THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

DEPARTMENT OF RESEARCH AND DEVELOPMENT

REPORT NO. 74-31

1973 ANNUAL SUMMARY REPORT

WATER QUALITY WITHIN THE WATERWAYS SYSTEM OF THE METROPOLITAN SANITARY DISTRICT

William R. Walters

August, 1974

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JOHN E. EGAN
PRESIDENT

THE
METROPOLITAN SANITARY DISTRICT
OF GREATER CHICAGO

100 EAST ERIE ST., CHICAGO, ILLINOIS 60611 . . . 751-5600

Cecil Lue-Hing
DIRECTOR
RESEARCH & DEVELOPMENT

December 11, 1974
(For Board Meeting of December 19, 1974
Revised December 17, 1974)

Mr. Bart T. Lynam
General Superintendent
O F F I C E

Agenda Summary: Submittal of a Report on Water Quality Within the Waterways of the Metropolitan Sanitary District of Greater Chicago for 1973

Dear Sir:

Submitted herewith, is a report titled "1973 Annual Summary Report - Water Quality Within the Waterways System of the Metropolitan Sanitary District".

Water quality in the waterways under the jurisdiction of the Metropolitan Sanitary District has been monitored at some fifty stations for thirty-five different parameters. It is shown that water quality conditions were generally improved during the year 1973 as compared to the years 1971 and 1972 respectively. This improvement is ascribed to the more normal storm patterns which occurred during 1973 vis-a-vis 1971 and 1972 percipitations.

Respectfully submitted.

C. Lue-Hing

Cecil Lue-Hing
Director
Research & Development

CLH:emc
Attachment

ACKNOWLEDGEMENT

Richard Johnson and Samprati Shah, members of the Experimental Design and Statistical Evaluation Section, assisted in the implementation of the Waterways Data Management System. Two former members of this section, Jean Woods, and Vacys Saulys, also assisted in the early stages of implementation.

Peter Gurskis drafted the figures appearing in this report, with assistance from Michael Salimbene.

Comments regarding waterways quality for the years 1972 and 1973 (previously published in Research and Development Annual Reports for those years) by Dr. David Lordi have been incorporated into this report, where relevant.

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SUMMARY AND CONCLUSIONS

Water quality data for the waterways within the jurisdiction of the Metropolitan Sanitary District of Greater Chicago have been evaluated on a comparative basis (35 parameters) for the years 1971, 1972, and 1973. Water quality data for the year 1973 have been compared with objective standards wherever possible (24 water quality criteria as adapted to the District sampling schedules and types of waters). In those sampled streams which possessed adequate annual frequencies of analyses, variable pairs whose scatter plots showed promise of significant correlation were subjected to regression analysis. The resulting regression statistics of the most significant, and potentially useful, paired variables were compared for the years 1971, 1972 and 1973.

(1) Water Quality Data for 1973 as Compared with State of Illinois Standards

State of Illinois water quality criteria were used as standards, where possible, for evaluating the status of the waterways quality for the year 1973. Twenty-four parameters were found to have applicable standards, and the results of the standards comparison were as follows:

(a) Eleven water quality parameters were found to be completely

within standards:

Temperature, pH, Phenols, Sulfate, Chloride, Arsenic, Barium, Cadmium, Selenium, Silver, and Zinc.

(b) Three parameters violated State standards only infrequently, or marginally: Total Chromium, Lead and Nickel.

(c) Seven parameters were in compliance, or essentially so, in some sectors but not in others: Total Dissolved Solids, Ammonia Nitrogen, Phosphorus Copper, Iron, Mercury, and Cyanide.

(d) Three parameters were found to be in consistent violation of standards throughout the waterways: Dissolved Oxygen, Hexane Solubles, and Fecal Coliform.

(2) Comparative Summary Evaluations of Water Qaulity

Of the 35 water quality parameters compared on an annual basis for the years 1971, 1972, and 1973, significant changes were noted as follows:

(a) Significant improvement was noted for:

Total Phosphorus (Des Plaines and Calumet Systems), Ammonia Nitrogen in Des Plaines and Calumet Systems , Bacterial Indicators (downstream of treatment plants), Phenols (in Des Plaines System), and the metals.

(b) Significant degradation during 1973 as compared with 1971 and 1972 was not noted for any parameter throughout the waterways.

(3) Correlations

Of the variable pairs investigated, the following were found to possess significantly high correlation, with quite similar regression coefficients for three years, at the respective sampling stations: (1) Total Suspended Solids vs. Inorganic Suspended Solids; (2) Total Dissolved Solids vs. conductivity; and (3) Ammonia Nitrogen vs. Total Nitrogen.

I. INTRODUCTION

It is the responsibility of the District to conduct surveillance regarding the water quality of the streams and canals within its jurisdiction. Consequently, annual reports written by the Research and Development Department have included sections dealing with results of their water quality surveillance (2), (3), (4), (15). It should be noted that the State of Illinois has also conducted water quality sampling programs within the District waterways, issuing a summary evaluation for the years 1968 through 1970 (1), and have developed a computerized data base for stream quality data, with the summary statistics printouts published for the years 1971 and 1972 (10), (11).

Waterways data are compared with existing State of Illinois water quality standards, where applicable. Profiles of all available parameters are graphically presented as bar charts indicating annual ranges and averages at the waterways sampling stations. Data for 1971 & 1972 were included on these bar charts to note any significant changes occurring during the period 1971-1973. Detailed and summary observations of water quality were made based on these graphs.

The waterways data management system contained

considerable data for treatment plant effluents as well as frequent samples at the Lemont and Lockport sampling stations. Using these data, regression analyses were made for a variety of paired variables for the years 1971, 1972, and 1973 in an attempt to arrive at useful estimating equations. It was hoped that certain parameters could be estimated with sufficient precision from other parameters, so as to reduce the workload on the Quality Control Laboratories.

