Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 23-25

TUNNEL AND RESERVOIR PLAN

THORNTON TRANSITIONAL FLOOD CONTROL RESERVOIR AND

WELLS ANNUAL GROUNDWATER MONITORING REPORT

FOR 2023

July 2024

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

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July 17, 2023

Mr. Sanjay Sofat
Bureau of Water
Illinois Environmental Protection Agency
P. O. Box 19276
Springfield, IL 62794-9276

Dear Mr. Sofat:

Subject: Tunnel and Reservoir Plan Thornton Transitional Flood Control Reservoir and Wells Annual Groundwater Monitoring Report for 2022

The report entitled "Tunnel and Reservoir Plan Thornton Transitional Flood Control Reservoir and Wells Annual Groundwater Monitoring Report for 2022" is attached.

Very truly yours,

Albert Cox

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

AC:EE:lf
Attachment
cc: Mr. Ryan Bahr (USEPA Region 5 - WC15J)
Mr. E. Podczerwinski
Dr. H. Zhang
cc w/o att: Mr. J. Murray
Mr. A. Gronski

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TUNNEL AND RESERVOIR PLAN
THORNTON TRANSITIONAL FLOOD CONTROL RESERVOIR AND WELLS ANNUAL GROUNDWATER MONITORING REPORT FOR 2023

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LIST OF ABBREVIATIONS

°C	degrees Celsius
Ag	silver
As	arsenic
B	boron
Ba	barium
BG	billion gallons
BOD_5	five-day biological oxygen demand
Cd	cadmium
Cl^-	chloride
CN^-	cyanide
Cr	chromium
Cu	copper
EC	electrical conductivity
F^-	fluoride
FC	fecal coliform
Fe	iron
Hg	mercury
IEPA	Illinois Environmental Protection Agency
L	liter
mg	milligram
Mn	manganese
NH_3-N	ammonia nitrogen
Ni	nickel
Pb	lead
SO_4^{2-}	sulfate
TCR	Thornton Composite Reservoir
TDS	total dissolved solids
TTR	Thornton Transitional Reservoir

ANNUAL DATA FOR THORNTON TRANSITIONAL RESERVOIR AND MONITORING WELLS

Introduction

This report is submitted annually to fulfill the reporting requirements of the Illinois Environmental Protection Agency (IEPA) regarding the utilization of the Thornton Transitional Reservoir (TTR) for flood control. The reporting requirements for groundwater quality monitoring of the TTR and adjacent wells were stated in Section 7 of the Scope of Work approved by the IEPA on August 6, 2001, modified on May 9, 2005, and last modified on March 14, 2019. The current monitoring program requires the four wells, QT-1, QT-2, QT-3 and QT-4, and the TTR to be sampled one time at each fill event. In addition, the four wells must be sampled once per quarter. This report includes:

1. Analytical data for the monitoring wells and TTR for 2023.

2. Review and comparison of analytical data for the monitoring wells with calculated statistical limits for previously analyzed background samples in order to evaluate exceedances in the concentrations of analytes.

