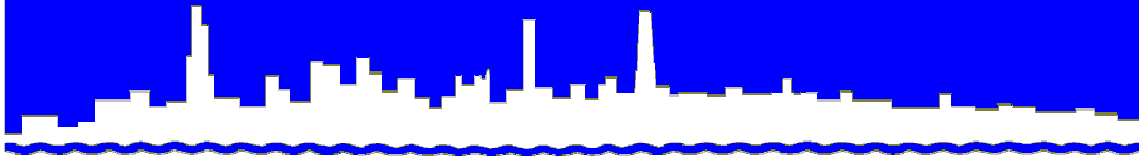


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 10-29

TUNNEL AND RESERVOIR PLAN

UPPER DES PLAINES TUNNEL SYSTEM

2009 ANNUAL GROUNDWATER MONITORING REPORT

June 2010

Protecting Our Water Environment

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June 18, 2010

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, 2009 Annual Groundwater Monitoring Report

Enclosed are three copies of "Tunnel and Reservoir Plan, Upper Des Plaines Tunnel System, 2009 Annual Groundwater Monitoring Report."

Very truly yours,

Louis Kollias
Director
Monitoring and Research

LK:HZ:lf
Enclosures

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TUNNEL AND RESERVOIR PLAN
UPPER DES PLAINES TUNNEL SYSTEM
2009 ANNUAL GROUNDWATER MONITORING REPORT

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INTRODUCTION

This report contains groundwater quality monitoring data for the year 2009 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 water quality monitoring wells, MW-1 through MW-6, while UDP 21 contains three water quality monitoring wells, MW-7 through MW-9. These nine water 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 water 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 2009 for 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 monitoring wells MW-7 through MW-9 for the UDP 21 Tunnel System.

Tables AIII-1 and AIII-2 in Appendix AIII contain water quality data for the UDP 20 monitoring wells. Tables AIII-3 and AIII-4 in Appendix AIII contain water quality data for the UDP 21 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. Water quality monitoring well MW-2 could not be sampled on May 28, 2009, due to an electrical problem with the pump. Water quality monitoring well MW-4 could not be sampled on June 11, 2009, because access to the well was blocked by construction around the well. Water quality monitoring well MW-8 could not be sampled on December 17, 2009, because there was insufficient water in the well to collect a sample.

SUMMARY OF DATA

Monitoring Wells Water Level Elevation Data

In Figure 1, the 2009 groundwater level elevation data for 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 monitoring wells are plotted to show the fluctuations in the water level elevations during 2009.

Similarly, in Figure 2, the 2009 groundwater elevation data for 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 monitoring wells are plotted to show the fluctuations in the water level elevation during 2009.

Water Quality Monitoring Wells Data

Table 1 contains summary statistics of the water quality parameters for the year 2009 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 2009 from water 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 (Std. Dev.), median, and coefficient of variation (Coeff. Var.) for the values of eight of the nine water quality parameters analyzed for 2009. The eight water quality parameters are: chloride (Cl), conductivity (Cond.), hardness as CaCO₃ (Hard.), ammonia nitrogen (NH₃-N), pH, sulfate (SO₄), 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. Median values were calculated using the Microsoft[®] Excel function MEDIAN. In instances where an even number of samples were collected and analyzed, the reported median is the average of the two numbers in the middle of the series.

FIGURE 1: 2009 MINIMUM, MEAN, AND MAXIMUM WATER LEVEL ELEVATIONS FOR THE UPPER DES PLAINES 20 TUNNEL SYSTEM MONITORING WELLS