II WATER QUALITY NETWORK

Description of Waterways

The Metropolitan Sanitary District is responsible for the quality of the water within the confines of Cook County. A map depicting the waterways is shown in Figure 1. Principal man-made water courses are the North Shore Channel connecting Lake Michigan at Wilmette to the North Branch of the Chicago River, the Sanitary and Ship Canal extending from the Chicago Avenue Controlling Works to the Lockport Powerhouse, and the Cal-Sag Channel connecting Calumet Harbor via the Calumet River with the Main Channel. The functions of the canal system are to provide navigational facilities for boats and barges as well as to serve as receiving waters for conveying the flows from tributary streams and sewage treatment plant effluents, and storm water runoffs from the Lake Michigan watershed to the Des Plaines watershed through the terminus at the Lockport Powerhouse. The principal river systems germane to the District's surveillance programs are: The Chicago River System branches flowing from the Lake County border on the north into the North Branch of the Chicago River; the Des Plaines River System flowing south from Lake County and joining with the discharge from the Main Channel downstream of the powerhouse at Lockport; and the Calumet River System which flows into the

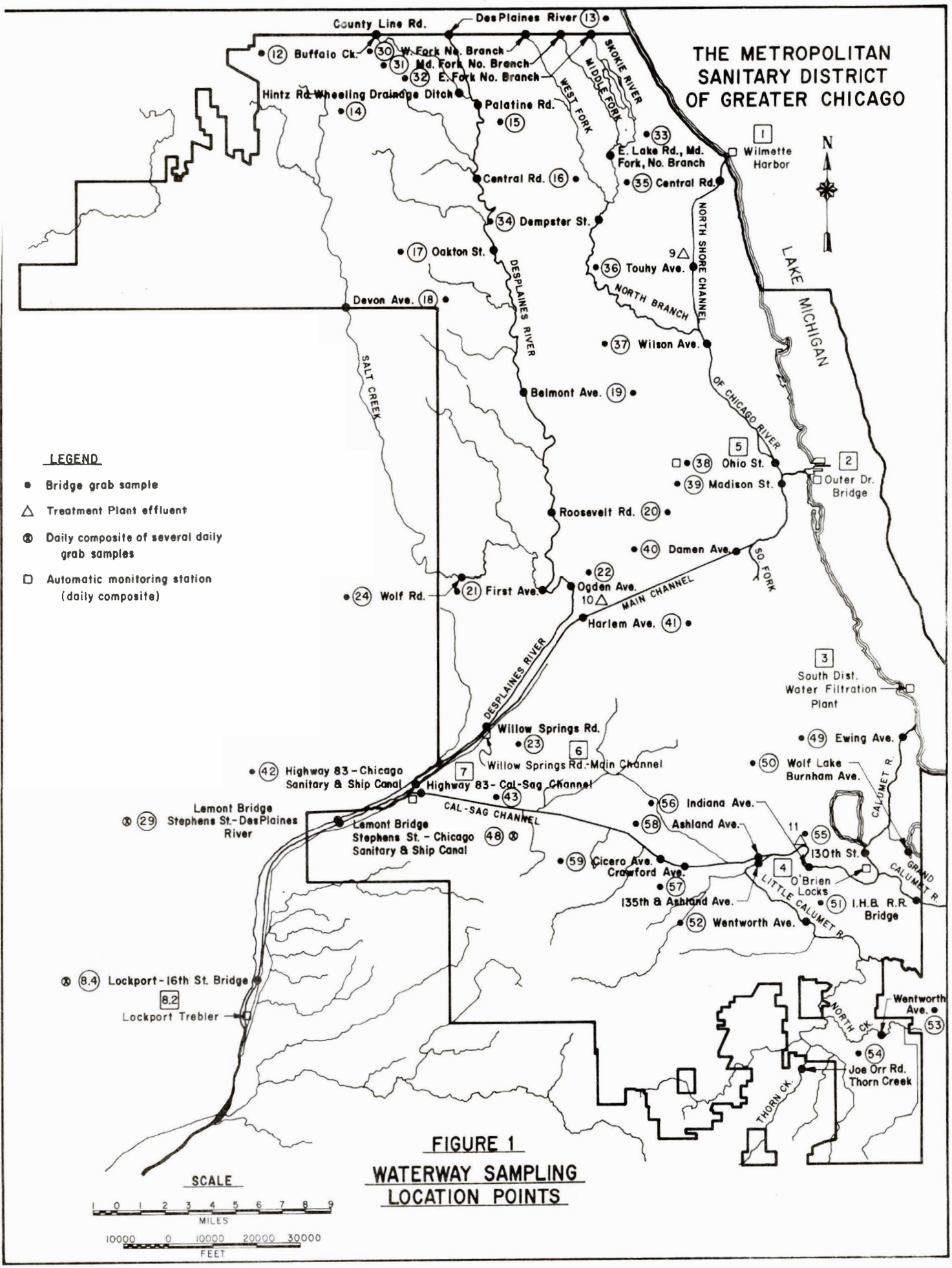

FIGURE 1

WATERWAY SAMPLING LOCATION POINTS

Cal-Sag Channel.

The lock systems handling boat traffic from and to Lake Michigan are located at the Chicago Controlling Works for connecting to the Main Channel, and at O'Brien Locks for connecting to the Cal-Sag Channel.

The Waterways Control Section of the M&O Department has the responsibility of adjusting lake water diversion into the canals (12), (13), (14). Direct diversion into the canals is accomplished at: Wilmette Pumping Station; Chicago River Controlling Works; and at O'Brien Locks. Due to the diversion limitiations imposed by federal decree, the diversion necessary to sustain navigation, and the leakages through locks, only a limited amount of lake water is available as dilution water to the canals. Consequently, the bulk of lake water is diverted during the summer months when stream oxygen demands are at their highest.

Types of Samples

Two types of samples were taken in the waterways: (1) Grab samples from bridges; and (2) 24-hour composite samples (see Figure 1, and Table A-2, Appendix A, for description of sample locations and types). Composite samples were taken at those locations which had on-site automatic sampling facilities available, as, for example, at the eight automatic monitoring stations, and the major treatment plant effluents. The laboratory at Lemont had staff available at this location to take several grab samples per day for purposes of compositing. The bulk of the sampling location were bridges which were visited on a nominal once-per-month frequency. Three of these "bridge sampling runs" were made each month (sometimes less during the winter months), one run for each of the three river systems: Chicago, Calumet, and Des Plaines.

There were a total of 39 bridge sampling locations; Twelve in the Calumet System, fourteen in the Chicago River System, and thirteen in the Des Plaines River System. Additional stream samples, daily composites, were taken at the eight automatic monitoring stations, as well as manually composited samples (several grab samples mixed together during each day) at Lemont, Stephens Street bridge (one station each for the Sanitary and Ship Canal, and for the Des Plaines River), and at Lockport, 16th Street Bridge.

