

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 18-32

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

THIRD QUARTER 2018

November 2018

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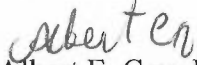
Dear Mr. Cobb:

Subject: Transmittal of the Report "Thornton Composite Reservoir Groundwater Monitoring Report Third Quarter 2018"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report Third Quarter 2018" transmitted electronically. The report is prepared for transmittal to the Illinois Environmental Protection Agency (IEPA) in accordance with the Thornton Composite Reservoir Groundwater Monitoring Plan. Also attached are the Excel spreadsheets of the Thornton Composite Reservoir raw data as required by the IEPA.

If you have any questions or would like to have additional information, please contact Dr. Pauline Lindo at (708) 588-4109 or pauline.lindo@mwr.org.

Very truly yours,


Albert E. Cox, Ph.D.
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Monitoring and Research Department

AC:PL:cm

Attachment

cc: Mr. E. Podczerwinski
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Third Quarter 2018

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LIST OF ACRONYMS

| Acronym | Definition |
|---------|-------------------------------|
| CCD | Chicago City Datum |
| CFU | Colony Forming Unit |
| CSF | Combined Sewer Flow |
| FC | Fecal Coliform |
| GMP | Groundwater Monitoring Plan |
| GPS | Groundwater Protection System |
| IAC | Illinois Administrative Code |
| M&R | Monitoring and Research |
| QC | Quality Control |
| TCR | Thornton Composite Reservoir |
| TDS | Total Dissolved Solids |
| TOC | Total Organic Carbon |

ACKNOWLEDGMENT

This report for the Thornton Composite Reservoir Groundwater Monitoring was generated by the Monitoring and Research (M&R) Department. All samples were collected by Andrews Engineering, Inc. (contractor) under Contract No. 18-100-11. All analyses were performed by the Analytical Laboratories Division of the Metropolitan Water Reclamation District of Greater Chicago. Special thanks are due to Ms. Mina Patel for compiling some data and to Ms. Coleen Maurovich for typing and formatting this report.

DISCLAIMER

Mention of proprietary equipment and chemicals in this report does not constitute endorsement by the Metropolitan Water Reclamation District of Greater Chicago.

INTRODUCTION

A Groundwater Protection System (GPS) was constructed for the Thornton Composite Reservoir (TCR) to protect against the exfiltration of combined sewer flow (CSF) into the surrounding dolomite aquifers. The CSFs and minimal amounts of stormwater are stored in the reservoir during and after large storm events. To monitor the performance of the GPS, a network of monitoring wells located outside the perimeter of the GPS is being monitored as discussed in the Revised Groundwater Monitoring Plan (GMP) (Black & Veatch, 2016). As explained in the Revised GMP, one sample of reservoir water, one of the Main Quarry Sump, and one from each of the seven wells are collected annually and analyzed for the Illinois Administrative Code (IAC) Title 35 Part 620 Class I groundwater constituents. In addition, following a reservoir fill event or during a routine quarterly event, groundwater is sampled from the seven wells and the Main Quarry Sump and tested for a targeted list of parameters that are more likely to be detected in CSF water.

