WATER TOWER INSPECTION AND ASSET MANAGEMENT

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USG WATER
SOLUTIONS

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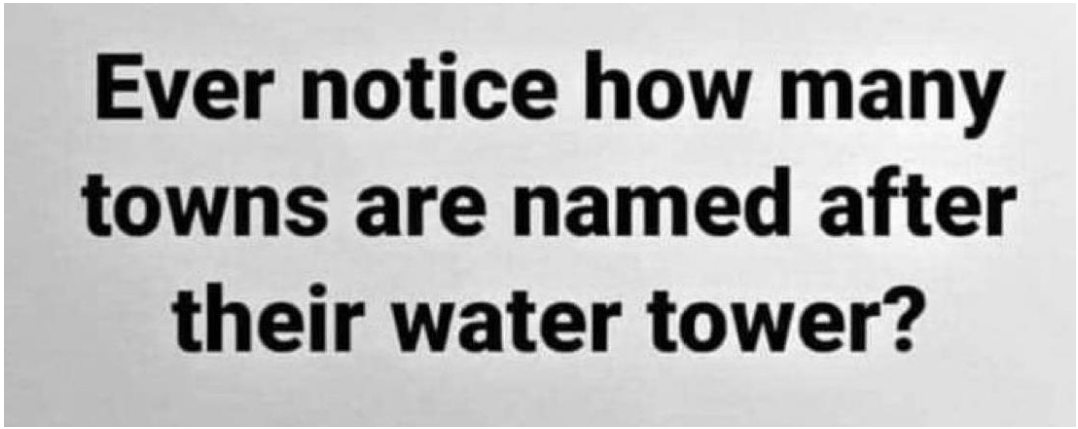
A FRIEND JUST ASK ME… DARYL, DO YOU KNOW HOW IMPORTANT WATER TOWERS ARE?



WHO IS USG WATER?

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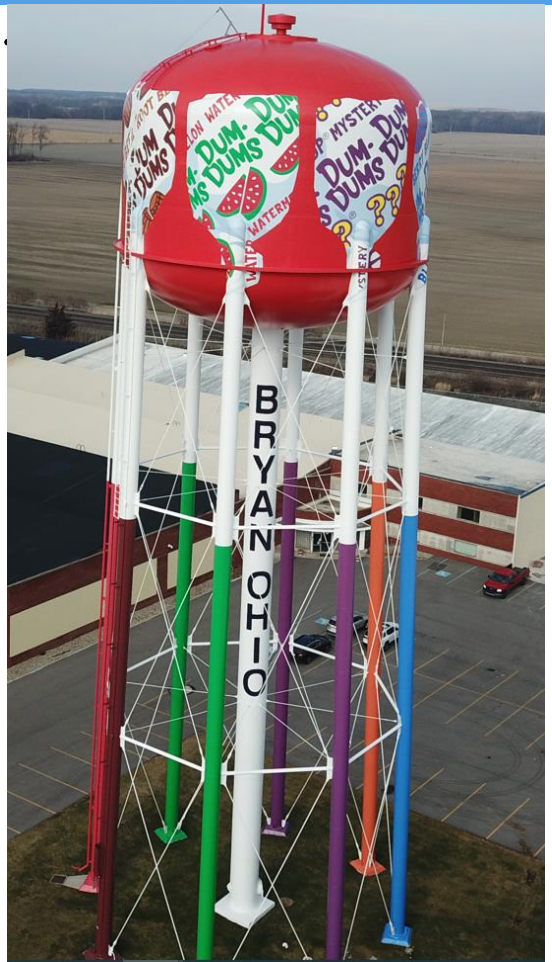
Who is USG Water?

Who is USG Water?

We have over 4,000 Municipal & Industrial customers	**We manage 8,000 + assets in a maintenance program**	**We are ISO 9001 Certified. Quality audits by 3rd party**

Who is USG Water?



Here is what we (the customer) want!

We want …

- Minimize Life Cycle Cost.
- No Change Orders.
- Fixed/Predictable Yearly Budget.
- Perpetual Warranty.
- Single Source of Contact.
- Regulatory Compliance.

Traditional Model

Traditional Model - Bid

- **Minimize Life Cycle Cost.**
- **No Change Orders.**
- **Fixed/Predictable Yearly Budget.**
- **Perpetual Warranty.**
- **Single Source of Contact.**
- **Regulatory Compliance.**

Asset Management Model

FRAGMENTED BUSINESS MODEL

Who takes responsibility when something goes wrong?

Customer wants “One Throat to Choke”!

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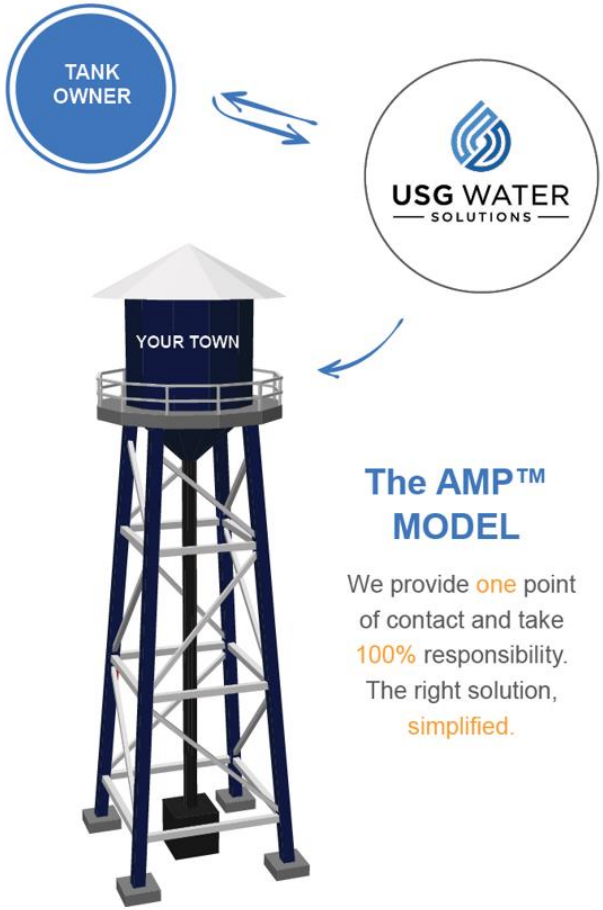
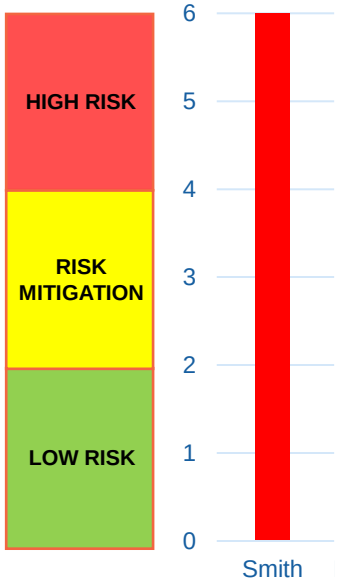
Asset Management Model

If something goes wrong, it is on us, not the customer.



The original tank inspection is the most important part of the process for us to make this work.

Maintenance Risk by Tank



Maintenance or Renovation is Recommended within the next:
3 years

Maintenance or Renovation is Recommended within the next:
3-5 years

Maintenance or Renovation is Recommended within the next:
5 or more

If we find a sanitary issue, we address it immediately.

Example Results

Asset Management Model

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Smith Tower	Exterior Rehab & Repairs	Visual Inspection	Visual Inspection	Visual Inspection	Interior Rehab	Visual Inspection	Visual Inspection	Visual Inspection	Visual Inspection	Washout Inspection
	$40,000	$40,000	$40,000	$40,000	$40,000	$16,500	$17,000	$18,000	$18,500	$19,000

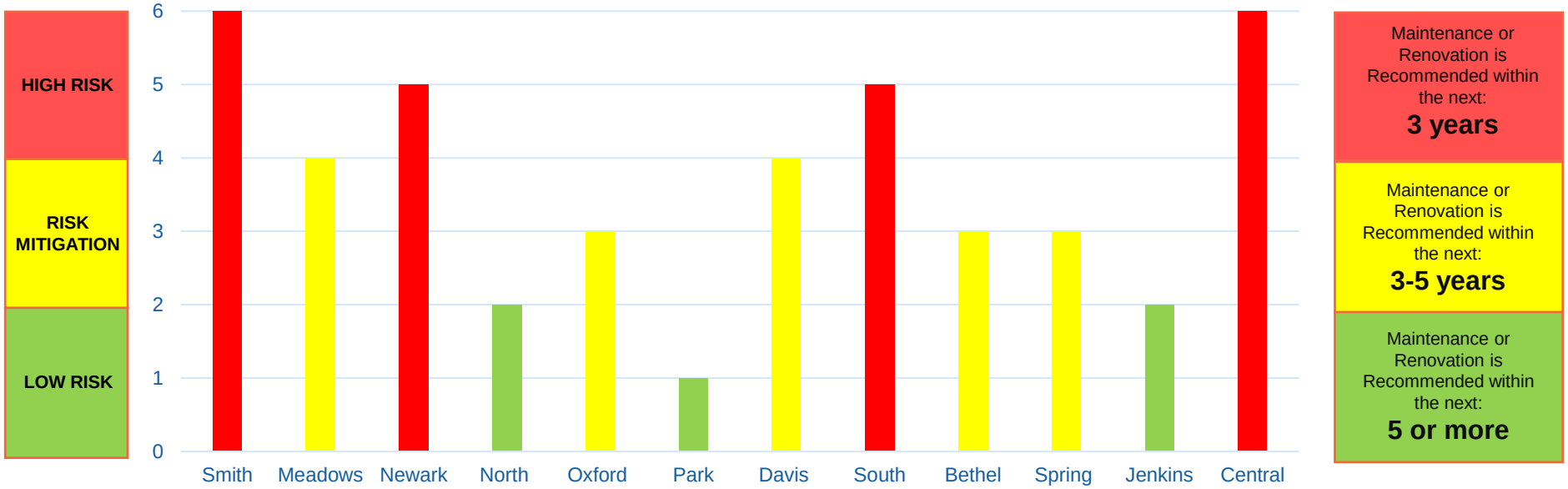
Yearly inpsections and washouts a minimum of every 5 years.

Repairs

New Frost Proof Vent
Add Cable Safety Climb
Repair overflow pipe/screen
Seal weld old Cathodic Protection Plates

Manage Antenna modifications (with your support)
Future exterior painting included
Future Interior Painting included (NSF 600)
We do all the engineering required
We do all of the EPA Permitting Required
You can cancel anytime you want

Maintenance Risk by Tank (12 Tanks)



If we find a sanitary issue, we address it immediately.

