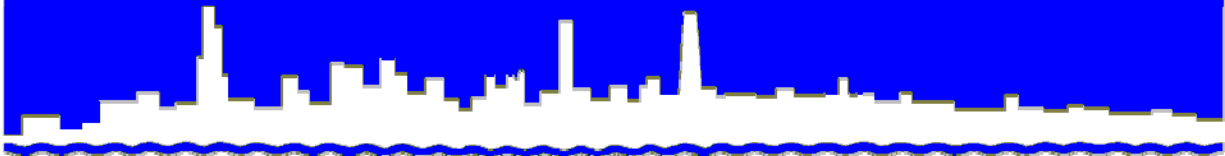


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

*MONITORING AND RESEARCH
DEPARTMENT*

REPORT NO. 19-19

TUNNEL AND RESERVOIR PLAN

GLORIA ALITTO MAJEWSKI

CHICAGO UNDERFLOW PLAN RESERVOIR

WATER QUALITY MONITORING WELLS

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2018

July 2019



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July 26, 2019

Chief
Bureau of Water
Illinois Environmental Protection Agency
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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 2018

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 2018."

Very truly yours,



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

AC:NK:cm
Attachment

cc w/att: Ms. Sally K. Swanson (USEPA Region 5 - WC15J) - (2)
Mr. E. Podczerwinski
Dr. H. Zhang
cc w/o att: Mr. J. Murray
Mr. T. Conway

Metropolitan Water Reclamation District of Greater Chicago
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**TUNNEL AND RESERVOIR PLAN
GLORIA ALITTO MAJEWSKI
CHICAGO UNDERFLOW PLAN RESERVOIR
WATER QUALITY MONITORING WELLS
ANNUAL GROUNDWATER MONITORING REPORT
FOR 2018**

**Monitoring and Research Department
Edward W. Podczerwinski, Director**

July 2019

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LIST OF ABBREVIATIONS

°C	degrees Celsius
CCD	Chicago City Datum
CFU	colony forming units
Cl ⁻	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 ₃ -N	ammonia nitrogen
SO ₄ ²⁻	sulfate
TDS	total dissolved solids
Temp	temperature
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 located 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 six fill events at this site during the weeks of 02/28/18 through 12/04/18. As a result, sampling of wells QK-1 through -4 was scheduled for six consecutive weeks (02/28 – 04/02/18) following fill event 1, six consecutive weeks (05/04 – 06/08/18) following event 2, eight consecutive weeks (06/14 – 08/01/18) following two consecutive fill events (3 and 4), six consecutive weeks, except for the week of 09/26/18, (08/30 – 10/12/18) for fill event 5, and six consecutive weeks (12/04/18 – 01/09/19) for fill event 6. Sampling could not be conducted for some weeks during the above periods because the access to the wells were blocked by construction equipment, wells were dry, or well pumps/sampling equipment did not function properly.

Summary of Data

Monitoring Wells. The analytical data for groundwater sampled during 2018 from monitoring wells QK-1 through -4, along with descriptive statistics, 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.

