Attachment #1

LANDMARK
Elevating Expectations

Happy Valley Reservoir (North and South)
Remotely Operated Vehicle Inspection and Report
July 31, 2019

Landmark Municipal Services
3091 Harrison Court
Burlington, ON CAN L7M 0W4
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905.319.7706 Fax

www.teamlandmark.com

August 13th, 2019

Town of the Blue Mountains

26 Bridge Street East
P.O. Box 310
Thornbury, ON.
N0H 2P0

Att: **Mr. Scott Hill**

shill@thebluemountains.ca

Tel: 519-599-5287

Re: **LMS Job #LM19048**
Remotely Operated Vehicle Inspection & Report (ROV) – Happy Valley Reservoirs (North and South)

Mr. Hill,

An ROV underwater camera inspection was performed at the above-mentioned potable water storage facility on **July 31st, 2019**. Interior surfaces were inspected with a remotely operated vehicle (ROV).

The ROV unit and tether cable were disinfected in accordance with AWWA-C652-11 Method #2 guidelines (200ppm solution) prior to entry into the tank interior.

The cast-in-place reinforced concrete reservoirs were constructed in the early 1980's and are located at 136 Happy Valley Road, Blue Mountain, ON. There are two (2) Reservoir cells at this facility.

All potable water storage facilities should be routinely inspected and maintained at 3-5 year intervals. Preventative maintenance ensures that facilities reach their designed life cycle with minimal downtime and maintenance costs over the life of the asset.

Below grade concrete reservoirs are not subject to the same thermal movements that structures exposed directly to the weather are. Diagonal cracks are most often found near corners, while vertical cracks appear more frequently along the length of the structure. Generally, both types of cracks are not structural in nature – they're due to volumetric changes in length. These defects have the potential for leaks and contamination, which lead to water quality issues

With careful planning and preparation, routine inspections provide valuable information regarding the causes of deterioration and distress (if applicable). Once identified, the appropriate remedy can be applied thus extending the useful life of the structure and its appurtenances.

A thorough internal inspection of each reservoir including, but not limited to: hatches, ladders, and other appurtenances was performed by the Landmark Municipal Services (LMS) Inspection Crew.

The editing, rendering and reporting was completed by the writer – Dave Baker NACE Certified Coatings Inspector – Level 2, CIP #36124.

Table of Contents:

1) South Reservoir – Summary of Findings / Observations

The South reservoir has a diameter of approximately 70 feet and is approximately 30 feet deep. The reservoir is buried approximately two thirds its depth below grade. The top third of the tank and its roof are not covered with overburden.

A. Tank Environment

High humidity is present above the water line. Sediment levels measured from 2 – 4 cm of lightweight non-organic material along with some granular and other larger material (i.e. silt, flocking).

Photo Reference #: 87 – 96

B. Cell Condition

The exterior concrete surfaces appear to be in good condition with no delamination, exposed wire mesh or reinforcement. There is some exposed aggregate and honey combing within the cell, likely the result of poor vibration technique during the placement, but this is relatively minor in severity.

The exterior side of the wall has many small cracks, as evidenced by efflorescence (calcium carbonate) that has been dissolved out of the concrete and been deposited. Cracks in concrete are normal, and usually represent relief of internal stresses during the curing process. Many times, these cracks are heterogeneously 'healed' by the calcium carbonate itself and do not represent water ingress or leaking. The roof to wall seal appears to be intact.

Photo Reference #: 20 – 59

The interior walls and center column appears to be in good condition, with no large or active cracks and with only moderate mineral staining. There seems to be deterioration of the Tape-Crete material between the wall and floor as well as on the vertical joints, with loose and delaminating slabs of the fine mortar that is embedded within the glass mesh; which is predominantly exposed. To what extent this seam treatment plays in the integrity of this joint is unknown, but this should be investigated further and repaired.

Photo Reference # 69, 70, 73, 78 – 94, 97 – 103

The ceiling appears to be in good condition, with only minor cracking and there are not spalled areas visible.

Photo Reference #: 104 – 111

C. Appurtenances

Venting

There are two (2) 14" diameter stainless steel gooseneck vents on this reservoir which have both coarse and fine screen installed as per the AWWA Ten States Standard. They are enclosed in an aluminum security cage.

Photo Reference #: 48 – 52

Hatches

There is one (1) 48" x 48" aluminum hatch on the roof which is in good condition. There is a locking hasp and padlock installed.

Photo Reference # 60 – 62

Ladders

There is a two-stage aluminum access ladder into the reservoir which is in good condition but does not meet code requirements being only 15" wide (code is 16"). An aluminum platform at the mid-point appears to be in good condition as well, although there is no kickplate installed. There is a cage around this ladder which qualifies as fall arrest according to the Occupational Health and Safety Act and Regulation for Industrial Establishments. All aluminum is mildly oxidized.

Photo Reference #: 62 – 67, 74 – 77

For security reasons there is no fixed access ladder from ground level to the reservoir roof.

Piping

The overflow piping within this reservoir is all stainless steel and appears to be in good condition

Photo Reference #: 70, 77, 101

2) North Reservoir – Summary of Findings / Observations

The North reservoir has a diameter of approximately 70 feet and is approximately 30 feet deep. The reservoir is buried approximately two thirds its depth below grade. The top third of the tank and its roof are not covered with overburden.

D. Tank Environment

High humidity is present above the water line. Sediment levels measured from 2 – 4 cm of lightweight non-organic material along with some granular and other larger material (i.e. silt, flocking).

