Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 15-22

TUNNEL AND RESERVOIR PLAN

CALUMET TUNNEL SYSTEM

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2014

July 2015

Metropolitan Water Reclamation District of Greater Chicago
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TUNNEL AND RESERVOIR PLAN CALUMET TUNNEL SYSTEM ANNUAL GROUNDWATER MONITORING REPORT FOR 2014

Monitoring and Research Department
Thomas C. Granato, Director

July 2015

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

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July 9, 2015

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, Calumet Tunnel System, Annual Groundwater Monitoring Report for 2014

Attached are three copies of "Tunnel and Reservoir Plan, Calumet Tunnel System, Annual Groundwater Monitoring Report for 2014."

Very truly yours,

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

TCG:PL:cm
Attachment

TCG:HZ:AC:LH:PL:cm

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

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Introduction

All monitoring and observation wells are located along the length of the Calumet Tunnel System. Four monitoring wells (QC-1, -2, -2-1, and -2-2) and 11 observation wells (OC-1 through OC-11) are located along the tunnel between Crawford Avenue and the Calumet Water Reclamation Plant. Seventeen monitoring wells (QC-3 through QC-19) are located between 140th Street and Indiana Avenue. Nine monitoring wells (QC-20 through QC-28) are positioned along Torrence Avenue, with the last nine monitoring wells (QC-29 through QC-37) along the Little Calumet River (Figures 1 and 2). Monitoring well QC-3 is abandoned with the approval from the Illinois Environmental Protection Agency (IEPA) (Appendix 1). Monitoring wells QC-1, -2, and QC-29 through QC-37 are sampled six times per year (IEPA memorandum dated July 9, 2004). Monitoring wells QC-2-1, -2-2, QC-4 through QC-7, and QC-9 through QC-28 are sampled three times per year (IEPA memoranda July 9, 2004, and February 23, 2006).

During 2014, all wells were sampled as required, except for QC-2-1, -33, and -36 (only one sample) and QC-1, -32, -34, and -37 (no samples). These wells are considered dry or intermittently dry. Their pumps were tested and classified as functional. Groundwater elevations in the monitoring wells were measured during each sampling event, while elevations in the observation wells were measured bi-weekly. The groundwater level in monitoring well QC-8-1 is no longer adequate for sampling. However, this well was converted to an observation well several years ago, and groundwater elevations are still measured bi-weekly.

Summary of Data

Monitoring Wells. The analytical data for groundwater sampled during 2014 from monitoring wells QC-2 through QC-36 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. Fecal coliform counts for all wells, except QC-2 (maximum of 370 CFU/100 mL), were undetectable. Table 2 lists the descriptive statistics for groundwater data of monitoring wells QC-2 through QC-36 for the year 2014.

Observation Wells. Groundwater elevations for observation wells OC-1 through -11 were measured at the required frequencies. Adjusted elevations were calculated relative to the Chicago city datum (579.48 ft. above mean sea level) at the intersection of Madison and State Streets (Table 3). The minimum, mean, and maximum values for each well were calculated and plotted to determine fluctuations in groundwater elevations during the year (Figure 3). Generally, these fluctuations appeared to be minimal throughout the year.

