

*Protecting Our Water Environment*



*Metropolitan Water Reclamation District of Greater Chicago*

***MONITORING AND RESEARCH  
DEPARTMENT***

***REPORT NO. 16-23***

***TUNNEL AND RESERVOIR PLAN***

***UPPER DES PLAINES TUNNEL SYSTEM***

***ANNUAL GROUNDWATER MONITORING REPORT***

***FOR 2015***

***July 2016***

**Metropolitan Water Reclamation District of Greater Chicago**  
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TUNNEL AND RESERVOIR PLAN  
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ANNUAL GROUNDWATER MONITORING REPORT  
FOR 2015

Monitoring and Research Department  
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July 2016

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## ANNUAL DATA FOR MONITORING WELLS

### Introduction

This system consists of two subsystems, 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 biweekly since these wells also function as observation wells.

During the year, all monitoring wells in the UDP Tunnel system were sampled at the required frequency. Monitoring Wells MW-2, -5, and -7 were all repaired and pumps replaced during 2014 through 2015. Following repairs, the wells were also decontaminated using the standard procedure to eliminate any fecal coliform bacteria that might have entered the wells during repairs.

### Summary of Data for Monitoring Wells

The analytical data for groundwater sampled during 2015 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 nondetectable, but during the month of June, an elevated FC count (840 CFU/100 mL) was observed in MW-5, due to contamination. Following the standard protocol for decontamination of this well, the FC count immediately returned to normal (<1 CFU/100 mL).

[Table 2](#) lists the descriptive statistics for the groundwater data of monitoring wells MW-1 through MW-9 for the year 2015. There were no significant changes observed in any analytes that would suggest any potential for groundwater contamination.

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, -7, and -8 during the year. A similar pattern of fluctuation was observed in Wells MW-1, -4, -7, and -8 over the last two years.

