MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 17-45

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

THIRD QUARTER 2017

November 2017

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

CECIL LUE-HING RESEARCH AND DEVELOPMENT COMPLEX
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November 3, 2017

Mr. Richard P. Cobb, P.G.
Deputy Division Manager
Division of Public Water Supplies
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, IL 62794

Dear Mr. Cobb:

Subject: Transmittal of the Report "Thornton Composite Reservoir Groundwater Monitoring Report Third Quarter 2017"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report Third Quarter 2017" 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 from TestAmerica Laboratory 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@mwrd.org.

Very truly yours,

Albert E. Cox, Ph.D.
Environmental Monitoring and Research Manager
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AC:PL:cm
Attachments
cc: Mr. E. Podczerwinski
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Thornton Composite Reservoir Groundwater Monitoring Report
Third Quarter 2017

By

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LIST OF ACRONYMS

Acronym	Definition
CCD	Chicago City Datum
CSF	Combined Sewer Flow
FC	Fecal Coliform
GMP	Groundwater Monitoring Plan
GPS	Groundwater Protection System
IAC	Illinois Administrative Code
M&R	Monitoring and Research
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 the Thornton Composite Reservoir contract 16-104-11. All analyses were performed by TestAmerica Analytical Laboratories, Inc. Special thanks are due 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 (8) 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 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

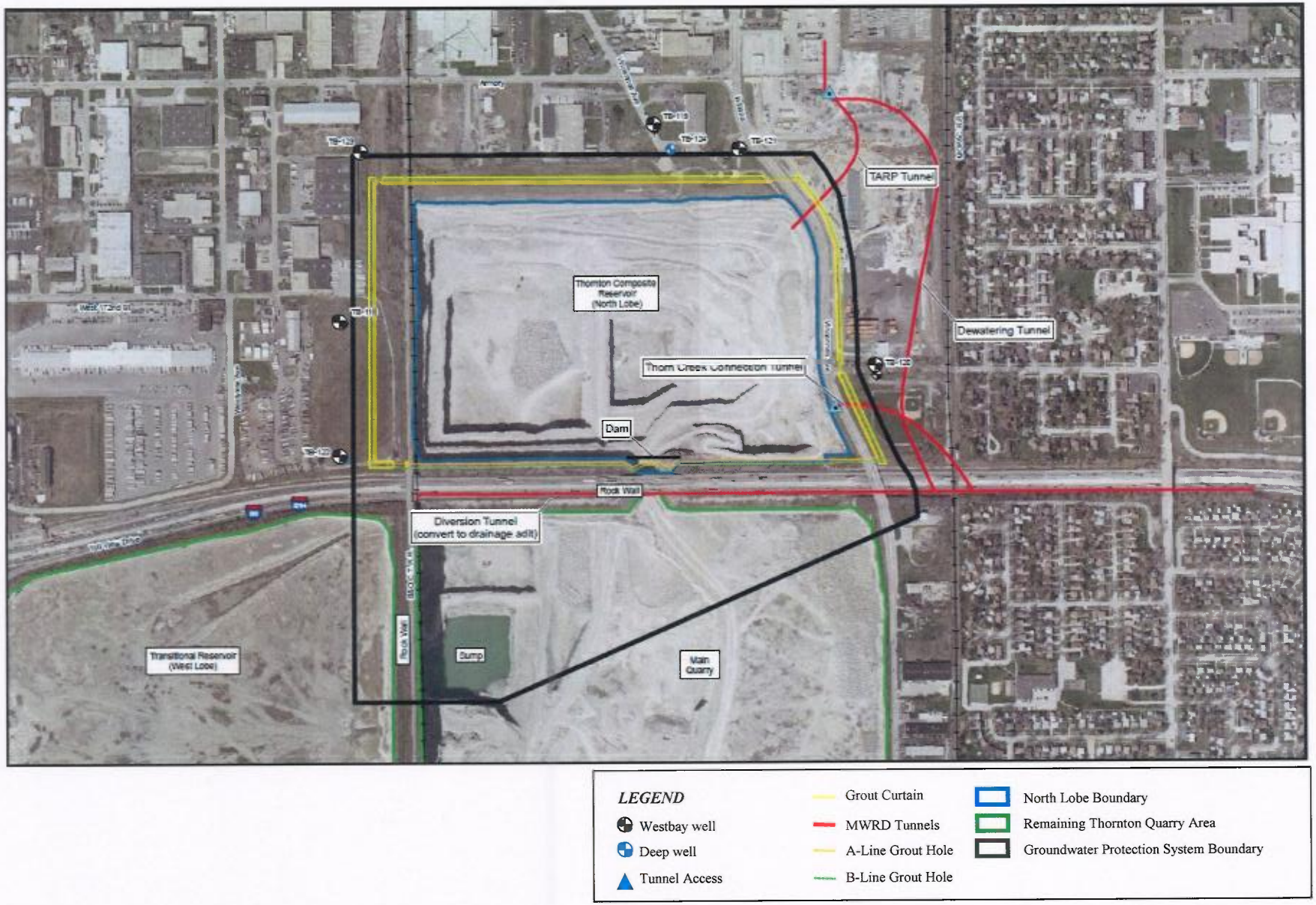

TABLE 1: CHARACTERISTICS OF MONITORING WELLS TB-118 THROUGH TB-124 AT THE THORNTON COMPOSITE RESERVOIR SITE

Well ID	Coordinates[1] Northing (ft)	Coordinates[1] Easting (ft)	Ground Surface El (ft, CCD[2])	Top of Riser El (ft, CCD[2])	Depth of Well (ft)	Sampling Port Interval (ft, CCD) 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			

[1]Illinois State Plane Coordinate System (NAD 1927).
[2]Chicago 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 2017. This report presents field activities, observations, and analytical (inorganic) data for surface and groundwater monitoring samples taken at the Main Quarry Sump and at all monitoring wells during the third quarter/fill-event sampling of July through September, 2017.

