

*Protecting Our Water Environment*



*Metropolitan Water Reclamation District of Greater Chicago*

***MONITORING AND RESEARCH  
DEPARTMENT***

***REPORT NO. 18-15***

***THORNTON COMPOSITE RESERVOIR***

***GROUNDWATER MONITORING REPORT***

***FOURTH QUARTER 2017***

***May 2018***

# Protecting Our Water Environment

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**Edward W. Podczewinski, P.E.**

Director of Monitoring and Research

April 9, 2018

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

Dear Mr. Cobb:

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

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report Fourth Quarter 2017" transmitted electronically. The report is prepared for transmittal to the Illinois Environmental Protection Agency (IEPA) in accordance with the Thornton Composite Reservoir Groundwater Monitoring Plan. Also attached are the Excel spreadsheets of the Thornton Composite Reservoir raw data from TestAmerica Laboratory as required by the IEPA.

If you have any questions or would like to have additional information, please contact Dr. Guanglong Tian at (708) 588-4201 or [guanglong.tian@mwr.org](mailto:guanglong.tian@mwr.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. Podczewinski

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**Thornton Composite Reservoir Groundwater Monitoring Report**  
**Fourth Quarter 2017**

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## LIST OF ACRONYMS

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Acronym	Definition
CCD	Chicago City Datum
CSF	Combined Sewer Flow
FC	Fecal Coliform
GMP	Groundwater Monitoring Plan
GPS	Groundwater Protection System
IAC	Illinois Administrative Code
M&R	Monitoring and Research
TCR	Thornton Composite Reservoir
TDS	Total Dissolved Solids
TOC	Total Organic Carbon

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## ACKNOWLEDGMENT

This report for the Thornton Composite Reservoir Groundwater Monitoring was generated by the Monitoring and Research (M&R) Department. All samples were collected by Andrews Engineering, Inc. (contractor) under the Thornton Composite Reservoir contract 16-104-11. All analyses were performed by TestAmerica Analytical Laboratories, Inc. Special thanks are due to Ms. Jennifer Wasik for providing staff support for preparing this report 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

