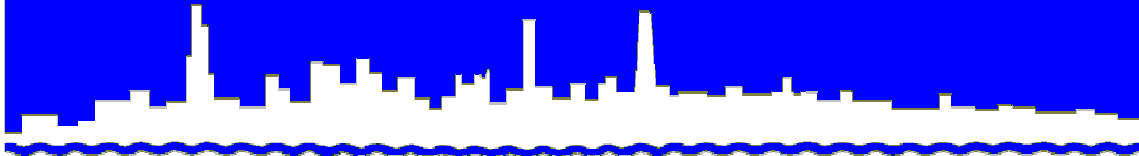


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***RESEARCH AND DEVELOPMENT
DEPARTMENT***

REPORT NO. 07-41

TUNNEL AND RESERVOIR PLAN

CALUMET TUNNEL SYSTEM

2006 ANNUAL GROUNDWATER MONITORING REPORT

July 2007

Terrence J. O'Brien
President
Kathleen Therese Meany
Vice President
Gloria Alitto Majewski
Chairman of Finance
Frank Avila
Patricia Horton
Barbara J. McGowan
Cynthia M. Santos
Debra Shore
Patricia Young

Metropolitan Water Reclamation District of Greater Chicago

100 EAST ERIE STREET CHICAGO, ILLINOIS 60611-3154 312-751-5600

Louis Kollias, P.E., BCEE
Director of Research and Development

312-751-5190

July 27, 2007

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, Calumet Tunnel System, 2006 Annual
Groundwater Monitoring Report

Enclosed are three copies of "Tunnel and Reservoir Plan, Calumet Tunnel System, 2006
Annual Groundwater Monitoring Report."

Very truly yours,

Louis Kollias
Director
Research and Development

LK:JSJ:lmf

Enclosures

cc w/enc: Ms. Sally K. Swanson (USEPA Region V—WC15J) (2)

Mr. Sobanski

Dr. Granato

Dr. O'Connor

Dr. Jain

Mr. MacDonald

Library

cc w/o enc: Mr. Jamjun

Ms. Nason

Metropolitan Water Reclamation District of Greater Chicago

100 East Erie Street Chicago, Illinois 60611-2803 312-751-5600

TUNNEL AND RESERVOIR PLAN
CALUMET TUNNEL SYSTEM
2006 ANNUAL GROUNDWATER MONITORING REPORT

TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES	ii
LIST OF FIGURES	iv
INTRODUCTION	1
Monitoring Data	1
Summary of Data	2
Observation Well Water Level Elevation Data	2
Water Quality Monitoring Well Data	2
APPENDICES	
AI—Location Map of Groundwater Observation Wells OC-1 Through OC-11 in the Calumet Tunnel System	AI-1
AII—2006 Groundwater Level Elevation Data for Observation Wells OC-1 Through OC-11 in the Calumet Tunnel System	AII-1
AIII—Location Map of Groundwater Quality Monitoring Wells QC-1, QC-2, QC-2.1, QC-2.2, QC-3 Through QC-7, and QC-9 Through QC-37 in the Calumet Tunnel System	AIII-1
AIV—2006 Groundwater Quality Data for Monitoring Wells QC-1, QC-2, QC-2.1, QC-2.2, QC-3 Through QC-7, and QC-9 Through QC-37 in the Calumet Tunnel System	AIV-1

LIST OF TABLES

<u>Table No.</u>		<u>Page</u>
1	Summary Statistics of the 2006 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-1, QC-2, QC-2.1, QC-2.2, and QC-3	3
2	Summary Statistics of the 2006 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-4, QC-5, QC-6, QC-7, and QC-9	5
3	Summary Statistics of the 2006 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-10 Through QC-14	7
4	Summary Statistics of the 2006 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-15 Through QC-19	9
5	Summary Statistics of the 2006 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-20 Through QC-24	11
6	Summary Statistics of the 2006 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-25 Through QC-29	13
7	Summary Statistics of the 2006 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-30 Through QC-34	15
8	Summary Statistics of the 2006 Data for the Water Quality Monitoring Wells in the Calumet Tunnel System: Wells QC-35 Through QC-37	17
AII-1	2006 Groundwater Level Elevation Data for Observation Wells OC-1 Through OC-11 in the Calumet Tunnel System	AII-1

LIST OF TABLES (Continued)

<u>Table No.</u>		<u>Page</u>
AIV-1	2006 pH, Conductivity, Temperature, Hardness, Ammonia Nitrogen, and Chloride Data for Water Quality Monitoring Wells QC-1, QC-2, QC-2.1, QC-2.2, QC-3 Through QC-7, and QC-9 Through QC-37 in the Calumet Tunnel System	AIV-1
AIV-2	2006 Sulfate, Total Organic Carbon, Total Dissolved Solids, Fecal Coliform, Water Elevation, and Recharge Data for Water Quality Monitoring Wells QC-1, QC-2, QC-2.1, QC-2.2, QC-3 Through QC-7, and QC-9 Through QC-37 in the Calumet Tunnel System	AIV-7

LIST OF FIGURES

<u>Figure No.</u>		<u>Page</u>
1	2006 Minimum, Mean, and Maximum Water Level Elevations for the Calumet Tunnel System Observation Wells	19
AI-1	Location Map of Groundwater Observation Wells OC-1 Through OC-11 in the Calumet Tunnel System	AI-1
AIII-1	Location Map of Groundwater Quality Monitoring Wells QC-1, QC-2, QC-2.1, QC-2.2, QC-3 Through QC-7, and QC-9 Through QC-37 in the Calumet Tunnel System	AIII-1

INTRODUCTION

This report contains 2006 data for the TARP Calumet Tunnel System compiled from the monitoring of the groundwater level elevations in the observation wells and monitoring of water quality in the water quality monitoring wells. The observation and monitoring wells are located along the Calumet Tunnel System. The tunnel between Crawford Avenue and the Calumet Water Reclamation Plant has four water quality wells (QC-1, QC-2, QC-2.1, and QC-2.2) and 11 observation wells (OC-1 through OC-11). The tunnel between 140th Street and Indiana Avenue has 17 water quality wells (QC-3 through QC-19). The tunnel on the Torrence Avenue leg has nine water quality wells (QC-20 through QC-28). The tunnel along the Little Calumet leg has nine water quality wells (QC-29 through QC-37).

Water quality monitoring wells QC-1, QC-2, and QC-29 through QC-37 are sampled six times per year (Illinois Environmental Protection Agency [IEPA] memorandum July 9, 2004). Water quality monitoring wells QC-2.1, QC-2.2, QC-3 through QC-7 (QC-8.1 is a dry well), and QC-9 through QC-28 are sampled three times per year (IEPA memoranda July 9, 2004, and February 23, 2006). Water level readings are taken at the same frequency. Groundwater observation wells OC-1 through OC-11 are sampled once every two weeks.

Monitoring Data

Appendix AI contains a location map of observation wells OC-1 through OC-11 located along the Calumet Tunnel System.

Table AII-1 in Appendix AII contains groundwater elevation data for 2006 for observation wells OC-1 through OC-11 shown in Appendix AI. Table AII-1 also contains the yearly minimum, mean, and maximum water level elevations of each observation well.

Appendix AIII contains a location map of the water quality monitoring wells QC-1, QC-2, QC-2.1, QC-2.2, QC-3 through QC-7, and QC-9 through QC-37 located along the Calumet Tunnel System.

Tables AIV-1 and AIV-2 in Appendix AIV contain water quality monitoring data for 2006 pertaining to the water quality wells QC-1, QC-2, QC-2.1, QC-2.2, and QC-3 through QC-37 (except for QC-8.1 which is a dry well) along the Calumet Tunnel System shown in Appendix AIII.

All of the wells in the Calumet system were visited for the required number of samples. However, in some instances the samples could not be collected. Water quality well QC-20 was not sampled on January 12, 2006, March 1, 2006, or April 3, 2006, because the pump fell into the well and could not be retrieved. Water quality well QC-2.1 could not be sampled on March 30, 2006, or April 13, 2006, because there was insufficient water in the well to collect a sample. Water quality wells QC-32 through QC-36 could not be sampled during 2006 because there was insufficient water in the wells to collect a sample. Water quality well QC-37 was not sampled on

January 26, 2006, April 20, 2006, June 15, 2006, August 23, 2006, or November 2, 2006, because there was insufficient water in the well.

Summary of Data

Observation Well Water Level Elevation Data. In Figure 1, the 2006 groundwater level elevation data for the observation wells (OC-1 through OC-11) of the Calumet Tunnel System have been plotted. In this figure, yearly minimum, mean, and maximum water level elevations of all 11 wells are plotted to show fluctuations in the water level elevations during 2006. Table AII-1 in Appendix AII contains the entire groundwater level elevation data for 2006 for all the observation wells in the Calumet Tunnel System.

Water Quality Monitoring Well Data. Tables 1 through 8 contain summary statistics of the water quality parameters for 2006 for water quality monitoring wells QC-1, QC-2, QC-2.1, QC-2.2, and QC-3 through QC-37 (except for well QC-8.1 which is a dry well) in the Calumet Tunnel System. These statistics were computed from the data collected from each water quality monitoring well in 2006. The summary statistics include minimum, mean, maximum, standard deviation (Std. Dev.), median and coefficient of variation (Coeff. Var.) for the nine water quality parameters analyzed during 2006. The nine water quality parameters are: chloride (Cl), conductivity (Cond.), fecal coliform (FC), hardness as CaCO₃ (Hard.), ammonia as NH₄⁺-N, pH, sulfate (SO₄), total dissolved solids (TDS), and total organic carbon (TOC).

