

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 19-06

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

FOURTH QUARTER/ANNUAL MONITORING 2018

April 2019

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April 8, 2019

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Dear Mr. Cobb:

Subject: Transmittal of the Report "Thornton Composite Reservoir Groundwater Monitoring Report Fourth Quarter/Annual Monitoring 2018"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report Fourth Quarter/Annual Monitoring 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@mwrdd.org.

Very truly yours,


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

AC:PL:cm
Attachment
cc: Mr. E. Podczewinski
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Thornton Composite Reservoir Groundwater Monitoring Report
Fourth Quarter/Annual Monitoring 2018

By

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LIST OF ACRONYMS

Acronym	Definition
B	Boron
CCD	Chicago City Datum
CFU	Colony Forming Unit
CSF	Combined Sewer Flow
EC	Electrical Conductivity
FC	Fecal Coliform
GMP	Groundwater Monitoring Plan
GPS	Groundwater Protection System
IAC	Illinois Administrative Code
MS	Matrix Sample
MSD	Matrix Sample Duplicate
Ni	Nickel
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 Department. All samples were collected by Andrews Engineering, Inc. (contractor) under the Thornton Composite Reservoir contract 18-100-11. All organic and metal analyses were performed by TestAmerica Analytical Laboratories, Inc. All inorganic analyses were performed by the Analytical Laboratories Division of the Metropolitan Water Reclamation District of Greater Chicago, while the Analytical Microbiology Laboratory performed the fecal coliform analyses. 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.

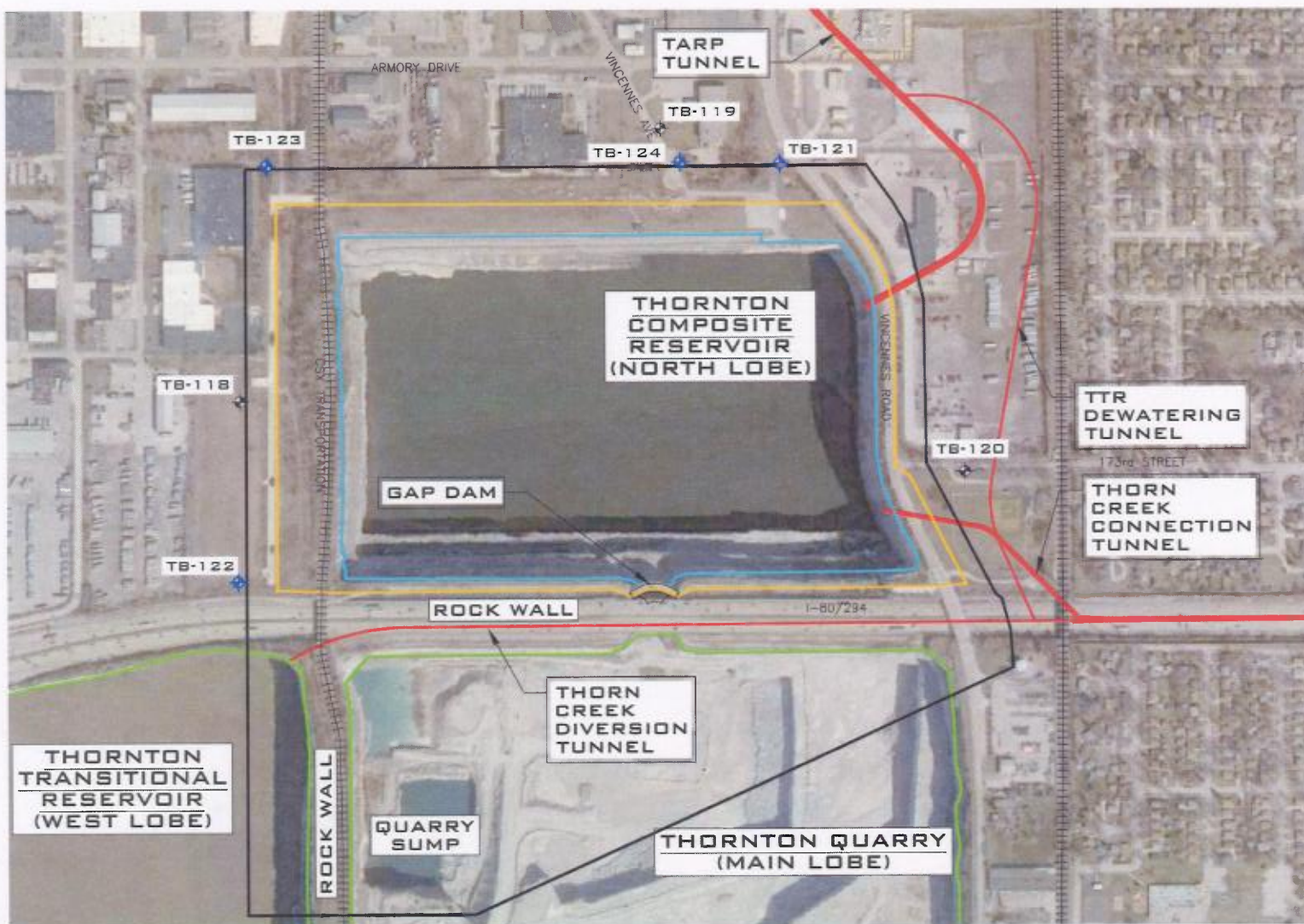
The monitoring well system consists of one deep well, TB-124, which monitors the underlying Galena Aquifer, and six vertical Westbay multi-level monitoring wells: TB-118, TB-119, TB-120, TB-121, TB-122, and TB-123, which monitor the Silurian Dolomite aquifers. As discussed in the Revised GMP, following a reservoir fill event, bi-weekly sampling is required as long as the water in the reservoir exceeds the critical 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 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.

