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Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 18-30

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

SECOND QUARTER 2018

October 2018

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September 28, 2018

Mr. Richard P. Cobb, P.G.
Deputy Division Manager
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Illinois Environmental Protection Agency
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Dear Mr. Cobb:

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

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report Second 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. Guanglong Tian at (708) 588-4201 or guanglong.tian@mwr.org.

Very truly yours,



Albert E. Cox, Ph.D.

Environmental Monitoring and Research Manager
Monitoring and Research Department

AC:NK:cm

Attachment

cc: Mr. E. Podczerwinski/Dr. H. Zhang
Dr. G. Tian/Dr. P. Lindo
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**THORNTON COMPOSITE RESERVOIR GROUNDWATER
MONITORING REPORT SECOND QUARTER 2018**

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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
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 the Thornton Composite Reservoir Contract 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.

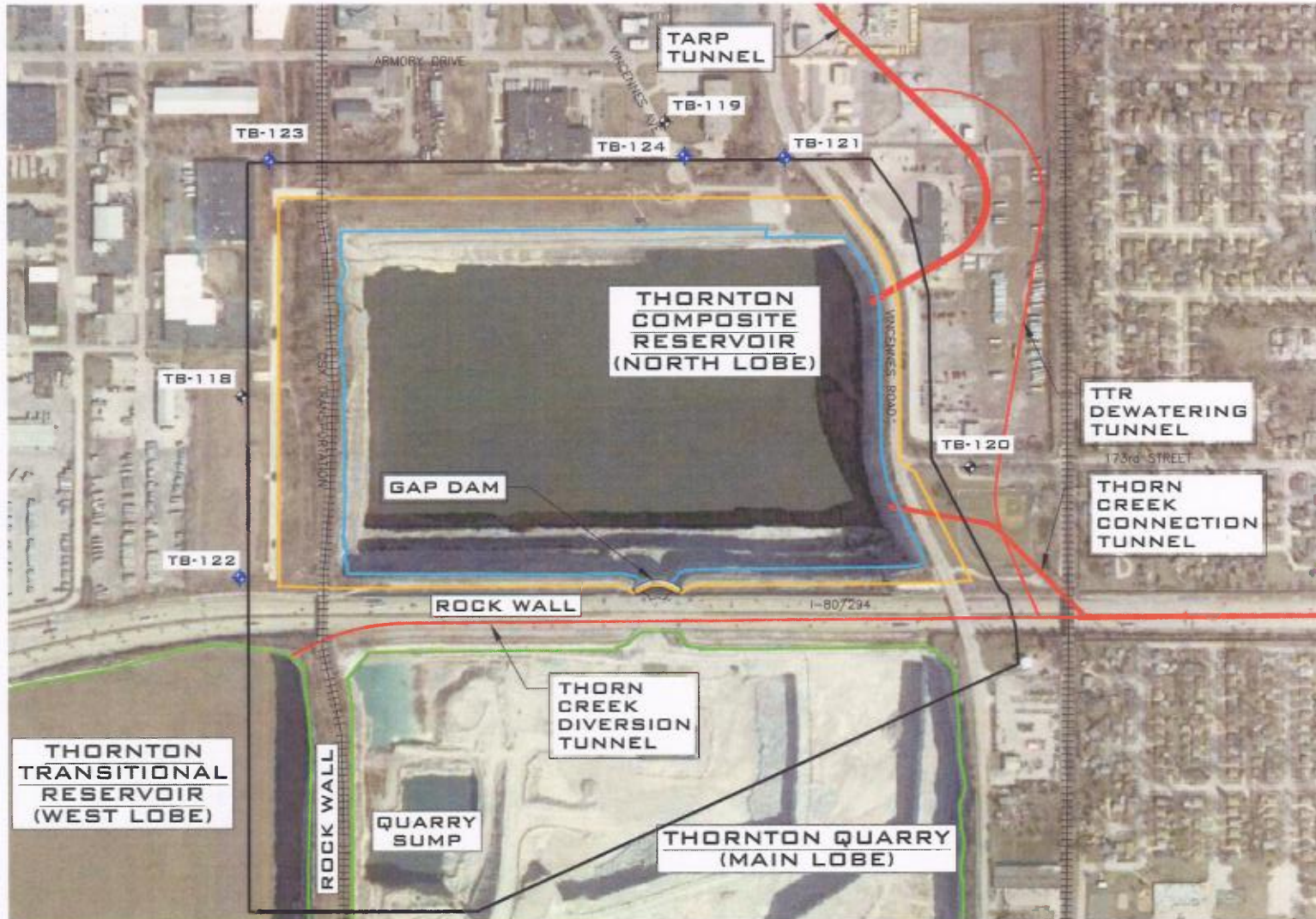
The monitoring well system consists of one deep well, TB-124, which monitors the underlying Galena Aquifer, and six vertical Westbay multi-level monitoring wells: TB-118, TB-119, TB-120, TB-121, TB-122, and TB-123, which monitor the Silurian Dolomite aquifers. As discussed in the Revised GMP, following 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 (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 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 were two fill events during the second 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 second quarter fill event samplings of May 15 - 17, 2018, and June 25 - 27, 2018.

