Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 14-31

TUNNEL AND RESERVOIR PLAN

GLORIA ALITTO MAJEWSKI

CHICAGOLAND UNDERFLOW PLAN RESERVOIR

WATER QUALITY MONITORING WELLS

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2013

September 2014

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago
100 East Erie Street Chicago, Illinois 60611-3154 312.751.5190

THOMAS C. GRANATO, Ph.D.
Director of Monitoring and Research

312.751.5190 f: 312.751.5194
thomas.granato@mwrd.org

September 26, 2014

Ms. Marcia Willhite
Bureau Chief
Bureau of Water
Illinois Environmental Protection Agency
P. O. Box 19276
Springfield, IL 62794-9276

Dear Ms. Willhite:

Subject: Tunnel and Reservoir Plan, Gloria Alitto Majewski Chicagoland Underflow Plan Reservoir Water Quality Monitoring Wells, Annual Groundwater Monitoring Report for 2013

Attached are three copies of "Tunnel and Reservoir Plan, Gloria Alitto Majewski Chicagoland Underflow Plan Reservoir Water Quality Monitoring Wells, Annual Groundwater Monitoring Report for 2013."

Very truly yours,

Thomas C. Granato, Ph.D.
Director
Monitoring and Research

TCG:PL:cm
Attachment
cc w/att: Ms. Sally K. Swanson (USEPA Region 5 - WC15J) - (2)
Dr. Zhang
Dr. Cox
Dr. Hundal
Dr. Lindo
cc w/o att: Mr. St. Pierre
Ms. Sharma
Mr. Cohen

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

TUNNEL AND RESERVOIR PLAN
GLORIA ALITTO MAJEWSKI
CHICAGOLAND UNDERFLOW PLAN RESERVOIR
WATER QUALITY MONITORING WELLS
ANNUAL GROUNDWATER MONITORING REPORT
FOR 2013

Monitoring and Research Department
Thomas C. Granato, Director

September 2014

TABLE OF CONTENTS

	Page
LIST OF TABLES	ii
LIST OF FIGURES	iii
ANNUAL DATA FOR MONITORING WELLS	1
Introduction	1
Summary of Data	1
Monitoring Wells	1

LIST OF TABLES

Table No.		Page
1	Analysis of Groundwater From Monitoring Wells QK-1 Through QK-4 in the Gloria Alitto Majewski Chicagoland Underflow Plan of the Tunnel and Reservoir Plan Sampled During 201	4
2	Descriptive Statistics for Groundwater Data of Monitoring Wells QK-1 through QK-4 in the Gloria Alitto Majewski Chicagoland Underflow Plan of the Tunnel and Reservoir Plan During 2013	7
3	Wells Reflecting Significant Increases in Concentrations of Specific Analytes Following Fill Events During 2013	10

LIST OF FIGURES

Figure No.		Page
1	Map of Four Monitoring Wells and Nine Private Wells Surrounding the Gloria Alitto Majewski Chicagoland Underflow Plan Reservoir	3

ANNUAL DATA FOR MONITORING WELLS

Introduction

Four monitoring wells, QK-1 through QK-4, are located on the perimeter of the Gloria Alitto Majewski Chicagoland Underflow Plan Reservoir. Well QK-1 is positioned at the northwest corner of the reservoir, with QK-2, -3, and -4 at the northeast, southeast, and southwest corners, respectively (Figure 1). In addition, there are nine privately owned water supply wells, WX1 through WX 9, which are located within 1,000 ft of the reservoir. The four monitoring wells are sampled quarterly (Illinois Environmental Protection Agency [IEPA] memorandum dated October 14, 1997). Groundwater elevations are measured during each sampling event. There are no observation wells associated with this site.

According to IEPA requirements, sampling and analysis will also be performed on a weekly basis for at least six weeks, following a rain event in which the reservoir is used to store combined sewer overflow from the Tunnel and Reservoir Plan system. There were two major fill events during 2013. After each event, the wells were sampled for six consecutive weeks, i.e. 3/13/2013 through 4/17/2013 and 4/22/2013 though 5/29/2013. During these two periods of 12 sampling events, only one sample was retrieved from Well QK-1 on 5/1/2013, following the installation of a new replacement pump in this well on 3/29/2013. On 4/3/2013, no sample was retrieved from QK-2 because there was insufficient water in the well. Again on 5/1/2013, no sample was obtained from Well QK-2 because access to that location was blocked by a large hose placed across the path by other personnel working onsite.

