RESEARCH AND DEVELOPMENT DEPARTMENT

REPORT NO. 08-53

TUNNEL AND RESERVOIR PLAN
O'HARE CUP RESERVOIR WATER QUALITY MONITORING WELLS
2006 ANNUAL GROUNDWATER MONITORING REPORT

SEPTEMBER 2008

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

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Director of Research and Development

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September 19, 2008

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, O'Hare Cup Reservoir Water Quality Monitoring Wells, 2006 Annual Groundwater Monitoring Report

Enclosed are three copies of "Tunnel and Reservoir Plan, O'Hare Cup Reservoir Water Quality Monitoring Wells, 2006 Annual Groundwater Monitoring Report."

Very truly yours,

Louis Kollias
Director
Research and Development

LK:HZ:lmf
Enclosure
cc w/enc: Ms. Sally K. Swanson (USEPA Region V—WC15J) (2)
Ms. Linda Sorn (COE) (2)
Mr. Jay Patel (IEPA Region 2—Des Plaines) (2)
Mr. Sobanski
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cc w/o enc: Mr. Jamjun
Mr. Cohen

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Louis Kollias, Director

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INTRODUCTION

This report contains data for the year 2007 for the four water quality monitoring wells located on the perimeter of the O'Hare CUP Reservoir (Figure 1). The four water quality monitoring wells are QK–1, QK–2, QK–3, and QK–4. Well QK–1 is located on the northwest side, QK–2 on the northeast side, QK–3 on the southeast side, and QK–4 on the southwest side of the reservoir. Also shown in Figure 1 are locations of the eight private water supply wells within 1,000 feet of the reservoir. Please note that originally there were ten private water supply wells, but one was abandoned as of January 25, 1996, and another was locked and left vacant in 2000, leaving only eight private water supply wells.

The Water Pollution Control Permit No. 1996–AB–3401 dated July 9, 1996, issued by the Illinois Environmental Protection Agency (IEPA) to construct and/or operate the O'Hare CUP Reservoir is subject to the following three special conditions:

> Special Condition 1: If this project is located within a wetlands, the U. S. Army Corps of Engineers (COE) may require a permit for construction pursuant to Section 404 of the Clean Water Act.
>
> Special Condition 2: The operational portion of this permit shall not become effective until the Permittee has received IEPA approval of a groundwater monitoring program for this site.
>
> Special Condition 3: The operating reports associated with the groundwater monitoring program shall be submitted quarterly to the IEPA's Maywood Regional Office and Springfield Permit Section.

Given below is the groundwater monitoring plan for the O'Hare CUP Reservoir as summarized in the IEPA letter dated October 14, 1997, to Mr. Joseph D. Jacobazzi of the COE, Chicago District:

1. The establishment of existing background concentrations at the site by sampling the four (4) monitoring wells a minimum of six times over the period of 12 months. Parameters to be sampled will be all of the Class I Standards parameters, with the exception of radioactive compounds, and the Tunnel and Reservoir Plan (TARP) indicator parameters.

2. The establishment of existing background concentrations for the inorganic Class I Standards parameters and TARP indicator parameters for the ten private wells within 1,000 feet of the reservoir with a minimum of three sampling events.

3. After the establishment of existing background concentrations, the four monitoring wells at the site shall be sampled quarterly for the TARP indicator

parameters. The results will be submitted to the IEPA in accordance with Special Condition 3 of Permit No. 1996–AB–3401.

4. Groundwater sampling of the TARP indicator parameters for event-based monitoring shall be conducted on a weekly basis following an event in which the reservoir is used to store combined sewage overflow from the TARP system. The weekly sampling frequency will continue until all sampling results indicate concentrations below the 95 percent confidence level established for the background concentrations. Event-based monitoring requirements will continue weekly for at least six weeks after the event.

   Until existing background confidence limits are established at each monitoring well, the event-based monitoring requirements will continue on a weekly basis for at least six weeks after the event. All samples from the monitoring wells will be compared to the Class I Standards until the 95 percent confidence levels have been determined for each parameter at each well. If the sampling reveals that the water quality has been impacted, sampling should continue on a weekly basis until there is no indication of groundwater being impacted.

