Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 13-21

TUNNEL AND RESERVOIR PLAN

MAINSTREAM 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

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 2012

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

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

Monitoring and Research Department
Thomas C. Granato, Director

July 2013

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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). However, several wells were sampled more frequently than required. 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 wells QM-65 and -66 could not be sampled throughout the year due to non-functional pumps. A work order has been prepared to replace these pumps. Monitoring well QM-59 has been dry since February 1995 and is no longer monitored. Groundwater elevation is no longer measured for observation well OM-17 because it was damaged in an accident. In a letter dated December 16, 2011 (Appendix I), the IEPA granted permission to the Metropolitan Water Reclamation District of Greater Chicago to abandon this well.

All monitoring wells in the Mainstream Tunnel System were visited for the required number of samples. However, in several instances, samples from specific wells could not be collected for various reasons. Monitoring wells QM-56 and -58 could not be sampled during 2012 because construction in the area rendered them inaccessible. Wells QM-62 and -82 could not be sampled for the required six times during the year because of inoperable pumps. As a result, QM-62 was sampled four times and QM-82 three times for the year. 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 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 in this table. Fecal coliform counts for QM-67 were much higher than expected during April through October. Table 2 lists the descriptive statistics for groundwater data of monitoring wells QM-53 through QM-82 for the year 2012.