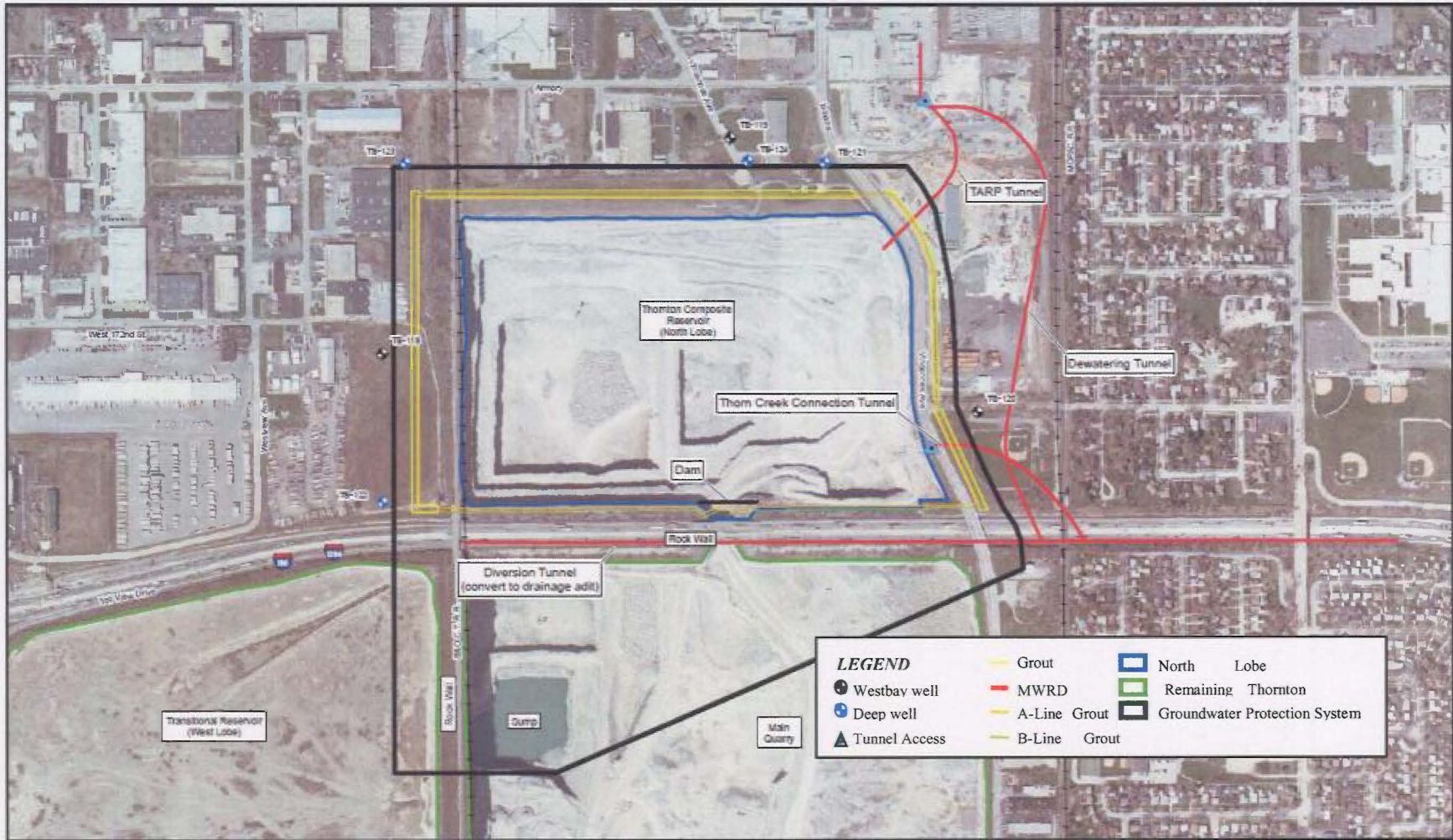


TABLE 1: CHARACTERISTICS OF MONITORING WELLS TB-118 THROUGH TB-124  
AT THE THORNTON COMPOSITE RESERVOIR SITE

Well ID	Coordinates <sup>1</sup>		Ground Surface El (ft, CCD <sup>2</sup> )	Top of Riser El (ft, CCD <sup>2</sup> )	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		

<sup>1</sup>Illinois State Plane Coordinate System (NAD 1927).

<sup>2</sup>Chicago City Datum (CCD).

will also be compared with the IAC Title 35 Part 620 Class I Groundwater Standards (IPCB, IEPA, 2013) to evaluate any exceedances in groundwater standards.

There was one fill event during the fourth quarter of 2017. There was also the annual sampling completed during this quarter which was not in conjunction with a fill event. 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 fourth quarter fill event sampling of November 20 – 27, 2017, as well as those samples taken at the Reservoir, the Main Quarry Sump, and at all monitoring wells for the annual sampling event of October 16 – 23, 2017.

## FIELD ACTIVITIES

The annual sampling event was conducted during October 16 – 23, 2017 and was not associated with a fill event. These samples were collected at the reservoir, the sump, the deep well, and at sampling port interval 2 of all multi-level wells. There was also one set of fill-event monitoring samples collected during November 20 – 27, 2017. These samples were collected at the sump, the deep well, and at sampling port interval 3 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 and Port 3 of each well and the corresponding groundwater elevations during this sampling period.

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

TABLE 2: DEVICES AND CORRESPONDING DATES OF SAMPLING DURING THE ANNUAL SAMPLING AND FILL EVENT OF THE FOURTH QUARTER 2017

Date of Sampling	Event	Device/Structure Sampled
10/16/2017	Annual Sampling	Main Quarry Sump, Thornton Composite Reservoir
10/17/2017	Annual Sampling	TB-120, TB-120 Dup
10/18/2017	Annual Sampling	TB-121
10/19/2017	Annual Sampling	TB-118, TB-123
10/20/2017	Annual Sampling	TB-122, TB-124
10/23/2017	Annual Sampling	TB-119
11/20/2017	Fill Event #9	Main Quarry Sump
11/21/2017	Fill Event #9	TB-118, TB-118 Dup, TB-122
11/22/2017	Fill Event #9	TB-120, TB-124
11/27/2017	Fill Event #9	TB-119, TB-121, TB-123

TABLE 3: SUMMARY OF GROUNDWATER ELEVATIONS AT SAMPLING PORT 2 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING THE MONITORING EVENT OF OCTOBER 2017

Well ID	Sampling Port 002 Elevation (ft CCD <sup>1</sup> )	Groundwater Elevation (ft CCD)
TB-118	-222	-98
TB-119	-222	-175
TB-120	-223	-201
TB-121	-221	-192
TB-122	-222	-176
TB-123	-221	-62
TB-124 <sup>2</sup>	NA <sup>3</sup>	-237

<sup>1</sup>Chicago City Datum.