Photo Reference #: 167 – 170

E. Cell Condition

The exterior concrete surfaces appear to be in good condition with no delamination, exposed wire mesh or reinforcement. There is some exposed aggregate and honey combing on the cell, likely the result of poor vibration technique during the placement, but this is relatively minor in severity.

The exterior side of the wall has many small cracks, as evidenced by efflorescence (calcium carbonate) that has been dissolved out of the concrete and been deposited. Cracks in concrete are normal, and usually represent relief of internal stresses during the curing process. Many times, these cracks are heterogeneously 'healed' by the calcium carbonate itself and do not represent water ingress or leaking. The roof to wall seal appears to be intact.

Photo Reference #: 112 – 136, 141 – 147

The interior wall surface and centre column appears to be in good condition, with no large or active cracks and with only moderate mineral staining.

Photo Reference #: 170 – 176

The ceiling appears to be in good condition, with only minor cracking and there are not spalled areas visible.

Photo Reference #: 184

F. Appurtenances

Venting

There are two (2) 14" diameter stainless steel gooseneck vents on this reservoir which have both coarse and fine screen installed as per the AWWA Ten States Standard. They are enclosed in an aluminum security cage.

Photo Reference #: 137 – 140

Hatches

There is one (1) 48" x 48" aluminum hatch on the roof which is in good condition. There is a locking hasp and padlock installed.

Photo Reference #: 148 – 150

Ladders

There is a two-stage aluminum access ladder into the reservoir which is in good condition and meets code requirements. An aluminum platform at the mid-point appears to be in good condition as well, although there is no kickplate installed. All aluminum is mildly oxidized.

Photo Reference #: 151 – 155

For security reasons there is no fixed access ladder from ground level to the reservoir roof.

Piping

Most of the pipes and fittings within the reservoir are at least moderately corroded, which is to be expected with carbon steel material. A substantial corrosion allowance is usually built in to allow for this, so it should not be considered a failure point at this time.

Photo Reference #: 156 – 166

Summary of Recommendations

The South reservoir should be drained and cleaned for further evaluation within the next 1 to 2 years. Once assessed, all seams should be repaired with modern materials to replace the failing Tape-Crete style joint treatment present and any active cracks should be chemically injected.

The North reservoir should be drained and cleaned for further evaluation within the next 2 to 4 years.

Happy Valley Reservoir

1. Clean and Disinfection – Price per Cell **$ 5,000**
2. Budget Allowance for Chemical Injection – Budget per Cell **$ 25,000**
   - Price assumes $5,000 per day x 5 days
   - Scaffold / access allowance per cell: $7,500
3. Budget pricing for joint treatment / repairs – Budget per Cell **$ 15,000**

Enclosed please find a photographic report of the ROV inspection along with videos of each cell.

Should you have any questions or comments regarding the content of this report, please contact us at 905-319-7700. We look forward to the opportunity of further interaction with The Town of Blue Mountains and thank you for your business.

Yours sincerely,
LANDMARK MUNICIPAL SERVICES

David Baker
NACE Certified Coating Inspector – Level 2, CIP No. 36124

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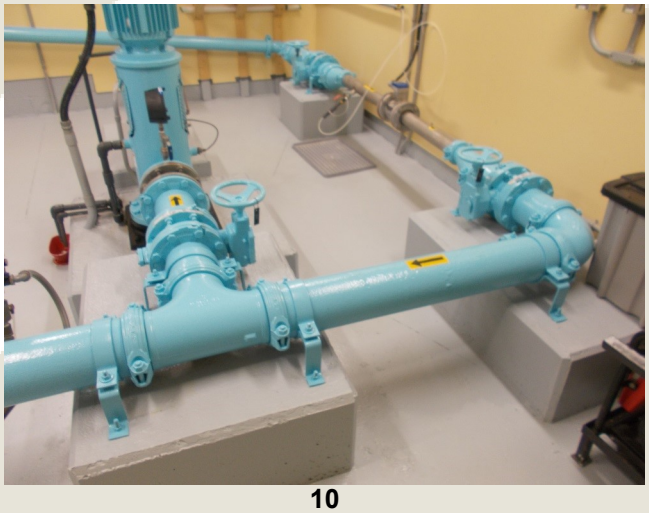

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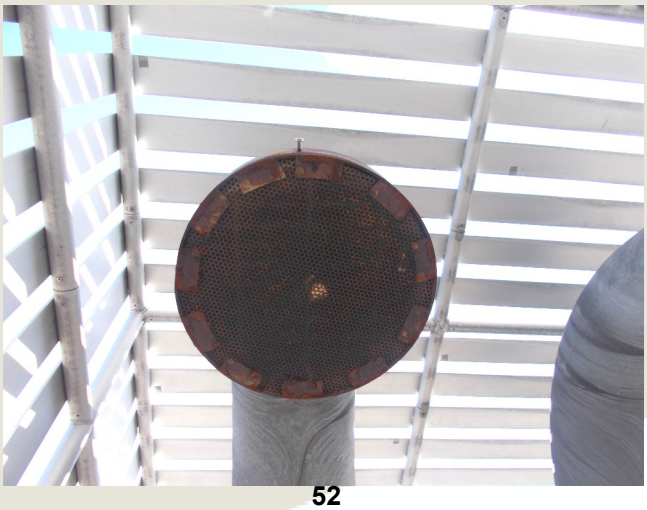

