Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 14-36

TUNNEL AND RESERVOIR PLAN

MAINSTREAM TUNNEL SYSTEM

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2013

September 2014

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago
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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, Mainstream Tunnel System, Annual Groundwater Monitoring Report for 2013

Attached are three copies of the "Tunnel and Reservoir Plan, Mainstream Tunnel System, 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

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TUNNEL AND RESERVOIR PLAN MAINSTREAM TUNNEL SYSTEM ANNUAL GROUNDWATER MONITORING REPORT FOR 2013

Monitoring and Research Department
Thomas C. Granato, Director

September 2014

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Introduction

The monitoring and observation wells are located along the length of the Mainstream Tunnel System between Morton Grove and Hodgkins, Illinois (Figures 1 and 2). The elevations for observation wells are measured at least six times per year, while the monitoring wells are sampled at various frequencies. Monitoring wells QM-53, -56, -58, -61, -66, -68 through -74, -76, -77, and -81 are sampled three times per year (Illinois Environmental Protection Agency [IEPA] memoranda dated July 9, 2004, and February 23, 2006). Monitoring wells QM-62 through -65, -67, -75, -78 through -80, and -82 are all sampled six times per year (IEPA memorandum dated July 9, 2004). Sampling of monitoring wells QM-51, -52, -54, -55, -57, and -60 was discontinued with the approval of the IEPA (memorandum dated May 4, 1994). Monitoring well QM-65 could not be sampled throughout the year due to a faulty pump, which is scheduled for replacement soon. Samples were retrieved from Well QM-66 in 2013, unlike during the previous year. This well may be classified as intermittently dry. Monitoring well QM-59 has been dry since February 1995 and is no longer monitored. Since observation well OM-17 was damaged in an accident about five years ago, the IEPA granted permission to the Metropolitan Water Reclamation District of Greater Chicago to abandon this well (Appendix A).

All monitoring wells in the Mainstream Tunnel System were sampled at the required frequencies. However, in a few instances, samples from specific wells could not be collected for various reasons. Monitoring wells QM-56 and -58 could not be sampled during 2013 because construction in the area rendered them inaccessible. The required six samples were retrieved during the year from Wells QM-62 and -82, unlike previous years. Both wells could be considered intermittently dry.

Summary of Data

Monitoring Wells. The analytical data for groundwater sampled during 2013 from monitoring wells QM-53 through QM-82 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 Wells QM-62, -63, -67, and -81 were much higher than expected at various times during the year, so these wells are scheduled for decontamination before the end of 2014. Table 2 lists the descriptive statistics for groundwater data of monitoring wells QM-53 through QM-82 for the year 2013.

Observation Wells. Groundwater elevations for observation wells OM-1 through -23 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). These fluctuations appeared to be minimal throughout the year.

