MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 15-20

TUNNEL AND RESERVOIR PLAN

MAINSTREAM TUNNEL SYSTEM

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2014

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, Mainstream Tunnel System, Annual Groundwater Monitoring Report for 2014

Attached are three copies of the "Tunnel and Reservoir Plan, Mainstream 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
cc/att: Ms. Sally K. Swanson (USEPA Region 5 - WC15J) - (2)
Dr. Zhang
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TUNNEL AND RESERVOIR PLAN MAINSTREAM TUNNEL SYSTEM ANNUAL GROUNDWATER MONITORING REPORT FOR 2014

Monitoring and Research Department
Thomas C. Granato, Director

July 2015

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ANNUAL DATA FOR MONITORING AND OBSERVATION WELLS

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. This well is scheduled for service. Similar to 2013, samples were retrieved from Well QM-66 in 2014. Monitoring well QM-59 has been dry since February 1995 and is no longer monitored. Monitoring of observation well OM-17 was discontinued with the approval of the IEPA (Appendix A).

Most 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 2014 because construction in the area rendered them inaccessible. The required six samples were retrieved during this year and last year from Wells QM-62 and -82, unlike previous years. Both wells were considered intermittently dry in the past.

Summary of Data

Monitoring Wells. The analytical data for groundwater sampled during 2014 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 (FC) counts in Wells QM-61, -62, -63, -64, and -67 were much higher than expected at various times during the year. Two wells (QM-62 and -63) were decontaminated using the standard procedure, and significant reductions in FC counts were observed in both wells. We are now in the process of decontaminating additional wells.

In October 2014, Wells QM-62 and -63 were selected for special evaluation by U.S. Geological Survey personnel. Following this evaluation, both wells were serviced and decontaminated. The pumps in both wells and PVC pipe in QM-63 were replaced. Table 2 lists the descriptive statistics for groundwater data of monitoring wells QM-53 through QM-82 for 2014.

Observation Wells. Measurement of groundwater elevations for observation wells OM-1 through -23 was attempted at the required frequencies. All measurements could not be performed as planned due to a number of factors limiting access to wells (Table 3, Footnote 3). Adjusted elevations

