

*Protecting Our Water Environment*



*Metropolitan Water Reclamation District of Greater Chicago*

***MONITORING AND RESEARCH  
DEPARTMENT***

***REPORT NO. 17-31***

***TUNNEL AND RESERVOIR PLAN***

***GLORIA ALITTO MAJEWSKI***

***CHICAGO UNDERFLOW PLAN RESERVOIR***

***WATER QUALITY MONITORING WELLS***

***ANNUAL GROUNDWATER MONITORING REPORT***

***FOR 2016***

***August 2017***

## Protecting Our Water Environment

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Edward W. Podczerwinski, P.E.  
Acting Director of Monitoring and Research

July 26, 2017

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

Dear Sir or Madam:

Subject: Tunnel and Reservoir Plan, Gloria Alitto Majewski Chicagoland  
Underflow Plan Reservoir Water Quality Monitoring Wells, Annual  
Groundwater Monitoring Report for 2016

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 2016."

Very truly yours,

Albert E. Cox  
Environmental Monitoring and Research Manager  
Monitoring and Research Department

AC:PL:cm  
Attachment

cc w/att: Ms. Sally K. Swanson (USEPA Region 5 - WC15J) - (2)  
Mr. Podczerwinski  
Dr. Zhang  
Dr. Cox  
Dr. Tian  
Dr. Lindo  
cc w/o att: Mr. St. Pierre  
Mr. Murray

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**TUNNEL AND RESERVOIR PLAN  
GLORIA ALITTO MAJEWSKI  
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WATER QUALITY MONITORING WELLS  
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FOR 2016**

**Monitoring and Research Department  
Edward W. Podczewinski, Acting Director**

**August 2017**

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## LIST OF ABBREVIATIONS

°C	degrees Celsius
CCD	Chicago City Datum
CFU	colony forming units
Cl <sup>-</sup>	chloride
EC	electrical conductivity
FC	fecal coliform
ft	feet
hr	hour
IEPA	Illinois Environmental Protection Agency
L	liter
m	meter
mg	milligram
mL	milliliter
mS	millisiemens
NH <sub>3</sub> -N	ammonia nitrogen
SO <sub>4</sub> <sup>2-</sup>	sulfate
TDS	total dissolved solids
TOC	total organic carbon



## 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, W1X through W9X, which are located within 1,000 ft of the reservoir. The four monitoring wells are sampled quarterly and for at least six consecutive weeks following each reservoir fill event in which the reservoir is used to store combined sewer flow from the Tunnel and Reservoir Plan system (Illinois Environmental Protection Agency [IEPA] memorandum dated October 14, 1997). Fill-event samples may substitute for quarterly samples, depending on the occurrence of fill events. Groundwater elevations are also measured during each sampling event. There are no observation wells associated with this site.

There were three fill events at this site during the weeks of 2/17/16 through 8/30/16. Based on IEPA requirements, the wells should be sampled for at least six consecutive weeks following a fill event. As a result, Wells QK-1 through -4 were generally sampled for six consecutive weeks (2/17 - 3/22/16), and again for 11 consecutive weeks (6/24 - 8/30/16), following two consecutive fill events. However, Well QK-3 was sampled for a total of only 11 weeks following all events due to heavy construction traffic and poor road conditions in the vicinity of this well. One additional quarterly sample was collected at each well in December.

### Summary of Data

**Monitoring Wells.** The analytical data for groundwater sampled during 2016 from monitoring wells QK-1 through -4 are presented in Table 1. Physical characteristics, such as elevation, groundwater temperature, and estimated time of recharge for each well between initial pumpdown and sampling are also included. Table 2 lists the overall descriptive statistics for the groundwater data for these wells during 2016.

Following repairs and flushing of these wells in 2014, and decontamination in 2014 and 2015, the FC population in Well QK-1 was finally controlled. Throughout 2016, FC in all wells at this site was undetectable (<1 CFU/100 mL), except in QK-3 during three sampling events of summer 2016 (Table 1).