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

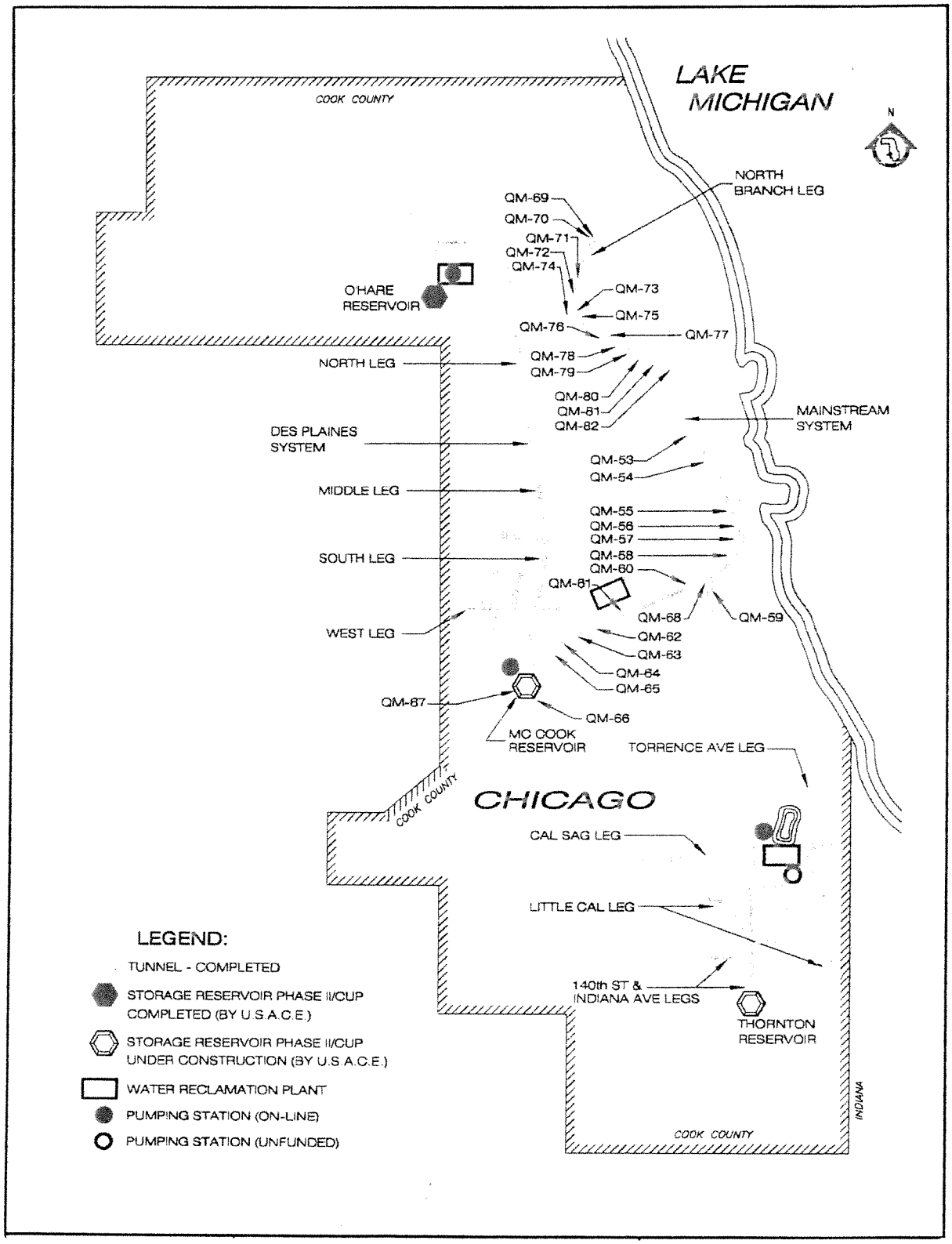


FIGURE 2: MAP OF OBSERVATION WELLS IN THE MAINSTREAM TUNNEL SYSTEM

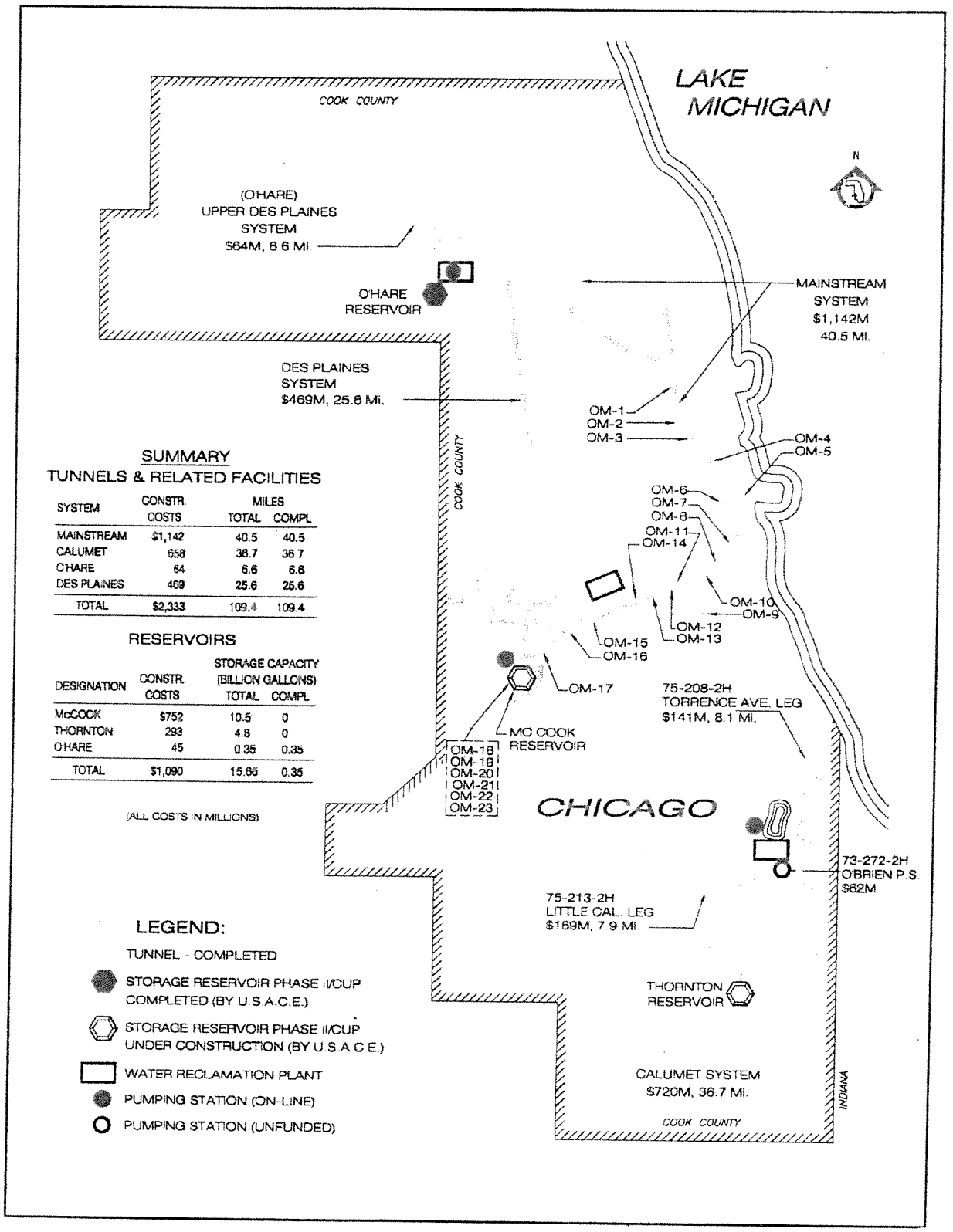


TABLE 1: ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2013

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.
QM-53	04/04/13	7.9	41	198	<1	19	34	0.12	152	<1	11.9	-37	<48
QM-53	06/13/13	7.4	51	226	<1	14	36	0.10	150	<1	12.3	-33	<48
QM-53	10/09/13	8.2	25	186	<1	15	33	<0.10	150	<1	12.4	-40	<48
QM-61	01/02/13	7.3	28	336	1	60	21	0.27	138	110	8.4	-174	<4
QM-61	05/13/13	7.6	47	378	2	67	23	0.60	147	28	13.9	-164	<4
QM-61	09/04/13	8.1	51	306	1	45	6	0.31	114	<1	14.4	-164	<4
QM-62	03/27/13	6.9	57	430	1	100	33	0.82	189	2,200	13.7	-191	<48
QM-62	05/15/13	7.3	60	396	1	57	36	0.67	188	23	14.7	-183	<48