<sup>2</sup>TB-124 is a conventional well screened from -663 to -698 ft below ground surface. During the October, one sample was taken at approximately 650 ft below ground surface.

<sup>3</sup>NA = Not Applicable.

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

Well ID	Sampling Port 003 Elevation (ft CCD <sup>1</sup> )	Groundwater Elevation (ft CCD)
TB-118	-293	-115
TB-119	-293	-175
TB-120	-294	-181
TB-121	-292	-179
TB-122	-293	-222
TB-123	-292	-85
TB-124 <sup>2</sup>	NA <sup>3</sup>	-243

<sup>1</sup>Chicago City Datum.

<sup>2</sup>TB-124 is a conventional well screened from -663 to -698 ft below ground surface. During Quarter 3, one sample was taken at approximately 650 ft below ground surface.

<sup>3</sup>NA = 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 during the Fourth Quarter (November 20-27, 2017) are presented in Table 6. During the November 2017 fill-event sampling, there were a few exceedances of the Part 620 groundwater standards, including pH, TDS, chloride, sulfate, and boron (Table 6). However, none of these parameters, except for pH, showed a concentration higher than the background maximum. The pH in TB-124 well water was 9.3 as compared to 8.4 for the background maximum

The analytical data for all well samples, the Thornton Composite Reservoir sample, and the Main Quarry Sump sample collected during the Annual sampling (October 16-23, 2017) are presented in Table 7. During the October 2017 annual sampling, there were a few exceedances of the Part 620 groundwater standards, including inorganic constituents: TDS and chloride, and organic constituents: Mecoprop, 2,4-Dinitrotoluene, Methylene Chloride (dichloromethane), Benzo[a]anthracene, Benzo[k]fluoranthene, and Bis(2-ethylhexyl) phthalate (Table 7). However, TB-122 was the only well showing TDS and chloride greater than the background maximum. Benzo[a]anthracene and Benzo[k]fluoranthene barely exceeded the Part 620 groundwater standards. Groundwater 2, 4-Dinitrotoluene had lower concentrations than the background maximum. The concentrations of Mecoprop and Bis (2-ethylhexyl) phthalate were only slightly higher than those of the background maximum. The exceedance of groundwater Methylene Chloride (dichloromethane) was observed only in three out of seven wells.

The fecal coliform (FC) populations of samples at all monitoring wells were all undetectable (Table 6 and Table 7). Fecal Coliform was detected at 3 CFU/100 mL in the Main Quarry sump and at >200 CFU/100 mL in the Thornton Composite Reservoir for the annual sampling event (Table 7).

TABLE 5: 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; 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
TOC	5310C
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 NOVEMBER 2017 MONITORING

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL <sup>1</sup>	Well								Sump
					TB 118	TB 118-Dup.	TB 119	TB 120	TB 121	TB 122	TB 123	TB 124	
pH		6.5 - 9.0	8.4		6.7	6.7	7.6	7.3	7.0	7.2	7.3	<b>9.3<sup>4</sup></b>	7.8
EC	mS/m	NL <sup>2</sup>	415		162	162	772	115	138	130	884	193	141
TDS	mg/L	1,200	2,960	10	1,200	1,200	480	720	950	870	540	<b>1,400</b>	1,200
TOC	"	NL <sup>3</sup>	1	1	3.5	3.5	1.8	2.4	1.9	2.4	1.8	1.8	1.7
Chloride	"	200	1,230	2	<b>340</b>	<b>340</b>	57	160	<b>250</b>	<b>240</b>	58	<b>300</b>	160
Sulfate	"	400	890	2	210	210	93	100	190	86	130	<b>620</b>	<b>550</b>
Ammonia as N	"	NL	NA <sup>3</sup>	0.2	0.50	0.52	0.42	0.26	0.54	0.53	0.68	1.0	0.20
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	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ag	mg/L	0.05	0.003	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
B	"	2	3.8	0.05	0.94	0.92	0.84	1.1	0.95	<b>2.5</b>	2.0	1.2	0.37
Be	"	0.004	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Co	"	1	0.035	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.018
Cr	"	0.1	86.4	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Cu	"	0.65	0.004	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Mn	"	0.15	0.183	0.0025	0.0043	0.0043	0.0060	0.0043	0.0028	0.0027	0.0026	0.0049	0.0025
Se	"	0.05	0.008	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
V	"	0.049	NA	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Zn	"	5	10	0.02	0.02	0.02	0.02	0.35	0.02	0.02	0.02	1.5	0.036
Ca	"	NL	276	0.2	140	140	77	100	120	67	80	45	140
Mg	"	NL	153	0.2	75	75	41	53	64	36	42	71	110

<sup>1</sup>Lab reporting limit.

