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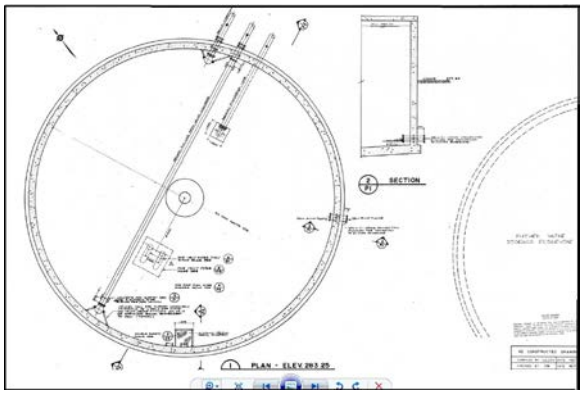
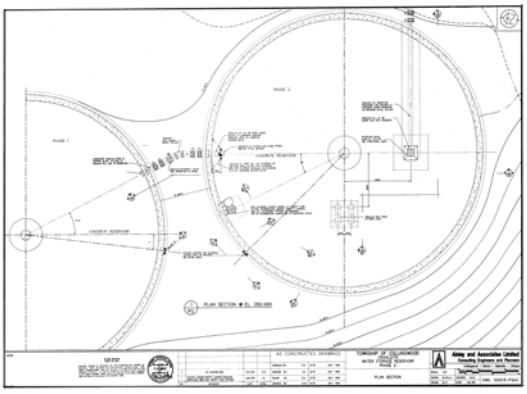
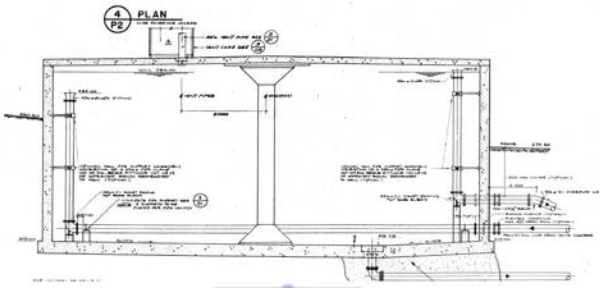
Visual Inspection of the Accessible Internal & External Areas of the Happy Valley Potable Water Reservoirs



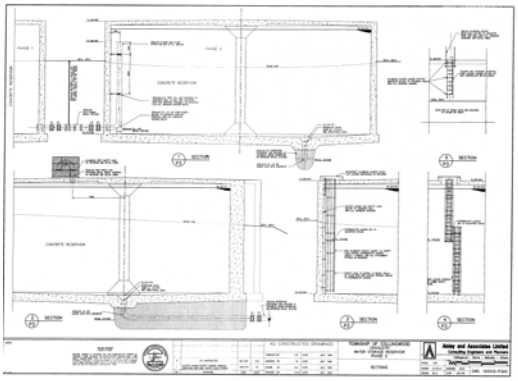
North Reservoir Cell – plan view



South Reservoir Cell – plan view



North Reservoir Cell – profile view



South Reservoir Cell – profile view

Client Rep : Rob Gilchrist, Water Supervisor, Water and Waste Water Services

Project : 2024-17-Q-OPS, Inspection of the Two (2) Happy Valley Reservoirs

Method : Disinfected, Submersible Video ROV for Internal, Underwater Areas

Location : 136 Happy Valley Road, The Blue Mountains, ON L9Y 0N9

Date : October 24, 2024

AIS Job No. : 20241009-TBM-01

Prepared by: Paul Keenan, Sr. Inspector

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1.0 Introduction:

At the request of The Town of the Blue Mountains, Water & Waste Water Services, internal video inspection of the two (2) circular concrete reservoirs, in accessible areas, was performed, using a submersible ROV with onboard lighting and high-resolution camera. The main purpose of the inspections was to obtain an overall condition assessment, including any need for cleaning. Inspection of accessible external areas of the reservoirs was also performed and results will be assessed, as much as practical, with recommendations and conclusions provided, as far as can be confidently reported.

2.0 Equipment:

Submersible, DeepTrekker, video ROV with high-resolution colour camera and lighting.

