

*Protecting Our Water Environment*



***Metropolitan Water Reclamation District of Greater Chicago***

***MONITORING AND RESEARCH  
DEPARTMENT***

***REPORT NO. 13-18***

***TUNNEL AND RESERVOIR PLAN***

***CALUMET TUNNEL SYSTEM***

***ANNUAL GROUNDWATER MONITORING REPORT***

***FOR 2012***

***July 2013***

**Protecting Our Water Environment**



**Metropolitan Water Reclamation District of Greater Chicago**

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July 25, 2013

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Ms. Marcia Willhite  
Bureau Chief  
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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 2012

Attached are three copies of "Tunnel and Reservoir Plan, Calumet Tunnel System, Annual Groundwater Monitoring Report for 2012."

Very truly yours,

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

TCG:HZ:AC:LH:PL:cm

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

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TUNNEL AND RESERVOIR PLAN CALUMET TUNNEL SYSTEM  
ANNUAL GROUNDWATER MONITORING  
REPORT FOR 2012

Monitoring and Research Department  
Thomas C. Granato, Director

July 2013

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## ANNUAL DATA FOR MONITORING AND OBSERVATION WELLS

### 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 140<sup>th</sup> 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, located along the tunnel between 140<sup>th</sup> Street and Indiana Avenue, is no longer sampled due to construction in its vicinity managed by the Village of South Holland. An Illinois Environmental Protection Agency (IEPA) memorandum dated April 22, 2008 (Appendix I) granted permission to the Metropolitan Water Reclamation District of Greater Chicago to abandon this well. 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). However, several wells were sampled more frequently than required. Groundwater elevations in the monitoring wells were measured during each sampling event, while elevations in the observation wells were measured bi-weekly. Monitoring well QC-8-1 is dry and is no longer sampled. However, groundwater elevations for this well were measured bi-weekly.

All monitoring wells in the Calumet Tunnel System were visited for the required number of samples. However, samples from a few wells could not be retrieved for various reasons. Wells QC-1, -32, -33, -34, and -37 could not be sampled due to inoperable pumps. Work orders have been issued for repairing these pumps.

### Summary of Data

**Monitoring Wells.** The analytical data for groundwater sampled during 2012 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 in this table. Fecal coliform counts for all wells were non-detectable except for QC-2 (maximum of 66 MPN/100 mL). Table 2 lists the descriptive statistics for groundwater data of monitoring wells QC-2 through QC-36 for the year 2012.

**Observation Wells.** Groundwater elevations for observation wells OC-1 through -11 were measured at the time of sampling. Final 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 groundwater elevations 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

