MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 19-32

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

THIRD QUARTER 2019

December 2019

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

CECIL LUE-HING RESEARCH AND DEVELOPMENT COMPLEX
6001 WEST PERSHING ROAD CICERO, ILLINOIS 60804-4112

Edward W. Podczerwinski, P.E.
Director of Monitoring and Research

November 22, 2019

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

Dear Mr. Cobb:

Subject: Transmittal of the Report "Thornton Composite Reservoir Groundwater Monitoring Report Third Quarter 2019"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report Third Quarter 2019" transmitted electronically. The report is prepared for transmittal to the Illinois Environmental Protection Agency (IEPA) in accordance with the Thornton Composite Reservoir Groundwater Monitoring Plan. Also attached is the Excel spreadsheet of the Thornton Composite Reservoir raw data as required by the IEPA.

If you have any questions or would like to have additional information, please contact Mr. Benjamin Morgan at (708) 588-3743 or MorganB@mwrd.org.

Very truly yours,

Albert Cox

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

AC:BM:cm
Attachment
cc: Mr. E. Podczerwinski

Metropolitan Water Reclamation District of Greater Chicago
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Thornton Composite Reservoir Groundwater Monitoring Report

Third Quarter 2019

By

Benjamin Morgan
Environmental Soil Scientist

Guanglong Tian
Principal Environmental Scientist

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

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

ACKNOWLEDGMENT

This report for the Thornton Composite Reservoir Groundwater Monitoring was generated by the Monitoring and Research (M&R) Department. All samples were collected by Tetra Tech, Inc. (contractor) under the Thornton Composite Reservoir Contract 19-105-11. Analyses were performed by the Analytical Laboratories Division and the Analytical Bacteriology Laboratory of the Metropolitan Water Reclamation District of Greater Chicago. 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 overflow (CSF) into the surrounding dolomite aquifers. The CSF 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 while the water in the reservoir remains 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 the 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 ft CCD) The sump contains mainly groundwater and small quantities of surface runoff, and it is sampled quarterly and during fill events, 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