Daily composite samples were obtained for each of the three major treatment plant effluents.

Two automatic sampling locations were associated with the monitoring stations at Lockport. Sampling in the forebay to the Lockport powerhouse was discontinued in 1971 and was superceded by a sampler in the powerhouse itself.

Types of Analysis of Waterways Samples

Depending upon the sample location, a given sample was assayed for any of the chemical, biological, or physical parameters listed in Table A-1, Appendix A. The samples from the automatic monitoring stations, with the exception of the Lockport monitoring station, were analyzed for 5-day BOD, and Total Suspended Solids (in some cases, also for the organic fraction of suspended solids). The samples from the bridge runs were analyzed for up to 41 constituents, although due to low yearly sampling frequencies for certain constituents, 35 constituents were evaluated in this report. The number of constituents reported at the composite sampling stations were usually considerably less than for the bridge runs.

Tables A3, and A4, in Appendix A, list the yearly frequencies of analyses for the various constituents at their respective sampling locations.

The 35 parameters included for purposes of evaluation of water quality in the District waterways are as follows:

(1) Oxygen Demand Related Measurements:

5-day Biological Oxygen Demand (BOD_5)

Chemical Oxygen Demand (COD)

Total Organic Carbon (TOC)

(2) Solids:

Total Suspended Solids

Total Inorganic Suspended Solids

Total Organic Suspended Solids

Total Solids

Total Dissolved Solids

(3) Bacterial Indicators:

Fecal Coliform

Total Coliform

Fecal Streptococcus

(4) Nitrogen:

Ammonia Nitrogen

Nitrate plus Nitrite Nitrogen.

(5) Dissolved Oxygen

(6) Phosphorus (total)

(7) Oil (hexane solubles)

(8) Phenol

(9) Temperature

(10) pH

(11) MBAS

(12) Anions:

Cyanide

Chloride

Sulfate

(13) Metals:

Arsenic

Barium

Cadmium

Copper

Chromium (hexavalent plus trivalent)

Iron

Lead

Mercury

Nickel

Selenium

Silver

Zinc

Scope of Data Management System

In order to facilitate the reporting and evaluation of waterways data a computerized data management system was designed and implemented in 1970. A detailed description of the system appears in Appendix A.

Briefly, the system was designed to store and manage data resulting from the assay of water samples taken at up to 61 locations. The current computer system coding schemes for sampling locations and types of assays as well as the frequencies and types of analysis performed at the respective sampling stations are described in Appendix A.

In addition to storage and retrieval capabilities the data management system comprises a variety of computer programs to provide data preliminary screening, generation of annual statistical reports, data listings, and graphs as computer terminal printouts. The principal types of computer outputs comprising the annual Waterways Data Compendiums (5),(6),(7),(8) are as follows:

(1) Annual frequencies of assays at sampling stations

(2) Yearly summary statistics for each constituent at all stations.

(3) Monthly and yearly summary statistics for those stations sampled frequently (not available in 1970 report).

(4) Regression Analyses (Not available in 1970 report)

(5) Scatter Plots (Not available in 1970 report)

(6) Time Series Plots

Effects of Atmospheric Precipitation

Quality in the District waterways is influenced by storm patterns and intensities Storms of sufficient intensity can cause overflows from combined sanitary and storm sewers, as well as occasional bypassing of raw, or partially treated sewage, from overloaded treatment plants. Consequently, it becomes important to include the history of precipitation when evaluating water quality conditions within the District's jurisdiction.

A tabulation of frequencies of occurrence of average daily precipitation intensities for the years 1971, 1972, and 1973, is shown in Table 1. High intensity storms occurred with comparable frequencies during the years 1971 and 1972, respectively. A more "normal" precipitation pattern was noted during 1973 when the incidence of heavy storms was notably less than for the two preceeding years. Total annual precipitation was 28.4 inches, 36.1 inches, and 33.2 inches for the years 1971, 1972, and 1973 respectively.

Since the frequency of sampling in the waterways was only about once per month, at most locations, the scheduling of samples to reflect "dry weather conditions" becomes an important consideration. Tabulations of the higher intensity precipitations (considered to be those greater than 0.5 inches per day), along with the waterways sampling schedules, are shown in Tables 2,

3, and 4, for the years 1971, 1972, and 1973, respectively. An examination of these data show that, in most instances, samples were taken after the major effects of storms had subsided. However, there were several instances where samples were taken on, or shortly after, the storm dates. For example, the following sample dates were observed to correspond to "wet weather conditions":

Storm date	Inches	Sample Date	River System
July 8, 1971	1.05	July 8, 1971	Des Plaines
December 14, 1971	0.68	December 14, 1970	Des Plaines
December 15, 1971	1.08	December 16, 1971	Calumet
June 14, 1972	1.27	June 14, 1972	Calumet
August 23, 1972	1.05	August 23, 1972	Des Plaines
October 11, 1972	0.63	October 11, 1972	Des Plaines
October 31, 1973	0.61	November 1, 1973	Calumet

On the basis of the prior observations regarding annual rainfall, it is anticipated that the water quality results for the year 1973 should be improved when compared to the years 1971 and 1972.

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 1

AVERAGE DAILY PRECIPITATION

Class Interval Inches		Frequency		
		1971 (1)	1972 (2)	1973 (3)
	0.3	336	332	330
0.3	0.5	11	16	14
0.5	0.7	7	4	8
0.7	0.9	5	5	6
0.9	1.1	2	4	3
1.1	1.3	2	1	3
1.3	1.5	0	1	1
1.5	1.7	1	1	0
1.7	1.9	0	1	0
1.9	2.1	1	0	0
2.1	2.3	0	1	0

(1) Averages of 10-12 rain gauge stations.
Annual precipitation during 1971 was 28.4 inches

(2) Averages of 9-11 rain gauge stations.
Annual precipitation during 1972 was 36.1 inches

(3) Averages of 12-20 rain gauge stations.
Annual precipitation during 1973 was 33.2 inches

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 2

PRECIPITATION AND RIVER SYSTEM SAMPLE DATES, 1971

Month	Precipitation (1) Monthly Inches	Above 0.5in. Day	Above 0.5in. Inches	River System Sample Dates Chicago	Calumet	DesPlaines
Jan.	1.18	3	0.57	-	5	13
Feb.	1.64	4	0.58	3,24	11	18
March	1.95	-	-	23	4	24
April	0.64	-	-	20	7	15
May	2.21	5	0.71	4	13	20
June	3.41	6	0.61	3,17	10,29	23
June						
July	4.20	4	0.74	1	21	8
July		5	1.21			
July		8	1.05			
July		23	0.78			
August	2.86	10	0.68	5	-	-
August		24	1.57			
Sept.	2.96	5	1.13	-	-	23
Sept.		19	0.74			
October	0.68	-	-	14	27	20
November	1.23	-	-	3	17	10
December	5.45	10	2.08	8,28	16	14
December		14	0.68			
December		15	1.08			
December		29	0.52			
December		30	0.65			
Annual	28.4		15.4		-	

(1) Averages of 10-12 rain gauges.

