

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

*MONITORING AND RESEARCH
DEPARTMENT*

REPORT NO. 15-25

TUNNEL AND RESERVOIR PLAN

UPPER DES PLAINES TUNNEL SYSTEM

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2014

July 2015

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June 29, 2015

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 2014

Attached are three copies of "Tunnel and Reservoir Plan, Upper Des Plaines Tunnel
System, Annual Groundwater Monitoring Report for 2014."

Very truly yours,

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

TCG:PL:cm

Attachment

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

Dr. Zhang

Dr. Cox

Dr. Hundal

Dr. Lindo

cc: Mr. St. Pierre

Ms. Sharma

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**TUNNEL AND RESERVOIR PLAN
UPPER DES PLAINES TUNNEL SYSTEM
ANNUAL GROUNDWATER MONITORING REPORT
FOR 2014**

**Monitoring and Research Department
Thomas C. Granato, Director**

July 2015

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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. The 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. In addition, groundwater elevations were measured bi-weekly since these wells also function as observation wells.

All monitoring wells in the UDP Tunnel system were sampled at the required frequency. However, samples could not be retrieved from a few wells. Monitoring Wells MW-2 and MW-5 could not be sampled during 2011 through 2014, probably due to inoperable pumps. For the first time since its installation, Well MW-7 did not yield any sample for the entire year. These defective wells are scheduled for service during 2015. Unlike the previous year, Wells MW-8 and -9 were sampled this year at the required frequency, following repairs in May 2013. Wells MW-2, -4, -5, and -7 will be repaired and decontaminated in 2015.

Summary of Data for Monitoring Wells

The analytical data for groundwater sampled during 2014 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. Fecal coliform (FC) counts for all wells were non-detectable, but in October sampling, elevated FC counts (490 CFU/100 mL) were observed in MW-8. [Table 2](#) lists the descriptive statistics for groundwater data of monitoring wells MW-1 through MW-9 for the year 2014.

Adjusted 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 values for each well were calculated and plotted to determine fluctuations in groundwater elevations during the year ([Figure 2](#)). Fluctuations were mainly evident in Wells MW-1, -4, -7, and -8 throughout the year. A similar fluctuation pattern was observed in Wells MW-1, -4, and -8 last year.