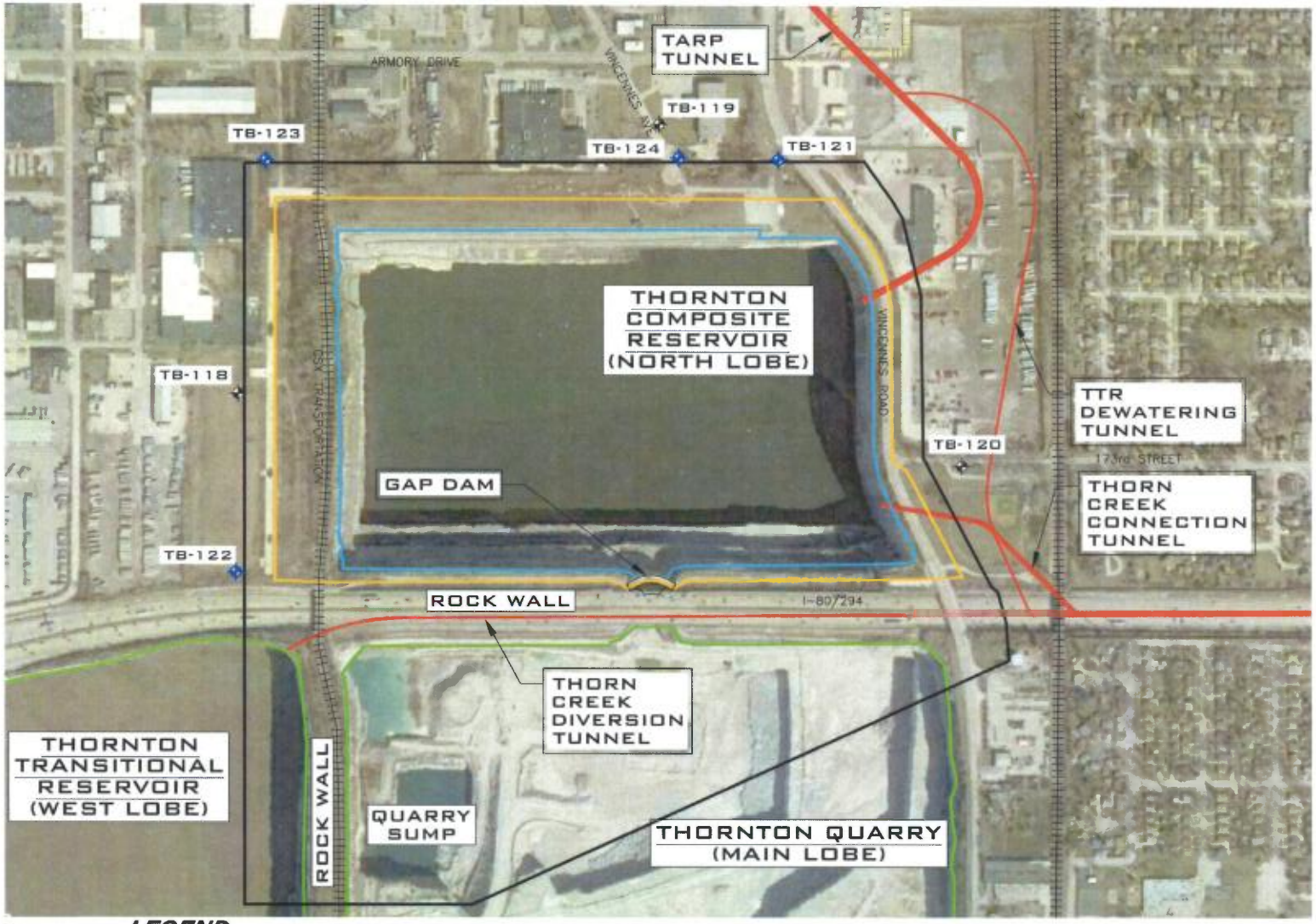

TABLE 1: CHARACTERISTICS OF MONITORING WELLS TB-118 THROUGH TB-124 AT THE THORNTON COMPOSITE RESERVOIR SITE

Well ID	Coordinates[1] Northing (ft)	Coordinates[1] Easting (ft)	Ground Surface El (ft, CCD[2])	Top of Riser El (ft, CCD[2])	Depth of Well (ft)	Sampling Port Interval (ft, CCD) 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			

[1]Illinois State Plane Coordinate System (NAD 1927).
[2]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 were two fill events during the third quarter of 2019. The first event (the second event of 2019) began in the second quarter, on April 29, and water elevation in the reservoir remained above -280 ft CCD continuously until August 6. Two bi-weekly fill event samplings were conducted on July 8 - 16 and July 23 – 25, 2019, at the Main Quarry Sump and all monitoring wells during this event in the third quarter. The second fill event during the quarter (the third event of 2019) began on August 18 and lasted for two days. One complete set of samples was collected at the Main Quarry Sump and all monitoring wells immediately following this event on August 21 – 23, 2019. Water elevation in the reservoir rose above -280 ft CCD on September 25, but this was not considered to be a fill event as this was due to dewatering of the Thornton Transitional Reservoir, which primarily contained water from Thorn Creek.

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 during fill event samplings conducted from July 8 – August 23, 2019.

FIELD ACTIVITIES

For this report period, three complete sets of samples were collected at the Main Quarry Sump, the deep well, and at sampling port interval 3 of all multi-level wells. Two sets were collected as part of bi-weekly fill event monitoring for the second fill event of 2019, from July 8 – 16 and from July 23 – 25. The third set was collected from August 21 – 23 for fill event monitoring during the third fill event of 2019. 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 Port 3 of each well. Table 3 lists the elevations at Port 3 of each well and the corresponding groundwater elevations during the fill event sampling in July and August 2019.

All samples were packed in ice and shipped to the Metropolitan Water Reclamation District of Greater Chicago's Analytical Laboratories Division for the analysis of selected inorganic constituents (IAC Title 35 Part 620 Class I Groundwater Standards) in accordance with the revised GMP. Additional aliquots were also prepared in the field and shipped in ice to the District's Analytical Bacteriology Laboratory for fecal coliform analysis.