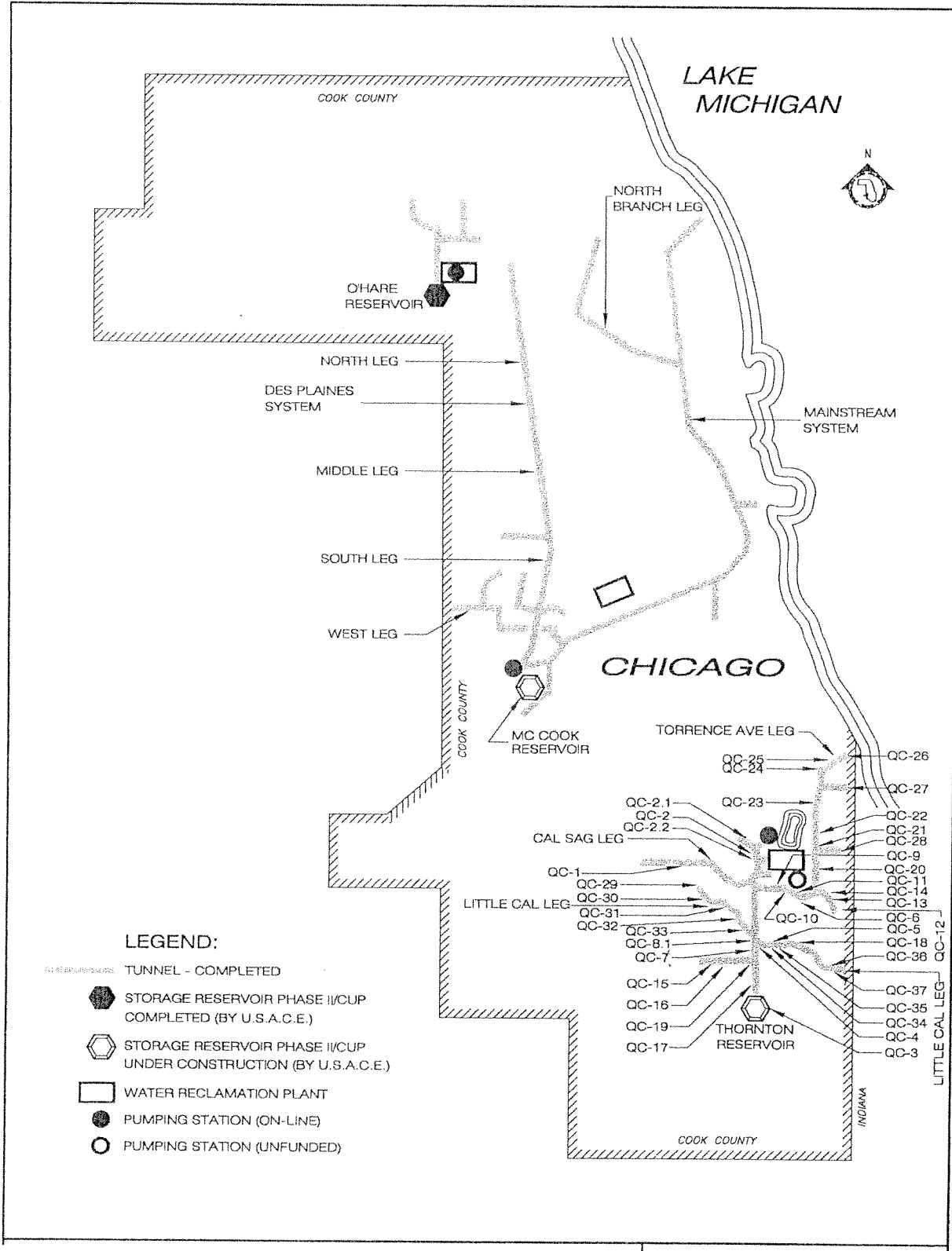




FIGURE 2: MAP OF OBSERVATION WELLS IN THE CALUMET TUNNEL SYSTEM

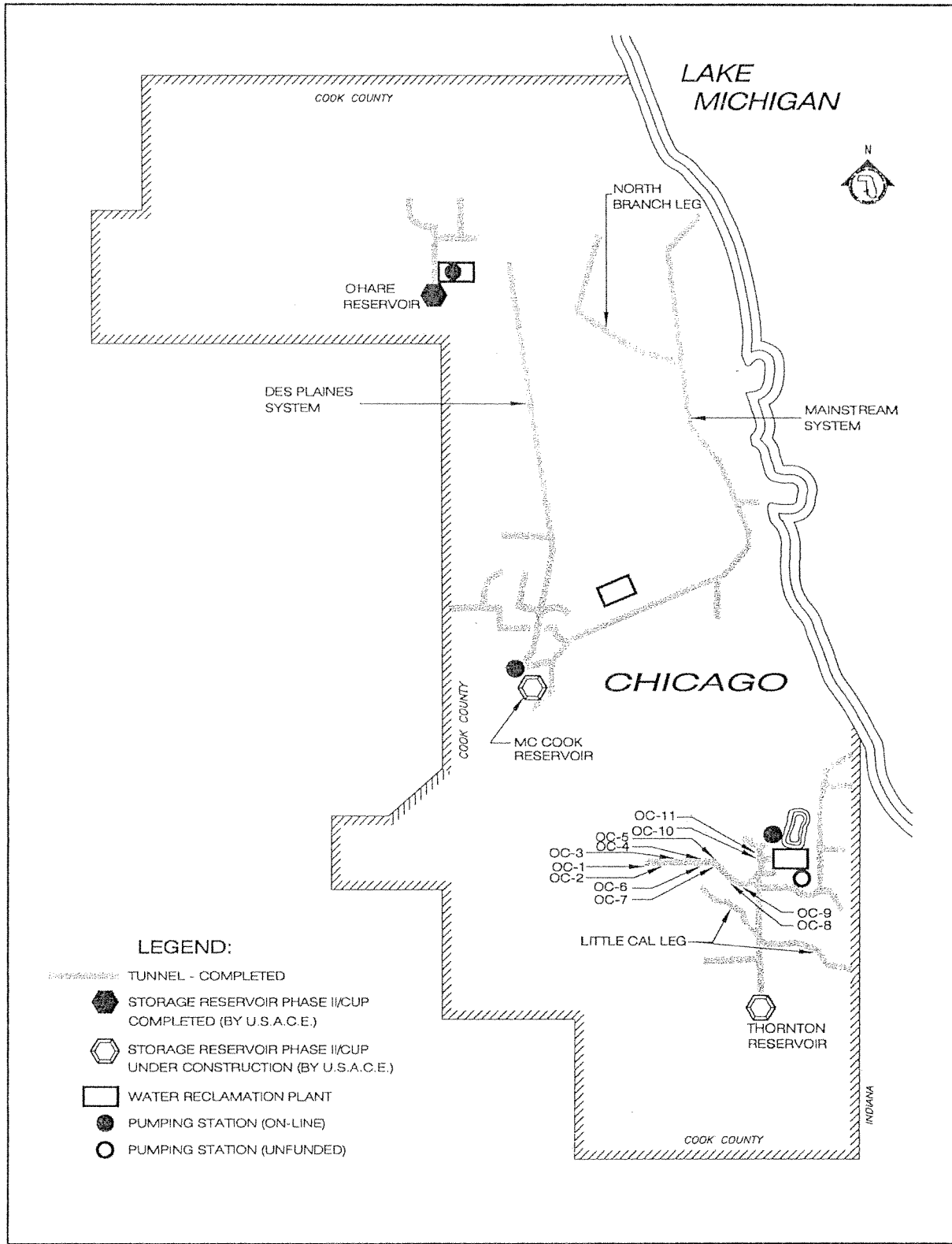


TABLE 1: ANALYSIS OF WATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

Well <sup>1</sup>	Sample Date	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
			mS/m				mg/L			MPN/100 mL	°C	ft	hr
QC-2	01/05/12	8.1	37	352	2	33	27	0.25	87	66	12.1	-280	<48
QC-2	03/22/12	8.0	43	336	1	31	26	0.14	79	<1	14.6	-293	<48
QC-2	05/03/12	7.2	52	394	1	31	28	0.16	85	<1	15.5	-274	<48
QC-2	07/19/12	7.8	30	400	5	32	26	0.49	86	3	14.5	-288	<48
QC-2	08/29/12	7.8	33	366	1	31	25	0.22	82	46	14.1	-271	<48
QC-2	10/18/12	7.0	25	432	1	31	27	0.16	84	3	15.3	-273	<48
4	QC-2-1	01/05/12	7.9	42	526	1	34	<5	62	<1	11.5	-282	<48
	QC-2-1	03/22/12	7.8	50	516	1	32	<5	63	<1	14.8	-280	<48
	QC-2-1	05/03/12	7.7	87	576	<1	34	<5	64	<1	15.2	-282	<48
	QC-2-1	08/29/12	8.1	53	564	1	32	8	58	<1	14.4	-285	<48
QC-2-2	01/05/12	8.4	36	360	1	15	29	0.24	48	<1	11.3	-282	<48
QC-2-2	05/03/12	7.3	84	370	1	13	29	0.42	47	<1	14.1	-279	<48
QC-2-2	08/29/12	8.0	62	366	1	12	27	0.35	44	<1	14.2	-279	<48
QC-4	01/05/12	8.0	43	428	<1	10	12	0.16	11	<1	11.3	-235	<48
QC-4	03/22/12	8.1	49	412	<1	<10	15	0.15	11	<1	13.7	-235	<48
QC-4	05/03/12	8.6	56	454	<1	<10	13	0.15	12	<1	12.8	-232	<48
QC-5	02/01/12	8.2	63	568	2	33	10	0.15	10	<1	9.7	-197	<48
QC-5	04/05/12	8.2	64	470	1	16	6	0.33	16	<1	12.1	-202	<48
QC-5	10/18/12	8.2	39	544	1	36	10	0.12	8	<1	12.6	-207	<48
QC-6	02/01/12	7.9	53	460	1	14	<5	0.34	16	<1	10.4	-189	<48
QC-6	04/05/12	8.1	51	552	1	35	10	0.13	8	<1	12.5	-195	<48
QC-6	10/18/12	8.4	37	454	2	13	5	0.50	16	<1	12.4	-203	<48

TABLE 1 (Continued): ANALYSIS OF WATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

Well <sup>1</sup>	Sample Date	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
			mS/m				mg/L			MPN/100 mL	°C	ft	hr
QC-7	02/01/12	8.3	46	480	1	19	<5	0.21	13	<1	12.1	-168	<48
QC-7	04/05/12	8.0	45	408	2	11	<5	0.26	11	<1	12.3	-167	<48
QC-7	10/25/12	8.0	56	394	1	10	<5	0.28	11	<1	13.8	-168	<48
QC-9	02/01/12	7.9	38	304	1	<10	35	0.68	62	<1	12.0	-248	<48
QC-9	04/05/12	8.1	37	328	1	10	39	0.48	63	<1	12.5	-255	<48
QC-9	07/19/12	8.3	32	380	5	<10	35	0.71	61	<1	14.0	-216	<48
QC-9	10/25/12	8.0	41	308	1	<10	34	0.11	61	<1	14.6	-220	<48
QC-10	02/15/12	8.3	43	406	<1	29	<5	0.12	12	<1	11.3	-222	<4
