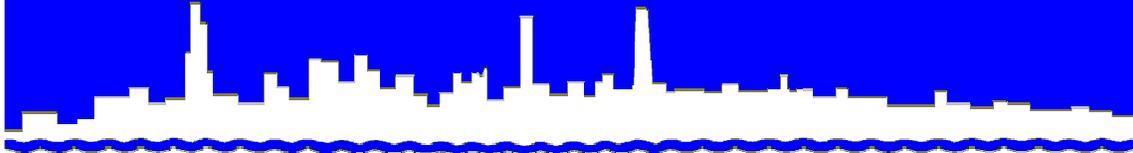


Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 13-23

TUNNEL AND RESERVOIR PLAN

UPPER DES PLAINES TUNNEL SYSTEM

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2012

July 2013

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

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July 25, 2013

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Ms. Marcia Willhite
Bureau 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, Annual
Groundwater Monitoring Report for 2012

Attached are three copies of "Tunnel and Reservoir Plan, Upper Des Plaines Tunnel System, Annual Groundwater Monitoring Report for 2012."

Very truly yours,

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

TCG:PL:cm

Attachment

cc w/att: Ms. Sally K. Swanson (USEPA Region 5 - WC15J) - (2)

Dr. Zhang

Dr. Cox

Dr. Hundal

Dr. Lindo

cc w/o att: Mr. St. Pierre

Ms. Sharma

Mr. Cohen

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TUNNEL AND RESERVOIR PLAN
UPPER DES PLAINES TUNNEL SYSTEM
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FOR 2012

Monitoring and Research Department
Thomas C. Granato, Director

July 2013

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ANNUAL DATA FOR MONITORING WELLS

Introduction

This system consists of two sub-systems, Upper Des Plaines (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 ([Figure 1](#)). These nine monitoring wells are all sampled six times per year (Illinois Environmental Protection Agency memorandum dated July 9, 2004). Groundwater elevations in the monitoring wells were measured during each sampling event, as well as bi-weekly, since these wells also function as observation wells.

All monitoring wells in the UDP Tunnel system were visited for the required number of samples. However, in several instances, samples could not be retrieved from a few wells. Monitoring wells MW-2 and MW-5 could not be sampled during 2012 because of inoperable pumps. Wells MW-8 and MW-9 were sampled only once and twice, respectively, during 2012 because of defective pumps. Work orders have been issued to replace or repair all defective pumps.

Summary of Data for Monitoring Wells

The analytical data for groundwater sampled during 2012 from monitoring wells MW-1 through MW-9 are presented in [Table 1](#). Physical characteristics, such as elevation, groundwater temperature, and estimated time of recharge for each well between initial drawdown and sampling, are also included in this table. Fecal coliform counts for all wells were non-detectable, but on June 27, 2012, well MW-7 contained 28 MPN/100 mL. [Table 2](#) lists the descriptive statistics for groundwater data of monitoring wells MW-1 through MW-9 for the year 2012.

Final groundwater elevations in wells MW-1 through MW-9 were calculated relative to the Chicago city datum (579.48 ft above mean sea level) at the intersection of Madison and State Streets ([Table 3](#)). The minimum, mean, and maximum groundwater elevations for each well were calculated and plotted to determine fluctuations in groundwater elevations during the year ([Figure 2](#)). Generally, these fluctuations were apparent in several wells throughout the year.