QM-62	08/22/13	7.8	51	412	3	47	43	0.64	188	11	14.1	-188	<48
QM-62	09/18/13	7.8	52	428	1	47	43	0.49	183	1	14.1	-86	<48
QM-62	10/10/13	7.6	44	370	1	46	41	0.52	177	870	13.7	-191	<48
QM-62	11/07/13	7.5	49	394	1	43	40	0.62	171	14,000	13.4	-162	<48
QM-63	02/28/13	7.2	103	1,812	3	49	1,002	2.2	1,051	<1	13.5	-191	<48
QM-63	05/15/13	7.4	198	1,862	2	48	982	2.4	945	15	14.4	-186	<48
QM-63	08/22/13	7.6	164	1,988	3	50	993	2.3	949	<1	14.2	-188	<48
QM-63	09/18/13	7.5	79	1,902	3	52	1,023	2.4	946	<1	14.9	-192	<48
QM-63	10/10/13	7.6	159	1,748	2	50	935	2.2	920	380	13.4	-217	<48
QM-63	11/07/13	7.6	151	1,658	2	47	849	2.4	834	3,300	13.2	-194	<48
QM-64	01/02/13	7.7	42	424	1	50	41	1.6	209	22	10.9	-174	<4
QM-64	05/13/13	7.2	54	428	2	56	34	1.7	203	36	14.1	-161	<4
QM-64	08/05/13	7.4	62	468	2	48	41	1.7	239	51	13.9	-171	<4
QM-64	09/04/13	7.8	56	408	1	48	30	1.5	189	1	15.1	-166	<4