QC-10	04/26/12	8.0	45	450	<1	31	<5	0.12	13	<1	12.1	-224	<4
QC-10	07/12/12	8.4	38	506	<1	30	<5	<0.10	11	<1	14.7	-231	<4
QC-10	12/05/12	8.4	40	392	<1	25	<5	0.14	9	<1	12.4	-236	<4
QC-11	02/15/12	8.1	35	286	<1	20	<5	0.15	20	<1	11.8	-224	<4
QC-11	04/26/12	8.0	37	314	<1	22	<5	0.14	20	<1	12.6	-225	<4
QC-11	07/12/12	8.3	34	366	2	21	<5	0.10	20	<1	14.8	-222	<4
QC-11	12/05/12	7.9	37	302	<1	14	<5	0.10	21	<1	12.1	-223	<4
QC-12	02/15/12	7.5	82	928	<1	37	310	0.33	187	<1	12.0	-238	<4
QC-12	04/26/12	7.8	84	1,000	<1	38	357	0.34	215	<1	12.2	-248	<4
QC-12	07/12/12	7.5	78	992	1	36	337	0.29	200	<1	13.5	-248	<4
QC-12	12/05/12	8.0	70	994	<1	30	393	0.36	232	<1	12.0	-248	<4

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TABLE 1 (Continued): ANALYSIS OF WATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

Well <sup>1</sup>	Sample Date	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
			mS/m	-----mg/L-----						MPN/100 mL	°C	ft	hr
QC-13	02/15/12	7.8	89	424	<1	51	31	0.18	37	<1	12.6	-237	<48
QC-13	04/25/12	7.8	38	420	<1	57	31	0.21	39	<1	13.2	-233	<48
QC-13	07/12/12	7.4	46	490	2	63	34	0.19	39	<1	14.3	-237	<48
QC-13	12/05/12	7.4	41	422	<1	48	26	0.19	41	<1	13.5	-239	<48
QC-14	02/01/12	7.5	77	700	3	132	<5	0.24	131	<1	11.9	-208	<48
QC-14	04/05/12	7.3	68	726	3	128	<5	0.27	161	<1	13.1	-213	<48
QC-14	07/19/12	7.6	67	810	4	135	<5	0.32	146	<1	14.9	-200	<48
QC-14	10/25/12	7.4	60	756	3	142	<5	0.29	148	<1	14.7	-216	<48
QC-15	03/22/12	8.3	36	304	<1	12	<5	0.22	16	<1	13.4	-215	<48
QC-15	05/03/12	8.4	45	332	<1	13	<5	0.18	12	<1	13.8	-217	<48
QC-15	07/19/12	8.5	31	360	6	12	<5	0.25	13	<1	15.6	-215	<48
QC-15	12/06/12	7.9	33	310	1	<10	<5	0.21	14	<1	11.6	-218	<48
QC-16	03/22/12	7.8	56	488	1	21	68	<0.10	84	<1	15.8	-256	<48
QC-16	07/19/12	8.0	49	588	4	22	65	<0.10	84	<1	16.0	-257	<48
QC-16	09/12/12	7.7	40	506	<1	22	138	0.27	84	<1	17.8	-260	<48
QC-17	03/22/12	8.3	46	506	<1	<10	183	0.28	164	<1	14.0	-193	<48
QC-17	05/03/12	7.7	71	528	<1	<10	185	0.27	159	<1	14.2	-193	<48
QC-17	07/26/12	8.2	70	512	8	<10	181	0.27	166	6	13.5	-186	<48
QC-17	10/25/12	7.4	45	520	<1	<10	180	0.28	156	<1	23.0	-207	<48
QC-18	03/22/12	8.9	43	358	<1	<10	31	<0.10	7	<1	13.7	-202	<48
QC-18	05/03/12	8.8	54	400	<1	<10	30	<0.10	7	<1	12.8	-201	<48
QC-18	07/26/12	9.0	55	428	7	<10	28	<0.10	7	<1	13.9	-194	<48
QC-18	10/25/12	8.9	44	370	<1	<10	27	0.10	7	<1	21.5	-204	<48

