Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

MONITORING AND RESEARCH DEPARTMENT

REPORT NO. 20-15

TUNNEL AND RESERVOIR PLAN

MCCOOK RESERVOIR

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2019

May 2020

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

CECIL LUE-HING RESEARCH AND DEVELOPMENT COMPLEX
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Edward W. Podczerwinski, P.E.
Director of Monitoring and Research

May 19, 2020

Mr. Richard P. Cobb, P.G.
Manager
Division of Public Water Supplies
Bureau of Water
Illinois Environmental Protection Agency
1021 North Grand Avenue East
Springfield, IL 62794

Dear Mr. Cobb:

Subject: Transmittal of the Report "Tunnel and Reservoir Plan McCook Reservoir Annual Groundwater Monitoring Report for 2019"

Please find attached the report entitled "Tunnel and Reservoir Plan McCook Reservoir Annual Groundwater Monitoring Report for 2019." The report was prepared for transmittal to the Illinois Environmental Protection Agency in accordance with the Chicagoland Underflow Plan McCook Reservoir Groundwater Monitoring and Analysis Plan.

If you have any questions or would like additional information, please contact Mr. Benjamin Morgan at (708) 588-3743 or morganb@mwrd.org.

Very truly yours,

Albert Cox

Albert E. Cox, Ph.D.
Environmental Monitoring and Research Manager
Monitoring and Research Department

AC:BM:cm
Attachment
cc: Mr. B. O'Neil, USACE
Mr. E. Podczerwinski
Dr. C. O'Connor
Dr. H. Zhang

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TUNNEL AND RESERVOIR PLAN
MCCOOK RESERVOIR
ANNUAL GROUNDWATER MONITORING REPORT
FOR 2019

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May 2020

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LIST OF ABBREVIATLONS

CCD	Chicago City Datum
Class I	Illinois Class I Potable Resource Groundwater Standards
COD	chemical oxygen demand
CSF	combined sewer flow
District	Metropolitan Water Reclamation District of Greater Chicago
IAC	Illinois Administrative Code
IEPA	Illinois Environmental Protection Agency
MAP	Monitoring and analysis plan
Reservoir	Chicagoland Underflow Plan McCook Reservoir
TARP	Tunnel and Reservoir Plan
TDS	total dissolved solids
TL	tolerance limit
TOC	total organic carbon
USACE	United States Army Corps of Engineers

ACKNOWLEDGMENT

The McCook Reservoir groundwater monitoring is conducted by the Monitoring and Research Department of the Metropolitan Water Reclamation District of Greater Chicago (District) under the Groundwater Monitoring and Analysis Plan prepared by the United States Army Corps of Engineers (USACE). Organic analyses were performed by TestAmerica Laboratories, Inc., inorganic analyses by the District's Analytical Laboratories Division, and fecal coliform analyses by the District's Analytical Microbiology Section. Special thanks to James Rivera and Regina Flowers for collecting samples and to Ms. Coleen Maurovich for typing and formatting this report.

DISCLAIMER

Mention of proprietary equipment, chemicals, and software in this report does not constitute endorsement by the District.

McCook Reservoir Site Description

The Chicagoland Underflow Plan McCook Reservoir (Reservoir), located within Lyons Township in western Cook County, is part of the Tunnel and Reservoir Plan (TARP). The Reservoir was designed to reduce flooding in the Chicago area by providing storage of combined sewer flow (CSF) during storms. Reservoir construction has been divided into two phases. Phase I of the Reservoir is complete and has been in operation since January 2018. Phase II of the Reservoir is still under construction and is anticipated to begin operation in 2029. When the capacity of the sewer systems is exceeded, the CSF is conveyed to the Reservoir by the TARP tunnels for storage until it can be treated at the Stickney Water Reclamation Plant.

The groundwater protection system surrounding the Reservoir is designed to prevent exfiltration of CSF from the Reservoir to the surrounding groundwater during high-stage conditions and control seepage of groundwater into the Reservoir during low-stage conditions. The groundwater protection system consists of a double-row grout curtain that completely surrounds Phases I and II of the Reservoir to a depth of -320 ft Chicago City Datum (CCD). The grouted area has achieved permeabilities of less than 1 lugeon.

Groundwater Monitoring Program

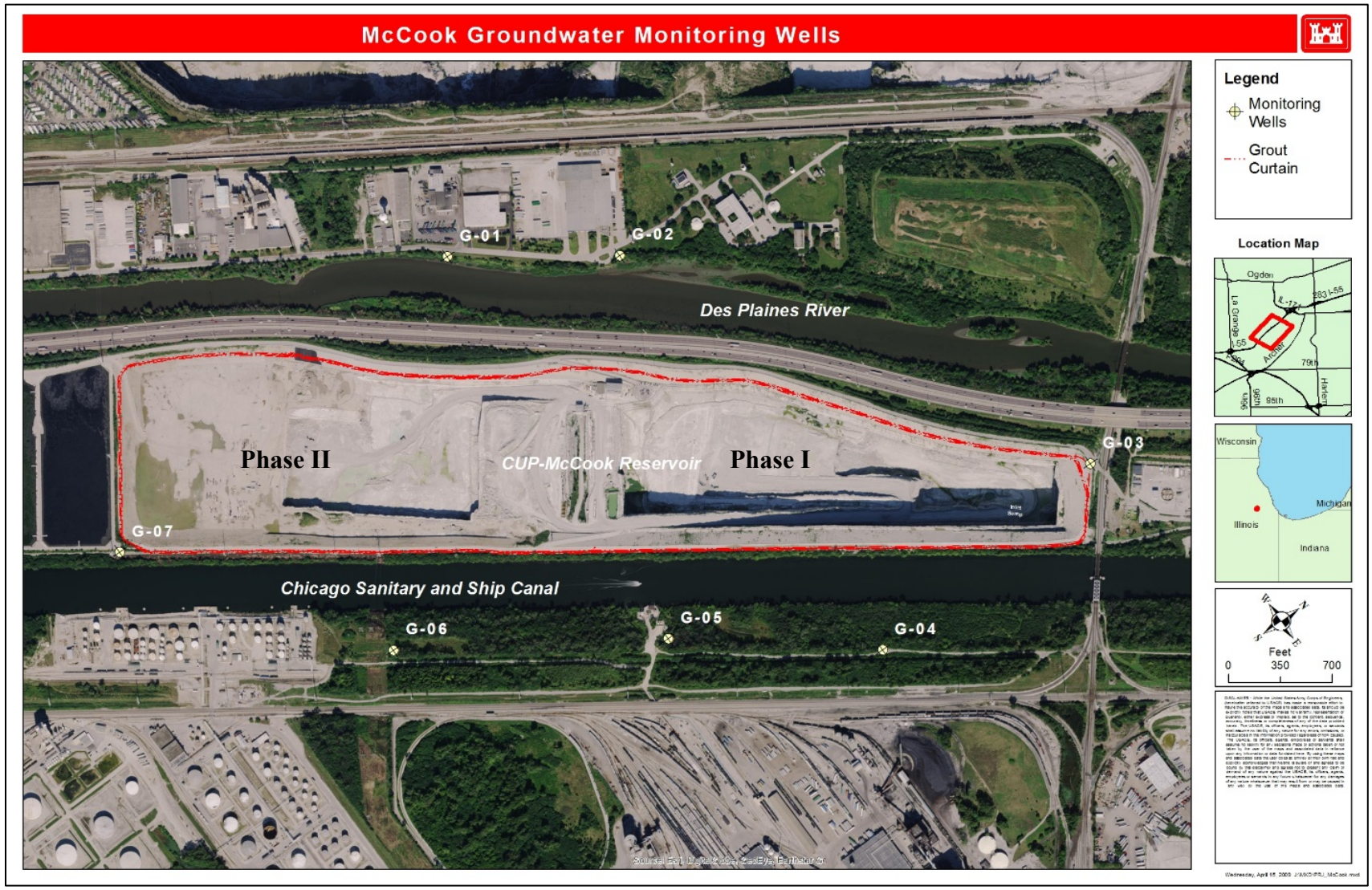
A Groundwater Monitoring and Analysis Plan (MAP) (USACE, 2014), including seven groundwater monitoring wells around the perimeter of the Reservoir (Figure 1), was developed by the USACE in coordination with the District and approved by the Illinois Environmental Protection Agency (IEPA) to monitor groundwater conditions and the performance of the groundwater protection system.