Project Description

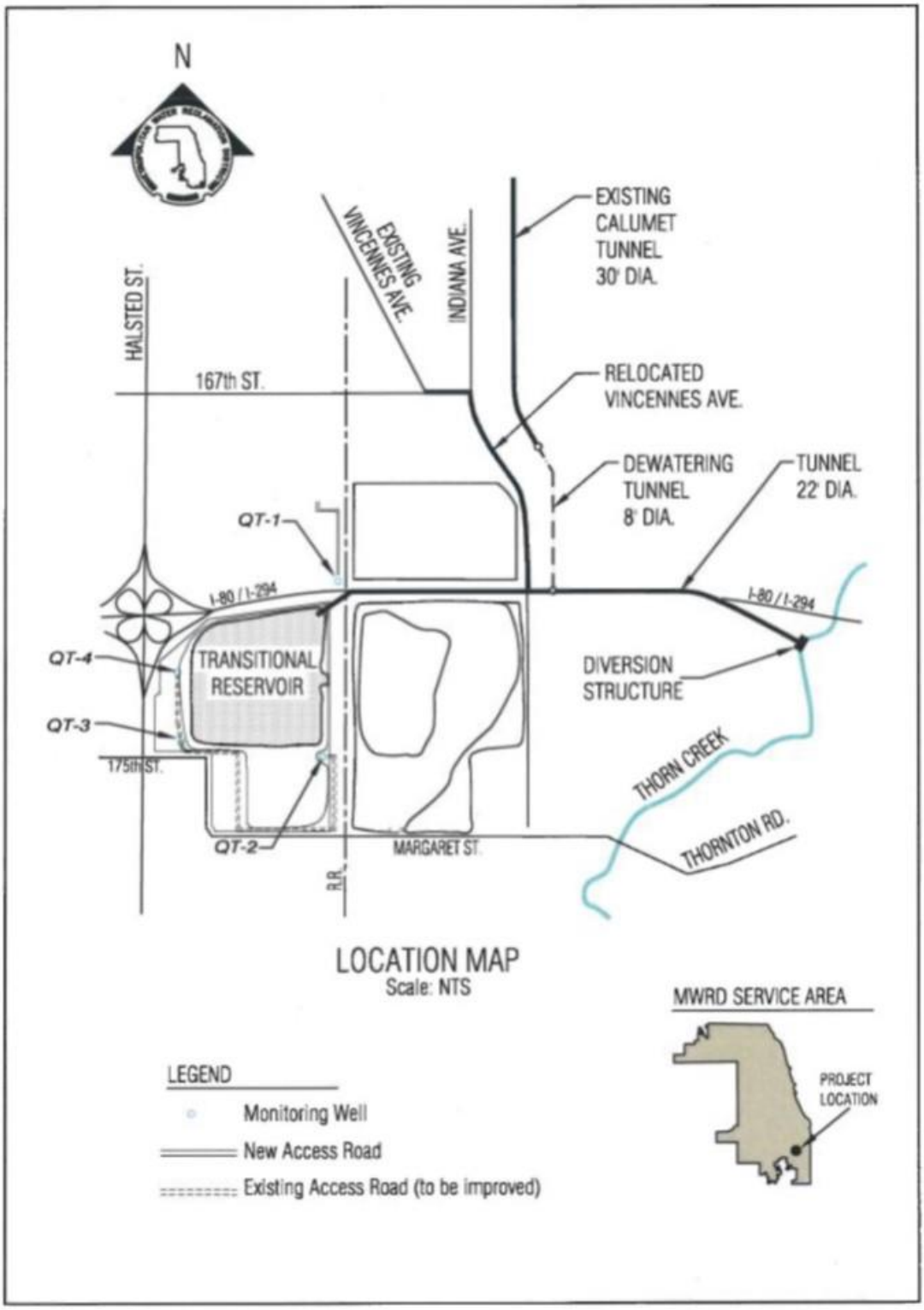
The TTR is located in the West Lobe of the Thornton Quarry, southeast of the intersection of the Tri-State Tollway and Halsted Street in Thornton, Illinois (Figure 1). The TTR was the final structure to be implemented for the Little Calumet River Watershed under the Natural Resources Conservation Service Little Calumet Watershed Plan of November 1998. The TTR provides 3.7 billion gallons (BG) of floodwater storage, increased from the original volume of 3.1 BG due to additional rock mining. This provides sufficient volume to capture a 100-year storm event from Thorn Creek at a point just south of the Tri-State Tollway. This project provides flood control benefits for 21 businesses and 4,400 residences. Within the Little Calumet watershed are the Illinois communities of Blue Island, Calumet City, Dixmoor, Dolton, Glenwood, Harvey, Lansing, Phoenix, Riverdale, and South Holland, which all benefit from the implemented flood control measures.

The TTR consists of a diversion structure at Thorn Creek, a 24-foot diameter dropshaft, and a 22-foot diameter conveyance tunnel to the Lower West Lobe of the Thornton Quarry. The project also includes an eight-foot diameter tunnel connected to the Calumet Tunnel and Reservoir Plan System that is utilized for TTR dewatering purposes only.

The analytes measured in these samples include:

1. pH, electrical conductivity (EC), total dissolved solids (TDS), five-day biological oxygen demand (BOD_5), cyanide (CN^-), fluoride (F^-), chloride (Cl^-), sulfate (SO_4^{2-}), ammonia nitrogen (NH_3-N), phenol, and trace metals silver (Ag), arsenic (As), boron (B), barium (Ba), cadmium (Cd), chromium (Cr),

FIGURE 1: THORNTON TRANSITIONAL RESERVOIR
MONITORING WELL LOCATIONS



copper (Cu), iron (Fe), mercury (Hg), manganese (Mn), nickel (Ni), and lead (Pb).