FIGURE 1: MAP OF MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM

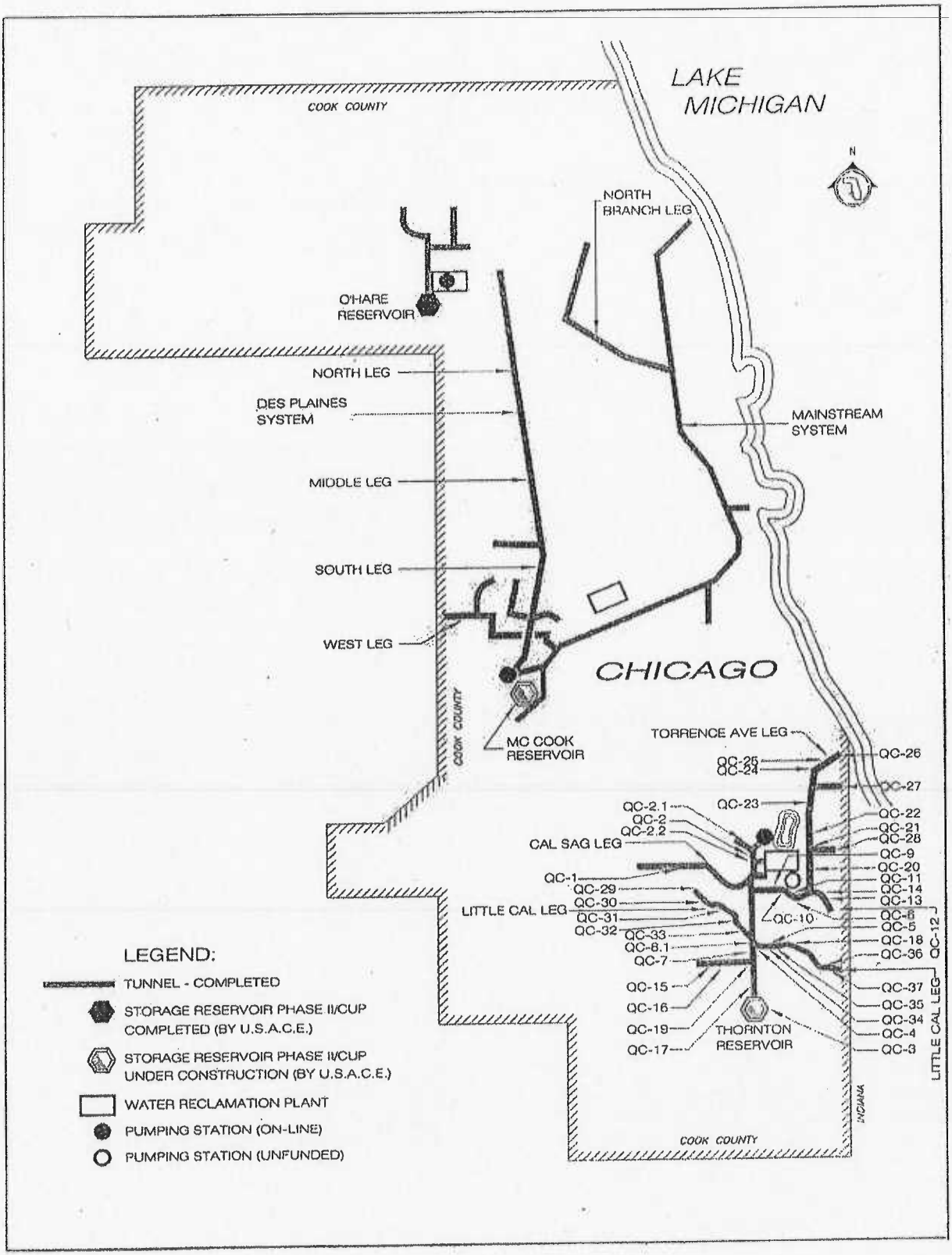

FIGURE 2: MAP OF OBSERVATION WELLS IN THE CALUMET TUNNEL SYSTEM

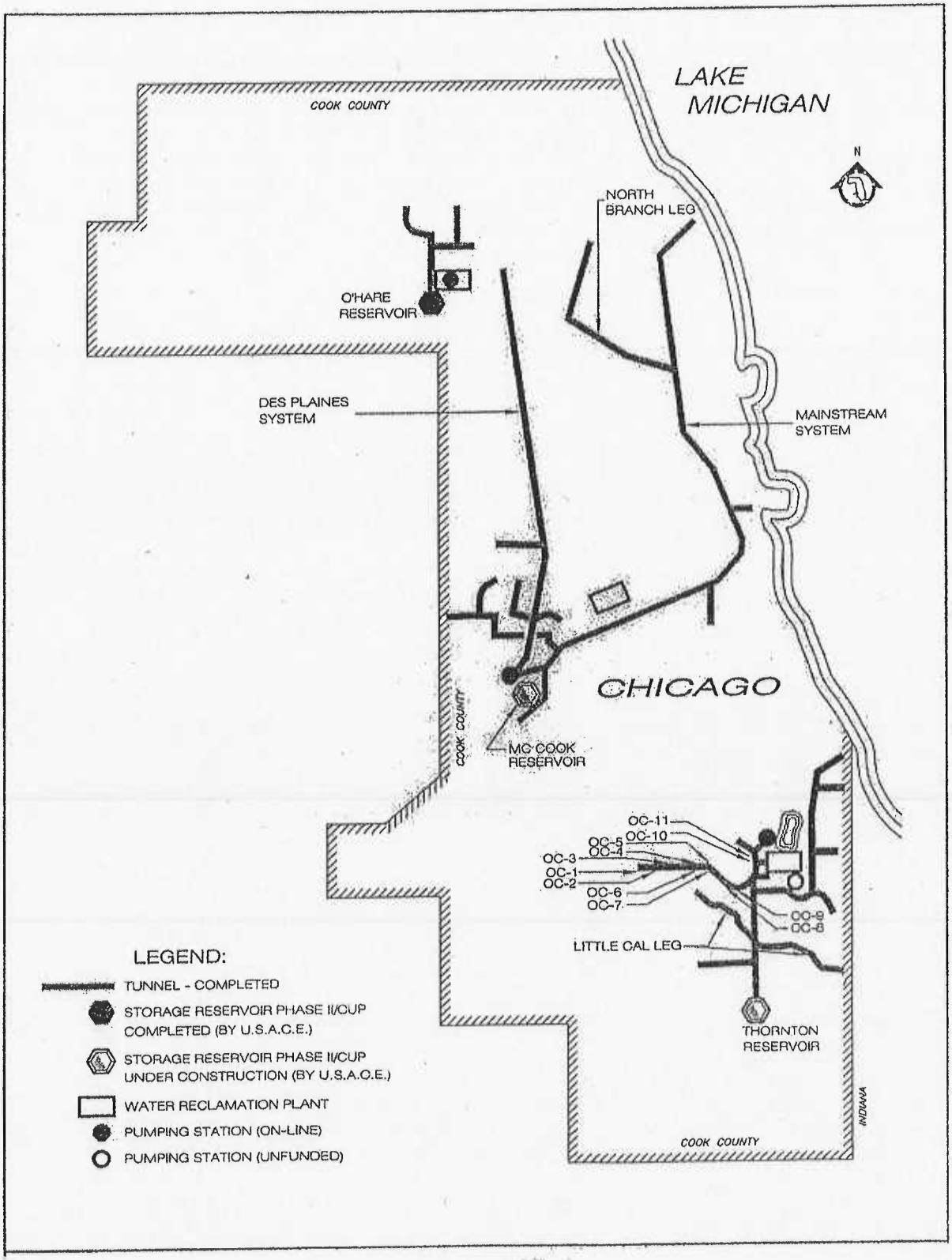

TABLE 1: ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2014

Well[1]	Date Sampled	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						CFU/100 mL	°C	ft	hr
QC-2	01/30/14	8.2	62	504	1	33	6	0.69	58	<1	11.5	-270	<48
QC-2	03/12/14	7.8	42	366	2	39	24	0.72	86	140	11.0	-271	<48
QC-2	06/05/14	8.3	47	350	2	33	25	0.85	84	370	14.0	-277	<48
QC-2	07/31/14	8.3	50	374	2	37	28	0.70	94	140	15.9	-293	<48
QC-2	09/24/14	8.4	47	356	2	34	21	0.74	92	150	14.6	-287	<48
QC-2	12/11/14	8.1	43	384	2	35	35	0.75	91	<1	12.1	-271	<48
QC-2-1	06/05/14	8.3	31	516	1	31	19	0.40	64	<1	16.0	-288	<48
QC-2-2	03/12/14	8.2	36	340	1	14	26	0.65	43	<1	10.7	-284	<48
QC-2-2	06/05/14	8.4	43	338	1	13	25	0.50	37	<1	14.5	-283	<48
QC-2-2	09/24/14	8.3	43	350	1	14	20	0.54	42	<1	14.4	-284	<48
QC-4	05/21/14	8.6	45	400	<1	<10	14	0.16	9	1	14.6	-228	<48
QC-4	08/07/14	8.8	50	434	<1	<10	14	0.17	10	<1	14.0	-193	<48
QC-4	11/12/14	8.7	50	426	<1	10	19	0.18	11	<1	11.2	-213	<48
QC-5	05/21/14	8.9	66	506	1	38	10	0.15	8	<1	13.6	-203	<48
QC-5	08/07/14	9.0	69	560	1	36	13	0.13	9	<1	13.4	-139	<48
QC-5	11/12/14	8.9	87	532	2	38	18	0.11	8	<1	11.3	-198	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2014