TABLE 2: DEVICES AND CORRESPONDING DATES OF SAMPLING DURING FILL EVENT SAMPLING IN JULY AND AUGUST 2019

Date of Sampling	Event	Device/Structure Sampled
07/08/2019	Fill Event #2, Sampling #3	TB-119, TB-120, TB-121
07/09/2019	Fill Event #2, Sampling #3	TB-124, Sump, Sump Duplicate
07/15/2016	Fill Event #2, Sampling #3	TB-118, TB-122
07/16/2019	Fill Event #2, Sampling #3	TB-123
07/23/2019	Fill Event #2, Sampling #4	TB-120, TB-121, TB-122
07/24/2019	Fill Event #2, Sampling #4	TB-118, TB-119, TB-119 Duplicate, Sump
07/25/2019	Fill Event #2, Sampling #4	TB-123, TB-124
08/21/2019	Fill Event #3	TB-120, TB-121, TB-121 Duplicate
08/22/2019	Fill Event #3	TB-118, TB-119, TB-122, TB-124
08/23/2019	Fill Event #3	TB-123, Sump

TABLE 3: SUMMARY OF GROUNDWATER ELEVATIONS AT SAMPLING PORT 3 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING FILL EVENT MONITORING IN JULY AND AUGUST 2019

Fill Event	Sample Date	Well ID	Sampling Port 003 Elevation	Groundwater Elevation
			---------- (ft CCD[1]) ----------	
2-3	07/15/2019	TB-118	-289	-89
2-3	07/08/2019	TB-119	-289	-158
2-3	07/08/2019	TB-120	-290	-160
2-3	07/08/2019	TB-121	-288	-165
2-3	07/15/2019	TB-122	-288	-160
2-3	07/16/2019	TB-123	-288	-48
2-3	07/09/2019	TB-124[2]	NA[3]	-328
2-4	07/24/2019	TB-118	-289	-88
2-4	07/24/2019	TB-119	-289	-160
2-4	07/23/2019	TB-120	-290	-168
2-4	07/23/2019	TB-121	-288	-167
2-4	07/23/2019	TB-122	-288	-156
2-4	07/25/2019	TB-123	-288	-47
2-4	07/25/2019	TB-124	NA	-326
3	08/22/2019	TB-118	-289	-89
3	08/22/2019	TB-119	-289	-162
3	08/21/2019	TB-120	-290	-183
3	08/21/2019	TB-121	-288	-169
3	08/22/2019	TB-122	-288	-158
3	08/23/2019	TB-123	-288	-48
3	08/22/2019	TB-124	NA	-326

[1]Chicago City Datum.
[2]TB-124 is a conventional well screened from -663 to -698 ft CCD. During July, one sample was taken at approximately 650 ft below ground surface.
[3]NA = Not Applicable.

ANALYTICAL RESULTS

Table 4 lists the analytical methods used by the laboratory for 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 all well samples and the Main Quarry Sump sample collected during the first sampling of fill event monitoring in July, from July 8 – 16, are presented in Table 5. There were a few exceedances of the Part 620 groundwater standards, including TDS, chloride, and sulfate as indicated in bold font in Table 5. None of these parameters showed a value higher than the background maximum.

The analytical data for all well samples and the Main Quarry Sump sample collected during the second sampling of fill event monitoring in July, from July 23 – 25, are presented in Table 6. There were a few exceedances of the Part 620 groundwater standards, including pH, TDS, chloride, sulfate, boron, and zinc as indicated in bold font in Table 6. Among these parameters, only pH and zinc showed a value higher than the background maximum.

The analytical data for all well samples and the Main Quarry Sump sample collected during fill event monitoring in August, from August 21 – 23, are presented in Table 7. There were a few exceedances of the Part 620 groundwater standards, including TDS, chloride, sulfate, and boron as indicated in bold font in Table 7. None of these parameters showed a value higher than the background maximum.