FIGURE 1: MAP OF MONITORING WELLS IN THE UPPER DES PLAINES TUNNEL SYSTEM

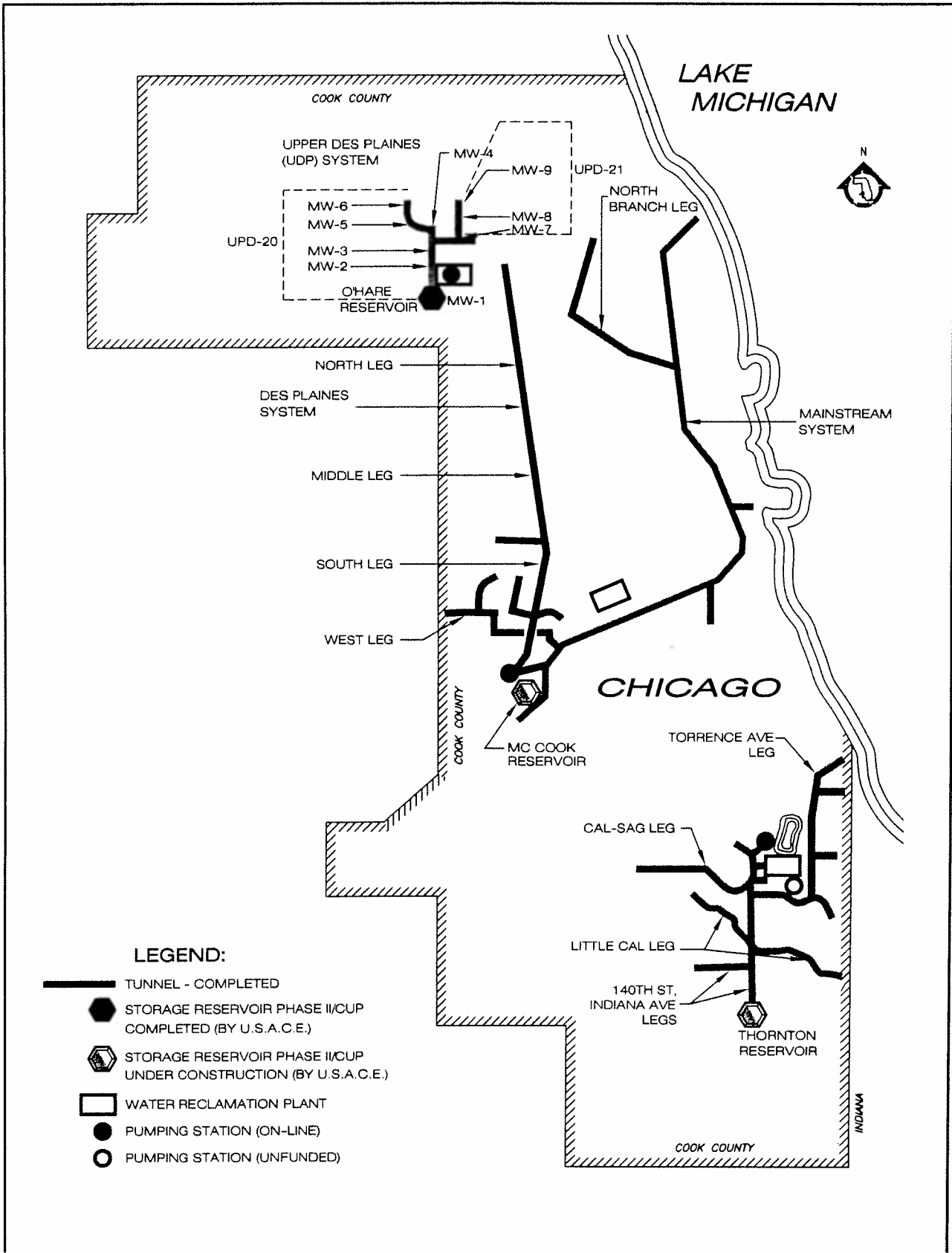


TABLE 1: ANALYSIS OF GROUNDWATER FROM MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2014

Well ¹	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ³	Recharge Time
			mS/m	----- mg/L -----						CFU/100 mL	°C	ft	hr
MW-1	02/26/14	7.6	133	1,106	<1	293	335	<0.10	356	1	11.5	11	<48
MW-1	03/27/14	7.6	100	810	<1	32	452	0.35	431	<1	11.9	18	<48
MW-1	06/04/14	7.2	81	792	1	33	385	0.31	422	13	15.1	12	<48
MW-1	09/11/14	8.2	84	778	<1	36	365	0.32	429	<1	14.5	16	<48
MW-1	10/09/14	7.4	82	674	<1	28	349	0.34	NA ⁴	<1	14.6	25	<48
MW-1	12/10/14	7.0	81	808	2	30	393	0.43	432	<1	14.9	-16	<48
MW-3	02/26/14	7.4	98	830	<1	29	449	0.33	452	<1	13.5	41	<48
MW-3	03/27/14	7.8	83	850	<1	13	509	0.34	452	<1	13.9	36	<48
MW-3	07/16/14	7.8	88	818	<1	13	429	0.34	456	<1	15.3	42	<48
MW-3	10/30/14	7.8	87	802	1	17	513	0.38	455	<1	14.5	42	<48
MW-3	12/10/14	7.7	81	826	<1	14	469	0.42	440	<1	13.8	40	<48
MW-3	12/17/14	8.0	86	840	1	13	454	0.42	425	<1	14.4	40	<48
MW-4	03/27/14	7.9	128	1,008	<1	104	404	0.13	541	<1	13.1	-18	<48
MW-4	05/01/14	6.9	99	978	<1	82	409	0.13	551	<1	13.7	-7.1	<48
MW-4	07/16/14	8.0	115	968	<1	73	385	0.13	561	<1	14.2	-0.1	<48
MW-4	10/30/14	7.7	101	950	<1	97	446	0.15	533	<1	13.9	-2.1	<48
MW-4	12/10/14	7.5	96	958	<1	70	401	0.19	541	<1	13.5	-7.1	<48
MW-4	12/17/14	7.5	101	952	<1	68	368	0.59	547	<1	13.7	-1.1	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2014

