



Extending Tank Life

Water Storage Tank Construction & Rehab

*2017 OTCO
Columbus*



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AWWA Standards & Manuals

- D100 – Welded Carbon Steel Tanks for Water Storage
- **D101 – Inspection of Water Tanks and Related Facilities**
- **D102 – Coating Steel Water-Storage Tanks**
- D103 – Factory-Coated Bolted Steel Tanks for Water Storage
- D104 – Impressed Current Cathodic Protection
- D106 – Sacrificial Anode Cathodic Protection
- D107 – Composite Elevated Tanks for Water Storage
- D108 – Aluminum Dome Roof
- C652 – Disinfection
- **M42 – Steel Water Storage Tanks**
- **McGraw Hill – Steel Water Storage Tanks**

Tank Design – New Construction

- Site Location
 - Elevation & Access
 - Drainage (overflow & foundation)
 - Foundation (4,000 -6,000 psf)
 - Visibility
- Water Modeling
 - Height; capacity; turnover; pumping; water mains
- Style – Coatings – Logo
- Appurtenances
- AWWA standards D101-D107

Site Surprises!



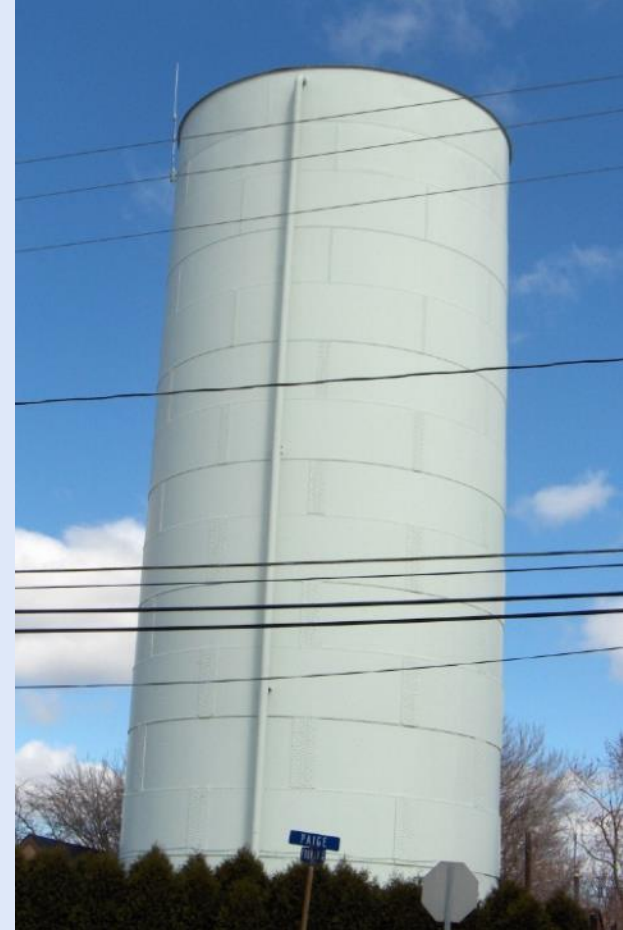
Tank Styles



Multi-Leg

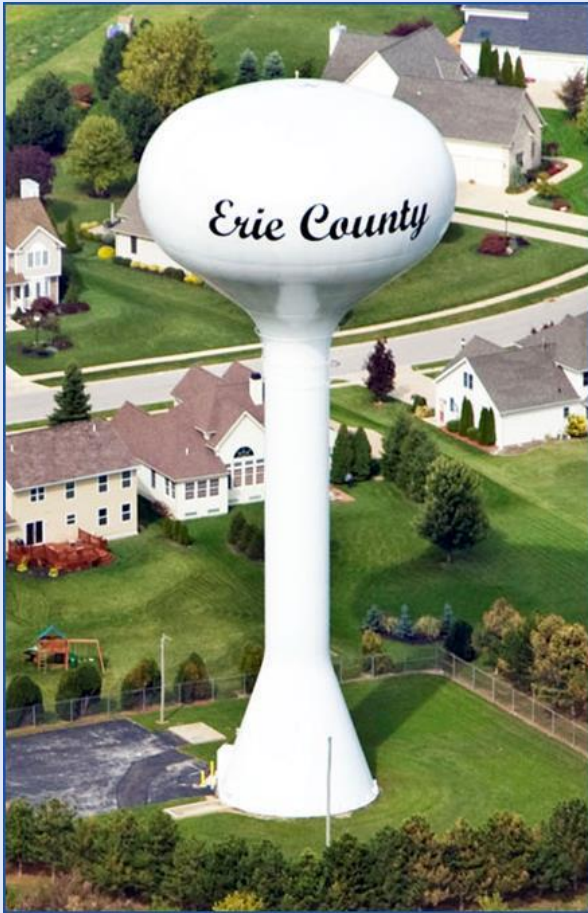


Hydropillar



Standpipe

Tank Styles



Spheroid



Bolted CET



Steel CET

Access Tube & Derrick/Boom - Spheroid



Completed Tank - Spheroid



Shaft & Derrick/Boom - CET



Bowl Raising CET



Construction Costs & Bidding

- 1.0 MG Tank
 - Steel Spheroid = \$2,500,000
 - CET Steel Bowl = \$2,300,000
 - CET Bolted Bowl = \$2,200,000
- Schedule
 - Contract duration 16-18 months
 - Construction 7-9 months
- Bid Alternate Styles
 - Few contractors; tight competition!

Many Years Later...



...Time for Rehabilitation!





Now What?



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Inspection

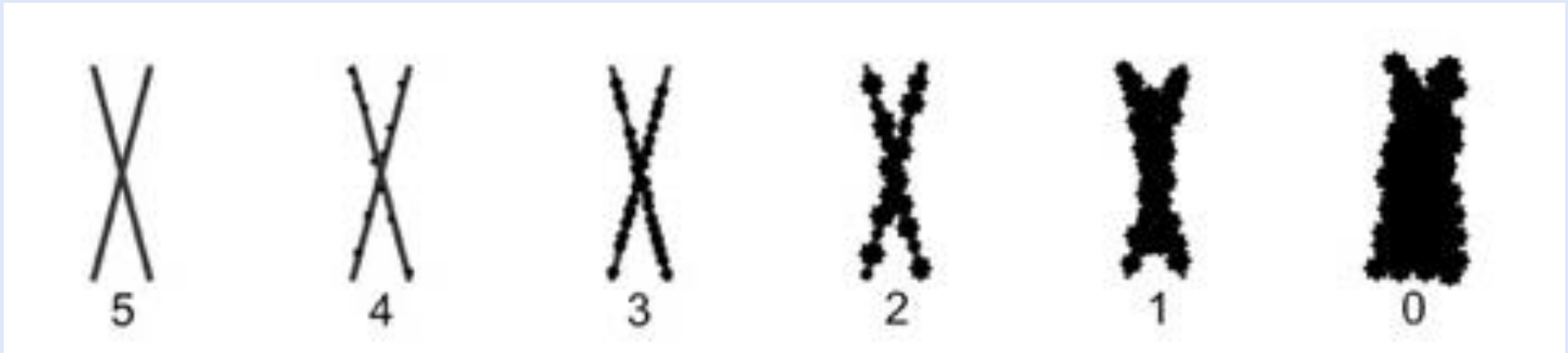
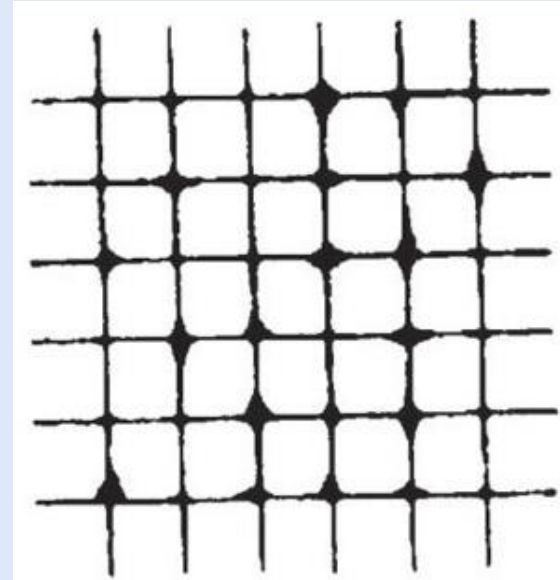
- AWWA M42
 - 3 year interval
 - Drain and wash out
- Experienced Inspector
 - Trained climber
 - Structural background
 - Coatings/Corrosion certification (SSPC/NACE)

