RESEARCH AND DEVELOPMENT DEPARTMENT

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CONTINUOUS DISSOLVED OXYGEN MONITORING IN CHICAGO AREA WADEABLE STREAMS DURING 2005

November 2006

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CONTINUOUS DISSOLVED OXYGEN MONITORING IN CHICAGO AREA WADEABLE STREAMS DURING 2005

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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 AND CONCLUSIONS

Summary

More than 30 years ago, the Metropolitan Water Reclamation District of Greater Chicago (District) determined that applicable dissolved oxygen (DO) standards for deep draft navigable waterways in the Chicago area could not be maintained exclusively by improving the effluent quality from the three major District Water Reclamation Plants (WRPs) and by capturing and treating combined sewer overflows (CSOs).

In order to provide supplemental aeration, the District constructed and operated two diffused air instream aeration stations and five sidestream elevated pool aeration (SEPA) stations in Chicago area waterways. In August 1996, the District began planning a comprehensive DO monitoring study to identify reaches in the Chicago Waterway System where the DO concentration is less than the applicable Illinois Pollution Control Board (IPCB) water quality standards.

Initially, 20 stations were selected for monitoring from Wilmette, Illinois, on the North Shore Channel to the Lockport Powerhouse and Lock on the Chicago Sanitary and Ship Canal, using continuous water quality monitors, Models 6600 and 6920 manufactured by YSI Incorporated (YSI), Yellow Springs, Ohio. This monitoring was extended further downstream to Jefferson Street in Joliet, Illinois, on the Des Plaines River beginning in March 2000. Additional stations were added to the DO monitoring network in August 2001 in order to monitor the Calumet River System.

The present wadeable streams continuous DO monitoring report includes hourly DO values measured at 12 stations. In the Chicago River System, one monitoring station was located at Central Park Avenue on the North Branch Chicago River. Eight stations were located in the Des Plaines River System, including four stations on the Des Plaines River (Devon Avenue, Irving Park Road, Ogden Avenue, and Material Service Road), and four stations on Salt Creek (Busse Lake Dam, J. F. Kennedy Boulevard, Thorndale Avenue, and Wolf Road). Three stations were located in the Calumet River System, including one station at Hohman Avenue on the Grand Calumet River and two stations on the Little Calumet River (Wentworth Avenue and Ashland Avenue).

Conclusions

Chicago River System. The results of the continuous DO monitoring conducted in wadeable streams in the Chicago River System at Central Park Avenue during 2005 indicated the following:

1. Four measurements of supersaturated DO concentrations were recorded, which is only 0.1 percent of the total number of DO measurements between July and December.

2. Hourly DO concentrations at or near zero were recorded eight times (0.2 percent).

3. Ninety-four percent of the DO measurements were above the IPCB DO standard.

Des Plaines River System. The results of the continuous DO monitoring conducted in wadeable streams in the Des Plaines River System during 2005 indicated the following:

1. A total of 1,445 incidents of DO supersaturation occurred including 110 (6.9 percent) at Devon Avenue, 233 (5.7 percent) at Ogden Avenue, and 414 (40.2 percent) at Material Service Road on the Des Plaines River, and 150 (9.7 percent) at Busse Lake Dam, 101 (2.5 percent) at J. F. Kennedy Boulevard, 205 (5.0 percent) at Thorndale Avenue, and 232 (5.5 percent) at Wolf Road on Salt Creek, possibly due to oxygen produced by algae during daylight hours.

2. Hourly DO concentrations at or near zero were recorded 19 times (0.5 percent) at Irving Park Road on the Des Plaines River.

3. Three stations recorded DO concentrations above the applicable IPCB standards at all times. These stations were Devon Avenue and Material Service Road on the Des Plaines River and Busse Lake Dam on Salt Creek.

4. One station was above the applicable IPCB DO Standard at least 99 percent but less than 100 percent of the time. This station was Ogden Avenue on the Des Plaines River.

5. The DO concentrations were above the IPCB DO standard at least 90 percent but less than 99 percent of the time at three stations on Salt Creek, including J. F. Kennedy Boulevard, Thorndale Avenue, and Wolf Road.

6. The DO concentrations at Irving Park Road on the Des Plaines River were above the IPCB DO standard 72.5 percent of the time.

Calumet River System. The results of the continuous DO monitoring conducted in wadeable streams in the Calumet River System during 2005 indicated the following:

1. A total of 337 incidents of DO supersaturation occurred including 4 (0.2 percent) at Hohman Avenue on the Grand Calumet River, and 9 (0.3 percent) at Wentworth Avenue and 324 (3.7 percent) at Ashland Avenue on the Little Calumet River, possibly due to oxygen produced by algae during daylight hours.

2. Hourly DO concentrations at or near zero were recorded for a total of 710 times at three stations, 526 times (31.3 percent) at Hohman Avenue on the Grand Calumet River, and 84 times (2.4 percent) at Wentworth Avenue and 100 times (1.1 percent) at Ashland Avenue on the Little Calumet River.

3. All three monitoring stations were maintaining DO concentrations above the applicable DO standard less than 70 percent of the time. Those stations were Hohman Avenue on the Grand Calumet River, and Ashland Avenue and Wentworth Avenue on the Little Calumet River.

The database resulting from the operation of the continuous DO monitors has been an important source of information for determining the DO levels in a complex, urbanized waterway system. This information will be useful in the future for determining the need and location for additional supplemental aeration capacity, understanding the temporal and transient impacts of CSOs, and assessing the effects of diurnal DO fluctuations on stream biota.

INTRODUCTION

The Chicago Waterway System (CWS) consists of 78 miles of canals, which serve the Chicago area for two principal purposes, the drainage of urban storm water runoff and treated municipal wastewater effluent and the support of commercial navigation. Approximately 75 percent of the length is composed of man-made canals where no waterway existed previously and the remainder is composed of natural streams that have been deepened, straightened and/or widened to such an extent that reversion to the natural state is not possible. The flow of water in the CWS is artificially controlled by hydraulic structures. The CWS has two river systems, the Calumet River System and the Chicago River System (Lanyon, 2002).

Over the years, increased pollutant loading from urbanization throughout the Chicago metropolitan area and low stream velocities in Chicago area deep-draft waterways have caused dissolved oxygen (DO) concentrations to fall below DO standards established by the Illinois Pollution Control Board (IPCB). More than 30 years ago, the District determined that applicable IPCB DO standards for Chicago area waterways could not be met exclusively by advanced wastewater treatment at its three major regional water reclamation plants (WRPs), Calumet, North Side, and Stickney, and by the capture and treatment of combined sewer overflows (CSOs). In order to increase the DO concentration in the Chicago and Calumet River Systems, the District designed and constructed artificial aeration systems (instream diffuser and sidestream elevated pool aeration SEPA stations) during the late 1970s and early 1990s, respectively.

From October 1994 through May 1996, the Research and Development Department (R&D) conducted weekly DO surveys in the Chicago River System. Water samples were collected manually, chemically fixed in the field, and returned to the laboratory for titration. The results from these surveys showed that DO concentrations in selected waterway reaches were less than IPCB DO standards applicable to these reaches.

In August 1996, R&D began developing a comprehensive field-monitoring program in order to locate and identify reaches in the Chicago River System where the DO concentration is less than the applicable IPCB DO standard. Initially, the program was to focus on the Chicago River System for a two-year period. Subsequently, the scope of the monitoring program was extended to four years, and the study area was expanded to include the Calumet River System for the latter two years. The resulting data have been used for the calibration and verification of a water quality model for the CWS.

Monitoring results for the CWS have been summarized by: (1) Polls (2002) from August 1998 through July 2000, (2) Dennison et al. (2004) from August 2000 through December 2001, (3) Dennison et al. (2004) from January 2002 through December 2002 (Chicago River System), and from August 2001 through December 2002 (Calum

MONITORING STATIONS

The CDOM Program and the Ambient Water Quality Monitoring (AWQM) Program supply the District with water quality data throughout the year for both the wadeable streams and deep-draft waterways within its jurisdiction. All stations for both programs are shown in Figure 1. In July of 2005, 11 new wadeable stream monitoring stations were added to the CDOM program. A station at Central Park Avenue on the North Branch Chicago River was added in the Chicago River System. Stations at Devon Avenue, Irving Park Road, Ogden Avenue, and Material Service Road on the Des Plaines River, and Busse Lake Dam, JFK Boulevard, Thorndale Avenue, and Wolf Road on Salt Creek, were added in the Des Plaines River System. Stations at Hohman Avenue on the Grand Calumet River and Wentworth Avenue on the Little Calumet River were added in the Calumet River System. D

