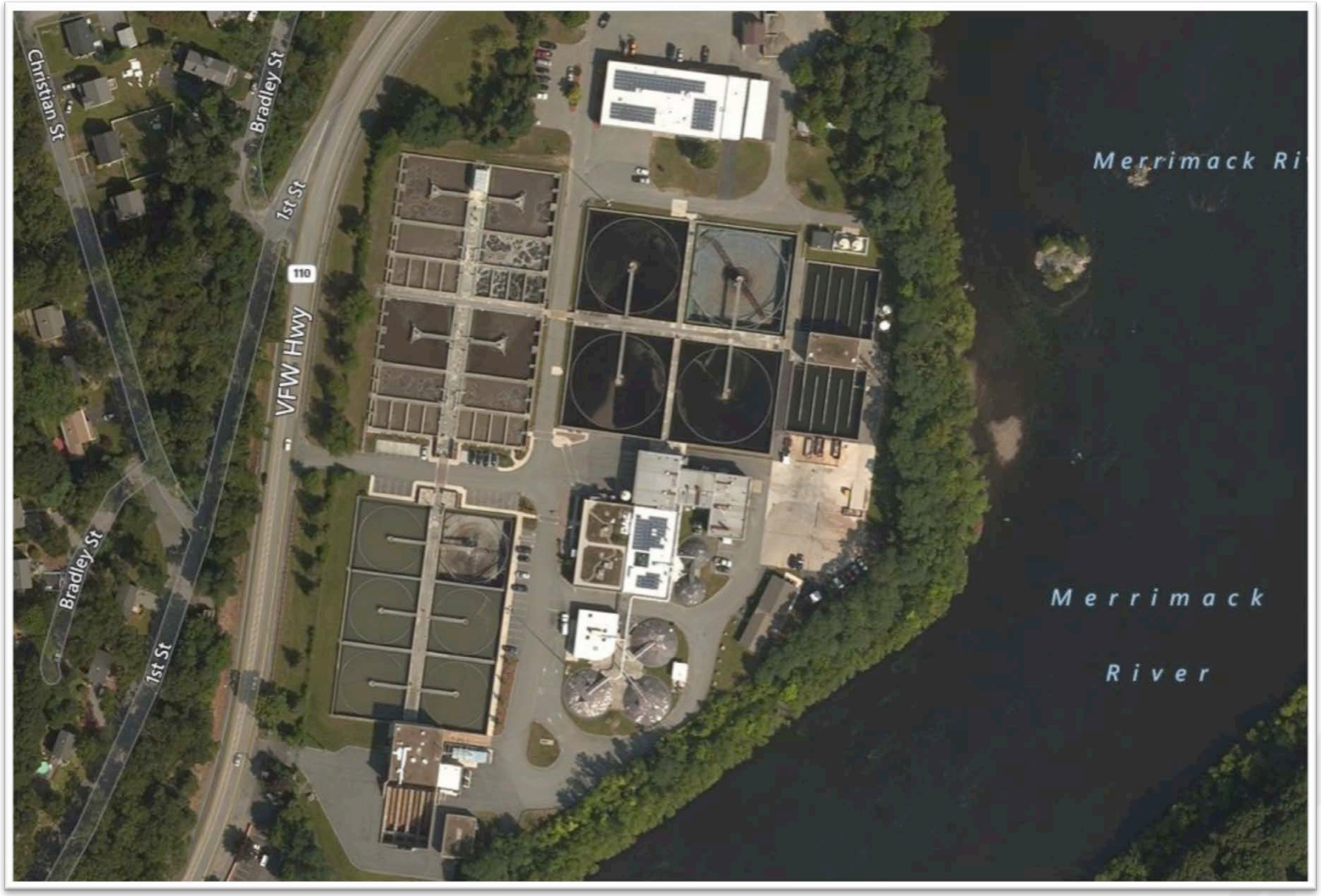
Clarifier Studies

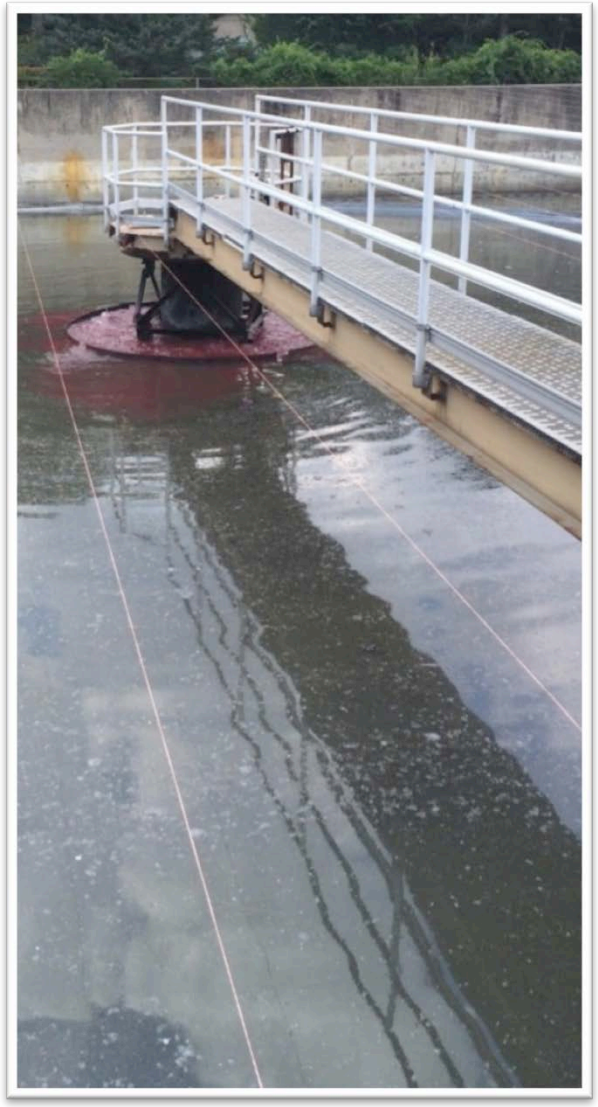
Target Process and Mechanical Improvements at LRWWU