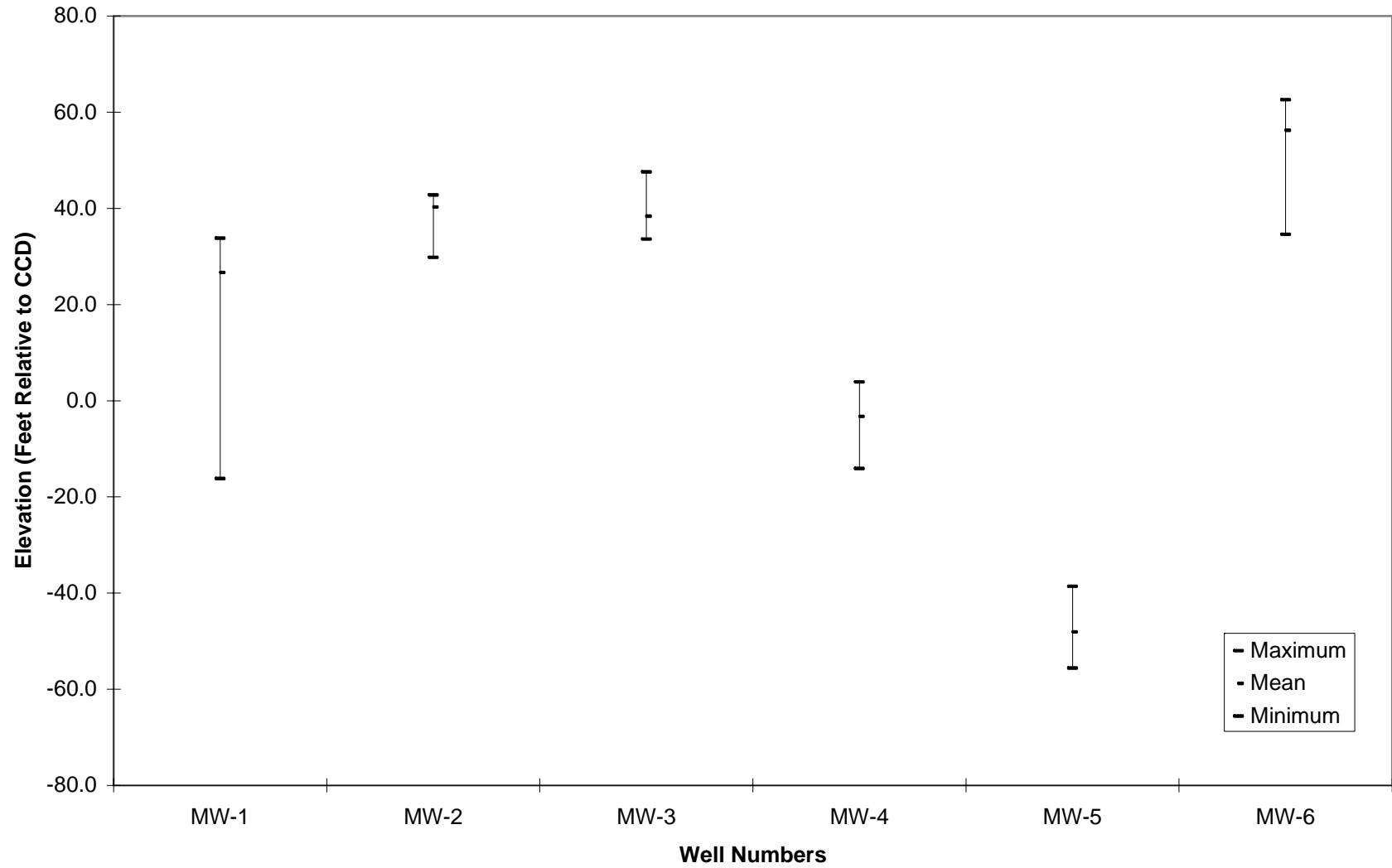


FIGURE 2: 2009 MINIMUM, MEAN, AND MAXIMUM WATER LEVEL ELEVATIONS FOR THE UPPER DES PLAINES 21 TUNNEL SYSTEM MONITORING WELLS