FIGURE 1: CONTINUOUS DISSOLVED OXYGEN MONITORING (CDOM) AND AMBIENT WATER QUALITY MONITORING (AWQM) SAMPLE STATIONS

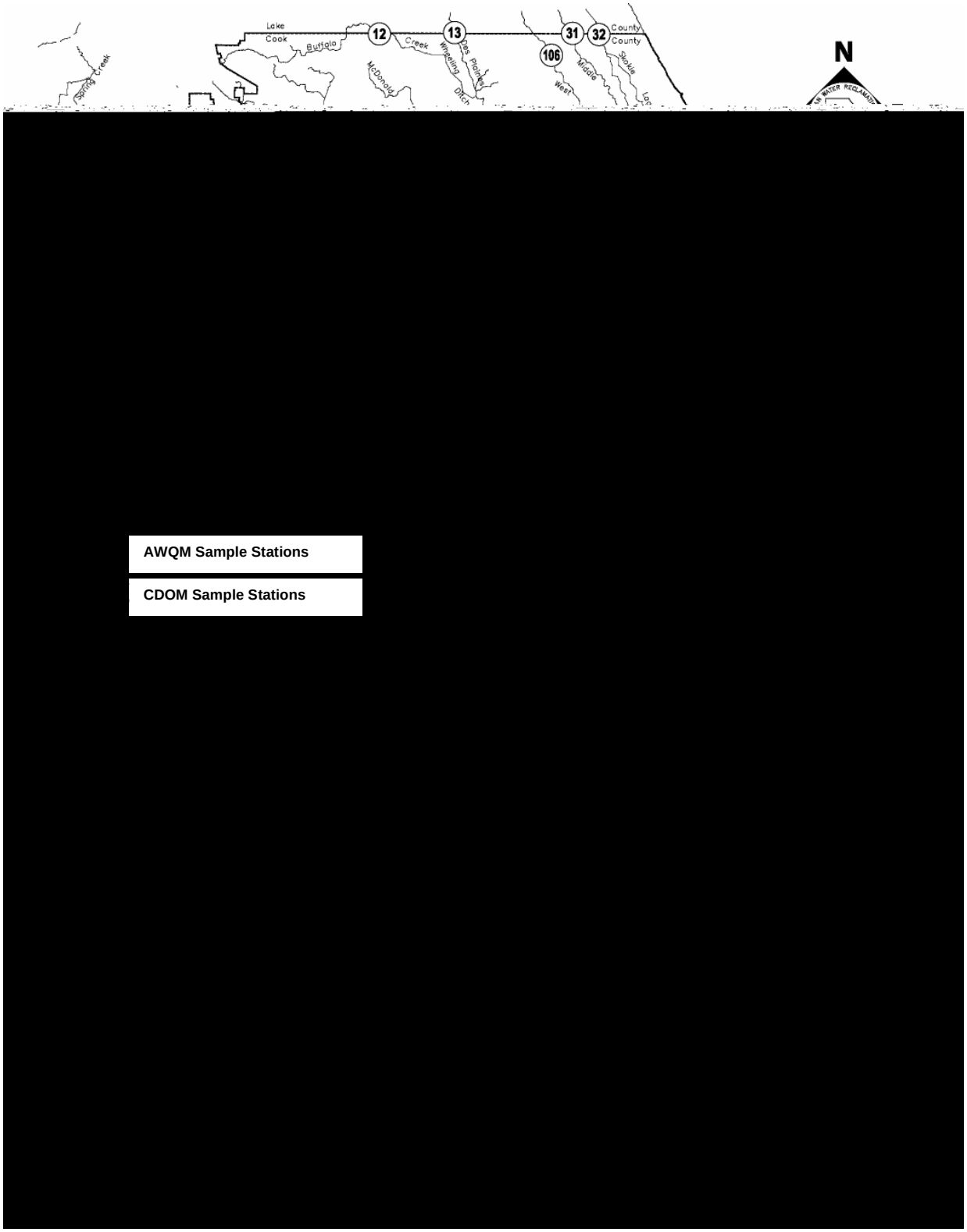


TABLE 1: WADEABLE STREAM CONTINUOUS DISSOLVED OXYGEN MONITORING STATIONS

Monitoring Station	Waterway	Description of Monitoring Station
	Chicago River System	
Central Park Avenue	North Branch Chicago River	0.8 mile above junction with North Shore

TABLE 1 (Continued): WADEABLE STREAM CONTINUOUS DISSOLVED OXYGEN MONITORING STATIONS

Monitoring Station	Waterway	Description of Monitoring Station
	Des Plaines River System (Continued)	
Thorndale Avenue	Salt Creek	2.6 miles below Egan WRP outfall; water quality monitor on southeast side of Thorndale Avenue bridge, 2 feet below water surface.
Wolf Road	Salt Creek	8.0 miles above junction with Des Plaines River; water quality monitor on northwest side of Wolf Road bridge, 1 foot below water surface.
	Calumet River System	
Hohman Avenue	Grand Calumet River	3.1 miles above junction with Calumet River; water quality monitor on southeast side of Hohman Avenue bridge, 1 foot below water surface.
Wentworth Avenue	Little Calumet River	12.4 miles above junction with Calumet-Sag Channel; water quality monitor on center of east side of Wentworth Avenue bridge, 2 feet below water surface.
Ashland Avenue	Little Calumet River	0.5 mile above junction with Calumet-Sag Channel; water quality monitor attached to east side Ashland Avenue bridge, 2 feet below water surface.

MATERIALS AND METHODS

Water Quality Monitor

In the present study, DO was measured hourly

After careful review of the DO data, weekly summary statistics (mean, minimum, maximum, and percent observations above DO standard), and individual line drawings for each monitoring station showing hourly DO concentrations were prepared.

Verification of Representative Data

During the spring, summer, and fall of 2005, cross-sectional DO surveys were conducted in the CWS to determine if a fixed continuous monitoring location represented the DO concentration across the waterway. Verification was achieved by comparing the DO concentrations measured in grab samples at multiple fixed locations and depths across the waterway with the fixed monitor measurements. The results from the cross-sectional surveys clearly showed that the differences across the waterway were minimal and equivalent to the DO concentration measured by the monitor at the fixed locations.

RESULTS AND DISCUSSION

The annual minimum, maximum, and mean DO concentrations measured at all 12 stations during 2005 are shown in Table 2.

The number and percent of measured DO concentrations rejected and removed from the Access® database following review during 2005 are summarized in Table 3. Based on the data review methodology previously described, 7.2 percent of the data were rejected. The number of DO concentrations rejected ranged from none to a high of 59.1 percent at Hohman Avenue on the Grand Calumet River.

The number and percent of DO concentrations above the applicable IPCB DO standard for each waterway during 2005 are presented in Table 4. The DO data shown in Table 4 do not include the DO concentrations rejected during the data review.

TABLE 2: MINIMUM, MAXIMUM, AND MEAN HOURLY DISSOLVED OXYGEN CONCENTRATIONS[1]

Monitoring Station	Waterway	DO Concentration (mg/L) Minimum	Maximum	Mean
	Chicago River System			
Central Park Avenue	North Branch Chicago River	0.0	14.1	8.0
	Des Plaines River System			
Devon Avenue	Des Plaines River	6.2	15.3	11.4
Irving Park Road	Des Plaines River	0.2	14.3	7.2
Ogden Avenue	Des Plaines River	4.6	16.3	9.1
Material Service Road	Des Plaines River	6.6	19.1	12.4
Busse Lake Dam	Salt Creek	8.4	13.9	12.1
J. F. Kennedy Boulevard	Salt Creek	3.4	13.0	7.6
Thorndale Avenue	Salt Creek	3.8	12.4	7.9
Wolf Road	Salt Creek	3.3	16.1	8.5
	Calumet River System			
Hohman Avenue	Grand Calumet River	0.0	11.5	2.6
Wentworth Avenue	Little Calumet River	0.0	12.4	4.9
Ashland Avenue	Little Calumet River	0.0	18.7	7.1

[1]Dissolved oxygen was measured hourly using a YSI Model 6920 or Model 6600 continuous water quality monitor.