MAP OF MONITORING WELLS IN THE UPPER DES PLAINES TUNNEL SYSTEM

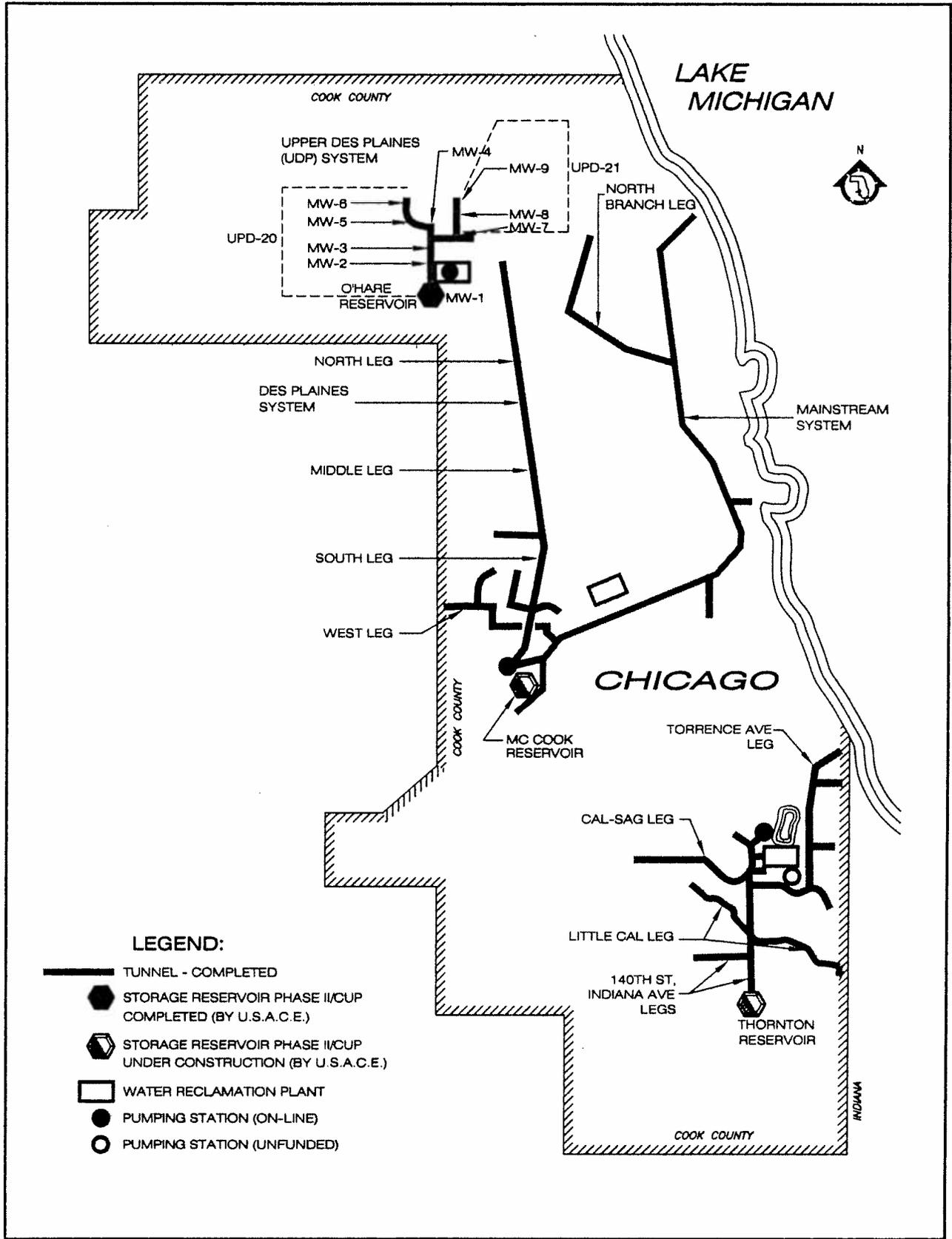


TABLE 1: ANALYSIS OF WATER FROM MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

Well ¹	Sample Date	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ³	Recharge
			mS/m	----- mg/L -----						MPN/100mL	°C	ft	hr
MW-1	01/26/12	7.5	77	1,070	<1	248	327	0.26	415	<1	12.9	16	<48
MW-1	03/15/12	7.3	78	796	<1	27	338	0.28	439	<1	15.0	14	<48
MW-1	05/24/12	7.2	58	772	<1	29	353	0.31	458	<1	15.0	14	<48
MW-1	08/16/12	7.2	80	814	10	29	368	0.32	440	<1	20.1	11	<48
MW-1	10/17/12	7.4	31	782	1	31	356	0.33	407	<1	15.7	12	<48
MW-1	12/12/12	7.0	73	786	<1	30	350	0.43	440	<1	14.8	16	<48
MW-3	01/26/12	7.1	68	898	1	99	412	0.37	423	<1	12.5	36	<48
MW-3	03/15/12	7.8	58	828	<1	14	408	0.34	449	<1	15.3	41	<48
MW-3	05/24/12	7.6	66	820	<1	13	431	0.34	474	<1	16.0	42	<48
MW-3	08/16/12	7.7	54	830	9	13	458	0.33	427	<1	19.8	37	<48
MW-3	10/17/12	7.5	49	838	<1	12	447	0.33	464	<1	15.2	40	<48
MW-3	12/12/12	7.5	63	772	<1	15	424	0.33	410	<1	14.1	34	<48
MW-4	01/26/12	7.6	70	912	<1	69	372	<0.10	558	<1	13.0	-13	<48
MW-4	03/15/12	7.8	79	944	<1	58	361	<0.10	566	<1	14.1	-3.1	<48
MW-4	05/24/12	7.6	74	904	<1	63	368	0.11	587	<1	14.1	-3.1	<48
MW-4	08/16/12	7.6	69	958	9	60	386	0.10	555	<1	21.5	-2.1	<48
MW-4	10/17/12	7.6	56	940	<1	62	372	<0.10	543	<1	16.2	-7.1	<48
MW-4	12/12/12	7.6	70	880	<1	64	368	0.23	541	<1	13.4	-20	<48
MW-6	01/19/12	7.0	35	412	2	23	187	0.35	240	<1	12.4	59	<4
MW-6	02/22/12	7.5	37	482	1	37	319	0.51	373	<1	13.8	59	<4

