EVALUATION OF THE

1,000,000 GALLON FLUTED PEDESTAL WATER TANK

“TYSON TANK”
ROBARDS, KENTUCKY

FOR

HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

April 22 and 23, 2014
14.031.H1145.003
May 23, 2014

SUBJECT:

The subject of this report is the field evaluation of the 1,000,000 gallon fluted pedestal water tank located in Robards, Kentucky. The tank was owned by Henderson Water Utility and was known as the “Tyson Tank.” The field evaluation was performed on April 22 and 23, 2014, by Jared C. Peyer, Jesse Jenkins, and Harold H. Knight of Tank Industry Consultants. The Owner’s representative on the site at the time of the field evaluation was Nancy Parker. The fluted pedestal was of welded steel construction. According to information on the tank nameplates, the tank was constructed in 1996 by Pitt-Des Moines, Inc., under contract number 55199. The tank nameplates also stated the tank was 1,000,000 gallons in capacity, 74 ft in diameter, and 115 ft to bottom capacity level.

OBJECTIVE:

The purpose of this washout and evaluation was to determine the condition of the interior wet, interior dry, exterior, exposed foundation, and accessories. The purpose of this report is to present the findings of the evaluation and to make recommendations for recoating, repairing, corrosion protection, and maintenance. Budget estimates for the work, anticipated life of the coating and the structure, and the replacement cost of the tank are also included.

AUTHORIZATION:

This washout, evaluation, and report were authorized in the Blanket Agreement signed by Tom Williams, P.E., General Manager dated February 10, 2014 and in Task Order Number 2014-01 also signed by Tom Williams on February 10, 2014.

EXECUTIVE SUMMARY:

The coating on the exterior of the tank appeared to be in good overall condition with no significant areas of coating failure or corrosion noted. The exterior surfaces will likely not require repainting within the 5 years although it would likely be more economical to repaint it when the interior wet surfaces are repainted. The coating on the interior dry surfaces of the tank was in poor condition with widespread areas of coating failure and corrosion noted. The interior dry surfaces should be recoated within the next 2 to 4 years. The interior wet coating was also in poor condition with several areas of corrosion noted. The corrosion in the bowl had allowed metal loss to occur, and the corrosion along the roof support structure had created sharp edges. The interior wet surfaces should be repainted within the next 1 to 2 years.

An Employee-Owned Company
ANSI/OSHA and Safety-Related Deficiencies: There were OSHA and safety-related deficiencies on this tank. These deficiencies included:

- some of the plastic shrouds over the interior dry light fixtures had melted,
- wiring was exposed at penetration in the access tube,
- the interior dry ladder side rails were dimensionally too small (ANSI A14.3),
- the bowl manhole and access tube ladder minimum head clearances were dimensionally too small (29 CFR 1910.27(c)(1)),
- the minimum bowl manhole ladder toe room was dimensionally too small (29 CFR 1910.27(c)(4)),
- the conduits and cables along the pedestal and access tube ladder side rails could restrict the climber’s use of the ladders (29 CFR 1910.27(b)(2)),
- the bracket on the interior wet container ladder safe-climbing device was broken,
- severe corrosion and metal loss were observed on the interior container ladder,
- the access openings through the platforms were not equipped with curbs (29 CFR 1910.27(a)(2)),
- the walkway handrail and platform handrails were dimensionally too small (29 CFR 1910.23(e)(3)(iii)), and
- the gap between the walkway floor and toe bar exceeded the maximum allowed width (29 CFR 1910.23(e)(4)).

If the Owner wishes to fully comply with OSHA and safety-related standards, it is recommended that these deficiencies be rectified.

AWWA, Sanitary, and Operational Deficiencies: There were AWWA, sanitary, and operational deficiencies on this tank as well:

- three roof couplings were open which could allow the ingress of insects,
- the container roof manholes were not locked,
- the screening on the access tube vent was torn,
- the roof vent pallet was warped,
- the roof vent horizontal screening was painted,
- the roof vent vertical screening was not adequately sized to prevent the ingress of insects, and
- a cable penetrated the top of the access tube into the wet container and there were gaps around the penetration.

These deficiencies should be corrected.

The safety-related, sanitary, and operating deficiencies listed above are not intended to be a complete list of deficiencies on this tank. The Owner should refer to the complete report text and accompanying photographs for a complete account of all observed deficiencies.

This evaluation and the reporting of the condition of this tank do not warrant the original structural condition of the tank or any of the original design for seismic loadings. Likewise, recommendations for this tank do not include modifications which may be required for compliance with present structural codes.
PHOTOGRAPHS:

Color photographs were taken of the visible portions of the foundation, tank interior wet, interior dry, and exterior and are included as a part of this report. The significant photographs are keyed to the observations. Photographs taken from the ROV video are included as a part of this report.

NOMENCLATURE:

Warning: Some appurtenances on this tank may be referred to as erection or rigging attachments, lugs, or brackets. This does not mean that they are safe for rigging. Each attachment for each tank should be evaluated on an individual basis by a structural engineer or an experienced rigger before being used. These devices may have been intended for only the original erectors and painters to use with specialized equipment.

ADHESION TESTS:

All adhesion tests performed during this evaluation were done in general accordance with ASTM D3359. The results are reported herein using the ASTM scale. The ASTM scale is a relative scale to rate adhesion from 0 to 5 with 5 being the best. A table of adhesion test results classification is included with this report following the sketch of the tank.

HEAVY METALS TESTS:

Samples of the exterior, interior dry, and interior coating systems were sent to a laboratory for atomic absorption analyses. The test results were as follows:

<table>
<thead>
<tr>
<th></th>
<th>Cadmium</th>
<th>Chromium</th>
<th>Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mg/kg</td>
<td>percent</td>
<td>mg/kg</td>
</tr>
<tr>
<td>Exterior</td>
<td>&lt;25</td>
<td>&lt;0.0025%</td>
<td>&lt;250</td>
</tr>
<tr>
<td>Interior Dry</td>
<td>&lt;25</td>
<td>&lt;0.0025%</td>
<td>&lt;250</td>
</tr>
<tr>
<td>Interior Wet</td>
<td>&lt;25</td>
<td>&lt;0.0025%</td>
<td>&lt;250</td>
</tr>
</tbody>
</table>

Tank Industry Consultants performs this test only to determine if there is lead, chromium or cadmium present in the coating samples. To limit damage to the existing coating, only small areas were tested. The small number of samples taken and the difficulty of retrieving all primer from the steel profile may cause the tests performed to not accurately represent the total coating system. Variations in thickness, types of coatings applied, and the interim cleaning and painting operations will also affect the actual readings. The reliability of the results is also dependent on the amount of primer included in the sample. The Consumer Product Safety Commission specifies that an amount greater than 0.06% lead is considered potentially hazardous. Additional testing to determine the amount of leachable contaminants present in the spent cleaning debris will need to be performed following cleaning operations at the time of repainting. Results from the laboratory analysis are included following the adhesion tables.
ULTRASONIC THICKNESS MEASUREMENTS:

Roof: (all readings were taken through coating)
  Cap: 0.240 in. to 0.244 in.
  Finger: 0.207 in. to 0.208 in.
Access Tube:
  Top: 0.274 in. to 0.277 in.
  Bottom: 0.275 in. to 0.278 in.
Shell:
  Ring #3: 0.266 in. to 0.268 in.
  Ring #2: 0.254 in. to 0.257 in.
  Ring #1: 0.303 in. to 0.306 in., bottom
Bowl:
  Finger: 0.379 in. to 0.382 in.
  Upper Cone: 0.487 in. to 0.490 in.
  Lower Cone: 0.762 in. to 0.764 in.
  Saucer: 0.399 in. to 0.400 in.
Walkway: 0.273 in. to 0.277 in.
Platforms: 0.229 in. to 0.231 in.
Fluted Pedestal:
  Girders: 0.229 in. to 0.231 in.
  Plates: 0.312 in. to 0.319 in.
Base Plate: 0.960 in. to 0.966 in.

