

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 17-28

TUNNEL AND RESERVOIR PLAN

DES PLAINES TUNNEL SYSTEM

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2016

August 2017

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Dear Sir or Madam:

Subject: Tunnel and Reservoir Plan, Des Plaines Tunnel System, Annual
Groundwater Monitoring Report for 2016

Attached are three copies of "Tunnel and Reservoir Plan, Des Plaines Tunnel System,
Annual Groundwater Monitoring Report for 2016."

Very truly yours,

Albert E. Cox
Environmental Monitoring and Research Manager
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AC:PL:cm

Attachment

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**TUNNEL AND RESERVOIR PLAN
DES PLAINES TUNNEL SYSTEM
ANNUAL GROUNDWATER MONITORING REPORT
FOR 2016**

**Monitoring and Research Department
Edward W. Podczerwinski, Acting Director**

August 2017

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LIST OF ABBREVIATIONS

°C	degrees Celsius
CFU	colony forming units
Cl ⁻	chloride
EC	electrical conductivity
FC	fecal coliform
ft	feet
hr	hour
L	liter
m	meter
mg	milligram
mS	millisiemens
NH ₃ -N	ammonia nitrogen
SO ₄ ²⁻	sulfate
TDS	total dissolved solids
TOC	total organic carbon

ANNUAL DATA FOR MONITORING WELLS

Introduction

All monitoring wells are located along the 13A extension, south leg, middle leg, and north leg of the Des Plaines Tunnel System (Figure 1). Monitoring wells QD-21 through -26, -28 through -32, -35, -36, and -38 through -60 are sampled three times per year, while QD-27, -33, -34, and -37 are sampled six times per year (Illinois Environmental Protection Agency memoranda July 9, 2004, and February 23, 2006).

All monitoring wells in the Des Plaines Tunnel System were sampled at the required frequencies during 2016. Wells QD-40 and -41 were sampled with the use of a higher-capacity generator. Groundwater elevations in the monitoring wells (Table 1) were measured during each sampling event.

Summary of Data for Monitoring Wells

The analytical data for groundwater sampled during 2016 from monitoring wells QD-21 through QD-60 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 counts for most wells were non-detectable. Table 2 lists the descriptive statistics for groundwater data of monitoring wells QD-21 through QD-60 for 2016.