TABLE 3: NUMBER AND PERCENT OF DISSOLVED OXYGEN VALUES NOT MEETING ACCEPTANCE CRITERIA[1]

Monitoring Station	Waterway	Number of DO Values Rejected	Percent of DO Values Rejected
	Chicago River System		
Central Park Avenue	North Branch Chicago River	0	0.0
	Des Plaines River System		

TABLE 4: NUMBER AND PERCENT OF DISSOLVED OXYGEN VALUES MEASURED ABOVE THE ILLINOIS POLLUTION CONTROL BOARD'S WATER QUALITY STANDARD[1]

Monitoring Station	Waterway	IPCB DO Standard	Number of DO Values	Number Above Standard	Percent Above Standard
	Chicago River System				
Central Park Avenue	North Branch Chicago River	5	4,285	4,029	94.0
	Des Plaines River System				
Devon Avenue	Des Plaines River	5	1,594	1,594	100.0
Irving Park Road	Des Plaines River	5	4,120	2,985	72.5
Ogden Avenue	Des Plaines River	5	4,122	4,108	99.7
Material Service Road	Des Plaines River	5	1,029	1,029	100.0
Busse Lake Dam	Salt Creek	5	1,547	1,547	100.0
J. F. Kennedy Boulevard	Salt Creek	5	4,058	3,764	92.8
Thorndale Avenue	Salt Creek	5	4,135	3,834	92.7
Wolf Road	Salt Creek	5	4,247	4,022	94.7
	Calumet River System				
Hohman Avenue	Grand Calumet River	5	1,683	270	16.0
Wentworth Avenue	Little Calumet River	5	3,527	1,575	44.7

TABLE 5: PERCENT OF DISSOLVED OXYGEN VALUES IN SELECTED RANGES

Monitoring Station	Waterway	Percent of DO Values in Range (mg/L) <1	1-2	2-3	3-4	4-5	>5
	Chicago River System						
Central Park Avenue	North Branch Chicago River	<1	<1	<1	1	4	94
	Des Plaines River System						
Devon Avenue	Des Plaines River	0	0	0	0	0	100
Irving Park Road	Des Plaines River	<1	2	5	8	12	73
Ogden Avenue	Des Plaines River	0	0	0	0	<1	>99
Material Service Road	Des Plaines River	0	0	0	0	0	100
Busse Lake Dam	Salt Creek	0	0	0	0	0	100
J. F. Kennedy Boulevard	Salt Creek	0	0	0	<1	7	93
Thorndale Avenue	Salt Creek	0	0	0	<1	7	93
Wolf Road	Salt Creek	0	0	0	<1	5	95
	Calumet River System						
Hohman Avenue	Grand Calumet River	31	20	15	9	9	16
Wentworth Avenue	Little Calumet River	2	6	11	19	17	45
Ashland Avenue	Little Calumet River	1	3	11	16	12	58

Chicago River System

North Branch Chicago River. *Central Park Avenue.* From July 6 through December 31, the maximum DO was 14.1 mg/L, the minimum was 0.0 mg/L, and the mean was 8.0 mg/L. The IPCB requires that the DO concentration in the portion of the North Branch Chicago River classified as General Use Waters shall not be less than 5.0 mg/L at any time. Compliance with the IPCB General Use DO standard was 94 percent. DO concentrations below the 5.0 mg/L standard occurred during July, August, September, and November (Figure 2). Only 27 out of 5,625 measurements (<1.0 percent) at Central Park Avenue were below 3.0 mg/L. No DO measurements were rejected.

Des Plaines River System

Des Plaines River. *Devon Avenue.* From October 26 through December 31, the DO ranged from 6.2 to 15.3 mg/L. The mean was 11.4 mg/L. The IPCB requires that the DO concentration in the portion of the Des Plaines River classified as General Use Waters shall not be less than 5.0 mg/L at any time. Compliance with

FIGURE 2: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT CENTRAL PARK AVENUE ON THE NORTH BRANCH CHICAGO RIVER FROM JULY 2005 THROUGH DECEMBER 2005

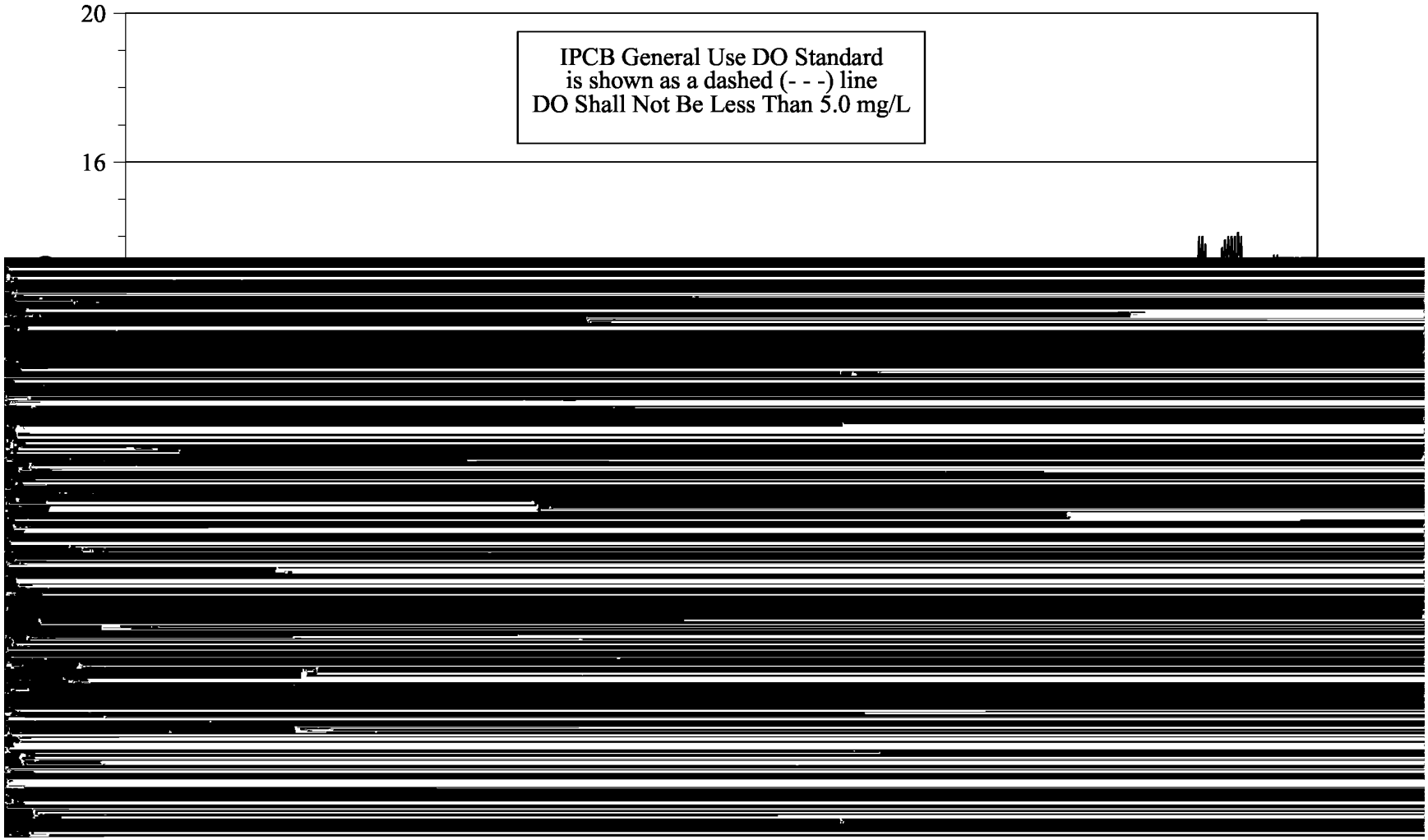


FIGURE 3: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT DEVON AVENUE ON THE DES PLAINES RIVER FROM OCTOBER 2005 THROUGH DECEMBER 2005