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

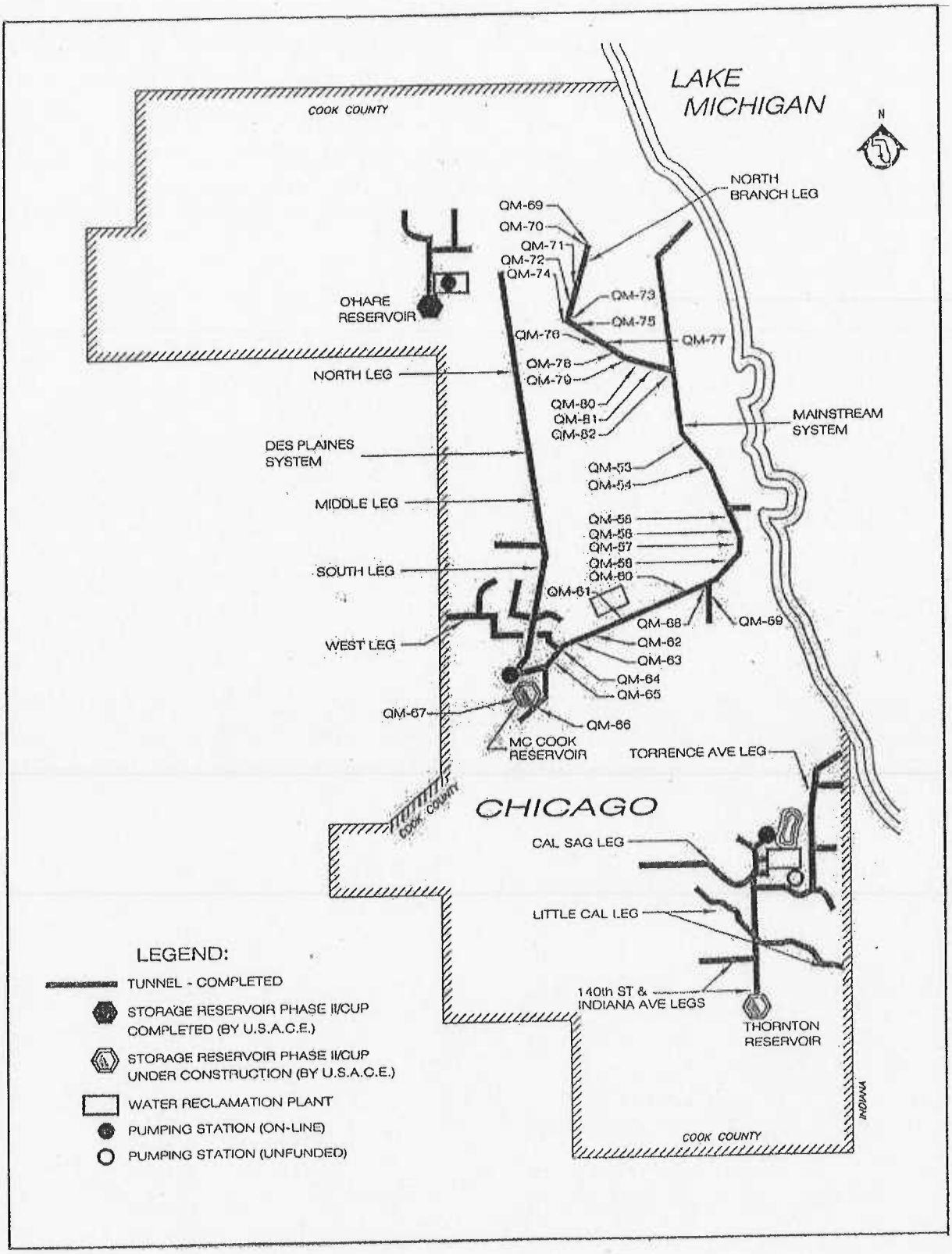


FIGURE 2: MAP OF OBSERVATION WELLS IN THE MAINSTREAM TUNNEL SYSTEM

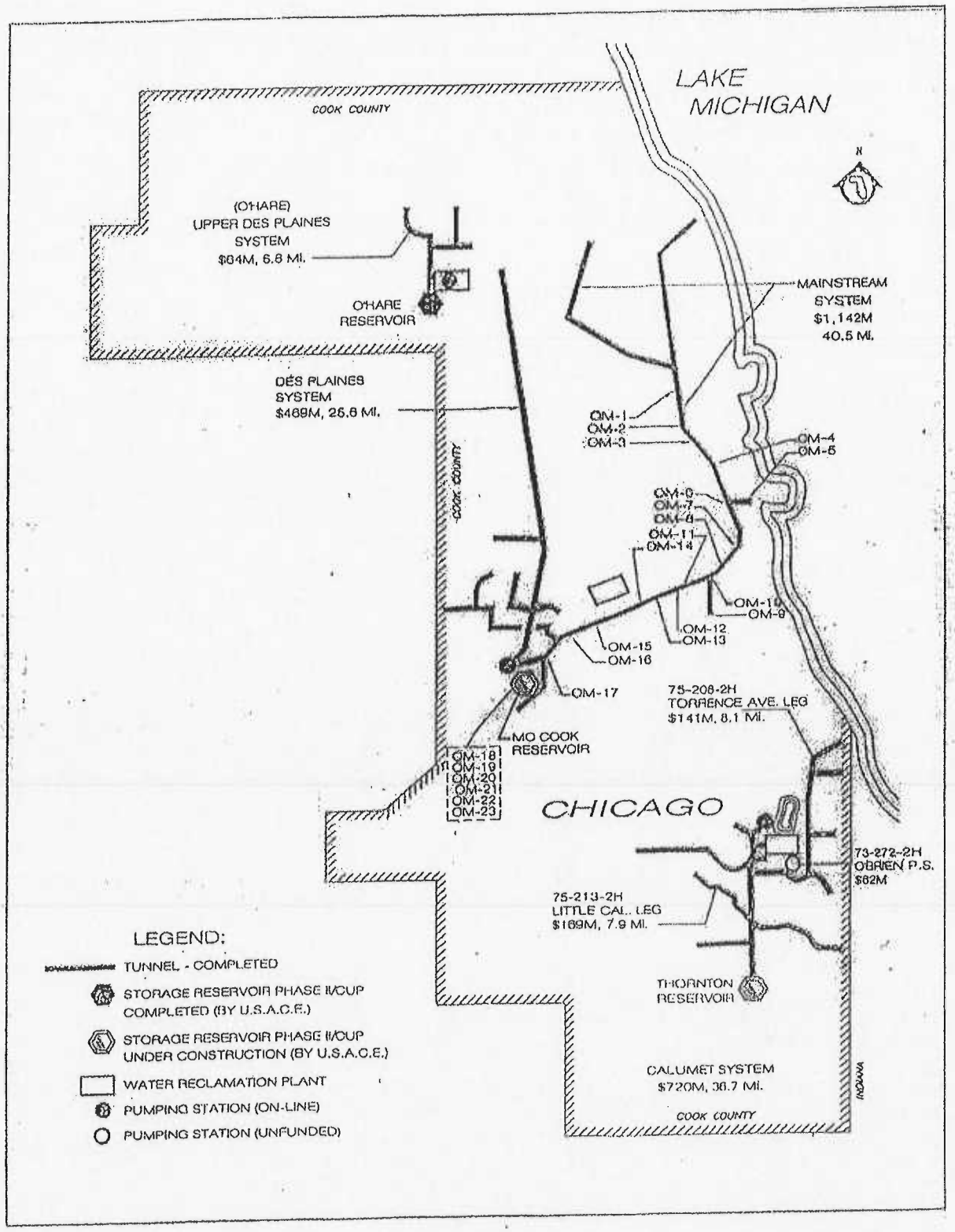


TABLE 1: ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QM-53 THROUGH QM-82 IN THE MAINSTREAM TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2014