NEWEA Spring Meeting - June 7, 2016

LRWWU Duck-Island WWTF

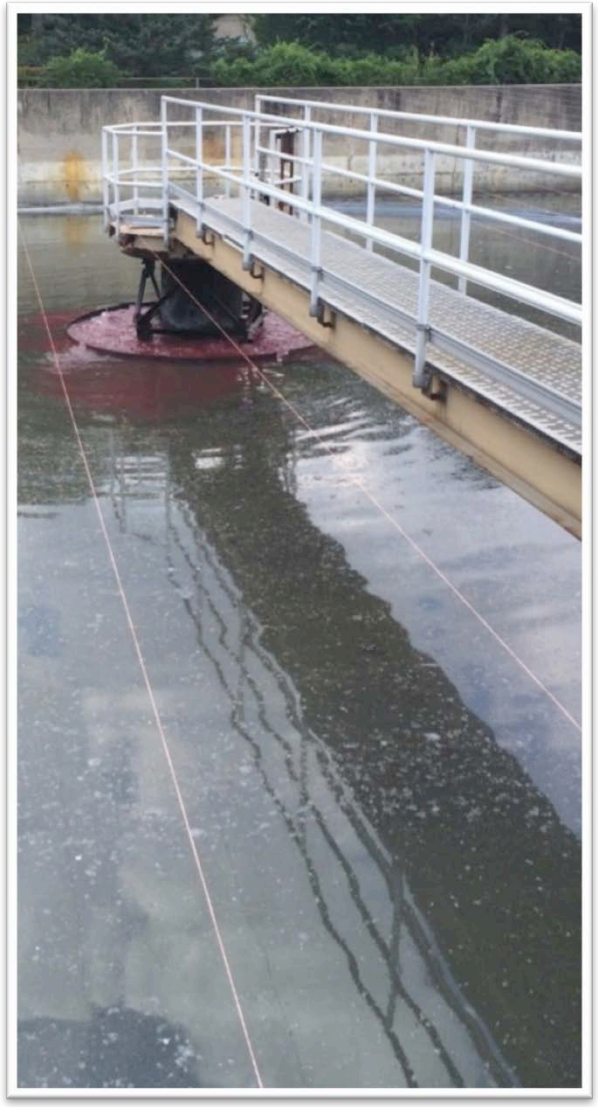


Project Motivation



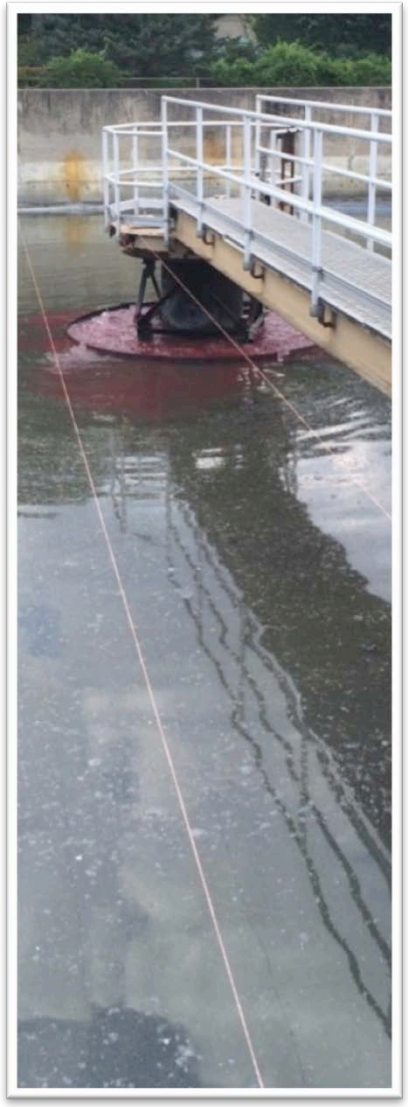
- 35 year old primary and secondary clarifiers
- Generally perform well
- Robust construction
- Mechanical issues with corner sweeps
- Parts nearing the end of their useful lives
- Opportunity to incorporate new technology
- Optimizing wet-weather performance
- Minimize down-time
- Prioritize limited funds

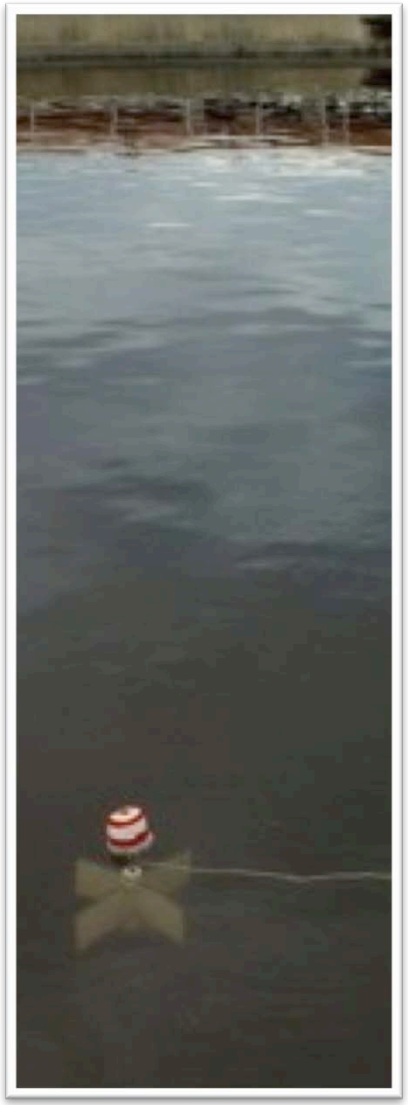
Methods of Assessment



- Clarifier Process Performance Study
- Structural Evaluation
- Corner Sweep Alternatives Evaluation
- Drive Mechanical Assessment

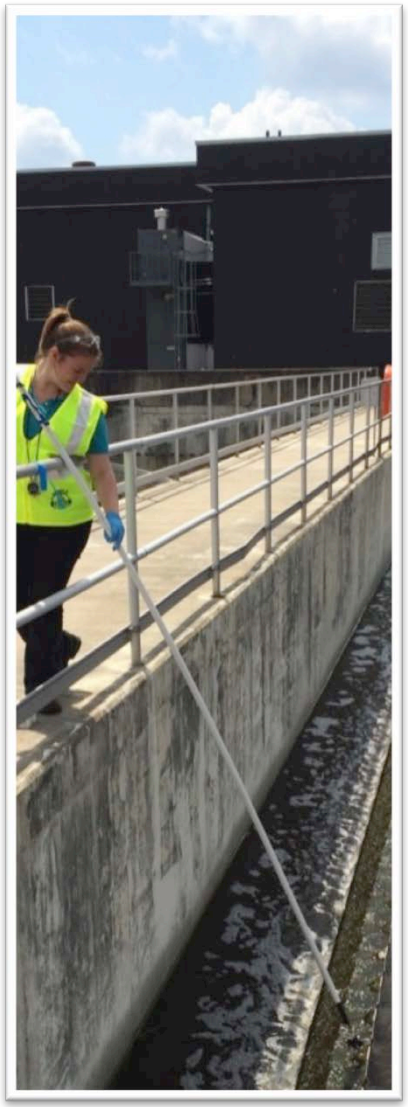
Clarifier Process Study





Test	Purpose	Results
Dye	Identify flow regime & short circuiting	Moderately severe short circuiting, esp. corners.
Drogues	Locate currents	Strong density currents at bottom of clarifiers

Clarifier Process Study



Test	Purpose	Results
Blanket Depths	Confirm solids removal capacity	No increase in blanket solids over range of test conditions. RAS not limiting
Solids	Performance indicator	Near-ideal performance up to 26 mgd.