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

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

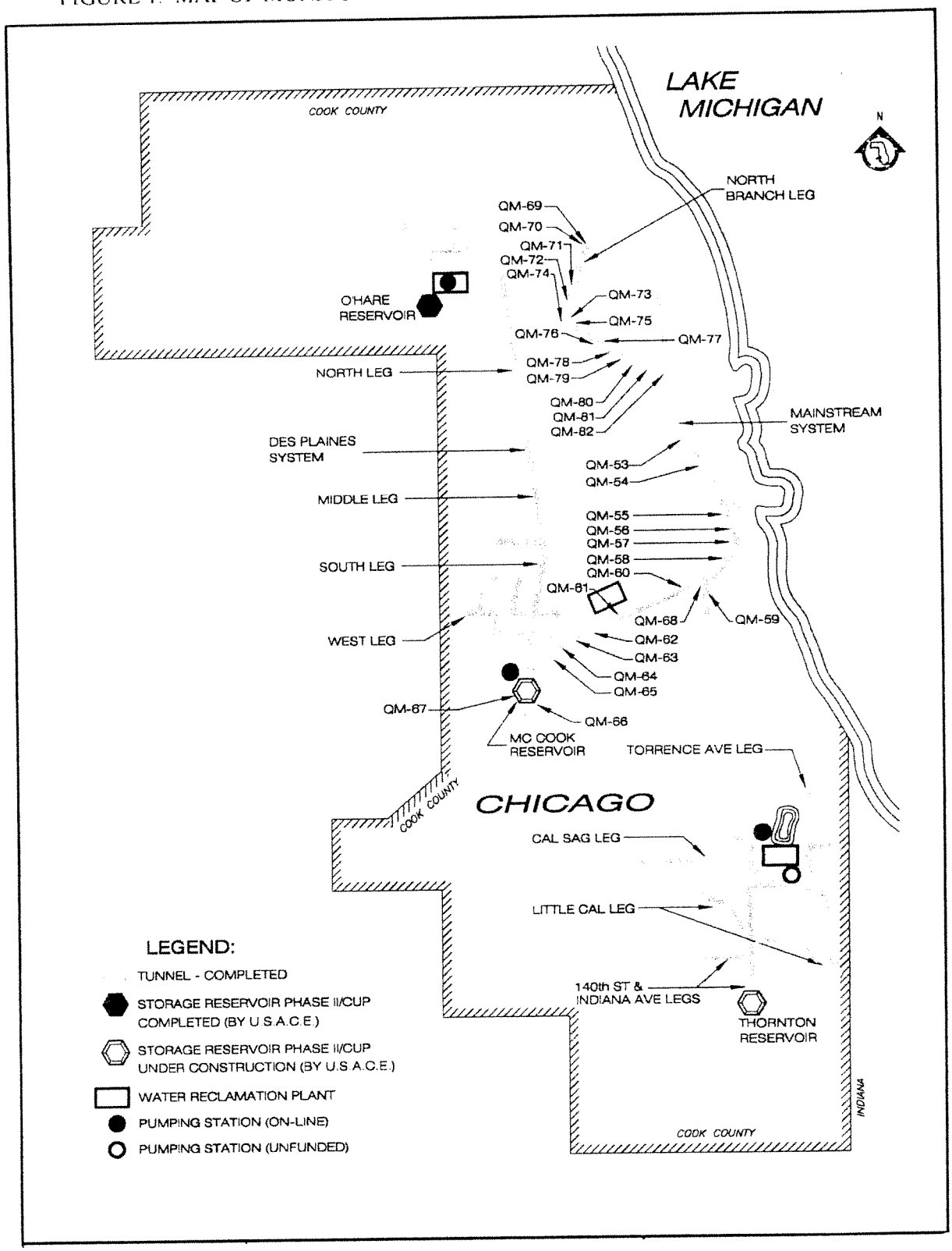


FIGURE 2: MAP OF OBSERVATION WELLS IN THE MAINSTREAM TUNNEL SYSTEM

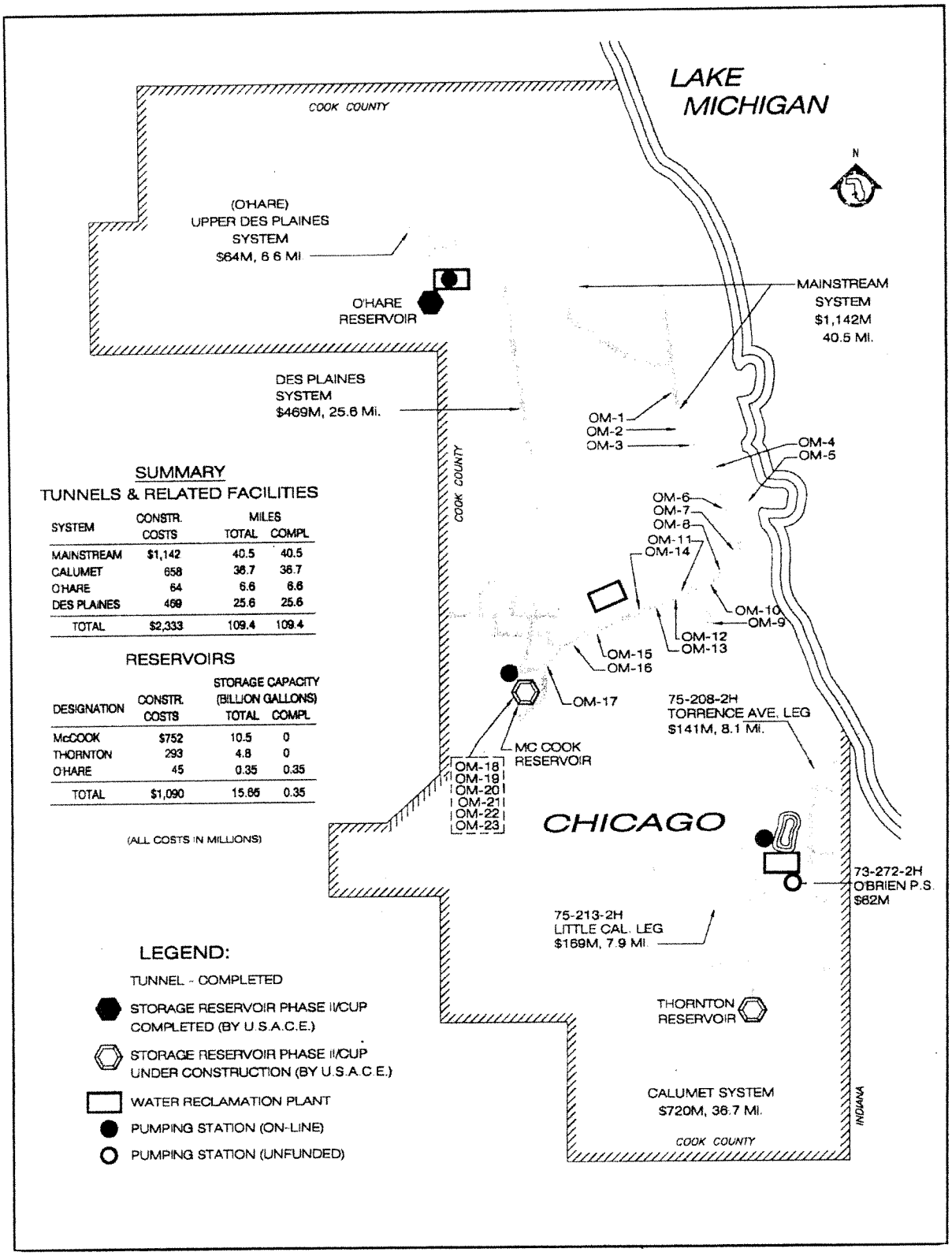


TABLE 1: ANALYSIS OF WATER FROM MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