<sup>2</sup>No existing limit.

<sup>3</sup>No analysis performed.

<sup>4</sup>Value bolded indicates the exceedance of Part 620 Groundwater Standard, applicable to samples collected from monitoring wells only.

TABLE 7: ANALYSIS OF GROUNDWATER SAMPLED FROM THE MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT IN OCTOBER 2017

Parameter	Part 620		Lab RL <sup>1</sup>	Well									
	Groundwater Standard	Maximum Background		TB-118	TB-119	TB-120	TB-120 Dup.	TB-121	TB-122	TB-123	TB-124	Sump	Reservoir
pH	6.5-9.0	8.4		6.7	7.8	7.1	7.1	7.3	7.1	7.4	8.9	7.6	7.1
EC (mS/m)	NL <sup>2</sup>	415		259	156	573	573	125	400	665	228	167	550
----- Concentration (mg/L) -----													
Total Dissolved Solids	1,200	2,960	10	1,700 <sup>4</sup>	1,000	1,200	1,200	750	3,000	390	1,700	1,400	290
TOC	NL	1	1	3.7	1.7	3.4	3.6	1.7	3.7	1.2	0.5	2.2	6.6
Cyanide, Total	0.2	ND <sup>3</sup>	0.010	<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	<0.20	0.32	0.33	0.23	0.45	<0.20	0.66	0.96	0.27	0.25
Chloride	200	1230	20	430	310	340	360	170	1,500	<20	350	180	62
Sulfate	400	890	20	220	180	200	200	110	370	26	650	530	48
Perchlorate	0.0049	5.1	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	ND <sup>3</sup>	<0.00005
Ammonia	NL	ND	0.4	0.44	0.51	0.33	0.38	0.59	0.33	0.54	0.91	0.20	3.3
<b>METALS</b>													
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	0.0012	0.0028	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0064	0.0019	0.0024
B	2.0	3.78	1.00	0.43	0.98	0.85	0.87	1.2	0.17	1.9	1.1	0.39	0.11
Ba	2.0	0.217	0.0025	0.065	0.035	0.049	0.050	0.038	0.10	0.055	<0.025	0.026	<0.025
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	0.012	<0.0010
Cr	0.10	86.4	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0084	<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	0.0066
Fe	5.0	3.25	0.10	0.46	0.99	0.15	0.15	0.12	0.11	<0.10	1.0	<0.10	0.95
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

TABLE 7 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM THE MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT IN OCTOBER 2017

Parameter	Part 620		Lab RL <sup>1</sup>	Well									
	Groundwater Standard	Maximum Background		TB-118	TB-119	TB-120	TB-120 Dup.	TB-121	TB-122	TB-123	TB-124	Sump	Reservoir
----- Concentration (mg/L) -----													
Mn	0.15	0.183	0.0025	0.0098	0.0065	0.0061	0.0062	0.0036	<0.025	<0.0025	0.0074	0.0036	0.060
Ni	0.10	0.093	0.0020	0.0086	0.0023	<0.0020	0.0027	<0.0020	0.0025	<0.0020	0.010	0.047	0.0035
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	0.0031
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	0.025	0.080	0.042	0.085	0.060	<0.020	<0.020	1.7	<0.020	0.029
Ca	NL	276	0.20	190	120	130	130	110	190	37	78	140	43
Mg	NL	153	0.20	93	66	68	69	57	91	21	66	110	17
Fecal coliform (CFU/100 mL)	1	ND	1	<1	<1	<1	<1	<1	<1	<1	<1	3	>200
HERBICIDES													
2,4,5-TP (Silvex)	0.05	<0.00028	0.00024	0.00028	0.00027	0.00025	0.00024	0.00025	0.00026	0.00028	0.00027	0.00024	0.00024
2,4-D	0.07	<0.00056	0.00048	0.00055	0.00054	0.00049	0.00048	0.00050	0.00053	0.00055	0.00053	0.00049	0.0011
Dalapon	0.20	ND	0.0048	0.0055	0.0054	0.0049	0.0048	0.0050	0.0053	0.0055	0.0053	0.0049	0.0048
Dicamba	0.21	ND	0.00048	0.00055	0.00054	0.00049	0.00048	0.00050	0.00053	0.00055	0.00053	0.00049	<0.00048
Dinoseb	0.007	ND	0.00096	0.0011	0.0011	0.00098	0.00096	0.0010	0.0011	0.0011	0.0011	0.00097	0.00096
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	<b>0.12</b>	0.13	<b>0.13</b>	<b>0.12</b>	<b>0.12</b>	<b>0.12</b>	<b>0.13</b>	<b>0.13</b>	<b>0.13</b>	<b>0.12</b>	0.12
Picloram	0.50	ND	0.00048	0.00055	0.00054	0.00049	0.00048	0.00050	0.00053	0.00055	0.00053	0.00049	0.00048