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

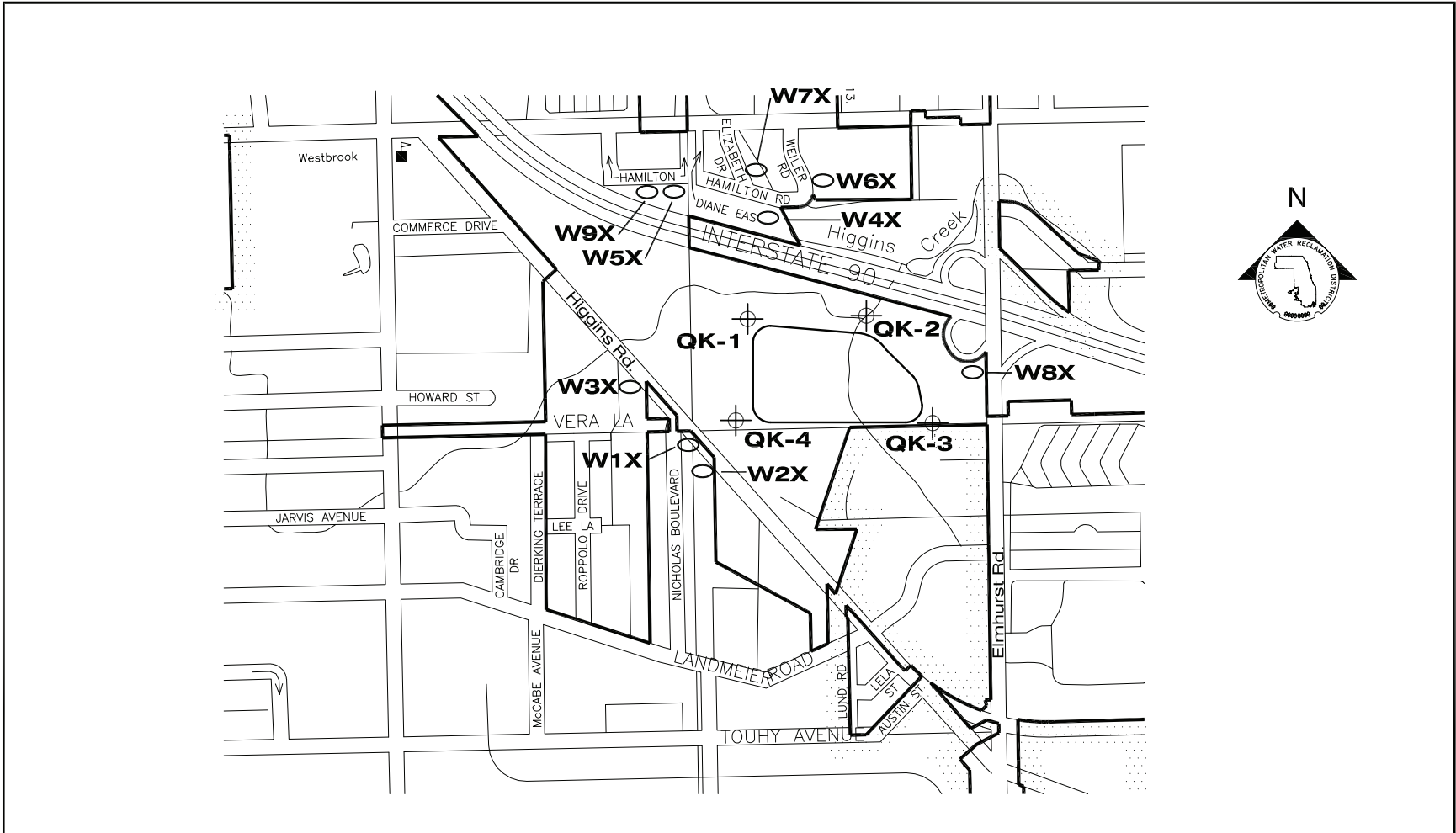


TABLE 1: ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER FROM MONITORING WELLS IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESRVOIR PLAN DURING 2018