Fecal coliform populations were detected at the Main Quarry Sump in all three fill event samples at 1 – 47 CFU/100 mL (Tables 5 – 7). Fecal coliform populations were undetected in all monitoring wells except for TB-123 during the first July fill event sampling at 340 CFU/100 mL (Table 5).

TABLE 4: ANALYTICAL METHODS USED FOR REQUIRED PARAMETERS

Parameters	Analytical Method
Chloride	SM 4500-Cl- D
Alkalinity, Bicarbonate	SM 2320 B
Total Dissolved Solids	SM 2540 C
Sulfate	USEPA 375.2R2.0,1993
Total Metals	SM3120B,1999
Ammonia (as N)	EPA 350.1
Hardness	SM 2340B,1997
TOC	SM 5310-C
Total Phenols	EPA 420.4
Fecal Coliform	SM 9221E

TABLE 5: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELLS TB-118 THROUGH TB-124 AND THE MAIN QUARRY SUMP AT THE THORNTON COMPOSITIE RESERVOIR SITE FOR THE FIRST SAMPLING OF FILL EVENT MONITORING IN JULY 2019

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL[1]	Well							Sump	Sump-D[2]
					TB-118	TB-119	TB-120	TB-121	TB-122	TB-123	TB-124		
pH		6.5 - 9.0	8.4	NL[3]	8.1	8.2	8.6	8.2	8.7	7.9	7.6	8.2	8.2
EC	mS/m	NL	415	NL	126	159	119	148	111	126	125	212	212
TDS	mg/L	1,200	2,960	25	**1312**	600	778	1094	770	568	**1560**	908	870
TOC	"	NL	1	1	<1.0	1.6	1.8	1.3	<1.0	<1.0	<1.0	1.7	1.8
Chloride	"	200	1,230	1	**391**	57	148	**264**	**232**	59	**287**	130	125
Sulfate	"	400	890	1	211	96	101	185	93	125	**638**	346	331
Ammonia as N	"	NL	ND[4]	0.30	0.49	0.62	0.41	0.62	0.42	0.61	1.1	<0.30	<0.30
Total Phenols	"	0.1	0.06	0.005	0.005	0.007	0.009	<0.005	<0.005	0.055	<0.005	0.007	<0.005
Fecal Coliform	CFU/100 mL	NL	<1	1	<1	<1	<1	<1	<1	340	<1	1	<1
Ag	mg/L	0.05	0.003	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
B	"	2	3.8	0.005	NRD[5]	0.868	0.961	0.847	NRD	1.79	0.895	0.238	0.239
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	0.004	0.005
Cr	"	0.1	86.4	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002
Cu	"	0.65	0.004	0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001
Mn	"	0.15	0.183	0.005	NRD	<0.005	<0.005	<0.005	NRD	<0.005	<0.005	<0.005	0.017
Se	"	0.05	0.008	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.003	<0.002	<0.002
V	"	0.049	ND	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	"	5	10	0.005	NRD	0.038	0.13	0.085	NRD	0.028	1.2	0.008	0.011
Ca	"	NL	276	0.5	NRD	87.1	98.1	143	NRD	77.6	65.1	102	123
Mg	"	NL	153	0.5	NRD	45.4	50.3	75.8	NRD	41.6	51.8	75.4	88.3

[1]Lab reporting limit.
[2]Duplicate sample.
[3]No existing limit.
[4]Not determined.
[5]No reportable data due to sample misidentification during transmittal or analysis.