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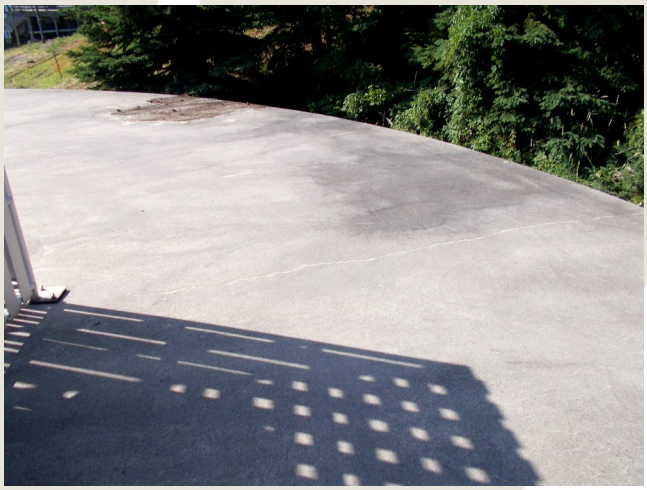

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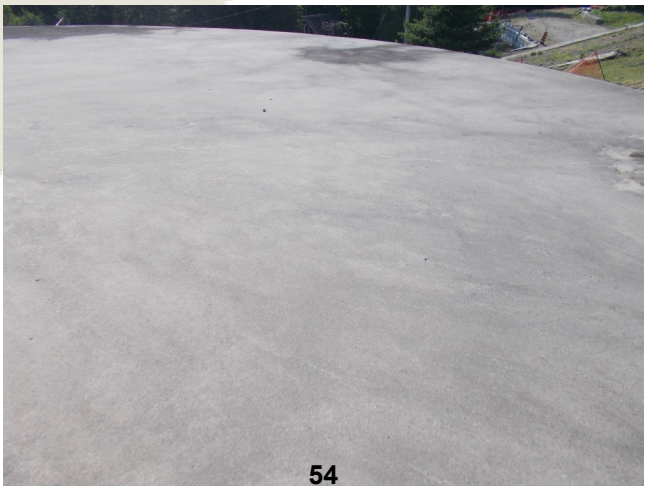

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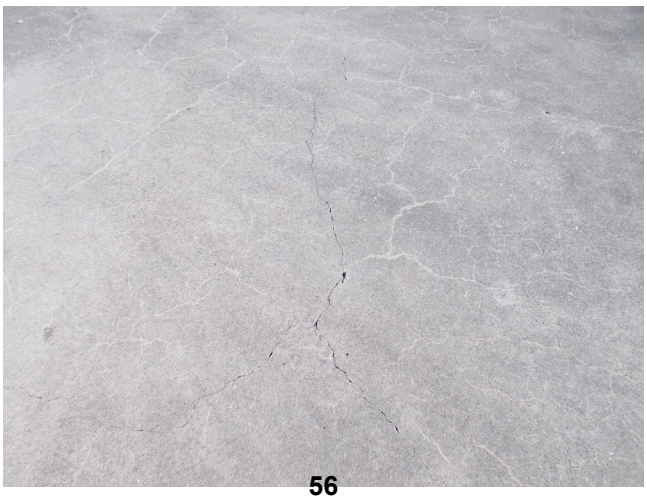

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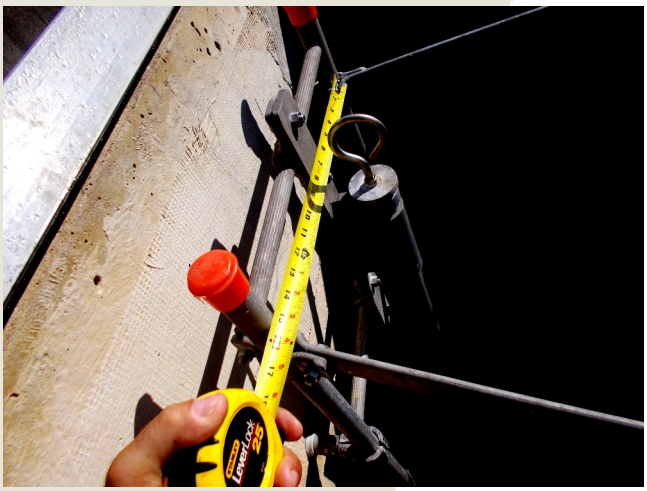

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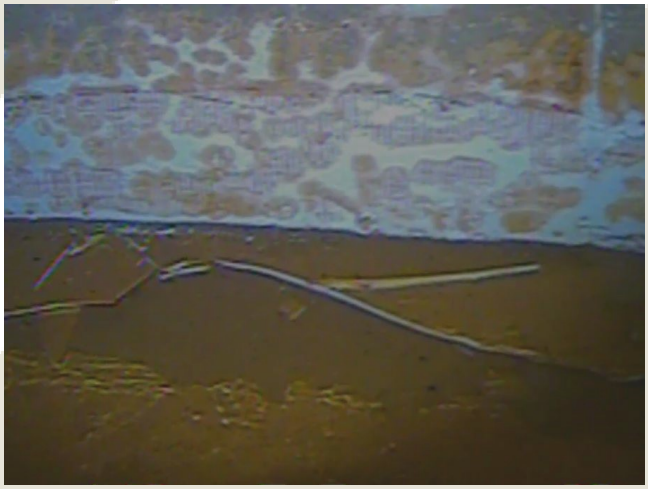