The objectives of the monitoring program as specified in the MAP are:

- To characterize local background groundwater quality by measuring Field, Routine, Organic, and Inorganic parameters prior to Reservoir operation.
- To assess potential exfiltration of CSF effluent into groundwater by measuring Field and Routine parameters while the Reservoir is in high-stage operation.
- To determine potential migration of groundwater contaminants into the Reservoir system from the surrounding area by measuring Field, Routine, Organic, and Inorganic parameters while the Reservoir is in low-stage operation.
- To evaluate long-term changes in groundwater quality associated with Reservoir operations.

To evaluate changes in groundwater quality, monitoring wells are installed 100 feet outside the grout curtain. However, due to physical constraints near the Reservoir where it would be impossible to install or access wells, some are located greater than 100 feet from the grout curtain. In the summer of 2016, a USACE investigation discovered that wells G-04 and G-05 exhibited signs of a compromised annular seal. These wells were re-drilled during fall 2017 and became operational for monitoring in November 2017.

FIGURE 1: MCCOOK RESERVOIR SITE AND MONITORING WELL LOCATIONS



Background Monitoring. Background monitoring began in the first quarter of 2016. Groundwater samples collected during the background monitoring program were analyzed for concentrations of organic and inorganic parameters and groundwater quality indicators based on Illinois Class I Potable Resource Groundwater standards constituents in 35 IAC 620.410 (Class I) and Illinois General Use Water Quality standards constituents in 35 IAC 302 B. Background monitoring results were used to determine upper tolerance limits (TL) in each well for all measured groundwater quality parameters to enable future assessment of groundwater protection system efficacy. The TL for all parameters were established in 2019 using all background data and the statistical approaches recommended in the MAP. The details are documented in the Appendix of the 2018 McCook annual report.

High-Stage/Fill-Event Monitoring. High-stage monitoring is initiated when water elevation in the Reservoir exceeds -265 ft CCD. The initial high-stage/fill-event threshold of -280 ft CCD was increased to -265 ft CCD in January 2018 to reflect the Reservoir operating conditions. During high-stage monitoring, samples are collected every 14 days until the Reservoir water elevation falls below -265 ft CCD. The intent of the high-stage program is to monitor time-series data when the Reservoir is under large positive (outward) gradients that have the potential to exfiltrate CSF water. For the current Phase I of the Reservoir operation, during high-stage monitoring events, only wells G-01, G-02, G-03, G-04, and G-05 must be monitored. The measurements and analyses include: four Field and nine Routine Parameters as specified in Table 2 of the MAP.

Low-Stage Semiannual Monitoring. Low-stage monitoring is implemented on a semiannual basis to collect water quality data when the Reservoir is acting as a regional groundwater sink. Low-stage sampling requires that water elevation in the Reservoir is at or below the "wet bottom" elevation (-265 ft CCD). Low-stage samples can only be collected after low-stage operation has been maintained for at least four days to ensure that monitoring results are characteristic of the regional groundwater and do not reflect re-infiltration of groundwater constituents that exfiltrated during high-stage operation. The first low-stage semiannual sampling occurs during the second quarter of each year (April-June), analyzing all eighty-one (81) Field, Routine, Organic, and Inorganic Parameters as specified in Tables 2, 3 and 4 of the MAP. The second low-stage semiannual sampling occurs during the fourth quarter of each year (October-December), analyzing only the Field and Routine Parameters. The two low-stage semiannual samplings require collecting samples from all seven wells.

This is the 2019 report under the groundwater monitoring program for the Reservoir. It presents field activities and analytical results for groundwater monitoring of Reservoir operations from January 1, 2019 – December 31, 2019. Monitoring conducted on January 2, 2020, is included in this report, as it was associated with a fill event that began on December 29, 2019.

Monitoring Activities for 2019

During 2019 operation, there were 11 high-stage Reservoir events. Eight of these events lasted for less than two weeks, requiring one sampling each. One event lasted for over seven weeks, requiring four samplings. One event lasted for nine weeks, requiring five samplings (only three could be conducted due to availability of personnel for sampling). One event lasted for over

21 weeks, requiring ten samplings. The Reservoir operated at high stage for a total of 307 days in 2019.

High-stage sampling events were conducted 25 times throughout 2019 (dates shown in Tables 1 – 5). Water samples were collected and immediately analyzed in the field for pH and electrical conductivity, and water temperature and depth were recorded. Samples were packed in ice and transported to District laboratories for analysis of the nine Routine parameters.

Frequent, and often prolonged, high-stage operations during the year limited the ability of sampling personnel to implement low-stage monitoring during the second quarter. The first low-stage semiannual monitoring sample collections were conducted during the third quarter of 2019 on September 11 and 12, 2019, after the Reservoir had been at low-stage for over four days. All seven wells were sampled. Water sample pH, electrical conductivity, temperature, and elevation were recorded in the field. Water samples were packed in ice and shipped to TestAmerica Laboratories, Inc. for analysis of Organic constituents in accordance with requirements specified in the MAP. Aliquots of each sample were also taken to the District's laboratories for analysis of Routine and Inorganic parameters.

The second semiannual sampling was conducted on November 19 and 20, 2019, following low-stage operation at the Reservoir for four days with intermittent periods of high-stage operation. All seven wells were sampled. Field parameters for each water sample were measured. Water samples were packed in ice and brought to the District's laboratories for analysis of Routine parameters.

Analytical Results for 2019

High-Stage/Fill Event Monitoring. All analytical results for all 30 high-stage samples collected from wells G-01, G-02, G-03, G-04, and G-05, and the duplicate samples, are reported in Tables 1 – 5, respectively. Analytical results that exceed Class I standards are shown in bold text in each table. Analytical results were compared to upper TL based on the background monitoring data.

Groundwater pH was below the Class I standard in two samples from well G-01, one sample each from wells G-02 and G-03, and three samples each from wells G-04 and G-05; however, it was below the lower TL in only one sample each from wells G-04 and G-05. Chloride concentrations exceeded Class I standards in all samples except one from well G-01, in two samples from well G-02, and in all samples from well G-03; however, it exceeded the upper TL in only one sample from well G-02. Sulfate exceeded the Class I standard in one sample from well G-01 and in most samples from well G-05, but it never exceeded the upper TL at these wells. The TDS exceeded the Class I standard in all samples from well G-01, in most samples from well G-03, in one sample from well G-04, and in three samples from well G-05. The TDS exceeded the upper TL in 11 samples from well G-04 and in three samples from well G-05. Fecal coliform bacteria were never detected during high-stage monitoring.