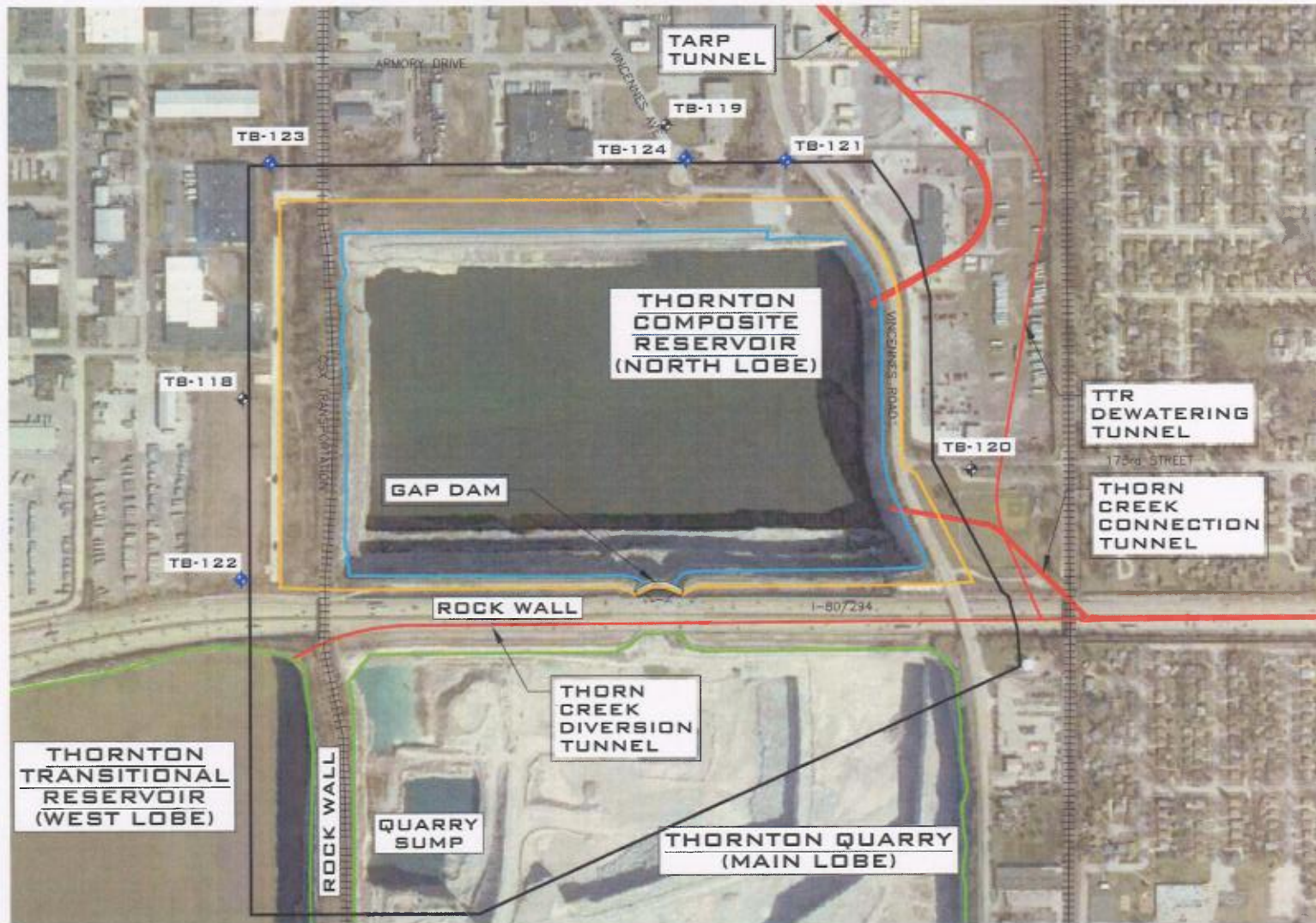
The monitoring well system consists of one deep well, TB-124, which monitors the underlying Galena Aquifer, and six vertical Westbay multi-level monitoring wells: TB-118, TB-119, TB-120, TB-121, TB-122, and TB-123, which monitor the Silurian Dolomite aquifers. As discussed in the Revised GMP, following a reservoir fill event, bi-weekly sampling is required as long as the water in the reservoir is above an elevation of -280 ft Chicago City Datum (CCD). Groundwater is sampled from each well at the first sample interval port immediately below the reservoir water elevation. Each of the multi-level monitoring wells is capable of monitoring four distinct 20-ft intervals in the Silurian Dolomite aquifer.

The locations of monitoring wells, quarry sump, TCR, and the GPS are presented in Figure 1. The Main Quarry Sump is located beyond the south boundary of the GPS, and is not a component of the TCR, but is an integral part of the Hanson Material Services mining quarry to the south of the TCR. This sump facilitates mining operations by minimizing the water level at the bottom of the quarry. It is possible that the bottom of this sump could extend beyond the lowest depth of the TCR (-297.5 CCD) ft. The sump contains mainly groundwater and small quantities of surface runoff, and it is sampled quarterly, along with the wells, to evaluate the potential migration of contaminants from the TCR to the sump.