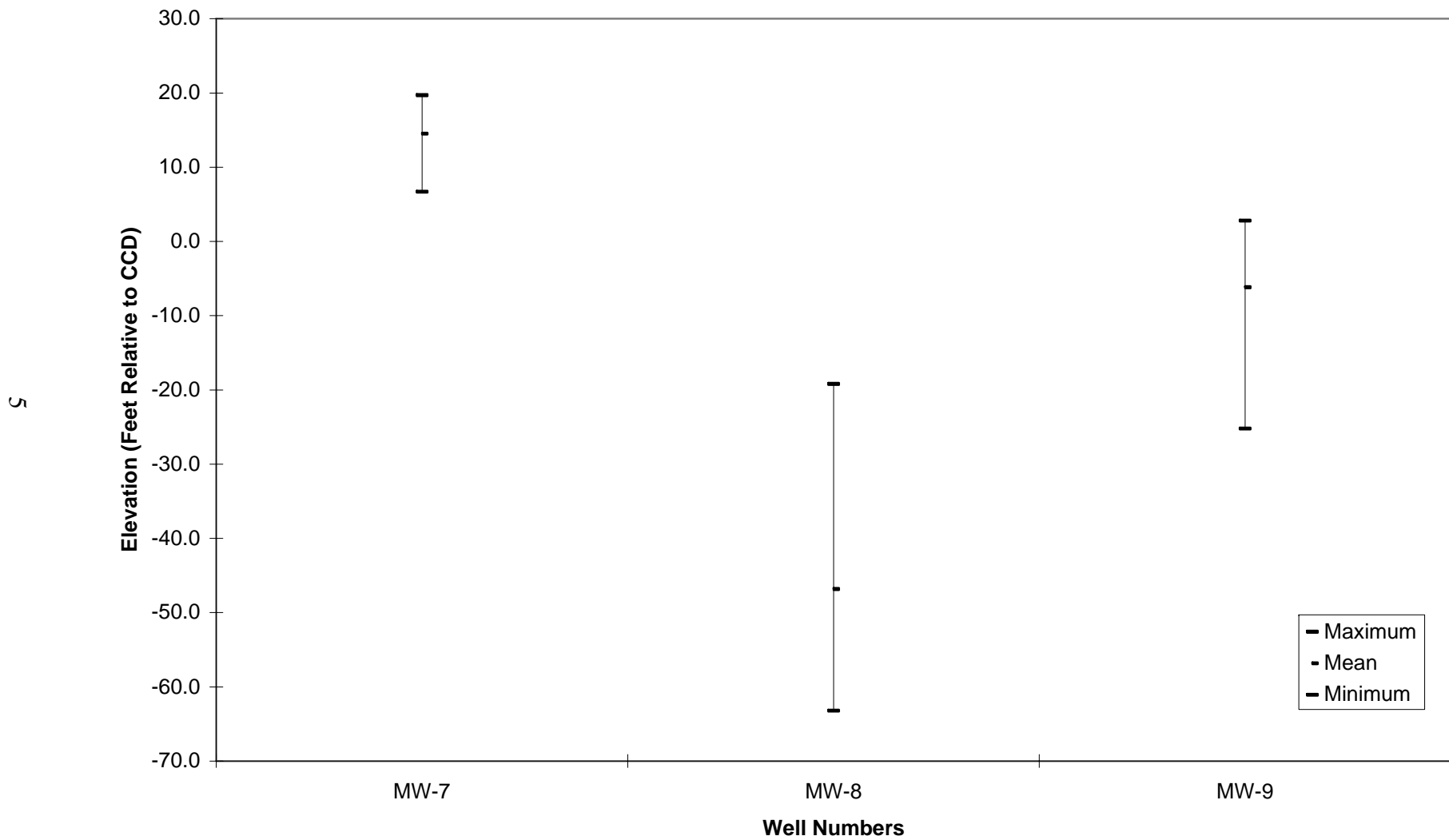


TABLE 1: SUMMARY STATISTICS FOR 2009 WATER QUALITY DATA FOR THE MONITORING WELLS IN UPPER DES PLAINES 20 TUNNEL SYSTEM: WELLS MW-1 THROUGH MW-6

Parameter ¹		Well Number					
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
Cl mg/L	Minimum	30	38	11	60	184	35
	Mean	35	260	16	65	279	40
	Maximum	41	1,149	21	68	597	43
	Std. Dev.	6	497	3	3	159	3
	Median	34	38	16	67	219	41
	Coeff. Var. (%)	16	191	21	5	57	7
FC cfu/100 mL	Minimum	1	1	1	1	1	1
	Geo. Mean	1	1	1	1	2	9
	Maximum	2	1	1	1	23	80
	Median	1	1	1	1	1	16
SO ₄ mg/L	Minimum	350	392	415	351	150	252
	Mean	353	401	431	365	272	297
	Maximum	356	409	456	389	390	326
	Std. Dev.	3	7	16	15	93	29
	Median	352	401	428	365	268	302
	Coeff. Var. (%)	1	2	4	4	34	10
NH ₃ -N mg/L	Minimum	0.26	0.56	0.31	0.04	0.02	0.40
	Mean	0.31	0.57	0.33	0.07	0.07	0.48
	Maximum	0.39	0.58	0.34	0.12	0.18	0.53
	Std. Dev.	0.07	0.01	0.01	0.03	0.06	0.05
	Median	0.28	0.57	0.33	0.07	0.06	0.48
	Coeff. Var. (%)	22.58	1.47	4.24	40.09	85.71	10.33
TOC mg/L	Minimum	1.0	1.0	1.0	1.0	1.0	1.1
	Mean	1.0	1.1	1.0	1.1	1.2	1.8
	Maximum	1.0	1.7	1.0	1.4	1.9	2.6
	Std. Dev.	0.0	0.3	0.0	0.2	0.4	0.6
	Median	1.0	1.0	1.0	1.0	1.0	1.8
	Coeff. Var. (%)	0.0	27.5	0.0	16.6	30.3	32.1