Well ¹	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ³	Recharge Time
			mS/m	----- mg/L -----						CFU /100 mL	°C	ft	hr
MW-6	02/20/14	7.2	79	734	<1	39	331	0.53	381	<1	12.9	66	<4
MW-6	05/01/14	7.4	73	684	1	44	318	0.63	343	<1	12.9	64	<4
MW-6	07/17/14	7.9	81	866	1	38	315	0.55	386	9	14.8	67	<4
MW-6	09/10/14	8.4	80	756	1	36	322	0.52	376	15	14.1	66	<4
MW-6	10/22/14	8.0	69	640	1	32	291	0.53	NA	6	14.2	67	<4
MW-6	12/17/14	7.4	68	758	<1	37	330	0.16	378	<1	12.8	67	<4
MW-8	03/27/14	8.2	143	1,176	1	361	287	0.19	305	<1	13.3	-33	<48
MW-8	05/01/14	8.3	69	394	1	122	77	0.66	98	2	14.1	-43	<48
MW-8	06/18/14	8.1	81	680	1	137	189	<0.10	199	1	15.4	-48	<48
MW-8	09/11/14	8.7	83	684	1	70	289	<0.10	347	27	14.6	-46	<48
MW-8	10/09/14	8.2	82	620	1	55	275	<0.10	354	490	14.4	-50	<48
MW-8	12/10/14	8.2	76	708	1	55	319	<0.10	349	<1	13.7	-61	<48
MW-9	02/26/14	8.2	81	726	1	37	277	0.40	385	<1	12.8	-1.2	<48
MW-9	03/27/14	8.2	78	748	1	35	365	0.44	363	<1	13.1	-6.2	<48
MW-9	06/04/14	7.5	78	658	1	56	295	0.19	297	<1	14.6	5.8	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2014

Well ¹	Date Sampled	pH	EC ²	TDS ²	TOC ²	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ³	Recharge Time
			mS/m	-----	-----	-----	mg/L	-----	-----	CFU/100 mL	°C	ft	hr
MW-9	09/11/14	8.5	81	622	1	55	255	0.28	352	<1	14.3	5.8	<48
MW-9	10/09/14	8.0	82	730	1	31	313	0.41	386	<1	14.5	7.8	<48
MW-9	12/10/14	7.8	78	750	1	29	340	0.53	376	<1	13.8	-2.2	<48

¹No samples obtained from Wells MW-2, -5, and -7; major repairs planned for 2015.

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

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

⁴No analysis; sample volume insufficient for re-run.

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 2014

Well	Statistic	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ²
			mS/m	----- mg/L -----					CFU/100 mL	
MW-1	Minimum	7.0	81	674	<1	28	335	<0.10	356	<1
	Mean	7.5	94	828	1	75	380	0.35	414	2
	Maximum	8.2	133	1,106	2	293	452	0.43	432	13
	Std. Dev.	0.4	21	145	0.4	107	42	0.05	33	NA ³
	Median	7.5	83	800	1	33	375	0.34	429	1
	Coeff. of Var. (%)	5.6	22	18	35	142	11	14	8	NA
MW-3	Minimum	7.4	81	802	<1	13	429	0.33	425	<1
	Mean	7.7	87	828	1	17	470	0.37	445	<1
	Maximum	8.0	98	850	1	29	513	0.42	456	<1
	Std. Dev.	0.2	6	17	0.0	6	34	0.04	13	NA
	Median	7.8	86	828	1	14	462	0.36	452	<1
	Coeff. of Var. (%)	2.6	7	2	0.0	38	7	11	3	NA
MW-4	Minimum	6.9	96	950	<1	68	368	0.13	541	<1
	Mean	7.6	107	969	<1	82	402	0.22	548	<1
	Maximum	8.0	128	1,008	<1	104	446	0.59	561	<1
	Std. Dev.	0.4	12	22	0.0	15	26	0.18	8	NA
	Median	7.6	101	963	<1	78	402	0.14	547	<1
	Coeff. of Var. (%)	5.5	12	2	0.0	18	6	83	2	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 2014