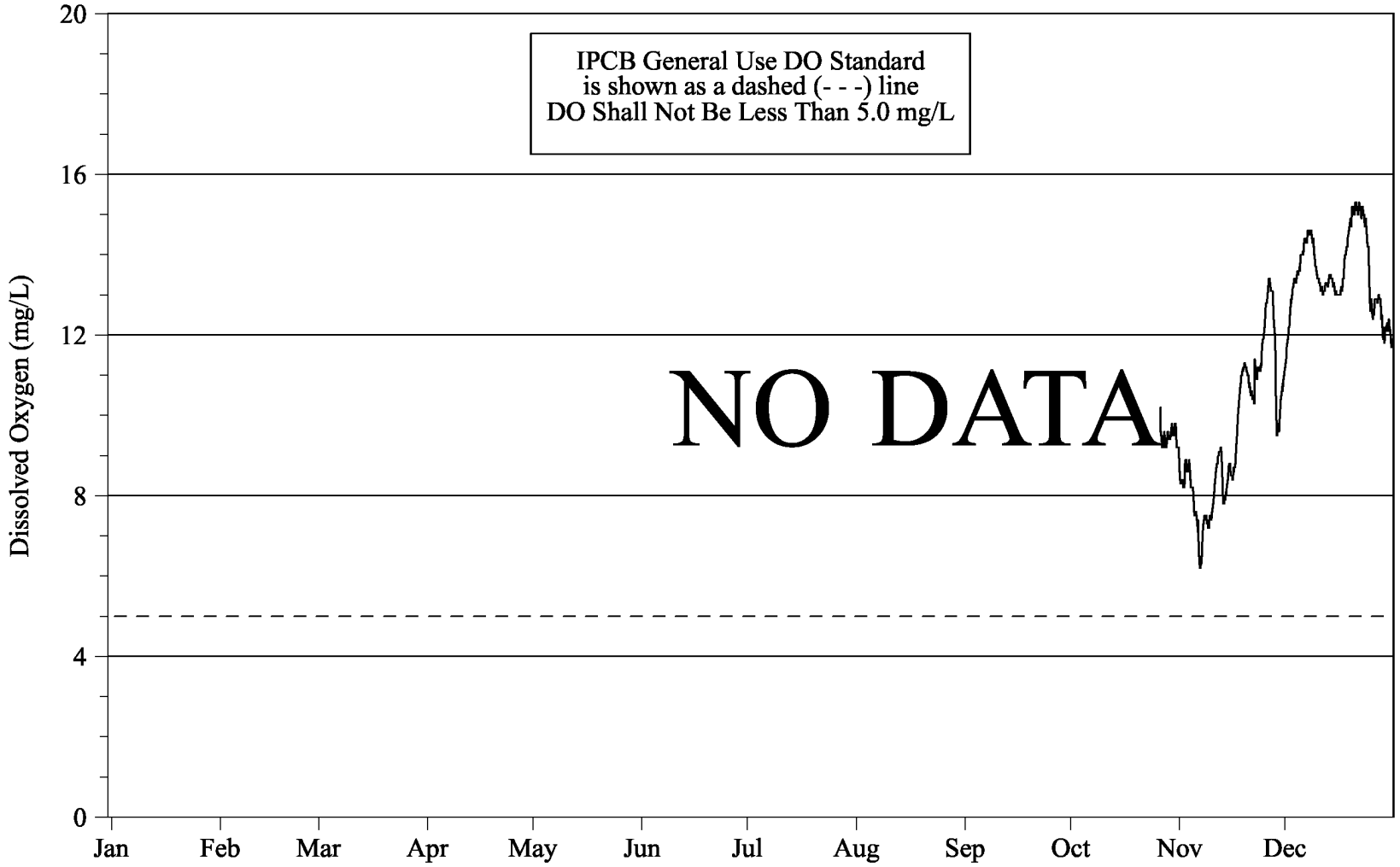


FIGURE 4: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT IRVING PARK ROAD ON THE DES PLAINES RIVER FROM JULY 2005 THROUGH DECEMBER 2005

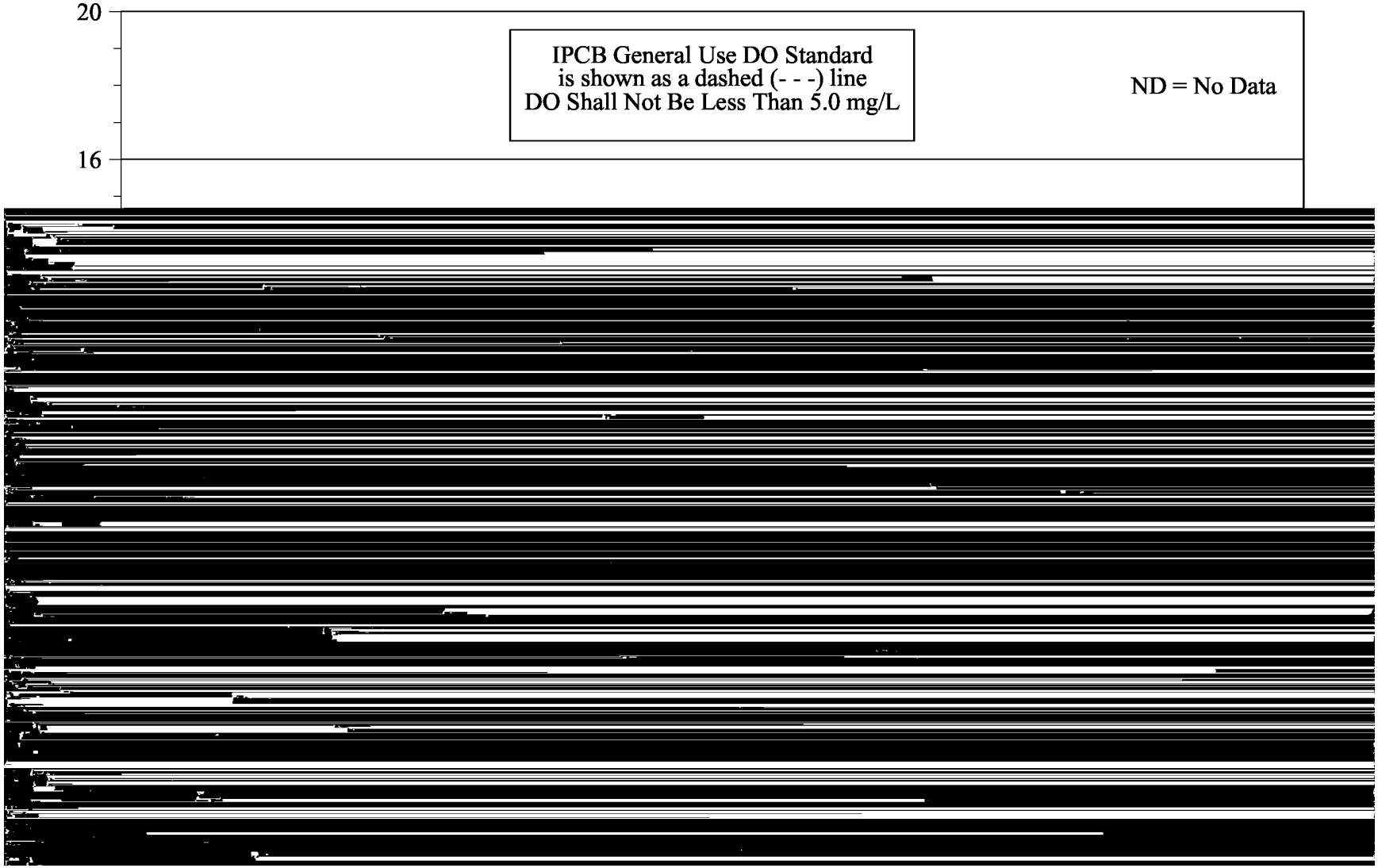


FIGURE 5: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT OGDEN AVENUE ON THE DES PLAINES RIVER FROM JULY 2005 THROUGH DECEMBER 2005

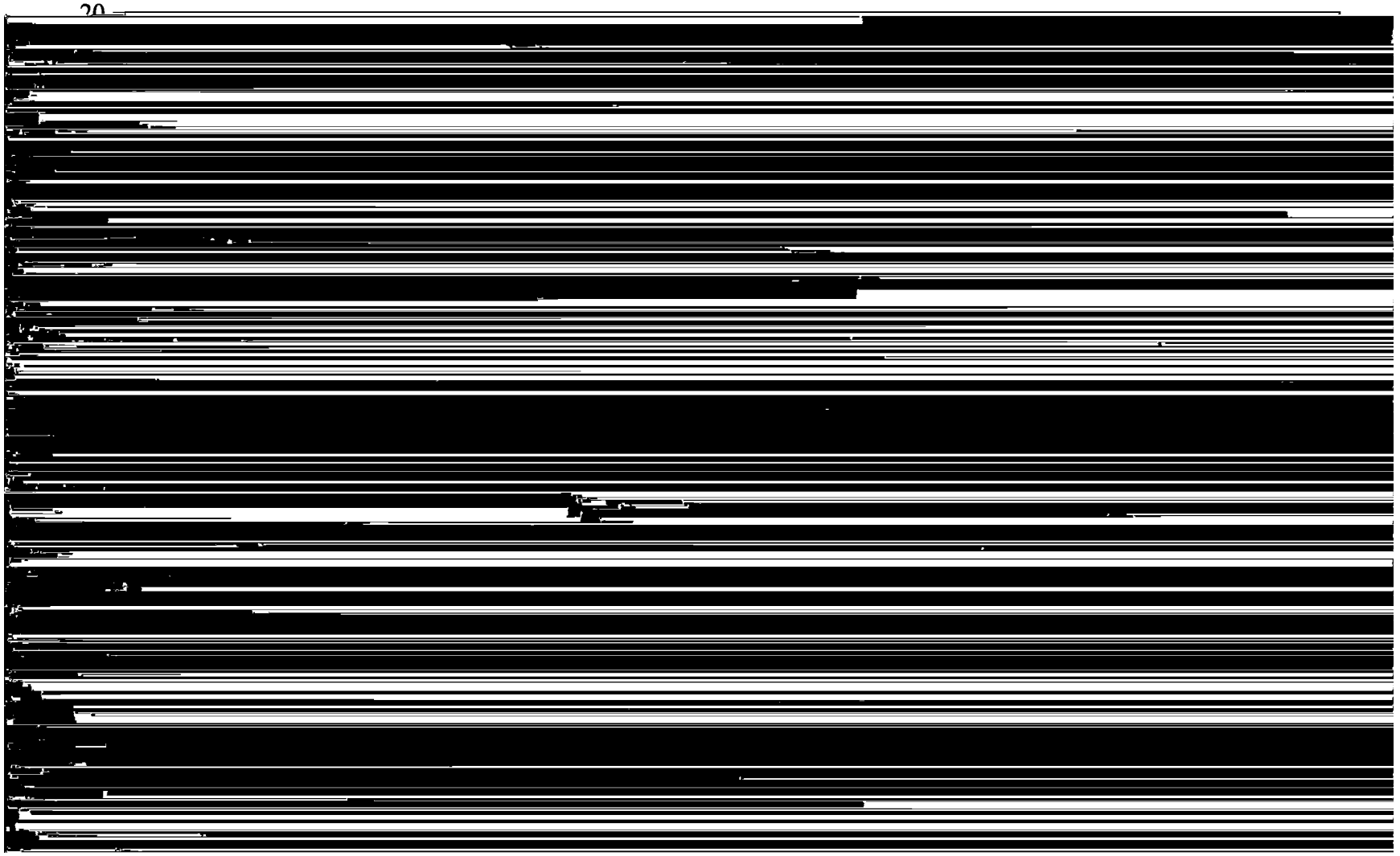


FIGURE 6: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT MATERIAL SERVICE ROAD ON THE DES PLAINES RIVER FROM OCTOBER 2005 THROUGH DECEMBER 2005