OBSERVATIONS:

A. Foundation and Site

SITE:
  Size: approx. 150 ft x 150 ft
  Fence:
    Type: chain link topped w/ 3 strands of barbed wire
    Height: 6 ft
  Gate:
    Location: southeast side of site
    Width: 17 ft 6 in.
    Locked: yes

Nearest Structure:
  Type: plant
  Direction: north
  Distance: approx. 400 ft
Nearest Overhead Power Lines: none

FOUNDATION:
   Type: concrete ringwall
   Projection above Grade:
      North: 16-1/2 in. to 20 in.
      South: 16 in. to 22 in.
      East: 4 in. to 16 in.
      West: 20 in. to 26 in.
   Grout: 7/8 in. to 1-1/4 in. thick
   Sealant: none visible

1. **Site Location**: The tank was located off of Quinn’s Landing Road near the Tyson plant in Robards, Kentucky. The surrounding areas were not developed. The Tyson plant was located to the north. No overhead power lines were located around the tank. (See photo 1)

2. **Site Conditions**: The tank site was covered with grass and appeared to be graded to provide adequate drainage away from the foundation. The tank site was enclosed by a chain link fence which was topped with barbed wire. The fence had a locked gate on the southeast side of the site. A hydrant was located on the southwest part of the site, and valve projections were located on the site. Miscellaneous pipes and other heavy equipment were stored on the site. (See photos 2-5)

3. **Foundation**: Except for minor hairline cracks, the exposed surface of the concrete foundation appeared to be in adequate condition. The top of the foundation exceeded the AWWA recommended projection of 6 in. to 12 in. above grade in all areas except the east side of the foundation. No coating was visible on the foundation except drips from the pedestal coating. Drain pipes were located in the perimeter of the foundation. (See photos 6-10)

4. **Grout**: There was a pad of grout located between the base plate and the top of the foundation. The grout appeared to be in poor condition with voids, undercuts, and cracks noted. No sealant was visible around the grout. (See photos 6-11)

B. **Exterior Surfaces**

DESCRIPTION:
   Construction: welded
   Type: fluted pedestal
NAMEPLATES:
   Number: 2
   Location: east side of lower pedestal

   AWWA D100 84
   Contract No. 55199
   Year Completed 1996
   Nominal Diameter 74'-0"
   Nominal Height 115'-0" to BCL
   Nominal Capacity 1000MG
   Material A36
   Heat Treatment N/A
   Fabricated and Erected by
   Pitt-Des Moines, Inc.
   Pitt-Des Moines, Inc.
   Built Under One or More of the
   Following Patents

BASE PLATE PROJECTION:
   Interior: 1-1/2 in. to 10-1/2 in.
   Exterior: 1-1/2 in. to 10-1/2 in.

OVERFLOW PIPE:
   Size: 12 in. diameter
   Air Break: 3-3/4 in.
   Flap Gate: yes
   Splash Pad: 3 ft 6 in. x 7 ft 6 in.

ACCESS DOOR:
   Size: 3 ft x 6 ft 7 in.
   Locked: yes

PEDESTAL PAINTER'S RAIL: 3 in. x 3 in. x 1/4 in., angle

PAINTER'S MANHOLE:
   Size: 22 in. diameter
   Hinged: yes, exterior
   Locked: no

SIGN: "TYSON"
   Location: east side of shell
   Letter Height: approx. 4 ft
   Letter Width: approx. 10 in.
   Brush Strokes: approx. 10 in.

TOP SHELL ANGLE:
   Size: 4 in. x 4 in. x 3/8 in.
   Orientation: leg out
ROOF OPENINGS:

Access Tube Manhole:
  Type: hinged cover
  Size: 24 in. diameter
  Curb: 7 in. projection
  Overlap: 2 in.
  Locked: no
  Vent:
    Size: 8 in. diameter
    Screening: 8 x 8 mesh

Container Roof Manhole #1:
  Type: hinged
  Size: 24 in. diameter
  Curb: 6 in.
  Welded: exterior and interior
  Overlap: 2 in.
  Locked: no

Container Roof Manhole #2:
  Type: flanged and bolted
  Size: 24 in. diameter
  Curb: 5-1/4 in. to 8 in. projection
  Cover: 33 in. diameter x 1/4 in. thick
  Flange: 4-1/4 in. projection x 1/4 in. thick
  Welded: exterior only
  Locked: no

Roof Vent:
  Type: clog-resistant
  Neck Height: 12 in.
  Neck Diameter: 24 in.
  Screen:
    Vertical: 2 x 2 mesh
    Horizontal: 16 x 16 mesh
  Cover: 48 in. diameter
EXTERIOR COATING AND METAL CONDITION:

<table>
<thead>
<tr>
<th>Coating Thickness</th>
<th>Approx. % Failure to</th>
<th>Adhesion</th>
<th>Metal Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Typical</td>
<td>Underlying Coating</td>
</tr>
<tr>
<td>Fluted Pedestal</td>
<td>5 mils to 14.5 mils</td>
<td>7 mils</td>
<td>&lt;1/2%</td>
</tr>
<tr>
<td>Bowl</td>
<td>5.5 mils to 9.5 mils</td>
<td>7 mils</td>
<td>Neg.</td>
</tr>
<tr>
<td>Shell</td>
<td>5 mils to 10 mils</td>
<td>6 mils</td>
<td>Neg.</td>
</tr>
<tr>
<td>Roof</td>
<td>6.5 mils to 15 mils</td>
<td>10 mils</td>
<td>&lt;1/2%</td>
</tr>
</tbody>
</table>

Key to Table

<table>
<thead>
<tr>
<th>Adhesion</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (very good)</td>
<td>T = Topcoat to Underlying Coating</td>
</tr>
<tr>
<td>4 (good)</td>
<td>S = Primer to Steel</td>
</tr>
<tr>
<td>3 (fair)</td>
<td>Neg. = negligible</td>
</tr>
<tr>
<td>2 (poor)</td>
<td></td>
</tr>
<tr>
<td>1 (very poor)</td>
<td></td>
</tr>
<tr>
<td>0 (very poor)</td>
<td></td>
</tr>
</tbody>
</table>

1. **Exterior Coating Condition**: The coating on the exterior of the tank appeared to be in good overall condition with no significant areas of coating failure or corrosion noted. The exterior coating exhibited poor to fair adhesion to the underlying coating and steel.

2. **Base Plate**: The base plate appeared to be in fair overall condition at the time of the field evaluation. Corrosion and layered rust were observed along the edge of the base plate, and the topcoating had peeled. (See photos 6-11)

3. **Fluted Pedestal Condition**: The fluted pedestal appeared to be in nearly its original structural condition at the time of the field evaluation. The coating on the pedestal appeared to be in good overall condition although there were spots of peeled topcoating and corrosion. These were located primarily on the north and west sides of the pedestal. The coating exhibited poor adhesion to the underlying coating, and the coating had chalked and faded. The pedestal was equipped with a personnel-sized door which was locked prior to and after the field evaluation. Two tank nameplates were attached to a bracket on the south part of the pedestal. A security light fixture was located on the southeast side of the lower pedestal although it was not determined if the fixture was operational at the time of the field evaluation. Two conduits penetrated both the lower east and west sides of the pedestal. A painter’s manhole was located near the top of the pedestal and a painter’s rail was located above the manhole. Minor corrosion was located on the painter’s rail. is the opinion of Tank Industry Consultants that the painter’s rail located should not be used for rigging purposes or personnel access. (See photos 11, 14-22)

4. **Overflow Pipe**: The overflow pipe projected from the lower fluted pedestal and extended slightly from the pedestal before discharging above a concrete splash pad. There was rip rap at the end of the splash pad. The discharge end of the overflow pipe had a flap gate. Corrosion was observed on the bolts around a flange near the end of the pipe. (See photos 12-13)

5. **Bowl Condition**: The coating appeared to be in good overall condition with no significant areas of coating failure noted. The coating had chalked, and it exhibited fair adhesion to the steel. (See photos 23-24)
6. **Shell Condition**: The contour of the tank shell appeared adequate as no significant irregularities were noted. The coating was in good overall condition with only a few isolated areas of topcoating failure noted. The coating had chaled, and it exhibited fair adhesion to the steel. A top shell angle was located at the roof-to-shell connection. A sign was located on the east side of the shell which read, “TYSON.” The sign was in good overall condition although it had faded slightly. (See photos 1, 25-28)

7. **Roof Condition**: There was a sanitary deficiency noted: three roof couplings were open which could allow the ingress of insects. The contour of the roof was irregular with peaking and banding noted. Five unused antenna masts were located on the roof. Thirteen threaded and plugged couplings were located in the roof cap although three were open. The coating on the roof was in good overall condition with a few areas of topcoating failure noted. Some of these areas were located at the base of the antenna masts. A few spots of corrosion were observed at what appeared to be scratches in the coating. The coating had chaled and faded, and it exhibited fair adhesion to the underlying coating. (See photos 29-36)