There were a few exceedances of upper TL for parameters that do not have established limits under Class I standards. The TOC exceeded the upper TL in three samples from well G-01. The COD exceeded the upper TL in two samples from well G-01, in one sample from well

TABLE 1: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-01 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2019

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	mg/L								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	5.3-8.1	586	3,845	2.7	40	1,280	730	0.13	2.8	1,607	<1	15.7	-106
1	01/08/19	6.7	205	**1,574**	3.6	45	**465**	321	0.24	3.9	809	<1	13.4	-117
2.1	01/23/19	6.8	270	**1,628**	1.2	28	**449**	321	0.24	3.7	870	<1	13.1	-115
2.2	02/07/19	6.8	201	**1,604**	1.5	34	**445**	305	0.24	4.4	870	<1	13.0	-118
2.3	02/28/19	6.8	195	**1,520**	1.2	31	**437**	300	0.23	4.3	821	<1	13.2	-114
2.4	03/12/19	6.7	181	**1,600**	2.2	24	**437**	328	0.26	4.3	838	<1	13.5	-116
2.4 DUP[4]	03/12/19	6.7	181	**1,588**	1.0	25	**441**	306	0.25	4.5	852	<1	13.5	-116
2.5	03/25/19	6.7	202	**1,562**	2.4	37	**438**	301	0.26	4.4	853	<1	13.1	-113
2.6	04/10/19	6.8	199	**1,556**	1.3	26	**440**	310	0.30	4.4	854	<1	13.2	-116
2.7	04/22/19	6.7	202	**1,548**	2.5	24	**445**	314	0.23	4.3	849	<1	13.6	-114
2.8	05/14/19	6.7	204	**1,862**	1.8	24	ND[5]	ND	0.26	4.1	873	<1	13.6	-113
2.9	05/30/19	6.8	198	**1,730**	1.7	24	**460**	308	0.25	4.6	833	<1	13.4	-108
2.9 DUP	05/30/19	6.8	198	**1,708**	1.7	32	**461**	309	0.24	4.5	868	<1	13.4	-108
2.10	06/12/19	6.8	259	**1,578**	1.8	25	**476**	335	0.23	4.1	881	<1	13.5	-110
3	06/26/19	6.8	193	**1,650**	1.8	31	**458**	314	0.22	4.1	872	<1	13.5	-111
4	07/09/19	6.9	199	**1,708**	1.7	<15	**458**	324	0.27	3.9	884	<1	13.4	-116
5.1	07/24/19	6.6	197	**1,646**	<1.0	15	183	156	0.23	4.1	858	<1	13.9	-112
5.2	08/06/19	6.6	185	**1,690**	1.7	18	**456**	310	0.29	4.1	848	<1	13.5	-112
5.2 DUP	08/06/19	6.6	185	**1,736**	1.7	21	**460**	314	0.27	4.1	864	<1	13.5	-112

TABLE 1 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-01 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2019

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	----------mg/L----------								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	NS	**NS**	**NS**	**NS**
	Upper TL[3]	5.3-8.1	586	3,845	2.7	40	1,280	730	0.13	2.8	1,607	<1	15.7	-106
5.3	08/22/19	6.8	192	**1,608**	2.0	17	**458**	327	0.17	3.8	889	<1	14.3	-114
5.4	09/04/19	**6.4**	200	**1,700**	1.5	20	**465**	333	0.16	3.8	882	<1	13.5	-114
6.1	09/18/19	**6.4**	186	**1,608**	1.6	17	**471**	361	<0.15	2.9	927	<1	13.5	-114
6.2	10/22/19	6.8	218	**1,906**	6.2	41	**554**	**465**	<0.15	0.9	1,051	<1	13.2	-110
6.3	11/06/19	6.7	199	**1,666**	2.7	24	**458**	332	<0.15	3.0	885	<1	13.3	-111
6.3 DUP	11/06/19	6.7	199	**1,636**	2.8	20	**468**	340	<0.15	3.0	895	<1	13.3	-111
7	11/25/19	6.7	192	**1,616**	1.6	28	**475**	330	0.21	3.7	834	<1	13.4	-111
8	12/05/19	6.7	194	**1,572**	1.6	17	**478**	331	0.38	3.5	849	<1	13.3	-112
9	12/12/19	6.7	168	**1,600**	1.4	20	**490**	337	0.19	3.7	891	<1	13.2	-113
10	12/17/19	6.7	196	**1,608**	1.4	22	**492**	345	<0.15	3.2	873	<1	13.2	-114
11	01/02/20	6.9	219	**1,660**	1.5	25	**507**	350	0.16	2.8	946	<1	13.3	-113
11 DUP	01/02/20	6.9	219	**1,630**	1.5	23	**504**	353	<0.15	2.8	920	<1	13.3	-113

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**

[2]No Standard established by 35 IAC Part 620.410.

[3]For pH, upper and lower tolerance limits are shown.

[4]Duplicate sample.

[5]No data. Test inadvertently not requested after change in analytical facilities.

TABLE 2: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-02 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2019

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	----------mg/L----------								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	5.7-8.1	182	1,214	4.3	31	383	207	0.68	2.2	791	<1	17.3	-69
1	01/08/19	6.8	112	880	2.5	18	180	167	0.32	1.9	567	<1	13.1	-82
1 DUP[4]	01/08/19	6.8	112	880	2.5	24	178	165	0.30	1.9	574	<1	13.1	-82
2.1	01/23/19	6.9	153	882	1.2	23	183	167	0.26	1.8	599	<1	12.8	-81
2.2	02/07/19	6.9	116	926	1.9	22	180	166	0.22	1.8	619	<1	13.1	-81
2.3	02/28/19	6.8	116	904	1.6	40	186	164	0.33	1.8	632	<1	13.0	-80
2.4	03/12/19	6.8	106	922	2.8	20	**206**	193	0.52	1.7	632	<1	13.6	-82
2.5	03/25/19	6.7	114	906	2.2	25	183	160	0.14	1.8	620	<1	13.0	-80
2.5 DUP	03/25/19	6.7	114	886	2.3	20	181	158	0.12	1.8	620	<1	13.0	-80
2.6	04/10/19	6.7	114	856	1.3	27	184	156	<0.15	1.7	609	<1	12.8	-81
2.7	04/22/19	6.7	115	882	3.2	19	185	154	0.16	1.8	597	<1	13.5	-80
2.8	05/14/19	6.8	118	948	2.5	20	ND[5]	ND[5]	0.30	2.0	609	<1	13.6	-79
2.9	05/30/19	6.9	113	946	2.2	17	180	155	0.25	1.9	591	<1	13.3	-76
2.10	06/12/19	6.8	117	908	2.5	16	190	172	0.23	2.0	631	<1	13.7	-78
2.10 DUP	06/12/19	6.8	117	932	2.5	17	190	172	0.20	2.0	620	<1	13.7	-78
3	06/26/19	6.7	108	930	2.5	23	168	ND[6]	<0.15	1.9	586	<1	14.8	-79
4	07/09/19	6.9	117	976	2.2	<15	194	171	<0.15	1.9	602	<1	14.1	-79
5.1	07/24/19	6.8	115	924	<1.0	17	**466**	325	0.18	2.0	615	<1	13.9	-78
5.2	08/06/19	6.7	110	984	2.2	<15	182	168	0.28	1.9	603	<1	13.9	-78