During the fourth quarter of 2018, there was no fill event. The annual sampling event was conducted during this quarter, independent of a fill event. This report presents field activities, observations, and analytical data for surface and groundwater monitoring samples taken at the Main Quarry Sump, the Thornton Composite Reservoir, and at all monitoring wells during the annual sampling event of October 8 - 15, 2018.

FIELD ACTIVITIES

The annual sampling event was conducted during October 8 - 15, 2018, and was not associated with a fill event. These samples were collected as scheduled (Table 2) at the reservoir, the sump, the deep well, and at sampling Port Interval 3 of all multi-level wells.

Using a WTW Multi 3400i pH/conductivity/temperature meter, the pH, electrical conductivity (EC), and temperature were measured and recorded for each sample 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 recorded during this sampling period at sampling Port 3 of each well and the corresponding calculated groundwater elevations.

All samples were packed in ice and shipped to IL State ELAP/NELAC-certified TestAmerica Laboratories, Inc. for the analysis of selected metals and organic constituents (IAC Title 35 Part 620 Class I Groundwater Standards) in accordance with the revised GMP for the annual samples. Additional aliquots were also prepared in the field and shipped in ice to the Metropolitan Water Reclamation District of Greater Chicago's Analytical Microbiology and Biomonitoring Laboratory for fecal coliform analysis and to the Analytical Laboratories Division for the required inorganic analysis.

TABLE 2: DEVICES AND CORRESPONDING DATES OF SAMPLING DURING THE ANNUAL MONITORING EVENT OF OCTOBER 2018

Date of Sampling	Event	Device/Structure Sampled
10/08/2018	Annual Sampling	TB-119, TB-119 Duplicate
10/09/2018	Annual Sampling	TB-118
10/10/2018	Annual Sampling	TB-120, Main Quarry Sump
10/11/2018	Annual Sampling	TB-124, Reservoir
10/12/2018	Annual Sampling	TB-121, TB-122
10/15/2018	Annual Sampling	TB-123

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

Well ID	Sampling Port 003 Elevation (ft CCD ¹)	Groundwater Elevation (ft CCD)
TB-118	-289	-92
TB-119	-289	-166
TB-120	-290	-201
TB-121	-288	-172
TB-122	-288	-166
TB-123	-288	-54
TB-124 ²	NA ³	-372

¹Chicago City Datum.