Salt Creek. *Busse Lake Dam .* From October 28 through December 31, the DO ranged from 8.4 to 13.9 mg/L. The mean was 12.1 mg/L. The IPCB requires that the DO concentration in the portion of Salt Creek classified as General Use Waters shall not be less than 5.0 mg/L at any time. Compliance with the IPCB General Use DO standard was 100 percent. There was no

FIGURE 7: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT BUSSE LAKE DAM ON SALT CREEK FROM OCTOBER 2005 THROUGH DECEMBER 2005

FIGURE 8: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT J. F. KENNEDY BOULEVARD ON SALT CREEK FROM JULY 2005 THROUGH DECEMBER 2005

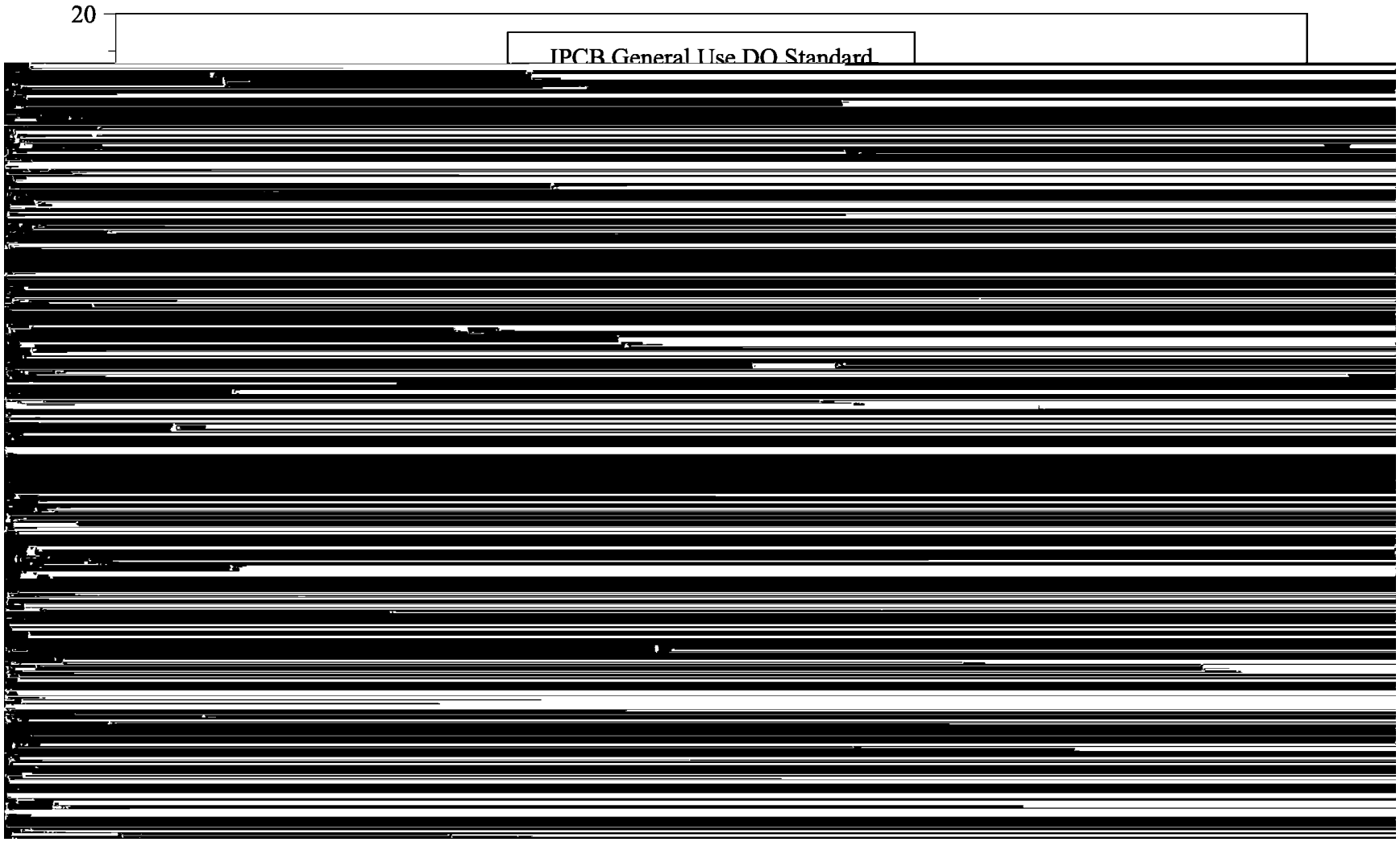


FIGURE 9: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT THORNDALE AVENUE ON SALT CREEK FROM JULY 2005 THROUGH DECEMBER 2005