Well	Statistic	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ²
			mS/m	----- mg/L -----					CFU/100 mL	
MW-6	Minimum	7.2	68	640	<1	32	291	0.16	343	<1
	Mean	7.7	75	740	1	38	318	0.49	373	3
	Maximum	8.4	81	866	1	44	331	0.63	386	15
	Std. Dev.	0.5	6	77	0.2	4	15	0.17	17	NA
	Median	7.7	76	745	1	38	320	0.53	378	4
	Coeff. of Var. (%)	6.0	8	10	18	10	5	34	5	NA
MW-8	Minimum	8.1	69	394	1	55	77	0.19	98	<1
	Mean	8.3	89	710	1	133	239	0.43	260	6
	Maximum	8.7	143	1,176	1	361	319	0.66	349	490
	Std. Dev.	0.2	27	256	0.0	117	91	0.33	109	NA
	Median	8.2	81	682	1	96	281	0.43	305	2
	Coeff. of Var. (%)	2.4	30	36	0.0	88	38	78	42	NA
MW-9	Minimum	7.5	78	622	1	29	255	0.19	297	<1
	Mean	8.0	80	706	1	41	307	0.38	355	<1
	Maximum	8.5	82	750	1	56	365	0.53	385	<1

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 2014

Well	Statistic	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform ²
			mS/m	----- mg/L -----						CFU/100 mL
	Std. Dev.	0.3	2	53	0.1	12	41	0.12	35	NA
	Median	8.1	79	728	1	36	304	0.41	363	<1
	Coeff. of Var. (%)	4.3	3	8	8	30	13	32	10	NA

¹EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.

²Geometric mean calculated.

³Not applicable for Fecal Coliform data.

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 2014

Date ¹	Observation Well No.								
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
----- Elevation (ft) ² -----									
01/14/14	36.8	46.8	NR ³	NR	-35.6	62.6	16.7	NR	NR
01/31/14	35.8	42.8	"	"	-35.6	61.6	16.7	-31.2	-0.20
02/14/14	NR	43.8	"	"	NR	65.6	18.7	NR	NR
02/24/14	35.8	43.8	40.6	"	"	63.6	18.7	"	-1.20
02/28/14	35.8	42.8	38.6	"	"	64.6	17.7	"	1.80
03/07/14	36.8	43.8	39.6	"	"	64.6	17.7	"	2.80
03/27/14	17.8	42.8	35.6	-18.1	-33.6	60.6	18.7	-33.2	-6.20
04/04/14	36.8	44.8	43.6	-1.10	-32.6	61.6	21.7	-11.2	3.80
04/29/14	38.8	43.8	43.6	-3.10	-33.6	61.6	23.7	-1.20	5.80
05/16/14	33.8	28.8	37.6	-16.1	-32.6	62.6	18.7	NR	-0.20
05/23/14	36.8	44.8	38.6	-0.10	-34.6	65.6	18.7	-32.2	0.80
06/20/14	37.8	44.8	40.6	-3.10	-33.6	64.6	18.7	-59.2	6.80
06/30/14	35.8	43.8	41.6	-3.10	-32.6	61.6	18.7	-50.2	4.80
07/11/14	36.8	43.8	39.6	0.90	-33.6	65.6	18.7	-36.2	3.80
07/25/14	35.8	43.8	41.6	1.90	-35.6	64.6	40.7	-31.2	4.80
08/01/14	35.8	43.8	41.6	1.90	-35.6	64.6	40.7	-31.2	4.80
08/15/14	36.8	42.8	41.6	0.90	-34.6	63.6	36.7	-12.2	3.80
09/11/14	15.8	43.8	42.6	0.90	-32.6	59.6	17.7	-46.2	5.80
09/19/14	35.8	43.8	39.6	1.90	-32.6	65.6	38.7	-27.2	2.80
10/03/14	34.8	41.8	37.6	0.90	-36.6	62.6	15.7	-14.2	2.80

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 2014

Date ¹	Observation Well No.								
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
	----- Elevation (ft) ² -----								
10/30/14	35.8	40.8	41.6	-2.10	-35.6	64.6	18.7	-41.2	4.80
11/14/14	36.8	41.8	41.6	-0.10	-34.6	63.6	19.7	-43.2	2.80
11/26/14	36.8	43.8	38.6	0.90	-35.6	65.6	18.7	-26.2	3.80
12/05/14	38.8	43.8	40.6	0.90	-36.6	62.6	18.7	-22.2	0.80
12/17/14	36.8	42.8	39.6	-1.10	-36.6	66.6	20.7	-33.2	1.80

¹Date measurements were taken.

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

³No readings. Wells inaccessible due to snow accumulation or flooding in vicinity of well.

FIGURE 2: MINIMUM, MEAN, AND MAXIMUM WATER 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 2014