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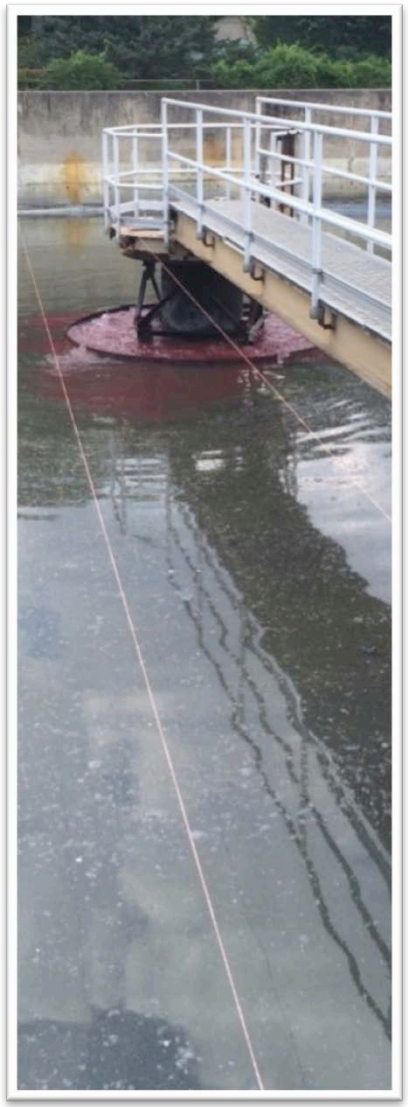
Clarifier Process Study



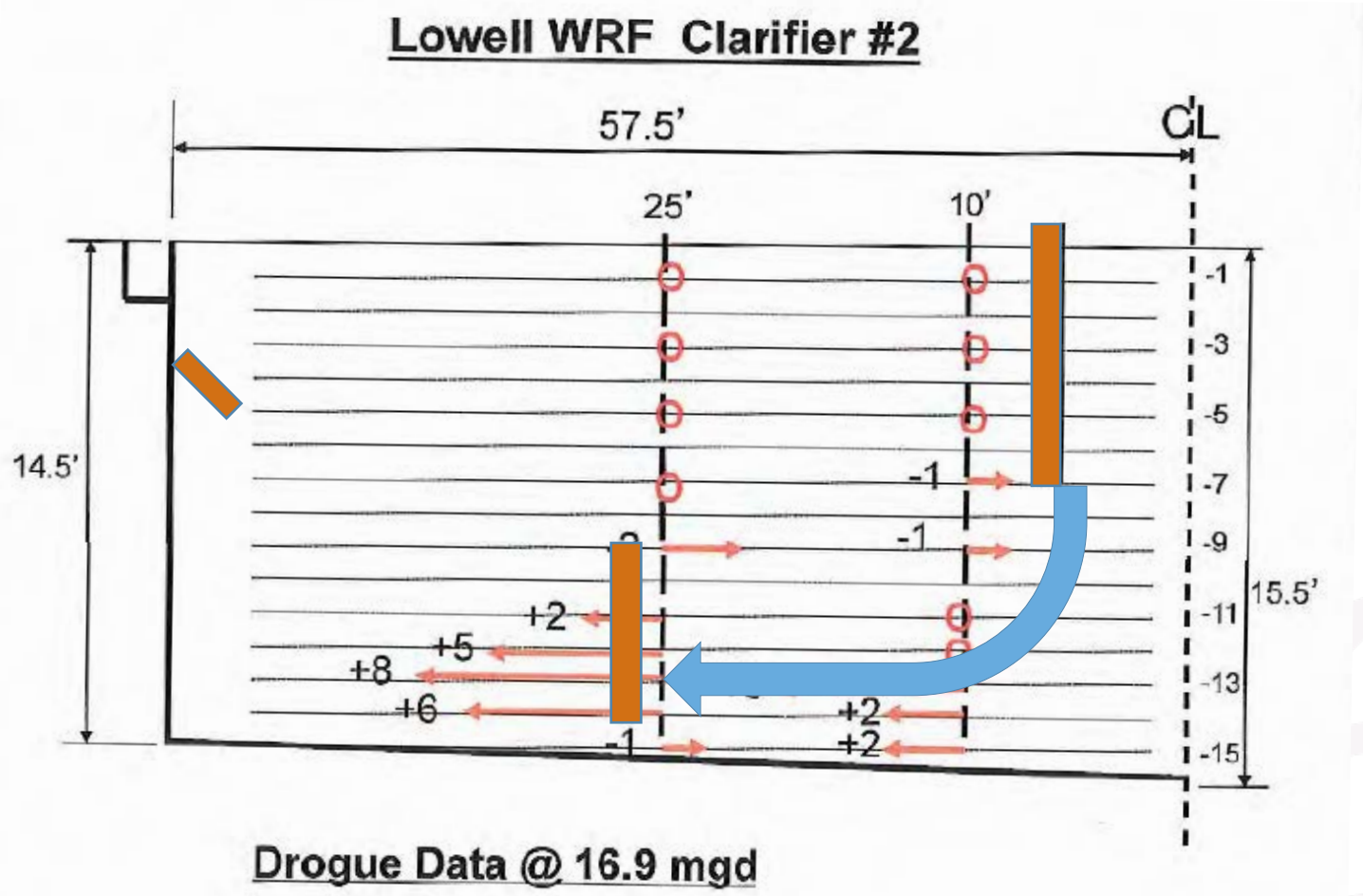
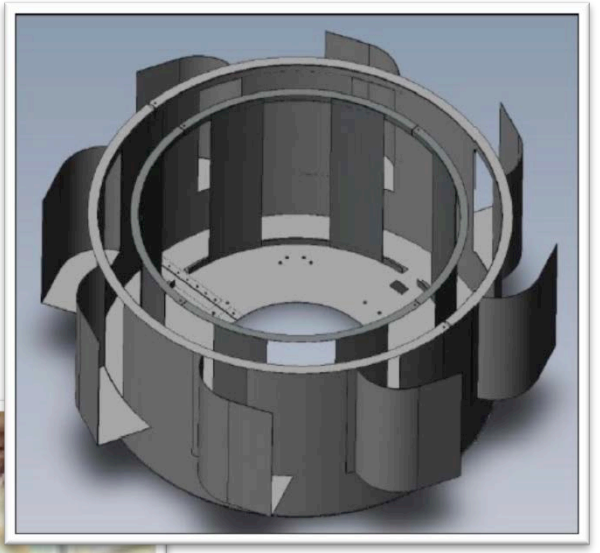


Figure D5

Clarifier Process Recommendations

Energy Dissipating Inlet

- Standard practice for optimal clarification
- Impinged flow performs better
- LA-EDI appears to be the best performer, esp. at high flows