TABLE 6: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELLS TB-118 THROUGH TB-124 AND THE MAIN QUARRY SUMP AT THE THORNTON COMPOSITIE RESERVOIR SITE FOR THE SECOND SAMPLING OF FILL EVENT MONITORING IN JULY 2019

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL[1]	Well								Sump
					TB-118	TB-119	TB-119-D[2]	TB-120	TB-121	TB-122	TB-123	TB-124	
pH		6.5 - 9.0	8.4	NL[3]	8.3	8.7	8.7	8.5	7.8	7.3	8.7	**9.4**	8.9
EC	mS/m	NL	415	NL	528	239	239	378	242	187	228	838	248
TDS	mg/L	1,200	2,960	25	**1,388**	504	500	702	1044	898	532	**1,564**	816
TOC	"	NL	1	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloride	"	200	1,230	1	**424**	59	59	141	**275**	**238**	60	**281**	121
Sulfate	"	400	890	1	218	101	100	96	192	94	127	**626**	314
Ammonia as N	"	NL	ND[4]	0.30	0.56	0.51	0.53	0.45	0.64	0.57	0.65	1.0	<0.30
Total Phenols	"	0.1	0.06	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.012	0.005	<0.005
Fecal Coliform	CFU/100 mL	NL	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	9
Ag	mg/L	0.05	0.003	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
B	"	2	3.8	0.005	0.666	0.849	0.869	0.954	0.964	**2.59**	1.68	0.964	0.256
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	0.005
Cr	"	0.1	86.4	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.015	0.011	0.013	<0.002
Cu	"	0.65	0.004	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.007	<0.001
Mn	"	0.15	0.183	0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.026	<0.005
Se	"	0.05	0.008	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.004	<0.002
V	"	0.049	ND	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	"	5	10	0.005	0.247	0.114	0.128	0.174	0.110	0.122	0.620	**34.4**	0.022
Ca	"	NL	276	0.5	167	80.5	84.2	89.5	128	67.9	77.7	112	93.6
Mg	"	NL	153	0.5	81.5	41.6	43.5	45.5	66.8	34.9	40.3	60.4	69.0

[1]Lab reporting limit.
[2]Duplicate sample.
[3]No existing limit.
[4]Not determined.

TABLE 7: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELLS TB-118 THROUGH TB-124 AND THE MAIN QUARRY SUMP AT THE THORNTON COMPOSITIE RESERVOIR SITE FOR FILL EVENT MONITORING IN AUGUST 2019

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL[1]	Well								Sump
					TB-118	TB-119	TB-120	TB-121	TB-121-D[2]	TB-122	TB-123	TB-124	
pH		6.5 - 9.0	8.4	NL[3]	8.5	8.2	7.8	6.3	6.3	8.1	7.7	8.6	7.8
EC	mS/m	NL	415	NL	123	112	139	187	187	154	108	232	158
TDS	mg/L	1,200	2,960	25	**1,378**	534	714	1,022	1,036	914	586	**1,550**	888
TOC	"	NL	1	1	2.3	1.4	1.3	<1.0	1.2	1.6	2.1	<1.0	2.0
Chloride	"	200	1,230	1	**411**	60	136	**262**	**262**	208	60	**263**	134
Sulfate	"	400	890	1	218	101	102	189	189	87	129	**556**	318
Ammonia as N	"	NL	ND[4]	0.30	0.55	0.52	0.47	0.65	0.67	0.52	0.62	1.1	<0.30
Total Phenols	"	0.1	0.06	0.005	0.010	0.005	<0.005	0.005	0.007	0.012	0.007	0.005	<0.005
Fecal Coliform	CFU/100 mL	NL	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	47
Ag	mg/L	0.05	0.003	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
B	"	2	3.8	0.005	0.695	0.831	0.947	0.951	0.940	**2.52**	1.71	0.856	0.276
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	0.005
Cr	"	0.1	86.4	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002
Cu	"	0.65	0.004	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Mn	"	0.15	0.183	0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Se	"	0.05	0.008	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002
V	"	0.049	ND	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	"	5	10	0.005	0.141	0.181	0.178	0.156	0.078	0.052	0.055	4.18	<0.005
Ca	"	NL	276	0.5	168	85.0	86.2	135	133	68.8	81.0	40.1	94.0
Mg	"	NL	153	0.5	82.7	43.7	43.9	69.9	69.6	35.4	43.4	39.1	71.5

[1]Lab reporting limit.
[2]Duplicate sample.
[3]No existing limit.
[4]Not determined.

REFERENCES

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