²TB-124 is a conventional well screened from -663 to -698 CCD. During the October event, one sample was taken at approximately 378 ft below ground surface.

³NA = Not Applicable.

ANALYTICAL RESULTS

Table 4 lists the analytical methods used by the laboratories for quantifying the 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 the Thornton Composite Reservoir, the Main Quarry Sump, and all well samples collected during the annual sampling event of October 8 - 15, 2018, are presented in Table 5. During this event, there were a few exceedances of the Part 620 groundwater standards noted for TDS, chloride, sulfate, and boron as indicated in bold font in Table 5. However, none of these parameters showed a concentration higher than the background maximum.

Almost all organic parameters were undetectable in these devices (Table 5). Mecoprop (MCP) and Bis(2-ethylhexyl)phthalate were undetectable, but their respective lab reporting limits (0.14 and 0.0087 mg/L) were higher than the Part 620 groundwater standards (0.007 and 0.006 mg/L, respectively) and background concentrations (<0.13 and 0.005 mg/L, respectively). Methylene chloride was detected in Well TB-120 (0.0059 mg/L), slightly higher than its Part 620 groundwater standard (0.0050 mg/L). No background maximum was established for this compound.

During the annual sampling event, the fecal coliform (FC) populations of samples collected at all monitoring wells were all undetectable (Table 5), except for Well TB-124 (40 CFU/100 mL). The FC detected in the Main Quarry sump was 1 CFU/100 mL. There was a very high population of FC (>200,000 CFU/100 mL) in the Thornton Composite Reservoir.

TABLE 4: ANALYTICAL METHODS USED FOR REQUIRED PARAMETERS

Chemical Parameters:	Analytical Method
<u>Inorganic:</u>	
Perchlorate	314.1
Chloride, Fluoride, Sulfate	300.0, Rev. 2.1
Alkalinity, Bicarbonate	2320B
Total Dissolved Solids	2540C
Cyanide	335.4R1.0
Nitrate as N	353.2R2.0
TAL metals	200.7 & 200.8
TOC	5310C
Fecal Coliform	SM 9221E
<u>Radiological:</u>	
Radium-226 (pCi/L)	903.1
Radium-228 (pCi/L)	904.0
<u>Organic:</u>	
HMX; RDX; TNB; and TNT	Explosive
Dicamba; 2,4-D; Dalapon; Dinoseb; MCP; Picloram; and Silvex	Herb/8151
Endothall	Pest/548
Endosulfan; Endrin; Heptachlor; Heptachlor Epoxide; alpha-BHC; Lindane; Methoxychlor; and Toxaphene	Pest/8081
Chlordane	Pest/8081A
Polychlorinated biphenyls (PCBs)	PCB/8082
Alachlor; Atrazine; and Simazine	Pest/525.2
Aldicarb; and Carbofuran	Pest/531.1
SVOCs including Phenols	SVOC/8270C
1,2-Dibromo-3-chloropropane; and ethylene dibromide	VOC/8011
VOCs including P-Dioxane, and Cumene	VOC/8260B