Well	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ⁴	Temp	Water Elevation ⁶	Recharge Time
			mS/m	----- mg/L -----						CFU/100 mL	°C	ft	hr
QK-1	02/28/18	7.1	172	1,706	1.3	137	898	0.16	970	980	11.9	-80.9	<4
QK-1	03/05/18	7.0	232	1,800	1.9	125	1,053	<0.10	1,081	360	11.7	-82.9	<4
QK-1	03/15/18	7.0	206	2,116	1.3	105	1,243	<0.10	1,169	360	13.8	-77.9	<4
QK-1	03/22/18	N/S ¹	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
QK-1	03/26/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
QK-1	04/02/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	Minimum	7.0	172	1,706	1.3	105	898	<0.10	970	360			
	Median	7.0	206	1,800	1.3	125	1,053	0.10	1,081	360			
	Mean	7.0	203	1,874	1.5	122	1,065	0.12	1,073	503			
	Maximum	7.1	232	2,116	1.9	137	1,243	0.16	1,169	980			
	Std. Dev.	0.0	30	215	0.3	16	173	0.03	100				
	Coeff. of Var. (%)	0.3	15	11	23	13	16	27	9				
Fill Event 2													
QK-1	05/04/18	6.9	180	1,540	2.2	96	782	0.46	969	170,000	12.2	-73.9	<4
QK-1	05/09/18	7.0	235	1,668	1.6	89	1,064	<0.10	1,234	880	12.9	-76.9	<4
QK-1	05/18/18	7.0	140	2,026	1.4	87	1,105	0.13	1,245	290	12.8	-79.9	<4
QK-1	05/25/18	7.1	211	2,110	1.1	85	1,125	<0.10	1,289	1,400	13.5	-77.9	<4
QK-1	06/01/18	6.8	147	1,954	1.3	89	1,212	0.18	1,365	75	13.3	-77.9	<4
QK-1	06/08/18	6.8	213	1,278	1.1	88	627	0.37	778	66	12.5	-79.9	<4
	Minimum	6.8	140	1,278	1.1	85	627	<0.10	778	66			
	Median	6.9	196	1,811	1.4	89	1,084	0.15	1,240	585			
	Mean	6.9	188	1,763	1.5	89	986	0.22	1,147	818			
	Maximum	7.1	235	2,110	2.2	96	1,212	0.46	1,365	170,000			
	Std. Dev.	0.1	39	323	0.4	4	228	0.15	225				
	Coeff. of Var. (%)	1.4	21	18	29	4	23	69	20				

TABLE 1 (Continued): ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER FROM MONITORING WELLS IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESRVOIR PLAN DURING 2018

Well	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ⁴	Temp	Water Elevation ⁶	Recharge Time
			mS/m			mg/L				CFU/100 mL	°C	ft	hr
Fill Events 3 and 4 Consecutive													
QK-1	06/14/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
QK-1	06/20/18	6.9	248	2,218	1.2	88	551	0.11	1,209	50	13.4	-77.9	<4
QK-1	06/28/18	7.2	215	2,086	1.7	93	1,033	NA ³	1,139	16,000	14.7	-77.9	<4
QK-1	07/02/18	7.0	148	2,070	1.7	95	1,121	<0.50	1,112	1,600	13.2	-79.9	<4
QK-1	07/11/18	7.2	190	1,706	1.5	44	1,163	<0.50	1,274	600	14.6	-81.9	<4
QK-1	07/17/18	6.9	235	1,658	1.5	89	916	<0.50	1,098	80	13.2	-82.9	<4
QK-1	07/27/18	7.0	236	1,496	1.2	84	929	<0.50	1,199	59	13.4	-82.9	<4
QK-1	08/01/18	7.2	230	1,932	1.2	83	1,184	NA	1,242	17	13.9	-82.9	<4
4	Minimum	6.9	148	1,496	1.2	44	551	<0.50	1,098	17			
	Median	7.0	230	1,932	1.5	88	1,033	0.50	1,199	80			
	Mean	7.1	215	1,881	1.4	82	985	0.37	1,182	250			
	Maximum	7.2	248	2,218	1.7	95	1,184	0.11	1,274	16,000			
	Std. Dev.	0.2	35	265	0.2	17	219	0.20	67				
	Coeff. of Var. (%)	2.3	16	14	16	21	22	54.0	6				
Fill Event 5													
QK-1	08/30/18	6.5	140	2,202	1.4	81	1,174	<0.50	1,504	130	13.6	-77.9	<4
QK-1	09/07/18	7.0	201	1,134	1.3	82	1,242	<0.50	1,317	35	13.2	-82.9	<4
QK-1	09/14/18	6.9	162	1,400	1.6	86	1,049	<0.50	1,181	13	13.1	-81.9	<4
QK-1	09/21/18	6.8	249	1,372	1.4	89	997	<0.50	1,250	8	13.3	-82.9	<4
QK-1	10/03/18	7.0	250	2,228	1.0	89	1,307	<0.50	1,489	NRR ⁵	13.3	-79.9	<4
QK-1	10/12/18	7.2	178	1,842	1.2	83	1,237	<0.50	1,390	10	13.2	-78.9	<4
	Minimum	6.5	140	1,134	1.0	81	997	<0.50	1,181	8			
	Median	6.9	189	1,621	1.4	85	1,205	<0.50	1,354	13			
	Mean	6.9	197	1,696	1.3	85	1,168	<0.50	1,355	22			