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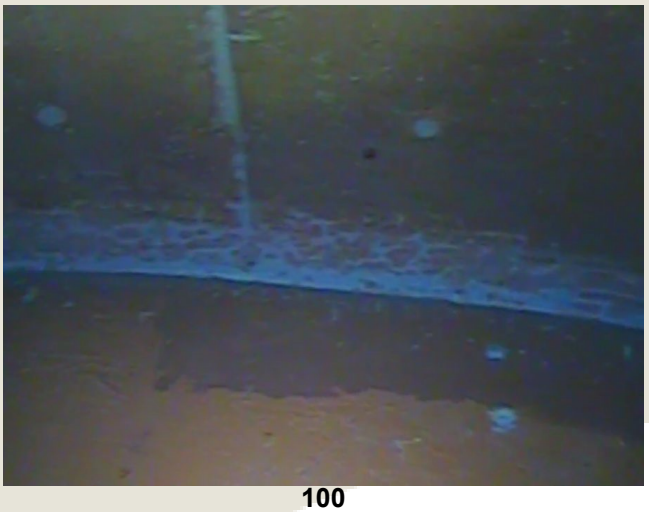

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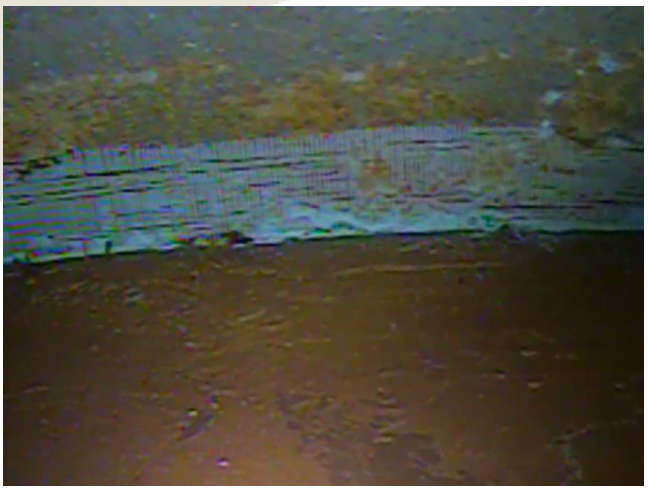

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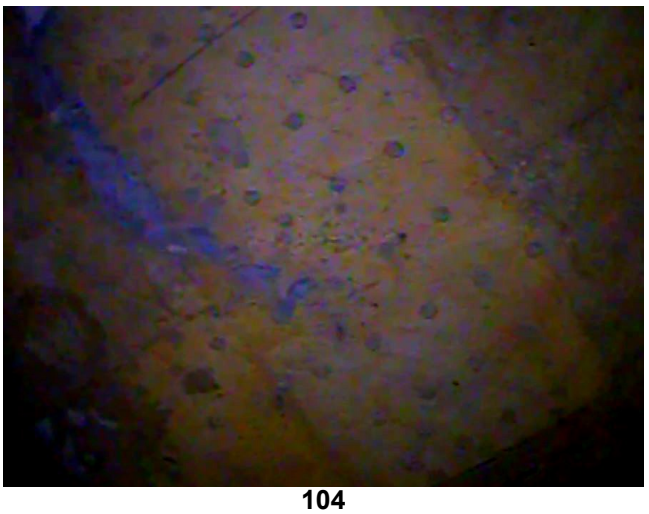

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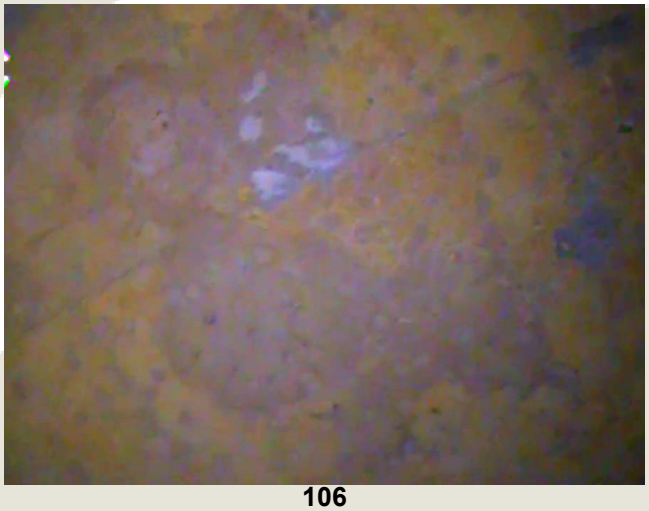

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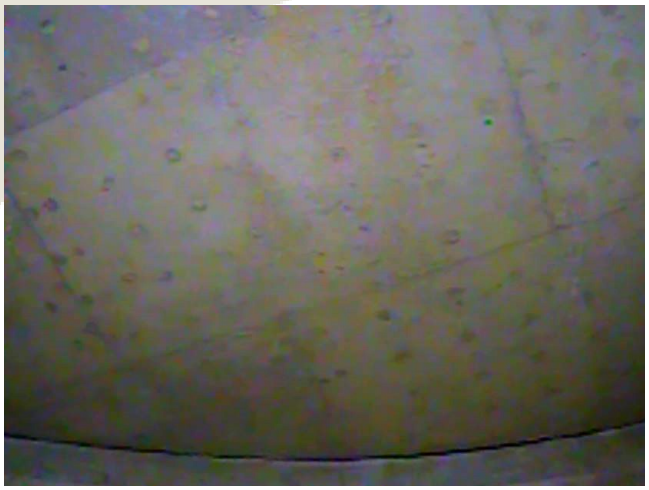