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

Parameter	Part 620 Groundwater			Well								Sump	Reservoir
	Standard	Maximum Background	Lab RL ¹	TB-118	TB-119	TB-119D	TB-120	TB-121	TB-122	TB-123	TB-124		
pH	6.5-9.0	8.4		7.0	7.1	7.1	7.2	7.0	7.2	7.2	8.4	7.6	7.6
EC (mS/m)	NL ²	415		222	86	86	123	153	151	93	221	161	64
----- Concentration (mg/L) -----													
Total Dissolved Solids	1,200	2,960	10	1,232	532	528	714	908	844	554	1,396⁵	1,116	306
TOC	NL	1	1	2.5	1.3	1.2	2.0	1.3	2.0	2.0	1.1	1.3	9.4
Cyanide, Total	0.2	ND ³	0.010	NA ⁴	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride	4.0	3.2	0.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	200	1,230	20	346	52	51	142	240	196	52	253	181	66
Sulfate	400	890	20	ND	93	89	65	186	91	128	610	457	38
Perchlorate	0.0049	5.1	0.00005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ammonia	NL	ND	0.5	<0.50	<0.50	<0.50	<0.50	0.60	0.51	0.62	1.2	<0.50	7.3
METALS													
Ag	0.05	<0.005	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
As	0.01	0.025	0.0010	0.0011	<0.0010	0.0012	0.0023	<0.0010	<0.0010	<0.0010	0.0095	0.0020	0.0016
B	2.0	3.78	0.050	0.74	0.83	0.84	0.94	1.0	2.4	1.7	1.0	0.46	0.14
Ba	2.0	0.217	0.0025	0.039	0.031	0.030	0.039	0.095	0.014	0.051	0.021	0.022	0.026
Be	0.004	<0.004	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cd	0.005	<0.005	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Co	1.0	0.035	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0130	<0.0010
Cr	0.10	86.4	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cu	0.65	<0.005	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0050
Fe	5.0	3.25	0.10	0.26	0.17	0.38	0.18	<0.10	<0.10	<0.10	1.0	0.20	0.44
Hg	0.002	<0.0005	0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Mn	0.15	0.183	0.0025	0.0120	0.0051	0.0100	0.0037	0.0026	0.0027	<0.0025	0.0037	0.0072	0.0560
Ni	0.10	0.093	0.0020	0.0047	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0072	0.0390	0.0029
Pb	0.0075	0.006	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00120

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TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE MAIN QUARRY SUMP, AND THE THORNTON COMPOSITE RESERVOIR DURING THE ANNUAL MONITORING EVENT OF OCTOBER 2018

Parameter	Part 620 Groundwater			Well								Sump	Reservoir
	Standard	Maximum Background	Lab RL ¹	TB-118	TB-119	TB-119D	TB-120	TB-121	TB-122	TB-123	TB-124		
----- Concentration (mg/L) -----													
Sb	0.006	0.012	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Se	0.05	<0.01	0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Tl	0.002	0.013	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
V	0.049	ND	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zn	5.0	9.95	0.020	0.044	<0.020	<0.020	0.024	0.021	<0.020	0.024	0.530	<0.020	0.023
Ca	NL	276	0.20	170	78	80	89	130	68	77	82	150	55
Mg	NL	153	0.20	83	41	41	45	68	35	41	50	120	26
Fecal coliform (CFU/100 mL)	1	ND	1	<1	<1	<1	<1	<1	<1	<1	40	1	>200,000
----- Concentration (mg/L) -----													
HERBICIDES													
2,4-D	0.07	<0.00056	0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	0.00570
2,4,5-TP (Silvex)	0.05	<0.00028	0.00048	<0.00048	<0.00048	<0.00048	<0.00048	<0.00048	<0.00048	<0.00048	<0.00048	<0.00048	<0.00048
Atrazine	0.003	<0.00022	0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022	<0.0022
Dalapon	0.20	ND	0.0056	<0.0056	<0.0056	<0.0056	<0.0056	<0.0056	<0.0056	<0.0056	<0.0056	<0.0056	<0.0056
Dicamba	0.21	ND	0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056
Dinoseb	0.007	ND	0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
Endothall	0.100	ND	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Mecoprop	0.007	<0.130	0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14
Picloram	0.50	ND	0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056	<0.00056
Simazine	0.004	ND	0.0018	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018	<0.0018