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

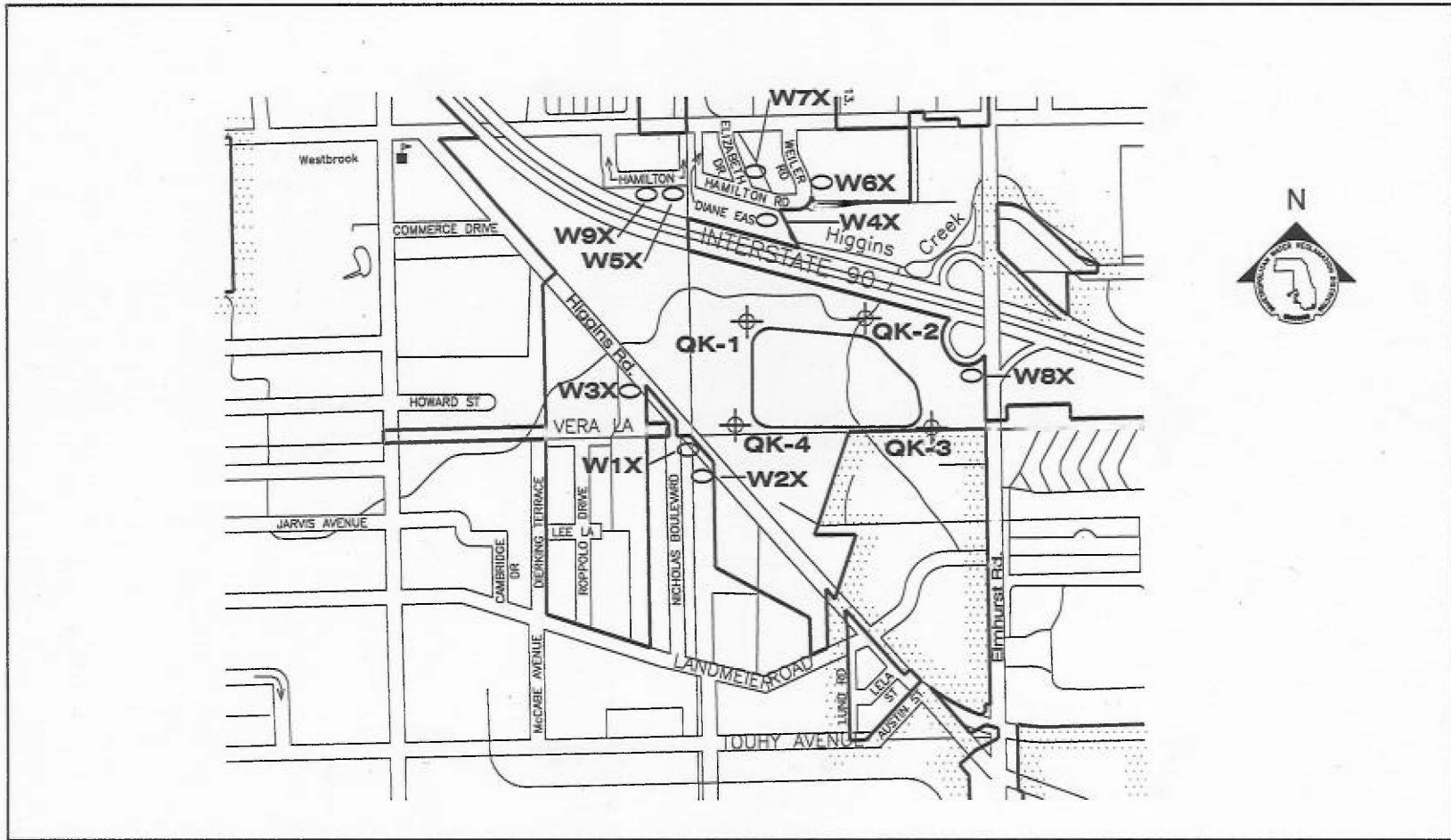


TABLE 1 : ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QK-1 THROUGH QK-4 IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2016

