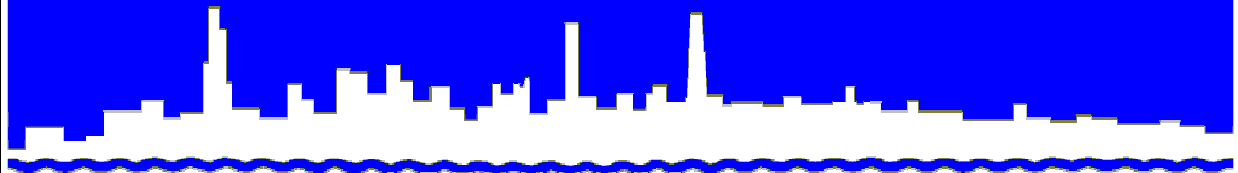


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

*MONITORING AND RESEARCH
DEPARTMENT*

REPORT NO. 17-23

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

FOURTH QUARTER 2016

May 2017

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May 9, 2017

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 Fourth Quarter 2016"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report Fourth Quarter 2016" 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@mwrdd.org.

Very truly yours,

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

AC:PL:cm
Attachments
cc: Mr. E. Podczerwinski
Dr. H. Zhang
Dr. G. Tian
Dr. P. Lindo

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**Thornton Composite Reservoir
Groundwater Monitoring Report
Fourth Quarter 2016**

**Pauline Lindo
Environmental Soil Scientist**

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Environmental Monitoring and Research Division**

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LIST OF ACRONYMS

Acronym	Definition
CCD	Chicago City Datum
CSO	Combined Sewer Overflow
District	Metropolitan Water Reclamation District of Greater Chicago
FC	Fecal Coliform
GMP	Groundwater Monitoring Plan
GPS	Groundwater Protection System
IAC	Illinois Administrative Code
M&R	Monitoring and Research
TCR	Thornton Composite Reservoir

ACKNOWLEDGEMENTS

This report for the Thornton Composite Reservoir Groundwater Monitoring was generated by the Monitoring and Research (M&R) Department according to the Thornton Composite Reservoir contract 16-104-11. All samples were collected by Andrew Engineering, Inc. (contractor) and the report prepared by the Soils Section. All analyses were performed by TestAmerica Analytical Laboratories, Inc. The final report was produced according to the new format guidelines of the Metropolitan Water Reclamation District of Greater Chicago's (District) M&R Department. Special thanks are due to Ms. Coleen Maurovich for preparing this report.

DISCLAIMER

Mention of proprietary equipment and chemicals in this report does not constitute endorsement by the District.

INTRODUCTION

A Groundwater Protection System (GPS) was constructed for the Thornton Composite Reservoir (TCR) to protect against the exfiltration of combined sewer overflow (CSO) into the surrounding dolomite aquifers. The CSOs 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 (Revised 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 CSO 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 Chicago City Datum (CCD) feet. 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 will also be compared with the IAC Title 35 Part 620 Class I Groundwater Standards (IPCB, Illinois EPA, 2013) to evaluate any exceedances in groundwater standards.

