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RESEARCH AND DEVELOPMENT DEPARTMENT

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WATER AND SEDIMENT QUALITY ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING 2006

July 2007

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WATER AND SEDIMENT QUALITY ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING 2006

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DISCLAIMER

Mention of proprietary equipment and chemicals in this report does not constitute endorsement by the Metropolitan Water Reclamation District of Greater Chicago.

SUMMARY

During May, August, and October 2006, the Metropolitan Water Reclamation District of Greater Chicago (District) conducted water quality surveys at 49 monitoring stations along a 133 nautical mile reach of the Illinois Waterway from the Lockport Lock to the Peoria Lock. Sediment quality was assessed at 14 of the monitoring stations in October. Based on results from the 2006 surveys, the following conclusions can be made concerning the water and sediment quality along the study reach:

Water Quality

During 2006, the mean concentration of total suspended solids (TSS) generally increased in the downstream direction along the Illinois Waterway from the Lockport Pool (17 mg/L) to the lower Peoria Pool (56 mg/L).

The mean concentration of five-day biochemical oxygen demand (BOD_5) remained between <2–4 mg/L throughout each of the sampled pools.

The mean dissolved oxygen (DO) concentration increased substantially along the waterway from the Lockport Pool (5.0 mg/L) to the upper Peoria Pool (9.3 mg/L). In the lower Peoria Pool, mean DO fell slightly (8.8 mg/L).

There was an increase in the mean pH from the Lockport Pool (7.1) to the lower Peoria Pool (8.4).

The mean ammonia nitrogen (NH_4-N) concentration decreased between the Lockport Pool (0.39 mg/L) and the lower Peoria Pool (0.09).

There was an overall decrease in mean nitrite plus nitrate nitrogen (NO_2+NO_3-N) and total nitrogen (TN) values from 5.76 and 7.24 mg/L, respectively, in the Lockport Pool to 3.84 and 5.34 mg/L, respectively, in the lower Peoria Pool.

There was a continuous increase in the mean concentration of un-ionized ammonia (NH_3-N) between the Lockport Pool (0.002 mg/L) and the lower Peoria Pool (0.009 mg/L). This was due largely to the increase in water pH that occurs along this reach.

The mean total Kjeldahl nitrogen (TKN) concentration decreased from the Lockport Pool (1.48 mg/L) to the Marseilles Pool (1.18 mg/L), and then increased to a mean of 1.50 mg/L in the lower Peoria Pool.

There was a considerable decrease in the mean total phosphorus (TP) concentration along the Illinois Waterway from the Lockport Pool (1.06 mg/L) to the lower Peoria Pool (0.49 mg/L).

Mean chlorophyll *a* concentration substantially increased along the Illinois Waterway from the Brandon Road Pool (6 µg/L) to the lower Peoria Pool (61 µg/L).

The mean concentration of cyanide was 0.003 mg/L or less throughout the Illinois Waterway sampling reach.

Mean phenols concentration throughout the Illinois Waterway was <0.005.

After peaking in the Brandon Road Pool, there were dramatic drops in the geometric mean density of fecal coliform (FC) and *E. coli* throughout the Dresden Island Pool. Fecal coliform and *E. coli* densities then remained fairly uniform along the Illinois Waterway until a spike in the lower Peoria Pool. The overall decreases in FC and *E. coli* from Lockport to the lower Peoria Pool were 492 to 72 cfu/100 mL, and 258 to 41 cfu/100 mL, respectively.

Mean total concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, and silver remained relatively constant from the Lockport to the lower Peoria Pool. Mean total zinc was highest from the Lockport through the Dresden Pool and decreased in the Marseilles through the lower Peoria Pool. The mean total iron and manganese concentrations increased progressively downstream to the lower Peoria Pool.

The mean dissolved concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, and silver remained similar from the Lockport Pool downstream to the lower Peoria Pool. Mean values of dissolved manganese and zinc were highest in the Lockport through the Dresden Island Pools and then were relatively uniform downstream to the lower Peoria Pool. Mean values of dissolved iron decreased from the Lockport to the Marseilles Pool, increased in the Starved Rock Pool, and finally decreased throughout the rest of the sampling reach.

Sediment Quality

The mean total solids (TS) concentration in sediment fluctuated throughout the Illinois Waterway and was highest in the Starved Rock and upper Peoria Pools.

The concentration of mean total volatile solids (TVS) was highest in the Brandon Road Pool (29 percent), decreased until the Starved Rock Pool (1 percent), and then slightly increased until the lower Peoria Pool (7 percent).

Mean ammonia nitrogen in sediment substantially decreased from 160 mg/kg in the Lockport Pool to a mean of 1 mg/kg in the Starved Rock Pool. Ammonia nitrogen increased again from Starved Rock to the lower Peoria Pool where the mean was 30 mg/kg.

The mean concentration of TKN in sediment decreased from the Lockport Pool (2,273 mg/kg) to the Starved Rock Pool (31 mg/kg) and increased downstream to the lower Peoria Pool (410 mg/kg).

Total phosphorus in the sediment decreased along the Illinois Waterway from the Lockport Pool (2,608 mg/kg) to the Starved Rock Pool (35 mg/kg), and increased until the lower Peoria Pool (268 mg/kg).

The mean concentration of total cyanide (TCN) in the sediment was highest in the Lockport Pool (3.719 mg/kg) and decreased through the Starved Rock Pool (<0.003 mg/kg). There was then an increase in cyanide until the lower Peoria Pool (0.072 mg/kg).

The mean concentration of phenols in the sediment was highest in the Lockport Pool (0.185 mg/kg) and generally decreased until the lower Peoria Pool (0.057 mg/kg).

Although the concentrations of the 11 trace metals measured in the sediment were variable among the 14 monitoring stations, considerably higher levels of cadmium, chromium, copper, iron, mercury, silver, and zinc were measured in the Lockport Pool compared to the remaining pools. Lead concentration was highest in the Brandon Road Pool, and there were relatively elevated levels of chromium, iron, lead, manganese, and zinc in some of the sediment from the Peoria Pools.

Elevated concentrations of mercury were detected at Stations 1 (1.265 mg/kg) and 8 (1.966 mg/kg) in the Lockport and Dresden Island Pools, respectively.

INTRODUCTION

The Illinois Waterway provides a water resource for agricultural and urban drainage, commercial and recreational navigation, electric power generation, fishing, industrial and public water supply, and other recreational activities. A principal function of this waterway is for stormwater and treated wastewater conveyance. At the upstream end of the Illinois Waterway, the District operates three major water reclamation plants (WRPs) in Cook County, Illinois, whose treated discharges make up approximately 90 percent of all point source treated wastewater flows entering the Illinois Waterway. These three WRPs provided wastewater treatment for an average flow of 1,256 million gallons per day in 2006.

The District first began monitoring the Illinois Waterway in 1977. With the exception of 1998, the District has conducted annual water quality surveys from the Lockport Lock to the Peoria Lock, a distance of 133 river miles, since 1984. Forty-nine monitoring stations in six navigational pools were selected for study. The primary purpose of the monitoring program is to assess water quality changes downstream of the District's major point source wastewater discharges. A secondary objective is to characterize the sediment chemistry at selected monitoring stations.

This report presents the results from the water and sediment quality surveys conducted during 2006. Data from previous years have been compiled in formal annual reports for 1977, 1983–1985, 1989, 1991, and 2002–2005.

DESCRIPTION OF THE STUDY AREA

Illinois Waterway

The Illinois Waterway extends from Grafton, Illinois, located on the Mississippi River upstream of St. Louis, Missouri, to Lake Michigan in Chicago, Illinois. The 327-mile waterway is composed of a series of eight navigational pools (Lockport, Brandon Road, Dresden Island, Marseilles, Starved Rock, Peoria, LaGrange, and Alton) whose lengths and United States Army Corps of Engineers waterway mile-point designations are presented in Table 1.

The pools were created in the 1930s by lock and dam structures to maintain the water depths required for commercial navigation. The present study area is a 133-mile reach of the Illinois Waterway extending from the Lockport Lock to the Peoria Lock (Figures 1 and 2).

TABLE 1: ILLINOIS WATERWAY NAVIGATIONAL POOLS

Navigational Pool	Inclusive Waterway Mile-Points	Length (Miles)
Lockport	327.2 - 291.0	36.2
Brandon Road	291.0 - 286.0	5.0
Dresden Island	286.0 - 271.5	14.5
Marseilles	271.5 - 247.0	24.5
Starved Rock	247.0 - 231.0	16.0
Peoria	231.0 - 157.6	73.4
LaGrange	157.6 - 80.2	77.4
Alton	80.2 - 0.0	80.2

Monitoring Stations

Forty-nine monitoring stations were selected for the study (Figures 1 and 2). Two stations were located on the Chicago Sanitary and Ship Canal (CSSC), 8 on the Des Plaines River, and 39 stations on the Illinois River. Table 2 lists the locations of the 49 monitoring stations.

FIGURE 1: MAP OF THE ILLINOIS WATERWAY FROM LOCKPORT TO MARSEILLES SHOWING SAMPLING STATIONS 1 TO 21

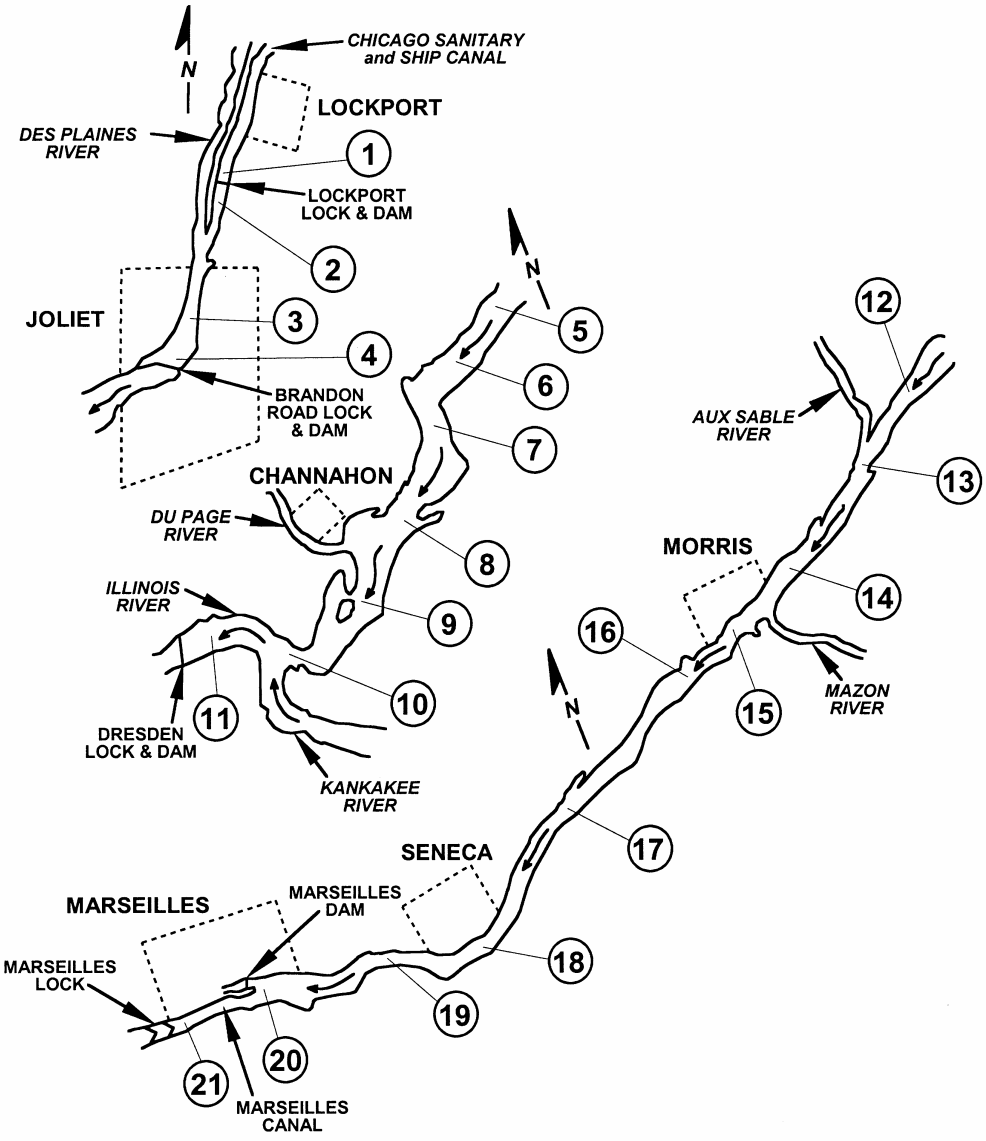

FIGURE 2: MAP OF ILLINOIS WATERWAY FROM OTTAWA TO PEORIA SHOWING SAMPLING STATIONS 22 TO 49

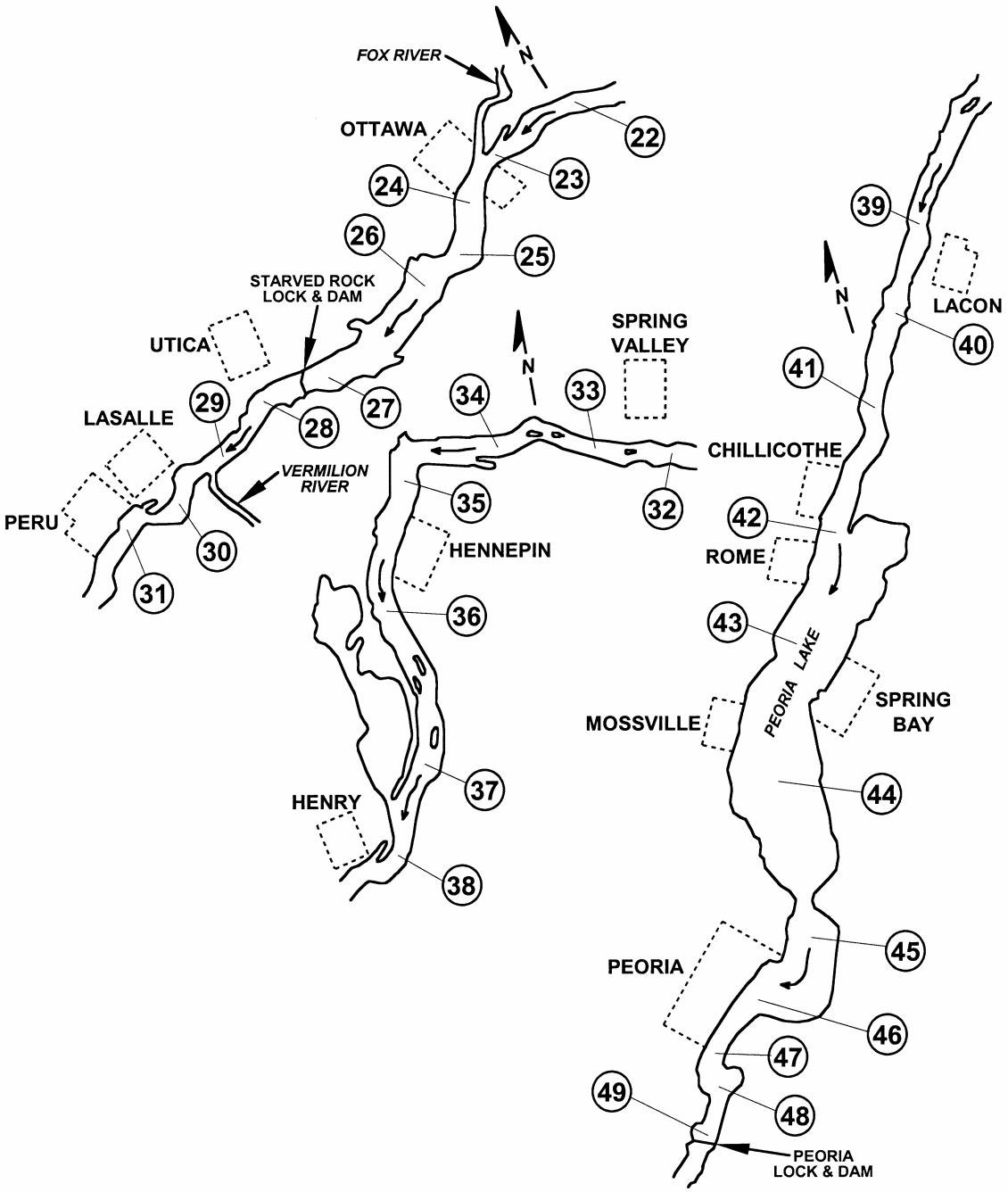

TABLE 2: MONITORING STATIONS ALONG THE ILLINOIS WATERWAY FROM LOCKPORT LOCK TO PEORIA LOCK

Station Number	Waterway	Waterway Mile-Point Location	Navigational Pool
1	Chicago Sanitary and Ship Canal	291.5	Lockport
2	Chicago Sanitary and Ship Canal	290.5	Brandon Road
3	Des Plaines River	287.3	Brandon Road
4	Des Plaines River	286.5	Brandon Road
5	Des Plaines River	285.0	Dresden Island
6	Des Plaines River	282.8	Dresden Island
7	Des Plaines River	280.5	Dresden Island
8	Des Plaines River	278.0	Dresden Island
9	Des Plaines River	276.1	Dresden Island
10	Des Plaines River	274.0	Dresden Island
11	Illinois River	272.4	Dresden Island
12	Illinois River	270.0	Marseilles
13	Illinois River	268.9	Marseilles
14	Illinois River	265.0	Marseilles
15	Illinois River	263.0	Marseilles
16	Illinois River	261.6	Marseilles
17	Illinois River	256.0	Marseilles
18	Illinois River	253.0	Marseilles
19	Illinois River	250.0	Marseilles
20	Illinois River	247.5	Marseilles
21	Illinois River	246.0	Marseilles
22	Illinois River	243.7	Starved Rock
23	Illinois River	240.6	Starved Rock
24	Illinois River	238.5	Starved Rock
25	Illinois River	236.8	Starved Rock
26	Illinois River	234.5	Starved Rock
27	Illinois River	231.7	Starved Rock

TABLE 2 (Continued): MONITORING STATIONS ALONG THE ILLINOIS WATERWAY FROM LOCKPORT LOCK TO PEORIA LOCK

Station Number	Waterway	Waterway Mile-Point Location	Navigational Pool
28	Illinois River	229.6	Peoria
29	Illinois River	226.9	Peoria
30	Illinois River	224.7	Peoria
31	Illinois River	222.6	Peoria
32	Illinois River	219.8	Peoria
33	Illinois River	217.1	Peoria
34	Illinois River	213.4	Peoria
35	Illinois River	209.4	Peoria
36	Illinois River	205.0	Peoria
37	Illinois River	200.4	Peoria
38	Illinois River	196.9	Peoria
39	Illinois River	190.0	Peoria
40	Illinois River	186.4	Peoria
41	Illinois River	183.2	Peoria
42	Illinois River	179.0	Peoria
43	Illinois River	174.9	Peoria
44	Illinois River	170.9	Peoria
45	Illinois River	165.3	Peoria
46	Illinois River	162.8	Peoria
47	Illinois River	160.6	Peoria
48	Illinois River	159.4	Peoria
49	Illinois River	158.2	Peoria

MATERIALS AND METHODS

Field Monitoring and Laboratory Analysis

Water. *Chemical Constituents*. Water samples for chemical analyses were collected from the 49 monitoring stations on May 1–4, May 9–12, August 7–10, August 15–18, October 2–5, and October 10–13, 2006. Samples were collected at a depth of three feet below the water surface in the center of the waterway with a submersible drainage pump. Water samples were collected for dissolved trace metal analysis by the Environmental Monitoring and Research Division (EM&RD) personnel with an air-driven Teflon bellows pump. Samples were filtered in the field through a 0.45 µm high capacity in-line groundwater sampling capsule (Gelman Laboratory) attached to the bellows pump. Prior to sample collection, the Teflon bellows pump was flushed with one gallon of de-ionized water followed by river water for two minutes. Except for FC and *E. coli*, all water samples were transported to the Cecil Lue-Hing R&D Laboratory in iced, insulated chests within 24 hours of collection. PDC Laboratories in Peoria, Illinois, were contracted to retrieve water samples from EM&RD personnel and perform FC and *E. coli* analysis.

The constituents analyzed in water, sample containers used, and preservation methods are presented in Table 3. Water temperature, turbidity, conductivity, DO, and pH were measured in the field using a calibrated YSI Incorporated, Model 6600 water quality monitor. In the laboratory, all constituents were analyzed using procedures established by the United States Environmental Protection Agency (USEPA), except for suspended solids, five-day biochemical oxygen demand, total cyanide, total and dissolved metals, and total mercury, which are described in the 20th edition of Standard Methods for the Examination of Water and Wastewater (Standard Methods) (1998).

The concentration of un-ionized ammonia (NH_3-N) was calculated using the equation given by the Illinois Environmental Protection Agency in Section 302.407 of Title 35.

Bacteria. Water samples for FC and *E. coli* analyses were collected from the 49 stations on the same day and at the same time as the chemical constituents. Samples were collected with a submersible drainage pump at a depth of three feet below the water surface in the center of the waterway. The sample was poured into a sterile, 175-mL plastic bottle containing 0.3 mL of a 15 percent solution of sodium thiosulfate and 0.1 mL of a 10 percent solution of EDTA. The bacteria samples were kept cool in iced, insulated chests. The analyses were performed within 24 hours by membrane filter analysis as described in Standard Methods.

Chlorophyll a. Water samples for chlorophyll analysis were collected at 22 selected monitoring stations (2, 3, 5, 7, 10, 11, 15, 18, 20, 22, 25, 27, 28, 31, 34, 36, 38, 41, 42, 44, 45, and 48) in the same manner as described for chemical constituents. The sample was poured into a 1-liter, wide-mouth, amber plastic bottle containing 1 mg of magnesium carbonate. The water samples were stored in iced, insulated chests. In the laboratory, the water samples were analyzed for chlorophyll *a*, *b*, and *c* using methods described in Standard Methods.

TABLE 3: CONSTITUENTS ANALYZED, SAMPLE CONTAINERS, AND PRESERVATION METHODS FOR WATER SAMPLES COLLECTED FROM THE ILLINOIS WATERWAY STUDY AREA

Constituent and Abbreviation	Units of Measure	Sample Container	Preservative
Water Temperature	°C	NA	Measured in Field
Total Suspended Solids (TSS)	mg/L	Plastic	Cool, 4°C
Turbidity	NTU	NA	Measured in Field
Conductivity	µS/cm	NA	Measured in Field
Five-Day Biochemical Oxygen Demand (BOD_5)	mg/L	Plastic	Cool, 4°C
Dissolved Oxygen	mg/L	NA	Measured in Field
pH	units	NA	Measured in Field
Ammonia Nitrogen (NH_4-N)	mg/L	Plastic	Cool, 4°C, H_2SO_4 to pH <2
Un-ionized Ammonia (NH_3-N)*	mg/L	---	---
Total Kjeldahl Nitrogen (TKN)	mg/L	Plastic	Cool, 4°C, H_2SO_4 to pH <2
Nitrite plus Nitrate Nitrogen (NO_2+NO_3-N)	mg/L	Plastic	Cool, 4°C, H_2SO_4 to pH <2
Total Phosphorus (TP)	mg/L	Plastic	Cool, 4°C
Chlorophyll *a*	µg/L	Plastic, Amber	Cool, 4°C, $MgCO_3$
Total Cyanide (TCN)	mg/L	Plastic	NaOH to pH 12
Phenols	mg/L	Glass	H_2SO_4 to pH <2
Total and Soluble Metals (Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Silver, and Zinc)	mg/L	Plastic	HNO_3 to pH <2
Fecal Coliform (FC)	cfu/100 mL	Sterile Plastic	Cool, 4°C, EDTA**, and Thiosulfate
E. coli	cfu/100 mL	Sterile Plastic	Cool, 4°C, EDTA, and Thiosulfate

NA = Not Applicable.
*Determined by calculation using water temperature, pH and NH_4-N.
**Ethylenediamine-tetraaceticacid.