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TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE MAIN QUARRY SUMP, AND THE THORNTON COMPOSITE RESERVOIR DURING THE ANNUAL MONITORING EVENT OF OCTOBER 2018

Parameter	Part 620			Well								Sump	Reservoir
	Groundwater Standard	Maximum Background	Lab RL ¹	TB-118	TB-119	TB-119D	TB-120	TB-121	TB-122	TB-123	TB-124		
----- Concentration (mg/L) -----													
PCBs													
PCB-1016 (Arochlor 1016)	0.0005	ND	0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045
PCB-1221 (Arochlor 1221)	0.0005	ND	0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045
PCB-1232 (Arochlor 1232)	0.0005	ND	0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045
PCB-1242 (Arochlor 1242)	0.0005	ND	0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045
PCB-1248 (Arochlor 1248)	0.0005	ND	0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045
PCB-1254 (Arochlor 1016)	0.0005	ND	0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045
PCB-1260 (Arochlor 1216)	0.0005	ND	0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045
PCBs, Total	0.0005	ND	0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045
PESTICIDES													
Alachlor	0.002	ND	0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045
Aldicarb	0.003	ND	0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
alpha-BHC (benzene hexachloride)	0.00011	ND	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Carbofuran	0.04	ND	0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Chlordane	0.002	ND	0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009

TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE MAIN QUARRY SUMP, AND THE THORNTON COMPOSITE RESERVOIR DURING THE ANNUAL MONITORING EVENT OF OCTOBER 2018

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL ¹	Well								Sump	Reservoir
				TB-118	TB-119	TB-119D	TB-120	TB-121	TB-122	TB-123	TB-124		
----- Concentration (mg/L) -----													
gamma-BHC (Lindane)	0.0002	ND	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Heptachlor	0.0004	ND	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Heptachlor epoxide	0.0002	ND	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Methoxychlor	0.040	ND	0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009
Toxaphene	0.003	ND	0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045
EXPLOSIVES													
1,3-Dinitrobenzene	0.0007	ND	0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043
2,4-Dinitrotoluene	0.0001	0.0684	0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043
2,6-Dinitrotoluene	0.0003	0.0197	0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022
1,3,5-Trinitrobenzene (TNB)	0.84	ND	0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011	<0.0011
2,4,6-Trinitrotoluene (TNT)	0.014	ND	0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043
Nitrobenzene	0.014	ND	0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043
HMX	1.4	0.04400	0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043	<0.00043
RDX (Cyclonite)	0.084	ND	0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022	<0.00022
VOCs													
1,1,1-Trichloroethane	0.200	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2-Trichloroethane	0.005	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethane	1.4	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethene	0.007	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloroethane	0.005	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloropropane	0.005	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE MAIN QUARRY SUMP, AND THE THORNTON COMPOSITE RESERVOIR DURING THE ANNUAL MONITORING EVENT OF OCTOBER 2018

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL ¹	Well								Sump	Reservoir
				TB-118	TB-119	TB-119D	TB-120	TB-121	TB-122	TB-123	TB-124		
----- Concentration (mg/L) -----													
1,2-Dibromo-3-Chloropropane	0.0002	ND	0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
1,2-Dibromoethane (Ethylene Dibromide)	0.00005	ND	0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
2-Butanone (Methyl Ethyl Ketone)	4.2	ND	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Acetone	6.3	ND	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0065	<0.0050	<0.0050	<0.0050	0.074
Benzene	0.005	ND	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Carbon disulfide	0.700	0.008	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020
Carbon tetrachloride	0.005	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chlorobenzene (benzene Cl)	0.100	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Chloroform	0.070	ND	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
cis-1,2-Dichloroethene	0.070	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ethylbenzene	0.700	ND	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0019
Isopropylbenzene (Cumene)	0.70	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Methylene Chloride (dichloromethane)	0.005	ND	0.0050	<0.0050	<0.0050	<0.0050	0.0059	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050
Methyl tert-butyl ether (MTBE)	0.070	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Tetrachloroethene	0.005	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene	1.0	0.008	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0011	<0.00050	0.0022