TABLE 1: SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-1, QC-2, QC-2.1, QC-2.2, AND QC-3

Parameter		Well Number				
		QC-1	QC-2	QC-2.1	QC-2.2	QC-3
Cl, mg/L	Minimum	62	34	14	13	12
	Mean	69	36	14	20	17
	Maximum	72	38	14	31	23
	Std. Dev.	4	2	0	10	6
	Median	70	37	14	15	16
	Coeff. Var.	6	4	0	50	33
Cond., µmhos/cm	Minimum	330	254	356	251	345
	Mean	933	452	356	420	448
	Maximum	1177	583	356	559	650
	Std. Dev.	311	150	0	156	175
	Median	1003	521	356	450	349
	Coeff. Var.	33	33	0	37	39
FC, ¹ cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	108	1	1	1
	Maximum	4	6000	1	1	1
	Geo. Std. Dev.	1	20	0	0	0
	Median	1	213	1	1	1
	Coeff. Var.	97	19	0	0	0
Hard., as CaCO ₃ , mg/L	Minimum	503	87	46	48	65
	Mean	538	92	46	52	67
	Maximum	566	97	46	57	70
	Std. Dev.	23	4	0	5	3
	Median	542	91	46	52	66
	Coeff. Var.	4	4	0	9	4
NH ₄ ⁺ -N, mg/L	Minimum	0.24	0.27	0.34	0.03	0.35
	Mean	0.28	0.51	0.34	0.24	0.38
	Maximum	0.31	0.73	0.34	0.44	0.41
	Std. Dev.	0.03	0.17	0.00	0.21	0.03
	Median	0.29	0.51	0.34	0.25	0.37
	Coeff. Var.	11.32	34.20	0.00	85.49	8.11

TABLE 1 (Continued): SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-1, QC-2, QC-2.1, QC-2.2, AND QC-3

Parameter	Well Number					
	QC-1	QC-2	QC-2.1	QC-2.2	QC-3	
pH	Minimum	7.2	7.1	7.2	7.3	7.4
	Mean	7.5	7.8	7.2	7.7	7.9
	Maximum	7.9	8.5	7.2	8.2	8.4
	Std. Dev.	0.2	0.5	0.0	0.5	0.5
	Median	7.5	7.9	7.2	7.5	7.9
	Coeff. Var.	3.3	6.6	0.0	6.2	6.3
SO ₄ , mg/L	Minimum	224	24	40	3	25
	Mean	247	27	40	21	27
	Maximum	283	30	40	31	30
	Std. Dev.	20	3	0	16	3
	Median	245	28	40	30	26
	Coeff. Var.	8	11	0	74	10
TDS, mg/L	Minimum	746	312	366	306	388
	Mean	804	374	366	383	409
	Maximum	874	420	366	514	438
	Std. Dev.	51	44	0	114	26
	Median	796	383	366	330	402
	Coeff. Var.	6	12	0	30	6
TOC, mg/L	Minimum	1.3	1.1	1.2	1.1	0.4
	Mean	1.5	1.2	1.2	1.1	0.5
	Maximum	1.8	1.3	1.2	1.2	0.5
	Std. Dev.	0.2	0.1	0.0	0.1	0.1
	Median	1.5	1.3	1.2	1.1	0.5
	Coeff. Var.	10.6	6.6	0.0	5.1	12.4

¹For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

TABLE 2: SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-4, QC-5, QC-6, QC-7, AND QC-9

Parameter		Well Number				
		QC-4	QC-5	QC-6	QC-7	QC-9
Cl, mg/L	Minimum	1	24	14	2	1
	Mean	7	25	15	13	7
	Maximum	10	25	16	27	12
	Std. Dev.	5	1	1	13	6
	Median	10	25	16	10	9
	Coeff. Var.	74	2	8	98	78
Cond., µmhos/cm	Minimum	353	477	401	448	248
	Mean	479	666	553	641	387
	Maximum	697	962	777	813	526
	Std. Dev.	190	260	198	183	139
	Median	386	558	481	661	386
	Coeff. Var.	40	39	36	29	36
FC, ¹ cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	1	1	1	1
	Maximum	1	1	1	1	1
	Geo. Std. Dev.	0	0	0	0	0
	Median	1	1	1	1	1
	Coeff. Var.	0	0	0	0	0
Hard., as CaCO ₃ , mg/L	Minimum	10	10	18	11	58
	Mean	11	10	19	12	62
	Maximum	11	10	20	12	64
	Std. Dev.	1	0	1	1	3
	Median	11	10	19	12	63
	Coeff. Var.	5	0	5	5	5
NH ₄ ⁺ -N, mg/L	Minimum	0.06	0.07	0.24	0.18	0.14
	Mean	0.10	0.10	0.28	0.38	0.22
	Maximum	0.14	0.13	0.33	0.70	0.32
	Std. Dev.	0.04	0.03	0.05	0.28	0.09
	Median	0.11	0.10	0.28	0.25	0.19
	Coeff. Var.	39.11	30.00	15.91	74.92	42.88

TABLE 2 (Continued): SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-4, QC-5, QC-6, QC-7, AND QC-9

Parameter		Well Number				
		QC-4	QC-5	QC-6	QC-7	QC-9
pH	Minimum	7.7	7.5	7.4	8.5	7.4
	Mean	8.4	8.3	8.3	8.6	7.8
	Maximum	8.8	8.8	8.8	8.6	8.3
	Std. Dev.	0.6	0.7	0.8	0.1	0.5
	Median	8.8	8.6	8.7	8.6	7.6
	Coeff. Var.	7.5	8.4	9.4	0.7	6.1
SO ₄ , mg/L	Minimum	14	5	10	1	30
	Mean	16	6	11	2	31
	Maximum	18	7	12	2	32
	Std. Dev.	2	1	1	1	1
	Median	15	6	11	2	31
	Coeff. Var.	13	17	9	35	3
TDS, mg/L	Minimum	428	570	482	410	312
	Mean	435	578	487	453	345
	Maximum	442	588	494	512	364
	Std. Dev.	7	9	6	53	28
	Median	436	576	486	438	358
	Coeff. Var.	2	2	1	12	8
TOC, mg/L	Minimum	0.4	0.8	1.1	1.1	0.8
	Mean	0.5	0.9	1.2	1.2	0.8
	Maximum	0.5	1.2	1.2	1.4	0.8
	Std. Dev.	0.1	0.2	0.1	0.2	0.0
	Median	0.5	0.8	1.2	1.2	0.8
	Coeff. Var.	12.4	24.7	4.9	12.4	0.0

¹For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

TABLE 3: SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-10 THROUGH QC-14

Parameter		Well Number				
		QC-10	QC-11	QC-12	QC-13	QC-14
Cl, mg/L	Minimum	29	23	23	42	87
	Mean	33	28	33	43	95
	Maximum	37	36	38	45	103
	Std. Dev.	4	7	8	2	8
	Median	32	24	37	43	94
	Coeff. Var.	12	26	26	4	8
Cond., µmhos/cm	Minimum	369	312	526	334	442
	Mean	460	370	1031	515	780
	Maximum	621	454	1441	670	969
	Std. Dev.	140	74	465	169	294
	Median	390	345	1125	540	930
	Coeff. Var.	30	20	45	33	38
FC, ¹ cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	1	1	1	1
	Maximum	1	1	1	1	1
	Geo. Std. Dev.	0	0	0	0	0
	Median	1	1	1	1	1
	Coeff. Var.	0	0	0	0	0
Hard., as CaCO ₃ , mg/L	Minimum	11	20	229	36	111
	Mean	11	21	232	37	114
	Maximum	12	21	236	38	117
	Std. Dev.	1	1	4	1	3
	Median	11	21	230	36	115
	Coeff. Var.	5	3	2	3	3
NH ₄ ⁺ -N, mg/L	Minimum	0.02	0.06	0.23	0.11	0.13
	Mean	0.07	0.08	0.27	0.16	0.15
	Maximum	0.12	0.10	0.29	0.19	0.19
	Std. Dev.	0.05	0.02	0.03	0.04	0.03
	Median	0.07	0.08	0.28	0.18	0.14
	Coeff. Var.	71.43	25.00	12.05	27.24	20.96

TABLE 3 (Continued): SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-10 THROUGH QC-14

Parameter		Well Number				
		QC-10	QC-11	QC-12	QC-13	QC-14
pH	Minimum	7.7	7.5	7.3	7.4	7.4
	Mean	8.1	7.8	7.6	7.8	7.5
	Maximum	8.4	8.1	8.0	8.1	7.6
	Std. Dev.	0.4	0.3	0.4	0.4	0.1
	Median	8.2	7.8	7.6	7.8	7.5
	Coeff. Var.	4.5	3.8	4.6	4.5	1.3
SO ₄ , ² mg/L	Minimum	1	0.4	382	38	1
	Mean	1	1.1	394	42	1
	Maximum	1	2.0	405	45	2
	Std. Dev.	0	0.8	12	4	1
	Median	1	1.0	394	43	1
	Coeff. Var.	0	71.3	3	9	43
TDS, mg/L	Minimum	348	280	956	476	580
	Mean	391	286	972	502	656
	Maximum	436	292	998	520	714
	Std. Dev.	44	6	23	23	69
	Median	390	286	962	510	674
	Coeff. Var.	11	2	2	5	10
TOC, mg/L	Minimum	0.3	0.2	0.3	0.5	2.0
	Mean	0.4	0.3	0.4	0.6	2.2
	Maximum	0.4	0.4	0.5	0.7	2.3
	Std. Dev.	0.1	0.1	0.1	0.1	0.2
	Median	0.4	0.3	0.5	0.6	2.2
	Coeff. Var.	15.7	33.3	26.6	16.7	7.1

¹For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

²For purposes of statistical evaluation, SO₄ values less than 0.4 (the detection limit) were set equal to 0.4.