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

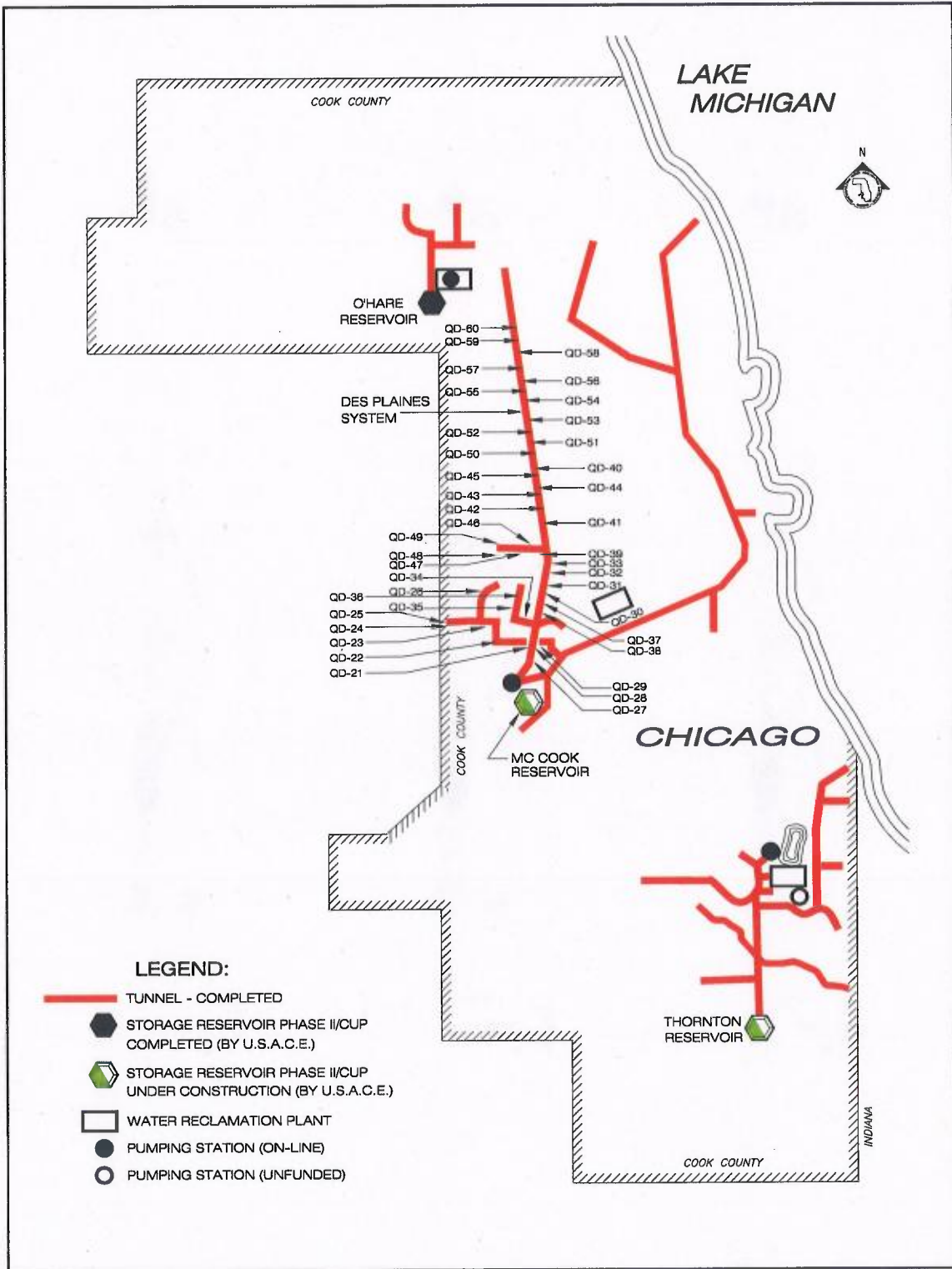


TABLE 1: ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2016

Well	Date Sampled	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ²	Recharge Time
			mS/m	----- mg/L -----						CFU/100 mL	°C	ft	hr
QD-21	05/31/16	6.9	213	1,558	<1.0	337	392	0.27	880	<1	13.3	-49	<4
QD-21	08/01/16	7.1	211	1,490	<1.0	283	350	0.20	771	<1	13.3	-50	<4
QD-21	11/02/16	6.8	181	1,418	<1.0	301	351	<0.10	766	<1	13.2	-44	<4
QD-22	05/31/16	7.0	149	918	1.1	128	217	0.38	702	<1	13.8	-14	<4
QD-22	08/01/16	7.0	159	1,116	1.7	130	297	0.41	720	<1	13.2	-18	<4
QD-22	11/02/16	7.0	155	936	1.4	128	229	0.43	649	<1	13.4	-17	<4
QD-23	05/31/16	6.9	189	1,264	1.3	223	339	0.51	856	<1	14.1	-22	<4
QD-23	08/03/16	6.6	204	1,426	1.3	266	373	0.52	837	<1	14.3	-24	<4
QD-23	11/02/16	6.9	210	1,326	1.6	229	351	0.57	791	<1	13.3	-24	<4
QD-24	05/31/16	7.0	161	1,040	2.1	162	262	0.68	713	<1	12.2	17	<4
QD-24	08/03/16	7.5	94	762	1.6	103	152	0.48	435	<1	12.4	23	<4
QD-24	11/02/16	7.1	165	990	2.4	151	225	0.69	606	<1	12.0	22	<4
QD-25	05/31/16	7.0	250	1,516	2.0	491	251	0.62	699	<1	11.7	32	<4
QD-25	08/03/16	7.2	233	1,616	1.2	509	239	0.65	623	<1	11.6	34	<4
QD-25	11/02/16	7.0	258	1,596	1.7	512	256	0.74	642	<1	11.1	34	<4
QD-26	05/19/16	7.7	86	524	1.9	10	107	0.63	409	<1	12.2	-0.8	<4
QD-26	08/10/16	7.4	87	570	<1.0	14	110	0.37	392	<1	12.3	-7	<4
QD-26	11/10/16	7.0	86	522	1.0	10	97	0.35	395	<1	12.0	-4	<4

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2016

Well	Date Sampled	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ²	Recharge Time
			mS/m	----- mg/L -----						CFU/100 mL	°C	ft	hr
QD-27	02/25/16	6.9	231	1,238	14	411	34	30	483	<1	12.3	-237	<48
QD-27	04/06/16	8.1	222	1,240	13	366	21	30	496	<1	13.1	-201	<48
QD-27	06/29/16	7.0	237	1,236	11	378	79	26	472	8	12.8	-183	<48
QD-27	09/08/16	7.3	244	1,272	13	392	40	28	507	36	12.8	-166	<48
QD-27	10/20/16	7.0	229	1,340	13	437	26	31	493	8	13.5	-170	<48
QD-27	12/08/16	7.1	255	1,266	13	387	38	31	473	7	11.9	-158	<48
QD-28	05/31/16	7.2	130	766	2.1	174	135	0.86	472	67	13.0	-97	<4
QD-28	08/01/16	7.0	141	914	<1.0	152	161	0.86	489	4	14.7	-112	<4
QD-28	11/09/16	7.2	131	774	1.3	145	154	1.1	457	<1	13.3	-99	<4
QD-29	05/31/16	6.9	164	976	1.5	162	263	0.41	730	1	13.2	-94	<4
QD-29	08/01/16	7.1	163	1,002	1.0	146	228	0.45	582	<1	14.5	-100	<4
QD-29	11/09/16	6.7	251	2,284	5.5	491	793	1.0	975	<1	13.2	-65	<4
QD-30	05/19/16	6.8	161	996	2.2	125	284	0.28	613	18	12.8	-93	<4
QD-30	08/10/16	7.1	129	944	<1.0	116	196	0.25	264	1	14.1	-116	<4
QD-30	11/10/16	7.0	141	946	1.2	118	247	0.43	562	1	12.2	-102	<4
QD-31	05/19/16	7.4	133	814	<1.0	103	165	0.13	239	710	12.1	-188	<4
QD-31	08/10/16	7.6	136	1,152	1.2	128	304	0.29	635	16	13.7	-192	<4
QD-31	11/10/16	7.5	145	936	<1.0	110	157	0.19	260	2	11.9	-194	<4
QD-32	05/19/16	9.1	327	1,914	<1.0	529	250	<0.10	50	1	11.9	-210	<48
QD-32	08/10/16	8.8	331	2,108	<1.0	526	168	0.19	35	<1	12.3	-214	<48
QD-32	11/10/16	9.1	325	1,954	<1.0	518	208	0.22	35	1	11.8	-213	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2016