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM 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
QM-64	10/23/13	7.6	53	414	2	52	37	1.6	193	27	13.0	-168	<4
QM-64	11/25/13	7.6	57	430	2	54	38	1.7	203	240	14.4	-166	<4
QM-66	04/04/13	10	89	1,244	<1	184	149	1.1	3	<1	13.0	-312	<48
QM-66	06/13/13	8.2	72	1,184	1	NA[4]	235	0.92	19	8	13.3	-316	<48
QM-66	10/10/13	11	283	1,400	<1	167	174	0.67	4	<1	14.2	-309	<48
QM-67	02/28/13	7.0	90	622	9	157	<5	12	294	1,300	12.4	-153	<48
QM-67	04/04/13	7.0	92	748	7	221	7	13	324	370	13.2	-151	<48
QM-67	06/13/13	7.3	83	744	3	311	8	12	289	2,600	12.1	-151	<48
QM-67	08/29/13	7.5	106	714	3	190	<5	12	270	11	14.5	-151	<48
QM-67	09/18/13	7.6	98	668	3	161	11	11	243	85	14.3	-153	<48
QM-67	10/10/13	7.5	87	576	3	139	13	11	230	570	13.9	-156	<48
QM-68	04/04/13	6.8	51	262	<1	31	39	0.62	212	17	13.5	-130	<48
QM-68	06/13/13	7.1	41	306	<1	25	37	0.60	204	11	12.5	-126	<48
QM-68	10/09/13	8.1	33	260	<1	26	33	0.63	196	570	13.6	-133	<48
QM-69	02/07/13	8.2	27	NA	3	35	NA	0.92	165	<1	10.5	-33	<48
QM-69	07/25/13	7.7	32	302	2	34	40	0.95	159	<1	14.0	-24	<48
QM-69	09/19/13	7.6	41	296	1	38	40	0.92	158	<1	10.8	-44	<48
QM-70	02/07/13	8.1	24	NA	1	47	NA	0.39	162	<1	11.0	-52	<48
QM-70	07/25/13	7.7	29	318	2	47	51	0.41	164	<1	19.1	-52	<48
QM-70	09/19/13	7.4	38	318	<1	48	49	0.40	162	<1	10.9	-73	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM 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
QM-71	02/07/13	7.7	30	NA	<1	126	NA	0.46	209	<1	10.9	-59	<48
QM-71	07/25/13	7.7	38	482	<1	122	66	0.48	211	<1	13.5	-58	<48
QM-71	09/19/13	7.6	48	506	<1	122	66	0.47	210	<1	10.4	-62	<48
QM-72	02/07/13	7.4	25	418	<1	124	<5	0.39	212	<1	11.5	-75	<48
QM-72	07/25/13	7.7	35	464	1	123	<5	0.40	230	<1	12.8	-79	<48
QM-72	09/19/13	7.3	42	514	1	126	<5	0.39	227	<1	10.4	-82	<48
QM-73	04/11/13	7.7	28	296	1	41	<5	0.31	168	<1	12.8	-166	<48
QM-73	08/22/13	7.8	38	302	1	34	<5	0.34	163	<1	13.9	-136	<48
QM-73	10/30/13	7.9	37	280	1	35	<5	0.35	162	<1	12.1	-161	<48
QM-74	04/11/13	8.1	27	254	2	15	<5	0.28	117	<1	12.7	-13	<48
QM-74	08/22/13	8.0	35	292	2	53	<5	0.17	113	<1	12.9	-13	<48
QM-74	10/30/13	8.0	35	262	2	56	<5	0.22	111	<1	12.4	-14	<48
QM-75	01/31/13	8.5	278	226	<1	12	15	0.18	707	<1	7.7	-77	<48
QM-75	04/11/13	7.4	24	216	<1	15	9	0.27	73	8	11.5	-62	<48
QM-75	06/13/13	8.0	166	234	<1	10	12	0.23	69	4	12.2	-78	<48
QM-75	09/19/13	7.8	25	222	<1	12	11	0.24	66	<1	12.3	-62	<48
QM-75	10/09/13	8.2	27	216	<1	13	8	0.28	64	40	12.4	-62	<48
QM-75	11/07/13	8.4	28	288	<1	14	6	0.29	64	270	11.9	-81	<48
QM-76	04/11/13	7.8	32	304	1	15	46	0.36	46	<1	12.5	-187	<48
QM-76	09/18/13	8.2	41	328	<1	12	17	0.28	42	<1	12.7	-187	<48
QM-76	10/09/13	8.7	36	292	<1	14	16	0.32	34	<1	13.1	-185	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM 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
QM-77	04/11/13	7.5	21	162	<1	13	<5	0.16	50	8	11.2	-174	<48
QM-77	09/18/13	8.1	22	188	<1	11	<5	<0.10	47	<1	13.7	-177	<48
QM-77	10/09/13	8.0	18	138	<1	10	<5	<0.10	48	22	12.2	-174	<48
QM-78	01/31/13	8.0	338	298	<1	10	45	<0.10	782	<1	6.4	-162	<48
QM-78	04/11/13	8.9	40	276	<1	13	42	0.10	11	<1	11.6	-166	<48
QM-78	06/13/13	8.7	227	300	<1	10	41	<0.10	10	<1	12.4	-160	<48
QM-78	08/29/13	9.0	34	322	<1	11	35	0.14	10	<1	12.9	-156	<48
QM-78	09/19/13	8.5	35	284	<1	11	42	<0.10	32	<1	12.1	-170	<48
QM-78	12/05/13	8.1	34	284	<1	11	39	0.10	10	<1	10.9	-160	<48
QM-79	01/31/13	7.9	362	322	<1	18	18	<0.10	415	<1	9.1	-152	<48
QM-79	04/11/13	9.0	38	446	<1	18	19	0.11	15	<1	11.5	-154	<48
QM-79	06/13/13	8.8	253	306	<1	15	17	<0.10	12	<1	11.8	-149	<48
QM-79	08/29/13	8.6	37	318	<1	15	20	<0.10	14	<1	14.1	-153	<48
QM-79	09/19/13	8.5	39	316	<1	20	14	0.11	8	<1	12.9	-156	<48
QM-79	12/05/13	8.0	35	274	<1	16	18	<0.10	12	<1	11.8	-147	<48
QM-80	02/07/13	8.0	22	180	<1	12	<5	<0.10	24	<1	11.8	-145	<48
QM-80	04/11/13	8.8	28	218	<1	15	<5	<0.10	26	<1	11.9	-138	<48
QM-80	06/13/13	8.4	194	202	<1	11	<5	<0.10	23	<1	12.1	-145	<48
QM-80	08/29/13	8.7	24	214	<1	13	<5	<0.10	23	<1	13.1	-146	<48
QM-80	09/19/13	8.5	24	186	<1	14	<5	<0.10	23	<1	13.0	-144	<48
QM-80	12/05/13	8.2	23	188	<1	13	<5	<0.10	22	<1	11.2	-137	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM 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
QM-81	02/07/13	7.8	22	230	<1	20	13	<0.10	35	<1	11.4	-130	<48
QM-81	04/11/13	8.3	40	232	<1	23	11	<0.10	37	<1	12.2	-127	<48
QM-81	09/19/13	8.2	30	242	<1	18	15	<0.10	34	760	12.3	-132	<48
QM-82	02/07/13	8.3	29	286	1	29	9	<0.10	15	<1	11.9	-186	<48
QM-82	04/11/13	8.8	50	276	1	30	800	0.10	18	<1	12.3	-188	<48
QM-82	06/13/13	8.6	25	318	1	28	12	0.10	14	<1	13.2	-189	<48
QM-82	08/29/13	8.6	38	342	1	29	8	<0.10	15	<1	15.1	-184	<48
QM-82	09/19/13	8.6	36	284	1	29	7	<0.10	16	<1	14.3	-189	<48
QM-82	12/05/13	8.3	35	276	1	30	10	<0.10	15	<1	12.5	-185	<48

[1]Samples retrieved from QM-66 during 2013; well classified as intermittently dry.
[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; sample insufficient for re-run.

