Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 23-19

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

FIRST QUARTER 2023

June 2023

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

CECIL LUE-HING RESEARCH AND DEVELOPMENT COMPLEX
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Edward W. Podczerwinski, P.E.
Director of Monitoring and Research

June 2, 2023

Mr. Michael Summers
Groundwater Section Manager
Bureau of Water/Public Water Supplies
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, IL 62794

Dear Mr. Summers:

Subject: Transmittal of the Report "Thornton Composite Reservoir Groundwater Monitoring Report First Quarter 2023"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report First Quarter 2023" transmitted electronically. The report is prepared for transmittal to the Illinois Environmental Protection Agency (IEPA) in accordance with the Thornton Composite Reservoir (TCR) Groundwater Monitoring Plan. Also attached is the Excel® spreadsheet of the TCR 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:lf
Attachments
cc: Mr. M. Brown, IEPA
Mr. E. Podczerwinski

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THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

FIRST QUARTER 2023

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Edward W. Podczerwinski, Director **June 2023**

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LIST OF ABBREVIATIONS

Acronym	Definition
CCD	Chicago City Datum
CFU	colony forming unit
CSF	combined sewer flow
EC	electrical conductivity
GMP	Groundwater Monitoring Plan
GPS	Groundwater Protection System
IAC	Illinois Administrative Code
TCR	Thornton Composite Reservoir
TDS	total dissolved solids
TOC	total organic carbon

ACKNOWLEDGMENTS

This report for the Thornton Composite Reservoir (TCR) Groundwater Monitoring was generated by the Monitoring and Research Department. All samples were collected by A3 Environmental Consultants (contractor) under TCR Contract 21-100-11. Analyses were performed by the Analytical Laboratories Division and the Analytical Microbiology Laboratory of the Metropolitan Water Reclamation District of Greater Chicago (District). Special thanks are due to Ms. Laura Franklin for typing and formatting 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 flow (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 from the Main Quarry Sump, and one from each of the seven wells are collected annually and analyzed for the Illinois Administrative Code Title 35 Part 620 Class I (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, sampling is required every two weeks while the water in the reservoir remains above an elevation of -280 feet 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 multilevel monitoring wells is capable of monitoring four distinct 20-foot intervals in the Silurian dolomite aquifer.

The locations of the monitoring wells, the quarry sump, the 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 feet 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 will also be compared with the Class I Groundwater Standards (Illinois Pollution Control Board, Illinois Environmental Protection Agency, 2013) to evaluate any exceedances in groundwater standards.

