Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 12-28

TUNNEL AND RESERVOIR PLAN

UPPER DES PLAINES TUNNEL SYSTEM

2011 ANNUAL GROUNDWATER MONITORING REPORT

July 2012

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago
100 EAST ERIE STREET CHICAGO, ILLINOIS 60611-3154 312.751.5190 f: 312.751.5194

BOARD OF COMMISSIONERS
Terrence J. O'Brien
President
Barbara J. McGowan
Vice President
Cynthia M. Santos
Chairman of Finance
Michael A. Alvarez
Frank Avila
Patricia Horton
Kathleen Therese Meany
Debra Shore
Mariyana T. Spyropoulos

THOMAS C. GRANATO, Ph.D.
Director of Monitoring and Research Department
thomas.granato@mwrd.org

July 11, 2012

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, 2011 Annual Groundwater Monitoring Report

Enclosed are three copies of "Tunnel and Reservoir Plan, Upper Des Plaines Tunnel System, 2011 Annual Groundwater Monitoring Report."

Very truly yours,

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

TCG:DGM:lf
Enclosures
cc w/enc: Ms. Sally K. Swanson (USEPA Region V - WC15J) - (2)
Dr. O'Connor
Dr. Cox
Dr. Zhang
Dr. Kozak
Mr. MacDonald
Library
cc w/o enc: Ms. Sharma
Mr. Cohen

Metropolitan Water Reclamation District of Greater Chicago
100 East Erie Street Chicago, Illinois 60611-2803 (312) 751-5600

TUNNEL AND RESERVOIR PLAN
UPPER DES PLAINES TUNNEL SYSTEM
2011 ANNUAL GROUNDWATER MONITORING REPORT

Monitoring and Research Department
Thomas C. Granato, Director

July 2012

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

This report contains groundwater quality and elevation monitoring data for the year 2011 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 monitoring wells, MW-1 through MW-6, while UDP 21 contains three monitoring wells, MW-7 through MW-9. These nine 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). Groundwater elevations were monitored once every two weeks as required.

MONITORING DATA

Appendix AI contains a location map of the nine monitoring wells, MW-1 through MW-9, for the TARP UDP System (Figure AI-1). Table AII-1 in Appendix AII contains groundwater elevation data for the year 2011 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 groundwater quality data for the UDP 20 monitoring wells. Tables AIII-3 and AIII-4 in Appendix AIII contain groundwater quality data for the UDP 21 monitoring wells.

All of the monitoring wells in the UDP Tunnel system were visited for the required number of sampling events. However, in some instances the monitoring wells could not be sampled. Monitoring wells MW-2 and MW-5 could not be sampled during 2011, because both pumps were inoperable. Work orders have been issued to fix both pumps.

SUMMARY OF DATA

Monitoring Wells Groundwater Elevation Data

In Figure 1, the 2011 groundwater 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 groundwater elevations of all six monitoring wells are plotted to show the range of the groundwater elevations during 2011.

Similarly, in Figure 2, the 2011 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 groundwater elevations of all three monitoring wells are plotted to show the range of the groundwater elevation during 2011.

Groundwater Quality Monitoring Data

Table 1 contains summary statistics of the groundwater quality parameters for the year 2011 for the UDP 20 Tunnel System, and Table 2 contains summary statistics of the groundwater quality parameters for the same period for the UDP 21 Tunnel System. The summary statistics are calculated from the groundwater quality data collected in 2011 from monitoring wells MW-1 through MW-6 (UDP 20), and MW-7 through MW-9 (UDP 21). The summary statistics include the minimum, mean, maximum, standard deviation (Stdv), median, and coefficient of variation (COV) for eight groundwater quality parameters analyzed for 2011. These eight groundwater quality parameters are: chloride (Cl), conductivity (Cond.), hardness (Hard.) as calcium carbonate ($CaCO_3$), ammonia nitrogen (NH_3-N), pH, sulfate (SO_4), total dissolved solids (TDS), and total organic carbon (TOC). For a ninth parameter, fecal coliform (FC), the minimum, geometric mean (Geo. Mean), maximum, and median were calculated. The statistical analysis of the analytical data was conducted using Microsoft® Excel functions.