TABLE 4: SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-15 THROUGH QC-19

Parameter		Well Number				
		QC-15	QC-16	QC-17	QC-18	QC-19
Cl, mg/L	Minimum	21	22	14	2	1
	Mean	22	24	16	7	3
	Maximum	22	26	20	10	5
	Std. Dev.	1	2	3	4	2
	Median	22	23	15	8	2
	Coeff. Var.	3	9	20	62	78
Cond., µmhos/cm	Minimum	271	329	292	260	679
	Mean	399	648	608	474	695
	Maximum	473	823	780	583	722
	Std. Dev.	111	276	274	185	23
	Median	452	791	751	578	685
	Coeff. Var.	28	43	45	39	3
FC, ¹ cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	1	2	1	1
	Maximum	1	1	5	1	1
	Geo. Std. Dev.	0	0	1	0	0
	Median	1	1	1	1	1
	Coeff. Var.	0	0	135	0	0
Hard., as CaCO ₃ , mg/L	Minimum	14	77	169	7	113
	Mean	14	79	175	7	122
	Maximum	14	80	182	7	132
	Std. Dev.	0	2	7	0	10
	Median	14	79	173	7	120
	Coeff. Var.	0	2	4	0	8
NH ₄ ⁺ -N, ² mg/L	Minimum	0.09	0.02	0.23	0.02	0.20
	Mean	0.14	0.05	0.25	0.05	0.22
	Maximum	0.20	0.10	0.27	0.07	0.25
	Std. Dev.	0.06	0.04	0.02	0.03	0.03
	Median	0.12	0.03	0.25	0.06	0.20
	Coeff. Var.	41.61	87.18	8.00	52.92	13.32

TABLE 4 (Continued): SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-15 THROUGH QC-19

Parameter		Well Number				
		QC-15	QC-16	QC-17	QC-18	QC-19
pH	Minimum	8.0	7.2	7.6	8.4	8.2
	Mean	8.2	7.7	7.9	8.8	8.3
	Maximum	8.3	8.0	8.0	9.4	8.5
	Std. Dev.	0.2	0.4	0.2	0.5	0.2
	Median	8.3	7.8	8.0	8.7	8.3
	Coeff. Var.	2.1	5.4	2.9	5.8	1.8
SO ₄ , ³ mg/L	Minimum	0.4	59	164	35	167
	Mean	0.9	62	182	39	170
	Maximum	2.0	67	192	42	173
	Std. Dev.	0.9	4	16	4	3
	Median	0.4	60	191	39	171
	Coeff. Var.	99.0	7	9	9	2
TDS, mg/L	Minimum	292	530	500	362	474
	Mean	336	563	536	380	489
	Maximum	372	588	578	390	500
	Std. Dev.	41	30	39	16	13
	Median	344	572	530	388	492
	Coeff. Var.	12	5	7	4	3
TOC, mg/L	Minimum	0.8	0.5	0.6	0.3	0.5
	Mean	0.8	0.6	0.6	0.4	0.5
	Maximum	0.9	0.6	0.7	0.4	0.6
	Std. Dev.	0.1	0.1	0.1	0.1	0.1
	Median	0.8	0.6	0.6	0.4	0.5
	Coeff. Var.	6.9	10.2	9.1	15.7	10.8

¹For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

²For purposes of statistical evaluation, NH₄⁺-N values less than 0.02 (the detection limit) were set equal to 0.02.

³For purposes of statistical evaluation, SO₄ values less than 0.4 (the detection limit) were set equal to 0.4.

TABLE 5: SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-20 THROUGH QC-24

Parameter	Well Number					
	QC-20 ¹	QC-21	QC-22	QC-23	QC-24	
Cl, mg/L	Minimum	—	14	14	18	27
	Mean	—	18	14	20	27
	Maximum	—	24	15	21	28
	Std. Dev.	—	5	1	2	1
	Median	—	17	14	20	27
	Coeff. Var.	—	28	4	8	2
Cond., µmhos/cm	Minimum	—	314	259	346	258
	Mean	—	455	342	475	553
	Maximum	—	571	385	549	993
	Std. Dev.	—	130	72	112	389
	Median	—	480	383	530	407
	Coeff. Var.	—	29	21	24	70
FC, ² cfu/100 mL	Minimum	—	1	1	1	1
	Geo. Mean	—	1	1	1	1
	Maximum	—	1	1	1	1
	Geo. Std. Dev.	—	0	0	0	0
	Median	—	1	1	1	1
	Coeff. Var.	—	0	0	0	0
Hard., as CaCO ₃ , mg/L	Minimum	—	12	25	6	11
	Mean	—	17	26	6	12
	Maximum	—	26	27	6	12
	Std. Dev.	—	8	1	0	1
	Median	—	13	26	6	12
	Coeff. Var.	—	46	4	0	5
NH ₄ ⁺ -N, mg/L	Minimum	—	0.03	0.10	0.03	0.07
	Mean	—	0.07	0.18	0.09	0.11
	Maximum	—	0.15	0.32	0.21	0.18
	Std. Dev.	—	0.07	0.12	0.10	0.06
	Median	—	0.03	0.13	0.04	0.08
	Coeff. Var.	—	98.97	65.07	108.39	55.30

TABLE 5 (Continued): SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-20 THROUGH QC-24

Parameter		Well Number				
		QC-20 ¹	QC-21	QC-22	QC-23	QC-24
pH	Minimum	—	7.6	7.7	7.9	7.9
	Mean	—	8.2	8.2	8.7	8.4
	Maximum	—	8.8	8.6	9.5	9.0
	Std. Dev.	—	0.6	0.5	0.8	0.6
	Median	—	8.3	8.2	8.6	8.3
	Coeff. Var.	—	7.3	5.5	9.3	6.6
SO ₄ , ³ mg/L	Minimum	—	0.4	2	1	0.4
	Mean	—	6.8	2	1	0.9
	Maximum	—	19.0	3	1	2.0
	Std. Dev.	—	10.6	1	0	0.9
	Median	—	1.0	2	1	0.4
	Coeff. Var.	—	155.4	25	0	99.0
TDS, mg/L	Minimum	—	346	256	342	256
	Mean	—	367	269	363	271
	Maximum	—	380	278	380	298
	Std. Dev.	—	19	11	19	23
	Median	—	376	272	366	260
	Coeff. Var.	—	5	4	5	9
TOC, ⁴ mg/L	Minimum	—	0.8	0.5	0.2	0.2
	Mean	—	2.8	0.9	0.3	0.3
	Maximum	—	6.7	1.2	0.4	0.5
	Std. Dev.	—	3.4	0.4	0.1	0.2
	Median	—	1.0	1.1	0.3	0.3
	Coeff. Var.	—	118.2	40.6	33.3	45.8

¹No samples were obtained, the well was dry during 2006.

²For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

³For purposes of statistical evaluation, SO₄ values less than 0.4 (the detection limit) were set equal to 0.4.

⁴For purposes of statistical evaluation, TOC values less than 0.2 (the detection limit) were set equal to 0.2.

TABLE 6: SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-25 THROUGH QC-29

Parameter		Well Number				
		QC-25	QC-26	QC-27	QC-28	QC-29
Cl, mg/L	Minimum	14	12	31	15	89
	Mean	15	20	31	15	110
	Maximum	17	36	31	15	123
	Std. Dev.	2	14	0	0	13
	Median	15	13	31	15	114
	Coeff. Var.	10	67	0	0	12
Cond., µmhos/cm	Minimum	219	230	261	272	329
	Mean	309	320	321	324	918
	Maximum	356	449	427	426	1077
	Std. Dev.	78	115	92	88	291
	Median	351	280	275	275	1027
	Coeff. Var.	25	36	29	27	32
FC, ¹ cfu/100 mL	Minimum	1	1	1	1	1
	Geo. Mean	1	1	1	1	1
	Maximum	1	1	1	2	1
	Geo. Std. Dev.	0	0	0	1	0
	Median	1	1	1	1	1
	Coeff. Var.	0	0	0	46	0
Hard., as CaCO ₃ , mg/L	Minimum	18	7	25	16	189
	Mean	18	7	26	16	222
	Maximum	18	7	27	16	249
	Std. Dev.	0	0	1	0	23
	Median	18	7	26	16	225
	Coeff. Var.	0	0	4	0	10
NH ₄ ⁺ -N, ² mg/L	Minimum	0.07	0.02	0.07	0.02	0.48
	Mean	0.14	0.05	0.15	0.02	0.54
	Maximum	0.29	0.09	0.29	0.02	0.61
	Std. Dev.	0.13	0.04	0.12	0.00	0.05
	Median	0.07	0.03	0.09	0.02	0.53
	Coeff. Var.	88.62	81.13	81.10	0.00	8.67

TABLE 6 (Continued): SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-25 THROUGH QC-29

Parameter		Well Number				
		QC-25	QC-26	QC-27	QC-28	QC-29
pH	Minimum	7.6	7.7	7.8	7.6	7.4
	Mean	8.3	8.3	8.1	8.1	7.7
	Maximum	8.8	9.3	8.5	8.8	7.9
	Std. Dev.	0.6	0.9	0.4	0.6	0.2
	Median	8.6	8.0	7.9	8.0	7.7
	Coeff. Var.	7.7	10.2	4.7	7.5	2.4
SO ₄ , ³ mg/L	Minimum	1	1	0.4	1	97
	Mean	1	1	0.8	1	111
	Maximum	2	1	1.0	1	124
	Std. Dev.	1	0	0.3	0	11
	Median	1	1	1.0	1	111
	Coeff. Var.	43	0	43.3	0	10
TDS, mg/L	Minimum	222	298	250	282	522
	Mean	245	337	299	319	622
	Maximum	264	388	346	342	714
	Std. Dev.	21	46	48	32	86
	Median	248	324	302	332	639
	Coeff. Var.	9	14	16	10	14
TOC, ⁴ mg/L	Minimum	0.2	0.2	0.2	0.8	0.5
	Mean	0.3	0.2	0.3	1.0	0.8
	Maximum	0.4	0.2	0.3	1.3	1.2
	Std. Dev.	0.1	0.0	0.1	0.3	0.3
	Median	0.2	0.2	0.3	0.8	0.8
	Coeff. Var.	43.3	0.0	21.7	29.9	33.7

¹For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

²For purposes of statistical evaluation, NH₄⁺-N values less than 0.02 (the detection limit) were set equal to 0.02.