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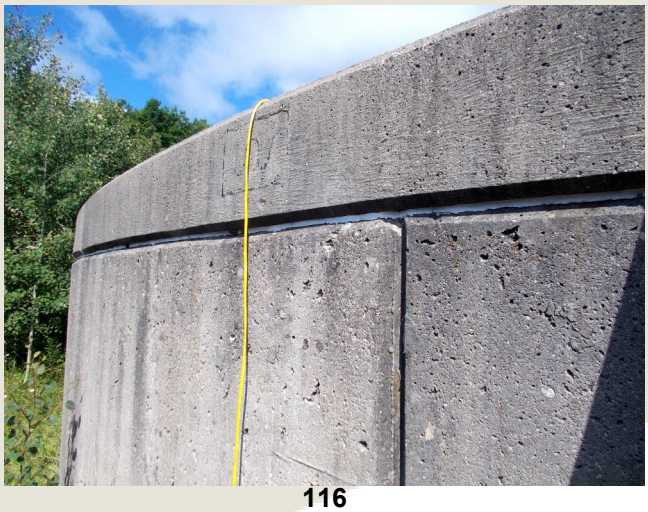

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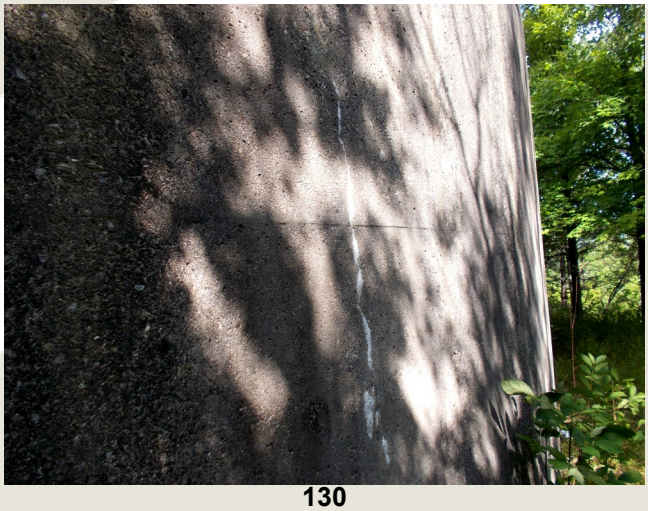

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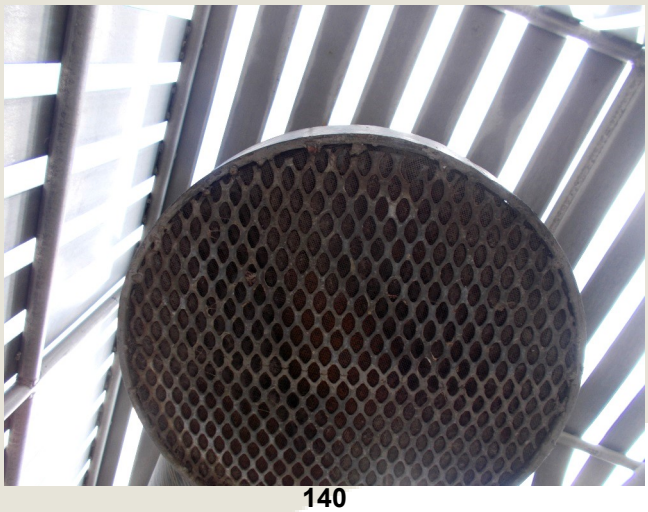

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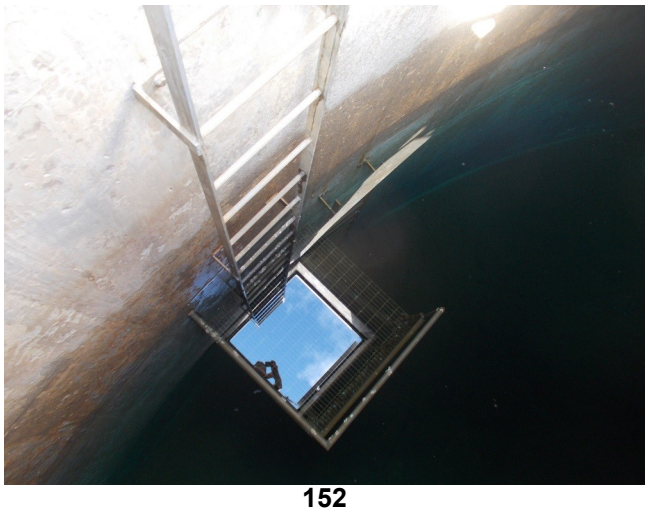

