Change is Good -
A Story of Brine, Biology, Backwashing, and Bad Steel in Batavia

March 21, 2023

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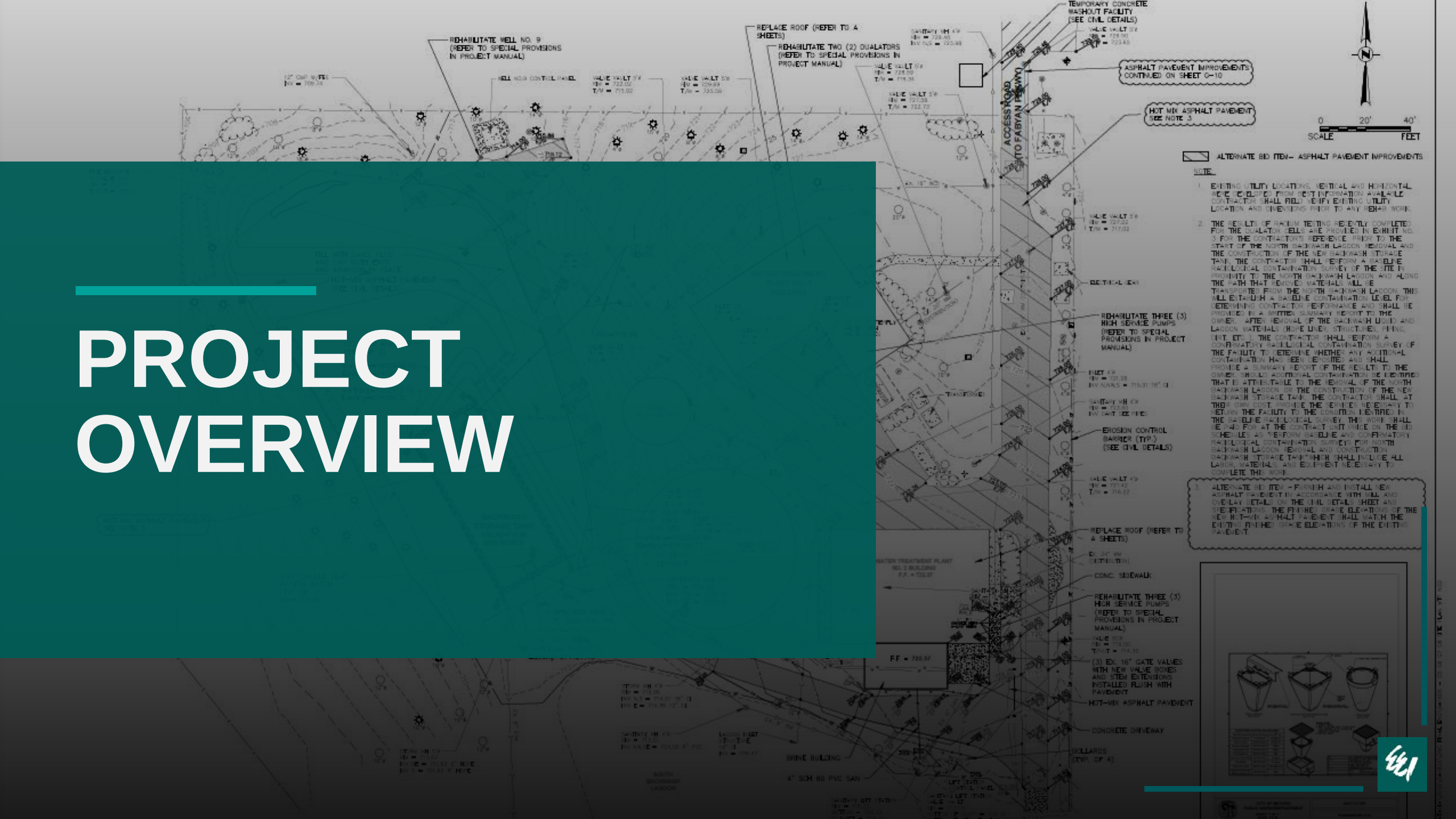
Project Engineer

CITY OF BATAVIA

Agenda

1. Project Overview
2. Backwashing
3. Brine
4. Bad Steel
5. Biology
6. Summary/Lessons Learned

PROJECT OVERVIEW



EXISTING SITE PLAN

NOTE: WELL #10 & WELL #11 LOCATED ON WENMOTH RD

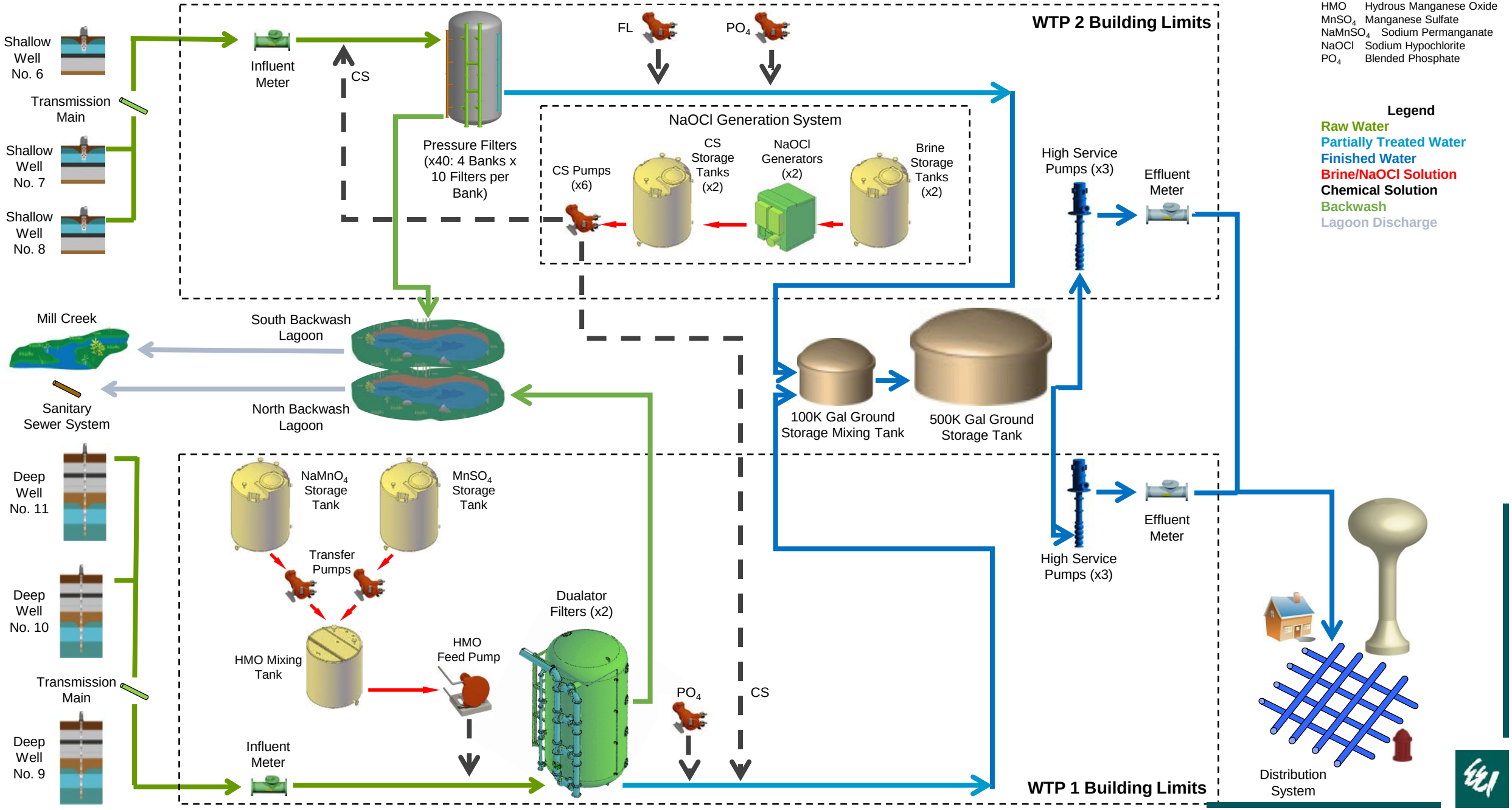
Water Treatment Plants 1 and 2 Process Flow Diagram