FIGURE 1: 2011 MINIMUM, MEAN, AND MAXIMUM GROUNDWATER ELEVATIONS FOR THE UPPER DES PLAINES 20 TUNNEL SYSTEM MONITORING WELLS

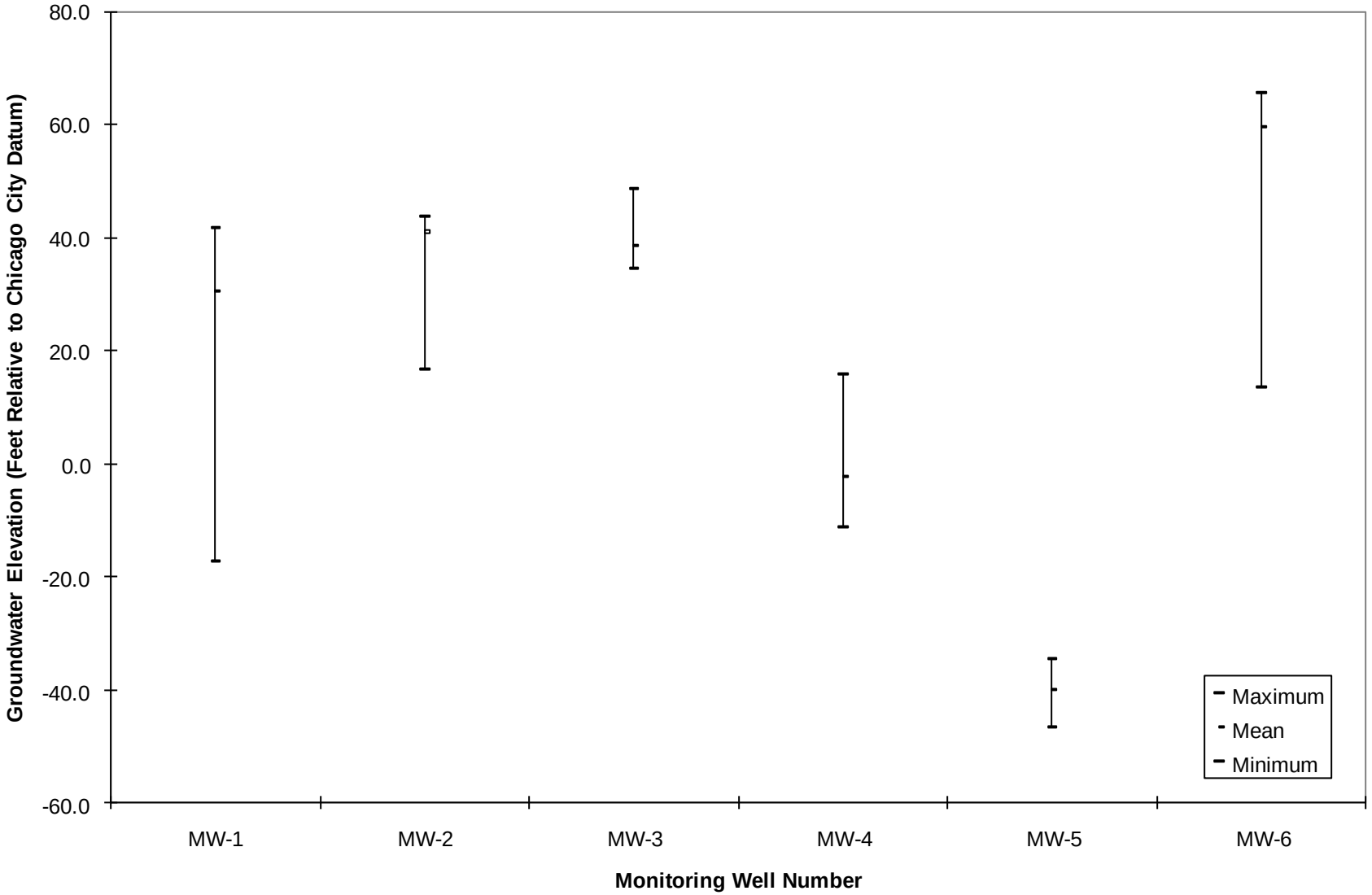


FIGURE 2: 2011 MINIMUM, MEAN, AND MAXIMUM GROUNDWATER ELEVATIONS FOR THE UPPER DES PLAINES 21 TUNNEL SYSTEM MONITORING WELLS