Well <sup>1</sup>	Date Sampled	pH	EC <sup>2</sup>	TDS <sup>2</sup>	TOC <sup>2</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform	Temp	Water Elevation <sup>3</sup>	Recharge Time
Fill Event 1			mS/m	----- mg/L -----						CFU/100mL	°C	ft	hr
QK-1	02/17/16	7.0	142	1,092	<1.0	43	583	0.24	676	<1	11.4	4.3	<4
QK-1	02/25/16	7.4	146	1,238	<1.0	30	746	<0.10	748	<1	10.9	5.3	<4
QK-1	02/29/16	7.4	155	894	1.0	<10	543	0.24	473	<1	12.1	8.0	<4
QK-1	03/09/16	7.5	145	1,048	<1.0	55	526	0.22	594	<1	12.3	5.3	<4
QK-1	03/14/16	6.9	149	1,182	1.1	34	683	<0.10	697	<1	12.2	5.3	<4
QK-1	03/22/16	7.5	143	1,026	<1.0	56	550	0.27	585	<1	11.6	8.3	<4
Fill Events 2 and 3 (consecutive)													
QK-1	06/24/16	7.5	124	888	<1.0	79	397	0.44	539	<1	15.1	5.3	<4
QK-1	06/29/16	7.3	143	1,142	<1.0	49	551	<0.10	613	<1	12.8	1.3	<4
QK-1	07/07/16	7.4	159	1,078	<1.0	64	386	0.29	572	<1	12.7	1.3	<4
QK-1	07/14/16	7.4	146	1,126	<1.0	51	537	0.17	622	<1	14.0	0.3	<4
QK-1	07/20/16	7.1	155	1,096	<1.0	59	472	0.29	582	<1	13.7	2.3	<4
QK-1	07/27/16	7.1	161	1,334	2.0	48	555	0.18	649	<1	13.3	5.3	<4
QK-1	08/03/16	7.2	149	1,080	<1.0	61	479	0.28	575	<1	14.6	5.3	<4
QK-1	08/10/16	7.2	153	1,058	<1.0	69	415	0.36	539	<1	13.2	4.3	<4
QK-1	08/17/16	7.2	155	966	<1.0	71	393	0.38	528	<1	13.4	3.3	<4
QK-1	08/26/16	6.8	158	1,036	<1.0	62	482	0.29	591	<1	13.5	2.3	<4
QK-1	08/30/16	7.1	157	1,238	1.0	42	544	0.16	668	<1	13.3	5.3	<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 2016