Well	Date Sampled	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ²	Recharge Time
			mS/m				mg/L			CFU/100 mL	°C	ft	hr
QD-33	02/25/16	8.1	262	1,596	<1.0	389	217	0.20	26	<1	11.2	-186	<48
QD-33	04/06/16	7.8	269	1,554	<1.0	335	215	0.19	27	<1	11.9	-187	<48
QD-33	06/29/16	8.6	240	1,652	4.8	356	205	<0.10	30	<1	12.9	-182	<48
QD-33	09/08/16	8.3	269	1,654	<1.0	359	206	0.26	28	1	13.5	-188	<48
QD-33	10/20/16	8.3	262	1,478	<1.0	310	172	<0.10	22	<1	12.5	-178	<48
QD-33	12/08/16	8.1	273	1,570	<1.0	345	205	0.26	33	<1	12.1	-188	<48
5 QD-34	02/03/16	7.0	147	994	1.2	147	273	0.54	681	1	12.4	-78	<4
QD-34	03/24/16	7.0	157	1,118	1.6	160	303	0.43	667	1	12.9	-82	<4
QD-34	07/25/16	7.1	96	494	14	112	52	2.9	292	19,000	13.7	-75	<4
QD-34	09/06/16	6.9	165	1,062	2.5	167	285	3.2	700	130	13.0	-73	<4
QD-34	10/31/16	7.0	163	1,078	1.6	161	268	0.53	658	4	12.8	-75	<4
QD-34	12/14/16	6.9	160	1,062	1.5	157	267	0.65	695	<1	12.3	-75	<4
QD-35	05/31/16	7.0	143	1,026	NRR ³	126	251	0.36	673	29	13.1	-70	<4
QD-35	08/01/16	7.1	149	NRR	1.6	142	240	0.39	653	<1	13.3	-84	<4
QD-35	11/21/16	6.9	148	974	1.3	101	291	<0.10	656	<1	12.7	-73	<4
QD-36	05/31/16	6.8	153	1,118	6.4	125	311	0.68	755	100	11.7	-82	<48
QD-36	08/01/16	6.9	164	1,220	2.0	120	336	0.39	741	170	14.1	-101	<48
QD-36	11/21/16	7.0	162	1,054	1.6	126	272	0.37	697	<1	11.3	-94	<48
QD-37	02/25/16	7.3	218	1,390	1.1	261	376	0.16	453	<1	12.1	-218	<48
QD-37	04/06/16	8.2	219	1,410	<1.0	238	373	0.23	506	<1	12.7	-206	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2016

Well	Date Sampled	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ²	Recharge Time
			mS/m	----- mg/L -----						CFU/100 mL	°C	ft	hr
QD-37	06/29/16	7.4	217	1,356	<1.0	257	383	<0.10	421	<1	13.1	-205	<48
QD-37	09/22/16	7.2	209	1,326	<1.0	251	346	0.21	382	<1	14.2	-210	<48
QD-37	10/20/16	7.6	211	1,332	<1.0	247	341	0.22	416	<1	13.2	-175	<48
QD-37	12/08/16	7.5	214	1,248	<1.0	252	347	0.23	385	<1	12.7	-197	<48
QD-38	05/19/16	7.5	125	690	1.7	152	108	0.25	172	<1	12.6	-195	<48
QD-38	08/10/16	7.7	133	814	<1.0	159	106	0.35	258	<1	12.9	-211	<48
QD-38	11/10/16	8.0	128	770	<1.0	159	97	0.35	239	<1	12.5	-207	<48
QD-39	02/25/16	8.3	122	788	<1.0	29	105	<0.10	17	<1	10.9	-147	<48
QD-39	07/27/16	8.0	125	864	<1.0	27	96	<0.10	19	<1	12.6	-142	<48
QD-39	09/22/16	8.4	126	940	<1.0	27	103	0.13	28	<1	12.4	-144	<48
QD-40	04/20/16	9.8	112	758	1.2	16	390	<0.10	17	<1	13.0	-114	<48
QD-40	09/22/16	9.4	119	750	1.1	14	354	<0.10	17	<1	13.4	-114	<48
QD-40	10/20/16	9.2	117	714	1.0	17	342	<0.10	21	<1	13.1	-122	<48
QD-41	04/20/16	7.1	97	748	1.5	16	364	0.26	419	<1	13.1	-142	<48
QD-41	07/27/16	7.5	104	842	1.9	17	337	0.24	395	<1	13.5	-114	<48
QD-41	09/22/16	7.6	106	924	1.8	18	360	0.27	419	<1	13.5	-122	<48
QD-42	04/20/16	7.5	102	734	1.0	20	325	0.27	395	<1	12.1	-120	<48
QD-42	07/27/16	7.7	106	854	<1.0	19	282	0.26	382	<1	13.0	-119	<48
QD-42	09/22/16	7.6	112	932	1.1	18	307	0.22	396	<1	12.5	-129	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2016