TABLE 1 (Continued): ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER FROM MONITORING WELLS IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESRVOIR PLAN DURING 2018

Well	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ⁴	Temp	Water Elevation ⁶	Recharge Time	
			mS/m	----- mg/L -----						CFU/100 mL	°C	ft	hr	
	Minimum	7.5	125	918	1.3	5.0	588	0.21	501	<1				
	Median	7.5	125	939	2.1	5.5	592	0.22	517	<1				
	Mean	7.5	125	939	2.1	5.5	592	0.22	517	<1				
	Maximum	7.5	126	960	2.9	6.0	596	0.23	533	<1				
	Std. Dev.	0.1	1	30	1.1	0.7	5	0.02	23					
	Coeff. of Var. (%)	0.8	0.7	3.2	54	13	0.9	8.1	4.4					
	Fill event 2													
9	QK-2	05/04/18	7.7	119	890	1.3	5	553	0.53	491	<1	12.5	-80.7	<4
	QK-2	05/09/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	QK-2	05/18/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	QK-2	05/25/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	QK-2	06/01/18	7.5	78	990	<1.0	5	577	0.26	528	<1	13.6	-81.7	<4
	QK-2	06/08/18	7.3	121	992	1.0	<5	604	0.25	535	<1	12.9	-88.7	<4
	Minimum	7.3	78	890	<1.0	<5	553	0.25	491	<1				
	Median	7.5	119	990	1.2	5	577	0.26	528	<1				
	Mean	7.5	106	957	1.2	5	578	0.34	518	<1				
	Maximum	7.7	121	992	1.3	5	604	0.53	535	<1				
	Std. Dev.	0.2	24	58	0.2	0.0	26	0.16	24					
	Coeff. of Var. (%)	2.6	23.0	6.1	18	0.0	4.5	46	4.6					
	Fill Events 3 and 4 Consecutive													
	QK-2	06/14/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	QK-2	06/20/18	7.5	119	932	1.4	5	273	0.25	452	<1	14.6	-82	<4
	QK-2	06/28/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	QK-2	07/02/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	QK-2	07/11/18	7.7	119	952	1.3	<5	574	<0.50	588	<1	14.3	-88	<4
	QK-2	07/17/18	7.5	118	912	1.3	<5	566	<0.50	537	<1	15.2	-89	<4
	QK-2	07/27/18	7.3	116	912	1.2	5	385	<0.50	500	<1	13.7	-90	<4
	QK-2	08/01/18	7.8	115	984	1.2	5	507	<0.50	464	<1	15.1	-90	<4

TABLE 1 (Continued): ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER FROM MONITORING WELLS IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESRVOIR PLAN DURING 2018

Well	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ⁴	Temp	Water Elevation ⁶	Recharge Time	
			mS/m	-----	-----	mg/L	-----	-----		CFU/100 mL	°C	ft	hr	
	Minimum	7.3	115	912	1.2	<5	273	<0.50	452	<1				
	Median	7.5	118	932	1.3	5	507	0.50	500	<1				
	Mean	7.6	117	938	1.3	5	461	0.45	508	<1				
	Maximum	7.8	119	984	1.4	5	574	0.25	588	<1				
	Std. Dev.	0.2	1.8	30	0.1	0.0	129	0.11	56					
	Coeff. of Var. (%)	2.7	1.5	3.2	6.5	0.0	28	25	11					
	Fill Event 5													
	QK-2	08/30/18	7.4	73	994	1.2	5	573	<0.50	459	<1	14.5	-82.7	<4
	QK-2	09/07/18	7.2	126	358	1.5	5	471	<0.50	578	<1	13.9	-89.7	<4
	QK-2	09/14/18	7.6	79	934	1.4	6	630	<0.50	492	<1	14.7	-88.7	<4
	QK-2	09/21/18	7.5	114	798	1.0	5	555	<0.50	506	<1	15.7	-89.7	<4
	QK-2	10/03/18	7.4	115	884	1.1	56	262	0.63	422	<1	13.5	-87.7	<4
	QK-2	10/12/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	Minimum	7.2	73	358	1.0	5	262	<0.50	422	<1				
	Median	7.4	114	884	1.2	5	555	0.50	492	<1				
	Mean	7.4	102	794	1.2	15	498	0.53	491	<1				
	Maximum	7.6	126	994	1.5	56	630	0.63	578	<1				
	Std. Dev.	0.1	24	254	0.2	23	144	0.10	58					
	Coeff. of Var. (%)	1.9	23	32	17	147	29	13	12					
	Fill Event 6													
	QK-2	12/04/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	QK-2	12/13/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	QK-2	12/19/18	7.4	119	884	1.6	5	542	<0.50	485	<1	11.8	-82.7	<4
	QK-2	12/27/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	QK-2	01/04/19	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	QK-2	01/09/19	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S