Well <sup>1</sup>	Date Sampled	pH	EC <sup>2</sup>	TDS <sup>2</sup>	TOC <sup>2</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform	Temp	Water Elevation <sup>3</sup>	Recharge Time
Fourth Quarter			mS/m	----- mg/L -----					CFU/100mL	°C	ft	hr	
QK-1	12/21/16	7.4	55	946	1.1	67	419	0.35	540	<1	10.1	3.3	<4
Fill Event 1													
QK-2	02/17/16	7.4	115	904	1.1	<10	585	0.40	490	<1	10.5	-6.0	<4
QK-2	02/25/16	7.3	122	880	<1.0	<10	588	0.25	479	<1	10.5	-3.0	<4
QK-2	02/29/16	7.8	121	816	<1.0	87	324	0.56	485	<1	12.3	-4.1	<4
QK-2	03/09/16	7.8	122	912	<1.0	<10	540	0.18	487	<1	12.5	-2.0	<4
QK-2	03/14/16	6.8	111	876	1.1	<10	565	0.17	476	<1	13.0	-1.0	<4
QK-2	03/22/16	7.0	116	896	<1.0	<10	599	0.23	472	<1	11.9	-4.0	<4
Fill Events 2 and 3 (consecutive)													
QK-2	06/24/16	7.8	122	952	<1.0	<10	616	0.42	533	<1	15.0	2.0	<4
QK-2	06/29/16	7.8	122	968	<1.0	<10	557	0.41	483	<1	15.1	-4.0	<4
QK-2	07/14/16	7.7	120	970	<1.0	<10	552	0.35	491	<1	15.3	-6.0	<4
QK-2	07/20/16	7.7	119	966	<1.0	<10	543	0.33	478	<1	15.7	-3.0	<4
QK-2	08/03/16	7.4	123	1,058	<1.0	<10	582	0.31	520	<1	16.5	-1.0	<4
QK-2	08/10/16	7.9	122	1,078	<1.0	<10	526	0.31	491	<1	15.7	-3.0	<4
QK-2	08/17/16	7.5	116	916	<1.0	<10	498	0.30	453	<1	16.1	-3.0	<4
QK-2	08/26/16	7.7	117	910	<1.0	<10	567	0.31	489	1	14.2	-5.0	<4
QK-2	08/30/16	7.7	116	1,028	<1.0	<10	547	0.42	478	<1	15.2	-1.0	<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 2016

Well <sup>1</sup>	Date Sampled	pH	EC <sup>2</sup>	TDS <sup>2</sup>	TOC <sup>2</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform	Temp	Water Elevation <sup>3</sup>	Recharge Time
Fourth Quarter			mS/m	----- mg/L -----						CFU/100mL	°C	ft	hr
QK-2	12/21/16	7.6	117	874	<1.0	<10	513	0.35	484	<1	9.9	-3.0	<4
Fill Event 1													
QK-3	02/17/16	6.9	188	1,654	<1.0	23	1,002	0.26	999	<1	10.1	-10	<4
QK-3	02/25/16	7.2	172	1,376	<1.0	20	898	0.29	810	<1	10.5	-8.5	<4
QK-3	02/29/16	7.2	144	1,204	<1.0	35	648	<0.10	720	<1	12.1	-12	<4
Fill Events 2 and 3 (consecutive)													
QK-3	06/24/16	7.1	145	1,122	<1.0	40	614	0.46	650	<1	13.2	-6.5	<4
QK-3	06/29/16	7.5	120	1,134	<1.0	21	611	0.30	600	7	12.9	-8.5	<4
QK-3	07/07/16	7.3	120	954	<1.0	22	447	0.52	482	1	13.2	-11	<4
QK-3	07/14/16	7.3	111	986	<1.0	22	459	0.47	475	<1	13.3	-12	<4
QK-3	07/20/16	6.6	105	948	<1.0	22	451	0.47	464	<1	14.3	-7.5	<4
QK-3	08/03/16	7.4	115	1,018	1.1	35	451	0.49	508	700	14.7	-7.5	<4
QK-3	08/17/16	6.5	103	874	<1.0	22	425	0.47	446	860	14.8	-11	<4
QK-3	08/26/16	7.1	104	838	<1.0	23	451	0.48	442	600	13.5	-7.5	<4

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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 2016

