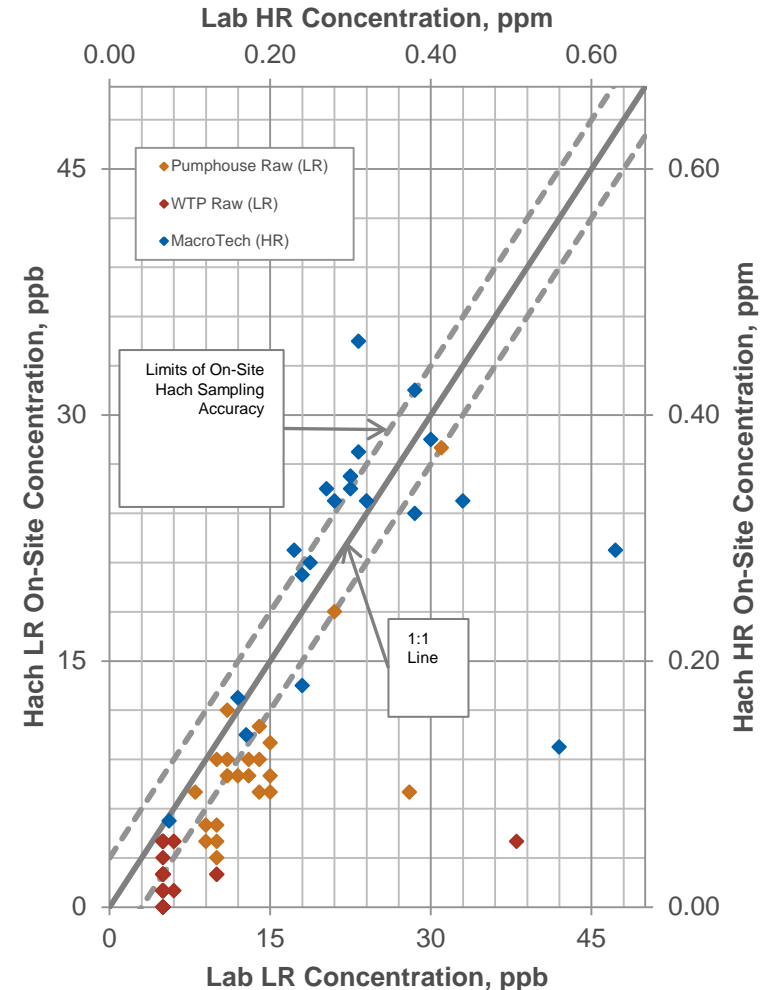
Pilot Study - MMU

- Full-scale pilot from March 2014 through February 2015
- Monitored copper at 7 locations in water system:
 - Raw at Lake
 - Raw Downstream of ZM injection
 - Raw at WTP
 - ZM copper solution line
 - Sedimentation tank sludge
 - Filter backwash waste
 - WTP finished water into distribution system
- Testing on-Site by MMU with lab split samples



Pilot Study - MMU

- Overall, pilot study was successful:
 - Equipment performed as intended
 - Lab split samples showed general agreement with on-site results
 - Distribution system samples indicated no statistical difference in pre- and post-pilot study samples
 - Iowa DNR approved pilot study results and permanent installation of equipment



Summary of Improvements

- MMU has existing 10-inch screened intake pipe and Pumphouse building on West Okoboji Lake
- Project included:
 - New 16-inch intake pipe
 - New copper Z-alloy™ screens on existing and new intake pipes
 - Chemical feed lines to inject copper ion solution at end of intake pipes
 - Hydroburst system to clean intake screens