TABLE 1 (Continued): ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER FROM MONITORING WELLS IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESRVOIR PLAN DURING 2018

Well	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ⁴	Temp	Water Elevation ⁶	Recharge Time	
			mS/m	----- mg/L -----					CFU/100 mL	°C	ft	hr		
	Minimum	7.4	119	884	1.6	5	542	<0.50	485	<1				
	Median	7.4	119	884	1.6	5	542	<0.50	485	<1				
	Mean	7.4	119	884	1.6	5	542	<0.50	485	<1				
	Maximum	7.4	119	884	1.6	5	542	<0.50	485	<1				
	Std. Dev.													
	Coeff. of Var. (%)													
	Fill Event 1													
8	QK-3	02/28/18	7.3	141	1,500	1.0	116	789	0.14	823	5,000	15.3	-91.0	<4
	QK-3	03/05/18	7.1	198	1,456	1.3	112	852	0.26	869	3,700	11.5	-96.0	<4
	QK-3	03/15/18	7.0	183	1,452	1.4	70	849	0.29	810	1,000	11.8	-91.0	<4
	QK-3	03/22/18	6.9	680	1,290	1.7	72	658	0.43	681	97	11.4	-95.0	<4
	QK-3	03/26/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	QK-3	04/02/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	Minimum	6.9	141	1,290	1.0	70	658	0.1	681	97				
	Median	7.1	191	1,454	1.4	92	819	0.3	817	2,350				
	Mean	7.1	301	1,425	1.4	93	787	0.3	796	1,157				
	Maximum	7.3	680	1,500	1.7	116	852	0.4	869	5,000				
	Std. Dev.	0.2	254	92	0.3	25	91	0.1	81					
	Coeff. of Var. (%)	2.5	85	6.5	21	27	12	42	10					
	Fill event 2													
	QK-3	05/04/18	7.1	180	1,026	2.1	98	432	0.15	627	44,000	12.9	-88.0	<4
	QK-3	05/09/18	7.2	110	744	1.9	60	270	0.52	456	4,300	12.8	-87.0	<4
	QK-3	05/18/18	6.9	102	906	1.4	58	327	0.58	457	2,700	12.5	-92.0	<4
	QK-3	05/25/18	7.4	103	742	1.0	60	282	0.54	441	9,900	13.5	-93.0	<4
	QK-3	06/01/18	7.4	66	770	1.1	56	254	0.67	401	2,400	13.5	-93.0	<4
	QK-3	06/08/18	7.0	100	754	1.1	56	270	0.61	436	460	12.8	-92.0	<4

TABLE 1 (Continued): ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER FROM MONITORING WELLS IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESRVOIR PLAN DURING 2018