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						MPN/100 mL	°C	ft	hr
QM-53	04/18/12	8.0	29	202	<1	15	37	<0.10	139	<1	12.2	-38	<4
QM-53	06/07/12	8.1	32	248	<1	15	37	0.11	141	<1	12.6	-41	<4
QM-53	08/15/12	8.3	18	226	14	14	36	<0.10	141	<1	12.8	-39	<4
QM-53	09/26/12	8.0	19	216	1	14	35	<0.10	134	<1	12.3	-40	<4
QM-61	01/04/12	7.7	37	304	1	53	13	0.37	118	4	6.8	-179	<4
QM-61	02/23/12	7.0	45	346	1	57	16	0.28	121	<1	13.1	-168	<4
QM-61	04/25/12	7.0	47	334	<1	57	20	0.27	125	<1	13.5	-178	<4
QM-61	09/06/12	7.4	31	358	1	58	20	0.29	127	500	24.3	-172	<4
QM-61	11/07/12	7.8	37	346	<1	61	18	0.27	126	<1	12.5	-172	<4
QM-62	09/26/12	7.9	59	432	2	67	34	1.2	182	260	13.5	-191	<4
QM-62	10/31/12	7.0	56	350	1	50	27	0.84	163	5	13.5	-190	<4
QM-62	11/29/12	7.6	32	400	1	50	29	0.58	157	<1	13.0	-191	<4
QM-62	12/13/12	7.7	48	252	1	27	39	0.52	153	<1	12.7	-192	<4
QM-63	02/09/12	7.5	98	1,786	3	51	1,009	2.1	959	<1	11.5	-191	<4
QM-63	04/18/12	7.4	160	1,834	2	53	1,063	2.2	998	130	13.7	-188	<4
QM-63	06/07/12	7.2	159	2,070	2	50	964	2.3	984	6	14.0	-188	<4
QM-63	08/09/12	7.1	58	1,928	12	50	936	2.2	1,006	<1	14.6	-188	<4
QM-63	09/26/12	7.2	65	1,630	2	49	871	1.9	832	520	15.9	-214	<4
QM-63	12/13/12	7.4	97	1,808	3	47	1,178	2.3	984	<1	15.6	-191	<4

TABLE 1 (Continued): ANALYSIS OF WATER FROM MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

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						MPN/100 mL	°C	ft	hr
QM-64	01/04/12	7.5	49	406	2	53	30	1.9	185	22	10.9	-160	<4
QM-64	02/23/12	7.2	48	618	1	52	38	1.8	193	<1	13.5	-156	<4
QM-64	04/25/12	7.4	67	408	1	52	39	1.8	195	<1	13.3	-170	<4
QM-64	09/06/12	7.7	41	420	1	51	35	1.7	181	9	14.1	-168	<4
QM-64	10/10/12	7.1	64	422	1	48	42	1.6	185	<1	13.4	-171	<4
QM-64	11/07/12	7.6	46	410	2	49	39	1.6	187	2	13.1	-172	<4
QM-67	02/09/12	7.1	80	626	4	151	13	10	236	48	11.0	-157	<48
QM-67	04/18/12	7.4	116	710	4	215	13	11	273	4,200	14.1	-150	<48
QM-67	06/07/12	7.3	115	746	3	197	9	12	282	2,000	14.1	-154	<48
QM-67	08/09/12	7.4	74	648	12	167	6	11	273	4,100	15.6	-148	<48
QM-67	10/31/12	7.3	69	572	4	139	9	11	238	830	12.7	-157	<48
QM-67	12/13/12	7.1	66	552	4	123	<5	11	233	24	10.8	-155	<48
QM-68	02/09/12	7.9	30	284	1	31	37	0.62	198	<1	12.4	-133	<48
QM-68	04/18/12	7.8	40	262	<1	29	38	0.57	192	<1	13.5	-128	<48
QM-68	06/07/12	7.9	44	376	<1	28	37	0.67	191	1	13.9	-130	<48
QM-68	08/09/12	7.7	67	310	13	27	38	0.55	199	<1	13.3	-131	<48
QM-68	11/29/12	7.1	25	346	<1	28	41	0.61	194	<1	15.1	-132	<48
QM-69	02/09/12	8.2	31	300	1	35	36	0.97	134	<1	10.1	-38	<48
QM-69	04/19/12	7.1	31	304	1	37	42	0.95	153	<1	13.7	-28	<48
QM-69	08/15/12	7.9	25	302	12	35	42	0.93	153	1	12.8	-29	<48
QM-69	11/29/12	7.9	31	318	1	37	37	0.94	141	<1	12.0	-35	<48

TABLE 1 (Continued): ANALYSIS OF WATER FROM MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