Summary of Data

Monitoring Wells. The analytical data for groundwater sampled during 2013 from monitoring wells QK-1 through QK-4 are presented in Table 1. Physical characteristics, such as elevation, groundwater temperature, and estimated time of recharge for each well between initial drawdown and sampling, are also included.

Because of repetitive high fecal coliform counts in Well QK-1, this well was decontaminated on 10/15/2013, using the United States Environmental Protection Agency's standard operating procedure of applying 15 percent hypochlorite solution. A count of 2,500 prior to decontamination was reduced to <4 MPN/100 mL after the process. The groundwater Cl concentration had also increased from 32 (pre-decontamination) to 46 mg/L after decontamination but decreased to 32 mg/L by 12/4/2013.

Table 2 lists the overall descriptive statistics for groundwater data of monitoring wells QK-1 through -4 for year 2013. Since there were two major rain events during the year, the data were separated by event per well and statistics calculated for each well. The analytical data showed that, following the first major rain event, there were significant increases in the concentrations of TDS, Cl^-, SO_4^{2-}, and Hardness in Wells QK-2 and -3 (Table 3), as reflected in samples analyzed after the second major rain event. There was no significant increase in the Cl^-

concentration in Well QK-2 between the first and second rain events, but there was in Well QK-3. There were no significant changes in the concentrations of any analytes in Well QK-4 following the rain events. For Well QK-1, a larger sample size would have been required in order to formulate similar conclusions.

FIGURE 1: MAP OF FOUR MONITORING WELLS AND NINE PRIVATE WELLS SURROUNDING THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN RESERVOIR