Inspection Guidelines

- Observations
 - Surfaces (coatings/adhesion/corrosion)
 - Lead paint (CPSC 600 ppm)
 - Structural
 - Sanitary
 - Safety & Security
 - Appurtenances
- Report
 - Findings/Rehab/Estimates
 - Photo log

Coating Adhesion Testing

- ASTM 3359 Tape Test
 - % flaking/detachment
 - Cross Cut
 - “X” Cut
 - Overcoat determination





Re-Paint? Overcoat? Clean?

Pressure Wash Cleaning

- Is tank simply “dirty”?
- “Mildew/Mold” = Fungus (microbe)
- Cleaning
 - 1) Disable fungus
 - 2) Heated pressure wash
 - 3) Microbe inhibitor
- \$5,000 - \$8,000



Overcoat Existing System

- Advantages
 - 30%-40% cost savings
 - Fast! No exterior blasting & containment
- Disadvantages
 - Less useful life
 - Total DFTs too “heavy”
- Surface Preparation
 - Low Pressure (<5,000 psi) Water Clean (SSPC LP WC)
 - Hand/Power Tool Cleaning (SSPC-SP2 or SP3)
- Primer - Epoxy (low viscosity; penetrating)



Surface Preparation & Coatings

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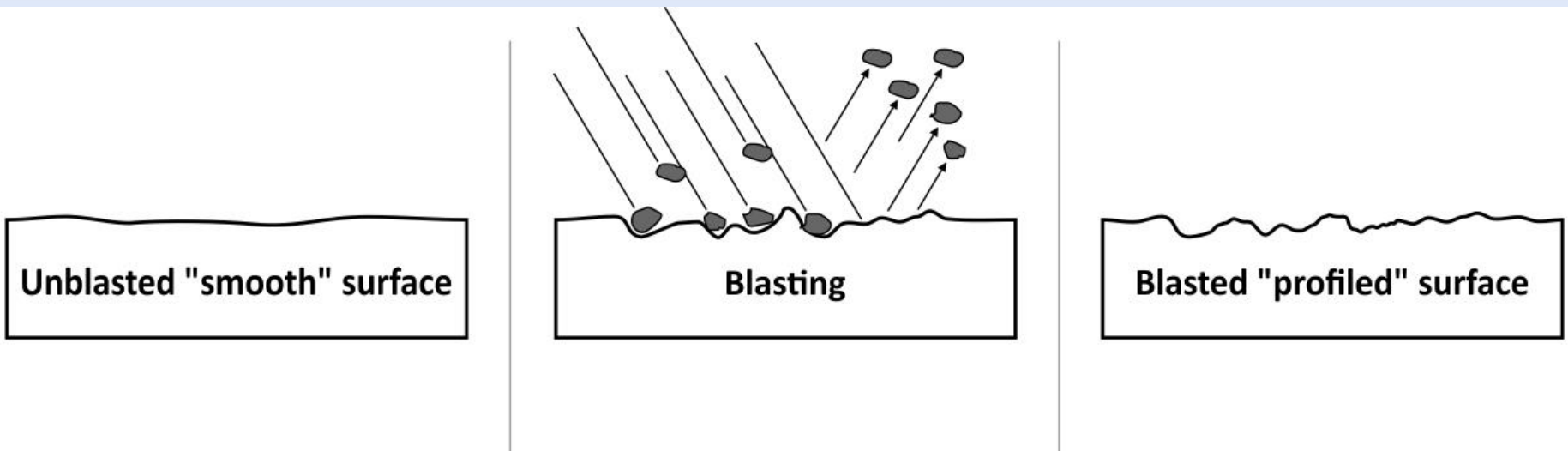
Standards & Regulatory

- AWWA D102 Coating Steel Water Storage Tanks
 - Outside coating systems (6)
 - Inside coating systems (5)
 - Minimum guidelines
- SSPC - Society of Protective Coatings
- NACE - National Association Corrosion Engineers
- OAC 3745-17-08
 - Restriction of Emission of Fugitive Dust
 - Lists affected Counties