Clarifier Structural Evaluation

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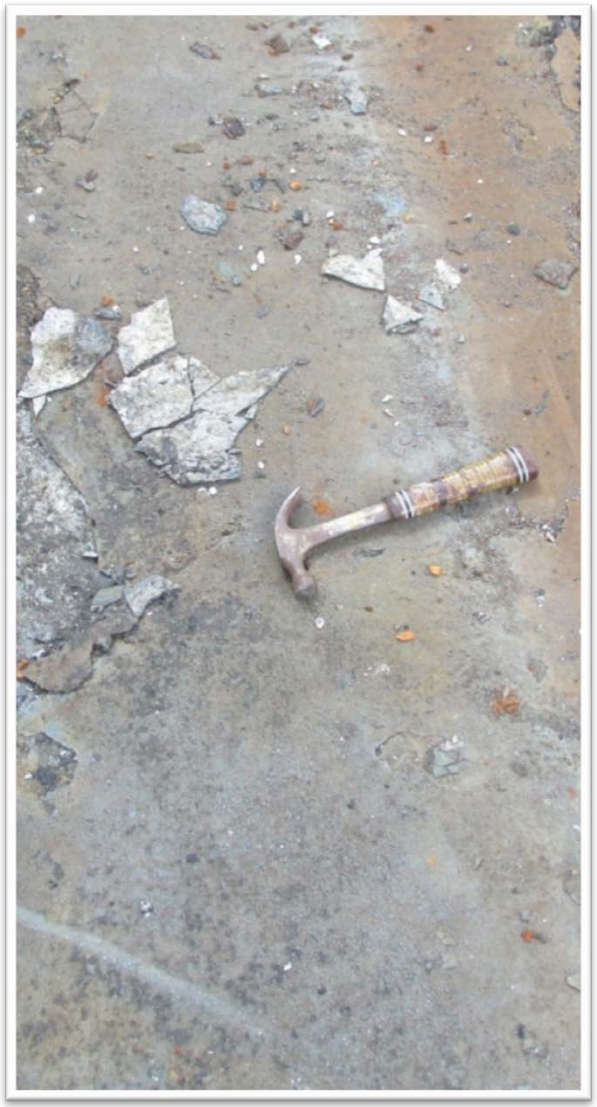
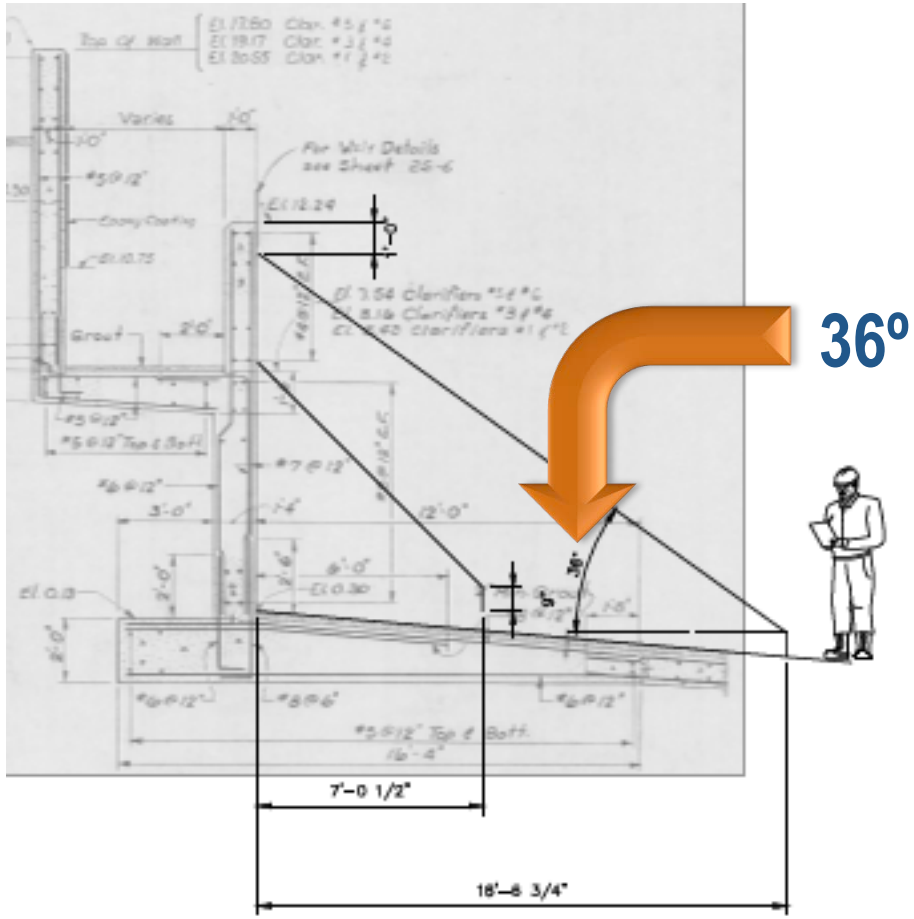


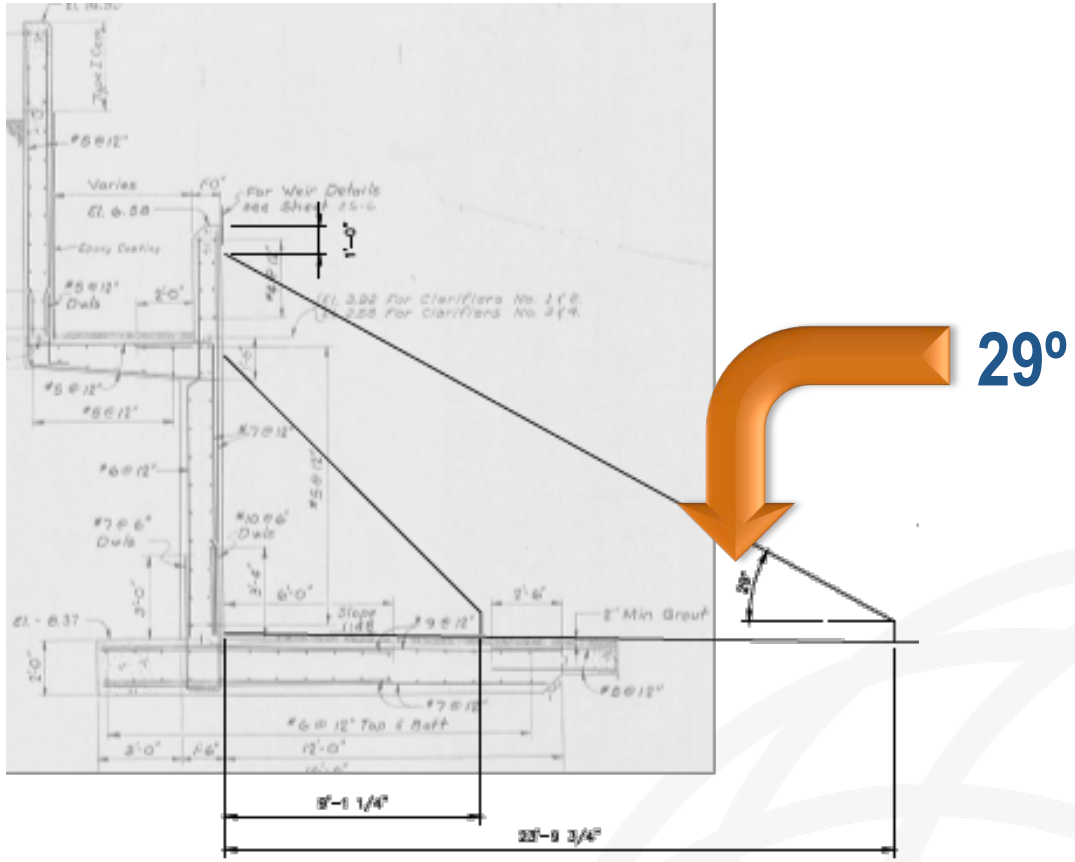
- Tank Floor Repair: $600,000
- Common Wall Repair & Coating: $1,100,000
- Other Concrete Repair: $3,000,000

