Holmbers Orchard Concrete Reservoir
2024 Inspection Report

CorrTech Report No. 16805-FOR-01-1

Prepared For:

Groton Utilities
295 Meridian Street
Groton, CT 06340

CORRTECH
CORROSION UNDERSTOOD

25 South Street
Hopkinton, MA 01748

2/12/2024

STATEMENT OF LIMITATION

Conclusions presented in this document are based on the services described and performed and not on tasks or procedures beyond the scope of the contracted services or time and budgetary constraints imposed by contract limitations.

CorrTech, Inc. has performed this assessment in a professional manner using the degree of skill and care exercised for similar projects under similar conditions by reputable and competent consultants, and in accordance with the procedures established within CorrTech's quality assurance, quality control protocol.

CorrTech, Inc. shall not be responsible for conditions or consequences arising from relevant facts that were concealed, withheld or not fully disclosed at the time the evaluation was performed.

Report Prepared by: Garth Lund
Project Engineer
AMPP Senior Certified Coatings Inspector #49983
October 23, 2024

Report Reviewed by: Ben Palmer
Project Manager
AMPP Certifed Coatings Inspector #44612
January 31, 2026

TABLE OF CONTENTS

INTRODUCTION

On January 19, 2024, CorrTech representatives, Derek O'Kane and Scott Murphy performed a corrosion and structural assessment of the exterior and interior of a drinking water storage tank for Groton Utilities. The inspection was conducted to establish the current condition of the tank's coatings and concrete substrate. The tank inspected included:

1.25 MG Holmbers Orchard Concrete Reservoir

For applicable standards used in this inspection, please see below.

The interior of the reservoir was inspected with the TankRover remotely operated vehicle, while full. The TankRover one of the most advanced drones for drinking water tank assessment. By using the TankRover the interior of the tank was inspected with no special preparation, confined space entry, no additional disinfection and no downtime.

The TankRover is equipped with a two-function gripping claw attachment used to manipulate sediment or debris. The unit has high-powered thrusters, which are used to maneuver throughout the tank and are used to wash away bottom sediment for observations. Video is recorded with audio narration on site with digital stills captured for the report.

The TankRover and all tether were prepared for the inspection by disinfecting equipment with a 200 ppm chlorine spray in accordance with AWWA C652-11.

The exterior portions of the tank were inspected by walking the roof and shell portions that were accessible from the ground.

The objectives of the assessment were to:

1. Perform field inspections and tests to assess the structural integrity of the tank.
2. Assess condition of any protective coatings present
3. Review the safety compliance of tank ladders and access.
4. Review sanitary protection equipment
5. Provide recommendations for rehabilitation.

APPLICABLE STANDARDS

AWWA D101 , 1986, AWWA D101, Inspecting Steel Tanks, Standpipes, Reservoirs, and Elevated Tanks, for Water Storage, American Water Works Association (AWWA) Standard D101, Inspecting Steel Tanks, Standpipes, Reservoirs, and Elevated Tanks for Water Storage
AWWA D110, 2013, AWWA D110, Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks, American Water Works Association (AWWA) Standard D110, Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks
CT DPH RCSA Section 19-13-B102, May, 2021, CT DPH RCSA Section 19-13-B102, Standards for Quality of Public Drinking Water, Connecticut Department of Public Health (CT DPH), Regulations of Connecticut State Agencies (RCSA) Section 19-13-B102, Standards for Quality of Public Drinking Water
AWWA C652, 2011, AWWA C652, Disinfection of Water-Storage Facilities, American Water Works Association (AWWA) Standard C652, Disinfection of Water-Storage Facilities

EXECUTIVE SUMMARY

The condition and recommendations for the tank are briefly summarized in this section. For detailed information regarding detailed tank conditions and the specific recommendations please refer to the designated section for the tank.

The Holmbers Orchard concrete reservoir is a prestressed concrete water storage tank with a capacity of 1,250,000 gallons.

The exterior shell of the tank is free of spalling, efflorescence, adhesion loss, corrosion, and cracking outside of single isolated area that has formed beneath the shell mounted later. The uncoated exterior roof has visible weathering and biological staining but no significant cracking or spalling.

The interior of this tank is completely intact with no visible cracking, spalling, or efflorescence. One isolated area of corrosion was found due to an exposed rebar tie in. All seam sealing material is intact with no visible adhesion loss. The interior piping and ladders are suffering from galvanic corrosion due to use of dissimilar metals.

