MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 11-23

TUNNEL AND RESERVOIR PLAN

UPPER DES PLAINES TUNNEL SYSTEM

2010 ANNUAL GROUNDWATER MONITORING REPORT

April 2011

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

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April 26, 2011

Ms. Marcia Willhite, Chief
Bureau of Water
Illinois Environmental Protection Agency
P. O. Box 19276
Springfield, IL 62794-9276

Dear Ms. Willhite:

Subject: Tunnel and Reservoir Plan, Upper Des Plaines Tunnel System, 2010 Annual Groundwater Monitoring Report

Enclosed are three copies of "Tunnel and Reservoir Plan, Upper Des Plaines Tunnel System, 2010 Annual Groundwater Monitoring Report."

Very truly yours,

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

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TUNNEL AND RESERVOIR PLAN
UPPER DES PLAINES TUNNEL SYSTEM
2010 ANNUAL GROUNDWATER MONITORING REPORT

Monitoring and Research Department
Thomas C. Granato, Acting Director

April 2011

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INTRODUCTION

This report contains groundwater quality monitoring data for the year 2010 for the Tunnel and Reservoir Plan (TARP) Upper Des Plaines (UDP) Tunnel System. This system consists of two subsystems, UDP 20 and UDP 21. UDP 20 contains six groundwater quality monitoring wells, MW-1 through MW-6, while UDP 21 contains three groundwater quality monitoring wells, MW-7 through MW-9. These nine groundwater quality monitoring wells are sampled six times per year with the exception of MW-1, which is sampled three times per year (Illinois Environmental Protection Agency memorandum July 9, 2004). Water levels were monitored once every two weeks as required.

MONITORING DATA

Appendix AI contains a location map of nine groundwater quality monitoring wells, MW-1 through MW-9 for the TARP UDP System. Table AII-1 in Appendix AII contains groundwater elevation data for the year 2010 for groundwater quality monitoring wells MW-1 through MW-6 for the UDP 20 Tunnel System, and Table AII-2 contains groundwater elevation data for the same period for groundwater quality monitoring wells MW-7 through MW-9 for the UDP 21 Tunnel System.

Tables AIII-1 and AIII-2 in Appendix AIII contain groundwater quality data for the UDP 20 groundwater quality monitoring wells. Tables AIII-3 and AIII-4 in Appendix AIII contain groundwater quality data for the UDP 21 groundwater quality monitoring wells.

All of the wells in the UDP Tunnel system were visited for the required number of samples. However, in some instances the wells could not be sampled. Groundwater quality monitoring well MW-2 could not be sampled on February 9, 2010, due to an electrical problem with the pump and on November 3, 2010, because the pump was inoperable. Groundwater quality monitoring well MW-5 could not be sampled on August 12, 2010, October 7, 2010, November 2, 2010, and December 1, 2010, because the pump was inoperable. A work order has been issued to repair the pump. Groundwater quality monitoring wells MW-8 and MW-9 could not be sampled on March 5, 2010, because snow blocked access to these wells.

SUMMARY OF DATA

Monitoring Wells Water Level Elevation Data

In Figure 1, the 2010 groundwater level elevation data for groundwater quality monitoring wells MW-1 through MW-6 of the UDP 20 Tunnel System have been plotted. In this figure, mean, minimum, and maximum water level elevations of all six groundwater quality monitoring wells are plotted to show the fluctuations in the water level elevations during 2010.

Similarly, in Figure 2, the 2010 groundwater elevation data for groundwater quality monitoring wells MW-7 through MW-9 of the UDP 21 Tunnel System have been plotted. Also, mean, minimum, and maximum water level elevations of all three groundwater quality monitoring wells are plotted to show the fluctuations in the water level elevation during 2010.

Water Quality Monitoring Wells Data

Table 1 contains summary statistics of the water quality parameters for the year 2010 for the UDP 20 Tunnel System, and Table 2 contains summary statistics of the water quality parameters for the same period for the UDP 21 Tunnel System. The summary statistics are computed from the water quality data collected in 2010 from groundwater quality monitoring wells MW-1 through MW-6 (UDP 20), and MW-7 through MW-9 (UDP 21). The summary statistics include minimum, mean, maximum, standard deviation (Stdv.), median, and coefficient of variation (COV) for the values of eight of the nine water quality parameters analyzed for 2010. The eight water quality parameters are: chloride (Cl), conductivity (Cond.), hardness as $CaCO_3$ (Hard.), ammonia nitrogen (NH_3-N), pH, sulfate (SO_4), total dissolved solids (TDS), and total organic carbon (TOC). For the ninth parameter, fecal coliform (FC), the minimum, geometric mean (Geo. Mean), maximum, and median are included. The statistical analysis of the data was conducted using Microsoft® Excel functions.