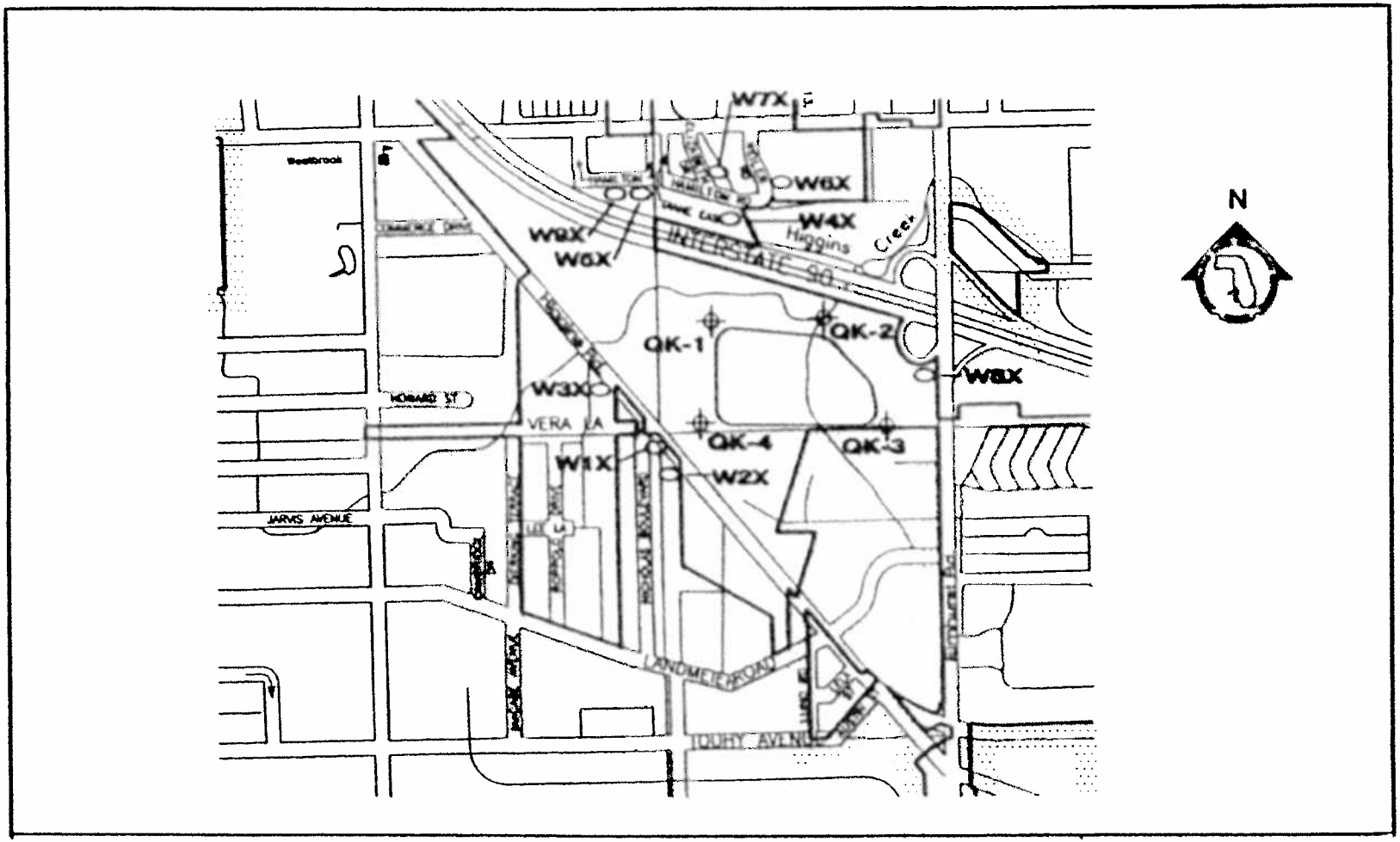

TABLE 1: ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QK-1 THROUGH QK-4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2013

Well[1]	Sample Date	pH	EC[2]	TDS[2]	TOC[2]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform	Temp	Water Elevation[3]	Recharge Time
			mS/m	mg/L						MPN/100 mL	°C	ft.	hr.
QK-1	05/01/13	6.8	204	2,976	2	115	1,582	0.69	1,953	2,500	16.7	5.3	<4
QK-1	10/16/13[4]	NA	NA	NA	NA	32	NA	NA	NA	NA	NA	NA	<4
QK-1	10/18/13[4]	NA	NA	NA	NA	46	NA	NA	NA	NA	NA	NA	<4
QK-1	12/04/13	NA	NA	1,142	1	32	533	<0.10	654	<4	NA	NA	<4
QK-2	03/13/13	7.5	108	960	<1	<10	536	<0.10	460	<1	6.8	-1.0	<4
QK-2	03/20/13	7.4	80	956	<1	<10	582	<0.10	90	<1	2.4	-4.0	<4
QK-2	03/27/13	7.6	75	928	<1	<10	487	<0.10	522	<1	10.8	-6.0	<4
QK-2	04/10/13	7.5	75	916	<1	<10	513	<0.10	531	<1	13.1	-6.0	<4
QK-2	04/17/13	7.3	92	928	<1	<10	494	<0.10	496	<1	9.2	-4.0	<4
QK-2	04/22/13	7.6	119	1,002	<1	<10	570	<0.10	572	<1	13.4	9.0	<4
QK-2	05/08/13	7.3	104	1,246	1	<10	685	<0.10	751	2	14.3	0.0	<4
QK-2	05/15/13	7.6	115	1,308	<1	<10	686	<0.10	739	<1	13.9	1.0	<4
QK-2	05/22/13	7.3	104	1,252	<1	<10	657	<0.10	703	<1	13.9	-2.0	<4
QK-2	05/29/13	7.3	106	1,352	1	<10	717	<0.10	686	<1	13.3	-4.0	<4
QK-2	12/04/13	7.2	90	930	<1	<10	500	<0.10	494	<1	9.8	-4.0	<4
QK-3	03/13/13	6.6	101	876	1	56	374	0.16	443	9,200	6.4	-6.5	<4
QK-3	03/20/13	7.3	64	856	<1	20	434	0.40	186	63	6.5	-6.5	<4
QK-3	03/27/13	7.5	72	876	<1	13	449	0.41	512	220	11.3	-7.5	<4
QK-3	04/03/13	7.0	101	1,036	1	15	542	0.38	592	940	11.5	-8.5	<4

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QK-1 THROUGH QK-4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2013