FIELD ACTIVITIES

For this report period, two sets of fill event samples were collected at the sump, the deep well, and sampling port interval 3 of all multi-level wells during May 15 – 17, 2018, and at the sump, the deep well, and sampling port interval 2 during June 25 – 27, 2018. 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 and Table 4 list the elevations at Port 3 (May) and Port 2 (June) 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 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 EVENTS OF MAY AND JUNE 2018

Date of Sampling	Event	Device/Structure Sampled
5/15/2018	Fill Event #3	TB-119, TB-121, TB-121 Dup
5/16/2018	Fill Event #3	TB-118, TB-120, TB-122, Main Quarry Sump
5/17/2018	Fill Event #3	TB-123, TB-124
6/25/2018	Fill Event #2	TB-118, TB-122, TB-123, TB-123 Dup
6/26/2018	Fill Event #2	TB-120, TB-121
6/27/2018	Fill Event #2	TB-119, TB-124, Main Quarry Sump

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

Well ID	Sampling Port 003 Elevation	Groundwater Elevation
	----- (ft CCD) -----	
TB-118	-293	-96
TB-119	-293	-171
TB-120	-294	-203
TB-121	-292	-177
TB-122	-293	-171
TB-123	-292	-56
TB-124 ²	NA ³	-378

¹Chicago City Datum.

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

³NA = Not Applicable.

TABLE 4: SUMMARY OF GROUNDWATER ELEVATIONS AT SAMPLING
 PORT 2 OF EACH WELL AND CORRESPONDING GROUNDWATER
 ELEVATIONS DURING THE MONITORING
 EVENT OF JUNE 2018

Well ID	Sampling Port 002 Elevation	Groundwater Elevation
	----- (ft CCD) -----	
TB-118	-222	-96
TB-119	-222	-169
TB-120	-223	-173
TB-121	-221	-178
TB-122	-222	-173
TB-123	-221	-59
TB-124 ²	NA ³	-377

¹Chicago City Datum.

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

³NA = Not Applicable.

ANALYTICAL RESULTS

Table 5 lists the analytical methods for parameters used by the laboratory. 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 at the fill event of May 15 - 17, 2018, and June 25 – 27, 2018 during the second quarter are presented in Tables 6 and 7, respectively. There were a few exceedances of the Part 620 groundwater standards, including TDS, chloride, and sulfate, as indicated in bold font in Tables 6 and 7. However, none of these parameters showed a concentration higher than the background maximum.

The fecal coliform (FC) populations of samples collected at the two fill events during the second quarter were generally undetectable at the monitoring wells. There were 6 CFU/100 mL at the Main Quarry Sump for the May fill event (Table 6) and 1 CFU/100 mL at the TB-120 well for the June fill event (Table 7).

TABLE 5: 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 6: ANALYSIS OF GROUNDWATER SAMPLED FROM THE MONITORING WELLS TB-118 THROUGH TB-124 AND THE MAIN QUARRY SUMP AT THE THORNTON COMPOSITE RESERVOIR SITE DURING THE MAY 2018 MONITORING