Construction Photos - MMU



Installing the new 16-inch pipe from shore



Assembling new 16-inch intake screen

Construction Photos - MMU



Laying out intake piping on frozen lake



Lowering intake pipe through ice

Construction Photos - MMU



Hydroburst tank inside Pumphouse Building

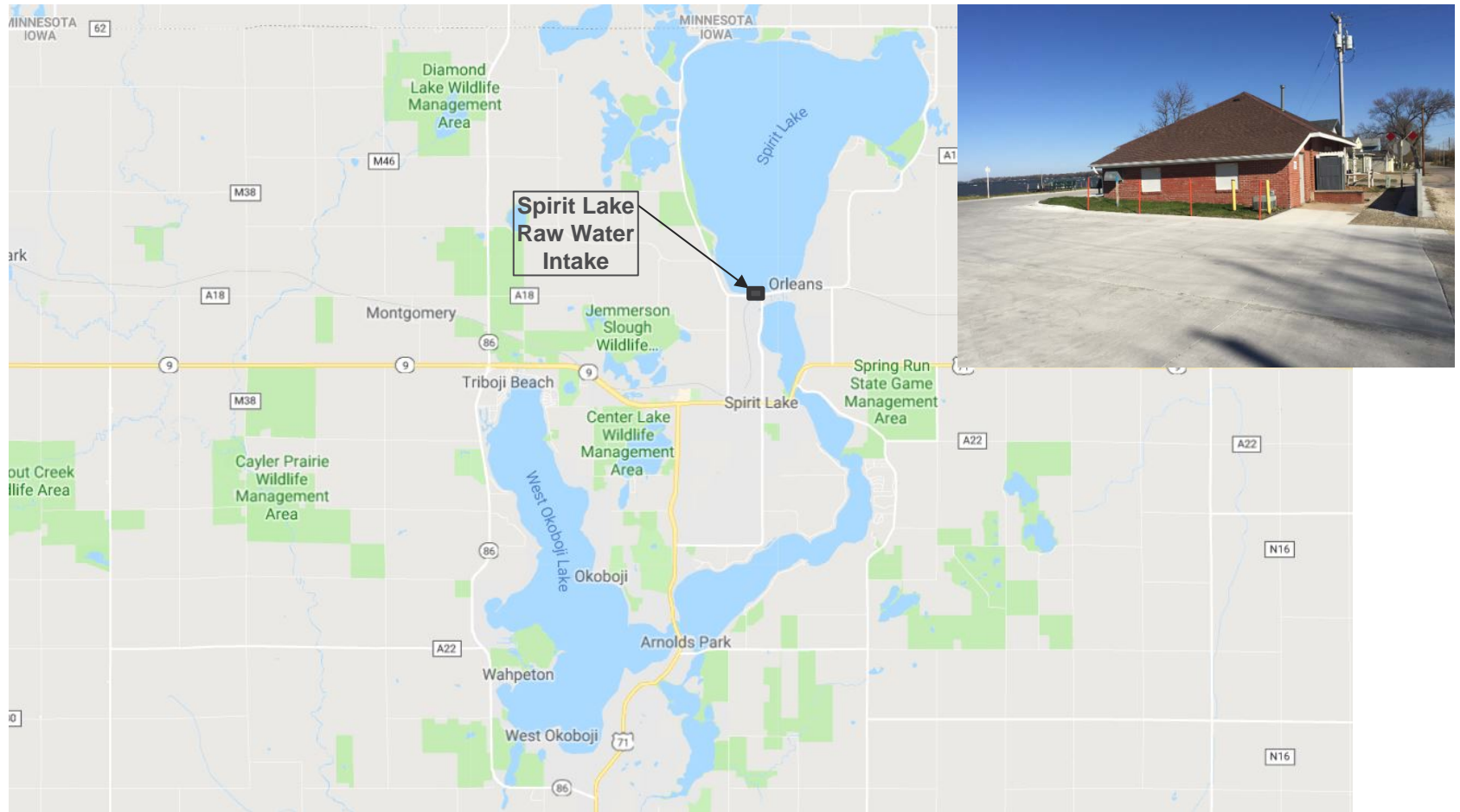


Hydroburst backwash of intake screen

Milford Municipal Utilities – Raw Water Improvements Summary of Construction Costs

Mobilization/General Requirements	\$ 160,280.10
Microtunnel 16" Steel Water Main	\$ 275,000.00
Air and Chemical Feed Systems	\$ 148,000.00
Site Piping	\$ 87,000.00
Submerged Piping Installation	\$ 375,000.00
New Intake Screen	\$ 80,000.00
Modifications to Existing Intake Screen	\$ 100,000.00
12" Building Connection	\$ 50,000.00
Electrical	\$ 25,000.00
TOTAL	\$ 1,300,280.10