3.0 Conclusions:

3.1 South Reservoir – 1st reservoir surveyed

3.1.1 As seen in the North Reservoir; typical brown sediment found across most areas of the floor less than 1" thick
3.1.2 Internal lining and protective coatings on the vertical wall joints are generally in good condition. Parging around the outer floor is flaked off in many areas.
3.1.3 The roof support column is in good condition.
3.1.4 Internal ladder structures appear intact and the ladders have protective safety cages for persons climbing the ladders, which are in good condition.
3.1.5 External cracks visible at random locations, deposit buildups and failed joint grouting, seen in various areas, were identified and photographed.

3.2 North Reservoir – 2nd reservoir surveyed

3.2.1 There is a thin layer of typical brown sediment across most areas of the floor, less than 1" thick but no evidence of large bits of concrete debris which would indicate deterioration of the walls or underside of the reservoir roof.
3.2.2 Internal lining and protective coatings on the vertical wall joints and around the lower wall to floor interface are generally in good condition except flaking of parging was seen around the outer edges of the floor.
3.2.3 The roof support column is in good condition.
3.2.4 Internal ladder structures appear intact, scale bits seen on floor below ladder. No fall arrest system is seen on the ladders so entry and egress will require continuous fall-protection for persons when using the ladder to do up and down.
3.2.5 External cracks, deposit buildups and failed joint grouting, seen in various areas, was identified and photographed.

3.3 Pumphouse and site equipment

3.3.1 Piping, valves and other equipment were externally, visually viewed and photographed inside the site pumphouse with no obvious anomalies or severe corrosion seen in the accessible areas viewed. Access to valve chambers is not practical.

4.0 Recommendations:

4.1 Compliance & Efficiency Coordinator and Water Supervisor, Water & Waste Water Services, Town of the Blue Mountains, to review this inspection report and video footage.
4.2 Plan to dewater and enter each of the two reservoirs and perform cleaning as well as more detailed inspections of the metal parts, thickness of piping, bolting corrosion including removal of scale and failed coating to better assess condition of these metal components.
4.3 Internal surfaces should be cleaned using a gentle-action detergent made by Moesslein Wassertechnik and **NO high-pressure spray to be used on any concrete surfaces.**
4.4 If and when the reservoir cells are entered for cleaning, maintenance or repairs, take the opportunity to test the integrity of the upper roof to wall joint seals, method to be discussed.
4.5 Remove external calcium and other deposits seen at random areas of the reservoir and at joints and monitor periodically to see if these areas have active leakage or increasing size.
4.6 Conduct phone or video conference meetings to fully discuss objectives of further actions.

5.0 Inspection/Discussion:

The South Reservoir was chosen to be internally, underwater video inspected first. The roof hatch cover was unlocked and opened to allow internal access for the submersible ROV. The ROV and associated submersible umbilical cable was sprayed, using a mixture of sodium hypochlorite supplied by Water & Wastewater Services, prior to the vehicle being lowered down through the square, roof access hatchway to the water surface. Recording, lighting and maneuverability functions were tested prior to beginning the internal inspection.

The North Reservoir was ROV inspected immediately after the South Reservoir in the same manner as the South Reservoir.

A repair procedure example, relevant to from our preferred consultant, Aquashield–Umengan Construction, is attached to this inspection report. Further discussions with The Town of the Blue Mountains are required to give accurate quotations for the repairs which are deemed to be required. The roof topside proposed repairs of the “spider-cracking” on the South Reservoir will be addressed and further discussed with The Town of the Blue Mountains.

5.1 **South Reservoir – details, explanations with comments of the inspection video**:

Highlights of the video below with a general location of the ROV and a brief comment next to each; Clock Time, in the table below, can be seen on the inspection video in upper left of display:

Clock Time	Comments
File 01	Labeled 2024-10-24_10-29-28_HV South Res
10:29:30	Beginning below roof hatch, testing lights, recording functions
10:29:35	View up at top of ladder structure, cage, sliding post appear in good condition
10:30:05	View up at roof to wall joint adjacent to hatchway
10:30:30	Moving ROV generally to right of ladder along water surface, good views of upper wall
10:32:00	Views down a section of wall. (@ 10:32:30 wide views of the ladder cage and structure)
10:33:00	Continue moving to right of ladder, views up at the roof to wall joint
10:33:25	Views down joint (@ 10:34:15 bottom of joint reached)
10:35:25	Good view of floor to wall joint, flaked off parging layer around outer floor edge
10:35:30	Sediment cleared using ROV motors to view bare area of flaked off parging layer
10:36:30	Continue moving right from manway along the floor to wall areas
10:37:15	Begin viewing up wall sections
10:38:00	Continue moving in same direction around outer floor area
10:40:15	View up a wall joint with protective coating, generally in good condition
10:40:30	Continue moving around outer floor to wall area
10:43:50	Good view straight down of floor to wall joint
10:44:15	Moving up wall joint
10:44:45	View of wall joint at roof
10:45:05	Good view of roof to wall joint
10:45:30	Begin pulling ROV back looking up; good views of underside of roof
10:48:30	Views up at the two roof vents
10:50:50	(end recording of File 01)
File 02	Labeled 2024-10-24_10-56-27_HV South Res
10:56:27	Starts recording
10:59:30	Begin moving ROV to the left of the ladder, views of the top funnel of the s/s fill pipe
11:00:00	Moving past fill pipe funnel, views of the walls
11:00:45	View of staining from the roof to wall joint
11:03:10	View down at parged area along wall with sediment cleared using ROV down motors
11:03:30	Continue moving left of ladder along wall to floor area
11:03:45	View down at joint grouting, continue moving along wall to floor area

11:05:00	Moving past wall joint, continue looking down at wall to floor area
11:06:15	View small section of floor with sediment cleared
11:06:45	Continue moving around outer floor area
11:07:00	Wide view of floor; continue moving around floor to wall area
11:08:45	Small spots of staining on outer floor coating, continue moving around outer floor area
11:11:00	Up wall to water surface
11:11:30	Begin pulling ROV back, looking up
11:12:20	Underside of roof, calcium deposits
11:12:30	Centre roof support pillar (views to 11:14:40)
11:15:30	Roof vent openings, again
11:16:00	View straight up into vent openings
11:17:00	Centre roof support pillar, again
11:18:30	Random views of main floor sediment (to 11:19:30)
11:21:00	Views of centre roof support pillar, again (to 11:25:30)
11:26:00	Pulling ROV back, looking up (end File 02 @ 11:26:27)
File 03	Labeled 2024-10-24_11-26-33_HV South Res
11:26:35	Pulling ROV back, looking up
11:29:00	Roof to wall area, near manway
11:31:00	Viewing down wall
11:32:00	Moving right of manway
11:32:30	Moving across floor with good views of sediment
11:37:30	Areas along wall to floor with sediment on flaked off areas of parging
11:37:50	Moving up wall
11:38:40	View staining at wall to roof joint
11:39:30	Minor roof cracking, calcium deposits
11:40:00	Pull ROV back, looking up (@ 11:41:00, pulling past roof support pillar)
11:42:00	Back at manway, looking up
11:44:45	Move to right of manway, good views of upper wall (to 11:47:30), joints ok where seen
11:47:30	Moving down a wall joint with protective coating cover to floor @ 11:49:00
11:49:40	Looking down at a floor joint
11:50:00	Moving up wall
11:51:00	Pulling back ROV
11:53:15	Moving down wall to floor (@ 11:56:30 end of File 03 recording)
File 04	Labeled 2024-10-24_11-56-37_HV South Res
11:56:35	Wide view of ladder structure
11:57:15	ROV lifted out of the reservoir (end recording File 04)