8. **Roof Manholes**: There were sanitary and AWWA deficiencies noted: (1) the roof manholes were not locked, and (2) the screening on the vent in the access tube manhole cover was torn. The roof was equipped with two container roof manholes and one access tube roof manhole. The roof manholes were welded on the exterior only. The manholes were not locked prior to or after the field evaluation. One of the container manholes had a hinged cover while the other was flanged with a bolted cover. The flanged cover appeared to have been cut into two pieces and repair welded with a flat bar. A vent was located in the cover of the access tube manhole, and the screening on the vent was shielded from wind-driven dust and debris. The screening on the vent was torn. (See photos 37-42)

9. **Roof Vent**: There were sanitary, AWWA, and operational deficiencies noted: (1) the pallet was warped, (2) the horizontal screening was painted, and (3) the vertical screening was not adequately sized to prevent the ingress of insects into the tank. The roof was equipped with what appeared to be a clog-resistant vent located in the roof cap. However, the pallet appeared to be warn. The vertically oriented screening was not adequately sized to prevent the ingress of insects into the tank. The horizontal screening was intact although it had been painted. (See photo 43)

C. **Interior Dry Surfaces**

**FLUTED PEDESTAL:**
- **Size**: approx. 52 ft diameter
- **Floor**: gravel and sand
- **Girders**:
  - **Number**: 6
  - **Size**: 24 in. to 33-1/4 in. wide
  - **Drain Holes**: 1 in. diameter
- **Vents**:
  - **Number**: 2 rings of 4 vents
  - **Locations**: above bottom and top girders
  - **Size**: 9-3/4 in. diameter
  - **Screening**: 1/8 in. thick perforated plate w/ 3/16 in. diameter holes
ANCHOR BOLTS:
   Number: 48
   Size: 1-1/2 in. diameter
   Chairs: none

INLET/OUTLET PIPE:
   Insulation: foam w/ plastic cover
   Brackets: 11-1/2 in. x 3/8 in., flat bar

OVERFLOW PIPE BRACKETS:
   Size: 9 in. x 3/8 in., flat bar
   Construction: welded

CONDENSATE CEILING: none

PEDESTAL LADDER:
   Number of Sections: 7
   Number of Rungs: 23 or 24 per section
   Width: 16 in.
   Side Rails: 2 in. x 3/8 in., flat bar
   Rung Size: 3/4 in. diameter
   Spacing: 12 in. on center
   Toe Room: 15-3/4 in.
   Head Clearance: 30 in. minimum
   Brackets:
      Construction: welded
      Size: 2-1/2 in. x 3/8 in., flat bar
      Spacing: approx. 10 ft to 11 ft
   Safe-Climbing Device: none

LADDER PLATFORMS:
   Number: 6
   Size: 5 ft x 9 ft 5 in.
   Safety Railing:
      Handrail:
         Height: 43 in.
         Size: 2 in. x 2 in. x 1/4 in., angle
         Uprights: 2-1/2 in. x 2-1/2 in. x 1/4 in., angle
         Mid-Rail: 2-1/2 in. x 1/4 in., flat bar
         Toe Bar:
            Type: rolled platform edge
            Height: 4 in.
   Access Openings:
      Size: 30 in. x 33 in.
      Curb: none
Closable Cover: yes

WALKWAY:
  Size: approx. 3 ft x 18 ft 5 in. long
  Safety Railing:
    Handrail:
      Height: 42 in.
      Size: 2 in. x 2 in. x 1/4 in., angle
    Uprights: 2-1/2 in. x 2-1/2 in. x 1/4 in., angle
    Mid-Rail: 2-1/4 in. x 1/4 in., flat bar
    Toe Bar:
      Size: 4 in. x 1/4 in., flat bar
      Height: 4-1/2 in. to 5 in. above walkway

RADIAL RODS:
  Number: 16
  Size: 1 in. diameter
  Rod Pins: approx. 1-1/4 in. diameter x 1-1/4 in. long

BOWL MANHOLE AND LADDER:
  Manhole:
    Type: single-crab
    Size: 24 in. diameter
    Neck: approx. 11 in. projection x 1 in. thick
    Bolt: 1 in. diameter x 12 in. long
    Cover: 26-1/4 in. diameter x 3/8 in. thick
  Ladder:
    Number of Rungs: 14
    Width: 16 in.
    Side Rails: 2 in. x 3/8 in., flat bar
    Rung Size: 3/4 in. diameter
    Spacing: 12 in. on center
    Toe Room: 2-1/4 in. minimum
    Head Clearance: 27 in. minimum
  Brackets:
    Size: 2-1/2 in. x 3/8 in., flat bar
    Construction: welded
    Spacing: 14 ft

BACKING BAR: 1-1/2 in. x 1/4 in., flat bar

ACCESS TUBE:
  Size: approx. 4 ft diameter
  Stiffeners:
    Number: 4
    Size: 3 in. x 3/8 in., flat bar
ACCESS TUBE LADDER:
Number of Rungs: 66
Width: 16 in.
Side Rails: 2 in. x 3/8 in., flat bar
Rung Size: 3/4 in. diameter
Spacing: 12 in. on center
Toe Room: 11 in. to 12-3/4 in.
Head Clearance: 23 in. minimum
Brackets:
Size: 2-5/8 in. x 3/8 in., flat bar
Construction: welded
Spacing: approx. 8 ft
Safe-Climbing Device: 3/8 in. diameter cable-type

INTERIOR DRY COATING AND METAL CONDITION:

<table>
<thead>
<tr>
<th>Coating Thickness</th>
<th>Approx. % Failure to</th>
<th>Adhesion</th>
<th>Metal Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>Typical</td>
<td>Underlying Coating</td>
<td>Rust</td>
</tr>
<tr>
<td>Fluted Pedestal</td>
<td>1.5 mils to 10.5 mils</td>
<td>Neg.</td>
<td>3%</td>
</tr>
<tr>
<td>Radial Rods</td>
<td>4.5 mils to 7 mils</td>
<td>Neg.</td>
<td>Neg.</td>
</tr>
<tr>
<td>Dry Bowl</td>
<td>2 mils to 6 mils</td>
<td>Neg.</td>
<td>5%</td>
</tr>
<tr>
<td>Access Tube</td>
<td>3 mils to 7 mils</td>
<td>Neg. &lt;1%</td>
<td>4 S</td>
</tr>
</tbody>
</table>

Key to Table
Adhesion
5 (very good)
4 (good)
3 (fair)
2 (poor)
1 (very poor)
0 (very poor)

T = Topcoat to Underlying Coating
S = Primer to Steel
Neg. = negligible

1. **Interior Dry Coating Condition:** The coating on the interior dry surfaces appeared to be in poor overall condition. Widespread areas of coating failure and corrosion were noted throughout the interior dry surfaces. The coating on the interior dry surfaces exhibited good adhesion to the steel.

2. **Interior Dry Lighting System:** There was a safety deficiency noted: some of the plastic shrouds over the fixtures had melted. Numerous shrouded light fixtures were located within the interior dry part of the tank. The shrouds were constructed of plastic, and it appeared the plastic was melted on two of the fixtures which indicate the lights burned too hot or the plastic was too weak. The fixtures were operational at the time of the field evaluation. (See photos 50, 54)

3. **Anchor Bolts:** The pedestal was equipped with 48 anchor bolts. Extensive corrosion and metal loss were noted on the anchor bolts and on the interior dry base plate surfaces surrounding them. (See photo 47-48)

4. **Fluted Pedestal Condition:** The coating on the interior dry pedestal appeared to be in poor condition. Several areas of peeled coating and corrosion were noted on the interior pedestal surfaces. The coating exhibited good adhesion to the steel. Several miscellaneous items, including lumber and 5-gallon buckets of disinfection materials, were stored in the base of the pedestal.
Electrical cabinets and equipment were located in the base of the pedestal. The pedestal floor was constructed of sand and gravel. A shed was located in the base of the pedestal which contained the base of the inlet/outlet pipe. The pedestal was equipped with six stiffening girders. The girders were equipped with drain holes, and no evidence of standing water was noted. There were, however, widespread areas of peeled coating and corrosion on the girders. Two sets of four screened vent openings were located in the pedestal just above the bottom girder and just above the top girder. The screening on these vents appeared to be intact at the time of the field evaluation. (See photos 44-46, 49-50, 55-59, 61-62)

5. **Inlet/Outlet Pipe**: The inlet/outlet pipe extended up the pedestal interior and penetrated the dry bowl. The pipe was covered with foam insulation which had a plastic jacket. The insulation and jacket were intact which prevented the evaluation of the pipe. The inlet/outlet pipe had welded flat bar brackets at the pedestal girders. The base of the inlet/outlet pipe was located in a shed. (See photos 46, 50)