A minor layer of soft sediment has accumulated up to ¼-in across the floor of the tank.

No sanitary deficiencies were found.

No structural deficiencies were found.

In accordance with current AWWA recommendations, the Holmbers Orchard tank should be next inspected in 2029.

A self closing swing gate should be installed at the shell ladder transition to the roof to meet current OSHA standards.

An AWWA vacuum relief style vent should be used wherever the use of fine mesh screen is required. Fine mesh can become clogged and lead to a negative pressure event that can damage the structural integrity of the tank.

The use of dissimilar metals within the tank should be addressed to prevent further corrosion/reduction from taking place and eventually leading to metal loss or section loss of the interior structures.

Tank Data

TANK DATA FOR Holmbers Orchard Concrete Reservoir											
Site Information	Fencing In Place:	Yes						Locks on Gates:	Yes		
Address:	Orchard Ln., Gales Ferry, CT							Vault Lock in Place:	Yes		
Tank Information	Tank Name:	Holmbers Orchard Concrete Reservoir						Tank Diameter:	60-ft		
Tank Height:	56-ft	Tank Capacity:	1,250,000 gallons		Previous Cleaning Date:		UNK				
Previous Inspect. Date:	UNK			Previous Coating Application:	UNK						
Foundation	Height:	Grade	Adequate Drainage:	Yes			Chime Plate Size:	N/A			
# of Anchors:	N/A	Anchor Bolt Diameter:		N/A			Chair Thickness	N/A			
Anchor Chair Dimensions:	N/A										
Shell Manhole	# of Manholes	2		Diameter:	24.5-in						
Ladder	Height from Ground:	101-in					Safety Cage:	Yes			
Anti Climb Lock :	Yes			Climbing Safety System Style:	Cable						
Rung to Rung Dim:	12-in	Distance from Shell:		14-in			Width:	17-in			
Overflow	Diameter:	11-in		Air Gap	16-in		Overflow Protection	Duck Bill			
Screen Condition:	UNK	Screen Type:	UNK				Splash Pad	N/A			
Roof Hatch	Dimensions:	42-in x 42-in		Sanitary Neck	3-in						
# of Hatches:	1	Hatch Cover Overlap	1.4-in				Lock	Yes			
Roof Vent	Style:	Mushroom		Diameter:	28-in						
Cap to Roof Distance:	10-in	Screen Condition:	Intact				Type:	Fine			
Roof Handrail Hts	Top Rail:	43-in		Mid Rail:	25-in		Toe Kick Plate:	4-in			
Interior	Sediment Depth:	1/4-in		Sediment Coverage:	90%						
Inlet/Outlet Pipe:	Combined			Sediment Ring:	No						
Interior Ladder	Climbing Safety System:	Rail		Style:	Standard						
Columns:	None		Column Number:	N/A			Interior Column Style	N/A			

OBSERVATIONS

Photos provided in the report were created from a digital camera and interior pictures were captured in digital format from the interior video. The interior images are as clear as our printed technology will allow. The copies in the report provide a reference for our comments. Keep in mind that for underwater video snaps, the video provides the greatest detail and should be viewed as part of the report.

Narration on the video is done in the field and some of the comments may be different than the written report.

INTERIOR

Roof Structure

This tank has an uncoated concrete self-supporting dome roof with no additional interior support structures. The roof is completely free of cracking and spalling. No corrosion of exposed rebar tie ins or efflorescence was observed either. There were no unsealed penetrations noted during the inspection.

Shell Structure

The shell is an uncoated concrete structure with seam sealer material applied to the vertical joints or seams. No cracking or spalling was found throughout the internal inspection. One isolated area of corrosion was found due to some exposed rebar tie ins.

Floor Structure

This tank has a flat uncoated concrete floor. The floor was almost entirely covered in a light layer of sediment with some bare areas. In these areas where the floor was exposed the substrate was completely intact with no visible cracking, spalling, corrosion, or efflorescence.

Sediment

A light layer of loose sediment has accumulated across much of the floor. There was no visible spalled material or foreign debris found within or under the sediment layer. This small amount of sediment is not a risk of being pulled into the outlet pipe of the tank.

Piping

A combination inlet and outlet pipe tree runs horizontally across the floor of the tank. The tank fills through rubber duck bills and drains through lower valves. Due to the use of stainless steel screens over the outlet valves galvanic corrosion can be observed forming along the length of the piping.