Corner Sweep Alternatives

1) Elimate sweeps with larger fillets
2) Elimate sweeps by filling corners
3) Keep but improve sweeps

Alternative 1: Larger Fillets

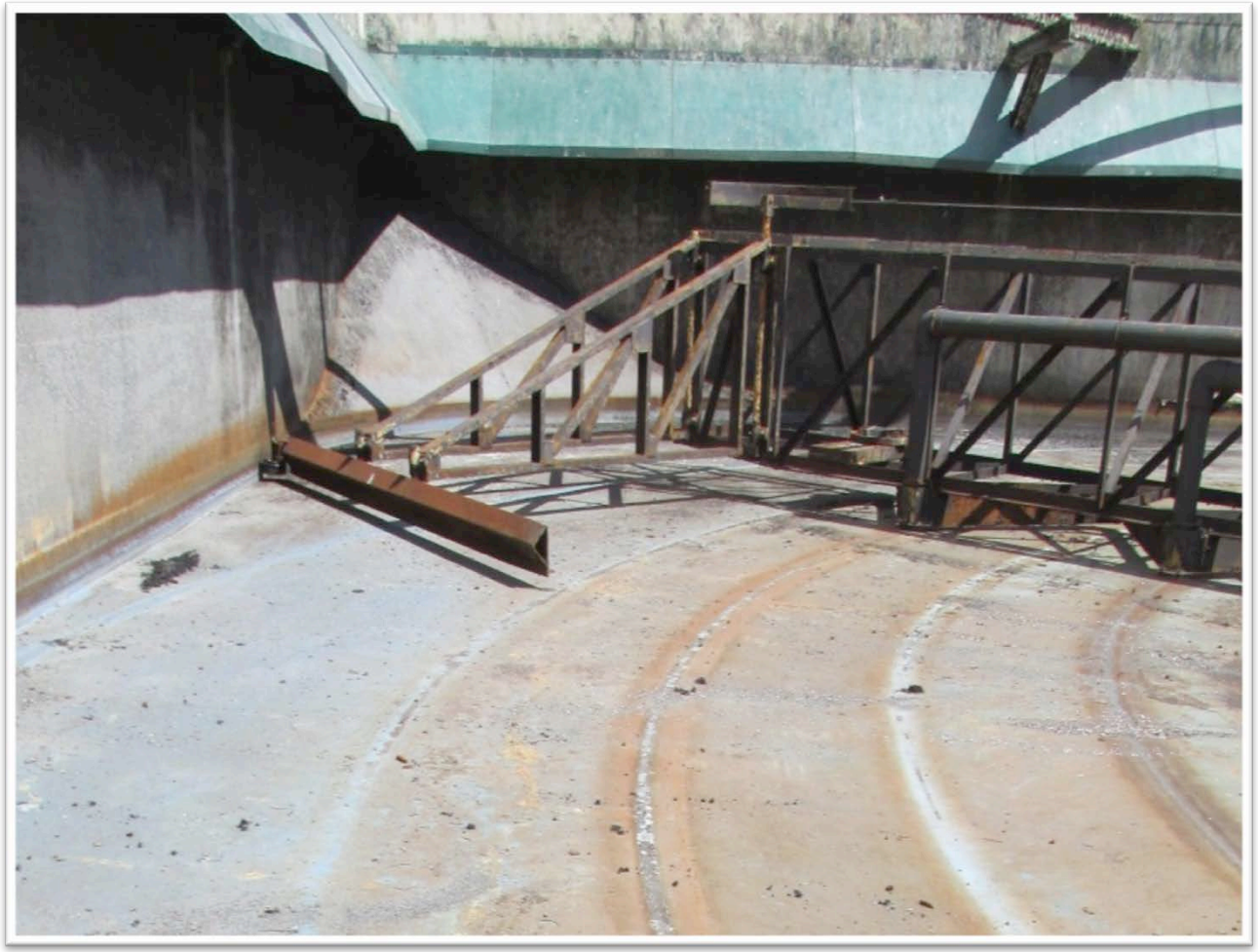




Alternative 2: Fill Corners

	Existing	Octagonal	Circular
Primary			
Surface Area, Each (sqft)	6,400	5,300	5,000
Peak Capacity, All (mgd)	115	95	90
Secondary			
Surface Area, Each (sqft)	13,225	11,000	10,400
Critical Capacity, All (mgd)	77	64	60
Capacity Remaining	**100%**	**83%**	**79%**