6. **Overflow Pipe**: The overflow pipe extended down from a penetration in the dry bowl, through the pedestal interior, and exited just above the floor. The overflow pipe was welded to flat bar brackets located at the pedestal girders. Corrosion was observed on the overflow pipe and brackets. (See photos 49-51, 68)

7. **Pedestal Ladder**: There were safety and OSHA deficiencies noted: (1) the 2 in. x 3/8 in. ladder side rails did not precisely meet the required 2-1/2 in. x 3/8 in. minimum, and (2) the conduit attached to the ladder brackets restricted the climber’s use of the ladder side rails. Six ladder sections extended from the pedestal floor up the pedestal to the walkway and to the painter’s manhole. The ladder sections were welded to brackets which were welded to the pedestal. The ladder sections and brackets to be in nearly their original structural condition at the time of this field evaluation. (See photos 49-50, 52-53, 62)

8. **Ladder Platforms**: There were safety and OSHA deficiencies noted: (1) the 2 in. x 2 in. x 1/4 in. handrails did not precisely meet the minimum required 2 in. x 2 in. x 3/8 in. minimum, and (2) the access openings were not equipped with 4 in. high curbs. There were six platforms along the pedestal ladder. The platforms were equipped with safety railing which was constructed of angle and flat bar members. Minor corrosion was observed on the platforms. The platforms had drain holes and no areas of trapped water were noted. The access openings through the platform floors had closeable covers. The height of the handrail on the top platform was less than on the remaining platforms because of its location just below the dry bowl. (See photos 49-50, 62)

9. **Walkway**: There were safety and OSHA deficiencies noted: (1) the 2 in. x 2 in. x 1/4 in. handrail did not meet the minimum required 2 in. x 2 in. x 3/8 in. minimum, and (2) the 1/2 in. to 1 in. gap between the toe bar and walkway exceeded the maximum allowed 1/4 in. gap. A walkway extended from the pedestal ladder to the bowl manhole ladder and access tube. The walkway was equipped with safety railing which was constructed of angle and flat bar members. The walkway was equipped with drain holes which appeared to provide adequate drainage. Widespread corrosion was observed on the walkway.

10. **Interior Dry Bowl Condition**: The coating on the dry bowl surfaces appeared to be in poor condition with widespread areas of peeled and cracked coating as well as corrosion were noted. A backing bar was welded around the bowl with corrosion observed along it. The coating exhibited good
adhesion to the steel. An approximately 4 ft x 4 ft welded steel patch plate was located in the bowl adjacent to the inlet/outlet pipe penetration. (See photos 60, 63-66, 68)

11. **Bowl Manhole and Ladder**: There were safety-related and OSHA deficiencies noted: (1) the 2 in. x 3/8 in. ladder side rails did not precisely meet the required 2-1/2 in. x 3/8 in. minimum, (2) the 2-1/2 in. minimum toe room did not meet the minimum required 7 in., and (3) the 27 in. minimum head clearance did not precisely meet the required 30 in. minimum. A single-crab manhole was located in the bowl. A ladder extended from the walkway to the bowl manhole. The toe room behind the ladder was restricted by the walkway handrail. The ladder was welded to brackets which were welded to the walkway and dry bowl. The ladder and brackets to be in nearly their original structural condition at the time of this field evaluation. (See photo 67)

12. **Radial Rods**: The interior dry pedestal was equipped with one set of radial rods which extended from the pedestal to the exterior of the access tube. The radial rods were equipped with wing plates and turnbuckles at the access tube and with clevis connections at the pedestal. The coating had chipped, checked, and peeled, but no significant corrosion was noted on the radial rods at the time of the field evaluation. The coating exhibited good adhesion to the steel. **The radial rods should not be used for rigging purposes.** (See photos 60, 68-69)

13. **Access Tube Condition**: There were sanitary and safety deficiencies noted: (1) a cable penetrated the top of the access tube into the wet container and there were gaps around the penetration, and (2) wiring was exposed at this penetration. The coating on the dry part of the access tube appeared to be in poor condition with widespread areas of peeled and cracked coating as well as corrosion were noted. Overspray and grit were present in the coating, and it appeared the coating had been scratched. The access tube coating exhibited good adhesion to the steel. There were corrosion and metal loss on the access tube floor. Four fully welded stiffeners were located in the access tube, and cracked and peeled coating and corrosion were observed along them. Cables extended up the interior of the access tube. Lugs were located around the base of the access tube exterior just below the bowl. **The lugs should not be used for rigging purposes.** (See photos 69-70, 72-76)

14. **Access Tube Ladder**: There were safety-related and OSHA deficiencies noted: (1) the 2 in. x 3/8 in. ladder side rails did not precisely meet the required 2-1/2 in. x 3/8 in. minimum, (2) the 23 in. minimum head clearance did not meet the minimum required 30 in., and (3) the cable attached to the ladder could restrict the climber’s use of the ladder side rails. A ladder extended from the walkway through the access tube to the roof. The ladder was equipped with a cable-type safe-climbing device. The ladder was welded to brackets which were welded to the access tube. The ladder and brackets to be in nearly their original structural condition at the time of this field evaluation. A cable was attached to the ladder side rails which interfered with the climber’s use of the ladder side rail. (See photos 71-72, 76)

**D. Interior Wet Surfaces**

**ROOF SUPPORT STRUCTURE:**
- **Stiffeners**: 5 in. x 3 in. x 1/4 in., angle
- **Center Hub**:
  - Construction: 2 flat bars welded together
  - **Size**: 7 in. x 3/8 in., flat bar
CATHODIC PROTECTION: none

INTERIOR CONTAINER LADDER:
   Number of Rungs: 52
   Width: 16 in.
   Side Rails: 3 in. x 1/2 in., flat bar
   Rung Size: 3/4 in. diameter
   Spacing: 12 in. on center
   Toe Room: 13 in.
   Brackets:
      Construction: welded
      Size: 2-5/8 in. x 3/8 in., flat bar
      Spacing: approx. 10 ft
   Safe-Climbing Device: 3/8 in. diameter cable-type

OVERFLOW:
   Inlet Type: weir box
   Location: near top of access tube

ACCESS TUBE STIFFENER:
   Location: 4th access rung ring
   Size: 4 in. x 1/2 in., flat bar

INLET/OUTLET PIPE:
   Size: 16 in. diameter
   Projection: 3-1/4 in. to 5 in. above bowl
   Protective Cover: none

INTERIOR WET COATING AND METAL CONDITION:

<table>
<thead>
<tr>
<th></th>
<th>Coating Thickness</th>
<th>Approx. % Failure to</th>
<th>Adhesion</th>
<th>Metal Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Typical</td>
<td>Primer</td>
<td>Rust</td>
</tr>
<tr>
<td>Roof</td>
<td>8.5 mils to 19 mils</td>
<td>13 mils</td>
<td>Neg.</td>
<td>2%</td>
</tr>
<tr>
<td>Shell</td>
<td>-</td>
<td>-</td>
<td>Neg.</td>
<td>10%</td>
</tr>
<tr>
<td>Wet Bowl</td>
<td>12 mils to 36 mils</td>
<td>17 mils</td>
<td>Neg.</td>
<td>5%</td>
</tr>
</tbody>
</table>

Key to Table
Adhesion 5 (very good) T = Topcoat to Underlying Coating
4 (good) S = Primer to Steel
3 (fair) Neg. = negligible
2 (poor)
1 (very poor)
0 (very poor)

1. Interior Wet Coating Condition: The coating on the interior wet surfaces appeared to be in poor overall condition with several areas of corrosion noted. The corrosion in the bowl had allowed
metal loss to occur, and the corrosion along the roof support structure had created sharp edges. The interior wet coating exhibited fair to good adhesion to the steel.