Well[1]	Date Sampled	pH	EC[2]	TDS[2]	TOC[2]	Cl-	$SO4^{2}$-	NH_3-N	Hardness	Fecal Coliform	Temp	Water Elevation[3]	Recharge Time
			mS/m	mg/L						CFU /100 mL	°C	ft	hr
QC-6	05/21/14	8.6	55	456	2	18	6	0.34	16	<1	13.7	-198	<48
QC-6	08/07/14	8.8	58	480	1	29	7	0.34	16	<1	13.9	-183	<48
QC-6	11/12/14	8.8	73	466	3	17	9	0.35	16	<1	11.6	-198	<48
QC-7	05/21/14	8.6	48	402	2	10	<5	0.29	10	<1	13.5	-167	<48
QC-7	08/07/14	8.6	50	420	1	10	<5	0.29	11	<1	13.2	-148	<48
QC-7	11/12/14	8.7	66	404	1	10	9	0.27	10	<1	11.7	-159	<48
QC-9	03/12/14	7.9	34	314	1	<10	37	0.35	63	<1	11.6	-255	<48
QC-9	06/05/14	8.3	39	390	1	10	36	0.65	61	<1	13.5	-223	<48
QC-9	10/23/14	8.3	34	318	1	12	38	0.30	63	<1	12.7	-247	<48
QC-10	02/19/14	7.8	48	382	<1	30	<5	0.11	11	<1	11.9	-225	<4
QC-10	05/14/14	8.0	42	386	<1	30	<5	0.11	9	<1	12.8	-205	<4
QC-10	08/21/14	8.7	48	642	<1	30	<5	0.10	11	<1	13.4	-177	<4
QC-10	11/19/14	8.8	46	622	1	NRR[4]	6	0.11	12	<1	11.8	-224	<4
QC-11	02/19/14	7.9	35	336	<1	21	<5	0.14	22	<1	12.5	-193	<4
QC-11	06/17/14	8.7	36	368	2	21	<5	0.18	20	<1	13.7	-223	<4
QC-11	09/30/14	8.6	35	296	<1	21	<5	0.16	21	<1	13.2	-224	<4

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2014

Well[1]	Date Sampled	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						CFU /100 mL	°C	ft	hr
QC-12	02/19/14	7.5	105	884	<1	36	339	0.33	181	<1	12.4	-213	<4
QC-12	06/17/14	8.2	99	888	<1	35	297	0.71	128	<1	13.3	-231	<4
QC-12	09/30/14	8.3	94	802	<1	36	222	0.95	129	<1	13.0	-234	<4
QC-13	04/02/14	8.3	50	414	<1	57	31	0.20	34	<1	12.1	-237	<48
QC-13	06/17/14	8.2	54	504	1	61	30	0.18	36	<1	13.9	-223	<48
QC-13	09/30/14	8.5	56	434	<1	60	25	0.20	36	<1	13.3	-229	<48
QC-14	03/20/14	6.9	82	786	4	168	<5	0.27	155	<1	12.6	-213	<48
QC-14	10/23/14	7.9	92	674	3	131	11	0.32	148	<1	12.5	-199	<48
QC-14	12/18/14	7.9	84	784	3	176	13	0.28	147	<1	12.3	-203	<48
QC-15	03/20/14	8.0	35	298	1	13	<5	0.93	14	<1	12.1	-218	<48
QC-15	10/23/14	8.8	37	300	1	12	6	0.26	15	<1	12.3	-223	<48
QC-15	12/18/14	8.7	35	292	2	12	<5	0.19	62	<1	11.6	-222	<48
QC-16	05/21/14	7.8	46	508	<1	24	77	<0.10	79	<1	14.4	-256	<48
QC-16	08/07/14	8.2	66	516	<1	23	69	<0.10	86	<1	16.1	-249	<48
QC-16	11/12/14	7.9	29	500	<1	24	81	<0.10	89	<1	11.2	-260	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2014