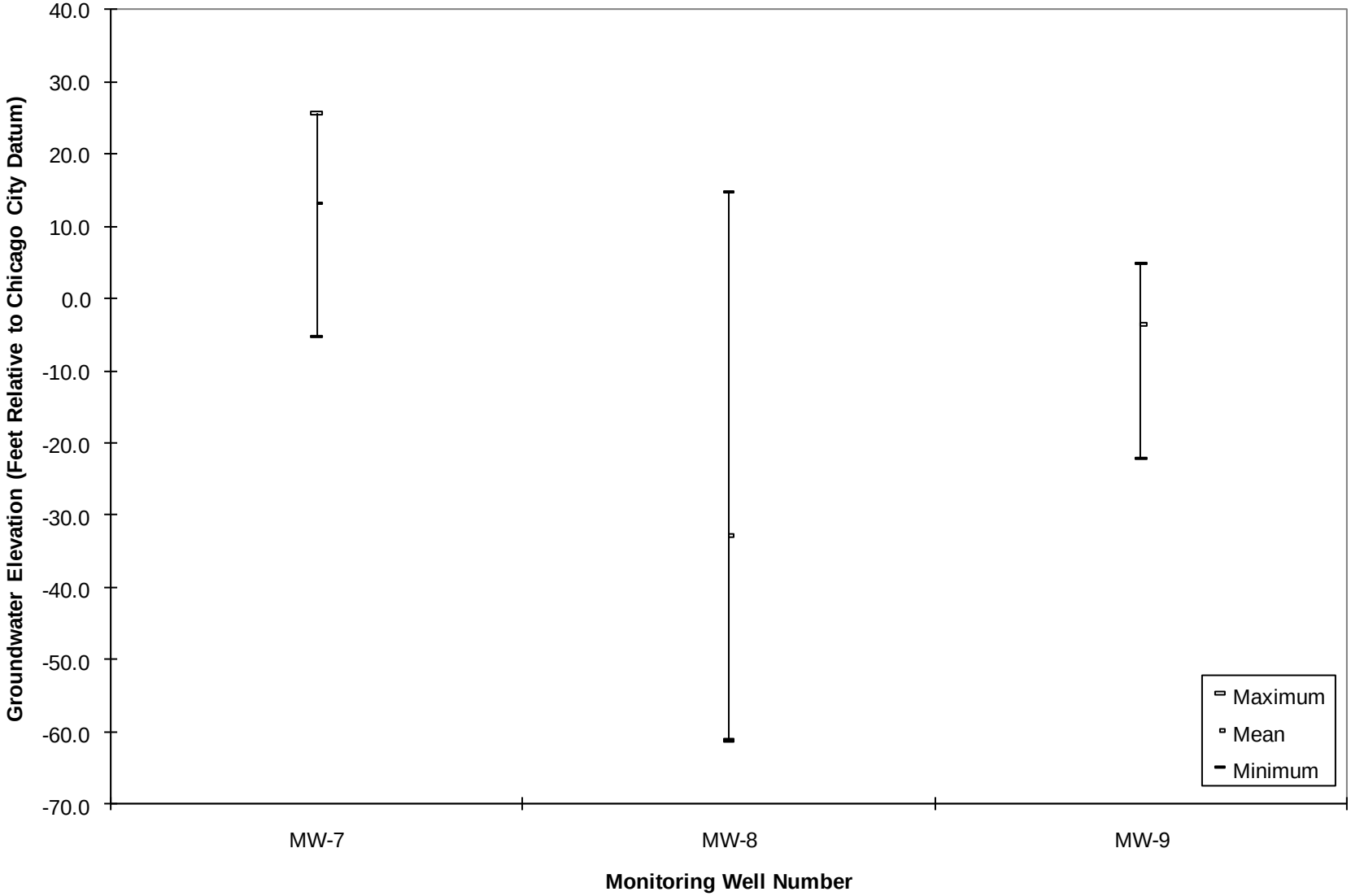


TABLE 1: SUMMARY STATISTICS FOR THE 2011 GROUNDWATER QUALITY DATA FOR THE MONITORING WELLS IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM: WELLS MW-1, MW-3, MW-4, AND MW-6

Parameter[1]		Monitoring Well Number			
		MW-1	MW-3	MW-4	MW-6
Cl	Minimum	31	12	59	29
mg/L	Mean	36	16	62	36
	Maximum	44	21	70	41
	Stdv	7	3	4	4
	Median	33	16	61	38
	COV	19	22	7	12
FC	Minimum	1	1	1	1
CFU/100 mL	Geo. Mean	2	2	1	3
	Maximum	11	6	2	52
	Median	1	1	1	1
SO_4	Minimum	331	398	354	259
mg/L	Mean	340	425	373	324
	Maximum	346	450	419	382
	Stdv	7	22	24	43
	Median	342	422	365	330
	COV	2	5	6	13
NH_3-N	Minimum	0.24	0.26	0.10	0.40
mg/L	Mean	0.29	0.32	0.11	0.49
	Maximum	0.36	0.36	0.14	0.55
	Stdv	0.06	0.04	0.02	0.06
	Median	0.26	0.33	0.10	0.51
	COV	22.43	12.63	15.31	13.10
TOC	Minimum	1.0	1.0	1.0	1.0
mg/L	Mean	1.0	1.0	1.0	1.3
	Maximum	1.1	1.1	1.0	2.1
	Stdv	0.1	0.04	0.0	0.4
	Median	1.0	1.0	1.0	1.1
	COV	5.6	4.0	0.0	33.7