2. **Roof Condition**: The roof plate seams appeared to be lapped and seal welded. The coating on the interior roof plates was in poor condition with numerous spots of coating failure and corrosion noted. The interior roof support structure consisted of fully welded radial stiffeners and a center hub. The center hub was constructed of two flat bar welded together. Corrosion and metal loss had created sharp edges on the stiffener and center hub members. Daylight was visible at the open roof couplings. (See photos 77-82, 84)

3. **Shell Condition**: The shell coating appeared to be in poor condition with numerous areas of corrosion noted. The corrosion was located in large clusters. The coating had also checked, and there were runs and sags, some measuring up to 20 ft long, in the shell coating. Rust staining had streaked onto the upper shell surfaces from the roof stiffener ends and from around the roof-to-shell connection. The shell coating was discolored due to mineral staining from the water. (See photos 85-87)

4. **Interior Container Ladder**: There were safety and OSHA deficiencies noted: (1) severe corrosion and metal loss were observed on the ladder, and (2) the bottom bracket on the ladder safe-climbing device was broken. The ladder was equipped with a cable-type safe-climbing device although the bottom bracket was broken. The interior container ladder was welded to brackets which were welded to the access tube. The interior container ladder and brackets appeared to be in poor condition with severe corrosion and metal loss noted primarily on the upper part of the ladder. The interior container ladder should not be used for personnel access, and the safe-climbing device should not be used for fall protection purposes. (See photos 91-92, 97-99)

5. **Overflow Pipe**: The overflow was equipped with a weir box inlet. The inlet was located near the top of the access tube, and the pipe extended down the access tube before penetrating the bowl. Corrosion was observed on the overflow pipe and weir box. (See photos 93-95)

6. **Bowl Condition**: The bowl coating was in poor condition with areas of blistered coating, corrosion, and metal loss noted. The metal loss typically measured 1/32 in. deep with the metal loss found measuring 1/16 in. deep. Four lugs were located on the bowl. The lugs should not be used for rigging purposes. (See photos 87-88, 100-104)

7. **Access Tube Condition**: The coating on the access tube surfaces appeared to be in poor overall condition with areas of peeled coating and corrosion observed. Sensor equipment projected from the top of the access tube. The interior wet container ladder was located on the access tube. A flat bar stiffener was located around the access tube. Lugs were located around the top of the access tube, and there was corrosion on the lugs. The lugs should not be used for rigging purposes. (See photos 83, 89-92, 96)

8. **Inlet/Outlet Pipe**: The inlet/outlet pipe projected above the bowl. The pipe was not equipped with a protective cover although a welded rod was located across the pipe diameter. (See photo 101)
RECOMMENDATIONS:

A. Foundation and Site

1. Site Maintenance: The site should be regarded so that the top of the foundation projects a minimum of 6 in. to a maximum of 12 in. above grade in all areas and so that proper drainage away from the foundation continues.

2. Tank and Site Security: Water tanks have been defined by some courts under certain circumstances as attractive nuisances. As such, there may be a significant potential liability to the Owner for injury to persons on the tank and tank site, even if access is not authorized. Recent events have prompted the entire water industry to consider measures that inhibit intentional acts that could threaten the water supply. A review of the security requirements for the tank and site is recommended to confirm that the existing measures are consistent with the Owner’s security requirements for their water system. Primary tank and site security should be focused on eliminating, preventing, and detecting unauthorized access to the tank. Such security measures might include routinely and periodically verifying all manholes, gates, and doors are locked. Other security measures might include installing warning signs, motion sensors, surveillance cameras, alarms on tank manholes, gates, and doors, and arranging more frequent site visits by law enforcement agencies.

3. Foundation: When the exterior is repainted, any unsound concrete should be chipped to sound material and the concrete should be brush-off blasted. Any deteriorated areas or voids found should have a bonding agent and a vinyl emollient modified concrete patching mortar applied to build up the surface to its original contour. The concrete should then be painted with a concrete sealer.

4. Grout Maintenance: All loose grout should be chipped away to solid material when the tank is empty. Any shim plates which can be easily removed should be taken out. Any voids in the grout should be filled with a nonshrinking, nonstaining, structural grout material. The grout should be placed as far back under the base plate as possible and squared off vertically with the edge of the base plate. Any gaps between the steel base plate and the grout should be filled with a flexible sealant.

B. Exterior Surfaces

1. Life of the Exterior Coating: The coating on the exterior of the tank appeared to be in good overall condition with no significant areas of coating failure or corrosion noted. Tank Industry Consultants believes that the exterior surfaces of the tank should not need to be repainted within the 5 years although it would likely be more economical to repaint it when the interior wet surfaces are repainted. Even though the existing pedestal and roof coatings exhibited poor adhesion to the steel, spot cleaning and topcoating may be a viable option if performed prior to the further deterioration of the existing coating adhesion. The exterior coating system should be evaluated immediately prior to preparing specifications to determine if the coating adhesion is still adequate to accept a topcoat.

2. Coating Testing: Prior to preparation of specifications for the cleaning and coating of the exterior of the tank, samples of the exterior coating system should be subjected to laboratory analysis to test for ingredients which may at that time be subject to regulations concerning their handling and disposal.
3. **Cleaning**: When the exterior is to be cleaned, all varieties of containment should be investigated. Containment of the wind-blown debris and containment of paint droplets may be required.

4. **Recommended Coating System**:
   
a. **Spot Clean and Topcoat**: If the exterior is to be repainted within the next few years, then spot cleaning and topcoating may be feasible. The typical life of a spot cleaned and topcoated system is approximately 7 to 8 years, but is highly dependent on previous surface preparation and the condition of the underlying coating system.

   b. **Coating Application**: The entire exterior surfaces of the tank should be high-pressure washed to remove chalked coating, mildew, and contaminants. After washing, the damaged and rusted areas should be spot cleaned to the equivalent of an SSPC-SP 6, Commercial Blast Cleaning, or SSPC-SP 11, Power Tool Cleaning to Bare Metal. All areas of excessive coating thickness and runs in the coating should be cleaned to the equivalent of an SSPC-SP 7, Brush-Off Blast Cleaning, to remove the excessive mils. The spot cleaned areas should receive a spot prime coat compatible with the present coating system. The entire exterior surfaces should then be intermediate coated and topcoated with a compatible coating system.

5. **Alternate Coating System**:
   
a. **Complete Cleaning and Repainting**: The optimum long-life coating system presently available for this site is an epoxy-polyurethane coating system. Properly formulated and applied polyurethanes have good resistance to condensation, mildew, and chipping. The polyurethanes also have excellent color and gloss retention and the longest expected service life of any of the common exterior tank coatings. The typical life of a properly applied epoxy-polyurethane coating system is approximately 15 to 20 years. These coatings are also presently manufactured to meet current VOC requirements.

   b. **Coating Application**: The entire tank exterior should be cleaned to the equivalent of an SSPC-SP 6, Commercial Blast Cleaning and have an epoxy-primed, epoxy intermediate and polyurethane finish coating system applied. However, care must be taken during the application of this particular coating system because this coating does have poor dry-fall characteristics, and potential damage to the surrounding property must be taken into consideration. The polyurethane coatings also require close monitoring of temperature and humidity during application.

6. **Effective Service Life**: Tank Industry Consultants defines the life of a coating as the amount of time before repainting becomes necessary due to coating failure and corrosion. During the coating life the Owner should expect the coating to lose its gloss, start to chalk, show signs of weathering, and possibly some rust staining. Future touch-up may be required on isolated coating failures. If aesthetics are a concern, the Owner may have to topcoat the repainted tank prior to the end of the expected service life. However, future topcoating would be less expensive than complete cleaning and recoating and could delay the next complete cleaning and repainting for many years.

7. **Other Systems**: With air emission volatile organic compounds (VOC) restrictions being put in place around the nation, alternative coating systems may become available which would be
viable options for this tank. The Owner should review the available systems prior to preparing specifications for the recoating project.

8. **Coating Curing:** It would be more economical to paint the tank exterior at the same time the interior wet is painted, since the tank must be drained while the exterior is painted, and the applied coatings cure. This will also reduce mobilization and observation costs.

9. **Rehabilitation Schedule:** To obtain the lowest possible prices for the work outlined in the recommendations, the Owner should have the specifications prepared and the work bid in the spring, with the work scheduled to start in early summer (if possible).

10. **Grinding and Bracket Removal:** Any unused brackets or erection lugs should be removed prior to the exterior repainting. Any weld burrs, weld spatter, or erection scars should be ground off to provide a smooth surface for the application of the coating.

11. **Electrical Apparatus:** All unused electrical conduit, fixtures, electrical equipment, and cabinets should be removed from the tank and tank site. All required equipment should be repaired and maintained in accordance with the National Electric Code (NEC).

12. **Nameplates:** The tank nameplates should be removed for the cleaning and coating of the tank and then be reattached to the tank using the existing bracket.

13. **Pedestal Painter’s Rail:** The painter’s rail on the pedestal should not be used for rigging purposes or personnel access.

14. **Coupling:** The three open couplings in the roof should be plugged.

15. **Existing Roof Manholes:** The roof manholes should be locked to improve water system security. Additionally, the cover on the flanged and bolted manhole should be replaced, and the new cover should include a retaining chain to secure the cover to the roof or manhole neck when it is removed. The screening on the access tube vent should be replaced.