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

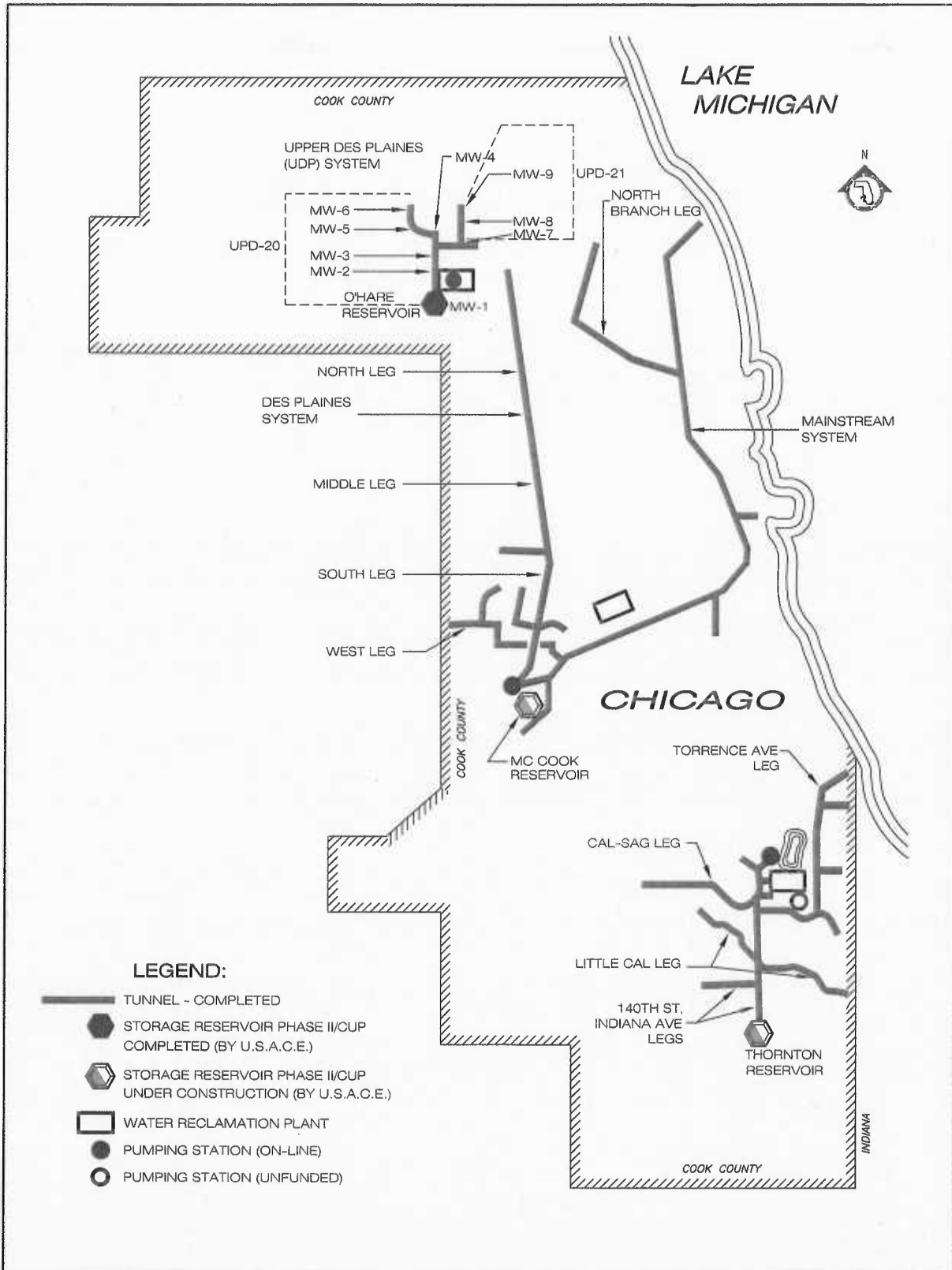


TABLE 1: ANALYSIS OF GROUNDWATER FROM MONITORING WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2015

Well <sup>1</sup>	Date Sampled	pH	EC <sup>2</sup>	TDS <sup>2</sup>	TOC <sup>2</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform	Temp.	Water Elevation <sup>3</sup>	Recharge Time	
			mS/m			mg/L				CFU/100 mL	°C	ft	hr	
MW-1	03/12/15	7.5	85	664	<1	<10	395	0.39	429	<1	15.1	15	<48	
MW-1	04/22/15	7.4	81	754	<1	31	368	0.35	451	<1	13.5	20	<48	
MW-1	06/10/15	7.6	84	814	<1	30	355	0.32	452	<1	18.2	15	<48	
MW-1	09/30/15	7.2	102	802	<1	33	382	0.56	455	<1	14.9	29	<48	
MW-1	10/28/15	7.4	108	726	<1	29	374	0.42	455	<1	15.3	19	<48	
MW-1	12/03/15	7.4	103	746	<1	30	400	0.26	450	<1	14.0	18	<48	
MW-1	12/16/15	7.6	103	712	<1	29	376	0.28	448	<1	14.3	19	<48	
3	MW-2	03/19/15	7.5	90	810	1	48	430	0.59	467	<1	13.3	44	<48
	MW-2	04/15/15	7.6	46	808	<1	<10	383	0.59	492	<1	14.6	42	<48
	MW-2	07/29/15	7.5	118	832	1	49	426	0.59	496	<1	15.6	43	<48
	MW-2	09/10/15	7.5	113	826	<1	49	421	0.59	488	<1	14.7	44	<48
	MW-2	10/28/15	7.6	114	774	<1	49	463	0.64	457	<1	14.1	44	<48
	MW-2	12/16/15	7.7	109	830	<1	47	406	0.56	490	<1	13.3	44	<48
MW-3	09/30/15	7.9	100	794	<1	18	455	0.59	458	<1	14.9	41	<48	
MW-3	10/08/15	7.4	110	790	2	13	483	0.33	447	<1	15.3	41	<48	
MW-3	10/28/15	7.4	109	764	1	12	442	0.42	463	<1	14.8	41	<48	
MW-3	11/18/15	7.9	104	788	<1	12	480	0.32	467	<1	15.2	40	<48	
MW-3	12/03/15	7.4	104	750	<1	14	467	0.28	427	<1	14.1	40	<48	
MW-3	12/16/15	7.8	105	766	<1	13	448	0.35	473	<1	14.7	42	<48	
MW-4	03/12/15	7.5	98	842	<1	67	389	0.12	522	<1	15.2	-4.1	<48	
MW-4	04/30/15	7.5	98	920	<1	64	378	0.12	557	<1	13.7	-8.1	<48	
MW-4	06/10/15	7.7	101	972	<1	68	358	0.10	556	<1	16.2	-2.1	<48	
MW-4	09/30/15	7.4	129	944	<1	68	388	0.33	542	<1	14.6	-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 2015