Well	Date Sampled	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ²	Recharge Time
			mS/m			mg/L				CFU/100 mL	°C	ft	hr
QD-43	04/20/16	7.4	101	706	1.3	50	231	0.31	471	<1	12.1	-138	<4
QD-43	07/27/16	7.4	109	854	<1.0	47	213	0.31	443	<1	12.6	-136	<4
QD-43	09/22/16	7.4	108	820	1.1	51	221	0.34	458	<1	12.4	-140	<4
QD-44	04/20/16	7.6	88	598	1.7	22	218	0.34	335	<1	11.2	-5	<48
QD-44	07/27/16	7.7	88	712	<1.0	21	210	0.33	324	1	11.5	-5	<48
QD-44	09/22/16	7.7	94	756	1.0	19	206	0.34	335	<1	11.7	-9	<48
7 QD-45	04/20/16	7.9	95	566	1.8	19	221	0.33	106	<1	12.1	-3	<4
QD-45	07/27/16	9.2	83	578	<1.0	17	213	0.29	103	<1	12.0	-3	<4
QD-45	09/22/16	8.4	89	582	1.0	17	215	0.30	116	<1	12.0	-6	<4
QD-46	05/31/16	7.9	94	556	2.4	31	116	0.17	84	3,500	13.1	-177	<48
QD-46	08/01/16	8.1	88	NRR	<1.0	13	128	0.22	83	31	13.0	-170	<48
QD-46	11/21/16	8.0	89	562	<1.0	10	127	0.23	81	<1	11.9	-173	<48
QD-47	02/25/16	7.9	72	502	1.0	14	162	0.22	241	<1	13.8	-0.2	<48
QD-47	08/24/16	7.6	81	492	1.0	14	165	0.25	226	<1	13.5	7	<48
QD-47	10/20/16	7.2	82	486	1.0	15	149	0.34	245	<1	13.2	8	<48
QD-48	02/25/16	8.5	73	502	1.3	<10	287	0.10	264	<1	12.6	-181	<48
QD-48	08/24/16	7.0	81	602	1.0	<10	261	10	242	<1	15.1	-177	<48
QD-48	10/20/16	7.8	88	576	1.5	<10	271	0.63	332	<1	13.3	-176	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2016

Well	Date Sampled	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water	Recharge
												Elevation ²	Time
		mS/m		----- mg/L -----				CFU/100 mL	°C	ft	hr		
QD-49	02/25/16	8.5	83	564	1.0	14	251	0.13	330	<1	12.2	-186	<48
QD-49	08/24/16	8.2	88	662	1.6	13	246	0.17	301	27	15.7	-181	<48
QD-49	10/20/16	7.9	91	568	<1.0	14	172	0.35	347	<1	13.2	-176	<48
QD-50	05/05/16	9.5	99	652	1.0	13	278	0.10	7	<1	11.7	-133	<48
QD-50	08/11/16	9.5	73	758	1.2	12	294	0.12	9	<1	14.8	-143	<48
QD-50	11/16/16	9.5	106	648	1.4	11	286	<0.10	26	<1	11.8	-146	<48
∞ QD-51	05/05/16	9.2	84	520	<1.0	13	125	<0.10	5	<1	11.6	-99	<48
QD-51	08/11/16	9.3	84	636	1.2	12	129	<0.10	5	<1	12.7	-118	<48
QD-51	11/16/16	9.3	88	500	1.1	12	136	<0.10	4	<1	11.8	-118	<48
QD-52	05/05/16	8.9	76	484	<1.0	16	146	0.10	18	28	12.7	-94	<48
QD-52	08/11/16	9.1	75	574	1.3	16	141	0.12	15	12	14.3	-120	<48
QD-52	11/16/16	9.0	78	468	<1.0	15	155	0.11	17	<1	13.1	-125	<48
QD-53	05/05/16	9.0	91	564	<1.0	19	161	<0.10	8	<1	12.6	-164	<48
QD-53	08/11/16	9.0	90	684	1.0	17	165	<0.10	10	<1	14.7	-167	<48
QD-53	11/16/16	9.1	94	562	1.2	18	170	<0.10	10	<1	13.0	-167	<48
QD-54	05/05/16	9.1	65	408	<1.0	18	148	0.22	36	<1	12.3	-17	<48
QD-54	08/11/16	8.9	69	490	<1.0	18	148	0.23	39	<1	13.2	-41	<48
QD-54	11/16/16	8.9	68	398	<1.0	16	153	0.21	36	<1	12.3	-40	<48

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER FROM MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2016