Well[1]	Sample Date	pH	EC[2]	TDS[2]	TOC[2]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform	Temp	Water Elevation[3]	Recharge Time
			mS/m	mg/L						MPN/100 mL	°C	ft.	hr.
QK-3	04/10/13	7.5	73	930	<1	17	493	0.29	567	24	10.5	-10.5	<4
QK-3	04/17/13	7.2	102	1,136	<1	16	577	0.34	690	37	10.9	-5.5	<4
QK-3	04/22/13	7.2	100	1,046	1	114	425	<0.10	678	2,500	12.5	21	<4
QK-3	05/01/13	7.4	108	1,332	1	92	611	<0.10	830	600	13.5	-5.5	<4
QK-3	05/08/13	6.8	86	1,578	1	67	763	<0.10	963	74	15.6	-4.5	<4
QK-3	05/15/13	7.4	67	1,410	<1	104	661	0.20	843	11	15.4	-6.5	<4
QK-3	05/22/13	7.4	125	1,412	1	<10	653	0.25	813	11	12.8	-7.5	<4
QK-3	05/29/13	7.2	128	1,554	<1	<10	691	0.27	852	7	13.0	-10	<4
QK-3	12/04/13	7.1	112	1,058	<1	36	472	0.10	616	1	9.6	-6.5	<4
QK-4	03/13/13	6.9	115	692	1	48	394	0.63	504	8	8.5	16	<4
QK-4	03/20/13	7.5	70	936	1	46	387	0.27	NRR[5]	<1	6.8	21	<4
QK-4	03/27/13	7.2	79	952	1	47	387	0.28	614	<1	11.2	21	<4
QK-4	04/03/13	7.2	119	974	2	47	388	0.30	583	<1	10.5	5.9	<4
QK-4	04/10/13	7.4	74	934	1	52	387	0.39	630	<1	14.9	21	<4
QK-4	04/17/13	7.0	110	956	1	50	388	0.39	600	<1	12.9	12	<4
QK-4	04/22/13	7.3	115	822	<1	94	292	0.54	541	2,000	18.3	48	<4
QK-4	05/01/13	7.6	93	968	1	63	373	0.29	564	700	14.6	6.9	<4
QK-4	05/08/13	7.2	101	1,082	1	51	458	0.45	634	72	21.0	22	<4

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QK-1 THROUGH QK-4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2013

Well[1]	Sample Date	pH	EC[2]	TDS[2]	TOC[2]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform	Temp	Water Elevation[3]	Recharge Time
			mS/m	mg/L						MPN/100 mL	°C	ft.	hr.
QK-4	05/15/13	7.3	58	1,130	1	50	482	0.61	668	7	16.1	11	<4
QK-4	05/22/13	6.9	109	1,160	2	<10	501	0.64	676	4	13.1	14	<4
QK-4	05/29/13	6.8	103	1,286	1	<10	441	0.69	681	2	13.2	11	<4
QK-4	12/04/13	7.1	119	900	1	51	352	0.56	527	<1	10.4	6.9	<4

[1]Pump in Well QK-1 replaced during 2013 but burned out shortly afterwards due to silt accumulation in well. Replacement to be installed later.
[2]EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.
[3]Relative to Chicago city datum (579.48 ft above mean sea level) at intersection of Madison and State Streets.
[4]No analysis or other readings required; pre- and post-decontamination samples (10/16 and 10/18/13) tested for Cl only.
[5]No reportable result.