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TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE MAIN QUARRY SUMP, AND THE THORNTON COMPOSITE RESERVOIR DURING THE ANNUAL MONITORING EVENT OF OCTOBER 2018

Parameter	Part 620			Well								Sump	Reservoir
	Groundwater Standard	Maximum Background	Lab RL ¹	TB-118	TB-119	TB-119D	TB-120	TB-121	TB-122	TB-123	TB-124		
----- Concentration (mg/L) -----													
trans-1,2-Dichloroethene	0.100	<0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Trichloroethene	0.005	<0.002	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Trichlorofluoromethane	2.1	ND	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Vinyl chloride	0.002	<0.002	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Xylenes, Total	10	<0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	0.0021
SVOCs													
1,2,4-Trichlorobenzene	0.070	0.05	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichlorobenzene (ortho-)	0.600	0.049	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,4-Dichlorobenzene (para-)	0.075	0.048	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2-Methylnaphthalene	0.028	0.034	0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017
2-Methylphenol	0.350	ND	0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017
Acenaphthene	0.42	0.077	0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087
Anthracene	2.10	ND	0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087
Benzo[a]anthracene	0.00013	ND	0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014	<0.00014
Benzo[a]pyrene	0.0002	ND	0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017
Benzo[b]fluoranthene	0.00018	ND	0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017
Benzo[k]fluoranthene	0.00017	ND	0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017
Benzoic acid	28	ND	0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	0.020	<0.017	<0.017
Bis(2-ethylhexyl) phthalate	0.006	0.005	0.0087	<0.0087	<0.0087	<0.0087	<0.0087	<0.0087	<0.0087	<0.0087	<0.0087	<0.0087	<0.0087

TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE MAIN QUARRY SUMP, AND THE THORNTON COMPOSITE RESERVOIR DURING THE ANNUAL MONITORING EVENT OF OCTOBER 2018

Parameter	Part 620 Groundwater			Well									
	Standard	Maximum Background	Lab RL ¹	TB-118	TB-119	TB-119D	TB-120	TB-121	TB-122	TB-123	TB-124	Sump	Reservoir
----- Concentration (mg/L) -----													
Chrysene	0.012	ND	0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017
Dibenz(a,h)anthracene	0.0003	ND	0.00026	<0.00026	<0.00026	<0.00026	<0.00026	<0.00026	<0.00026	<0.00026	<0.00026	<0.00026	<0.00026
Diethyl phthalate	5.60	ND	0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043
Di-n-butyl phthalate	0.700	ND	0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043
Fluoranthene	0.280	0.113	0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087
Fluorene	0.280	ND	0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087
Hexachloro-cyclopentadiene	0.050	ND	0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Indeno[1,2,3-cd]pyrene	0.00043	ND	0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017	<0.00017
Naphthalene	0.140	ND	0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087
Pentachlorophenol	0.001	0.1690	0.00028	<0.00028	<0.00028	<0.00028	<0.00028	<0.00028	<0.00028	<0.00028	<0.00028	<0.00028	<0.00028
Phenolics, Total Recoverable	0.100	0.062	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Pyrene	0.210	0.126	0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087	<0.00087
RADIOACTIVITY													
Radium-226 (pCi/L)	20	4.31	0.124	2.42	1.59	1.74	0.987	3.16	1.48	1.77	4.50	0.374	0.246
Radium-228 (pCi/L)	20	2.58	0.580	1.14	<0.580	0.628	0.869	1.45	0.640	1.15	0.667	0.615	0.580

¹Lab reporting limit.

²No recorded limits available.

³No data available.

⁴Assignment of analysis to the lab inadvertently omitted.

⁵For well and sump samples only, concentrations in bold font indicate their exceedance of Part 620 Class 1 Groundwater Standards.

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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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.