Chemical Abbreviations

CS	Chlorine Solution
FL	Fluoride
HMO	Hydrous Manganese Oxide
$MnSO_4$	Manganese Sulfate
$NaMnSO_4$	Sodium Permanganate
NaOCl	Sodium Hypochlorite
PO_4	Blended Phosphate

Legend

- Raw Water
- Partially Treated Water
- Finished Water
- Brine/NaOCl Solution
- Chemical Solution
- Backwash
- Lagoon Discharge



WATER TREATMENT PLANTS MODIFICATIONS PROJECT SCOPE

WTP #2 EXPANSION

Expansion of brine area for new brine equipment and salt storage area. Inclusion of new office space and additional bathroom.

DUALATORS

Rehabilitation of filtration equipment and replacement of media in two Dualators in WTP #1

BACKWASH STORAGE TANK

New underground backwash storage tank to replace open north backwash lagoon

HIGH SERVICE PUMPS

Rehabilitation of six high service pumps

WELLS NO. 9, 10 & 11

Rehabilitation of Deep Wells and pumping equipment

SODIUM HYPOCHLORITE FEED PUMPS

Replacement and relocation of feed pumps

Construction Overview

BIDDING/CONTRACTING

Awarded to Whittaker Construction & Excavating, Inc. for $4,411,037.48

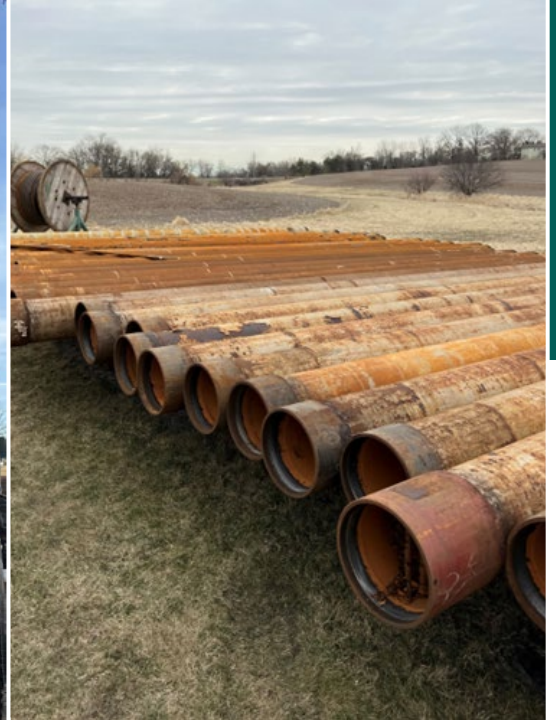
SCHEDULE

Notice to Proceed: May 27, 2021
Substantial Completion: July 27, 2022
Final Completion: September 25, 2022
Contract Amendment Final Completion: June 2, 2023

FUNDING

IEPA SRF Loan
20 Year Term
1.35% Interest Rate



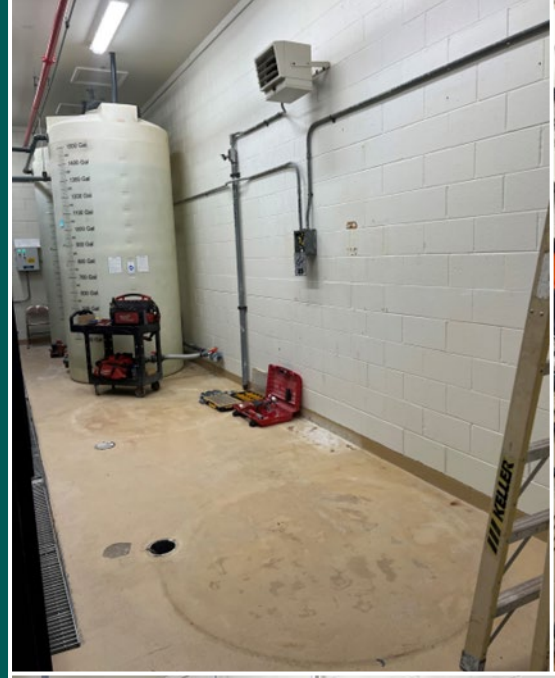


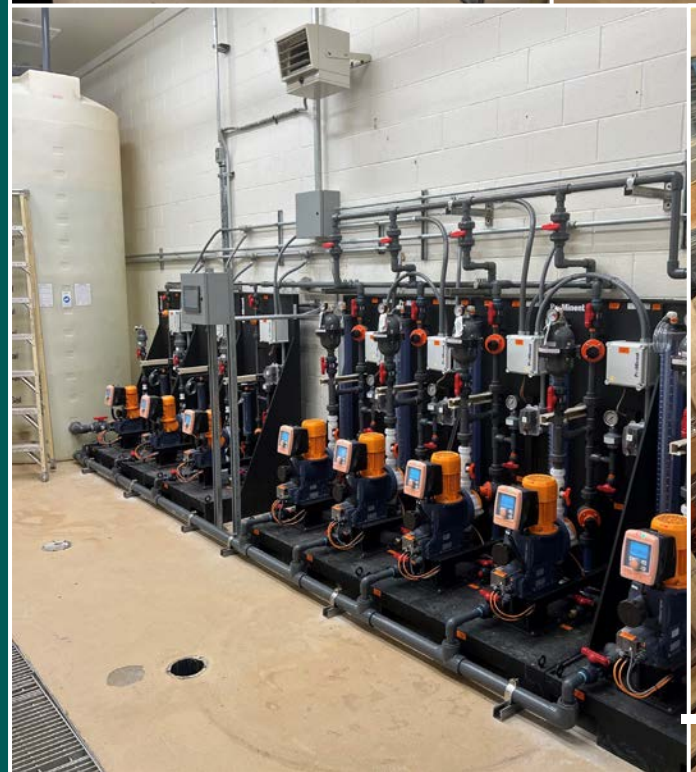

DEEP WELL AND HIGH SERVICE PUMP REHAB

- All equipment pulled and inspected
- All work phased to minimize disruption to operations
- Wells' motors reused and pumps replaced
- New level transducers for Wells
- Planned HSP motors' replacements