Dissolved Mercury. The Method Detection Limit (MDL) for total and dissolved mercury was 0.05 µg/L during 2006 (Standard Methods). Dissolved mercury was only analyzed if the total mercury value was greater than twice the MDL (0.10 µg/L).

Sediment. *Chemical Constituents.* Sediment samples were collected during the 2006 survey at 14 of the 49 monitoring stations (1, 2, 5, 8, 12, 18, 23, 28, 32, 35, 38, 41, 44, and 48). Over the period of October 2–5, 2006, one sediment sample was taken with a 6- x 6-inch Ponar grab sampler from each of the 14 stations. The sediment sample was transferred to a wide-mouth, quart glass jar and analyzed for TS, TVS, ammonia, TKN, NO_2+NO_3-N, TP, TCN, phenols, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc. The constituents analyzed, sample containers, and preservation methods are summarized in Table 4. All constituents were analyzed according to USEPA procedures except TS, TVS, TCN, and total and soluble metals, which are from Standard Methods.

TABLE 4: CONSTITUENTS ANALYZED, SAMPLE CONTAINERS, AND PRESERVATION METHODS FOR SEDIMENT SAMPLES COLLECTED FROM THE ILLINOIS WATERWAY STUDY AREA

Constituent and Abbreviation	Units of Measure[1]	Sample Container	Preservative
Total Solids (TS)	Percent	Glass	Cool, 4°C
Total Volatile Solids (TVS)	Percent	Glass	Cool, 4°C
Ammonia Nitrogen (NH_4-N)	mg/kg	Glass	Cool, 4°C
Total Kjeldahl Nitrogen (TKN)	mg/kg	Glass	Cool, 4°C
Nitrite plus Nitrate Nitrogen (NO_2+NO_3-N)	mg/kg	Glass	Cool, 4°C
Total Phosphorus (TP)	mg/kg	Glass	Cool, 4°C
Total Cyanide (TCN)	mg/kg	Glass	Cool, 4°C
Phenols	mg/kg	Glass	Cool, 4°C
Total and Soluble Metals (Arsenic, Cadmium, Chromium Copper, Iron, Lead, Manganese, Mercury, Nickel, Silver, and Zinc)	mg/kg	Glass	Cool, 4°C

[1]Expressed on a dry weight basis.

RESULTS AND DISCUSSION

Water Quality

Water quality in lotic ecosystems can be evaluated by assessing a combination of biological, chemical, and physical parameters, including bacterial levels, the concentrations of dissolved gases, dissolved and suspended inorganic and organic compounds, nutrients, water temperature, and rate of flow. Methods for measuring the biological and chemical constituents and the physical properties of water are well defined, and they have considerable precision. While sediment data can reflect long-term conditions, water samples are indicative of the water quality only at the time of monitoring.

In order to describe water quality in the Illinois Waterway, the 133-mile study area was divided by navigational pool:

1. Lockport (Station 1),
2. Brandon Road (Stations 2–4),
3. Dresden Island (Stations 5–11),
4. Marseilles (Stations 12–21),
5. Starved Rock (Stations 22–27), and
6. Peoria, upper Peoria (Stations 28–41), and lower Peoria (Stations 42–49).

The Peoria Pool was subdivided based on geo-morphological differences between the upper and lower reaches.

The concentrations of the 38 constituents measured at each of the 49 monitoring stations, including calculated values for NH_3-N and TN, are presented in Appendices AI through AVII. The water quality data for selected parameters are summarized by navigational pool in Table 5. When the analytical result was less than the MDL, the MDL value was used to calculate the mean.

Dissolved mercury data are not reported in the appendices because the few stations analyzed for dissolved mercury generally resulted in values less than the MDL. Dissolved mercury was only analyzed if the total mercury value was greater than twice the MDL (<0.10 µg/L).

Dissolved mercury analyses were performed on water samples from Stations 10, 11, 13, 16, 24, 29, and 42 during the month of May, and all of the results were below the MDL of 0.05 µg/L. Dissolved mercury concentration was also below the MDL at Station 10 in October. However, at Stations 12 and 14, dissolved mercury measured 0.06 and 0.05 µg/L, respectively, in

TABLE 5: SUMMARY OF WATER QUALITY FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2006

Navigational Pool	Constituents[a]	Range	Average
Lockport	Water Temperature (°C)[b]	18.2 – 28.7	22.5
	TSS	12 – 22	17
	Turbidity (NTU)[b]	3 – 44	18
	Conductivity (µS/cm)[b]	684 – 1,213	879
	BOD_5	<2 – 3	2
	Dissolved Oxygen (DO)[b]	3.6 – 6.0	5.0
	pH (units)[b]	6.5 – 7.4	7.1
	NH_4-N	0.20 – 0.62	0.39
	NH_3-N	0.001 – 0.004	0.002
	TKN	1.13 – 1.98	1.48
	NO_2+NO_3-N	4.89 – 6.87	5.76
	TN	6.02 – 8.66	7.24
	TP	0.57 – 1.38	1.06
	Chlorophyll *a* (µg/L)	No Data	No Data
	Total Cyanide	0.003 – 0.004	0.003
	Phenols	All values <0.005	<0.005
	FC (cfu/100 mL)	130 – 1,200	492[c]
	E. coli (cfu/100 mL)	160 – 510	258[c]
Brandon Road	Water Temperature (°C)[b]	16.2 – 29.5	22.1
	TSS	10 – 64	24
	Turbidity (NTU)[b]	9 – 43	21
	Conductivity (µS/cm)[b]	679 – 1,280	908
	BOD_5	<2 – 9	4
	Dissolved Oxygen (DO)[b]	3.6 – 7.5	5.7
	pH (units)[b]	6.4 – 7.6	7.2
	NH_4-N	0.10 – 0.59	0.34
	NH_3-N	0.001 – 0.005	0.003
	TKN	1.06 – 1.86	1.43
	NO_2+NO_3-N	4.60 – 7.57	5.85
	TN	5.66 – 9.43	7.28
	TP	0.61 – 1.35	1.03
	Chlorophyll *a* (µg/L)	3 – 13	6
	Total Cyanide	<0.003 – 0.004	0.003
	Phenols	All values <0.005	<0.005
	FC (cfu/100 mL)	60 – 2,100	522[c]
	E. coli (cfu/100 mL)	40 – 600	184[c]

TABLE 5 (Continued): SUMMARY OF WATER QUALITY FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2006

Navigational Pool	Constituents[a]	Range	Average
Dresden Island	Water Temperature (°C)[b]	15.6 – 33.1	22.7
	TSS	7 – 320	33
	Turbidity (NTU)[b]	9 – 174	29
	Conductivity (µS/cm)[b]	647 – 1,277	910
	BOD_5	<2 – 6	3
	Dissolved Oxygen (DO)[b]	5.6 – 9.7	7.8
	pH (units)[b]	7.3 – 7.9	7.5
	NH_4-N	0.02 – 0.52	0.23
	NH_3-N	<0.001 – 0.009	0.004
	TKN	0.89 – 2.27	1.43
	NO_2+NO_3-N	3.57 – 7.50	5.37
	TN	4.69 – 9.36	6.80
	TP	0.58 – 1.78	0.97
	Chlorophyll *a* (µg/L)	2 – 34	10
	Total Cyanide	<0.003 – 0.004	0.003
	Phenols	All values <0.005	<0.005
	FC (cfu/100 mL)	<10 – 6,000	240[c]
	E. coli (cfu/100 mL)	<10 – 6,500	137[c]
Marseilles	Water Temperature (°C)[b]	15.5 – 30.0	21.6
	TSS	9 – 148	34
	Turbidity (NTU)[b]	8 – 140	34
	Conductivity (µS/cm)[b]	654 – 1,051	804
	BOD_5	<2 – 6	3
	Dissolved Oxygen (DO)[b]	6.8 – 10.5	8.8
	pH (units)[b]	7.5 – 8.3	8.0
	NH_4-N	<0.02 – 0.28	0.11
	NH_3-N	<0.001 – 0.025	0.005
	TKN	0.73 – 3.90	1.17
	NO_2+NO_3-N	2.54 – 6.69	4.38
	TN	3.48 – 9.83	5.55
	TP	0.32 – 1.36	0.59
	Chlorophyll *a* (µg/L)	3 – 37	15
	Total Cyanide	<0.003 – 0.003	0.003
	Phenols	All values <0.005	<0.005
	FC (cfu/100 mL)	<10 – 3,400	71[c]
	E. coli (cfu/100 mL)	<10 – 1,700	54[c]

TABLE 5 (Continued): SUMMARY OF WATER QUALITY FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2006

Navigational Pool	Constituents[a]	Range	Average
Starved Rock	Water Temperature (°C)[b]	14.6 – 29.3	21.2
	TSS	11 – 169	42
	Turbidity (NTU)[b]	14 – 168	39
	Conductivity (µS/cm)[b]	678 – 1,036	809
	BOD_5	<2 – 5	3
	Dissolved Oxygen (DO)[b]	7.1 – 12.9	9.2
	pH (units)[b]	7.4 – 8.8	8.1
	NH_4-N	<0.02 – 0.34	0.10
	NH_3-N	<0.001 – 0.040	0.007
	TKN	0.95 – 1.79	1.25
	NO_2+NO_3-N	2.55 – 6.80	4.27
	TN	3.60 – 8.27	5.52
	TP	0.32 – 0.93	0.54
	Chlorophyll *a* (µg/L)	6 – 106	33
	Total Cyanide	<0.003 – 0.003	0.003
	Phenols	All values <0.005	<0.005
	FC (cfu/100 mL)	<10 – 1,400	63[c]
	E. coli (cfu/100 mL)	<10 – 300	41[c]
Upper Peoria	Water Temperature (°C)[b]	16.3 – 28.8	21.5
	TSS	9 – 182	46
	Turbidity (NTU)[b]	16 – 128	44
	Conductivity (µS/cm)[b]	697 – 977	799
	BOD_5	<2 – 6	4
	Dissolved Oxygen (DO)[b]	4.7 – 12.5	9.3
	pH (units)[b]	7.7 – 8.7	8.2
	NH_4-N	<0.02 – 0.30	0.08
	NH_3-N	<0.001 – 0.029	0.007
	TKN	0.64 – 3.34	1.37
	NO_2+NO_3-N	2.52 – 7.25	4.34
	TN	4.01 – 9.63	5.71
	TP	0.29 – 1.07	0.53
	Chlorophyll *a* (µg/L)	18 – 98	42
	Total Cyanide	All values <0.003	<0.003
	Phenols	All values <0.005	<0.005
	FC (cfu/100 mL)	<10 – 700	64[c]
	E. coli (cfu/100 mL)	<10 – 300	30[c]

TABLE 5 (Continued): SUMMARY OF WATER QUALITY FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2006

Navigational Pool	Constituents[a]	Range	Average
Lower Peoria	Water Temperature (°C)[b]	16.5 – 27.9	20.9
	TSS	27 – 146	56
	Turbidity (NTU)[b]	34 – 104	64
	Conductivity (µS/cm)[b]	639 – 954	767
	BOD_5	<2 – 7	4
	Dissolved Oxygen (DO)[b]	4.1 – 12.7	8.8
	pH (units)[b]	8.1 – 8.8	8.4
	NH_4-N	<0.02 – 0.39	0.09
	NH_3-N	<0.001 – 0.032	0.009
	TKN	0.51 – 2.24	1.50
	NO_2+NO_3-N	1.84 – 7.07	3.84
	TN	3.35 – 9.17	5.34
	TP	0.31 – 0.71	0.49
	Chlorophyll *a* (µg/L)	30 – 119	61
	Total Cyanide	All values <0.003	<0.003
	Phenols	All values <0.005	<0.005
	FC (cfu/100 mL)	<10 – 670	72[c]
	E. coli (cfu/100 mL)	<10 – 390	41[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

October, and in August dissolved mercury concentration was 0.14 µg/L at Station 8. No other analyses were conducted for dissolved mercury.

Spatial Variability Along the Illinois Waterway. *Total Suspended Solids*. As shown in Figure 3, TSS generally increased in concentration from Lockport to the Peoria Pool. The increase in TSS along the Illinois Waterway may be related to an increase in agricultural runoff. There was a sharp increase in TSS at Station 10 in the Dresden Island Pool in 2006. In general, TSS was elevated relative to the 2005 data, perhaps reflective of the drought conditions in 2005 versus the increased rain events in 2006.

Dissolved Oxygen. Dissolved oxygen concentration trends along the Illinois Waterway are shown in Figure 4. The dramatic increase in DO between Stations 4 and 5 is directly attributable to the natural re-aeration resulting from water passing over the Brandon Road Dam. The mean DO concentration along the Illinois Waterway remained above 8.0 mg/L below the Dresden Island Lock and Dam to the end of the sampling reach.

Ammonia Nitrogen. Ammonia nitrogen rapidly decreased in the Brandon Road and Dresden Island Pools (Figure 5). Mean NH_4-N remained relatively uniform from Marseilles to the lower Peoria Pool.

Total Nitrogen. As shown in Figure 6, there was a general decrease in TN concentration from the Lockport Pool to the lower Peoria Pool. The sharp decrease in TN between Stations 10 and 12 may be attributable to the confluence of the Kankakee River with the Des Plaines River.

Total Phosphorus. Mean concentrations of TP generally decreased along the Illinois Waterway from the Lockport Pool through the Marseilles Pool, and then remained relatively stable, as shown in Figure 7. The sharp decrease in TP between Stations 10 and 12 may be attributable to the confluence of the Kankakee River with the Des Plaines River.

Fecal Coliform. Geometric mean FC peaked in the Brandon Road Pool, decreased drastically along the Dresden Island Pool, and then remained rather uniform along the Illinois Waterway into the Peoria Pool (Figure 8). FC sharply increased in the lower Peoria Pool at Station 47. In general, geometric mean FC values from Marseilles to the lower Peoria Pool were higher in 2006 than in 2005, perhaps due to the increased wet weather in 2006.

Trace Metals. Mean total concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, and silver remained relatively constant from the Lockport to the lower Peoria Pool (Table 6). Mean total zinc was highest from the Lockport through the Dresden Pool and

FIGURE 3: MEAN TOTAL SUSPENDED SOLIDS CONCENTRATION AT 49 STATIONS ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING MAY, AUGUST, AND OCTOBER 2006

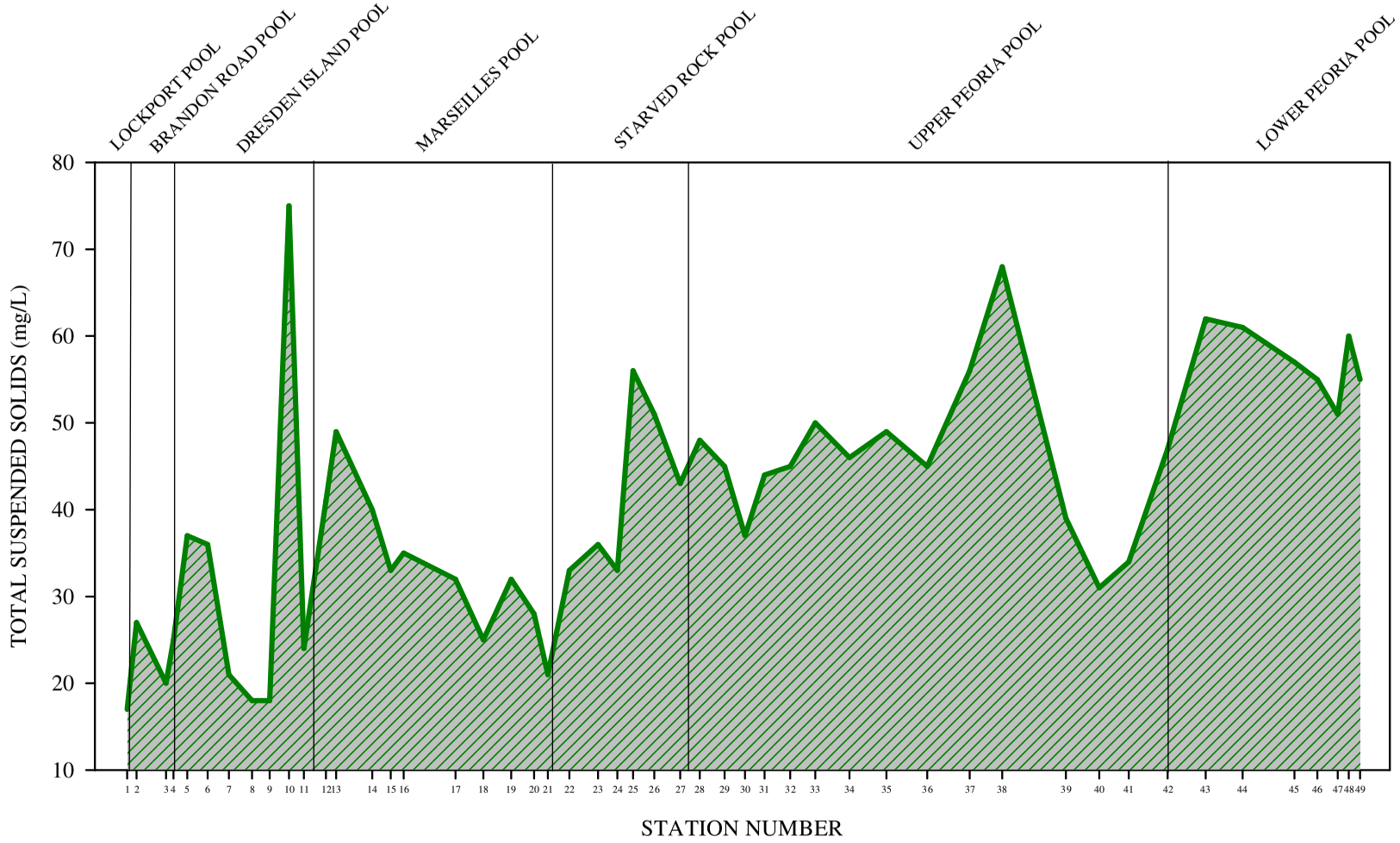

FIGURE 4: MEAN DISSOLVED OXYGEN CONCENTRATION AT 49 STATIONS ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING MAY, AUGUST, AND OCTOBER 2006

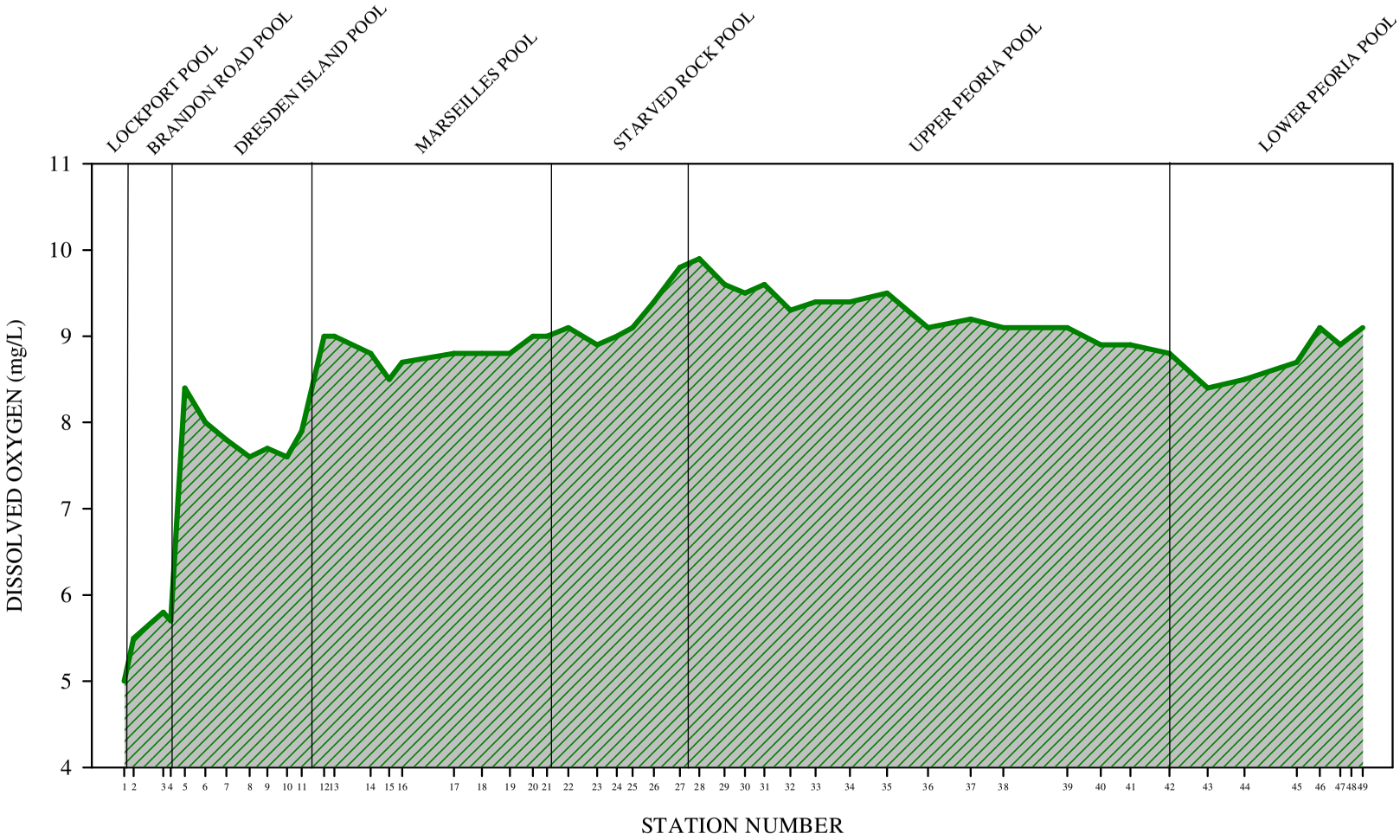

FIGURE 5: MEAN AMMONIA NITROGEN CONCENTRATION AT 49 STATIONS ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING MAY, AUGUST, AND OCTOBER 2006