Well <sup>1</sup>	Date Sampled	pH	EC <sup>2</sup>	TDS <sup>2</sup>	TOC <sup>2</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform	Temp.	Water Elevation <sup>3</sup>	Recharge Time
			mS/m				mg/L			CFU/100 mL	°C	ft	hr
MW-4	10/28/15	7.3	128	886	<1	63	388	0.17	558	<1	14.0	-1.1	<48
MW-4	12/03/15	7.4	123	896	<1	68	400	<0.10	560	<1	13.5	-1.1	<48
MW-5	04/01/15	7.0	89	NA <sup>4</sup>	NA	411	NA	NA	NA	<1	14.1	-35	<48
MW-5	04/30/15	7.9	91	760	1	93	291	0.26	292	<1	13.1	-56	<48
MW-5	06/10/15	8.1	123	924	3	301	171	<0.10	165	840	14.8	-56	<48
MW-5	10/28/15	8.8	183	1,010	2	351	180	0.32	151	1	14.8	-55	<48
MW-5	11/18/15	8.1	146	894	<1	221	268	0.41	236	<1	14.3	-56	<48
MW-5	12/03/15	9.0	144	786	1	299	121	0.12	94	<1	14.1	-56	<48
MW-5	12/16/15	7.9	131	812	<1	129	283	0.49	303	<1	13.1	-56	<48
MW-6	01/21/15	7.4	79	670	1	38	317	0.54	364	<1	13.3	67	<4
MW-6	03/30/15	7.2	83	698	1	40	336	0.55	380	<1	13.4	67	<4
MW-6	07/27/15	7.6	94	718	2	37	356	0.56	397	1	15.8	65	<4
MW-6	09/02/15	7.9	106	632	2	33	279	0.51	344	<1	14.5	65	<4
MW-6	11/30/15	7.6	90	718	<1	36	350	0.49	379	<1	13.2	66	<4
MW-6	12/17/15	6.9	108	736	<1	37	347	0.46	394	<1	12.0	66	<4
MW-7	03/30/15	7.3	93	NA	NA	37	NA	NA	NA	<1	14.4	21	<4
MW-7	04/15/15	7.1	97	806	<1	43	367	0.51	503	<1	14.6	18	<4
MW-7	07/29/15	7.4	113	784	<1	41	402	0.53	495	<1	16.5	19	<4
MW-7	09/10/15	7.6	116	832	<1	38	399	0.54	511	<1	15.9	21	<4
MW-7	10/26/15	6.6	62	826	<1	36	387	0.55	494	<1	6.8	21	<4
MW-7	11/30/15	7.0	111	828	<1	37	392	0.50	504	<1	15.5	20	<4
MW-7	12/14/15	7.1	115	812	<1	37	358	0.51	532	<1	15.4	21	<4

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 2015

Well <sup>1</sup>	Date Sampled	pH	EC <sup>2</sup>	TDS <sup>2</sup>	TOC <sup>2</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform	Temp.	Water Elevation <sup>3</sup>	Recharge Time
			mS/m			mg/L				CFU/100 mL	°C	ft	hr
MW-8	02/19/15	12	92	750	1	69	377	<0.10	409	<1	12.1	-50	<48
MW-8	04/22/15	7.9	99	864	1	135	301	<0.10	418	<1	13.2	-47	<48
MW-8	06/04/15	7.9	99	764	1	91	305	<0.10	391	21	16.9	-47	<48
MW-8	09/30/15	8.4	108	720	1	83	294	0.18	355	<1	15.1	-51	<48
MW-8	10/28/15	7.7	118	772	<1	54	374	0.12	443	2	15.1	-31	<48
MW-8	12/03/15	9.0	144	804	1	281	143	0.15	113	<3	13.7	-59	<48
MW-8	12/16/15	8.1	104	834	<1	48	326	<0.10	437	<1	14.4	-59	<48
5 MW-9	02/19/15	11	80	648	1	37	357	0.42	350	1	11.8	-3.2	<48
MW-9	04/22/15	7.8	78	700	1	30	336	0.41	388	<1	14.0	7.8	<48
MW-9	06/04/15	7.7	85	684	1	32	321	0.39	378	<1	14.6	8.8	<48
MW-9	09/30/15	7.9	102	658	1	30	318	0.80	353	<1	14.4	7.8	<48
MW-9	10/28/15	7.5	104	720	<1	32	348	0.50	368	<1	14.5	5.8	<48
MW-9	12/03/15	7.8	99	674	<1	30	355	0.25	373	<1	14.3	8.8	<48
MW-9	12/16/15	7.8	99	712	<1	30	339	0.31	390	<1	14.3	6.8	<48

<sup>1</sup>All wells functional following major repairs during 2015.