TABLE 2: DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
			mS/m	mg/L						MPN/100 mL
QM-53	Minimum	7.4	25	186	<1	14	33	0.10	150	<1
	Mean	7.9	39	203	<1	16	34	0.11	151	<1
	Maximum	8.2	51	226	<1	19	36	0.12	152	<1
	Std. Dev.	0.4	13	21	0	3	2	0.01	1	NA[3]
	Median	7.9	41	198	<1	15	34	0.11	150	<1
	Coeff. of Var. (%)	5.2	34	10	0	17	5	13	1	NA
QM-61	Minimum	7.3	28	306	1	45	6	0.27	114	<1
	Mean	7.7	42	340	2	57	16	0.39	133	15
	Maximum	8.1	51	378	2	67	23	0.60	147	110
	Std. Dev.	0.4	12	36	1	11	9	0.18	17	NA
	Median	7.6	47	336	1	60	21	0.31	138	28
	Coeff. of Var. (%)	5.7	29	11	36	20	55	46	13	NA
QM-62	Minimum	6.9	44	370	1	43	33	0.49	171	1
	Mean	7.5	52	405	2	57	39	0.63	183	138
	Maximum	7.8	60	430	3	100	43	0.82	189	14,000
	Std. Dev.	0.3	6	23	1	22	4	0.12	7	NA
	Median	7.5	52	404	1	47	40	0.63	186	447
	Coeff. of Var. (%)	4.4	11	6	54	38	11	19	4	NA
QM-63	Minimum	7.2	79	1,658	2	47	849	2.2	834	1
	Mean	7.5	142	1,828	2	49	964	2.3	941	16
	Maximum	7.6	198	1,988	3	52	1,023	2.4	1,051	3,300
	Std. Dev.	0.2	44	116	0.1	2	64	0.07	69	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
			mS/m	mg/L						MPN/100 mL
	Median	7.5	155	1,837	2	50	987	2.3	946	8
	Coeff. of Var. (%)	2.3	31	6	5	4	7	3.2	7	NA
QM-64	Minimum	7.2	42	408	1	48	30	1.5	189	1
	Mean	7.6	54	429	2	51	37	1.6	206	25
	Maximum	7.8	62	468	2	56	41	1.7	239	240
	Std. Dev.	0.2	7	21	0.1	3	4	0.08	18	NA
	Median	7.6	55	426	2	51	37	1.6	203	32
	Coeff. of Var. (%)	2.9	13	5	10	6	11	4.6	9	NA
QM-66	Minimum	8.2	72	1,184	<1	167	149	0.67	3	<1
	Mean	9.8	148	1,276	<1	176	186	0.89	9	2
	Maximum	11	283	1,400	1	184	235	1.1	19	8
	Std. Dev.	1.4	117	111	0	12	44	0.20	9	NA
	Median	10	89	1,244	1	176	174	0.92	4	1
	Coeff. of Var. (%)	15	79	9	0	7	24	23	103	NA
QM-67	Minimum	7.0	83	576	3	139	7	11	230	11
	Mean	7.3	93	679	5	197	10	12	275	296
	Maximum	7.6	106	748	9	311	13	13	324	2,600
	Std. Dev.	0.3	8	70	2	63	2	0.70	35	NA
	Median	7.4	91	691	3	176	10	12	280	470
	Coeff. of Var. (%)	3.5	9	10	52	32	25	5.9	13	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
QM-68	Minimum	6.8	33	260	<1	25	33	0.60	196	11
	Mean	7.3	42	276	<1	27	36	0.62	204	47
	Maximum	8.1	51	306	<1	31	39	0.63	212	570
	Std. Dev.	0.6	9	26	0	3	3	0.02	8	NA
	Median	7.1	41	262	<1	26	37	0.62	204	17
	Coeff. of Var. (%)	8.7	21	9	0	12	9	2.5	4	NA
QM-69	Minimum	7.6	27	296	1	34	40	0.92	158	<1
	Mean	7.8	33	299	2	36	40	0.93	161	<1
	Maximum	8.2	41	302	3	38	40	1.0	165	<1
	Std. Dev.	0.3	7	4	1	2	0.2	0.02	4	NA
	Median	7.7	32	299	2	35	40	0.92	159	<1
	Coeff. of Var. (%)	3.9	21	1	51	6	1	1.9	2	NA
QM-70	Minimum	7.4	24	318	1	47	49	0.39	162	<1
	Mean	7.7	30	318	1	47	50	0.40	163	<1
	Maximum	8.1	38	318	2	48	51	0.41	164	<1
	Std. Dev.	0.3	7	0	0.4	1	1	0.01	1	NA
	Median	7.7	29	318	1	47	50	0.40	162	<1
	Coeff. of Var. (%)	4.3	23	0	28	1	3	2.5	1	NA
QM-71	Minimum	7.6	30	482	<1	122	66	0.46	209	<1
	Mean	7.6	39	494	<1	123	66	0.47	210	<1
	Maximum	7.7	48	506	<1	126	66	0.48	211	<1
	Std. Dev.	0.0	9	17	0	2	0.4	0.01	1	NA
	Median	7.7	38	494	<1	122	66	0.47	210	<1

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
	Coeff. of Var. (%)	0.5	24	3	0	2	1	2.1	0	NA
QM-72	Minimum	7.3	25	418	<1	123	<5	0.39	212	<1
	Mean	7.5	34	465	1	124	<5	0.39	223	<1
	Maximum	7.7	42	514	1	126	<5	0.40	230	<1
	Std. Dev.	0.2	9	48	0.2	2	0	0.01	10	NA
	Median	7.4	35	464	1	124	<5	0.39	227	<1
	Coeff. of Var. (%)	2.9	26	10	21	1	0	1.5	4	NA
QM-73	Minimum	7.7	28	280	1	34	<5	0.31	162	<1
	Mean	7.8	34	293	1	37	<5	0.33	164	<1
	Maximum	7.9	38	302	1	41	<5	0.35	168	<1
	Std. Dev.	0.1	6	11	0.1	4	0	0.02	3	NA
	Median	7.8	37	296	1	35	<5	0.34	163	<1
	Coeff. of Var. (%)	1.4	17	4	4	10	0	6.2	2	NA
QM-74	Minimum	8.0	27	254	2	15	<5	0.17	111	<1
	Mean	8.0	32	269	2	41	<5	0.22	114	<1
	Maximum	8.1	35	292	2	56	<5	0.28	117	<1
	Std. Dev.	0.1	5	20	0.2	23	0	0.06	3	NA
	Median	8.0	35	262	2	53	<5	0.22	113	<1
	Coeff. of Var. (%)	0.6	15	7	12	55	0	25	3	NA
QM-75	Minimum	7.4	24	216	<1	10	6	0.18	64	1
	Mean	8.0	91	234	<1	13	10	0.25	174	8
	Maximum	8.5	278	288	<1	15	15	0.29	707	270