TABLE 2: DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QK-1 THROUGH QK-4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well[1]	Statistic	pH	EC[2]	TDS[2]	TOC[2]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[3]
			mS/m	mg/L						MPN/100 mL
QK-1	Minimum	6.8	204	1,142	1	32	533	<0.10	654	<4
	Mean	6.8	204	2,059	2	56	1,057	0.40	1,304	87
	Maximum	6.8	204	2,976	2	115	1,582	0.69	1,953	2,500
	Std. Dev.	NA[4]	NA	1,297	1	40	741	0.42	919	NA
	Median	6.8	204	2,059	2	39	1,057	0.40	1,304	1,252
	Coeff. of Var. (%)	NA	NA	63	53	71	70	105	71	NA
QK-2	Minimum	7.3	75	916	<1	<10	487	<0.10	90	<1
Fill event_1	Mean	7.5	86	938	<1	<10	522	<0.10	420	<1
	Maximum	7.6	108	960	<1	<10	582	<0.10	531	<1
	Std. Dev.	0.1	14	19	0	0	38	0.0	186	NA
	Median	7.5	80	928	<1	<10	513	<0.10	496	<1
	Coeff. of Var. (%)	1.8	16	2	0	0	7	0.0	44	NA
QK-2	Minimum	7.2	90	930	<1	<10	500	<0.10	494	<1
Fill event_2	Mean	7.4	106	1,182	1	<10	636	<0.10	658	1
	Maximum	7.6	119	1,352	1	<10	717	<0.10	751	2
	Std. Dev.	0.2	10	173	0.1	0	83	0.0	102	NA
	Median	7.3	105	1,249	1	<10	671	<0.10	695	<1

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QK-1 THROUGH QK-4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well[1]	Statistic	pH	EC[2]	TDS[2]	TOC[2]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[3]
			mS/m	mg/L						MPN/100 mL
	Coeff. of Var. (%)	2.1	9	15	7	0	13	0.0	16	NA
QK-3	Minimum	6.6	64	856	<1	13	374	0.16	186	1
Fill event_1	Mean	7.2	85	952	1	23	478	0.33	498	218
	Maximum	7.5	102	1,136	1	56	577	0.41	690	9,200
	Std. Dev.	0.3	17	112	0.1	16	75	0.09	174	NA
	Median	7.3	87	903	1	17	471	0.36	540	142
	Coeff. of Var. (%)	4.7	20	12	12	72	16	29	35	NA
QK-3	Minimum	6.8	67	1,046	<1	9	425	<0.10	616	1
Fill event_2	Mean	7.2	104	1,341	1	62	611	0.16	799	37
	Maximum	7.4	128	1,578	1	114	763	0.27	963	2,500
	Std. Dev.	0.2	22	215	0.1	44	121	0.08	116	NA
	Median	7.2	108	1,410	1	67	653	0.10	830	11
	Coeff. of Var. (%)	2.9	21	16	11	72	20	52	15	NA
QK-4	Minimum	6.9	70	692	1	46	387	0.27	504	<1
Fill event_1	Mean	7.2	94	907	1	48	388	0.38	586	1
	Maximum	7.5	119	974	2	52	394	0.63	630	8
	Std. Dev.	0.2	23	106	0.2	2	3	0.14	49	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QK-1 THROUGH QK-4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well[1]	Statistic	pH	EC[2]	TDS[2]	TOC[2]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[3]
			mS/m	mg/L						MPN/100 mL
	Median	7.2	95	944	1	48	388	0.35	600	1
	Coeff. of Var. (%)	3.2	24	12	21	5	1	36	8	NA
QK-4	Minimum	6.8	58	822	<1	50	292	0.29	527	<1
Fill event_2	Mean	7.2	100	1,050	1	62	414	0.54	613	42
	Maximum	7.6	119	1,286	2	94	501	0.69	681	2,000
	Std. Dev.	0.3	20	161	0.2	19	77	0.13	67	NA
	Median	7.2	103	1,082	1	51	441	0.56	634	40
	Coeff. of Var. (%)	3.7	20	15	18	30	19	25	11	NA

[1]Only 2 samples obtained from Wells QK-1 during 2013; well silted up, resulting in pump failure.
[2]EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.
[3]Geometric mean calculated.
[4]Not applicable.

TABLE 3: WELLS REFLECTING SIGNIFICANT INCREASES IN CONCENTRATIONS OF SPECIFIC ANALYTES FOLLOWING FILL EVENTS DURING 2013

Well/Event no.	TDS[1]	Cl	SO_4^{2-}	Hardness
	mg/L			
QK-2				
Event_1[2]	938	-	522	420
Event_2[3]	1232	-	663	690
p-value (α =0.05)	0.0005	-	0.0006	0.0084
QK-3				
Event_1	952	23	478	498
Event_2	1389	63	634	830
p-value (α=0.05)	0.0007	0.0003	0.0187	0.0020

[1]Total dissolved solids.
[2]3/13/13 through 4/17/13.
[3]4/22/13 through 5/29/13.