TABLE 1 (Continued): ANALYSIS OF WATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

Well <sup>1</sup>	Sample Date	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
			mS/m	----- mg/L -----						MPN/100 mL	°C	ft	hr
QC-19	03/29/12	8.1	46	418	<1	<10	152	0.30	120	<1	12.0	-129	<48
QC-19	07/26/12	8.5	43	470	13	<10	141	0.28	106	<1	14.1	-131	<48
QC-19	09/12/12	8.4	35	428	<1	<10	65	<0.10	89	<1	13.4	-122	<48
QC-20	03/29/12	7.3	31	266	3	18	<5	0.14	20	<1	12.6	-267	<48
QC-20	05/10/12	8.0	42	258	<1	18	<5	0.15	20	<1	12.7	-265	<48
QC-20	07/26/12	8.4	42	286	7	19	<5	0.10	19	<1	18.9	-263	<48
QC-20	12/06/12	7.7	27	266	<1	11	<5	0.15	20	<1	10.8	-267	<48
QC-21	03/29/12	7.3	40	376	7	20	8	0.14	44	<1	12.5	-241	<48
QC-21	05/10/12	7.8	51	398	8	20	<5	<0.10	46	<1	13.1	-280	<48
QC-21	07/26/12	7.7	53	440	18	18	5	<0.10	50	<1	13.4	-255	<48
QC-21	10/25/12	7.9	51	394	7	19	<5	<0.10	64	<1	19.1	-280	<48
QC-22	03/29/12	8.1	38	254	2	13	5	0.22	36	<1	11.9	-228	<48
QC-22	05/10/12	8.0	39	266	2	13	6	0.21	35	<1	13.0	-263	<48
QC-22	07/26/12	7.9	25	290	9	13	<5	0.22	36	<1	13.1	-243	<48
QC-23	03/29/12	8.2	38	316	<1	20	<5	0.10	6	<1	11.1	-228	<48
QC-23	05/10/12	9.0	50	354	<1	19	<5	<0.10	6	<1	12.6	-238	<48
QC-23	07/26/12	7.7	32	386	7	19	<5	<0.10	6	<1	13.0	-228	<48
QC-24	03/29/12	8.5	36	234	<1	27	<5	0.14	14	<1	12.2	-236	<48
QC-24	05/10/12	8.4	29	198	<1	28	<5	0.14	14	<1	12.4	-223	<48
QC-24	07/26/12	7.8	24	264	10	28	<5	0.14	14	<1	13.1	-229	<48

TABLE 1 (Continued): ANALYSIS OF WATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

Well <sup>1</sup>	Sample Date	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
			mS/m			----- mg/L -----				MPN/100 mL	°C	ft	hr
QC-25	03/29/12	8.5	33	242	<1	12	19	0.13	24	<1	12.7	-235	<48
QC-25	05/10/12	8.2	27	228	<1	12	9	0.14	26	<1	12.8	-231	<48
QC-25	08/02/12	7.8	30	244	8	12	7	0.16	22	<1	13.7	-238	<48
QC-26	03/29/12	9.1	40	272	<1	12	<5	<0.10	6	<1	12.7	-228	<48
QC-26	05/10/12	8.5	31	274	<1	11	<5	<0.10	7	<1	12.7	-222	<48
QC-26	08/02/12	7.8	32	266	11	10	<5	0.11	6	<1	13.4	-226	<48
QC-27	03/29/12	8.4	37	244	<1	31	6	0.16	24	<1	12.9	-204	<48
QC-27	05/10/12	8.2	29	258	<1	32	<5	0.15	25	<1	12.3	-206	<48
QC-27	08/02/12	7.9	27	262	4	28	<5	0.18	25	<1	12.9	-212	<48
QC-28	03/29/12	8.1	39	264	2	13	<5	<0.10	16	<1	13.4	-243	<48
QC-28	05/10/12	8.1	27	304	1	12	<5	<0.10	16	<1	13.1	-244	<48
QC-28	08/02/12	8.0	30	290	5	12	<5	<0.10	17	<1	12.7	-244	<48
QC-29	02/02/12	7.4	51	716	1	168	129	0.54	257	<1	11.2	-60	<48
QC-29	06/14/12	7.4	86	1,096	2	204	184	0.79	426	<1	13.5	-58	<48
QC-29	08/02/12	7.6	50	950	7	189	180	0.73	404	<1	15.3	-58	<48
QC-29	10/18/12	7.0	41	890	1	182	168	0.71	368	<1	12.3	-62	<48
QC-29	11/15/12	6.7	83	954	2	70	188	0.76	408	<1	11.5	-56	<48
QC-30	02/02/12	7.6	70	380	<1	<10	70	0.15	55	<1	11.3	-139	<48
QC-30	05/17/12	7.8	42	402	1	<10	85	0.40	65	<1	13.1	-137	<48
QC-30	06/14/12	8.3	43	500	4	<10	65	0.14	54	<1	24.1	-134	<48
QC-30	08/02/12	8.1	33	434	10	<10	65	0.13	55	<1	12.9	-133	<48
QC-30	10/18/12	7.7	39	406	<1	<10	76	0.40	57	<1	12.5	-131	<48

