

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 18-17

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

FIRST QUARTER 2018

July 2018

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July 17, 2018

Mr. Richard P. Cobb, P.G.
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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 First Quarter 2018"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report First 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 is the Excel spreadsheet 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
First 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.

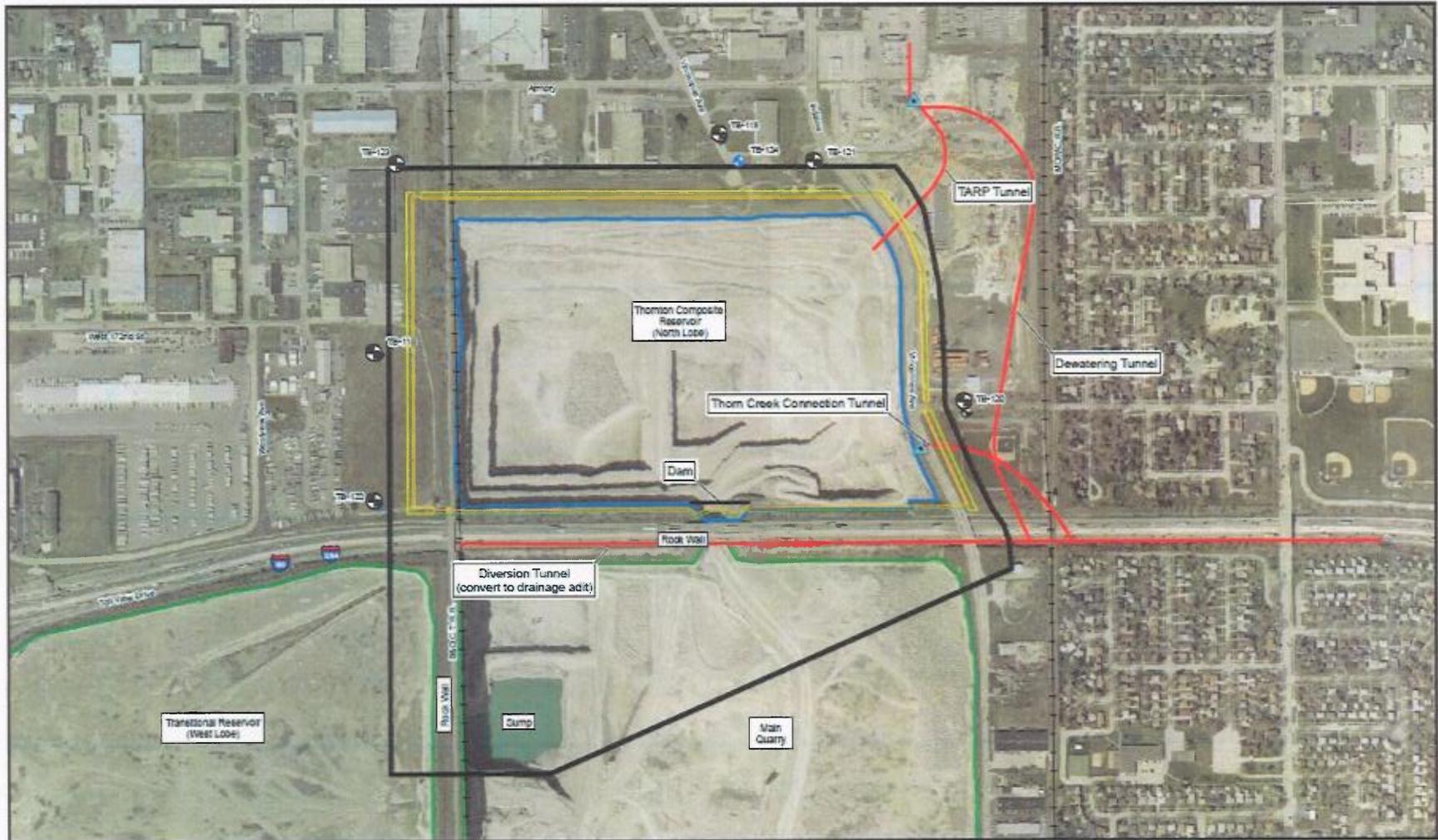
The monitoring well system consists of one deep well, TB-124, which monitors the underlying Galena Aquifer, and six vertical Westbay multi-level monitoring wells: TB-118, TB-119, TB-120, TB-121, TB-122, and TB-123, which monitor the Silurian Dolomite aquifers. As discussed in the Revised GMP, following 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			
	Grout Curtain		North Lobe Boundary
	Westbay well		Remaining Thornton Quarry Area
	Deep well		Groundwater Protection System Boundary
	Tunnel Access		MWRD Tunnels
			A-Line Grout Hole
			B-Line Grout Hole