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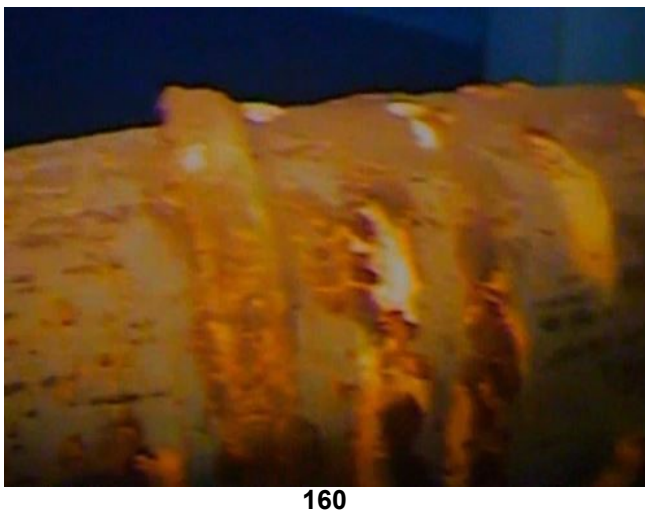

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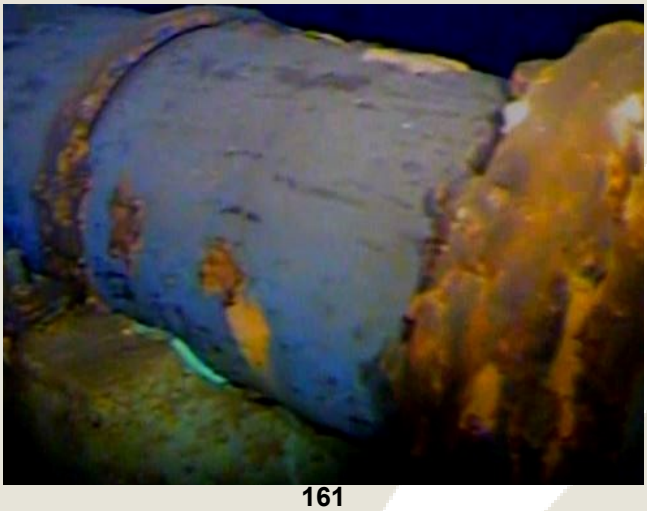

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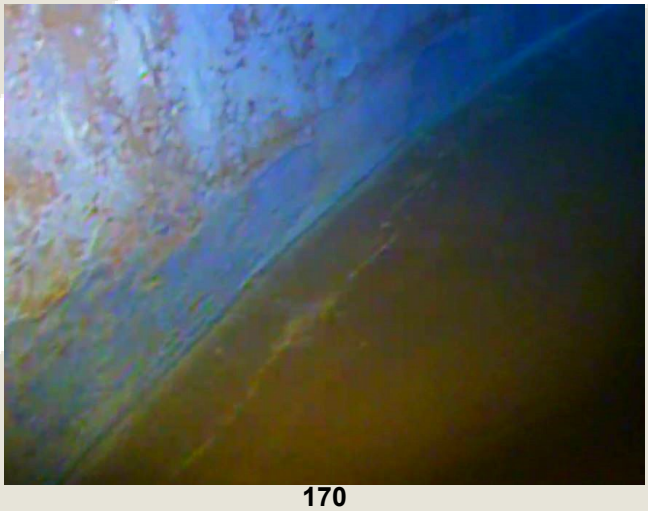

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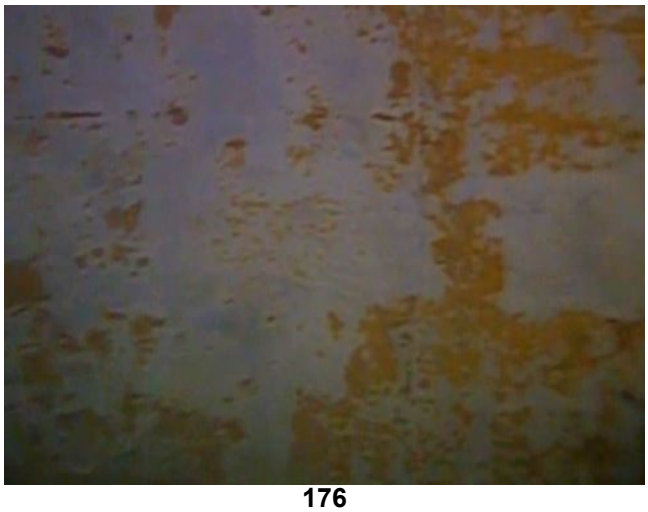

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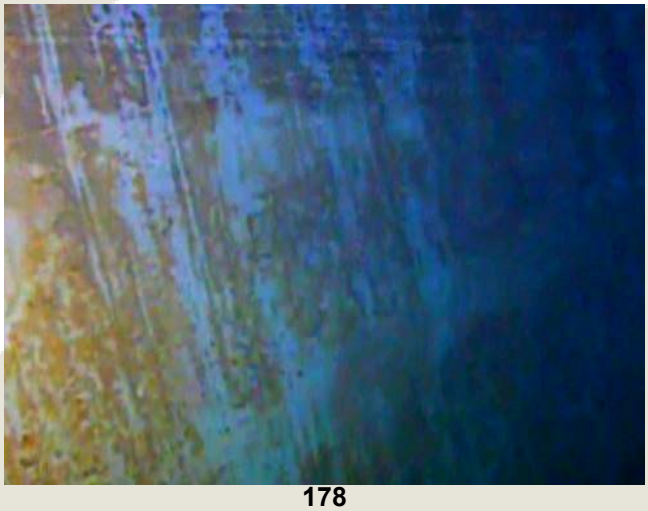

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LANDMARK
Elevating Expectations