TABLE 1 (Continued): ANALYSIS OF WATER FROM MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

Well <sup>1</sup>	Sample Date	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
			mS/m	----- mg/L -----						MPN/100 mL	°C	ft	hr
QC-30	11/21/12	8.1	40	384	1	<10	73	0.23	58		11.2	-129	<48
QC-30	12/06/12	7.6	42	408	<1	<10	79	0.30	61	<1	10.1	-136	<48
QC-31	02/02/12	7.1	53	564	1	15	184	1.1	245	<1	11.6	-72	<48
QC-31	05/17/12	7.6	51	574	1	15	182	1.1	242	<1	14.2	-58	<48
QC-31	06/14/12	7.7	51	584	2	15	184	1.0	235	<1	13.6	-62	<48
QC-31	08/02/12	7.6	43	588	7	14	185	1.0	246	<1	13.5	-61	<48
QC-31	10/18/12	7.6	48	574	1	15	183	1.1	234	<1	13.1	-60	<48
QC-31	11/21/12	7.9	55	552	1	14	190	1.0	238		13.1	-59	<48
QC-31	12/06/12	7.6	50	574	1	<10	200	1.1	237	<1	12.0	-65	<48
QC-35	10/24/12	8.3	102	942	1	32	88	<0.10	24	<1	23.3	-152	<48
QC-36	10/24/12	8.6	90	856	<1	32	28	<0.10	14	<1	21.2	-130	<48

<sup>1</sup>Wells QC-1 and QC-32 through QC-37 either could not be sampled, or only a single sample was retrieved; non-functional pumps.

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

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

TABLE 2: DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2012

Well <sup>1</sup>	Statistic	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 <sup>3</sup>
			mS/m	----- mg/L -----						MPN/100 mL
QC-2	Minimum	7.0	25	336	1	31	25	0.14	79	<1
	Mean	7.6	37	380	2	32	27	0.24	84	13
	Maximum	8.1	52	432	5	33	28	0.49	87	66
	Std. Dev.	0.4	9	35	1	1	1	0.13	3	NA <sup>4</sup>
	Median	7.8	35	380	1	31	27	0.19	85	25
	Coeff. of Var. (%)	5.4	26	9	65	3	4	55	3	NA
QC-2-1	Minimum	7.7	42	516	1	32	<5	0.54	58	<1
	Mean	7.9	58	546	1	33	6	0.64	62	<1
	Maximum	8.1	87	576	1	34	8	0.70	64	<1
	Std. Dev.	0.2	20	29	0.1	1	1	0.07	3	NA
	Median	7.8	52	545	1	33	5	0.66	63	<1
	Coeff. of Var. (%)	2.3	34	5	5	3	17	11	4	NA
QC-2-2	Minimum	7.3	36	360	1	12	27	0.24	44	<1
	Mean	7.9	57	365	1	13	28	0.34	46	<1
	Maximum	8.4	84	370	1	15	29	0.42	48	<1
	Std. Dev.	0.4	21	5	0.1	2	1	0.09	2	NA
	Median	8.0	54	366	1	13	29	0.35	47	<1
	Coeff. of Var. (%)	5.5	37	1	8	11	4	27	4	NA
QC-4	Minimum	8.0	43	412	<1	<10	12	0.15	11	<1
	Mean	8.2	49	448	<1	<10	22	0.16	11	<1
	Maximum	8.6	56	498	<1	10	48	0.19	12	<1
	Std. Dev.	0.3	6	38	0	0	17	0.02	1	NA
	Median	8.1	49	441	<1	10	14	0.16	11	<1
	Coeff. of Var. (%)	4.0	13	8	0	0	79	12	4	NA



TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2012

Well <sup>1</sup>	Statistic	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 <sup>3</sup>
			mS/m	----- mg/L -----						MPN/100 mL
QC-5	Minimum	8.2	39	470	1	16	6	0.12	8	<1
	Mean	8.2	55	539	1	30	9	0.19	11	<1
	Maximum	8.2	64	574	2	36	12	0.33	16	<1
	Std. Dev.	0.0	14	48	0.1	9	2	0.10	4	NA
	Median	8.2	63	556	1	34	10	0.15	10	<1
	Coeff. of Var. (%)	0.1	26	9	9	31	25	51	33	NA
QC-6	Minimum	7.9	37	454	1	13	5	0.13	8	<1
	Mean	8.1	47	502	1	19	7	0.33	14	<1
	Maximum	8.4	53	552	2	35	10	0.50	16	<1
	Std. Dev.	0.3	9	52	0.1	11	2	0.15	4	NA
	Median	8.1	51	501	1	14	6	0.35	16	<1
	Coeff. of Var. (%)	3.2	18	10	9	56	34	46	29	NA
QC-7	Minimum	8.0	45	394	1	10	<5	0.21	11	<1
	Mean	8.1	49	424	1	13	<5	0.26	12	<1
	Maximum	8.3	56	480	2	19	<5	0.29	13	<1
	Std. Dev.	0.2	6	38	0.1	4	0	0.04	1	NA
	Median	8.0	46	411	1	11	<5	0.27	11	<1
	Coeff. of Var. (%)	2.1	13	9	9	35	0	14	9	NA
QC-9	Minimum	7.9	32	304	1	<10	34	0.11	61	<1
	Mean	8.1	37	330	2	<10	36	0.50	62	<1
	Maximum	8.3	41	380	5	10	39	0.71	63	<1
	Std. Dev.	0.2	4	35	2	1	3	0.28	1	NA
	Median	8.0	38	318	1	<10	35	0.58	62	<1
	Coeff. of Var. (%)	2.2	10	11	92	10	7	56	2	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2012