SODIUM HYPOCHLORITE PUMPS

- New pump skids installed in old brine area
- Replaced existing wall mounted pumps
- New skids provide better reliability and functionality





BACKWASHING

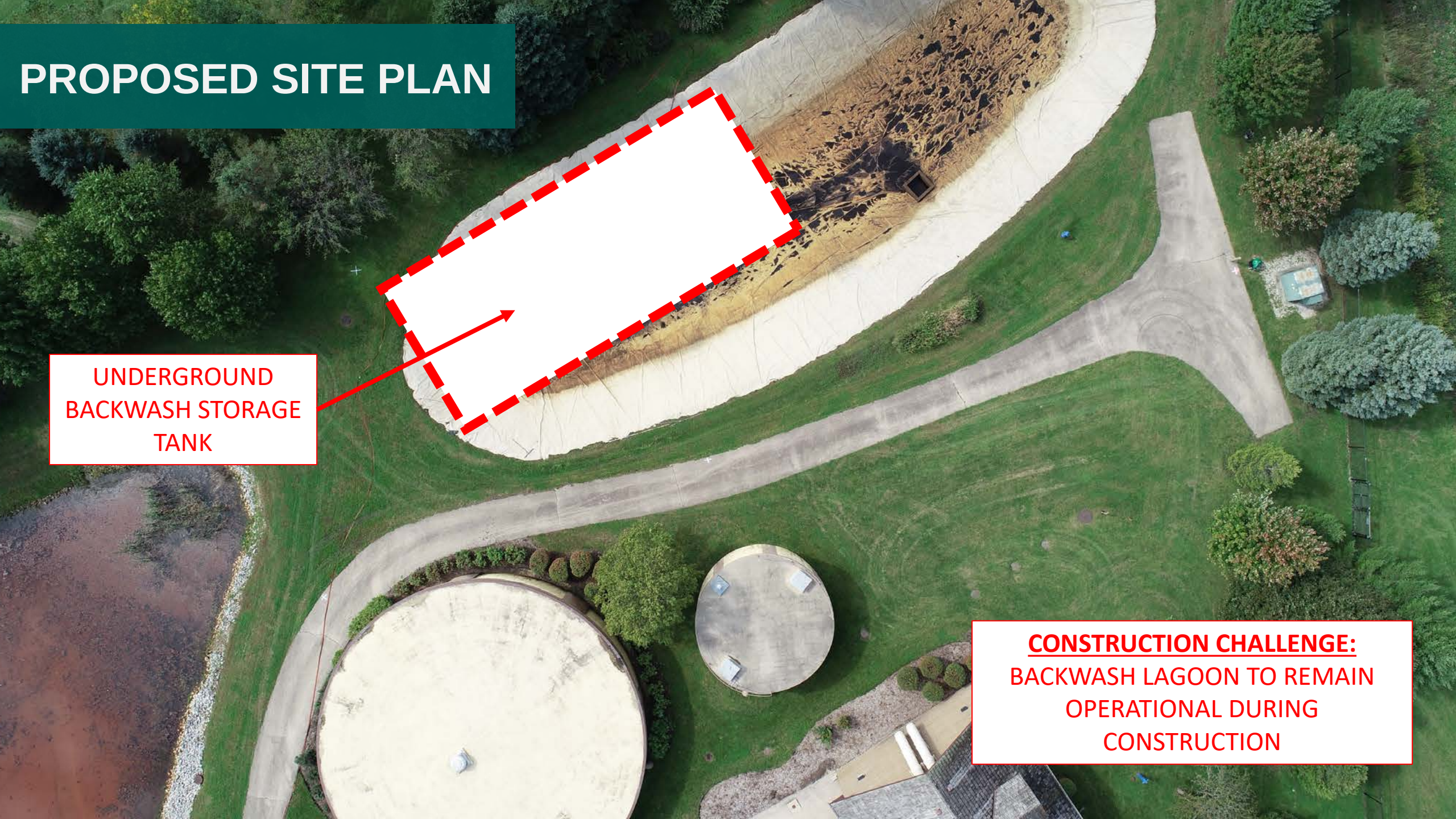
EXISTING BACKWASH LAGOON

- Radium-laden solid accumulation requiring periodic disposal as special waste
- Frequent high-volume washdowns of lagoon (average 1,300,000 gallons/year)
- Open to environment
- Safety concerns

PROPOSED UNDERGROUND BACKWASH TANK DESIGN GOALS:

- Prevent solid accumulation
- Improve operational efficiency
- Improve safety

PROPOSED SITE PLAN



BYPASS PUMP PLAN

PRECAST CONCRETE DIVIDING BLOCKS

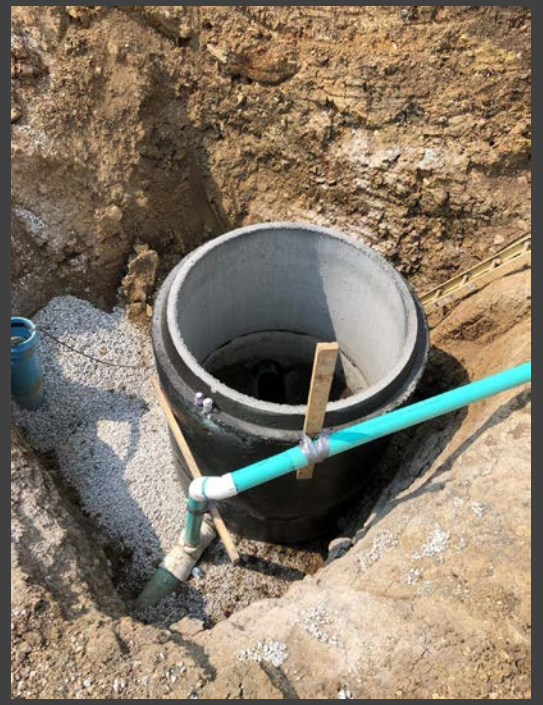
REMOVED LINER

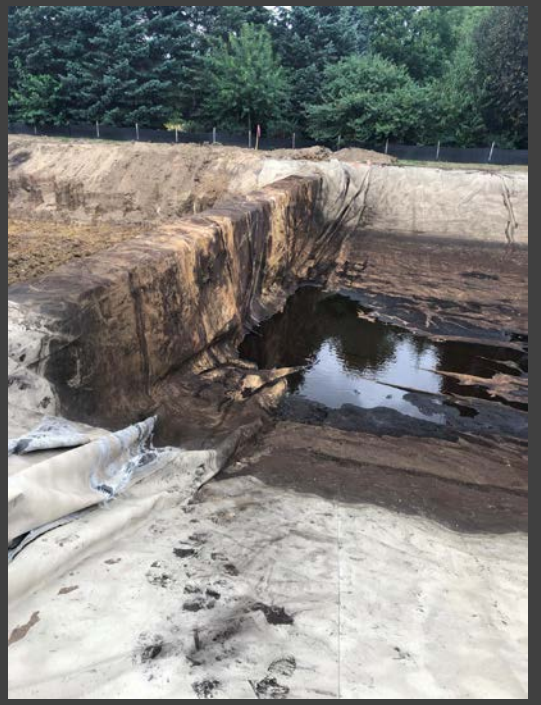
NEW MANHOLE

X2 TEMPORARY BYPASS PUMPS

BYPASS PUMP LINE

GRAVITY FLOW TO LIFT STATION





Underground backwash storage tank during construction

New access hatch to access underground backwash tank

Sloped tank floor to prevent solids accumulation and to direct flow to effluent

Old lagoon filled in and site regraded and seeded over backwash tank

BRINE


REHABILITATE WELL NO. 9 (REFER TO SPECIAL PROVISIONS IN PROJECT MANUAL)
REPLACE ROOF (REFER TO A SHEETS)
REHABILITATE TWO (2) DUALATORS (REFER TO SPECIAL PROVISIONS IN PROJECT MANUAL)
TEMPORARY CONCRETE WASHOUT FACILITY (SEE CIVIL DETAILS)
ASPHALT PAVEMENT IMPROVEMENTS CONTINUED ON SHEET C-10
HOT MIX ASPHALT PAVEMENT SEE NOTE 3
ACCESS ROAD TO FABYAN PKWY
SCALE 0 20' 40' FEET
ALTERNATE BID ITEM– ASPHALT PAVEMENT IMPROVEMENTS
NOTE:
REHABILITATE THREE (3) HIGH SERVICE PUMPS (REFER TO SPECIAL PROVISIONS IN PROJECT MANUAL)
EROSION CONTROL BARRIER (TYP.) (SEE CIVIL DETAILS)
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CONC. SIDEWALK
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(3) EX. 16" GATE VALVES WITH NEW VALVE BOXES AND STEM EXTENSIONS INSTALLED FLUSH WITH PAVEMENT
HOT-MIX ASPHALT PAVEMENT
CONCRETE DRIVEWAY
BOLLARDS (TYP. OF 4)
BRINE BUILDING
4" SCH 80 PVC SAN

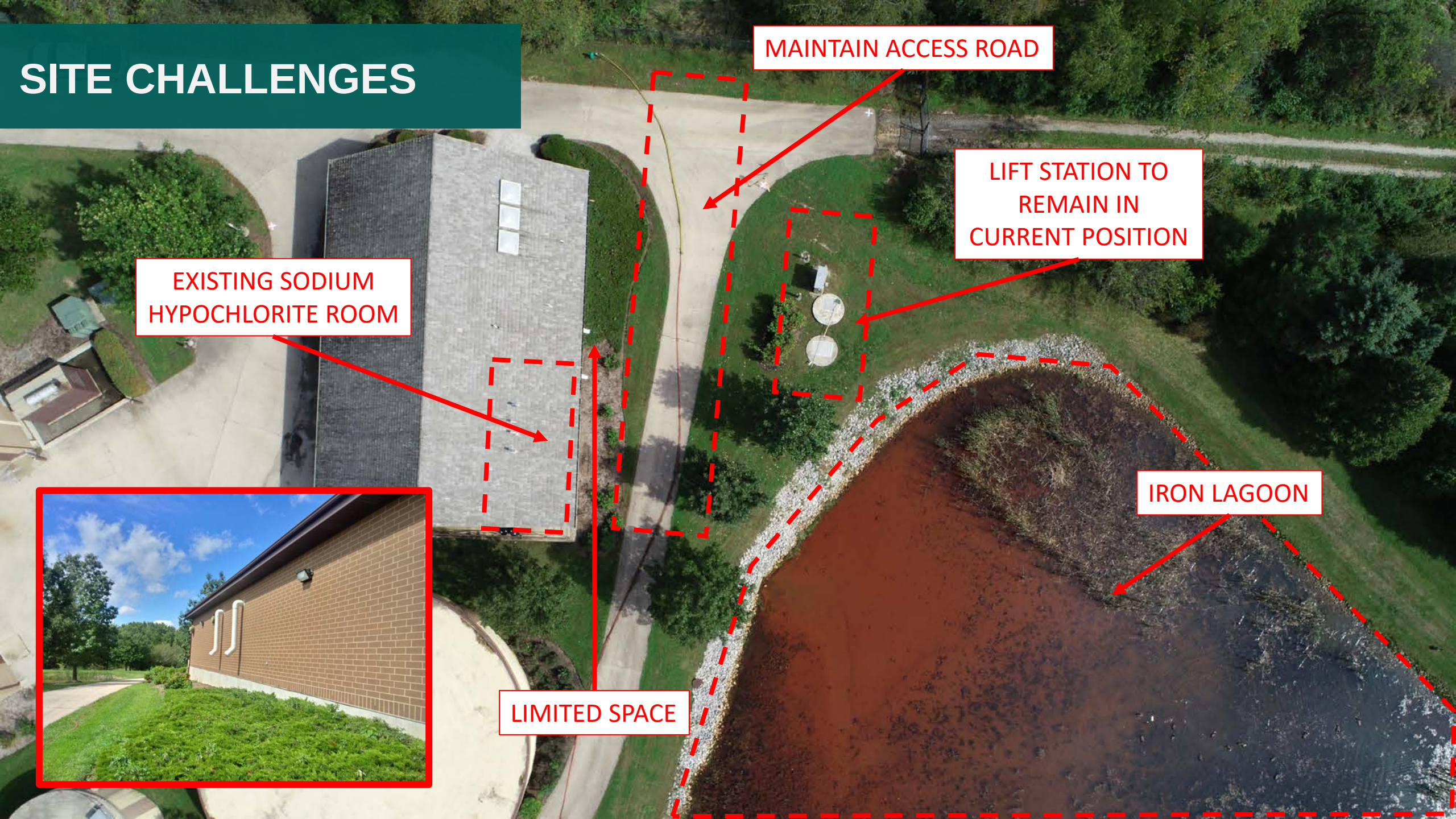
EXISTING BRINE AREA

- Brine tanks located in cramped room along with chlorine generators, sodium hypochlorite tanks, and misc. piping
- Very difficult for operators to load salt into brine tanks (safety concerns)
  - 8 pallets of salt, 49 bags per pallet loaded one bag at a time up a ladder into tanks
- No dedicated salt storage location

PROPOSED BRINE BUILDING ADDITION DESIGN:

- New brine tanks in recessed area
- Added salt storage space

SITE CHALLENGES

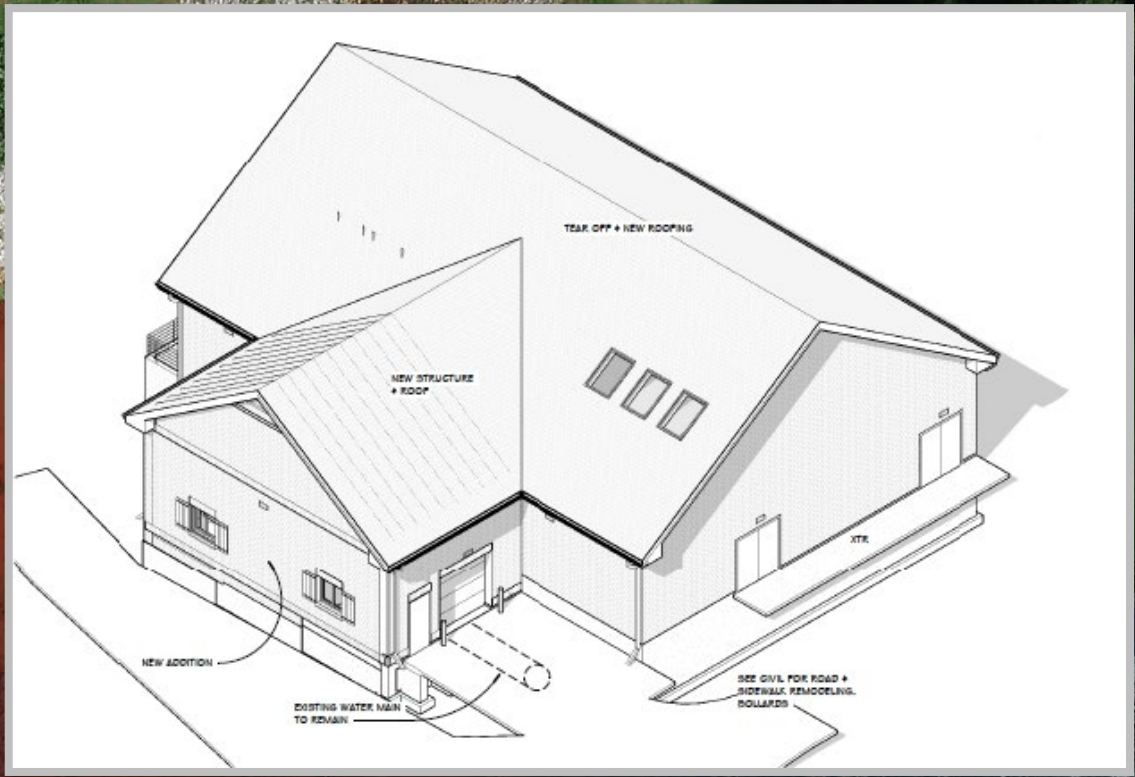


PROPOSED SITE PLAN

CONCRETE DRIVEWAY

RELOCATE ROAD

BRINE AREA ADDITION



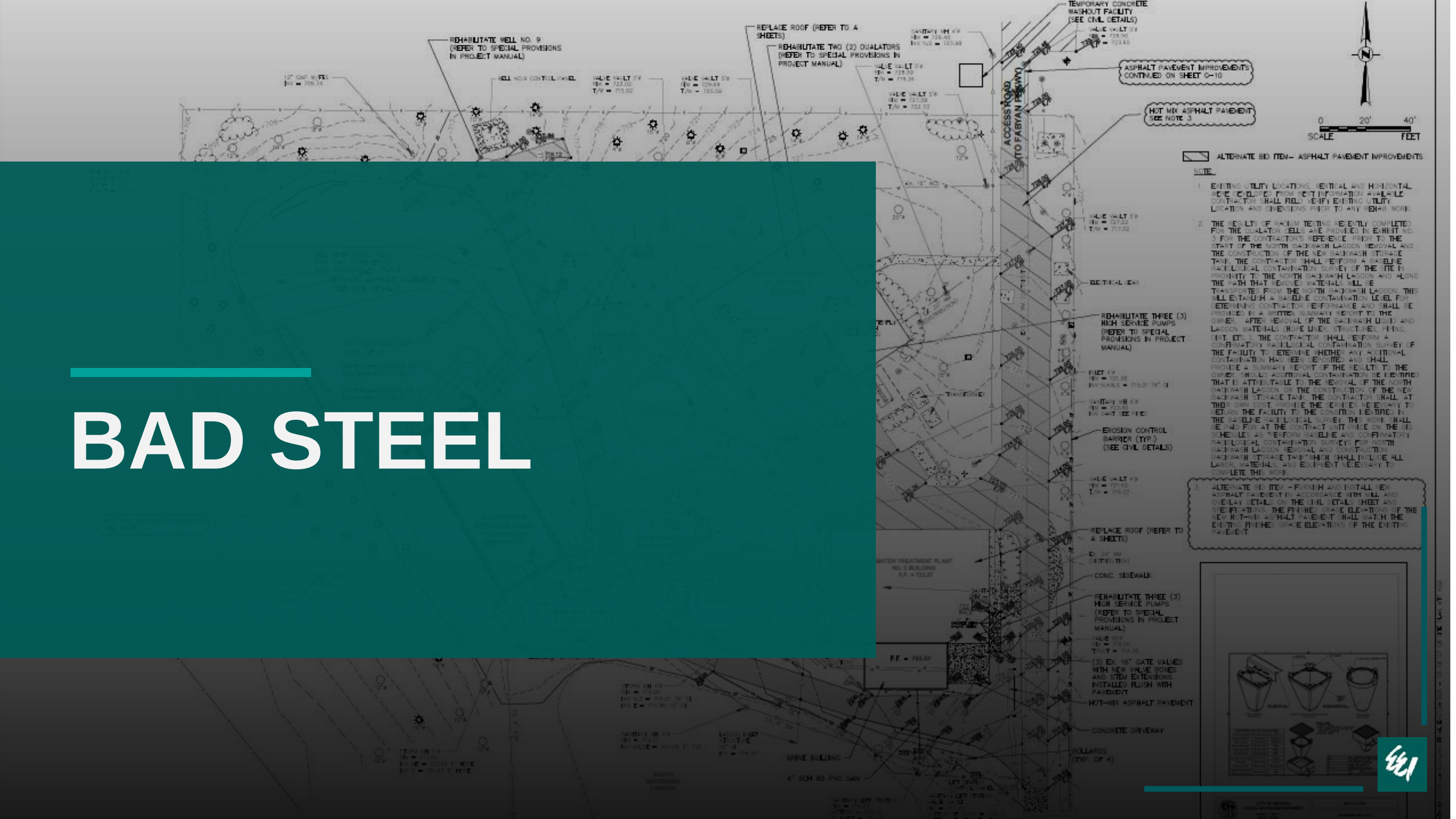
Completed Brine addition with relocated access road