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TABLE 3

PRECIPITATION AND RIVER SYSTEM SAMPLE DATES, 1972

Month	Precipitation (1) Monthly Inches	Above 0.5in. Day	Above 0.5in. Inches	River System Sample Dates Chicago	Calumet	DesPlaines
Jan.	0.72	-	-	19	12	5
Feb.	0.55	-	-	-	17	2
March	3.35	12	1.33	-	-	-
April	3.06	16	0.87	5,26	19	12
April		21	0.74			
May	2.73	-	-	31	17	3
June	2.56	14	1.27	21	14	7
July	3.16	14	0.61	19	12	5, 27
July		17	1.02			
August	6.65	6	0.66	16	9	23
August		22	0.88			
August		23	1.05			
August		25	2.12			
Sept.	5.31	13	1.06	-	6	-
Sept.		17	0.92			
Sept.		28	1.78			
October	2.02	11	0.63	5	25	11
October		22	0.63			
November	2.94	13	0.80	1, 29	-	8
December	3.09	12	1.51	-	6	7
December		30	0.79			
Annual	36.14		18.67			

(1) Averages of 9-11 rain gauges

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 4

PRECIPITATION AND RIVER SYSTEM SAMPLE DATES, 1973

Month	Precipitation (1) Monthly Inches	Above 0.5in. Day	Above 0.5in. Inches	River System Sample Dates Chicago	Calumet	DesPlaines
Jan.	1.21	3	0.62	31	24	30
Feb.	0.67	-	-	28	22	27
March	3.68	29	0.60	21	7	15
March		31	0.89			
April	4.51	9	0.58	25	12	5
April		21	1.32			
April		30	0.91			
May	3.87	25	0.69	24	16	15
May		27	1.28			
June	2.60	5	0.57	27	20	19
June		16	1.12			
July	3.40	4	0.77	25	24	11
July		20	0.60			
August	1.46	-	-	15	8	1
Sept.	4.08	17	1.02	26	20	13
Sept.		24	0.75			
Sept.		29	0.65			
October	3.38	12	0.75	25	3	10
October		13	0.80			
October		31	0.61			
Nov.	1.05	31	1.06	14	1	8
December	3.31	4	1.13	12	27	-
December		13	0.89			
Annual	33.22		17.61			

(1) Averages of 12-20 rain gauges

III. DISCUSSION OF WATERWAYS QUALITY CONDITIONS

Bar charts showing the annual ranges and averages for the various constituents measured within the waterways are shown in Appendix B, Figures B1 through B35. Each parameter is represented by a set of four bar charts, one for each of the following four defined waterways sectors:

(a) The Chicago River System (North Sector) is comprised of the North Shore Channel, and the North Branch of the Chicago River (East, West, and Middle Forks of the North Branch.)

(b) Chicago River System - South Sector
This is the sector downstream of the confluence with the Chicago River, including the Sanitary and Ship Canal, to the Lockport powerhouse and dam.

(c) The Calumet River System comprising the principal navigable portion: the Calumet River to the confluence with the Little Calumet River, culminating in the Cal-Sag Channel which, in turn, flows into the Sanitary and Ship Canal. Tributaries to this system are: the Grand Calumet River, the Little Calumet River, North Creek, and Thorn Creek.

(d) The Des Plaines River System consisting of the Des Plaines River from the Lake County Line (County Line Road) to its confluence with the Sanitary and Ship Canal downstream of the Lockport powerhouse, and tributaries to the Des Plaines

River as follows: Buffalo Creek, Wheeling Drainage Ditch, and Salt Creek.

In order to facilitate use of the bar charts, it is suggested that the reader familiarize himself with the tributary as well as the main stem sampling station sequences for the three principal river systems:

(a) The Chicago River System (North and South Sectors)

North Branch Tributaries:

County Line Road, West Fork

County Line Road, Mid Fork

County Line Road, East Fork

East Lake Road, Mid Fork

Dempster Street, North Branch

Main Stem

Central Road, North Shore Channel

Touhy Road, North Shore Channel

Wilson Avenue, North Branch

Ohio Street, North Branch

Madison Street, South Branch

Damen Avenue, South Branch

Harlem Avenue, Sanitary and Ship Canal

Highway 83, Sanitary and Ship Canal

Lemont, Stephens St., Sanitary and Ship Canal

Lockport, 16th Street, Sanitary and Ship Canal

(b) The Calumet River System

Tributaries:

Joe Orr Road, Thorn Creek

Wentworth Avenue, North Creek

Wentworth Avenue, Little Calumet River

135th and Ashland, Little Calumet River

Wolf Lake, Burnham Avenue

Indiana Harbor Belt R. R. Bridge, Grand Calumet River

Main Stem

Ewing Avenue, Calumet River

130th St., Calumet River

Indiana Avenue, Calumet River

Ashland Avenue, Little Calumet River

Crawford Avenue, Cal-Sag Channel

Cicero Avenue, Cal-Sag Channel

Highway 83, Cal-Sag Channel

(c) Des Plaines River System

Tributaries:

County Line Road, Buffalo Creek

Hintz Road Wheeling Drainage Ditch

First Avenue, Salt Creek

Wolf Road, Salt Creek

Main Stem

County Line Road, Palatine Road, Central Road,

Oakton Street, Belmont Avenue, Roosevelt Road,

Ogden Avenue, Willow Springs Road,

Lemont, Stephens Street

Dissolved Oxygen (Figure B-7)

Generally, the dissolved oxygen levels were highest as the water entered from Lake Michigan and decreased downstream. The North Sector of the Chicago River System averaged 7.6 mg/l at Central Road and dropped to 3.4 mg/l at Ohio Street during 1973. The level at Central Road was slightly lower than preceding years. With the input of diversion water through the Chicago River the average level increased to 5.5 mg/l at Madison Street on the South Branch of the Chicago River and then slowly declined in the downstream stations on the Chicago Sanitary and Ship Canal to 3.3 mg/l. At Damen Avenue these D.O. levels were slightly lower during 1973 than in preceding years.