Typical Service Contract

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Smith	Exterior Rehab & Washout	Visual Inspection	Visual Inspection	Visual Inspection	Interior Rehab	Visual Inspection	Visual Inspection	Visual Inspection	Visual Inspection	Washout Inspection
Newark	Visual Inspection	Exterior Rehab & Washout	Visual Inspection	Visual Inspection	Visual Inspection	Interior Rehab	Visual Inspection	Visual Inspection	Visual Inspection	Visual Inspection
South	Visual Inspection	Visual Inspection	Interior Rehab	Visual Inspection	Visual Inspection	Visual Inspection	Visual Inspection	Exterior Rehab & Washout	Visual Inspection	Visual Inspection

THE INSPECTION

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Goals of the Inspection

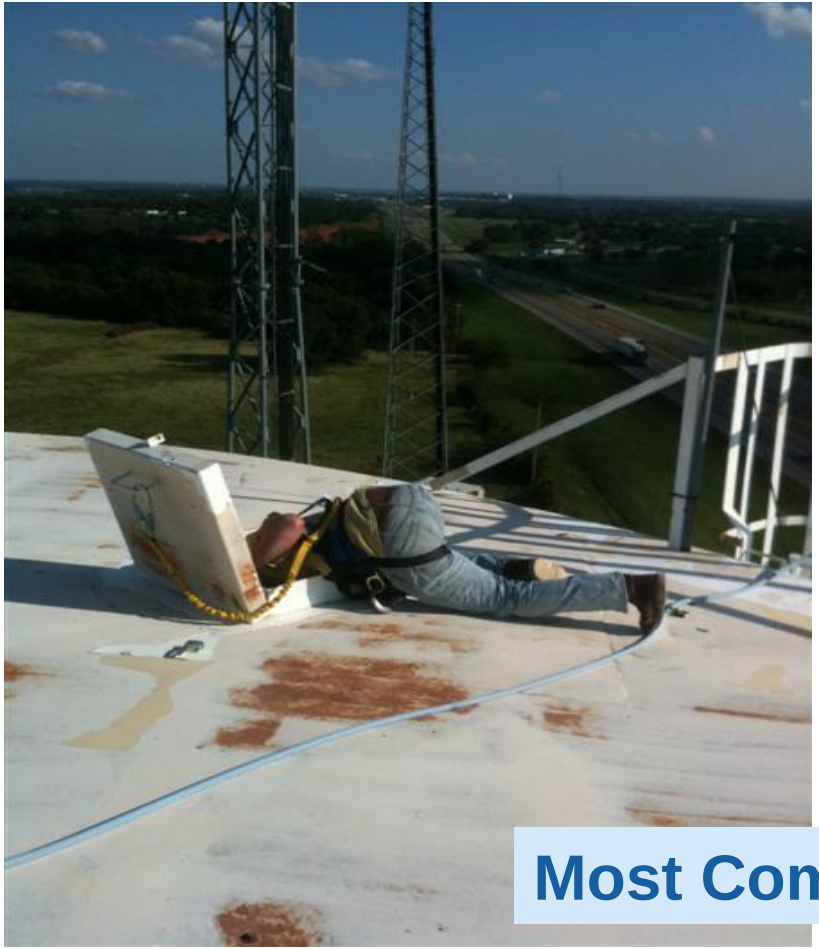
1. Determine the current condition of the water tower
2. Educate you (the customer) on the current condition
3. Develop a scope of work to get the tower back to A+ condition (like new)
4. Develop a plan to keep it maintained in the future (Preventative)
5. The plan should minimize life cycle cost (30-50% cheaper)
6. The plan should achieve state/local compliance (AWWA-10 State Standards)