FIGURE 1: 2010 MINIMUM, MEAN, AND MAXIMUM WATER LEVEL ELEVATIONS FOR THE UPPER DES PLAINES 20 TUNNEL SYSTEM GROUNDWATER QUALITY MONITORING WELLS

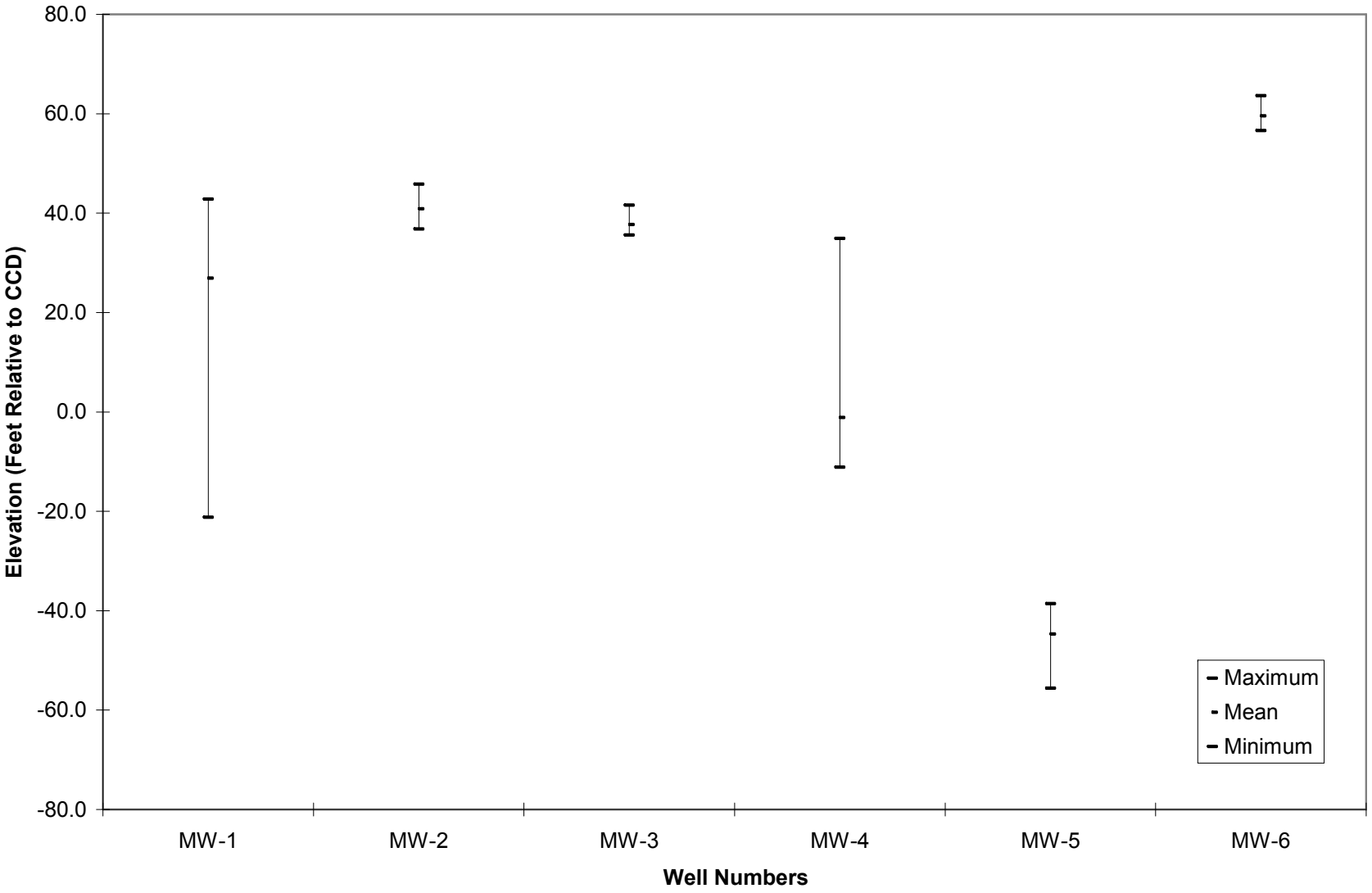


FIGURE 2: 2010 MINIMUM, MEAN, AND MAXIMUM WATER LEVEL ELEVATIONS FOR THE UPPER DES PLAINES 21 TUNNEL SYSTEM GROUNDWATER QUALITY MONITORING WELLS