³For purposes of statistical evaluation, SO₄ values less than 0.4 (the detection limit) were set equal to 0.4.

⁴For purposes of statistical evaluation, TOC values less than 0.2 (the detection limit) were set equal to 0.2.

TABLE 7: SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-30 THROUGH QC-34

Parameter		Well Number				
		QC-30	QC-31	QC-32 ¹	QC-33 ¹	QC-34 ¹
Cl, mg/L	Minimum	10	17	—	—	—
	Mean	16	18	—	—	—
	Maximum	19	18	—	—	—
	Std. Dev.	3	0	—	—	—
	Median	16	18	—	—	—
	Coeff. Var.	19	2	—	—	—
Cond., µmhos/cm	Minimum	250	318	—	—	—
	Mean	502	688	—	—	—
	Maximum	648	913	—	—	—
	Std. Dev.	174	245	—	—	—
	Median	596	810	—	—	—
	Coeff. Var.	35	36	—	—	—
FC, ² cfu/100 mL	Minimum	1	1	—	—	—
	Geo. Mean	2	1	—	—	—
	Maximum	49	1	—	—	—
	Geo. Std. Dev.	19	0	—	—	—
	Median	1	1	—	—	—
	Coeff. Var.	804	0	—	—	—
Hard., as CaCO ₃ , mg/L	Minimum	55	219	—	—	—
	Mean	56	230	—	—	—
	Maximum	57	238	—	—	—
	Std. Dev.	1	8	—	—	—
	Median	56	232	—	—	—
	Coeff. Var.	2	3	—	—	—
NH ₄ ⁺ -N, ³ mg/L	Minimum	0.02	0.78	—	—	—
	Mean	0.14	0.86	—	—	—
	Maximum	0.27	0.94	—	—	—
	Std. Dev.	0.11	0.07	—	—	—
	Median	0.15	0.85	—	—	—
	Coeff. Var.	79.29	7.59	—	—	—

TABLE 7 (Continued): SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM:
WELLS QC-30 THROUGH QC-34

Parameter	Well Number					
	QC-30	QC-31	QC-32 ¹	QC-33 ¹	QC-34 ¹	
pH	Minimum	7.5	7.5	—	—	—
	Mean	7.9	7.6	—	—	—
	Maximum	8.5	7.8	—	—	—
	Std. Dev.	0.5	0.1	—	—	—
	Median	7.6	7.6	—	—	—
	Coeff. Var.	6.0	1.7	—	—	—
SO ₄ , mg/L	Minimum	55	152	—	—	—
	Mean	64	168	—	—	—
	Maximum	79	192	—	—	—
	Std. Dev.	8	14	—	—	—
	Median	63	165	—	—	—
	Coeff. Var.	13	8	—	—	—
TDS, mg/L	Minimum	204	520	—	—	—
	Mean	385	555	—	—	—
	Maximum	466	636	—	—	—
	Std. Dev.	103	41	—	—	—
	Median	435	544	—	—	—
	Coeff. Var.	27	7	—	—	—
TOC, mg/L	Minimum	0.7	0.7	—	—	—
	Mean	1.0	0.9	—	—	—
	Maximum	1.5	1.1	—	—	—
	Std. Dev.	0.3	0.1	—	—	—
	Median	0.9	0.9	—	—	—
	Coeff. Var.	29.7	15.0	—	—	—

¹No samples were obtained, the well was dry during 2006.

²For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

³For purposes of statistical evaluation, NH₄⁺-N values less than 0.02 (the detection limit) were set equal to 0.02.

TABLE 8: SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM: WELLS QC-35 THROUGH QC-37

Parameter		Well Number		
		QC-35 ¹	QC-36 ¹	QC-37
Cl, mg/L	Minimum	—	—	25
	Mean	—	—	25
	Maximum	—	—	25
	Std. Dev.	—	—	0
	Median	—	—	25
	Coeff. Var.	—	—	0
Cond., µmhos/cm	Minimum	—	—	710
	Mean	—	—	710
	Maximum	—	—	710
	Std. Dev.	—	—	0
	Median	—	—	710
	Coeff. Var.	—	—	0
FC, ² cfu/100 mL	Minimum	—	—	1
	Geo. Mean	—	—	1
	Maximum	—	—	1
	Geo. Std. Dev.	—	—	0
	Median	—	—	1
	Coeff. Var.	—	—	0
Hard., as CaCO ₃ , mg/L	Minimum	—	—	22
	Mean	—	—	22
	Maximum	—	—	22
	Std. Dev.	—	—	0
	Median	—	—	22
	Coeff. Var.	—	—	0
NH ₄ ⁺ -N, mg/L	Minimum	—	—	0.12
	Mean	—	—	0.12
	Maximum	—	—	0.12
	Std. Dev.	—	—	0.00
	Median	—	—	0.12
	Coeff. Var.	—	—	0.00

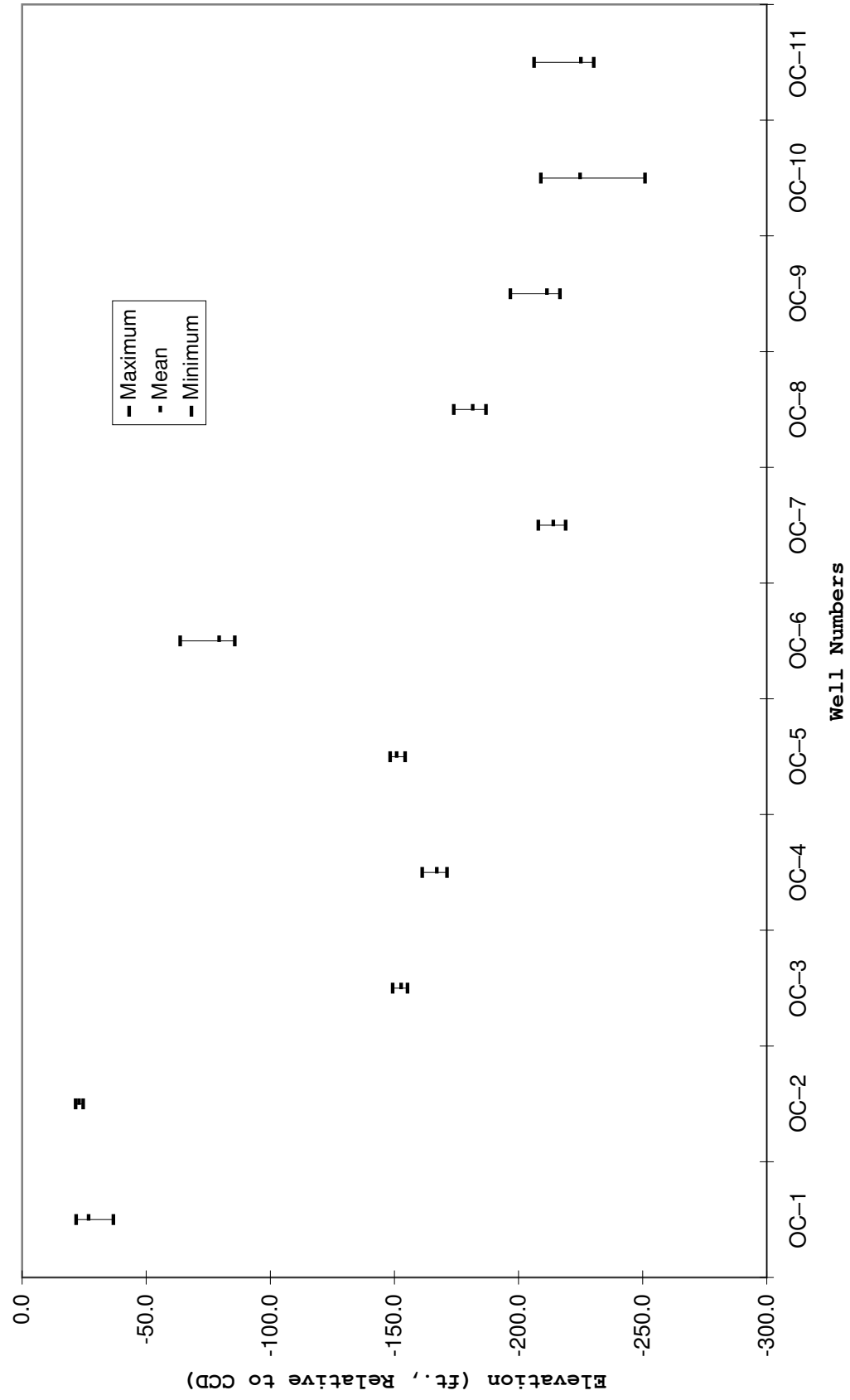
TABLE 8 (Continued): SUMMARY STATISTICS OF THE 2006 DATA FOR THE WATER QUALITY MONITORING WELLS IN THE CALUMET TUNNEL SYSTEM:
WELLS QC-35 THROUGH QC-37

Parameter	Well Number		
	QC-35 ¹	QC-36 ¹	QC-37
pH	Minimum	—	8.1
	Mean	—	8.1
	Maximum	—	8.1
	Std. Dev.	—	0.0
	Median	—	8.1
	Coeff. Var.	—	0.0
SO ₄ , mg/L	Minimum	—	121
	Mean	—	121
	Maximum	—	121
	Std. Dev.	—	0
	Median	—	121
	Coeff. Var.	—	0
TDS, mg/L	Minimum	—	1050
	Mean	—	1050
	Maximum	—	1050
	Std. Dev.	—	0
	Median	—	1050
	Coeff. Var.	—	0
TOC, mg/L	Minimum	—	4.5
	Mean	—	4.5
	Maximum	—	4.5
	Std. Dev.	—	0.0
	Median	—	5.0
	Coeff. Var.	—	0.0

¹No samples were obtained, the well was dry during 2006.