Case Study #2 – Raw Water Improvements, Spirit Lake, Iowa



Project Highlights

- Utilized Fortress MC equipment by ONG, Inc.
- Iowa DNR required 12-month pilot study
- New screen on existing intake
- New intake piping and screen using barges on open water
- Chemical feed system added with no building addition



Summary of Improvements

- Spirit Lake had 10-inch and 18-inch screened intake pipe and Pumphouse building on Big Spirit Lake
- Project included:
 - New 18-inch intake pipe
 - New copper Z-alloy™ screens on existing and new intake pipes
 - Chemical feed lines to inject copper ion solution at end of intake pipes
 - Hydroburst system to clean intake screens



Construction Photos – Spirit Lake

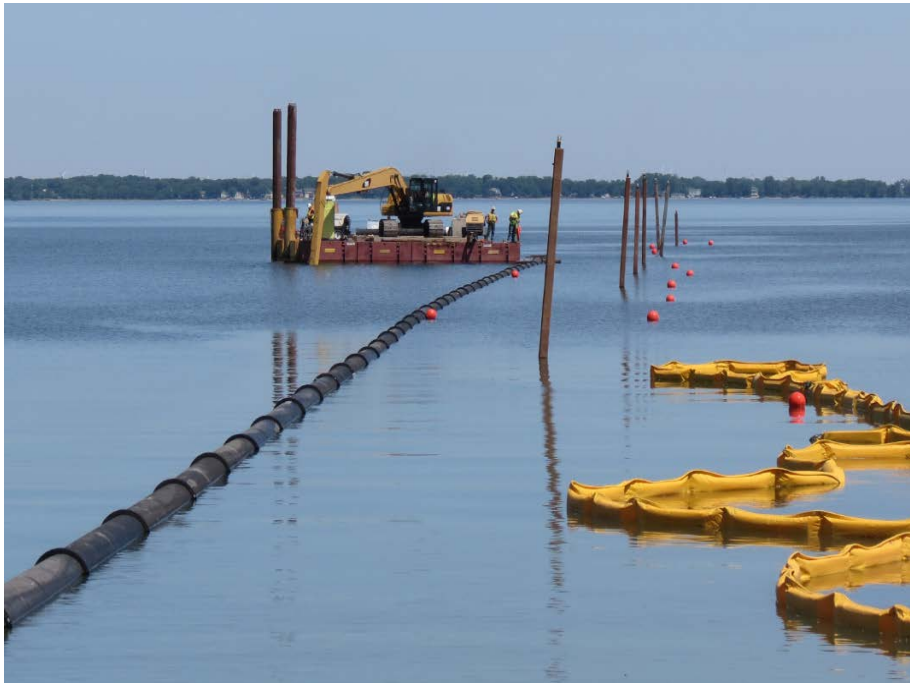


Dewatering at shore