TABLE 1 (Continued): ANALYSIS OF WATER FROM MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2012

Well ¹	Sample Date	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ³	Recharge
			mS/m	----- mg/L -----						MPN/100mL	°C	ft	hr
MW-6	04/11/12	7.0	55	744	1	38	347	0.57	392	<1	13.8	59	<4
MW-6	06/06/12	7.3	35	768	1	36	323	0.53	384	<1	14.6	60	<4
MW-6	08/21/12	7.1	57	788	1	39	319	0.52	386	<1	14.9	56	<4
MW-6	10/03/12	7.3	40	778	<1	40	339	0.48	379	<1	13.1	58	<4
MW-7	01/18/12	7.1	62	850	<1	37	383	0.54	518	<1	14.5	17	<4
MW-7	03/07/12	6.8	67	882	1	41	374	0.56	504	<1	15.0	18	<4
MW-7	04/11/12	7.4	94	868	<1	37	405	0.54	527	<1	13.8	19	<4
MW-7	06/27/12	7.1	91	936	<1	36	385	0.53	513	28	16.8	18	<4
MW-7	08/21/12	7.5	66	896	1	35	353	0.56	499	<1	15.4	17	<4
MW-7	10/24/12	6.8	68	936	<1	37	370	0.54	501	<1	16.7	17	<4
MW-8	01/26/12	7.8	62	490	1	114	135	<0.10	178	<1	13.3	-30	<48
MW-9	01/26/12	7.8	58	750	1	32	341	0.45	395	<1	13.9	-2.2	<48
MW-9	03/15/12	7.8	71	740	1	29	325	0.43	377	<1	15.4	1.8	<48

¹Wells MW-2 and -5 could not be sampled during 2012; MW-8 sampled once, MW-9 sampled twice; pumps non-functional.

²EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.

³Relative to Chicago city datum (579.48 ft above mean sea level) measured at intersection of Madison and State Streets.

TABLE 2: DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2012

Well ¹	Sample Date	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ³
			mS/m	----- mg/L -----						MPN/100mL
MW-1	Minimum	7.0	31	772	1	27	327	0.26	407	<1
	Mean	7.3	66	837	3	66	348	0.32	433	<1
	Maximum	7.5	80	1,070	10	248	368	0.43	458	<1
	Std. Dev.	0.2	19	115	4	89	14	0.06	19	NA ⁴
	Median	7.2	75	791	1	30	351	0.32	440	<1
	Coeff. of Var. (%)	2.5	29	14	147	136	4	18	4	NA
MW-3	Minimum	7.1	49	772	1	12	408	0.33	410	<1
	Mean	7.5	60	831	2	28	430	0.34	441	<1
	Maximum	7.8	68	898	9	99	458	0.37	474	<1
	Std. Dev.	0.2	7	40	3	35	20	0.02	25	NA
	Median	7.6	60	829	1	14	428	0.34	438	<1
	Coeff. of Var. (%)	3.3	13	5	140	126	5	4.6	6	NA
MW-4	Minimum	7.6	56	880	1	58	361	0.10	541	<1
	Mean	7.6	70	923	2	63	371	0.12	558	<1
	Maximum	7.8	79	958	9	69	386	0.23	587	<1
	Std. Dev.	0.1	8	29	3	4	9	0.05	17	NA
	Median	7.6	70	926	1	63	370	0.10	557	<1
	Coeff. of Var. (%)	1.1	11	3	140	6	2	42	3	NA
MW-6	Minimum	7.0	35	412	1	23	187	0.35	240	<1
	Mean	7.2	43	662	1	36	306	0.49	359	<1
	Maximum	7.5	57	788	2	40	347	0.57	392	<1
	Std. Dev.	0.2	10	169	0.5	6	59	0.08	59	NA
	Median	7.2	38	756	1	38	321	0.52	382	<1
	Coeff. of Var. (%)	2.9	23	25	33	18	19	15	16	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2012