FIGURE 1: MONITORING WELL AND MAIN QUARRY SUMP LOCATIONS

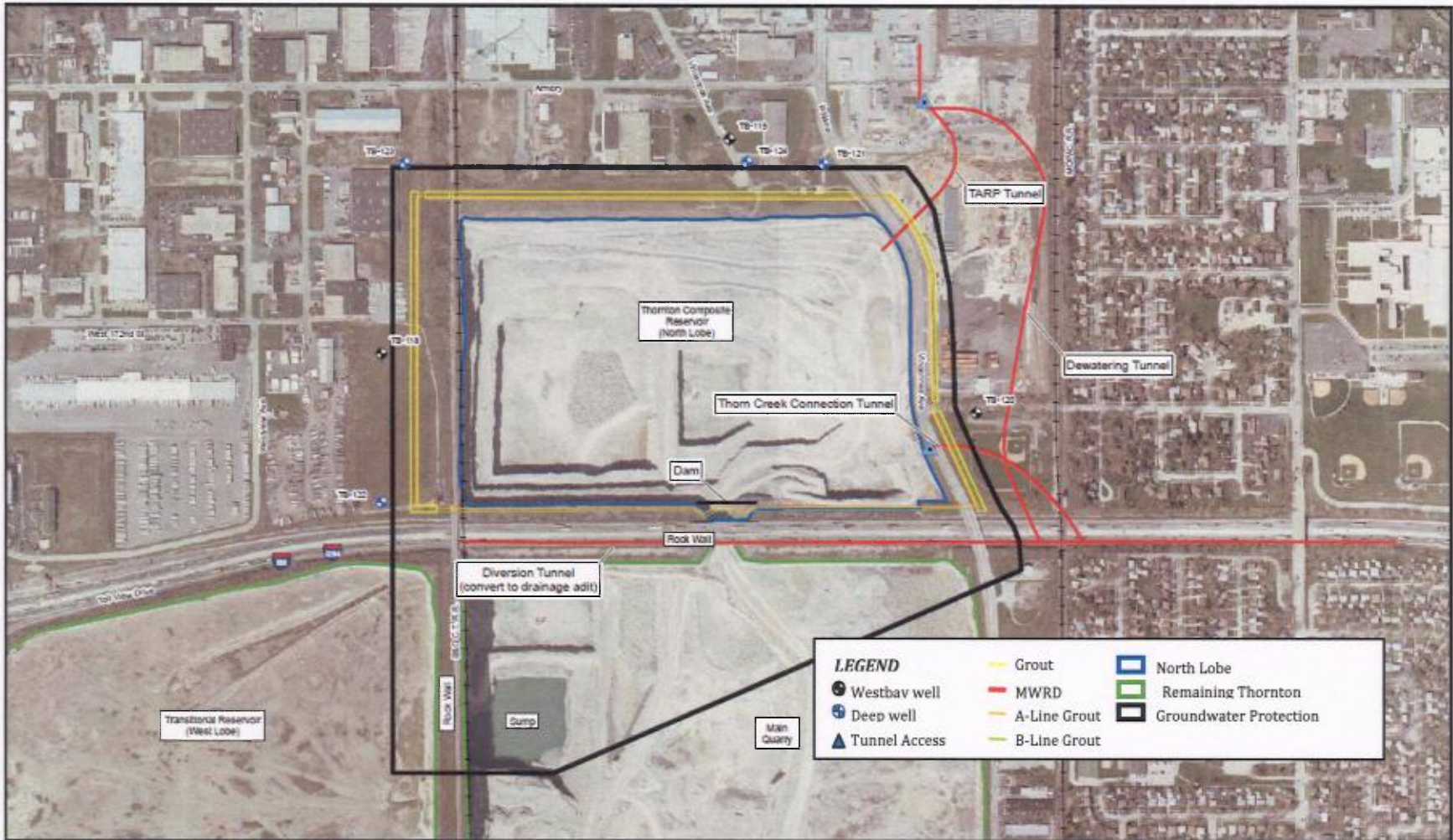


TABLE 1: CHARACTERISTICS OF MONITORING WELLS TB-118 THROUGH TB-124
AT THE THORNTON COMPOSITE RESERVOIR SITE

Well ID	Coordinates ¹		Ground Surface El ² (ft, CCD)	Top of Riser El ² (ft, CCD)	Depth of Well (ft)	Sampling Port Interval (ft, CCD)			
	Northing (ft)	Easting (ft)				Interval 1	Interval 2	Interval 3	Interval 4
TB-118	1791110.38	693560.44	38.5	41.5	532	-85 to -105	-212 to -232	-283 to -303	-392 to -412
TB-119	1792316.63	695509.39	27.9	29.5	529	-85 to -105	-212 to -232	-283 to -303	-392 to -412
TB-120	1790782.31	696888.93	40.0	42.1	540	-86 to -106	-213 to -233	-284 to -304	-393 to -413
TB-121	1792193.10	696044.98	29.4	30.4	461	-84 to -104	-211 to -231	-282 to -302	-391 to -411
TB-122	1790288.61	693549.38	48.8	51.7	480	-85 to -105	-212 to -232	-283 to -303	-392 to -412
TB-123	1792185.60	693685.69	28.9	31.8	460	-84 to -104	-211 to -231	-282 to -302	-391 to -411
TB-124	1792200.77	695591.56	29.6	29.2	728			-663 to -698	

¹Illinois State Plane Coordinate System (NAD 1927).