TABLE 1 (Continued): SUMMARY STATISTICS FOR 2009 WATER 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 mg/L	Minimum	830	818	806	914	810	664
	Mean	1,087	844	964	944	1,148	716
	Maximum	1,576	890	1,576	984	1,936	768
	Std. Dev.	423	29	301	26	436	39
	Median	856	838	854	940	939	724
	Coeff. Var. (%)	39	3	31	3	38	5
Hard. mg/L as CO ₃	Minimum	392	411	399	482	146	294
	Mean	414	436	416	500	226	331
	Maximum	425	469	433	516	304	372
	Std. Dev.	19	26	13	14	57	28
	Median	425	429	416	499	218	335
	Coeff. Var. (%)	5	6	3	3	25	8
Cond. µmhos/cm	Minimum	547	466	590	693	782	332
	Mean	597	569	625	734	999	592
	Maximum	630	665	662	802	1,340	845
	Std. Dev.	44	96	27	46	200	201
	Median	613	625	629	727	986	567
	Coeff. Var. (%)	7	17	4	6	20	34
pH unit	Minimum	7.5	7.4	7.4	7.1	7.3	7.6
	Mean	7.7	7.7	7.5	7.5	8.1	7.7
	Maximum	7.9	7.9	7.6	7.7	9.0	7.7
	Std. Dev.	0.2	0.2	0.1	0.2	0.6	0.1
	Median	7.7	7.6	7.6	7.6	8.1	7.7
	Coeff. Var. (%)	2.6	2.8	1.3	3.2	7.4	0.7

¹For purposes of statistical evaluation, any value less than the appropriate MDL or LOQ was set equal to the value of the MDL or LOQ.

TABLE 2: SUMMARY STATISTICS FOR 2009 WATER 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 mg/L	Minimum	34	35	31
	Mean	36	112	47
	Maximum	39	352	71
	Std. Dev.	2	135	17
	Median	36	58	40
	Coeff. Var. (%)	5	120	37
FC cfu/100 mL	Minimum	1	1	1
	Geo. Mean	2	3	1
	Maximum	11	12	1
	Median	1	1	1
SO ₄ mg/L	Minimum	385	139	302
	Mean	394	257	335
	Maximum	412	352	359
	Std. Dev.	10	80	20
	Median	391	284	339
	Coeff. Var. (%)	3	31	6
NH ₃ -N mg/L	Minimum	0.48	0.02	0.02
	Mean	0.51	0.16	0.34
	Maximum	0.54	0.42	0.43
	Std. Dev.	0.02	0.16	0.16
	Median	0.51	0.16	0.41
	Coeff. Var. (%)	3.79	102.32	46.73
TOC mg/L	Minimum	1.0	1.0	1.1
	Mean	1.0	1.1	1.2
	Maximum	1.2	1.3	1.4
	Std. Dev.	0.1	0.1	0.1
	Median	1.0	1.1	1.1
	Coeff. Var. (%)	7.9	11.1	11.2

TABLE 2 (Continued): SUMMARY STATISTICS FOR 2009 WATER QUALITY DATA FOR THE MONITORING WELLS IN UPPER DES PLAINES 21 TUNNEL SYSTEM: WELLS MW-7 THROUGH MW-9