Surface Preparation

SURFACE	PREPARATION GRADE	DESCRIPTION	MIL PROFILE	NOTES
Wet Interior	SSPC-SP5/NACE 1	White Metal	2.0-2.5	Highest blast grade. No staining allowed.
Dry Interior	SSPC-SP10/NACE 2	Near White Metal	2.0-2.5	2nd highest blast grade. 5% staining allowed.
Dry Interior - Alternate	SSPC-SP6/NACE 3	Commercial	2.0-2.5	33% staining allowed.
Exterior	SSPC-SP10/NACE 2	Near White Metal	2.0-2.5	2nd highest blast grade. 5% staining allowed.
Exterior - Alternate	SSPC-SP6/NACE 3	Commercial	2.0-2.5	33% staining allowed.
Exterior - Overcoat	SSPC-LP/HP WC	Low/High Pressure Water Clean	N/A	1,000 - 10,000 psi
Dry Interior/Exterior	SSPC-SP3; 11; 15	Power Tool Cleaning (Reg; Commercial; Bare Metal)	1.0	Spot corrosion/Edges

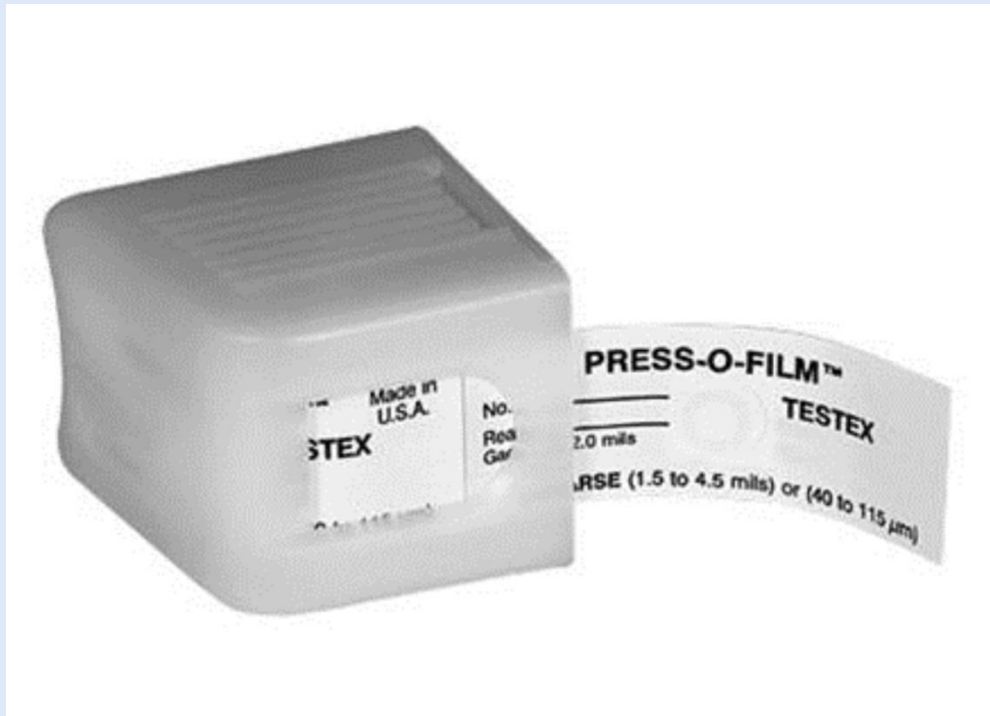
Surface Preparation Notes



- 2.0-2.5 mil profile typical
- Too much or too little profile = ***BAD!***
- Do not blast/grind flat welds
- Protect electrical/control cabinets; receptacles