16. **Clog-Resistant Vent:** As the existing vent pallet was warped, the vertically oriented screening was not adequately sized, and the horizontally oriented screening had been painted, it is recommended the existing vent should be replaced with a new, clog-resistant vent.

C. **Interior Dry Surfaces**

1. **Life of the Interior Dry Coating:** The coating on the interior dry surfaces of the tank was in poor condition with widespread areas of coating failure and corrosion noted. It is believed most of the interior dry surfaces will likely require recoating within the next 2 to 4 years. Due to the extent of coating failure noted, the interior dry surfaces should be completely blast cleaned and repainted.

2. **Coating Testing:** Prior to preparation of specifications for the cleaning and coating of the interior dry portions of the tank, samples of the coating system should be subjected to laboratory analysis to test for ingredients which may at that time be subject to regulations concerning their handling and disposal.
3. **Interior Dry Cleaning and Repainting:** The interior dry surfaces should be completely cleaned to the equivalent of an SSPC-SP 6, Commercial Blast Cleaning and have a two-coat epoxy coating system applied. The typical life of a properly formulated and applied epoxy coating system is approximately 15 to 20 years or more in a dry environment. These coatings are also presently manufactured to meet current VOC requirements.

4. **Grinding and Bracket Removal:** Any unused brackets or erection lugs should be removed prior to the interior dry repainting. Any weld burrs, weld spatter, or erection scars should be ground off to provide a smooth surface for the application of the coating.

5. **Radial Rods and Access Tube Lugs:** The radial rods and access tube lugs should not be used for rigging purposes.

6. **Inlet/Outlet Pipe:** At the time of recoating and repairs, the insulation should be removed from the inlet/outlet pipe, and its condition determined. If the pipe is in good condition, it should be cleaned and painted in accordance with the recommendations listed above. If it is not, the pipe may require additional metal loss repairs or even replacement.

7. **Anchor Bolts:** The anchor bolts and surrounding interior dry base plate surfaces will likely require metal loss repairs at the time of interior dry recoating and repairs.

8. **Bowl Manhole:** At the time of recoating and repairs, the gasket dry bowl manhole should be replaced.

9. **Interior Dry Ladders:** The ladders should be replaced with new ladders which meet current dimensional requirements. The cables and conduits should be relocated from the ladder side rails. The ladders and platforms should be modified to allow adequate toe and head clearance.

10. **Ladder Platforms:** The access openings through the platforms should be equipped with 4 in. high curbs, and the handrails should be replaced with new ones which meet current dimensional requirements.

11. **Walkway:** The handrail should be replaced with a rail which meets current dimensional requirements, and the toe bar should be lowered so the gap between it and the walkway is less than 1/4 in. wide.

12. **Interior Dry Lighting:** The lighting fixtures in the interior dry portions of the tank should be regularly maintained. Any burned out bulbs, damaged globes, or missing cages or fixtures should be replaced. The plastic shrouds should be replaced with shrouds which are more suitable for the heat emitted from the lights.

13. **Access Tube:** The opening located around the cable penetration through the upper access tube into the container should be sealed, and the exposed wiring should be covered.

**D. Interior Wet Surfaces**

1. **Life of the Interior Wet Coating:** The coating on the interior wet surfaces appeared to be in poor overall condition with several areas of corrosion noted. The corrosion in the bowl had allowed
metal loss to occur, and the corrosion along the roof support structure had created sharp edges. The interior wet surfaces should be repainted within the next 1 to 2 years before more significant metal loss occurs in the bowl or on the roof support structure members. It is recommended that when the interior wet is completely cleaned and repainted, an epoxy coating system should be used.

2. **Coating Testing**: Prior to preparation of specifications for the cleaning and coating of the interior of the tank, samples of the interior coating system should be subjected to laboratory analysis to test for ingredients which may at that time be subject to regulations concerning their handling and disposal.

3. **Recommended Interior Wet Coating System**:

   a. **Epoxy Coating System**: The optimum long-life coating system presently available for the interior wet surfaces of water tanks is a two-component epoxy coating system. A two-coat epoxy system is recommended for the interior wet of this tank. This coating system should meet the certification criteria of ANSI/NSF 61 and state department of health regulations.

   b. **Coating Application**: When the interior wet is to be repainted, the entire tank interior wet should be cleaned to the equivalent of an SSPC-SP 10, Near-White Blast Cleaning and an epoxy coating system applied.

   c. **Service Life**: The typical life of a properly formulated and applied epoxy coating system is approximately 12 to 15 years in immersion service. Tank Industry Consultants defines the life of a coating as the expected service life before repainting becomes necessary due to coating failure and corrosion.

4. **Cathodic Protection**: When the tank is rehabilitated the brackets and fittings should be installed for the future installation of a cathodic protection system.

   a. **Type**: When the cathodic protection system is installed, an ice-resistant cathodic protection system which features long-life anodes, automatic potential and current control should be specified.

   b. **Scheduling**: After the interior is completely cleaned and recoated, the cathodic protection system should not be energized until after the First Anniversary Evaluation. The Owner should conduct washouts and evaluations approximately every 3 years to monitor the need for cathodic protection. As the interior coating begins to show signs of failure, the cathodic protection system should be energized to aid in minimizing corrosion below the top capacity level.

   c. **Maintenance**: Cathodic protection, if used and maintained properly, will control active corrosion below the water level and extend the useful life of a coating system. It should be noted that maintenance as recommended by the cathodic protection manufacturer is required for the cathodic protection system to work properly. Without proper monitoring, the cathodic protection system may operate too high and cause the coating to blister, or the system may operate too low and not adequately protect the exposed steel surfaces.

5. **Pit Welding and Pit Filling**: After initial cleaning, all significant pitting which is found should be welded, and all pitting with rough edges that would make the pitting difficult to coat properly
should be filled with a solventless epoxy seam sealer. (It was estimated that approximately 5 square inches of pits will require welding, and approximately 2 gallons of seam sealer will be required for pit repair.)

6. **Rough Edges:** All unused brackets should be removed from the interior and exterior surfaces at the time of the next recoating. Any weld burrs, spatter, scars or rough edges in the steel should be ground smooth to provide a better surface for coating. (It was estimated that approximately 30 man-hours of grinding will be required on the interior of the tank.)

7. **Roof Support Structure:** After abrasive blast cleaning, the roof support structure should be carefully evaluated as metal loss repairs may be necessary at areas where the metal loss was not previous visible.

8. **Interior Container Ladder:** Interior ladders may be susceptible to ice damage and accelerated rates of corrosion. If the Owner decides to keep the interior ladder, the ladder should be replaced with a ladder which meets current dimensional requirements. The safe-climbing device should be replaced with a new corrosion-resistant device. **The interior container ladder should not be used for personnel access, and the safe-climbing device should not be used for fall protection purposes**

9. **Overflow:** If possible, the part of the overflow pipe located in the wet container should be relocated to the interior dry part of the access tube.
ECONOMIC FACTORS:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
<th>Life in Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement of tank with a new one</td>
<td>$2,400,000</td>
<td>75+</td>
</tr>
</tbody>
</table>

The following is a complete list of repairs and estimated costs for their respective recommendations found in the RECOMMENDATION section of this report.

<table>
<thead>
<tr>
<th>Item</th>
<th>Sanitary &amp; Safety</th>
<th>Scheduled Maintenance Repairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean and Paint Exterior:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spot Clean and Topcoat</td>
<td>$215,000</td>
<td></td>
</tr>
<tr>
<td>Containment</td>
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<tr>
<td>SP 6, Complete Clean, Epoxy/Polyurethane System</td>
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<td>Containment</td>
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<td>Clean and Paint Interior Dry:</td>
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<tr>
<td>Complete Clean and Repaint</td>
<td>160,000</td>
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<tr>
<td>Clean and Paint Interior Wet:</td>
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<td></td>
</tr>
<tr>
<td>SP 10, 2-Coat Epoxy System</td>
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<tr>
<td>Cathodic Protection System</td>
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<td>Miscellaneous Chipping and Grinding</td>
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<tr>
<td>Seam Sealing</td>
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<tr>
<td>Pit Repair</td>
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<tr>
<td>Repair Foundation</td>
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<td></td>
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<tr>
<td>Contingency for Roof Support Structure Repairs</td>
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<tr>
<td>Replace Interior Dry Ladders</td>
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<tr>
<td>Replace Walkway and Platform Handrails</td>
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<tr>
<td>Lower Walkway Toe Bar</td>
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<td>Modify Platform Access Openings</td>
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<tr>
<td>Remove Interior Container Ladder</td>
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<tr>
<td>Replace Interior Container Ladder Safe-Climbing Device</td>
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<td>Relocate Overflow Pipe to Interior Dry Access Tube</td>
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<td>Modify Existing Roof Manholes</td>
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<td>Replace Clog-Resistant Roof Vent</td>
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</tr>
<tr>
<td>Contingency Items</td>
<td>5,000</td>
<td>7,000</td>
</tr>
</tbody>
</table>

Estimates are believed to be a high average of bids that would be received in 2014.