Initial setup for installation of intake line

Construction Photos – Spirit Lake



Installation of intake line



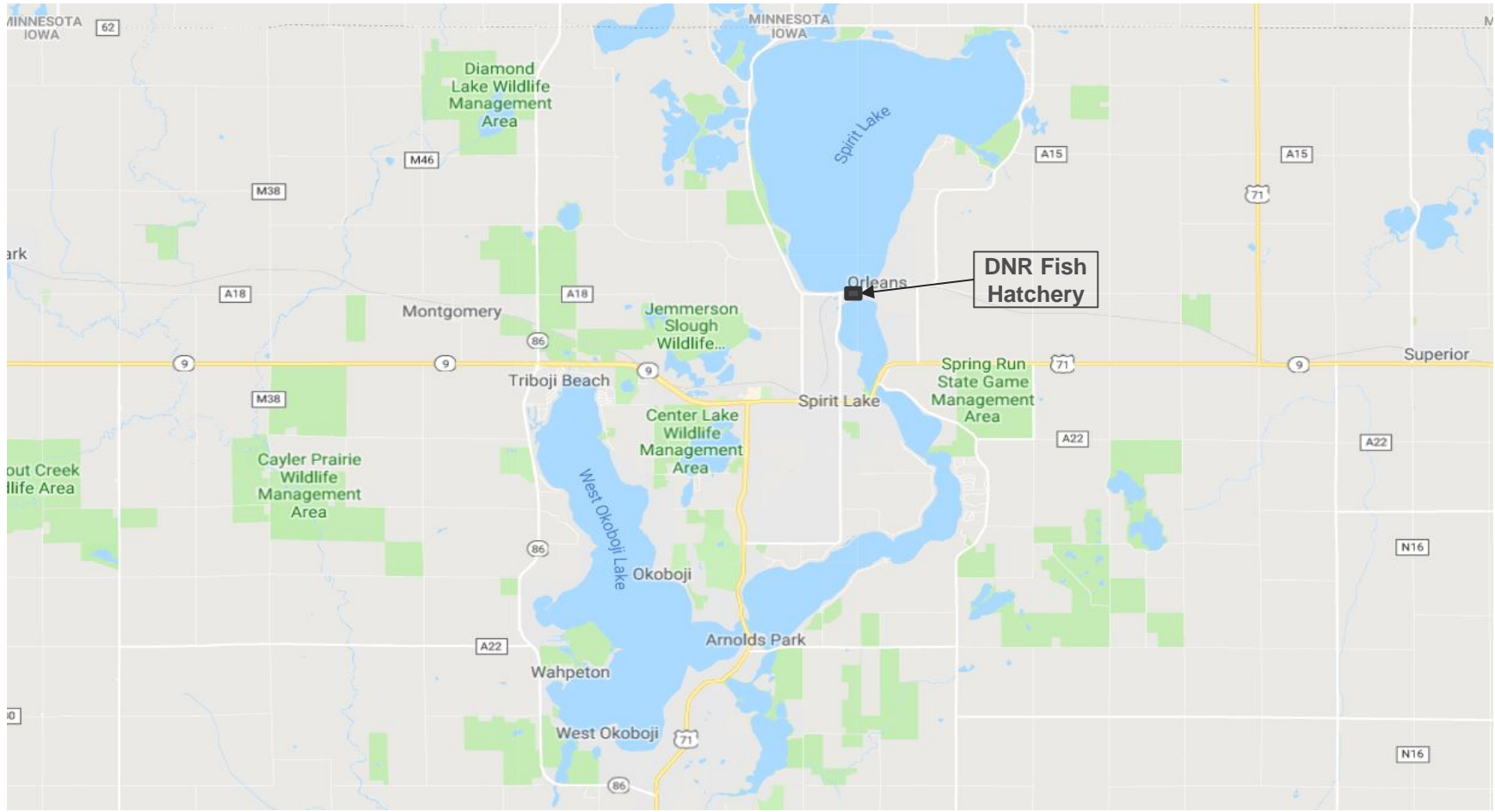
Installation of intake screen

Construction Photos – Spirit Lake



Panoramic of inside pump station

Case Study #3 – Spirit Lake Fish Hatchery, Iowa DNR

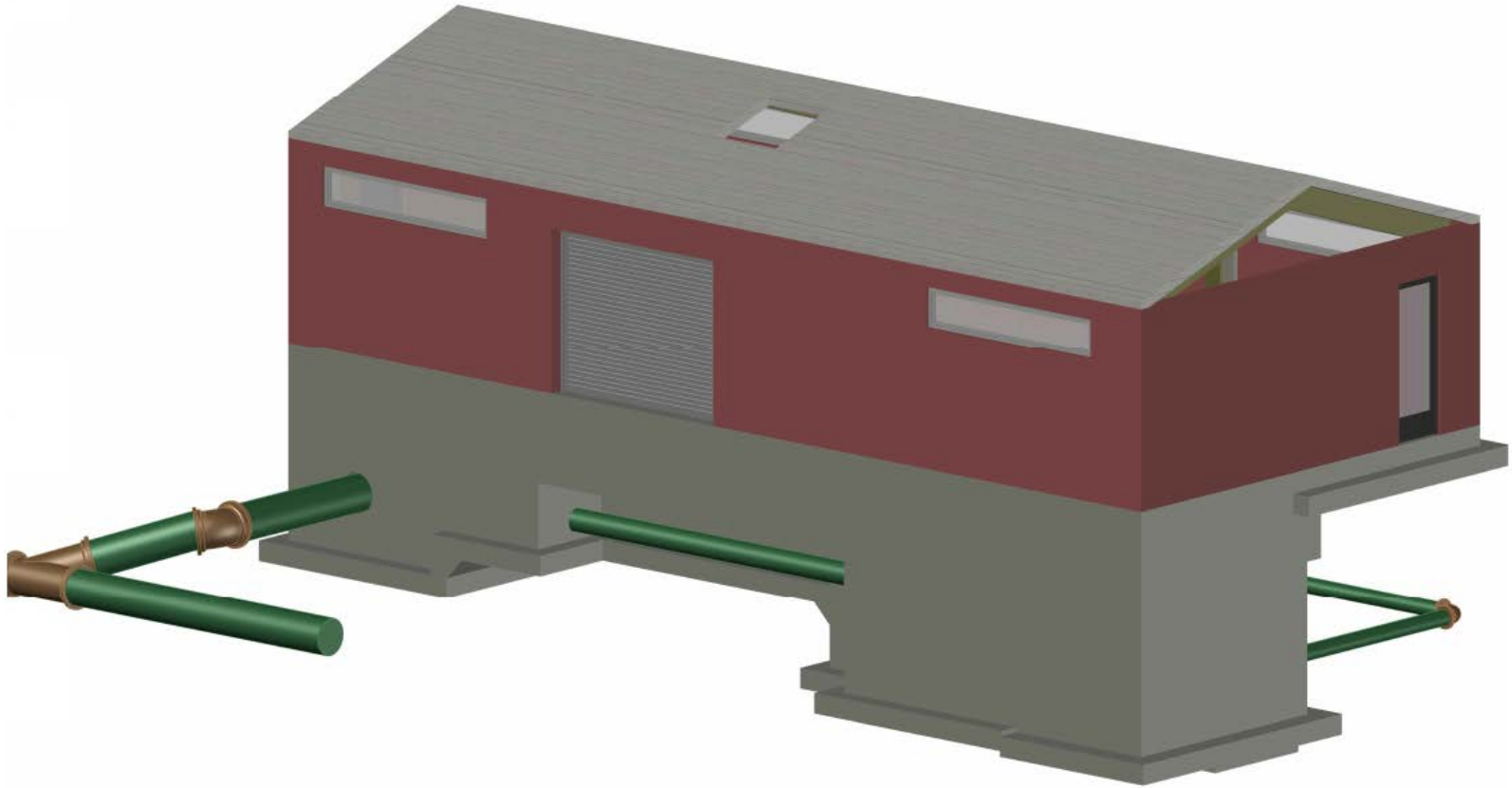


Case Study #3 – Spirit Lake Fish Hatchery, Iowa DNR