Table 1 lists the characteristics of all wells at the TCR site (well location coordinates, elevations and depths, and the sampling port interval elevations).

Prior to the TCR becoming operational in November 2015, eight sampling events were conducted on a quarterly basis for two years (May 2012 through March 2014) to provide background data on the existing groundwater quality. In order to evaluate the effectiveness of the grout curtain and the GPS, the Revised GMP (2016) presents the analysis of data for all samples collected during the background monitoring period and provides a baseline for comparison with routine monitoring data. Changes over time in groundwater calcium and magnesium concentrations would also be useful in tracking the occurrence of infiltration/exfiltration. Groundwater analytical data routinely generated for the monitoring wells, reservoir, and sump

FIGURE 1: MONITORING WELL AND MAIN QUARRY SUMP LOCATIONS



LEGEND

- ⊕ WESTBAY WELL
- ⊕ DEEP WELL

- TARP TUNNEL
- GROUT CURTAIN

- THORNTON COMPOSITE RESERVOIR
- HMS THORNTON QUARRY
- GROUNDWATER PROTECTION

TABLE 1: CHARACTERISTICS OF MONITORING WELLS TB-118 THROUGH TB-124 AT THE THORNTON COMPOSITE RESERVOIR SITE

| Well ID | Coordinates ¹ | | Ground Surface El (ft, CCD ²) | Top of Riser El (ft, CCD ²) | Depth of Well (ft) | Sampling Port Interval (ft, CCD) | | | |
|---------|--------------------------|--------------|---|---|--------------------|----------------------------------|--------------|--------------|--------------|
| | Northing (ft) | Easting (ft) | | | | Interval 1 | Interval 2 | Interval 3 | Interval 4 |
| TB-118 | 1,791,110.38 | 693,560.44 | 38.5 | 41.5 | 532 | -85 to -105 | -212 to -232 | -283 to -303 | -392 to -412 |
| TB-119 | 1,792,316.63 | 695,509.39 | 27.9 | 29.5 | 529 | -85 to -105 | -212 to -232 | -283 to -303 | -392 to -412 |
| TB-120 | 1,790,782.31 | 696,888.93 | 40.0 | 42.1 | 540 | -86 to -106 | -213 to -233 | -284 to -304 | -393 to -413 |
| TB-121 | 1,792,193.10 | 696,044.98 | 29.4 | 30.4 | 461 | -84 to -104 | -211 to -231 | -282 to -302 | -391 to -411 |
| TB-122 | 1,790,288.61 | 693,549.38 | 48.8 | 51.7 | 480 | -85 to -105 | -212 to -232 | -283 to -303 | -392 to -412 |
| TB-123 | 1,792,185.60 | 693,685.69 | 28.9 | 31.8 | 460 | -84 to -104 | -211 to -231 | -282 to -302 | -391 to -411 |
| TB-124 | 1,792,200.77 | 695,591.56 | 29.6 | 29.2 | 728 | | -663 to -698 | | |

¹Illinois State Plane Coordinate System (NAD 1927).

²Chicago City Datum (CCD).

will also be compared with the IAC Title 35 Part 620 Class I Groundwater Standards (IPCB, IEPA, 2013) to evaluate any exceedances in groundwater standards.

There was one fill event during the third quarter of 2018. This report presents field activities, observations, and analytical data for surface and groundwater monitoring samples taken at the Main Quarry Sump and at all monitoring wells for the third quarter/fill event sampling of September 10 and 26 - 28, 2018.

FIELD ACTIVITIES

For this report period, one set of fill-event samples was collected at the sump, the deep well, and at sampling port interval 3 of all multi-level wells. Samples were collected according to the schedule listed in Table 2. This is the fourth sampling event of the year and the only one for the third quarter.

Using a WTW Multi 3400i pH/conductivity/temperature meter, the pH, electrical conductivity (EC), and temperature of each sample were measured and recorded immediately after collection.