Well	Date Sampled	pH	EC ¹	TDS ¹	TOC ¹	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Fecal Coliform	Temp	Water Elevation ²	Recharge Time
			mS/m				mg/L			CFU/100 mL	°C	ft	hr
QD-55	05/05/16	8.2	70	450	<1.0	15	164	0.23	132	<1	11.9	-28	<48
QD-55	08/11/16	7.3	82	516	<1.0	16	189	<0.10	178	<1	14.0	-148	<48
QD-55	11/16/16	8.1	78	420	<1.0	15	206	<0.10	187	<1	12.3	-148	<48
QD-56	05/05/16	7.0	57	284	<1.0	11	14	0.22	55	<1	11.2	-68	<48
QD-56	08/31/16	8.5	53	356	<1.0	11	13	1.2	59	<1	11.5	-56	<48
QD-56	11/16/16	8.3	52	220	<1.0	10	18	0.22	59	<1	11.1	-77	<48
QD-57	05/05/16	7.1	58	330	<1.0	13	59	0.26	35	250	11.1	-109	<48
QD-57	08/31/16	8.7	59	432	1.0	14	79	0.34	51	3,500	11.4	-86	<48
QD-57	11/16/16	8.5	57	308	<1.0	12	58	0.23	19	1	11.3	-118	<48
QD-58	08/31/16	7.6	45	346	<1.0	10	<5	0.29	123	<1	11.7	-122	<48
QD-58	10/20/16	7.0	47	254	<1.0	12	<5	0.23	135	<1	11.9	-129	<48
QD-58	11/16/16	7.7	47	204	<1.0	11	<5	0.29	118	<1	11.7	-127	<48
QD-59	05/05/16	6.8	70	356	<1.0	77	29	0.31	236	<1	10.9	-50	<48
QD-59	08/31/16	7.8	69	408	<1.0	85	21	0.28	207	<1	12.2	-49	<48
QD-59	11/16/16	7.9	64	302	<1.0	76	26	0.31	226	<1	11.5	-57	<48
QD-60	05/05/16	7.1	68	378	<1.0	41	97	0.37	251	<1	12.7	-63	<48
QD-60	08/31/16	7.7	67	488	<1.0	42	104	0.35	259	<1	12.7	-114	<48
QD-60	11/16/16	7.8	67	348	<1.0	42	105	0.38	253	<1	11.8	-114	<48

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

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

³No reportable result.

TABLE 2: DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2016

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
QD-21	Minimum	6.8	181	1,418	<1.0	283	350	<0.1	766	<1
	Median	6.9	210	1,490	<1.0	301	351	0.2	771	<1
	Mean	6.9	202	1,489	<1.0	307	364	0.19	806	<1
	Maximum	7.0	213	1,558	<1.0	337	392	0.27	880	<1
	Std. Dev	0.1	18	70	NA	27	24	0.52	64	NA ³
	Coeff. of Var. (%)	2.0	9	5	NA	9	7	273	8	NA
QD-22	Minimum	7.0	149	918	1.1	128	217	0.38	649	<1
	Median	7.0	155	936	1.4	128	229	0.41	702	<1
	Mean	7.0	154	990	1.4	129	248	0.41	690	<1
	Maximum	7.0	159	1,116	1.7	130	297	0.43	720	<1
	Std. Dev	0	5	109	0.3	1	43	0.03	37	NA
	Coeff. of Var. (%)	0	3	11	21.0	1	17	6.0	5	NA
QD-23	Minimum	6.6	189	1,264	1.3	223	339	0.51	791	<1
	Median	6.9	204	1,326	1.3	229	351	0.52	837	<1
	Mean	6.8	201	1,339	1.4	239	354	0.53	828	<1
	Maximum	6.9	210	1,426	1.6	266	373	0.57	856	<1
	Std. Dev	0.2	11	82	0.2	23	17	0.03	33	NA
	Coeff. of Var. (%)	3.0	5	6	12.0	10	5	6.0	4	NA
QD-24	Minimum	7.0	94	762	1.6	103	152	0.48	435	<1
	Median	7.1	161	990	2.1	151	225	0.68	606	<1
	Mean	7.2	140	931	2.0	139	213	0.62	585	<1
	Maximum	7.5	164	1,040	2.4	162	262	0.69	713	<1
	Std. Dev	0.3	40	148	0.4	31	56	0.12	140	NA
	Coeff. of Var. (%)	4.0	29	16	20.0	23	26	19.0	24	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2016

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
QD-25	Minimum	7.0	233	1,516	1.2	491	239	0.62	623	<1
	Median	7.0	250	1,596	1.7	509	251	0.65	642	<1
	Mean	7.1	247	1,576	1.6	504	249	0.67	655	<1
	Maximum	7.2	258	1,616	2.0	512	256	0.74	699	<1
	Std. Dev	0.1	13	53	0.4	11	9	0.06	40	NA
	Coeff. of Var. (%)	1.0	5	3	25.0	2	4	9.0	6	NA
QD-26	Minimum	7.0	86	522	<1.0	10	97	0.35	392	<1
	Median	7.4	86	524	<1.0	10	107	0.37	395	<1
	Mean	7.4	86	539	1.3	11	105	0.45	399	<1
	Maximum	7.6	87	570	1.9	14	110	0.63	409	<1
	Std. Dev	0.3	1	27	1.4	2	7	0.16	9	NA
	Coeff. of Var. (%)	4.0	1	5	106	20	7	35.0	2	NA
QD-27	Minimum	6.9	222	1,236	10.8	366	21	26	472	<1
	Median	7.0	234	1,253	13.2	390	36	30	488	8
	Mean	7.2	236	1,265	12.9	395	40	29	487	5
	Maximum	8.1	255	1,340	14.3	437	79	31	507	36
	Std. Dev	0.4	12	40	1.2	25	20	1.9	14	1
	Coeff. of Var. (%)	6.0	5	3	9.0	6	51	7.0	3	23
QD-28	Minimum	7.0	130	766	<1.0	145	135	0.86	457	<1
	Median	7.2	131	774	1.3	152	154	0.86	472	4
	Mean	7.2	134	818	1.5	157	150	0.94	473	6
	Maximum	7.2	141	914	2.1	174	161	1.1	489	67
	Std. Dev	0.1	6	83	1.4	15	13	0.14	16	2
	Coeff. of Var. (%)	2.0	5	10	99.0	10	9	15.0	3	31