5.2 North Reservoir – details, explanations with comments of the inspection video:

Clock Time	Comments
File 05	Labeled 2024-10-24_13-27-06_HV North Res
13:27:05	Begin recording
13:27:30	Views of the access ladder below the manway, no safety cage or fall-arrest rail seen
13:29:30	View up at the roof to wall joint, some staining seen
13:29:45	Moving right (counter clock-wise, if orientation is looking down) of hatchway at
13:31:20	Views up at roof, roof to wall
13:31:30	Down wall to view outer floor
13:32:20	Floor to wall area, blueish “sand” seen buildup around the floor edge
13:33:15	Continue moving around the floor to wall area
13:36:15	Viewing horizontal fill pipe, concrete supports, flanges and pipe to wall interface
13:39:15	View up vertical overflow pipe, funnel and structural wall attachments
13:40:45	View white, smooth area of roof underside above pipe funnel opening
13:41:00	Pull ROV back viewing up at roof
13:43:15	Back at start point, below manway
13:44:00	Begin moving left of hatchway (clock-wise, if orientation is looking down)
13:44:15	Vertical pipe funnel, structural attachments, typical rust deposits
13:46:00	Moving past and around the vertical pipe
13:46:30	View up at main roof joint, white deposits
13:47:15	Wide view looking back at the ladder structure
13:47:20	Continue moving “clock-wise” viewing the upper walls
13:48:00	Move to the floor to wall area, continue moving around the outer floor – good views
13:49:00	Viewing up, continue clock-wise around the outside
13:49:30	Overflow pipe reached from the opposite side
13:50:30	Pulling ROV back, looking up
13:51:00	Roof support pillar
13:51:50	View down at horizontal fill pipe adjacent to bottom of support pillar
13:53:50	Roof vent openings (13:57:00 end of File 05)
File 06	Labeled 2024-10-24_13-57-13_HV North Res
13:57:05	Begin recording; close up views of remaining bits of concrete surfacing
13:58:30	Views down at wall areas
14:01:45	Upper section of vertical pipe funnel
14:06:30	Roof support pillar, again
14:08:15	ROV pulled out onto plastic tarp, (end of File 06 recording)

6.1 South Reservoir – photos with comments

Overall view of South Reservoir

Concrete base for roof manway; two cracks marked

Manway cover; rubber seal in good condition

Protective cage around two gooseneck vents

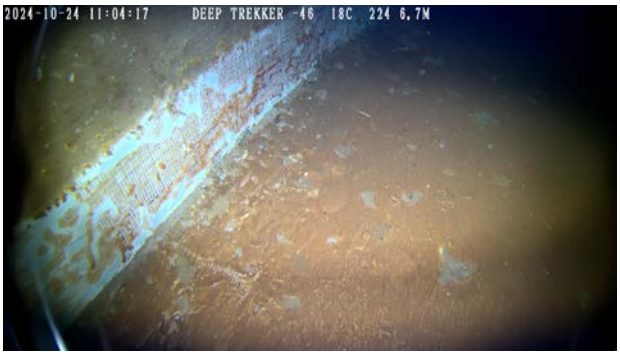
Underside of 1st gooseneck vent screen – ok

Underside of 2nd gooseneck vent screen – ok

6.1 South Reservoir – photos with comments (continued)

Outer floor, parging layer flaked off

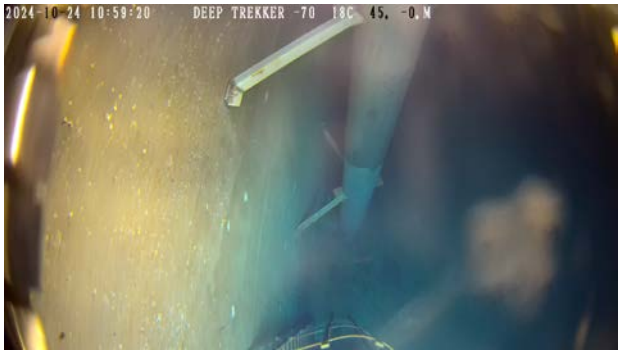
Cleared sediment away; cracked parging underneath



Wall to floor joint

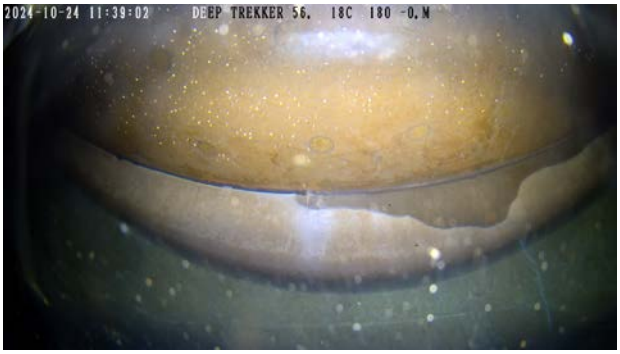
Floor to wall area; sediment cleared away by ROV

