

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 23-43

***THORNTON COMPOSITE RESERVOIR
GROUNDWATER MONITORING REPORT
SECOND QUARTER 2023***

August 2023

Protecting Our Water Environment

BOARD OF COMMISSIONERS

Kari K. Steele
President
Patricia Theresa Flynn
Vice President
Marcelino Garcia
Chairman of Finance
Precious Brady-Davis
Yumeka Brown
Cameron Davis
Daniel Pogorzelski
Eira L. Corral Sepúlveda
Mariyana T. Spyropoulos

Metropolitan Water Reclamation District of Greater Chicago

100 EAST ERIE STREET CHICAGO, ILLINOIS 60611-3154 312.751.5190 f: 312.751.5194

Edward W. Podczewinski, P.E.

Director of Monitoring and Research
podczewinski@mwr.org

August 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 Second Quarter 2023"

Please find attached the report entitled "Thornton Composite Reservoir Groundwater Monitoring Report Second 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@mwr.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. Podczewinski

Metropolitan Water Reclamation District of Greater Chicago
100 East Erie Street Chicago, Illinois 60611-2803 (312) 751-5600

**THORNTON COMPOSITE RESERVOIR
GROUNDWATER MONITORING REPORT
SECOND QUARTER 2023**

By

**Benjamin Morgan
Environmental Soil Scientist**

**Guanglong Tian
Principal Environmental Scientist**

**Albert Cox
Environmental Monitoring and Research Manager**

**Heng Zhang
Assistant Director of Monitoring and Research
Environmental Monitoring and Research Division**

TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES	ii
LIST OF FIGURES	iii
LIST OF ABBREVIATIONS	iv
ACKNOWLEDGMENTS	v
DISCLAIMER	v
INTRODUCTION	1
FIELD ACTIVITIES	5
ANALYTICAL RESULTS	8
REFERENCES	11

LIST OF TABLES

<u>Table No.</u>		<u>Page</u>
1	Characteristics of Monitoring Wells TB-118 Through TB-124 at the Thornton Composite Reservoir Site	3
2	Devices and Corresponding Dates of Sampling During Fill Event Sampling in April 2023	6
3	Summary of Elevations at Sampling Port 3 of Each Well and Corresponding Groundwater Elevations During Fill Event Sampling in April 2023	7
4	Analytical Methods Used for Required Parameters	9
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 April 2023	10

LIST OF FIGURES

<u>Figure No.</u>		<u>Page</u>
1	Monitoring Well and Main Quarry Sump Locations	2

LIST OF ABBREVIATIONS

Abbreviation	Definition
Ag	silver
B	boron
Be	beryllium
CCD	Chicago City Datum
CFU	colony forming units
Co	cobalt
Cr	chromium
CSF	combined sewer flow
Cu	copper
District	Metropolitan Water Reclamation District of Greater Chicago
EC	electrical conductivity
FC	fecal coliform
ft	feet
GMP	Groundwater Monitoring Plan
GPS	Groundwater Protection System
L	liter
m	meter
mg	milligram
Mn	manganese
mS	millisiemens
N	nitrogen
Se	selenium
TCR	Thornton Composite Reservoir
TDS	total dissolved solids
TOC	total organic carbon
USEPA	United States Environmental Protection Agency
Zn	zinc
mL	milliliter

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 23-102-11. 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,