<sup>2</sup>EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.

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

<sup>4</sup>No analysis; only FC and Cl required following well decontamination.

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 2015

Well	Statistic	pH	EC <sup>1</sup>	TDS <sup>1</sup>	TOC <sup>1</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform <sup>2</sup>
			mS/m	mg/L						CFU/100 mL
MW-1	Minimum	7.2	81	664	<1	<10	355	0.26	429	<1
	Mean	7.4	95	745	<1	30	379	0.37	449	<1
	Maximum	7.6	108	814	<1	33	400	0.56	455	<1
	Std. Dev.	0.1	11	52	0.0	2	15	0.10	9	NA <sup>3</sup>
	Median	7.4	102	746	<1	30	376	0.35	451	<1
	Coeff. of Var. (%)	1.9	12	7	0.0	5	4	28	2	NA
MW-2	Minimum	7.5	46	774	<1	<10	383	0.56	457	<1
	Mean	7.5	98	813	1	48	421	0.59	482	<1
	Maximum	7.7	118	832	1	49	463	0.64	496	<1
	Std. Dev.	0.1	28	22	0.0	1	27	0.03	16	NA
	Median	7.6	111	818	1	49	424	0.59	489	<1
	Coeff. of Var. (%)	1.1	28	3	0.0	2	6	4.4	3	NA
MW-3	Minimum	7.4	100	750	<1	12	442	0.28	427	<1
	Mean	7.6	105	775	1	14	463	0.38	456	<1
	Maximum	7.9	110	794	2	18	483	0.59	473	<1
	Std. Dev.	0.3	4	18	0.0	2	17	0.11	17	NA
	Median	7.6	105	777	<1	13	461	0.34	461	<1
	Coeff. of Var. (%)	3.3	4	2	0.0	16	4	29	4	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 2015

Well	Statistic	pH	EC <sup>1</sup>	TDS <sup>1</sup>	TOC <sup>1</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform <sup>2</sup>
			mS/m				mg/L			CFU/100 mL
MW-4	Minimum	7.3	98	842	<1	63	358	0.10	522	<1
	Mean	7.5	113	910	<1	66	383	0.17	549	<1
	Maximum	7.7	129	972	<1	68	400	0.33	560	<1
	Std. Dev.	0.1	15	46	0.0	2	14	0.09	15	NA
	Median	7.5	112	908	<1	68	388	0.12	557	<1
	Coeff. of Var. (%)	1.9	14	5	0.0	3	4	56	3	NA
MW-5	Minimum	7.0	89	760	<1	93	121	0.12	94	<1
	Mean	8.1	129	864	2	258	219	0.32	207	3
	Maximum	9.0	183	1,010	3	411	291	0.49	303	840
	Std. Dev.	0.7	33	95	0.5	116	71	0.14	84	NA
	Median	8.1	131	853	2	299	224	0.32	201	1
	Coeff. of Var. (%)	8.1	25	11	26	45	32	44	40	NA
MW-6	Minimum	6.9	79	632	<1	33	279	0.5	344	<1
	Mean	7.4	93	695	2	37	331	0.5	376	<1
	Maximum	7.9	108	736	2	40	356	0.6	397	<1
	Std. Dev.	0.4	12	38	1	2	29	0.0	20	NA
	Median	7.5	92	708	1	37	341	0.5	380	<1
	Coeff. of Var. (%)	5.0	12	6	36	6	9	7.5	5	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 2015