Stainless steel funnel and vertical pipe



View stainless steel pipe and brackets

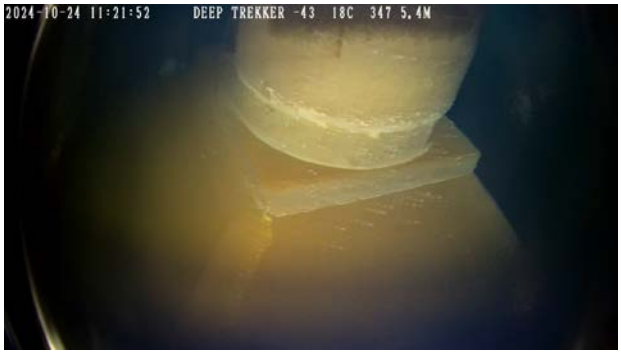
6.1 South Reservoir – photos with comments (continued)



Roof to wall joint; some staining seen

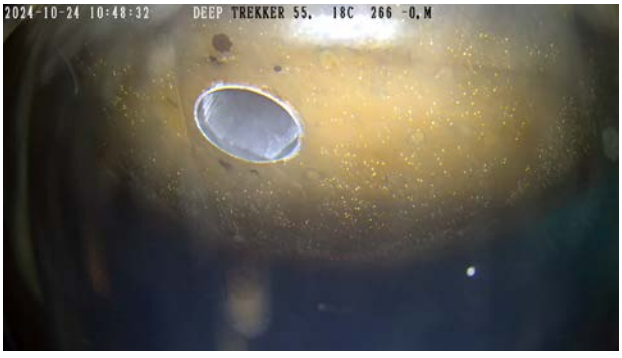
Wide view of wall to floor joint

View up at roof support pillar to roof interface



View down at roof support pillar to floor interface

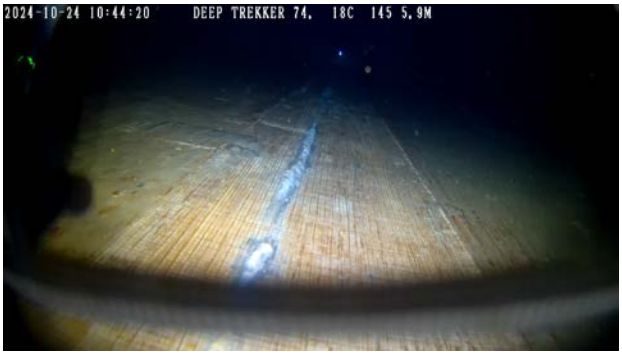
View up at roof to wall joint interface



One of two roof vent openings

6.1 South Reservoir – photos with comments (continued)

Ladder bottom, see pipe and support behind it



View up wall joint; white deposits coming through

Upper ladder cage and tie off post

South Reservoir - view from North Reservoir roof

Roof top “spider crack”