TOOLS USED DURING AN INSPECTION

Common Tools

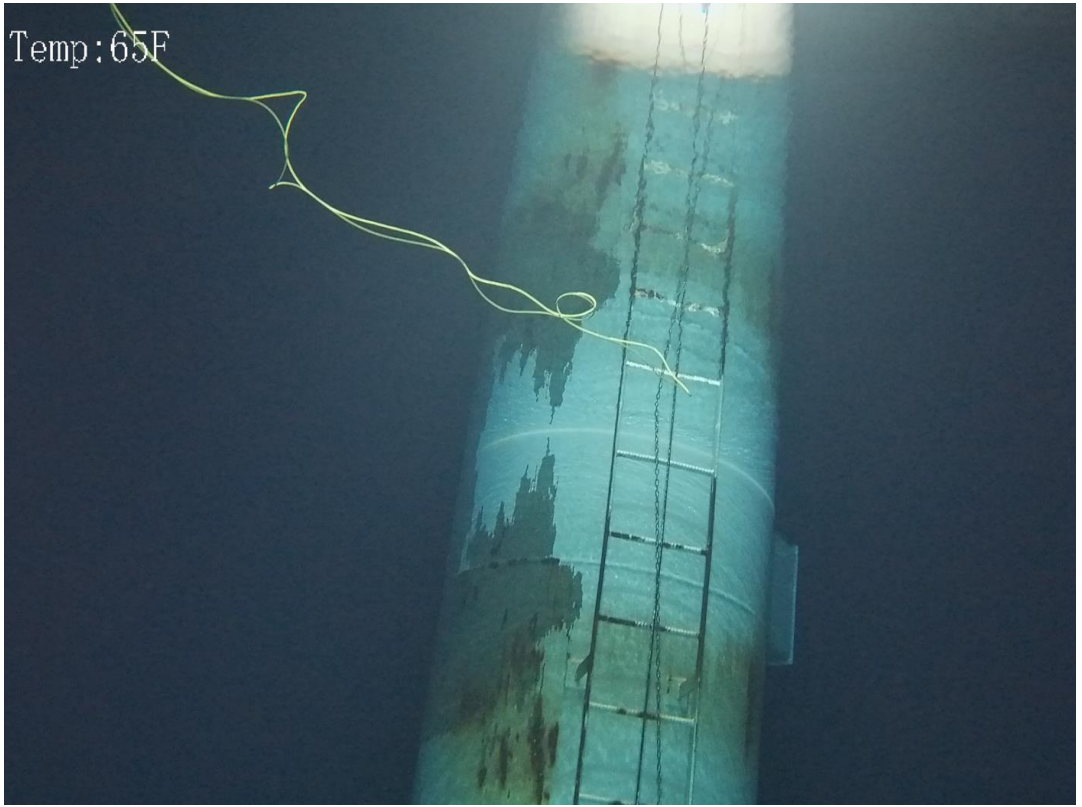
TYPES OF INSPECTIONS

Visual Inspection



Most Common Method

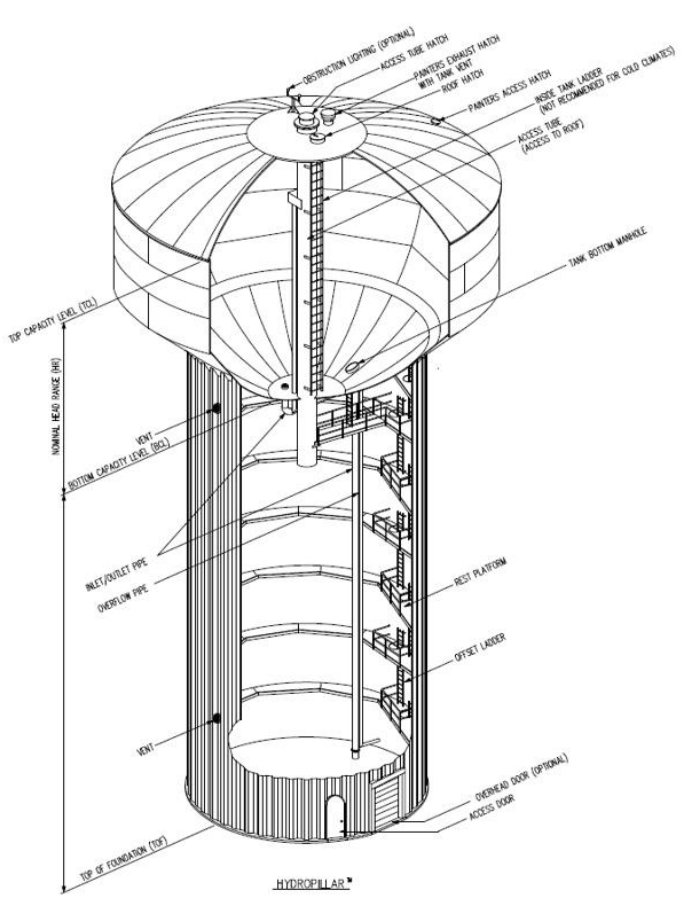
ROV Inspection

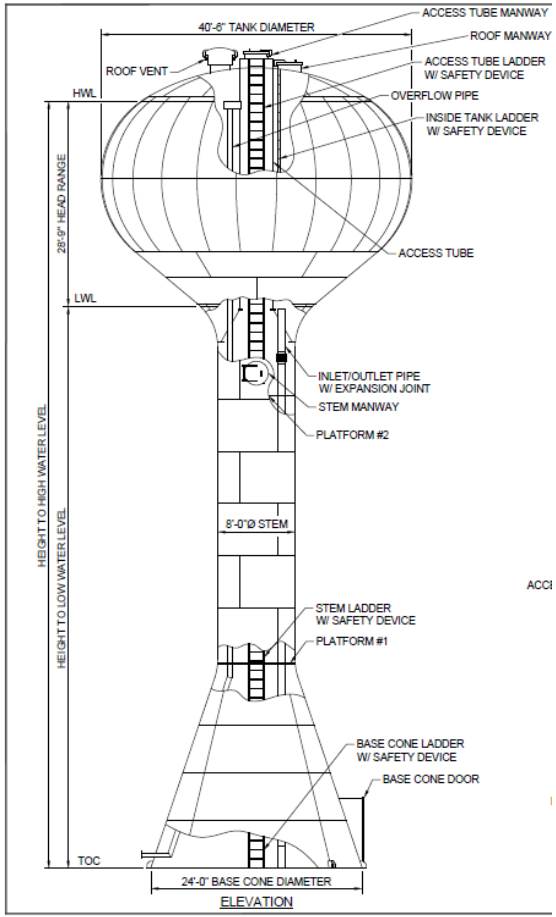


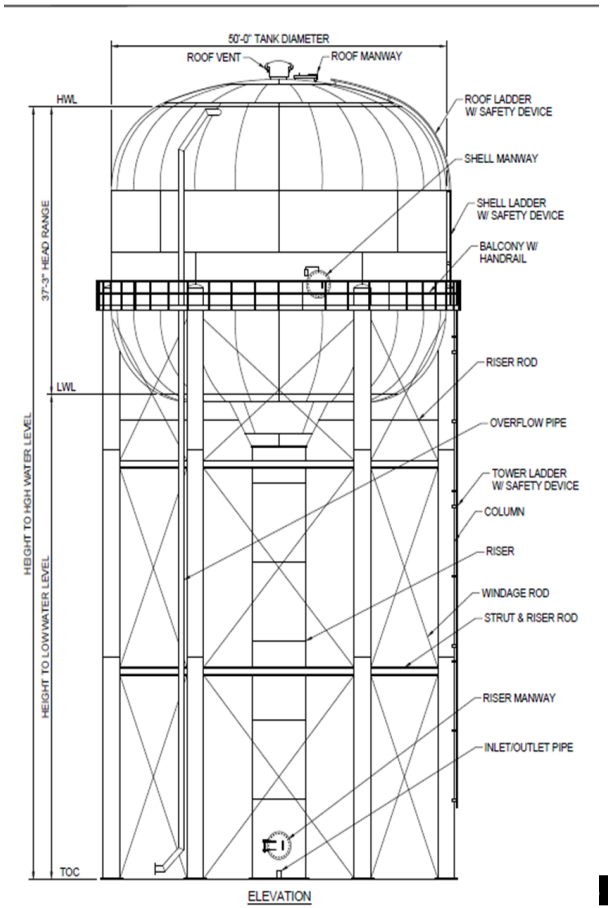
Washout Inspection

Dive Inspection

3 primary types of tanks







Check list - APP

Water Storage Tank Condition Assessment Report

Project:		**Proj #:**		**Evaluation Type:**	
Location:		**Task #:**		**Tank Design:**	
Inspector:		**Date:**		**Capacity:**	Gallons

Exterior Tank Conditions: All questions are Yes / No / NA / NR unless listed (G/F/P) for Good / Fair / Poor / NA / NR

Tank Area	Item of Concern	Status	Tank Area	Item of Concern	Status
Exterior	Coating visual assessment? (G/F/P)		Vent	Design meets state standards?	
Coating	Actionable checking / delamination?			Screen intact?	
	Actionable corrosion / deterioration?			Separate vent and overflow?	
	Is there any graffiti paint or etchings?			Vent is accessible for repair?	
	Coating adhesion assessment? (G/F/P)			Vent extends to exterior of enclosure?	
	Does soiling impact visual appearance?		Overflow	Meets state standard?	
	Head wall to cylinder sealant intact?			Actionable corrosion / deterioration?	
Exterior	Structural visual assessment? (G/F/P)			Unsealed penetrations present?	
Structure	Are all plate seams sealed?			Overflow extends to exterior of enclosure?	
	Significant pitting or metal loss visible?			Required air gap present?	
	Are all visible penetrations sealed?			Screen is intact or was replaced?	
	Circulation lines in sound condition?			Flapper is functional or was replaced?	
	Sight glass / sensors in sound condition?			Drain, spillway or rip-rap present?	
Tank Access	At least two manholes present?		Tank Safety	Access tube, ladder or stairway present?	
	Access points meet state standards?			Required fall arrest system present?	
	All external access points secured?			Safe access to tank interior possible?	
	Ground entry at least 24" above grade?			Confined space ventilation required?	
	External equipment limits tank access?			Unsafe standing water near electrical?	
Tank Support	Cylinder equipped with external support?		Pump House	Tank access inside secondary structure?	
	Actionable corrosion / deterioration?		or Enclosure	Is entry to the enclosure locked?	
	External soil coverage erosion occurring?			Coating on pipes & valves? (G/F/P)	
	Leakage from the head wall evident?			Enclosure equipped with a sump / drain?	
	Undermining of the tank grounds noted.			Enclosure free of standing water?	

Interior Tank & Site Conditions: All questions are Yes / No / NA / NR unless listed (G/F/P) for Good / Fair / Poor / NA / NR

Tank Area	Item of Concern	Status	Tank Area	Item of Concern	Status
Interior	Coating visual assessment? (G/F/P)		Water quality	Water quality visually acceptable?	
Coatings	Actionable blistering / delamination?			Significant staining or biofilm present?	
	Actionable corrosion / deterioration?			Root growth or soil infiltration present?	
	Coating adhesion assessment? (G/F/P)			Significant floor sediment present?	
	Coating at penetrations is acceptable?			Is there a mixing system present?	
Interior	Structural visual assessment? (G/F/P)			Is there a cathodics system present?	
Structure	Are cylinder round seams sealed?		Site	Is site equipped with a security fence?	

COATINGS

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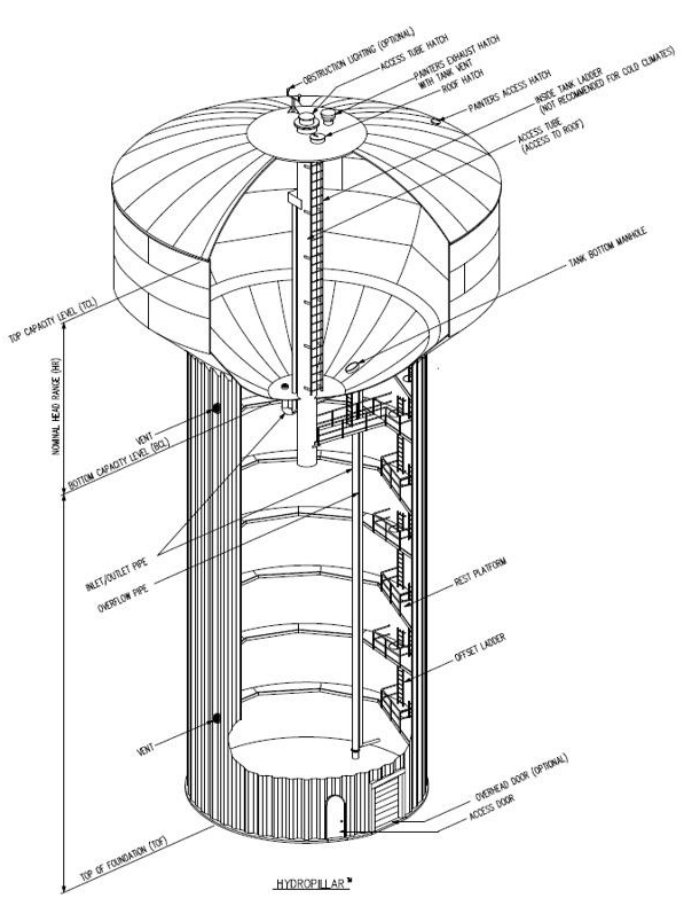
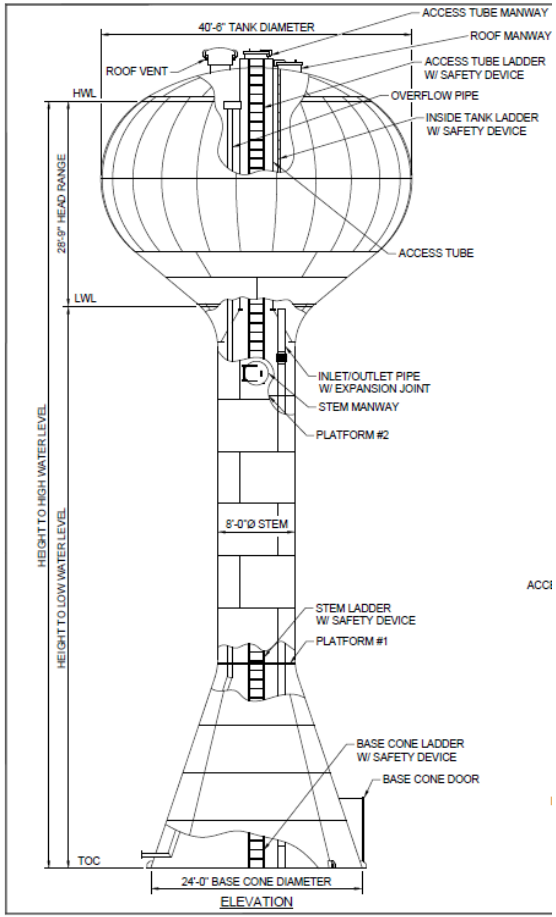
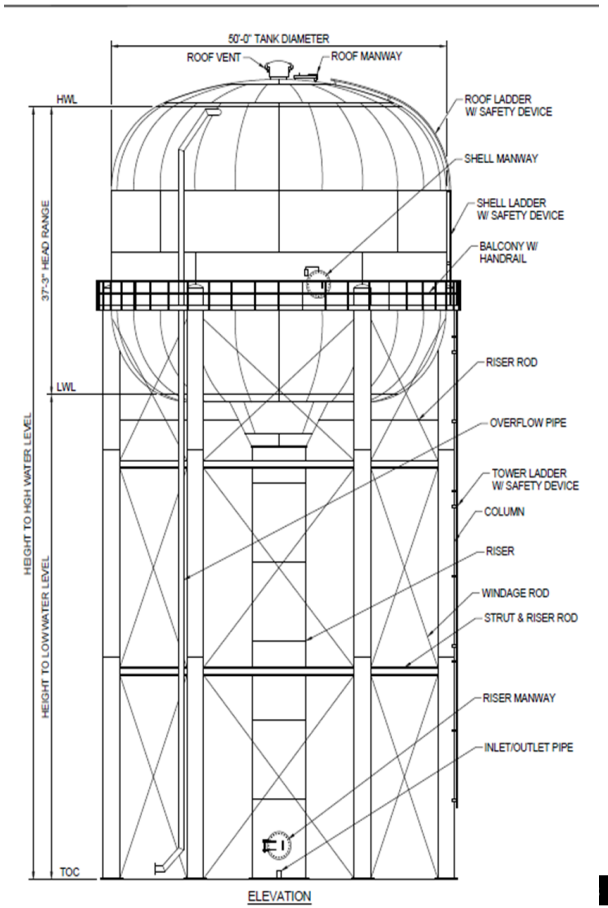
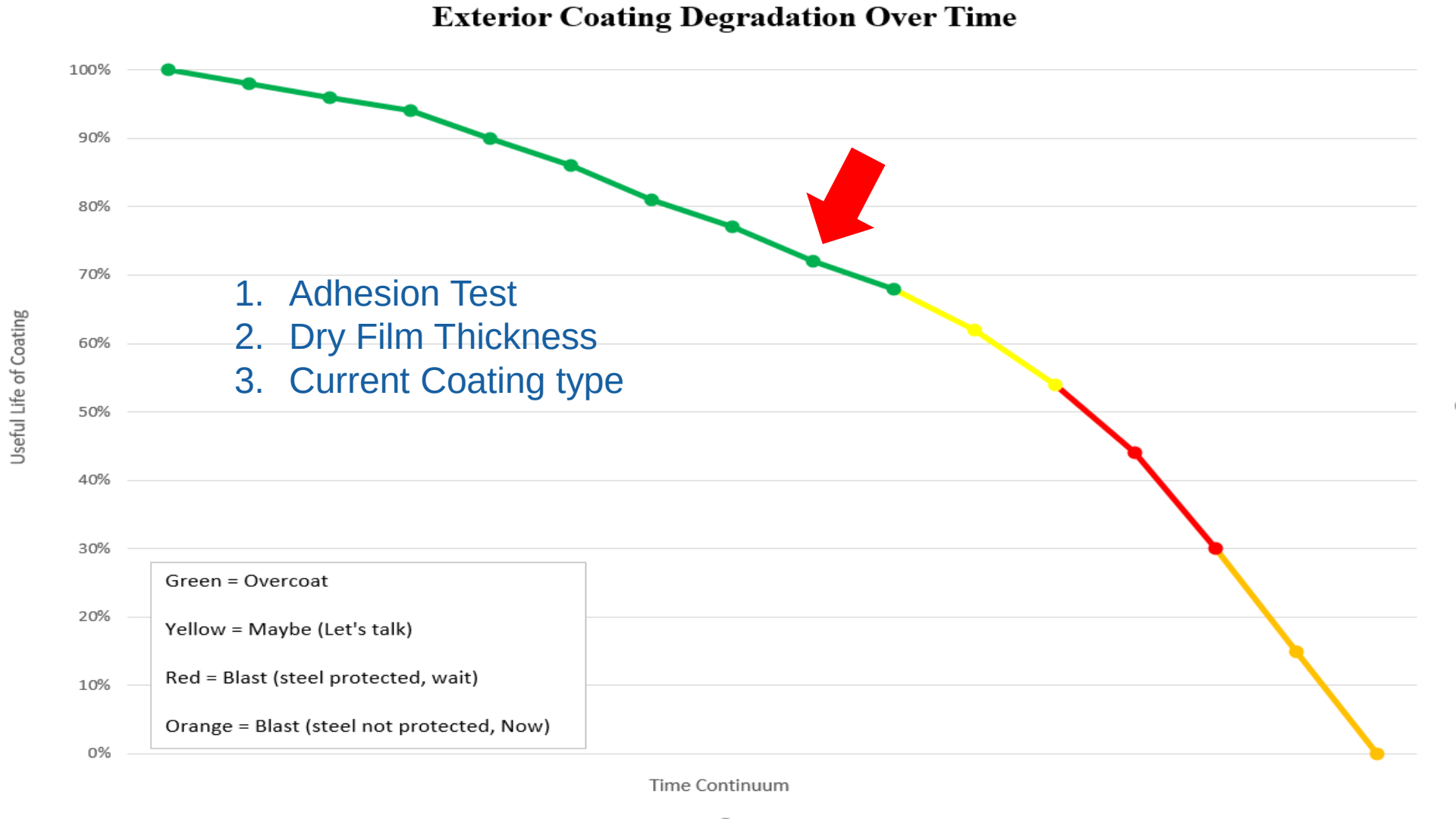
Coatings