1 The replacement estimate includes costs associated with new tank fabrication and erection, foundation, painting, and engineering. The budget estimate given does not include costs associated with tank demolition, site acquisition, and distribution interruptions.
The following economic factors include only those work items which the Engineer believes to be the minimum to properly maintain this tank from an operational standpoint. Other items related to safety and risk management should be evaluated by the Owner.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
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<tbody>
<tr>
<td>Clean and Paint Exterior:</td>
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<tr>
<td>Spot Clean and Topcoat</td>
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<td>Clean and Paint Interior Dry:</td>
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<td>Clean and Paint Interior Wet:</td>
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<td>Repair Foundation</td>
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<tr>
<td>Contingency for Roof Support Structure Repairs</td>
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<tr>
<td>Replace Interior Dry Ladders</td>
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</tr>
<tr>
<td>Replace Walkway and Platform Handrails</td>
<td>15,000</td>
</tr>
<tr>
<td>Lower Walkway Toe Bar</td>
<td>2,000</td>
</tr>
<tr>
<td>Modify Platform Access Openings</td>
<td>6,000</td>
</tr>
<tr>
<td>Remove Interior Container Ladder</td>
<td>2,000</td>
</tr>
<tr>
<td>Relocate Overflow Pipe to Interior Dry Access Tube</td>
<td>3,000</td>
</tr>
<tr>
<td>Modify Existing Roof Manholes</td>
<td>2,000</td>
</tr>
<tr>
<td>Replace Clog-Resistant Roof Vent</td>
<td>8,000</td>
</tr>
<tr>
<td>Contingency Items</td>
<td>10,000</td>
</tr>
</tbody>
</table>

**Total of Engineer's Recommendations**  $772,000

Tank Industry Consultants has no control over the cost of labor, materials, or equipment, or over the contractors’ methods of determining prices, or over competitive bidding, or the market conditions. Opinions of probable cost, as provided for herein, are to be made on the basis of our experience and qualifications and represent our best judgment as design professionals familiar with the design, maintenance, and construction of concrete and steel plate structures. However, Tank Industry Consultants cannot and does not guarantee that proposals, bids, or the construction cost will not vary from opinions of probable cost prepared for the Owner.

Due to the numerous potential scopes of work which exist, the Owner should obtain an updated budget estimate once the final scope of work has been determined. This would enable the Owner to accurately budget monies for additional mobilization costs and damaged coating rehabilitation costs.

Engineering and resident observation costs are not included in the Total of the Engineer's Recommendations because these fees are dependent upon the scope of work to be performed. Tank Industry Consultants performs all facets of the engineering services which would be required for this project. Estimated fees for engineering and resident observation will be furnished upon request.
CLOSURE:

Brief Summation: Henderson Water Utility has a 1,000,000 gallon fluted pedestal tank. The coating on the exterior of the tank appeared to be in good overall condition with no significant areas of coating failure or corrosion noted. The exterior surfaces will likely not require repainting within the 5 years although it would likely be more economical to repaint it when the interior wet surfaces are repainted. The coating on the interior dry surfaces of the tank was in poor condition with widespread areas of coating failure and corrosion noted. The interior dry surfaces should be recoated within the next 2 to 4 years. The interior wet coating was also in poor condition with several areas of corrosion noted. The corrosion in the bowl had allowed metal loss to occur, and the corrosion along the roof support structure had created sharp edges. The interior wet surfaces should be repainted within the next 1 to 2 years. Proper maintenance after completing the recommendations herein would include periodic washouts and evaluations approximately every 3 to 5 years in accordance with AWWA recommendations.

Contractor Selection: The work should be performed by a competent bonded contractor, chosen from competitive bids taken on complete and concise specifications. The coatings used should be furnished by an experienced water tank coating manufacturer, supplying the field service required for application of technical coatings.

Standards for Repairs and Coatings: All work done and coatings applied should be applied in accordance with NACE, ANSI/NSF Standard 61, the manufacturer's recommendation, AWWA D100 and AWWA D102 (latest revisions), and the SSPC: The Society for Protective Coatings.

Observation of Work: Observation of the work in progress by experienced personnel will offer additional assurance of quality protective coating application. Observations can be performed on a continuous basis or spot (critical phase) basis. The actual cost of observation may be less using spot as opposed to full-time resident observation; however, with spot observation it is often necessary for work to be redone to comply with the specifications. This somewhat lowers the quality of the finished product, lengthens the job, and is frequently a cause of conflict between the contractor, Owner, and field technician. Resident full-time observation minimizes the amount of "rework" required.

Anniversary and Maintenance Evaluations: An anniversary evaluation should be conducted prior to the end of the one year bonded guarantee. Washouts and coating, structural, sanitary, safety, and corrosion evaluations should be conducted not less than every three years.

Time Frame: If the work is not performed within the next 18 months, the structure should be reevaluated prior to the preparation of specifications and solicitation of bids.

Specifications and Bidding Documents: The recommendations in this report are not intended to be specifications on which a contractor can bid. Complete bidding documents must include general and special conditions, detailed technical specifications, and other information necessary for the competitive bidding process. To properly protect the interests of the Owner, Contractor, and Engineer; the initial evaluation, the technical specifications, legal portions of the contract documents, and the observation should be performed by the same firm or with close coordination of all parties involved.
Limitations of Evaluation: It is believed that the conditions reported herein reflect the condition of the tank as observed on the date of the evaluation, using reasonable care in making the observations, and safety in gaining access to the tank. Should latent defects be discovered during the cleaning of the structure, they should be brought to the attention of the Owner and the Engineer.

Seismic and Wind Loadings: This tank is located in a region of high seismic activity. This evaluation and the reporting of the condition of this tank do not warrant the structural condition of the tank or any of the original design for seismic loadings. Likewise, recommendations for this tank do not include modifications which may be required for compliance with present structural codes. It is possible the tank was erected in compliance with pre-existing industry standards which have since been replaced by more restrictive standards.

Hazardous Materials in Coatings: It should be taken into consideration that Federal, State, and local environmental agencies have placed stricter controls on the removal of heavy-metal based coatings from steel structures by the use of conventional abrasive blasting techniques. The paint and blast residue may be considered to be hazardous waste depending on the concentration of heavy-metal particles in residue.

Please contact Tank Industry Consultants if you have any questions or comments.

Respectfully submitted,

Tank Industry Consultants

Jennifer Coon, CHMM, CET

Gregory R. “Chip” Stein, P.E.
Managing Principal

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### Classification of Adhesion Test Results

<table>
<thead>
<tr>
<th>Method A – X Cut Tape Test</th>
<th>Surface</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approx. 1.5 in. long cuts at 30 deg. to 45 deg. apart.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No peeling or removal.</td>
<td>x</td>
<td>5</td>
</tr>
<tr>
<td>Trace peeling or removal along incisions.</td>
<td>x</td>
<td>4</td>
</tr>
<tr>
<td>Jagged removal along incisions up to 1/16 in. (1.6mm) on either side.</td>
<td>x</td>
<td>3</td>
</tr>
<tr>
<td>Jagged removal along most of incisions up to 1/8 in. (3.2mm) on either side.</td>
<td>x</td>
<td>2</td>
</tr>
<tr>
<td>Removal from most of the area of the X under the tape.</td>
<td>x</td>
<td>1</td>
</tr>
<tr>
<td>Removal beyond the area of the X.</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method B – Lattice Cut Tape Test</th>
<th>Surface</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Six parallel cuts at 2mm apart.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The edges of the cuts are completely smooth; none of the squares of the lattice are detached.</td>
<td>No Failure</td>
<td>5</td>
</tr>
<tr>
<td>Small flakes of the coating are detached at intersections; less than 5% of the lattice is affected.</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Small flakes of the coating are detached along edges and at intersections of cuts. The area affected is 5% to 15% of the lattice.</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>The coating has flaked along the edges and on parts of the squares. The area affected is 15% to 35% of the lattice.</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>The coating has flaked along the edges of cuts in large ribbons and whole squares have detached. The area affected is 35% to 65% of the lattice.</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Flaking and detachment worse than grade 1.</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