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2016

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
QD-29	Minimum	6.7	162	976	1.0	146	228	0.41	582	<1
	Median	6.9	164	1,002	1.5	162	263	0.45	730	<1
	Mean	6.9	192	1,421	2.7	266	428	0.63	762	<1
	Maximum	7.1	250	2,284	5.5	491	792	1.0	975	<1
	Std. Dev	0.2	50	748	2.5	195	316	0.34	198	NA
	Coeff. of Var. (%)	3.0	26	53	92.0	73	74	54.0	26	NA
QD-30	Minimum	6.8	129	944	<1.0	116	196	0.25	264	1
	Median	7.0	141	946	1.2	118	247	0.28	562	0
	Mean	7.0	144	962	1.5	120	242	0.32	480	3
	Maximum	7.1	161	996	2.2	125	284	0.43	613	2
	Std. Dev	0.1	16	29	1.5	5	44	0.1	189	10
	Coeff. of Var. (%)	2.0	11	3	101	4	18	30.0	39	375
QD-31	Minimum	7.4	133	814	<1.0	103	157	0.13	239	0
	Median	7.5	136	936	<1.0	110	165	0.19	260	2
	Mean	7.5	138	967	1.1	114	209	0.2	378	3
	Maximum	7.6	145	1,152	1.2	128	304	0.29	635	71
	Std. Dev	0.1	6	171	0.12	13	82	0.08	223	15
	Coeff. of Var. (%)	1.0	5	18	10.5	11	39	40.0	59	545
QD-32	Minimum	8.8	325	1,914	<1.0	518	168	<0.1	35	<1
	Median	9.1	326	1,954	<1.0	526	208	0.19	35	<1
	Mean	9.0	328	1,992	<1.0	524	209	0.17	40	<1
	Maximum	9.1	331	2,108	<1.0	529	250	0.22	50	<1
	Std. Dev	0.2	3	102	NA	6	41	0.32	9	NA
	Coeff. of Var. (%)	2.0	1	5	NA	1	20	186	22	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2016

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
QD-33	Minimum	7.8	240	1,478	<1.0	310	172	<0.1	22	<1
	Median	8.2	266	1,583	<1.0	350	206	0.2	28	<1
	Mean	8.2	263	1,584	1.6	349	203	0.18	28	<1
	Maximum	8.6	273	1,654	4.8	389	217	0.26	33	<1
	Std. Dev	0.3	12	66	2.2	26	17	0.32	4	NA
	Coeff. of Var. (%)	3.0	4	4	134	8	8	171	13	NA
QD-34	Minimum	6.9	96	494	1.2	112	52	0.43	292	<1
	Median	7.0	158	1,062	1.6	158	271	0.6	674	3
	Mean	7.0	148	968	3.8	151	241	1.3	616	15
	Maximum	7.1	165	1,118	14.2	167	303	3.1	700	19,000
	Std. Dev	0.1	26	236	5.1	20	94	1.3	159	7,746
	Coeff. of Var. (%)	1.0	18	24	136	13	39	95.0	26	52,877
QD-35	Minimum	6.9	143	<25	1.3	101	240	<0.1	653	<1
	Median	7.0	148	974	1.6	126	251	0.36	656	<1
	Mean	7.0	147	675	14.9	123	261	0.28	661	3
	Maximum	7.1	149	1,026	41.9	142	291	0.39	673	29
	Std. Dev	0.1	3	32	23.4	21	27	0.6	11	1
	Coeff. of Var. (%)	1.0	2	5	156	17	10	212	2	43
QD-36	Minimum	6.8	153	1,054	1.6	120	272	0.37	697	<1
	Median	6.9	162	1,118	2.0	125	311	0.39	741	100
	Mean	6.9	160	1,131	3.3	124	306	0.48	731	26
	Maximum	7.0	164	1,220	6.4	126	336	0.68	755	170
	Std. Dev	0.1	6	84	2.7	3	32	0.17	30	4
	Coeff. of Var. (%)	1.0	3	7	80.0	3	11	36.0	4	16

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2016

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
QD-37	Minimum	7.2	209	1,248	<1.0	238	341	0.1	382	<1
	Median	7.4	215	1,344	<1.0	252	360	0.22	418	<1
	Mean	7.5	215	1,344	1.0	251	361	0.19	427	<1
	Maximum	8.2	219	1,410	1.1	261	383	0.23	506	<1
	Std. Dev	0.4	4	57	0.04	8	18	0.05	47	NA
	Coeff. of Var. (%)	5.0	2	4	4.0	3	5	27.0	11	NA
QD-38	Minimum	7.5	125	690	<1.0	152	97	0.25	172	<1
	Median	7.7	128	770	<1.0	159	106	0.35	239	<1
	Mean	7.7	129	758	1.2	157	104	0.32	223	<1
	Maximum	8.0	133	814	1.7	159	108	0.35	258	<1
	Std. Dev	0.2	4	63	1.3	4	6	0.06	45	NA
	Coeff. of Var. (%)	3.0	3	8	106	3	6	18.0	20	NA
QD-39	Minimum	8.0	122	788	<1.0	27	96	<0.1	17	<1
	Median	8.2	125	864	<1.0	27	103	<0.1	19	<1
	Mean	8.2	124	864	<1.0	28	101	0.11	21	<1
	Maximum	8.4	126	940	<1.0	29	105	0.13	28	<1
	Std. Dev	0.2	2	76	NA	1	5	0.02	6	NA
	Coeff. of Var. (%)	2.0	2	9	NA	4	4	15.7	27	NA
QD-40	Minimum	9.2	112	714	1.0	14	342	<0.1	17	<1
	Median	9.4	117	750	1.1	16	354	<0.1	17	<1
	Mean	9.5	116	741	1.1	16	362	<0.1	18	<1
	Maximum	9.8	119	758	1.2	17	390	<0.1	21	<1
	Std. Dev	0.3	4	23	0.1	2	25	NA	2	NA
	Coeff. of Var. (%)	3.0	3	3	9.0	10	7	NA	13	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLSQD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2016