Well ¹	Sample Date	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ³
			mS/m	----- mg/L -----						MPN/100mL
MW-7	Minimum	6.8	62	850	1	35	353	0.53	499	<1
	Mean	7.1	75	895	1	37	378	0.55	510	2
	Maximum	7.5	94	936	1	41	405	0.56	527	28
	Std. Dev.	0.3	14	35	0.1	2	17	0.01	11	NA
	Median	7.1	67	889	1	37	378	0.54	509	<1
	Coeff. of Var. (%)	4.2	19	4	13	5	5	2.2	2.1	NA
MW-9	Minimum	7.8	58	740	1	29	325	0.43	377	<1
	Mean	7.8	65	745	1	31	333	0.44	386	<1
	Maximum	7.8	71	750	1	32	341	0.45	395	<1
	Std. Dev.	0.0	9	7	0.1	2	12	0.01	13	NA
	Median	7.8	65	745	1	31	333	0.44	386	<1
	Coeff. of Var. (%)	0.3	14	1	7	7	4	3.2	3	NA

¹Wells MW-2 and -5 could not be sampled during 2012; MW-8 sampled once, MW-9 sampled twice; pumps non-functional.

²EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.

³Geometric mean calculated.

⁴Not applicable.

TABLE 3: GROUNDWATER ELEVATIONS FOR MONITORING/OBSERVATION WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2012

Date ¹	Monitoring/Observation Well								
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
	----- Elevation (ft) ² -----								
01/12/12	35.8	42.8	38.6	-2.1	-39.6	64.6	13	-46	-1.2
01/27/12	-19.2	42.8	40.6	-10.1	-34.6	63.6	18	-52	1.8
02/10/12	27.8	39.8	37.6	-1.1	-44.6	56.6	2.7	-23	-19.2
02/17/12	42.8	44.8	39.6	-2.1	-35.6	63.6	17	-55	1.8
02/28/12	27.8	39.8	36.6	-2.1	-43.6	55.6	3.7	-25	-20.2
03/09/12	43.8	44.8	39.6	-4.1	-36.6	61.6	16	-54	1.8
03/23/12	43.8	44.8	40.6	-0.10	-35.6	62.6	17	-55	2.8
04/13/12	35.8	43.8	38.6	-1.1	-35.6	64.6	18	-40	8.8
04/27/12	38.8	44.8	40.6	0.90	-34.6	64.6	15	-35	3.8
05/11/12	29.8	42.8	41.6	3.9	-36.6	61.6	16	-32	-8.2
05/25/12	-7.2	42.8	40.6	-7.1	-36.6	63.6	18	-28	0.80
06/08/12	34.8	42.8	39.6	-1.1	-34.6	59.6	17	-23	1.8
06/22/12	34.8	42.8	37.6	-1.1	-35.6	55.6	18	-18	0.80
06/29/12	33.8	42.8	37.6	-2.1	-34.6	55.6	20	-18	-0.20
07/13/12	33.8	41.8	36.6	0.90	-42.6	56.6	15	-15	-3.2
07/27/12	32.8	40.8	38.6	-1.1	-40.6	57.6	16	-13	-5.2
08/10/12	35.8	42.8	38.6	-1.1	-35.6	55.6	18	-16	2.8
08/24/12	34.8	42.8	39.6	-2.1	-35.6	59.6	18	-21	0.80
09/07/12	36.8	42.8	37.6	-5.1	-41.6	63.6	16	-47	-3.2
09/28/13	41.8	41.8	40.6	1.9	-36.6	61.6	17	-0.20	0.80
10/05/12	42.8	40.8	41.6	2.9	-34.6	57.6	17	-0.20	-0.20
10/19/12	16.8	44.8	40.6	-7.1	-35.6	63.6	18	-2.2	27.8
11/02/12	33.8	41.8	39.6	-0.10	-33.6	59.6	14	-20	-7.2

TABLE 3 (Continued): GROUNDWATER ELEVATIONS FOR MONITORING/OBSERVATION WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2012

Date ¹	Monitoring/Observation Well								
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
	----- Elevation (ft) ² -----								
11/16/12	21.8	42.8	41.6	31.9	-35.6	61.6	17	6.8	-23.2
11/30/12	33.8	40.8	36.6	-2.1	-36.6	61.6	16	6.8	-0.20
12/21/12	42.8	44.8	39.6	-2.1	29.0	63.6	17	-55	-1.2

¹Dates measurements were taken.

²Relative to Chicago city datum (579.48 ft above mean sea level) at intersection of Madison and State Streets.

FIGURE 2: MINIMUM, MEAN, AND MAXIMUM WATER ELEVATIONS FOR MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2012