ASTM 3359 Standard Test Methods for Measuring Adhesion by Tape Test

Tank Industry Consultants

7740 West New York Street
Indianapolis, Indiana 46214

Telephone – 317/271–3100
FAX – 317/271–3300
### - CERTIFICATE OF ANALYSIS -

**Disp. Code:** E1MSP  
**Report Date:** 01-May-14 12:35 PM

**Client ID:** TANK_INDUST  
Tank Industry Consultants  
7740 West New York Street  
Indianapolis, Indiana 46214

**Attn:** Julie White  
**Phone:** (317) 271-3100  
**FAX:** (317) 271-3300

**Our Lab #** 14005388-001  
**Your Sample ID:** Exterior Flute West Side Bottom  
**Collection Date:** 04/28/14  
**Collected By:** Client  
**Receipt Date:** 04/29/14 11:00

**Your Project #** 14031.H1145.003  
**Your Project Name:** Paint Samples  
**Sample Type:** Paint Chips

**Total Metals, ICP-AES**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Analytical Method</th>
<th>Prep Method</th>
<th>Prep Date</th>
<th>By</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SW846 6010B</td>
<td>SW846 3050B</td>
<td>4/30/2014</td>
<td>amyers</td>
</tr>
<tr>
<td><strong>Result</strong></td>
<td><strong>Units</strong></td>
<td><strong>Quant. Limit</strong></td>
<td><strong>CAS #</strong></td>
<td><strong>Analysis Date</strong></td>
</tr>
<tr>
<td>Cadmium, Cd</td>
<td>&lt; 25.0 mg/kg</td>
<td>25.0</td>
<td>7440-43-9</td>
<td>05/01/14</td>
</tr>
<tr>
<td>Chromium, Cr</td>
<td>&lt; 250 mg/kg</td>
<td>250</td>
<td>7440-47-3</td>
<td>05/01/14</td>
</tr>
<tr>
<td>Lead, Pb</td>
<td>&lt; 250 mg/kg</td>
<td>250</td>
<td>7439-92-1</td>
<td>05/01/14</td>
</tr>
</tbody>
</table>

**Our Lab #** 14005388-002  
**Your Sample ID:** Interior Dry Access Tube Manhole  
**Collection Date:** 04/28/14  
**Collected By:** Client  
**Receipt Date:** 04/29/14 11:00

**Your Project #** 14031.H1145.003  
**Your Project Name:** Paint Samples  
**Sample Type:** Paint Chips

**Total Metals, ICP-AES**

<table>
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<th>By</th>
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<td>SW846 3050B</td>
<td>4/30/2014</td>
<td>amyers</td>
</tr>
<tr>
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<td><strong>Units</strong></td>
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<td>250</td>
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</tr>
<tr>
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<td>7439-92-1</td>
<td>05/01/14</td>
</tr>
</tbody>
</table>

**Lab #** 14005388-002  
**Sample ID:** Interior Dry Access Tube Manhole Neck  
**Page 1 of 2**
Total Metals, ICP-AES

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Analytical Method</th>
<th>Prep Method</th>
<th>Prep Date</th>
<th>By</th>
<th>Result</th>
<th>Units</th>
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<td>&lt; 25.0</td>
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<td></td>
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<td>mg/kg</td>
<td>250</td>
<td>7440-47-3</td>
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<tr>
<td>Lead, Pb</td>
<td></td>
<td></td>
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<td></td>
<td>&lt; 250</td>
<td>mg/kg</td>
<td>250</td>
<td>7439-92-1</td>
<td>05/01/14</td>
<td>kfoitz</td>
</tr>
</tbody>
</table>

Lab Manager: [Signature]

Date: 5/1/2014
1. Tank and site.

2. Site gate.

Henderson Water Utility

“Tyson Tank”
14.031.H1145.003

Henderson, Kentucky
3. Valve projections on site.

4. Equipment stored on site.
5. Unused pipes and hydrant on site.

6. Drain pipe in foundation.
7. Tank foundation, grout, and rust staining on base plate.

8. Tank foundation, grout, and corrosion and rust staining on base plate.
9. Corrosion and rust staining on base plate.

11. Conduits penetrating pedestal.

12. Overflow pipe discharge.
13. Corrosion on overflow pipe flange bolts.

14. Pedestal access door.

16. Tank nameplates.
17. Topcoating failures on pedestal.

18. Topcoating failures on pedestal.
19. Pedestal vent.

20. Pedestal.

22. Corrosion on painter’s rail.
23. Bowl exterior.

24. Bowl exterior.
25. Sign on shell.

26. Sign on shell.
27. Shell exterior.

28. Top shell angle.
29. Irregular roof contour.

30. Roof exterior.
31. Spot coating failure on roof.

32. Spot coating failure on roof.
33. Open roof coupling.

34. Unused antenna mast.
35. Coating failures along antenna mast.

36. Roof exterior.
37. Container roof manhole.

38. Corrosion and welded flat bar on flanged and bolted roof manhole.
39. Corrosion and metal loss on flanged and bolted manhole and welded flat bar.

40. Access tube manhole and vent.
41. Access tube manhole.

42. Corrosion around vent opening in access tube manhole cover.
43. Clog-resistant vent and couplings.

44. Pedestal access door.
45. Items stored in base of pedestal.

46. Shed in base of pedestal.
47. Corrosion and metal loss on interior dry base plate, anchor bolt, and nut.

48. Corrosion and metal loss on interior dry base plate, anchor bolt, and nut.
49. Overflow pipe, pedestal ladder, platform, and girder.

50. Overflow pipe, pedestal ladder, platforms, light fixtures, and insulated inlet/outlet pipe.
51. Overflow pipe and bracket.

52. Pedestal ladder sections and platform.
53. Conduit on pedestal ladder bracket.

54. Melted cover on light fixture.
55. Peeled coating and corrosion on pedestal.

56. Peeled coating and corrosion on pedestal.

Henderson Water Utility

"Tyson Tank"

14.031.H1145.003

Henderson, Kentucky
57. Corrosion on pedestal.

58. Underside of pedestal girder.
59. Peeled coating and corrosion on pedestal girder.

60. Radial rods and corrosion on dry bowl.
61. Pedestal vent opening and girder.

62. Underside of platform at painter’s manhole.
63. Corrosion along dry bowl backing bar.

64. Corrosion and welded steel patch plate on dry bowl.
65. Corrosion on dry bowl around inlet/outlet pipe.

66. Corrosion on dry bowl around overflow pipe.
67. Bowl manhole and ladder.

68. Overflow pipe, radial rods, and corrosion on dry bowl.
69. Radial rod attachment to access tube, lugs around top of access tube, corrosion on dry bowl, and pipe penetrations.

70. Corrosion and metal loss on access tube floor.
71. Cable on access tube ladder side rail.

72. Access tube, ladder, safe-climbing device, cable, and corrosion along stiffeners.
73. Corrosion on access tube.

74. Corrosion on access tube.
75. Exposed wiring at equipment penetrating in access tube.

76. Corrosion near top of access tube.
77. Access tube, interior container ladder, roof, and support structure.

78. Corrosion on roof support structure.
79. Corrosion and metal loss on roof support structure.

80. Corrosion and metal loss on roof support structure.
81. Corrosion on roof interior and around coupling opening.

82. Corrosion on roof interior.
83. Sensor equipment extending from access tube.

84. Daylight at opening roof couplings.
85. Shell interior.

86. Shell interior.
87. Corrosion on shell and bowl.

88. Corrosion on bowl.
89. Cracked coating and corrosion on access tube.

90. Cracked coating and corrosion on access tube.
91. Corrosion and metal loss on access tube, lugs, and interior container ladder.

92. Corrosion and metal loss on access tube lugs and interior container ladder bracket.
93. Corrosion in overflow inlet weir box.

94. Corrosion on overflow inlet weir box.
95. Corrosion on overflow pipe.

96. Corrosion on access tube.

Henderson Water Utility

"Tyson Tank"

14.031.H1145.003

Henderson, Kentucky
97. Corrosion on interior container ladder.

98. Corrosion and rust tubercles on interior ladder.

Henderson Water Utility

“Tyson Tank”

14.031.H1145.003

Henderson, Kentucky
99. Broken interior container ladder safe-climbing device.

100. Bowl manhole and blistered coating.
101. Corrosion, blistered coating, inlet/outlet pipe, and lug on bowl.

102. Overflow pipe, corrosion on bowl, and lug.
103. Access tube penetration through bowl and bowl lugs.

104. Lug on bowl.