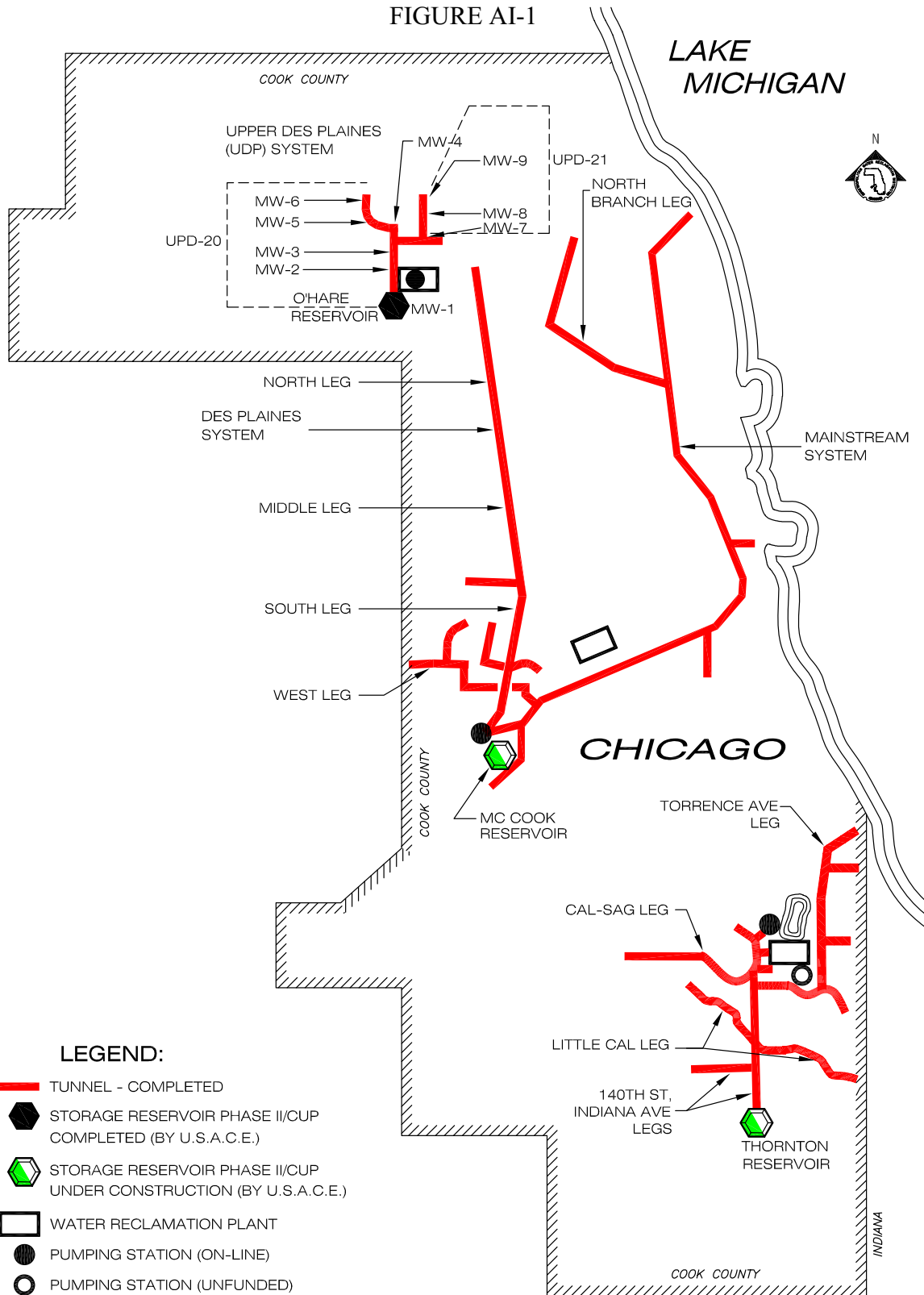
Parameter		Well Number		
		MW-7	MW-8	MW-9
TDS mg/L	Minimum	798	688	542
	Mean	861	944	877
	Maximum	926	1,536	1,536
	Std. Dev.	53	347	340
	Median	873	786	792
	Coeff. Var. (%)	6	37	39
Hard. mg/L as CO ₃	Minimum	446	211	347
	Mean	473	305	367
	Maximum	493	367	377
	Std. Dev.	18	60	11
	Median	474	318	369
	Coeff. Var. (%)	4	20	3
Cond. µmhos/cm	Minimum	530	597	540
	Mean	778	820	709
	Maximum	976	1,001	868
	Std. Dev.	180	170	129
	Median	794	895	687
	Coeff. Var. (%)	23	21	18
pH unit	Minimum	7.2	7.3	7.3
	Mean	7.5	8.1	7.7
	Maximum	7.7	8.6	8.0
	Std. Dev.	0.2	0.5	0.3
	Median	7.6	8.3	7.7
	Coeff. Var. (%)	2.3	6.7	3.6

¹For purposes of statistical evaluation, any value less than the appropriate MDL or LOQ was set equal to the value of the MDL or 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