The Calumet River System showed an average of 9.0 mg/l at Ewing Avenue near the mouth of the Calumet River and declined to 3.9 mg/l at Highway 83 in the Cal-Sag Channel, above its confluence with the Sanitary and Ship Canal. In general there was no substantial change in D.O. levels in this river system.

Several stations had samples in 1973 for which no dissolved oxygen was detected, generally during the summer months. These stations included Central Road on the North Shore Channel, Harlem Avenue and Highway 83 on the Sanitary and Ship Canal, Ashland, Cicero Avenue and Highway 83 on the Cal-Sag Channel, at Indiana Harbor Belt R.R. on the Grand Calumet River, as well as the stations on Thorn Creek and North Creek.

Comparison with 1971-1972 shows that the D.O. levels entering from Lake Michigan were substantially lower although still quite high averaging 7.6 mg/l. The lower stations in the Chicago River system North Sector averaged generally about the same. The middle and east forks of the North Branch having shown increasing D.O. levels over previous years leveled off in 1973. Ohio Street showed the same range of D.O. levels. In the South Sector of the Chicago River System the D.O. levels during 1973 were slightly higher when compared to the previous two years with the averages ranging from 1.2 to 5.5 mg/l.

Along the main waterways of the Calumet River System the D.O. levels were approximately the same in 1973 as compared to preceding years. However, at Highway 83 on the Cal-Sag Channel the D.O. level continued to decline in comparison to 1971-1972.

The average dissolved oxygen levels found in the Des Plaines River during 1973 ranged between 6.0 mg/l and 10.24 mg/l. Several of the grab samples taken were found to be zero, while some values greater than saturation were recorded. This may be due to photosynthetic oxygen production. The D.O. levels observed in Salt Creek averaged 10.5 mg/l at the upper station and declined to 6.5 mg/l at the lower station (First Avenue) which is an improvement over preceding years.

Biochemical Oxygen Demand (BOD) (Figure B-2)

The BOD data show that the BOD of the entering Lake water into the North Shore Channel was about 5 mg/l at Central Road, slightly higher than preceding years. Below the North Side Treatment Works, the BOD level was 9.3 mg/l at Touhy Avenue. In the lower section of the North Branch of the Chicago River the BOD level reached an average of 8.2 mg/l which was essentially the same as in 1972.

The West Fork of the North Branch of the Chicago River entered Cook County with an average BOD of 10.2 mg/l as compared to the other two Forks which averaged 4.6 mg/l.

The observed range of BOD in the South Sector of the Chicago River System was between 1 and 32 mg/l. The highest average BOD for this sector occurred at Highway 83 in the Chicago Sanitary and Ship Canal, above the confluence with the Cal-Sag Channel. This was about 2 mg/l higher than previous years.

In the Calumet River System the BOD at the Calumet River Stations, Lake side of the O'Brien Locks, averaged 4.0 mg/l with individual values between 1 and 8 mg/l.

The BOD increased to 8.8 mg/l just below the Calumet Sewage Treatment Works outfall and the confluence of the Little Calumet and Grand Calumet Rivers. Passing down the Cal-Sag

Channel the BOD declined to 6.2 mg/l at Highway 83 just above the confluence with the Sanitary and Ship Canal.

The individual levels observed in the Des Plaines River ranged from 1 mg/l to a high of 18 mg/l. On the average the BOD crossing the Lake-Cook County line was 6.7 mg/l which was slightly higher than for 1971-1972. The BOD levels decreased slightly moving downstream to an average of 5.0 mg/l at Willow Springs Road. The BOD levels found in Salt Creek increased from an average of 3.3 mg/l to 6.1 mg/l just above the junction with the Des Plaines River at First Avenue.

Chemical Oxygen Demand (COD) (Figure B-1)

The chemical oxygen demand is another parameter used as an indication of the organic loading placed on the stream.

In the North Sector of the Chicago River System high COD levels were found in the W. Fork of the North Branch of the Chicago River during 1973, these values averaged 85 mg/l at County Line Road. The other two Forks had average COD levels of 56 mg/l. These levels were the same as found in 1972. The average values for the main waterway ranged from a low of 36 mg/l for incoming Lake water at Central Road in the North Shore Channel to a high of 67 mg/l at Wilson Avenue in the North Branch. Below Wilson Avenue the levels decreased to 59 mg/l.

In the South Sector of the Chicago River System the average concentrations increased from a low of 41 mg/l at Madison Street in the Chicago River to a high of 58 mg/l at Highway 83 in the Sanitary and Ship Canal. The COD levels in 1973 were generally the same as those observed in 1971-72.

Similar to BOD, relatively high concentrations of COD were found in the tributaries to the Calumet River System with the highest concentration in 1971 through 1973, observed in Thorn Creek at Joe Orr Road, which averaged 133 mg/l COD in 1973 and in North Creek at Wentworth Avenue which averaged 143 mg/l.

Thorn Creek receives discharge from the Bloom Township Sanitary District Treatment Plant, which is outside the jurisdiction of the Metropolitan Sanitary District. North Creek flows into Illinois from Indiana east of the Wentworth Avenue sampling station.

The COD levels generally rose as one proceeded downstream from Lake Michigan. The average at Ewing Avenue on the Calumet River was 43 mg/l with levels increasing to 98 mg/l at Ashland Avenue on the Little Calumet River. Then the COD levels slowly declined to 71 mg/l at Highway 83 in the Calumet-Sag Channel.

The data show that generally the 1973 levels were the same as those found in 1972 in the Chicago River System. However, the COD levels in the Calumet River System were generally higher in 1973 as compared to the preceding years.

The COD levels found in the Des Plaines River ranged between 58 mg/l and 64 mg/l which were lower than 1971-72. The average concentrations for 1973 were relatively constant at about 63 mg/l as the Des Plaines River enters the northern part of Cook County and downstream to the level of 58 mg/l at Willow Springs Road. The average COD levels in Salt Creek rose slightly proceeding downstream from 59 mg/l at Devon Avenue to a high of 75 mg/l downstream at Wolf Road. These levels were slightly lower than observed in 1972.