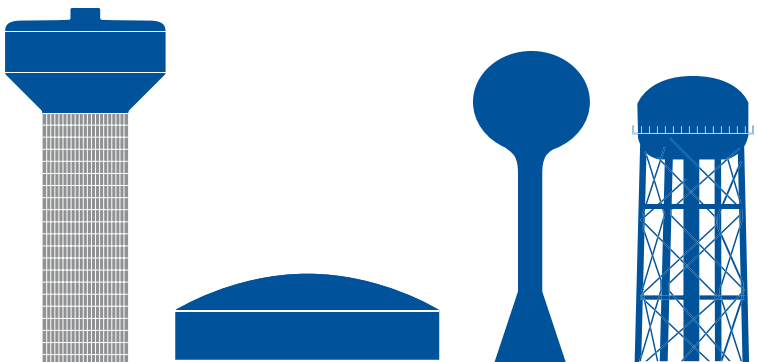
Municipal Services

Storage Tank Maintenance

Extend Service Life

Single Source Responsibility

Expert Inspection, Maintenance And Repairs
For All Types Of Water Storage Tanks



Expert inspection, maintenance, and repairs for all types of water storage tanks

- Safe, efficient, issue-free operation of your water storage infrastructure
- Full compliance with all applicable regulations across Canada

Landmark Municipal Services (LMS) brings more than 30 years of insight and innovation in water storage to owners and operators of tanks and systems of all types. Our complete range of services and packages provide predictability, continuity and flexibility for this essential function of municipal governments.

Inspections

Regular, scheduled inspections are critical for long-term efficiency. LMS conducts various types of inspections, all with comprehensive reports detailing repairs performed or recommended and upgrade requirements, with photo documentation and related cost estimates.

CIR: **Clean, Inspect & Report:** AWWA (American Water Works Association) recommends that water storage tanks be washed out and inspected on a minimum three-year cycle.

SIR: **Safety Inspection & Report:** A thorough interior and exterior review of structure and operations for compliance with applicable government regulations.

ROV: **Remotely Operated Vehicle:** ROV inspections eliminate the inconvenience and expense of taking your tank out of service. LMS provides real-time, in-water evaluations with a remotely operated vehicle.

LMS inspections provide a complete review of all critical factors:

- Site works
- Foundations
- Support structure
- Ladders/landings
- Accessories
- Valves and piping
- Metal conditions
- Exterior coatings
- Interior linings
- Antenna and communications equipment
- Safety and rescue equipment

Safety Upgrades and Training

LMS can provide safe access and rescue systems that meet or exceed the requirements of the Occupational Health & Safety Act for “vessel entry and rescue” as well as “fall arrest.”



Tank Modifications

Skilled LMS professionals provide practical, proven and fully engineered modifications for all types of storage tanks, leveraging experience as one of the leading tank builders in North America. Our vertical integration adds design, fabrication and coatings expertise when needed, with single source management and responsibility.



Coatings and Linings

LMS services include all surface preparation and recoating of all interior and exterior areas. Options range from spot preparation to total blast cleaning with full containment for environmental protection. All lining materials applied to interior surfaces are ANSI and NSF 61 approved.



Safety is the Key




Inspections:

- Clean, Inspect & Report (CIR)
- Safety Inspection & Report (SIR)
- Remotely Operated Vehicle (ROV)

Safety:

- Confined space
- Fall arrest
- Training

Maintenance:

- Tank Asset Management Program (TAMP)
- Annual programs
- Coatings/linings

Lightning Protection:

- Design
- Installation
- Inspection

Antenna and Communications Systems

- Design
- Structural fabrication & installation
- Inspection

Demolition

- Partial
- Total

Modifications

- Engineering
- Tank hydrodynamic mixing systems
- Site works
- Balconies/handrails
- Manholes
- Hatches
- Venting and vacuum relief
- Welding and fabrication
- Electrical/instrumentation
- Heat trace
- Insulation and cladding
- Security systems

Landmark delivers consistent, high quality results.

Contact us today to discuss the best solution for your next project.

LANDMARK
Elevating Expectations

Landmark Municipal Services • 3091 Harrison Court
Burlington, ON L7M 0W4 • 905.319.7700 Phone
www.teamlandmark.com • info@teamlandmark.com

Landmark Coatings

Specialty Mobile Operations

Uncompromising commitment to safety. World class technical skill. Go-anywhere mobility. Landmark delivers factory applied quality to your site.

LANDMARK
Elevating Expectations

Developed and refined throughout 25 years of storage tank coatings and lining work, Landmark's specialty crews work wherever you need them…on projects that we design, fabricate and build, or on existing infrastructure requiring repair and recoating. The Society for Protective Coatings (SSPC) has recognized our technical skills and processes with their prestigious QP-1 certification, so you can rely on thoroughly tested multi-craft services on the most demanding jobs, with the added benefits of uncompromising safety and nationwide mobility.