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
QM-53	03/13/14	8.1	23	202	<1	15	36	<0.10	146	<1	10.9	-47	<48
QM-53	06/25/14	8.4	23	240	<1	15	36	<0.10	141	<1	12.6	-23	<48
QM-53	12/18/14	7.9	24	190	<1	15	33	<0.10	146	<1	10.9	-37	<48
QM-61	04/02/14	6.9	106	340	1	64	25	0.36	120	12	13.3	-169	<4
QM-61	06/19/14	7.9	48	394	1	65	29	0.42	142	3,400	16.8	-152	<4
QM-61	09/15/14	8.8	46	392	1	76	33	0.55	174	18,000	14.2	-150	<4
QM-62	01/15/14	7.0	141	712	2	214	63	1.0	255	16,200	13.0	-149	<48
QM-62	03/13/14	7.1	91	442	2	97	35	0.68	179	1,100	10.7	-195	<48
QM-62	04/09/14	7.4	48	376	1	51	45	0.55	166	24	14.4	-179	<48
QM-62	09/17/14	7.9	44	364	1	65	15	0.77	160	8,500	16.1	-171	<48
QM-62	10/20/14	NAR[4]	NAR	NAR	NAR	56	NAR	NAR	NAR	3,400	NAR	-159	<48
QM-62	10/29/14	7.8	62	320	1	60	20	0.53	800	990	13.2	-166	<48
QM-62	12/04/14	8.2	47	338	1	58	16	0.53	150	14	14.5	-191	
QM-63	01/15/14	7.7	163	1,552	5	307	623	2.3	662	14,800	12.8	-141	<48
QM-63	03/13/14	7.3	145	1,810	3	62	1,045	2.1	911	140	12.8	-190	<48
QM-63	03/27/14	6.9	153	1,840	3	53	1,110	2.2	884	7	13.1	-192	<48
QM-63	04/09/14	7.6	59	1,828	3	51	1,042	2.3	903	<1	13.3	-172	<48
QM-63	09/17/14	7.7	155	1,670	2	49	874	2.0	917	69	15.4	-165	<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 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
QM-63	10/20/14	NAR	NAR	NAR	NAR	29	NAR	NAR	NAR	41,000	NAR	-157	<48
QM-63	10/29/14	7.8	147	1,500	2	55	925	1.9	152	200	13.4	-168	<48
QM-64	02/27/14	7.4	53	442	1	72	43	1.7	207	50	12.6	-172	<4
QM-64	04/16/14	7.3	55	430	2	59	44	1.7	220	1	13.6	-163	<4
QM-64	06/19/14	7.6	61	466	2	56	44	1.6	201	86	15.9	-151	<4
QM-64	09/15/14	8.3	52	418	1	61	32	1.8	212	220	15.1	-164	<4
QM-64	10/15/14	7.7	62	436	2	55	46	1.8	227	3,700	13.9	-127	<4
QM-64	12/03/14	7.6	56	424	1	53	39	1.7	203	34	14.3	-172	<4
QM-66	08/14/14	10.4	183	1,474	1	172	251	1.2	10	<1	15.1	-310	<48
QM-66	11/20/14	10.0	185	1,306	<1	163	272	0.36	6	<1	8.5	-313	<48
QM-67	01/15/14	7.8	113	740	11	213	11	13	303	12,700	12.6	-157	<48
QM-67	03/13/14	7.4	127	1,040	4	418	6	15	357	300	12.0	-154	<48
QM-67	04/23/14	6.7	121	1,048	3	402	9	15	348	1,600	13.2	-149	<48
QM-67	09/17/14	7.8	139	852	3	266	6	13	272	320	15.0	-149	<48
QM-67	10/29/14	7.7	97	620	4	181	9	13	213	140	13.2	-151	<48
QM-67	12/04/14	7.9	89	604	4	162	10	12	213	72	13.3	-152	<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 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
QM-68	03/13/14	7.9	33	246	<1	26	38	0.57	198	4	11.7	-126	<48
QM-68	06/25/14	7.4	34	300	<1	25	37	0.62	184	210	14.5	-94	<48
QM-69	05/29/14	8.2	37	326	1	34	40	0.92	142	<1	12.6	-33	<48
QM-69	08/14/14	8.2	38	294	1	35	35	0.89	150	<1	11.6	-38	<48
QM-69	11/25/14	8.3	36	292	1	36	43	0.91	146	<1	10.4	-28	<48
QM-70	03/06/14	7.8	38	330	1	48	52	0.39	156	<1	10.8	-52	<48
QM-70	06/26/14	7.8	41	368	<1	49	48	0.41	147	<1	13.4	-53	<48
QM-70	09/25/14	8.2	41	338	1	50	47	0.45	156	<1	12.6	-52	<48
QM-71	03/06/14	7.4	56	494	<1	127	68	0.45	221	<1	11.3	-60	<48
QM-71	06/26/14	8.0	54	626	<1	126	64	0.46	192	<1	13.2	-54	<48
QM-71	09/25/14	8.1	59	510	<1	127	61	0.48	200	<1	12.0	-62	<48
QM-72	05/29/14	7.8	50	462	<1	128	<5	0.38	210	<1	12.4	-75	<48