Well <sup>1</sup>	Date Sampled	pH	EC <sup>2</sup>	TDS <sup>2</sup>	TOC <sup>2</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform	Temp	Water Elevation <sup>3</sup>	Recharge Time
Fill Event 1			mS/m	----- mg/L -----				CFU/100mL	°C	ft	hr		
QK-4	02/17/16	7.0	118	788	<1.0	102	283	0.68	492	<1	11.2	8.9	<4
QK-4	02/25/16	7.3	123	798	<1.0	111	281	0.58	483	<1	11.0	8.9	<4
QK-4	02/29/16	7.6	125	1,132	<1.0	17	682	0.38	630	<1	11.6	8.5	<4
QK-4	03/09/16	7.7	125	812	1.0	96	278	0.56	476	<1	12.4	21	<4
QK-4	03/14/16	7.3	116	804	<1.0	102	294	0.57	472	<1	12.3	20	<4
QK-4	03/22/16	7.5	122	796	<1.0	100	284	0.63	466	<1	12.1	24	<4
Fill Events 2 and 3 (consecutive)													
QK-4	06/24/16	7.4	120	848	<1.0	109	280	0.61	474	<1	13.0	19	<4
QK-4	06/29/16	7.4	124	862	<1.0	112	267	0.51	480	<1	12.3	10	<4
QK-4	07/07/16	6.6	144	906	<1.0	97	268	0.61	475	<1	12.5	4	<4
QK-4	07/14/16	7.4	122	874	<1.0	90	293	0.51	476	<1	14.7	4	<4
QK-4	07/20/16	7.3	123	914	<1.0	108	255	0.61	489	<1	12.5	6	<4
QK-4	07/27/16	7.4	123	990	<1.0	110	240	0.62	476	<1	12.4	20	<4
QK-4	08/03/16	7.4	123	882	<1.0	106	269	0.62	479	<1	13.0	20	<4
QK-4	08/10/16	7.4	124	906	1.2	96	279	0.58	482	<1	12.8	16	<4
QK-4	08/17/16	7.4	121	852	<1.0	106	252	0.59	474	6	13.2	15	<4
QK-4	08/26/16	7.4	123	908	<1.0	106	281	0.58	489	<1	12.1	13	<4
QK-4	08/30/16	7.3	123	906	1.1	107	281	0.70	487	<1	12.6	21	<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 2016

Well <sup>1</sup>	Date Sampled	pH	EC <sup>2</sup>	TDS <sup>2</sup>	TOC <sup>2</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform	Temp	Water Elevation <sup>3</sup>	Recharge Time
Quarterly Event			mS/m	----- mg/L -----						CFU/100mL	°C	ft	hr
QK-4	12/21/16	7.1	118	830	<1.0	83	289	0.52	476	<1	10.8	17	<4

<sup>1</sup>Fewer samples from Well QK-3 during 2016; access blocked by highway construction equipment and traffic; soft puddles near well.

<sup>2</sup>EC = electrical conductivity; TDS = total dissolved solids; TOC = total organic carbon.

<sup>3</sup>Relative to Chicago City Datum (579.48 ft above mean sea level) at the intersection of Madison and State Streets.

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 2016

Well	Statistic	pH	EC <sup>1</sup>	TDS <sup>1</sup>	TOC <sup>1</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform <sup>2</sup>
Fill Event 1			mS/m	----- mg/L -----					CFU/100 mL	
QK-1	Minimum	6.9	142	894	<1.0	30	526	0.22	473	<1
	Median	7.4	145	1,070	<1.0	43	567	0.24	635	<1
	Mean	7.3	147	1,080	<1.0	44	605	0.24	629	<1
	Maximum	7.5	155	1,238	1.1	56	746	0.27	748	<1
	Std. Dev	0.25	5	122	0.04	12	89	0.02	98	NA
	Coeff. of Var. (%)	3.5	3	11	4.1	27	15	8.50	16	NA
Fill Events 2 and 3 (consecutive)										
QK-1	Minimum	6.8	124	888	<1.0	42	386	0.16	528	<1
	Median	7.2	155	1,080	<1.0	61	479	0.29	582	<1
	Mean	7.2	151	1,095	1.0	60	474	0.28	589	<1
	Maximum	7.5	161	1,334	1.0	79	555	0.44	668	<1
	Std. Dev	0.19	10	121	0.30	11	67	0.09	46	NA
	Coeff. of Var. (%)	2.6	7	11	30.2	19	14	32.9	7.7	NA
Fill Event 1										
QK-2	Minimum	6.8	111	816	<1.0	<10	324	0.17	472	<1
	Median	7.3	118	888	<1.0	<10	575	0.24	482	<1
	Mean	7.3	118	881	1.0	23	534	0.30	482	<1
	Maximum	7.8	122	912	1.1	87	599	0.56	490	<1
	Std. Dev	0.41	5	35	0.05	31	105	0.15	6.9	NA
	Coeff. of Var. (%)	5.6	4	4	5.2	135	20	51.1	1.4	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 2016