TABLE 2 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-02 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2019

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	----------mg/L----------								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	5.7-8.1	182	1,214	4.3	31	383	207	0.68	2.2	791	<1	17.3	-69
5.3	08/22/19	6.8	105	888	2.4	<15	175	143	<0.15	1.8	636	<1	14.0	-79
5.3 DUP	08/22/19	6.8	105	934	2.3	<15	181	147	<0.15	1.8	650	<1	14.0	-79
5.4	09/04/19	6.7	112	954	2.1	<15	183	153	<0.15	2.0	600	<1	13.6	-80
6.1	09/18/19	**6.3**	100	886	2.4	<15	182	144	<0.15	2.0	609	<1	13.4	-79
6.2	10/22/19	6.9	106	896	2.9	<15	179	147	0.23	1.9	586	<1	12.9	-78
6.3	11/06/19	6.8	103	906	3.1	16	187	145	<0.15	1.8	559	<1	12.7	-76
7	11/25/19	6.7	111	938	2.2	18	183	165	0.16	1.9	636	<1	13.7	-78
7 DUP	11/25/19	6.7	111	930	2.7	19	183	165	0.16	1.9	611	<1	13.7	-78
8	12/05/19	6.7	113	902	2.1	15	182	160	0.24	1.8	627	<1	13.6	-78
9	12/12/19	6.7	96	938	2	13	186	173	0.18	1.9	639	<1	13.3	-78
10	12/17/19	6.8	110	876	1.9	<15	186	162	<0.15	1.9	597	<1	13.0	-79
11	01/02/20	7.1	119	862	2.2	27	189	144	<0.15	1.8	603	<1	12.8	-79

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**
[2]No Standard established by 35 IAC Part 620.410.
[3]For pH, upper and lower tolerance limits are shown.
[4]Duplicate sample.
[5]No data. Test inadvertently not requested after change in analytical facilities.
[6]No data. Test canceled by analytical lab due to precision failure after duplicate and retested samples did not confirm results.

TABLE 3: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-03 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2019

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	----------mg/L----------								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	5.7-8.4	312	1,826	19.3	93	618	167	0.24	32	570	<1	18.3	-95
1	1/08/2019	6.9	159	1,152	9.1	55	**369**	149	<0.10	24	441	<1	13.9	-109
2.1	1/23/2019	7.1	224	**1,210**	7.0	58	**383**	152	ND[4]	ND[4]	485	<1	13.6	-108
2.1 DUP[5]	1/23/2019	7.1	224	**1,208**	7.0	56	**386**	153	0.11	23	493	<1	13.6	-108
2.2	2/07/2019	7.1	171	1,192	8.8	60	**371**	150	0.16	23	473	<1	13.4	-108
2.3	2/28/2019	6.9	163	1,104	7.7	59	**358**	151	<0.10	22	450	<1	13.5	-91
2.4	3/12/2019	6.8	151	1,098	9.2	58	**427**	172	<0.10	23	472	<1	13.8	-101
2.5	3/25/2019	6.9	167	1,174	9.6	64	**352**	144	0.10	22	454	<1	13.7	-96
2.6	4/10/2019	7.0	154	958	6.7	49	**338**	134	0.19	19	433	<1	13.4	-106
2.6 DUP	4/10/2019	7.0	154	1,040	6.7	46	**337**	134	0.18	19	446	<1	13.4	-106
2.7	4/22/2019	6.9	154	1,078	8.1	46	**340**	132	<0.15[6]	19	433	<1	14.2	-104
2.8	5/14/2019	6.9	151	1,148	7.5	58	ND[7]	ND[7]	<0.15	18	424	<1	13.8	-70
2.9	5/30/2019	6.9	156	**1,216**	8.5	50	**339**	156	<0.15	19	473	<1	13.3	-55
2.10	6/12/2019	7.0	165	1,132	8.5	42	**346**	185	<0.15	20	512	<1	14.1	-80
3	6/26/2019	6.8	151	**1,202**	8.7	46	**308**	202	<0.15	22	541	<1	14.5	-102
3 DUP	6/26/2019	6.8	151	**1,202**	8.8	48	**311**	204	<0.15	19	541	<1	14.5	-102
4	7/09/2019	7.0	171	**1,310**	10.1	47	**360**	187	<0.15	19	566	<1	14.2	-107
5.1	7/24/2019	7.0	179	**1,308**	8.4	51	**425**	149	<0.15	23	520	<1	14.8	-106
5.2	8/06/2019	6.7	168	**1,544**	11.0	62	**433**	160	<0.15	25	568	<1	14.1	-103

TABLE 3 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-03 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2019

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	----------mg/L----------								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	5.7-8.4	312	1,826	19.3	93	618	167	0.24	32	570	<1	18.3	-95
5.3	08/20/2019	**6.1**	176	**1,360**	10.5	59	**453**	151	0.19	24	556	<1	14.1	-104
5.4	09/04/2019	6.8	181	**1,374**	9.4	70	**441**	147	0.31	24	528	<1	14.0	-105
5.4 DUP	09/04/2019	6.8	181	**1,390**	9.4	64	**438**	146	<0.15	25	605	<1	14.0	-105
6.1	09/18/2019	6.6	161	**1,294**	10.2	56	**435**	142	<0.15	25	545	<1	14.0	-108
6.2	10/22/2019	6.9	175	**1,294**	10.4	53	**426**	132	0.25	23	529	<1	13.8	-103
6.3	11/06/2019	6.7	168	**1,244**	8.8	45	**417**	140	<0.15	23	491	<1	13.1	-91
7	11/25/2019	6.8	171	**1,268**	9.3	62	**419**	149	<0.15	23	512	<1	13.8	-108
8	12/05/2019	6.8	170	1,184	8.5	52	**407**	143	0.17	19	489	<1	13.9	-108
8 DUP	12/05/2019	6.8	170	**1,232**	8.6	51	**417**	136	<0.15	22	496	<1	13.9	-108
9	12/12/2019	6.8	148	**1,256**	8.4	50	**418**	148	<0.15	24	498	<1	13.7	-109
10	12/17/2019	6.8	171	**1,200**	9.0	47	**421**	142	<0.15	22	510	<1	13.8	-110
11	01/02/2020	7.1	180	**1,210**	10.1	58	**429**	137	<0.15	24	511	<1	13.7	-109

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**
[2]No Standard established by 35 IAC Part 620.410.
[3]For pH, upper and lower tolerance limits are shown.
[4]No data. Analysis canceled by lab because sample was not preserved at required pH < 2 when received.
[5]Duplicate sample.
[6]The reporting limit for total P changed in April 2019 because of annual methods verification.
[7]No data. Test inadvertently not requested after change in analytical facilities.