Recessed brine tanks and brine piping, new tables for easy salt loading

New concrete loading dock and overhead access door

Interior salt storage space, new office, and new bathroom

BAD STEEL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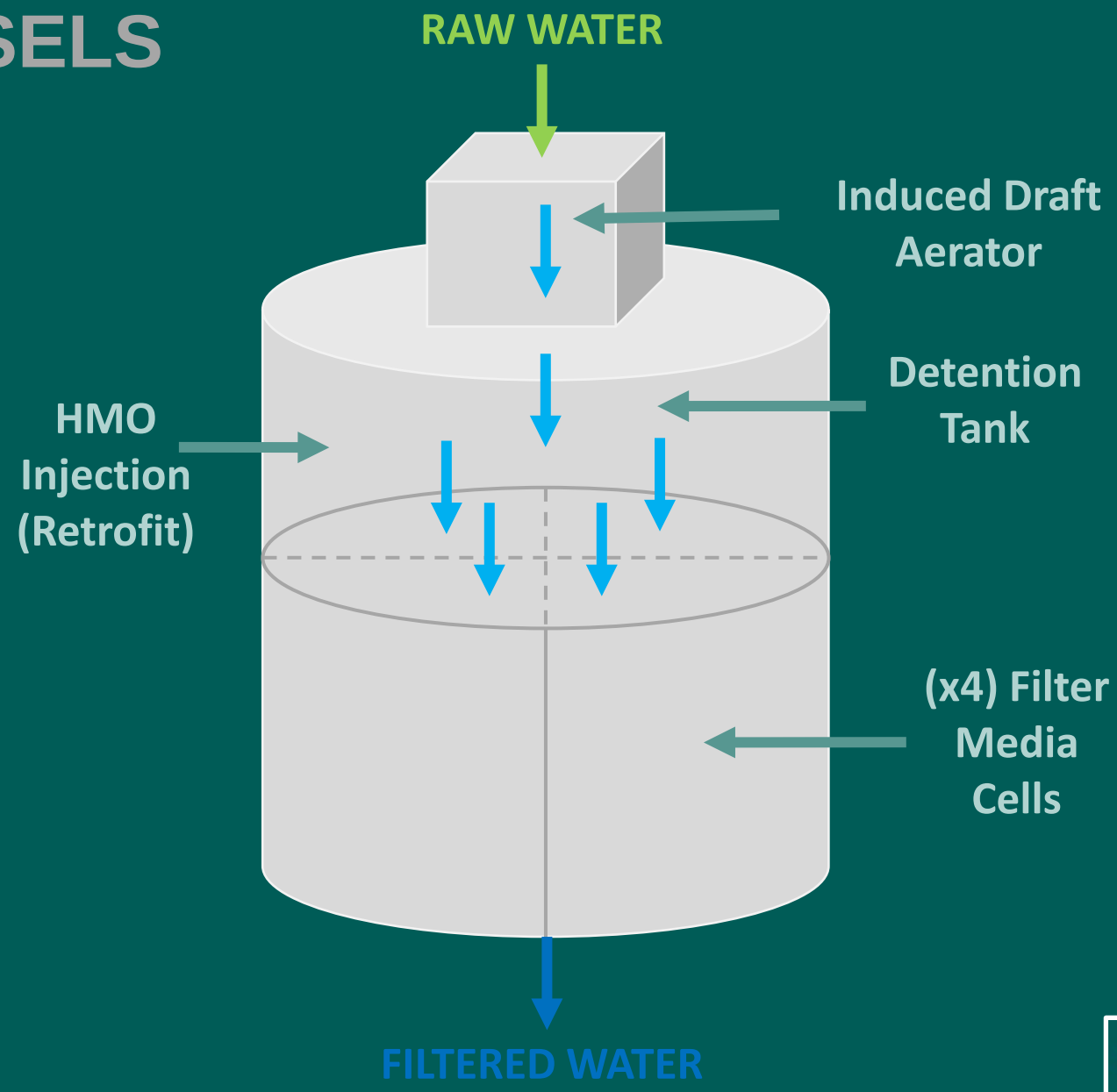
4" SCH 80 PVC SAN

DUALATOR FILTER VESSELS

- Original treatment plant for shallow wells to treat iron and manganese
- Converted to HMO system in mid-2000's for radium removal for deep wells
  - **In service since early 90’s**



DUALATOR REHAB ANTICIPATION

- New concrete underdrain system
- Steel repairs in Detention Tank
- Coating system cleaning and overcoat
- Replacement of all valves and actuator system

DUALATOR DESIGN CHALLENGES

- Both tanks to remain completely operational during peak usage months
  - Only one tank offline at a time
- No previous rehab records
- Assumptions made for scope of repair because Dualators' interiors could not be inspected prior to construction

DUALATOR 2 CONDITION

Induced Draft Aerator

- Aerator trays in worse condition than expected and required replacement
- Aerator spray nozzles required replacement

Detention Tank - Floor

- Detention tank floor had severe pitting

Detention Tank – Misc.

- PVC vent lines damaged
- HMO feed piping and Detention Tank drain line to be replaced

DUALATOR 2 CONDITION

Tank Concrete Pad

- Concrete pad required minor repairs and sealing

Coating System

- Interior required full sandblasting and recoating
- Exterior required cleaning and topcoat

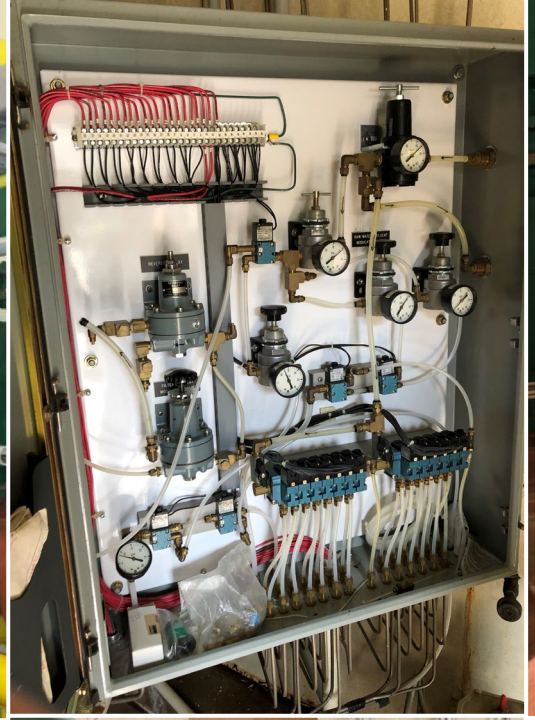
Filter Cells - Underdrain

- Underdrain required replacement and concrete fill (planned)

DUALATOR 2 CONDITION

Filter Cells - Troughs

- Welds failed on structural supports
- Welds failed on trough support components
- Pitting in trough steel
- New structural supports required for all troughs
    - Solution identified that did not require full trough replacements (cost savings)