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						MPN/100 mL	°C	ft	hr
QM-70	02/09/12	7.9	33	318	<1	50	53	0.39	154	<1	11.2	-57	<48
QM-70	04/19/12	7.6	34	316	<1	49	53	0.39	153	<1	11.8	-57	<48
QM-70	10/04/12	7.0	49	328	<1	52	51	0.38	150	<1	13.0	-54	<48
QM-71	02/09/12	7.9	43	452	<1	127	67	0.47	192	<1	10.7	-60	<48
QM-71	04/19/12	7.7	45	460	<1	131	69	0.45	202	<1	11.5	-55	<48
QM-71	08/15/12	7.4	34	520	7	124	64	0.46	202	<1	12.5	-57	<48
QM-71	10/04/12	7.1	85	464	<1	130	69	0.43	198	<1	11.2	-57	<48
QM-72	02/09/12	8.0	35	374	1	121	<5	0.40	209	<1	11.1	-82	<48
QM-72	08/15/12	7.3	34	472	11	128	<5	0.38	212	<1	12.7	-75	<48
QM-72	10/04/12	7.3	33	432	1	134	<5	0.34	215	1	12.1	-77	<48
QM-73	04/19/12	7.7	44	290	1	37	<5	0.29	153	<1	12.3	-164	<48
QM-73	06/07/12	7.7	27	364	1	34	<5	0.25	151	<1	20.9	-166	<48
QM-73	08/16/12	7.5	34	282	8	35	<5	0.24	154	<1	13.9	-153	<48
QM-73	11/29/12	7.8	41	322	1	36	<5	0.34	157	<1	11.1	-155	<48
QM-74	04/19/12	8.0	41	254	1	55	18	0.23	103	<1	11.5	-13	<48
QM-74	06/07/12	8.1	27	320	1	53	<5	0.20	102	<1	14.7	-13	<48
QM-74	08/16/12	7.9	26	256	9	54	<5	0.24	99	<1	13.3	-34	<48
QM-74	11/29/12	7.9	30	280	1	57	<5	0.29	100	<1	10.7	-34	<48

TABLE 1 (Continued): ANALYSIS OF WATER FROM MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

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						MPN/100 mL	°C	ft	hr
QM-75	01/25/12	8.2	22	226	<1	12	10	0.29	64	<1	11.5	-71	<48
QM-75	03/08/12	7.9	29	228	<1	16	10	0.28	62	<1	11.8	-73	<48
QM-75	05/23/12	8.2	28	220	1	12	9	0.28	63	2	13.0	-74	<48
QM-75	07/12/12	8.2	14	304	1	13	13	0.21	61	<1	13.5	-74	<48
QM-75	09/13/12	8.1	24	244	10	12	10	0.25	61	<1	12.5	-78	<48
QM-75	11/01/12	7.8	30	208	<1	13	10	0.24	72	<1	11.5	-78	<48
QM-76	04/19/12	8.5	40	292	1	13	47	0.31	37	<1	12.1	-187	<48
QM-76	06/07/12	7.8	32	440	1	12	80	0.19	73	<1	14.0	-188	<48
QM-76	10/04/12	7.7	28	326	1	12	58	0.18	64	<1	13.0	-183	<48
QM-77	04/19/12	7.0	25	284	<1	10	<5	<0.10	47	<1	12.1	-179	<48
QM-77	06/07/12	7.8	24	154	<1	10	<5	<0.10	46	<1	14.0	-182	<48
QM-77	10/04/12	7.9	14	148	<1	10	<5	0.10	42	<1	13.3	-182	<48
QM-78	01/25/12	8.7	27	298	<1	11	46	<0.10	10	<1	10.8	-155	<48
QM-78	03/08/12	8.0	37	302	<1	22	42	<0.10	9	<1	11.5	-166	<48
QM-78	05/23/12	8.6	35	286	<1	11	42	<0.10	9	<1	12.1	-166	<48
QM-78	07/12/12	8.8	22	344	<1	11	43	<0.10	10	<1	13.7	-152	<48
QM-78	09/13/12	8.7	34	308	10	11	43	<0.10	8	<1	15.8	-160	<48
QM-78	11/01/12	8.4	38	272	<1	11	43	<0.10	9	<1	11.2	-166	<48

TABLE 1 (Continued): ANALYSIS OF WATER FROM MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