2. Other parameters: fecal coliform (FC), groundwater temperature, and water elevation.

There were three significant rain events in 2023 which resulted in the diversion of Thorn Creek water to the TTR on February 17, 2023, March 31, 2023, and May 3, 2023 (Table 1). Since the Thornton Composite Reservoir (TCR) was placed in service in October 2015, water accumulation in the TTR has generally been used to flush the TCR for odor control. As a result, water was impounded in the TTR between January and December 2023. According to the current monitoring plan approved in March 2019, the TTR should be sampled once at each fill event, and four monitoring wells sampled once at each fill event and once every quarter. Based on the three rain events, three sampling events for the reservoir and seven sampling events for the TTR wells are required. However, reservoir sampling was only conducted following the March 31, 2023, and May 3, 2023, fill events. The reservoir sampling for the first fill event (February 17, 2023) was not done due to hazardous road conditions caused by snow and ice accumulation.

It is necessary to note that in September 2023, as components of Calumet Tunnel and Reservoir System Final Reservoir Preparation project, Thorn Creek Overflow Tunnel was connected to the TCR and the TTR was decommissioned. Thus, starting in 2023, all monitoring (reservoir and groundwater wells) at the TTR was discontinued, and no report will be submitted in the future.

Summary of Data for Monitoring Wells and Reservoir

Analytical data for all sampling events are presented in Tables 2 through 6 for wells QT-1, QT-2, QT-3, QT-4, and the TTR, respectively.

The parameters in the wells that exceeded the upper 95 percent confidence limits established from the background samples of respective wells are presented in Table 7. Total dissolved solids and chloride exceeded the established limit in two wells, QT-1 and QT-3. Sulfate and barium exceeded the established limit in well QT-3. Cyanide and arsenic exceeded the established limit in two wells, QT-1 and QT-2. Manganese exceeded the limit in well QT-1 only. However, for all exceedances, the corresponding concentration was much lower in the reservoir than in the wells.

TABLE 1: DIVERSIONS TO THE THORNTON TRANSITIONAL FLOOD CONTROL RESERVOIR DURING 2023

Date of Diversion	Volume Collected in Thornton Transitional Reservoir Million Gallons	Rainfall (Measured at Calumet WRP) Inches	Date Reservoir Completely Drained	Sample Collected
02/17/22	399	0.76	NA[1]	No[2]
03/31/22	313	1.25	NA	Yes
05/03/22	231	1.17	NA	Yes
Total	943	3.18		

[1]NA = Not applicable. Recent protocol for the operation of the Thornton Transitional Reservoir keeps the reservoir approximately five percent full to allow makeup water to be fed into the Thornton Composite Reservoir.
[2]No water sampling was conducted due to hazardous road conditions caused by snow and ice accumulation.

TABLE 2: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-1 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Event	Sample Date	pH	EC mS/m	TDS	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
				mg/L											
Upper 95% Confidence Limit		7.6	NL[1]	2,408	NL	0.002	0.59	589	508	NL	NL	<0.0008	0.001	NL	0.095
Fill Event	02/24/22	7.1	293	2,202	NRR[2]	<0.005	0.33	957	318	0.41	<0.005	<0.004	<0.002	0.23	0.073
1st Quarter	03/10/22	7.4	278	2,172	<2	<0.005	0.35	992	326	<0.30	NRR[3]	<0.004	<0.002	0.21	0.084
Fill Event	04/06/22	7.1	301	2,354	<2	<0.005	0.35	940	298	0.33	<0.005	<0.004	<0.002	0.26	0.086
Fill Event	05/06/22	7.3	301	2,398	<2	0.009	0.33	907	296	0.39	<0.005	<0.004	<0.002	0.25	0.081
2nd Quarter	06/02/22	7.1	302	2,290	<2	<0.005	0.34	904	302	0.32	<0.005	<0.004	0.002	0.23	0.095
3rd Quarter	08/04/22	7.1	294	2,302	<2	<0.005	0.32	950	302	0.31	<0.005	<0.004	<0.002	0.25	0.082
4th Quarter	10/27/22	7.3	313	2,522	<2	<0.005	0.34	953	285	0.32	<0.005	<0.004	<0.002	0.23	0.086