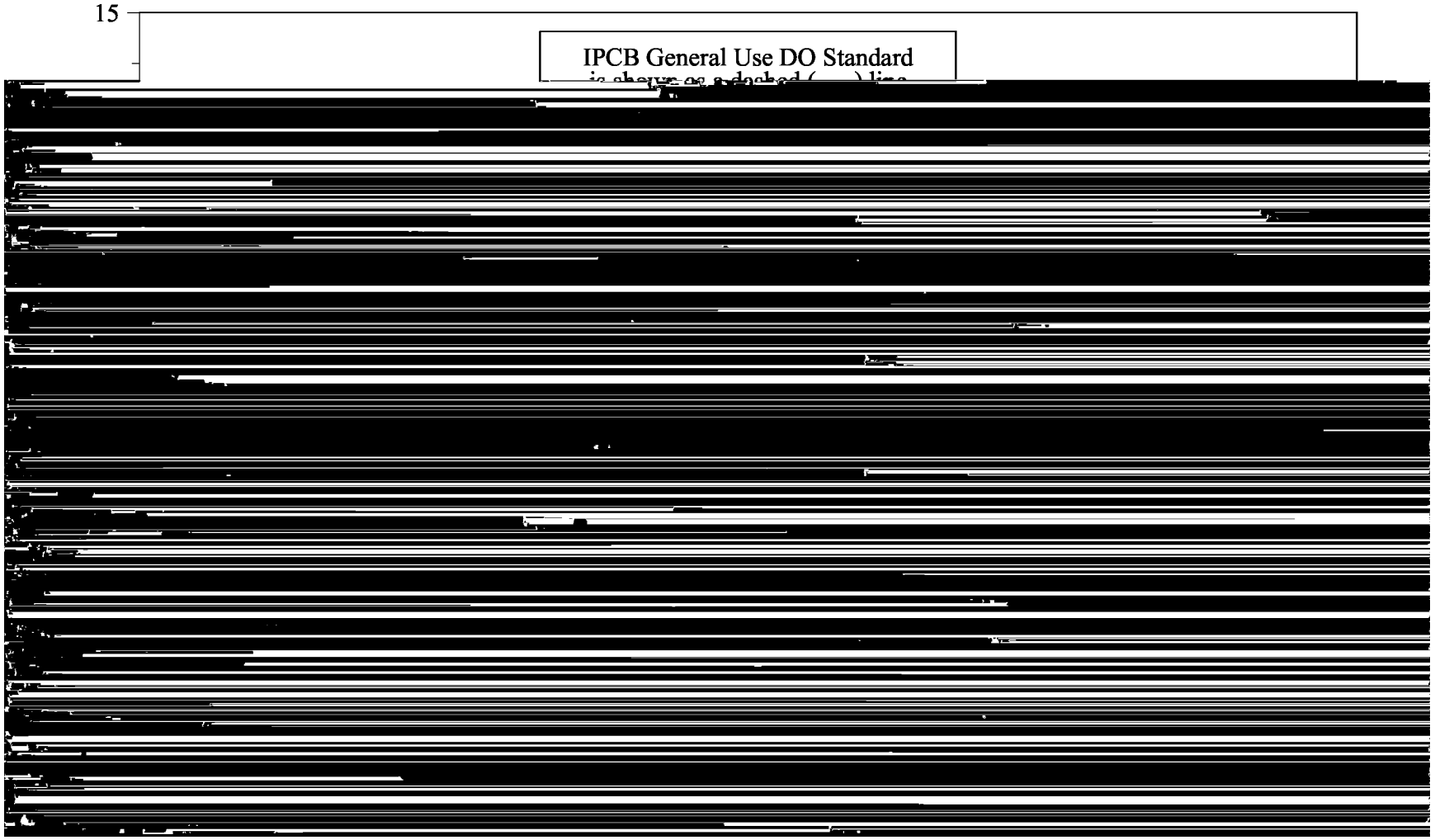
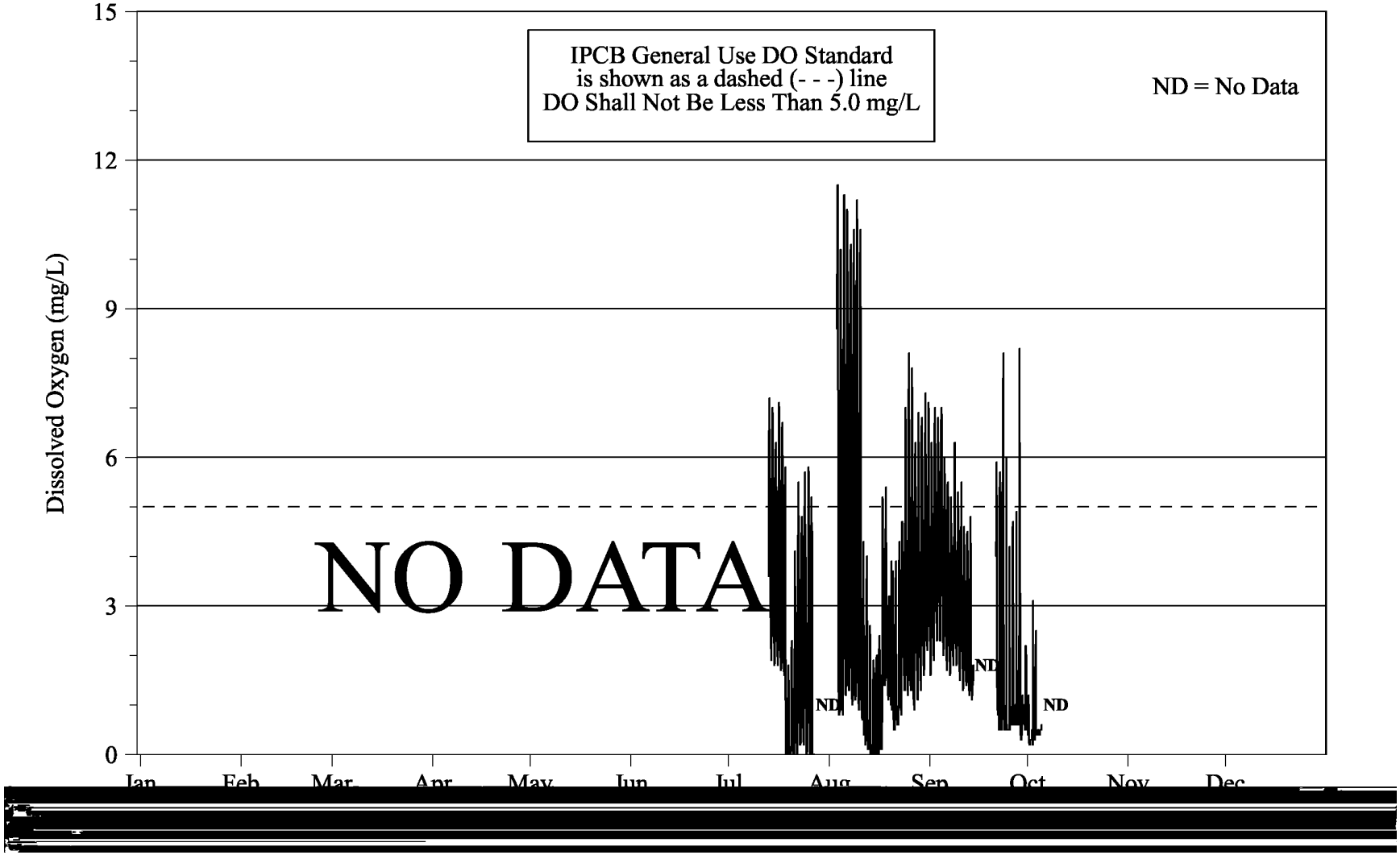


FIGURE 11: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT HOHMAN AVENUE ON THE GRAND CALUMET RIVER FROM JULY 2005 THROUGH DECEMBER 2005



Little Calumet River. *Wentworth Avenue.* From July 6 through November 30, the DO ranged from 0.0 to 12.4 mg/L. The mean was 4.9 mg/L. The IPCB requires that the DO concentration in the portion of the Little Calumet River classified as General Use Waters shall not be less than 5.0 mg/L at any time. Compliance with the IPCB General Use DO standard was 44.7 percent. DO concentrations below the 5.0 mg/L standard occurred during July, August, September, October, and November (Figure 12). DO concentrations below 3.0 mg/L at Wentworth Avenue accounted for 19.9 percent of all measurements. At this station, 17.7 percent of DO measurements were rejected.

Ashland Avenue. From January 1 through December 31, the maximum DO was 18.7 mg/L, the minimum was 0.0 mg/L, and the mean was 7.1 mg/L. The IPCB requires that the DO concentration in the portion of the Little Calu

FIGURE 12: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT WENTWORTH AVENUE ON THE LITTLE CALUMET RIVER FROM JANUARY 2005 THROUGH DECEMBER 2005