Corner Alternative 3: Improved Sweeps



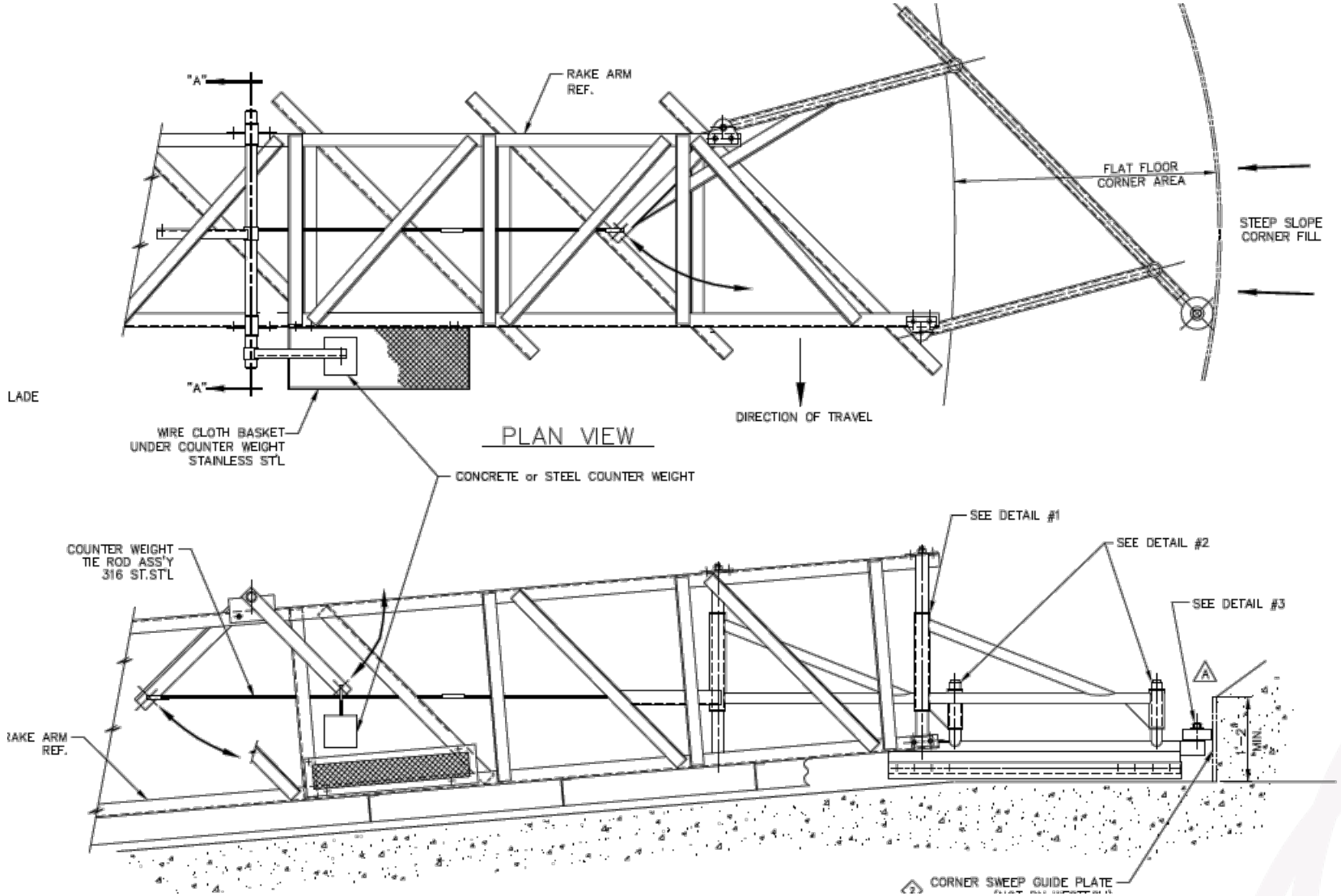
New Corner Sweeps

- Maximize Flow
- Reduce emergency shutdowns
- Offline only once a year

Corner Alternative 3: Improved Sweeps

Corner Alternative 3: Improved Sweeps

Corner Alternative 3: Linkage

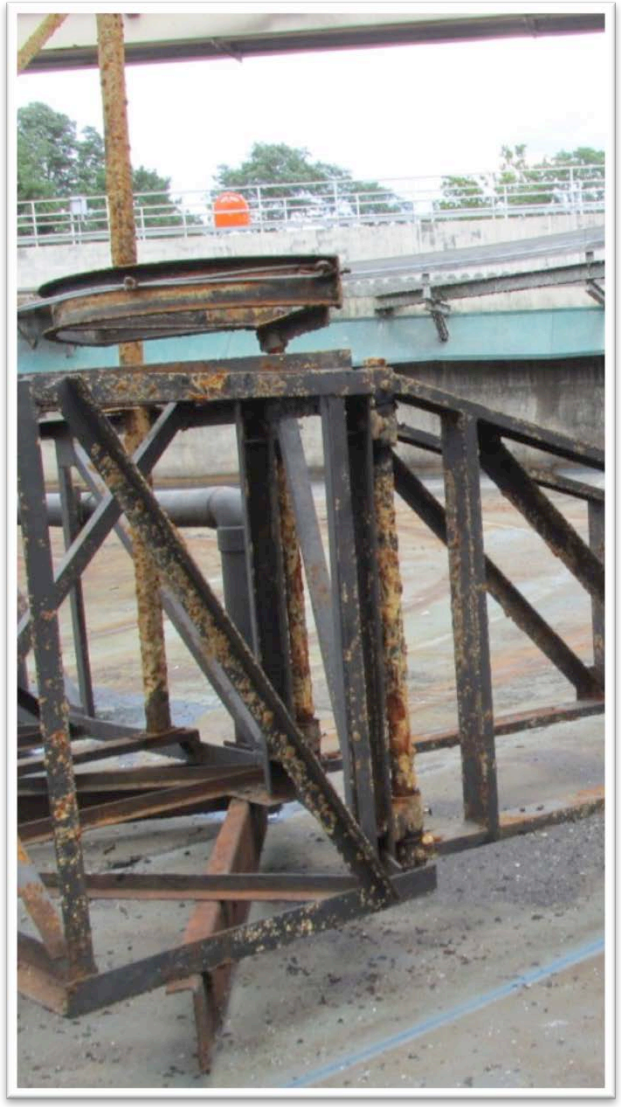


Corner Alternative 3: Plastic Chain and Improved Wheel

Existing Design Improvements

- Chain and Sprocket Design
- Ultra High Molecular Weight Polyethylene Wheels
- Reduced counter weight
- Sealed Wheel Bearing
- Metal track

Corner Sweep Recommendation



- Keep the existing corner sweep design
  - Maintain Existing Capacity
  - Less expensive
- Careful specification:
  - Plastic chain & sprocket
  - Sealed bearing UHMW polyethylene wheel
  - Full-circumference steel rail
  - Submit load ratings for components
  - Warranty, references

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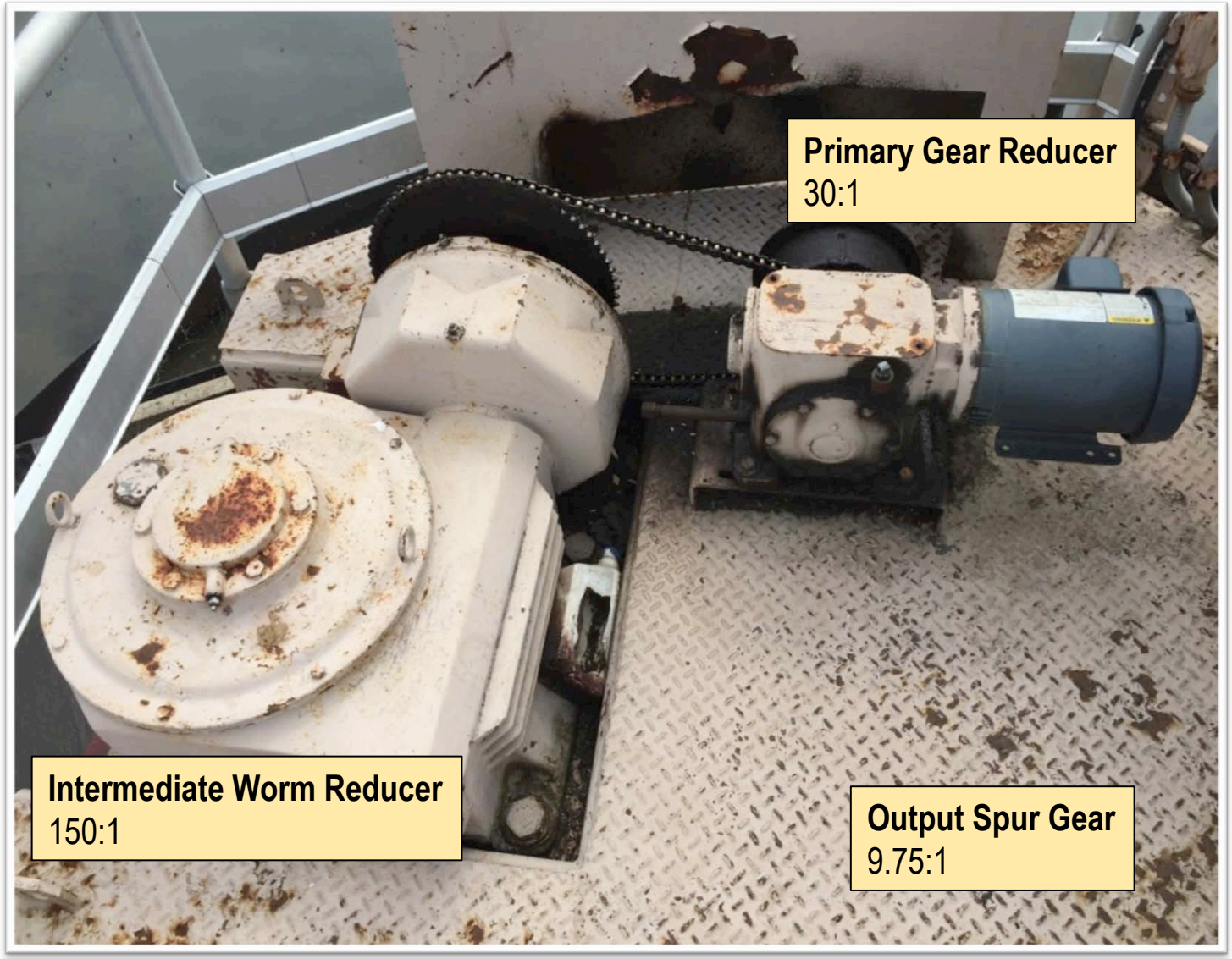
Drive Mechanical Assessment