TABLE 2 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-1 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp.	Water Elevation[4]	Recharge Time
		mg/L								CFU/100 mL	°C	feet	hours
Upper 95% Confidence Limit		0.002	0.005	0.022	49	0.00005	0.094	0.005	0.019	NL	NL	NL	NL
Fill Event	02/24/22	<0.002	<0.004	0.002	24	<0.0005	0.147	<0.002	<0.002	<1	12.3	NA	<48
1st Quarter	03/10/22	<0.002	<0.004	<0.002	22	<0.0005	0.120	<0.002	<0.002	<1	12.4	-150	<48
Fill Event	04/06/22	<0.002	<0.004	0.006	17	<0.0005	0.085	<0.002	<0.002	<1	12.9	-151	<48
Fill Event	05/06/22	<0.002	<0.004	<0.002	14	<0.0005	0.067	<0.002	<0.002	<1	12.3	-151	<48
2nd Quarter	06/02/22	<0.002	<0.004	0.014	17	<0.0005	0.085	<0.002	<0.002	<1	14.2	-151	<48
3rd Quarter	08/04/22	<0.002	<0.004	0.007	15	<0.0005	0.069	<0.002	<0.002	<1	13.2	-149	<48
4th Quarter	10/27/22	<0.002	<0.004	0.005	14	<0.0005	0.066	<0.002	<0.002	<1	12.3	-159	<48

[1]NL = No limit.
[2]No reportable data due to quality assurance/quality control failure (sample could not be rerun because holding time was exceeded).
[3]No reportable data due to improper preservation of sample.
[4]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

TABLE 3: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-2 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Event	Sample Date	pH	EC mS/m	TDS	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
				mg/L											
Upper 95% Confidence Limit		7.5	NL[1]	2,651	NL	0.002	0.38	478	757	NL	NL	0.0001	0.006	NL	0.069
Fill Event	02/24/22	7.3	122	1,010	NDR[2]	<0.005	0.26	146	448	0.35	<0.005	<0.004	0.043	0.18	0.036
1st Quarter	03/10/22	7.2	118	1,004	<2	<0.005	0.25	146	457	0.31	NDR[3]	<0.004	0.046	0.19	0.040
Fill Event	04/06/22	7.2	123	1,076	<2	<0.005	0.26	145	433	0.34	<0.005	<0.004	0.041	0.21	0.038
Fill Event	05/06/22	7.2	120	1,070	<2	0.010	0.27	142	410	0.34	<0.005	<0.004	0.052	0.20	0.037
2nd Quarter	06/02/22	7.0	121	1,018	<2	<0.005	0.27	146	402	0.35	<0.005	<0.004	0.042	0.20	0.040
3rd Quarter	08/04/22	7.3	121	1,158	<2	<0.005	0.24	153	422	<0.30	<0.005	<0.004	0.046	0.20	0.038
4th Quarter	10/27/22	7.2	132	1,100	<2	<0.005	0.25	155	413	0.31	<0.005	<0.004	0.051	0.20	0.043

TABLE 3 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-2 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp.	Water Elevation[4]	Recharge Time
		mg/L								CFU/100 mL	°C	feet	hours
Upper 95% Confidence Limit		0.002	0.007	0.033	5.0	0.0003	0.063	NL	0.019	NL	NL	NL	NL
Fill Event	02/24/22	<0.002	<0.004	<0.002	3	<0.0005	0.027	0.007	<0.002	<1	13.5	-192	<48
1st Quarter	03/10/22	<0.002	<0.004	<0.002	2	<0.0005	0.033	0.005	<0.002	<1	13.5	-192	<48
Fill Event	04/06/22	<0.002	<0.004	<0.002	2	<0.0005	0.023	0.005	<0.002	<1	14.0	-191	<48
Fill Event	05/06/22	<0.002	<0.004	0.005	2	<0.0005	0.018	0.007	<0.002	<1	14.0	-192	<48
2nd Quarter	06/02/22	<0.002	<0.004	<0.002	2	<0.0005	0.016	0.005	<0.002	<1	15.0	-192	<48
3rd Quarter	08/04/22	<0.002	<0.004	<0.002	3	<0.0005	0.025	0.004	<0.002	<1	14.5	-193	<48
4th Quarter	10/27/22	<0.002	<0.004	0.003	3	<0.0005	0.027	0.014	0.004	<1	13.7	-193	<48