Well <sup>1</sup>	Statistic	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 <sup>3</sup>
			mS/m	----- mg/L -----						MPN/100 mL
QC-10	Minimum	8.0	38	392	<1	25	<5	0.12	9	<1
	Mean	8.3	42	439	<1	29	<5	0.13	11	<1
	Maximum	8.4	45	506	<1	31	<5	0.14	13	<1
	Std. Dev.	0.2	3	51	0	3	0	0.01	2	NA
	Median	8.3	42	428	<1	30	<5	0.12	12	<1
	Coeff. of Var. (%)	2.3	7	12	0	9	0	9.1	15	NA
QC-11	Minimum	7.9	34	286	<1	14	<5	0.10	20	<1
	Mean	8.1	36	317	<1	19	<5	0.12	20	<1
	Maximum	8.3	37	366	2	22	<5	0.15	21	<1
	Std. Dev.	0.2	1	35	0.3	4	0	0.03	1	NA
	Median	8.0	36	308	2	21	<5	0.12	20	<1
	Coeff. of Var. (%)	2.6	4	11	30	19	0	21	2	NA
QC-12	Minimum	7.5	70	928	<1	30	310	0.29	187	<1
	Mean	7.7	78	979	<1	35	349	0.33	209	<1
	Maximum	8.0	84	1,000	1	38	393	0.36	232	<1
	Std. Dev.	0.2	6	34	0	4	35	0.03	19	NA
	Median	7.7	80	993	1	37	347	0.34	208	<1
	Coeff. of Var. (%)	3.0	8	3	18	10	10	8.9	9	NA
QC-13	Minimum	7.4	38	420	<1	48	26	0.18	37	<1
	Mean	7.6	54	439	<1	55	31	0.19	39	<1
	Maximum	7.8	89	490	2	63	34	0.21	41	<1
	Std. Dev.	0.2	24	34	0.3	7	3	0.01	2	NA
	Median	7.6	44	423	1	54	31	0.19	39	<1
	Coeff. of Var. (%)	2.8	45	8	30	12	10	6.5	4	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2012

Well <sup>1</sup>	Statistic	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 <sup>3</sup>
			mS/m	----- mg/L -----						MPN/100 mL
QC-14	Minimum	7.3	60	700	3	128	<5	0.24	131	<1
	Mean	7.5	68	748	3	134	<5	0.28	147	<1
	Maximum	7.6	77	810	4	142	<5	0.32	161	<1
	Std. Dev.	0.1	7	47	0	6	0	0.03	12	NA
	Median	7.4	67	741	3	134	<5	0.28	147	<1
	Coeff. of Var. (%)	1.8	10	6	15	4	0	12	8	NA
QC-15	Minimum	7.9	31	304	1	12	<5	0.18	12	<1
	Mean	8.3	36	327	4	12	<5	0.22	14	<1
	Maximum	8.5	45	360	6	13	<5	0.25	16	<1
	Std. Dev.	0.3	6	25	4	1	0	0.03	2	NA
	Median	8.3	35	321	4	12	<5	0.22	14	<1
	Coeff. of Var. (%)	3.2	17	8	99	5	0	13	12	NA
QC-16	Minimum	7.7	40	488	1	21	65	<0.10	84	<1
	Mean	7.8	49	527	3	22	90	0.16	84	<1
	Maximum	8.0	56	588	4	22	138	0.27	84	<1
	Std. Dev.	0.2	8	53	2	1	41	0.1	0	NA
	Median	7.8	49	506	3	22	68	0.27	84	<1
	Coeff. of Var. (%)	2.3	16	10	85	3	46	63	0	NA
QC-17	Minimum	7.4	45	506	<1	<10	180	0.27	156	<1
	Mean	7.9	58	517	3	<10	182	0.28	161	2
	Maximum	8.3	71	528	8	<10	185	0.28	166	6
	Std. Dev.	0.5	14	10	4	0	2	0.01	5	NA
	Median	8.0	58	516	1	<10	182	0.28	162	1
	Coeff. of Var. (%)	5.7	25	2	129	0	1	2.1	3	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2012