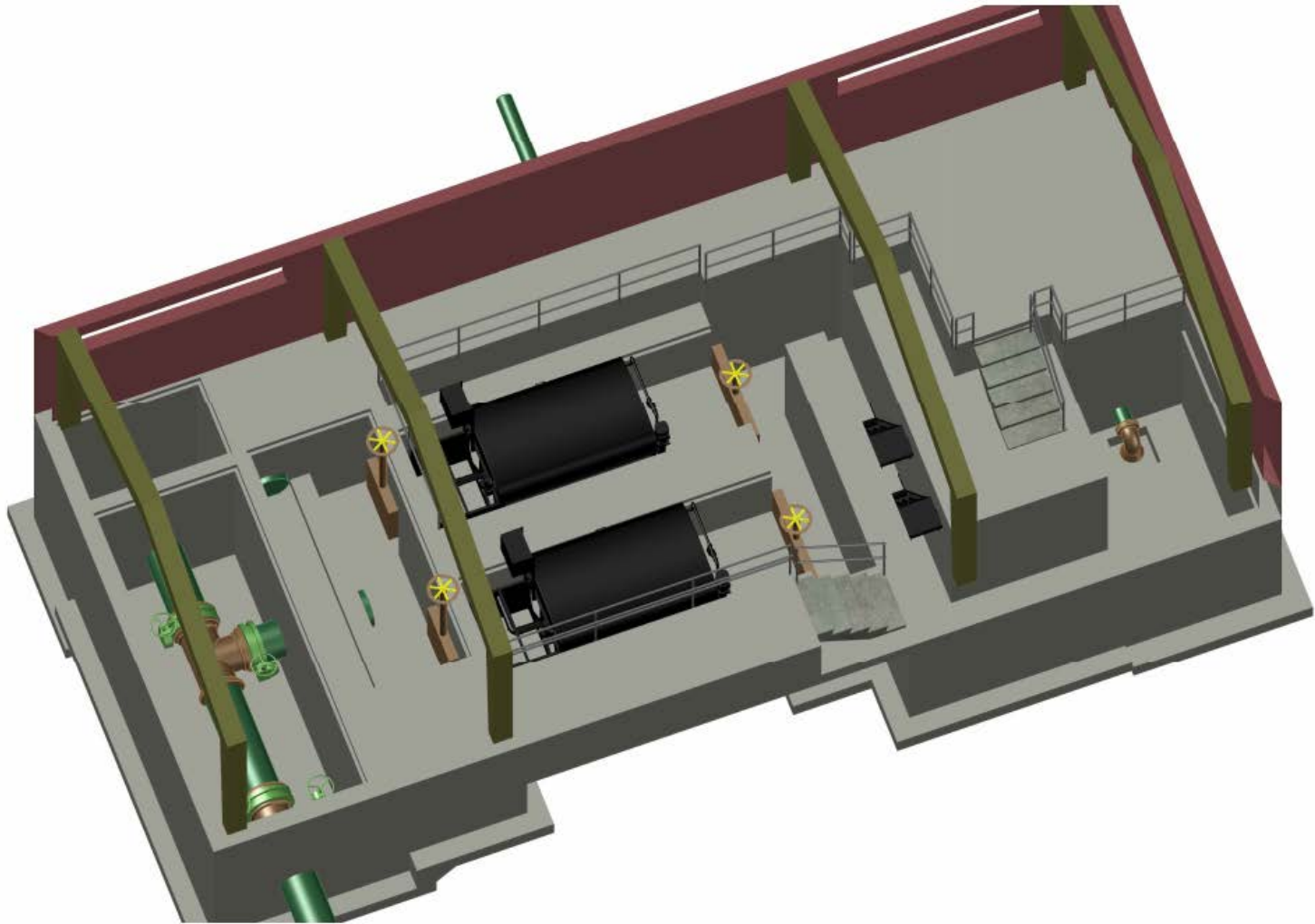
- Use of oxidizing chemicals not allowed due to toxicity to fish hatchlings
- Will use drum screens as physical barrier
- Hatchery staff will transport hatchlings to many other lakes in Iowa
- New screen on existing intake
- New building addition
- Degassing of nitrogen
- Liquid oxygen feed equip.
- UV Disinfection