TABLE 4: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-04 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2019

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	----------	----------	----------	----------	mg/L	----------	----------	----------	CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	6.3-9.2	179	1,100	8.1	30	213	584	0.11	19	746	<1	17.0	-34
1	01/07/19	6.8	130	1,034	4.3	28	145	278	<0.10	9.8	651	<1	14.3	-36
2.1	01/24/19	6.8	166	1,050	2.5	24	152	285	<0.10	11	682	<1	13.9	-35
2.2	02/05/19	6.9	134	980	2.7	40	157	296	0.13	10	664	<1	14.1	-36
2.2 DUP[4]	02/05/19	6.9	134	1,108	3.0	34	153	289	0.12	10	657	<1	14.1	-36
2.3	02/26/19	6.9	134	1,060	3.5	25	153	291	<0.10	10	657	<1	14.0	-26
2.4	03/14/19	6.7	127	1,066	3.5	35	150	286	<0.10	9.8	643	<1	14.3	-34
2.5	03/29/19	6.9	113	1,064	3.7	20	153	292	<0.10	10	657	<1	14.2	-32
2.6	04/11/19	6.8	132	**1,236**	2.7	22	153	287	<0.15[5]	10	668	<1	14.5	-34
2.7	04/26/19	6.8	135	1,014	4.1	25	151	288	<0.15	10	654	<1	14.6	-37
2.7 DUP	04/26/19	6.8	135	990	4.2	28	151	289	<0.15	10	658	<1	14.6	-37
2.8	05/17/19	6.6	128	1,026	3.7	27	ND[6]	ND	<0.15	10	656	<1	14.3	-22
2.9	05/28/19	6.8	160	1,134	3.7	16	ND	ND	<0.15	10	667	<1	15.0	-19
2.10	06/10/19	6.8	118	1,050	4.2	25	150	316	<0.15	9.9	648	<1	15.3	-24
3	06/24/19	7.0	117	1,156	4.0	19	147	286	0.15	9.8	650	<1	14.9	-35
4	07/11/19	6.7	132	1,092	3.9	20	151	298	<0.15	9.6	621	<1	15.1	-35
4 DUP	07/11/19	6.7	132	1,098	4.0	18	154	299	<0.15	9.7	640	<1	15.1	-35
5.1	07/22/19	6.9	129	1,110	1.8	<15	148	291	<0.15	9.3	635	<1	14.8	-33
5.2	08/09/19	6.8	124	1,166	3.9	28	150	298	<0.15	9.9	695	<1	15.1	-33

TABLE 4 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-04 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2019

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	mg/L								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	6.3-9.2	179	1,100	8.1	30	213	584	0.11	19	746	<1	17.0	-34
5.3	08/20/19	**6.2**	120	1,130	4.1	22	154	321	0.20	10	674	<1	15.0	-27
5.4	09/03/19	6.6	138	1,118	4.6	25	158	315	<0.15	11	674	<1	15.0	-32
6.1	09/16/19	**6.3**	137	1,112	4.1	16	151	308	<0.15	11	704	<1	14.7	-35
6.1 DUP	09/16/19	**6.3**	137	1,116	4.2	<15	157	320	<0.15	11	693	<1	14.7	-35
6.2	10/21/19	**6.4**	111	1,080	4.4	<15	157	305	<0.15	10	698	<1	14.3	-35
6.3	11/04/19	6.6	131	1,100	4.2	15	154	321	<0.15	11	686	<1	14.3	-25
7	11/27/19	6.8	125	1,092	4.0	16	154	294	<0.15	9.9	674	<1	14.4	-33
8	12/03/19	6.7	108	1,090	3.8	20	135	399	<0.15	9.9	701	<1	14.5	-33
9	12/10/19	6.6	113	1,122	4.3	17	168	337	<0.15	11	692	<1	13.4	-33
9 DUP	12/10/19	6.6	113	1,112	4.3	21	167	337	<0.15	11	693	<1	13.4	-33
10	12/18/19	6.6	137	1,118	4.0	<15	164	334	<0.15	11	713	<1	13.9	-34
11	01/02/20	6.5	134	1,092	4.1	19	161	322	<0.15	10	703	<1	14.3	-35

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**
[2]No Standard established by 35 IAC Part 620.410.
[3]For pH, upper and lower tolerance limits are shown.
[4]Duplicate sample.
[5]The reporting limit for total P changed in April 2019 as a result of annual methods verification.
[6]No data. Test inadvertently not requested after change in analytical facilities.

TABLE 5: ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-05 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2019

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	mg/L								CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	6.3-9.4	219	1,200	29.8	102	159	499	0.32	6.6	738	<1	15.3	-38
1	01/07/19	6.7	128	1,050	3.4	17	125	394	0.16	6.7	724	<1	13.8	-35
2.1	01/24/19	6.8	130	1,146	1.8	15	130	390	<0.10	6.3	762	<1	13.5	-36
2.2	02/05/19	6.9	134	1,166	1.2	27	133	**400**	0.12	6.3	723	<1	13.3	-37
2.3	02/26/19	6.9	133	1,140	2.1	21	128	**412**	<0.10	6.6	742	<1	14.2	-32
2.3 DUP[4]	02/26/19	6.9	133	1,090	2.1	17	127	**410**	0.10	6.6	734	<1	14.2	-32
2.4	03/14/19	6.7	125	1,130	2.5	28	123	394	0.15	6.0	709	<1	13.6	-34
2.5	03/29/19	6.8	131	**1,376**	1.2	25	128	**401**	0.13	6.0	717	<1	13.7	-35
2.6	04/11/19	6.8	128	1,194	1.7	15	124	**401**	0.21	6.3	751	<1	14.3	-37
2.7	04/26/19	6.7	131	1,082	2.8	21	125	**408**	<0.15[5]	6.3	755	<1	14.1	-35
2.8	05/17/19	6.7	128	1,090	2.3	18	ND[6]	ND	<0.15	6.6	717	<1	14.0	-28
2.8 DUP	05/17/19	6.7	128	1,144	2.2	16	ND	ND	<0.15	6.6	747	<1	14.0	-28
2.9	05/28/19	6.7	160	**1,220**	2.1	<15	ND	ND	<0.15	6.5	739	<1	14.2	-19
2.10	06/10/19	6.8	112	1,100	2.4	<15	124	**445**	<0.15	6.5	759	<1	14.4	-23
3	06/24/19	7.0	116	1,178	2.4	<15	112	**415**	0.19	6.0	700	<1	14.1	-36
4	07/11/19	6.6	109	1,184	2.5	<15	120	**420**	0.23	6.2	715	<1	14.6	-35
5.1	07/22/19	6.9	125	1,160	1.0	<15	118	**404**	0.20	5.9	724	<1	14.5	-34
5.1 DUP	07/22/19	6.9	125	1,168	1.0	<15	121	**411**	0.15	5.9	713	<1	14.5	-34

TABLE 5 (Continued): ANALYSIS OF GROUNDWATER SAMPLED FROM MONITORING WELL G-05 AT THE MCCOOK RESERVOIR SITE DURING HIGH-STAGE OPERATION IN 2019