TABLE 7 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM THE MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT IN OCTOBER 2017

Parameter	Part 620		Lab RL <sup>1</sup>	Well									
	Groundwater Standard	Maximum Background		TB-118	TB-119	TB-120	TB-120 Dup.	TB-121	TB-122	TB-123	TB-124	Sump	Reservoir
----- Concentration (mg/L) -----													
PCBs													
PCB-1016 (Arochlor 1016)	0.0005	ND	0.00038	0.00046	0.00044	0.00040	0.00042	0.00044	0.00047	0.00042	0.00044	0.00041	0.00038
PCB-1221 (Arochlor 1221)	0.0005	ND	0.00038	0.00046	0.00044	0.00040	0.00042	0.00044	0.00047	0.00042	0.00044	0.00041	0.00038
PCB-1232 (Arochlor 1232)	0.0005	ND	0.00038	0.00046	0.00044	0.00040	0.00042	0.00044	0.00047	0.00042	0.00044	0.00041	0.00038
PCB-1242 (Arochlor 1242)	0.0005	ND	0.00038	0.00046	0.00044	0.00040	0.00042	0.00044	0.00047	0.00042	0.00044	0.00041	0.00038
PCB-1248 (Arochlor 1248)	0.0005	ND	0.00038	0.00046	0.00044	0.00040	0.00042	0.00044	0.00047	0.00042	0.00044	0.00041	0.00038
PCB-1254 (Arochlor 1016)	0.0005	ND	0.00038	0.00046	0.00044	0.00040	0.00042	0.00044	0.00047	0.00042	0.00044	0.00041	0.00038
PCB-1260 (Arochlor 1216)	0.0005	ND	0.00038	0.00046	0.00044	0.00040	0.00042	0.00044	0.00047	0.00042	0.00044	0.00041	0.00038
PESTICIDES													
Alachlor	0.002	ND	0.00038	0.00046	0.00044	0.00040	0.00042	0.00044	0.00047	0.00042	0.00044	0.00041	0.00038
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	0.000038	0.000046	0.000044	0.000040	0.000042	0.000044	0.000047	0.000042	0.000044	0.000041	0.000038
Atrazine	0.003	<0.00022	0.0019	0.0023	0.0023	0.0021	0.0022	0.0024	0.0023	0.0023	0.0021	0.0020	0.0190
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	0.000076	0.000093	0.000089	0.000080	0.000085	0.000089	0.000093	0.000084	0.000088	0.000082	0.000076
Endrin	0.002	ND	0.000038	0.000046	0.000044	0.000040	0.000042	0.000044	0.000047	0.000042	0.000044	0.000041	0.000038
Gamma-BHC (Lindane)	0.0002	ND	0.000038	0.000046	0.000044	0.000040	0.000042	0.000044	0.000047	0.000042	0.000044	0.000041	0.000038

TABLE 7 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM THE MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT IN OCTOBER 2017