5. A preventive response will be required if any of the detected contaminants exceed the levels specified in the Standards, Subsection 620.310(a)(3). The COE and Metropolitan Water Reclamation District of Greater Chicago (District) have the option to demonstrate that the O'Hare CUP Reservoir is not the source of contamination.

6. In the event that a Class I Standard is exceeded due to the storage of combined sewage in the reservoir, a groundwater management zone may be required.

   Unless the concentrations which exceed Class I Standards are due to natural causes, the COE and/or District will be responsible for the remediation of groundwater contamination on site.

7. In the event that any of the Class I Standards are exceeded in any potable water supply well as a result of leakage from the O'Hare CUP Reservoir, an alternate water supply shall be supplied with either the COE or District bearing all costs as associated with providing the alternate water supply.

Out of the seven above items summarizing the groundwater monitoring plan for the O'Hare CUP Reservoir, the requirements under items 3 and 4 are to be fulfilled by the District. The remainder of the requirements set forth under items 1, 2, 5, 6, and 7 are to be fulfilled by the COE.

According to item 3 referred to above, the four water quality monitoring wells located on the perimeter of the O'Hare CUP Reservoir are to be sampled quarterly for the TARP water quality indicator parameters. The ten TARP water quality parameters to be analyzed are: chloride

(Cl), conductivity (Cond.), fecal coliform (FC), hardness (Hard.), ammonia (NH_4^+–N), pH, sulfate (SO_4), total dissolved solids (TDS), total organic carbon (TOC), and temperature (Temp.).

This report fulfills the requirements, as set forth under items 3 and 4 referred to above, which are to be completed by the District.

Monitoring Data

Quarterly Monitoring. Table 1 contains the 2007 data for ten TARP water quality indicator parameters obtained from samples collected on a quarterly basis from the four (QK–1, QK–2, QK–3, and QK–4) water quality monitoring wells located on the perimeter of the O'Hare CUP Reservoir. On September 26, 2007, water quality monitoring wells QK–1 and QK–2 could not be sampled because there was insufficient water in the wells to collect a sample. On November 20, 2007, water quality monitoring well QK–1 could not be sampled because there was insufficient water in the well to collect a sample.

Table 2 contains summary statistics of the water quality parameters for the year 2007 quarterly samples for all four wells QK–1 through QK–4. The summary statistics include minimum, mean, maximum, standard deviation (Std. Dev.), median, and coefficient of variation (Coeff. Var.) of the values of the TARP water quality indicator parameters analyzed during 2007.

Fill Event Monitoring. The O'Hare CUP Reservoir experienced two fill events that required sampling in 2007. The first fill event began on December 21, 2006, and the second on August 8, 2007. Sampling of these events was conducted according to item 4 requirements as described on page 2. According to this requirement, sampling of the TARP indicator parameters for fill event-based monitoring should be conducted on a weekly basis following a fill event. As required, the weekly sampling continued for at least six weeks or until all sampling results indicated concentrations below the 95 percent confidence level for background concentration.

December 21, 2006, Fill Event. Table 3 contains water quality data for water quality monitoring wells QK–1 through QK–4 for the December 21, 2006, fill event. Sampling covered the period of December 21, 2006, through January 29, 2007.

All wells were sampled as required with the following exceptions. On January 10, 2007, and January 18, 2007, water quality monitoring well QK–1 could not be monitored because there was insufficient water in the well to collect a sample. On January 10, 2007, and January 25, 2007, water quality monitoring well QK–2 could not be monitored because there was insufficient water in the well to collect a sample.

August 8, 2007, Fill Event. Table 4 contains water quality data for water quality monitoring wells QK–1 through QK–4 for the August 8, 2007, fill event. Sampling covered the period of August 8, 2007, through September 26, 2007.

All wells were sampled as required with the following exceptions. On August 15, 2007, water quality monitoring wells QK–2 and QK–4 could not be sampled because there was insufficient water in the wells to collect a sample. On September 5, 2007, water quality monitoring well QK–2 could not be sampled because access to the well was blocked. On September 12, 2007, water quality monitoring wells QK–1 and QK–2 could not be sampled because access to the wells was blocked. On September 18, 2007, water quality monitoring well QK–1 could not be sampled because there was insufficient water in the well to collect a sample, and water quality monitoring well QK–2 could not be sampled because access to the well was blocked. On September 26, 2007, water quality monitoring well QK–2 could not be sampled because the pump was inoperable due to electrical problems. This pump has since been repaired.