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
QD-41	Minimum	7.0	97	748	1.5	16	337	0.24	395	<1
	Median	7.4	104	842	1.8	17	360	0.26	419	<1
	Mean	7.4	102	838	1.7	17	353	0.26	411	<1
	Maximum	7.6	106	924	1.9	18	364	0.27	419	<1
	Std. Dev	0.3	5	88	0.2	1	15	0.02	14	NA
	Coeff. of Var. (%)	4.0	5	11	12.0	6	4	6.0	3	NA
QD-42	Minimum	7.5	102	734	<1.0	18	282	0.22	382	<1
	Median	7.6	106	854	<1.0	19	307	0.26	395	<1
	Mean	7.6	107	840	1.0	19	305	0.25	391	<1
	Maximum	7.6	112	932	1.1	20	325	0.27	396	<1
	Std. Dev	0.1	5	100	0.06	1	22	0.03	8	NA
	Coeff. of Var. (%)	1.0	5	12	5.6	5	7	11.0	2	NA
QD-43	Minimum	7.4	101	706	<1.0	47	213	0.31	443	<1
	Median	7.4	108	820	1.1	50	221	0.31	458	<1
	Mean	7.4	106	793	1.1	49	222	0.32	457	<1
	Maximum	7.4	109	854	1.3	51	231	0.34	471	<1
	Std. Dev	0	4	78	0.06	2	9	0.02	14	NA
	Coeff. of Var. (%)	0	4	10	5.6	4	4	5.0	3	NA
QD-44	Minimum	7.6	88	598	<1.0	19	206	0.33	324	<1
	Median	7.7	88	712	<1.0	21	210	0.34	335	<1
	Mean	7.6	90	689	1.2	21	211	0.34	331	<1
	Maximum	7.7	94	756	1.7	22	218	0.34	335	<1
	Std. Dev	0.1	3	82	0.40	2	7	0.01	6	NA
	Coeff. of Var. (%)	1.0	4	12	32.8	7	3	2.0	2	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLSQD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2016

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
QD-45	Minimum	7.9	82	566	<1.0	17	213	0.29	103	<1
	Median	8.4	89	578	<1.0	17	215	0.3	106	<1
	Mean	8.5	89	575	1.3	18	216	0.31	108	<1
	Maximum	9.2	94	582	1.8	19	220	0.33	116	<1
	Std. Dev	0.6	6	8	0.46	1	4	0.02	7	NA
	Coeff. of Var. (%)	7.0	7	1	36.5	7	2	7.0	6	NA
QD-46	Minimum	7.9	88	556	<1.0	10	116	0.17	81	<1
	Median	8.0	89	559	<1.0	13	127	0.22	83	31
	Mean	8.0	90	559	1.5	18	124	0.21	83	48
	Maximum	8.1	94	562	2.4	31	128	0.23	84	3,500
	Std. Dev	0.1	3	4.2	0.46	11	6	0.03	2	36
	Coeff. of Var. (%)	1.0	3	0.76	36.5	63	5	16.0	2	75
QD-47	Minimum	7.2	72	486	1.0	14	149	0.22	226	<1
	Median	7.6	81	492	1.0	14	162	0.25	241	<1
	Mean	7.6	79	493	1.0	14	159	0.27	237	<1
	Maximum	7.9	82	502	1.0	15	165	0.34	245	<1
	Std. Dev	0.3	6	8	0.0	1	9	0.06	10	NA
	Coeff. of Var. (%)	5.0	7	2	0.0	4	5	23.0	4	NA
QD-48	Minimum	7.0	73	502	1.0	<10	261	0.1	242	<1
	Median	7.8	81	576	1.3	<10	271	0.63	264	<1
	Mean	7.8	81	560	1.3	<10	273	3.6	279	<1
	Maximum	8.5	88	602	1.5	<10	287	10.1	332	<1
	Std. Dev	0.8	7	52	0.30	NA	13	5.6	47	NA
	Coeff. of Var. (%)	10.0	9	9	20.0	NA	5	156	17	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLS QD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2016