Ladders

Directly below the roof hatch and each lower shell manhole are section of straight interior ladders. Currently all the ladders are free of section loss and metal loss. However, reduction can be observed on all three ladders due the use of dissimilar metals throughout the tank. The worst case is on the roof hatch ladder where a stainless steel ladder safety climb has been attached directly to the ladder.

EXTERIOR

Manholes

This tank has two lower shell pressure style manholes. Each manhole was free of significant corrosion and visible leaks.

Ladder

The roof is accessed via a shell mounted ladder. This ladder runs from approximately 9-ft above grade to the roof of the tank and is equipped with a safety cage, anti-climb, and cable safety climb device. The anti-climb was locked prior to and after the completion of the inspection.

Overflow

This tank has an internal overflow pipe that is encased within the concrete. The pipe runs from a funnel below the tank roof, down the shell, to where it eventually exits the lower shell above grade. It then discharges into a grated concrete catch basin. The discharge point for the overflow is equipped with a rubber duck bill. The presence of or condition of any screening could not be observed during this inspection.

Shell

The exterior shell of the tank has a gunite like surfacing material over the concrete substrate. One area of cracking was noted beneath shell mounted ladder. This cracking appears to be strictly in the top surfacing layer and does not extend into the substrate of the shell. The remainder of the shell is completely intact with not visible cracking, spalling, corrosion, efflorescence, or adhesion loss of the surfacing material.

Roof Hatch

A single perimeter roof hatch is used to access the interior of the tank. This hatch is an aluminum Bilco style hatch installed on a concrete collar. Combined with the concrete collar the sanitary lip of the hatch meets all regulations. The gasket inside the hatch cover is completely intact and in place. This hatch was locked prior to and after the completion of the inspection.

Roof Vent

This tank vents through a singular central finial mushroom style roof vent. The vent opening is screened completely with intact fine mesh screen. It should be noted that the use of fine mesh screen without any form of vacuum relief can lead to damage to the tank structure in the event the screen becomes clogged.

Handrails

Handrails are installed to either side of the shell ladder. These railings meet all current OSHA standards and are free of corrosion and section loss.

Roof

The exterior roof of the tank is an uncoated concrete structure. Slight weathering and biological staining have formed on the roof and roof perimeter. No spalling, cracking, corrosion, or efflorescence was noted during the inspection.

RECOMMENDATIONS

In accordance with current AWWA recommendations, the Holmbers Orchard Concrete Reservoir should be next inspected in 2029.

The use of dissimilar metals within the tank should be addressed to prevent further corrosion/reduction from taking place and eventually leading to metal loss or section loss of the interior structures.

AWWA compliant vent should be installed.
Roof vent does not meet current AWWA D100 standard or the generally accepted Ten States Standard for sanitary protection. Insect screens are now part of the normal sanitary standard and in order to use these fine screens. Fine mesh screens are subject to clogging due to freeze up in the winter so a special vent assembly is needed. Vents should be installed which can relieve both a positive or negative pressure should the fine mesh screen become clogged. An AWWA vacuum/pressure relief vent provides for the safe use of insect screen and should be designed for easy inspection and maintenance of the screens.

Self-Closing Swing Gate should be installed if the Owner wants to be compliant with current OSHA Fall Protection requirements.
In order to be in compliance with OSHA Standard 1910.23(a)(2) all railing openings or platform pass through openings should be equipped with a self-closing swing gate. Although this standard strictly addresses new construction after 11/19/2018 it is advisable to modify existing tanks with this safety device. If existing ladders are substantially modified or replaced on an existing tank then this new standard would apply.

