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October 15, 2021

Town of Deep River
c/o Brad Sweet
Senior Operations Manager
Ontario Clean Water Agency
560 Abbie Lane, PO Box 128
Petawawa, ON
K8H 3R9

Re: Project No: DEERIN6097-2118 - Deep River Water Tank Condition Assessment

Dear Mr. Sweet:

The Ontario Clean Water Agency (OCWA) is pleased to submit our findings and recommendations for the rehabilitation of the Deep River Elevated Tank.

1 Background

The Deep River Elevated Tank is located in the Town of Deep River (Town), Ontario. The tank is owned by the Town and serves the nearby communities. The tank was built in 1961 and is showing signs of coating deterioration and corrosion of the surfaces. Inspections of both the internal and external surfaces were conducted to be able to assess the overall condition of the tank as well as to look at the existing essential safety features of the tank. The condition assessment was performed with the objective of obtaining details of the tank condition to be used for the development of a scope of work for rehabilitation to extend the life of the tank. The inspections were undertaken by PW Makar Coatings Inspection Ltd (PW Makar) between June and August of 2021 under the direction of OCWA Project Planning and Delivery Group (PPDG).

2 Main Findings of the Inspection

The following describes the main findings of the inspection based on the inspection reports provided by PW Makar.

2.1 Overall Appearance of Exterior

The tank exterior displays a significant presence of surface corrosion evident by the rust coloured areas. Corrosion of the exterior surface is largely concentrated on a circumferential band on the tank shell near the roof. However there are corrosion spots of varying degree throughout the exterior surface of the tank as well as on the tank legs and riser. The inspection report states that the coating on the exterior surface is in a generally poor condition. Besides the corrosion, the existing coating exhibits areas of chalking, discolouration and mold formation more so on the legs, riser and bowl of the tank. There is noticeable chalking of the white top coat both along the shell and in particular on the roof surface which is a result of UV degradation. The entire surface of the tank has lost its gloss and in particular there are noticeable patches of colour distortion as the top coat begins to deteriorate non-uniformly.

2.2 Corrosion

The level of rusting is considered severe and despite no pitting of the surface observed on the tank shell or bowl at this time, remedial action to re-establish the coating on the surface is necessary to prevent further deterioration of the steel that may lead to pitting and formation of leaks.

2.3 Existing Condition of Exterior Coatings

As described the existing coating system is in poor condition with large areas where the coating is deteriorated and replaced by rust/rust staining. The coating has peeled off on some areas on the riser. The existing coating was identified as an alkyd type coating comprising of 6 layers. The tank would have been painted originally in 1961 with 3 layers (primer, mid coat & top coat) and presumably at different times since then with another three maintenance coats. Measurements of the thickness of the coating system were done at two hundred locations and the readings ranged from a low of 18.99 mils to a high of 28.43 mils with an overall average of 23.6 mils (note 1 mil ~ 0.025 mm).

Testing of the existing coating system bond strength was conducted during the inspection using relevant ASTM standards. The adhesion and cohesion results indicate good intra-coat bonding and strong bonds between the coating system and the steel substrate. These results indicate that despite the obvious signs of degradation and delamination of the top coat at spots, the overall coating system is still generally well bonded to the steel substrate. The detail results are described in the PW Makar inspection report attached.

No lead testing of the exterior paint was done during this inspection since lead testing results were available from previous testing in 2014. Lab tests results from that time reveal a lead content of 2.84% by weight on the legs and 6.96% by weight on the roof. This lead content is significant and will have to be considered when planning for tank rehabilitation works.

2.4 Existing Condition of Interior Coatings

The inspection of the interior was undertaken by ROV on August 31, 2021. The interior coating system was found to be in a very good condition except for a few isolated areas of spot rusting and minimum spots of partial intra coating delamination.

Above the water line no appreciable deterioration was found. Some spots were noted with minimum rusting or rust streaks on the painter's nipple holes (holes in the roof for accommodating cabling for painters swing stages). Some small initial rusting beginning in the crevices between the roof supports and the roof sheeting were noted. In the water level 'equalization zone' or fluctuation area, there are some small spots along weld seams or uneven areas where the top coat has disbonded probably by ice action.

The coating on the lower shell and the bowl is in good condition with little or minimal signs of rusting. Near and around the access manway (Shell manway or Platform manway) there is a bit of rusting along the welds and joints though not severe at this time, these can develop if left unrepaired. Due to the sediment on the lower bowl and floor of the tank, the ROV camera was unable to provide a clear picture of the condition of these areas. Judging from the condition of the coating over the rest of the tank interior, it is very likely that the coating on the lower shell and floor areas are also in good condition. The areas around the wet riser opening exhibit some minor rusting in the weld grooves and at the jointings. The extent of the coating deterioration here is not clearly discernable due to the sediment as previously mentioned. No attempt was made to move the ROV into the wet riser due to the many obstacles at the opening.

The details of the findings are presented in the interior inspection report which is attached to this report.

2.5 Safety and Structural Items

The inspection report identifies a number of structural and safety improvements required in order to bring the elevated tank up to current safety requirements. These are well detailed in the inspection report and it is not intended to duplicate these in this paragraph. These will be itemized in the recommendations section of this report.

3 Conclusions and Recommendations

3.1 Conclusions

The existing coating on the tank exterior is in poor condition. The coating deterioration is being caused by weathering and UV deterioration. UV deterioration is the breakdown of the resin by the sunlight UV rays penetrating the top coat and breaking down the pigments and polymer chains. It results in the loss of gloss, changing of the colour (fading & non-uniformity) and the chalking of the outer surface that gradually washes away making the film thinner and thinner. Deterioration of the coating exposes the steel substrate to corrosion. Corrosion in the form of rusting is occurring and will accelerate if the surfaces are not cleaned and the coating re-established.

The present condition of the tank exterior warrants remedial work to extend the life of the tank and improve the tank's overall appearance. Re-establishing the coating system would extend the life of the tank by acting as a barrier to corrosion of the steel substrate consequently extending the life of the tank.

The tank can either be over-coated or a completely new coating system applied. The present condition of the tank coating warrants complete removal and application of a new coating system. Two main properties that support this conclusion, as determined from the inspection, are the number of existing coating layers and the overall paint system thickness. The industry acceptance for over-coating is the existing paint thickness of less than between 12-15 mils and the number of paint layers of 3 or less. Both of these criteria are currently exceeded on this tank exterior. The existing paint thickness is averaging more that 23.6 mils and there are 6 layers of paint on the tank at present.

The existing coating on the tank interior is in good condition. There is minimum coating repairs required on the interior.

3.2 Recommendations

The following general scope of work is recommended for the tank exterior.

The coating system on the exterior should be completely removed by abrasive blasting and a new coating system applied. This will require the tank to be completely shrouded during the blasting due to the presence of lead in the exterior coating. After the blasting, a new paint system should be applied in accordance with ANSI/AWWA Outside Coating System No.4 (OCS-4). This is a three (3) coat system consisting of an organic or inorganic zinc rich primer, an intermediate coat of an aliphatic polyurethane and a finish coat of fluorourethane. The zinc primer will provide a level of cathodic protection to the steel while the top coat of the fluorourethane will provide outstanding resistance to ultra-violet light degradation thus providing long term gloss and colour retention. This top coat can be provided in a variety of colours.

Remedial works should be done on the tank exterior within the next 1 to 2 years. This will prevent further deterioration of the steel substrate. At the same time, improving the overall appearance of the tank.

For the interior, only spot repairs of the coating is recommended as follows.

The interior should be washed by high pressure water spray to remove sediment deposits and any other contaminants or loose coating material. After washing, all deteriorated coating or rust spot locations should be identified (repair areas). These areas should be repaired by abrading to bare metal by suitable hand tool or power tool cleaning, and then applying a suitable repair coating material. The repair material must be suitable for use in potable water tanks and meet the NSF requirements.
The inspector was unable to identify the type of existing coating with a level of certainty, however suggested that the coating is most likely an epoxy. This can be verified at the time of the repair. If it is an epoxy then a suitable epoxy material should be used to re-establish the coating to the repair areas after abrading. If the existing coating is not an epoxy, then a suitable alternative repair material could be selected at the time.