²Chicago City Datum (CCD).

There was no fill event during the fourth quarter of 2016. This report presents field activities, observations, and analytical (organic and inorganic) data for surface and groundwater monitoring samples taken at the Reservoir, the Main Quarry Sump, and all monitoring wells during the annual sampling event of December 12 – 28, 2016, which substituted for the fourth-quarter sampling. Laboratory analyses of all samples were performed by IL State ELAP/NELAC-certified Test America Laboratories, Inc. All samples were analyzed for constituents listed in the IAC Title 35 Part 620 Class I Groundwater Standards.

FIELD ACTIVITIES

The annual sampling event was conducted during December 12 - 28, 2016, and was not associated with a fill event. These samples also fulfilled the requirements for 2016 fourth quarter monitoring. During this period, there was very little water at the bottom of the reservoir. Due to extremely cold temperatures and intermittent holidays, groundwater samples were collected over an extended period of time at sampling port Interval 3 of all multi-level wells, and at the deep well, sump, and reservoir (Table 2).

TABLE 2: DEVICES AND CORRESPONDING DATES OF SAMPLING DURING THE ANNUAL SAMPLING EVENT OF DECEMBER 2016

Date of Sampling	Device/Structure Sampled
12/12/2016	Main Quarry Sump
12/13/2016	TB-119
12/14/2016	TB-119 Duplicate (D)
12/16/2016	TB-121
12/20/2016	TB-120 and -122
12/22/2016	TB-118 and -123
12/23/2016	TB-124
12/28/2016	Thornton Composite Reservoir

Each water sample collected was immediately analyzed in the field for pH and electrical conductivity. The temperature of each sample was also recorded.

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

All samples were packed in ice and shipped to Test America Laboratories, Inc. for the analysis of both organic and inorganic constituents, in accordance with the permit requirements for annual samples.

TABLE 3: SUMMARY OF ELEVATIONS AT PORT 3 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING THE SAMPLING EVENT OF DECEMBER 2016

Well and Interval ID	Sampling Port 003 Elevation (ft CCD)	Interval 3 Groundwater Elevation (ft CCD)
TB-118-003	-289	-99
TB-119-003	-289	-176
TB-120-003	-290	-194
TB-121-003	-288	-177
TB-122-003	-288	-158
TB-123-003	-288	-57
TB-124 ¹	-450	-382 ²

¹TB-124 is a conventional well screened from -663 to -698 CCD, and sample was taken at an elevation of approximately -450 ft.

²Interval 3 elevation not applicable, but groundwater elevation at time of sampling was -382 CCD.

ANALYTICAL RESULTS

The analytical methods and parameters used by the laboratory are provided in Table 4. Analytical results were reviewed to identify any analytes that exceeded the Illinois Class I Groundwater Standards (35 IAC Part 620). Table 5 shows the results of analyses for all well samples collected during the December fourth-quarter sampling.

During the December 2016 annual sampling event, among the inorganic analytes, there were a few exceedances of the Part 620 groundwater standards for total dissolved solids, chloride, sulfate, and boron, as indicated in bold numbers in Table 5. However, none of these parameters had a concentration higher than the maximum background concentration.

Of all the organic constituents tested, only two in the reservoir sample exceeded the Part 620 groundwater standard: benzo[b]fluoranthene (0.00043 mg/L) and bis (2-ethylhexyl) phthalate (0.0079 mg/L). All other organic contaminants tested were below the Illinois Environmental Protection Agency's Part 620 groundwater standards.