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						MPN/100 mL	°C	ft	hr
QM-79	01/25/12	9.1	32	284	<1	17	18	<0.10	11	<1	11.0	-153	<48
QM-79	03/08/12	7.9	37	302	<1	26	18	<0.10	11	<1	11.3	-151	<48
QM-79	05/23/12	8.6	34	294	<1	16	19	<0.10	11	<1	12.5	-146	<48
QM-79	07/12/12	8.5	19	352	<1	17	22	<0.10	12	<1	20.7	-149	<48
QM-79	09/13/12	8.9	33	304	8	16	18	<0.10	11	<1	12.6	-145	<48
QM-79	11/01/12	8.4	41	286	<1	17	16	<0.10	11	<1	11.8	-155	<48
QM-80	01/25/12	8.6	32	172	<1	13	<5	<0.10	20	<1	11.4	-144	<48
QM-80	03/08/12	7.8	25	192	<1	16	<5	<0.10	21	<1	12.3	-142	<48
QM-80	05/23/12	7.9	22	184	<1	13	<5	<0.10	23	<1	14.7	-145	<48
QM-80	07/12/12	8.3	13	228	<1	12	<5	<0.10	21	<1	22.7	-143	<48
QM-80	09/13/12	7.0	39	200	10	13	<5	<0.10	21	<1	14.7	-139	<48
QM-80	11/01/12	8.4	13	192	<1	13	<5	<0.10	21	<1	9.9	-143	<48
QM-81	03/08/12	7.9	30	226	<1	22	11	<0.10	30	<1	12.5	-131	<48
QM-81	05/23/12	8.0	28	228	<1	21	11	<0.10	32	<1	15.0	-131	<48
QM-81	09/13/12	8.0	40	244	7	20	12	<0.10	31	<1	13.8	-137	<48
QM-81	11/01/12	8.5	29	228	<1	21	12	<0.10	30	<1	10.0	-128	<48
QM-82	09/13/12	7.8	43	312	11	29	7	<0.10	13	<1	13.6	-188	<48
QM-82	10/04/12	7.8	15	284	1	30	11	<0.10	14	<1	13.5	-188	<48
QM-82	12/13/12	8.5	30	268	1	26	12	<0.10	16	<1	15.1	-185	<48

[1]Wells QM-56 and -58 inaccessible; business closed. QM-65 and -66 not sampled; non-functional pumps. QM-62 and -82 sampled <6 times; pumps broken.
[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.

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 2012

Well[1]	Statistic	pH	EC[2]	TDS[2]	TOC[2]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[3]
			mS/m	mg/L						MPN/100 mL
QM-53	Minimum	8.0	18	202	1	14	35	<0.10	134	<1
	Mean	8.1	24	223	4	15	36	0.11	139	<1
	Maximum	8.3	32	248	14	15	37	0.11	141	<1
	Std. Dev.	0.1	7	19	6	0.6	0.9	0.01	3	0
	Median	8.0	24	221	1	15	36	0.10	140	<1
	Coeff. of Var. (%)	1.7	29	9	152	4	3	4.9	2	0
QM-61	Minimum	7.0	31	304	<1	53	13	0.27	118	<1
	Mean	7.4	39	338	1	57	17	0.30	123	45
	Maximum	7.8	47	358	1	61	20	0.37	127	500
	Std Dev.	0.4	6	21	0.1	3	3	0.04	4	NA[4]
	Median	7.4	37	346	1	57	18	0.28	125	252
	Coeff. of Var. (%)	4.8	16	6	10	5	19	14	3	NA
QM-62	Minimum	7.0	32	252	1	27	27	0.52	153	<1
	Mean	7.6	48	359	1	49	32	0.78	164	36
	Maximum	7.9	59	432	2	67	39	1.2	182	260
	Std. Dev.	0.4	12	79	0.2	16	5.5	0.30	13	NA
	Median	7.7	52	375	1	50	31	0.71	160	133
	Coeff. of Var. (%)	5.0	25	22	13	34	17	39	8	NA
QM-63	Minimum	7.1	58	1,630	2	47	871	1.9	832	6
	Mean	7.3	106	1,843	4	50	1,003	2.2	961	74
	Maximum	7.5	160	2,070	12	53	1,178	2.3	1,006	520
	Std. Dev.	0.2	45	147	4	2	107	0.15	65	NA
	Median	7.3	97	1,821	3	50	987	2.2	984	130
	Coeff. of Var. (%)	2.4	42	8	94	4	11	6.7	7	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 2012

Well[1]	Statistic	pH	EC[2]	TDS[2]	TOC[2]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[3]
			mS/m	mg/L						MPN/100 mL
QM-64	Minimum	7.1	41	406	1	48	30	1.6	181	<1
	Mean	7.4	53	447	1	51	37	1.7	188	7
	Maximum	7.7	67	618	2	53	42	1.9	195	22
	Std. Dev.	0.2	11	84	0.1	2	4	0.12	5	NA
	Median	7.4	49	415	1	52	39	1.7	186	9
	Coeff. of Var. (%)	3.2	20	19	6	4	11	6.8	3	NA
QM-67	Minimum	7.1	66	552	3	123	6	10	233	24
	Mean	7.3	87	642	5	165	10	11	256	566
	Maximum	7.4	116	746	12	215	13	12	282	4,200
	Std. Dev.	0.1	23	76	4	35	3	0.69	22	NA
	Median	7.3	77	637	4	159	9	11	256	1,415
	Coeff. of Var. (%)	2.0	26	12	70	21	32	6.2	9	NA
QM-68	Minimum	7.1	25	262	<1	27	37	0.55	191	<1
	Mean	7.7	41	316	5	29	38	0.60	195	1
	Maximum	7.9	67	376	13	31	41	0.67	199	1
	Std. Dev.	0.3	16	46	7	2	2	0.05	4	0
	Median	7.8	40	310	1	28	38	0.61	194	1
	Coeff. of Var. (%)	4.2	39	15	138	5	4	7.7	2	0
QM-69	Minimum	7.1	25	300	1	35	36	0.93	134	1
	Mean	7.8	29	306	4	36	39	0.95	145	1
	Maximum	8.2	31	318	12	37	42	1.0	153	1
	Std. Dev.	0.5	3	8	5	1	3	0.02	9	0
	Median	7.9	31	303	1	36	39	0.95	147	1
	Coeff. of Var. (%)	6.5	10	3	136	3	9	1.8	6	0