After the interior repairs are completed and inspected, sufficient time should be allowed for curing the coating on the repair areas in accordance with the respective material specifications.

The following briefly lists other safety and miscellaneous repairs and upgrades recommended.

- Modify overflow pipe to provide safe space on walkway adjacent to overflow pipe
- New ladder with compliant Fall Arrest System from ground to tank walkway
- New ladder with compliant Fall Arrest System from tank walkway to roof
- Install D Rings on ladders
- Install Davit port bases on roof near access manway and on walkway near shell manway
- Modify egress at top of ladder from ground to walkway (remove obstructions)
- Install cable tray from ground to walkway for all cables and wires
- Install cables and wires in tray and neaten all wires and cables from ground to tank roof
- Increase rail height around the tank by 6 inches (15 cm) for regulatory compliance
- Increase the kick plate on all railing to atleast 5 inches (12.7 cm) for regulatory compliance
- Repair the internal ladder between shall manway & floor of the tank
- Replace the ladder in the valve chamber with new wider ladder and fall arrest system
- Clean and repaint all pipes and valves in valve chamber
- Extend drain pipe away from tank leg
- Remove loose concrete, brush blast to clean surface, fill in holes and spalls with suitable cementitious grout and apply breathable cementitious coating over exposed concrete foundation footings.

4 Construction Cost Estimate

The following estimated costs are derived from recent tendered works.

Item	Estimated Cost (Excluding HST)
General	
Mobilization & Demobilization	$120,000
Insurance & Bonds	$30,000
Submittals & As-Builts	$8,000
Interior	
Cleaning Tank	$10,000
Undertake Spot Repairs	$20,000
Exterior	
Scaffolding	$320,000
Tank Enclosure	$100,000
Abrasive Blast Cleaning	$200,000
Apply new coating system	$150,000
New Logo	$15,000
Safety Improvements/Upgrades	$120,000
Other Miscellaneous Works	$50,000
Subtotal	**$1,143,000**
Construction Estimate Contingency 20%	$228,600
Total Construction Cost Estimate	**$1,371,600**

5 Project Budget and Scheduling

5.1 Overall Project Budget

The following table presents an estimated overall project budget for the remedial works recommended above.

Activity	Estimated Amount	Comments
Construction Cost Estimate	$1,371,600	As detailed above
Estimated Engineering & Project Management & Independent Coating and Welding Inspections (10% construction cost)	$137,160	Includes development of scope, specifications, tendering, contract admin, and third party coating and welding inspections during construction
Total Estimated Project Budget	**$1,508,760**	Excluding HST
(Rounded)	**$1.5 M**	Excluding HST

5.2 Project Scheduling

The tank would need to be drained completely in order to undertake the rehabilitation works recommended. In recognition of this requirement and the need to maintain a satisfactory water supply, Operations may consider taking the tank down for the work during a low water demand period.

Ruling out work in the summer (due to higher water demand), which is the ideal painting season, and considering also that the duration of the work is expected to be 10 - 12 weeks, late summer/early fall may present the next most favourable time to undertake the works. This time may also be drier and less humid than the spring meaning less chance of interruptions due to rainfall.

As the work is recommended to be done within the next 1 to 2 years, it should be planned for the late summer into fall of 2022 or 2023.

We are pleased to provide this report and to offer our continued services if required. Please feel free to call the undersigned or James (905 491 3043) for any questions or clarifications required.

Rajkumar Roopchand, MSc., P.Eng, NACE Member
Tel: 905-491-3055; Cell 416-427-7747

Attachments:

Deep River Water Tank Exterior Inspection Report by PW Makar
Deep River Water Tank Interior Inspection Report by PW Makar

PW MAKAR
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Ontario Clean Water Agency
Deep River Water Tower
Deep River, Ontario

Coatings and Linings Assessment

June 22, 2021

Deep River Water Tower.

Inspected and reported by: Joel Willock
PW Makar Coatings Inspection Ltd.
National Association of Corrosion Engineers (NACE)
Certified Level I Coatings Inspector #082031.

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1. Scope

1.1. PW MAKAR COATINGS INSPECTION LTD. has been retained by Ontario Clean Water Agency (OCWA) in Deep River, Ontario to conduct an exterior coatings and safety assessment and an interior linings assessment of the Deep River multi leg potable water tower in Deep River, Ontario**.**

1.1.1. The exterior coatings assessment consisted of dry film thickness readings, adhesion bond strength testing and a visual assessment of the exterior coating current condition.

1.1.2. PW MAKAR COATINGS INSPECTION LTD. Conducted an aerial drone inspection of the Deep River water tower on June 22, 2021.

1.1.2.1. Notice to reader; The PW MAKAR Coatings Inspection Ltd. Aerial drone is registered with the Ministry of Transport and employees have aerial drone operation certifications with the Ministry of Transport.

1.1.3. Joel Willock Certified N.A.C.E. International Coatings Inspector #082031 of PW MAKAR COATINGS INSPECTION LTD. reported on the warranty coatings and linings assessment of the Deep River multi leg potable water tower.

1.1.4. The interior CCTV ROV inspection on the Deep River water tower was not completed at the time of assessment due to no accessible access to the roof hatchway.

1.1.5. Please refer to the attached Pictorial Report for more details.

2. Exterior Coatings Assessment

2.1. On this date, June 22, 2021. A visual assessment was conducted on the exterior coatings system on the bowl, riser and legs of the Deep River water tower.

2.2. The original external protective coating system of the Deep River Water Tower is of unknown age.

2.3. The coatings system on the water tower at the time of inspection was found to be in poor condition with approximately 30% coatings deterioration occurring.

2.4. There appears to be no pitting visible on the exterior of the Deep River water tower.

2.5. The water tower consists of a coatings system with which appears to consist of 6 layers. It appears to have three (3) white/cream top coats, two (2) green mid coats and one (1) red prime coat layers.

2.5.1. Mold and rust staining are visible on the legs, riser and bowl surface.

2.6. An MEK Solvent wipe test was performed for paint type. There was a softening of the

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coating reaction to the MEK solvent, indicating the exterior coating system as being an Alkyd based coating.

2.6.1. A cloth rag saturated with MEK solvent was held to the surface of the water tower. The rag was removed and the topcoat was tested for its hardness

2.7. Ten (10) exterior coatings adhesion bond strength tests were performed on the tower bowl, riser and legs and the results are as follows.

2.7.1. The adhesion tests were defined in terms of qualitative (i.e. test procedures) and quantitative methods (i.e. bond strength). Results for the test areas were completed in accordance with ASTM D4541 standards. Values are reported in addition to the failure plane and percentage of the failure at the failure plane. Results report values based on cohesive failure (failure or break in any one coat, coating layer pulling apart) or adhesive failure (a layer separating from the lower level). A glue failure represents; a cohesive failure of the glue or adhesion failure of the glue if the pull dolly/stub disbands from the first coat.

2.7.2. Tests were conducted utilizing a DeFelsko PosiTest AT-A automatic Type V Tester.

2.8. Reporting of the ten (10) adhesion bond strength tests were noted as below. **Note**, all the adhesion bond strength tests were found to be acceptable. Adhesion bond strengths of 350 psi or greater are considered acceptable.

2.8.1. Test Area #1 – Water Tower Leg #1
White topcoat
1639 psi
Failure plane: 100% cohesive (Prime coat layer separating/shearing from prime coat layer) – Red prime coat.

2.8.2. Test Area #2 – Water Tower Leg #2
White topcoat
1155 psi
Failure plane: 100% cohesive (Prime coat layer separating/shearing from prime coat layer) – Red prime coat.

2.8.3. Test Area #3 – Water Tower Leg #3
White topcoat
1420 psi
Failure plane: 100% cohesive (Prime coat layer separating/shearing from prime coat layer) – Red prime coat.

2.8.4. Test Area #4 – Water Tower Leg #4
White topcoat
1600 psi
Failure plane: 100% cohesive (Prime coat layer separating/shearing from prime coat layer) – Red prime coat.