TABLE 4: ANALYTICAL METHODS USED FOR REQUIRED PARAMETERS

Chemical Parameters:	Analytical Method
<u>Inorganic:</u>	
Perchlorate	314.1
Chloride	325.2
Alkalinity, Bicarbonate	2320B
Total Dissolved Solids	2540C
Cyanide	335.4R1.0
Nitrate as N	353.2R2.0
Fluoride	4500-F,C
Sulfate	4500-SO4-2C or D
TAL metals	6010B & 7470A
TOC	5310C
Fecal Coliform	SM 9221E
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; MCPPP; 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
TOC	5310C
Fecal Coliform	SM 9221E

TABLE 5: ANALYSIS OF WATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT OF DECEMBER 2016

Well	TB-118-003			TB-119-003			TB-119-003D			TB-120-003			TB-121-003			TB-122-003			TB-123-003			TB-124			Sump			Reservoir											
Date sampled	12/22/16			12/13/16			12/14/16			12/20/16			12/16/16			12/20/16			12/22/16			12/23/16			12/12/16			12/28/16											
Parameter	Groundwater			Maximum			Standard			Background			Lab RL ¹																										
	Concentration (mg/L)																																						
pH	6.5 - 9.0			8.4			7.8			7.9			7.7			8.0			7.3			7.7			7.7			8.1			8.1			7.6					
EC (mS/m)	NL ²			415			154			47			83			105			105			86			63			179			0.08			ND ³					
Total Dissolved Solids	1,200			2,960			10			1,100			500			520			780			940			900			570			1,600			1,300			880		
TOC	NL			1			1			4			2			2			3			2			3			2			1			10			12		
Cyanide, Total	0.2			ND			0.010			<0.010			<0.010			<0.010			<0.010			<0.010			<0.010			<0.010			<0.010			<0.010					
Fluoride	4.0			3.2			0.20			0.24			0.42			0.48			0.47			0.29			0.82			0.49			1.0			0.30			0.23		
Chloride	200			1,230			20			430			50			56			160			210			230			55			280			180			350		
Sulfate	400			890			20			230			92			91			110			200			88			130			640			540			59		
Perchlorate	0.0049			5.1			0.000050			<0.000050			<0.000050			<0.000050			<0.000050			<0.000050			<0.000050			<0.000050			<0.000050			0.000098			0.000570		
Ammonia	NL			ND ³			0.4			0.45			0.41			0.48			0.46			0.55			0.55			0.62			0.95			<0.20			4.5		
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			<0.0010			<0.0010			<0.0010			0.0031			<0.0010			<0.0010			<0.0010			0.0036			<0.0010			0.0018		
B	2.0			3.78			1.00			<1.00			<1.00			<1.00			1.1			2.4			1.8			1.3			<1.00			<1.00			<1.00		
Ba	2.0			0.217			0.0025			0.0330			0.0310			0.0310			0.0350			0.0970			0.0170			0.0440			0.0220			0.0280			0.0410		
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			0.0150			<0.0010		
Cr	0.10			86.4			0.0050			0.0430			<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			0.0027			<0.0020			<0.0020			<0.0020			<0.0020			<0.0020			<0.0020			0.0072		
Fe	5.0			3.25			0.10			0.35			0.43			0.27			0.28			<0.10			0.10			<0.10			0.96			<0.10			0.76		
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			0.0090			0.0071			0.0046			0.0040			0.0028			0.0034			0.0024			0.0044			<0.0025			0.072		
Ni	0.10			0.093			0.0020			0.0290			<0.0020			<0.0020			<0.0020			<0.0020			0.0025			<0.0020			0.0086			0.0540			0.0041		
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			0.0019		
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		

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TABLE 5 (Continued): ANALYSIS OF WATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT OF DECEMBER 2016