Surface Preparation Inspection

- Inspection:
 - Visual
 - Profile tape/thickness gauge or digital



Containment – TEPE Type

- Totally Enclosed Painting Environment



Containment – Rigging

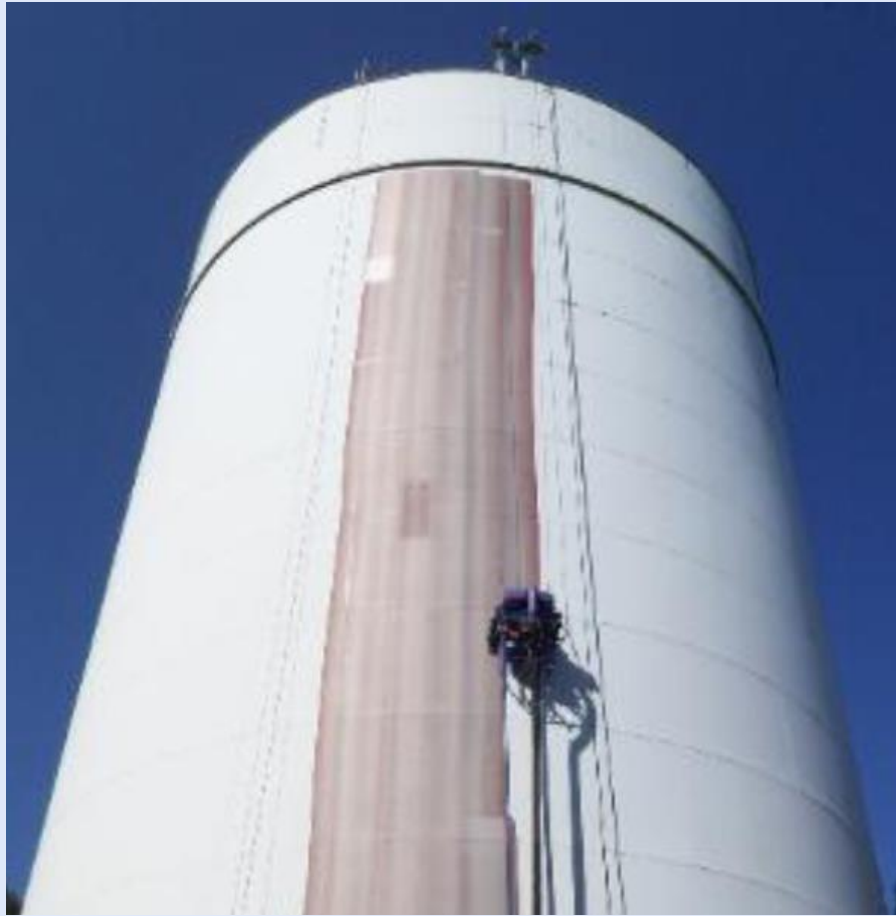


Center Pulley Assembly



Outriggers

Remote Robot Wet Blast Unit



Coatings

SURFACE	TYPE	LAYER	MIL DFT	NOTES
Wet Interior *spray gun application	Zinc or Epoxy	Primer	3	Mositure cure; fast and low temp. cure
	Epoxy	Stripe Coat	3	Brush apply at welds
	Epoxy	Intermediate	4	
	Epoxy	Finish	5	Caulk welds/lap seams
* Metallizing (alt.)	Total		12	* 100% Solids Elastomeric Polyurethane (alt.)
Dry Interior *spray gun application	Epoxy	Primer	3	
	Epoxy	Finish	6	Apply in two coats
	Total		9	
Exterior *phenolic core non-shedding roller	Zinc or Epoxy	Primer	3	
	Epoxy	Intermediate	3	
*Fluoropolymer (alt.)	Polyurethane	Finish	3	Better gloss/color retention
	Total		9	
*Fluoropolymer (alt.)	Polyurethane	Logo	3	UV resistant; Best gloss/color retention

Coating Inspection

- Dry Film Thickness (DFT)
- Temperature – air & surface
- Dew Point & Relative Humidity - Psychrometer
- Runs/drips/pinholes/holidays/stripping/ghosting