Replace or Refurbish

- Existing Drives are 35 year old FMC/Link-Belt model SB-G/-SU
- Originally designed for the mining industry
- .04 RPM
- Evaluation by **Interstate Water and Wastewater Specialist, LLC**

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Drive Mechanical Assessment

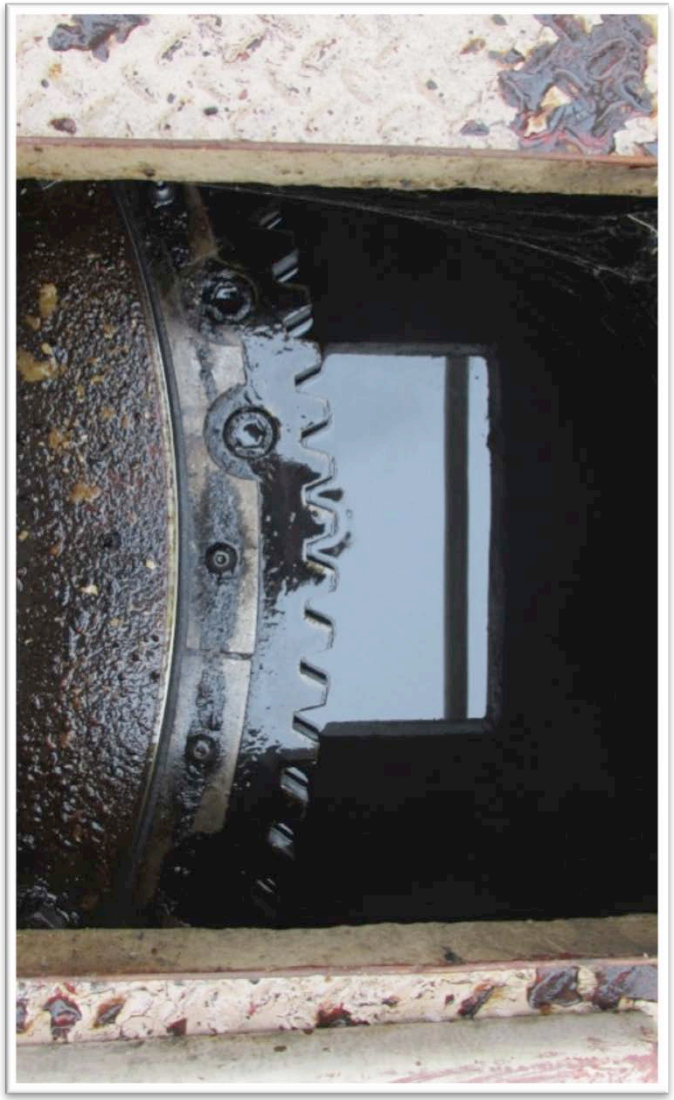
Drive Mechanical Evaluation

Evaluation and Findings

	Required Peak Torque (ft-lbs)	Drive Operating Torque (ft-lbs)	Drive Peak Torque (ft-lbs)
Primary	29,800	23,830	57,200
Secondary	43,000	34,430	96,300

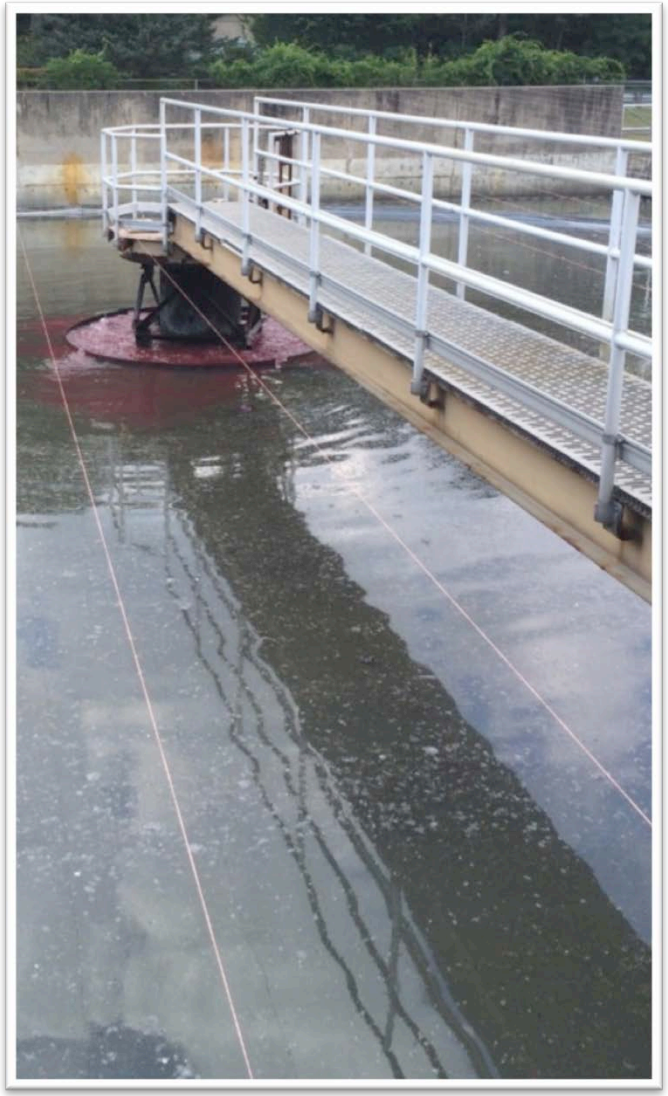
- Overall good shape with a rated life of 48 years
- Main Bearing wear is at 40% to 60% of remaining design life
- Worm Gear may need to be replaced on some units
- Intermediate (worm & pinion) bearings and seals need to be replaced

Drive Mechanical Recommendations



- Replacement cost is $90k versus $30k to $50k
- Rehab estimated at $10k to $25k per drive
- Mating plates required for new mechanisms
- Minimize risk, best quality
- Still requires crane, bridge removal, freight, painting
- Bridges can also be retained