OBSTRUCTION LIGHTING (OPTIONAL)
ACCESS TUBE HATCH
PAINTERS EXHAUST HATCH WITH TANK VENT
ROOF HATCH
PAINTERS ACCESS HATCH
INSIDE TANK LADDER (NOT RECOMMENDED FOR COLD CLIMATES)
ACCESS TUBE (ACCESS TO ROOF)
TANK BOTTOM MANHOLE
TOP CAPACITY LEVEL (TCL)
NOMINAL HEAD RANGE (HR)
VENT
BOTTOM CAPACITY LEVEL (BCL)
INLET/OUTLET PIPE
OVERFLOW PIPE
REST PLATFORM
OFFSET LADDER
VENT
OVERHEAD DOOR (OPTIONAL)
ACCESS DOOR
TOP OF FOUNDATION (TOF)
HYDROPILLAR®


40'-6" TANK DIAMETER
ACCESS TUBE MANWAY
ROOF MANWAY
ROOF VENT
ACCESS TUBE LADDER W/ SAFETY DEVICE
HWL
OVERFLOW PIPE
INSIDE TANK LADDER W/ SAFETY DEVICE
28'-9" HEAD RANGE
ACCESS TUBE
LWL
INLET/OUTLET PIPE W/ EXPANSION JOINT
STEM MANWAY
PLATFORM #2
HEIGHT TO HIGH WATER LEVEL
HEIGHT TO LOW WATER LEVEL
8'-0"Ø STEM
STEM LADDER W/ SAFETY DEVICE
PLATFORM #1
BASE CONE LADDER W/ SAFETY DEVICE
BASE CONE DOOR
TOC
24'-0" BASE CONE DIAMETER
ELEVATION


50'-0" TANK DIAMETER
ROOF VENT
ROOF MANWAY
HWL
ROOF LADDER W/ SAFETY DEVICE
SHELL MANWAY
SHELL LADDER W/ SAFETY DEVICE
BALCONY W/ HANDRAIL
37'-3" HEAD RANGE
LWL
RISER ROD
OVERFLOW PIPE
TOWER LADDER W/ SAFETY DEVICE
COLUMN
HEIGHT TO HIGH WATER LEVEL
HEIGHT TO LOW WATER LEVEL
RISER
WINDAGE ROD
STRUT & RISER ROD
RISER MANWAY
INLET/OUTLET PIPE
TOC
ELEVATION

Exterior Coating Degradation Over Time



Exterior Coatings

Coatings attach to the tank in 2 ways

1. Mechanical Bond
2. Chemical Bond

We send samples of the coatings to a 3rd party lab. The lab will tell us the type of coatings that are currently on the tank. This will help us determine the correct coating to apply so we get a chemical bond.

The lab also does a heavy metal test for us to determine if there is any lead or chromium in the coatings

Exterior Coatings- AWWA D102

AWWA D102 Coating Systems

OUTSIDE COATING SYSTEMS

OCS No. 1 (three or four coat alkyd) Aluminum, Metallic, Alkyd, Silicone Alkyd

OCS No. 2 (three coat) Moisture cured Polyurethane

OCS No. 3 (three coat) Water-based Acrylic or Modified Acrylic

OCS No. 4 (three coat) Zinc rich primer (organic or inorganic), Aliphatic Polyurethane, Aliphatic Fluorourethane

OCS No. 5 (three coat) Epoxy primer, Epoxy intermediate, Aliphatic Polyurethane

OCS No. 6 (three coat) Zinc rich primer (organic or inorganic), Epoxy intermediate, Aliphatic Polyurethane

Exterior Coatings- ASTM D 3359

ASTM D 3359 – Method a test:

Designation: D 3359 – 97

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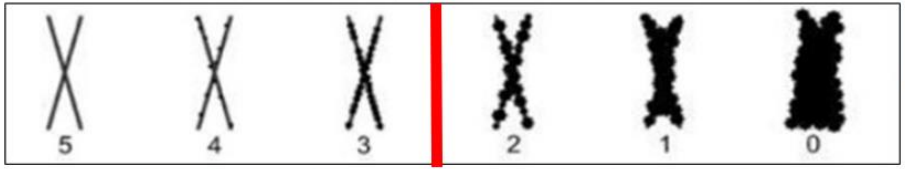
Standard Test Methods for Measuring Adhesion by Tape Test[1]

1. Scope

1.1 These test methods cover procedures for assessing the adhesion of coating films to metallic substrates by applying and removing pressure-sensitive tape over cuts made in the film. Page No 1

3.1 *Test Method A*—An X-cut is made in the film to the substrate, pressure-sensitive tape is applied over the cut and then removed, and adhesion is assessed qualitatively on the 0 to 5 scale. Page No 1

Rating	Description
5A	No peeling or removal
4A	Trace peeling or removal along the incisions
3A	Jagged removal along the incisions up to 1/16″ on either side
2A	Jagged removal along the incisions up to 1/8″ on either side
1A	Removal of most of the coating from the area of the "X" unde the tape
0A	Removal of coating beyond the area of the "X"



Overcoat Full Blast

1. Cut "X" mark

2. Place 25mm wide Transparent Tape.

3. Remove the tape quickly.

Exterior Coatings

Exterior Coatings – Overcoat

ASTM D 3359 – Method a test:

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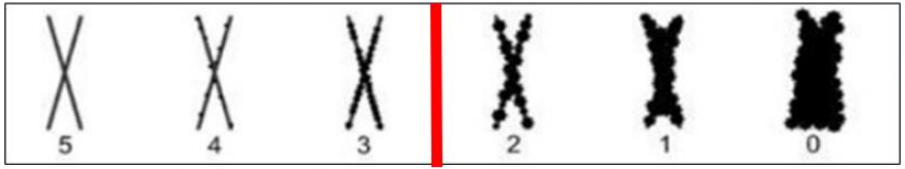
3.1 *Test Method A*—An X-cut is made in the film to the substrate, pressure-sensitive tape is applied over the cut and then removed, and adhesion is assessed qualitatively on the 0 to 5 scale. Page No 1

Rating	Description
5A	No peeling or removal
4A	Trace peeling or removal along the incisions
3A	Jagged removal along the incisions up to 1/16″ on either side
2A	Jagged removal along the incisions up to 1/8″ on either side
1A	Removal of most of the coating from the area of the "X" unde the tape
0A	Removal of coating beyond the area of the "X"



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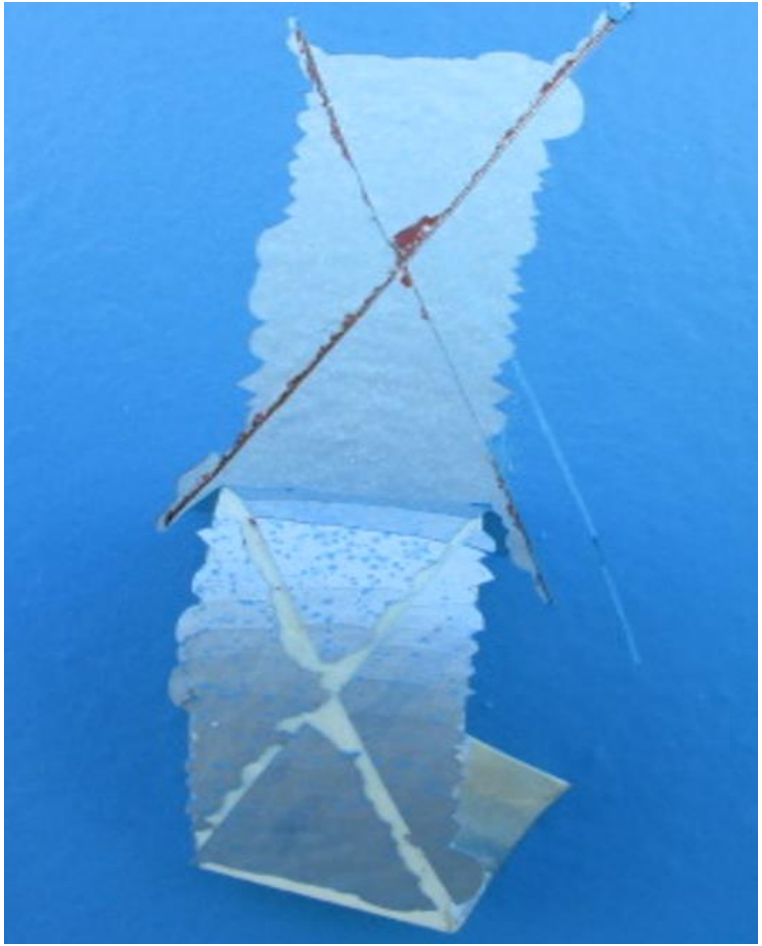
Exterior Coatings



Coatings are ***not*** chemically compatible.