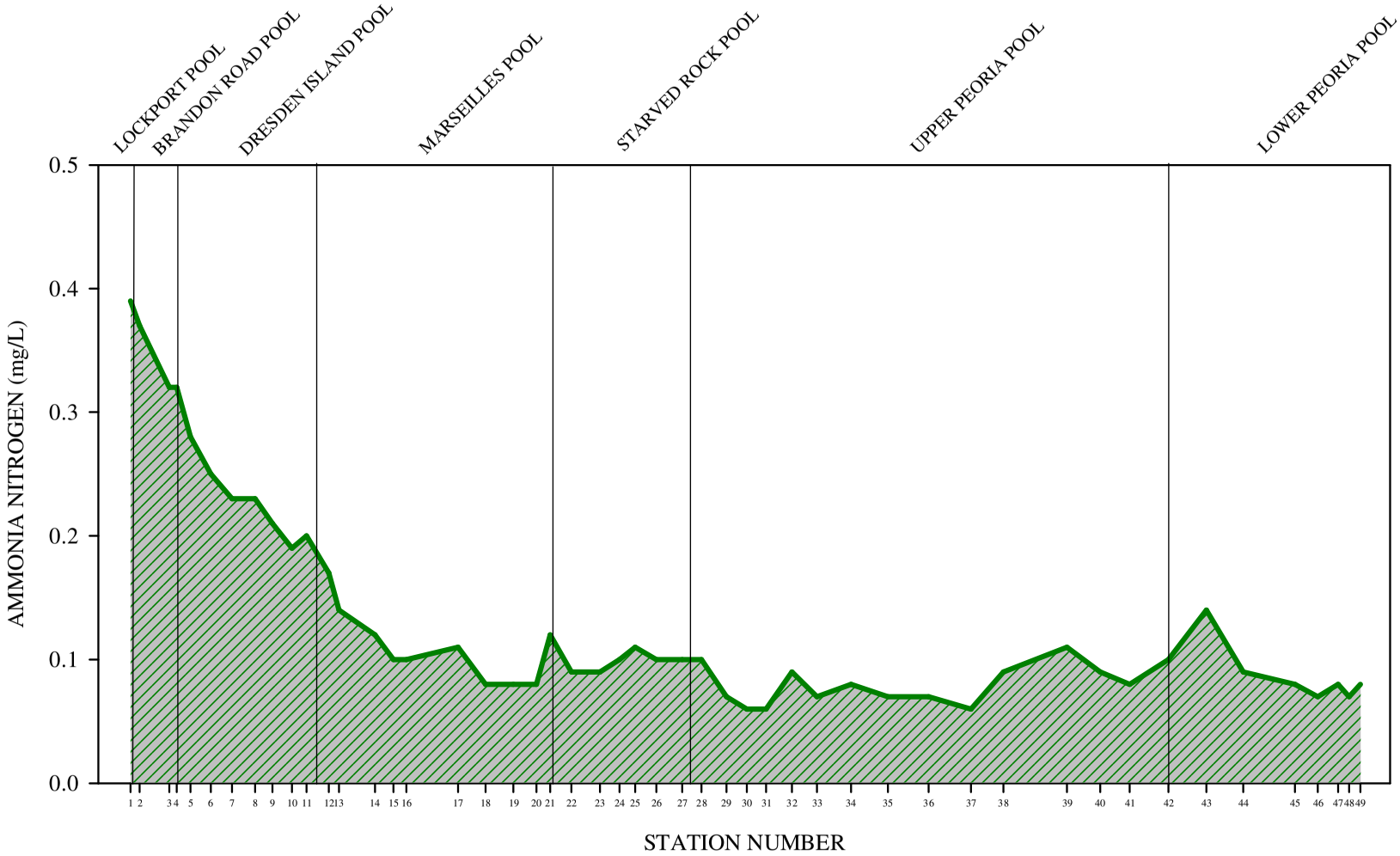

FIGURE 6: MEAN TOTAL NITROGEN CONCENTRATION AT 49 STATIONS ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING MAY, AUGUST, AND OCTOBER 2006

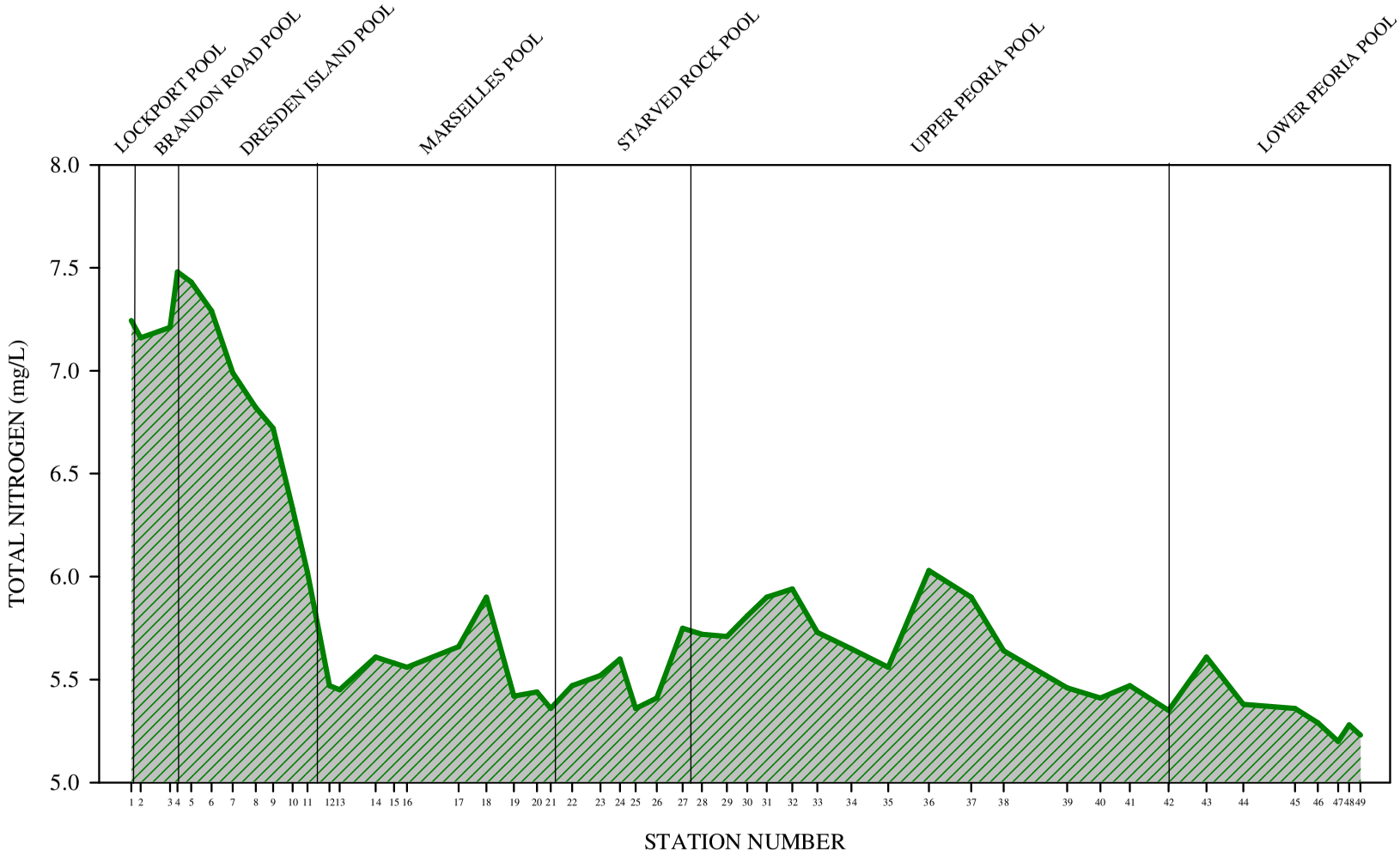

FIGURE 7: MEAN TOTAL PHOSPHORUS CONCENTRATION AT 49 STATIONS ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING MAY, AUGUST, AND OCTOBER 2006

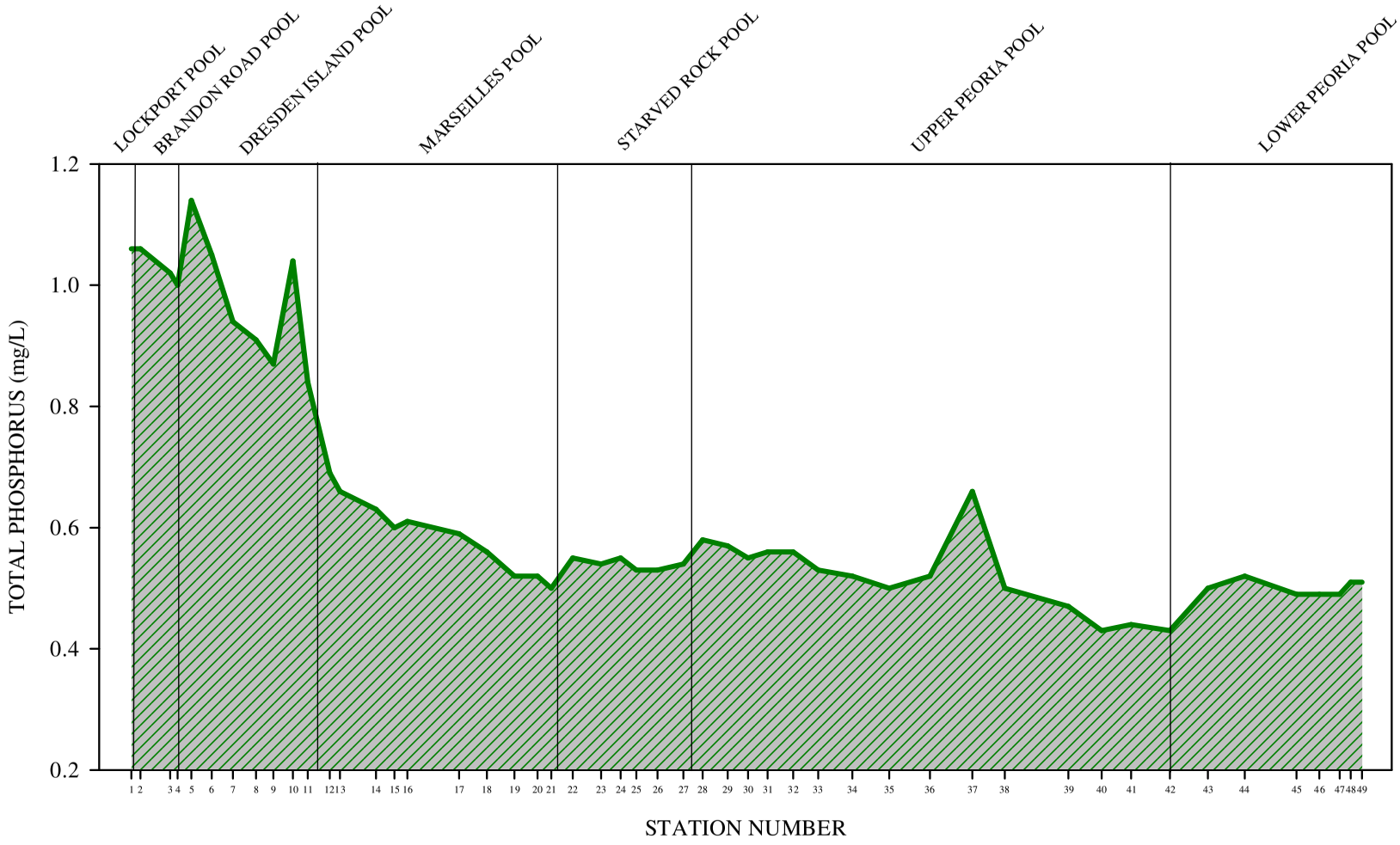

FIGURE 8: GEOMETRIC MEAN FECAL COLIFORM AT 49 STATIONS ALONG THE ILLINOIS WATERWAY FROM THE LOCKPORT LOCK TO THE PEORIA LOCK DURING MAY, AUGUST, AND OCTOBER 2006

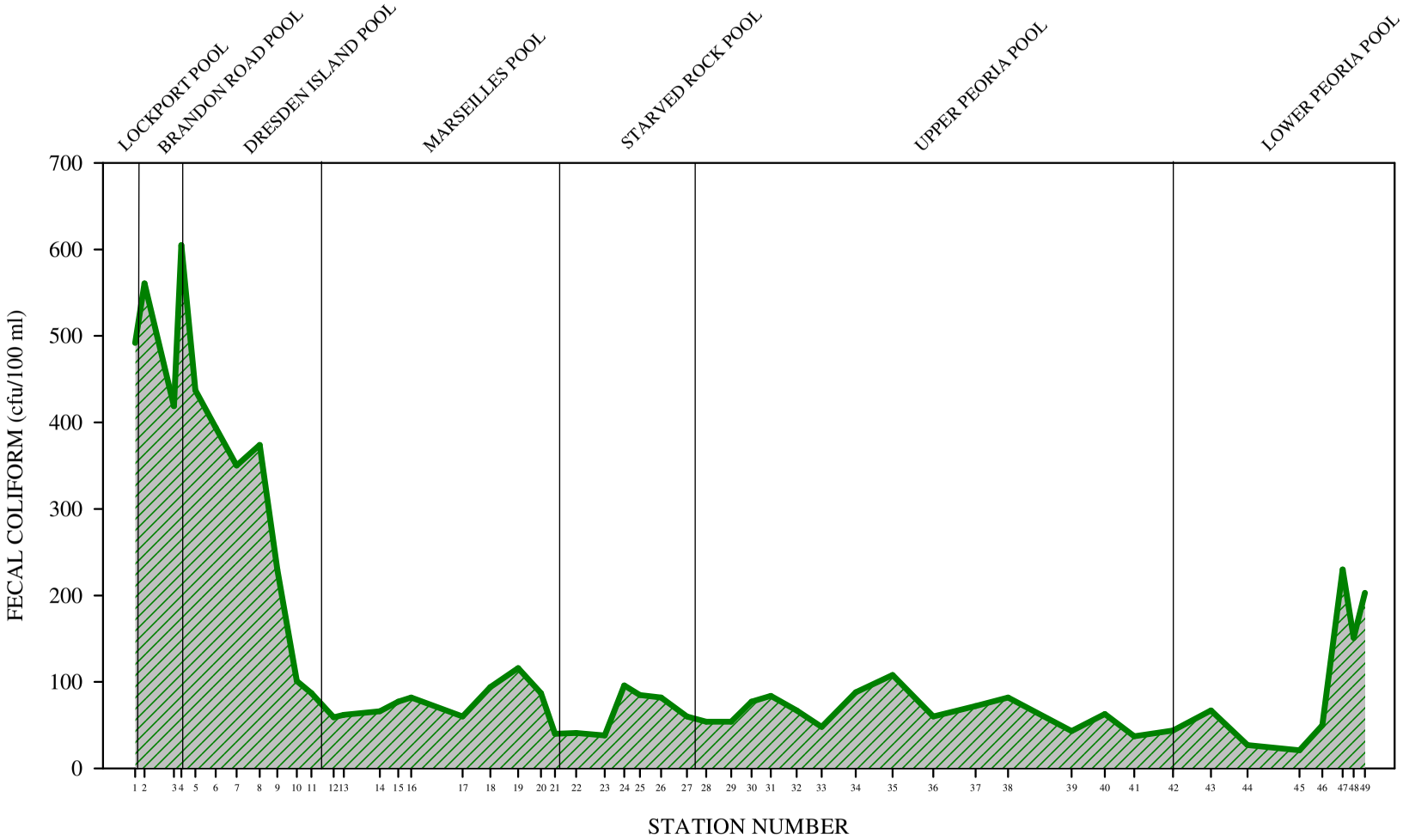

TABLE 6: SUMMARY OF METALS CONCENTRATIONS FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2006

Navigational Pool	Constituents[a]	Range	Average
Lockport	Total Arsenic	All values <0.02	<0.02
	Dissolved Arsenic	<0.01 – 0.01	0.01
	Total Cadmium	<0.02 – 0.009	0.003
	Dissolved Cadmium	0.0004 – 0.0010	0.0007
	Total Chromium	0.0023 – 0.0117	0.0046
	Dissolved Chromium	<0.0005 – 0.0016	0.0009
	Total Copper	0.0010 – 0.0060	0.0025
	Dissolved Copper	<0.002 – 0.003	0.002
	Total Iron	0.40 – 0.65	0.55
	Dissolved Iron	0.011 – 0.043	0.030
	Total Lead	<0.003 – 0.011	0.007
	Dissolved Lead	<0.004 – 0.008	0.005
	Total Manganese	0.0216 – 0.0369	0.0309
	Dissolved Manganese	0.0124 – 0.0331	0.0233
	Total Mercury (µg/L)	<0.05 – 0.06	0.05
	Total Nickel	0.003 – 0.010	0.006
	Dissolved Nickel	0.0026 – 0.0054	0.0036
	Total Silver	<0.0006 – 0.0013	0.0007
	Dissolved Silver	All values <0.0006	<0.0006
	Total Zinc	0.025 – 0.046	0.034
	Dissolved Zinc	0.012 – 0.034	0.018
Brandon Road	Total Arsenic	All values <0.02	<0.02
	Dissolved Arsenic	<0.01 – 0.01	0.01
	Total Cadmium	<0.02 – 0.005	0.002
	Dissolved Cadmium	<0.0004 – 0.0013	0.0006
	Total Chromium	0.0019 – 0.0084	0.0040
	Dissolved Chromium	<0.0005 – 0.0015	0.0009
	Total Copper	<0.0005 – 0.0080	0.0031
	Dissolved Copper	<0.002 – 0.002	0.002
	Total Iron	0.23 – 1.67	0.68
	Dissolved Iron	<0.004 – 0.087	0.030
	Total Lead	<0.003 – 0.013	0.007
	Dissolved Lead	<0.004 – 0.010	0.005
	Total Manganese	0.0199 – 0.0577	0.0340
	Dissolved Manganese	0.0098 – 0.0334	0.0223
	Total Mercury (µg/L)	<0.05 – 0.08	0.05

TABLE 6 (Continued): SUMMARY OF METALS CONCENTRATIONS FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2006

Navigational Pool	Constituents[a]	Range	Average
Brandon Road (Continued)	Total Nickel	0.003 – 0.009	0.005
	Dissolved Nickel	0.0025 – 0.0055	0.0034
	Total Silver	<0.0006 – 0.0011	0.0006
	Dissolved Silver	All values <0.0006	<0.0006
	Total Zinc	0.022 – 0.064	0.033
	Dissolved Zinc	0.011 – 0.032	0.017
Dresden Island	Total Arsenic	<0.02 – 0.02	0.02
	Dissolved Arsenic	<0.01 – 0.01	0.01
	Total Cadmium	<0.002 – 0.005	0.002
	Dissolved Cadmium	<0.0004 – 0.0016	0.0007
	Total Chromium	0.0007 – 0.0339	0.0048
	Dissolved Chromium	<0.0005 – 0.0017	0.0008
	Total Copper	<0.0005 – 0.0430	0.0045
	Dissolved Copper	<0.002 – 0.002	0.002
	Total Iron	0.26 – 9.85	1.06
	Dissolved Iron	<0.004 – 0.087	0.029
	Total Lead	<0.003 – 0.051	0.008
	Dissolved Lead	<0.004 – 0.009	0.005
	Total Manganese	0.0215 – 0.2033	0.0433
	Dissolved Manganese	0.0012 – 0.0357	0.0204
	Total Mercury (µg/L)	<0.05 – 0.29	0.07
	Dissolved Mercury (µg/L)	<0.05 – 0.14	0.07
	Total Nickel	0.003 – 0.014	0.005
	Dissolved Nickel	0.002 – 0.0043	0.0029
	Total Silver	<0.0006 – 0.0013	0.0007
	Dissolved Silver	All values <0.0006	<0.0006
	Total Zinc	0.015 – 0.219	0.038
	Dissolved Zinc	0.008 – 0.043	0.016
Marseilles	Total Arsenic	All values <0.02	<0.02
	Dissolved Arsenic	<0.01 – 0.01	0.01
	Total Cadmium	<0.002 – 0.004	0.002
	Dissolved Cadmium	0.0004 – 0.0013	0.0006
	Total Chromium	<0.0005 – 0.0261	0.0040
	Dissolved Chromium	<0.0005 – 0.0013	0.0007
	Total Copper	<0.0005 – 0.0230	0.0030

TABLE 6 (Continued): SUMMARY OF METALS CONCENTRATIONS FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2006

Navigational Pool	Constituents[a]	Range	Average
Marseilles (Continued)	Dissolved Copper	<0.002 – 0.002	0.002
	Total Iron	0.30 – 4.69	1.08
	Dissolved Iron	<0.004 – 0.071	0.017
	Total Lead	<0.003 – 0.027	0.007
	Dissolved Lead	<0.004 – 0.009	0.005
	Total Manganese	0.0261 – 0.1090	0.0509
	Dissolved Manganese	0.0010 – 0.0273	0.0068
	Total Mercury (µg/L)	<0.05 – 0.13	0.06
	Dissolved Mercury (µg/L)	<0.05 – 0.06	0.05
	Total Nickel	<0.002 – 0.010	0.003
	Dissolved Nickel	0.0006 – 0.0024	0.0014
	Total Silver	<0.0006 – 0.0009	0.0006
	Dissolved Silver	All values <0.0006	<0.0006
	Total Zinc	0.010 – 0.120	0.025
	Dissolved Zinc	0.005 – 0.021	0.009
Starved Rock	Total Arsenic	All values <0.02	<0.02
	Dissolved Arsenic	<0.01 – 0.01	0.01
	Total Cadmium	<0.002 – 0.003	0.002
	Dissolved Cadmium	<0.0004 – 0.0016	0.0007
	Total Chromium	0.0005 – 0.0122	0.0032
	Dissolved Chromium	<0.0005 – 0.0014	0.0007
	Total Copper	<0.0005 – 0.0140	0.0023
	Dissolved Copper	<0.002 – 0.002	0.002
	Total Iron	0.35 – 5.37	1.33
	Dissolved Iron	<0.004 – 0.082	0.025
	Total Lead	<0.003 – 0.019	0.006
	Dissolved Lead	<0.004 – 0.009	0.005
	Total Manganese	0.0281 – 0.1510	0.0580
	Dissolved Manganese	0.0009 – 0.0125	0.0036
	Total Mercury (µg/L)	<0.05 – 0.17	0.06
	Dissolved Mercury (µg/L)	All values <0.05	<0.05
	Total Nickel	<0.002 – 0.007	0.003
	Dissolved Nickel	<0.0004 – 0.0022	0.0013
	Total Silver	<0.0006 – 0.0008	0.0006

TABLE 6 (Continued): SUMMARY OF METALS CONCENTRATIONS FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2006

Navigational Pool	Constituents[a]	Range	Average
Starved Rock (Continued)	Dissolved Silver	All values <0.0006	<0.0006
	Total Zinc	0.010 – 0.075	0.021
	Dissolved Zinc	0.005 – 0.025	0.009
Upper Peoria	Total Arsenic	<0.02 – 0.02	0.02
	Dissolved Arsenic	<0.01 – 0.01	0.01
	Total Cadmium	<0.002 – 0.004	0.002
	Dissolved Cadmium	0.0004 – 0.0014	0.0006
	Total Chromium	<0.0005 – 0.0119	0.0029
	Dissolved Chromium	<0.0005 – 0.0013	0.0007
	Total Copper	<0.0005 – 0.0140	0.0021
	Dissolved Copper	<0.002 – 0.002	0.002
	Total Iron	0.42 – 4.26	1.40
	Dissolved Iron	<0.004 – 0.210	0.019
	Total Lead	<0.003 – 0.018	0.006
	Dissolved Lead	<0.004 – 0.011	0.005
	Total Manganese	0.0353 – 0.1289	0.0611
	Dissolved Manganese	0.0008 – 0.0155	0.0027
	Total Mercury (µg/L)	<0.05 – 0.21	0.06
	Dissolved Mercury (µg/L)	All values <0.05	<0.05
	Total Nickel	<0.002 – 0.006	0.003
	Dissolved Nickel	<0.0004 – 0.0030	0.0014
	Total Silver	<0.0006 – 0.0008	0.0006
	Dissolved Silver	All values <0.0006	<0.0006
	Total Zinc	0.010 – 0.073	0.022
	Dissolved Zinc	0.003 – 0.019	0.008
Lower Peoria	Total Arsenic	<0.02 – 0.02	0.02
	Dissolved Arsenic	<0.01 – 0.02	0.01
	Total Cadmium	<0.002 – 0.003	0.002
	Dissolved Cadmium	<0.0004 – 0.0015	0.0007
	Total Chromium	0.0013 – 0.0067	0.0034
	Dissolved Chromium	<0.0005 – 0.0015	0.0007
	Total Copper	<0.0005 – 0.0070	0.0022
	Dissolved Copper	<0.002 – 0.002	0.002
	Total Iron	0.77 – 3.54	1.85
	Dissolved Iron	<0.004 – 0.048	0.015

TABLE 6 (Continued): SUMMARY OF METALS CONCENTRATIONS FROM THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, MAY, AUGUST, AND OCTOBER 2006

Navigational Pool	Constituents[a]	Range	Average
Lower Peoria (Continued)	Total Lead	<0.003 – 0.011	0.006
	Dissolved Lead	<0.004 – 0.009	0.005
	Total Manganese	0.0480 – 0.1405	0.0891
	Dissolved Manganese	0.0010 – 0.0077	0.0025
	Total Mercury (µg/L)	<0.05 – 0.32	0.06
	Dissolved Mercury (µg/L)	All values <0.05	<0.05
	Total Nickel	0.002 – 0.006	0.004
	Dissolved Nickel	<0.0004 – 0.0032	0.0016
	Total Silver	<0.0006 – 0.0006	0.0006
	Dissolved Silver	All values <0.0006	<0.0006
	Total Zinc	0.012 – 0.049	0.023
	Dissolved Zinc	0.002 – 0.018	0.006

[a]Expressed in mg/L except where noted.

decreased in the Marseilles through the lower Peoria Pool. The mean total iron and manganese concentrations increased progressively downstream to the lower Peoria Pool.