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
	Std. Dev.	0.4	107	27	0	2	3	0.04	261	NA
	Median	8.1	28	224	<1	13	10	0.26	68	6
	Coeff. of Var. (%)	5.0	117	12	0	14	30	16	150	NA
QM-76	Minimum	7.8	32	292	<1	12	16	0.28	34	<1
	Mean	8.2	36	308	1	14	26	0.32	41	<1
	Maximum	8.7	41	328	1	15	46	0.36	46	<1
	Std. Dev.	0.4	5	18	0	2	17	0.04	6	NA
	Median	8.2	36	304	1	14	17	0.32	42	<1
	Coeff. of Var. (%)	5.2	14	6	0	11	64	13	15	NA
QM-77	Minimum	7.5	18	138	<1	10	<5	<0.10	47	<1
	Mean	7.8	20	163	<1	11	<5	0.12	48	6
	Maximum	8.1	22	188	<1	13	<5	0.16	50	22
	Std. Dev.	0.3	2	25	0	2	0	0.03	2	NA
	Median	8.0	21	162	<1	11	<5	0.16	48	8
	Coeff. of Var. (%)	4.4	9	15	0	13	0	25	3	NA
QM-78	Minimum	8.0	34	276	<1	10	35	<0.10	10	<1
	Mean	8.5	118	294	<1	11	41	0.11	143	<1
	Maximum	9.0	338	322	<1	13	45	0.14	782	<1
	Std. Dev.	0.4	132	16	0	1	3	0.02	313	NA
	Median	8.6	37	291	<1	11	42	0.10	11	<1
	Coeff. of Var. (%)	4.9	112	6	0	10	8	20	220	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
QM-79	Minimum	7.9	35	274	<1	15	14	<0.10	8	<1
	Mean	8.5	127	330	<1	17	18	0.10	79	<1
	Maximum	9.0	362	446	<1	20	20	0.11	415	<1
	Std. Dev.	0.4	144	59	0	2	2	0.01	164	NA
	Median	8.5	39	317	<1	17	18	0.10	13	<1
	Coeff. of Var. (%)	5.3	113	18	0	12	11	5.2	207	NA
QM-80	Minimum	8.0	22	180	<1	11	<5	<0.10	22	<1
	Mean	8.4	52	198	<1	13	<5	<0.10	24	<1
	Maximum	8.8	194	218	<1	15	<5	<0.10	26	<1
	Std. Dev.	0.3	70	16	0	1	0	0.00	1	NA
	Median	8.4	24	195	<1	13	<5	<0.10	23	<1
	Coeff. of Var. (%)	3.4	133	8	0	11	0	0.00	6	NA
QM-81	Minimum	7.8	22	230	<1	18	11	<0.10	34	<1
	Mean	8.1	31	235	<1	20	13	<0.10	35	9
	Maximum	8.3	40	242	<1	23	15	<0.10	37	760
	Std. Dev.	0.3	9	6	0	3	2	<0.10	2	NA
	Median	8.2	30	232	<1	20	13	0.00	35	1
	Coeff. of Var. (%)	3.1	29	3	0	12	14	<0.10	4	NA
QM-82	Minimum	8.3	25	276	1	28	7	<0.10	14	<1
	Mean	8.5	35	297	1	29	141	0.10	16	<1

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2013

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
	Maximum	8.8	50	342	1	30	800	0.10	18	<1
	Std. Dev.	0.2	9	27	0.1	1	323	0.00	1	NA
	Median	8.6	35	285	1	29	9	0.10	15	<1
	Coeff. of Var. (%)	2.1	24	9	11	3	229	0.00	9	NA

[1]EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.
[2]Geometric mean calculated.
[3]Not applicable.

TABLE 3: GROUNDWATER ELEVATIONS FOR OBSERVATION WELLS OM-1 THROUGH OM-23 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2013

