Memorandum

To: David Stoneback, Utilities Director, City of Evanston
From: Mark White and Wendell Yang*
Date: December 16, 2013
Subject: Evanston Finished Water Reservoir Inspection Report

Tank Inspection
CDM Smith was retained by the City of Evanston to visually inspect and assess the structural condition of their existing 5 million gallon finished water reservoir located near the water plant at 555 Lincoln Street, Evanston, Illinois. The inspection of the tank interior was performed by Wendell Yang, registered structural engineer from CDM Smith, on November 12, 2013 in conjunction with the inspection by the CTL Group. The inspection was performed from an inflatable raft with the water level in the reservoir lowered to approximately 9 feet below the bottom of the tank roof slab. (See Photo #1 in this report).

Tank Construction
The existing reservoir is a below-ground storage tank, which was constructed of cast-in-place reinforced concrete in 1934. The tank has the approximate dimensions of 140’Wx260’Lx20’H. The roof slab of the tank is currently being used as a parking lot by Northwestern University.

Inspection Findings
1. UNDERSIDE OF THE ROOF SLAB: The underside of the roof slab appeared to be in poor condition. Numerous cracks with efflorescence (Photo #2), surface spalls and exposed reinforcing steel (Photo #3) were visible. Extensive condensation was present (Photo #4). These structural deteriorations appear to have been caused mainly by long-term freeze-thaw actions. The roof slab is in much worse condition than other parts of the tank because it is at the ground level and is subject to freeze-thaw condition more readily than other parts of the tank. Deicing materials used in the parking lot are expected to have contributed further to the deteriorations of the roof slab structure. It is likely that small amount of surface water may be infiltrating into the tank through some of the larger roof cracks. Walker Restoration Consultants removed four concrete core samples from the top side of the roof slab. CTL Group obtained the core samples from Walker and cut, lapped and examined the samples. All four core samples exhibit extensive surface-parallel cracking. The results are included in the 12/04/2013 inspection report prepared by the CTL group noted as Reference Document No. 2 listed below. Similar core sample test results may be

* Wendell Yang is a registered professional engineer and registered structural engineer in the state of Illinois
seen in the 12/21/2012 inspection report prepared by the CTL Group noted as Reference Document No.1 listed below.

2. **INTERIOR OF TANK WALLS:** The interior surfaces of the tank walls above the water level appeared to be generally in good condition. Some cracks (Photo #5) and surface scaling (Photo #6) were observed, but, the structural integrity of the tank walls did not appear to have been compromised by the cracks and scaling (Photo #7). The tank walls below the water level, though not totally visible, did not appear to have any significant structural defects. Four core samples were extracted from the exterior of the east wall and examined by the CTL Group. The results are included in the 12/04/2013 inspection report by the CTL Group noted as Reference Document No. 2 listed below. All four core samples revealed that this concrete is in generally good condition.

3. **INTERIOR SUPPORT COLUMNS:** A total of 72 columns (6 rows of 12) were visually inspected. All columns appeared to be in generally good condition. Mild scaling was observed on most column surfaces above the water level (Photo #8), but it did not appear that the scaling has caused any structural damage to the support columns. Several columns have cracks and efflorescence in the drop panels and column capitals (Photo #9), but it did not appear that the cracks have compromised the structural integrity of the columns.

4. **TANK FLOOR SLAB:** The tank bottom slab was observed through the water with the aid of flashlight. The slab appeared to be generally in good condition. There was no observation of any structural defects or damages on the slab surface.

**Conclusions and Recommendations**

1. The roof slab of the reservoir is in poor structural condition. The overall structural condition of the rest of the reservoir appears to be good. With anticipated full snow and vehicle loading on the roof slab, the safety of people is of great concern. It is recommended that vehicle loads be restricted to passenger cars only. During heavy snow, the number of cars allowed in the parking lot may need to be restricted.

2. If the city decides to continue the service of the reservoir, it is recommended that the entire roof slab with all of the column drop panels be replaced with new concrete and all surface cracks on walls and floor slab be patched with epoxy grout within the next 5 years. Installation of an epoxy liner within the reservoir is not recommended at this time.

3. While the reservoir is still in service, it is recommended that the interior of the roof slab be inspected and monitored annually until the roof slab is replaced with new concrete.

4. After the repair/replacement is completed, it is estimated that the tank structure will have an approximate remaining service life of 30 years.
Estimated Construction Cost

1. The construction cost for the roof slab replacement was previously estimated to be $4.8 million with a range of accuracy from +40% to -20%, i.e., $6.7 to $3.8 million. The itemized breakdown of this cost estimate is included in the August 22, 2013 memorandum titled “Review of CTL Group Finished Water Reservoir Assessment Report” by CDM Smith, noted as Reference Document No. 3 below.

2. The construction cost of the crack repairs in the walls and the floor slab is estimated to be approximately $200,000. Based upon description of cracks in the December 21, 2012 Finished Water Inspection Report (CTL Group) a total length of visible cracks in the walls and floor slab was estimated at 1,000 linear feet. A repair cost of $200 per linear foot was assumed, which includes repair, contractor overhead and profit, and engineering.

Reference Documents


Photo #9