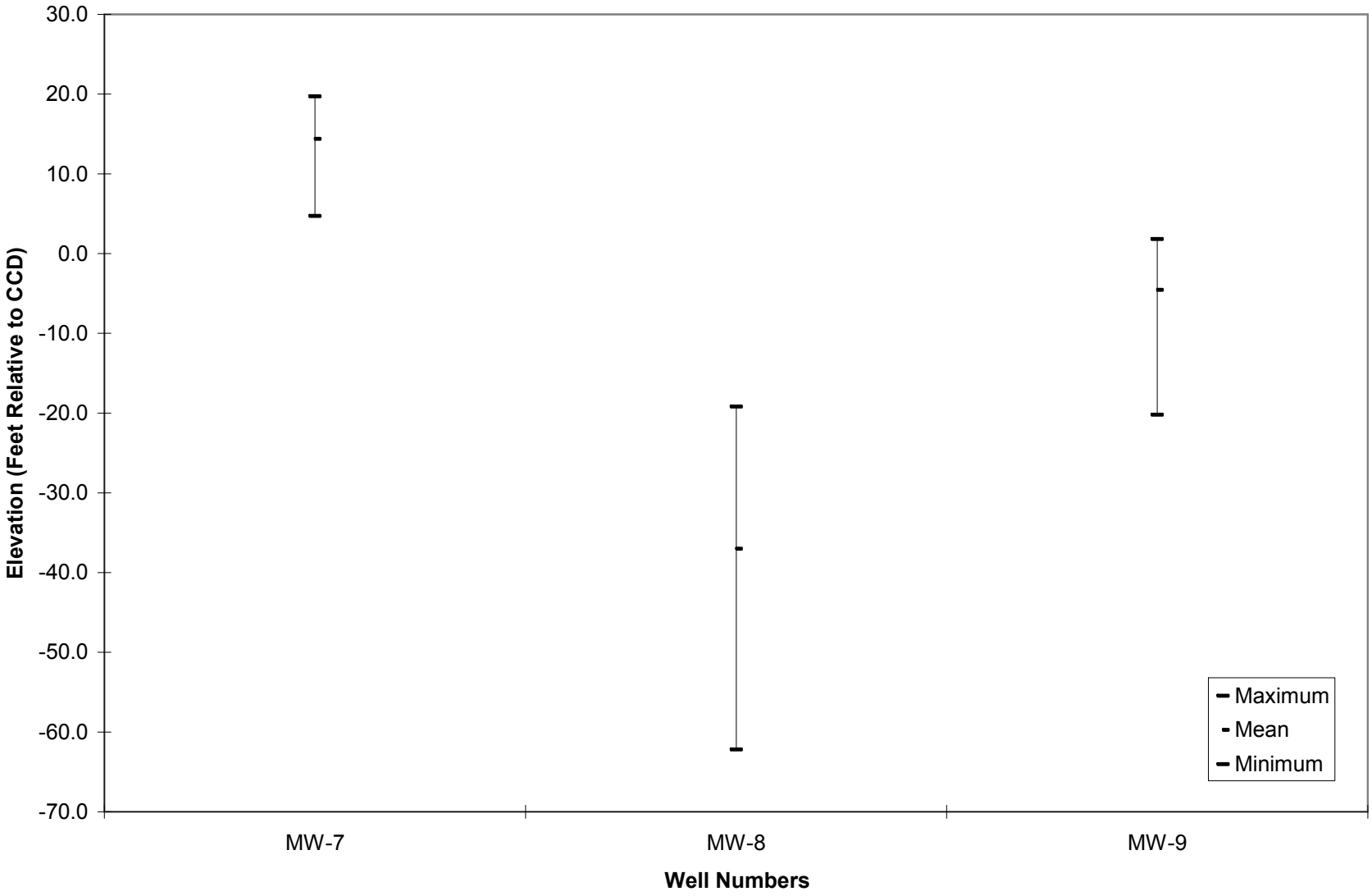


TABLE 1: SUMMARY STATISTICS FOR THE 2010 GROUNDWATER QUALITY DATA FOR THE MONITORING WELLS IN UPPER DES PLAINES 20 TUNNEL SYSTEM: WELLS MW-1 THROUGH MW-6

Parameter[1]		Well Number					
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
Cl	Minimum	28	32	15	54	206	35
mg/L	Mean	31	37	15	61	242	36
	Maximum	35	43	17	71	277	37
	Stdv.	4	5	1	6	50	1
	Median	31	37	15	60	242	36
	COV	11	12	5	11	21	2
FC	Minimum	1	1	1	1	1	1
cfu/100 mL	Geo. Mean	1	1	1	1	1	1
	Maximum	1	1	1	2	1	3
	Median	1	1	1	1	1	1
SO_4	Minimum	357	379	392	347	126	288
mg/L	Mean	368	403	435	371	152	319
	Maximum	379	422	471	381	179	350
	Stdv.	11	18	26	12	38	23
	Median	369	405	439	374	152	324
	COV	3	4	6	3	25	7
NH_3-N	Minimum	0.28	0.55	0.29	0.07	0.02	0.46
mg/L	Mean	0.30	0.57	0.33	0.09	0.03	0.52
	Maximum	0.31	0.60	0.34	0.11	0.03	0.57
	Stdv.	0.02	0.02	0.02	0.02	0.01	0.04
	Median	0.31	0.57	0.33	0.08	0.03	0.52
	COV	5.77	3.87	5.76	19.33	28.28	8.49
TOC	Minimum	1.0	1.0	1.0	1.0	1.0	1.0
mg/L	Mean	1.0	1.0	1.0	1.0	1.0	1.2
	Maximum	1.0	1.0	1.0	1.0	1.0	1.4
	Stdv.	0.0	0.0	0.0	0.0	0.0	0.1
	Median	1.0	1.0	1.0	1.0	1.0	1.2
	COV	0.0	0.0	0.0	0.0	0.0	11.8