Well	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ⁴	Temp	Water Elevation ⁶	Recharge Time	
			mS/m	-----	-----	mg/L	-----	-----	-----	CFU/100 mL	°C	ft	hr	
	Minimum	6.9	66	742	1.0	56	254	0.15	401	460				
	Median	7.2	103	762	1.3	59	276	0.56	449	3,500				
	Mean	7.2	110	824	1.4	65	306	0.51	470	4,212				
	Maximum	7.4	180	1026	2.1	98	432	0.67	627	44,000				
	Std. Dev.	0.2	38	117	0.5	16	67	0.18	80					
	Coeff. of Var. (%)	2.8	34	14	32	25	22	36	17					
	Fill Events 3 and 4 Consecutive													
6	QK-3	06/14/18	7.0	102	942	1.0	60	264	0.62	444	>20,000	13.1	-94.0	<4
	QK-3	06/20/18	7.3	100	758	1.1	57	271	0.76	374	7,000	13.8	-91.0	<4
	QK-3	06/28/18	7.3	100	870	1.8	65	262	NA	420	1,100	15.0	-91.0	<4
	QK-3	07/02/18	6.8	68	852	1.2	57	253	0.62	394	2,600	14.4	-94.0	<4
	QK-3	07/11/18	6.8	96	846	1.5	60	268	0.62	449	890	15.6	-96.0	<4
	QK-3	07/17/18	7.1	102	732	1.3	56	271	0.67	459	1,900	13.9	-96.0	<4
	QK-3	07/27/18	7.3	103	816	1.1	56	307	0.64	449	260	13.6	-96.0	<4
	QK-3	08/01/18	7.7	102	898	1.1	56	292	0.61	421	120	14.6	-97.0	<4
	Minimum	6.8	68	732	1.0	56	253	0.61	374	120				
	Median	7.2	101	849	1.2	57	269	0.62	433	1,500				
	Mean	7.1	97	839	1.3	58	273	0.65	426	1,464				
	Maximum	7.7	103	942	1.8	65	307	0.76	459	>20,000				
	Std. Dev.	0.3	12	69	0.3	3.2	18	0.05	30					
	Coeff. of Var. (%)	4.1	12	8.3	21	5.4	6.5	8.4	7.0					

TABLE 1 (Continued): ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER FROM MONITORING WELLS IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESRVOIR PLAN DURING 2018

Well	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ⁴	Temp	Water Elevation ⁶	Recharge Time
			mS/m	----- mg/L -----					CFU/100 mL	°C	ft	hr	
Fill Event 5													
QK-3	08/30/18	7.11	65	792	1.7	60	256	0.51	411	120,000	13.8	-91.0	<4
QK-3	09/07/18	7.28	114	498	1.4	51	251	0.57	542	6,800	13.4	-91.0	<4
QK-3	09/14/18	6.78	67	806	1.1	57	297	0.67	421	630	14.7	-95.0	<4
QK-3	09/21/18	7.16	102	336	1.0	56	277	0.62	409	210	13.4	-95.0	<4
QK-3	10/03/18	7.25	108	694	1.4	<10	553	<0.50	442	57	12.9	-92.0	<4
QK-3	10/12/18	7.95	107	788	1.1	55	32	0.59	483	300	12.6	-86.0	<4
	Minimum	6.8	65	336	1.0	<10	32	<0.50	409	57			
	Median	7.2	102	698	1.3	55	277	0.59	442	630			
	Mean	7.2	90	659	1.3	49	281	0.58	451	1,311			
	Maximum	8.0	114	806	1.7	60	553	0.67	542	120,000			
	Std. Dev.	0.4	22	177	0.2	17	152	0.1	48				
	Coeff. of Var. (%)	5.3	24	27	19	36	54	12	11				
Fill Event 6													
QK-3	12/04/18	7.4	138	974	1.4	84	409	<0.50	632	21,000	11.5	-83.0	<4
QK-3	12/13/18	8.0	79	662	1.0	62	301	0.57	416	2,900	11.8	-83.0	<4
QK-3	12/19/18	7.4	111	684	<1.0	63	351	0.54	429	800	12.9	-83.0	<4
QK-3	12/27/18	7.8	79	822	1.0	61	326	0.60	435	200	11.8	-82.0	<4
QK-3	01/04/19	8.0	781	670	<1.0	56	331	0.61	443	30	11.1	-83.0	<4
QK-3	01/09/19	8.5	768	814	<1.0	55	334	0.60	438	40	11.4	-89.0	<4
	Minimum	7.4	79	662	<1.0	55	301	<0.50	416	30			
	Median	7.9	124	749	1.0	62	333	0.58	437	500			
	Mean	7.9	326	771	1.1	64	342	0.57	466	476			
	Maximum	8.5	781	974	1.4	84	409	0.61	632	21,000			
	Std. Dev.	0.4	348	123	0.2	11	37	0.04	82				
	Coeff.oOf Var. (%)	5.6	107	16	15	17	11	7.4	18				