Prior to sampling the multi-level wells, hydrostatic pressure was measured to calculate the groundwater elevation at Port 3 of each well. Table 3 lists the elevations at Port 3 of each well and the corresponding groundwater elevations during this sampling period.

All samples were packed in ice and shipped to the Metropolitan Water Reclamation District of Greater Chicago's Analytical Laboratories Division for the analysis of selected inorganic constituents (IAC Title 35 Part 620 Class I Groundwater Standards) in accordance with the revised GMP for the fill-event samples. Additional aliquots were also prepared in the field and shipped in ice to the District's Analytical Microbiology and Biomonitoring Laboratory for fecal coliform analysis.

TABLE 2: DEVICES AND CORRESPONDING DATES OF SAMPLING DURING THE FILL
EVENT OF SEPTEMBER 2018

| Date of Sampling | Device/Structure Sampled |
|------------------|------------------------------|
| 9/10/2018 | TB-120, TB-120 Dup |
| 9/26/2018 | TB-122 ¹ |
| 9/27/2018 | TB-119, TB-121, TB-124, Sump |
| 9/28/2018 | TB-118, TB-123 |

¹Matrix and matrix duplicate sampled at Well TB-122.

TABLE 3: SUMMARY OF GROUNDWATER ELEVATIONS AT SAMPLING PORT 3 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING THE MONITORING EVENT OF SEPTEMBER 2018

| Well ID | Sampling Port 003 Elevation | Groundwater Elevation |
|---------------------|--------------------------------|--------------------------|
| | ----- (ft CCD) ----- | |
| TB-118 | -289 | -92 |
| TB-119 | -289 | -166 |
| TB-120 | -290 | -200 |
| TB-121 | -288 | -172 |
| TB-122 | -288 | -222 |
| TB-123 | -288 | -53 |
| TB-124 ² | NA ³ | -370 |

¹Chicago City Datum.

²TB-124 is a conventional well screened from -663 to -698 ft below ground surface. During September, one sample was taken at approximately 650 ft below ground surface.

³NA = Not Applicable.

ANALYTICAL RESULTS

Table 4 lists the analytical methods used by the laboratory for various parameters. Analytical results were reviewed to identify any analytes that exceeded the Illinois Class I Groundwater Standards (35 IAC Part 620).

The analytical data for all well samples and the Main Quarry Sump sample collected during the third-quarter fill event of September 10 and 26-28, 2018 are presented in Table 5. There were a few exceedances of the Part 620 groundwater standards, including pH, TDS, chloride, sulfate, and boron, as indicated in bold font in Table 5. The pH in Well TB-124 (9.4) was higher than the background maximum of 8.4. None of the other parameters showed a higher concentration than the background.

The fecal coliform (FC) populations of samples collected during the third quarter were generally undetectable at all monitoring wells. At the Main Quarry Sump, only 1 CFU/100 mL was detectable during this event (Table 5).

TABLE 4: ANALYTICAL METHODS USED FOR REQUIRED PARAMETERS

| Inorganic Chemical Parameters | Analytical Method |
|-------------------------------|----------------------|
| Chloride | SM 4500-Cl- D |
| Alkalinity, Bicarbonate | SM 2320 B |
| Total Dissolved Solids | SM 2540 C |
| Sulfate | USEPA 375.2R2.0,1993 |
| TAL metals | SM3120B,1999 |
| Ammonia (as N) | EPA 350.1 |
| Hardness | SM 2340B,1997 |
| TOC | SM 5310-C |
| Others: | |
| Phenols | EPA 420.4 |
| Fecal Coliform | SM 9221E |