FIGURE 1: MONITORING WELL AND MAIN QUARRY SUMP LOCATIONS

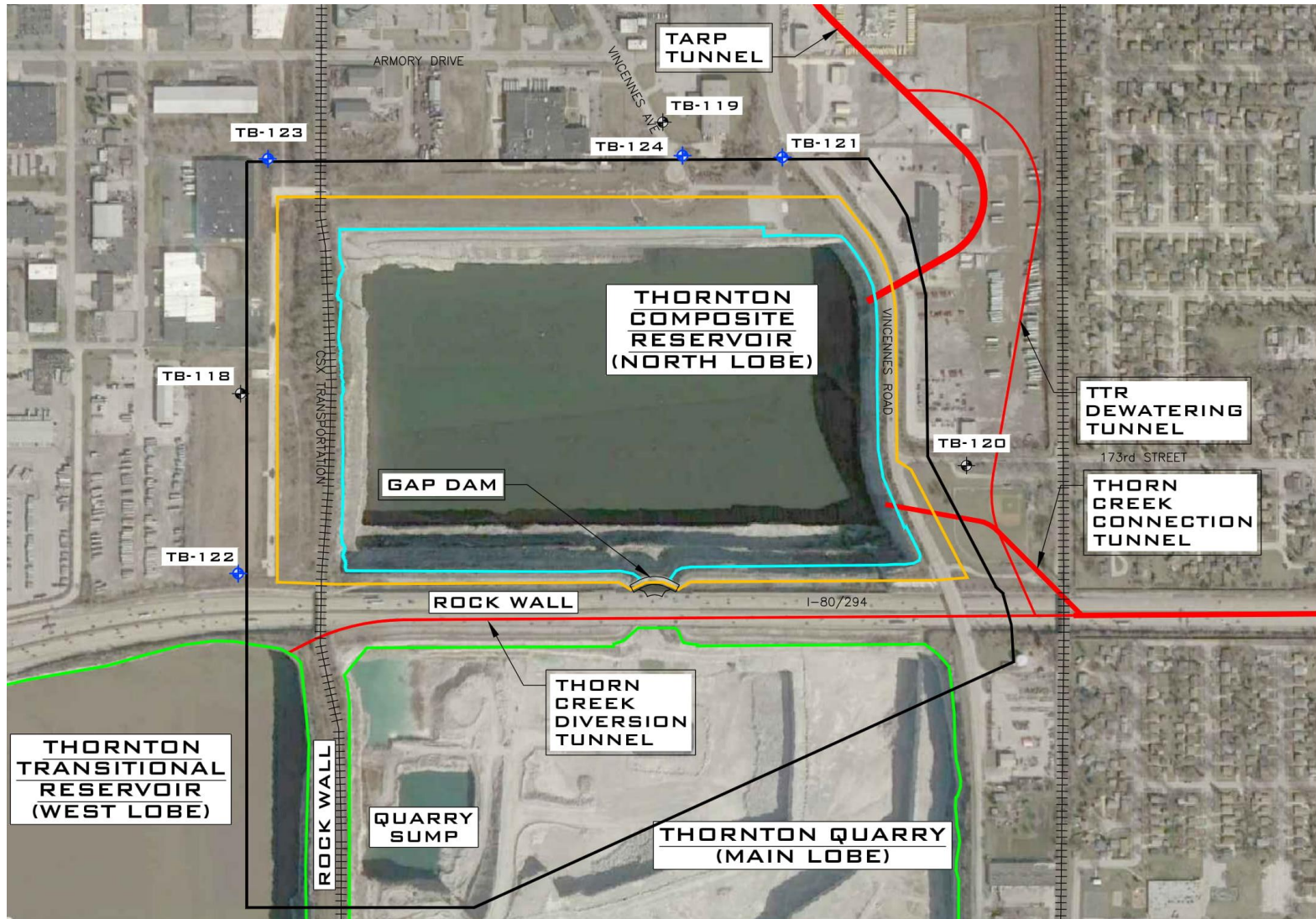


TABLE 1: CHARACTERISTICS OF MONITORING WELLS TB-118 THROUGH TB-124 AT THE THORNTON COMPOSITE RESERVOIR SITE

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	

¹Illinois State Plane Coordinate System (NAD 1927).

²Chicago City Datum (CCD).

³TB-124 is a conventional well screened from -663 to -698 ft CCD. Samples are taken at approximately 650 ft below ground surface.

Illinois Environmental Protection Agency, 2013) to evaluate any exceedances in groundwater standards.

There was one fill event during the second quarter of 2023 (the second event of 2023). The fill event began on April 2 and lasted until April 9, requiring one time of sampling. One complete set of fill event samples was collected during April 6–11, 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 April 6–11, 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 April 6–11, 2023. 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 at Port 3 of each well to calculate the groundwater elevation. 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 FILL
EVENT SAMPLING IN APRIL 2023

Date of Sampling	Device/Structure Sampled
-----Fill Event #2-----	
04/06/23	TB-118, TB-122, TB-123
04/07/23	TB-124, Main Quarry Sump
04/11/23	TB-119, TB-120, TB-121

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

Sample Date	Well ID	Sampling Port	Groundwater Elevation
			------(ft CCD ¹)-----
04/06/23	TB-118	-289	-85
04/11/23	TB-119	-289	-164
04/11/23	TB-120	-290	-216
04/11/23	TB-121	-288	-169
04/06/23	TB-122	-288	-162
04/06/23	TB-123	-288	-47
04/07/23	TB-124 ²	NA ³	-423

¹Chicago City Datum.

²TB-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 April 2023.

³Not 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 April 6–11 for fill event monitoring are presented in Table 5. There were a few exceedances of the Class I groundwater standards, including total dissolved solids (TDS), chloride, sulfate, and boron, as indicated in bold font in Table 5. Of these parameters, none 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 APRIL 2023

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL ²	Well ¹							Sump
					TB-118	TB-119	TB-120	TB-121	TB-122	TB-123	TB-124	
pH		6.5–9.0	8.4	NL ³	7.5	7.1	7.3	7.3	7.5	7.2	7.1	8.0
EC	mS/m	NL	415	NL	56.0	85.9	110	149	112	73.1	160	113
TDS	mg/L	1,200	2,960	25	404	568	666	1,058	962	594	1,502	1,198
TOC	"	NL	1	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloride	"	200	1,230	1	429	84.0	137	321	252	69.6	287	200
Sulfate	"	400	890	1	199	114	85.5	186	93.9	127	650	482
Ammonia as N	"	NL	ND ⁴	0.3	0.61	0.49	0.36	0.60	1.1	0.71	1.1	<0.30
Total Phenol	"	0.1	0.06	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
Ag	mg/L	0.05	0.003	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
B	"	2	3.8	0.005	0.795	0.855	1.05	0.984	2.32	1.54	0.938	0.288
Be	"	0.004	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Co	"	1	0.035	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.008
Cr	"	0.1	86.4	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.013	<0.004
Cu	"	0.65	0.004	0.002	<0.002	<0.002	<0.002	<0.002	0.004	<0.002	<0.002	<0.002
Mn	"	0.15	0.183	0.001	0.005	0.006	0.004	0.003	0.006	0.003	0.003	0.004
Se	"	0.05	0.008	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
V	"	0.049	ND	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zn	"	5	10	0.010	0.017	0.034	0.024	0.019	0.025	0.031	0.283	<0.010
Ca	"	NL	276	0.5	174	90.0	95.1	141	80.8	82.7	9.09	143
Mg	"	NL	153	0.5	86.1	46.5	48.3	73.3	41.7	44.2	95.3	111

¹A well duplicate sample was inadvertently not collected.

²Laboratory reporting limit.

³No existing limit.

⁴Not 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.