Well				TB-118-	TB-119-	TB-119-	TB-120-	TB-121-	TB-122-	TB-123-	TB-124	Sump	Reservoir
				003	003	003D	003	003	003	003	12/23/16	12/12/16	12/28/16
Date sampled				12/22/16	12/13/16	12/14/16	12/20/16	12/16/16	12/20/16	12/22/16	12/23/16	12/12/16	12/28/16
Parameter	Groundwater Standard	Maximum Background	Lab RL ¹										
----- Concentration (mg/L) -----													
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	0.070	<0.020	0.036	0.053	0.027	0.031	0.023	0.910	<0.020	0.056
Ca	NL	276	0.20	150	83	76	86	130	64	69	81	150	72
Mg	NL	153	0.20	77	44	40	44	68	34	38	70	110	26
Fecal coliform ⁴ (CFU/100 mL)	1	ND	1	<10	<10	<10	<10	<10	<10	<10	<10	<10	>2000
HERBICIDES													
2,4,5-TP (Silvex)	0.05	<0.00028	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
2,4-D	0.07	<0.00056	0.00051	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051	0.00260
Dalapon	0.20	ND	0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Dicamba	0.21	ND	0.00051	<0.00051	0.00051	0.00051	0.00051	0.00051	0.00051	0.00051	0.00051	0.00051	0.00051
Dinoseb	0.007	ND	0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
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
MCP (Mecoprop)	0.007	<0.130	0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
Picloram	0.50	ND	0.00051	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051	<0.00051
PCBs													
PCB-1016 (Arochlor 1016)	0.0005	ND	0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038
PCB-1221 (Arochlor 1221)	0.0005	ND	0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038
PCB-1232 (Arochlor 1232)	0.0005	ND	0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038
PCB-1242 (Arochlor 1242)	0.0005	ND	0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038
PCB-1248 (Arochlor 1248)	0.0005	ND	0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038

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TABLE 5 (Continued): ANALYSIS OF WATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT OF DECEMBER 2016

Well Date sampled	Groundwater Standard	Maximum Background	Lab RL ¹	TB-118-	TB-119-	TB-119-	TB-120-	TB-121-	TB-122-	TB-123-	TB-124	Sump	Reservoir
				003 12/22/16	003 12/13/16	003D 12/14/16	003 12/20/16	003 12/16/16	003 12/20/16	003 12/22/16	12/23/16	12/12/16	12/28/16
Parameter				Concentration (mg/L)									
PCB-1254 (Arochlor 1016)	0.0005	ND	0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038
PCB-1260 (Arochlor 1216)	0.0005	ND	0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038	<0.00038
PESTICIDES													
Alachlor	0.002	ND	0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041
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	0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041
Atrazine	0.003	<0.00022	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
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 (technical)	0.002	ND	0.000081	<0.000081	<0.000081	<0.000081	<0.000081	<0.000081	<0.000081	<0.000081	<0.000081	<0.000081	<0.000081
Endrin	0.002	ND	0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041
gamma-BHC (Lindane)	0.0002	ND	0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041
Heptachlor	0.0004	ND	0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041
Heptachlor epoxide	0.0002	ND	0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041	<0.000041
Methoxychlor	0.040	ND	0.000081	<0.000081	<0.000081	<0.000081	<0.000081	<0.000081	<0.000081	<0.000081	<0.000081	<0.000081	<0.000081
Simazine	0.004	ND	0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016
Toxaphene	0.003	ND	0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041
EXPLOSIVES													
1,3-Dinitrobenzene	0.0007	ND	0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041
2,4-Dinitrotoluene	0.0001	0.0684	0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041
2,6-Dinitrotoluene	0.0003	0.0197	0.00039	<0.00039	<0.00039	<0.00039	<0.00039	<0.00039	<0.00039	<0.00039	<0.00039	<0.00039	<0.00039

TABLE 5 (Continued): ANALYSIS OF WATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT OF DECEMBER 2016

Well	Groundwater Maximum			TB-118-	TB-119-	TB-119-	TB-120-	TB-121-	TB-122-	TB-123-	TB-124	Sump	Reservoir
	Standard	Background	Lab RL ¹	003	003	003D	003	003	003	003	12/23/16	12/12/16	12/28/16
Date sampled				12/22/16	12/13/16	12/14/16	12/20/16	12/16/16	12/20/16	12/22/16	12/23/16	12/12/16	12/28/16
Parameter				Concentration (mg/L)									
1,3,5-Trinitrobenzene (TNB)	0.84	ND	0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
2,4,6-Trinitrotoluene (TNT)	0.014	ND	0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041
Nitrobenzene	0.014	ND	0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041
HMX	1.4	0.04400	0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041	<0.00041
RDX (Cyclonite)	0.084	ND	0.00021	<0.00021	<0.00021	<0.00021	<0.00021	<0.00021	<0.00021	<0.00021	<0.00021	<0.00021	0.00061
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
1,2-Dibromo-3-Chloropropane	0.0002	ND	0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018
1,2-Dibromoethane (Ethylene Dibromide)	0.00005	ND	0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018
2-Butanone (MEK, 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	0.0053	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0510
Benzene	0.005	ND	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Carbon disulfide	0.700	0.008	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<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, phenyl 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

