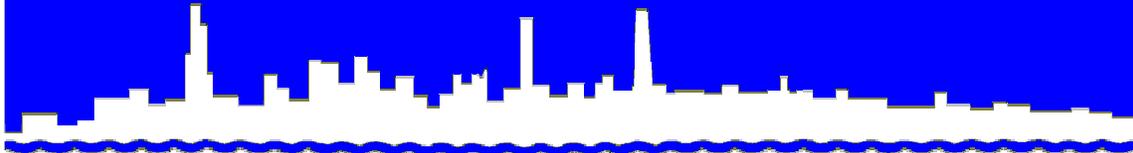


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

*MONITORING AND RESEARCH
DEPARTMENT*

REPORT NO. 16-26

THORNTON COMPOSITE RESERVOIR

GROUNDWATER MONITORING REPORT

FIRST QUARTER 2016

August 2016

Protecting Our Water Environment

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August 17, 2016

Mr. S. Alan Keller
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Illinois Environmental Pollution Control
1021 North Grand Avenue East
Springfield, IL 62794

Dear Mr. Keller:

Subject: Transmittal of the Report "Thornton Composite Reservoir Groundwater Monitoring Report First Quarter 2016"

Please find attached two copies of the report "Thornton Composite Reservoir Groundwater Monitoring Report First Quarter 2016." The report was prepared for transmittal to the Illinois Environmental Protection Agency (IEPA) in accordance with the Groundwater Monitoring Plan. Also attached is a CD-ROM of the Thornton Composite Reservoir raw data from Grace Analytical Laboratory as required by the IEPA.

If you have any questions or would like additional information, please contact Dr. Pauline Lindo at (708) 588-4109 or pauline.lindo@mwr.org.

Very truly yours,

Thomas C. Granato, Ph.D., BCES
Director
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TCG:HZ:PL:cm
Attachments
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**Thornton Composite Reservoir
Groundwater Monitoring Report
First Quarter 2016**

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TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES	ii
LIST OF FIGURES	iii
LIST OF ACRONYMS	iv
ACKNOWLEDGEMENTS AND DISCLAIMER	v
INTRODUCTION	1
FIELD ACTIVITIES	4
ANALYTICAL RESULTS	6
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	Summary of Elevations at Port 3 of Each Well and Corresponding Groundwater Elevations During the Monitoring/Fill Event of January 2016	5
3	Analytical Methods Used for Required Parameters	7
4	Analysis of Groundwater From Monitoring Wells TB-118-003 Through TB-124 at the Thornton Composite Reservoir Site Sampled During the Monitoring/Fill Event of January 2016	8
5	Analysis of Groundwater Sampled From the Quarry Sump Located South of the Thornton Composite Reservoir Site During the Monitoring/Fill Event of January 2016	10

LIST OF FIGURES

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

LIST OF ACRONYMS

Acronym	Definition
CCD	Chicago City Datum
CSO	combined sewer overflow
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

ACKNOWLEDGEMENTS

This report for the Thornton Composite Reservoir Groundwater Monitoring was generated for the Engineering Department by the consultants of Black and Veatch, according to Engineering Contract 04-203-4F. All samples were collected and reports drafted by Black and Veatch, and all analyses performed by Grace Analytical Laboratory, Inc. The final report was produced according to the new format guidelines of the Metropolitan Water Reclamation District of Greater Chicago's (District) Monitoring and Research (M&R) Department. Special thanks are due to Ms. Coleen Maurovich for her tireless efforts in converting the original report and all tables to the M&R Department's new format.

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) has been constructed for the Thornton Composite Reservoir (TCR) to protect against the exfiltration of combined sewer overflow (CSO) into the surrounding dolomite aquifers. The CSOs 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 (Revised GMP) (Black & Veatch, 2015). According to the Revised GMP, one sample of reservoir water, one of the quarry sump, and one from each of the seven wells are collected annually or following a fill event and analyzed for the Illinois Administrative Code (IAC) Title 35 Part 620 Class I constituents. In addition, during a reservoir fill event or a quarterly sampling event, groundwater is sampled from seven wells and the quarry sump and tested for a targeted list of parameters that are more likely to be detected in CSO water. Prior to the TCR becoming operational, eight (8) sampling events were executed on a quarterly basis for two years (April 2012 through March 2014) to provide background data on the existing groundwater quality.

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, groundwater is sampled from each well at the first sample interval port immediately below the water elevation in the TCR. Each of the multi-level monitoring wells monitors four distinct depths within a 20-ft interval in the Silurian Dolomite aquifer.

The locations of monitoring wells, quarry sump, TCR, and the GPS are presented in Figure 1. The 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 Chicago City Datum [CCD]). The sump contains mainly groundwater and some 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).

This report presents field activities, observations, and analytical data for well and quarry sump groundwater samples collected during January 11 – 13, 2016, while the water elevation in the reservoir resulting from the reservoir fill event of December 29 – 31, 2015, was still above -280 CCD. Laboratory analyses of all samples were performed by IL State ELAP/NELAC-certified Grace Analytical Lab, Inc.