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2.8.5. Test Area #5 – Water Tower Leg #5
White topcoat
1512 psi
Failure plane: 5% adhesive (Mid coat layer separating/shearing from prime coat layer) – Grey mid coat and red prime coat.
95% cohesive (Prime coat layer separating/shearing from Prime coat layer) – Red prime coat.

2.8.6. Test Area #6 – Water Tower Leg #6
White topcoat
1342 psi
Failure plane: 100% cohesive (Prime coat layer separating/shearing from prime coat layer) – Red prime coat

2.8.7. Test Area #7 – Water Tower Riser #1
White topcoat
1307 psi
Failure plane: 95% adhesive (Mid coat layer separating/shearing from prime coat layer) – Green mid coat and red prime coat.
5% cohesive (Mid coat layer separating/shearing from Mid coat layer) – Cream prime coat.

2.8.8. Test Area #8 – Water Tower Riser #2
White topcoat
882 psi
Failure plane: 5% adhesive (Top coat layer separating/shearing from mid coat layer) – Cream top coat and green mid coat.
95% cohesive (Prime/Mid coat layer separating/shearing from Prime/Mid coat layer) – Red prime coat / Cream mid coat

2.8.9. Test Area #9 – Water Tower Upper Bowl #1
White topcoat
1322 psi
Failure plane: 5% adhesive (Top coat layer separating/shearing from prime coat layer) – White top coat and red prime coat.
95% cohesive (Prime coat layer separating/shearing from Prime coat layer) – Red prime coat.

2.8.10. Test Area #10 – Water Tower Upper Bowl #2
White topcoat
703 psi
Failure plane: 100% cohesive (Top coat layer separating/shearing from top coat layer) – White top coat.

2.9. Two hundred (200) Dry pant film thickness readings (DFT) were taken on the tower bowl, riser and legs of the Deep River water tower. The readings were found to be as follows;

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2.9.1.

Item	Number of Readings	Average reading in mils
Leg #1	25	24.52
Leg #2	25	27.46
Leg #3	25	23.57
Leg #4	25	20.21
Leg #5	25	20.81
Leg #6	25	18.99
Riser	25	24.85
Upper Bowl	25	28.43
	Total 200	**Average 23.60**

2.9.2. Fifty (50) Dry pant film thickness readings (DFT) were taken on the Valve house chamber pipelines of the Deep River water tower. The readings were found to be as follows;

2.9.2.1. The average DFT reading in the valve chamber was 6.39 mils.

3. Concrete Base Pads

3.1. The concrete tower base pads on the tower legs and riser have been recently coated with an unknown coating. The concrete pads are showing signs of cracking and are slightly weathered.

3.2. The drainpipe drains onto the concrete base pad of the tower leg onto a flat concrete pad on the ground level. The drain pipe is recommended to be extended away from the tower leg drainpipe to stop future erosion from occurring.

3.3. Two (2) stormwater manway hatches are on the grounds of the tower structure. The cover plates are secure and in good condition at the time of the inspection.

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4. Ladders, Fall Arrest Systems and Equipment

4.1. The ladder to the bowl platform/walkway has a number of issues.

4.1.1. The width of the ladder rungs is 16”, which includes the 2 ¼” aluminum ridge rail, fall arrest system. Therefore, the total working area of the ladder rung is 13 ¾”.

4.1.1.1. OH&S specifies a ladder rung spacing total ladder rung length of 23.6”

4.1.2. The ladder rung to the water tower leg spacing on the vertical ladder from the ground to the platform/walkway is 3” total.

4.1.2.1. OH&S specifies a ladder rung to wall spacing total depth of 5.9”

4.1.3. The ladder to the bowl platform/walkway, there is an obstruction to access on and egress off the ladder structure to the bowl platform/walkway. At the top of the ladder structure there is the placement of the walkway handrailing and the extended aluminum ridge rail, fall arrest system.

4.1.3.1. Internet cables are attached to the ladder and handrail system and should be moved to avoid obstructions of access and egress from the walkway and ladder system.

4.1.3.2. OH&S specifies it shall be clear of obstructions at the top of the ladder for access and egress.

4.1.3.3. Redesigning the access and egress at the top of the ladder to bowl platform/walkway is needed.

4.1.4. The ladder at the bowl platform/walkway has the 4” platform/walkway toeboard interfering with the foot placement on the ladder rung. There is also a ladder support plate underneath the kickplate that interferes with foot placement.

4.1.4.1. The platform/walkway railing system cross support beams interfere with foot placement above the kickplate along with addition internet cables crossing around and under the ladder system making access and egress difficult to the platform/walkway.

4.1.4.2. Again, this is an obstruction at the top of the ladder structure and redesigning is needed.

4.1.5. The bowl platform/walkway toeboard is 4” around the entire bowl area.

4.1.5.1. OH&S specifies a toeboard of 5” is required.

4.1.6. The bowl platform/walkway handrail height around the tower bowl is 37” in total height.

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4.1.6.1. OH&S specifies a hand railing height of 35”, the railing exceeds this standard.

4.2. On the bowl platform/walkway, access between the tower legs at the tower bowl and the handrails is only 15” and only 12” at the drainpipe to handrail.

4.2.1. OH&S specifies platforms shall be at least 18” wide.

4.3. A total of fifteen (15) communication dishes/equipment and associated wiring is affixed to the handrailing of the Deep River water tower.

4.3.1. Five (5) communication dishes/equipment and associated wiring are affixed to the platform/walkway railing and ten (10) affixed to the bowl roof railing.

4.3.2. Internet communication cable lines are attached and strung around the tower and need to be cleaned up and affixed in a safe and tidy manner to avoid obstructions.

4.4. The ladder to the bowl roof is the same dimensions as the ladder to the bowl platform/walkway and has a width of the ladder rungs is also 16”, which includes the 2 ¼”, aluminum ridge rail, fall arrest system.

4.4.1. OH&S specifies a ladder total ladder rung length of 23.6”

4.5. The bowl platform/walkway manway is 26” in diameter.

4.5.1. OH&S specifies the manway needs to be increased to 30” diameter.

4.6. The ground level riser manway measured 30” diameter and was in good condition at the time of inspection.

4.7. The bowl roof vent cover was inspected and in good worker order.

4.8. The valve chamber is located in the communication/Valve house on the water tower grounds.

4.8.1. Valve chamber handrail ladder rungs widths are 16”.

4.8.1.1. OH&S specifies a ladder total ladder rung length of 23.6”

4.8.2. There is no fall arrest, davit base at the manway of the valve house chamber.

4.8.3. There is no D-Ring tie off points associated with the valve house chamber.

4.8.4. Internet communication cables require cable management in and around the communication/Valve chamber house.

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4.9. The fence line was inspected and the 3-level barb wire security wire needs to be repaired to maximize security around the water tower.

4.10. The fixed access ladders on the water tower have an aluminum ridge rail, fall arrest system in place and is a TS design. The TS design ridge rails are now being replaced with FRL rail systems.

PWMAKAR
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Inspection
Ltd.

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Ontario Clean Water Agency
Deep River Water Tower
Deep River, Ontario

Digital Pictorial Report

Tuesday – June 2, 2021

Digital Image #1. – Deep River Water Tower – The exterior coating system on the bowl area of the Deep River water tower were visually inspected and at the time was found to be in poor condition with approximately 30% coatings deterioration occurring.

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Digital Image #2. – Deep River Water Tower – The exterior coating system on the bowl area of the Deep River water tower were visually inspected and at the time was found to be in poor condition with approximately 30% coatings deterioration occurring.

Digital Image #3. – Deep River Water Tower – The exterior coating system on the leg area of the Deep River water tower were visually inspected and at the time was found to be in poor condition with approximately 30% coatings deterioration occurring.

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Digital Image #4. – Deep River Water Tower – The exterior coating system on the leg area of the Deep River water tower were visually inspected and at the time was found to be in poor condition with approximately 30% coatings deterioration occurring

Digital Image #5. – Deep River Water Tower – The exterior coating system on the Deep River water tower appeared to have 6 layers of previous coatings applied.

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Digital Image #6. – Deep River Water Tower – A cloth rag saturated with MEK solvent was held to the surface of the water tower roof. The rag was removed and the white topcoat was tested for its hardness.