TABLE 5 (Continued): ANALYSIS OF WATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT OF DECEMBER 2016

Well	Date sampled	Groundwater Standard	Maximum Background	Lab RL ¹	TB-118-	TB-119-	TB-119-	TB-120-	TB-121-	TB-122-	TB-123-	TB-124	Sump	Reservoir
					003	003	003D	003	003	003	003	003	12/22/16	12/23/16
					Concentration (mg/L)									
Chloroform	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	<0.0010
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	<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	<0.00050	<0.00050
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	<0.0010
Methylene Chloride (dichloromethane)	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	<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	<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	<0.0010
Toluene	1.0	0.008	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00066	<0.00050	0.00310
Total Xylenes	10	<0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012
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	<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	<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	<0.0010
Vinyl chloride	0.002	<0.002	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
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	<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	<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	<0.0010
2-Methylnaphthalene	0.028	0.034	0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016
2-Methylphenol	0.350	ND	0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016
Acenaphthene	0.42	0.077	0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079
Anthracene	2.10	ND	0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079
Benzo[a]anthracene	0.00013	ND	0.00013	<0.00013	<0.00013	<0.00013	<0.00013	<0.00013	<0.00013	<0.00013	<0.00013	<0.00013	<0.00013	<0.00013

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TABLE 5 (Continued): ANALYSIS OF WATER SAMPLED AT MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT OF DECEMBER 2016

Well	Date sampled	Groundwater Standard	Maximum Background	Lab RL ¹	TB-118-	TB-119-	TB-119-	TB-120-	TB-121-	TB-122-	TB-123-	TB-124	Sump	Reservoir
					003	003	003D	003	003	003	003	003	12/23/16	12/12/16
					----- Concentration (mg/L) -----									
Benzo[a]pyrene	0.0002	ND	0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	0.00018
Benzo[b]fluoranthene	0.00018	ND	0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	0.00043
Benzo[k]fluoranthene	0.00017	ND	0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016
Benzoic acid	28	ND	0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Bis(2-ethylhexyl) phthalate	0.006	0.005	0.0079	<0.0079	<0.0079	<0.0079	<0.0079	<0.0079	<0.0079	<0.0079	<0.0079	<0.0079	<0.0079	<0.0079
Chrysene	0.012	ND	0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	0.00048
Dibenz(a,h)anthracene	0.0003	ND	0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024	<0.00024
Diethyl phthalate	5.60	ND	0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	0.00076
Di-n-butyl phthalate	0.700	ND	0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Fluoranthene	0.280	0.113	0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	0.00100
Fluorene	0.280	ND	0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079
Hexachlorocyclopentadiene	0.050	ND	0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Indeno[1,2,3-cd]pyrene	0.00043	ND	0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	0.00019
Naphthalene	0.140	ND	0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079
Pentachlorophenol	0.001	0.1690	0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025
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	0.0065
Pyrene	0.210	0.126	0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079
RADIOACTIVITY														
Radium-226 (pCi/L)	20	4.31	1.13	2.45	1.41	1.32	1.44	2.03	1.20	1.43	5.59	<1.13	<1.13	1.19
Radium-228 (pCi/L)	20	2.58	1.48	<1.48	<1.48	<1.48	<1.48	<1.48	<1.48	<1.48	<1.48	<1.48	<1.48	2.81

¹Lab reporting limit.

²No recorded limits available.

³No data available.

⁴<10 CFU/100 ml is reported as no detection as a 10 mL aliquot was used for FC analysis of samples.

REFERENCES

Black & Veatch. "Revised Groundwater Monitoring Plan, Groundwater Protection System, Thornton Composite Reservoir, Contract 04-203-4F," prepared by Black & Veatch for Metropolitan Water Reclamation District of Greater Chicago, 2016.

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