FIELD ACTIVITIES

For this report period, one set of fill-event monitoring samples was collected at the sump, the deep well, and at sampling port interval 4 of all multi-level wells. These fill-event samples also fulfilled the monitoring requirement for the third quarter of 2017. Samples were collected according to the schedule listed in Table 2.

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 the port sampled. Table 3 lists the elevations at Port 4 of each well and the corresponding groundwater elevations during this sampling period.

All samples were packed in ice and shipped to IL State ELAP/NELAC-certified TestAmerica Laboratories, Inc. for the analysis of selected inorganic constituents (IAC Title 35 Part 620 Class I Groundwater Standards) only, in accordance with the revised GMP for the fill-event samples. Additional aliquots were also prepared in the field and shipped in ice by Test America to Arro Laboratory, Inc. for fecal coliform analysis.

TABLE 2: DEVICES AND CORRESPONDING DATES OF SAMPLING DURING THE FILL EVENT OF JULY 2017

Date of Sampling	Device/Structure Sampled
July 25-27 Event:	
07/25/2017	TB-119, TB-121
07/26/2017	TB-120, TB-120 Dup, TB-123, Sump
07/27/2017	TB-118, TB-122, TB-124

TABLE 3: SUMMARY OF GROUNDWATER ELEVATIONS AT SAMPLING PORT 4 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING THE MONITORING EVENT OF JULY 2017

Well ID	Sampling Port 004 Elevation (ft CCD[1])	Groundwater Elevation (ft CCD)
TB-118	-398	-92
TB-119	-398	-178
TB-120	-399	-154
TB-121	-397	-188
TB-122	-397	-165
TB-123	-397	-52
TB-124[2]	NA[3]	-241

[1]Chicago City Datum.
[2]TB-124 is a conventional well screened from -663 to -698 ft below ground surface. During Quarter 3, one sample was taken at approximately 650 ft below ground surface.
[3]NA = Not Applicable.

ANALYTICAL RESULTS

Table 4 lists the analytical methods for parameters used by the laboratory. The analytical data for all well samples and the Main Quarry Sump sample collected during the third quarter (July 25-27, 2017) are presented in Table 5. Analytical results were reviewed to identify any analytes that exceeded the Illinois Class I Groundwater Standards (35 IAC Part 620).

During the July-September 2017 quarterly/fill-event sampling, among the inorganic analytes, there were a few exceedances of the Part 620 groundwater standards, including total dissolved solids (TDS), chloride, sulfate, and boron, as indicated in bold font in Table 5. These exceedances occurred in several wells and in the sump. However, none of these constituents showed concentrations exceeding the maximum background levels.

The fecal coliform (FC) populations of well samples collected during the sampling event of this quarter at all monitoring wells were all undetectable (Table 5). Fecal Coliform was detected in the Main Quarry sump at a low count of 30 CFU/100 mL (Table 5).

TABLE 4: ANALYTICAL METHODS USED FOR REQUIRED PARAMETERS

Inorganic Chemical Parameters	Analytical Method[1]
Chloride	325.2
Alkalinity, Bicarbonate	2320B
Total Dissolved Solids	2540C
Sulfate	4500-SO4-2 C or D
TAL metals	6010B & 7470A
Ammonia (as N)	350.1R2.0
Hardness	2340B
TOC	5310C
Others:	
Phenols	SVOC/8270C
Fecal Coliform	SM 9221E

[1]All standard EPA methods used by NELAC-certified and other laboratories.

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 JULY MONITORING

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL[1]	Well								
					TB-118	TB-119	TB-120	TB-120-D[2]	TB-121	TB-122	TB-123	TB-124	Sump
pH		6.5 - 9.0	8.4	NL[3]	6.8	7.4	6.9	6.9	7.8	7.6	7.3	8.4	7.9
EC	mS/m	NL	415	NL	221	165	281	281	134	248	91	227	137
TDS	mg/L	1,200	2,960	10	1,500	1,000	1,800	1,800	890	1,700	610	1,700	1,100
TOC	"	NL	1.0	1.0	2.7	2.4	2.7	2.7	2.2	<1.0	1.4	<1.0	1.9
Chloride	"	200	1,230	2	440	250	410	420	140	330	42	330	130
Sulfate	"	400	890	2	220	170	280	300	150	250	66	660	400
Ammonia as N	"	NL	NA[4]	0.20	0.51	0.34	0.52	0.51	0.41	0.41	0.36	1.0	<0.20
Total Phenol	"	0.10	0.06	0.005	<0.005	<0.005	<0.005	<0.005	<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	30
Ag	mg/L	0.05	0.003	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.000:	<0.0005	<0.0005	<0.0005
B	"	2	3.8	0.050	1.5	2.1	3.0	3.0	2.7	4.8	2.7	1.2	0.36
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	0.010
Cr	"	0.1	86.4	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	"	0.65	0.004	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Mn	"	0.15	0.183	0.0025	0.0060	0.0037	0.0042	0.0041	<0.0025	<0.002:	<0.0025	0.0048	<0.0025
Se	"	0.05	0.008	0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.002:	<0.0025	<0.0025	<0.0025
V	"	0.049	NA	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zn	"	5	10	0.020	0.020	0.046	0.033	0.093	0.024	0.395	0.039	1.7	0.020
Ca	"	NL	276	0.20	140	36	36	35	20	15	16	67	120
Mg	"	NL	153	0.20	71	20	21	20	11	7	95	75	93

[1]Lab reporting limit.
[2]Duplicate sample.
[3]No existing limit.
[4]No analysis performed.

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, 2016, "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.