The mean dissolved concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, and silver remained fairly uniform from the Lockport Pool downstream to the lower Peoria Pool (Table 6). Mean values of dissolved manganese and zinc were highest in the Lockport through the Dresden Island Pools and then were relatively uniform downstream to the lower Peoria Pool. Mean values of dissolved iron decreased from the Lockport to the Marseilles Pool, increased in the Starved Rock Pool, and finally decreased throughout the rest of the sampling reach.

Nutrient Flux

Total flux of TN and TP were estimated by multiplying their concentrations at a given point by the discharge at that point. District discharge data from Lockport were used in the flux calculations for Station 1 (Lockport Pool), as well as data obtained from the United States Geological Survey (USGS) Web site (http://waterdata.usgs.gov/nwis/). The sampling stations in common with USGS gauging stations included Stations 26 (Starved Rock Pool), 39 (Upper Peoria Pool), and 49 (Lower Peoria Pool). The nutrient flux was determined in tons per day for each of these four stations during the six sampling events (Table 7).

Total phosphorus flux was highest during the first week in October at Stations 1, 26, and 39 due to increased discharge during that week. Total phosphorus flux fluctuated throughout the various seasons in the Illinois Waterway, and spatial patterns were not consistent.

At Stations 26, 39, and 49, TN flux was generally highest during the month of May, due to agricultural runoff and drainage. Nitrogen flux at these stations was also elevated in October because of increased discharge. Nitrogen sources and flux are further evaluated and discussed in the Addendum Report entitled, "Isotopic Composition of Nitrate in the Illinois Waterway, 2006," at the end of this report.

Waterway Use Designations

The Illinois Pollution Control Board (IPCB) has designated water uses for particular waters within the State of Illinois. All waters in Illinois are designated as General Use except those designated as Secondary Contact and Indigenous Aquatic Life waters. The CSSC and the Des Plaines River from its confluence with the CSSC to the Interstate Highway 55 (I-55) bridge are classified as Secondary Contact waters (Stations 1–8). The Des Plaines River downstream of the I-55 bridge (Station 9) and the Illinois River are General Use waters (Stations 10–49).

Water Quality Standards. *Dissolved Oxygen*. The General Use and Secondary Contact Use Standards for DO are 5.0 and 4.0 mg/L, respectively. The Secondary Contact Standard was not achieved during the first week in August at Stations 1–4 (DO concentrations ranged from

TABLE 7: FLUX OF TOTAL NITROGEN AND TOTAL PHOSPHORUS AT STATIONS 1, 26, 39, AND 49 ALONG THE ILLINOIS WATERWAY DURING 2006 SAMPLING EVENTS

Station No./ Date	Discharge (ft^3/s)[a]	Total Phosphorus Flux (tons/day)	Total Nitrogen Flux (tons/day)
Station 1	Chicago Sanitary and Ship Canal[b]		
05/01/06	2,872	8.99	66.81
05/12/06	3,128	11.64	73.05
08/07/06	2,453	7.41	42.14
08/18/06	2,697	7.35	43.79
10/02/06	5,164	15.18	103.92
10/13/06	2,042	3.14	34.86
Station 26	Illinois River		
05/02/06	12,000	20.07	241.61
05/11/06	8,780	9.71	166.17
08/08/06	4,180	7.33	47.75
08/17/06	4,460	6.62	44.88
10/03/06	19,500	33.13	282.28
10/12/06	9,170	8.16	115.18
Station 39	Illinois River		
05/03/06	17,500	17.46	326.49
05/10/06	13,900	12.75	301.69
08/09/06	7,200	9.90	81.60
08/16/06	7,050	12.36	81.54
10/04/06	21,600	36.70	291.18
10/11/06	13,600	12.47	158.61
Station 49	Illinois River		
05/04/06	15,200	15.99	289.85
05/09/06	15,500	20.07	375.05
08/10/06	6,560	10.97	59.26
08/15/06	8,060	13.48	80.48
10/05/06	18,200	22.58	206.81
10/10/06	18,200	24.05	200.68

[a]Discharge data accessed from United States Geological Survey: http://waterdata.usgs.gov/nwis/

[b]District discharge data from Lockport used for Station 1.

3.6–3.9 mg/L). During this same week, DO concentrations were below the General Use Standard at Stations 40, 41, and 43 (DO concentrations ranged from 4.1–4.8 mg/L).

Fecal Coliform. During the first week of May sampling, FC exceeded the General Use Standard of 400 cfu/100 mL at Stations 24–26, 31, 33–36, 47, and 49. The FC concentrations ranged from 460 to 1,400 cfu/100 mL. During the first week of August sampling, FC measured 470 cfu/100 mL at Stations 47 and 48 in the lower Peoria Pool, and during the first week of October sampling FC concentrations at Stations 9 and 47–48 were 560, 540, and 670 cfu/100 mL, respectively. During the second week of October, FC concentrations were above the standard at Stations 10–16, 20, 22, 28, 30, 32, 34, 35, and 47. The FC concentrations ranged from 420–6,000 cfu/100 mL.

Total Mercury. The Water Quality Standard for the Protection of Human Health for total mercury in General Use waters is 0.012 µg/L. The concentration of total mercury at all stations in the sampling area equaled or exceeded the MDL of 0.05 µg/L at some time during 2006. The total mercury values for the remaining stations and dates were less than the MDL, so it is not known whether they actually exceeded the Human Health Standard for mercury.

Sediment Quality

Sediment quality can considerably impact overlying water quality, benthic community structure, food chain dynamics, and other elements of freshwater ecosystems. Since sediment acts as a reservoir for persistent or bioaccumulative contaminants, sediment data reflects a long-term record of quality.

The concentrations of the eight general chemistry constituents measured in sediment at each of the 14 selected monitoring stations are presented in Table 8. The concentrations of 11 measured trace metals for these same stations are presented in Table 9.

TABLE 8: CHEMICAL CHARACTERISTICS OF SEDIMENT COLLECTED FROM MONITORING STATIONS IN THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, OCTOBER 2006

Station No.	Navigational Pool	Constituents (Expressed on a dry weight basis)							
		Total Solids (%)	Total Volatile Solids (% of Total)	Ammonia Nitrogen (mg/kg)	Total Kjeldahl Nitrogen (mg/kg)	Nitrite + Nitrate Nitrogen (mg/kg)	Total Phos-phorus (mg/kg)	Total Cyanide (mg/kg)	Phenols (mg/kg)
1	Lockport	30	13	160	2,273	26	2,608	3.719	0.185
2	Brandon Road	69	29	3	601	5	510	0.213	0.061
5	Dresden Island	67	4	10	278	4	720	1.368	0.075
8	Dresden Island	67	5	38	538	4	1,048	1.489	0.061
12	Marseilles	77	2	3	64	1	129	<0.003	0.078
18	Marseilles	65	4	6	377	3	221	0.054	0.072
23	Starved Rock	78	1	1	31	2	35	<0.003	0.032
28	Peoria	79	1	1	59	1	22	0.028	0.045
32	Peoria	79	1	<1	60	1	61	0.009	0.044
35	Peoria	73	1	<1	74	1	57	0.031	0.078
38	Peoria	41	6	24	485	4	382	0.225	0.065
41	Peoria	63	3	5	180	3	235	0.020	0.043
44	Peoria	50	7	21	379	<1	320	0.058	0.042
48	Peoria	41	6	38	440	1	216	0.086	0.071

TABLE 9: TRACE METALS IN SEDIMENT COLLECTED FROM MONITORING STATIONS IN THE LOCKPORT, BRANDON ROAD, DRESDEN ISLAND, MARSEILLES, STARVED ROCK, AND PEORIA POOLS OF THE ILLINOIS WATERWAY, OCTOBER 2006

Station No.	Navigational Pool	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Silver	Zinc
		(mg/kg dry weight)										
1	Lockport	2	27.4	235	237	27,609	239	439	1.265	67.8	3.2	1,251
2	Brandon Road	<1	1.3	26	21	14,105	420	211	0.705	32.0	<0.3	166
5	Dresden Island	<1	2.3	41	48	19,927	124	295	0.830	60.1	<0.3	237
8	Dresden Island	2	2.2	35	38	20,098	64	385	1.966	25.3	<0.3	222
12	Marseilles	<1	0.4	21	4	6,713	16	243	0.083	11.0	<0.3	48
18	Marseilles	<1	0.4	19	37	18,267	15	312	0.306	19.2	<0.3	61
23	Starved Rock	<1	<0.4	10	2	10,851	6	239	0.294	7.8	<0.3	30
28	Peoria	<1	<0.4	8	3	6,025	7	167	0.058	6.3	<0.3	37
32	Peoria	<1	<0.4	6	3	5,525	7	156	0.083	6.3	<0.3	43
35	Peoria	<1	<0.4	7	3	5,240	7	126	0.320	4.8	<0.3	43
38	Peoria	<1	1.6	46	34	22,086	32	590	0.641	34.8	<0.3	194
41	Peoria	1	0.9	24	14	19,199	14	520	0.226	14.7	<0.3	88
44	Peoria	<1	2.3	43	30	22,187	31	619	0.630	21.8	<0.3	187
48	Peoria	<1	1.4	47	32	23,169	28	543	0.740	23.7	<0.3	175

APPENDIX AI

WATER QUALITY AT STATION 1 IN THE LOCKPORT POOL DURING MAY, AUGUST, AND OCTOBER 2006

TABLE AI-1: WATER QUALITY AT STATION 1 IN THE CHICAGO SANITARY AND SHIP CANAL MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	18.2[b]	28.7[b]	22.5
Total Suspended Solids	12	22	17
Turbidity (NTU)	3[b]	44[b]	18
Conductivity (µS/cm)	684[b]	1,213[b]	879
Five-Day Biochemical Oxygen Demand	<2	3	2
Dissolved Oxygen	3.6[b]	6.0[b]	5.0
pH (units)	6.5[b]	7.4[b]	7.1
Ammonia Nitrogen	0.20	0.62	0.39
Un-ionized Ammonia	0.001	0.004	0.002
Total Kjeldahl Nitrogen	1.13	1.98	1.48
Nitrite plus Nitrate Nitrogen	4.89	6.87	5.76
Total Nitrogen	6.02	8.66	7.24
Total Phosphorus	0.57	1.38	1.06
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	0.003	0.004	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.009	0.003
Dissolved Cadmium	0.0004	0.0010	0.0007
Total Chromium	0.0023	0.0117	0.0046
Dissolved Chromium	<0.0005	0.0016	0.0009
Total Copper	0.0010	0.0060	0.0025
Dissolved Copper	<0.002	0.003	0.002
Total Iron	0.40	0.65	0.55
Dissolved Iron	0.011	0.043	0.030
Total Lead	<0.003	0.011	0.007
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0216	0.0369	0.0309
Dissolved Manganese	0.0124	0.0331	0.0233
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	0.003	0.010	0.006
Dissolved Nickel	0.0026	0.0054	0.0036
Total Silver	<0.0006	0.0013	0.0007
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.025	0.046	0.034
Dissolved Zinc	0.012	0.034	0.018
Fecal Coliform (cfu/100 mL)	130	1,200	492[c]
E.coli (cfu/100 mL)	160	510	258[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

APPENDIX AII

WATER QUALITY AT STATIONS 2–4 IN THE BRANDON ROAD POOL DURING MAY, AUGUST, AND OCTOBER 2006

TABLE AII-1: WATER QUALITY AT STATION 2 IN THE CHICAGO SANITARY AND SHIP CANAL MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	18.2[b]	28.9[b]	22.5
Total Suspended Solids	13	55	27
Turbidity (NTU)	9[b]	43[b]	28
Conductivity (µS/cm)	679[b]	1,212[b]	883
Five-Day Biochemical Oxygen Demand	3	9	5
Dissolved Oxygen	3.9[b]	6.9[b]	5.5
pH (units)	6.4[b]	7.5[b]	7.1
Ammonia Nitrogen	0.19	0.57	0.37
Un-ionized Ammonia	0.001	0.004	0.003
Total Kjeldahl Nitrogen	1.15	1.75	1.42
Nitrite plus Nitrate Nitrogen	4.65	6.92	5.73
Total Nitrogen	5.80	8.67	7.16
Total Phosphorus	0.61	1.35	1.06
Chlorophyll *a* (µg/L)	4	9	6
Total Cyanide	<0.003	0.004	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.005	0.003
Dissolved Cadmium	0.0004	0.0013	0.0007
Total Chromium	0.0027	0.0084	0.0051
Dissolved Chromium	<0.0005	0.0013	0.0009
Total Copper	<0.0005	0.0080	0.0046
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.23	1.67	0.83
Dissolved Iron	0.010	0.087	0.035
Total Lead	0.004	0.013	0.009
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0236	0.0577	0.0359
Dissolved Manganese	0.0127	0.0334	0.0236
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	0.003	0.009	0.005
Dissolved Nickel	0.0025	0.0055	0.0037
Total Silver	<0.0006	0.0008	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.023	0.064	0.038
Dissolved Zinc	0.012	0.032	0.018
Fecal Coliform (cfu/100 mL)	240	1,000	561[c]
E. coli (cfu/100 mL)	80	570	205[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AII-2: WATER QUALITY AT STATION 3 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.8[b]	29.5[b]	21.9
Total Suspended Solids	11	36	20
Turbidity (NTU)	9[b]	29[b]	18
Conductivity (µS/cm)	703[b]	1,27 3[b]	916
Five-Day Biochemical Oxygen Demand	<2	3	3
Dissolved Oxygen	3.8[b]	7.2[b]	5.8
pH (units)	7.1[b]	7.5[b]	7.3
Ammonia Nitrogen	0.10	0.59	0.32
Un-ionized Ammonia	0.001	0.005	0.003
Total Kjeldahl Nitrogen	1.06	1.73	1.40
Nitrite plus Nitrate Nitrogen	4.60	7.03	5.81
Total Nitrogen	5.66	8.73	7.21
Total Phosphorus	0.67	1.28	1.02
Chlorophyll *a* (µg/L)	3	13	7
Total Cyanide	<0.003	0.004	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.004	0.002
Dissolved Cadmium	0.0004	0.0011	0.0006
Total Chromium	0.0022	0.0052	0.0038
Dissolved Chromium	<0.0005	0.0012	0.0009
Total Copper	<0.0005	0.0040	0.0026
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.34	1.07	0.67
Dissolved Iron	<0.004	0.048	0.028
Total Lead	<0.003	0.011	0.006
Dissolved Lead	<0.004	0.010	0.005
Total Manganese	0.0201	0.0475	0.0342
Dissolved Manganese	0.0098	0.0301	0.0210
Total Mercury (µg/L)	<0.05	0.07	0.05
Total Nickel	0.003	0.008	0.005
Dissolved Nickel	0.0025	0.0050	0.0033
Total Silver	<0.0006	0.0007	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.025	0.046	0.032
Dissolved Zinc	0.012	0.024	0.016
Fecal Coliform (cfu/100 mL)	60	2,100	419[c]
E. coli (cfu/100 mL)	40	260	105[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AII-3 WATER QUALITY AT STATION 4 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.2[b]	29.4[b]	21.8
Total Suspended Solids	10	64	25
Turbidity (NTU)	11[b]	26[b]	17
Conductivity (µS/cm)	713[b]	1,280[b]	923
Five-Day Biochemical Oxygen Demand	<2	9	4
Dissolved Oxygen	3.6[b]	7.5[b]	5.7
pH (units)	7.1[b]	7.6[b]	7.3
Ammonia Nitrogen	0.11	0.58	0.32
Un-ionized Ammonia	0.001	0.005	0.003
Total Kjeldahl Nitrogen	1.11	1.86	1.46
Nitrite plus Nitrate Nitrogen	4.72	7.57	6.02
Total Nitrogen	5.83	9.43	7.48
Total Phosphorus	0.73	1.28	1.00
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.004	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.004	0.002
Dissolved Cadmium	<0.0004	0.0008	0.0006
Total Chromium	0.0019	0.0041	0.0031
Dissolved Chromium	<0.0005	0.0015	0.0009
Total Copper	<0.0005	0.0040	0.0022
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.30	0.87	0.54
Dissolved Iron	<0.004	0.042	0.026
Total Lead	<0.003	0.009	0.006
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0199	0.0418	0.0320
Dissolved Manganese	0.0107	0.0309	0.0223
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	0.004	0.007	0.005
Dissolved Nickel	0.0026	0.0046	0.0033
Total Silver	<0.0006	0.0011	0.0007
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.022	0.037	0.029
Dissolved Zinc	0.011	0.025	0.015
Fecal Coliform (cfu/100 mL)	260	1,100	605[c]
E. coli (cfu/100 mL)	100	600	288[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

APPENDIX AIII

WATER QUALITY AT STATIONS 5–11 IN THE DRESDEN ISLAND POOL DURING MAY, AUGUST, AND OCTOBER 2006

TABLE AIII-1: WATER QUALITY AT STATION 5 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.0[b]	29.4[b]	21.5
Total Suspended Solids	21	80	37
Turbidity (NTU)	20[b]	49[b]	34
Conductivity (µS/cm)	710[b]	1,277[b]	930
Five-Day Biochemical Oxygen Demand	3	4	3
Dissolved Oxygen	6.8[b]	9.7[b]	8.4
pH (units)	7.3[b]	7.7[b]	7.5
Ammonia Nitrogen	0.09	0.52	0.28
Un-ionized Ammonia	0.001	0.006	0.004
Total Kjeldahl Nitrogen	1.35	1.82	1.63
Nitrite plus Nitrate Nitrogen	4.09	7.30	5.81
Total Nitrogen	5.74	9.10	7.43
Total Phosphorus	0.74	1.42	1.14
Chlorophyll *a* (µg/L)	3	12	8
Total Cyanide	<0.003	0.004	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.005	0.003
Dissolved Cadmium	0.0004	0.0008	0.0006
Total Chromium	0.0030	0.0129	0.0070
Dissolved Chromium	<0.0005	0.0013	0.0008
Total Copper	0.0020	0.0170	0.0062
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.65	2.72	1.38
Dissolved Iron	<0.004	0.061	0.036
Total Lead	0.007	0.017	0.011
Dissolved Lead	<0.004	0.009	0.006
Total Manganese	0.0287	0.0813	0.0503
Dissolved Manganese	0.0170	0.0357	0.0234
Total Mercury (µg/L)	<0.05	0.09	0.06
Total Nickel	0.003	0.009	0.006
Dissolved Nickel	0.0026	0.0042	0.0031
Total Silver	<0.0006	0.0011	0.0007
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.031	0.090	0.052
Dissolved Zinc	0.012	0.029	0.018
Fecal Coliform (cfu/100 mL)	300	700	437[c]
E. coli (cfu/100 mL)	150	440	285[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIII-2: WATER QUALITY AT STATION 6 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	17.4[b]	33.1[b]	23.8
Total Suspended Solids	13	98	36
Turbidity (NTU)	12[b]	36[b]	24
Conductivity (µS/cm)	717[b]	1,274[b]	927
Five-Day Biochemical Oxygen Demand	<2	3	3
Dissolved Oxygen	5.9[b]	9.3[b]	8.0
pH (units)	7.4[b]	7.8[b]	7.5
Ammonia Nitrogen	0.08	0.51	0.25
Un-ionized Ammonia	0.002	0.009	0.004
Total Kjeldahl Nitrogen	0.94	2.27	1.59
Nitrite plus Nitrate Nitrogen	4.06	7.50	5.70
Total Nitrogen	5.00	9.36	7.29
Total Phosphorus	0.76	1.50	1.05
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.004	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.003	0.002
Dissolved Cadmium	0.0004	0.0012	0.0006
Total Chromium	0.0023	0.0132	0.0050
Dissolved Chromium	<0.0005	0.0013	0.0008
Total Copper	<0.0005	0.0150	0.0053
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.36	3.17	1.11
Dissolved Iron	0.013	0.044	0.028
Total Lead	0.005	0.019	0.010
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0271	0.0868	0.0424
Dissolved Manganese	0.0107	0.0331	0.0212
Total Mercury (µg/L)	<0.05	0.09	0.06
Total Nickel	0.003	0.007	0.005
Dissolved Nickel	0.0023	0.0040	0.0030
Total Silver	<0.0006	0.0008	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.022	0.087	0.039
Dissolved Zinc	0.010	0.041	0.018
Fecal Coliform (cfu/100 mL)	200	900	394[c]
E. coli (cfu/100 mL)	110	290	156[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIII-3: WATER QUALITY AT STATION 7 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	17.7[b]	31.3[b]	23.2
Total Suspended Solids	11	35	21
Turbidity (NTU)	10[b]	52[b]	25
Conductivity (µS/cm)	682[b]	1,264[b]	914
Five-Day Biochemical Oxygen Demand	<2	3	3
Dissolved Oxygen	6.4[b]	8.8[b]	7.8
pH (units)	7.3[b]	7.8[b]	7.5
Ammonia Nitrogen	0.09	0.45	0.23
Un-ionized Ammonia	0.002	0.006	0.004
Total Kjeldahl Nitrogen	1.01	1.81	1.46
Nitrite plus Nitrate Nitrogen	4.26	7.23	5.53
Total Nitrogen	5.27	9.04	6.99
Total Phosphorus	0.69	1.14	0.94
Chlorophyll *a* (µg/L)	4	15	8
Total Cyanide	<0.003	0.004	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	0.02	0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.003	0.002
Dissolved Cadmium	<0.0004	0.0009	0.0006
Total Chromium	0.0016	0.0045	0.0033
Dissolved Chromium	<0.0005	0.0012	0.0008
Total Copper	<0.0005	0.0050	0.0030
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.34	0.94	0.68
Dissolved Iron	<0.004	0.040	0.027
Total Lead	<0.003	0.010	0.006
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0256	0.0480	0.0353
Dissolved Manganese	0.0066	0.0331	0.0225
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	0.003	0.005	0.004
Dissolved Nickel	0.0026	0.0041	0.0032
Total Silver	<0.0006	0.0010	0.0007
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.018	0.042	0.032
Dissolved Zinc	0.010	0.043	0.018
Fecal Coliform (cfu/100 mL)	100	1,200	350[c]
E. coli (cfu/100 mL)	70	180	129[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIII-4: WATER QUALITY AT STATION 8 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	17.2[b]	30.4[b]	22.9
Total Suspended Solids	10	33	18
Turbidity (NTU)	13[b]	33[b]	19
Conductivity (µS/cm)	662[b]	1,241[b]	906
Five-Day Biochemical Oxygen Demand	<2	3	2
Dissolved Oxygen	5.9[b]	8.7[b]	7.6
pH (units)	7.3[b]	7.8[b]	7.5
Ammonia Nitrogen	0.11	0.43	0.23
Un-ionized Ammonia	0.002	0.006	0.003
Total Kjeldahl Nitrogen	0.89	1.75	1.31
Nitrite plus Nitrate Nitrogen	4.26	6.95	5.51
Total Nitrogen	5.31	8.67	6.82
Total Phosphorus	0.70	1.10	0.91
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.004	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.003	0.002
Dissolved Cadmium	<0.0004	0.0016	0.0007
Total Chromium	0.0014	0.0044	0.0030
Dissolved Chromium	<0.0005	0.0011	0.0008
Total Copper	<0.0005	0.0060	0.0026
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.34	1.20	0.61
Dissolved Iron	<0.004	0.087	0.038
Total Lead	<0.003	0.010	0.006
Dissolved Lead	<0.004	0.006	0.005
Total Manganese	0.0215	0.0453	0.0345
Dissolved Manganese	0.0044	0.0329	0.0205
Total Mercury (µg/L)	<0.05	0.11	0.07
Total Nickel	0.003	0.006	0.004
Dissolved Nickel	0.0024	0.0043	0.0030
Total Silver	<0.0006	0.0010	0.0007
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.019	0.036	0.027
Dissolved Zinc	0.009	0.036	0.016
Fecal Coliform (cfu/100 mL)	110	1,400	374[c]
E. coli (cfu/100 mL)	110	260	151[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIII-5: WATER QUALITY AT STATION 9 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.6[b]	30.8[b]	22.5
Total Suspended Solids	7	31	18
Turbidity (NTU)	9[b]	28[b]	19
Conductivity (µS/cm)	656[b]	1,218[b]	902
Five-Day Biochemical Oxygen Demand	<2	3	2
Dissolved Oxygen	6.3[b]	8.8[b]	7.7
pH (units)	7.4[b]	7.9[b]	7.6
Ammonia Nitrogen	0.05	0.42	0.21
Un-ionized Ammonia	0.001	0.007	0.004
Total Kjeldahl Nitrogen	0.93	2.04	1.40
Nitrite plus Nitrate Nitrogen	4.02	6.61	5.32
Total Nitrogen	5.43	8.35	6.72
Total Phosphorus	0.62	1.09	0.87
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.004	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.003	0.002
Dissolved Cadmium	0.0004	0.0015	0.0007
Total Chromium	0.0007	0.0045	0.0027
Dissolved Chromium	<0.0005	0.0011	0.0008
Total Copper	<0.0005	0.0030	0.0019
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.29	0.80	0.54
Dissolved Iron	<0.004	0.040	0.023
Total Lead	<0.003	0.010	0.005
Dissolved Lead	<0.004	0.006	0.005
Total Manganese	0.0229	0.0498	0.0336
Dissolved Manganese	0.0060	0.0348	0.0190
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	0.003	0.006	0.004
Dissolved Nickel	0.0021	0.0043	0.0028
Total Silver	<0.0006	0.0011	0.0007
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.015	0.036	0.024
Dissolved Zinc	0.008	0.028	0.015
Fecal Coliform (cfu/100 mL)	30	560	230[c]
E. coli (cfu/100 ml)	60	100	71[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIII-6: WATER QUALITY AT STATION 10 IN THE DES PLAINES RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.8[b]	30.1[b]	22.6
Total Suspended Solids	17	320	75
Turbidity (NTU)	14[b]	174[b]	47
Conductivity (µS/cm)	671[b]	1,230[b]	901
Five-Day Biochemical Oxygen Demand	<2	6	4
Dissolved Oxygen	5.6[b]	8.7[b]	7.6
pH (units)	7.4[b]	7.8[b]	7.6
Ammonia Nitrogen	0.02	0.32	0.19
Un-ionized Ammonia	<0.001	0.007	0.003
Total Kjeldahl Nitrogen	1.01	2.17	1.41
Nitrite plus Nitrate Nitrogen	4.02	5.83	4.91
Total Nitrogen	5.14	7.50	6.33
Total Phosphorus	0.63	1.78	1.04
Chlorophyll *a* (µg/L)	5	14	9
Total Cyanide	<0.003	0.003	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.003	0.002
Dissolved Cadmium	0.0004	0.0013	0.0007
Total Chromium	0.0018	0.0339	0.0089
Dissolved Chromium	<0.0005	0.0017	0.0010
Total Copper	<0.0005	0.0430	0.0093
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.48	9.85	2.27
Dissolved Iron	<0.004	0.058	0.028
Total Lead	<0.003	0.051	0.013
Dissolved Lead	<0.004	0.006	0.004
Total Manganese	0.0301	0.2033	0.0666
Dissolved Manganese	0.0039	0.0303	0.0191
Total Mercury (µg/L)	<0.05	0.29	0.12
Total Nickel	0.004	0.014	0.006
Dissolved Nickel	0.0024	0.0033	0.0029
Total Silver	<0.0006	0.0013	0.0008
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.019	0.219	0.062
Dissolved Zinc	0.013	0.018	0.015
Fecal Coliform (cfu/100 mL)	10	6,000	101[c]
E. coli (cfu/100 mL)	30	6,500	198[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIII-7: WATER QUALITY AT STATION 11 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.6[b]	30.0[b]	22.4
Total Suspended Solids	11	55	24
Turbidity (NTU)	9[b]	135[b]	39
Conductivity (µS/cm)	647[b]	1,218[b]	891
Five-Day Biochemical Oxygen Demand	3	5	4
Dissolved Oxygen	6.0[b]	8.7[b]	7.9
pH (units)	7.4[b]	7.9[b]	7.6
Ammonia Nitrogen	0.03	0.32	0.20
Un-ionized Ammonia	<0.001	0.008	0.004
Total Kjeldahl Nitrogen	0.95	1.41	1.21
Nitrite plus Nitrate Nitrogen	3.57	5.93	4.81
Total Nitrogen	4.69	7.25	6.02
Total Phosphorus	0.58	1.01	0.84
Chlorophyll *a* (µg/L)	4	34	13
Total Cyanide	<0.003	0.003	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	0.02	0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	<0.0004	0.0009	0.0007
Total Chromium	0.0008	0.0074	0.0037
Dissolved Chromium	<0.0005	0.0014	0.0009
Total Copper	<0.0005	0.0080	0.0031
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.26	2.27	0.86
Dissolved Iron	<0.004	0.050	0.026
Total Lead	<0.003	0.012	0.007
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0229	0.0621	0.0404
Dissolved Manganese	0.0012	0.0311	0.0173
Total Mercury (µg/L)	<0.05	0.14	0.07
Total Nickel	0.003	0.005	0.004
Dissolved Nickel	0.0024	0.0032	0.0027
Total Silver	<0.0006	0.0008	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.015	0.046	0.029
Dissolved Zinc	0.011	0.015	0.013
Fecal Coliform (cfu/100 mL)	<10	2,500	87[c]
E. coli (cfu/100 mL)	<10	1,900	72[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