Typical roof topside crack

6.1 South Reservoir – photos with comments (continued)

Roof top cracks around centre support area

Example of multiple cracks with white deposits

View of wet deposits from concrete layer

Wide view of area where wet deposits are seen

Example of crack indication with white deposits

Roof hatch secured and locked after inspection

6.2 North Reservoir – photos with comments

Overall view of the North Reservoir

Roof hatch open during video inspection

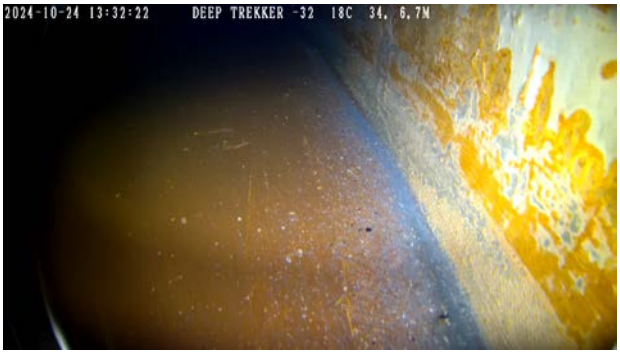
Protective cage around roof vent piping

One strap on top of protective cage is bent inward

Vent one of two, screening is ok

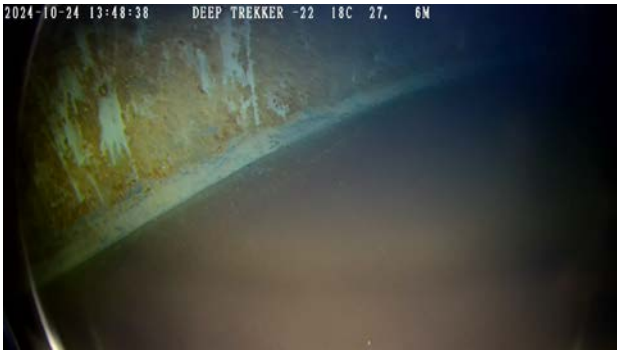
Vent two of two, screening is ok

6.2 North Reservoir – photos with comments (continued)



Wall to floor area, blue bits of grainy debris

Ladder bottom, bits of scale laying loose on floor



Typical thin layer of sediment across the floor

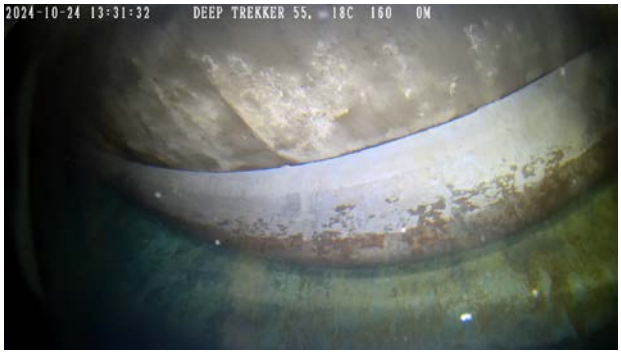
Fill pipe to wall interface, scale deposits on pipe

View down at ladder platform

Overflow pipe to wall interface

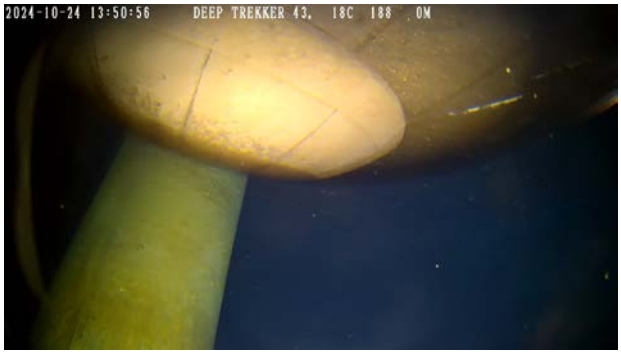
6.2 North Reservoir – photos with comments (continued)

Upper portion of overflow pipe and bracket



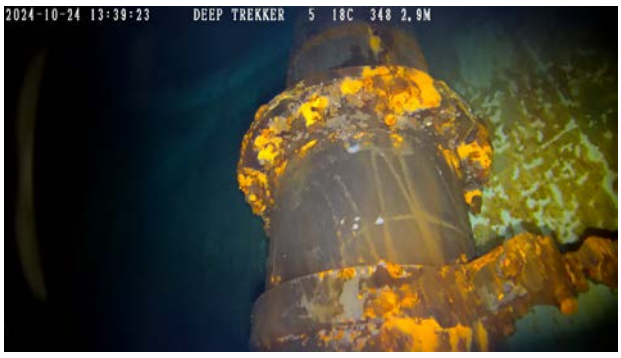
Section of the roof to wall joint

View up into one of two roof vents



View upper portion of centre roof support pillar

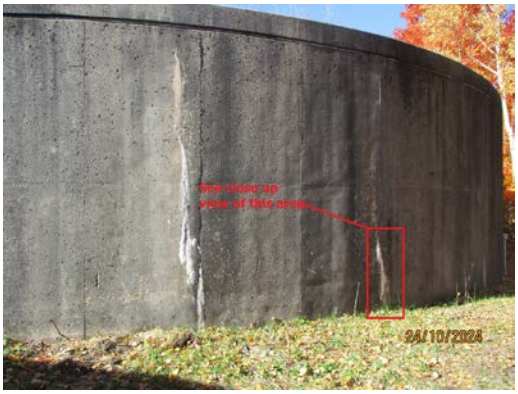
View lower portion of centre roof support pillar