Summary of Improvements



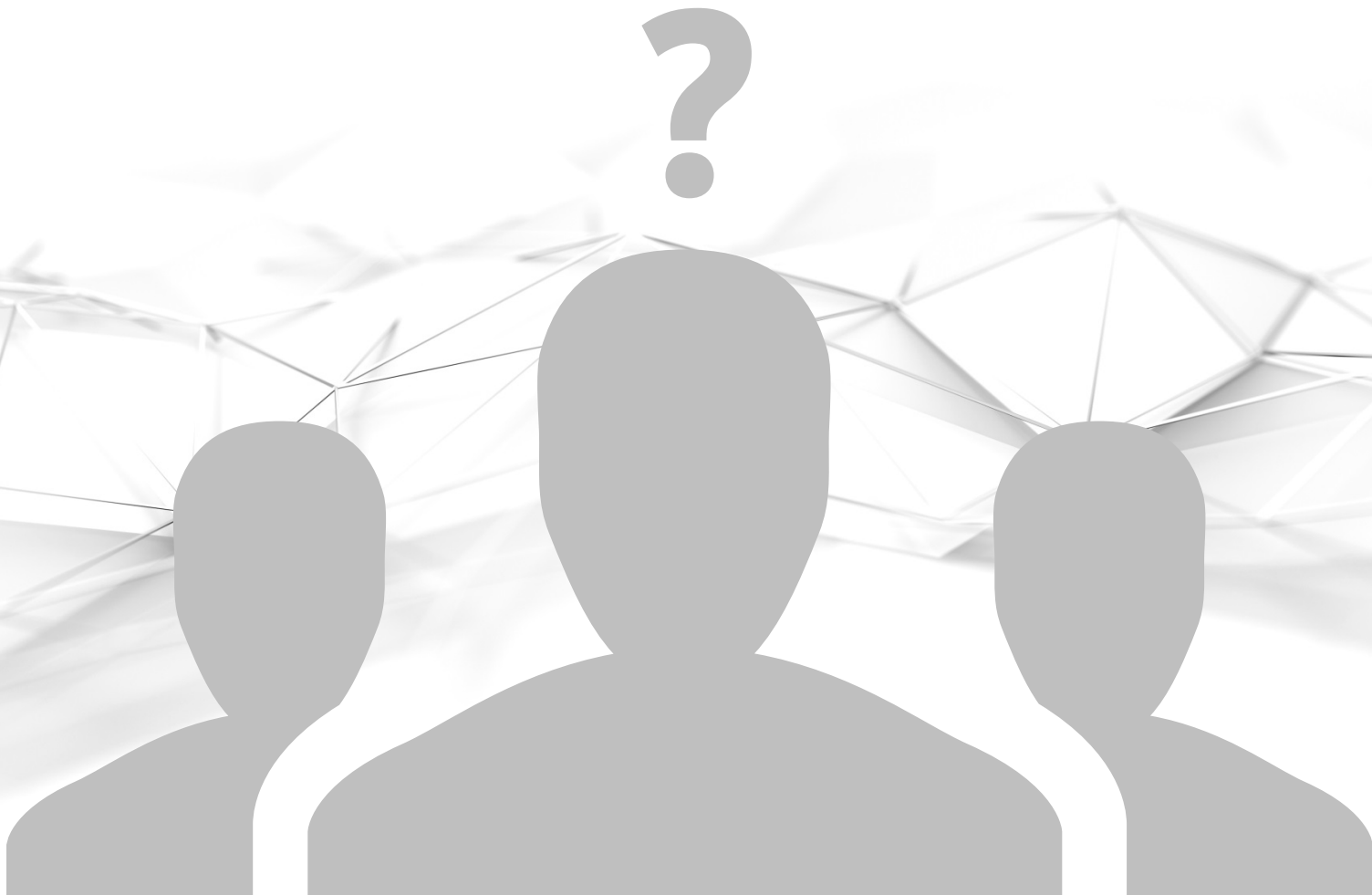
Summary of Improvements



DNR Fish Hatchery – Raw Water Improvements Engineer’s Opinion of Probable Costs

Mobilization/General Requirements	\$ 140,000.00
Sitework	\$ 63,000.00
2 - 25 um Drum Filter	\$ 100,000.00
UV System	\$ 56,000.00
Slide Gates	\$ 36,000.00
Weir Gates	\$ 44,000.00
High Capacity Intake Screen	\$ 85,000.00
Process Pipe and Valves	\$ 150,000.00
Aerator/Degassification	\$ 140,000.00
Liquid Oxygen Feed System	\$ 40,000.00
Filter Building	\$ 650,000.00
Contingency - 10%	\$ 150,000.00
Preliminary Opinion of Construction Costs	\$ 1,654,000.00

Questions from the Audience?



Contact Information



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