APPENDIX AIV

WATER QUALITY AT STATIONS 12–21 IN THE MARSEILLES POOL DURING MAY, AUGUST, AND OCTOBER 2006

TABLE AIV-1: WATER QUALITY AT STATION 12 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.7[b]	30.0[b]	21.9
Total Suspended Solids	13	146	41
Turbidity (NTU)	16[b]	140[b]	43
Conductivity (µS/cm)	657[b]	1,051[b]	824
Five-Day Biochemical Oxygen Demand	<2	5	3
Dissolved Oxygen	7.2[b]	10.4[b]	9.0
pH (units)	7.5[b]	8.1[b]	7.9
Ammonia Nitrogen	<0.02	0.28	0.17
Un-ionized Ammonia	<0.001	0.025	0.008
Total Kjeldahl Nitrogen	0.73	1.71	1.13
Nitrite plus Nitrate Nitrogen	2.91	5.64	4.34
Total Nitrogen	3.78	6.91	5.47
Total Phosphorus	0.39	1.35	0.69
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.003	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0012	0.0007
Total Chromium	0.0008	0.0261	0.0065
Dissolved Chromium	<0.0005	0.0013	0.0008
Total Copper	<0.0005	0.0220	0.0049
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.47	4.47	1.37
Dissolved Iron	<0.004	0.029	0.021
Total Lead	<0.003	0.026	0.008
Dissolved Lead	<0.004	0.006	0.005
Total Manganese	0.0345	0.1051	0.0552
Dissolved Manganese	0.0020	0.0273	0.0131
Total Mercury (µg/L)	<0.05	0.11	0.07
Total Nickel	0.002	0.010	0.004
Dissolved Nickel	0.0013	0.0021	0.0017
Total Silver	<0.0006	0.0008	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.011	0.110	0.035
Dissolved Zinc	0.008	0.017	0.011
Fecal Coliform (cfu/100 mL)	<10	3,400	59[c]
E. coli (cfu/100 mL)	20	1,700	88[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIV-2: WATER QUALITY AT STATION 13 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.5[b]	30.0[b]	21.9
Total Suspended Solids	12	148	49
Turbidity (NTU)	21v	130[b]	45
Conductivity (µS/cm)	657[b]	1,000[b]	809
Five-Day Biochemical Oxygen Demand	<2	5	3
Dissolved Oxygen	7.1[b]	10.2[b]	9.0
pH (units)	7.5[b]	8.2[b]	8.0
Ammonia Nitrogen	<0.02	0.23	0.14
Un-ionized Ammonia	<0.001	0.012	0.006
Total Kjeldahl Nitrogen	0.85	1.70	1.17
Nitrite plus Nitrate Nitrogen	2.83	5.62	4.28
Total Nitrogen	3.68	6.88	5.45
Total Phosphorus	0.37	1.35	0.66
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.003	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0010	0.0007
Total Chromium	0.0016	0.0173	0.0053
Dissolved Chromium	<0.0005	0.0011	0.0008
Total Copper	<0.0005	0.0220	0.0047
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.61	4.69	1.61
Dissolved Iron	<0.004	0.030	0.019
Total Lead	<0.003	0.027	0.009
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0371	0.1084	0.0661
Dissolved Manganese	0.0013	0.0250	0.0114
Total Mercury (µg/L)	<0.05	0.13	0.07
Total Nickel	0.002	0.008	0.004
Dissolved Nickel	0.0012	0.0022	0.0016
Total Silver	<0.0006	0.0008	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.014	0.113	0.036
Dissolved Zinc	0.007	0.021	0.010
Fecal Coliform (cfu/100 mL)	10	2,800	62[c]
E. coli (cfu/100 mL)	10	1,600	54[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIV-3: WATER QUALITY AT STATION 14 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.7[b]	29.7[b]	21.9
Total Suspended Solids	11	146	40
Turbidity (NTU)	12[b]	125[b]	38
Conductivity (µS/cm)	659[b]	1,038[b]	816
Five-Day Biochemical Oxygen Demand	<2	6	4
Dissolved Oxygen	6.8[b]	10.3[b]	8.8
pH (units)	7.5[b]	8.2[b]	7.9
Ammonia Nitrogen	0.04	0.18	0.12
Un-ionized Ammonia	0.002	0.008	0.005
Total Kjeldahl Nitrogen	0.76	1.98	1.26
Nitrite plus Nitrate Nitrogen	2.80	5.65	4.35
Total Nitrogen	3.56	7.41	5.61
Total Phosphorus	0.37	1.36	0.63
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	0.003	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0011	0.0007
Total Chromium	0.0007	0.0191	0.0050
Dissolved Chromium	<0.0005	0.0012	0.0008
Total Copper	<0.0005	0.0230	0.0044
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.37	4.65	1.29
Dissolved Iron	<0.004	0.023	0.017
Total Lead	<0.003	0.027	0.008
Dissolved Lead	<0.004	0.009	0.006
Total Manganese	0.0296	0.1090	0.0523
Dissolved Manganese	0.0013	0.0207	0.0090
Total Mercury (µg/L)	<0.05	0.10	0.06
Total Nickel	0.002	0.008	0.003
Dissolved Nickel	0.0012	0.0022	0.0016
Total Silver	<0.0006	0.0006	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.010	0.120	0.033
Dissolved Zinc	0.006	0.013	0.009
Fecal Coliform (cfu/100 mL)	10	800	66[c]
E. coli (cfu/100 mL)	10	800	78[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIV-4: WATER QUALITY AT STATION 15 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.6[b]	29.3[b]	21.8
Total Suspended Solids	12	107	33
Turbidity (NTU)	15[b]	86[b]	32
Conductivity (µS/cm)	656[b]	1,005[b]	803
Five-Day Biochemical Oxygen Demand	3	5	4
Dissolved Oxygen	6.8[b]	10.4[b]	8.5
pH (units)	7.6[b]	8.2[b]	8.0
Ammonia Nitrogen	<0.02	0.16	0.10
Un-ionized Ammonia	<0.001	0.007	0.004
Total Kjeldahl Nitrogen	0.82	1.63	1.15
Nitrite plus Nitrate Nitrogen	2.86	5.69	4.43
Total Nitrogen	3.68	7.25	5.58
Total Phosphorus	0.34	1.26	0.60
Chlorophyll *a* (µg/L)	3	26	11
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0011	0.0007
Total Chromium	0.0006	0.0132	0.0040
Dissolved Chromium	<0.0005	0.0008	0.0006
Total Copper	0.0005	0.0160	0.0033
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.33	3.10	1.04
Dissolved Iron	<0.004	0.027	0.017
Total Lead	<0.003	0.020	0.007
Dissolved Lead	<0.004	0.009	0.005
Total Manganese	0.0267	0.0849	0.0494
Dissolved Manganese	0.0011	0.0180	0.0076
Total Mercury (µg/L)	<0.05	0.10	0.07
Total Nickel	0.002	0.006	0.003
Dissolved Nickel	0.0006	0.0024	0.0014
Total Silver	<0.0006	0.0007	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.011	0.083	0.028
Dissolved Zinc	0.005	0.010	0.007
Fecal Coliform (cfu/100 mL)	10	1,100	77[c]
E. coli (cfu/100 mL)	<10	600	56[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIV-5: WATER QUALITY AT STATION 16 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.6[b]	29.1[b]	21.8
Total Suspended Solids	9	120	35
Turbidity (NTU)	8[b]	84[b]	32
Conductivity (µS/cm)	654[b]	1,013[b]	802
Five-Day Biochemical Oxygen Demand	<2	5	3
Dissolved Oxygen	6.9[b]	10.3[b]	8.7
pH (units)	7.6[b]	8.2[b]	8.0
Ammonia Nitrogen	<0.02	0.15	0.10
Un-ionized Ammonia	<0.001	0.008	0.004
Total Kjeldahl Nitrogen	0.83	1.51	1.10
Nitrite plus Nitrate Nitrogen	2.82	5.89	4.46
Total Nitrogen	3.65	7.20	5.56
Total Phosphorus	0.33	1.31	0.61
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0009	0.0006
Total Chromium	<0.0005	0.0244	0.0056
Dissolved Chromium	<0.0005	0.0010	0.0007
Total Copper	<0.0005	0.0160	0.0034
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.31	3.22	1.07
Dissolved Iron	<0.004	0.022	0.016
Total Lead	<0.003	0.018	0.007
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0261	0.0892	0.0498
Dissolved Manganese	0.0014	0.0166	0.0070
Total Mercury (µg/L)	<0.05	0.13	0.07
Total Nickel	0.002	0.010	0.004
Dissolved Nickel	0.0011	0.0020	0.0015
Total Silver	<0.0006	0.0007	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.013	0.082	0.027
Dissolved Zinc	0.006	0.011	0.008
Fecal Coliform (cfu/100 mL)	10	900	82[c]
E. coli (cfu/100 mL)	10	520	47[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIV-6: WATER QUALITY AT STATION 17 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.5[b]	29.5[b]	21.6
Total Suspended Solids	14	72	32
Turbidity (NTU)	11[b]	71[b]	31
Conductivity (µS/cm)	662[b]	1,001[b]	797
Five-Day Biochemical Oxygen Demand	3	4	4
Dissolved Oxygen	6.9[b]	10.2[b]	8.8
pH (units)	7.6[b]	8.2[b]	8.0
Ammonia Nitrogen	0.02	0.24	0.11
Un-ionized Ammonia	0.001	0.015	0.005
Total Kjeldahl Nitrogen	0.90	1.28	1.11
Nitrite plus Nitrate Nitrogen	2.80	6.60	4.55
Total Nitrogen	3.70	7.88	5.66
Total Phosphorus	0.33	1.08	0.59
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0008	0.0006
Total Chromium	<0.0005	0.0093	0.0032
Dissolved Chromium	<0.0005	0.0010	0.0007
Total Copper	<0.0005	0.0110	0.0027
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.39	2.41	0.99
Dissolved Iron	<0.004	0.022	0.016
Total Lead	<0.003	0.014	0.007
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0275	0.0746	0.0492
Dissolved Manganese	0.0010	0.0085	0.0043
Total Mercury (µg/L)	<0.05	0.05	0.05
Total Nickel	0.002	0.005	0.003
Dissolved Nickel	0.0010	0.0020	0.0014
Total Silver	<0.0006	0.0008	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.010	0.062	0.024
Dissolved Zinc	0.007	0.015	0.010
Fecal Coliform (cfu/100 mL)	10	340	60[c]
E. coli (cfu/100 mL)	30	190	56[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIV-7: WATER QUALITY AT STATION 18 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.7[b]	29.4[b]	21.6
Total Suspended Solids	12	52	25
Turbidity (NTU)	12[b]	52[b]	30
Conductivity (µS/cm)	671[b]	1,018[b]	793
Five-Day Biochemical Oxygen Demand	3	3	3
Dissolved Oxygen	6.8[b]	10.1[b]	8.8
pH (units)	7.6[b]	8.3[b]	8.0
Ammonia Nitrogen	<0.02	0.13	0.08
Un-ionized Ammonia	<0.001	0.006	0.004
Total Kjeldahl Nitrogen	0.87	3.90	1.55
Nitrite plus Nitrate Nitrogen	2.61	6.60	4.35
Total Nitrogen	3.48	9.83	5.90
Total Phosphorus	0.34	0.71	0.56
Chlorophyll *a* (µg/L)	5	34	16
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0011	0.0006
Total Chromium	<0.0005	0.0056	0.0027
Dissolved Chromium	<0.0005	0.0009	0.0007
Total Copper	<0.0005	0.0060	0.0017
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.30	1.74	0.83
Dissolved Iron	<0.004	0.017	0.014
Total Lead	<0.003	0.009	0.006
Dissolved Lead	<0.004	0.005	0.004
Total Manganese	0.0261	0.0674	0.0460
Dissolved Manganese	0.0013	0.0144	0.0057
Total Mercury (µg/L)	<0.05	0.07	0.06
Total Nickel	<0.002	0.003	0.002
Dissolved Nickel	0.0007	0.0018	0.0012
Total Silver	<0.0006	0.0009	0.0007
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.010	0.035	0.018
Dissolved Zinc	0.006	0.015	0.008
Fecal Coliform (cfu/100 mL)	40	240	94[c]
E. coli (cfu/100 mL)	10	160	36[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIV-8: WATER QUALITY AT STATION 19 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.7[b]	29.4[b]	21.4
Total Suspended Solids	17	71	32
Turbidity (NTU)	16[b]	56[b]	27
Conductivity (µS/cm)	670[b]	1,023[b]	793
Five-Day Biochemical Oxygen Demand	3	3	3
Dissolved Oxygen	6.9[b]	10.0[b]	8.8
pH (units)	7.7[b]	8.3[b]	8.0
Ammonia Nitrogen	<0.02	0.13	0.08
Un-ionized Ammonia	<0.001	0.007	0.004
Total Kjeldahl Nitrogen	0.88	1.22	1.01
Nitrite plus Nitrate Nitrogen	2.54	6.69	4.41
Total Nitrogen	3.50	7.77	5.42
Total Phosphorus	0.32	0.78	0.52
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0007	0.0005
Total Chromium	0.0007	0.0062	0.0029
Dissolved Chromium	<0.0005	0.0013	0.0007
Total Copper	<0.0005	0.0070	0.0019
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.53	2.04	1.02
Dissolved Iron	<0.004	0.021	0.015
Total Lead	<0.003	0.010	0.005
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0359	0.0824	0.0548
Dissolved Manganese	0.0016	0.0059	0.0036
Total Mercury (µg/L)	<0.05	0.07	0.06
Total Nickel	0.002	0.004	0.003
Dissolved Nickel	0.0009	0.0016	0.0012
Total Silver	<0.0006	0.0007	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.012	0.039	0.020
Dissolved Zinc	0.006	0.016	0.010
Fecal Coliform (cfu/100 mL)	50	390	116[c]
E. coli (cfu/100 mL)	20	180	48[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIV-9: WATER QUALITY AT STATION 20 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.9[b]	29.3[b]	21.4
Total Suspended Solids	14	56	28
Turbidity (NTU)	13[b]	43[b]	24
Conductivity (µS/cm)	677[b]	1,030[b]	797
Five-Day Biochemical Oxygen Demand	<2	4	3
Dissolved Oxygen	7.2[b]	10.5[b]	9.0
pH (units)	7.7[b]	8.3[b]	8.0
Ammonia Nitrogen	<0.02	0.19	0.08
Un-ionized Ammonia	<0.001	0.013	0.005
Total Kjeldahl Nitrogen	0.94	1.27	1.09
Nitrite plus Nitrate Nitrogen	2.64	6.64	4.36
Total Nitrogen	3.58	7.71	5.44
Total Phosphorus	0.34	0.67	0.52
Chlorophyll *a* (µg/L)	6	37	18
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0012	0.0006
Total Chromium	<0.0005	0.0060	0.0025
Dissolved Chromium	<0.0005	0.0011	0.0007
Total Copper	<0.0005	0.0060	0.0019
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.37	2.06	0.88
Dissolved Iron	<0.004	0.020	0.014
Total Lead	<0.003	0.010	0.005
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0287	0.0823	0.0474
Dissolved Manganese	0.0012	0.0047	0.0026
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	0.002	0.004	0.003
Dissolved Nickel	0.0010	0.0019	0.0014
Total Silver	<0.0006	0.0007	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.011	0.036	0.018
Dissolved Zinc	0.006	0.010	0.008
Fecal Coliform (cfu/100 mL)	30	470	87[c]
E. coli (cfu/100 mL)	20	140	52[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AIV-10: WATER QUALITY AT STATION 21 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.6[b]	29.2[b]	21.3
Total Suspended Solids	15	28	21
Turbidity (NTU)	18[b]	33[b]	24
Conductivity (µS/cm)	692[b]	1,032[b]	808
Five-Day Biochemical Oxygen Demand	<2	3	2
Dissolved Oxygen	7.1[b]	9.9[b]	9.0
pH (units)	7.8[b]	8.3[b]	8.1
Ammonia Nitrogen	<0.02	0.26	0.12
Un-ionized Ammonia	<0.001	0.016	0.007
Total Kjeldahl Nitrogen	0.94	1.28	1.10
Nitrite plus Nitrate Nitrogen	2.63	5.93	4.26
Total Nitrogen	3.61	7.21	5.36
Total Phosphorus	0.33	0.72	0.50
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.004	0.002
Dissolved Cadmium	0.0004	0.0013	0.0006
Total Chromium	0.0016	0.0028	0.0022
Dissolved Chromium	<0.0005	0.0012	0.0007
Total Copper	<0.0005	0.0030	0.0014
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.50	0.79	0.71
Dissolved Iron	<0.004	0.071	0.025
Total Lead	<0.003	0.006	0.005
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0332	0.0465	0.0387
Dissolved Manganese	0.0012	0.0078	0.0037
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	0.002	0.005	0.003
Dissolved Nickel	0.0010	0.0021	0.0015
Total Silver	<0.0006	0.0007	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.013	0.021	0.017
Dissolved Zinc	0.006	0.012	0.007
Fecal Coliform (cfu/100 mL)	<10	170	40[c]
E. coli (cfu/100 mL)	10	190	46[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