DUALATOR VALVES

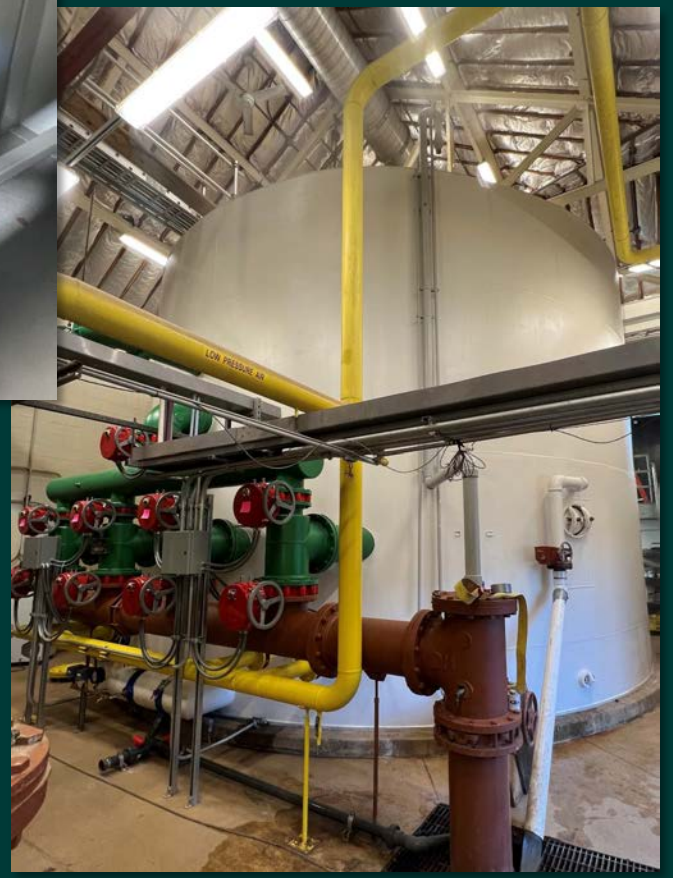
- Original System:
  - Pneumatic Valves
    - No Manual Operation Mode
  - Airlines Tied in Control Cabinet
  - Limited SCADA Capabilities
- New System:
  - Electric Actuated Valves
    - Manual Handwheel
  - Automated Display Cabinet
  - Added SCADA Capabilities

Fully recoated aerator with new nozzles and spray trays

Fully recoated filter cells with new trough supports and concrete underdrain system

Fully recoated detention tank with new HMO piping, drain valve, and PVC vents

Fully recoated exterior and all new valves and actuators



BIOLOGY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SCALE
0
20'
40'
FEET
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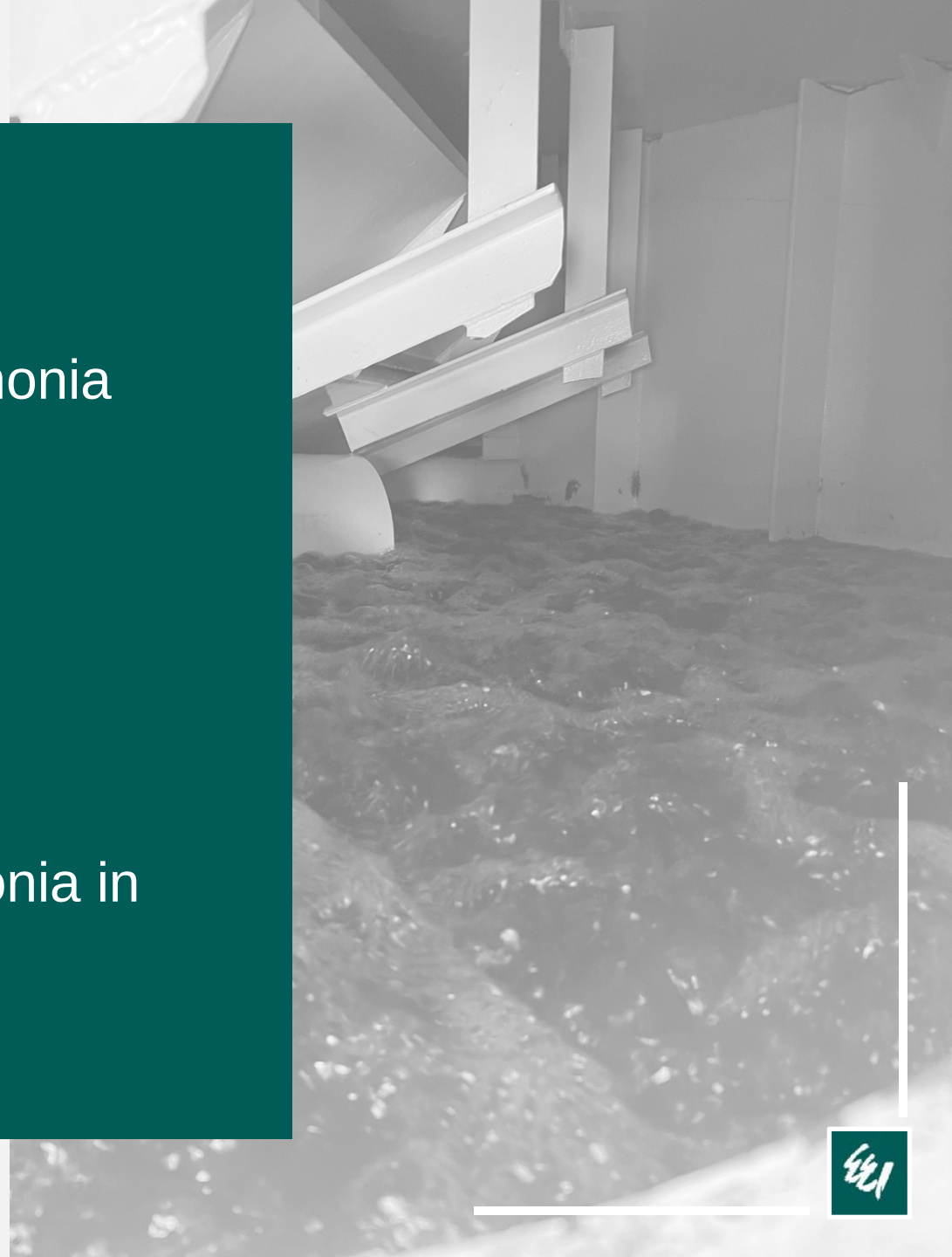
Existing Filter Cell Media

- City identified that Filters removed ammonia from raw water
  - ~0.45 mg/L raw ammonia and no ammonia at effluent of Dualators
- BIOLOGICALLY ACTIVE FILTER
  - Nitrifying bacteria that oxidize ammonia in the filter media



Filter Operation Data

RAW AMMONIA CONCENTRATION
0.45 mg/L

(9 ppm Chlorine to treat 1 ppm Ammonia)