TABLE 1 (Continued): SUMMARY STATISTICS FOR THE 2010 GROUNDWATER QUALITY DATA FOR THE MONITORING WELLS IN UPPER DES PLAINES 20 TUNNEL SYSTEM: WELLS MW-1 THROUGH MW-6

Parameter[1]		Well Number					
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
TDS	Minimum	788	828	808	910	780	666
mg/L	Mean	852	865	882	998	782	730
	Maximum	920	900	1,034	1,174	784	784
	Stdv.	66	35	92	100	3	42
	Median	848	865	838	964	782	741
	COV	8	4	10	10	0.36	6
Hard.	Minimum	415	398	420	519	116	347
mg/L as $CaCO_3$	Mean	422	454	437	534	145	362
	Maximum	436	474	458	560	174	368
	Stdv.	12	38	13	17	41	8
	Median	415	473	437	529	145	365
	COV	3	8	3	3	28	2
Cond.	Minimum	577	580	395	554	865	470
µmhos/cm	Mean	781	663	517	728	867	685
	Maximum	987	792	577	897	868	910
	Stdv.	205	95	72	128	2	189
	Median	780	640	534	720	867	665
	COV	26	14	14	18	0.24	28
pH	Minimum	7.3	7.5	7.2	7.5	8.4	7.5
unit	Mean	7.4	7.6	7.5	7.8	8.6	7.7
	Maximum	7.5	7.9	7.8	8.1	8.9	7.9
	Stdv.	0.1	0.2	0.3	0.2	0.4	0.2
	Median	7.5	7.6	7.5	7.7	8.6	7.6
	COV	1.6	2.4	3.5	3.0	4.3	2.7

[1]For purpose of statistical evaluation, any value less than the appropriate limit of quantification (LOQ) was set equal to the value of the LOQ.

TABLE 2: SUMMARY STATISTICS FOR THE 2010 GROUNDWATER QUALITY DATA FOR THE MONITORING WELLS IN UPPER DES PLAINES 21 TUNNEL SYSTEM: WELLS MW-7 THROUGH MW-9

Parameter		Well Number		
		MW-7	MW-8	MW-9
Cl	Minimum	28	48	30
mg/L	Mean	44	68	32
	Maximum	99	126	33
	Stdv.	27	33	1
	Median	35	54	32
	COV	62	48	4
FC	Minimum	1	1	1
cfu/100 mL	Geo. Mean	1	4	1
	Maximum	2	840	1
	Median	1	1	1
SO_4	Minimum	371	243	326
mg/L	Mean	385	298	352
	Maximum	401	354	396
	Stdv.	11	51	26
	Median	386	303	348
	COV	3	17	7
NH_3-N	Minimum	0.49	0.02	0.38
mg/L	Mean	0.52	0.03	0.41
	Maximum	0.54	0.06	0.43
	Stdv.	0.02	0.02	0.02
	Median	0.52	0.02	0.41
	COV	4.63	63.89	5.17
TOC	Minimum	1.0	1.0	1.0
mg/L	Mean	1.1	1.1	1.1
	Maximum	1.4	1.3	1.4
	Stdv.	0.2	0.2	0.2
	Median	1.0	1.1	1.0
	COV	15.3	13.3	16.6

TABLE 2 (Continued) SUMMARY STATISTICS FOR THE 2010 GROUNDWATER QUALITY DATA FOR THE MONITORING WELLS IN UPPER DES PLAINES 21 TUNNEL SYSTEM: WELLS MW-7 THROUGH MW-9