Parameter	Part 620 Groundwater Standard	Maximum Background	Lab RL <sup>1</sup>	Well									
				TB-118	TB-119	TB-120	TB-120 Dup.	TB-121	TB-122	TB-123	TB-124	Sump	Reservoir
----- Concentration (mg/L) -----													
Heptachlor	0.0004	ND	0.000038	0.000046	0.000044	0.000040	0.000042	0.000044	0.000047	0.000042	0.000044	0.000041	0.000038
Heptachlor epoxide	0.0002	ND	0.000038	0.000046	0.000044	0.000040	0.000042	0.000044	0.000047	0.000042	0.000044	0.000041	0.000038
Methoxychlor	0.040	ND	0.000076	0.000093	0.000089	0.000080	0.000085	0.000089	0.000093	0.000084	0.000088	0.000082	0.000076
Simazine	0.004	ND	0.0016	0.0019	0.0018	<0.0016	0.0017	0.0018	0.0019	0.0017	0.0018	<0.0016	<0.0016
Toxaphene	0.003	ND	0.00038	0.00046	0.00044	0.00040	0.00042	0.00044	0.00047	0.00042	0.00044	0.00041	0.00038
EXPLOSIVES													
1,3-Dinitrobenzene	0.0007	ND	0.00044	0.00047	0.00046	0.00048	0.00046	0.00046	0.00048	0.00048	0.00046	0.00044	0.00044
2,4-Dinitroto- luene	0.0001	0.0684	0.00044	<b>0.00047</b>	<b>0.00046</b>	0.00048	<b>0.00046</b>	<b>0.00046</b>	<b>0.00048</b>	<b>0.00048</b>	<b>0.00046</b>	<b>0.00044</b>	0.00044
2,6-Dinitroto- luene	0.0003	0.0197	0.00022	0.00023	0.00023	0.00024	0.00023	0.00023	0.00024	0.00024	0.00023	0.00022	0.00022
1,3,5-Trinitro- benzene (TNB)	0.84	ND	0.00100	0.0012	0.0011	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0011	0.0011
2,4,6-Trinitro- toluene (TNT)	0.014	ND	0.00041	0.00047	0.00046	0.00048	0.00046	0.00046	0.00048	0.00048	0.00046	0.00044	0.00044
Nitrobenzene	0.014	ND	0.00041	0.00047	0.00046	0.00048	0.00046	0.00046	0.00048	0.00048	0.00055	0.00044	0.00044
HMX	1.4	0.04400	0.00041	0.00047	0.00046	0.00048	0.00046	0.00046	0.00048	0.00048	0.00046	0.00044	0.00044
RDX (Cyclonite)	0.084	ND	0.00021	0.00023	0.00023	0.00024	0.00023	0.00023	0.00024	0.00024	0.00023	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

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TABLE 7 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM THE MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT IN OCTOBER 2017

Parameter	Part 620			Well									
	Groundwater Standard	Maximum Background	Lab RL <sup>1</sup>	TB-118	TB-119	TB-120	TB-120 Dup.	TB-121	TB-122	TB-123	TB-124	Sump	Reservoir
				----- Concentration (mg/L) -----									
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 (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	<0.0050	<0.0050	<0.0050	<0.0050	0.046
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)	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	0.0010	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	<0.00050
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



TABLE 7 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM THE MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT IN OCTOBER 2017

Parameter	Part 620			Well									
	Groundwater Standard	Maximum Background	Lab RL <sup>1</sup>	TB-118	TB-119	TB-120	TB-120 Dup.	TB-121	TB-122	TB-123	TB-124	Sump	Reservoir
----- Concentration (mg/L) -----													
Methylene Chloride (dichloromethane)	0.005	ND	0.0050	<b>0.017</b>	<0.0050	<0.0050	<0.0050	<b>0.016</b>	<0.0050	<b>0.017</b>	<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	<0.00050	<0.00050	<0.0016
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
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	0.00050	<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
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	0.0016	0.0018	0.0018	0.0017	0.0017	0.0019	0.0018	0.0018	0.0017	0.0016	<0.0016
2-Methylphenol	0.350	ND	0.0016	0.0018	0.0018	0.0017	0.0017	0.0019	0.0018	0.0018	0.0017	0.0016	0.015
Acenaphthene	0.42	0.077	0.00079	0.00091	0.00090	0.00084	0.00087	0.00095	0.00091	0.00091	0.00085	0.00080	0.0076
Anthracene	2.10	ND	0.00079	0.00091	0.00090	0.00084	0.00087	0.00095	0.00091	0.00091	0.00085	0.00080	0.0076
Benzo[a]anthracene	0.00013	ND	0.00013	0.00015	<b>0.00015</b>	<b>0.00014</b>	0.00014	<b>0.00016</b>	<b>0.00015</b>	<b>0.00015</b>	<b>0.00014</b>	0.00013	0.0012
Benzo[a]pyrene	0.0002	ND	0.00016	0.00018	0.00018	0.00017	0.00017	0.00019	0.00018	0.00018	0.00017	0.00016	0.0015