TABLE 1: 2007 GROUNDWATER QUALITY DATA FOR O'HARE CUP RESERVOIR
WATER QUALITY MONITORING WELLS QK–1 THROUGH QK–4

Well	Date of Sampling	Cl mg/L	Cond.[1] µmhos/cm	FC[1] cfu/100 mL	Hard. mg/L	NH_4^+–N mg/L	pH[1]	SO_4 mg/L	TDS mg/L	TOC mg/L	Temp. °C
QK–1	1/4/07	6	1,122	<1	534	0.14	7.9	593	1,062	0.7	12
QK–1	5/30/07	34	778	<1	653	0.03	7.7	610	1,188	0.7	14
QK–1	9/26/07	35	1,098	2,900	678	0.04	7.2	701	1,222	0.8	12
QK–1	11/20/07	Well could not be sampled									
QK–2	1/4/07	8	1,239	1,000	680	<0.02	7.8	615	1,226	0.6	11
QK–2	5/30/07	6	731	<1	465	0.13	8.0	558	966	0.7	18
QK–2	9/26/07	Well could not be sampled									
QK–2	11/20/07	Well could not be sampled									
QK–3	1/4/07	91	1,001	1	928	<0.02	7.2	709	1,608	1.2	11
QK–3	5/30/07	40	560	<1	419	0.15	7.8	305	764	0.7	13
QK–3	9/26/07	38	1,010	40	380	0.47	7.1	292	810	0.7	10
QK–3	11/20/07	39	996	2	433	0.45	7.3	297	750	0.8	12
QK–4	1/4/07	49	1,066	<1	534	0.36	7.1	314	926	0.8	12
QK–4	5/30/07	56	680	<1	522	0.35	7.7	330	896	0.8	13
QK–4	9/26/07	34	1,159	1,100	620	0.56	7.0	450	1,028	0.9	12
QK–4	11/20/07	43	1,193	5	565	0.48	7.5	394	964	0.8	12

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

TABLE 2: SUMMARY STATISTICS OF THE 2007 QUARTERLY SAMPLING DATA FOR O'HARE CUP RESERVOIR WATER QUALITY MONITORING WELLS QK–1 THROUGH QK–4

Parameters		Well Number			
		QK–1	QK–2	QK–3	QK–4
Cl, mg/L	Minimum	6	6	38	34
	Mean	25	7	52	46
	Maximum	35	8	91	56
	Std. Dev.	16	1	26	9
	Median	34	7	40	46
	Coeff. Var.	66	20	50	20
Cond., µmhos/cm	Minimum	778	731	560	680
	Mean	999	985	892	1,025
	Maximum	1,122	1,239	1,010	1,193
	Std. Dev.	192	359	221	236
	Median	1,098	985	999	1,113
	Coeff. Var.	19	36	25	23
FC,[1] cfu/100 mL	Minimum	1	1	1	1
	Geo. Mean	14	32	3	9
	Maximum	2,900	1,000	40	1,100
	Geo. Std. Dev.	100	132	7	28
	Median	1	501	2	3
	Coeff. Var.	700	418	238	322

TABLE 2 (Continued): SUMMARY STATISTICS OF THE 2007 QUARTERLY SAMPLING DATA FOR O'HARE CUP RESERVOIR WATER QUALITY MONITORING WELLS QK–1 THROUGH QK–4

Parameters		Well Number			
		QK–1	QK–2	QK–3	QK–4
Hard., mg/L	Minimum	534	465	380	522
	Mean	622	573	540	560
	Maximum	678	680	928	620
	Std. Dev.	77	152	260	44
	Median	653	573	426	550
	Coeff. Var.	12	27	48	8
NH_4^+–N,[2] mg/L	Minimum	0.03	0.02	0.02	0.35
	Mean	0.07	0.08	0.27	0.44
	Maximum	0.14	0.13	0.47	0.56
	Std. Dev.	0.06	0.08	0.22	0.10
	Median	0.04	0.08	0.30	0.42
	Coeff. Var.	86.90	103.71	81.86	23.04
pH	Minimum	7.2	7.8	7.1	7.0
	Mean	7.6	7.9	7.4	7.3
	Maximum	7.9	8.0	7.8	7.7
	Std. Dev.	0.4	0.1	0.3	0.3
	Median	7.7	7.9	7.3	7.3
	Coeff. Var.	4.7	1.8	4.2	4.5