Next Steps and Choices



Capital Improvement Plan - $11M Budgeted	Estimated Cost
Complete Rehab and Structural Repair	$12,500,000
Secondary Clarifiers Only with Structural Repair	$7,500,000
All Clarifiers with Priority Structural Repair Only	$7,300,000
Secondary Clarifiers and Priority Structural Repair	$4,510,000

Construction to begin May 2017

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Questions/Discussion

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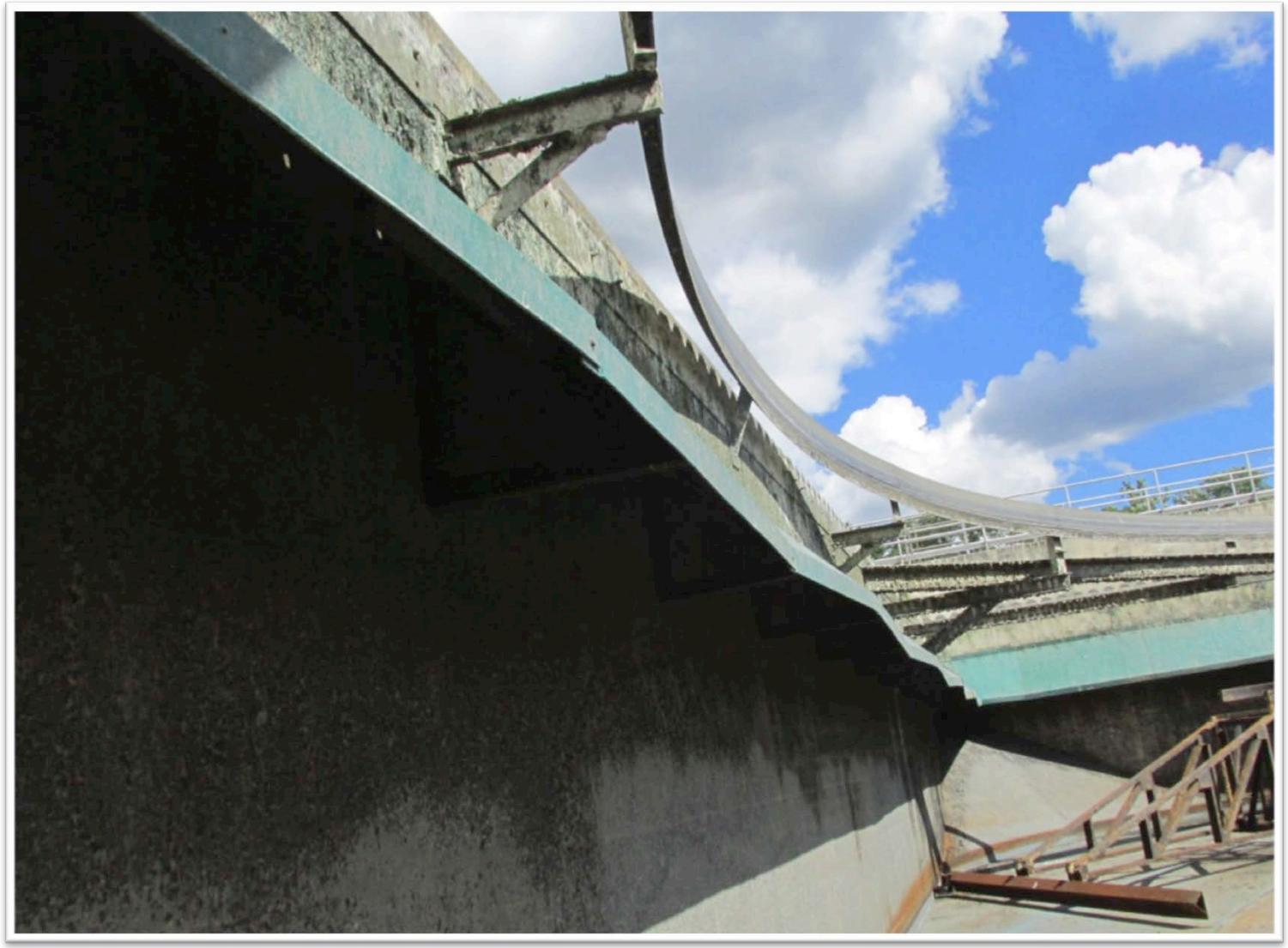
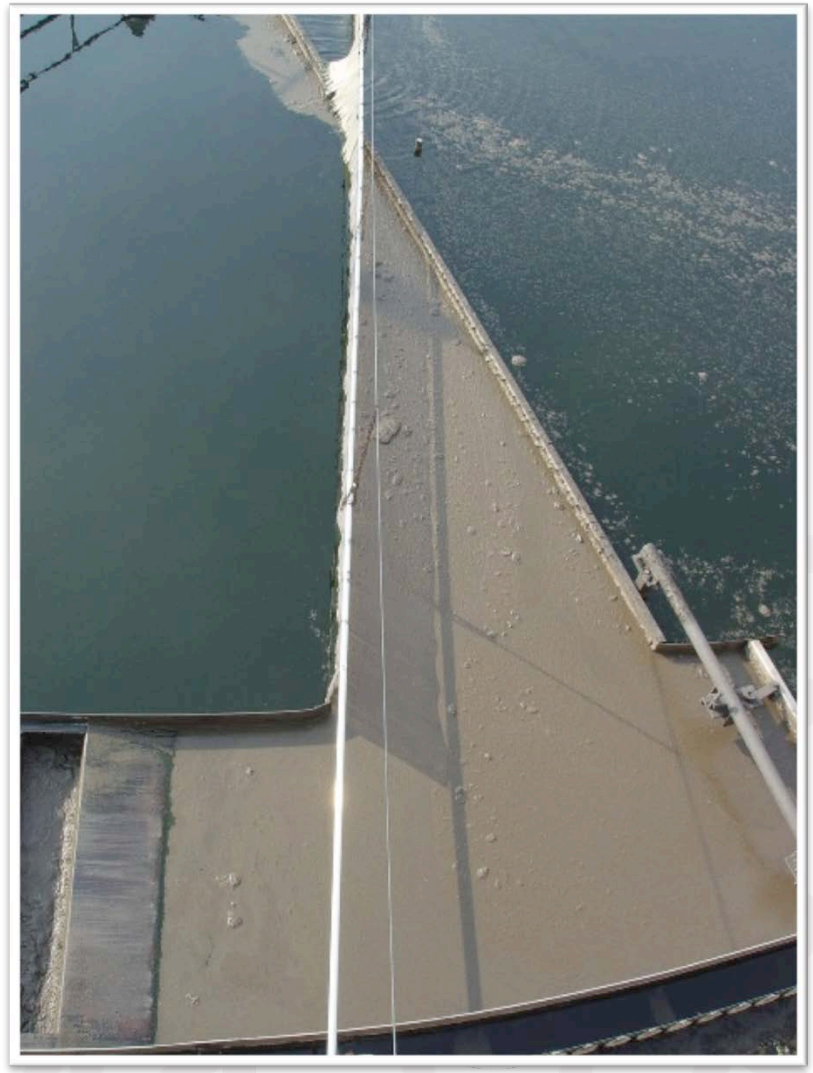
Clarifier Structural Evaluation



Clarifier Process Recommendations

Clarifier Process Recommendations