Thickness Gauge



Wet Interior Inspection

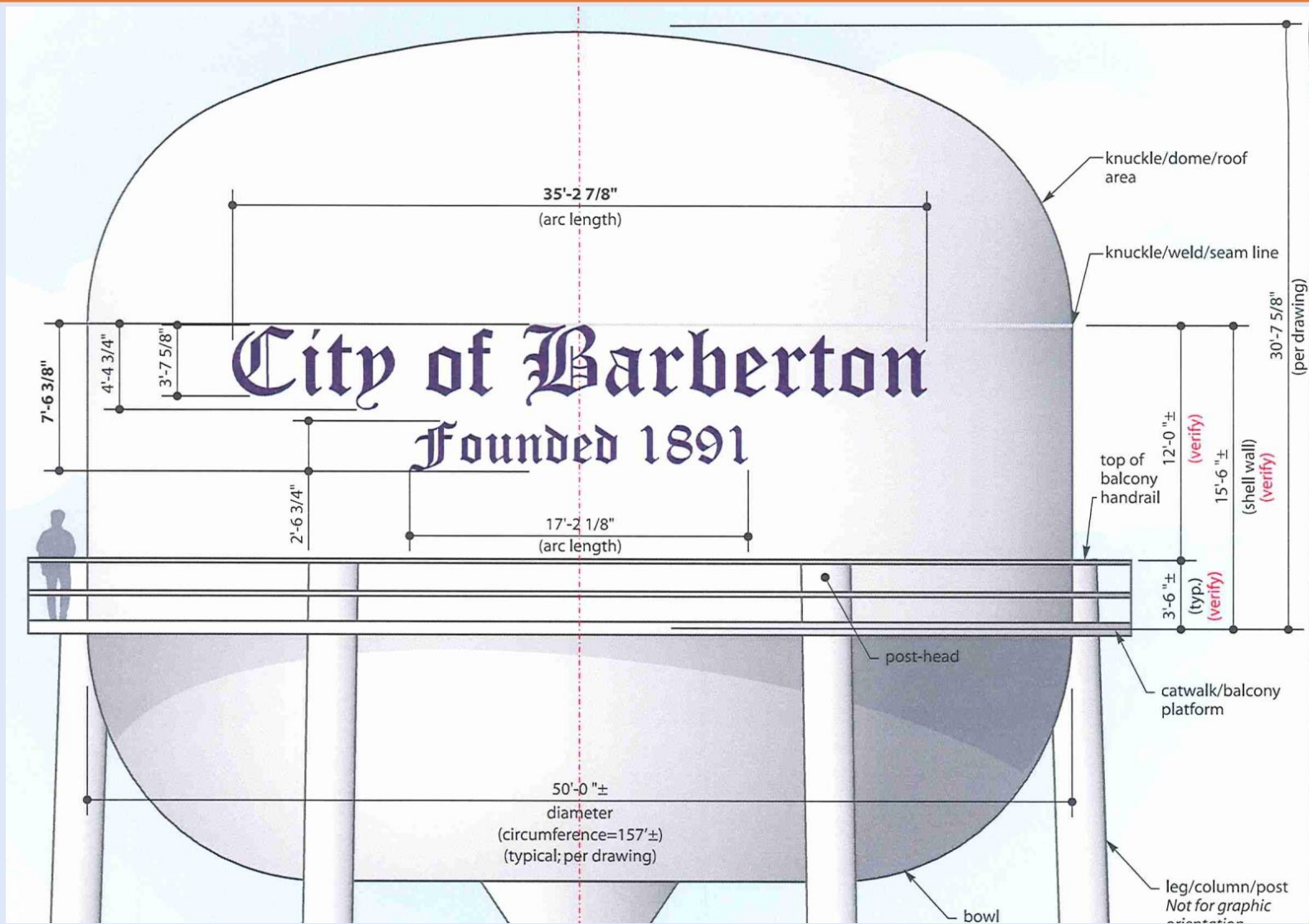
- Prior to filling & disinfection
 - Solvent Rub Test (ASTM 5402-6)
 - Spark/Holiday test (low voltage)



Logo – Sizing



Logo – Contractor Submittal



Painting Costs & Bidding

- All Surfaces & Full Containment & Repairs
 - 1.0 MG = \$600K
 - .75 MG = \$500K
 - .50 MG = \$400K
- Bidding
 - Break out large items
 - Contingency Allowance
 - Local landscaper for site restoration
- Planning
 - 90 days duration
 - Tank out of service! Modeling & field trials!