Date[1]	Observation Well No.										
	OM-1	OM-2	OM-3	OM-4	OM-5	OM-6	OM-7	OM-8	OM-9	OM-10	OM-11
	Elevation (ft)[2]										
01/04/13	NR[3]	-44.7	-47.7	NR	-78.5	-45.4	-76.6	-65.2	-41.8	NR	-52.4
01/18/13	"	-43.7	-49.7	"	-80.5	-44.4	-70.6	-64.2	-41.8	-29.0	-48.4
02/15/13	"	-48.7	-61.7	"	-87.5	-45.4	-76.6	-68.2	-44.8	-29.0	-42.4
02/22/13	"	-44.7	-43.7	"	-80.5	-45.4	-70.6	-61.2	-41.8	-31.0	NR
03/01/13	-51.8	-43.7	-48.7	"	-77.5	-45.4	-71.6	-58.2	-38.8	-29.0	NR
03/22/13	NR	-43.7	-46.7	"	-77.5	-45.4	-73.6	-58.2	-38.8	-28.0	-47.4
04/02/13	"	-39.7	-54.7	-94.6	-74.5	-45.4	-91.6	-59.2	-44.8	-31.0	-55.4
04/26/13	"	-42.7	-48.7	-90.6	-75.5	-45.4	-71.6	-58.2	-37.8	-28.0	-47.4
05/03/13	"	-43.7	-48.7	-96.6	-77.5	-45.4	-71.6	-59.2	-38.8	-29.0	-55.4
05/17/13	"	-43.7	-49.7	-90.6	-77.5	-40.4	-71.6	-56.2	-38.8	-31.0	-55.4
06/14/13	"	-41.7	-51.7	-92.6	-75.5	-43.4	-84.6	-60.2	-38.8	-30.0	-51.4
07/19/13	"	-43.7	-51.7	-95.6	-80.5	-48.4	-76.6	-60.2	-38.8	-29.0	-55.4
08/09/13	"	-43.7	-45.7	-92.6	-78.5	-45.4	-74.6	-59.2	-39.8	-28.0	-55.4
08/30/13	"	-43.7	-50.7	-91.6	-78.5	-43.4	-71.6	-57.2	-38.8	-31.0	-56.4
09/13/13	"	-41.7	-49.7	-92.6	-74.5	-40.4	-70.6	-56.2	-37.8	NR	-54.4
09/27/13	"	-40.7	-47.7	-90.6	-75.5	-40.4	-73.6	-57.2	-36.8	"	-53.4
10/11/13	"	-41.7	-46.7	-89.6	-77.5	-42.4	-71.6	-57.2	-36.8	"	-53.4
10/25/13	-50.8	-39.7	-55.7	-92.6	-75.5	-45.4	-71.6	-59.2	NR	"	-56.4
11/15/13	NR	-42.7	-47.7	-88.6	-79.5	-43.4	-73.6	-58.2	-37.8	"	-54.4
11/22/13	"	-43.7	-45.7	-89.6	-81.5	-42.4	-72.6	-57.2	-35.8	"	-53.4
12/06/13	"	-41.7	-48.7	-89.6	-76.5	-44.4	-90.6	-60.2	-42.8	"	-56.4
12/13/13	"	-42.7	-48.7	-90.6	-74.5	-45.4	-70.6	-56.2	-36.8	"	-55.4

TABLE 3 (Continued): GROUNDWATER ELEVATIONS FOR OBSERVATION WELLS OM-1 THROUGH OM-23 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2013

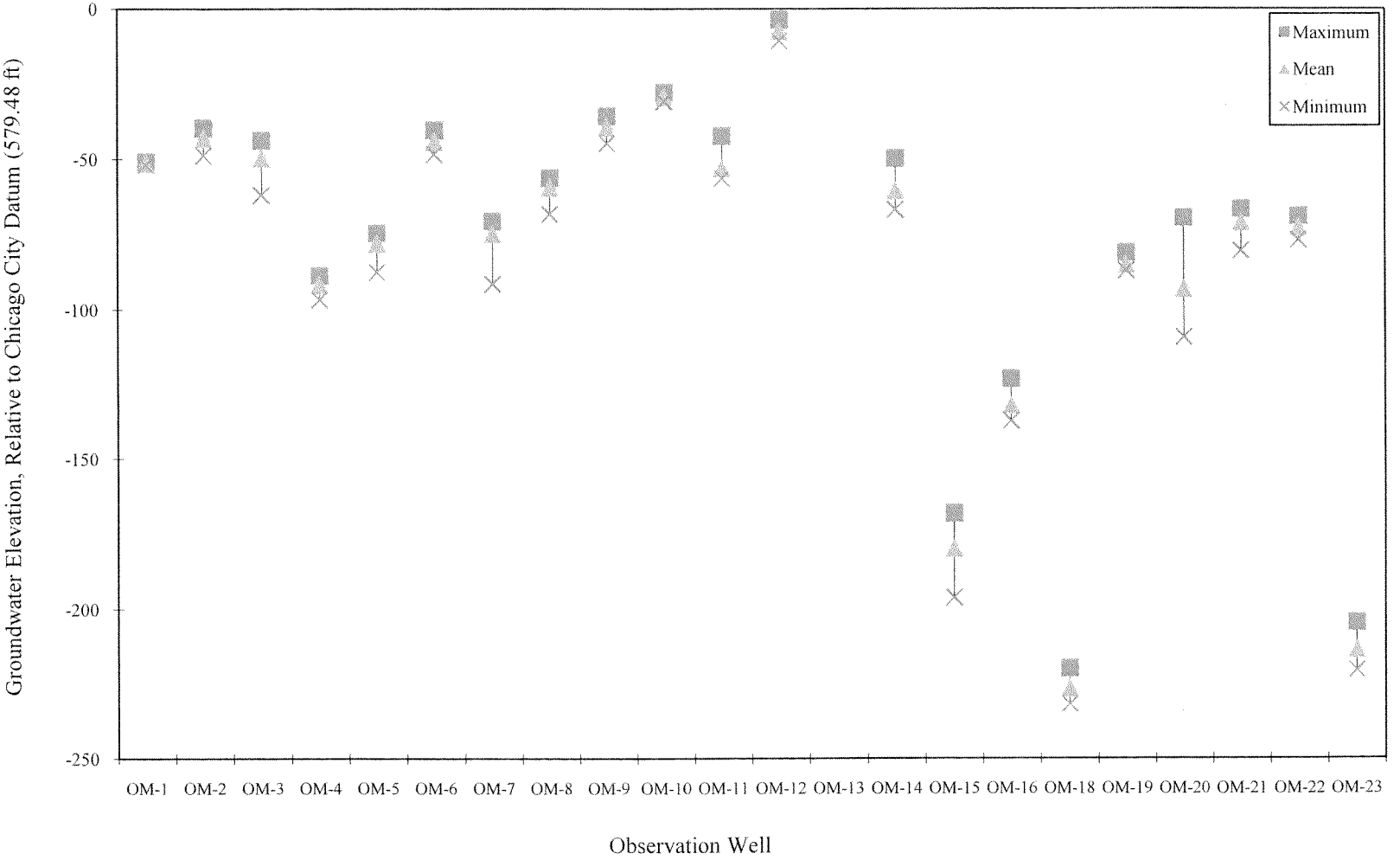
Date[1]	Observation Well No.										
	OM-12	OM-13	OM-14	OM-15	OM-16	OM-18	OM-19	OM-20	OM-21	OM-22	OM-23
	Elevation (ft)[2]										
01/11/13	-5.7	NR[3]	-58.8	-179	-135	-230	-84.5	-102	-66.9	-72.3	-214
01/25/13	-9.7	"	-59.8	-175	-133	-229	-84.5	-83.9	-68.9	-73.3	-221
02/01/13	-6.7	"	-58.8	-178	-131	-223	-86.5	-107	-72.9	-72.3	-209
02/15/13	-4.7	"	-60.8	-181	-133	-225	-87.5	-104	-69.9	-71.3	-211
03/15/13	-10.7	"	-60.8	-182	-138	-232	-86.5	-86.9	-72.9	-76.3	-221
03/29/13	-7.7	"	-60.8	-181	-129	-220	-87.5	-110	-69.9	-71.3	-210
04/05/13	-5.7	"	-59.8	-181	-134	-229	-85.5	-103	-71.9	-71.3	-214
04/18/13	-5.7	"	-59.8	-183	-135	-231	-86.5	-104	-73.9	-71.3	-216
05/10/13	-8.7	"	-58.8	-177	-134	-226	-84.5	-83.9	-68.9	-71.3	-217
05/24/13	-6.7	"	-59.8	-180	-133	-224	-81.5	-81.9	-69.9	-69.3	-215
06/07/13	-9.7	"	-63.8	-186	-135	-224	-86.5	-104	-71.9	-74.3	-218
06/21/13	-5.7	"	-62.8	-181	-132	-226	-85.5	-107	-72.9	-75.3	-220
07/19/13	NR	"	NR	-186	-127	-225	-86.5	-100	-70.9	-74.3	-207
08/09/13	"	"	-62.8	-196	-124	-221	-84.5	-102	-69.9	-73.3	-205
08/30/13	-6.7	"	-58.8	-184	-137	-225	-87.5	-94.9	-72.9	-72.3	-212
09/13/13	-9.7	"	-58.8	-178	-138	-230	-84.5	-81.9	-68.9	-73.3	-218
09/27/13	-8.7	"	-62.8	-177	-138	-230	-83.5	-81.9	-69.9	-74.3	-219
10/18/13	NR	"	-65.8	-169	-128	-228	-86.5	-80.9	-72.9	-76.3	-207
10/25/13	"	"	-66.8	-168	-126	-226	-87.5	-78.9	-71.9	-74.3	-206
11/08/13	-3.7	"	-61.8	-180	-135	-226	-85.5	-100	-74.9	-72.3	-211