[1]NL = No limit.
[2]No reportable data due to quality assurance/quality control failure (sample could not be rerun because holding time was exceeded).
[3]No reportable data due to improper preservation of sample.
[4]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

TABLE 4: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-3 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Event	Sample Date	pH	EC mS/m	TDS	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
				mg/L											
Upper 95% Confidence Limit		7.8	NL[1]	1,353	NL	0.002	0.36	190	238	NL	NL	0.0292	<0.002	NL	0.082
Fill Event	02/24/22	6.9	181	1,404	NDR[2]	<0.005	0.21	474	256	0.41	<0.005	<0.004	<0.002	0.30	0.088
1st Quarter	03/10/22	7.3	149	1,518	<2	<0.005	0.22	517	286	0.35	NDR[3]	<0.004	<0.002	0.26	0.096
Fill Event	04/06/22	7.2	168	1,538	<2	<0.005	0.22	449	251	0.36	<0.005	<0.004	<0.002	0.29	0.106
Fill Event	05/06/22	7.2	166	1,532	<2	<0.005	0.22	418	234	0.37	<0.005	<0.004	<0.002	0.33	0.087
2nd Quarter	06/02/22	7.1	172	1,504	<2	<0.005	0.23	466	263	0.36	<0.005	<0.004	<0.002	0.32	0.109
3rd Quarter	08/04/22	7.1	155	1,458	<2	<0.005	0.21	414	216	0.37	<0.005	<0.004	<0.002	0.31	0.080
4th Quarter	10/27/22	7.0	182	1,274	<2	<0.005	0.23	376	200	0.37	<0.005	<0.004	<0.002	0.32	0.085

TABLE 4 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-3 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp.	Water Elevation[4]	Recharge Time
		mg/L								CFU/100 mL	°C	feet	hours
Upper 95% Confidence Limit		0.001	0.006	0.022	21	0.00005	0.158	NL	0.014	NL	NL	NL	NL
Fill Event	02/24/22	<0.002	<0.004	<0.002	6	<0.0005	0.115	<0.002	<0.002	<1	11.8	-183	<48
1st Quarter	03/10/22	<0.002	<0.004	0.003	8	<0.0005	0.120	0.003	<0.002	<1	11.7	-183	<48
Fill Event	04/06/22	<0.002	<0.004	0.002	3	<0.0005	0.077	0.006	<0.002	<1	12.8	-184	<48
Fill Event	05/06/22	<0.002	<0.004	0.004	8	<0.0005	0.128	<0.002	<0.002	<1	12.0	-183	<48
2nd Quarter	06/02/22	<0.002	<0.004	0.003	3	<0.0005	0.083	0.002	<0.002	<1	13.3	-183	<48
3rd Quarter	08/04/22	<0.002	<0.004	0.003	8	<0.0005	0.114	<0.002	<0.002	<1	13.3	-183	<48
4th Quarter	10/27/22	<0.002	<0.004	<0.002	7	<0.0005	0.105	<0.002	<0.002	<1	12.1	-184	<48

[1]NL = No limit.
[2]No reportable data due to quality assurance/quality control failure (sample could not be rerun because holding time was exceeded).
[3]No reportable data due to improper preservation of sample.
[4]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

TABLE 5: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-4 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Event	Sample Date	pH	EC mS/m	TDS	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
				mg/L											
Upper 95% Confidence Limit		7.7	NL[1]	2,034	NL	0.002	0.39	590	314	NL	NL	0.0033	NL	NL	0.181
Fill Event	02/24/22	7.3	135	1,084	NDR[2]	<0.005	0.23	276	223	0.37	<0.005	<0.004	<0.002	0.35	0.080
1st Quarter	03/10/22	7.2	134	938	<2	<0.005	0.25	281	225	<0.30	NDR[3]	<0.004	<0.002	0.32	0.078
Fill Event	04/06/22	7.2	144	1,144	<2	<0.005	0.24	273	220	0.35	<0.005	<0.004	<0.002	0.36	0.084
Fill Event	05/06/22	7.2	137	1,152	<2	<0.005	0.24	261	210	0.35	<0.005	<0.004	<0.002	0.37	0.079
2nd Quarter	06/02/22	7.3	140	1,136	<2	<0.005	0.25	272	197	0.32	<0.005	<0.004	<0.002	0.36	0.083
3rd Quarter	08/04/22	7.2	142	1,216	<2	<0.005	0.22	279	208	0.30	<0.005	<0.004	<0.002	0.36	0.079
4th Quarter	10/27/22	7.6	134	894	<2	<0.005	0.20	270	132	0.34	<0.005	<0.004	<0.002	0.35	0.057

TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL QT-4 AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp.	Water Elevation[4]	Recharge Time
		mg/L								CFU/100 mL	°C	feet	hours
Upper 95% Confidence Limit		0.001	0.022	0.035	24	0.00004	0.203	NL	0.018	NL	NL	NL	NL
Fill Event	02/24/22	<0.002	<0.004	<0.002	9	<0.0005	0.057	<0.002	<0.002	<1	14.1	-92	<48
1st Quarter	03/10/22	<0.002	<0.004	<0.002	10	<0.0005	0.071	<0.002	<0.002	<1	13.8	-91	<48
Fill Event	04/06/22	<0.002	<0.004	<0.002	11	<0.0005	0.095	<0.002	<0.002	<1	13.6	-91	<48
Fill Event	05/06/22	<0.002	<0.004	0.003	10	<0.0005	0.090	0.005	<0.002	<1	12.7	-90	<48
2nd Quarter	06/02/22	<0.002	<0.004	0.004	11	<0.0005	0.105	<0.002	<0.002	<1	13.4	-90	<48
3rd Quarter	08/04/22	<0.002	<0.004	<0.002	8	<0.0005	0.056	<0.002	<0.002	<1	13.6	-90	<48
4th Quarter	10/27/22	<0.002	<0.004	<0.002	2	<0.0005	0.031	<0.002	<0.002	<1	15.1	-91	<48

[1]NL = No limit.
[2]No reportable data due to quality assurance/quality control failure (sample could not be rerun because holding time was exceeded).
[3]No reportable data due to improper preservation of sample.
[4]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

TABLE 6: ANALYSIS OF FILL EVENT WATER STORED IN THE THORNTON TRANSITIONAL RESERVOIR SAMPLED DURING 2023

Event	Sample Date	pH	TDS	BOD_5	CN^-	F^-	Cl^-	SO_4^{2-}	NH_3-N	Phenol	Ag	As	B	Ba
			mg/L											
1st Fill Event	02/17/22	No sample collected[1]												
2nd Fill Event	04/01/22	6.7	434	NDR[2]	<0.005	0.17	85	44	0.71	<0.005	<0.004	0.003	0.05	0.045
3rd Fill Event	05/04/22	7.4	574	4	<0.005	0.18	62	55	<0.30	<0.005	<0.004	0.003	0.06	0.035

TABLE 6 (Continued): ANALYSIS OF FILL EVENT WATER STORED IN THE THORNTON TRANSITIONAL RESERVOIR SAMPLED DURING 2023

Event	Sample Date	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Fecal Coliform	Temp.	Water Elevation[3]
		mg/L								CFU/100 mL	°C	feet
1st Fill Event	02/17/22	No sample collected[1]										
2nd Fill Event	04/01/22	<0.002	0.006	0.010	6	<0.0005	0.107	0.008	0.007	7,400	8.0	-202
3rd Fill Event	05/04/22	<0.002	0.005	0.007	4	<0.0005	0.099	0.007	0.005	3,800	16.4	-215

[1]No water quality sample was obtained due to hazardous road conditions caused by snow and ice accumulation at Thornton quarry.
[2]No reportable data due to quality assurance/quality control failure (sample could not be rerun because holding time was exceeded).
[3]Relative to Chicago City Datum (579.48 feet above mean sea level) at intersection of State and Madison Streets.

TABLE 7: EXCEEDANCES[1] DETECTED IN WELLS AT THE THORNTON TRANSITIONAL RESERVOIR SITE DURING 2023

Well Number	Parameters Exceeding Limit
QT-1	TDS, CN^-, Cl^-, As, Mn,
QT-2	CN^-, As
QT-3	TDS, Cl^-, SO_4^{2-}, Ba
QT-4	None

[1]Concentrations of analytes which exceeded upper limits of 95 percent confidence intervals for background samples.