QM-72	08/14/14	8.6	50	412	<1	126	<5	0.38	214	<1	12.5	-90	<48
QM-72	11/25/14	8.1	49	396	1	127	<5	0.39	216	<1	10.7	-86	<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 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
QM-73	04/23/14	7.5	33	216	<1	12	13	0.25	63	<1	11.6	-155	<48
QM-73	06/26/14	8.0	38	378	1	34	<5	0.29	142	<1	12.7	-153	<48
QM-73	09/25/14	8.1	38	300	1	34	<5	0.34	150	<1	12.8	-160	<48
QM-74	03/06/14	7.9	32	268	1	58	<5	0.23	109	<1	10.4	-17	<48
QM-74	06/26/14	8.3	34	332	1	59	<5	0.28	100	<1	13.0	-29	<48
QM-74	09/25/14	8.3	34	270	1	58	<5	0.26	107	<1	11.8	-11	<48
QM-75	03/05/14	8.1	27	226	<1	13	11	0.25	67	12	11.0	-80	<48
QM-75	04/23/14	8.2	27	266	1	34	<5	0.29	156	4	11.8	-75	<48
QM-75	06/18/14	8.0	28	250	<1	12	10	0.26	62	1	13.4	-76	<48
QM-75	09/25/14	8.4	27	226	<1	13	10	0.27	65	2	13.7	-77	<48
QM-75	12/04/14	8.6	27	212	1	13	11	0.29	64	<1	11.6	-79	<48
QM-76	03/05/14	8.5	23	344	<1	12	61	0.29	42	<1	10.2	-186	<48
QM-76	06/18/14	8.1	42	372	1	11	72	0.24	60	<1	13.2	-180	<48
QM-76	11/06/14	8.7	34	278	<1	12	31	0.30	32	<1	11.0	-186	<48
QM-77	03/05/14	7.5	18	180	<1	11	<5	0.14	45	77	11.9	-184	<48
QM-77	06/18/14	8.2	19	196	<1	12	<5	0.13	45	220	12.3	-177	<48
QM-77	11/06/14	8.6	18	158	<1	10	<5	0.16	40	12	11.1	-177	<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 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
QM-78	01/16/14	7.8	34	290	<1	15	41	0.11	11	<1	10.1	-164	<48
QM-78	03/05/14	8.5	32	332	<1	12	43	0.11	9	<1	9.6	-165	<48
QM-78	04/24/14	8.0	42	282	<1	10	41	0.30	9	<1	12.1	-162	<48
QM-78	10/01/14	9.0	35	290	<1	11	36	<0.10	9	<1	12.8	-155	<48
QM-78	11/06/14	8.9	33	284	<1	11	44	<0.10	8	<1	10.9	-158	<48
QM-78	12/04/14	9.1	32	286	<1	11	46	<0.10	10	<1	10.9	-158	<48
QM-79	01/16/14	8.0	34	302	<1	15	18	<0.10	14	<1	10.8	-146	<48
QM-79	04/24/14	8.2	41	280	<1	14	19	0.10	14	<1	12.3	-150	<48
QM-79	06/25/14	9.0	34	284	<1	15	14	<0.10	11	1	14.3	-132	<48
QM-79	10/01/14	8.8	31	278	<1	15	14	<0.10	12	<1	12.3	-138	<48
QM-79	11/06/14	9.0	32	270	<1	17	20	<0.10	11	<1	10.8	-139	<48
QM-79	12/04/14	9.0	34	278	<1	16	20	<0.10	12	<1	10.8	-153	<48
QM-80	01/29/14	7.9	23	174	<1	13	<5	<0.10	22	<1	11.0	-149	<48
QM-80	03/05/14	8.3	21	192	<1	13	<5	<0.10	23	<1	10.5	-141	<48
QM-80	04/24/14	7.9	31	188	<1	12	<5	<0.10	22	<1	11.9	-134	<48
QM-80	10/01/14	8.9	24	196	<1	13	<5	<0.10	22	<1	13.1	-143	<48
QM-80	11/06/14	8.7	23	184	<1	13	<5	<0.10	20	<1	11.5	-142	<48
QM-80	12/04/14	8.7	22	172	<1	13	<5	<0.10	22	<1	11.5	-139	<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 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
QM-81	05/29/14	8.4	31	226	<1	20	12	0.25	29	<1	13.8	-130	<48
QM-81	08/14/14	8.5	40	216	<1	21	8	<0.10	32	<1	13.4	-134	<48
QM-81	11/06/14	8.4	29	212	<1	21	18	<0.10	30	<1	12.9	-125	<48
QM-82	01/29/14	8.0	35	270	1	30	10	0.10	15	<1	11.8	-186	<48
QM-82	03/05/14	8.4	34	282	1	29	10	<0.10	16	<1	11.1	-188	<48
QM-82	04/24/14	8.1	39	288	1	28	12	0.10	15	<1	12.0	-183	<48
QM-82	10/01/14	8.7	36	286	1	30	10	<0.10	15	<1	13.9	-186	<48
QM-82	11/06/14	8.1	34	266	2	29	12	<0.10	14	<1	12.4	-183	<48
QM-82	12/04/14	8.7	38	278	1	30	10	<0.10	15	<1	11.9	-190	<48