We work in a wide range of applications for the private sector, the military and municipal authorities:

- Industrial facilities
- Terminals
- Petrochemical plants
- Water and wastewater
- Oil and gas exploration and production
- Aircraft fueling facilities
- Lead abatement

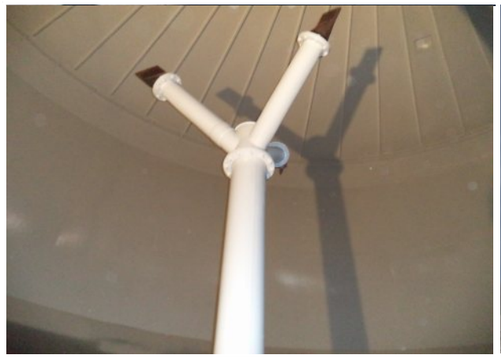
Safety

Safety is the Key

Landmark's uncompromising commitment to safety protects people, property and the environment. We apply equally rigorous standards for all locations, require ongoing training and testing for all crews, and utilize site evaluations, Hazard Identification and Risk Assessments (HIRA) and root cause analysis to continually drive performance improvement. Landmark employs the best available safeguards for the job, such as advanced, self-contained respiratory equipment on many applications. And we stay at the forefront of best practices and efficient reporting with our membership in ISNetworld. Core values and comprehensive safety and health programs, along with SSPC C-3 accreditation for de-leading steel structures, safeguards against environmental impact.

Skill

Landmark's technical capabilities start with specification assistance, based on in-depth knowledge of industry suppliers and their latest products, and insights from our own operations. Our crews are fully equipped to perform surface preparation and coatings work on virtually any type of steel structure, utilizing a broad array of coatings including polyurethanes, 100% solids and fiberglass reinforced systems. Our crews perform all coatings work in accordance with the Landmark Quality Assurance Manual for Surface Preparation and Coating. They are trained to implement all of the required process controls and conduct workmanship inspections to meet or exceed all applicable standards and client expectations.



Routine quality evaluations include but are not limited to:

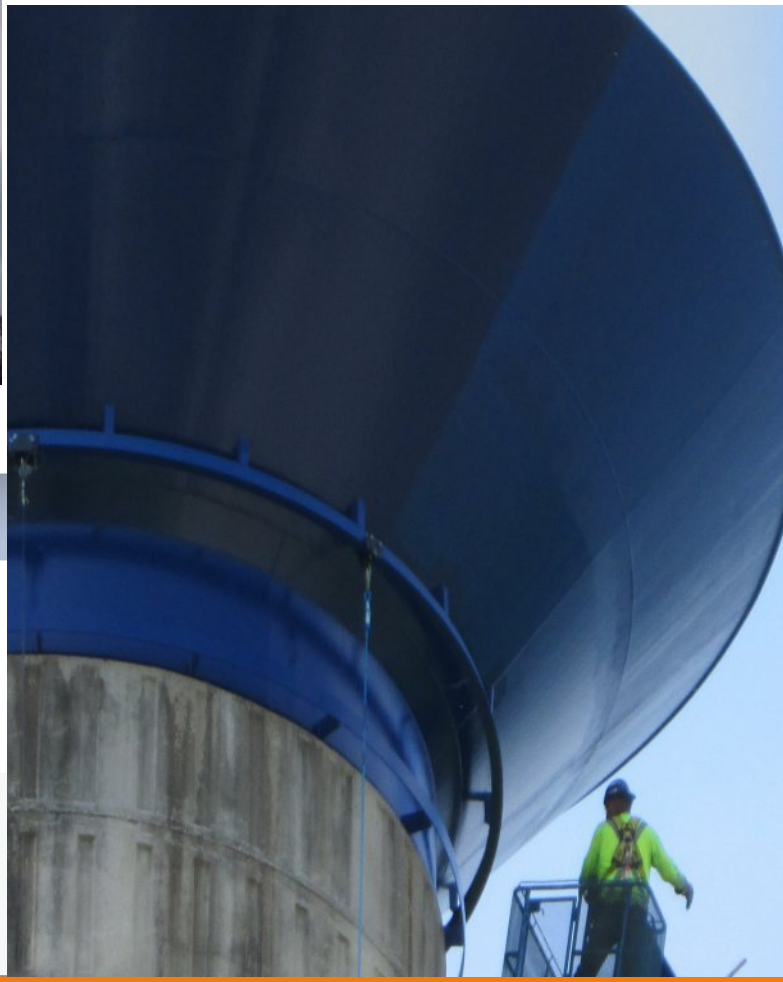
- Measurement of environmental conditions
- Verification of surface cleanliness prior to coating or lining
- Wet and dry film thickness measurement
- Holiday testing (low or high voltage, depending on lining thickness)

Daily logs track all inspection activity, and are available upon request.

Specialized equipment enables Landmark to manage dehumidification on work in enclosed spaces such as tank lining and recoating, and to protect the environment with blast media recycling and a full or partial containment on exterior surface preparation and coating. In addition, site specific plans for environmental monitoring, hazardous material management, and disposal of wastes are developed for all tank rehabilitations where existng coatings contain toxic metals. And for high-profile projects with community impact, Landmark has perfected the art of translating even the most intricate graphics to the public stage with precise reproduction. The utilization of dust collection systems ensures complete extraction of dusts for not only a cleaner surface prior to paint application, but as well as containment of dusts generated. This provides necessary air exchanges for confined space work.

Mobility

Landmark capabilities are completely mobile for deployment nationwide or beyond, without limitations. Specially outfitted trailers move containerized equipment to the project site, and then serve as mobile command centers for the crews. All required assets are at hand, coordinated with local supply lines as appropriate.



You can count on Landmark Mobile Specialty Coatings to reliably protect your investment and extend the life of critical infrastructure. Contact us today to discuss the best solution and a quote on your next project.

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Burlington, Ontario L7M 0W4
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www.teamlandmark.com

HAPPY VALLEY RESERVOIR (NORTH & SOUTH) - ROV INSPECTION AND REPORT: JULY 31, 2019