TABLE 2 (Continued): SUMMARY STATISTICS OF THE 2007 QUARTERLY SAMPLING DATA FOR O'HARE CUP RESERVOIR WATER QUALITY MONITORING WELLS QK–1 THROUGH QK–4

Parameters		Well Number			
		QK–1	QK–2	QK–3	QK–4
SO_4, mg/L	Minimum	593	558	292	314
	Mean	635	587	401	372
	Maximum	701	615	709	450
	Std. Dev.	58	40	206	62
	Median	610	587	301	362
	Coeff. Var.	9	7	51	17
TDS, mg/L	Minimum	1,062	966	750	896
	Mean	1,157	1,096	983	954
	Maximum	1,222	1,226	1,608	1,028
	Std. Dev.	84	184	417	57
	Median	1,188	1,096	787	945
	Coeff. Var.	7	17	42	6
TOC, mg/L	Minimum	0.70	0.60	0.70	0.80
	Mean	0.73	0.65	0.85	0.83
	Maximum	0.80	0.70	1.20	0.90
	Std. Dev.	0.06	0.07	0.24	0.05
	Median	0.70	0.65	0.75	0.80
	Coeff. Var.	7.87	10.88	28.01	6.06

[1]For purposes of statistical evaluation, fecal coliform values less than 1 were set equal to 1.
[2]For purposes of statistical evaluation, ammonium nitrogen values less than 0.02 mg/L were set equal to 0.02 mg/L.

TABLE 3: 2007 GROUNDWATER QUALITY DATA FOR O'HARE CUP RESERVOIR
WATER QUALITY MONITORING WELLS QK–1 THROUGH QK–4
FILL EVENT DECEMBER 21, 2006

Well	Date of Sampling	Cl mg/L	Cond.[1] µmhos/cm	FC[1] cfu/100 mL	Hard. mg/L	NH_4^+–N mg/L	pH[1]	SO_4 mg/L	TDS mg/L	TOC mg/L	Temp. °C
QK–1	12/26/06	13	536	1,100	684	<0.02	7.7	635	1,202	0.9	11
QK–1	1/4/07	6	1,122	<1	534	0.14	7.9	593	1,062	0.7	12
QK–1	1/10/07	Well could not be sampled									
QK–1	1/18/07	Well could not be sampled									
QK–1	1/25/07	12	1,090	<1	500	0.11	7.1	413	1,020	0.7	11
QK–1	1/29/07	20	1,004	20	646	0.03	6.9	538	1,148	0.7	9
QK–2	12/26/06	6	538	<1	536	0.14	7.7	616	1,042	0.7	11
QK–2	1/4/07	8	1,239	1,000	680	<0.02	7.8	615	1,226	0.6	11
QK–2	1/10/07	Well could not be sampled									
QK–2	1/18/07	6	472	<1	523	0.12	7.9	1,361	1,044	0.7	10
QK–2	1/25/07	Well could not be sampled									
QK–2	1/29/07	5	846	<1	482	0.13	7.6	549	970	0.6	10
QK–3	12/26/06	51	520	<1	641	<0.02	7.6	528	1,106	0.9	11
QK–3	1/4/07	91	1,001	1	928	<0.02	7.2	709	1,608	1.2	11
QK–3	1/10/07	43	836	<1	471	0.29	7.5	332	858	0.9	10
QK–3	1/18/07	36	423	<1	395	0.32	7.8	789	722	0.7	10
QK–3	1/25/07	36	911	<1	401	0.28	7.1	278	734	0.7	10
QK–3	1/29/07	35	705	<1	384	0.28	7.3	287	710	0.7	10
QK–4	12/26/06	59	514	<1	509	0.47	7.8	313	896	0.9	11
QK–4	1/4/07	49	1,066	<1	534	0.36	7.1	314	926	0.8	12
QK–4	1/10/07	66	852	<1	472	0.41	7.6	270	832	0.7	11

TABLE 3 (Continued): 2007 GROUNDWATER QUALITY DATA FOR O'HARE CUP RESERVOIR
WATER QUALITY MONITORING WELLS QK–1 THROUGH QK–4
FILL EVENT DECEMBER 21, 2006