Well <sup>1</sup>	Statistic	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 <sup>3</sup>
			mS/m	----- mg/L -----						MPN/100 mL
QC-18	Minimum	8.8	43	358	<1	<10	27	0.10	7	<1
	Mean	8.9	49	389	3	<10	29	0.10	7	<1
	Maximum	9.0	55	428	7	<10	31	0.10	7	<1
	Std. Dev.	0.1	6	31	3	0	2	0.00	0	NA
	Median	8.9	49	385	7	<10	29	0.10	7	<1
	Coeff. of Var. (%)	1.0	13	8	120	0	6	0.00	0	NA
QC-19	Minimum	8.1	35	418	<1	<10	65	0.28	89	<1
	Mean	8.3	41	439	5	<10	119	0.29	105	<1
	Maximum	8.5	46	470	13	<10	152	0.30	120	<1
	Std. Dev.	0.2	6	28	7	0	48	0.01	16	NA
	Median	8.4	43	428	1	<10	141	0.29	106	<1
	Coeff. of Var. (%)	2.2	15	6	137	0	40	4.9	15	NA
QC-20	Minimum	7.3	27	258	3	11	<5	0.10	19	<1
	Mean	7.9	35	269	5	17	<5	0.14	20	<1
	Maximum	8.4	42	286	7	19	<5	0.15	20	<1
	Std. Dev.	0.5	8	12	3	4	0	0.02	1	NA
	Median	7.9	37	266	5	18	<5	0.15	20	<1
	Coeff. of Var. (%)	6.1	21	4	63	22	0	18	3	NA
QC-21	Minimum	7.3	40	376	7	18	<5	<0.10	44	<1
	Mean	7.7	49	402	10	19	6	<0.10	51	<1
	Maximum	7.9	53	440	18	20	8	0.14	64	<1
	Std. Dev.	0.3	6	27	5	1	2	0.02	9	NA
	Median	7.7	51	396	7	20	6	<0.10	48	<1
	Coeff. of Var. (%)	3.7	13	7	55	5	25	18	18	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2012

Well <sup>1</sup>	Statistic	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 <sup>3</sup>
			mS/m	----- mg/L -----						MPN/100 mL
QC-22	Minimum	7.9	25	254	2	13	<5	0.21	35	<1
	Mean	8.0	34	270	4	13	5	0.22	36	<1
	Maximum	8.1	39	290	9	13	6	0.22	36	<1
	Std. Dev.	0.1	8	18	4	0	0.4	0.01	1	NA
	Median	8.0	38	266	2	13	5	0.22	36	<1
	Coeff. of Var. (%)	1.2	24	7	107	0	8	2.7	2	NA
QC-23	Minimum	7.7	32	316	<1	19	<5	<0.10	6	<1
	Mean	8.3	40	352	<1	19	<5	<0.10	6	<1
	Maximum	9.0	50	386	7	20	<5	0.10	6	<1
	Std. Dev.	0.7	9	35	4	1	0	3.6	0	NA
	Median	8.2	38	354	7	19	<5	1.0	6	<1
	Coeff. of Var. (%)	7.8	22	10	117	3	0	117	0	NA
QC-24	Minimum	7.8	24	198	<1	27	<5	0.14	14	<1
	Mean	8.2	30	232	4	28	<5	0.14	14	<1
	Maximum	8.5	36	264	10	28	<5	0.14	14	<1
	Std. Dev.	0.4	6	33	5	1	0	0.00	0	NA
	Median	8.4	29	234	<1	28	<5	0.14	14	<1
	Coeff. of Var. (%)	4.5	20	14	128	2	0	0.00	0	NA
QC-25	Minimum	7.8	27	228	<1	12	7	0.13	22	<1
	Mean	8.2	30	238	<1	12	12	0.14	24	<1
	Maximum	8.5	33	244	8	12	19	0.16	26	<1
	Std. Dev.	0.4	3	9	1	0	6	0.02	2	NA
	Median	8.2	30	242	8	12	9	0.14	24	<1
	Coeff. of Var. (%)	4.3	10	4	119	0	55	11	8	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2012

Well <sup>1</sup>	Statistic	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 <sup>3</sup>
			mS/m	----- mg/L -----						MPN/100 mL
QC-26	Minimum	7.8	31	266	<1	10	<5	<0.10	6	<1
	Mean	8.5	35	271	4	11	<5	<0.10	6	<1
	Maximum	9.1	40	274	11	12	<5	0.11	7	<1
	Std. Dev.	0.7	5	4	6	1	0	0.10	1	NA
	Median	8.5	32	272	1	11	<5	<0.10	6	<1
	Coeff. of Var. (%)	7.9	14	2	133	9	0	5.6	9	NA
QC-27	Minimum	7.9	27	244	<1	1	<5	0.15	24	<1
	Mean	8.2	31	255	2	8	<5	0.16	25	<1
	Maximum	8.4	37	262	4	12	6	0.18	25	<1
	Std. Dev.	0.2	5	9	2	5	0.5	0.02	1	NA
	Median	8.2	29	258	1	10	5	0.16	25	<1
	Coeff. of Var. (%)	2.8	16	4	89	60	9	9.4	2	NA
QC-28	Minimum	8.0	27	264	1	12	<5	<0.10	16	<1
	Mean	8.1	32	286	3	12	<5	<0.10	16	<1
	Maximum	8.1	39	304	5	13	<5	<0.10	17	<1
	Std. Dev.	0.1	6	20	2	1	0	0.00	1	NA
	Median	8.1	30	290	2	12	<5	<0.10	16	<1
	Coeff. of Var. (%)	0.9	19	7	87	5	0	0.00	4	NA
QC-29	Minimum	6.7	41	716	1	70	129	0.54	257	<1
	Mean	7.2	62	921	2	163	170	0.71	373	<1
	Maximum	7.6	86	1,096	7	204	188	0.79	426	<1
	Std. Dev.	0.4	21	137	2	53	24	0.10	68	NA
	Median	7.4	51	950	2	182	180	0.73	404	<1
	Coeff. of Var. (%)	5.2	33	15	92	33	14	14	18	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QC-2 THROUGH QC-36 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2012

Well <sup>1</sup>	Statistic	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 <sup>3</sup>
			mS/m	----- mg/L -----						MPN/100 mL
QC-30	Minimum	7.6	33	380	1	<10	65	0.13	54	<1
	Mean	7.9	44	416	4	<10	73	0.25	58	<1
	Maximum	8.3	70	500	10	<10	85	0.40	65	<1
	Std. Dev.	0.3	12	41	4	0	7	0.12	4	NA
	Median	7.8	42	406	2	<10	73	0.23	57	<1
	Coeff. of Var. (%)	3.7	27	10	106	0	10	47	7	NA
QC-31	Minimum	7.1	5	552	1	14	182	1.0	234	<1
	Mean	7.6	43	573	2	15	187	1.0	240	<1
	Maximum	7.9	53	588	7	15	200	1.1	246	<1
	Std. Dev.	0.2	17	12	2	1	6	0.0	5	NA
	Median	7.6	50	574	1	15	184	1.1	238	<1
	Coeff. of Var. (%)	3.0	40	2	113	4	3	3.6	2	NA

<sup>1</sup>Wells QC-1 and QC-32 through QC-37 either could not be sampled, or only a single sample was retrieved; non-functional pumps.