Fill Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
			mS/m	----------				mg/L				CFU/100 mL	°C	ft CCD
	Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
	Upper TL[3]	6.3-9.4	219	1,200	29.8	102	159	499	0.32	6.6	738	<1	15.3	-38
5.2	08/09/19	6.7	121	1,080	2.4	15	123	**409**	<0.15	6.3	791	<1	14.5	-34
5.3	08/20/19	**6.3**	113	**1,212**	2.5	17	126	**426**	<0.15	6.4	731	<1	14.3	-32
5.4	09/03/19	**6.4**	129	1,176	2.4	<15	127	**414**	<0.15	6.2	714	<1	14.1	-29
6.1	09/16/19	**6.1**	129	1,172	2.9	<15	130	**431**	<0.15	6.5	761	<1	14.2	-34
6.2	10/21/19	6.5	103	1,160	2.6	<15	130	391	<0.15	5.9	704	<1	13.9	-33
6.2 DUP	10/21/19	6.5	103	1,172	2.7	<15	131	393	<0.15	6.0	674	<1	13.9	-33
6.3	11/04/19	6.7	123	1,170	2.3	<15	134	**407**	<0.15	6.1	713	<1	13.6	-28
7	11/27/19	6.7	124	1,186	2.3	108	136	**422**	<0.15	6.2	755	<1	14.1	-35
8	12/03/19	6.7	101	1,158	2.1	<15	156	316	<0.15	6.4	775	<1	13.6	-35
9	12/10/19	6.7	102	1,150	2.5	<15	139	**439**	<0.15	6.7	732	<1	13.4	-35
10	12/18/19	6.6	133	1,118	2.1	<15	137	**434**	0.16	6.7	757	<1	13.8	-37
10 DUP	12/18/19	6.6	133	1,134	2.1	<15	136	**429**	0.20	6.7	773	<1	13.8	-37
11	01/02/20	6.6	128	1,120	2.3	<15	139	**419**	0.18	6.3	771	<1	13.9	-36

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**
[2]No Standard established by 35 IAC Part 620.410.
[3]For pH, upper and lower tolerance limits are shown.
[4]Duplicate sample.
[5]The reporting limit for total P changed in April 2019 because of annual methods verification.
[6]No data. Test inadvertently not requested after change in analytical facilities.

G-02, in two samples from well G-04, and in one sample from well G-05. Ammonia exceeded the upper TL in all except two samples from well G-01 and in six samples from well G-05. Total phosphorus exceeded the upper TL in all except five samples from well G-01, in two samples from well G-03, and in three samples from well G-04. The reporting limit for total phosphorus was greater than the upper TL at wells G-01 and G-04. Hardness exceeded the upper TL in one sample from well G-03 and 13 samples from well G-05. Groundwater elevation exceeded the upper TL at five events in well G-03, at 13 events in well G-04, and at all events in well G-05.

Low-Stage Semiannual Monitoring. All results for Field and Routine parameters and TL for low-stage semiannual sampling are reported in Table 6. The results for Inorganic and radioactive parameters are reported in Table 7, and all associated upper TL for parameters in Table 7 are listed in Table 8. The results for Organic parameters are reported in Table 9, and all associated upper TL for parameters in Table 9 are listed in Table 10. Analytical results that exceed the Class I standards are shown in bold text in Tables 6, 7 and 9. Analytical results were compared to upper TL based on the background monitoring data.

There were a few exceedances of Class I standards and upper TL by Routine and Field parameters (Table 6). Chloride concentrations exceeded the Class I standard in all samples at well G-01, G-03, and G-07, but never exceeded the upper TL in any well. Sulfate concentrations exceeded the Class I standard in all samples at wells G-05 and G-07, but never exceeded the upper TL in any well. The TDS exceeded the Class I standard in all samples at wells G-01 and G-07, and in the first semiannual sample at wells G-03 and G-05; however, it exceeded the upper TL only in the first semiannual sample at wells G-04 and G-05. Ammonia exceeded the upper TL only at well G-01. Total phosphorus exceeded the upper TL only at well G-01. Total phosphorus was below the reporting limit in all samples from wells G-04 and G-06, but the reporting limit was higher than the upper TL at these wells. The TOC exceeded the upper TL only in the first semiannual sample at well G-02. The COD exceeded the upper TL in the second semiannual sample at well G-06 and in the first semiannual sample at well G-07. Groundwater elevation exceeded the upper TL only in the samples from well G-05. Fecal coliform was not detected in any sample.

Among the Inorganic parameters that are measured once per year during the first low-stage semiannual sampling event, only boron at well G-06 exceeded the Class I standard (Table 7); however, it did not exceed the upper TL for that well. Fluoride exceeded the upper TL in all wells. Cobalt, iron, manganese, nickel, lead, and zinc exceeded the upper TL only at well G-07. Nitrate-nitrogen was below the reporting limit in wells G-02 to G-07, but the reporting limit was higher than the upper TL for these wells. Radioactive parameters did not exceed Class I standards or upper TL at any well.

There were a few detections of Organic parameters in groundwater collected during the first low-stage semiannual sampling (Table 9). Trichloroethene was detected in well G-07, but did not exceed the Class I standard or upper TL for that well. Cis-1,2-Dichloroethene was detected in wells G-06 and G-07, but did not exceed the Class I standard. However, it exceeded the upper TL in well G-07. Benzene exceeded the upper TL in well G-06, but did not exceed the Class I standard. Vinyl chloride exceeded the Class I standard in well G-06, but it did not exceed the upper TL for that well.

TABLE 6: ANALYSIS OF ROUTINE PARAMETERS IN GROUNDWATER SAMPLED FROM EACH MONITORING WELL AT THE MCCOOK RESERVOIR SITE DURING LOW-STAGE SEMIANNUAL SAMPLING IN 2019

Well	Sampling Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
				mS/m	mg/L								CFU/100 mL	°C	ft CCD
		Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
G-01		Upper TL[3]	5.3-8.1	586	3,845	2.7	40	1,280	730	0.13	2.8	1,607	<1	15.7	-106
	1	09/12/19	6.8	216	**1,764**	1.5	22	**470**	357	0.19	3.1	779	<1	13.4	-114
	2	11/19/19	6.6	171	**1,606**	1.5	22	**480**	343	0.19	3.3	851	<1	13.2	-112
G-02		Upper TL	5.7-8.1	182	1,214	4.3	31	383	207	0.68	2.2	791	<1	17.3	-69
	1	09/12/19	7.0	111	960	4.7	29	184	156	<0.15	1.8	561	<1	13.1	-80
	1 DUP[4]	09/12/19	7.0	111	942	4.7	19	184	156	<0.15	1.8	555	<1	13.1	-80
	2	11/19/19	6.7	96	886	2.2	24	192	163	0.23	1.9	591	<1	13.4	-78
G-03		Upper TL	5.7-8.4	312	1,826	19.3	93	618	167	0.24	32	570	<1	18.3	-95
	1	09/12/19	7.0	181	**1,478**	10.3	59	**448**	146	<0.15	25	508	<1	14.1	-109
	2	11/20/19	6.9	155	1,074	6.8	41	**393**	148	<0.15	18	467	<1	14.0	-117
G-04		Upper TL	6.3-9.2	179	1,100	8.1	30	213	584	0.11	19	746	<1	17.0	-34
	1	09/11/19	6.9	156	1,136	4.2	18	148	301	<0.15	11	626	<1	14.7	-34
	2	11/19/19	6.9	132	1,092	4.3	24	166	329	<0.15	10	654	<1	13.9	-34
G-05		Upper TL	6.3-9.4	219	1,200	29.8	102	159	499	0.32	6.6	738	<1	15.3	-38
	1	09/11/19	6.9	121	**1,204**	2.4	<15	122	**405**	<0.15	6.2	644	<1	14.2	-31
	2	11/19/19	6.9	126	1,118	2.7	<15	139	**433**	<0.15	6.1	700	<1	13.3	-35