Well	Statistic	pH	EC <sup>1</sup>	TDS <sup>1</sup>	TOC <sup>1</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	NH <sub>3</sub> -N	Hardness	Fecal Coliform <sup>2</sup>
			mS/m	mg/L						CFU/100 mL
MW-7	Minimum	6.6	62	784	<1	36	358	0.5	494	<1
	Mean	7.1	101	815	<1	38	384	0.5	507	<1
	Maximum	7.6	116	832	<1	43	402	0.6	532	<1
	Std. Dev.	0.3	19	18	0.0	3	18	0.0	14	NA
	Median	7.1	111	819	<1	37	390	0.5	504	<1
	Coeff. of Var. (%)	4.5	19	2	0.0	7	5	3.8	3	NA
MW-8	Minimum	7.7	92	720	<1	48	143	0.1	113	<1
	Mean	8.7	109	787	1	109	303	0.2	367	<1
	Maximum	11.8	144	864	1	281	377	0.2	443	<1
	Std. Dev.	1.5	17	50	0.1	81	78	0.0	116	NA
	Median	8.1	104	772	1	83	305	0.2	409	<1
	Coeff. of Var. (%)	17	16	6	11	75	26	20.0	32	NA
MW-9	Minimum	7.5	78	648	<1	30	318	0.3	350	<1
	Mean	8.3	92	685	1	32	339	0.4	371	<1
	Maximum	11.3	104	720	1	37	357	0.8	390	<1
	Std. Dev.	1.3	11	27	0.1	3	15	0.2	16	NA
	Median	7.8	99	684	1	30	339	0.4	373	<1
	Coeff. of Var. (%)	16	12	4	5	8	5	40.4	4	NA

<sup>1</sup>EC = electrical conductivity; TDS = total dissolved solids; TOC = total dissolved organic carbon.

<sup>2</sup>Geometric mean calculated.

<sup>3</sup>Not 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 2015

Date <sup>1</sup>	Observation Well No.								
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
	-----Elevation (ft) <sup>2</sup> -----								
01/16/15	36.8	43.8	39.6	2.9	-34.6	66.6	19.7	-32.2	2.8
01/29/15	35.8	42.8	39.6	-2.1	-35.6	65.6	18.7	-26.2	1.8
02/06/15	NA <sup>3</sup>	44.8	NA	-7.1	NA	NA	19.7	NA	NA
02/11/15	"	45.8	"	-7.1	-34.6	66.6	20.7	-16.2	1.8
03/06/15	"	44.8	"	-6.1	NA	65.6	23.7	-19.2	-1.2
03/20/15	36.8	43.8	39.6	-0.1	-38.6	66.6	17.7	-27.2	3.8
04/02/15	36.8	42.8	41.6	0.9	-35.6	65.6	20.7	-8.2	6.8
04/23/15	-7.2	44.8	39.6	-0.1	-48.6	65.6	18.7	-58.2	-2.2
05/01/15	37.8	43.8	41.6	-7.1	-59.6	67.6	19.7	-48.2	8.8
05/29/15	36.8	43.8	41.6	0.9	-49.6	66.6	18.7	-15.2	7.8
06/05/15	36.8	44.8	40.6	-0.1	-48.6	65.6	19.7	-56.2	3.8
06/30/15	37.8	44.8	39.6	-0.1	-47.6	63.6	20.7	-28.2	5.8
07/07/15	35.8	43.8	39.6	-3.1	-46.6	61.6	5.70	-18.2	4.8
07/29/15	36.8	45.8	39.6	0.9	-41.6	62.6	20.7	-41.2	5.8
08/07/15	37.8	45.8	39.6	0.9	-41.6	62.6	20.7	-41.2	5.8
08/28/15	37.8	44.8	43.6	-1.1	-41.6	63.6	16.7	-23.2	-3.2
09/04/15	39.8	43.8	41.6	0.9	-46.6	64.6	18.7	16.8	2.8
09/18/15	NA	46.8	NA	-3.1	-46.6	62.6	45.7	NA	3.8
10/09/15	36.8	44.8	39.6	-0.1	-40.6	64.6	21.7	-39.2	-1.2
10/16/15	37.8	43.8	40.6	-1.1	-43.6	63.6	22.7	-41.2	-2.2
11/13/15	35.8	43.8	38.6	-0.1	-51.6	64.6	19.7	-32.2	6.8
11/24/15	34.8	41.8	NA	-0.1	NA	64.6	19.7	NA	NA
12/01/15	37.8	42.8	39.6	1.9	-49.6	65.6	19.7	-17.2	5.8
12/16/15	18.8	43.8	41.6	-0.1	-55.6	65.6	20.7	-59.2	6.8

<sup>1</sup>Date measurements were taken.

<sup>2</sup>Relative to Chicago city datum (579.48' above mean sea level) at intersection of State and Madison Streets.

<sup>3</sup>No reading. Well inaccessible due to snow accumulation or swamping 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 2015