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 El ² (ft, CCD)	Top of Riser El ² (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	1791110.38	693560.44	38.5	41.5	532	-85 to -105	-212 to -232	-283 to -303	-392 to -412
TB-119	1792316.63	695509.39	27.9	29.5	529	-85 to -105	-212 to -232	-283 to -303	-392 to -412
TB-120	1790782.31	696888.93	40.0	42.1	540	-86 to -106	-213 to -233	-284 to -304	-393 to -413
TB-121	1792193.10	696044.98	29.4	30.4	461	-84 to -104	-211 to -231	-282 to -302	-391 to -411
TB-122	1790288.61	693549.38	48.8	51.7	480	-85 to -105	-212 to -232	-283 to -303	-392 to -412
TB-123	1792185.60	693685.69	28.9	31.8	460	-84 to -104	-211 to -231	-282 to -302	-391 to -411
TB-124	1792200.77	695591.56	29.6	29.2	728	-663 to -698			

¹Illinois State Plane Coordinate System (NAD 1927).

²Chicago City Datum (CCD).

FIELD ACTIVITIES

In January 2016, the TCR was filled with CSO to an elevation of -272 CCD and remained above elevation -280 CCD. According to the Revised GMP, CSO elevations in the TCR above -280 CCD require bi-weekly groundwater sampling. During the first quarterly sampling/fill event of 2016, groundwater samples were collected from sampling port Interval 3 at all six multi-level wells and the deep well. On January 11, 2016, one sample was collected from Well TB-123 while duplicate samples were collected from Well TB-122. On January 12, single samples were collected from Wells TB-119 and -124. On January 13, single samples were collected from Wells TB-118, -120, and -121. The quarry sump was sampled on January 15, 2016.

Each well sample collected was immediately analyzed in the field for pH and conductivity. The temperature of each sample was also recorded.

Prior to the sampling of the multi-level wells, hydrostatic pressure was measured to calculate the groundwater elevation at the port sampled. Table 2 lists the elevations at Port 3 of each well and the corresponding groundwater elevations during the first quarter monitoring/fill event of January 2016.

All samples were packed in ice and submitted to Grace Analytical Laboratory, Inc., for the relevant analyses.

TABLE 2: SUMMARY OF ELEVATIONS AT PORT 3 OF EACH WELL AND CORRESPONDING GROUNDWATER ELEVATIONS DURING THE MONITORING/FILL EVENT OF JANUARY 2016

Well and Interval ID	Sampling Port 003 Elevation (ft CCD)	Interval 3 Groundwater Elevation (ft CD)
TB-118-003	-289	NR ¹
TB-119-003	-289	NR
TB-120-003	-290	NR
TB-121-003	-288	NR
TB-122-003	-288	-172
TB-123-003	-288	-45
TB-124 ²	-663	-382 ³

¹No reading; no pressure data available for wells TB-118, TB-119, TB-120, TB-121 and TB-124 because field pressure readings were incorrectly displayed due to extremely cold weather.

²TB-124 is a conventional well screened from -663 to -698 CCD, and the sample was taken at an elevation of approximately -450 ft CCD.

³Interval 3 elevation not applicable to this well; the groundwater elevation at time of sampling was -382 CCD .

ANALYTICAL RESULTS

The analytical methods for parameters used by the laboratory are listed in Table 3. The analytical data for all well samples and the sump sample collected during January 2016 are presented in Tables 4 and 5, respectively. Analytical results were reviewed to identify any analytes that exceeded the Illinois Class I Groundwater Standards (35 IAC Part 620).

During the January 2016 sampling event, boron was present in TB-122-003 (duplicate samples) and TB-123-003 at concentrations that exceeded the Tier 1 groundwater standard of 2 mg/L. The boron concentrations at TB-122-003, TB-122-003D, and TB-123-003 were 2.3, 2.3, and 2.1 mg/L, respectively. Boron exceeded the Tier 1 groundwater standard during several background sampling events, and samples from TB-122-004 for the fifth quarter event contained the maximum concentration of 3.8 mg/L.

During this event, chloride in TB-118-003 (235 mg/L) exceeded the Tier 1 groundwater standard of 200 mg/L. Chloride exceeded the Tier 1 groundwater standard during several background sampling events, with the maximum concentration (1,230 mg/L) detected in TB-122-002 during the second-quarter event.

In addition, the concentration of TDS in TB-118-003 (1,250 mg/L) exceeded the Tier 1 groundwater standard of 1,200 mg/L. These concentrations also exceeded the Tier 1 groundwater standards during several background sampling events. The maximum background concentration (2,960 mg/L) was detected at TB-122-002 during the second-quarter event.