TABLE 3 (Continued): GROUNDWATER ELEVATIONS FOR OBSERVATION WELLS OM-1 THROUGH OM-23 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2013

Date[1]	Observation Well No.										
	OM-12	OM-13	OM-14	OM-15	OM-16	OM-18	OM-19	OM-20	OM-21	OM-22	OM-23
	Elevation (ft)[2]										
11/19/13	-9.7	"	-59.8	-177	-137	-230	-84.5	-82.9	-68.9	-74.3	-220
12/03/13	-7.7	"	-58.8	-183	-134	-226	-83.5	-103	-71.9	-73.3	-213
12/20/13	-8.7	"	-49.8	-171	-129	-228	-85.5	-69.9	-80.9	-77.3	-221

[1]Date measurements were taken.
[2]Relative to Chicago city datum (579.48' above mean sea level) at intersection of State and Madison Streets.
[3]No reading. Wells inaccessible due to closure of business, locked gates, snow accumulation, or heavy truck traffic; OM-13 broken.

FIGURE 3: MINIMUM, MEAN, AND MAXIMUM WATER ELEVATIONS FOR OBSERVATION WELLS OM-1 THROUGH OM-23 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2013



APPENDIX A

DECEMBER 16, 2011, LETTER FROM THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY TO THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO AUTHORIZING ABANDONMENT OF OBSERVATION WELL OM-17 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-3397
PAT QUINN, GOVERNOR JOHN J. KIM, INTERIM DIRECTOR

217/785-4787

December 16, 2011

Dear Dr. Granato, Director
Monitoring and Research
Metropolitan Water Reclamation District of Greater Chicago
100 East Erie Street
Chicago, IL 60611-3154

The purpose of this letter is to respond to the letter sent to Marcia Willhite, Chief of the Bureau of Water (BOW). Ms. Willhite requested on December 12, 2011 that the Groundwater Section review and respond to your request to abandon groundwater observation well OM 17.

Accordingly, the Groundwater Section, Division of Public Water Supplies, BOW has reviewed and approves of your request to properly abandon groundwater observation well OM 17.

I trust that this will meet you needs should you have any further questions or concerns please feel free to contact me or Bill Buscher, Manager, Hydrogeology and Compliance Unit, Groundwater Section at 217/785-4787.

Sincerely,

Richard P. Cobb, P.G.
Deputy Division Manager
Division of Public Water Supplies
Bureau of Water

DIRECTOR OF [illegible]
2011 DEC 22 PM 4:01
OF GREATER CHGO.

4302 N. Main St., Rockford, IL 61103 (815)987-7760
595 S. State, Elgin, IL 60123 (847)608-3131
2125 S. First St., Champaign, IL 61820 (217)278-5800
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