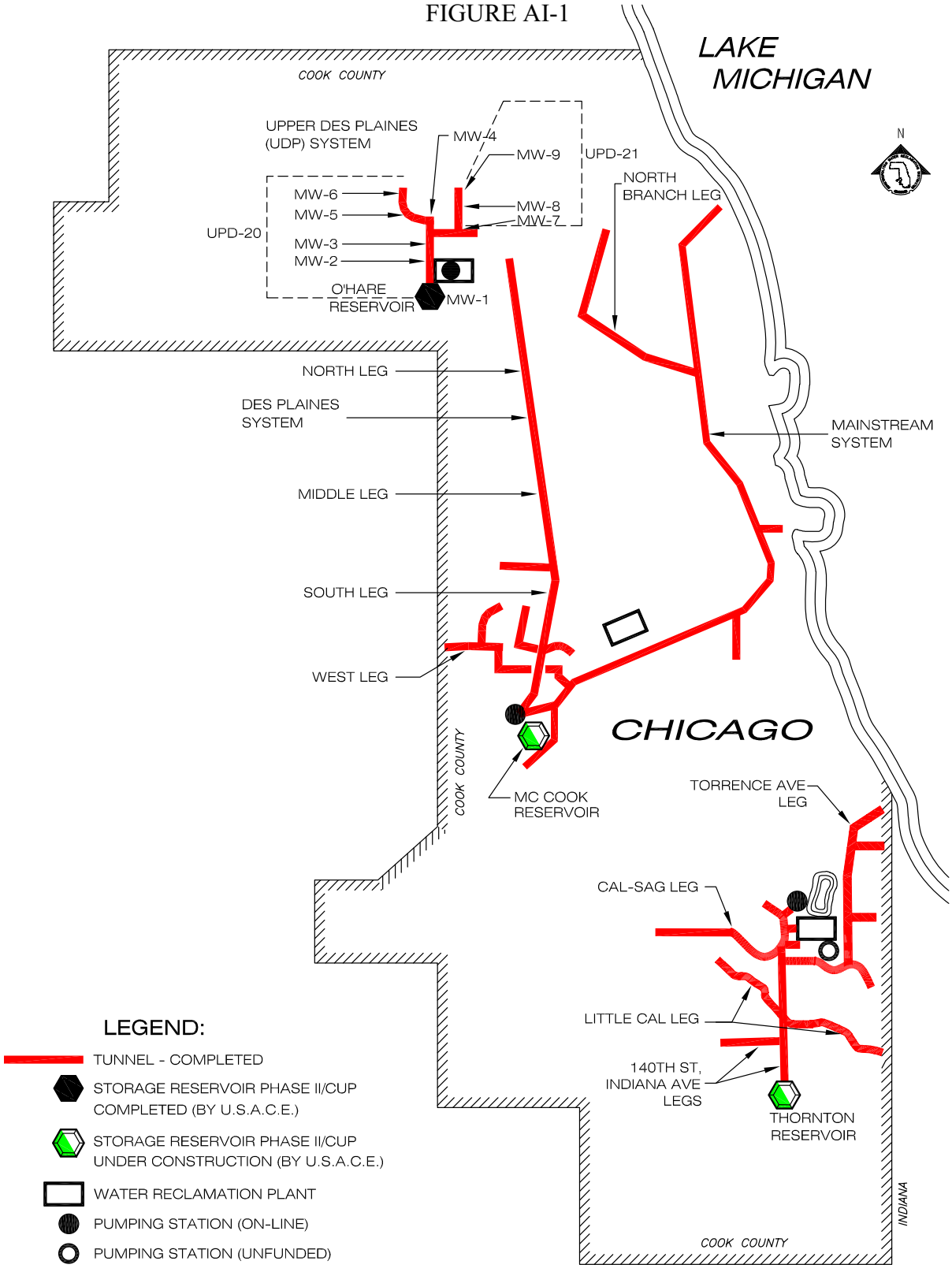
Parameter		Well Number		
		MW-7	MW-8	MW-9
TDS	Minimum	854	742	756
mg/L	Mean	881	793	843
	Maximum	908	860	946
	Stdv.	18	47	86
	Median	880	776	842
	COV	2	6	10
Hard.	Minimum	472	238	364
mg/L as $CaCO_3$	Mean	497	341	380
	Maximum	519	406	391
	Stdv.	20	70	12
	Median	501	340	387
	COV	4	21	3
Cond.	Minimum	452	510	503
µmhos/cm	Mean	720	755	644
	Maximum	901	1,250	850
	Stdv.	153	288	138
	Median	735	685	592
	COV	21	38	22
pH	Minimum	7.2	7.2	7.3
unit	Mean	7.5	8.1	7.8
	Maximum	8.1	8.8	8.5
	Stdv.	0.3	0.6	0.4
	Median	7.5	8.1	7.7
	COV	4.6	7.7	5.5

[1]For purpose of statistical evaluation, any value less than the appropriate limit of quantification (LOQ) was set equal to the value of the LOQ.

APPENDIX AI

LOCATION MAP OF GROUNDWATER QUALITY MONITORING WELLS
MW-1 THROUGH MW-6 (UPPER DES PLAINES 20), AND
MW-7 THROUGH MW-9 (UPPER DES PLAINES 21)
IN THE UPPER DES PLAINES TUNNEL SYSTEM

FIGURE AI-1



UPPER DES PLAINES TUNNEL SYSTEM LOCATION MAP OF GROUNDWATER QUALITY MONITORING WELLS

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

APPENDIX AII

2010 GROUNDWATER LEVEL ELEVATION DATA
FOR MONITORING WELLS MW-1 THROUGH MW-6 (UPPER DES PLAINES 20),
AND MW-7 THROUGH MW-9 (UPPER DES PLAINES 21)
IN THE UPPER DES PLAINES TUNNEL SYSTEM

TABLE AII-1: 2010 GROUNDWATER LEVEL ELEVATION* DATA FOR GROUNDWATER QUALITY MONITORING WELLS MW-1 THROUGH MW-6 IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM

Date	Observation Wells					
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
1/8/10	**	45.8	**	**	**	**
1/22/10	32.8	37.8	37.6	-1.1	-47.6	58.6
2/5/10	29.8	38.8	35.6	-2.1	-48.6	57.6
2/19/10	33.8	42.8	39.6	1.9	-46.6	63.6
2/26/10	-20.2	41.8	38.6	**	**	**
3/5/10	28.8	37.8	35.6	-2.1	**	59.6
3/12/10	34.8	41.8	38.6	-2.1	-44.6	63.6
3/26/10	27.8	36.8	38.6	-3.1	-46.6	58.6
4/16/10	-21.2	39.8	35.6	-0.1	-48.6	61.6
4/23/10	26.8	41.8	38.6	-2.1	-43.6	56.6
4/30/10	42.8	41.8	37.6	-4.1	-55.6	56.6
5/21/10	33.8	42.8	41.6	-0.1	-46.6	61.6
6/4/10	33.8	41.8	37.6	-2.1	-40.6	61.6
6/25/10	32.8	41.8	38.6	34.9	-38.6	59.6
7/9/10	34.8	42.8	37.6	-3.1	-49.6	59.6
7/16/10	33.8	41.8	36.6	-2.1	-47.6	58.6
8/6/10	33.8	41.8	37.6	-2.1	-39.6	59.6
8/20/10	33.8	39.8	38.6	-3.1	-40.6	57.6
9/3/10	33.8	39.8	37.6	-2.1	-40.6	57.6
9/10/10	32.8	39.8	37.6	-3.1	-41.6	59.6
10/1/10	32.8	39.8	37.6	-2.1	-41.6	60.6
10/8/10	33.8	39.8	37.6	-11.1	-43.6	59.6
10/22/10	29.8	40.8	38.6	-2.1	-47.6	57.6
11/5/10	-15.2	39.8	35.6	-6.1	-42.6	59.6
11/19/10	31.8	40.8	36.6	-3.1	-46.6	56.6
12/10/10	33.8	40.8	37.6	-3.1	-41.6	60.6
12/17/10	33.8	41.8	37.6	-3.1	-42.6	62.6
Minimum	-21.2	36.8	35.6	-11.1	-55.6	56.6
Mean	26.9	40.8	37.7	-1.1	-44.7	59.6
Maximum	42.8	45.8	41.6	34.9	-38.6	63.6

*Elevations are in feet relative to Chicago City Datum.
**Snow blocked access to well.

TABLE AII-2: 2010 GROUNDWATER LEVEL ELEVATION* DATA FOR GROUNDWATER QUALITY MONITORING WELLS MW-7 THROUGH MW-9 IN THE UPPER DES PLAINES 21 TUNNEL SYSTEM

Date	Observation Wells		
	MW-7	MW-8	MW-9
1/8/10	15.7	**	**
1/22/10	5.7	-44.2	-20.2
2/5/10	17.7	-47.2	-16.2
2/19/10	16.7	**	**
2/26/10	15.7	**	**
3/5/10	13.7	**	**
3/12/10	16.7	-22.2	-0.2
3/26/10	8.7	-41.2	-15.2
4/16/10	19.7	-41.2	-14.2
4/23/10	16.7	-58.2	-3.2
4/30/10	16.7	-33.2	-1.2
5/21/10	4.7	-40.2	-1.2
6/4/10	15.7	-36.2	-1.2
6/25/10	6.7	-33.2	-13.2
7/9/10	16.7	-48.2	0.8
7/16/10	16.7	-43.2	1.8
8/6/10	14.7	-30.2	-2.2
8/20/10	14.7	-50.2	0.8
9/3/10	14.7	-38.2	0.8
9/10/10	14.7	-40.2	-0.2
10/1/10	14.7	-22.2	-4.2
10/8/10	13.7	-19.2	-4.2
10/22/10	16.7	-20.2	-0.2
11/5/10	13.7	-62.2	-2.2
11/19/10	15.7	-26.2	-5.2
12/10/10	15.7	-26.2	-1.2
12/17/10	14.7	-28.2	-3.2
Minimum	4.7	-62.2	-20.2
Mean	14.4	-37.0	-4.5
Maximum	19.7	-19.2	1.8

*Elevations are in feet relative to Chicago City Datum.
**Snow blocked access to well.