Digital Image #7. – Deep River Water Tower – There was a softening of the coating reaction to the MEK solvent, indicating the exterior coating system as being an Alkyd based coating

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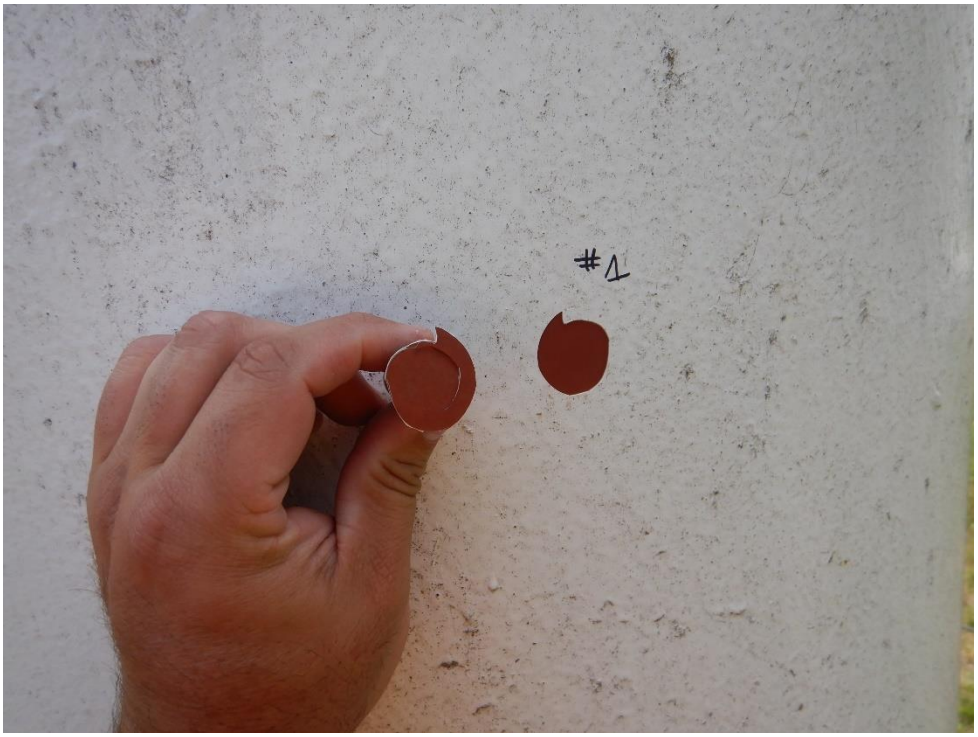
Digital Image #8. – Deep River Water Tower – DeFelsko PosiTest AT-A automatic Type V Tester used for adhesion bond strength test in ten (10) locations on the water tower legs, riser and upper bowl.



Digital Image #9. – Deep River Water Tower – Adhesion bond strength test pull results location #1 of ten (10) locations on the water tower legs, riser and upper bowl.

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Digital Image #10. – Deep River Water Tower – Adhesion bond strength test pull results location #1 of ten (10) locations on the water tower legs, riser and upper bowl utilizing the DeFelsko PosiTest AT-A Automatic Type V Tester.

Digital Image #10. – Deep River Water Tower – Two hundred (200) dry film thickness readings were taken on the exterior of the Deep River Water Tower with PosiTector 6000. The average DFT was 23.60 mils.

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Digital Image #11. – Deep River Water Tower – The tower leg concrete base pads and riser base pad are in good condition with only small amounts of visible weathering and small cracking visible.

Digital Image #12. – Deep River Water Tower – The tower leg concrete base pad and drainpipe pad are in good condition with only small amounts of visible weathering and small cracking visible. Drainpipe is recommended to be extended to avoid future deterioration of leg concrete base pad.

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Digital Image #13. – Deep River Water Tower – Two stormwater manways are on the grounds of the tower and are in good condition.

Digital Image #14. – Deep River Water Tower – The ladder to the bowl width of the ladder rungs is 16”, which includes the 2 ¼ “aluminum ridge rail, fall arrest system. OH&S specifies a ladder rung spacing total of 23.6”.

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Digital Image #15. – Deep River Water Tower – The ladder from the platform/walkway to the bowl roof width of the ladder rungs is 16”, which includes the 2 ¼ “aluminum ridge rail, fall arrest system. OH&S specifies a ladder rung spacing total of 23.6”.

Digital Image #16. – Deep River Water Tower – The ladder rung to the water tower leg spacing on the vertical ladder from the ground to the platform/walkway is 3” total. OH&S specifies a ladder rung depth spacing total of 5.9”.

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Digital Image #17. – Deep River Water Tower – Internet communication cables are attached to the ground to bowl ladder and obstruct the ladder and the safety rest seats and is recommended to by affix in a clean manner that will not obstruct access and egress.

Digital Image #18. – Deep River Water Tower – Internet communication cables hindered the access and egress to the bowl walkway/platform as well as the placement of the walkway handrail, toeboard, extended aluminum ridge rail and fall arrest system.

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Digital Image #19. – Deep River Water Tower – The bowl platform/walkway handrail height around the tower bowl is 37” in total height. OH&S specifies a hand railing height of 35”.

Digital Image #20. – Deep River Water Tower – The bowl platform/walkway toeboard is 4” around the entire bowl area. OH&S specifies a toeboard of 5” is required.

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Digital Image #21. – Deep River Water Tower – The bowl platform/walkway, the access between the tower legs at the bowl and the handrailing is only 15”. OH&S specifies platforms shall be at least 18” wide.

Digital Image #22. – Deep River Water Tower – The bowl platform/walkway, the access between the drainpipe and the handrailing is only 12”. OH&S specifies platforms shall be at least 18” wide.

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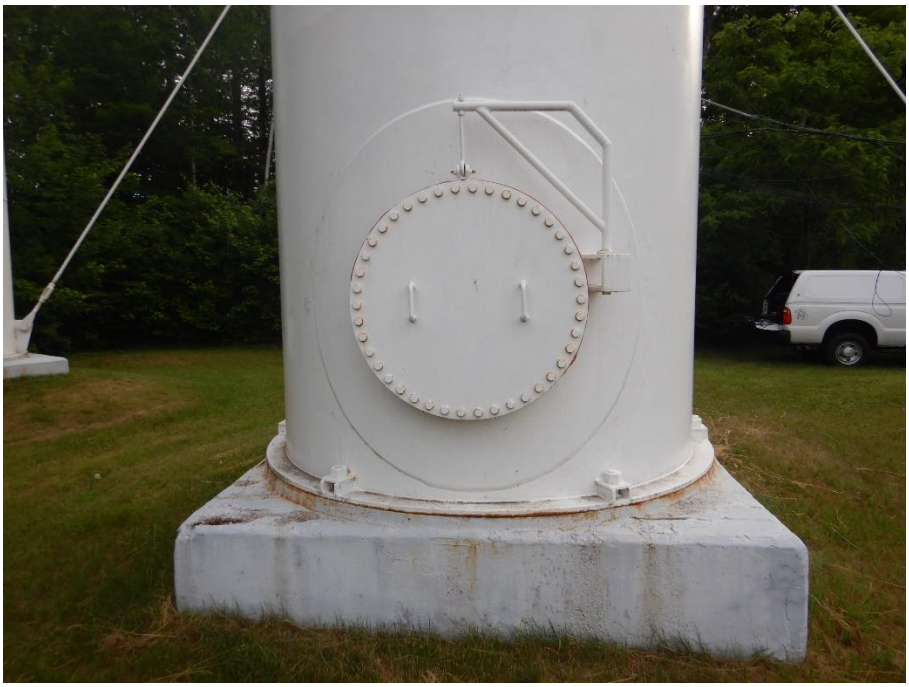
Digital Image #23. – Deep River Water Tower – Same image as above, the bowl platform/walkway, the access between the drainpipe and the handrailing is only 12”. OH&S specifies platforms shall be at least 18” wide.



Digital Image #24. – Deep River Water Tower – The ground level manway is 30” in diameter and meets OH&S requirements.

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Digital Image #25. – Deep River Water Tower – The platform/walkway manway is 26” in diameter. OH&S requires a 30” manway.