TABLE 1 (Continued): ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER FROM MONITORING WELLS IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESRVOIR PLAN DURING 2018

Well	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ⁴	Temp	Water Elevation ⁶	Recharge Time
			mS/m	----- mg/L -----					CFU/100 mL	°C	ft	hr	
Fill Event 1													
QK-4	02/28/18	7.4	91	790	1.1	94	292	0.69	461	550	12.5	-71.8	<4
QK-4	03/05/18	7.2	114	814	1.7	111	286	0.67	459	420	10.7	-76.8	<4
QK-4	03/15/18	7.3	121	780	1.4	92	313	0.70	445	120	12.2	-63.8	<4
QK-4	03/22/18	7.0	115	762	1.3	78	328	0.70	445	68	11.3	-77.8	<4
QK-4	03/26/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
QK-4	04/02/18	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
	Minimum	7.0	91	762	1.1	78	286	0.67	445	68			
	Median	7.2	114	785	1.4	93	303	0.69	452	270			
	Mean	7.2	110	787	1.4	94	305	0.69	453	208			
	Maximum	7.4	121	814	1.7	111	328	0.70	461	550			
	Std. Dev.	0.2	13	22	0.3	14	19	0.01	8.7				
	Coeff. of Var. (%)	2.6	12	3	15	14	6	7.4	1.9				
Fill Event 2													
QK-4	05/04/18	7.3	117	826	1.9	95	293	0.71	478	49	12.1	-59.8	<4
QK-4	05/09/18	7.3	114	814	2.4	84	300	0.63	465	20	12.7	-67.8	<4
QK-4	05/18/18	7.2	105	938	1.3	97	307	0.68	475	2	12.0	-76.8	<4
QK-4	05/25/18	7.4	115	788	<1.0	88	299	0.66	448	9	13.5	-66.8	<4
QK-4	06/01/18	7.2	69	844	<1.0	95	292	0.63	444	3	12.4	-67.8	<4
QK-4	06/08/18	7.2	110	844	1.0	94	324	0.65	462	<1	12.1	-75.8	<4
	Minimum	7.2	69	788	<1.0	84	292	0.63	444	<1			
	Median	7.3	112	835	1.2	95	299	0.65	464	6			
	Mean	7.3	105	842	1.4	92	302	0.66	462	6			
	Maximum	7.4	117	938	2.4	97	324	0.71	478	49			
	Std. Dev.	0.1	18	51	0.6	5.0	12	0.03	14				
	Coeff. of Var. (%)	0.8	17	6.1	15	5.5	3.9	7.4	3.0				

TABLE 1 (Continued): ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER FROM MONITORING WELLS IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESRVOIR PLAN DURING 2018