The only way to solve this is to perform a full blast on the tower. You can't paint over this and solve the problem.

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Exterior Coatings – Overcoat

ASTM D 3359 – Method a test:

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3A	Jagged removal along the incisions up to 1/16″ on either side
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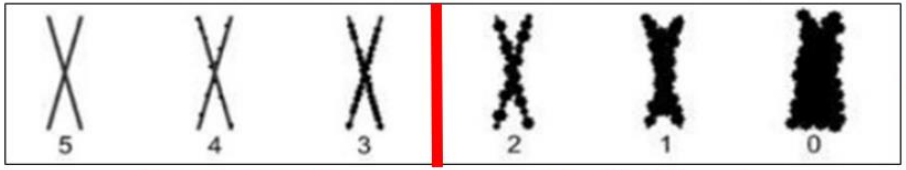
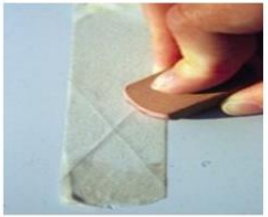


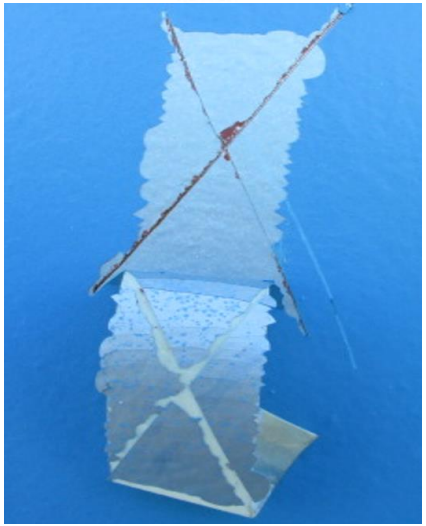
Overcoat Full Blast

1. Cut "X" mark

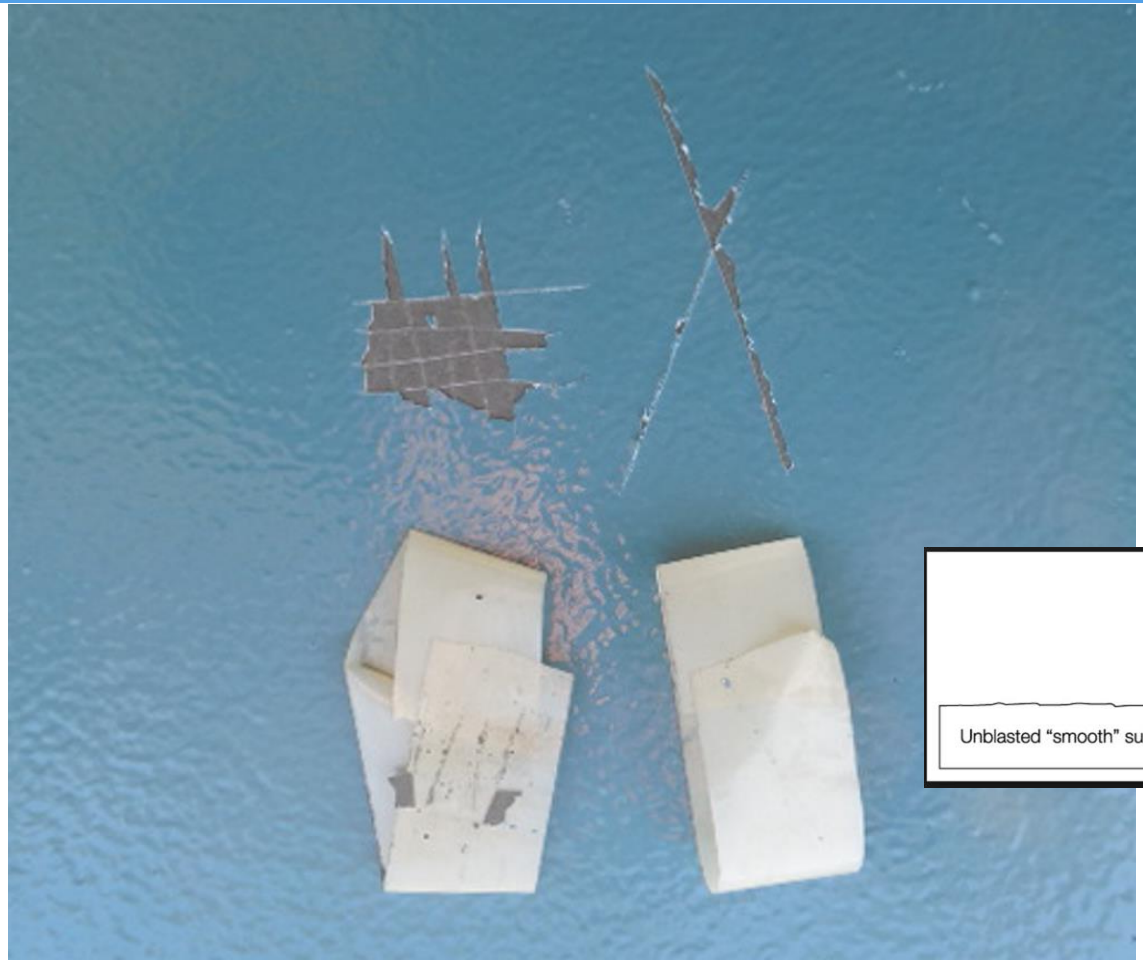


2. Place 25mm wide Transparent Tape.

3. Remove the tape quickly.

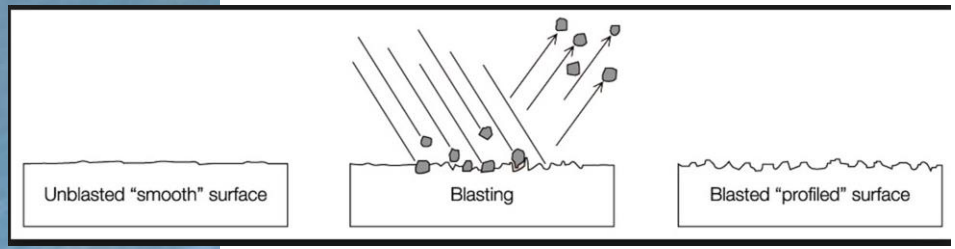


Exterior Coatings



Failure – What happened here?

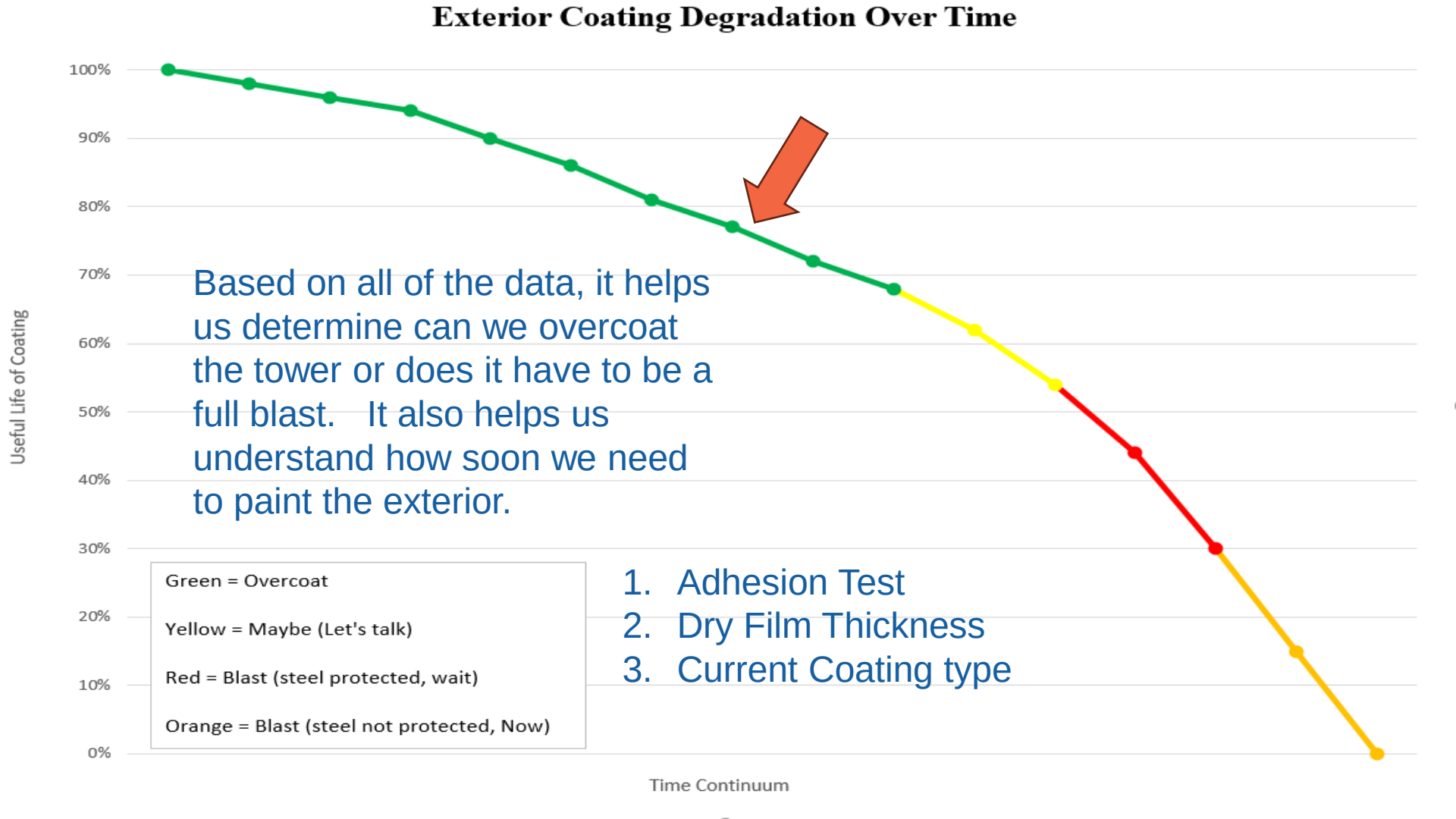
This is a mechanical failure. The steel does not have a ***Profile*** to hold the coatings.