2009 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: 2009 GROUNDWATER LEVEL ELEVATION* DATA FOR 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
1/9/09	**	**	**	**	**	**
1/23/09	**	***	**	**	**	**
2/4/09	29.8	40.8	**	**	**	60.6
2/26/09	27.8	38.8	43.6	-3.1	-47.6	57.6
3/6/09	27.8	38.8	39.6	1.9	-42.6	58.6
3/20/09	31.8	42.8	36.6	1.9	-47.6	61.6
4/3/09	32.8	40.8	34.6	-3.1	-47.6	58.6
4/16/09	31.8	40.8	41.6	-7.1	-48.6	39.6
4/29/09	32.8	40.8	39.6	-6.1	-46.6	34.6
5/1/09	18.8	40.8	39.6	-0.1	-45.6	34.6
5/22/09	30.8	41.8	37.6	-0.1	-48.6	57.6
5/29/09	31.8	40.8	36.6	-1.1	-49.6	58.6
6/12/09	-16.2	40.8	37.6	-5.1	-55.6	61.6
6/26/09	29.8	39.8	38.6	-1.1	-46.6	58.6
7/10/09	31.8	40.8	36.6	-3.1	-38.6	58.6
7/24/09	30.8	40.8	38.6	-6.1	-48.6	57.6
8/7/09	29.8	38.8	37.6	-5.1	-51.6	55.6
8/21/09	31.8	41.8	36.6	-2.1	-49.6	58.6
8/28/09	33.8	40.8	46.6	3.9	-48.6	59.6
9/10/09	30.8	40.8	47.6	-6.1	-55.6	59.6
9/24/09	2.8	29.8	36.6	-11.1	-51.6	58.6
10/19/09	30.8	40.8	34.6	-14.1	-50.6	58.6
10/30/09	33.8	42.8	38.6	-5.1	-48.6	62.6
11/6/09	31.8	40.8	36.6	-5.1	-48.6	60.6
11/20/09	28.8	40.8	35.6	-1.1	-48.6	57.6
12/4/09	11.8	40.8	36.6	-3.1	-47.6	58.6
12/11/09	29.8	40.8	38.6	-1.1	-46.6	57.6
12/18/09	25.8	39.8	33.6	0.9	-40.6	56.6
Minimum	-16.2	29.8	33.6	-14.1	-55.6	34.6
Mean	26.7	40.3	38.4	-3.3	-48.1	56.3
Maximum	33.8	42.8	47.6	3.9	-38.6	62.6

*Elevations are in feet relative to Chicago City Datum.

**Snow blocked access to well.

***Construction blocked access to well.

TABLE AII-2: 2009 GROUNDWATER LEVEL ELEVATION* DATA FOR MONITORING WELLS MW-7 THROUGH MW-9 IN THE UPPER DES PLAINES 21 TUNNEL SYSTEM

Date	Observation Wells		
	MW-7	MW-8	MW-9
1/9/09	**	**	**
1/23/09	12.7	**	**
2/4/09	13.7	-45.2	-23.2
2/26/09	14.7	-54.2	-4.2
3/6/09	19.7	-35.2	**
3/20/09	14.7	-34.2	-23.2
4/3/09	14.7	-27.2	-2.2
4/16/09	12.7	-19.2	-3.2
4/29/09	15.7	-23.2	-8.2
5/1/09	17.7	-58.2	-13.2
5/22/09	6.7	-51.2	1.8
5/29/09	7.7	-50.2	2.8
6/12/09	19.7	-63.2	-3.2
6/26/09	19.7	-61.2	-3.2
7/10/09	12.7	-48.2	-2.2
7/24/09	18.7	-45.2	-25.2
8/7/09	11.7	-56.2	-2.2
8/21/09	14.7	-52.2	-2.2
8/28/09	15.7	-47.2	2.8
9/10/09	13.7	-57.2	-0.2
9/24/09	14.7	-55.2	1.8
10/19/09	17.7	-55.2	1.8
10/30/09	6.7	-50.2	-0.2
11/6/09	15.7	-48.2	2.8
11/20/09	14.7	-33.2	-23.2
12/4/09	14.7	-50.2	-3.2
12/11/09	14.7	-33.2	-25.2
12/18/09	15.7	-63.2	-0.2
Minimum	6.7	-63.2	-25.2
Mean	14.5	-46.8	-6.2
Maximum	19.7	-19.2	2.8

*Elevations are in feet relative to Chicago City Datum.