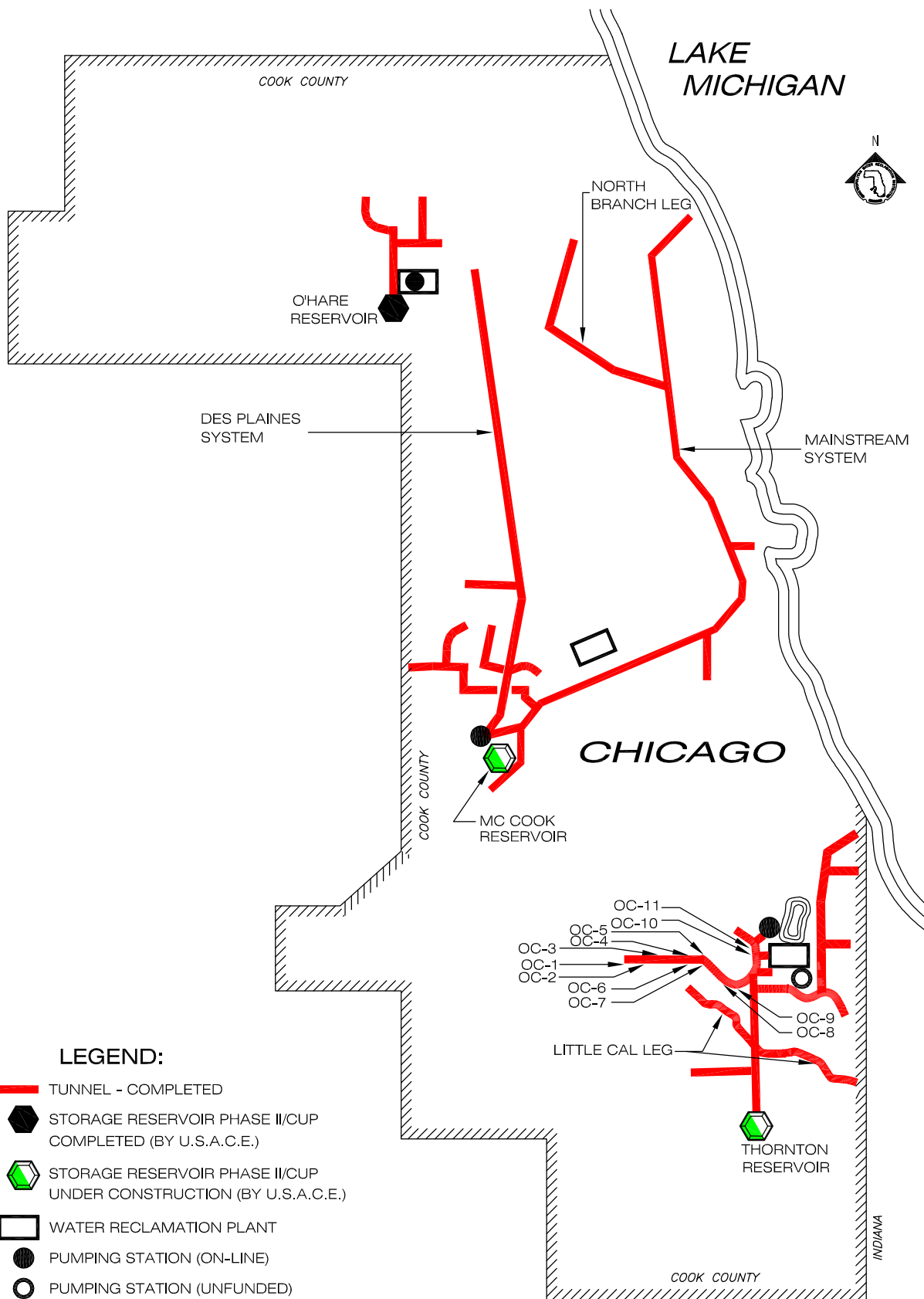
²For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.

FIGURE 1: 2006 MINIMUM, MEAN, AND MAXIMUM WATER LEVEL ELEVATIONS FOR THE CALUMET TUNNEL SYSTEM OBSERVATION WELLS



APPENDIX AI

LOCATION MAP OF GROUNDWATER OBSERVATION WELLS
OC-1 THROUGH OC-11
IN THE CALUMET TUNNEL SYSTEM



**CALUMET TUNNEL SYSTEM
LOCATION MAP OF
GROUNDWATER OBSERVATION WELLS**

METROPOLITAN WATER RECLAMATION
DISTRICT OF GREATER CHICAGO

APPENDIX AII

2006 GROUNDWATER LEVEL ELEVATION DATA
FOR OBSERVATION WELLS OC-1 THROUGH OC-11
IN THE CALUMET TUNNEL SYSTEM

TABLE AII-1: 2006 GROUNDWATER LEVEL ELEVATION* DATA FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM

Date	Observation Well					
	OC-1	OC-2	OC-3	OC-4	OC-5	OC-6
	feet					
1/13/06	-26.8	-22.6	-151.3	-169.2	-150.3	-79.7
1/27/06	-27.8	-23.6	-153.3	-167.7	-152.3	-79.7
2/10/06	-28.8	-24.6	-151.3	-167.2	-150.3	-79.7
2/17/06	-29.8	-22.6	-153.3	-168.2	-150.3	-80.7
2/24/06	-26.8	-22.6	-154.3	-167.2	-150.3	-81.7
3/10/06	-26.8	-22.6	-152.3	-166.2	-151.3	-78.7
3/24/06	-26.8	-24.6	-152.3	-171.2	-150.3	-78.7
4/7/06	-26.8	-23.6	-153.3	-167.2	**	-63.7
4/14/06	-25.8	-22.6	-152.8	-166.2	-151.3	-80.7
4/28/06	-25.8	-22.1	-152.3	-166.2	-150.8	-75.7
5/5/06	-25.8	-22.6	-152.3	-167.2	-151.3	-81.2
5/19/06	-25.8	-21.6	-154.3	-171.2	-151.3	-81.7
6/9/06	-25.8	-23.1	-153.8	-166.2	-150.3	-82.7
6/16/06	***	-23.6	-152.3	-167.2	-151.3	-80.7
6/23/06	***	-22.6	-152.3	-165.2	-150.3	-83.7
7/14/06	***	-24.6	-155.3	-169.2	-154.3	-85.7
7/28/06	-27.8	-23.6	-153.3	-166.2	-150.3	-78.7
8/11/06	-26.8	-22.6	-153.3	-167.2	-151.8	-80.7
8/25/06	-27.8	-22.6	-153.3	-166.2	-151.8	-80.7
9/7/06	-26.8	-23.6	-154.3	-165.2	*****	-81.7
9/22/06	-25.8	****	-150.3	-165.2	-148.3	-74.7
9/29/06	-26.8	-22.6	-153.3	-167.2	-150.3	-78.7
10/13/06	-25.8	****	-152.3	-166.2	-151.3	-79.7
10/20/06	-21.8	-23.6	-151.3	-167.2	-149.3	-81.7
11/3/06	-36.8	-23.6	-154.3	-168.2	-150.3	-80.7
11/24/06	-23.8	-21.6	-152.3	-169.2	-152.3	-79.7
12/8/06	-24.8	-21.6	-149.3	-161.2	-151.3	-80.7
12/22/06	-25.3	-22.6	-152.8	-166.2	-150.3	-71.7
Minimum	-36.8	-24.6	-155.3	-171.2	-154.3	-85.7
Mean	-26.8	-23.0	-152.7	-167.1	-150.9	-79.4
Maximum	-21.8	-21.6	-149.3	-161.2	-148.3	-63.7

TABLE AII-1 (Continued): 2006 GROUNDWATER LEVEL ELEVATION* DATA FOR OBSERVATION WELLS OC-1 THROUGH OC-11 IN THE CALUMET TUNNEL SYSTEM