Total Organic Carbon (TOC) (Figure B-25)

It is evident that concentrations reported for this parameter during 1971 were excessively high in the upper tributaries to the Chicago River, as well as downstream of the North Side sewage treatment plant at Touhy Avenue. A similar situation was observed in 1971 in the tributaries to the main stem of the Calumet system. Abnormally high concentrations were also noted in the upper Des Plaines River system during 1971. To a lesser extent, the same phenomena were also evident in the case of BOD_5 and COD concentrations. By contrast, 1973 was a somewhat more normal year regarding storm intensities, and this fact is reflected in much lower TOC concentrations in 1973 at the respective sampling stations. In general, TOC concentrations were significantly lower throughout in 1973 as compared to 1971 and 1972 data.

Ammonia Nitrogen (Figure B-8)

As the incoming Lake waters mixed with effluents discharged from the treatment plants and other sources, the ammonia nitrogen levels increased rapidly. Ammonia nitrogen averaged 0.84 mg/l-N near the lake at Central Road in the North Shore Channel and increased below the NSTP to 4.4 mg/l-N. The ammonia levels of incoming lake water were higher than those found in 1971-72. A further increase occurred downstream at Ohio Street to a level of 5.5 mg/l. Relatively high ammonia levels were observed entering the West and East Forks of the North Branch of the Chicago River at the County Line Road where averages of 6.3 and 6.0 mg/l-N were found. Both these stations were substantially higher than in 1972.

After mixing with Chicago River water the average concentration decreased to 3.3 mg/l-N. Further down the Sanitary and Ship Canal the level increased to 6.2 mg/l below the West-Southwest STW discharge at Harlem Avenue and remained at high levels in the lower part of the waterways system.

Within the Calumet River System the ammonia concentration ranged from 1.3 mg/l-N at 92nd Street near the mouth of the Calumet River to 9.0 mg/l at Ashland Avenue below the Calumet STW. These levels were about the same as observed in 1972. A significant amount of ammonia-N also enters the Calumet River

in the vicinity below 130th Street from the Grand Calumet and Little Calumet Rivers. The highest ammonia concentrations occurred at Indiana Harbor Belt R.R. Bridge in the Grand Calumet River, with a maximum of 31.6 mg/l and an average of 13.3 mg/l. This sampling station is near the Illinois-Indiana State line. The Grand Calumet River has part of its flow originating in Northern Indiana and receives discharges from several municipal treatment plants and industrial wastes. These wastes comprise a substantial portion of the flow.

The Des Plaines River had comparatively low ammonia nitrogen levels. The average concentrations ranged between 0.39 mg/l and 1.21 mg/l as N. A significant contribution of ammonia was made by Salt Creek, where the annual 1973 average concentration increased from 0.3 mg/l at Devon Avenue to 2.9 mg/l at Wolf Road, dropping to 1.6 mg/l at First Avenue due to dilution from Salt Creek tributaries.

Comparisons of annual averages for the period 1971 - 1973 in the main stems of the three river systems show: (1) 1972 and 1973 concentrations were roughly comparable and were lower than 1971 concentrations for both Chicago and Des Plaines River Systems; and (2) no significant improvement was noted for the Calumet main stem.

Nitrite-Nitrate Nitrogen (Figure B-9)

Nitrite and Nitrate forms of nitrogen are generally a result of biological conversion of ammonia and organic nitrogen. Streams with sufficient oxygen will favor the oxidation of ammonia to nitrite and nitrate; whereas, streams depleted in D.O. will result in utilization of the oxygen in the nitrate, thus converting the nitrogen to ammonia and nitrogen gas.

In the Chicago River System the average nitrite-nitrate N increased from a low of 0.5 mg/l as N near Lake Michigan to a level of 2.61 mg/l as N below the North Side STW in the North Shore Channel.

In the southern sector of the Chicago River System the nitrite-nitrate levels exhibited a slow decline moving downstream. The average nitrite-nitrate levels decreased from 1.73 mg/l N at Madison Street in the North Branch of the Chicago River to 0.91 mg/l N at Highway 83 in the Sanitary and Ship Canal.

At all stations there was a substantial variation. Individual concentrations observed in the Chicago River System varied from a low of 0.03 mg/l to a high of 7.00 mg/l as N.

In the Calumet River System the average nitrite plus nitrate nitrogen levels ranged between 0.62 mg/l and 1.73 mg/l.

The highest concentration occurred at 130th Street in the Calumet River with an average of 1.73 mg/l N. The nitrite-nitrate levels slowly decreased from 1.65 mg/l as N below the Calumet STW to 0.94 mg/l as N at Highway 83 on the Cal-Sag Channel.

In general, the Des Plaines River System had the highest levels encountered for all of the river systems. The levels decreased slightly from 1.58 mg/l N at the County Line Road downstream to 1.15 mg/l N at Roosevelt Road and then increased to 1.81 mg/l in the downstream section of the Des Plaines River below the input of Salt Creek. One tributary, Wheeling Ditch, had relatively high concentrations averaging 4.13 mg/l as N during 1973. The overall levels were about the same as observed in 1971-1972.

Total Phosphorus as P (Figure B-19)

In the North Sector of the Chicago River the total phosphorus levels climbed back to levels observed prior to 1972.* In 1973 the phosphorus concentrations of the incoming Lake waters averaged 1.07 mg/l P and increased moving downstream to 3.26 mg/l P at Ohio Street. These levels were approximately 0.8 to 1.4 mg/l higher than 1972 values.

In the South Sector of the Chicago River System the opposite pattern was observed with the phosphorus levels decreasing as the water moved downstream. The average concentration in 1973 at Madison Street was 2.21 mg/l and at the downstream station of Highway 83 the average was 1.10 mg/l. The levels were higher than 1972 and more in line with those observed in 1971.

In the Calumet River System the 1973 levels were generally the same as those in 1972 at a number of the stations. At the lake side of the O'Brien Locks the phosphorus average levels ranged between 0.33 and 0.50 mg/l as P. Downstream of the Calumet STW the phosphorus levels averaged between 1.49 and 1.08 mg/l. Thorn Creek had the highest phosphorus concentration averaging 3.36 mg/l at Joe Orr Road in 1973.