[1]Two samples retrieved from QM-66 during 2014; 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 additional analyses required; pre-decontamination samples (10/20) tested for Cl and FC only. Post-decontamination testing done on regular samples.

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 2014

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
			mS/m	mg/L						CFU/100 mL
QM-53	Minimum	7.9	23	190	<1	15	33	<0.10	141	<1
	Mean	8.1	23	211	<1	15	35	<0.10	144	<1
	Maximum	8.4	24	240	<1	15	36	<0.10	146	<1
	Std. Dev.	0.2	0.4	26	0.0	0	1	0.00	3	NA[3]
	Median	8.1	23	202	<1	15	36	<0.10	146	<1
	Coeff. of Var. (%)	2.9	2	12	0.0	0	4	0.00	2	NA
QM-61	Minimum	6.9	46	340	1	64	25	0.36	120	12
	Mean	7.9	67	375	1	68	29	0.44	145	902
	Maximum	8.8	106	394	1	76	33	0.55	174	3,400
	Std. Dev.	1.0	34	31	0.0	7	4	0.10	27	NA
	Median	7.9	48	392	1	65	29	0.42	142	3,400
	Coeff. of Var. (%)	12	51	8	0.0	10	14	22	19	NA
QM-62	Minimum	7.0	44	320	1	51	15	0.53	150	14
	Mean	7.6	72	425	1	91	32	0.68	182	777
	Maximum	8.2	141	712	2	214	63	1.0	255	16,200
	Std. Dev.	0.5	38	147	0.3	62	19	0.19	42	NA
	Median	7.6	55	370	1	63	28	0.62	166	1,100
	Coeff. of Var. (%)	6.1	53	34	22	69	59	28	23	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 2014

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
			mS/m	mg/L						CFU/100 mL
QM-63	Minimum	6.9	59	1,500	2	49	623	1.9	662	<1
	Mean	7.5	137	1,700	3	96	936	2.1	855	188
	Maximum	7.8	163	1,840	5	307	1,110	2.3	917	41,000
	Std. Dev.	0.3	39	149	1	103	176	0.17	109	NA
	Median	7.6	150	1,740	3	54	983	2.2	903	140
	Coeff. of Var. (%)	4.7	28	9	34	108	19	8.0	13	NA
QM-64	Minimum	7.3	52	418	1	53	32	1.6	201	1
	Mean	7.6	56	436	1	59	41	1.7	209	70
	Maximum	8.3	62	466	2	72	46	1.8	220	3,700
	Std. Dev.	0.3	4	17	0.1	7	5	0.06	8	NA
	Median	7.6	56	433	1	58	44	1.7	207	68
	Coeff. of Var. (%)	4.4	7	4	9	12	13	3.3	4	NA
QM-66	Minimum	10.0	183	1,306	<1	163	251	0.36	6	<1
	Mean	10.2	184	1,390	1	168	261	0.79	8	<1
	Maximum	10.4	185	1,474	1	172	272	1.2	10	<1
	Std. Dev.	0.3	1	119	0.1	6	15	0.61	3	NA
	Median	10.2	184	1,390	1	168	261	0.79	8	<1
	Coeff. of Var. (%)	3.3	1	9	9	4	6	77	35	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 2014

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
			mS/m	mg/L						CFU/100 mL
QM-67	Minimum	6.7	89	604	3	162	6	12	213	72
	Mean	7.5	114	817	5	274	8	13	299	520
	Maximum	7.9	139	1,048	11	418	11	15	357	12,700
	Std. Dev.	0.5	18	197	3	111	2	1.2	59	NA
	Median	7.7	117	796	4	240	9	13	303	310
	Coeff. of Var. (%)	6.1	16	24	66	41	24	9.3	20	NA
QM-68	Minimum	7.4	33	246	<1	25	37	0.57	184	4
	Mean	7.6	34	273	<1	26	37	0.60	191	29
	Maximum	7.9	34	300	<1	26	38	0.62	198	210
	Std. Dev.	0.3	1	38	0.0	1	1	0.04	10	NA
	Median	7.6	34	273	<1	26	37	0.60	191	107
	Coeff. of Var. (%)	4.1	4	14	0.0	3	3	5.9	5	NA
QM-69	Minimum	8.2	36	292	1	34	35	0.89	142	<1
	Mean	8.2	37	304	1	35	40	0.91	146	<1
	Maximum	8.3	38	326	1	36	43	0.92	150	<1
	Std. Dev.	0.1	1	19	0.1	1	4	0.02	4	NA
	Median	8.2	37	294	1	35	40	0.91	146	<1
	Coeff. of Var. (%)	0.6	3	6	5	3	10	1.7	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 2014