APPENDIX AV

WATER QUALITY AT STATIONS 22–27 IN THE STARVED ROCK POOL DURING MAY, AUGUST, AND OCTOBER 2006

TABLE AV-1: WATER QUALITY AT STATION 22 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.7[b]	29.3[b]	21.4
Total Suspended Solids	20	73	33
Turbidity (NTU)	14[b]	59[b]	29
Conductivity (µS/cm)	678[b]	1,033[b]	806
Five-Day Biochemical Oxygen Demand	<2	4	3
Dissolved Oxygen	7.8[b]	10.4[b]	9.1
pH (units)	7.4[b]	8.3[b]	8.0
Ammonia Nitrogen	<0.02	0.13	0.09
Un-ionized Ammonia	<0.001	0.009	0.004
Total Kjeldahl Nitrogen	0.95	1.31	1.08
Nitrite plus Nitrate Nitrogen	2.71	6.69	4.39
Total Nitrogen	3.67	7.73	5.47
Total Phosphorus	0.35	0.72	0.55
Chlorophyll *a* (µg/L)	6	32	17
Total Cyanide	<0.003	0.003	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.003	0.002
Dissolved Cadmium	0.0004	0.0016	0.0007
Total Chromium	0.0015	0.0063	0.0032
Dissolved Chromium	<0.0005	0.0012	0.0007
Total Copper	<0.0005	0.0070	0.0018
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.47	2.22	1.02
Dissolved Iron	<0.004	0.023	0.017
Total Lead	0.004	0.010	0.007
Dissolved Lead	<0.004	0.009	0.005
Total Manganese	0.0297	0.0906	0.0535
Dissolved Manganese	0.0014	0.0054	0.0029
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	0.002	0.004	0.003
Dissolved Nickel	0.0011	0.0020	0.0014
Total Silver	<0.0006	0.0007	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.014	0.038	0.021
Dissolved Zinc	0.006	0.025	0.011
Fecal Coliform (cfu/100 mL)	<10	430	41[c]
E. coli (cfu/100 mL)	<10	270	52[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AV-2: WATER QUALITY AT STATION 23 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	15.5[b]	29.2[b]	21.3
Total Suspended Solids	11	85	36
Turbidity (NTU)	17[b]	68[b]	30
Conductivity (µS/cm)	687[b]	1,036[b]	806
Five-Day Biochemical Oxygen Demand	3	3	3
Dissolved Oxygen	7.6[b]	10.2[b]	8.9
pH (units)	7.6[b]	8.3[b]	8.0
Ammonia Nitrogen	<0.02	0.17	0.09
Un-ionized Ammonia	<0.001	0.011	0.005
Total Kjeldahl Nitrogen	0.97	1.37	1.14
Nitrite plus Nitrate Nitrogen	2.71	6.59	4.38
Total Nitrogen	3.68	7.82	5.52
Total Phosphorus	0.34	0.73	0.54
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0005	0.0008	0.0006
Total Chromium	0.0011	0.0074	0.0031
Dissolved Chromium	<0.0005	0.0010	0.0008
Total Copper	<0.0005	0.0070	0.0018
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.38	2.63	1.06
Dissolved Iron	0.012	0.078	0.032
Total Lead	<0.003	0.011	0.006
Dissolved Lead	<0.004	0.009	0.005
Total Manganese	0.0281	0.1036	0.0536
Dissolved Manganese	0.0009	0.0107	0.0040
Total Mercury (µg/L)	<0.05	0.05	0.05
Total Nickel	0.002	0.004	0.003
Dissolved Nickel	0.0009	0.0022	0.0014
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.012	0.042	0.020
Dissolved Zinc	0.007	0.010	0.009
Fecal Coliform (cfu/100 mL)	<10	280	38[c]
E. coli (cfu/100 mL)	10	100	22[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AV-3: WATER QUALITY AT STATION 24 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	14.6[b]	28.7[b]	21.0
Total Suspended Solids	13	73	33
Turbidity (NTU)	18[b]	115[b]	43
Conductivity (µS/cm)	702[b]	1,001[b]	813
Five-Day Biochemical Oxygen Demand	<2	4	3
Dissolved Oxygen	7.5[b]	9.9[b]	9.0
pH (units)	7.5[b]	8.4[b]	8.1
Ammonia Nitrogen	<0.02	0.17	0.10
Un-ionized Ammonia	<0.001	0.016	0.007
Total Kjeldahl Nitrogen	1.03	1.79	1.35
Nitrite plus Nitrate Nitrogen	2.57	6.80	4.25
Total Nitrogen	3.60	7.90	5.60
Total Phosphorus	0.32	0.73	0.55
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.003	0.002
Dissolved Cadmium	0.0005	0.0010	0.0007
Total Chromium	0.0010	0.0061	0.0030
Dissolved Chromium	<0.0005	0.0012	0.0007
Total Copper	<0.0005	0.0060	0.0018
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.35	3.26	1.29
Dissolved Iron	0.011	0.082	0.037
Total Lead	<0.003	0.011	0.007
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0301	0.1071	0.0568
Dissolved Manganese	0.0014	0.0125	0.0047
Total Mercury (µg/L)	<0.05	0.17	0.07
Total Nickel	<0.002	0.005	0.003
Dissolved Nickel	0.0008	0.0019	0.0013
Total Silver	<0.0006	0.0007	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.010	0.036	0.021
Dissolved Zinc	0.005	0.017	0.010
Fecal Coliform (cfu/100 mL)	10	560	96[c]
E. coli (cfu/100 mL)	20	160	46[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AV-4: WATER QUALITY AT STATION 25 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	14.6[b]	28.8[b]	21.0
Total Suspended Solids	16	169	56
Turbidity (NTU)	14[b]	168[b]	51
Conductivity (µS/cm)	706[b]	975[b]	810
Five-Day Biochemical Oxygen Demand	<2	5	3
Dissolved Oxygen	7.6[b]	10.1[b]	9.1
pH (units)	7.6[b]	8.5[b]	8.1
Ammonia Nitrogen	<0.02	0.20	0.11
Un-ionized Ammonia	<0.001	0.016	0.007
Total Kjeldahl Nitrogen	1.05	1.43	1.19
Nitrite plus Nitrate Nitrogen	2.55	6.33	4.17
Total Nitrogen	3.60	7.46	5.36
Total Phosphorus	0.33	0.69	0.53
Chlorophyll *a* (µg/L)	18	79	35
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	<0.0004	0.0010	0.0006
Total Chromium	0.0005	0.0086	0.0033
Dissolved Chromium	<0.0005	0.0012	0.0007
Total Copper	<0.0005	0.0060	0.0030
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.38	5.37	1.64
Dissolved Iron	<0.004	0.073	0.024
Total Lead	<0.003	0.009	0.006
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0296	0.1510	0.0648
Dissolved Manganese	0.0011	0.0064	0.0029
Total Mercury (µg/L)	<0.05	0.07	0.06
Total Nickel	0.002	0.007	0.004
Dissolved Nickel	<0.0004	0.0021	0.0012
Total Silver	<0.0006	0.0008	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.011	0.036	0.021
Dissolved Zinc	0.005	0.012	0.009
Fecal Coliform (cfu/100 mL)	10	1,000	85[c]
E. coli (cfu/100 mL)	20	140	68[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AV-5: WATER QUALITY AT STATION 26 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	14.8[b]	29.0[b]	21.0
Total Suspended Solids	19	113	51
Turbidity (NTU)	16[b]	146[b]	45
Conductivity (µS/cm)	715[b]	988[b]	813
Five-Day Biochemical Oxygen Demand	<2	4	3
Dissolved Oxygen	8.3[b]	10.7[b]	9.4
pH (units)	7.6[b]	8.5[b]	8.2
Ammonia Nitrogen	<0.02	0.26	0.10
Un-ionized Ammonia	<0.001	0.016	0.008
Total Kjeldahl Nitrogen	1.00	1.64	1.25
Nitrite plus Nitrate Nitrogen	2.59	6.10	4.17
Total Nitrogen	3.73	7.47	5.41
Total Phosphorus	0.33	0.65	0.53
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	<0.0004	0.0010	0.0007
Total Chromium	0.0007	0.0075	0.0031
Dissolved Chromium	<0.0005	0.0012	0.0008
Total Copper	<0.0005	0.0040	0.0018
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.42	4.56	1.53
Dissolved Iron	<0.004	0.052	0.020
Total Lead	<0.003	0.012	0.005
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0341	0.1247	0.0611
Dissolved Manganese	0.0013	0.0066	0.0039
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	<0.002	0.006	0.003
Dissolved Nickel	<0.0004	0.0021	0.0013
Total Silver	<0.0006	0.0006	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.014	0.034	0.021
Dissolved Zinc	0.005	0.013	0.008
Fecal Coliform (cfu/100 mL)	<10	1,400	82[c]
E. coli (cfu/100 mL)	30	60	38[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AV-6: WATER QUALITY AT STATION 27 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.3[b]	28.6[b]	21.6
Total Suspended Solids	15	102	43
Turbidity (NTU)	16[b]	67[b]	35
Conductivity (µS/cm)	744[b]	938[b]	805
Five-Day Biochemical Oxygen Demand	3	5	4
Dissolved Oxygen	7.1[b]	12.9[b]	9.8
pH (units)	7.8[b]	8.8[b]	8.3
Ammonia Nitrogen	<0.02	0.34	0.10
Un-ionized Ammonia	0.001	0.040	0.011
Total Kjeldahl Nitrogen	1.31	1.72	1.48
Nitrite plus Nitrate Nitrogen	2.57	6.80	4.28
Total Nitrogen	3.92	8.27	5.75
Total Phosphorus	0.32	0.93	0.54
Chlorophyll *a* (µg/L)	22	106	45
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	<0.0004	0.0012	0.0012
Total Chromium	0.0005	0.0122	0.0122
Dissolved Chromium	<0.0005	0.0014	0.0014
Total Copper	<0.0005	0.0140	0.0140
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.43	4.26	4.26
Dissolved Iron	<0.004	0.033	0.033
Total Lead	<0.003	0.019	0.019
Dissolved Lead	<0.004	0.006	0.006
Total Manganese	0.0354	0.1220	0.1220
Dissolved Manganese	0.0014	0.0062	0.0062
Total Mercury (µg/L)	<0.05	0.06	0.06
Total Nickel	0.002	0.007	0.007
Dissolved Nickel	<0.0004	0.0018	0.0018
Total Silver	<0.0006	0.0006	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.011	0.075	0.075
Dissolved Zinc	0.005	0.015	0.015
Fecal Coliform (cfu/100 mL)	10	260	60[c]
E. coli (cfu/100 mL)	<10	300	39[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

APPENDIX AVI

WATER QUALITY AT STATIONS 28–41 IN THE UPPER PEORIA POOL DURING MAY, AUGUST, AND OCTOBER 2006

TABLE AVI-1: WATER QUALITY AT STATION 28 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.3[b]	28.1[b]	21.5
Total Suspended Solids	16	129	48
Turbidity (NTU)	21[b]	128[b]	51
Conductivity (µS/cm)	748[b]	974[b]	805
Five-Day Biochemical Oxygen Demand	<2	5	3
Dissolved Oxygen	7.5[b]	12.5[b]	9.9
pH (units)	7.7[b]	8.6[b]	8.2
Ammonia Nitrogen	0.03	0.26	0.10
Un-ionized Ammonia	0.001	0.029	0.009
Total Kjeldahl Nitrogen	1.22	1.72	1.44
Nitrite plus Nitrate Nitrogen	2.66	6.71	4.28
Total Nitrogen	4.09	8.15	5.72
Total Phosphorus	0.32	1.02	0.58
Chlorophyll *a* (µg/L)	18	92	42
Total Cyanides	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.003	0.002
Dissolved Cadmium	0.0004	0.0009	0.0006
Total Chromium	0.0008	0.0119	0.0039
Dissolved Chromium	<0.0005	0.0012	0.0007
Total Copper	<0.0005	0.0140	0.0031
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.60	4.26	1.58
Dissolved Iron	<0.004	0.034	0.021
Total Lead	<0.003	0.018	0.007
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0382	0.1166	0.0630
Dissolved Manganese	0.0015	0.0072	0.0041
Total Mercury (µg/L)	<0.05	0.09	0.06
Total Nickel	<0.002	0.006	0.003
Dissolved Nickel	0.0005	0.0021	0.0013
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.013	0.073	0.026
Dissolved Zinc	0.004	0.010	0.008
Fecal Coliform (cfu/100 mL)	<10	700	54[c]
E. coli (cfu/100 mL)	<10	300	31[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-2: WATER QUALITY AT STATION 29 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.4[b]	27.9[b]	21.5
Total Suspended Solids	9	112	45
Turbidity (NTU)	20[b]	103[b]	48
Conductivity (µS/cm)	743[b]	977[b]	807
Five-Day Biochemical Oxygen Demand	<2	6	4
Dissolved Oxygen	7.5[b]	11.6[b]	9.6
pH (units)	7.7[b]	8.6[b]	8.2
Ammonia Nitrogen	0.02	0.14	0.07
Un-ionized Ammonia	0.001	0.014	0.006
Total Kjeldahl Nitrogen	1.19	1.68	1.38
Nitrite plus Nitrate Nitrogen	2.70	6.67	4.33
Total Nitrogen	4.05	8.14	5.71
Total Phosphorus	0.31	1.04	0.57
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0005	0.0012	0.0007
Total Chromium	0.0005	0.0094	0.0033
Dissolved Chromium	<0.0005	0.0013	0.0007
Total Copper	<0.0005	0.0110	0.0028
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.48	3.25	1.38
Dissolved Iron	<0.004	0.025	0.017
Total Lead	0.003	0.014	0.006
Dissolved Lead	<0.004	0.006	0.005
Total Manganese	0.0370	0.0938	0.0574
Dissolved Manganese	0.0010	0.0054	0.0032
Total Mercury (µg/L)	<0.05	0.21	0.08
Total Nickel	0.002	0.006	0.003
Dissolved Nickel	<0.0004	0.0023	0.0015
Total Silver	<0.0006	0.0008	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.012	0.060	0.023
Dissolved Zinc	0.003	0.017	0.008
Fecal Coliform (cfu/100 mL)	10	400	54[c]
E. coli (cfu/100 mL)	<10	270	43[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-3: WATER QUALITY AT STATION 30 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.4[b]	27.9[b]	21.5
Total Suspended Solids	13	77	37
Turbidity (NTU)	20[b]	83[b]	43
Conductivity (µS/cm)	745[b]	973[b]	807
Five-Day Biochemical Oxygen Demand	<2	5	3
Dissolved Oxygen	7.1[b]	11.3[b]	9.5
pH (units)	7.8[b]	8.6[b]	8.2
Ammonia Nitrogen	<0.02	0.15	0.06
Un-ionized Ammonia	<0.001	0.010	0.004
Total Kjeldahl Nitrogen	1.08	1.50	1.31
Nitrite plus Nitrate Nitrogen	2.68	6.73	4.50
Total Nitrogen	4.12	7.81	5.81
Total Phosphorus	0.31	0.96	0.55
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0011	0.0006
Total Chromium	<0.0005	0.0076	0.0030
Dissolved Chromium	<0.0005	0.0010	0.0007
Total Copper	<0.0005	0.0090	0.0027
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.52	2.58	1.31
Dissolved Iron	<0.004	0.033	0.018
Total Lead	<0.003	0.011	0.007
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0353	0.0848	0.0553
Dissolved Manganese	0.0009	0.0043	0.0027
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	0.002	0.005	0.003
Dissolved Nickel	<0.0004	0.0021	0.0013
Total Silver	<0.0006	0.0006	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.013	0.049	0.022
Dissolved Zinc	0.010	0.019	0.012
Fecal Coliform (cfu/100 mL)	10	700	77[c]
E. coli (cfu/100 mL)	<10	150	25[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-4: WATER QUALITY AT STATION 31 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.4[b]	28.0[b]	21.5
Total Suspended Solids	15	108	44
Turbidity (NTU)	21[b]	87[b]	39
Conductivity (µS/cm)	744[b]	958[b]	806
Five-Day Biochemical Oxygen Demand	3	5	4
Dissolved Oxygen	7.0[b]	11.7[b]	9.6
pH (units)	7.8[b]	8.7[b]	8.2
Ammonia Nitrogen	<0.02	0.17	0.06
Un-ionized Ammonia	<0.001	0.010	0.005
Total Kjeldahl Nitrogen	1.01	1.56	1.30
Nitrite plus Nitrate Nitrogen	2.78	7.25	4.61
Total Nitrogen	4.31	8.26	5.90
Total Phosphorus	0.29	1.07	0.56
Chlorophyll *a* (µg/L)	18	75	40
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0007	0.0006
Total Chromium	0.0005	0.0069	0.0029
Dissolved Chromium	<0.0005	0.0011	0.0007
Total Copper	<0.0005	0.0080	0.0019
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.55	2.88	1.35
Dissolved Iron	<0.004	0.036	0.016
Total Lead	<0.003	0.011	0.005
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0356	0.0883	0.0567
Dissolved Manganese	0.0017	0.0042	0.0031
Total Mercury (µg/L)	<0.05	0.07	0.05
Total Nickel	<0.002	0.005	0.003
Dissolved Nickel	<0.0004	0.0021	0.0014
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.013	0.043	0.022
Dissolved Zinc	0.003	0.015	0.008
Fecal Coliform (cfu/100 mL)	10	460	84[c]
E. coli (cfu/100 mL)	10	150	25[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-5: WATER QUALITY AT STATION 32 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.4[b]	28.0[b]	21.5
Total Suspended Solids	18	83	45
Turbidity (NTU)	16[b]	106[b]	45
Conductivity (µS/cm)	739[b]	954[b]	804
Five-Day Biochemical Oxygen Demand	3	5	4
Dissolved Oxygen	7.0[b]	11.2[b]	9.3
pH (units)	7.8[b]	8.5[b]	8.2
Ammonia Nitrogen	0.02	0.19	0.09
Un-ionized Ammonia	0.001	0.019	0.006
Total Kjeldahl Nitrogen	1.12	1.82	1.39
Nitrite plus Nitrate Nitrogen	2.84	7.23	4.55
Total Nitrogen	4.15	8.35	5.94
Total Phosphorus	0.31	1.07	0.56
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0013	0.0006
Total Chromium	0.0006	0.0059	0.0030
Dissolved Chromium	<0.0005	0.0013	0.0008
Total Copper	<0.0005	0.0070	0.0018
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.55	3.26	1.42
Dissolved Iron	<0.004	0.210	0.048
Total Lead	<0.003	0.009	0.005
Dissolved Lead	<0.004	0.006	0.005
Total Manganese	0.0394	0.0971	0.0585
Dissolved Manganese	0.0008	0.0155	0.0041
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	0.002	0.005	0.003
Dissolved Nickel	<0.0004	0.0020	0.0014
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.014	0.037	0.022
Dissolved Zinc	0.004	0.012	0.008
Fecal Coliform (cfu/100 mL)	<10	430	67[c]
E. coli (cfu/100 mL)	10	190	27[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-6: WATER QUALITY AT STATION 33 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.5[b]	28.2[b]	21.5
Total Suspended Solids	20	93	50
Turbidity (NTU)	22[b]	104[b]	45
Conductivity (µS/cm)	738[b]	959[b]	803
Five-Day Biochemical Oxygen Demand	<2	5	4
Dissolved Oxygen	7.0[b]	11.7[b]	9.4
pH (units)	7.8[b]	8.5[b]	8.2
Ammonia Nitrogen	0.03	0.16	0.07
Un-ionized Ammonia	0.001	0.011	0.005
Total Kjeldahl Nitrogen	0.97	1.43	1.23
Nitrite plus Nitrate Nitrogen	2.92	6.89	4.50
Total Nitrogen	4.09	7.86	5.73
Total Phosphorus	0.32	0.84	0.53
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0005	0.0013	0.0007
Total Chromium	<0.0005	0.0069	0.0030
Dissolved Chromium	<0.0005	0.0010	0.0007
Total Copper	<0.0005	0.0070	0.0020
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.47	3.21	1.49
Dissolved Iron	<0.004	0.045	0.020
Total Lead	<0.003	0.009	0.005
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0378	0.0944	0.0608
Dissolved Manganese	0.0010	0.0037	0.0022
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	0.002	0.005	0.003
Dissolved Nickel	<0.0004	0.0024	0.0013
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.013	0.044	0.022
Dissolved Zinc	0.003	0.018	0.009
Fecal Coliform (cfu/100 mL)	<10	470	48[c]
E. coli (cfu/100 mL)	<10	160	25[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-7: WATER QUALITY AT STATION 34 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.6[b]	28.0[b]	21.5
Total Suspended Solids	23	89	46
Turbidity (NTU)	19[b]	105[b]	45
Conductivity (µS/cm)	734[b]	961[b]	800
Five-Day Biochemical Oxygen Demand	3	3	3
Dissolved Oxygen	6.8[b]	12.1[b]	9.4
pH (units)	7.9[b]	8.5[b]	8.2
Ammonia Nitrogen	<0.02	0.17	0.08
Un-ionized Ammonia	0.001	0.023	0.007
Total Kjeldahl Nitrogen	0.99	1.42	1.25
Nitrite plus Nitrate Nitrogen	2.88	6.80	4.40
Total Nitrogen	4.08	7.79	5.65
Total Phosphorus	0.31	0.72	0.52
Chlorophyll *a* (µg/L)	19	83	39
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0009	0.0006
Total Chromium	0.0005	0.0070	0.0030
Dissolved Chromium	<0.0005	0.0009	0.0007
Total Copper	<0.0005	0.0070	0.0023
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.65	3.05	1.55
Dissolved Iron	<0.004	0.041	0.018
Total Lead	<0.003	0.013	0.006
Dissolved Lead	<0.004	0.006	0.005
Total Manganese	0.0384	0.1100	0.0630
Dissolved Manganese	0.0014	0.0031	0.0022
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	<0.002	0.005	0.004
Dissolved Nickel	<0.0004	0.0023	0.0014
Total Silver	<0.0006	0.0006	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.015	0.046	0.024
Dissolved Zinc	0.004	0.010	0.008
Fecal Coliform (cfu/100 mL)	<10	690	88[c]
E. coli (cfu/100 mL)	10	220	35[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-8: WATER QUALITY AT STATION 35 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.8[b]	28.8[b]	21.8
Total Suspended Solids	21	95	49
Turbidity (NTU)	16[b]	107[b]	42
Conductivity (µS/cm)	729[b]	965[b]	798
Five-Day Biochemical Oxygen Demand	3	5	4
Dissolved Oxygen	6.5[b]	11.8[b]	9.5
pH (units)	7.9[b]	8.6[b]	8.2
Ammonia Nitrogen	0.02	0.14	0.07
Un-ionized Ammonia	0.001	0.018	0.006
Total Kjeldahl Nitrogen	1.09	1.49	1.24
Nitrite plus Nitrate Nitrogen	2.77	6.55	4.33
Total Nitrogen	4.09	7.65	5.56
Total Phosphorus	0.30	0.72	0.50
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0009	0.0006
Total Chromium	<0.0005	0.0064	0.0029
Dissolved Chromium	<0.0005	0.0011	0.0007
Total Copper	<0.0005	0.0060	0.0018
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.46	3.02	1.42
Dissolved Iron	<0.004	0.030	0.017
Total Lead	<0.003	0.012	0.006
Dissolved Lead	<0.004	0.010	0.005
Total Manganese	0.0353	0.1031	0.0613
Dissolved Manganese	0.0013	0.0031	0.0022
Total Mercury (µg/L)	<0.05	0.09	0.06
Total Nickel	<0.002	0.005	0.003
Dissolved Nickel	<0.0004	0.0024	0.0014
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.011	0.041	0.020
Dissolved Zinc	0.004	0.011	0.007
Fecal Coliform (cfu/100 mL)	<10	670	108[c]
E. coli (cfu/100 mL)	<10	150	25[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-9: WATER QUALITY AT STATION 36 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.7[b]	28.7[b]	21.7
Total Suspended Solids	12	96	45
Turbidity (NTU)	24[b]	101[b]	47
Conductivity (µS/cm)	720[b]	965[b]	797
Five-Day Biochemical Oxygen Demand	<2	4	3
Dissolved Oxygen	6.5[b]	11.9[b]	9.1
pH (units)	7.9[b]	8.5[b]	8.2
Ammonia Nitrogen	0.02	0.14	0.07
Un-ionized Ammonia	0.001	0.014	0.005
Total Kjeldahl Nitrogen	1.07	3.34	1.69
Nitrite plus Nitrate Nitrogen	2.88	6.37	4.34
Total Nitrogen	4.01	9.63	6.03
Total Phosphorus	0.33	0.67	0.52
Chlorophyll *a* (µg/L)	18	81	38
Total Cyanide	<0.003	0.003	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0007	0.0006
Total Chromium	0.0006	0.0060	0.0028
Dissolved Chromium	<0.0005	0.0012	0.0007
Total Copper	<0.0005	0.0070	0.0018
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.42	3.00	1.49
Dissolved Iron	<0.004	0.026	0.016
Total Lead	<0.003	0.011	0.006
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0353	0.1063	0.0635
Dissolved Manganese	0.0015	0.0036	0.0023
Total Mercury (µg/L)	<0.05	0.09	0.06
Total Nickel	0.002	0.005	0.003
Dissolved Nickel	<0.0004	0.0023	0.0015
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.013	0.041	0.023
Dissolved Zinc	0.004	0.014	0.008
Fecal Coliform (cfu/100 mL)	<10	580	60[c]
E. coli (cfu/100 mL)	<10	270	30[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-10: WATER QUALITY AT STATION 37 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.5[b]	28.7[b]	21.7
Total Suspended Solids	23	127	56
Turbidity (NTU)	21[b]	100[b]	50
Conductivity (µS/cm)	715[b]	965[b]	795
Five-Day Biochemical Oxygen Demand	<2	4	3
Dissolved Oxygen	6.5[b]	12.4[b]	9.2
pH (units)	7.9[b]	8.6[b]	8.2
Ammonia Nitrogen	<0.02	0.13	0.06
Un-ionized Ammonia	<0.001	0.010	0.005
Total Kjeldahl Nitrogen	1.14	2.81	1.55
Nitrite plus Nitrate Nitrogen	3.02	6.58	4.35
Total Nitrogen	4.22	9.39	5.90
Total Phosphorus	0.32	1.07	0.66
Chlorophyll *a* (µg/L)	ND	ND	ND
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.003	0.002
Dissolved Cadmium	0.0004	0.0012	0.0007
Total Chromium	<0.0005	0.0077	0.0031
Dissolved Chromium	<0.0005	0.0010	0.0007
Total Copper	<0.0005	0.0080	0.0023
Dissolved Copper	<0.002	0.002	0.002
Total Iron	0.50	3.78	1.58
Dissolved Iron	<0.004	0.025	0.017
Total Lead	<0.003	0.012	0.007
Dissolved Lead	<0.004	0.011	0.005
Total Manganese	0.0356	0.1289	0.0662
Dissolved Manganese	0.0011	0.0023	0.0016
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	0.002	0.005	0.004
Dissolved Nickel	0.0004	0.0023	0.0015
Total Silver	<0.0006	0.0006	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.010	0.050	0.023
Dissolved Zinc	0.005	0.009	0.007
Fecal Coliform (cfu/100 mL)	<10	300	72[c]
E. coli (cfu/100 mL)	<10	280	61[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-11: WATER QUALITY AT STATION 38 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.6[b]	28.5[b]	21.5
Total Suspended Solids	21	182	68
Turbidity (NTU)	37[b]	54[b]	43
Conductivity (µS/cm)	708[b]	957[b]	794
Five-Day Biochemical Oxygen Demand	<2	5	3
Dissolved Oxygen	6.1[b]	12.1[b]	9.1
pH (units)	8.0[b]	8.6[b]	8.2
Ammonia Nitrogen	0.02	0.13	0.09
Un-ionized Ammonia	0.001	0.018	0.008
Total Kjeldahl Nitrogen	1.10	1.59	1.40
Nitrite plus Nitrate Nitrogen	2.88	6.58	4.25
Total Nitrogen	4.30	8.16	5.64
Total Phosphorus	0.34	0.73	0.50
Chlorophyll *a* (µg/L)	22	89	46
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	0.02	0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.003	0.002
Dissolved Cadmium	0.0004	0.0014	0.0007
Total Chromium	0.0006	0.0067	0.0031
Dissolved Chromium	<0.0005	0.0013	0.0008
Total Copper	<0.0005	0.0060	0.0020
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.63	3.15	1.50
Dissolved Iron	<0.004	0.032	0.019
Total Lead	<0.003	0.011	0.005
Dissolved Lead	<0.004	0.005	0.004
Total Manganese	0.0448	0.1144	0.0688
Dissolved Manganese	0.0023	0.0044	0.0035
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	0.002	0.005	0.004
Dissolved Nickel	<0.0004	0.0023	0.0014
Total Silver	<0.0006	0.0007	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.014	0.043	0.023
Dissolved Zinc	0.003	0.012	0.006
Fecal Coliform (cfu/100 mL)	20	340	82[c]
E. coli (cfu/100 mL)	40	160	68[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-12: WATER QUALITY AT STATION 39 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.8[b]	28.2[b]	21.4
Total Suspended Solids	23	73	39
Turbidity (NTU)	31[b]	61[b]	42
Conductivity (µS/cm)	701[b]	957[b]	793
Five-Day Biochemical Oxygen Demand	<2	4	3
Dissolved Oxygen	5.9[b]	12.2[b]	9.1
pH (units)	8.1[b]	8.6[b]	8.3
Ammonia Nitrogen	0.04	0.20	0.11
Un-ionized Ammonia	0.003	0.022	0.009
Total Kjeldahl Nitrogen	0.92	1.53	1.31
Nitrite plus Nitrate Nitrogen	2.67	6.66	4.15
Total Nitrogen	4.20	8.05	5.46
Total Phosphorus	0.34	0.65	0.47
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.003	0.002
Dissolved Cadmium	0.0004	0.0008	0.0005
Total Chromium	<0.0005	0.0051	0.0025
Dissolved Chromium	<0.0005	0.0009	0.0006
Total Copper	<0.0005	0.0070	0.0021
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.93	2.62	1.33
Dissolved Iron	<0.004	0.024	0.015
Total Lead	<0.003	0.011	0.006
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0476	0.0901	0.0639
Dissolved Manganese	0.0012	0.0037	0.0019
Total Mercury (µg/L)	<0.05	0.05	0.05
Total Nickel	0.002	0.004	0.003
Dissolved Nickel	<0.0004	0.0030	0.0015
Total Silver	<0.0006	0.0006	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.015	0.035	0.022
Dissolved Zinc	0.003	0.012	0.006
Fecal Coliform (cfu/100 mL)	<10	220	43[c]
E. coli (cfu/100 mL)	10	110	22[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-13: WATER QUALITY AT STATION 40 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.8[b]	27.8[b]	21.4
Total Suspended Solids	27	36	31
Turbidity (NTU)	36[b]	48[b]	42
Conductivity (µS/cm)	699[b]	954[b]	789
Five-Day Biochemical Oxygen Demand	3	4	4
Dissolved Oxygen	4.8[b]	12.4[b]	8.9
pH (units)	8.1[b]	8.6[b]	8.3
Ammonia Nitrogen	<0.02	0.30	0.09
Un-ionized Ammonia	<0.001	0.029	0.008
Total Kjeldahl Nitrogen	0.64	1.74	1.28
Nitrite plus Nitrate Nitrogen	2.57	6.79	4.13
Total Nitrogen	4.29	8.16	5.41
Total Phosphorus	0.32	0.61	0.43
Chlorophyll *a* (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0009	0.0006
Total Chromium	0.0008	0.0029	0.0022
Dissolved Chromium	<0.0005	0.0010	0.0007
Total Copper	<0.0005	0.0030	0.0014
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.83	1.25	1.10
Dissolved Iron	<0.004	0.035	0.018
Total Lead	<0.003	0.006	0.004
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0455	0.0859	0.0586
Dissolved Manganese	0.0014	0.0038	0.0024
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	0.002	0.005	0.003
Dissolved Nickel	<0.0004	0.0028	0.0015
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.013	0.022	0.017
Dissolved Zinc	0.003	0.008	0.005
Fecal Coliform (cfu/100 mL)	<10	200	63[c]
E. coli (cfu/100 mL)	<10	80	20[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVI-14: WATER QUALITY AT STATION 41 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.8[b]	27.9[b]	21.4
Total Suspended Solids	28	44	34
Turbidity (NTU)	38[b]	48[b]	42
Conductivity (µS/cm)	697[b]	949[b]	786
Five-Day Biochemical Oxygen Demand	3	4	4
Dissolved Oxygen	4.7[b]	12.4[b]	8.9
pH (units)	8.2[b]	8.7[b]	8.3
Ammonia Nitrogen	<0.02	0.26	0.08
Un-ionized Ammonia	<0.001	0.026	0.008
Total Kjeldahl Nitrogen	1.28	1.51	1.42
Nitrite plus Nitrate Nitrogen	2.52	6.66	4.05
Total Nitrogen	4.03	8.16	5.47
Total Phosphorus	0.34	0.60	0.44
Chlorophyll *a* (µg/L)	32	98	49
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.004	0.002
Dissolved Cadmium	0.0004	0.0010	0.0006
Total Chromium	0.0013	0.0029	0.0022
Dissolved Chromium	<0.0005	0.0008	0.0006
Total Copper	<0.0005	0.0030	0.0014
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.82	1.31	1.09
Dissolved Iron	<0.004	0.023	0.014
Total Lead	<0.003	0.008	0.005
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0502	0.0839	0.0587
Dissolved Manganese	0.0014	0.0030	0.0019
Total Mercury (µg/L)	<0.05	0.05	0.05
Total Nickel	0.002	0.005	0.003
Dissolved Nickel	<0.0004	0.0029	0.0014
Total Silver	<0.0006	0.0006	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.014	0.025	0.018
Dissolved Zinc	0.003	0.009	0.006
Fecal Coliform (cfu/100 mL)	<10	260	37[c]
E. coli (cfu/100 mL)	<10	90	21[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