Date	Observation Well				
	OC-7	OC-8	OC-9	OC-10	OC-11
	feet				
1/13/06	-212.0	-178.9	-210.7	-243.0	-226.3
1/27/06	-215.5	-179.9	-214.7	-251.0	-228.8
2/10/06	-214.0	-176.9	-212.7	-244.0	-226.3
2/17/06	-213.0	-180.9	-212.7	-243.0	-230.3
2/24/06	-216.0	-179.9	-209.7	-224.0	-229.3
3/10/06	-215.0	-178.9	-213.7	-249.0	-228.8
3/24/06	-216.0	-185.9	-209.7	-222.0	-226.3
4/7/06	-215.0	-182.9	-213.7	-223.0	-227.3
4/14/06	-214.5	-182.9	-213.7	-223.0	-227.3
4/28/06	-213.0	-179.9	-213.7	-222.0	-226.3
5/5/06	-214.0	-182.9	-213.7	-218.0	-226.8
5/19/06	-219.0	-181.9	-208.7	-225.0	-226.3
6/9/06	-214.0	-181.9	-212.7	-225.0	-228.3
6/16/06	-214.0	-180.9	-212.7	-219.0	-227.3
6/23/06	-219.0	-181.9	-212.7	-222.0	-226.3
7/14/06	-219.0	-186.9	-216.7	-223.0	-230.3
7/28/06	-214.0	-182.9	-213.7	-221.0	-228.3
8/11/06	-216.0	-181.9	-214.7	-225.0	-227.8
8/25/06	-217.0	-182.9	-215.7	-225.0	-227.3
9/7/06	-217.0	-182.9	-213.7	-223.0	-228.3
9/22/06	-209.0	-173.9	-212.7	-215.0	-224.3
9/29/06	-209.0	-179.9	-211.7	-217.0	-223.3
10/13/06	-216.0	-181.9	-213.7	-216.0	-224.3
10/20/06	-211.0	-181.9	-196.7	-215.0	-208.3
11/3/06	-213.0	-185.9	-214.7	-219.0	-225.3
11/24/06	-209.0	-186.9	-199.7	-217.0	-216.3
12/8/06	-208.0	-179.9	-198.7	-209.0	-206.3
12/22/06	-210.0	-179.9	-212.7	-216.5	-222.3
Minimum	-219.0	-186.9	-216.7	-251.0	-230.3
Mean	-214.0	-181.6	-211.5	-224.8	-225.2
Maximum	-208.0	-173.9	-196.7	-209.0	-206.3

*Relative to Chicago City Datum.

**Access to well blocked by fallen tree. Tree has been removed.

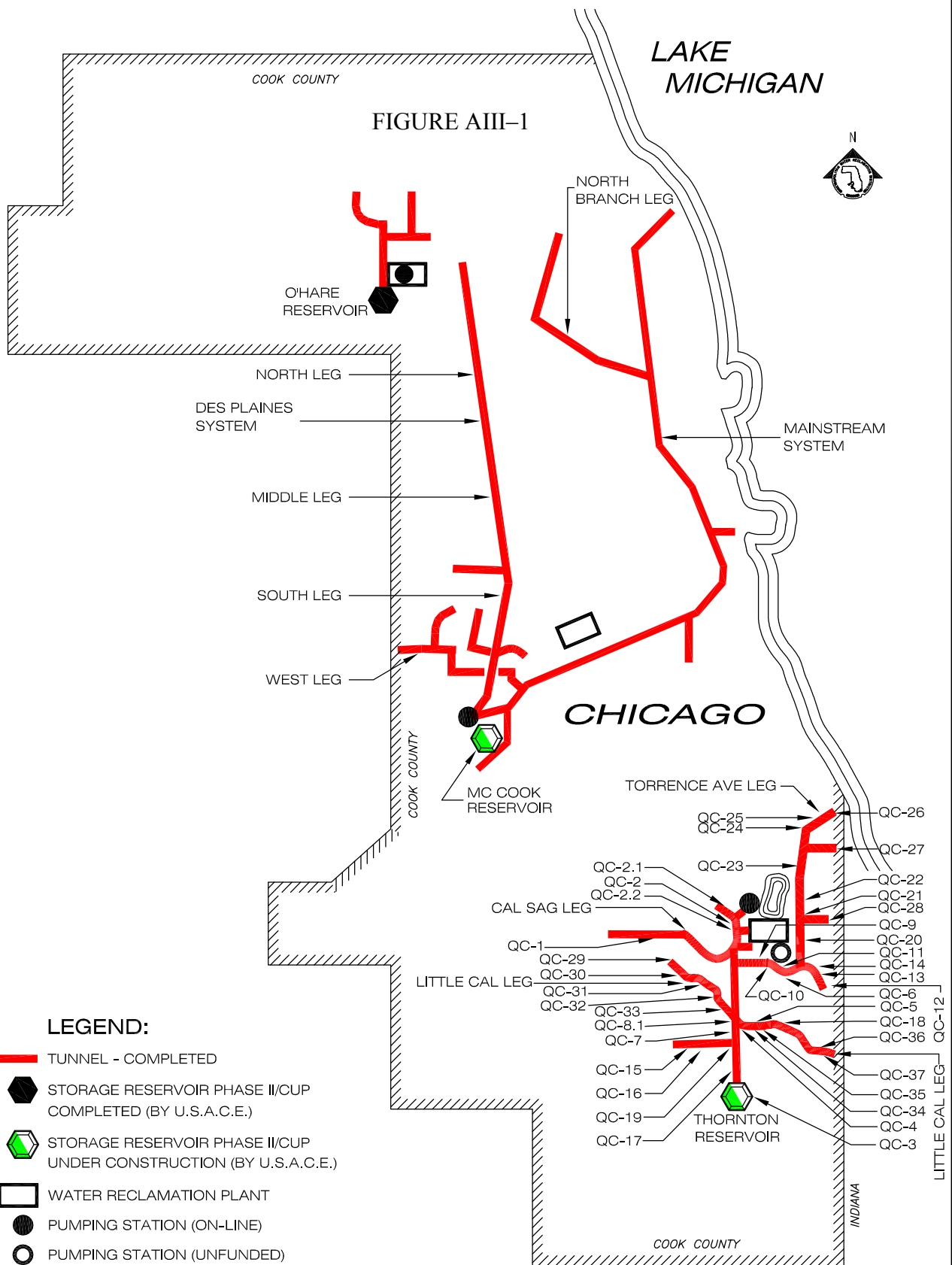
***Access to well blocked by piled-up debris.

****Gate locked, unable to access well.

*****Access road to well blocked.

APPENDIX AIII

LOCATION MAP OF GROUNDWATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM



**CALUMET TUNNEL SYSTEM
LOCATION MAP OF GROUNDWATER
QUALITY MONITORING WELLS**

METROPOLITAN WATER RECLAMATION
DISTRICT OF GREATER CHICAGO

APPENDIX AIV

2006 GROUNDWATER QUALITY DATA FOR MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

TABLE AIV-1: 2006 pH, CONDUCTIVITY, TEMPERATURE, HARDNESS, AMMONIA NITROGEN, AND CHLORIDE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	pH ¹	Cond. ¹ µmhos/cm	Temp. °C	Hard. as CaCO ₃ mg/L	NH ₄ ⁺ -N mg/L	Cl mg/L
QC-1	3/2/06	7.2	330	11	503	0.24	62
QC-1	3/30/06	7.5	993	13	555	0.26	66
QC-1	4/13/06	7.4	1177	13	566	0.31	68
QC-1	9/28/06	7.7	925	13	520	0.31	71
QC-1	10/26/06	7.4	1012	12	539	0.26	72
QC-1	12/7/06	7.9	1160	11	545	0.31	72
QC-2	3/2/06	7.1	254	12	87	0.41	35
QC-2	3/30/06	8.2	485	13	96	0.40	34
QC-2	4/13/06	7.6	583	14	97	0.27	36
QC-2	7/20/06	7.5	272	14	92	0.62	37
QC-2	9/28/06	8.1	558	14	89	0.61	38
QC-2	10/26/06	8.5	557	12	90	0.73	38
QC-2.1	3/2/06	7.2	356	11	46	0.34	14
QC-2.1	3/30/06			Well could not be sampled			
QC-2.1	4/13/06			Well could not be sampled			
QC-2.2	3/2/06	7.3	251	11	57	0.44	31
QC-2.2	3/30/06	8.2	450	13	48	0.25	13
QC-2.2	4/13/06	7.5	559	14	52	0.03	15
QC-3	5/18/06	7.4	349	12	70	0.41	16
QC-3	8/31/06	8.4	650	14	66	0.37	23
QC-3	11/9/06	7.9	345	13	65	0.35	12
QC-4	5/18/06	7.7	353	12	11	0.14	10
QC-4	8/31/06	8.8	697	15	11	0.06	1
QC-4	11/9/06	8.8	386	12	10	0.11	10
QC-5	5/18/06	7.5	477	12	10	0.13	25
QC-5	8/31/06	8.6	962	15	10	0.10	25
QC-5	11/9/06	8.8	558	13	10	0.07	24