TABLE 7 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM THE MONITORING WELLS TB-118 THROUGH TB-124, THE THORNTON COMPOSITE RESERVOIR, AND THE MAIN QUARRY SUMP DURING THE ANNUAL SAMPLING EVENT IN OCTOBER 2017

Parameter	Part 620		Lab RL <sup>1</sup>	Well									
	Groundwater Standard	Maximum Background		TB-118	TB-119	TB-120	TB-120 Dup.	TB-121	TB-122	TB-123	TB-124	Sump	Reservoir
----- Concentration (mg/L) -----													
Benzo[b]fluoranthene	0.00018	ND	0.00016	0.00018	0.00018	0.00017	0.00017	0.00019	0.00018	0.00018	0.00017	0.00016	0.0015
Benzo[k]fluoranthene	0.00017	ND	0.00016	<b>0.00018</b>	<b>0.00018</b>	0.00017	0.00017	<b>0.00019</b>	0.00018	<b>0.00018</b>	0.00017	0.00016	0.0015
Benzoic acid	28	ND	0.016	0.018	0.018	0.017	0.017	0.019	0.018	0.018	0.0084	0.016	0.15
Bis(2-ethylhexyl) phthalate	0.006	0.005	<b>0.0079</b>	<b>0.0091</b>	<b>0.009</b>	<b>0.0084</b>	<b>0.0087</b>	<b>0.0095</b>	<b>0.0091</b>	<b>0.0091</b>	<b>0.0085</b>	<b>0.008</b>	0.076
Chrysene	0.012	ND	0.00016	0.00018	0.00018	0.00017	0.00017	0.00019	0.00018	0.00018	0.00017	0.00016	0.0015
Dibenz(a,h)anthracene	0.0003	ND	0.00024	0.00027	0.00027	0.00025	0.00026	0.00029	0.00027	0.00027	0.00026	0.00024	0.0023
Diethyl phthalate	5.60	ND	0.0016	0.0045	0.0045	0.0042	0.0044	0.0048	0.0046	0.0046	0.0043	0.0040	0.038
Di-n-butyl phthalate	0.700	ND	0.0040	0.0045	0.0045	0.0042	0.0044	0.0048	0.0046	0.0046	0.0043	0.0040	0.038
Fluoranthene	0.280	0.113	0.00079	0.00091	0.00090	0.00084	0.00087	0.00095	0.00091	0.00091	0.00085	0.00080	0.0076
Fluorene	0.280	ND	0.00079	0.00091	0.00090	0.00084	0.00087	0.00095	0.00091	0.00091	0.00085	0.00080	0.0076
Hexachlorocyclopenta diene	0.050	ND	0.016	0.018	0.018	0.017	0.017	0.019	0.018	0.018	0.017	0.016	0.15
Indeno[1,2,3- cd]pyrene	0.00043	ND	0.00016	0.00018	0.00018	0.00017	0.00017	0.00019	0.00018	0.00018	0.00017	0.00016	0.0015
Naphthalene	0.140	ND	0.00079	0.00091	0.00090	0.00084	0.00087	0.00095	0.00091	0.00091	0.00085	0.00080	0.0076
Pentachlorophenol	0.001	0.1690	0.00024	0.00028	0.00027	0.00025	0.00024	0.00025	0.00026	0.00028	0.00027	0.00024	0.00024
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	0.00076	0.00091	0.00090	0.00084	0.00087	0.00095	0.00091	0.00091	0.00085	0.00080	0.0076
RADIOACTIVITY													
Radium-226 (pCi/L)	20	4.31	1.13	2.00	1.95	1.23	1.25	0.985	1.46	0.872	3.91	0.542	0.169
Radium-228 (pCi/L)	20	2.58	1.48	0.711	0.691	0.924	0.902	0.767	1.32	0.385	0.942	0.604	1.00

<sup>1</sup>Lab reporting limit.

<sup>2</sup>No existing limits.

<sup>3</sup>No data available.

<sup>4</sup>Value bolded indicates its exceedance of the 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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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.