Digital Image #26. – Deep River Water Tower – The bowl roof air vent is in good condition at the time of inspection.

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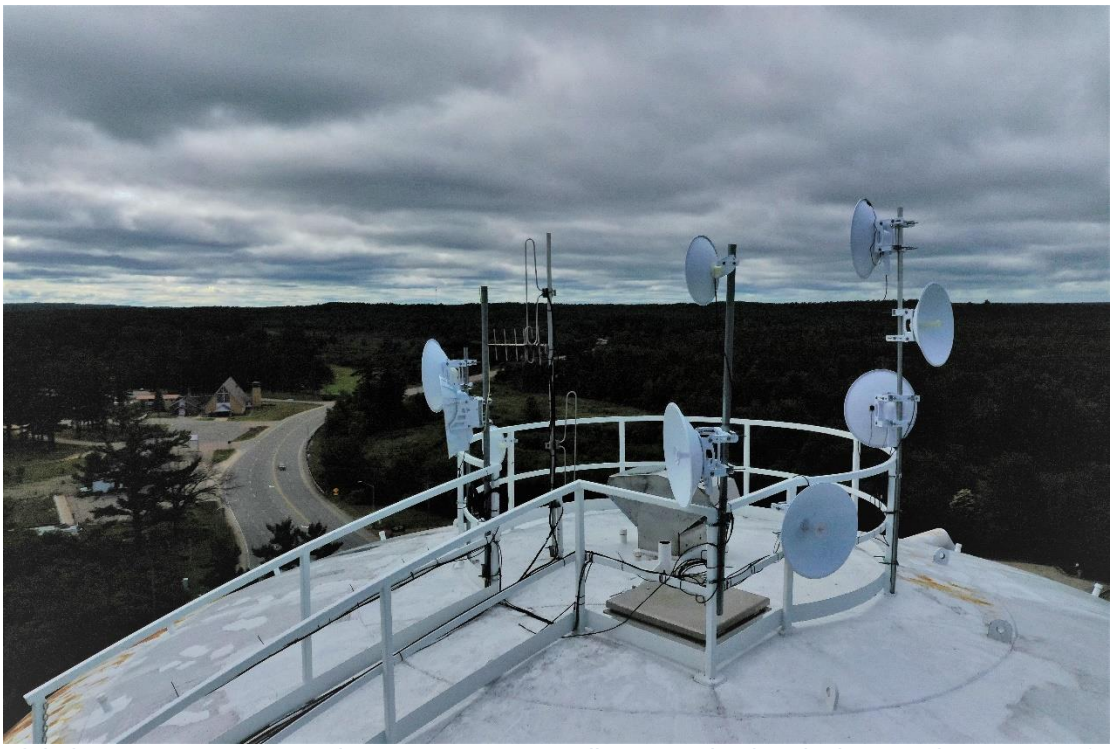

Digital Image #27. – Deep River Water Tower – All communication devices on the tower roof appeared to be securely attached at the time of inspection. No aircraft warning lights are on the water tower roof.

Digital Image #28. – Deep River Water Tower – Same image as above, all communication devices on the tower roof appeared to be securely attached at the time of inspection. No aircraft warning lights are on the water tower roof.

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Digital Image #29. – Deep River Water Tower – Communication / Valve chamber house in good condition at the time of inspection. Internet cable management is required.

Digital Image #30. – Deep River Water Tower – Communication internet cables require cable management. Cables are tangled and hanging and are obstructing movement around the water tower grounds.

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Digital Image #31. – Deep River Water Tower – The valve chamber coating system within the valve chamber has mechanical damage and corrosion occurring.

Digital Image #32. – Deep River Water Tower – The valve chamber ladder has no D-Ring at the top of the ladder or fall arrest system in place.

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Digital Image #32. – Deep River Water Tower – The valve chamber ladder width of the ladder rungs is 16”. OH&S specifies a ladder rung spacing total of 23.6”.

Digital Image #33. – Deep River Water Tower – The ladder rung to the chamber wall spacing on the vertical ladder is 6 ¼ “total. This meets OH&S requirement of a ladder rung depth spacing total of 5.9”.

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Digital Image #34. – Deep River Water Tower – The valve chamber coating system within the valve chamber has mechanical damage and corrosion occurring.

Digital Image #35. – Deep River Water Tower – Fifty (50) dry film thickness readings were taken on the pipeline of the Deep River Water Tower in the valve chamber with PosiTector 6000. The average DFT was 6.39 mils.

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Digital Image #36. – The fence line was inspected and the 3-level barb wire security wire needs to be repaired to maximize security around the water tower.

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Ontario Clean Water Agency

Renfrew County – Deep River ON
Deep River Multi-Leg Potable Water Tower

Above and Below the Waterline - Interior
CCTV ROV Linings Assessment Report

August 31, 2021

Deep River – Multi-Leg Potable Water Tower – Shell Area – Broken Platform Manway Access Handrailing.

Prepared for: Mr. Rajkumar Roopchand, MSc. P. Eng.
Senior Project Manager
Project Planning & Delivery Group
Ontario Clean Water Agency

Prepared By: Paul Makar
NACE Certified Level III Linings Inspector **#137**.
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1. Preamble

1.1. PW MAKAR COATINGS INSPECTION LTD. has been retained by the Ontario Clean Water Agency (OCWA) to conduct an above and below the waterline interior closed circuit television (CCTV) remotely controlled vehicle (ROV) linings assessment of the Deep River multi-leg potable water tower in Deep River Ontario.

1.2. This writer has no date as to when the lining system was applied in the Deep River water tower.

1.2.1. As well this writer does not know the type of lining system applied.

1.2.1.1. After reviewing the above and below videos and video images it appears that the lining system might be a type of epoxy.

2. Interior Lining System – Roof Area.

2.1. The lining system on the roof area of the Deep River Tower appears to be in good condition, with a few very minor isolated areas of spot rust streaking apparent at this time

2.1.1. There are painters nozzles attached to the roof area, very little rusting is occurring from the nozzles.

3. Interior Lining System – Shell Areas.

3.1. Generally, the lining system on the shell area of the Deep River Tower appears to be in very good condition.

3.1.1. This upper area of the shell, appears to be in the “water fluctuation zone”, where water and particularly ice builds up in the winter months and fluctuates up and down within the tower. The ice rubs the lining system where there are protrusions i.e. weld seams and skip welds.

3.1.1.1. The ice damage to the lining system is minor and there is no rust streaking or exposed substrate, just exposed primer and/or mid coats.

3.1.2. There is rust streaking from Platform Manway access handrailings and ladder rungs to the bowl area.

3.1.2.1. The right side of the platform manway, has a handrailing that is broken.

4. Internal Lining System – Floor area.

4.1. The bowl floor area coating system could not be evaluated due to the sediment on the bowl floor areas.

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4.1.1. There is construction material or parts of a cathodic protection system identified on the bowl floor area.

4.2. The riser could not be CCTV ROV evaluated due to the tight access and amount of internal attachents within the riser.

5. Conclusion

5.1. The lining system in the Deep River multi-leg potable water tower appears to be in very good condition at this time. There is some lining damage at the upper area of the shell due to ice fluctuation on the weld seams and skip welds no exposed substrate or rust streaking is present in the damaged areas.

5.2. There is a broken handrailing on the right side of the platform manway. The ladder rungs from the platform manway down to the bowl did not appear to be defective at this time.