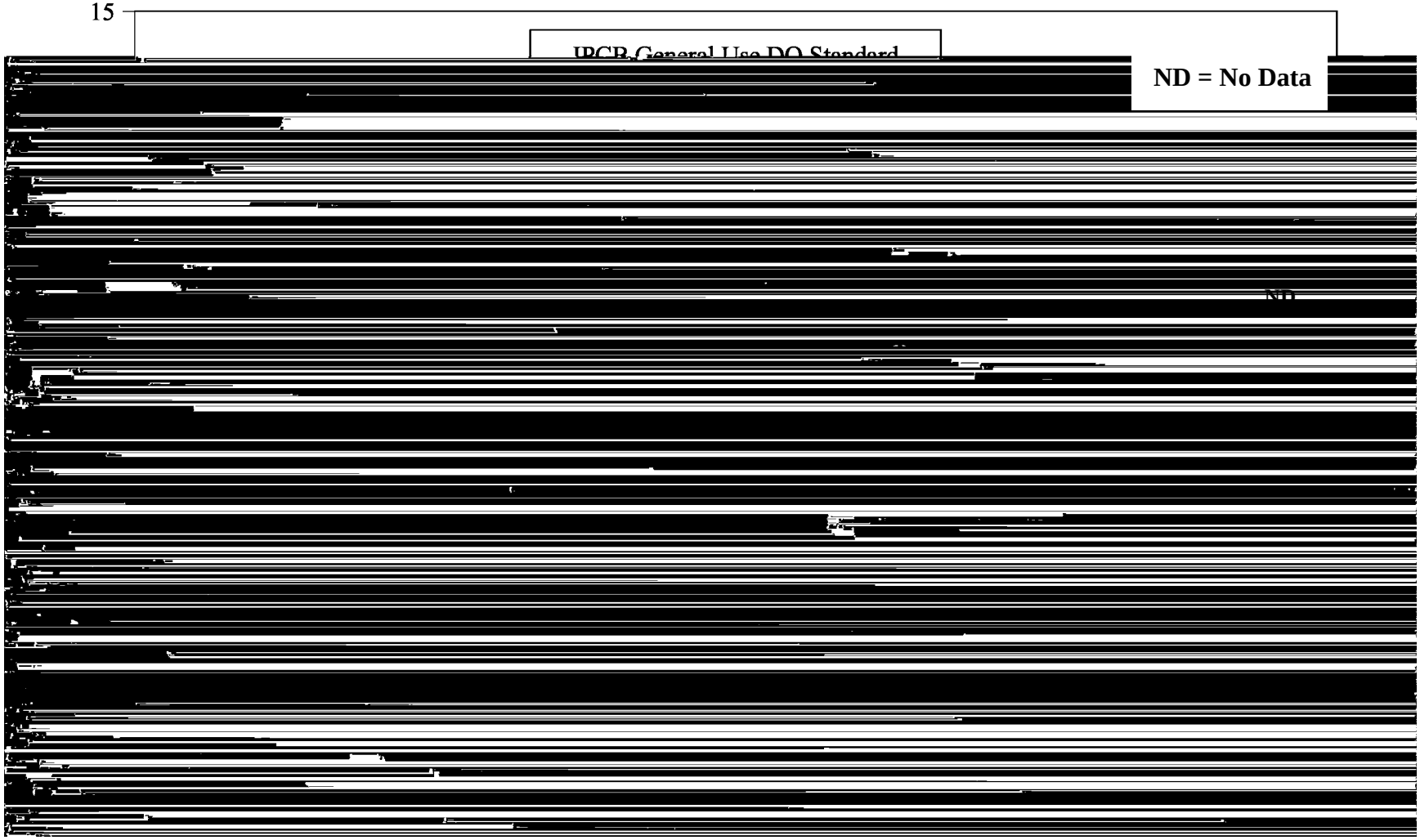
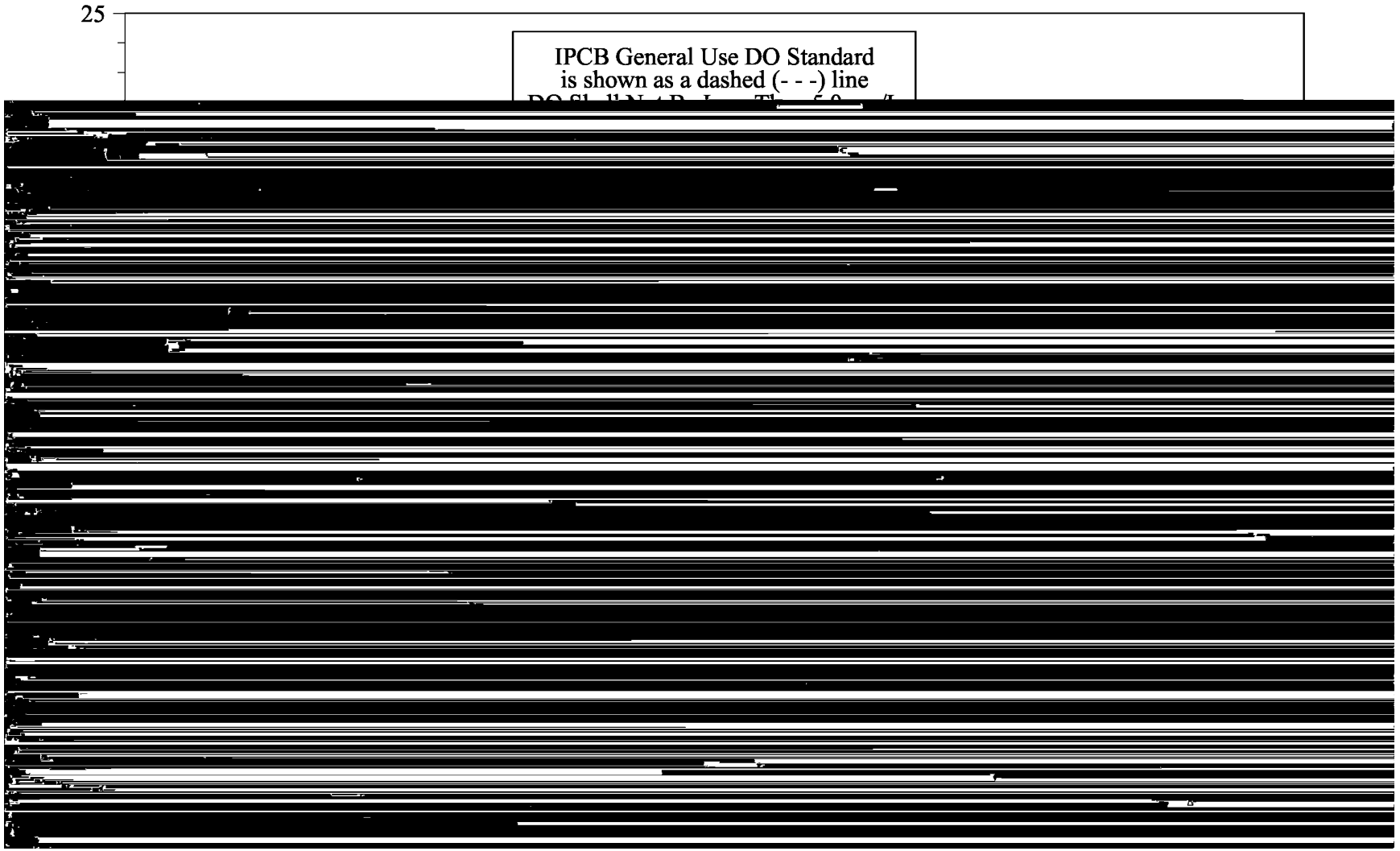


FIGURE 13: DISSOLVED OXYGEN CONCENTRATION MEASURED HOURLY AT ASHLAND AVENUE ON THE LITTLE CALUMET RIVER FROM JULY 2005 THROUGH DECEMBER 2005



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APPENDIX A

WEEKLY DO SUMMARY STATISTICS AT ALL WADEABLE STREAM MONITORING STATIONS DURING 2005

TABLE A-1: WEEKLY DO SUMMARY STATISTICS AT CENTRAL PARK AVENUE ON THE NORTH BRANCH CHICAGO RIVER DURING 2005

TABLE A-2: WEEKLY DO SUMMARY STATISTICS AT DEVON AVENUE ON THE DES PLAINES RIVER DURING 2005

Monitoring Dates	Number of DO Values	DO Concentration (mg/L)			Percent DO Values Above IPCB Standard
		Min	Max	Mean	
10/24/05 - 10/30/05	106	9.2	10.2	9.5	100
10/31/05 -11/06/05	168	6.2	9.7	8.2	100
11/07/05 -11/13/05	168	6.2	9.2	7.9	100
11/14/05 -11/20/05	168	7.9	11.3	9.7	100
11/21/05 - 11/27/05	168	10.3	13.4	11.8	100
11/28/05 - 12/04/05	168	9.5	13.6	11.7	100
12/05/05 - 12/11/05	168	13.0	14.6	13.9	100
12/12/05 - 12/18/05	168	13.0	14.4	13.3	100
12/19/05 - 12/25/05	168	12.5	15.3	14.6	100
12/26/05 - 12/31/05	144	11.7	13.0	12.4	100

TABLE A-3: WEEKLY DO SUMMARY STATISTICS AT IRVING PARK ROAD
ON THE DES PLAINES RIVER DURING 2005

Monitoring Dates	Number of DO Values	DO Concentration (mg/L)			Percent DO Values Above IPCB Standard
		Min	Max	Mean	
07/04/05 - 07/10/05	110	1.0	4.5	2.9	0
07/11/05 - 07/17/05	168	0.5	5.1	2.4	2
07/18/05 - 07/24/05	168	0.2	5.1	3.0	1
07/25/05 - 07/31/05	168	2.1	5.6	3.8	11
08/01/05 - 08/07/05	168	2.6	6.0	4.0	24
08/08/05 - 08/14/05	59	3.1	6.4	4.4	32
08/15/05 - 08/21/05	111	3.2	5.7	4.5	13
08/22/05 - 08/28/05	168	4.1	6.0	5.1	57
08/29/05 - 09/04/05	168	4.5	6.2	5.3	68
09/05/05 - 09/11/05	168	4.2	6.1	5.1	48
09/12/05 - 09/18/05	168	4.2	7.0	5.4	68
09/19/05 - 09/25/05	168	4.7	6.5	5.4	95
09/26/05 - 10/02/05	168	5.1	7.6	6.3	100
10/03/05 - 10/09/05	168	5.1	8.2	6.3	100
10/10/05 - 10/16/05	167	6.6	8.4	7.3	100
10/17/05 - 10/23/05	168	6.9	8.8	7.9	100
10/24/05 - 10/30/05	168	8.1	10.0	9.2	100
10/31/05 - 11/06/05	169	6.2	9.4	8.0	100
11/07/05 - 11/13/05	168	6.1	8.9	7.5	100
11/14/05 - 11/20/05	168	7.1	11.3	9.5	100
11/21/05 - 11/27/05	168	9.3	12.5	11.0	100
11/28/05 - 12/04/05	168	8.6	13.3	11.1	100
12/05/05 - 12/11/05	168	12.4	14.3	13.4	100
12/12/05 - 12/18/05	168	10.9	13.0	12.0	100
12/19/05 - 12/25/05	168	10.3	13.7	12.3	100
12/26/05 - 12/31/05	144	9.3	11.5	10.6	100

TABLE A-5: WEEKLY DO SUMMARY STATISTICS AT MATERIAL SERVICE ROAD ON THE DES PLAINES RIVER DURING 2005

Monitoring Dates	Number of DO Values	DO Concentration (mg/L)			Percent DO Values Above IPCB Standard
		Min	Max	Mean	
10/24/05- 10/30/05	83	10.5	16.2	12.9	100
10/31/05-11/06/05	169	7.9	16.5	11.3	100
11/07/05-11/13/05	168	6.6	13.6	9.6	100
11/14/05-11/20/05	168	9.6	15.5	12.1	100
11/21/05- 11/27/05	167	11.2	19.1	14.5	100
11/28/05- 12/04/05	168	9.7	17.0	12.4	100
12/05/05- 12/11/05	106	14.3	17.8	15.8	100