TABLE 5: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELLS TB-118 THROUGH TB-124 AND THE MAIN QUARRY SUMP AT THE THORNTON COMPOSITE RESERVOIR SITE DURING THE MONITORING EVENT OF SEPTEMBER 2018

| Parameter | Unit | Part 620 Groundwater Standard | Maximum Background | Lab RL ¹ | Well | | | | | | | | Sump |
|----------------|------------|-------------------------------------|-----------------------|---------------------|---------|---------|---------|-----------------------|---------|---------|---------|---------|---------|
| | | | | | TB-118 | TB-119 | TB-120 | TB-120-D ² | TB-121 | TB-122 | TB-123 | TB-124 | |
| pH | | 6.5 - 9.0 | 8.4 | NL ³ | 7.0 | 7.1 | 6.8 | 6.8 | 6.8 | 6.8 | 7.2 | 9.4 | 7.6 |
| EC | mS/m | NL | 415 | NL | 190 | 84 | 118 | 118 | 156 | 141 | 95 | 196 | 166 |
| TDS | mg/L | 1,200 | 2,960 | 25 | 1,170 | 494 | 786 | 774 | 962 | 756 | 600 | 1,358 | 1,264 |
| TOC | " | NL | 1 | 1 | 2.8 | 1.5 | 1.8 | 1.7 | 1.5 | 2.0 | 1.6 | 1.4 | 1.3 |
| Chloride | " | 200 | 1,230 | 5 | 274 | 51 | 144 | 146 | 237 | 156 | 54 | 257 | 195 |
| Sulfate | " | 400 | 890 | 5 | 202 | 95 | 110 | 108 | 173 | 73 | 128 | 594 | 527 |
| Ammonia as N | " | NL | ND ⁴ | 0.50 | <0.50 | 0.52 | <0.50 | <0.50 | 0.62 | 0.52 | 0.64 | 1.4 | <0.50 |
| Total Phenol | " | 0.1 | 0.06 | 0.005 | <0.005 | <0.005 | <0.005 | NA ⁵ | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Fecal Coliform | CFU/100 mL | NL | <1 | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 1 |
| Ag | mg/L | 0.05 | 0.003 | 0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 |
| B | " | 2 | 3.8 | 0.03 | 0.84 | 0.88 | 1.0 | 0.99 | 0.96 | 2.6 | 1.8 | 0.95 | 0.44 |
| Be | " | 0.004 | 0.002 | 0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Co | " | 1 | 0.035 | 0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.007 |
| Cr | " | 0.1 | 86.4 | 0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Cu | " | 0.65 | 0.004 | 0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Mn | " | 0.15 | 0.183 | 0.001 | 0.0047 | 0.0050 | 0.0038 | 0.0034 | 0.0020 | 0.0024 | 0.0022 | 0.0021 | 0.0035 |
| Se | " | 0.05 | 0.008 | 0.001 | <0.001 | <0.001 | 0.006 | 0.008 | <0.001 | 0.001 | <0.001 | 0.001 | <0.001 |
| V | " | 0.049 | ND | 0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Zn | " | 5 | 10 | 0.005 | 0.010 | 0.006 | 0.017 | 0.017 | 0.008 | 0.008 | 0.008 | 0.785 | 0.006 |
| Ca | " | NL | 276 | 1 | 148 | 77 | 95 | 91 | 125 | 65 | 76 | 33 | 123 |
| Mg | " | NL | 153 | 1 | 72 | 39 | 47 | 45 | 64 | 34 | 40 | 47 | 105 |

¹Lab reporting limit.

²Duplicate sample.

³No existing limit.

⁴Not determined.

⁵Not analyzed due to instrument malfunction.

REFERENCES

Black & Veatch, 2014, "Background Groundwater Quality Report for Thornton Composite Reservoir," prepared for the Metropolitan Water Reclamation District of Greater Chicago, July 2014.

Black & Veatch, 2016c, "Revised Groundwater Monitoring Plan, Groundwater Protection System for Thornton Composite Reservoir," prepared for the Metropolitan Water Reclamation District of Greater Chicago, May 2016.

Illinois EPA, 2012, 35 Illinois Administrative Code (IAC) Part 620 Class I Groundwater Standards, 2012.

Illinois Pollution Control Board, 2013, Illinois Administrative Code Title 35: Environmental Protection, Subtitle F: Potable Water Supplies, Chapter I: Pollution Control Board, Part 620 – Groundwater Quality, October 7, 2013.