CHLORINE REQUIRED TO REMOVE AMMONIA
4.05 mg/L

+

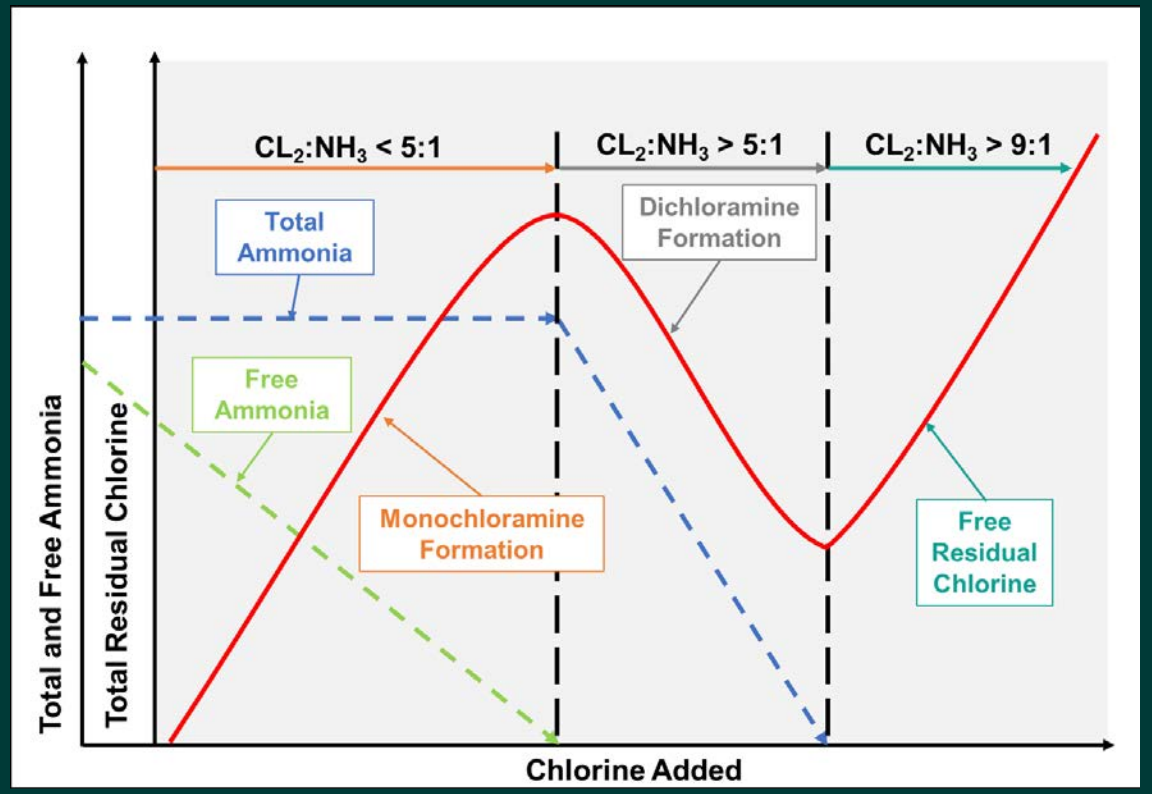
TARGET FREE RESIDUAL - EFFLUENT
1.05 - 1.10 mg/L

=

CHLORINE DEMAND IF NOT BIO ACTIVE
5.25 – 5.45 mg/L

≠

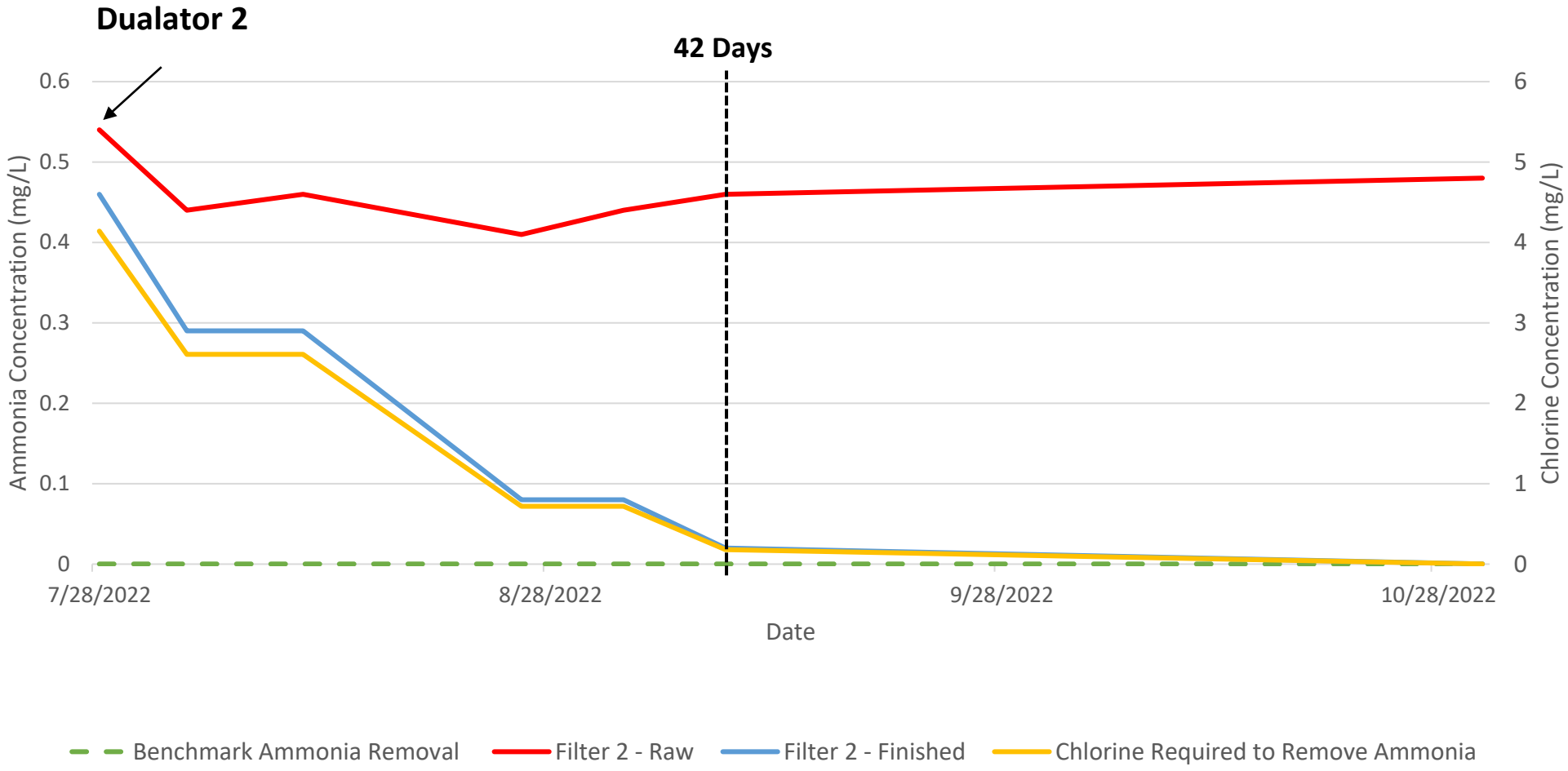
ACTUAL CHLORINE DEMAND
1.05 - 1.10 mg/L



STRATEGY TO MAINTAIN BIOLOGY

- ~165 gallons of media pulled from each filter cell of each Dualator and stored in small tanks as seed media
  - Approx. 1/12 of total media
  - Total remaining media removed and disposed = 7,280 gallons
- Raw water pumped through storage tanks to keep media biologically active
- Existing media was used to re-seed new media with nitrifiers when installation occurred

Dualator 2 – Post Media Replacement



SUMMARY/ LESSONS LEARNED

SUMMARY / LESSONS LEARNED

BIOLOGY IS YOUR FRIEND

Recognize whether you have biologically active filtration, how to cultivate it for optimal treatment, and how to maintain it through construction activities

ASSUME THE WORST

If inspection of steel tank interior before construction is not possible, assume significant repairs required of aging components

SAFETY FIRST

Look for potential safety issues and opportunities for improvements

TEAMWORK

Coordination key to allow Operators to keep facilities operational during construction

PROACTIVITY SAVES

Proactively rehabilitate equipment to reduce potential for catastrophic failure and more costly repairs

THANK YOU

We value your time and appreciate the opportunity to present this afternoon.

Engineering Enterprises, Inc.

CITY OF BATAVIA

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