TABLE 1 (Continued): SUMMARY STATISTICS FOR THE 2011 GROUNDWATER QUALITY DATA FOR THE MONITORING WELLS IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM: WELLS MW-1, MW-3, MW-4, AND MW-6

Parameter[1]		Monitoring Well Number			
		MW-1	MW-3	MW-4	MW-6
TDS	Minimum	750	804	922	710
mg/L	Mean	827	858	976	792
	Maximum	968	960	1,102	1,044
	Stdv	122	57	67	128
	Median	764	853	958	743
	COV	15	7	7	16
Hard.	Minimum	374	426	534	313
mg/L	Mean	409	441	551	366
	Maximum	435	456	560	384
	Stdv	31	11	9	26
	Median	418	444	555	375
	COV	8	3	2	7
Cond.	Minimum	649	460	644	396
µmhos/cm	Mean	702	676	805	583
	Maximum	770	967	1,042	913
	Stdv	62	199	179	183
	Median	688	636	735	557
	COV	9	29	22	31
pH	Minimum	7.1	7.1	7.4	7.2
unit	Mean	7.5	7.4	7.6	7.5
	Maximum	7.8	7.9	7.9	7.9
	Stdv	0.4	0.3	0.2	0.3
	Median	7.5	7.3	7.5	7.6
	COV	4.8	4.6	2.2	3.7

[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. Additionally, any FC concentration lower than the lower detection limit was set equal to the lower detection limit, and any FC concentration greater than the upper detection limit was set equal to the upper detection limit.

TABLE 2: SUMMARY STATISTICS FOR THE 2011 GROUNDWATER QUALITY DATA FOR THE MONITORING WELLS IN THE UPPER DES PLAINES 21 TUNNEL SYSTEM: WELLS MW-7 THROUGH MW-9

Parameter[1]		Monitoring Well Number MW-7	MW-8	MW-9
Cl	Minimum	36	18	31
mg/L	Mean	37	44	33
	Maximum	40	58	38
	Stdv	2	14	3
	Median	37	47	32
	COV	4	33	8
FC	Minimum	1	1	1
CFU/100 mL	Geo. Mean	5	2	1
	Maximum	5,100	33	1
	Median	1	1	1
SO_4	Minimum	324	200	289
mg/L	Mean	380	280	341
	Maximum	411	387	389
	Stdv	30	83	34
	Median	386	263	342
	COV	8	30	10
NH_3-N	Minimum	0.44	0.10	0.28
mg/L	Mean	0.52	0.10	0.34
	Maximum	0.55	0.10	0.43
	Stdv	0.04	0.00	0.06
	Median	0.53	0.10	0.31
	COV	7.81	0.00	19.14
TOC	Minimum	1.0	1.0	1.0
mg/L	Mean	1.0	1.0	1.0
	Maximum	1.0	1.0	1.1
	Stdv	0.0	0.0	0.04
	Median	1.0	1.0	1.0
	COV	0.0	0.0	4.0

TABLE 2 (Continued): SUMMARY STATISTICS FOR THE 2011 GROUNDWATER QUALITY DATA FOR THE MONITORING WELLS IN THE UPPER DES PLAINES 21 TUNNEL SYSTEM: WELLS MW-7 THROUGH MW-9