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
			mS/m	mg/L						CFU/100 mL
QM-70	Minimum	7.8	38	330	<1	48	47	0.39	147	<1
	Mean	7.9	40	345	1	49	49	0.42	153	<1
	Maximum	8.2	41	368	1	50	52	0.45	156	<1
	Std. Dev.	0.3	2	20	0.1	1	3	0.03	5	NA
	Median	7.8	41	338	1	49	48	0.41	156	<1
	Coeff. of Var. (%)	3.2	4	6	6	2	6	7.3	3	NA
QM-71	Minimum	7.4	54	494	<1	126	61	0.45	192	<1
	Mean	7.8	56	543	<1	127	64	0.46	204	<1
	Maximum	8.1	59	626	<1	127	68	0.48	221	<1
	Std. Dev.	0.4	2	72	0.0	1	4	0.02	15	NA
	Median	8.0	56	510	<1	127	64	0.46	200	<1
	Coeff. of Var. (%)	4.9	4	13	0.0	0	6	3.3	7	NA
QM-72	Minimum	7.8	49	396	<1	126	<5	0.38	210	<1
	Mean	8.2	49	423	1	127	<5	0.38	213	<1
	Maximum	8.6	50	462	1	128	<5	0.39	216	<1
	Std. Dev.	0.4	1	34	0	1	0	0.01	3	NA
	Median	8.1	50	412	1	127	<5	0.38	214	<1
	Coeff. of Var. (%)	4.8	2	8	9	1	0	1.5	1	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 2014

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
			mS/m	mg/L						CFU/100 mL
QM-73	Minimum	7.5	33	216	<1	12	<5	0.25	63	<1
	Mean	7.8	36	298	1	27	7	0.29	118	<1
	Maximum	8.1	38	378	1	34	13	0.34	150	<1
	Std. Dev.	0.3	3	81	0.0	13	5	0.05	48	NA
	Median	8.0	38	300	1	34	13	0.29	142	<1
	Coeff. of Var. (%)	3.8	8	27	0.0	48	71	15	41	NA
QM-74	Minimum	7.9	32	268	1	58	<5	0.23	100	<1
	Mean	8.1	34	290	1	58	<5	0.26	105	<1
	Maximum	8.3	34	332	1	59	<5	0.28	109	<1
	Std. Dev.	0.2	1	36	0.1	1	0	0.03	5	NA
	Median	8.3	34	270	1	58	<5	0.26	107	<1
	Coeff. of Var. (%)	2.8	4	13	4	1	0	9.8	4	NA
QM-75	Minimum	8.0	27	212	<1	12	<5	0.25	62	<1
	Mean	8.3	27	236	1	17	9	0.27	83	2
	Maximum	8.6	28	266	1	34	11	0.29	156	12
	Std. Dev.	0.2	1	22	0.2	10	3	0.02	41	NA
	Median	8.2	27	226	1	13	10	0.27	65	2
	Coeff. of Var. (%)	2.7	2	9	18	56	33	6.6	49	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 2014

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
			mS/m	mg/L						CFU/100 mL
QM-76	Minimum	8.1	23	278	<1	11	31	0.24	32	<1
	Mean	8.4	33	331	1	12	54	0.28	45	<1
	Maximum	8.7	42	372	1	12	72	0.30	60	<1
	Std. Dev.	0.3	9	48	0.1	1	21	0.03	14	NA
	Median	8.5	34	344	1	12	61	0.29	42	<1
	Coeff. of Var. (%)	3.5	29	15	9	5	39	12	32	NA
QM-77	Minimum	7.5	18	158	<1	10	<5	0.13	40	12
	Mean	8.1	18	178	<1	11	<5	0.14	43	59
	Maximum	8.6	19	196	<1	12	<5	0.16	45	220
	Std. Dev.	0.6	1	19	0.0	1	0	0.02	3	NA
	Median	8.2	18	180	<1	11	<5	0.14	45	77
	Coeff. of Var. (%)	7.0	4	11	0.0	9	0	11	7	NA
QM-78	Minimum	7.8	32	282	<1	10	36	<0.10	8	<1
	Mean	8.6	34	294	<1	12	42	0.14	9	<1
	Maximum	9.1	42	332	<1	15	46	0.30	11	<1
	Std. Dev.	0.5	4	19	0.0	2	3	0.08	1	NA
	Median	8.7	33	288	<1	11	42	0.11	9	<1
	Coeff. of Var. (%)	6.3	12	6	0.0	15	8	57	11	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 2014