TABLE A-6: WEEKLY DO SUMMARY STATISTICS AT BUSSE LAKE DAM
ON SALT CREEK DURING 2005

Percent DO

TABLE A-7: WEEKLY DO SUMMARY STATISTICS AT J. F. KENNEDY BOULEVARD ON SALT CREEK DURING 2005

Monitoring Dates	Number of DO Values	DO Concentration (mg/L)			Percent DO Values Above IPCB Standard
		Min	Max	Mean	
07/04/05 - 07/10/05	110	4.3	13.0	8.2	80
07/11/05 - 07/17/05	168	3.4	11.4	6.7	66
07/18/05 - 07/24/05	168	4.0	10.6	6.4	66
07/25/05 - 07/31/05	168	4.7	11.0	7.2	96
08/01/05 - 08/07/05	168	4.3	12.0	7.5	85
08/08/05 - 08/14/05	168	4.5	12.6	7.2	88
08/15/05 - 08/21/05	168	4.8	10.5	7.0	98
08/22/05 - 08/28/05	136	4.6	10.0	6.5	81
08/29/05 - 09/04/05	168	4.8	10.8	7.0	94
09/05/05 - 09/11/05	168	4.6	10.9	7.1	83
09/12/05 - 09/18/05	168	4.4	10.5	6.7	84
09/19/05 - 09/25/05	96	4.5	9.2	6.9	98
09/26/05 - 10/02/05	105	5.4	9.4	7.3	100
10/03/05 - 10/09/05	110	6.2	9.1	7.2	100
10/10/05 - 10/16/05	168	5.5	8.9	6.8	100
10/17/05 - 10/23/05	167	4.2	8.6	6.3	98
10/24/05 - 10/30/05	168	6.0	10.0	7.3	100
10/31/05 - 11/06/05	169	6.1	9.5	7.2	100
11/07/05 - 11/13/05	168	6.7	10.1	7.9	100
11/14/05 - 11/20/05	168	7.2	10.2	8.6	100
11/21/05 - 11/27/05	168	7.0	10.3	8.2	100
11/28/05 - 12/04/05	168	7.5	11.9	10.4	100
12/05/05 - 12/11/05	168	8.0	9.6	8.6	100
12/12/05 - 12/18/05	165	7.2	9.8	8.4	100
12/19/05 - 12/25/05	168	7.6	10.0	8.4	100
12/26/05 - 12/31/05	144	9.4	11.6	10.0	100

TABLE A-8: WEEKLY DO SUMMARY STATISTICS AT THORNDALE AVENUE ON SALT CREEK DURING 2005

Monitoring Dates	Number of DO Values	DO Concentration (mg/L)			Percent DO Values Above IPCB Standard
		Min	Max	Mean	
07/04/05 - 07/10/05	111	4.4	12.3	8.2	86
07/11/05 - 07/17/05	168	3.8	11.9	7.5	74
07/18/05 - 07/24/05	168	3.9	11.8	6.9	71
07/25/05 - 07/31/05	168	4.1	12.4	7.4	77
08/01/05 - 08/07/05	168	4.2	12.3	7.7	79
08/08/05 - 08/14/05	168	4.4	12.3	7.2	86
08/15/05 - 08/21/05	168	4.5	10.5	7.0	94
08/22/05 - 08/28/05	115	4.7	10.2	6.9	88
08/29/05 - 09/04/05	168	4.8	11.2	7.3	91
09/05/05 - 09/11/05	167	4.6	11.4	7.3	79
09/12/05 - 09/18/05	167	4.4	11.3	7.3	89
09/19/05 - 09/25/05	140	5.3	10.6	7.2	100
09/26/05 - 10/02/05	109	6.3	10.8	8.0	100
10/03/05 - 10/09/05	168	6.1	10.0	7.6	100
10/10/05 - 10/16/05	159	5.6	10.5	7.3	100
10/17/05 - 10/23/05	168	5.3	10.5	7.1	100
10/24/05 - 10/30/05	168	6.1	11.3	7.7	100
10/31/05 - 11/06/05	169	5.6	10.3	7.1	100
11/07/05 - 11/13/05	168	6.7	10.6	8.1	100
11/14/05 - 11/20/05	168	6.8	11.1	8.7	100
11/21/05 - 11/27/05	168	7.1	10.5	8.2	100
11/28/05 - 12/04/05	168	7.1	12.1	10.3	100
12/05/05 - 12/11/05	168	8.3	10.2	9.1	100
12/12/05 - 12/18/05	168	8.2	10.5	9.0	100
12/19/05 - 12/25/05	166	7.7	10.5	8.9	100
12/26/05 - 12/31/05	144	9.4	12.1	10.2	100

TABLE A-9: WEEKLY DO SUMMARY STATISTICS AT WOLF ROAD
ON SALT CREEK DURING 2005

TABLE A-10: WEEKLY DO SUMMARY STATISTICS AT HOHMAN AVENUE
ON THE GRAND CALUMET RIVER DURING 2005

Monitoring Dates	Number of DO Values	DO Concentration (mg/L)			Percent DO Values Above IPCB Standard
		Min	Max	Mean	
07/11/05- 07/17/05	110	1.7	7.2	4.1	39
07/18/05- 07/24/05	168	0.0	5.8	1.6	5
07/25/05- 07/31/05	59	0.0	5.8	1.7	7
08/01/05- 08/07/05	109	0.8	11.5	5.4	49
08/08/05- 08/14/05	168	0.0	11.2	2.7	19
08/15/05- 08/21/05	168	0.0	5.4	1.7	2
08/22/05- 08/28/05	168	0.6	8.1	3.0	18
08/29/05- 09/04/05	168	1.3	7.3	4.0	32
09/05/05- 09/11/05	168	1.3	6.3	3.2	13
09/12/05- 09/18/05	59	1.1	4.8	2.2	0
09/19/05- 09/25/05	110	0.5	8.1	1.8	14
09/26/05- 10/02/05	168	0.2	8.2	1.1	3
10/03/05- 10/09/05	60	0.3	2.5	0.5	0

TABLE A-12: WEEKLY DO SUMMARY STATISTICS AT ASHLAND AVENUE
ON THE LITTLE CALUMET RIVER DURING 2005

Monitoring Dates	Number of DO Values	DO Concentration (mg/L)			Percent DO Values Above IPCB Standard
		Min	Max	Mean	
01/01/05 - 01/02/05	48	9.4	11.5	10.3	100
01/03/05 - 01/09/05	168	10.8	12.9	12.3	100
01/10/05 - 01/16/05	166	10.7	12.9	11.9	100
01/17/05 - 01/23/05	168	11.7	13.0	12.4	100
01/24/05 - 01/30/05	168	10.8	12.5	11.7	100
01/31/05 - 02/06/05	168	10.5	11.3	10.9	100
02/07/05 - 02/13/05	168	10.6	13.4	11.7	100
02/14/05 - 02/20/05	168	10.7	12.8	11.8	100
02/21/05 - 02/27/05	168	11.1	13.7	12.5	100
02/28/05 - 03/06/05	168	10.3	13.0	11.7	100
03/07/05 - 03/13/05	168	9.4	15.0	12.0	100
03/14/05 - 03/20/05	168	10.2	18.7	14.1	100
03/21/05 - 03/27/05	168	10.3	18.3	13.1	100
03/28/05 - 04/03/05	168	6.9	15.0	10.8	100
04/04/05 - 04/10/05	167	6.1	12.7	8.8	100
04/11/05 - 04/17/05	1/05	8.8		100	45.9(168

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TABLE A-12 (Continued): WEEKLY DO SUMMARY STATISTICS AT ASHLAND AVENUE ON THE LITTLE CALUMET RIVER DURING 2005

Monitoring Dates	Number of DO Values	DO Concentration (mg/L)			Percent DO Values Above IPCB Standard
		Min	Max	Mean	
08/01/05 - 08/07/05	168	1.1	7.2	3.9	27
08/08/05 - 08/14/05	168	0.8	5.9	3.3	11
08/15/05 - 08/21/05	168	1.6	4.2	3.1	0
08/22/05 - 08/28/05	167	2.3	4.6	3.5	0
08/29/05 - 09/04/05	168	2.4	6.1	3.7	8
09/05/05 - 09/11/05	168	2.3	6.8	3.8	5
09/12/05 - 09/18/05	168	2.2	5.9	3.7	10
09/19/05 - 09/25/05	168	2.3	4.1	3.2	0
09/26/05 - 10/02/05	168	2.0	5.6	3.8	3
10/03/05 - 10/09/05	168	2.2	5.6	3.9	21
10/10/05 - 10/16/05	168	4.1	5.6	4.9	54
10/17/05 - 10/23/05	168	4.7	7.0	5.7	91
10/24/05 - 10/30/05	168	5.9	8.5	7.6	100
10/31/05 - 11/06/05	169	2.9	7.7	5.5	63
11/07/05 - 11/13/05	168	1.6	6.4	4.7	51
11/14/05 - 11/20/05	168	4.4	9.3	6.7	72
11/21/05 - 11/27/05	167	6.6	10.3	8.7	100
11/28/05 - 12/04/05	168	5.7	12.3	9.7	100
12/05/05 - 12/11/05	168	10.7	12.8	12.0	100
12/12/05 - 12/18/05	168	10.7	12.8	11.4	100
12/19/05 - 12/25/05	168	9.7	13.8	12.8	100
12/26/05 - 12/31/05	144	9.8	11.9	11.0	100