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 2012

Well[1]	Statistic	pH	EC[2]	TDS[2]	TOC[2]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[3]
			mS/m	mg/L						MPN/100 mL
QM-70	Minimum	7.0	33	316	<1	49	51	0.38	150	<1
	Mean	7.5	39	321	<1	50	53	0.39	152	<1
	Maximum	7.9	49	328	<1	52	53	0.39	154	<1
	Std. Dev.	0.4	9	6	0	2	1	0.01	2	NA
	Median	7.6	34	318	<1	50	53	0.39	153	<1
	Coeff. of Var. (%)	5.9	23	2	0	3	3	1.5	1	NA
QM-71	Minimum	7.1	34	452	1	124	64	0.43	192	<1
	Mean	7.5	52	474	2	128	67	0.45	199	<1
	Maximum	7.9	85	520	7	131	69	0.47	202	<1
	Std. Dev.	0.4	23	31	3	3	2	0.02	5	NA
	Median	7.5	44	462	1	129	68	0.46	200	<1
	Coeff. of Var. (%)	4.8	44	7	118	2	3	3.8	2	NA
QM-72	Minimum	7.3	33	374	1	121	<5	0.34	209	<1
	Mean	7.5	34	426	4	128	<5	0.37	212	<1
	Maximum	8.0	35	472	11	134	<5	0.40	215	1
	Std. Dev.	0.4	1	49	6	7	0	0.03	3	NA
	Median	7.3	34	432	1	128	<5	0.38	212	<1
	Coeff. of Var. (%)	5.4	3	12	132	5	0	8.2	1	NA
QM-73	Minimum	7.5	27	282	1	34	<5	0.24	151	<1
	Mean	7.7	37	315	3	36	<5	0.28	154	<1
	Maximum	7.8	44	364	8	37	<5	0.34	157	<1
	Std. Dev.	0.1	8	37	3	1	0	0.05	3	NA
	Median	7.7	37	306	1	36	<5	0.27	154	<1
	Coeff. of Var. (%)	1.4	21	12	118	4	0	16	2	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 2012

Well[1]	Statistic	pH	EC[2]	TDS[2]	TOC[2]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[3]
			mS/m	mg/L						MPN/100 mL
QM-74	Minimum	7.9	26	254	1	53	5	0.20	99	<1
	Mean	8.0	31	278	3	55	8	0.24	101	<1
	Maximum	8.1	41	320	9	57	18	0.29	103	<1
	Std. Dev.	0.1	7	31	4	2	6	0.04	2	NA
	Median	7.9	28	268	1	55	5	0.24	101	<1
	Coeff. of Var. (%)	1.3	22	11	119	3	78	16	2	NA
QM-75	Minimum	7.8	14	208	1	12	9	0.21	61	<1
	Mean	8.1	24	238	4	13	10	0.26	64	1
	Maximum	8.2	30	304	10	16	13	0.29	72	2
	Std. Dev.	0.2	6	34	5	2	1	0.03	4	NA
	Median	8.1	26	227	1	13	10	0.27	63	<1
	Coeff. of Var. (%)	2.2	25	14	129	12	12	12	7	NA
QM-76	Minimum	7.7	28	292	1	12	47	0.18	37	<1
	Mean	8.0	33	353	1	12	62	0.23	58	<1
	Maximum	8.5	40	440	1	13	80	0.31	73	<1
	Std. Dev.	0.4	6	78	0.1	1	17	0.07	19	NA
	Median	7.8	32	326	1	12	58	0.19	64	<1
	Coeff. of Var. (%)	5.4	19	22	6	5	27	32	32	NA
QM-77	Minimum	7.0	14	148	<1	10	<5	<0.10	42	<1
	Mean	7.6	21	195	<1	10	<5	0.10	45	<1
	Maximum	7.9	25	284	<1	10	<5	0.10	47	<1
	Std. Dev.	0.5	6	77	0	0	0	0.10	3	NA
	Median	7.8	24	154	<1	10	<5	0.10	46	<1
	Coeff. of Var. (%)	6.2	27	39	0	0	0	100	6	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 2012