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 first 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 first quarter fill event samplings of February 21 – 23, 2018, and March 7, 13, and 14, 2018.

FIELD ACTIVITIES

For the fill event, two sets of samples were collected, one during February 21 – 23, 2018, and the other during March 7, 13, and 14, 2018. These samples were collected at the sump, the deep well, and sampling port interval 2 of all multi-level wells. 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 2 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 TWO SAMPLINGS FOR THE FILL
EVENT OF THE FIRST QUARTER 2018

Date of Sampling	Event	Device Sampled
02/21/2018	Sampling #1	TB-120
02/22/2018	Sampling #1	TB-119, TB-121, TB-124, TB-124 Dup, Main Quarry Sump
02/23/2018	Sampling #1	TB-118, TB-122, TB-123
03/07/2018	Sampling #2	TB-123
03/13/2018	Sampling #2	TB-118, TB-118 Dup, TB-120, TB-122, Main Quarry Sump
03/14/2018	Sampling #2	TB-119, TB-121, TB-124

TABLE 3: SUMMARY OF ELEVATIONS AT SAMPLING PORT 2 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING THE MONITORING EVENT OF FEBRUARY 2018

Well ID	Sampling Port 002 Elevation (ft CCD ¹)	Groundwater Elevation (ft CCD)
TB-118	-222	-96
TB-119	-222	-173
TB-120	-223	-180
TB-121	-221	-181
TB-122	-222	-175
TB-123	-221	-60
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 Quarter 3, one sample was taken at approximately 650 ft below ground surface.

³NA = Not Applicable.

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

Well ID	Sampling Port 002 Elevation (ft CCD ¹)	Groundwater Elevation (ft CCD)
TB-118	-222	-95
TB-119	-222	-171
TB-120	-223	-150
TB-121	-221	-179
TB-122	-222	-170
TB-123	-221	-57
TB-124 ²	NA ³	-372

¹Chicago City Datum.

²TB-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.

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 first (February 21 - 23, 2018) and second (March 7, 13, and 14, 2018) samplings of the fill event during the first 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 samplings of the fill event during the sampling events of this quarter were undetectable at all monitoring wells, except for TB-118 and TB-120 for the first sampling (Table 6 and Table 7). The FC detected in these wells was at a low count of 3 CFU/100 mL at TB-118 and 1 CFU/100 mL at TB-120 (Table 6).

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 MONITORING WELLS TB-118 THROUGH TB-124 AND THE MAIN QUARRY SUMP AT THE THORNTON COMPOSITE RESERVOIR SITE AT THE FIRST SAMPLING OF THE FEBRUARY 2018 FILL EVENT