Well	Statistic	pH	EC <sup>1</sup>	TDS <sup>1</sup>	TOC <sup>1</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform
			mS/m	----- mg/L -----						CFU/100 mL
Fill Events 2 and 3 (consecutive)										
QK-2	Minimum	7.4	116	910	<1.0	<10	498	0.30	453	<1
	Median	7.7	120	968	<1.0	<10	552	0.33	489	<1
	Mean	7.7	120	983	<1.0	<10	554	0.35	491	<1
	Maximum	7.9	123	1,078	<1.0	<10	616	0.42	533	<1
	Std. Dev	0.16	3	59	NA	NA	33	0.05	24	NA
	Coeff. of Var. (%)	2.1	2	6	NA	NA	6	14.6	4.8	NA
Fill Event 1										
QK-3	Minimum	6.9	144	1,204	<1.0	20	648	<0.10	720	<1
	Median	7.2	172	1,376	<1.0	23	898	0.28	810	<1
	Mean	7.1	168	1,411	<1.0	26	849	0.23	843	<1
	Maximum	7.2	188	1,654	<1.0	35	1,002	0.29	999	<1
	Std. Dev	0.17	22	227	NA	8	182	0.10	142	NA
	Coeff. of Var. (%)	2.4	13	16	NA	31	21	43.5	17	NA
Fill Events 2 and 3 (consecutive)										
QK-3	Minimum	6.5	103	838	<1.0	21	425	0.30	442	<1
	Median	7.2	113	970	<1.0	22	451	0.47	479	4
	Mean	7.1	115	984	<1.0	26	489	0.46	508	15

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 2016

Well	Statistic	pH	EC <sup>1</sup>	TDS <sup>1</sup>	TOC <sup>1</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform <sup>2</sup>
			mS/m	----- mg/L -----						CFU/100 mL
	Maximum	7.5	145	1,134	1.10	40	614	0.52	650	860
	Std. Dev	0.38	14	106	0.05	7	77	0.07	76	378
	Coeff. of Var. (%)	5.3	12	11	4.8	28	16	14.5	15	2,520
Fill Event 1										
QK-4	Minimum	7.0	116	788	<1.0	17	278	0.38	466	<1
	Median	7.4	123	801	<1.0	101	284	0.58	480	4
	Mean	7.4	121	855	<1.0	88	350	0.57	503	15
	Maximum	7.7	125	1,132	<1.0	111	682	0.68	630	860
	Std. Dev	0.24	4	136	NA	35	163	0.10	63	378
	Coeff. of Var. (%)	3.3	3	16	NA	40	46	18.0	12	2,520
Fill Events 2 and 3 (consecutive)										
QK-4	Minimum	6.6	120	848	<1.0	90	240	0.51	474	<1
	Median	7.4	123	906	<1.0	106	269	0.61	479	<1
	Mean	7.3	125	895	<1.0	104	270	0.59	480	1
	Maximum	7.4	144	990	1.2	112	293	0.70	489	6
	Std. Dev	0.25	7	40	0.06	7	15	0.05	5.9	1.4
	Coeff. of Var. (%)	3.4	5	4	6.1	7	6	8.9	1.2	140

<sup>1</sup>EC = electrical conductivity; TDS = total dissolved solids; TOC = total organic carbon.

<sup>2</sup>Geometric mean is evaluated since data are assumed to be Log-Normally Distributed.

<sup>3</sup>Not applicable.