Written by; Paul Makar
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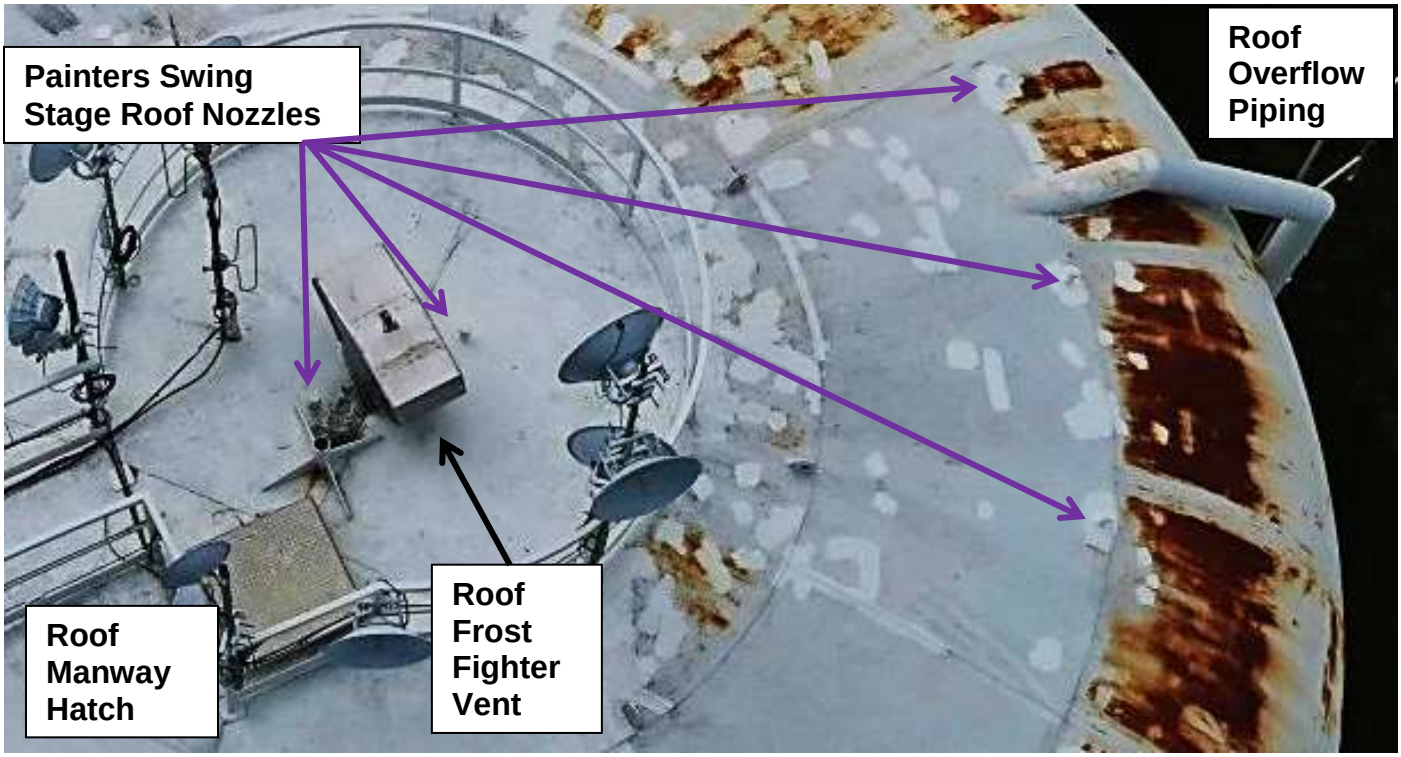
CCTV ROV Pictorial Report

Ontario Clean Water Agency

Renfrew County – Deep River On.
Deep River Multi-Leg Potable Water Tower

Above and Below the Waterline - Interior
CCTV ROV Linings Assessment Report

August 31, 2021.



Aerial Drone Image #1 – Deep River Multi-Leg Potable Water Tower – **Exterior** – Roof Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Description of exterior roof accessories.

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Aerial Drone Image #2 – Deep River Multi-Leg Potable Water Tower – **Exterior** – Roof Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Same as previous image. Discription of exterior roof accessories.

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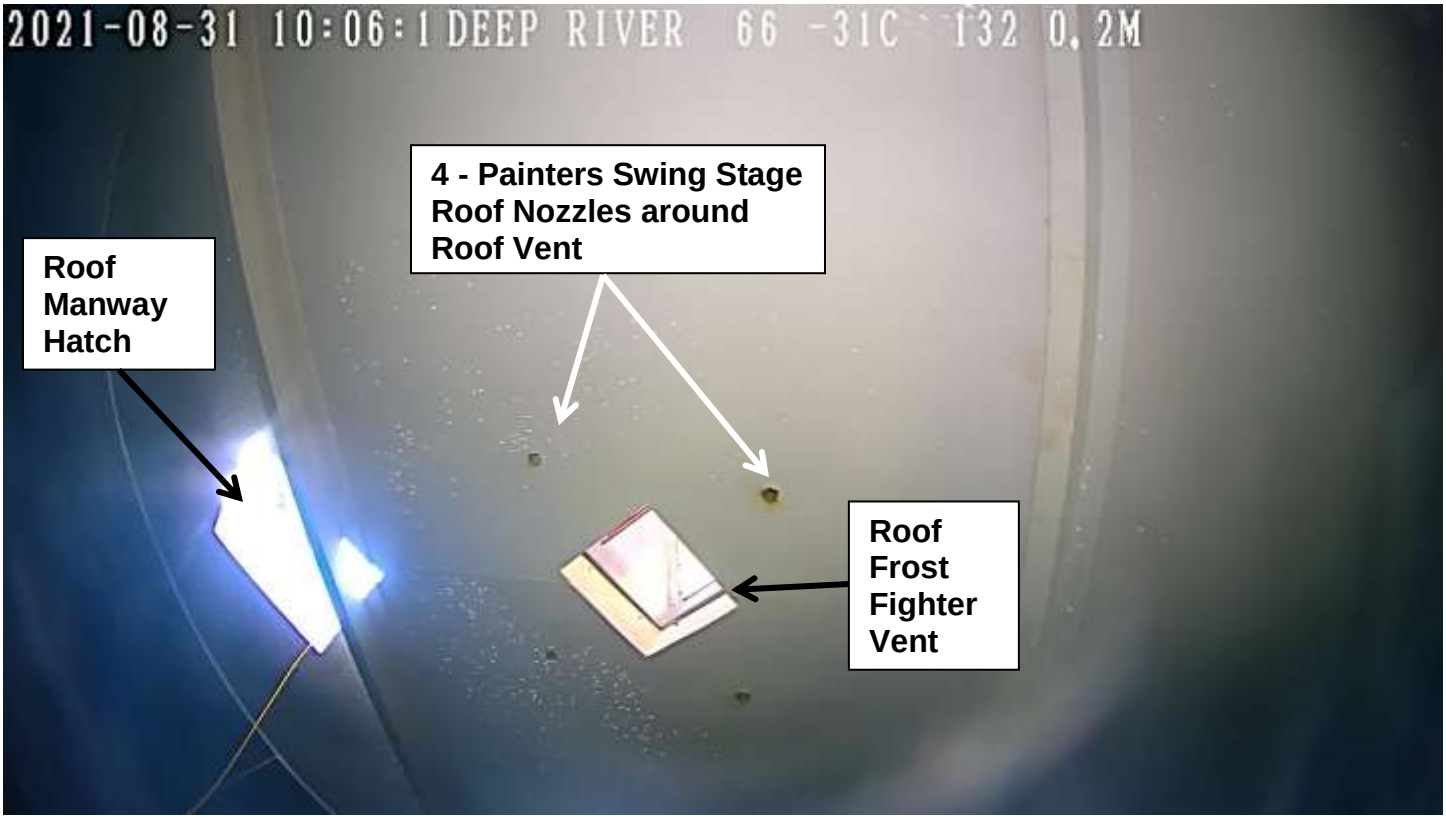

Video Image #1 – Deep River Multi-Leg Potable Water Tower – **Above the Waterline** – Roof Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). The lining system on the roof area of the Deep River Tower appears to be in good condition, with a few very minor isolated areas of spot rust streaking apparent at this time.

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Video Image #2 – Deep River Multi-Leg Potable Water Tower – **Above the Waterline** – Roof Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). The lining system on the roof area of the Deep River Tower appears to be in good condition, with a few very minor isolated areas of spot rust streaking apparent at this time.

Video Image #3 – Deep River Multi-Leg Potable Water Tower – **Above the Waterline** – Roof Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Same as previous video image, image cropped and zoomed in. Rust present on roof weld seam.