Well	Date of Sampling	Cl mg/L	Cond.[1] µmhos/cm	FC[1] cfu/100 mL	Hard. mg/L	NH_4^+–N mg/L	pH[1]	SO_4 mg/L	TDS mg/L	TOC mg/L	Temp. °C
QK–4	1/18/07	60	466	<1	491	0.39	8.0	272	850	0.7	10
QK–4	1/25/07	64	1,070	<1	481	0.38	7.1	288	878	0.7	10
QK–4	1/29/07	63	836	<1	475	0.40	7.3	296	850	0.8	9

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

TABLE 4: 2007 GROUNDWATER QUALITY DATA FOR O'HARE CUP RESERVOIR
WATER QUALITY MONITORING WELLS QK–1 THROUGH QK–4
FILL EVENT AUGUST 8, 2007

Well	Date of Sampling	Cl mg/L	Cond.[1] µmhos/cm	FC[1] cfu/100 mL	Hard. mg/L	NH_4^+–N mg/L	pH[1]	SO_4 mg/L	TDS mg/L	TOC mg/L	Temp. °C
QK–1	8/8/07	31	1,325	6,200	551	0.03	7.1	458	1,076	1.0	13
QK–1	8/15/07	14	1,195	2,400	684	<0.02	7.5	558	1,208	0.7	14
QK–1	8/21/07	59	470	>200,000	330	1.11	7.7	161	650	2.3	12
QK–1	8/29/07	51	725	30,000	755	0.82	8.0	648	1,388	1.5	12
QK–1	9/5/07	64	610	63,000	1,339	0.57	7.2	373	2,146	1.5	14
QK–1	9/12/07	Well could not be sampled									
QK–1	9/18/07	Well could not be sampled									
QK–1	9/26/07	35	1,098	2,900	678	0.04	7.2	701	1,222	0.8	12
QK–2	8/8/07	3	1,169	<1	441	0.20	7.8	499	954	0.8	15
QK–2	8/15/07	Well could not be sampled									
QK–2	8/21/07	6	588	<1	485	0.20	7.8	518	1,024	0.7	12
QK–2	8/29/07	4	652	35	557	0.08	7.5	450	1,140	0.7	13
QK–2	9/5/07	Well could not be sampled									
QK–2	9/12/07	Well could not be sampled									
QK–2	9/18/07	Well could not be sampled									
QK–2	9/26/07	Well could not be sampled									
QK–3	8/8/07	39	1,169	500	477	0.22	7.4	350	924	0.8	16
QK–3	8/15/07	35	910	68	412	0.34	7.7	258	790	0.8	13
QK–3	8/21/07	57	481	12,000	509	0.43	7.7	349	970	1.4	13
QK–3	8/29/07	33	502	2,000	1,086	<0.02	7.6	797	2,046	0.8	12
QK–3	9/5/07	43	2,172	3,000	1,239	0.08	7.1	969	2,402	0.8	13
QK–3	9/12/07	41	996	130	421	0.47	7.4	290	762	0.8	13

TABLE 4 (Continued): 2007 GROUNDWATER QUALITY DATA FOR O'HARE CUP RESERVOIR
WATER QUALITY MONITORING WELLS QK–1 THROUGH QK–4
FILL EVENT AUGUST 8, 2007

Well	Date of Sampling	Cl mg/L	Cond.[1] µmhos/cm	FC[1] cfu/100 mL	Hard. mg/L	NH_4^+–N mg/L	pH[1]	SO_4 mg/L	TDS mg/L	TOC mg/L	Temp. °C
QK–3	9/18/07	40	402	180	394	0.48	7.7	247	746	0.7	13
QK–3	9/26/07	38	1,010	40	380	0.47	7.1	292	810	0.7	10
QK–4	8/8/07	49	1,238	<1	520	0.49	7.2	305	974	0.9	14
QK–4	8/15/07	Well could not be sampled									
QK–4	8/21/07	74	584	7,800	461	0.53	7.8	251	886	0.8	12
QK–4	8/29/07	63	640	8,700	463	0.51	7.9	249	860	0.9	12
QK–4	9/5/07	44	1,224	19,000	502	0.24	7.3	336	1,146	0.9	13
QK–4	9/12/07	41	924	800	564	0.44	7.2	387	958	0.9	12
QK–4	9/18/07	32	581	200	601	0.51	7.8	332	1,070	0.9	13
QK–4	9/26/07	34	1,159	1,100	620	0.56	7.0	450	1,028	0.9	12