Appendix I: Photographs

1) Tank overview

2) Shell mounted roof access ladder with safety climb and cage

3) Overflow pipe with duck bill discharging into concrete catch basin

4) 1 of 2 lower shell manholes

5) 2 of 2 lower shell manholes

6) Typical condition of the exterior tank shell free of cracking and spalling

7) Typical condition of the exterior tank shell\

10) Typical condition of the upper shell

8) Intact shell surfacing material free of adhesion loss

11) Tank shell free from visible cracking and spalling

9) Cracking located beneath the shell ladder

12) Biological staining along the rim of the roof

13) Roof railings and hatch

16) Typical condition of the exterior roof

14) Central finial mushroom style vent

17) Biological staining of the exterior roof

15) Intact fine mesh screening

18) Weathering of exterior roof surfacing material

19) Exterior roof free of cracking and spalling

22) Perimeter roof railings flanking the shell ladder

20) Typical roof seam

23) Bilco stlye roof hatch

21) Area of discoloration on the exterior roof

24) Interior ladder with safety climb installed under hatch

25) Intact hatch cover gasket

28) Typical condition of the interior roof

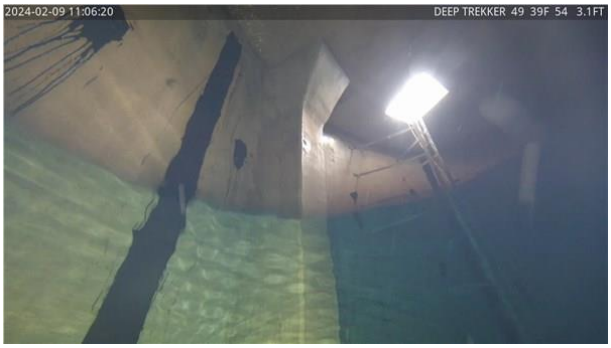
26) Interior overview

29) Interior overflow funnel

27) Typical condition of the interior above water shell

30) Locked roof hatch

31) 00:29 - Perimeter roof hatch with ladder underneath



34) 2:16 - Interior overflow pipe encased in concrete

32) 00:51 - Typical condition of the above water shell and roof

35) 3:27 - Central tank roof and vent opening

33) 1:54 - Interior roof free from cracking and spalling

36) 4:11 - Typical condition of the interior roof free of spalling and cracking

37) 4:40 - Typical condition of the submerged interior shell

38) 4:51 - Intact seam seal material

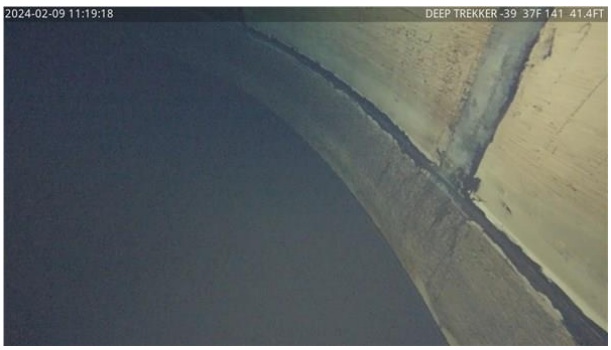
39) 6:44 - Typical condition of the interior ladder

40) 7:08 - Concrete casing around interior overflow pipe

41) 7:42 - Intact shell substrate free of cracking and spalling

42) 8:50 - Corrosion cell from exposed rebar tie in

43) 12:40 - Oxidation of interior ladder due to dissimilar metals used on the safety climb



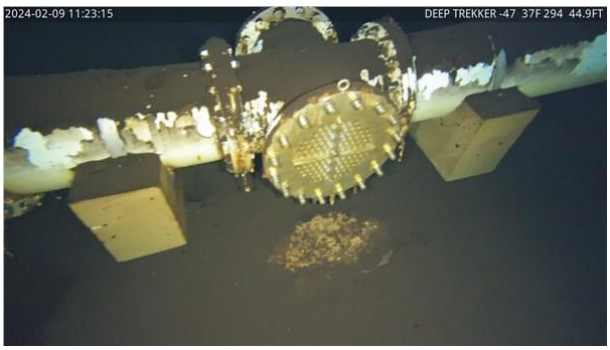
46) 15:14 - Typical condition of the lower shell and perimeter floor

44) 13:02 - Lower shell manhole with ladder

47) 15:40 - Second lower shell manhole with ladder

45) 14:27 - Combination inlet and outlet tree runnning horizontally across the tank floor

48) 17:36 - Inlet pipe with rubber duck bill



49) 19:10 - Stainless steel outlet grate causing galvanic corrosion on the piping

50) 21:31 - 1/4-in layer of sediment forming across the floor of the tank

51) 22:54 - Intact floor below the sediment layer

GLOSSARY OF TERMS FOR STEEL/CONCRETE TANKS

Adhesion- State in which two surfaces are held together by interfacial forces which may consist off valence forces or interlocking action or both

Aggregate- Granular material, such as sand, gravel, crushed stone, crushed hydraulic-cement concrete, or iron blast-furnace slag used with a hydraulic cementing medium to produce either concrete or mortar.

Bugholes- Small regular or irregular cavities, usually not exceeding 15 mm in diameter, resulting from entrapment of air bubbles in the surface of formed concrete during placement and compaction.