Exterior Coatings – Dry Film Thickness

Dry Film Thickness
What is it?
Why do we care?

Exterior Coating Degradation Over Time



Based on all of the data, it helps us determine can we overcoat the tower or does it have to be a full blast. It also helps us understand how soon we need to paint the exterior.

Green = Overcoat

Yellow = Maybe (Let's talk)

Red = Blast (steel protected, wait)

Orange = Blast (steel not protected, Now)

1. Adhesion Test
2. Dry Film Thickness
3. Current Coating type

Interior Dry

The goal of the interior dry is just to make sure the coatings are protecting the steel. Does not affect water at all nor does the public see the dry interior.

Interior Dry

1. Non compatible coatings were used.

2. Technically no corrosion of steel. Looks bad but no steel loss.

3. The only way to fix this is to do a full interior dry blast down to the steel and start over.

Interior Dry

The platforms in the dry interior tend to always have corrosion. We typically just hand tool clean/prep these areas and paint them. Again, we just want to stop corrosion.

Wet Interior

1. We typically always do a full blast (SSPC 10) and replace the wet interior. We do this based on AWWA D102 4.6.3.2.
2. NSF 600 is now in place.
3. We do not touch the coatings until we have received the heavy metal results from the lab.
4. The interior bowl is a permit required confined space area per OSHA.

SANITARY

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Sanitary

1. Vents
2. Screens
3. Hatches
4. Cathodic protection roof plates
5. Rigging couplers – Open on the roof

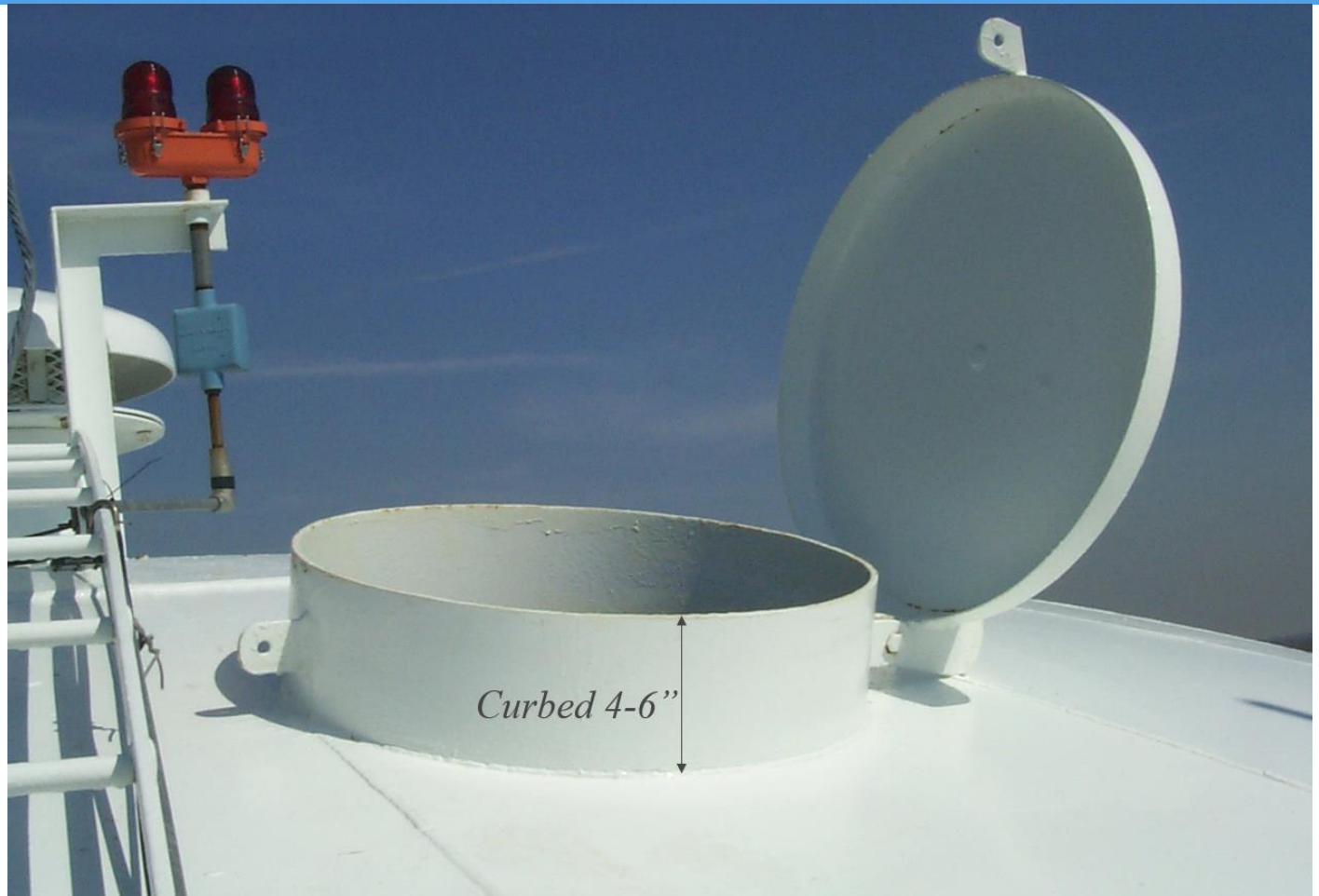
Let’s take a look at some these items.

Sanitary

Old style hatch that does not have a curb.

Why is this important?

Sanitary



Sanitary

Old style cathodic protection plate. We would seal weld these shut.

Sanitary

Replaced Cathodic Protection plates with seal welded rigging couplers. These have been primed before the tank was painted.

Sanitary

Sanitary

What's the white stuff on the vent and the top of the tank?

Sanitary

Sanitary

7.1.9 Vents

Finished water storage structures shall be vented. The overflow pipe shall not be considered a vent. Open construction between the sidewall and roof is not permissible.

Vents:

a) Shall prevent the entrance of surface water and rainwater.

b) Shall exclude birds and other animals.

c) Should exclude insects and dust, as much as this function can be made compatible with effective

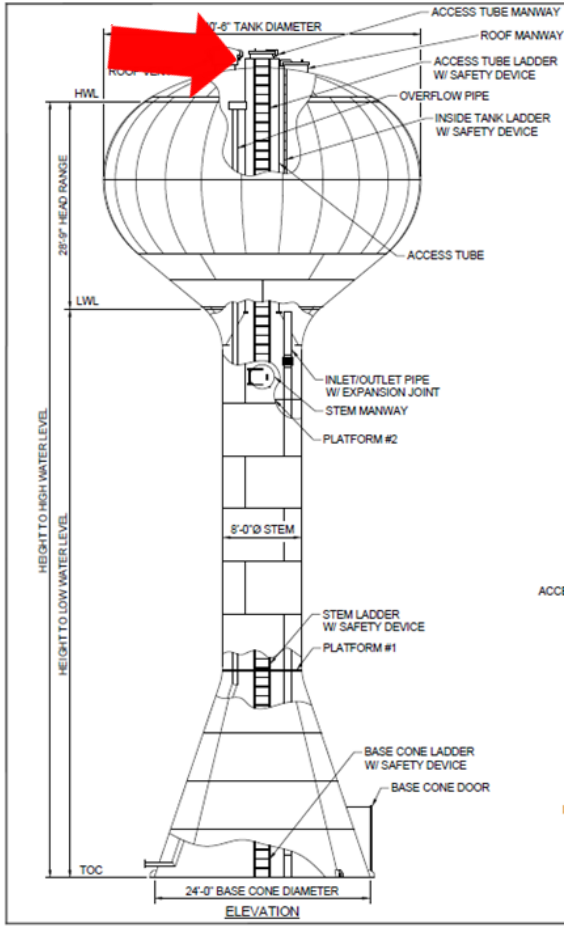
e) Shall, on elevated tanks and standpipes, open downward, and be fitted with twenty-four mesh non-corrodible screen in combination with an automatically resetting pressure-vacuum relief mechanism.