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

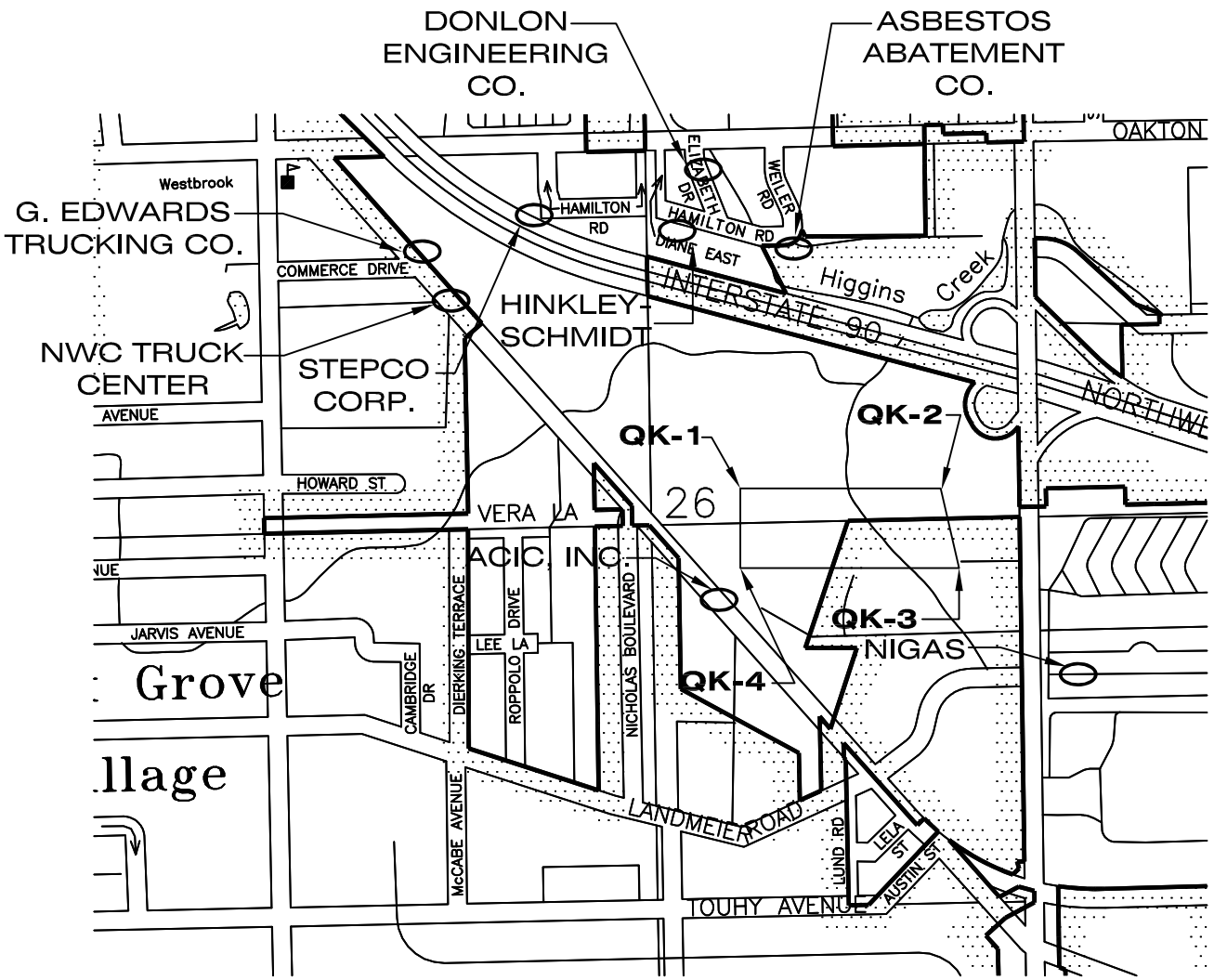

FIGURE 1

LOCATION OF FOUR WATER QUALITY MONITORING WELLS AND EIGHT PRIVATE WELLS

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

H:\DMAC\OHAREWATERQUALITYMONITORS.dwg, 06/14/04 at 13.56