Scale and deposits on overflow piping & bracket

6.2 North Reservoir – photos with comments (continued)

Grouting missing - external roof-wall joint



* Typical cracking with white deposits

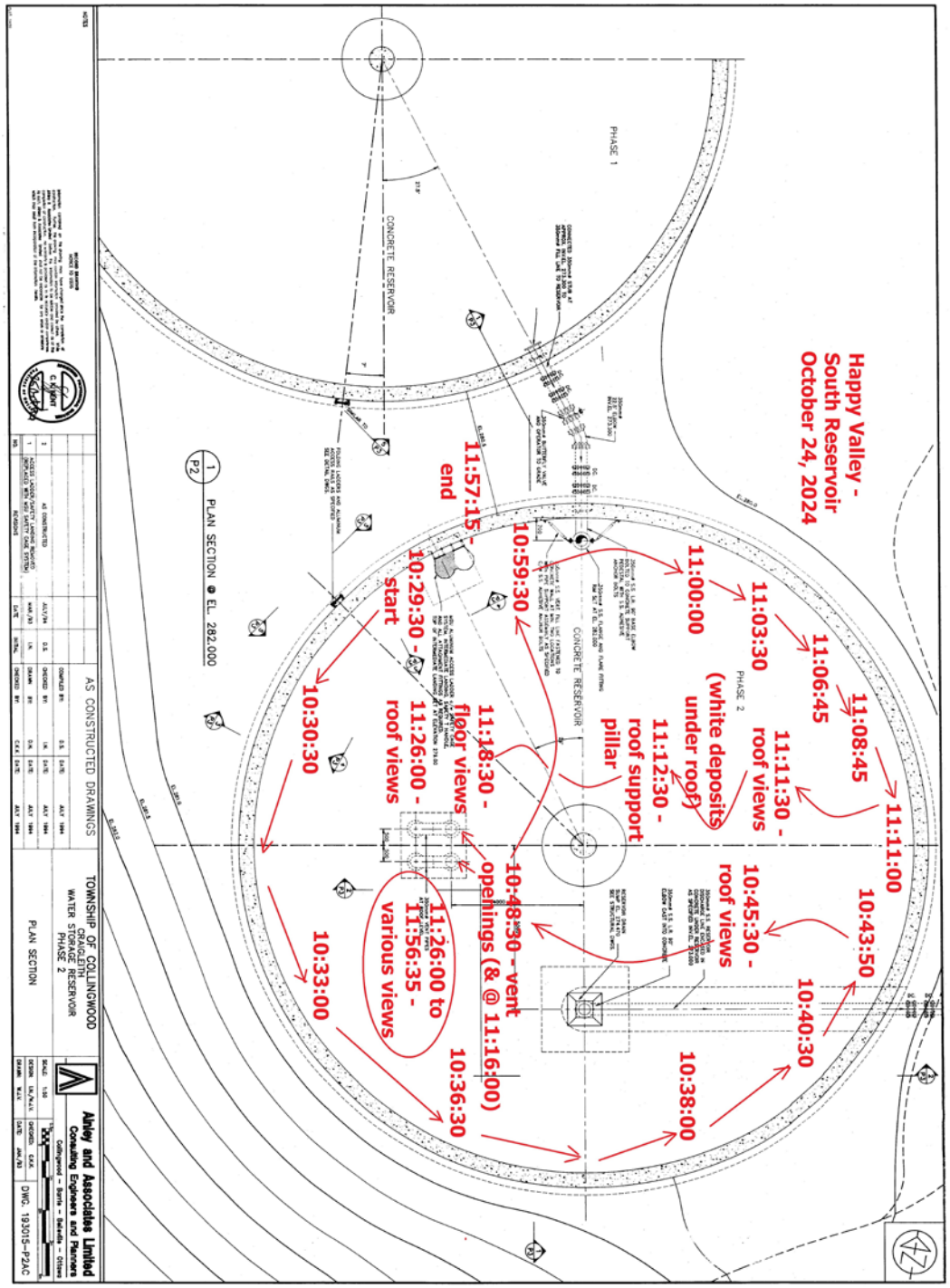
*Close up view: Typical cracking

Typical area of white deposits at joint

Typical white deposits

Area of the intersection of topside roof joints

7.1 South Reservoir – sketch of reservoir, plan view with approximate path of ROV



7.2 North Reservoir – sketch of reservoir, plan view with approximate path of ROV