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
QD-49	Minimum	7.8	83	564	<1.0	13	172	0.13	301	<1
	Median	8.2	88	568	<1.0	14	246	0.17	330	<1
	Mean	8.2	87	598	1.2	14	223	0.22	326	3
	Maximum	8.4	91	662	1.6	14	251	0.35	347	27
	Std. Dev	0.3	4	55	0.35	1	44	0.12	23	1
	Coeff. of Var. (%)	4.0	4	9	29.8	4	20	54.0	7	43
QD-50	Minimum	9.5	72	648	1.0	11	278	<0.1	7	<1
	Median	9.5	99	652	1.2	12	286	<0.1	9	<1
	Mean	9.5	92	686	1.2	12	286	0.11	14	<1
	Maximum	9.5	106	758	1.4	13	294	0.12	26	<1
	Std. Dev	0.0	18	62	0.2	1	8	0.32	10	NA
	Coeff. of Var. (%)	0.0	19	9	17.0	8	3	296	75	NA
QD-51	Minimum	9.2	84	500	<1.0	12	125	<0.1	4	<1
	Median	9.3	84	520	1.1	12	129	<0.1	5	<1
	Mean	9.3	85	552	1.1	12	130	0.1	5	<1
	Maximum	9.3	88	636	1.2	13	136	<0.1	5	<1
	Std. Dev	0.1	2	73	0.1	1	6	0.32	1	NA
	Coeff. of Var. (%)	1.0	3	13	9.1	5	4	316	12	NA
QD-52	Minimum	8.9	75	468	<1.0	15	141	0.1	15	<1
	Median	9.0	76	484	<1.0	16	146	0.11	17	12
	Mean	9.0	76	509	1.1	16	147	0.11	17	7
	Maximum	9.1	78	574	1.3	16	155	0.12	18	28
	Std. Dev	0.1	2	57	0.17	1	7	0.01	2	1
	Coeff. of Var. (%)	1.0	2	11	15.7	4	5	9.0	9	19

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLSQD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2016

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
QD-53	Minimum	9.0	90	562	<1.0	17	161	<0.1	8	<1
	Median	9.0	91	564	<1.0	18	165	<0.1	10	<1
	Mean	9.0	92	603	1.1	18	165	0.1	9	<1
	Maximum	9.1	94	684	1.2	19	170	<0.1	10	<1
	Std. Dev	0.05	2	70	0.12	1	4	0.32	1	NA
	Coeff. of Var. (%)	0.5	2	12	10.5	6	2	316	12	NA
QD-54	Minimum	8.9	65	398	<1.0	16	148	0.21	36	<1
	Median	8.9	68	408	<1.0	18	148	0.22	36	<1
	Mean	9.0	67	432	<1.0	17	150	0.22	37	<1
	Maximum	9.1	69	490	<1.0	18	153	0.23	39	<1
	Std. Dev	0.1	2	50	NA	1	3	0.01	2	NA
	Coeff. of Var. (%)	1.0	3	12	NA	7	2	5.0	5	NA
QD-55	Minimum	7.3	70	420	<1.0	15	164	<0.1	132	<1
	Median	8.0	78	450	<1.0	15	189	<0.1	178	<1
	Mean	7.9	77	462	<1.0	15	186	0.14	166	<1
	Maximum	8.2	82	516	<1.0	16	206	0.23	187	<1
	Std. Dev	0.5	6	49	NA	1	21	0.32	30	NA
	Coeff. of Var. (%)	6.0	8	11	NA	4	11	221	18	NA
QD-56	Minimum	7.0	52	220	<1.0	10	13	0.22	55	<1
	Median	8.3	53	284	<1.0	11	14	0.22	59	<1
	Mean	7.9	54	287	<1.0	11	15	0.53	58	<1
	Maximum	8.5	57	356	<1.0	11	18	1.1	59	<1
	Std. Dev	0.8	3	68	NA	1	3	0.54	2	NA
	Coeff. of Var. (%)	10.0	5	24	NA	5	18	102	4	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLSQD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2016

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
QD-57	Minimum	7.1	56	308	<1.0	12	58	0.23	19	0
	Median	8.5	58	330	<1.0	13	59	0.26	35	25
	Mean	8.1	58	357	<1.0	13	65	0.28	35	10
	Maximum	8.7	59	432	<1.0	14	79	0.34	51	350
	Std. Dev	0.9	1	66	NA	1	12	0.06	16	236
	Coeff. of Var. (%)	11.0	2	19	NA	8	18	21.0	46	2,468
QD-58	Minimum	7.0	45	204	<1.0	10	<5	0.23	118	<1
	Median	7.6	47	254	<1.0	11	<5	0.29	123	<1
	Mean	7.4	46	268	<1.0	11	<5	0.27	125	<1
	Maximum	7.7	47	346	<1.0	12	<5	0.29	135	<1
	Std. Dev	0.4	1	72	NA	1	NA	0.03	9	NA
	Coeff. of Var. (%)	5.0	2	27	NA	9	NA	13.0	7	NA
QD-59	Minimum	6.8	64	302	<1.0	76	21	0.28	207	<1
	Median	7.8	69	356	<1.0	77	26	0.31	226	<1
	Mean	7.5	68	355	<1.0	79	25	0.3	223	<1
	Maximum	7.9	70	408	<1.0	85	29	0.31	236	<1
	Std. Dev	0.6	3	53	NA	5	4	0.02	15	NA
	Coeff. of Var. (%)	8.0	5	15	NA	6	17	6.0	7	NA

TABLE 2 (Continued): DESCRIPTIVE STATISTICS FOR GROUNDWATER DATA OF MONITORING WELLSQD-21 THROUGH QD-60 IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2016

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
QD-60	Minimum	7.1	67	348	<1.0	41	97	0.35	251	<1
	Median	7.7	67	378	<1.0	42	104	0.37	253	<1
	Mean	7.6	67	405	<1.0	42	102	0.37	254	<1
	Maximum	7.8	68	488	<1.0	42	105	0.38	259	<1
	Std. Dev	0.4	0.4	74	NA	1	4	0.02	4	NA
	Coeff. of Var. (%)	5.0	0	18	NA	1	4	4.0	2	NA

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

²Geometric mean is evaluated since data are assumed to be Log-Normally Distributed.

³Not applicable.