Well[1]	Date Sampled	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						CFU /100 mL	°C	ft	hr
QC-17	03/12/14	7.5	47	522	<1	<10	197	0.30	184	<1	10.1	-169	<48
QC-17	10/23/14	8.1	60	470	<1	<10	188	0.23	137	<1	12.9	-193	<48
QC-17	12/18/14	8.0	53	512	6	<10	173	0.19	165	<1	11.4	-164	<48
QC-18	03/12/14	8.4	40	386	<1	<10	30	0.11	8	<1	10.9	-230	<48
QC-18	10/23/14	9.2	44	346	<1	<10	31	0.13	8	<1	12.3	-206	<48
QC-18	12/18/14	8.5	41	354	1	<10	27	0.10	12	<1	11.2	-220	<48
QC-19	05/14/14	7.9	51	456	<1	<10	176	0.29	111	<1	12.3	-131	<48
QC-19	08/21/14	7.3	52	484	<1	<10	158	0.30	116	<1	13.3	-137	<48
QC-19	11/12/14	8.2	53	430	<1	<10	145	0.29	107	<1	12.0	-127	<48
QC-20	05/14/14	7.2	46	306	<1	19	<5	0.15	19	<1	12.5	-269	<48
QC-20	08/21/14	8.0	33	328	<1	18	<5	0.15	20	<1	13.7	-269	<48
QC-20	11/12/14	8.4	37	292	12	19	38	0.15	40	<1	11.4	-272	<48
QC-21	05/14/14	7.4	32	338	3	18	13	0.20	35	<1	12.1	-261	<48
QC-21	08/21/14	8.1	44	412	3	17	9	0.10	41	<1	14.6	-252	<48
QC-21	11/12/14	8.2	44	536	NRR	NRR	14	<0.10	45	<1	11.3	-241	<48
QC-22	05/14/14	7.8	38	278	1	13	7	0.22	49	<1	11.8	-229	<48
QC-22	08/21/14	8.3	35	420	2	12	<5	0.32	49	<1	13.4	-260	<48
QC-22	11/19/14	8.4	31	256	3	14	9	0.30	39	<1	11.0	-250	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2014

Well[1]	Date Sampled	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						CFU /100 mL	°C	ft	hr
QC-23	05/22/14	8.7	40	316	<1	21	<5	0.10	6	<1	12.8	-232	<48
QC-23	08/27/14	8.7	42	466	<1	19	<5	0.13	22	<1	13.6	-239	<48
QC-23	11/19/14	9.2	39	350	12	20	<5	0.12	3	<1	11.2	-221	<48
QC-24	05/22/14	8.5	28	224	<1	27	<5	0.14	13	<1	12.0	-236	<48
QC-24	08/27/14	8.8	30	336	<1	30	<5	0.17	21	<1	13.5	-236	<48
QC-24	11/19/14	8.7	28	244	2	27	<5	0.15	13	<1	11.6	-236	<48
QC-25	05/22/14	7.8	25	218	<1	13	7	0.12	25	<1	13.2	-239	<48
QC-25	08/27/14	8.4	28	336	<1	14	10	0.19	19	<1	13.7	-232	<48
QC-25	11/19/14	8.2	27	228	3	13	13	0.15	31	<1	11.9	-231	<48
QC-26	05/22/14	9.0	32	270	<1	12	<5	0.10	6	<1	13.0	-225	<48
QC-26	08/27/14	9.0	38	440	<1	14	<5	0.13	6	<1	13.4	-225	<48
QC-26	11/19/14	8.4	32	268	2	12	<5	0.11	5	<1	11.9	-226	<48
QC-27	05/22/14	8.1	29	240	<1	31	<5	0.16	23	<1	12.9	-208	<48
QC-27	08/27/14	8.7	30	332	<1	30	<5	0.19	23	<1	13.7	-199	<48
QC-27	11/19/14	8.8	29	240	<1	31	<5	0.17	24	<1	11.6	-204	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2014