**Snow blocked access to well.

APPENDIX AIII

2009 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: 2009 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER 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	2/25/09	34	<1	350	0.39	<1.0	856
MW-1	6/11/09	41	2	356	0.28	<1.0	1,576
MW-1	9/24/09	30	<1	352	0.26	<1.0	830
MW-2	2/10/09	1,149	<1	401	0.57	1.7	890
MW-2	5/28/09			Well could not be sampled			
MW-2	6/10/09	38	<1	392	0.58	1.0	854
MW-2	9/10/09	38	<1	405	0.57	1.0	818
MW-2	11/24/09	39	<1	399	0.56	1.0	822
MW-2	12/16/09	38	<1	409	0.56	1.0	838
MW-3	4/2/09	16	<1	417	0.34	<1.0	806
MW-3	5/14/09	21	<1	456	0.33	1.0	852
MW-3	5/11/09	14	<1	441	0.34	<1.0	1,576
MW-3	7/11/09	18	<1	423	0.32	<1.0	882
MW-3	9/24/09	11	<1	415	0.31	<1.0	812
MW-3	12/2/09	16	<1	432	0.31	1.0	856
MW-4	4/2/09	67	<1	356	0.12	<1.0	940
MW-4	5/14/09	63	<1	389	0.06	<1.0	952
MW-4	6/11/09			Well could not be sampled			
MW-4	7/16/09	67	1	365	0.07	<1.0	984
MW-4	9/24/09	60	<1	351	0.04	<1.0	930
MW-4	12/2/09	68	1	365	0.08	1.4	914
MW-5	4/2/09	597	1	150	0.06	<1.0	1,378
MW-5	5/14/09	264	<1	390	<0.02	<1.0	988
MW-5	6/11/09	211	<1	309	0.02	<1.0	1,936
MW-5	7/19/09	189	23	354	0.18	1.9	886
MW-5	9/24/09	226	2	205	0.09	<1.0	890
MW-5	12/2/09	184	<1	227	0.05	1.3	810
MW-6	2/10/09	41	<1	252	0.40	2.6	664
MW-6	3/12/09	41	<1	288	0.45	2.1	718
MW-6	5/25/09	43	37	326	0.50	1.8	730
MW-6	6/24/09	35	80	278	0.46	1.7	678

TABLE AIII-1 (Continued): 2009 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER 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	7/29/09	37	16	315	0.53	1.2	738
MW-6	9/29/09	40	<1	319	0.52	1.1	768

¹The method detection limit (MDL) or limit of quantification (LOQ) is 10 mg/L for Cl (LOQ), 2.0 mg/L for SO₄ (LOQ), 0.02 mg/L NH₃-N (MDL), 1.0 mg/L for TOC (LOQ), and 40 mg/L for TDS (LOQ). The detection limit for the FC analysis using the membrane filter method varies with the actual sample volume analyzed.

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

TABLE AIII-2: 2009 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS MW-1 THROUGH MW-6 IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM

Well	Date of Sampling	Hard. as CO ₃ mg/L	Cond. ¹ μmhos/cm	pH ¹ unit	Temp. °C	Elevation ² Feet	Recharge ³ Hours	
MW-1	2/25/09	425	630	7.9	14.0	14	<48	
MW-1	6/11/09	392	547	7.7	14.0	9	<48	
MW-1	9/24/09	425	613	7.5	16.0	3	<48	
MW-2	2/10/09	458	665	7.4	14.0	37	<48	
MW-2	5/28/09	Well could not be sampled						
MW-2	6/10/09	429	466	7.9	14.0	43	<48	
MW-2	9/10/09	411	466	7.9	14.0	43	<48	
MW-2	11/24/09	414	625	7.6	13.0	37	<48	
MW-2	12/16/09	469	625	7.6	13.0	40	<48	
MW-3	4/2/09	418	638	7.4	12.0	-37	<48	
MW-3	5/14/09	399	620	7.6	15.0	39	<48	
MW-3	5/11/09	413	662	7.5	15.0	38	<48	
MW-3	7/11/09	433	590	7.6	15.0	39	<48	
MW-3	9/24/09	427	640	7.4	16.0	37	<48	
MW-3	12/2/09	405	601	7.6	14.0	39	<48	
MW-4	4/2/09	499	727	7.6	13.0	-7	<48	
MW-4	5/14/09	491	754	7.7	14.0	-9	<48	
MW-4	6/11/09	Well could not be sampled						
MW-4	7/16/09	482	802	7.1	15.0	-6	<48	
MW-4	9/24/09	513	693	7.6	13.0	6	<48	
MW-4	12/2/09	516	693	7.6	13.0	-2	<48	
MW-5	4/2/09	146	1,340	9.0	13.0	-55	<48	
MW-5	5/14/09	234	1,052	8.3	14.0	-57	<48	
MW-5	6/11/09	275	782	7.6	14.0	-56	<48	
MW-5	7/19/09	304	919	7.9	16.0	-57	<48	
MW-5	9/24/09	197	1,055	7.3	19.0	-56	<48	
MW-5	12/2/09	201	846	8.2	13.0	-56	<48	
MW-6	2/10/09	294	332	7.6	13.0	57	<4	
MW-6	3/12/09	336	441	7.6	13.0	57	<4	
MW-6	5/25/09	346	800	7.6	14.0	62	<4	
MW-6	6/24/09	306	532	7.7	14.0	61	<4	