* The city of Chicago initiated a ban on the sale of high phosphate detergents in February 1971, which was nullified by court action in March, 1973.

The Grand Calumet River sampling station which averaged 4.1 mg/l P in 1972 decreased to 1.97 mg/l P in 1973.

The phosphorus concentrations in the Des Plaines River System just south of the Cook-Lake County line averaged 0.65 mg/l P, then the levels varied between 0.38 and 0.50 mg/l downstream to Roosevelt Road. Salt Creek which is a tributary to the Des Plaines River showed a substantial input of phosphorus as it passed through DuPage County. The levels increased from an average of 0.19 mg/l at Devon Avenue to an average of 1.49 mg/l at Wolf Road, and decreased to 1.32 mg/l at First Avenue as a result of tributary dilution.

Fecal Coliform (Figure B-4)

In the North Sector of the Chicago River System the counts decreased below the North Side STW while increasing further downstream. At Central Road the geometric mean of 3134 per 100 mg/l was higher than Touhy Avenue, with a geometric mean of 477 per 100 ml. The highest counts occurred at Ohio Street on the North Branch of the Chicago River with a geometric mean of 12,705 per 100 ml in 1973. This was a significant improvement as compared to 1971-72, when higher counts were observed at the upstream stations.

The highest counts observed in the South Sector of the Chicago River System were at Damen Avenue, South Branch of the Chicago River with a geometric mean of 5,512 per 100 ml. These levels decreased down to Harlem Avenue, Sanitary and Ship Canal which had the lowest geometric mean in 1973 of 770 per 100 ml. This was the same trend observed in 1972 and can be attributed to chlorination at the West-Southwest STW.

In the Calumet River System the counts were lower near the mouth of the Calumet River, the geometric mean at Ewing Avenue was 152 per 100 ml increasing to 3,100 per 100 ml at Indiana Avenue. The highest counts were observed at Ashland Avenue on the Cal-Sag Channel with a geometric mean of 738 per 100 ml.

in 1973. Extremely high fecal coliform counts were obtained on the Grand Calumet and Little Calumet Rivers just below the Indiana-Illinois line averaging 18,200 and 24,500 per 100 ml.

Comparison of 1973 observed counts with 1972 and 1971 data shows that the 1973 geometric means were generally lower in the Chicago River System, especially at Touhy Avenue in the North Shore Channel and Harlem Avenue on the Sanitary and Ship Canal. In the Calumet River System the geometric mean counts in 1973 were slightly lower than 1972 for the upstream stations and about the same for the downstream stations. A similar situation was noted when comparing 1972 data with 1971 data.

Total Coliform (Figure B-3)

The total coliform classification includes organisms of both non-fecal as well as fecal origin.

The geometric mean during 1973 in the upper sector of the North Shore Channel was 85,533 per 100 ml at Central Avenue, decreasing to 20,950 per ml below the discharge of the North Side STW. This was a reversal of the trends noted in 1971-72 and could be attributed to increased chlorination. The counts then increased to a high of 47, 848 per 100 ml at Ohio Street on the North Branch of the Chicago River. This level was rather constant through the South Sector of the Chicago River System up to Harlem Avenue, below the West-Southwest STW, where the counts dropped to 45, 508 per 100 ml. This level was substantially lower than observed in 1971 - 1972.

The Calumet River had levels of 6,857 per 100 ml at Ewing Avenue coming in from Lake Michigan which sharply increased below the junction with the Grand Calumet River to 68,437 per 100 ml at Indiana Avenue. The highest levels were observed in the Little Calumet River at Wentworth Avenue just below the Illinois-Indiana line.

The total coliform counts gradually increased moving downstream in the Des Plaines River. The geometric means for 1973 ranged from 52,510 per 100 ml at County Line Road to 177,934

per 100 ml at the Roosevelt Road sampling station. The counts found at both Belmont Avenue and Roosevelt Road were ten-fold higher than those observed in 1971-72.

Fecal Streptococcus (Figure B-5)

In general, the overall pattern for the period 1971-1973 in the District waterways for Fecal Streptococcus was quite similar to the results noted for fecal coliform (Figure B-4).

Overall, one could not claim either gross improvement, nor gross reduction, in water quality for Fecal Streptococcus throughout the District's waterways during this three-year period. However, there were significant changes at some specific sampling locations.

In the Chicago River System significant improvement was noted downstream of the North Side treatment plant at Touhy Avenue, where the geometric means for the years 1971, 1972, 1973 were, respectively, about 5000 c/100 ml., 800 c/100 ml., and 300 c/100 ml. Similar improvement downstream of the West-Southwest treatment plant was noted at Harlem Avenue in the Sanitary and Ship Canal. In both of these instances however, the improvement was short-lived and no improvement could be noted at Highway 83 on the Sanitary and Ship Canal for the year 1973 (about 1000 c/100 ml) as compared to the previous years, 1971 and 1972. Obviously, improved treatment plant effluent chlorination techniques were effective, but could not cope with the effects of combined sewer overflows

and treatment plant bypasses which occur during intense storms.

The main stem of the Calumet River System showed little change in Fecal Streptococcus levels during the period 1971-1973, however, there was evidence of steady degradation of quality at Highway 83, in the Cal-Sag Channel, where the following levels were noted for the years 1971, 1972, 1973, respectively, as about 100 c/100 ml., 700 c/100 ml., and 1300 c/100 ml. The tributaries to the main stem of the Calumet System became progressively higher in Fecal Streptococcus levels during the years 1971, 1972, 1973, respectively.

The main stem of the Des Plaines River System remained relatively unchanged for Fecal Streptococcus levels during the period 1971-1973. The geometric mean at Willow Springs Road in 1973 was 275 c/100 ml.

pH (Figure B-18)

The natural buffer capacity in the waterways was sufficient to maintain pH within acceptable limits during all observations at all stations except for two yearly maximums in the Des Plaines River, where a pH value of 9.1 was recorded in 1973 at Palatine Road, and a value of 9.2 in 1971, at Central Road. In general, during 1973, upstream values in the main stems of the Calumet and Chicago River systems were in the range of 7 - 8, dropped somewhat and then rose again prior to leaving the systems. Values were generally higher in the Des Plaines system, entering at County Line Road in the pH range of about 6.7 - 8.4, during 1973, and leaving at Lemont in the annual range of about 7.2 - 8.7. Overall, the pH values were slightly lower for the tributaries to the Chicago River and Calumet River systems in 1972 and 1973, than in 1971.