Well[1]	Statistic	pH	EC[2]	TDS[2]	TOC[2]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[3]
			mS/m	mg/L						MPN/100 mL
QM-78	Minimum	8.0	22	272	1	11	42	<0.10	8	<1
	Mean	8.5	32	302	3	13	43	<0.10	9	<1
	Maximum	8.8	38	344	10	22	46	<0.10	10	<1
	Std. Dev.	0.3	6	24	4	4	2	0.00	1	NA
	Median	8.6	34	300	1	11	43	<0.10	9	<1
	Coeff. of Var. (%)	3.6	19	8	148	35	4	0.00	8	NA
QM-79	Minimum	7.9	19	284	<1	16	16	<0.10	11	<1
	Mean	8.6	33	304	2	18	18	<0.10	11	<1
	Maximum	9.1	41	352	8	26	22	<0.10	12	<1
	Std. Dev.	0.4	7	25	3	4	2	0.00	0.4	NA
	Median	8.6	34	298	1	17	18	<0.10	11	<1
	Coeff. of Var. (%)	5.0	23	8	132	21	11	0.00	4	NA
QM-80	Minimum	7.0	13	172	1	12	<5	<0.10	20	<1
	Mean	8.0	24	195	2	13	<5	<0.10	21	<1
	Maximum	8.6	39	228	10	16	<5	<0.10	23	<1
	Std. Dev.	0.6	10	19	4	1	0	0.00	1	NA
	Median	8.1	23	192	1	13	<5	<0.10	21	<1
	Coeff. of Var. (%)	7.2	43	10	145	10	0	0.00	5	NA
QM-81	Minimum	7.9	28	226	1	20	11	<0.10	30	<1
	Mean	8.1	32	232	2	21	11	<0.10	31	<1
	Maximum	8.5	40	244	7	22	12	<0.10	32	<1
	Std. Dev.	0.3	6	8	3	0.8	0.4	0.00	1	NA
	Median	8.0	29	228	1	21	11	<0.10	31	<1
	Coeff. of Var. (%)	3.2	19	4	118	4	4	0.00	3	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 2012

Well[1]	Statistic	pH	EC[2]	TDS[2]	TOC[2]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[3]
			mS/m	mg/L						MPN/100 mL
QM-82	Minimum	7.8	15	268	1	26	7	<0.10	13	<1
	Mean	8.0	29	288	4	28	10	<0.10	14	<1
	Maximum	8.5	43	312	11	30	12	<0.10	16	<1
	Std. Dev.	0.4	14	22	6	2	2	0.00	2	NA
	Median	7.8	30	284	1	29	11	<0.10	14	<1
	Coeff. of Var. (%)	4.9	48	8	126	7	24	0.00	11	NA