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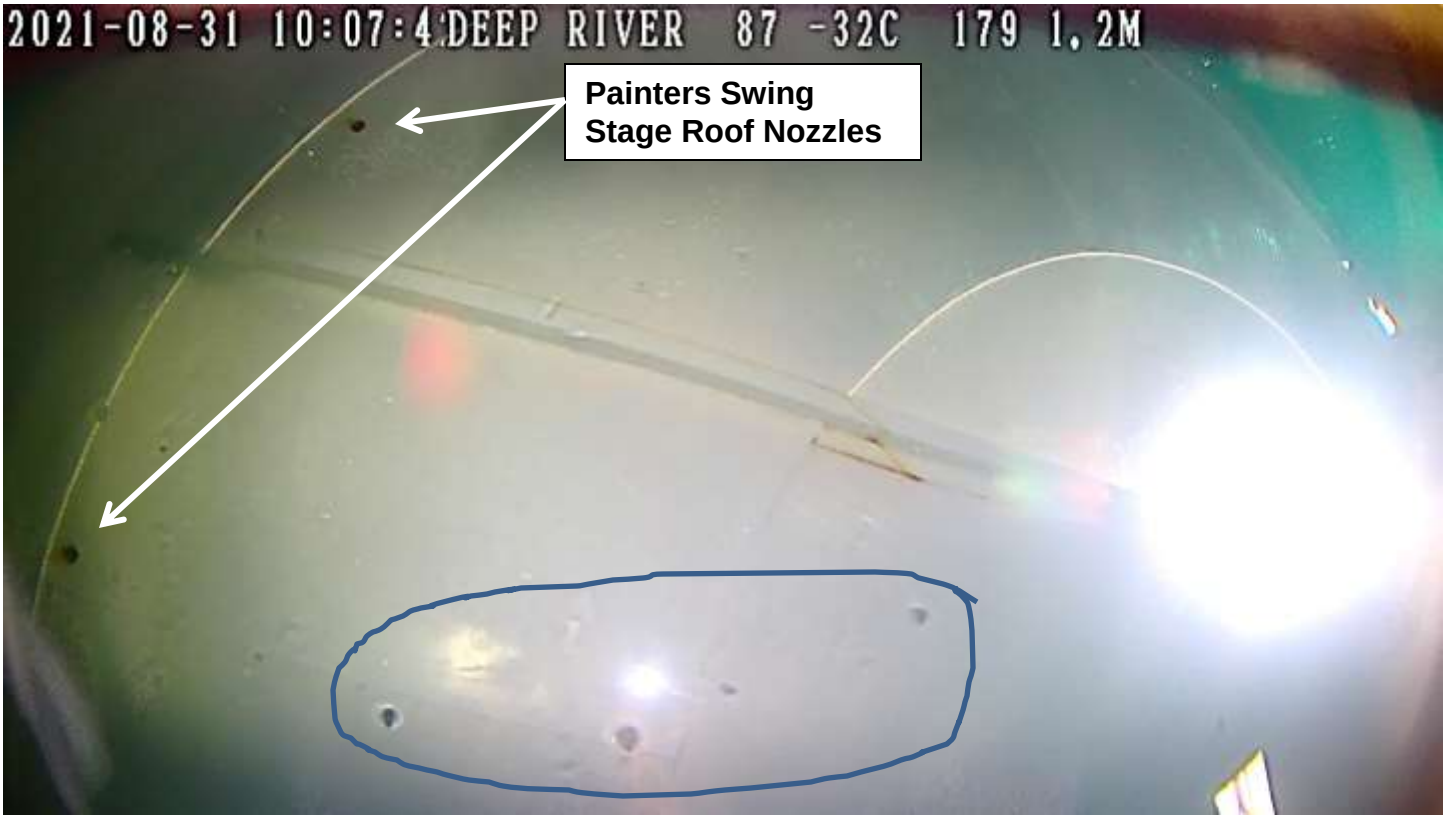

Video Image #4 – Deep River Multi-Leg Potable Water Tower – **Above the water level** – Roof Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout).* A few very minor isolated areas of spot rust streaking appearent at this time. *("This writer is not assured of the dark spots on the roof area, which has been circled in blue, they may be painters swing stage nozzles or exposed primer/mid coats since there is no rust streaking from the dark spots").*

Video Image #5 – Deep River Multi-Leg Potable Water Tower – **Above the water level** – Roof Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Same as previous video image, image cropped and zoomed in. *("This writer is not assured of the dark spots on the roof area, which has been circled in blue, they may be painters swing stage nozzles or exposed primer/mid coats, since there is no rust streaking from the dark spots").*

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Video Image #6 – Deep River Multi-Leg Potable Water Tower – **Above the water level** – Roof Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Roof overflow pipe and painters nozzle.

Video Image #7 – Deep River Multi-Leg Potable Water Tower – **Above the Waterline** – Roof Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Same as previous video image, image cropped and zoomed in.

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Video Image #8 – Deep River Multi-Leg Potable Water Tower – **Below the Waterline** – Upper Shell Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Generally the lining system on the shell area of the Deep River Tower appears to be in good condition. This upper area of the shell, appears to be in the "water fluctuation zone", where water and particularly ice builds up in the winter months and fluctuates up and down within the tower and rubs the lining system where there is protrusions. In this area, the protrusions are the weld seam and skip welds. Please note there is no rust streaking, just exposed primer and/or mid coats.

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Video Image #9 – Deep River Multi-Leg Potable Water Tower – **Below the Waterline** – Upper Shell Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Generally, the lining system on the shell area of the Deep River Tower appears to be in good condition. This upper area of the shell, appears to be in the "water fluctuation zone", where water and particularly ice builds up in the winter months and fluctuates up and down within the tower and rubs the lining system where there is protrusions. In this area, the protrusions are the weld seam and skip welds. Please note there is no rust streaking, just exposed primer and/or mid coats.

Photo #1 & 2. PW MAKAR COATINGS INSPECTION LTD., Upgraded underwater ROV, CCTV system with laser pointer. Laser pointer red dots are 25mm or 0.98" apart up to 2m away from an object.

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Video Image #10 – Deep River Multi-Leg Potable Water Tower – **Below the Waterline** – Upper Shell Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Same as previous image.

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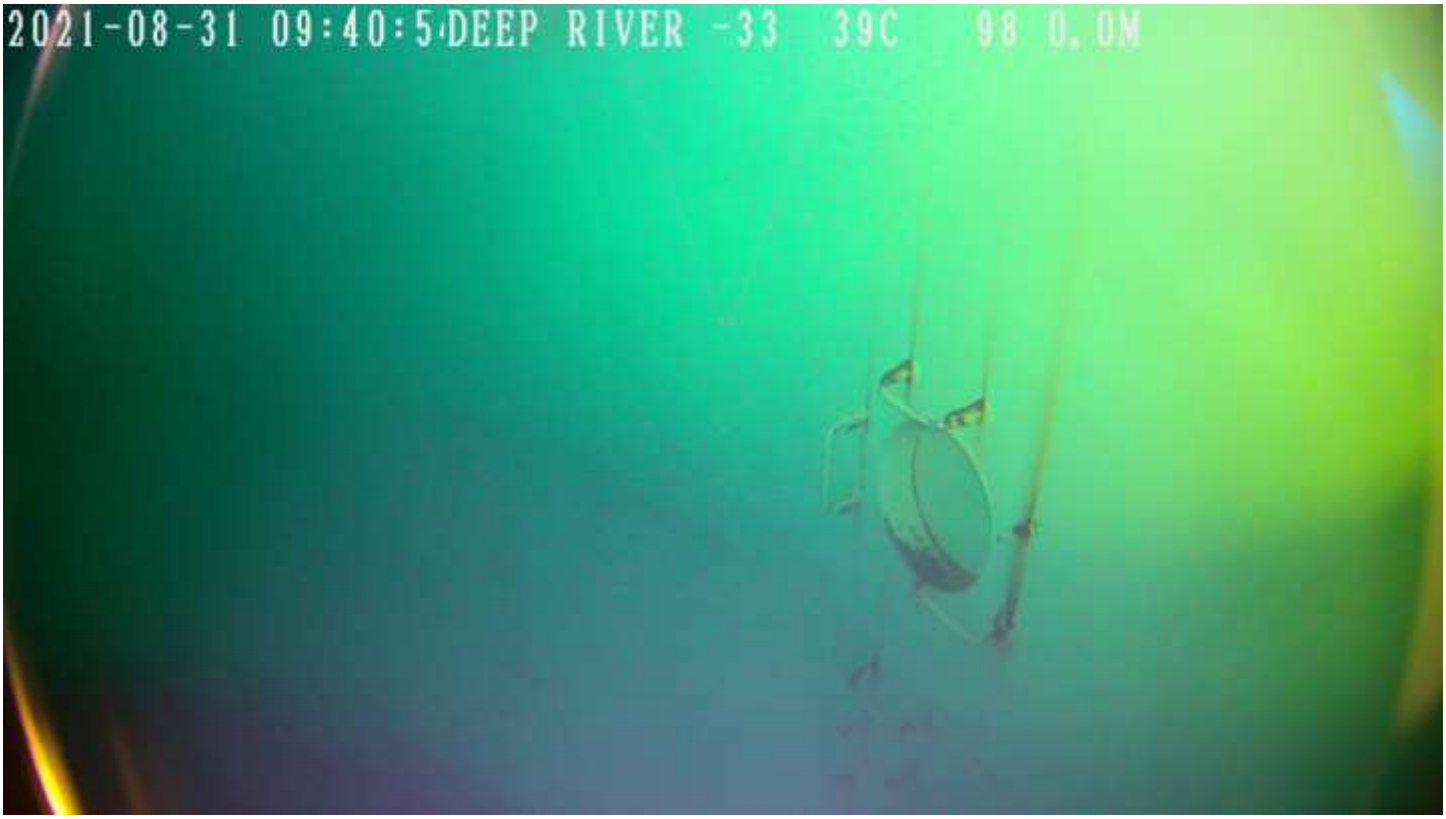