FIGURE 1: MONITORING WELL AND MAIN QUARRY SUMP LOCATIONS

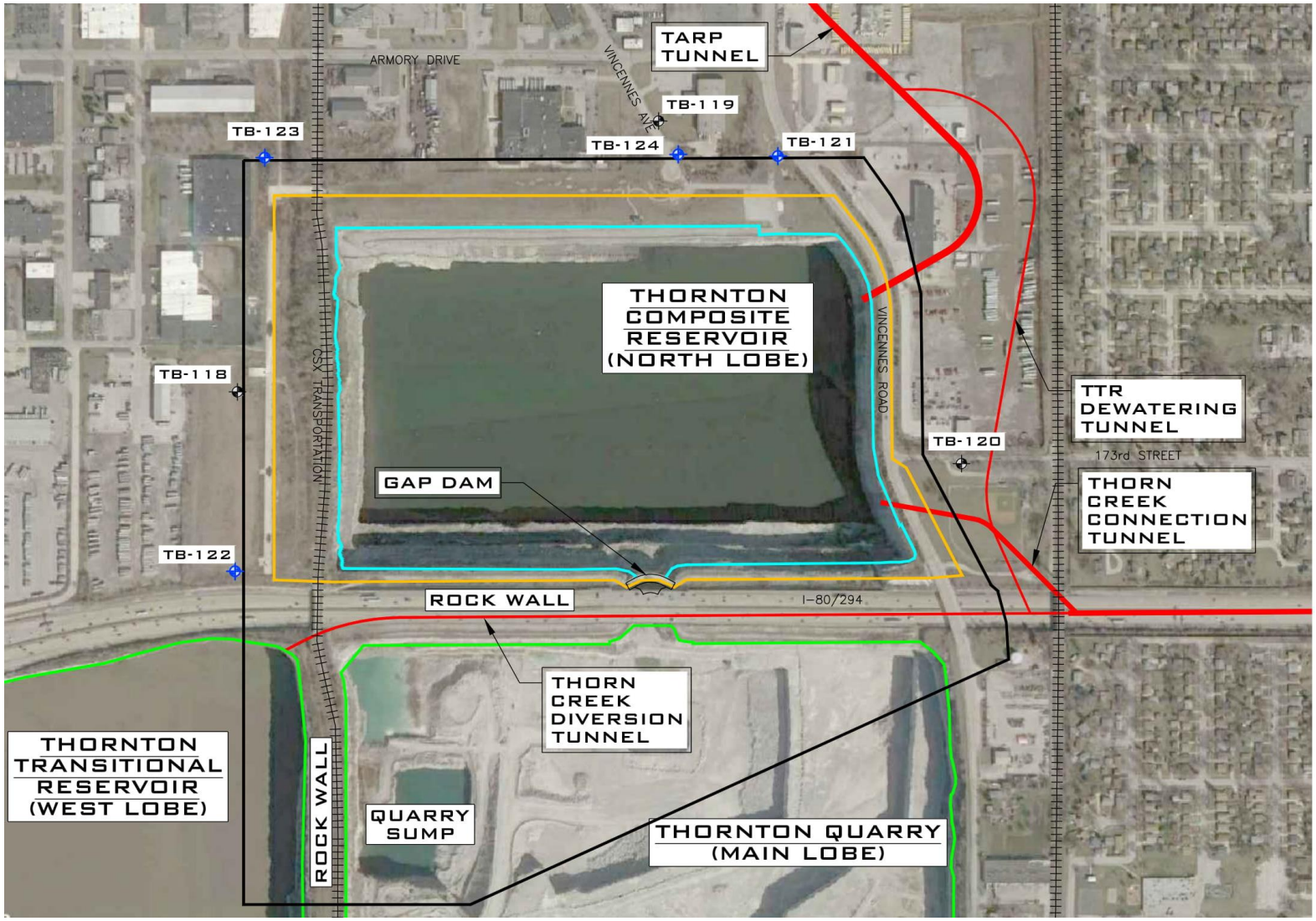

TABLE 1: CHARACTERISTICS OF MONITORING WELLS TB-118 THROUGH TB-124 AT THE THORNTON COMPOSITE RESERVOIR SITE

Well ID	Coordinates[1]		Ground Surface Elevation (ft, CCD[2])	Top of Riser Elevation (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	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[3]	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).
[3]TB-124 is a conventional well screened from -663 to -698 ft CCD. Samples are taken at approximately 650 ft below ground surface.

There was one fill event during the first quarter of 2023 (the first event of 2023). The fill event began on February 10 and lasted until February 12, requiring a single sampling. One complete set of fill event samples was collected during February 14 – 16, 2023, at the Main Quarry Sump and all monitoring wells. A duplicate well sample was inadvertently not collected.

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 from February 14 – 16, 2023.

FIELD ACTIVITIES

For this report period, fill event samples were collected at the Main Quarry Sump, the deep well, and at sampling port interval 3 of all multilevel wells from February 14 – 16, 2023. A well duplicate sample was inadvertently not collected. Sample collection dates are shown in Table 2.

Using an Oakton PC450 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 multilevel 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 February.

All samples were packed in ice and shipped to the Metropolitan Water Reclamation District of Greater Chicago's (District's) Analytical Laboratories Division for the analysis of selected inorganic constituents (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 Microbiology Laboratory for fecal coliform (FC) analysis.

TABLE 2: DEVICES AND CORRESPONDING DATES OF SAMPLING DURING THE FILL EVENT SAMPLING IN FEBRUARY 2023

Date of Sampling	Device/Structure Sampled
Fill Event #1	
02/14/23	TB-124, Main Quarry Sump
02/15/23	TB-119, TB-120, TB-121
02/16/23	TB-118, TB-122, TB-123

TABLE 3: SUMMARY OF ELEVATIONS AT SAMPLING PORT 3 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING FILL EVENT SAMPLING IN FEBRUARY 2023

Sample Date	Well ID	Sampling Port	Groundwater Elevation
		(ft CCD[1])	
		Fill #1	
02/16/23	TB-118	-289	-87
02/15/23	TB-119	-289	-165
02/15/23	TB-120	-290	-222
02/15/23	TB-121	-288	-169
02/16/23	TB-122	-288	-167
02/16/23	TB-123	-288	-51
02/14/23	TB-124[2]	NA[3]	-388

[1]Chicago City Datum.
[2]TB-124 is a conventional well screened from -663 to -698 ft CCD. Samples were taken at approximately 650 ft below ground surface during the fill event sampling in February 2023.
[3]Not applicable.