TABLE 6 (Continued): ANALYSIS OF ROUTINE PARAMETERS IN GROUNDWATER SAMPLED FROM EACH MONITORING WELL AT THE MCCOOK RESERVOIR SITE DURING LOW-STAGE SEMIANNUAL SAMPLING IN 2019

Well	Sampling Event	Sample Date	pH	EC	TDS	TOC	COD	Cl^-	SO_4^{2-}	Total P	NH_3-N	Hardness	FC	Temp	Elevation
				mS/m	---------- mg/L ----------								CFU/100 mL	°C	ft CCD
		Class I Std[1]	**6.5-9.0**	**NS[2]**	**1,200**	**NS**	**NS**	**200**	**400**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
G-06		Upper TL	6.0-7.9	176	1,324	3.8	17	147	392	0.081	3.7	804	<1	16.2	-13
	1	09/11/19	7.0	103	1,036	2.4	<15	109	300	<0.15	2.9	604	<1	13.3	-19
	2	11/19/19	6.9	105	970	2.6	20	120	330	<0.15	2.7	672	<1	12.5	-19
	2 DUP	11/19/19	6.9	105	980	2.7	<15	118	325	<0.15	2.8	676	<1	12.5	-19
G-07		Upper TL	5.8-7.8	536	2,856	12.2	62	558	610	4.3	192[5]	1,430	<1	20.3	-3
	1	09/12/19	6.8	290	**2,014**	10.4	117	**338**	**563**	1.8	184[5]	1,011	<1	13.9	-6
	2	11/20/19	6.6	255	**1,616**	9.2	53	**320**	**535**	1.7	171[5]	878	<1	13.6	-6

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. Bold text indicates exceedance.
[2]No Standard established by 35 IAC Part 620.410.
[3]For pH, upper and lower tolerance limits are shown.
[4]Duplicate sample.
[5]McCook Reservoir site was previously unpaved biosolids lagoons. Elevated NH_3-N may reflect infiltration or drilling through old biosolids lagoon sediments.

TABLE 7: ANALYSIS OF INORGANIC AND RADIOACTIVE PARAMETERS IN GROUNDWATER SAMPLED FROM EACH MONITORING WELL AT THE MCCOOK RESERVOIR SITE DURING LOW-STAGE SEMINNUAL SAMPLING IN 2019

Parameter	Units	Class I Std[1]	G-01	G-02	G-02 DUP[2]	G-03	G-04	G-05	G-06	G-07
Ag	mg/L	0.05	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
As	"	0.01	<0.001	<0.001	<0.001	<0.001	0.0013	<0.001	<0.001	0.0041
B	"	2.00	0.38	0.32	0.33	0.66	1.9	1.8	**4.9**	0.28
Ba	"	2.00	0.034	0.055	0.057	0.076	0.038	0.039	0.019	0.055
Be	"	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cd	"	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Co	"	1.00	<0.001	<0.001	<0.001	0.0013	<0.001	<0.001	<0.001	0.0056
Cr	"	0.1	<0.002	0.029	0.044	0.021	<0.002	<0.002	<0.002	<0.002
Cu	"	0.65	<0.001	<0.001	<0.001	<0.001	0.0012	<0.001	<0.001	0.0052
CN	"	0.2	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
F	"	4.00	0.36	0.30	0.30	0.52	0.48	0.39	0.43	0.22
Fe	"	5.00	0.11	0.94	0.97	0.77	0.72	0.60	0.29	4.2
Hg	"	0.002	ND[3]	ND	ND	ND	ND	ND	ND	ND
Mn	"	0.15	0.018	0.019	0.019	0.025	0.011	0.023	0.0051	0.078
Ni	"	0.1	<0.001	0.033	0.035	0.030	0.002	<0.001	<0.001	0.011
NO_3-N	"	10.0	0.36	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Pb	"	0.0075	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0040
Sb	"	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Se	"	0.05	<0.002	<0.002	<0.002	0.0035	<0.002	<0.002	<0.002	<0.002
Tl	"	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	"	5.00	0.0061	0.0098	0.010	0.0054	0.010	0.0066	0.0095	0.065
Ra-226	pCi/L	20.0	1.51	0.989	0.844	1.66	1.56	1.50	1.39	1.74
Ra-228	"	20.0	1.59	0.879	0.842	1.63	1.20	0.789	0.963	2.24

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**

[2]Duplicate sample.

[3]No data. The analysis was canceled by the analytical lab because digestion temperature was outside of the acceptable range.

TABLE 8: UPPER TOLERANCE LIMITS FOR INORGANIC AND RADIOACTIVE PARAMETERS AT THE MCCOOK RESERVOIR SITE ESTABLISHED BY BACKGROUND MONITORING PRIOR TO OPERATION IN JANUARY 2018

Parameter	Units	G-01	G-02	G-03	G-04	G-05	G-06	G-07
Ag	mg/L	0.025	0.025	0.025	0.025	0.025	0.025	0.025
As	"	0.0018	0.025	0.0028	0.0035	0.0027	0.025	0.0086
B	"	0.598	0.51	1.09	2.5	2.5	7.1	0.59
Ba	"	0.048	0.092	0.15	0.095	0.053	0.058	0.09
Be	"	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Cd	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Co	"	0.035	0.0081	0.0032	0.035	0.035	0.035	0.0048
Cr	"	0.025	0.633	0.13	0.035	0.035	0.035	0.035
Cu	"	0.0044	0.015	0.0095	0.0031	0.0025	0.0062	0.0074
CN	"	0.1	0.1	0.1	0.1	0.1	0.1	0.1
F	"	0.05	0.05	0.33	0.4	0.35	0.37	0.05
Fe	"	4.92	10.5	4.48	1.37	0.95	1.43	2.44
Hg	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Mn	"	0.099	0.103	0.21	0.036	0.026	0.021	0.012
Ni	"	0.011	0.25	0.065	0.0092	0.0062	0.05	0.01
NO_3-N	"	1.08	0.075	0.075	0.075	0.075	0.075	0.075
Pb	"	0.00375	0.00375	0.0056	0.0077	0.00375	0.00375	0.00375
Sb	"	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Se	"	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Tl	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zn	"	0.01	0.01	0.01	0.057	0.1	0.069	0.01
Ra-226	pCi/L	2.78	2.33	2.58	1.89	1.60	2.24	3.75
Ra-228	"	3.19	1.51	4.12	3.08	1.65	1.89	4.64

TABLE 9: ANALYSIS OF ORGANIC PARAMETERS IN GROUNDWATER SAMPLED FROM EACH MONITORING WELL AT THE MCCOOK RESERVOIR SITE DURING LOW-STAGE SEMIANNUAL SAMPLING IN 2019