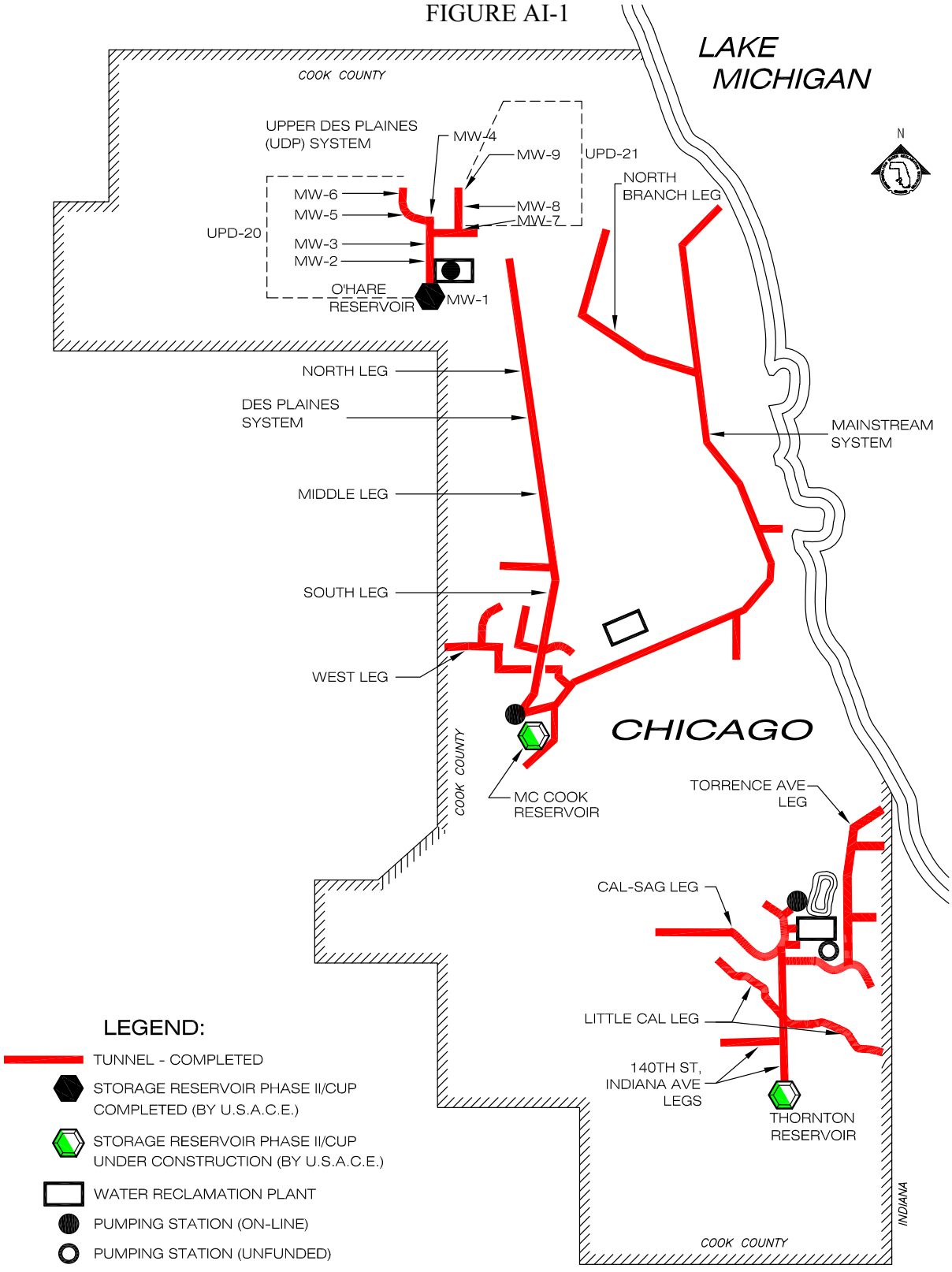
Parameter[1]		Monitoring Well Number MW-7	MW-8	MW-9
TDS	Minimum	842	498	702
mg/L	Mean	933	709	794
	Maximum	1,170	864	854
	Stdv	120	160	55
	Median	892	740	814
	COV	13	23	7
Hard.	Minimum	460	237	343
mg/L	Mean	495	343	388
	Maximum	522	466	430
	Stdv	21	103	35
	Median	495	330	394
	COV	4	30	9
Cond.	Minimum	505	480	473
µmhos/cm	Mean	694	745	677
	Maximum	999	1,210	810
	Stdv	182	255	117
	Median	672	708	701
	COV	26	34	17
pH	Minimum	7.0	8.0	7.5
unit	Mean	7.2	8.2	7.7
	Maximum	7.4	8.7	8.0
	Stdv	0.2	0.3	0.2
	Median	7.3	8.0	7.7
	COV	2.2	3.9	2.6

[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. Additionally, any FC concentration lower than the lower detection limit was set equal to the lower detection limit, and any FC concentration greater than the upper detection limit was set equal to the upper detection limit.

APPENDIX AI

LOCATION MAP OF 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 MONITORING WELLS

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

APPENDIX AII

2011 GROUNDWATER 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: 2011 GROUNDWATER ELEVATION* DATA FOR MONITORING WELLS MW-1, MW-3, MW-4, AND MW-6 IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM

Date	Monitoring Well Number					
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
1/7/11	33.8	41.8	36.6	-2.1	-41.6	61.6
1/28/11	34.8	42.8	40.6	-9.1	-40.6	63.6
2/4/11	**	42.8	**	**	**	**
2/18/11	-17.2	42.8	38.6	-3.1	-44.6	62.6
3/4/11	34.8	42.8	39.6	-2.1	-38.6	63.6
3/18/11	30.8	38.8	38.6	-3.1	-46.6	57.6
4/15/11	31.8	40.8	38.6	-3.1	-40.6	59.6
4/22/11	35.8	42.8	36.6	-1.1	-40.6	61.6
4/29/11	36.8	43.8	38.6	-1.1	-37.6	64.6
5/13/11	35.8	41.8	37.6	-2.1	-37.6	61.6
5/20/11	6.8	41.8	35.6	-11.1	-38.6	60.6
6/10/11	30.8	40.8	38.6	-0.1	-44.6	57.6
6/17/11	34.8	16.8	38.6	-3.1	-40.6	63.6
6/24/11	41.8	43.8	48.6	1.9	-37.6	64.6
7/8/11	35.8	42.8	38.6	-3.1	-39.6	63.6
7/15/11	35.8	41.8	38.6	-2.1	-41.6	64.6
8/17/11	7.8	42.8	35.6	-11.1	-38.6	59.6
8/24/11	36.8	41.8	37.6	-2.1	-38.6	61.6
9/2/11	36.8	42.8	38.6	-4.1	-41.6	63.6
9/29/11	33.8	39.8	38.6	-1.1	-34.6	57.6
10/14/11	32.8	40.8	34.6	-6.1	-34.6	58.6
10/27/11	36.8	42.8	38.6	-2.1	-38.6	13.6
11/15/11	36.8	42.8	36.6	-1.1	-41.6	61.6
11/18/11	27.8	39.8	38.6	-1.1	-43.6	57.6
12/9/11	39.8	43.8	45.6	15.9	-35.6	65.6
12/14/11	29.8	40.8	37.6	0.9	-41.6	58.6
Minimum	-17.2	16.8	34.6	-11.1	-46.6	13.6
Mean	30.5	41.0	38.6	-2.3	-40.0	59.6
Maximum	41.8	43.8	48.6	15.9	-34.6	65.6

*Groundwater elevations are in feet relative to Chicago City Datum.
**Snow blocked access to monitoring well.

TABLE AII-2: 2011 GROUNDWATER ELEVATION* DATA FOR MONITORING WELLS MW-7 THROUGH MW-9 IN THE UPPER DES PLAINES 21 TUNNEL SYSTEM

Date	Monitoring Well Number		
	MW-7	MW-8	MW-9
1/7/11	14.7	-29.2	-2.2
1/28/11	16.2	-33.2	-6.2
2/4/11	14.7	**	**
2/18/11	16.7	**	-3.2
3/4/11	15.7	9.8	-1.2
3/18/11	14.7	-25.2	-13.2
4/15/11	-5.3	-43.2	-5.2
4/22/11	14.7	-28.2	-1.2
4/29/11	17.7	-19.2	-0.2
5/13/11	16.7	-3.2	-0.2
5/20/11	16.7	-54.2	-2.2
6/10/11	15.7	-57.2	-11.2
6/17/11	14.7	-48.2	-1.2
6/24/11	6.7	14.8	-0.2
7/8/11	13.7	-47.2	-1.2
7/15/11	13.7	-48.2	-0.2
8/17/11	15.7	-54.2	-2.2
8/24/11	16.7	-3.2	-0.2
9/2/11	13.7	-45.2	-1.2
9/29/11	12.7	-41.2	0.8
10/14/11	13.7	-47.2	-0.2
10/27/11	13.7	-47.2	-0.2
11/15/11	14.7	-28.2	-0.2
11/18/11	2.7	-23.2	-20.2
12/9/11	25.7	-61.2	4.8
12/14/11	-5.3	-25.2	-22.2
Minimum	-5.3	-61.2	-22.2
Mean	13.1	-32.8	-3.6
Maximum	25.7	14.8	4.8

*Groundwater elevations are in feet relative to Chicago City Datum.
**Snow blocked access to monitoring well.

APPENDIX AIII

2011 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: 2011 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR MONITORING WELLS MW-1 THROUGH MW-6 IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM

Monitoring Well Number	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	3/31/11	33	<1	346	0.36	1.1	750
MW-1	7/14/11	31	<1	331	0.26	ND	968
MW-1	12/1/11	44	11	342	0.24	ND	764
MW-2	1/26/11	Monitoring well could not be sampled[3]					
MW-2	2/1/11	Monitoring well could not be sampled[3]					
MW-2	4/6/11	Monitoring well could not be sampled[3]					
MW-2	6/20/11	Monitoring well could not be sampled[3]					
MW-2	8/19/11	Monitoring well could not be sampled[3]					
MW-2	10/20/11	Monitoring well could not be sampled[3]					
MW-3	1/27/11	16	<1	450	0.34	ND	854
MW-3	3/31/11	19	<1	432	0.26	ND	852
MW-3	5/19/11	21	2	413	0.28	ND	872
MW-3	7/20/11	12	<1	398	0.35	1.1	960
MW-3	9/22/11	15	6	447	0.32	ND	804
MW-3	11/22/11	13	<1	407	0.36	ND	804
MW-4	1/27/11	70	<1	375	ND	ND	952
MW-4	3/31/11	60	<1	366	ND	ND	926
MW-4	5/19/11	59	<1	364	ND	ND	988
MW-4	7/20/11	59	<1	354	ND	ND	1,102
MW-4	9/22/11	62	2	419	ND	ND	964
MW-4	11/22/11	64	<1	359	0.14	ND	922
MW-5	1/27/11	Monitoring well could not be sampled[3]					
MW-5	3/31/11	Monitoring well could not be sampled[3]					
MW-5	5/19/11	Monitoring well could not be sampled[3]					
MW-5	7/20/11	Monitoring well could not be sampled[3]					
MW-5	9/22/11	Monitoring well could not be sampled[3]					
MW-5	11/22/11	Monitoring well could not be sampled[3]					
MW-6	1/26/11	39	<1	348	0.55	ND	740
MW-6	2/1/11	41	<1	337	0.53	ND	746
MW-6	4/6/11	34	<1	382	0.40	1.3	804

TABLE AIII-1 (Continued): 2011 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR MONITORING WELLS MW-1 THROUGH MW-6 IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM

Monitoring Well Number	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	6/20/11	37	7	293	0.48	1.0	1,044
MW-6	8/19/11	29	52	259	0.43	2.1	710
MW-6	10/20/11	38	1	324	0.55	1.2	710

ND = Not detected based on limit of quantification (LOQ).

[1]The LOQ is 10 mg/L for Cl, 15 mg/L for SO_4, 0.10 mg/L for NH_3-N, 1.0 mg/L for TOC, and 60 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 analyzed; all others were filtered through a 0.45-µm membrane prior to analysis.

[3]Monitoring well could not be sampled for reasons provided in text.

TABLE AIII-2: 2011 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR MONITORING WELLS MW-1 THROUGH MW-6 IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM

Monitoring Well Number	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] Unit	Temp.[1] °C	Groundwater Elevation[2] Feet	Recharge[3] Hours
MW-1	3/31/11	374	770	7.5	13.8	7.8	<48
MW-1	7/14/11	435	688	7.8	15.3	12.8	<48
MW-1	12/1/11	418	649	7.1	13.7	18.8	<48
MW-2	1/26/11	Monitoring well could not be sampled[4]					
MW-2	2/1/11	Monitoring well could not be sampled[4]					
MW-2	4/6/11	Monitoring well could not be sampled[4]					
MW-2	6/20/11	Monitoring well could not be sampled[4]					
MW-2	8/19/11	Monitoring well could not be sampled[4]					
MW-2	10/20/11	Monitoring well could not be sampled[4]					
MW-3	1/27/11	445	853	7.1	13.8	35.6	<48
MW-3	3/31/11	426	505	7.3	13.2	31.6	<48
MW-3	5/19/11	442	967	7.1	15.7	37.6	<48
MW-3	7/20/11	445	460	7.4	15.9	39.6	<48
MW-3	9/22/11	429	677	7.9	14.8	38.6	<48
MW-3	11/22/11	456	595	7.7	14.4	37.6	<48
MW-4	1/27/11	555	1,010	7.4	12.3	-16.1	<48
MW-4	3/31/11	534	674	7.6	13.3	-13.1	<48
MW-4	5/19/11	548	1,042	7.5	14.2	-7.1	<48
MW-4	7/20/11	556	666	7.4	14.9	-18.1	<48
MW-4	9/22/11	560	795	7.9	14.3	-7.1	<48
MW-4	11/22/11	555	644	7.7	13.4	-12.1	<48
MW-5	1/27/11	Monitoring well could not be sampled[4]					
MW-5	3/31/11	Monitoring well could not be sampled[4]					
MW-5	5/19/11	Monitoring well could not be sampled[4]					
MW-5	7/20/11	Monitoring well could not be sampled[4]					
MW-5	9/22/11	Monitoring well could not be sampled[4]					
MW-5	11/22/11	Monitoring well could not be sampled[4]					
MW-6	1/26/11	375	396	7.2	12.7	63.6	<4
MW-6	2/1/11	384	913	7.4	11.3	55.6	<4
MW-6	4/6/11	378	552	7.8	13.4	61.6	<4
MW-6	6/20/11	369	632	7.8	15.0	63.6	<4

TABLE AIII-2 (Continued): 2011 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR MONITORING WELLS MW-1 THROUGH MW-6 IN THE UPPER DES PLAINES 20 TUNNEL SYSTEM

Monitoring Well Number	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] Unit	Temp.[1] °C	Groundwater Elevation[2] Feet	Recharge[3] Hours
MW-6	8/19/11	313	443	7.3	16.4	59.6	<4
MW-6	10/20/11	374	561	7.9	13.1	57.6	<4

[1]Unfiltered samples analyzed; all others were filtered through a 0.45-µm membrane prior to analysis.
[2]Groundwater elevations are relative to Chicago City Datum.
[3]Refers to elapsed time after initial drawdown before the monitoring well recovered sufficiently for sampling.
[4]Monitoring well could not be sampled for reasons provided in text.