TABLE AIII-2 (Continued): 2009 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS MW-1 THROUGH MW-6 IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM

Well	Date of Sampling	Hard. as CO ₃ mg/L	Cond. ¹ μmhos/cm	pH ¹ unit	Temp. °C	Elevation ² Feet	Recharge ³ Hours
MW-6	7/29/09	333	845	7.7	14.0	58	<4
MW-6	9/29/09	372	601	7.7	14.0	60	<4

¹Unfiltered samples, all others were filtered through 0.45 μm membrane.

²Water level elevations are relative to Chicago City Datum.

³Refers to elapsed time after initial drawdown before the well recovered sufficiently for sampling.

TABLE AIII-3: 2009 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR WATER QUALITY MONITORING WELLS MW-7 THROUGH MW-9 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-7	1/27/09	35	11	397	0.52	<1.0	898
MW-7	2/10/09	36	2	398	0.51	1.2	926
MW-7	5/28/09	39	<1	385	0.48	1.0	798
MW-7	9/10/09	37	<1	412	0.51	<1.0	876
MW-7	11/24/09	34	<1	386	0.51	<1.0	798
MW-7	12/16/09	35	<1	386	0.54	<1.0	870
MW-8	2/25/09	352	<1	139	0.16	1.0	966
MW-8	4/30/09	63	9	286	0.18	1.0	786
MW-8	6/11/09	35	<1	352	0.42	1.1	1,536
MW-8	7/16/09	58	12	225	<0.02	1.1	688
MW-8	9/24/09	51	1	284	<0.02	1.3	742
MW-8	12/17/09	Well could not be sampled					
MW-9	2/25/09	71	<1	323	0.42	1.1	844
MW-9	4/30/09	37	<1	347	0.42	1.1	810
MW-9	6/11/09	66	<1	302	<0.02	1.1	1,536
MW-9	7/16/09	43	<1	359	0.36	1.1	774
MW-9	9/24/09	34	<1	337	0.39	1.4	756
MW-9	12/17/09	31	<1	341	0.43	1.3	542

¹The method detection limit (MDL) or limit of quantification (LOQ) is 10 mg/L for Cl (LOQ), 2.0 mg/L for SO₄ (LOQ), 0.02 mg/L NH₃-N (MDL), 1.0 mg/L for TOC (LOQ), and 40 mg/L for TDS (LOQ). The detection limit for the FC analysis using the membrane filter method varies with the actual sample volume analyzed.

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

TABLE AIII-4: 2009 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR WATER QUALITY MONITORING WELLS MW-7 THROUGH MW-9 IN THE UPPER DES PLAINES 21 TUNNEL SYSTEM

Well	Date of Sampling	Hard. as CO ₃ mg/L	Cond. ¹ μmhos/cm	pH ¹ unit	Temp. °C	Elevation ² Feet	Recharge ³ Hours
MW-7	1/27/09	485	976	7.2	13.0	12	<4
MW-7	2/10/09	493	612	7.5	14.0	12	<4
MW-7	5/28/09	446	530	7.7	15.0	14	<4
MW-7	9/10/09	483	794	7.6	16.0	14	<4
MW-7	11/24/09	463	794	7.6	16.0	14	<4
MW-7	12/16/09	465	962	7.6	13.0	14	<4
MW-8	2/25/09	211	920	8.5	14.0	-54	<48
MW-8	4/30/09	318	895	7.8	14.0	-61	<48
MW-8	6/11/09	367	597	8.3	15.0	-60	<48
MW-8	7/16/09	289	1,001	7.3	15.0	-62	<48
MW-8	9/24/09	341	687	8.6	16.0	-60	<48
MW-8	12/17/09	Well could not be sampled					
MW-9	2/25/09	365	674	8.0	14.0	-4	<48
MW-9	4/30/09	371	868	7.7	14.0	0	<48
MW-9	6/11/09	367	620	8.0	14.0	0	<48
MW-9	7/16/09	347	853	7.6	14.0	-2	<48
MW-9	9/24/09	376	700	7.3	17.0	0	<48
MW-9	12/17/09	377	540	7.5	14.0	0	<48

¹Unfiltered samples, all others were filtered through 0.45 μm membrane.

²Water level elevations are relative to Chicago City Datum.

³Refers to elapsed time after initial drawdown before the well recovered sufficiently for sampling.