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- 124	TB-124- Dup	
pH		6.5-9.0	8.4		6.9	7.1	6.8	7.4	6.8	7.6	7.8	7.8	7.3
EC	mS/m	NL ²	415		269	142	225	147	396	146	213	213	133
TDS	mg/L	1,200	2,960	25	1,516⁴	910	1,284	668	2,708	344	1,524	1,522	1,008
TOC	"	NL	1	1	1.9	1.1	1.5	1	1.9	<1.0	<1.0	<1.0	1
Chloride	"	200	1,230	5	547	249	355	139	1,089	8	277	278	113
Sulfate	"	400	890	5	210	182	232	105	325	19	589	650	468
Ammonia as N	"	NL	NA ³	0.1	0.48	0.61	0.37	0.65	0.32	0.52	1.04	1.05	<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	<1	1	3	<1	1	ND ⁵	<1	<1	ND	ND	<1
II Ag	mg/L	0.05	0.003	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
B	"	2	3.8	0.03	0.415	0.938	0.72	1.021	0.144	1.761	1.177	1.182	0.314
Be	"	0.004	0.002	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Co	"	1	0.035	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0179
Cr	"	0.1	86.4	0.003	0.004	<0.003	<0.003	0.003	0.003	<0.003	0.004	0.004	0.005
Cu	"	0.65	0.004	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Mn	"	0.15	0.183	0.001	0.0082	0.0057	0.0058	0.0029	0.011	0.0016	0.004	0.0061	0.0075
Se	"	0.05	0.008	0.005	0.02	0.005	0.005	<0.005	0.015	<0.005	<0.005	<0.005	<0.005
V	"	0.049	NA	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	0.021	0.062	0.009	0.016	<0.005	0.02	1.208	1.429	0.009
Ca	"	NL	276	1	188	121	145	104	179	37	70	77	127
Mg	"	NL	153	1	91	65	72	57	85	22	63	65	91

¹Lab reporting limit.

²No existing limit.

³No analysis performed.

⁴Values bolded indicate the exceedance of Part 620 Groundwater Standard applicable to samples collected from monitoring wells only.

⁵Not determined due to QC failure during laboratory analysis.

TABLE 7: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELLS TB-118 THROUGH TB-124 AND THE MAIN QUARRY SUMP AT THE THORNTON COMPOSITE RESERVOIR SITE AT THE SECOND SAMPLING OF THE FEBRUARY 2018 FILL EVENT

Parameter	Unit	Part 620			Well								Sump
		Groundwater Standard	Maximum Background	Lab RL ¹	TB-118	TB-118-Dup	TB-119	TB-120	TB-121	TB-122	TB-123	TB-124	
pH		6.5-9.0	8.4		6.4	6.4	7.2	6.8	6.8	6.8	7.1	8.9	7.0
EC	mS/m	NL ²	415		239	239	144	171	110	261	64	199	126
TDS	mg/L	1,200	2,960	25	1,644⁴	1,654	954	1,156	680	1,788	300	1,388	922
TOC	"	NL	1	1	<1.0	1	<1.0	1.1	<1.0	1.5	<1.0	<1.0	<1.0
Chloride	"	200	1,230	5	585	583	249	298	148	558	10	263	128
Sulfate	"	400	890	5	209	211	168	191	112	314	19	518	381
Ammonia as N	"	NL	NA ³	0.1	0.41	0.38	0.52	<0.10	0.64	0.29	0.51	1.17	<0.10
Total Phenol	"	0.1	0.06	0.005	<.0005	<.0005	<.0005	0.008	<.0005	<.0005	0.02	0.005	<.0005
Fecal Coliform	CFU/100 mL	NL	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ag	mg/L	0.05	0.003	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
B	"	2	3.8	0.03	0.435	0.429	0.959	0.245	1.058	0.231	1.922	1.034	0.264
Be	"	0.004	0.002	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Co	"	1	0.035	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0087
Cr	"	0.1	86.4	0.003	<0.003	<0.003	<0.003	0.004	<0.003	<0.003	<0.003	0.003	<0.003
Cu	"	0.65	0.004	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Mn	"	0.15	0.183	0.001	0.0088	0.009	0.0055	0.0076	0.0028	0.0206	0.0015	0.003	0.0062
Se	"	0.05	0.008	0.005	0.013	0.014	0.009	0.015	0.01	0.01	<0.005	<0.005	0.006
V	"	0.049	NA	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	0.02	0.012	0.01	0.008	0.018	0.006	0.008	0.968	0.007
Ca	"	NL	276	1	187	187	123	135	107	172	37	40	114
Mg	"	NL	153	1	91	91	65	64	58	85	22	61	75

¹Lab reporting limit.

²No existing limit.

³No analysis performed.

⁴Values bolded indicate the exceedance of Part 620 Groundwater Standard applicable to samples collected from monitoring wells only.

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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