APPENDIX AIII

2010 GROUNDWATER QUALITY DATA FOR MONITORING WELLS MW-1 THROUGH MW-6 (UPPER DES PLAINES 20), AND MW-7 THROUGH MW-9 (UPPER DES PLAINES 21) IN THE UPPER DES PLAINES TUNNEL SYSTEM

TABLE AIII-1: 2010 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR GROUNDWATER QUALITY MONITORING WELLS MW-1 THROUGH MW-6 IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM

Well	Date of Sampling	Cl^{1} mg/L	$FC^{1,2}$ cfu/100 mL	SO_4^{1} mg/L	NH_3-N^{1} mg/L	TOC^{1} mg/L	TDS mg/L
MW-1	2/25/10	31	<1	357	0.31	1.0	788
MW-1	5/22/10	28	<1	379	0.31	<1.0	848
MW-1	7/1/10	35	<1	369	0.28	<1.0	920
MW-2	1/20/10	43	<1	379	0.55	<1.0	828
MW-2	2/9/10	Well could not be sampled					
MW-2	7/28/10	37	<1	408	0.56	<1.0	888
MW-2	9/15/10	32	<1	422	0.60	<1.0	900
MW-2	10/6/10	37	<1	403	0.58	1.0	842
MW-2	11/3/10	Well could not be sampled					
MW-3	4/29/10	<15	<1	471	0.32	<1.0	840
MW-3	5/27/10	<15	<1	435	0.33	<1.0	956
MW-3	8/12/10	<15	<1	447	0.34	<1.0	1,034
MW-3	10/7/10	<15	<1	423	0.33	<1.0	818
MW-3	11/4/10	<15	<1	392	0.29	<1.0	808
MW-3	12/1/10	17	<1	442	0.34	<1.0	836
MW-4	4/29/10	60	<1	377	0.11	<1.0	972
MW-4	5/27/10	54	<1	373	0.07	<1.0	1,052
MW-4	8/12/10	71	2	381	0.10	<1.0	1,174
MW-4	10/7/10	65	<1	371	0.08	<1.0	956
MW-4	11/4/10	55	<1	347	0.08	<1.0	924
MW-4	12/1/10	59	<1	375	0.07	<1.0	910
MW-5	4/29/10	277	<1	126	<0.02	<1.0	780
MW-5	5/27/10	206	<1	179	0.03	<1.0	784
MW-5	8/12/10	Well could not be sampled					
MW-5	10/7/10	Well could not be sampled					
MW-5	11/2/10	Well could not be sampled					
MW-5	12/1/10	Well could not be sampled					
MW-6	1/12/10	36	<1	295	0.47	1.2	700
MW-6	2/9/10	37	<1	288	0.46	1.4	666
MW-6	5/28/10	36	<1	327	0.53	1.3	784
MW-6	8/18/10	35	3	330	0.51	1.2	750

TABLE AIII-1 (Continued): 2010 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR GROUNDWATER QUALITY MONITORING WELLS MW-1 THROUGH MW-6 IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM

Well	Date of Sampling	Cl^{1} mg/L	$FC^{1,2}$ cfu/100 mL	$SO_4{}^{1}$ mg/L	NH_3-N^{1} mg/L	TOC^{1} mg/L	TDS mg/L
MW-6	9/22/10	37	<1	321	0.55	1.0	748
MW-6	12/21/10	36	<1	350	0.57	1.1	734

[1]The limit of quantification is 15 mg/L for Cl, 2.0 mg/L for SO_4, 0.02 mg/L for NH_3-N, 1.0 mg/L for TOC, and 40 mg/L for TDS. The detection limit for the FC analysis using the membrane filter method varies based on the actual sample analyzed.

[2]Unfiltered samples, all others were filtered through 0.45 µm membrane.

TABLE AIII-2: 2010 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR GROUNDWATER QUALITY MONITORING WELLS MW-1 THROUGH MW-6 IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] Unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
MW-1	2/25/10	436	987	7.5	10.9	3.8	<48
MW-1	5/22/10	415	780	7.3	19.1	1.8	<48
MW-1	7/1/10	415	577	7.5	12.6	2.8	<48
MW-2	1/20/10	472	580	7.9	13.4	39.8	<48
MW-2	2/9/10	Well could not be sampled					
MW-2	7/28/10	398	792	7.6	13.3	43.8	<48
MW-2	9/15/10	473	674	7.5	15.7	38.8	<48
MW-2	10/6/10	474	605	7.6	14.5	39.8	<48
MW-2	11/3/10	Well could not be sampled					
MW-3	4/29/10	420	489	7.6	15.4	37.6	<48
MW-3	5/27/10	429	574	7.2	15.9	38.6	<48
MW-3	8/12/10	440	577	7.5	12.6	39.6	<48
MW-3	10/7/10	433	573	7.3	15.0	35.6	<48
MW-3	11/4/10	443	496	7.8	14.2	33.6	<48
MW-3	12/1/10	458	395	7.8	12.7	32.6	<48
MW-4	4/29/10	519	830	8.1	14.2	-6.1	<48
MW-4	5/27/10	519	771	7.6	14.5	-5.1	<48
MW-4	8/12/10	535	897	8.0	16.9	-2.1	<48
MW-4	10/7/10	523	669	7.5	13.9	-8.1	<48
MW-4	11/4/10	547	645	7.8	13.4	-12.1	<48
MW-4	12/1/10	560	554	7.6	11.0	-13.1	<48
MW-5	4/29/10	116	865	8.9	13.7	-55.6	<48
MW-5	5/27/10	174	868	8.4	14.8	-53.6	<48
MW-5	8/12/10	Well could not be sampled					
MW-5	10/7/10	Well could not be sampled					
MW-5	11/2/10	Well could not be sampled					
MW-5	12/1/10	Well could not be sampled					
MW-6	1/12/10	365	901	7.6	6.1	57	<4
MW-6	2/9/10	347	663	7.9	12.6	62.6	<4
MW-6	5/28/10	364	910	7.7	12.1	57.6	<4
MW-6	8/18/10	367	666	7.5	14.9	58.6	<4