Cathodic Protection - The use of a sacrificial metal or energized substance to polarize the structures surfaces and prevents corrosion.

Chalking - The degradation of a paint binders when exposed to ultra-violet light which creates a loose residue on the surface.

Chemical Attack- Decomposition of a coating or concrete due to the action of a chemical.

Chime- Portion of tank floor plate that extends outside the tank shell and rests on top of the foundation.

Contraction Joint- Formed, sawed, or tooled groove in a concrete structure to create a weakened plane and regulate the location of cracking resulting

Corrosion Cell - A concentrated localized site of accelerated corrosion that creates pitting.

Disbondment- The loss of adhesion between a coating and the substrate.

Dry Film Thickness - Total thickness of a paint film when completely cured.

Efflorescence- A white crystalline or powdery deposit on the surface of concrete. Efflorescence results from leaching of lime or calcium hydroxide out of a permeable concrete mass over time by water, followed by reaction with carbon dioxide and acidic pollutants.

Finish- The texture of a concrete surface after compaction and finishing operations have been performed.

Finial Vent - The central roof vent on top of a water tank.

Grout- A plastic mixture of cementitious materials and water used as a filler for cracks, or other void spaces, in concrete surfaces to be coated.

Holiday - A hole or void in a protective coating that may be invisible to the unaided eye that extends to the substrate.

Honey Comb- Voids left in concrete due to failure of the mortar to effectively fill the spaces among coarse aggregate particles.

Hydraulic, Hydrostatic Pressure- A force exerted on the concrete/coating interface due to the level of the ground water.

Isolation Joint- A separation between adjoining parts of a concrete structure

Joint Sealant- Compressible material used to exclude water and solid foreign materials from joints.

Lap Joint Seam- Overlapping seam between roof plates that is open and un-welded on the interior.

Laitance- A thin, weak brittle layer of cement and aggregate fines on a concrete surface. The amount of laitance is influenced by the degree of working or the amount of water in the concrete.

Lead Abatement - The removal of a lead bearing paint system.

Lead Encapsulation - The covering over of a lead based paint by applying a compatible topcoat.

Osmotic Blister - Raised coating area created by buildup of fluid under the coating. Fluid moves through coating in response to water/solvent concentrations between coating and tank water.

Osmotic Pressure- A force exerted on the concrete /coating interface through the capillaries in the concrete due to a moisture differential across the coating.

Overflow Weir Box- internal or external box that captures water above the operating height of the tank and directs it to an overflow pipe.

Pack Rust/Crevice Corrosion- Advanced form of steel corrosion that forms visible layers of oxidized steel swollen larger than the original steel plate thickness, usually found between steel plates or surfaces.

Pinholes- Film defect characterized by small pore-like flaws in a coating which extend entirely through the applied film and have the general appearance of pinpricks, fine holes, or voids when viewed by reflected light.

Plastic Cracking or Shrinkage- Cracking that occurs in the surface of fresh concrete soon after it is placed and while it is still plastic,

Porosity- The ratio usually expressed as a percentage, of the volume of voids in a material to the total volume of the material, including the voids.

Reflective Cracking-Cracking that develops in a coating directly over a dynamic crack in concrete.

Rigging plug- Thread steel nipple welded to a tank roof for the purposes of rigging painting cables. Usually sealed with a threaded plug when not in use.

ROV - Remotely operated vehicle, underwater inspection device "TankRover" by CorrTech

Screen Mesh- Number of openings per linear inch of screen.

Silt - Material that accumulates in the bottom of a water tank originating from treatment by products, raw water particles and distribution system debris.

Silt Stop- Solid cylinder installed on a floor inlet or outlet pipe to extend the pipe above the floor. Pipe prevents floor sediment from being stirred up or sucked out of the tank during flow.

Static Cracks- A crack in the concrete surface whose width does not change.

GLOSSARY OF TERMS FOR STEEL/CONCRETE TANKS

Stich or Skip Weld- Method of welding two pieces of steel together with intermittent short sections of weld bead. Leaves open lap joints along the unwelded sections.

Tubercle - Domed shaped buildup of corrosion products over an active corrosion site. Promotes metal loss through pitting due to differential oxygen concentrations.

Ultrasonic Measurement - The use of high frequency sound waves passed through a material to measure the time required to return. The time required to pass through the material is correlated to the speed of sound in the substrate to yield an actual thickness at a specific location.

Vapor Barrier- Waterproof membrane placed under concrete floor slabs that are placed on grade.