Well[1]	Date Sampled	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						CFU /100 mL	°C	ft	hr
QC-28	05/22/14	8.6	31	256	2	13	<5	0.10	15	<1	13.7	-245	<48
QC-28	08/27/14	8.6	33	382	1	12	<5	<0.10	16	<1	13.8	-238	<48
QC-28	11/19/14	8.9	37	246	1	12	<5	0.10	16	<1	12.1	-238	<48
QC-29	01/30/14	7.2	113	788	1	164	165	0.75	315	<1	11.6	-55	<48
QC-29	03/20/14	7.2	102	1,022	2	201	226	0.81	449	<1	11.4	-54	<48
QC-29	04/10/14	7.1	114	902	2	179	194	0.75	380	<1	12.1	-59	<48
QC-29	07/31/14	7.4	110	970	2	198	202	0.80	446	<1	13.2	-55	<48
QC-29	10/08/14	7.6	112	880	2	149	163	0.80	397	<1	12.5	-55	<48
QC-29	12/11/14	7.9	111	926	2	177	186	0.76	391	<1	11.1	-54	<48
QC-30	01/30/14	8.1	50	400	1	10	86	0.38	60	<1	12.0	-129	<48
QC-30	03/20/14	7.1	46	388	1	<10	88	0.40	62	<1	11.1	-130	<48
QC-30	04/10/14	8.4	44	412	1	10	92	0.45	69	<1	12.4	-129	<48
QC-30	07/31/14	8.5	46	424	1	11	92	0.44	64	1	13.3	-128	<48
QC-30	10/08/14	8.5	44	340	1	16	64	0.15	49	<1	12.1	-138	<48
QC-30	12/11/14	8.2	48	430	1	13	100	0.48	66	<1	10.8	-128	<48
QC-31	01/30/14	8.0	63	536	1	17	181	0.86	215	<1	11.8	-53	<48
QC-31	03/20/14	7.3	62	564	1	15	183	1.1	244	<1	12.0	-53	<48
QC-31	04/10/14	8.0	62	572	1	15	195	1.5	234	<1	13.0	-58	<48
QC-31	07/31/14	7.8	67	562	1	14	194	1.1	251	<1	13.1	-53	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2014

Well[1]	Date Sampled	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						CFU /100 mL	°C	ft	hr
QC-31	10/08/14	7.9	32	528	1	13	166	1.1	209	<1	12.7	-60	<48
QC-31	12/11/14	7.7	74	570	1	16	190	1.0	243	<1	12.1	-59	<48
QC-33	04/03/14	7.9	53	496	1	26	58	0.27	11	<1	12.9	-168	<48
QC-35	02/13/14	8.0	106	908	1	32	42	0.12	16	<1	11.1	-153	<48
QC-35	09/04/14	10.0	108	910	4	30	31	<0.10	12	<1	15.3	-156	<48
QC-36	02/13/14	8.0	92	804	<1	31	8	0.10	10	<1	10.6	-134	<48

[1]No samples retrieved from Wells QC-1, -32, -34, and -37; considered intermittently or permanently dry; only one sample from QC-2-1, -33, and -36.
[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 reportable result; values very high: 208 (QC-10, 11/19, Cl); 642 and 83 (QC-21, 11/12, TOC and Cl, respectively).