Sanitary

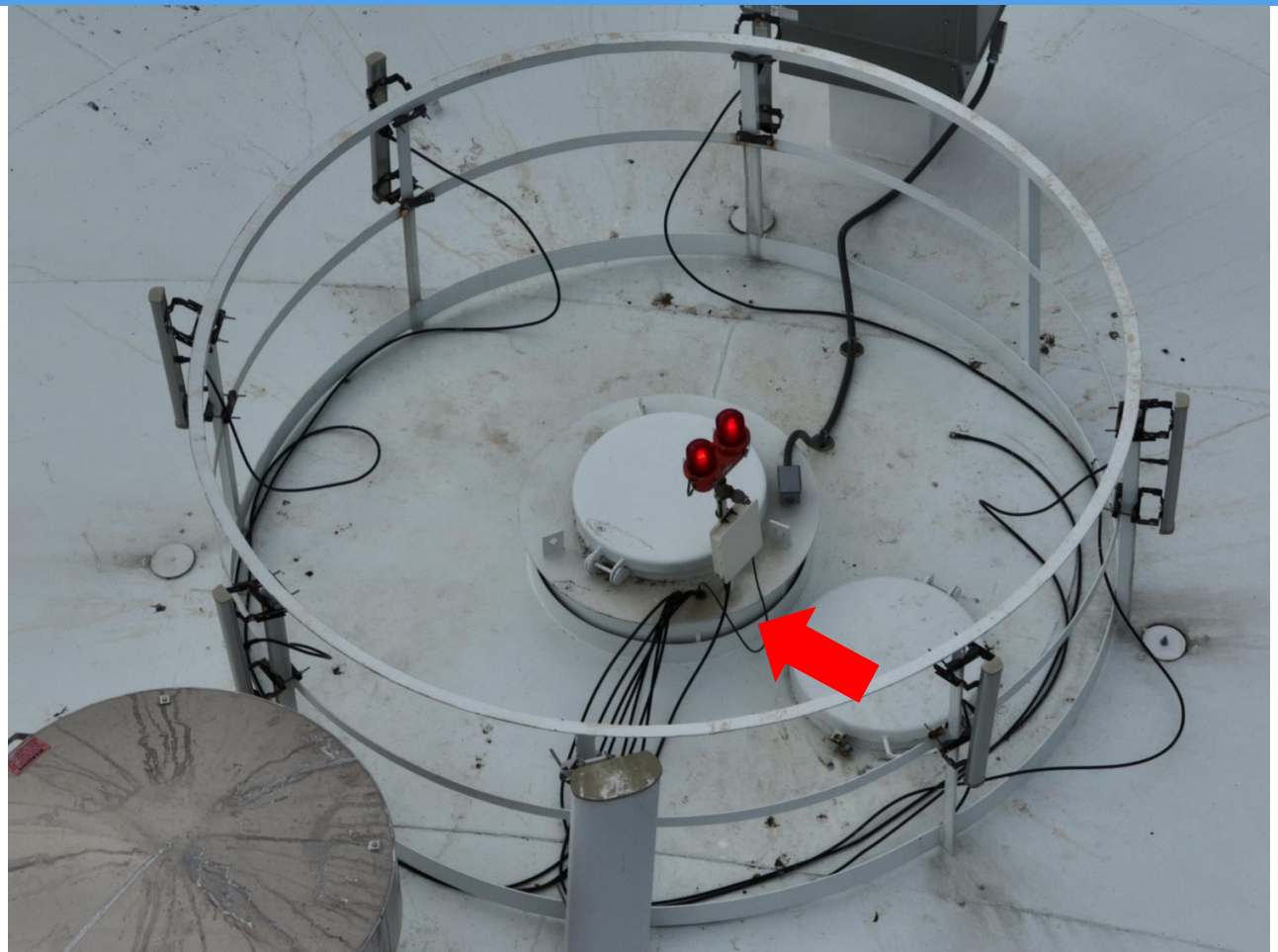
Sanitary

Sanitary

Sanitary


ACCESS TUBE MANWAY
ROOF MANWAY
ACCESS TUBE LADDER
W/ SAFETY DEVICE
OVERFLOW PIPE
INSIDE TANK LADDER
W/ SAFETY DEVICE
HWL
28'-9" HEAD RANGE
ACCESS TUBE
LWL
INLET/OUTLET PIPE
W/ EXPANSION JOINT
STEM MANWAY
PLATFORM #2
HEIGHT TO HIGH WATER LEVEL
HEIGHT TO LOW WATER LEVEL
8'-0"Ø STEM
STEM LADDER
W/ SAFETY DEVICE
PLATFORM #1
BASE CONE LADDER
W/ SAFETY DEVICE
BASE CONE DOOR
TOC
24'-0" BASE CONE DIAMETER
ELEVATION

Sanitary



Sanitary

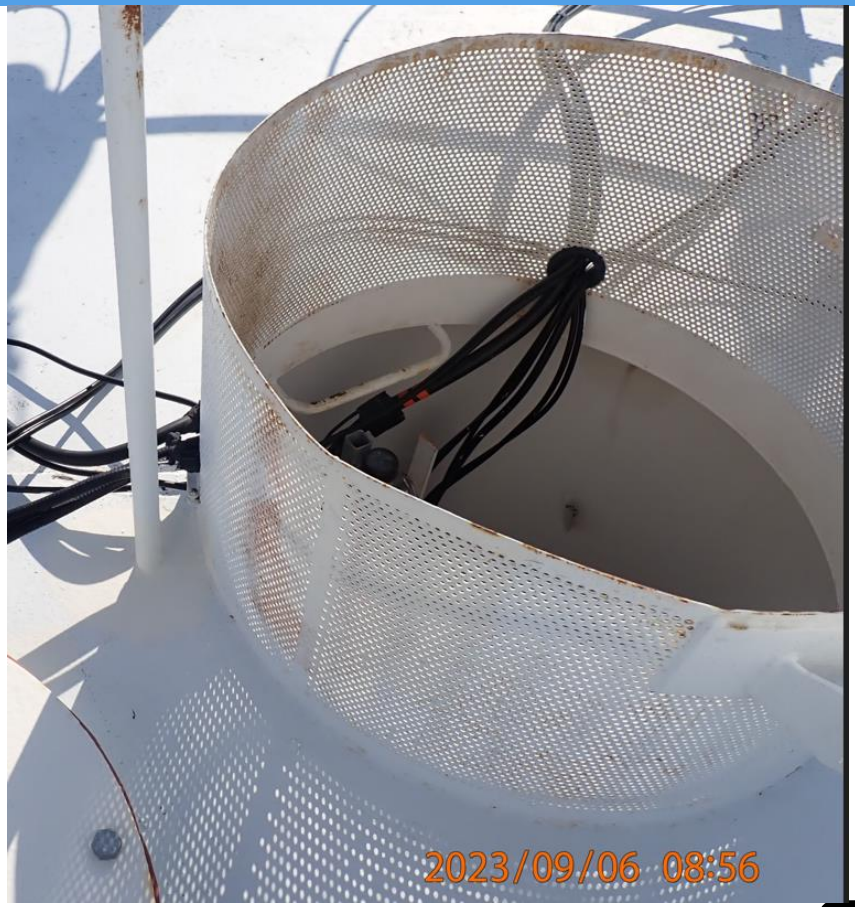
Sanitary

Sanitary

Sanitary

Where is the roof vent?

Sanitary



Sanitary

Sanitary

7.1.7 Overflow

All water storage structures shall be provided with an overflow that extends down to an elevation between 12 and 24 inches above the ground surface, and discharges over a drainage inlet structure or a splash plate. No overflow may be connected directly to any drain, sanitary sewer or storm sewer. All overflow pipes shall be located so that any discharge is visible.

a) When an internal overflow pipe is used on elevated tanks, it shall be in the access tube or inside an enclosed support structure. For vertical drops on other types of storage facilities, the overflow pipe shall be located on the outside of the structure.

b) Overflow pipe shall not be in the wetted interior of the storage structure.

c) The overflow shall open downward and be screened with twenty-four mesh non-corrodible screen. The screen shall be installed within the overflow pipe at a location least susceptible to damage by vandalism. A mesh-fitted mechanical flap valve is acceptable provided the flapper is supplied with non-corroding and non-seizing hinges. The flap valve shall be spring loaded or counterweighted, so it closes and forms a tight seal after the overflow event.

d) Use of a solid flapper or duckbill valve should be considered to minimize air movement and ice formation in the tank. When a solid flapper is used, a screen shall be provided inside the overflow. If a duckbill valve is used, a screen is not required. Provisions must be included to prevent the flapper or duckbill from freezing shut.

e) The overflow pipe shall be of sufficient diameter to permit the discharge of water in excess of the maximum filling rate.

Sanitary

If we find a sanitary issue, we will notify you immediately.