Parameter	Unit	Class I Std[1]	Max RL[2]	G-01	G-02	G-02 DUP[3]	G-03	G-04	G-05	G-06	G-07
HERBICIDES											
2,4-D	mg/L	0.07	0.00049	<0.00048	<0.00048	<0.00049	<0.00048	<0.00048	<0.00048	<0.00048	<0.00049
Silvex (2,4,5-TP)	"	0.05	0.00025	<0.00024	<0.00024	<0.00025	<0.00024	<0.00024	<0.00024	<0.00024	<0.00025
Atrazine	"	0.003	0.0021	<0.0020	<0.0021	<0.0020	<0.0020	<0.0019	<0.0020	<0.0021	<0.0020
Dalapon	"	0.2	0.0049	<0.0048	<0.0048	<0.0049	<0.0048	<0.0048	<0.0048	<0.0048	<0.0049
Simazine	"	0.004	0.0017	<0.0016	<0.0016	<0.0016	<0.0016	<0.0015	<0.0016	<0.0017	<0.0017
PCBs, Total	"	0.00005	0.00043	<0.00040	<0.00040	<0.00040	<0.00041	<0.00039	<0.00039	<0.00043	<0.00042
PESTICIDES											
Alachlor	"	0.002	0.00043	<0.00040	<0.00040	<0.00040	<0.00041	<0.00039	<0.00039	<0.00043	<0.00042
Aldicarb	"	0.003	0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Carbofuran	"	0.04	0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Chlordane (technical)	"	0.002	0.000085	<0.000080	<0.000079	<0.000079	<0.000082	<0.000077	<0.000078	<0.000085	<0.000083
Endrin	"	0.002	0.000043	<0.000040	<0.000040	<0.000040	<0.000041	<0.000039	<0.000039	<0.000043	<0.000042
gamma-BHC (Lindane)	"	0.0002	0.000043	<0.000040	<0.000040	<0.000040	<0.000041	<0.000039	<0.000039	<0.000043	<0.000042
Heptachlor	"	0.0004	0.000043	<0.000040	<0.000040	<0.000040	<0.000041	<0.000039	<0.000039	<0.000043	<0.000042
Heptachlor epoxide	"	0.0002	0.000043	<0.000040	<0.000040	<0.000040	<0.000041	<0.000039	<0.000039	<0.000043	<0.000042
Methoxychlor	"	0.04	0.000085	<0.000080	<0.000079	<0.000079	<0.000082	<0.000077	<0.000078	<0.000085	<0.000083
Toxaphene	"	0.003	0.00043	<0.00040	<0.00040	<0.00040	<0.00041	<0.00039	<0.00039	<0.00043	<0.00042
VOCs											
1,1,1-Trichloroethane	"	0.2	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1,2-Trichloroethane	"	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,1-Dichloroethene	"	0.007	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloroethane	"	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichloropropane	"	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dibromo-3-Chloropropane	"	0.0002	0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000017	<0.000018
Ethylene Dibromide	"	0.00005	0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000018	<0.000017	<0.000018
Benzene	"	0.005	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00065	<0.00050
Carbon tetrachloride	"	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

TABLE 9 (Continued): ANALYSIS OF ORGANIC PARAMETERS IN GROUNDWATER SAMPLED FROM EACH MONITORING WELL AT THE MCCOOK RESERVOIR SITE DURING LOW-STAGE SEMIANNUAL SAMPLING IN 2019

Parameter	Unit	Class I Std[1]	Max RL[2]	G-01	G-02	G-02 DUP[3]	G-03	G-04	G-05	G-06	G-07
VOCs continued											
Chlorobenzene	mg/L	0.1	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
cis-1,2-Dichloroethene	"	0.07	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0038	0.0055
Ethylbenzene	"	0.7	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Methylene Chloride	"	0.005	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Methyl tert-butyl ether	"	0.07	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Styrene	"	0.1	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Tetrachloroethene	"	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene	"	1	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
trans-1,2-Dichloroethene	"	0.1	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Trichloroethene	"	0.005	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00053
Vinyl chloride	"	0.002	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	**0.089**	<0.0010
Xylenes, Total	"	10	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
SVOCs											
1,2,4-Trichlorobenzene	"	0.07	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,2-Dichlorobenzene	"	0.6	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
1,4-Dichlorobenzene	"	0.075	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Benzo[a]pyrene	"	0.0002	0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016
Bis(2-ethylhexyl) phthalate	"	0.006	0.0082	<0.0078	<0.0082	<0.0080	<0.0078	<0.0078	<0.0078	<0.0082	<0.0081
Hexachlorocyclopentadiene	"	0.05	0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Pentachlorophenol	"	0.001	0.00025	<0.00024	<0.00024	<0.00025	<0.00024	<0.00024	<0.00024	<0.00024	<0.00025
Phenolics, Total	"	0.1	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

[1]Illinois Administrative Code Title 35 Part 620.410 Class I Standards. **Bold text indicates exceedance.**
[2]Maximum Lab Reporting Limit for analyses of an analyte at all monitoring wells.
[3]Duplicate sample.

TABLE 10: UPPER TOLERANCE LIMITS FOR ORGANIC PARAMETERS AT THE MCCOOK RESERVOIR SITE ESTABLISHED BY BACKGROUND MONITORING PRIOR TO OPERATION IN JANUARY 2018

Parameter	Units	G-01	G-02	G-03	G-04	G-05	G-06	G-07
HERBICIDES								
2,4-D	mg/L	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Silvex (2,4,5-TP)	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Atrazine	"	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Dalapon	"	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Simazine	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
PCBs, Total	"	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
PESTICIDES								
Alachlor	"	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Aldicarb	"	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Carbofuran	"	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Chlordane (technical)	"	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Endrin	"	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
gamma-BHC (Lindane)	"	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Heptachlor	"	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Heptachlor epoxide	"	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Methoxychlor	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Toxaphene	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
VOCs								
1,1,1-Trichloroethane	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
1,1,2-Trichloroethane	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
1,1-Dichloroethene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
1,2-Dichloroethane	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
1,2-Dichloropropane	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
1,2-Dibromo-3-Chloropropane	"	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
1,2-Dibromoethane	"	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025
Benzene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.00057	0.0025
Carbon tetrachloride	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025

TABLE 10 (Continued): UPPER TOLERANCE LIMITS FOR ORGANIC AT THE MCCOOK RESERVOIR SITE ESTABLISHED BY BACKGROUND MONITORING PRIOR TO OPERATION IN JANUARY 2018

Parameter	Units	G-01	G-02	G-03	G-04	G-05	G-06	G-07
VOCs continued								
Chlorobenzene	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001
cis-1,2-Dichloroethene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0130	0.0029
Ethylbenzene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Methylene Chloride	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Methyl tert-butyl ether	"	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Styrene	"	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Tetrachloroethene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Toluene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
trans-1,2-Dichloroethene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Trichloroethene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0011
Vinyl chloride	"	0.001	0.001	0.001	0.001	0.0052	0.203	0.001
Xylenes, Total	"	0.0025	0.0025	0.0025	0.0025	0.0022	0.0025	0.0025
SVOCs								
1,2,4-Trichlorobenzene	"	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025
1,2-Dichlorobenzene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
1,4-Dichlorobenzene	"	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Benzo[a]pyrene	"	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Bis(2-ethylhexyl) phthalate	"	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Hexachlorocyclopentadiene	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Pentachlorophenol	"	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Phenolics, Total	"	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025

REFERENCES

Illinois Administrative Code title 35, § 620.410 Groundwater Quality Standards for Class I: Potable Resource Groundwater (Amended at 36 Ill. Reg. 15206, effective October 5, 2012).

United States Army Corps of Engineers (USACE). 2014. Chicago Underflow Plan McCook Reservoir Lyons Township, Illinois. Groundwater Monitoring and Analysis Plan. Amended July 2014. Approved by IEPA April 2015.