Repair & Maintenance



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Typical Repair Items

- Hatch gaskets
- Fall protection
- Safety lugs
- Light bulbs & globes
- Roof vent
- Riser debris guard
- Overflow trough
- Bowl drain valve
- Foundation patching



Aviation Light

- FAA Advisory Circular
 - Obstruction Marking and Lighting
 - AC 70/7460-1K
- LED (+100,000 hrs)



Cathodic Protection

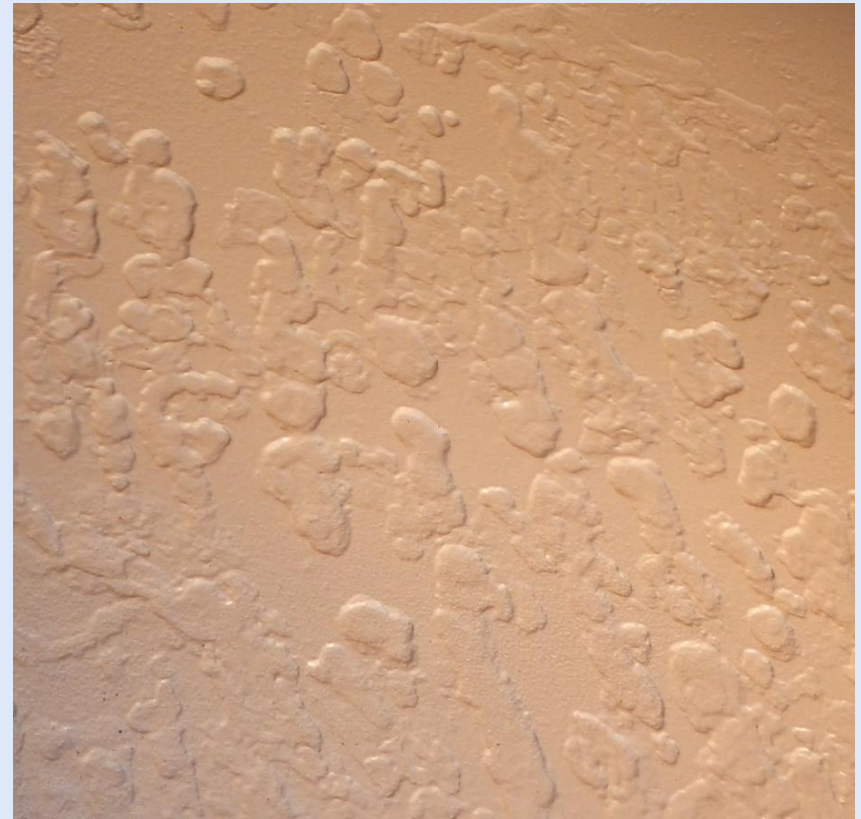
- Replacement & Rehab
 - Rectifier
 - Mounting hooks & cables
 - Anodes & wiring
 - Pressure entrance fitting
 - Ice break
 - Inactive for 1st year!



Close old hand holes!

Pitting

- Wet interior
 - Fluctuation zone
 - Debris and ice
 - Corrosion hides severity
- Concerns
 - Decreases thickness
 - No uniform film build
- Fill pits prior to painting
 - Epoxy solids
 - \$3,000 to \$40,000



Ladders & Safety Rail

- Safety
 - OSHA
 - Fall Protection
- Ladder
 - \$75-\$125 per ft
- Safety Rail
 - \$10,000