TABLE AIV-1 (Continued): 2006 pH, CONDUCTIVITY, TEMPERATURE, HARDNESS, AMMONIA NITROGEN, AND CHLORIDE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	pH ¹	Cond. ¹ µmhos/cm	Temp. °C	Hard. as CaCO ₃ mg/L	NH ₄ ⁺ -N mg/L	Cl mg/L
QC-6	5/18/06	7.4	401	12	20	0.33	16
QC-6	8/31/06	8.8	777	15	19	0.28	16
QC-6	11/9/06	8.7	481	13	18	0.24	14
QC-7	5/17/06	8.6	813	14	12	0.70	27
QC-7	8/31/06	8.5	661	18	12	0.25	10
QC-7	11/9/06	8.6	448	13	11	0.18	2
QC-9	1/12/06	7.4	386	12	58	0.32	9
QC-9	5/17/06	8.3	526	14	64	0.19	<1
QC-9	7/20/06	7.6	248	14	63	0.14	12
QC-10	5/24/06	8.2	621	13	12	0.12	32
QC-10	8/23/06	7.7	390	14	11	0.02	29
QC-10	11/30/06	8.4	369	12	11	0.07	37
QC-11	1/5/06	7.5	345	12	20	0.08	23
QC-11	5/24/06	8.1	454	13	21	0.10	24
QC-11	8/23/06	7.8	312	13	21	0.06	36
QC-12	1/5/06	7.3	1125	12	229	0.29	37
QC-12	5/24/06	8.0	1441	14	230	0.28	38
QC-12	8/23/06	7.6	526	13	236	0.23	23
QC-13	1/5/06	7.4	540	12	36	0.18	42
QC-13	5/24/06	8.1	670	14	38	0.19	45
QC-13	6/8/06	7.8	334	13	36	0.11	43
QC-14	3/9/06	7.4	442	13	117	0.13	94
QC-14	7/27/06	7.6	930	16	115	0.19	103
QC-14	9/28/06	7.5	969	13	111	0.14	87

TABLE AIV-1 (Continued): 2006 pH, CONDUCTIVITY, TEMPERATURE, HARDNESS, AMMONIA NITROGEN, AND CHLORIDE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	pH ¹	Cond. ¹ µmhos/cm	Temp. °C	Hard. as CaCO ₃ mg/L	NH ₄ ⁺ -N mg/L	Cl mg/L
QC-15	3/9/06	8.0	271	12	14	0.12	22
QC-15	7/27/06	8.3	452	16	14	0.20	22
QC-15	9/28/06	8.3	473	13	14	0.09	21
QC-16	1/12/06	7.2	329	11	77	0.03	22
QC-16	8/31/06	8.0	823	14	80	0.10	23
QC-16	11/9/06	7.8	791	12	79	<0.02	26
QC-17	6/8/06	7.6	292	12	169	0.23	15
QC-17	7/27/06	8.0	751	14	182	0.27	14
QC-17	12/7/06	8.0	780	12	173	0.25	20
QC-18	3/9/06	8.4	260	12	7	<0.02	8
QC-18	7/27/06	8.7	583	14	7	0.07	2
QC-18	10/26/06	9.4	578	12	7	0.06	10
QC-19	5/25/06	8.5	685	14	120	0.25	5
QC-19	8/31/06	8.3	722	14	132	0.20	1
QC-19	11/9/06	8.2	679	12	113	0.20	2
QC-20	1/12/06			Well could not be sampled			
QC-20	3/1/06			Well could not be sampled			
QC-20	4/3/06			Well could not be sampled			
QC-21	5/25/06	8.8	480	15	12	0.15	17
QC-21	8/17/06	7.6	314	13	13	0.03	24
QC-21	11/9/06	8.3	571	13	26	0.03	14
QC-22	5/25/06	8.6	385	15	25	0.32	15
QC-22	8/17/06	7.7	259	14	26	0.13	14
QC-22	11/9/06	8.2	383	14	27	0.10	14

TABLE AIV-1 (Continued): 2006 pH, CONDUCTIVITY, TEMPERATURE, HARDNESS, AMMONIA NITROGEN, AND CHLORIDE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	pH ¹	Cond. ¹ μmhos/cm	Temp. °C	Hard. as CaCO ₃ mg/L	NH ₄ ⁺ -N mg/L	Cl mg/L
QC-23	5/25/06	8.6	530	13	6	0.21	21
QC-23	8/17/06	7.9	346	13	6	0.03	20
QC-23	11/9/06	9.5	549	13	6	0.04	18
QC-24	5/25/06	8.3	993	14	11	0.18	28
QC-24	8/17/06	7.9	258	13	12	0.07	27
QC-24	11/9/06	9.0	407	13	12	0.08	27
QC-25	5/25/06	8.6	356	14	18	0.29	17
QC-25	8/17/06	7.6	219	13	18	0.07	14
QC-25	11/9/06	8.8	351	13	18	0.07	15
QC-26	5/25/06	9.3	449	14	7	0.09	13
QC-26	8/17/06	7.7	230	13	7	0.03	12
QC-26	11/16/06	8.0	280	12	7	<0.02	36
QC-27	5/25/06	8.5	427	14	25	0.29	31
QC-27	8/17/06	7.8	261	13	26	0.09	31
QC-27	11/16/06	7.9	275	11	27	0.07	31
QC-28	5/25/06	8.8	426	16	16	0.02	15
QC-28	8/17/06	7.6	272	14	16	0.02	15
QC-28	11/16/06	8.0	275	11	16	<0.02	15
QC-29	1/26/06	7.4	1052	11	189	0.50	89
QC-29	3/9/06	7.7	1001	12	202	0.61	101
QC-29	4/19/06	7.5	1077	12	228	0.54	121
QC-29	6/15/06	7.8	986	14	221	0.56	113
QC-29	8/31/06	7.9	1061	14	249	0.48	115
QC-29	9/21/06	7.6	329	12	243	0.52	123
QC-30	1/26/06	8.5	648	12	55	0.09	16
QC-30	3/9/06	7.6	612	12	57	<0.02	16
QC-30	4/19/06	7.5	599	12	56	0.27	15

TABLE AIV-1 (Continued): 2006 pH, CONDUCTIVITY, TEMPERATURE, HARDNESS, AMMONIA NITROGEN, AND CHLORIDE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	pH ¹	Cond. ¹ μmhos/cm	Temp. °C	Hard. as CaCO ₃ mg/L	NH ₄ ⁺ -N mg/L	Cl mg/L
QC-30	6/15/06	8.4	593	15	57	0.21	17
QC-30	8/24/06	7.6	311	12	55	0.02	10
QC-30	9/21/06	7.5	250	12	55	0.24	19
QC-31	1/26/06	7.6	913	12	230	0.91	18
QC-31	3/9/06	7.5	837	12	234	0.78	18
QC-31	4/19/06	7.5	819	13	238	0.94	17
QC-31	6/15/06	7.8	800	16	235	0.89	18
QC-31	8/24/06	7.5	440	13	219	0.81	18
QC-31	9/21/06	7.7	318	12	221	0.81	18
QC-32	1/26/06						
QC-32	3/9/06						
QC-32	4/18/06						
QC-32	6/15/06						
QC-32	8/24/06						
QC-32	11/2/06						
QC-33	1/12/06						
QC-33	3/9/06						
QC-33	4/18/06						
QC-33	6/15/06						
QC-33	9/21/06						
QC-33	11/2/06						
QC-34	4/20/06						
QC-34	3/9/06						
QC-34	4/20/06						
QC-34	6/15/06						
QC-34	9/21/06						
QC-34	11/2/06						
QC-35	1/26/06						
QC-35	3/9/06						

TABLE AIV-1 (Continued): 2006 pH, CONDUCTIVITY, TEMPERATURE, HARDNESS, AMMONIA NITROGEN, AND CHLORIDE DATA FOR WATER QUALITY MONITORING WELLS QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37 IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	pH ¹	Cond. ¹ µmhos/cm	Temp. °C	Hard. as CaCO ₃ mg/L	NH ₄ ⁺ -N mg/L	Cl mg/L
QC-35	4/18/06			Well could not be sampled			
QC-35	6/15/06			Well could not be sampled			
QC-35	9/21/06			Well could not be sampled			
QC-35	11/2/06			Well could not be sampled			
QC-36	1/26/06			Well could not be sampled			
QC-36	4/20/06			Well could not be sampled			
QC-36	4/18/06			Well could not be sampled			
QC-36	6/15/06			Well could not be sampled			
QC-36	8/23/06			Well could not be sampled			
QC-36	11/2/06			Well could not be sampled			
QC-37	1/26/06			Well could not be sampled			
QC-37	3/9/06	8.1	710	14	22	0.12	25
QC-37	4/20/06			Well could not be sampled			
QC-37	6/15/06			Well could not be sampled			
QC-37	8/23/06			Well could not be sampled			
QC-37	11/2/06			Well could not be sampled			

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

TABLE AIV-2: 2006 SULFATE, TOTAL ORGANIC CARBON,
TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND
RECHARGE DATA FOR WATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-1	3/2/06	283	1.8	760	<1	-152	<48
QC-1	3/30/06	246	1.5	786	4	-161	<48
QC-1	4/13/06	243	1.5	806	<1	-161	<48
QC-1	9/28/06	224	1.5	746	<1	-163	<48
QC-1	10/26/06	239	1.3	874	<1	-167	<48
QC-1	12/7/06	247	1.5	852	<1	-163	<48
QC-2	3/2/06	30	1.3	412	<1	-277	<48
QC-2	3/30/06	24	1.2	334	390	-285	<48
QC-2	4/13/06	24	1.1	312	32	-278	<48
QC-2	7/20/06	30	1.2	400	35	-289	<48
QC-2	9/28/06	26	1.3	366	6000	-281	<48
QC-2	10/26/06	30	1.3	420	590	-273	<48
QC-2.1	3/2/06	40	1.2	366	<1	-295	<48
QC-2.1	3/30/06			Well could not be sampled			
QC-2.1	4/13/06			Well could not be sampled			
QC-2.2	3/2/06	3	1.2	514	<1	-278	<48
QC-2.2	3/30/06	30	1.1	330	1	-279	<48
QC-2.2	4/13/06	31	1.1	306	<1	-280	<48
QC-3	5/18/06	26	0.4	402	<1	-222	<48
QC-3	8/31/06	25	0.5	438	<1	-207	<48
QC-3	11/9/06	30	0.5	388	<1	-216	<48
QC-4	5/18/06	14	0.5	442	<1	-228	<48
QC-4	8/31/06	15	0.4	428	<1	-229	<48
QC-4	11/9/06	18	0.5	436	<1	-224	<48
QC-5	5/18/06	5	0.8	588	<1	-209	<48
QC-5	8/31/06	6	0.8	570	<1	-131	<48
QC-5	11/9/06	7	1.2	576	<1	-207	<48