TABLE AIII-2 (Continued): 2010 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR GROUNDWATER QUALITY MONITORING WELLS MW-1 THROUGH MW-6 IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] Unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
MW-6	9/22/10	361	501	7.5	14.4	58.6	<4
MW-6	12/21/10	368	470	7.9	11.8	61.6	<4

[1]Unfiltered samples, all others were filtered through 0.45 µm membrane.
[2]Water level elevations are relative to Chicago City Datum.
[3]Refers to elapsed time after initial drawdown before the well recovered sufficiently for sampling.

TABLE AIII-3: 2010 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR GROUNDWATER QUALITY MONITORING WELLS MW-7 THROUGH MW-9 IN THE UPPER DES PLAINES 21 TUNNEL SYSTEM

Well	Date of Sampling	Cl^{1} mg/L	$FC^{1,2}$ cfu/100 mL	$SO_4{}^{1}$ mg/L	NH_3-N^{1} mg/L	TOC^{1} mg/L	TDS mg/L
MW-7	1/20/10	36	<1	371	0.50	<1.0	854
MW-7	2/9/10	99	<1	385	0.54	1.4	874
MW-7	7/28/10	35	2	391	0.50	<1.0	884
MW-7	9/15/10	28	<1	401	0.54	<1.0	892
MW-7	10/6/10	34	<1	386	0.54	<1.0	908
MW-7	11/3/10	30	<1	374	0.49	1.0	876
MW-8	3/5/10	Well could not be sampled					
MW-8	5/22/10	126	<1	243	0.02	1.0	742
MW-8	7/1/10	62	<1	354	<0.02	<1.0	860
MW-8	8/12/10	54	840	249	<0.02	1.3	820
MW-8	10/27/10	52	<1	303	0.06	1.1	768
MW-8	11/4/10	48	1	340	<0.02	1.3	776
MW-9	3/5/10	Well could not be sampled					
MW-9	5/22/10	33	<1	348	0.43	1.0	842
MW-9	7/1/10	31	<1	396	0.41	1.0	910
MW-9	8/12/10	30	<1	349	0.43	1.0	946
MW-9	10/27/10	32	<1	326	0.40	1.0	756
MW-9	11/4/10	33	<1	344	0.38	1.4	760

[1]The limit of quantification is 15 mg/L for Cl, 2.0 mg/L for SO_4, 0.02 mg/L for NH_3-N, 1.0 mg/L for TOC, and 40 mg/L for TDS. The detection limit for the FC analysis using the membrane filter method varies based on the actual sample analyzed.

[2]Unfiltered samples, all others were filtered through 0.45 µm membrane.

TABLE AIII-4: 2010 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR GROUNDWATER QUALITY MONITORING WELLS MW-7 THROUGH MW-9 IN THE UPPER DES PLAINES 21 TUNNEL SYSTEM

Well	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] Unit	Temp. °C	Elevation[2] Feet	Recharge[3] Hours
MW-7	1/20/10	519	730	8.1	14.0	15.7	<4
MW-7	2/9/10	515	901	7.3	13.9	15.7	<4
MW-7	7/28/10	472	819	7.4	14.1	15.7	<4
MW-7	9/15/10	497	740	7.5	16.3	15.7	<4
MW-7	10/6/10	505	676	7.5	15.2	14.7	<4
MW-7	11/3/10	475	452	7.2	9.8	10.7	<4
MW-8	3/5/10	Well could not be sampled					
MW-8	5/22/10	238	1,250	8.4	15.0	-57.2	<48
MW-8	7/1/10	340	510	7.8	13.7	-62.2	<48
MW-8	8/12/10	313	685	8.1	16.8	-52.2	<48
MW-8	10/27/10	406	611	8.8	14.5	-58.2	<48
MW-8	11/4/10	406	721	7.2	14.8	-58.2	<48
MW-9	3/5/10	Well could not be sampled					
MW-9	5/22/10	364	850	7.6	15.8	1.8	<48
MW-9	7/1/10	371	561	7.8	14.0	3.2	<48
MW-9	8/12/10	387	713	7.7	15.8	-7.2	<48
MW-9	10/27/10	391	592	8.5	14.2	0.2	<48
MW-9	11/4/10	388	503	7.3	14.6	-8.2	<48

[1]Unfiltered samples, all others were filtered through 0.45 µm membrane.
[2]Water level elevations are relative to Chicago City Datum.
[3]Refers to elapsed time after initial drawdown before the well recovered sufficiently for sampling.