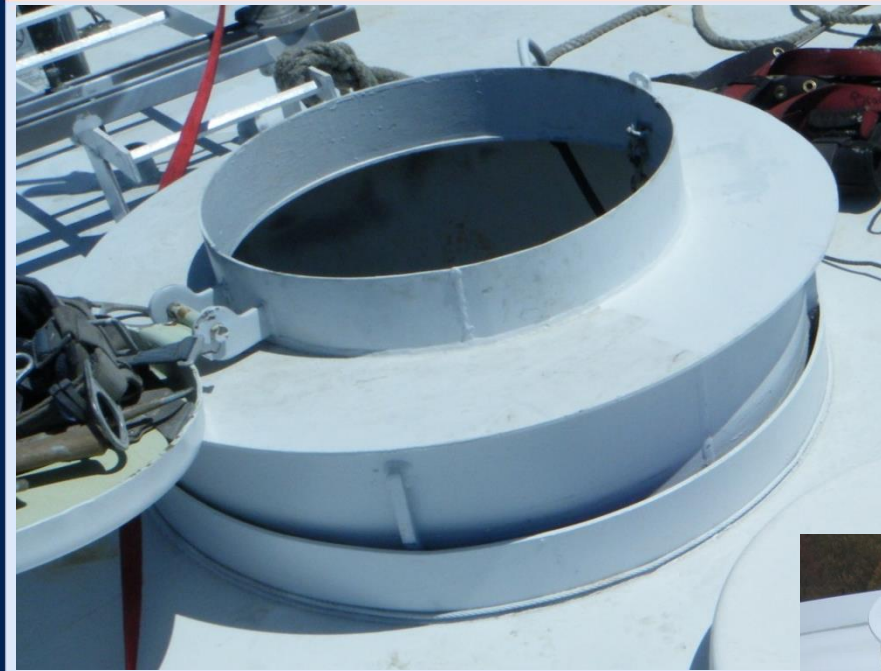
Access Hatches

- Full replacement
\$4K-\$6K

- Replace hinges/hasps



Access Tube Roof Vent



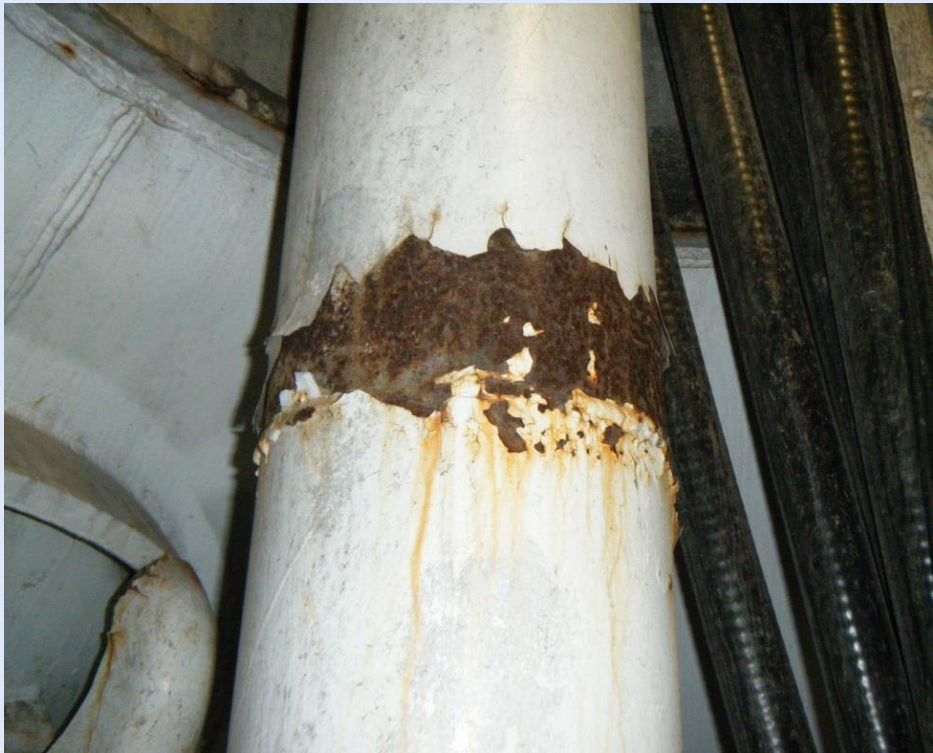
Riser Pipe Insulation

- Replacement
 - Rigid fiberglass insulation
 - Metal jacket
 - Flexible aluminum
- \$10K-\$20K



Overflow Pipe

- Failed weld joints
- Replacement \$15K - \$20K



Erosion Protection

- **Overflow Outlet**
 - Flange pest screen
 - Counter weighted
 - Duck bill valve
 - Swing Box

- **Splash Block**
 - Protect foundations
 - Direct water off site



Cellular Equipment

- Cellular Agreements
 - OSHA standards
 - Third party PE submittals
 - Allow maintenance/shutdowns
- Coordinate work in advance
- PPE for workers



Should You Mix?

- Low tank turnover?
- Trouble maintaining disinfectant residual?
- High THM's?
- Ice problems?



Mixing - Water Quality

- Active vs. Passive
 - Mechanical
 - Bubbler
 - Draft Tube
 - Duck Bill



– Spray Aeration

Lake Erie Shores & Islands -LESI

THE
HURON
WATER
TOWER



City of Huron & LESI





Questions?

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