SECURITY

USG WATER SOLUTIONS

Security - Fences

Security

Security

Security – Ladder Gate

STRUCTURAL

USG WATER SOLUTIONS

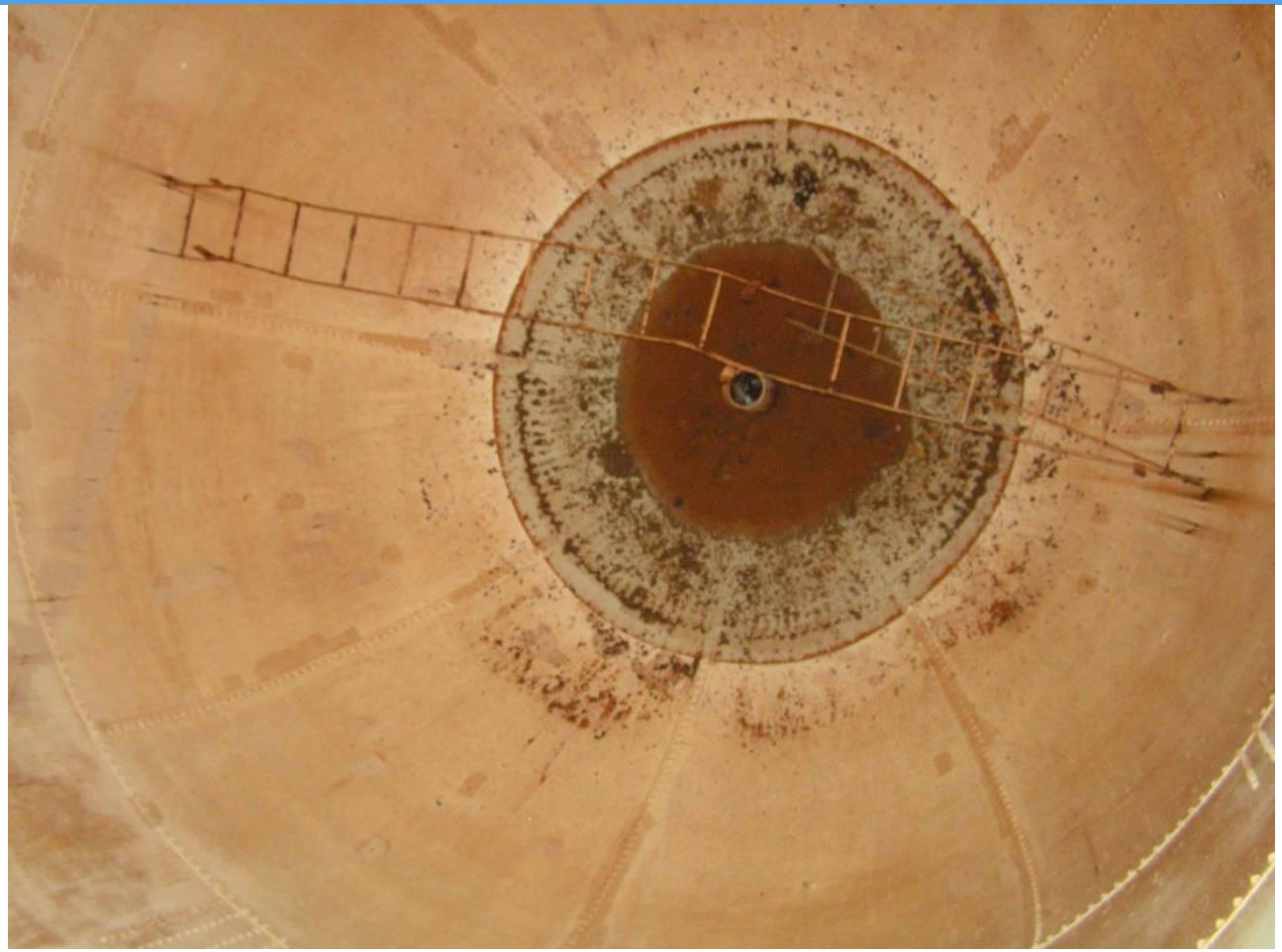
Structural

Structural

Structural

Structural

Structural



Structural

Structural

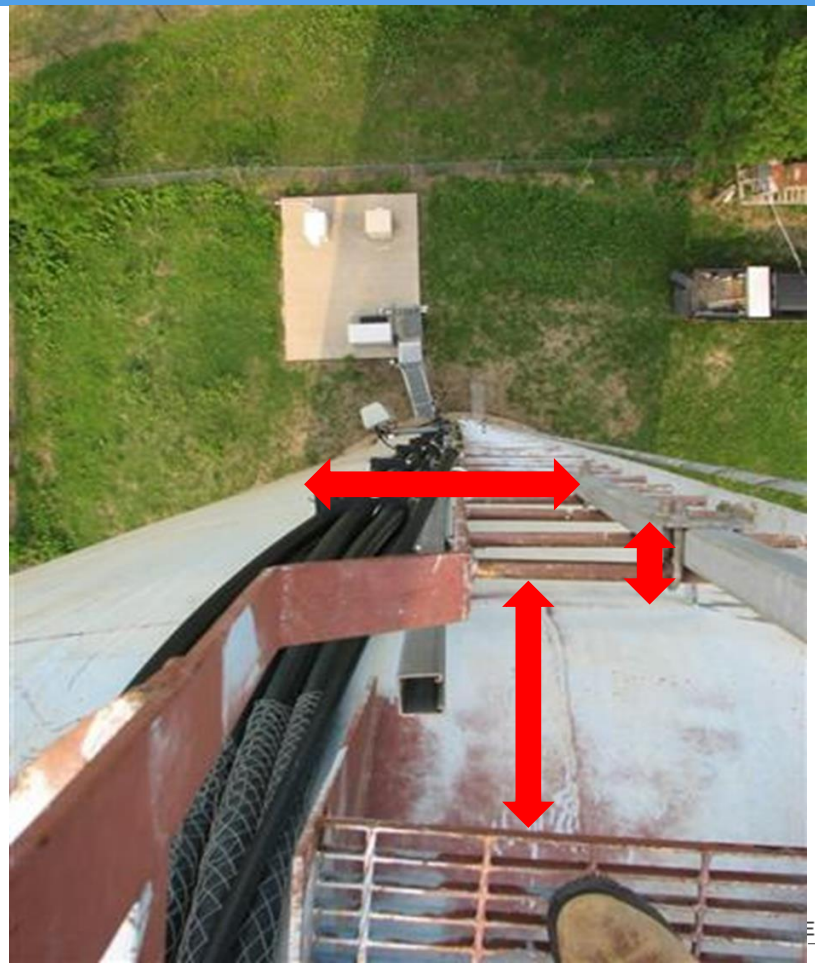
SAFETY

Safety

Safety Conditions: Fixed Ladders

- 29 CFR 1910.27
  - Minimum design load of 200 lbs.
  - 12 in. rung distance
  - 16 in. minimum side rail distance
  - 7 in. toe clearance
  - 15 in. clearance from centerline
  - 30 in. headroom

Safety



1. 12” rung distance
2. 15” clearance from centerline
3. 7” Toe Clearance

Safety

Safety


Ladders must be fixed now. They can't roll.
This ladder looks safe… right?

Safety

Safety

The inspection is complete!

We now have information on:

All coatings (exterior, dry interior, wet interior)
Safety
Sanitary
Structural
Security

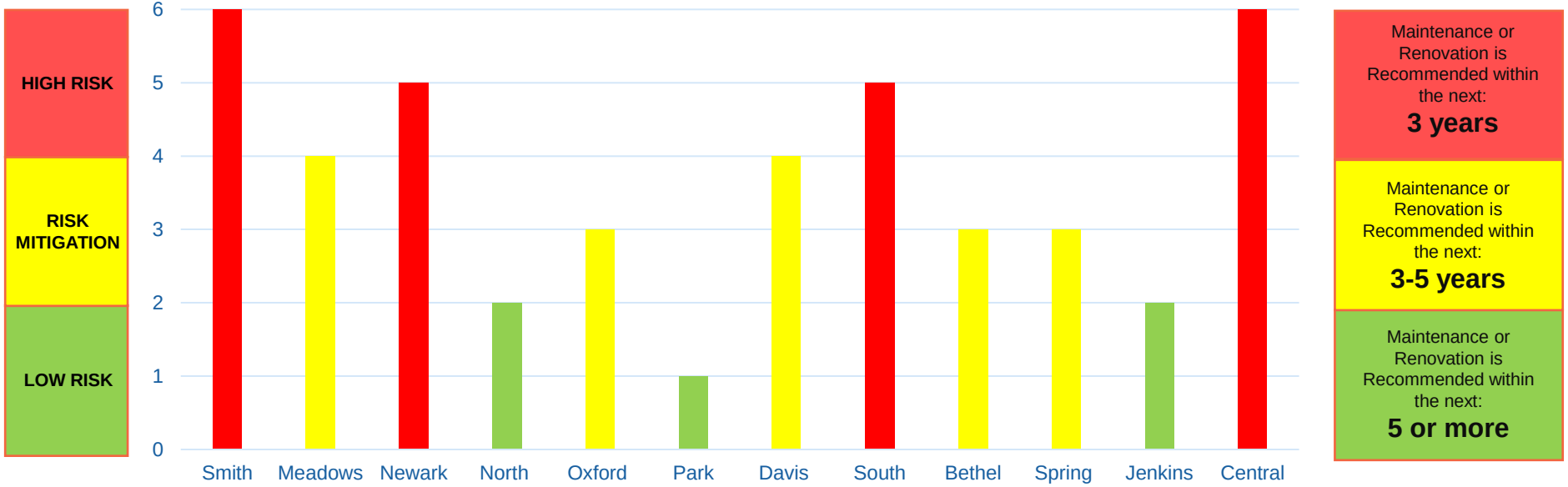
This information allows us to score your tank(s)

USG WATER SOLUTIONS

What happens next?

1. We submit all of our field reports to our engineering team
2. We send all coating samples to the lab
3. We develop of list of repairs and prioritize sanitary issues
4. We develop a painting schedule for the Exterior, Interior wet and Interior dry
5. We create budgetary proposal
6. Once the results from the lab are received, we sit with the you to discuss the game plan by tower.

Maintenance Risk by Tank (12 Tanks)



If we find a sanitary issue, we address it immediately.

Typical Service Contract

Asset Management Model

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Smith Tower	Exterior Rehab & Repairs	Visual Inspection	Visual Inspection	Visual Inspection	Interior Rehab	Visual Inspection	Visual Inspection	Visual Inspection	Visual Inspection	Washout Inspection
	$40,000	$40,000	$40,000	$40,000	$40,000	$16,500	$17,000	$18,000	$18,500	$19,000

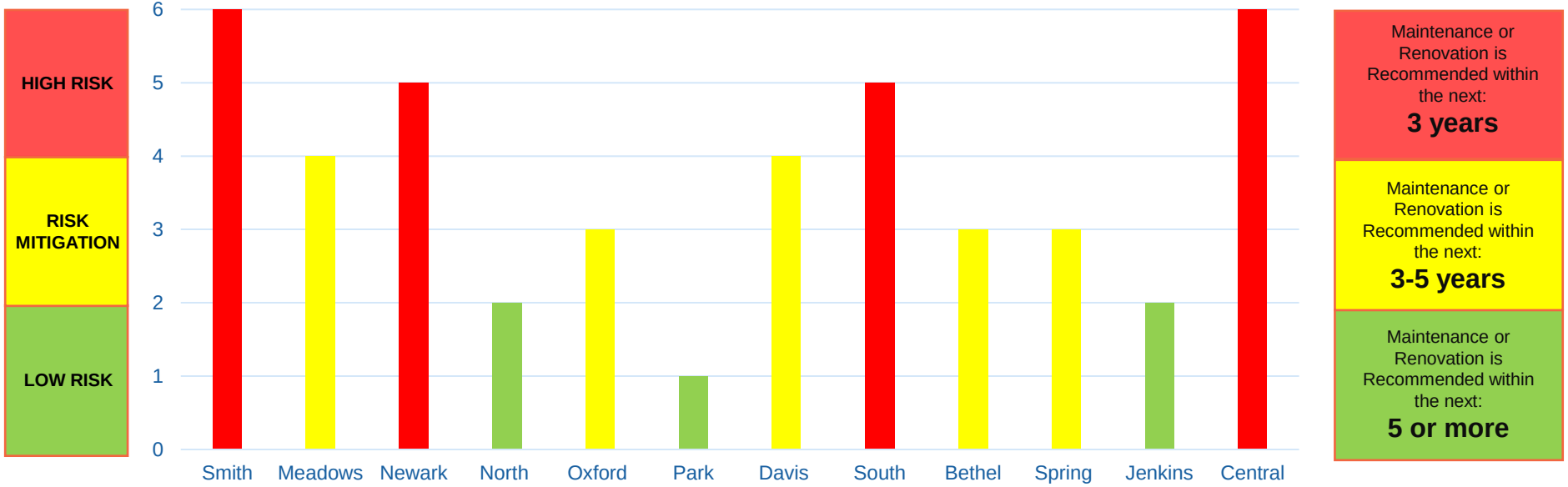
Yearly inpsections and washouts a minimum of every 5 years.

Repairs

New Frost Proof Vent
Add Cable Safety Climb
Repair overflow pipe/screen
Seal weld old Cathodic Protection Plates

Manage Antenna modifications (with your support)
Future exterior painting included
Future Interior Painting included (NSF 600)
We do all the engineering required
We do all of the EPA Permitting Required
You can cancel anytime you want

Maintenance Risk by Tank (12 Tanks)



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Typical Service Contract

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Smith	Exterior Rehab & Washout	Visual Inspection	Visual Inspection	Visual Inspection	Interior Rehab	Visual Inspection	Visual Inspection	Visual Inspection	Visual Inspection	Washout Inspection
Newark	Visual Inspection	Exterior Rehab & Washout	Visual Inspection	Visual Inspection	Visual Inspection	Interior Rehab	Visual Inspection	Visual Inspection	Visual Inspection	Visual Inspection
South	Visual Inspection	Visual Inspection	Interior Rehab	Visual Inspection	Visual Inspection	Visual Inspection	Visual Inspection	Exterior Rehab & Washout	Visual Inspection	Visual Inspection

You know have a program that …

- Minimize Life Cycle Cost.
- No Change Orders.
- Fixed/Predictable Yearly Budget.
- Perpetual Warranty.
- Single Source of Contact.
- Regulatory Compliance.

THANK YOU!!

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USG WATER SOLUTIONS

WATER QUALITY

USG WATER SOLUTIONS

Mixing and THM's

Mixing and THM’s