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
			mS/m	mg/L						CFU/100 mL
QM-79	Minimum	8.0	31	270	<1	14	14	<0.10	11	<1
	Mean	8.7	35	282	<1	15	17	<0.10	12	<1
	Maximum	9.0	41	302	<1	17	20	0.10	14	<1
	Std. Dev.	0.4	3	11	0.0	1	3	0.00	1	NA
	Median	8.9	34	279	<1	15	18	0.10	12	<1
	Coeff. of Var. (%)	5.0	10	4	0.0	7	17	0.00	11	NA
QM-80	Minimum	7.9	21	172	<1	12	<5	<0.10	20	<1
	Mean	8.4	24	184	<1	13	<5	<0.10	22	<1
	Maximum	8.9	31	196	<1	13	<5	<0.10	23	<1
	Std. Dev.	0.4	4	10	0.0	0	0	0.00	1	NA
	Median	8.5	23	186	<1	13	<5	<0.10	22	<1
	Coeff. of Var. (%)	5.0	15	5	0.0	3	0	0.00	5	NA
QM-81	Minimum	8.4	29	212	<1	20	8	<0.10	29	<1
	Mean	8.4	33	218	<1	21	13	0.15	30	<1
	Maximum	8.5	40	226	<1	21	18	0.25	32	<1
	Std. Dev.	0.1	6	7	0.0	1	5	0.09	2	NA
	Median	8.4	31	216	<1	21	12	0.10	30	1
	Coeff. of Var. (%)	0.6	18	3	0.0	3	41	60	5	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 2014

Well	Statistic	pH	EC[1]	TDS[1]	TOC[1]	Cl^-	SO_4^{2-}	NH_3-N	Hardness	Fecal Coliform[2]
			mS/m	mg/L						CFU/100 mL
QM-82	Minimum	8.0	34	266	1	28	10	<0.10	14	<1
	Mean	8.3	36	278	1	29	10	<0.10	15	<1
	Maximum	8.7	39	288	2	30	12	0.10	16	<1
	Std. Dev.	0.3	2	9	0.3	1	1	0.00	1	NA
	Median	8.3	35	280	1	30	10	0.10	15	<1
	Coeff. of Var. (%)	3.9	6	3	24	3	9	0.00	4	NA

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

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 2014

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]										
01/10/14	NR[3]	NR	-48.7	-89.6	-74.5	-45.4	-70.6	-59.2	-34.8	NR	-51.4
01/24/14	"	-38.7	-53.7	-94.6	-74.5	-45.4	-70.6	-58.2	-43.8	-31.0	-55.4
02/07/14	-51.8	NR	-52.7	NR	-74.5	-40.4	-73.6	-58.2	-37.8	NR	NR
02/26/14	-49.8	"	-46.7	"	-72.5	NR	NR	-55.2	-36.8	"	"
03/28/14	-40.8	-41.7	-46.7	"	-73.5	-40.4	-68.6	-55.2	-36.8	-29.0	-56.4
04/11/14	-41.8	-42.7	-44.7	"	-73.5	-39.4	-65.6	-56.2	-34.8	NR	-55.4
05/30/14	-38.8	-40.7	-42.7	-87.6	-73.5	-39.4	-69.6	-55.2	-36.8	"	-74.4
06/25/14	-36.8	-37.7	-39.7	-78.6	-71.5	-43.4	-68.6	-54.2	-28.8	-20.0	-39.4
07/31/14	NR	NR	NR	NR	-72.5	-39.4	-71.6	-44.2	-34.8	NR	-43.4
08/08/14	-47.8	-42.7	-44.7	-85.6	-71.5	-42.4	-71.6	-53.2	-34.8	"	-72.4
09/26/14	-49.8	-50.7	-45.7	-90.6	-72.5	-40.4	-68.6	-54.2	-35.8	"	-56.4
10/31/14	-47.8	-52.7	-46.7	-88.6	-74.5	-40.4	-67.6	-56.2	-36.8	"	-55.4
11/21/14	-44.8	-54.7	-45.7	-90.6	-72.5	-43.4	-69.6	-58.2	-36.8	"	-53.4
12/19/14	NR	-23.7	-46.7	-90.6	-71.5	-39.4	-68.6	-54.2	-35.8	"	-56.4

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 2014

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]										
01/09/14	-10.7	NR	NR	-170	-132	-224	-85.5	-71.9	-78.9	-77.3	-219
01/17/14	-9.70	"	"	-176	-138	-231	-85.5	-82.9	-69.9	-73.3	-220
02/14/14	NR	"	"	-172	-128	-211	NR	NR	-72.9	-78.3	NR
02/27/14	"	"	-64.8	-158	-125	-228	-86.5	-69.9	-77.9	-77.3	-219
03/14/14	-9.70	"	NR	-162	-124	-225	-84.5	-69.9	-74.9	-76.3	-199
04/18/14	NR	"	-65.8	-178	-128	-226	-83.5	-70.9	-74.9	-74.3	-195
05/09/14	-7.70	"	-63.8	-170	-127	-222	-84.5	-72.9	-74.9	-76.3	-203
06/13/14	NR	"	-69.8	-133	-117	-215	NR	-67.9	-74.9	-73.3	-142
07/31/14	"	"	-61.8	-154	-121	-214	"	NR	-71.9	-74.3	-208
08/21/14	"	"	NR	-156	-123	-222	"	"	-71.9	-75.3	-202
09/05/14	"	"	-61.8	-148	-118	-199	"	-69.9	-69.9	-75.3	-203
10/10/14	"	"	NR	-147	-120	-217	"	-68.9	-69.9	-74.3	-185
11/21/14	"	"	-68.8	-145	-127	-231	"	-86.9	-71.9	-76.3	-227
12/12/14	"	"	-67.8	-164	-130	-232	"	-83.9	-74.9	-77.3	-227