Well	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ⁴	Temp	Water Elevation ⁶	Recharge Time
			mS/m			mg/L				CFU/100 mL	°C	ft	hr
Fill Events 3 and 4 Consecutive													
QK-4	06/14/18	7.3	112	1,036	1.0	106	285	0.71	471	1	13.0	-75.8	<4
QK-4	06/20/18	7.3	115	832	1.8	97	481	0.64	448	<1	13.3	-66.8	<4
QK-4	06/28/18	7.5	117	920	1.7	96	295	NA	464	<1	13.7	-68.8	<4
QK-4	07/02/18	7.0	70	940	1.7	89	320	0.73	417	<1	13.2	-72.8	<4
QK-4	07/11/18	7.3	118	842	1.5	113	272	0.68	480	<1	13.8	-78.8	<4
QK-4	07/17/18	7.2	110	818	1.6	93	301	0.72	497	<1	12.9	-79.8	<4
QK-4	07/27/18	7.5	109	818	1.2	96	297	0.70	476	<1	12.8	-80.8	<4
QK-4	08/01/18	7.2	99	882	1.2	87	267	0.66	445	1	15.8	-79.8	<4
	Minimum	7.0	70	818	1.0	87	267	0.64	417	<1			
	Median	7.3	111	862	1.2	96	296	0.70	468	1			
	Mean	7.3	106	886	1.4	97	315	0.69	462	1			
	Maximum	7.5	118	1,036	1.8	113	481	0.73	497	1			
	Std. Dev.	0.2	16	76	0.3	8.6	69	0.04	25				
	Coeff. of Var. (%)	2.3	15	8.6	15	8.9	22	7.4	5.4				
Fill Event 5													
QK-4	08/30/18	6.8	73	934	1.4	97	267	0.64	466	<1	13.2	-68.8	<4
QK-4	09/07/18	7.2	119	828	1.3	84	243	0.60	473	<1	12.6	-78.8	<4
QK-4	09/14/18	7.1	74	866	1.4	96	316	0.74	472	<1	13	-80.8	<4
QK-4	09/21/18	7.4	108	704	1.3	94	301	0.65	471	<1	13.2	-80.8	<4
QK-4	10/03/18	7.5	112	802	1.2	104	249	0.64	477	<1	12.7	-77.8	<4
QK-4	10/12/18	7.3	117	772	1.2	98	283	0.55	467	<1	12.4	-65.8	<4
	Minimum	6.8	73	704	1.2	84	243	0.55	466	<1			
	Median	7.3	110	815	1.2	97	275	0.64	472	<1			
	Mean	7.2	101	818	1.4	96	277	0.64	471	<1			
	Maximum	7.5	119	934	1.4	104	316	0.74	477	<1			
	Std. Dev.	0.2	22	79	0.1	6.6	29	0.06	4.0				
	Coeff. of Var. (%)	3.3	21	10	15	6.9	10	7.4	0.9				

TABLE 1 (Continued): ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER FROM MONITORING WELLS IN THE GLORIA ALITTO MAJEWSKI CHICAGOLAND UNDERFLOW PLAN OF THE TUNNEL AND RESRVOIR PLAN DURING 2018

Well	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ⁴	Temp	Water Elevation ⁶	Recharge Time
Fill Event 6			mS/m	-----	-----	mg/L	-----	-----		CFU/100 mL	°C	ft	hr
QK-4	12/04/18	7.5	115	802	1.1	101	280	0.72	777	<1	11.8	-64.8	<4
QK-4	12/13/18	7.6	89	796	1.0	108	279	0.69	476	<1	12.0	-65.8	<4
QK-4	12/19/18	7.4	122	794	1.6	109	301	0.68	480	<1	12.5	-68.8	<4
QK-4	12/27/18	7.6	92	818	1.0	114	270	0.68	470	<1	12.5	-69.8	<4
QK-4	01/04/19	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	-71.8	N/S
QK-4	01/09/19	7.6	826	796	2.0	72	315	0.73	440	<1	11.2	-77.8	<4
	Minimum	7.4	89	794	1.0	72	270	0.68	440	<1			
	Median	7.6	115	796	1.2	108	280	0.69	476	<1			
	Mean	7.5	249	801	1.4	101	289	0.70	529	<1			
	Maximum	7.6	826	818	2.0	114	315	0.73	777	<1			
	Std. Dev.	0.1	323	10	0.4	17	18	0.02	140				
	Coeff. of Var. (%)	1.3	130	1.2	15	17	6.4	7.4	26				

¹NS: No samples, due to access blocked by highway construction equipment, dry well, well malfunction, or sampling equipment failure.

²EC = electrical conductivity; TDS = total dissolved solids; TOC = total organic carbon.

³NA: Not analyzed due to sample beyond holding time.

⁴Geomean

⁵NRR: No reportable result due to confluent growth of fecal coliformn.

⁶Relative to Chicago City Datum (579.48 ft above mean sea level) at the intersection of Madison and State Streets.