TABLE AIII-3: 2011 CHLORIDE, FECAL COLIFORM, SULFATE, AMMONIA NITROGEN, TOTAL ORGANIC CARBON, AND TOTAL DISSOLVED SOLIDS DATA FOR MONITORING WELLS MW-7 THROUGH MW-9 IN THE UPPER DES PLAINES 21 TUNNEL SYSTEM

Monitoring Well Number	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	1/26/11	36	<1	411	0.54	ND	892
MW-7	2/1/11	38	<1	394	0.52	ND	892
MW-7	4/13/11	36	<1	375	0.44	ND	872
MW-7	7/27/11	38	5,100	324	0.51	1.0	1,170
MW-7	9/8/11	40	2	399	0.54	1.0	928
MW-7	11/16/11	36	<1	377	0.55	1.0	842
MW-8	1/27/11	58	<1	361	ND	ND	864
MW-8	3/31/11	18	<1	208	ND	ND	570
MW-8	5/19/11	54	<1	313	ND	1.0	844
MW-8	7/14/11	44	33	214	ND	ND	640
MW-8	9/22/11	50	1	387	ND	ND	840
MW-8	12/1/11	38	1	200	ND	ND	498
MW-9	1/27/11	34	<1	346	0.40	1.0	756
MW-9	3/31/11	32	<1	362	0.29	1.0	818
MW-9	5/19/11	32	<1	337	0.32	1.1	826
MW-9	7/14/11	38	<1	289	0.28	ND	854
MW-9	9/22/11	32	<1	389	0.43	1.0	810
MW-9	12/1/11	31	<1	321	0.29	ND	702

ND = Not detected based on limit of quantification (LOQ).

[1]The LOQ is 10 mg/L for Cl, 15 mg/L for SO_4, 0.10 mg/L for NH_3-N, 1.0 mg/L for TOC, and 60 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 analyzed; all others were filtered through a 0.45-µm membrane prior to analysis.

TABLE AIII-4: 2011 HARDNESS, CONDUCTIVITY, pH, TEMPERATURE, ELEVATION, AND RECHARGE DATA FOR MONITORING WELLS MW-7 THROUGH MW-9 IN THE UPPER DES PLAINES 21 TUNNEL SYSTEM

Monitoring Well Number	Date of Sampling	Hard. mg/L	Cond.[1] µmhos/cm	pH[1] Unit	Temp.[1] °C	Groundwater Elevation[2] Feet	Recharge[3] Hours
MW-7	1/26/11	498	538	7.2	12.9	15.7	<4
MW-7	2/1/11	522	622	7.3	13.7	14.7	<4
MW-7	4/13/11	492	999	7.0	15.4	16.7	<4
MW-7	7/27/11	460	777	7.3	15.2	14.7	<4
MW-7	9/8/11	487	721	7.0	15.4	11.7	<4
MW-7	11/16/11	509	505	7.4	13.7	13.7	<4
MW-8	1/27/11	466	702	8.0	13.7	-30.2	<48
MW-8	3/31/11	253	1,210	8.7	14.0	-58.2	<48
MW-8	5/19/11	397	800	8.1	15.7	-53.2	<48
MW-8	7/14/11	263	564	8.0	16.7	-63.2	<48
MW-8	9/22/11	441	715	8.0	14.5	-30.2	<48
MW-8	12/1/11	237	480	8.6	14.2	-62.2	<48
MW-9	1/27/11	377	473	7.5	12.7	-5.2	<48
MW-9	3/31/11	430	810	7.8	12.9	-3.2	<48
MW-9	5/19/11	413	750	7.5	14.4	-0.2	<48
MW-9	7/14/11	343	707	7.6	14.3	-2.2	<48
MW-9	9/22/11	410	694	7.9	14.4	0.8	<48
MW-9	12/1/11	354	630	8.0	14.0	0.8	<48

[1]Unfiltered samples analyzed; all others were filtered through a 0.45-µm membrane prior to analysis.
[2]Groundwater elevations are relative to Chicago City Datum.
[3]Refers to elapsed time after initial drawdown before the monitoring well recovered sufficiently for sampling.