Video Image #11 – Deep River Multi-Leg Potable Water Tower – **Below the Waterline** – Lower Shell Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Generally, the lining system on the shell area of the Deep River Tower appears to be in good condition. Rust streaking from Platform Manway access handrailings. Note, on the right side of the manway, the handrailing is broken.

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Video Image #12 – Deep River Multi-Leg Potable Water Tower – **Below the Waterline** – Lower Shell Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Generally, the lining system on the shell area of the Deep River Tower appears to be in good condition. Rust streaking from platform manway access handrailings. Note, on the right side of the manway, the handrailing is broken.

Video Image #13 – Deep River Multi-Leg Potable Water Tower – **Below the Waterline** – Lower Shell Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Generally, the lining system on the shell area of the Deep River Tower appears to be in good condition. Platform mainway ladder rungs appear to be intact at this time.

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Video Image #14 – Deep River Multi-Leg Potable Water Tower – **Below the Waterline** – Lower Shell Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Generally, the lining system on the shell area of the Deep River Tower appears to be in good condition. Same as previous video image. Platform mainway ladder rungs appear to be intact at this time.

Video Image #15 – Deep River Multi-Leg Potable Water Tower – **Below the Waterline** – Lower Shell Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Generally, the lining system on the shell area of the Deep River Tower appears to be in good condition. Same as previous video image. Platform mainway ladder rungs appear to be intact at this time. Note the sediment from the bowl area.

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Video Image #16 – Deep River Multi-Leg Potable Water Tower – **Below the Waterline** – Lower Shell Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Center riser and floor bowl area. Bowl coating system could not be evaluated due to the sediment on the bowl floor areas. Construction material or parts of a cathodic protection system was identified on the bowl floor area.

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Video Image #17 – Deep River Multi-Leg Potable Water Tower – **Below the Waterline** – Lower Shell Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Center riser and floor bowl area. Bowl coating system could not be evaluated due to the sediment on the bowl floor areas. Construction material or parts of a cathodic protection system was identified on the bowl floor area.

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Video Image #18 – Deep River Multi-Leg Potable Water Tower – **Below the Waterline** – Lower Shell Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Center riser and floor bowl area. Bowl coating system could not be evaluated due to the sediment on the bowl floor areas. Construction material or parts of a cathodic protection system was identified on the bowl floor area.

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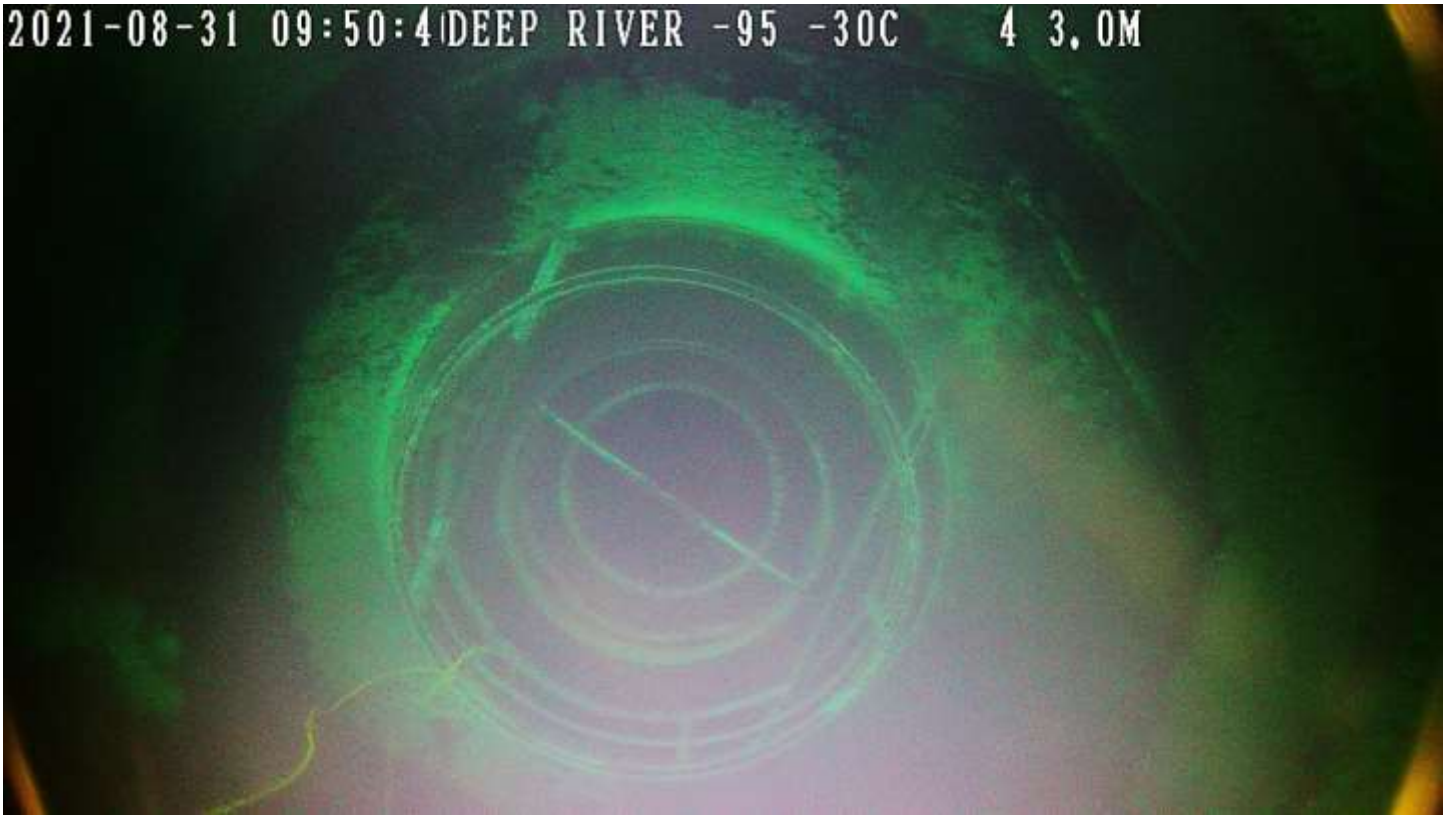

Video Image #19 – Deep River Multi-Leg Potable Water Tower – **Below the Waterline** – Lower Shell Area. (*Video Image enhanced – brightness & Contrast, to make lining defects standout*). Center riser and floor bowl area. CCTV ROV looking down into the riser.