APPENDIX AVII

WATER QUALITY AT STATIONS 42–49 IN THE LOWER PEORIA POOL DURING MAY, AUGUST, AND OCTOBER 2006

TABLE AVII-1: WATER QUALITY AT STATION 42 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.7[b]	27.9[b]	21.3
Total Suspended Solids	27	91	47
Turbidity (NTU)	34[b]	85[b]	50
Conductivity (µS/cm)	691[b]	939[b]	778
Five-Day Biochemical Oxygen Demand	3	4	3
Dissolved Oxygen	5.2[b]	12.3[b]	8.8
pH (units)	8.1[b]	8.7[b]	8.3
Ammonia Nitrogen	<0.02	0.28	0.10
Un-ionized Ammonia	<0.001	0.028	0.011
Total Kjeldahl Nitrogen	0.51	1.80	1.36
Nitrite plus Nitrate Nitrogen	2.44	6.74	3.99
Total Nitrogen	3.92	8.54	5.35
Total Phosphorus	0.31	0.56	0.43
Chlorophyll a (µg/L)	30	105	49
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.003	0.002
Dissolved Cadmium	0.0004	0.0009	0.0006
Total Chromium	0.0013	0.0061	0.0030
Dissolved Chromium	<0.0005	0.0010	0.0007
Total Copper	<0.0005	0.0060	0.0018
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	0.77	3.27	1.56
Dissolved Iron	<0.004	0.024	0.014
Total Lead	<0.003	0.008	0.005
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0480	0.1061	0.0749
Dissolved Manganese	0.0010	0.0019	0.0015
Total Mercury (µg/L)	<0.05	0.32	0.10
Total Nickel	0.002	0.005	0.004
Dissolved Nickel	0.0007	0.0028	0.0015
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.012	0.040	0.022
Dissolved Zinc	0.003	0.008	0.005
Fecal Coliform (cfu/100 mL)	<10	190	44[c]
E. coli (cfu/100 mL)	10	70	35[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVII-2: WATER QUALITY AT STATION 43 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.8 [b]	27.7[b]	21.1
Total Suspended Solids	37	146	62
Turbidity (NTU)	46[b]	65[b]	58
Conductivity (µS/cm)	667[b]	954[b]	784
Five-Day Biochemical Oxygen Demand	<2	5	3
Dissolved Oxygen	4.1[b]	12.6[b]	8.4
pH (units)	8.1[b]	8.6[b]	8.3
Ammonia Nitrogen	<0.02	0.39	0.14
Un-ionized Ammonia	0.001	0.032	0.011
Total Kjeldahl Nitrogen	1.15	2.07	1.53
Nitrite plus Nitrate Nitrogen	2.45	6.93	4.09
Total Nitrogen	3.75	9.00	5.61
Total Phosphorus	0.34	0.67	0.50
Chlorophyll a (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0006	0.0012	0.0008
Total Chromium	0.0021	0.0067	0.0036
Dissolved Chromium	<0.0005	0.0010	0.0007
Total Copper	<0.0005	0.0070	0.0025
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	1.18	3.54	1.84
Dissolved Iron	<0.004	0.027	0.016
Total Lead	<0.003	0.010	0.006
Dissolved Lead	<0.004	0.009	0.005
Total Manganese	0.0515	0.1117	0.0783
Dissolved Manganese	0.0015	0.0034	0.0025
Total Mercury (µg/L)	<0.05	0.07	0.06
Total Nickel	0.003	0.005	0.004
Dissolved Nickel	<0.0004	0.0032	0.0015
Total Silver	<0.0006	0.0006	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.017	0.049	0.025
Dissolved Zinc	0.003	0.007	0.005
Fecal Coliform (cfu/100 mL)	<10	310	67[c]
E. coli (cfu/100 mL)	<10	150	20[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVII-3: WATER QUALITY AT STATION 44 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	16.5 [b]	27.1[b]	20.3
Total Suspended Solids	35	113	61
Turbidity (NTU)	53[b]	104[b]	69
Conductivity (µS/cm)	651[b]	923[b]	770
Five-Day Biochemical Oxygen Demand	<2	6	4
Dissolved Oxygen	5.0[b]	11.6[b]	8.5
pH (units)	8.1[b]	8.6[b]	8.3
Ammonia Nitrogen	<0.02	0.33	0.09
Un-ionized Ammonia	<0.001	0.027	0.008
Total Kjeldahl Nitrogen	1.09	2.12	1.42
Nitrite plus Nitrate Nitrogen	2.23	7.05	3.96
Total Nitrogen	3.41	9.17	5.38
Total Phosphorus	0.38	0.71	0.52
Chlorophyll a (µg/L)	36	112	55
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.02	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0005	0.0011	0.0006
Total Chromium	0.0022	0.0057	0.0039
Dissolved Chromium	<0.0005	0.0010	0.0007
Total Copper	<0.0005	0.0060	0.0025
Dissolved Copper	<0.002	0.002	0.002
Total Iron	1.49	3.50	2.07
Dissolved Iron	<0.004	0.026	0.015
Total Lead	<0.003	0.008	0.006
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0520	0.1395	0.0888
Dissolved Manganese	0.0029	0.0077	0.0042
Total Mercury (µg/L)	<0.05	0.09	0.06
Total Nickel	0.003	0.006	0.004
Dissolved Nickel	0.0007	0.0029	0.0015
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.020	0.039	0.026
Dissolved Zinc	0.003	0.008	0.006
Fecal Coliform (cfu/100 mL)	<10	100	27[c]
E. coli (cfu/100 mL)	<10	50	25[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVII-4: WATER QUALITY AT STATION 45 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	17.1[b]	26.4[b]	20.4
Total Suspended Solids	37	77	57
Turbidity (NTU)	56[b]	94[b]	70
Conductivity (µS/cm)	639[b]	897[b]	763
Five-Day Biochemical Oxygen Demand	<2	5	3
Dissolved Oxygen	5.9[b]	11.4[b]	8.7
pH (units)	8.2[b]	8.7[b]	8.4
Ammonia Nitrogen	<0.02	0.24	0.08
Un-ionized Ammonia	<0.001	0.023	0.008
Total Kjeldahl Nitrogen	1.29	2.04	1.53
Nitrite plus Nitrate Nitrogen	1.95	7.05	3.83
Total Nitrogen	3.41	9.09	5.36
Total Phosphorus	0.42	0.62	0.49
Chlorophyll a (µg/L)	38	118	67
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0015	0.0007
Total Chromium	0.0017	0.0041	0.0033
Dissolved Chromium	<0.0005	0.0015	0.0008
Total Copper	<0.0005	0.0040	0.0026
Dissolved Copper	<0.002	0.002	0.002
Total Iron	1.59	2.12	1.86
Dissolved Iron	<0.004	0.048	0.018
Total Lead	0.003	0.009	0.006
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0620	0.1223	0.0910
Dissolved Manganese	0.0013	0.0047	0.0030
Total Mercury (µg/L)	<0.05	0.06	0.05
Total Nickel	0.003	0.006	0.004
Dissolved Nickel	0.0006	0.0027	0.0016
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.020	0.026	0.023
Dissolved Zinc	0.003	0.013	0.007
Fecal Coliform (cfu/100 mL)	<10	50	21[c]
E. coli (cfu/100 mL)	<10	60	23[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVII-5: WATER QUALITY AT STATION 46 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	17.4[b]	26.3[b]	20.6
Total Suspended Solids	39	70	55
Turbidity (NTU)	43[b]	88[b]	68
Conductivity (µS/cm)	640[b]	857[b]	756
Five-Day Biochemical Oxygen Demand	<2	6	4
Dissolved Oxygen	5.9[b]	11.7[b]	9.1
pH (units)	8.2[b]	8.7[b]	8.4
Ammonia Nitrogen	<0.02	0.23	0.07
Un-ionized Ammonia	<0.001	0.020	0.007
Total Kjeldahl Nitrogen	1.21	1.96	1.52
Nitrite plus Nitrate Nitrogen	1.87	7.07	3.77
Total Nitrogen	3.45	9.03	5.29
Total Phosphorus	0.36	0.68	0.49
Chlorophyll a (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0010	0.0006
Total Chromium	0.0028	0.0046	0.0035
Dissolved Chromium	<0.0005	0.0011	0.0008
Total Copper	<0.0005	0.0030	0.0020
Dissolved Copper	<0.002	0.002	0.002
Total Iron	1.40	2.45	1.91
Dissolved Iron	<0.004	0.024	0.015
Total Lead	0.004	0.011	0.007
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0611	0.1405	0.0943
Dissolved Manganese	0.0016	0.0043	0.0029
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	0.003	0.005	0.004
Dissolved Nickel	0.0004	0.0029	0.0015
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.020	0.025	0.023
Dissolved Zinc	0.004	0.018	0.009
Fecal Coliform (cfu/100 mL)	10	380	50[c]
E. coli (cfu/100 mL)	<10	70	28[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVII-6: WATER QUALITY AT STATION 47 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	17.7[b]	27.0[b]	21.1
Total Suspended Solids	34	69	51
Turbidity (NTU)	58[b]	80[b]	69
Conductivity (µS/cm)	642[b]	875[b]	763
Five-Day Biochemical Oxygen Demand	<2	7	4
Dissolved Oxygen	6.0[b]	12.0[b]	8.9
pH (units)	8.2[b]	8.7[b]	8.4
Ammonia Nitrogen	<0.02	0.22	0.08
Un-ionized Ammonia	<0.001	0.022	0.010
Total Kjeldahl Nitrogen	1.15	1.94	1.48
Nitrite plus Nitrate Nitrogen	1.91	6.94	3.72
Total Nitrogen	3.41	8.88	5.20
Total Phosphorus	0.39	0.62	0.49
Chlorophyll a (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	0.02	0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	<0.0004	0.0009	0.0006
Total Chromium	0.0018	0.0044	0.0032
Dissolved Chromium	<0.0005	0.0012	0.0007
Total Copper	<0.0005	0.0030	0.0019
Dissolved Copper	<0.002	0.002	0.002
Total Iron	1.19	2.31	1.81
Dissolved Iron	<0.004	0.024	0.013
Total Lead	<0.003	0.008	0.006
Dissolved Lead	<0.004	0.008	0.005
Total Manganese	0.0618	0.1225	0.0944
Dissolved Manganese	0.0012	0.0031	0.0021
Total Mercury (µg/L)	<0.05	0.09	0.06
Total Nickel	0.003	0.005	0.004
Dissolved Nickel	0.0006	0.0028	0.0017
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.021	0.030	0.024
Dissolved Zinc	0.003	0.006	0.004
Fecal Coliform (cfu/100 mL)	<10	540	230[c]
E. coli (cfu/100 mL)	<10	390	78[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVII-7: WATER QUALITY AT STATION 48 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2006

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	17.8[b]	26.9[b]	21.1
Total Suspended Solids	48	73	60
Turbidity (NTU)	48[b]	93[b]	71
Conductivity (µS/cm)	643[b]	872[b]	763
Five-Day Biochemical Oxygen Demand	<2	7	4
Dissolved Oxygen	5.9[b]	12.0[b]	9.0
pH (units)	8.2[b]	8.7[b]	8.4
Ammonia Nitrogen	<0.02	0.20	0.07
Un-ionized Ammonia	<0.001	0.020	0.007
Total Kjeldahl Nitrogen	1.26	2.14	1.58
Nitrite plus Nitrate Nitrogen	1.84	6.93	3.70
Total Nitrogen	3.36	9.07	5.28
Total Phosphorus	0.38	0.63	0.51
Chlorophyll a (µg/L)	44	119	73
Total Cyanide	<0.003	0.003	0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0011	0.0006
Total Chromium	0.0016	0.0060	0.0036
Dissolved Chromium	<0.0005	0.0011	0.0007
Total Copper	<0.0005	0.0030	0.0021
Dissolved Copper	<0.002	0.002	0.002
Total Iron	1.46	2.24	1.85
Dissolved Iron	<0.004	0.034	0.017
Total Lead	<0.003	0.007	0.005
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0673	0.1341	0.0948
Dissolved Manganese	0.0014	0.0032	0.0022
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	0.003	0.006	0.004
Dissolved Nickel	0.0008	0.0028	0.0016
Total Silver	<0.0006	0.0006	0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.020	0.026	0.023
Dissolved Zinc	0.003	0.013	0.006
Fecal Coliform (cfu/100 mL)	40	670	151[c]
E. coli (cfu/100 mL)	80	230	114[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

TABLE AVII-8: WATER QUALITY AT STATION 49 IN THE ILLINOIS RIVER
MAY, AUGUST, AND OCTOBER 2005

Constituents[a]	Minimum	Maximum	Mean
Water Temperature (°C)	17.9[b]	27.0[b]	21.1
Total Suspended Solids	35	100	55
Turbidity (NTU)	47[b]	68[b]	60
Conductivity (µS/cm)	647[b]	872[b]	762
Five-Day Biochemical Oxygen Demand	<2	7	4
Dissolved Oxygen	6.0[b]	12.7[b]	9.2
pH (units)	8.1[b]	8.8[b]	8.4
Ammonia Nitrogen	<0.02	0.20	0.08
Un-ionized Ammonia	<0.001	0.022	0.009
Total Kjeldahl Nitrogen	1.10	2.24	1.56
Nitrite plus Nitrate Nitrogen	1.85	6.73	3.68
Total Nitrogen	3.35	8.97	5.23
Total Phosphorus	0.39	0.62	0.51
Chlorophyll a (µg/L)	No Data	No Data	No Data
Total Cyanide	<0.003	<0.003	<0.003
Phenols	<0.005	<0.005	<0.005
Total Arsenic	<0.02	<0.02	<0.02
Dissolved Arsenic	<0.01	0.01	0.01
Total Cadmium	<0.002	0.002	0.002
Dissolved Cadmium	0.0004	0.0010	0.0006
Total Chromium	0.0015	0.0051	0.0033
Dissolved Chromium	<0.0005	0.0009	0.0006
Total Copper	<0.0005	0.0030	0.0022
Dissolved Copper	<0.002	<0.002	<0.002
Total Iron	1.48	2.85	1.89
Dissolved Iron	<0.004	0.027	0.015
Total Lead	<0.003	0.011	0.007
Dissolved Lead	<0.004	0.007	0.005
Total Manganese	0.0655	0.1170	0.0961
Dissolved Manganese	0.0011	0.0017	0.0015
Total Mercury (µg/L)	<0.05	0.08	0.06
Total Nickel	0.003	0.005	0.004
Dissolved Nickel	0.0005	0.0029	0.0018
Total Silver	<0.0006	<0.0006	<0.0006
Dissolved Silver	<0.0006	<0.0006	<0.0006
Total Zinc	0.019	0.032	0.023
Dissolved Zinc	0.002	0.013	0.007
Fecal Coliform (cfu/100 mL)	90	470	203[c]
E. coli (cfu/100 mL)	60	170	113[c]

[a]Expressed in mg/L except where noted.
[b]Field measurement.
[c]Geometric mean.