ANALYTICAL RESULTS

Table 4 lists the analytical methods used by the laboratory for measured parameters. Analytical results were reviewed to identify any analytes that exceeded the Class I groundwater standards.

The analytical data for all well samples and the Main Quarry Sump sample collected from February 14 – 16 for fill event monitoring are presented in Table 5. There were a few exceedances of the Class I groundwater standards, including pH, total dissolved solids (TDS), chloride, sulfate, and boron, as indicated in bold font in Table 5. Of these parameters, only pH exceeded the background maximum. Fecal coliform bacteria were not detected in any sample during this fill event sampling (Table 5).

TABLE 4: ANALYTICAL METHODS USED FOR REQUIRED PARAMETERS

Parameters	Analytical Method
Ammonia (as N)	USEPA 350.1
Boron and Target Analyte List metals except calcium, magnesium, and mercury	USEPA 200.8
Chloride, sulfate	USEPA 300.0
Fecal coliform	SM 9222D
Hardness (as calcium and magnesium)	SM 3120B, SM 2340B
Mercury	SM 3112B
Phenols	USEPA 420.4
Total dissolved solids	SM 2540C
Total organic carbon	SM 5310B

TABLE 5: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELLS TB-118 THROUGH TB-124 AND THE MAIN QUARRY SUMP AT THE THORNTON COMPOSITE RESERVOIR SITE FOR FILL EVENT SAMPLING IN FEBRUARY 2023

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL[2]	Well[1]							
					TB-118	TB-119	TB-120	TB-121	TB-122	TB-123	TB-124	Sump
pH		6.5–9.0	8.4	NL[3]	**9.3**	8.6	8.6	8.3	**9.1**	8.4	**10.4**	**10.2**
EC	mS/m	NL	415	NL	167	73.1	82.9	120	116	73.6	190	113
TDS	mg/L	1,200	2,960	25	**1,322**	544	610	980	876	546	1,182	**1,238**
TOC	"	NL	1	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	16.7	<5.0
Chloride	"	200	1,230	1	**445**	84	140	**322**	**262**	66	**213**	**207**
Sulfate	"	400	890	1	203	115	88	189	98	129	391	**531**
Ammonia as N	"	NL	ND[4]	0.3	0.55	0.60	0.47	0.71	0.60	0.70	1.80	<0.30
Total Phenol	"	0.1	0.06	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.024	<0.005
Fecal Coliform	CFU/100 mL	NL	<1	1	<1	<1	<1	<1	<1	<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
B	"	2	3.8	0.005	0.726	0.885	0.905	0.919	**2.96**	1.58	0.566	0.351
Be	"	0.004	0.002	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	0.015
Cr	"	0.1	86.4	0.002	<0.002	<0.002	0.007	0.003	0.003	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	0.005	<0.001
Mn	"	0.15	0.183	0.001	0.005	0.006	0.007	0.003	0.003	0.003	<0.001	<0.001
Se	"	0.05	0.008	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.003	0.002
V	"	0.049	ND	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	"	5	10	0.005	0.009	0.016	0.023	0.010	0.013	0.012	0.962	0.006
Ca	"	NL	276	0.5	162	92.5	90.4	136	77.5	84.3	64.2	133
Mg	"	NL	153	0.5	80.1	48.1	46.0	71.5	40.4	45.4	<0.50	113

[1]A well duplicate sample was inadvertently not collected.
[2]Laboratory reporting limit.
[3]No existing limit.
[4]Not determined.

REFERENCES

Black & Veatch, 2014, "Background Groundwater Quality Report for Thornton Composite Reservoir," prepared for the Metropolitan Water Reclamation District of Greater Chicago, July 2014.

Black & Veatch, 2016, "Revised Groundwater Monitoring Plan, Groundwater Protection System for Thornton Composite Reservoir," prepared for the Metropolitan Water Reclamation District of Greater Chicago, May 2016.

Illinois Environmental Protection Agency, 2012, 35 Illinois Administrative Code 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.