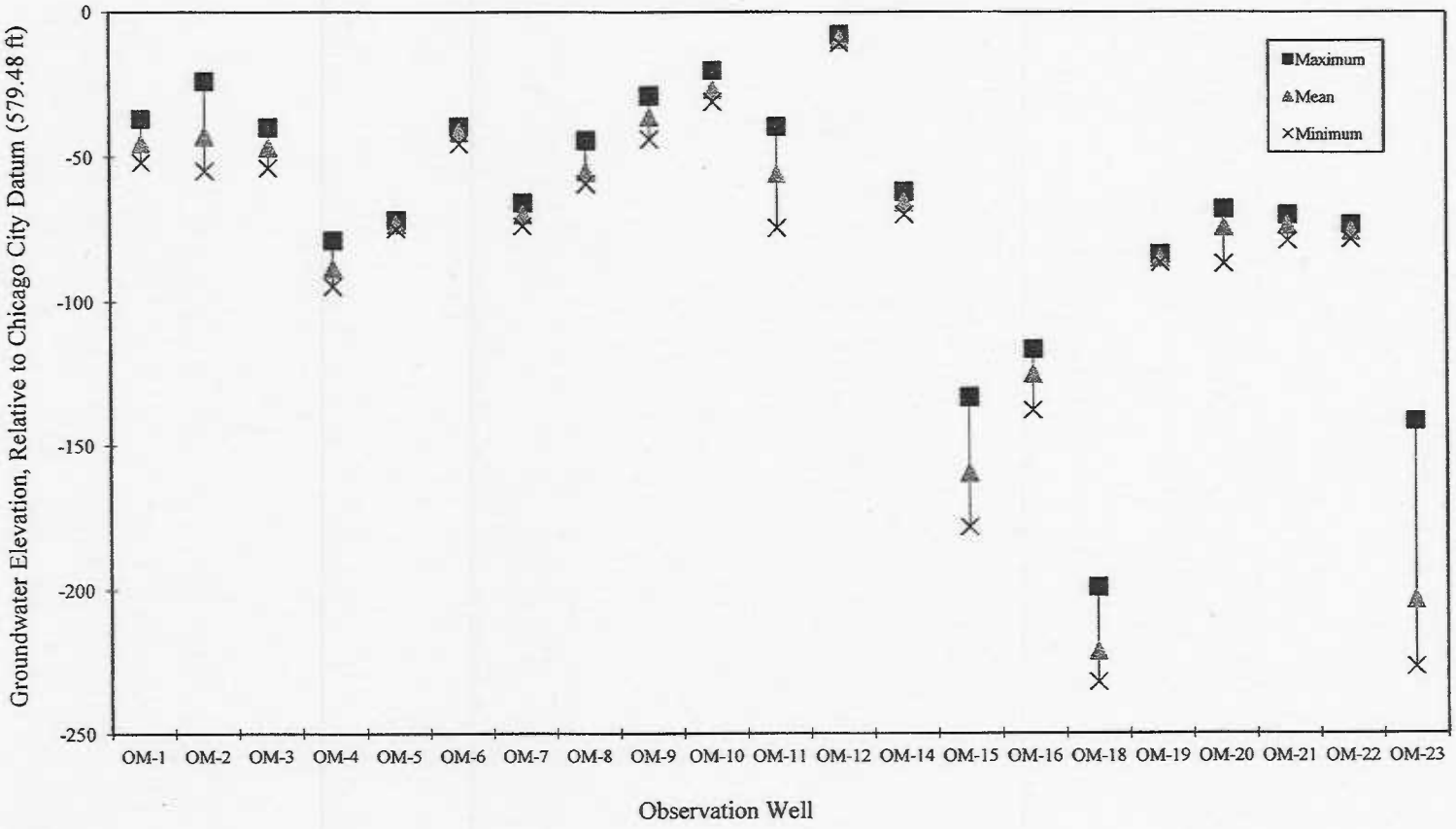
[1]Date measurements were taken.

[2]Relative to Chicago city datum (579.48 ft. above mean sea level) at intersection of State and Madison Streets.

[3]No readings. Wells inaccessible due to closure of business, locked gates, snow accumulation, or heavy truck traffic; OM-13 broken; OM-17 damaged in accident.

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. However, OM-23 appeared to experience significant fluctuations during June 2014.

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 2014



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
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OF ...R. 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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