ADDENDUM REPORT

ISOTOPIC COMPOSITION OF NITRATE IN THE ILLINOIS WATERWAY, 2006

ADDENDUM

Nitrogen Isotope Composition

During the October, 2004 Illinois Waterway survey, 49 special samples were collected for stable nitrogen isotope ratio analysis by the University of Illinois at Chicago. Results of these analyses indicated that the overall isotopic composition of the nitrate in the Illinois River generally resembled isotope ratios associated with manure and septic system inputs.

In order to better understand the impact of seasonal agricultural activities, weather conditions, and flow on nitrate isotopes along the Illinois Waterway, a monthly sampling program was implemented during 2005. During 2006, between March and October, a sample was collected for nitrate isotope analysis from a subset of 7 out of the 49 Illinois Waterway stations (Addendum Table 1). The nitrate isotope data from these seven stations, as well as from Stickney WRP effluent, are reported in Addendum Table AI-1.

This addendum entitled, *Isotopic Composition of Nitrate in the Illinois Waterway, 2006,* presents the results from the Illinois Waterway Nitrogen Isotope Sampling Project and was prepared by Neil Sturchio, Sam Huang, and M. Gonzalez-Meler from the University of Illinois, Chicago.

Isotopic Composition of Nitrate in the Illinois Waterway, 2006

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April 3, 2007

Introduction

The Illinois Waterway Monitoring Project of the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) has conducted annual water quality surveys along the Illinois Waterway from the Lockport Lock to the Peoria Lock since 1984. This represents a distance of about 133 river miles, from upstream of the confluence of the Des Plaines and Kankakee Rivers to downstream of the City of Peoria. These surveys are done to monitor the impact of the large amount of treated effluent released into the waterway system by the MWRDGC.

The measurement of stable isotope ratios of nitrogen and oxygen in nitrate is known to provide useful constraints on the sources and transformations of nitrate in surface waters and ground waters. The MWRDGC contracted the University of Illinois at Chicago to obtain stable isotope ratio analyses of nitrogen and oxygen in nitrate, and hydrogen and oxygen in water, for their water quality survey beginning in October 2004. These isotopic parameters are not normally measured during the MWRDGC's surveys, but it was anticipated that valuable insights into the occurrence and behavior of nitrate in the Illinois River might be gained from including such measurements in the survey to complement other water quality data generated by the MWRDGC. The results of the stable isotope ratio measurements of nitrogen and oxygen in nitrate sampled during 2006 are the subject of this brief report. A supplemental report will be prepared based on the results of the hydrogen and oxygen isotope ratio measurements of the water samples collected during 2006.

The specific objectives of the stable isotope ratio measurements are: (1) to determine if different sources of nitrate can be distinguished isotopically in the Illinois River, (2) to determine if there is isotopic evidence for denitrification occurring in the Illinois River, and (3) how are different sources of nitrate and denitrification processes related to tributary inputs and river characteristics along the waterway, as well as seasonal changes in temperature, discharge, and agricultural activities.

Methods

Samples of river water were collected on a monthly basis by MWRDGC personnel from March through October 2006 at a subset of 7 of the 49 regular sampling stations (stations 1, 4, 8,

20, 23, 30, 39). In addition, treated effluent samples were taken from the Stickney Water Reclamation Plant (SWRP) at least monthly from March through October.

For river samples, water was pumped from a depth of three feet in mid-stream and passed through a 0.45-micron filter. About 250 mL of water from each station was collected and frozen in high-density polyethylene (HDPE) bottles. Samples for nitrate isotope analysis were stored frozen until analysis, except for a brief thawing for subsampling. Subsamples for hydrogen and oxygen isotope analysis and ion chromatography were preserved under refrigeration in 20-mL glass vials with polyseal caps and 60-mL HDPE bottles, respectively.

Stable isotope ratio analyses of nitrate were performed in replicate by the bacterial denitrification method of Casciotti et al. (2002), using a Finnigan Delta Plus isotope ratio mass spectrometer in continuous flow mode. Stable isotope analyses of hydrogen and oxygen in water were performed by the conventional hydrogen equilibration (Coplen et al., 1991) and carbon dioxide equilibration (Nelson, 2000) methods, respectively. All isotope ratios are reported in delta (δ) notation in units of per mil (‰) deviation relative to a standard reference material, where:

$$\delta = [(R_{sample}/R_{standard}) - 1) \times 1000$$

and R is the isotope ratio of $^{2}H/^{1}H$, $^{15}N/^{14}N$, or $^{18}O/^{16}O$. The standard reference materials used for normalization of ratios are Vienna Standard Mean Ocean Water (VSMOW) for H and O isotope ratios (Coplen, 1996), and atmospheric nitrogen for N isotope ratios. Analytical precision of isotope ratios is typically about ±1–2‰ for H isotope ratios in water, ±0.1–0.2 per mil for O isotope ratios in water, and ±0.3–0.5 ‰ for N and O isotope ratios in nitrate.

Concentrations of nitrate, sulfate and chloride were measured by ion chromatography using a Dionex 500 ion chromatograph calibrated with certified reference solutions. Accuracies of nitrate, sulfate, and chloride concentrations are within ±5% of the value reported.

Water discharge data were obtained from the U. S. Geological Survey (http://waterdata.usgs.gov/nwis/), which records daily streamflow near four of the regular MWRDGC survey stations (#1, #26, #39, and #49).

Results and Discussion

Analytical results are listed in the Appendix. The order of discussion of these results in the following pages is: nitrate concentration vs. river distance; nitrate flux vs. river distance; and correlations of the nitrogen and oxygen isotopic compositions of nitrate. The changes in nitrate concentration, flux, and isotopic composition with time are also discussed with reference to data collected in prior years of this study.

Nitrate concentration variations with river distance and time

Nitrate concentration data as a function of downstream river distance for samples collected during March through October 2006 are shown in Figure 1. The overall patterns observed in 2006 are similar to those of 2004-2005. There is an overall decrease in nitrate concentration from Lockport to Peoria at most times of year. A large change in concentration occurs between stations 8 (Dresden) and 20 (Marseilles), because the Kankakee River joins the Des Plaines River to form the Illinois River between these stations. This change is positive in April and May, whereas it is negative in other months. These changes are interpreted to reflect differences in land use in the Des Plaines watershed (mainly urban) vs. the Kankakaee watershed (mainly agricultural), whereby the large spring influx of agricultural nitrate is more apparent downstream of the Kankakee River. The generally decreasing concentration of nitrate downstream of Kankakee with time (March through October) may indicate the increasing extent of flushing of agricultural nitrate from the soil in the Kankakee watershed.

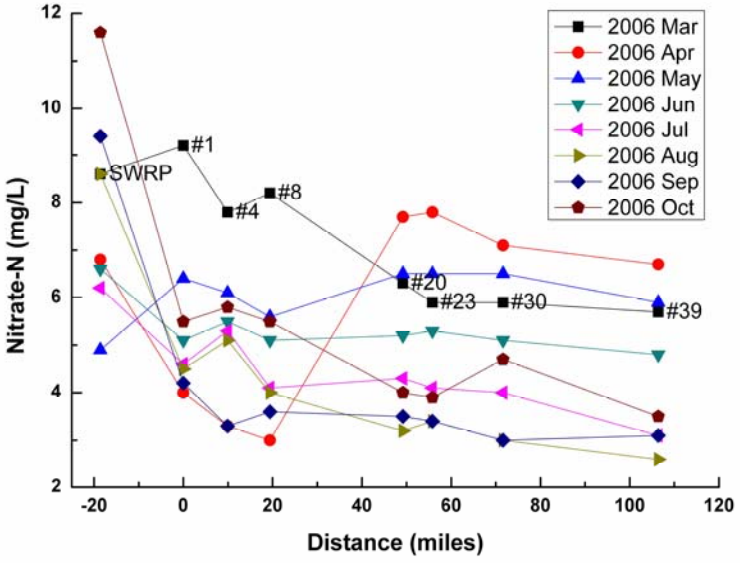

Figure 1. Monthly nitrate-N concentration (mg/L) vs. downstream river distance (in miles) from Lockport Lock, March through October 2006.

Nitrate flux variations with river distance and time

The total nitrate load carried by the river is best considered in terms of nitrate flux. Nitrate flux in the river is defined as the product of concentration and discharge. Using available discharge data from the U. S. Geological Survey's streamflow monitoring network, nitrate flux at station 39 was calculated for the times of sampling. Nitrate flux and discharge as a function of time is shown in Figure 2. There is clearly a strong correlation between nitrate flux and discharge.

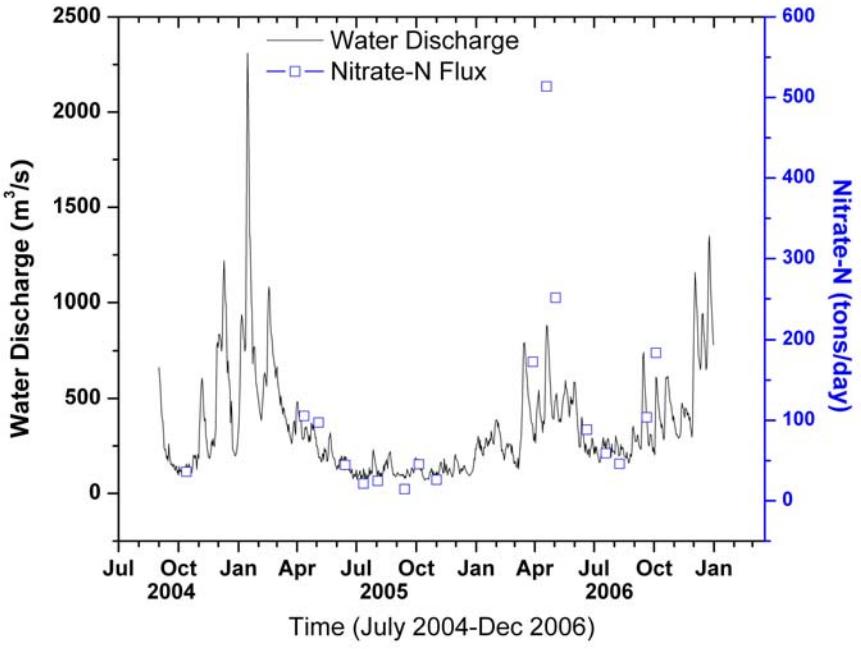

Figure 2. Nitrate flux (tons/day of NO_3) and discharge (m^3/sec) vs. time at station 39 (Henry, IL). Nitrate flux and discharge are strongly correlated.

Isotopic composition of nitrate

Additional insights into the sources and removal mechanisms of nitrate can be gained from considering the isotopic compositions of nitrogen (N) and oxygen (O) in nitrate. Figure 3 recaps the correlations between $\delta^{18}O$ and $\delta^{15}N$ values of nitrate for each of the four major sampling events (October 2004, May 2005, August 2005, and October 2005) observed to date. Also shown in Figure 3 are isotopic data for nitrate sampled during spring from tile drainage systems in central Illinois (Panno et al., 2006) and the slope of a typical laboratory denitrification trend. Field denitrification trends tend to have a somewhat higher slope (i.e. 0.7-0.8) (Böttcher et al., 1990).

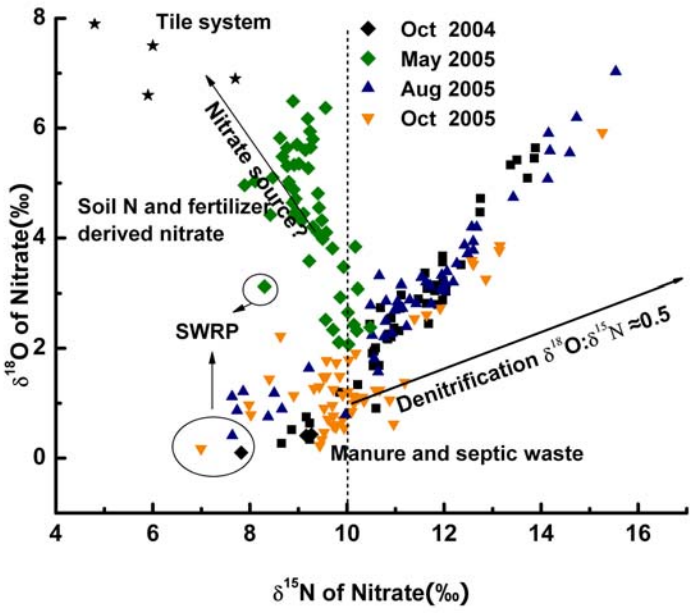

Figure 3. $\delta^{18}O$ (‰) vs. $\delta^{15}N$ (‰) of nitrate in the Illinois Waterway during quarterly sampling, October 2004-October 2005. Also shown are data for nitrate from tile drainage systems (Panno et al., 2006) and typical denitrification trend (Kendall, 1998).

There is a similar pattern of increasing values with downstream distance in three of these four data sets (October 2004, August 2005, and October 2005). This pattern is consistent with progressive denitrification with downstream distance, which is also consistent with the observed decreases in nitrate concentration and nitrate flux with downstream distance. Denitrification has a characteristic slope of 0.5 to 1.0 on a $\delta^{18}O$ vs. $\delta^{15}N$ diagram (Bottcher et al., 1990). However, during the May 2005 sampling, there was a distinct pattern of nitrate isotopic compositions, in which the $\delta^{15}N$ value decreased slightly while the $\delta^{18}O$ value increased with downstream distance. This pattern cannot be explained by denitrification, but it can be explained by mixing of isotopically distinct sources of nitrate. The increase of nitrate flux with downstream distance observed during May 2005 indicates that such mixing was occurring along the waterway at that time.

Nitrate isotopic data for monthly samples collected at the subset of sampling stations during 2004-2006 are compared in Figure 4. The timing of the spring flush "mixing" event can be clearly seen in this figure. The data for 2006 indicate that the input of fertilizer-derived nitrate was well underway by the end of March, and that this input was relatively larger through the July 2006 sampling than for the comparable interval during 2005. This may reflect the

generally higher nitrate flux and discharge in 2006 as compared with 2005. To a lesser extent, this relatively larger input of agricultural nitrate persists through October 2006.

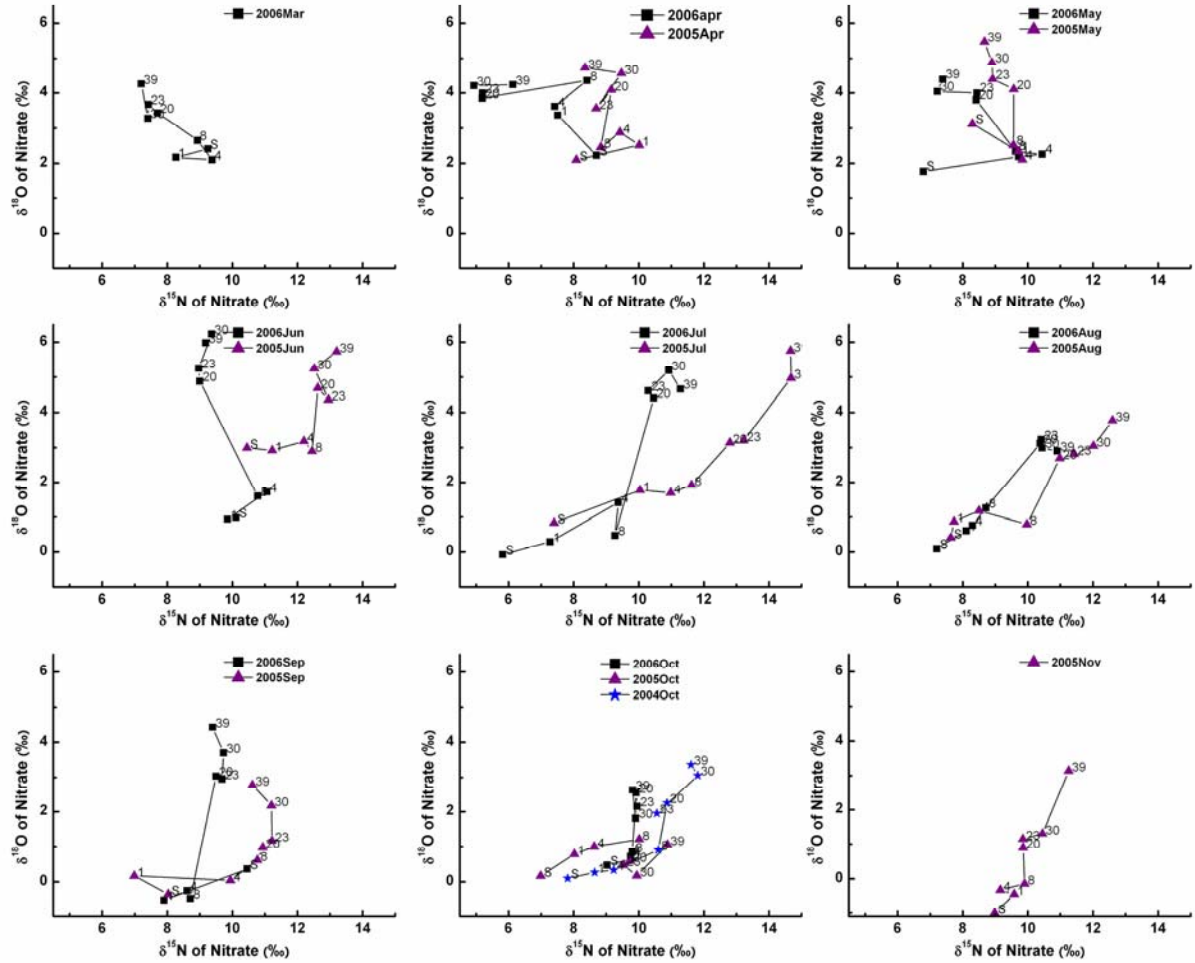

Figure 4. Monthly variations in nitrate isotopic composition in the Illinois Waterway, October 2004-October 2006. Samples not collected during winter months (December through February).

Summary and Conclusions

1. During 2006, overall patterns of nitrate concentration and isotopic composition were similar to those observed during 2004-2005, but there were some significant differences.

2. Isotopic data for nitrate indicate that the overall extent of apparent downstream denitrification (d15N > 10 ‰) was less during 2006, and the influence of agricultural nitrate was relatively larger and was observed for a longer period than in 2005.

3. Nitrate flux is strongly correlated with discharge over entire 2004-2006 period of observation.

4. Denitrification is most effective during periods of low discharge.

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ADDENDUM TABLE 1: ILLINOIS WATERWAY NITROGEN ISOTOPE STUDY
MONTHLY SAMPLING LOCATIONS AND ACCESS POINTS

Station Number	River Mile	Illinois Waterway Pool	Access Point (River Mile)
39	190.0	Peoria	Lacon ramp (189.0)
30	224.7	Peoria	LaSalle ramp (224.0)
23	240.6	Starved Rock	Ottawa ramp (239.7)
20	247.5	Marseilles	Illini State Park ramp (247.4)
8	278.0	Dresden Island	Big Basin Marina (277.8)
4	286.5	Brandon Road	Illinois Route 6 ramp (286.4)
1	291.5	Lockport	Cargill Elevator (292.6)

ADDENDUM APPENDIX A

NITRATE ISOTOPE DATA AT STATIONS 1, 4, 8, 20, 23, 30, AND 39 ALONG THE ILLINOIS WATERWAY DURING MARCH THROUGH OCTOBER 2006

ADDENDUM TABLE A-1: NITRATE ISOTOPE DATA AT STATIONS 1, 4, 8, 20, 23, 30, AND 39 ALONG THE ILLINOIS WATERWAY DURING MARCH THROUGH OCTOBER 2006

Station No.	Waterway	NO3-N (mg/L)	$\delta^{15}N\ NO_3$	$\delta^{18}O\ NO_3$
MARCH				
	Stickney WRP Effluent*	8.61	9.25	2.41
1	Chicago Sanitary and Ship Canal	9.21	8.27	2.17
4	Des Plaines River	7.77	9.38	2.10
8	Des Plaines River	8.17	8.93	2.65
20	Illinois River	6.27	7.70	3.43
23	Illinois River	5.87	7.42	3.67
30	Illinois River	5.86	7.41	3.27
39	Illinois River	5.74	7.20	4.26
APRIL				
	Stickney WRP Effluent*	6.76	8.70	2.23
1	Chicago Sanitary and Ship Canal	4.01	7.51	3.36
4	Des Plaines River	3.26	7.42	3.62
8	Des Plaines River	2.99	8.41	4.36
20	Illinois River	7.75	5.19	3.85
23	Illinois River	7.80	5.20	4.00
30	Illinois River	7.15	4.93	4.21
39	Illinois River	6.73	6.13	4.24
MAY				
	Stickney WRP Effluent*	4.92	6.79	1.78
1	Chicago Sanitary and Ship Canal	6.40	9.72	2.19
4	Des Plaines River	6.06	10.44	2.26
8	Des Plaines River	5.60	9.63	2.34
20	Illinois River	6.48	8.41	3.80
23	Illinois River	6.45	8.43	4.00
30	Illinois River	6.47	7.22	4.04
39	Illinois River	5.87	7.38	4.39
JUNE				
	Stickney WRP Effluent*	6.55	10.11	0.99
1	Chicago Sanitary and Ship Canal	5.08	9.85	0.94
4	Des Plaines River	5.53	11.06	1.73
8	Des Plaines River	5.08	10.78	1.61
20	Illinois River	5.22	9.00	4.88
23	Illinois River	5.25	8.97	5.25
30	Illinois River	5.13	9.36	6.23
39	Illinois River	4.75	9.18	5.98

ADDENDUM TABLE A-1 (Continued): NITRATE ISOTOPE DATA AT STATIONS 1, 4, 8, 20, 23, 30, AND 39 ALONG THE ILLINOIS WATERWAY DURING MARCH THROUGH OCTOBER 2006

Station No.	Waterway	NO3-N (mg/L)	$\delta^{15}N$ NO_3	$\delta^{18}O$ NO_3
JULY				
	Stickney WRP Effluent*	6.17	5.82	-0.08
1	Chicago Sanitary and Ship Canal	4.55	7.28	0.29
4	Des Plaines River	5.34	9.37	1.42
8	Des Plaines River	4.12	9.27	0.47
20	Illinois River	4.30	10.46	4.41
23	Illinois River	4.06	10.29	4.61
30	Illinois River	3.98	10.92	5.19
39	Illinois River	3.08	11.28	4.66
AUGUST				
	Stickney WRP Effluent*	8.56	7.21	0.10
1	Chicago Sanitary and Ship Canal	4.48	8.11	0.61
4	Des Plaines River	5.08	8.30	0.76
8	Des Plaines River	3.96	8.71	1.26
20	Illinois River	3.21	10.38	3.12
23	Illinois River	3.36	10.41	3.22
30	Illinois River	3.02	10.44	2.99
39	Illinois River	2.61	10.91	2.90
SEPTEMBER				
	Stickney WRP Effluent*	9.39	10.45	0.37
1	Chicago Sanitary and Ship Canal	4.23	7.90	-0.53
4	Des Plaines River	3.28	8.61	-0.25
8	Des Plaines River	3.56	8.71	-0.48
20	Illinois River	3.53	9.50	3.03
23	Illinois River	3.39	9.68	2.95
30	Illinois River	3.01	9.73	3.70
39	Illinois River	3.09	9.39	4.43
OCTOBER				
	Stickney WRP Effluent*	11.58	9.03	0.47
1	Chicago Sanitary and Ship Canal	5.48	9.76	0.65
4	Des Plaines River	5.76	9.75	0.72
8	Des Plaines River	5.52	9.80	0.85
20	Illinois River	3.99	9.92	2.55
23	Illinois River	3.95	9.95	2.16
30	Illinois River	4.74	9.90	1.82
39	Illinois River	3.49	9.81	2.64

*Grab sample taken from the outfall at the Stickney Water Reclamation Plant.