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL ¹	Well								Sump
					TB-118	TB-119	TB-120	TB-121	TB-121-D ²	TB-122	TB-123	TB-124	
pH		6.5 - 9.0	8.4	NL ³	6.7	6.7	7.0	6.8	6.8	7.0	7.2	8.5	7.8
EC	mS/m	NL	415	NL ³	180	83.3	119	154	154	144	96.4	217	139
TDS	mg/L	1,200	2,960	25	1,154	488	750	956	978	760	684	1506	996
TOC	"	NL ³	1	1	2.5	1.8	2.1	1.7	1.4	2.1	1.6	<1.0	2
Chloride	"	200	1,230	5	265	52	145	233	235	166	53	271	152
Sulfate	"	400	890	5	220	NA ⁵	NA	NA	NA	NA	140	649	NA
Ammonia as N	"	NL ³	ND ⁴	0.1	0.52	0.45	0.37	0.58	0.61	0.49	0.64	1.17	<0.10
Total Phenol	"	0.1	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 ³	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	6
Ag	mg/L	0.05	0.003	0.001	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
B	"	2	3.8	0.03	0.88	0.95	0.96	1	0.98	2.54	1.95	1.11	0.25
Be	"	0.004	0.002	0.001	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Co	"	1	0.035	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0089
Cr	"	0.1	86.4	0.003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	"	0.65	0.004	0.004	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Mn	"	0.15	0.183	0.001	<0.0050	0.0057	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Se	"	0.05	0.008	0.005	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
V	"	0.049	ND	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zn	"	5	10	0.005	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.786	<0.100
Ca	"	NL ³	276	1	152	80.7	94.6	128	131	68.8	79.3	59.7	111
Mg	"	NL ³	153	1	74.2	41.0	47.1	65.5	67.1	34.8	42.0	58.0	74.5

¹Lab reporting limit.

²Duplicate sample.

³No existing limit.

⁴Not determined.

⁵No analysis performed due to instrument malfunction.

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TABLE 7: ANALYSIS OF GROUNDWATER SAMPLED FROM THE MONITORING WELLS TB-118 THROUGH TB-124 AND THE MAIN QUARRY SUMP AT THE THORNTON COMPOSITE RESERVOIR SITE DURING THE JUNE 2018 MONITORING

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL ¹	Well								Sump
					TB-118	TB-119	TB-120	TB-121	TB-122	TB-123	TB-123-D ²	TB-124	
pH		6.5 - 9.0	8.4	NL ³	7.2	6.7	6.7	6.8	6.9	7.5	7.5	8.3	8.0
EC	mS/m	NL	415	NL ³	269	160	211	121	393	59.3	59.3	226	151
TDS	mg/L	1,200	2,960	25	1,680	1048	1,342	736	2,622	408	418	1572	1,118
TOC	"	NL ³	1	1	2.2	1.5	2	1.3	2.3	1.1	1.1	<1.0	1.7
Chloride	"	200	1,230	5	558	264	353	139	979	7	8	275	165
Sulfate	"	400	890	5	232	181	219	114	359	24.0	25.7	639	416
Ammonia as N	"	NL ³	ND ⁴	0.1	0.47	0.58	0.28	0.68	0.33	0.58	0.57	1.13	<0.10
Total Phenol	"	0.1	0.06	0.005	0.008	0.006	0.006	0.005	0.008	0.005	0.005	0.005	<0.005
Fecal Coliform	CFU/100 mL	NL ³	<1	1	<1	<1	1	<1	<1	<1	<1	<1	<1
Ag	mg/L	0.05	0.003	0.001	0.0058	<0.0050	<0.0050	<0.0050	0.0057	<0.0050	<0.0050	<0.0050	<0.0050
B	"	2	3.8	0.03	0.42	0.92	0.48	1.01	0.16	1.71	1.91	1.09	0.31
Be	"	0.004	0.002	0.001	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Co	"	1	0.035	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0127
Cr	"	0.1	86.4	0.003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cu	"	0.65	0.004	0.004	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Mn	"	0.15	0.183	0.001	0.0086	0.0071	0.0073	<0.0050	0.0148	<0.0050	<0.0050	<0.0050	<0.0050
Se	"	0.05	0.008	0.005	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
V	"	0.049	ND	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zn	"	5	10	0.005	<0.100	0.29	<0.100	<0.100	<0.100	<0.100	<0.100	0.918	<0.100
Ca	"	NL ³	276	1	187	127	145	100	190	37.7	35.8	66.6	113.5
Mg	"	NL ³	153	1	88.9	65.5	67.8	52.7	88.5	21.2	20.2	57.1	84.8

¹Lab reporting limit.

²Duplicate sample.

³No existing limit.

⁴Not determined.

REFERENCES

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

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