The Tier 1 pH groundwater standard (6.5 to 9.0) was exceeded in Well TB-124, which had a pH of 12. The elevated pH reading at TB-124 is consistent with the annual December 2015 pH result but inconsistent with pH readings (8.1 - 8.4) during all quarterly background sampling events. The elevated pH at TB-124 appears to be an anomaly. If the pH at TB-124 continues to be elevated, this well may need to be re-developed prior to the next sampling event.

For the Westbay wells, pH readings ranged from 7.4 at TB-118-003 to 7.9 at TB-122-003. Conductivity ranged from 67 mS/m at TB-123-003 to 211 mS/m at TB-124.

All samples collected were analyzed for FC. The results of samples from the monitoring wells were all negative for FC, but the quarry sump was positive for this parameter.

TABLE 3: ANALYTICAL METHODS USED FOR REQUIRED PARAMETERS

Inorganic Chemical Parameters:	Analytical Method ¹
Chloride	325.2
Alkalinity, bicarbonate	2320B
Total Dissolved Solids	2540C
Sulfate	4500-SO4-2 C or D
TAL metals	6010B & 7470A
Ammonia (as N)	350.1R2.0
Hardness	2340B
TOC	5310C
Others:	
Phenols	SVOC/8270C
Fecal Coliform	SM 9221E

¹All standard EPA methods used by NELAC-certified and other laboratories.

TABLE 4 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS TB-118-003 THROUGH TB-124 AT THE THORNTON COMPOSITE RESERVOIR SITE SAMPLED DURING THE MONITORING/FILL EVENT OF JANUARY 2016

Date Sampled		Well										
		01/13/16	01/12/16	01/13/16	01/13/16	01/11/16	01/11/16	01/11/16	01/11/16	01/12/16		
Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL ¹	Well							
					TB-118- 003 ²	TB-119- 003	TB-120- 003	TB-121- 003	TB-122- 003	TB-122- 003D ³	TB-123- 003	TB-124
Cr	"	0.1	86.4	0.005	0.006	0.014	0.012	NA ⁵	0.006	0.006	NA	0.011
Cu	"	0.65	0.004	0.005	<0.005	<0.005	0.014	<0.005	<0.005	<0.005	<0.005	<0.005
Mn	"	0.15	0.183	0.005	<0.005	0.006	<0.005	0.005	<0.005	<0.005	<0.005	<0.005
Se	"	0.05	0.008	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
V	"	0.049	NA	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Zn	"	5	10	0.01	0.02	0.08	0.02	0.02	0.05	0.11	0.07	4.0
Ca	"	NL ⁴	276	0.5	140	71	81	122	60	60	35	40
Mg	"	NL	153	0.5	67	39	40	61	30	30	18	1

¹Lab reporting limit.

²Names of wells listed and followed by three digits (-003) indicate that samples were collected at port #3 in each well.

³Duplicate sample.

⁴No existing limit.

⁵No analysis performed.

TABLE 5: ANALYSIS OF GROUNDWATER FROM THE QUARRY SUMP LOCATED SOUTH OF THE THORNTON COMPOSITE RESERVOIR SITE SAMPLED DURING THE MONITORING/FILL EVENT OF JANUARY 2016

Parameter	Unit	Part 620 Groundwater Standard	Maximum Background	Lab RL ¹	Quarry Sump 01/15/2016
pH		6.5-9.0	8.4	NL	8.2
Electrical Conductivity	mS/m	NL ²	415	0.5	104
Total Dissolved Solids	mg/L	1,200	2,960	1,200	631
Total Organic Carbon	"	NL	1	0.1	3.7
Chloride	"	200	1,230	5	98
Sulfate	"	400	890	15	315
Ammonia as N	"	NL	NA ³	0.10	<0.10
Phenol	"	0.10	0.06	0.01	<0.01
Fecal Coliform	CFU/100 mL	NL	<1	1	>1
Ag	mg/L	0.05	0.003	0.005	<0.005
B	"	2	3.8	0.05	0.17
Be	"	0.004	0.002	0.004	<0.004
Co	"	1	0.035	0.005	<0.005
Cr	"	0.1	86.4	0.005	<0.005
Cu	"	0.65	0.004	0.005	<0.005
Mn	"	0.15	0.183	0.005	0.007
Se	"	0.05	0.008	0.01	<0.01
V	"	0.049	NA	0.01	<0.01
Zn	"	5	10	0.01	<0.01
Ca	"	NL	276	0.5	71
Mg	"	NL	153	0.5	39

¹Lab reporting limit.

²No limit.

³No analysis.

REFERENCES

Arcadis. "Groundwater Monitoring Plan, Groundwater Protection System, Thornton Composite Reservoir, Contract 05-208-4F," prepared by Arcadis for Metropolitan Water Reclamation District of Greater Chicago, October 2, 2009.

Black & Veatch. "Revised Groundwater Monitoring Plan, Groundwater Protection System, Thornton Composite Reservoir, Contract 04-203-4F," prepared by Black & Veatch for Metropolitan Water Reclamation District of Greater Chicago, January 7, 2015.

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.