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

<sup>3</sup>Geometric mean calculated.

<sup>4</sup>Not applicable.

TABLE 3: GROUNDWATER ELEVATIONS FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2012

Date <sup>1</sup>	Observation Well No.											
	OC-1	OC-2	OC-3	OC-4	OC-5	OC-6	OC-7	OC-8	OC-8-1	OC-9	OC-10	OC-11
----- Elevation (ft) <sup>2</sup> -----												
01/13/12	-27.8	-21.6	-148	-162	-144	-79.7	-203	-184	-242	-205	-209	-215
01/27/12	-27.8	-21.6	-155	-169	-145	-72.7	-210	-184	-241	-211	-210	-223
02/10/12	-26.8	-23.6	-151	-171	-148	-78.7	-211	-185	-241	-214	-212	-225
02/17/12	-30.8	-24.6	-155	-165	-152	-81.7	-208	-183	-231	-212	-222	-220
02/24/12	-30.8	-25.6	-154	-164	-152	-79.7	-209	-183	-231	-212	-224	-220
03/09/12	-27.8	-23.6	-146	NR <sup>3</sup>	-145	-79.7	-214	-188	-238	-211	-207	-229
03/16/12	-30.8	-24.6	-154	NR	-152	-81.7	-208	-182	-230	-212	-223	-220
04/06/12	-25.8	-21.6	-146	-165	-141	-75.7	-207	-182	-235	-209	-214	-218
04/13/12	-28.8	-21.6	-147	-173	-143	-80.7	-212	-186	-237	-212	-208	-227
04/19/12	-28.8	-23.6	-145	NR	-144	-79.7	-212	-186	-238	-211	-207	-226
05/04/12	-24.8	-20.6	-143	NR	-142	-75.7	-199	-178	-235	-200	-213	-209
05/11/12	-31.8	-25.6	-155	-164	-152	-79.7	-207	-180	-231	-212	-222	-219
05/18/12	-31.8	-25.6	-155	-164	-150	-79.7	-209	-183	-221	-216	-222	-221
06/01/12	-26.8	-22.6	-143	NR	-147	-76.7	-202	-180	-241	-204	-213	-216
06/08/12	-25.8	-23.6	-150	-175	-141	-82.7	-215	-188	-241	-213	-211	-222
06/29/12	-26.8	-22.6	-146	-172	-140	-78.7	-211	-190	-216	-211	-207	-217
07/20/12	-28.8	-20.6	-148	-172	-144	-81.7	-211	-186	-238	-211	-209	-227
07/26/12	-26.8	-23.6	-156	NR	-152	-80.7	-213	-185	-243	-216	-224	-223
08/03/12	-28.8	-23.6	-148	-174	-143	-81.7	-213	-194	-220	-209	-209	-218
08/24/12	-26.8	-22.6	-145	-171	-141	-78.7	-211	-197	-218	-207	-207	-216
08/31/12	-27.8	-21.6	-145	-168	-144	-81.7	-209	-188	-238	-212	-207	-229
09/07/12	-27.8	-21.6	-149	-166	-150	-79.7	-210	-183	-237	-213	-219	-220
09/14/12	-24.8	-21.6	-156	-167	-153	-80.7	-211	-184	-236	-214	-221	-220



TABLE 3 (Continued): GROUNDWATER ELEVATIONS FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2012

Date <sup>1</sup>	Observation Well No.											
	OC-1	OC-2	OC-3	OC-4	OC-5	OC-6	OC-7	OC-8	OC-8-1	OC-9	OC-10	OC-11
----- Elevation (ft) <sup>2</sup> -----												
09/28/12	-25.8	-21.6	-147	-169	-145	-81.7	-208	-188	-242	-217	-215	-230
10/05/12	-27.8	-22.6	-144	-167	-141	-79.7	-211	-198	-218	-206	-207	-216
10/26/12	-26.8	-22.6	-145	-171	-147	-79.7	-210	-187	-240	-218	-218	-232
11/02/12	-28.8	-24.6	-151	-168	-145	-80.7	-209	-183	-238	-216	-223	-225
11/08/12	-27.8	-22.6	-145	-170	-147	-80.7	-209	-187	-240	-218	-217	-232
11/30/12	-26.8	-23.6	-149	-169	-144	-78.7	-212	-189	-242	-215	-219	-228
12/14/12	-27.8	-21.6	-146	-167	-142	-81.7	-209	-194	-240	-213	-216	-230
12/20/12	-26.8	-22.6	-151	-165	-145	-79.7	-211	-185	-240	-216	-218	-227

<sup>1</sup>Dates measurements were taken.

<sup>2</sup>Relative to Chicago city datum (579.48 ft above mean sea level) at intersection of Madison and State Streets.

<sup>3</sup>No reading; well inaccessible.

FIGURE 3: MINIMUM, MEAN, AND MAXIMUM WATER ELEVATIONS FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2012