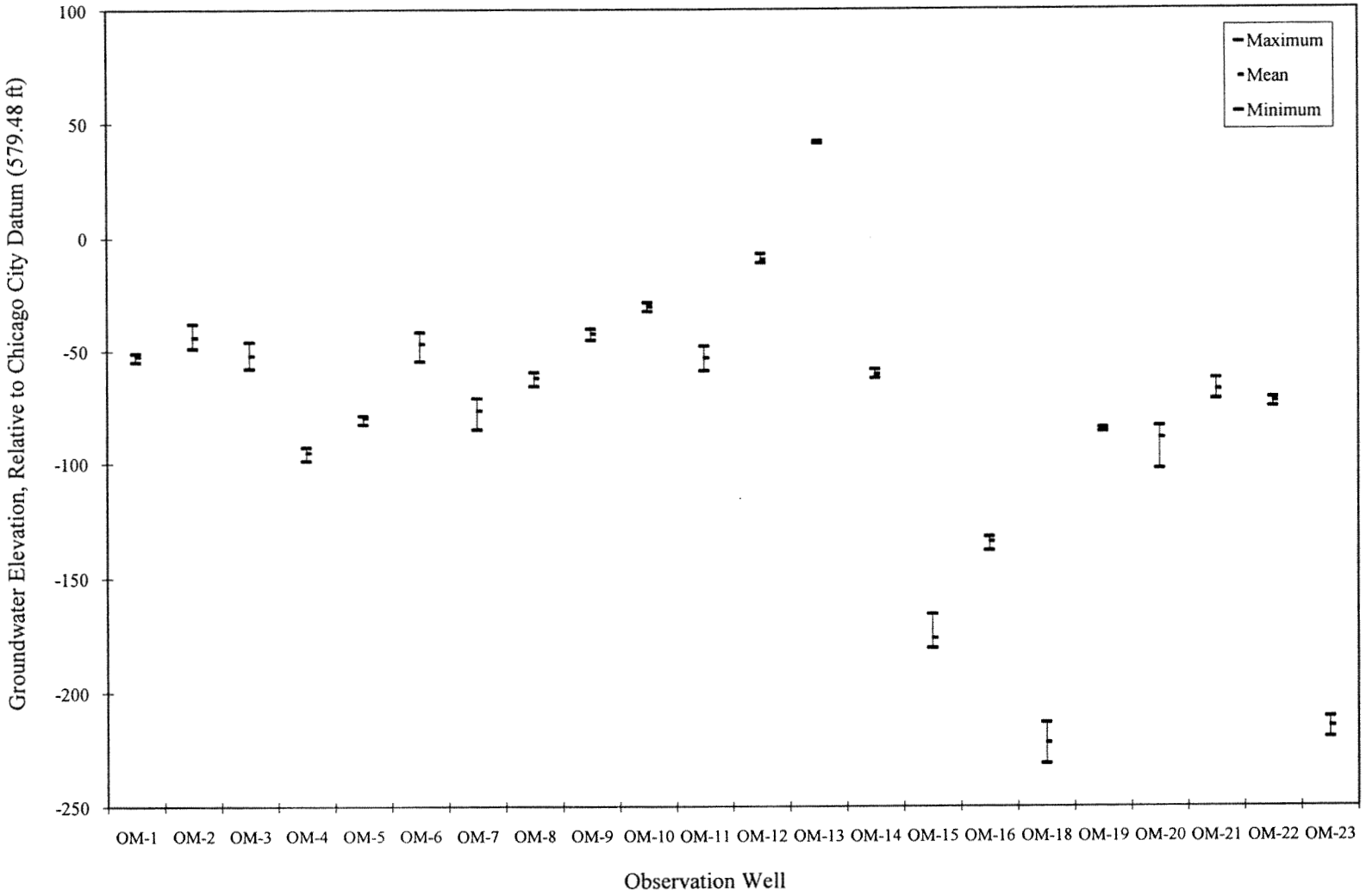
[1]Wells QM-56 and -58 inaccessible; business closed. QM-65 and -66 not sampled; non-functional pumps. QM-62 and -82 sampled <6 times; pumps broken.
[2]EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.
[3]Geometric mean calculated.
[4]Not applicable.

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 2012

Well	Elevation[1]					
	02/03/12[2]	04/27/12[2]	06/29/12[2]	08/17/12[2]	10/12/12[2]	12/07/12[2]
	ft					
OM-1	-50.8	-52.8	-50.8	NR[3]	-51.8	-54.8
OM-2	-37.7	-46.7	-38.7	-43.7	-48.7	-46.7
OM-3	-51.6	-50.7	-54.7	-45.7	-57.7	-50.7
OM-4	-92.6	-92.6	-93.6	-97.6	-98.6	NR
OM-5	-82.5	-79.5	-78.5	-78.5	-79.5	-78.5
OM-6	-54.4	-41.4	-47.4	-45.4	-45.4	-45.4
OM-7	-84.6	-76.6	-75.6	-70.6	-75.6	-73.6
OM-8	-60.2	-60.2	-60.2	-59.2	-65.2	-65.2
OM-9	-40.8	-41.8	-44.8	-39.8	-44.8	-39.8
OM-10	-32.0	-30.0	-29.0	-28.0	-32.0	-28.0
OM-11	-52.4	-54.4	-56.4	-47.4	-58.4	-47.4
OM-12	-8.7	-6.7	-9.7	-10.7	-10.7	NR
OM-13	41.4	42.4	41.4	41.4	NR	42.4
OM-14	-60.8	-59.8	-59.8	-57.8	-61.8	-59.8
OM-15	-176	-180	-165	-178	-177	-178
OM-16	-133	-134	-134	-134	-132	-138
OM-18	-220	-229	-219	-213	-219	-231
OM-19	-83.5	-85.5	NR	-83.5	-84.5	-84.5
OM-20	-82.9	-102	-92.9	-83.9	-85	-82.9
OM-21	-63.9	-67.9	-61.9	-70.9	-66.9	-69.9
OM-22	-71.3	-73.3	-71.3	-71.3	-70.3	-74.3
OM-23	-211	-215	-211	-219	-214	-220

[1]Relative to Chicago city datum (579.48 ft above mean sea level) at intersection of Madison and State Streets.
[2]Dates measurements were taken.
[3]No reading; well inaccessible.

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 2012



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 ...ER
2011 DEC 22 PM 4:01
OF GREATER CHICAGO

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