TABLE AIV-2 (Continued): 2006 SULFATE, TOTAL ORGANIC CARBON,
TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND
RECHARGE DATA FOR WATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-6	5/18/06	10	1.2	486	<1	-206	<48
QC-6	8/31/06	11	1.1	494	<1	-207	<48
QC-6	11/9/06	12	1.2	482	<1	-201	<48
QC-7	5/17/06	2	1.1	438	<1	-178	<48
QC-7	8/31/06	2	1.4	512	<1	-163	<48
QC-7	11/9/06	1	1.2	410	<1	-175	<48
QC-9	1/12/06	31	0.8	358	<1	-239	<48
QC-9	5/17/06	30	0.8	312	<1	-246	<48
QC-9	7/20/06	32	0.8	364	<1	-247	<48
QC-10	5/24/06	1	0.4	436	<1	-220	<4
QC-10	8/23/06	1	0.3	390	<1	-223	<4
QC-10	11/30/06	1	0.4	348	<1	-209	<4
QC-11	1/5/06	2	0.3	280	<1	-219	<4
QC-11	5/24/06	1	0.4	286	<1	-220	<4
QC-11	8/23/06	<0.4	0.2	292	<1	-221	<4
QC-12	1/5/06	394	0.5	962	<1	-243	<4
QC-12	5/24/06	382	0.5	956	<1	-239	<4
QC-12	8/23/06	405	0.3	998	<1	-241	<4
QC-13	1/5/06	43	0.6	520	<1	-246	<48
QC-13	5/24/06	45	0.7	510	<1	-243	<48
QC-13	6/8/06	38	0.5	476	<1	-243	<48
QC-14	3/9/06	2	2.3	714	<1	-218	<48
QC-14	7/27/06	1	2.2	674	<1	-217	<48
QC-14	9/28/06	1	2.0	580	<1	-210	<48

TABLE AIV-2 (Continued): 2006 SULFATE, TOTAL ORGANIC CARBON,
TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND
RECHARGE DATA FOR WATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-15	3/9/06	2	0.9	372	<1	-229	<48
QC-15	7/27/06	<0.4	0.8	344	<1	-225	<48
QC-15	9/28/06	<0.4	0.8	292	<1	-221	<48
QC-16	1/12/06	60	0.5	572	<1	-214	<48
QC-16	8/31/06	59	0.6	588	<1	-254	<48
QC-16	11/9/06	67	0.6	530	<1	-254	<48
QC-17	6/8/06	164	0.6	530	<1	-160	<48
QC-17	7/27/06	192	0.6	500	<1	-157	<48
QC-17	12/7/06	191	0.7	578	5	-130	<48
QC-18	3/9/06	42	0.4	362	<1	-207	<48
QC-18	7/27/06	35	0.4	388	<1	-205	<48
QC-18	10/26/06	39	0.3	390	<1	-212	<48
QC-19	5/25/06	167	0.5	474	<1	-115	<48
QC-19	8/31/06	171	0.5	500	<1	-98	<48
QC-19	11/9/06	173	0.6	492	<1	-109	<48
QC-20	1/12/06			Well could not be sampled			
QC-20	3/1/06			Well could not be sampled			
QC-20	4/3/06			Well could not be sampled			
QC-21	5/25/06	1	1.0	346	<1	-266	<48
QC-21	8/17/06	<0.4	0.8	376	<1	-267	<48
QC-21	11/9/06	19	6.7	380	<1	-266	<48
QC-22	5/25/06	2	1.1	278	<1	-264	<48
QC-22	8/17/06	2	0.5	256	<1	-265	<48
QC-22	11/9/06	3	1.2	272	<1	-235	<48

TABLE AIV-2 (Continued): 2006 SULFATE, TOTAL ORGANIC CARBON,
TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND
RECHARGE DATA FOR WATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-23	5/25/06	1	0.4	366	<1	-239	<48
QC-23	8/17/06	1	<0.2	380	<1	-241	<48
QC-23	11/9/06	1	0.3	342	<1	-240	<48
QC-24	5/25/06	<0.4	1.0	260	<1	-233	<48
QC-24	8/17/06	2	<0.2	298	<1	-236	<48
QC-24	11/9/06	<0.4	0.3	256	<1	-234	<48
QC-25	5/25/06	1	0.2	264	<1	-235	<48
QC-25	8/17/06	1	<0.2	248	<1	-235	<48
QC-25	11/9/06	2	0.4	222	<1	-235	<48
QC-26	5/25/06	1	<0.2	298	<1	-230	<48
QC-26	8/17/06	1	0.2	324	<1	-231	<48
QC-26	11/16/06	1	<0.2	388	<1	-228	<48
QC-27	5/25/06	<0.4	0.3	302	<1	-210	<48
QC-27	8/17/06	1	<0.2	346	<1	-206	<48
QC-27	11/16/06	1	0.3	250	<1	-206	<48
QC-28	5/25/06	1	0.8	342	<1	-244	<48
QC-28	8/17/06	1	1.3	332	<2	-244	<48
QC-28	11/16/06	1	0.8	282	<1	-243	<48
QC-29	1/26/06	97	0.6	522	<1	-56	<48
QC-29	3/9/06	122	0.7	596	<1	-57	<48
QC-29	4/19/06	108	1.1	524	<1	-49	<48
QC-29	6/15/06	100	0.9	692	<1	-63	<48
QC-29	8/31/06	124	0.5	682	<1	-46	<48
QC-29	9/21/06	114	1.2	714	<1	-60	<48
QC-30	1/26/06	66	0.8	204	<1	-140	<48
QC-30	3/9/06	79	0.7	426	<1	-137	<48

TABLE AIV-2 (Continued): 2006 SULFATE, TOTAL ORGANIC CARBON,
TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND
RECHARGE DATA FOR WATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-30	4/19/06	61	0.9	322	4	-100	<48
QC-30	6/15/06	55	1.5	450	<1	-136	<48
QC-30	8/24/06	61	0.9	444	<1	-143	<48
QC-30	9/21/06	64	1.2	466	49	-143	<48
QC-31	1/26/06	164	0.9	520	<1	-89	<48
QC-31	3/9/06	192	0.9	534	<1	-87	<48
QC-31	4/19/06	166	0.9	636	<1	-87	<48
QC-31	6/15/06	152	0.8	542	<1	-98	<48
QC-31	8/24/06	160	0.7	552	<1	-92	<48
QC-31	9/21/06	175	1.1	546	<1	-90	<48
QC-32	1/26/06			Well could not be sampled			
QC-32	3/9/06			Well could not be sampled			
QC-32	4/18/06			Well could not be sampled			
QC-32	6/15/06			Well could not be sampled			
QC-32	8/24/06			Well could not be sampled			
QC-32	11/2/06			Well could not be sampled			
QC-33	1/12/06			Well could not be sampled			
QC-33	3/9/06			Well could not be sampled			
QC-33	4/18/06			Well could not be sampled			
QC-33	6/15/06			Well could not be sampled			
QC-33	9/21/06			Well could not be sampled			
QC-33	11/2/06			Well could not be sampled			
QC-34	4/20/06			Well could not be sampled			
QC-34	3/9/06			Well could not be sampled			
QC-34	4/20/06			Well could not be sampled			
QC-34	6/15/06			Well could not be sampled			
QC-34	9/21/06			Well could not be sampled			
QC-34	11/2/06			Well could not be sampled			

TABLE AIV-2 (Continued): 2006 SULFATE, TOTAL ORGANIC CARBON,
TOTAL DISSOLVED SOLIDS, FECAL COLIFORM, WATER ELEVATION, AND
RECHARGE DATA FOR WATER QUALITY MONITORING WELLS
QC-1, QC-2, QC-2.1, QC-2.2, QC-3 THROUGH QC-7, AND QC-9 THROUGH QC-37
IN THE CALUMET TUNNEL SYSTEM

Well	Date of Sampling	SO ₄ mg/L	TOC mg/L	TDS mg/L	FC ¹ cfu/100 mL	Water Elevation ² Feet	Recharge ³ Hours
QC-35	1/26/06			Well could not be sampled			
QC-35	3/9/06			Well could not be sampled			
QC-35	4/18/06			Well could not be sampled			
QC-35	6/15/06			Well could not be sampled			
QC-35	9/21/06			Well could not be sampled			
QC-35	11/2/06			Well could not be sampled			
QC-36	1/26/06			Well could not be sampled			
QC-36	4/20/06			Well could not be sampled			
QC-36	4/18/06			Well could not be sampled			
QC-36	6/15/06			Well could not be sampled			
QC-36	8/23/06			Well could not be sampled			
QC-36	11/2/06			Well could not be sampled			
QC-37	1/26/06			Well could not be sampled			
QC-37	3/9/06	121	4.5	1050	<1	-133	<48
QC-37	4/20/06			Well could not be sampled			
QC-37	6/15/06			Well could not be sampled			
QC-37	8/23/06			Well could not be sampled			
QC-37	11/2/06			Well could not be sampled			

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.