Temperature (Figure B-17)

No significant overall differences were noted for temperatures during the period 1971-1973. The general pattern when proceeding downstream in any one of the three main stems is a rise in water temperature due primarily to the addition of heat from sewage treatment plant effluents, as well as from the use of some of the water for cooling industrial plants and utilities.

The average yearly temperature rise from the Lake to Lockport during 1973 was $2^{o}C$, while the average yearly temperature rise for the Des Plaines River main stem from County Line Road (Lake - Cook counties) to Lemont was $0.2^{o}C$.

Total Dissolved Solids (Figure B-10)

In the North Sector of the Chicago River System the dissolved solids concentration increased going from Lake Michigan to sampling stations below the North Side STW. The average dissolved solids concentration entering at Central Road from Lake Michigan was 215 mg/l. The dissolved solids then increased to an average of 508 mg/l at Ohio Street. There is evidence of the dilution affect of the Lake waters from the Chicago River with resulting dissolved solids dropping to an average of 377 mg/l at Madison Street. The concentrations then rose sharply below the West-Southwest STW to levels of 490 mg/l which were higher than the dissolved solids observed in 1972.

In the Calumet River System a similar pattern was noted with a level of 259 mg/l near the Lake and increasing levels downstream with a sharp rise below the Calumet STW at Ashland Avenue to 673 mg/l. The highest concentrations of dissolved solids were observed in Thorn Creek averaging 1029 mg/l. Thorn Creek drains a large agricultural area which could contribute to the high dissolved solids. In addition the Bloom Township Sanitary District, which is an area outside of the Metropolitan Sanitary District, has a treatment plant which discharges into Thorn Creek upstream of the Joe Orr Road sampling station.

In the Des Plaines River System the average dissolved solids concentrations ranged between 594 and 832 mg/l. The highest concentrations were observed in the tributaries to the Des Plaines River with Buffalo Creek averaging 680 mg/l and Salt Creek having average concentrations from 722 to 832 mg/l.

Total Solids (Figure B-13)

As would be expected, the means and ranges for this parameter during the period 1971-1973 followed the patterns already described for Total Dissolved Solids (Figure B-10), and differ at most stations by scale only. The variation in concentration when proceeding downstream in the main stems of both the Chicago and Calumet Systems during 1973 were similar: Lake water containing about 200 mg/l to 300 mg/l (based on annual averages) was increased in total solids concentrations by admixture with tributary streams (containing considerably higher solids) as well as treatment plant effluents, storm water overflows, and treatment plant bypasses, so that the water leaving at Lockport contained about 700 mg/l of Total Solids. Little variation in the Des Plaines River System was noted, except for several extreme ranges induced by storm conditions in 1971.

No overall significant differences were noted for the three years, respectively, in the main stems of the three rivers, however, the tributaries were usually lower in Total Solids for the years 1972, 1973 as compared to 1971.

Total Suspended Solids (Figure B-15)

Probably the single most striking feature of the data for the period 1971 - 1973 is the extreme annual concentration ranges occurring at most stations. The impact of the intense storm patterns, typical of the years 1971 - 1972, are especially evident in the Des Plaines River, where all of the maximum concentrations above 400 mg/l occurred during 1971, and the lowest annual ranges and means were observed during 1973, the most "normal" year insofar as storm patterns were concerned. During 1973, Total Suspended Solids concentration increased from an average of 45 mg/l at County Line Road to 73 mg/l at Lemont, with the highest increase occurring downstream of Willow Springs Road.

Extreme concentration ranges were also evident in the Calumet and Chicago River Systems, however they occurred at various stations during 1972 and 1973 as well as during 1971. Most of the extreme ranges were recorded at the tributaries to the Calumet System, while large annual concentration ranges were noted in the main stem of the Chicago River System at: Touhy Avenue, Lemont, and Lockport. Water leaving the system at Lockport had an annual average of 26.5 mg/l of Total Suspended Solids during 1973, considerably lower than for 1971.

Overall, within the variations of the data at respective stations for the period 1971 - 1973, one cannot say that water quality regarding Total Suspended Solids had changed during the period 1971 - 1973 in the Chicago and Calumet Systems.

Organic Suspended Solids (Figure B-11)

The effects of annual precipitation patterns on Organic Suspended Solids concentrations are particularly apparent in the Des Plaines River System during the period 1971 - 1973. The lowest concentrations were recorded during 1973 at most of the stations in the Des Plaines River. This is attributed to the lower frequency of high intensity storms which occurred during 1973 as compared to the years 1971 and 1972. Average 1973 concentration in this river system was 15 mg/l of Organic Suspended Solids upstream at County Line Road, and 21 mg/l at Lemont, with most of the increase occurring downstream of Willow Springs Road.

With the exception of a few stations, the 1973 average annual concentrations were lower in the Chicago River System than they were in 1971 or 1972. Water leaving the system at Lockport during 1973 had an annual average concentration of 12 mg/l of Organic Suspended Solids, representing about 45% of the total suspended solids.

No significant differences overall were evident in the main stem of the Calumet River System, between the years 1971, 1972, and 1973, at respective sampling locations. The farthest downstream sampling station, Highway 83, had a 1973 annual average concentration of 8 mg/l. Organic Suspended Solids. The largest yearly fluctuations in concentration occurred in the tributaries to the main stem of the Calumet System.

Inorganic Suspended Solids (Figure B-12)

The same general remarks made previously for Organic Suspended Solids can be applied to the 1971 - 1973 annual averages and ranges for Inorganic Suspended Solids. The annual average concentrations and ranges during 1973 were less at most sampling locations, than they were during the years 1971 and 1972.

In the Des Plaines River System main stem, the annual average concentrations during 1973 were 53 mg/l at Lake-Cook Road, 22 mg/l at Ogden Avenue and 52 mg/l at Lemont.

Water leaving the Chicago River System at Lockport had an annual 1973 average concentration of 15 mg/l, while the average concentration leaving the Calumet River System at Highway 83 in the Cal-Sag Channel, was 34 mg/l., which is about 76% of the total suspended solids at this location.

Chloride (Figure B-20)

The highest concentrations of Chloride ion were in the Thorn Creek and Little Calumet River tributaries to the main stem of the Calumet System (over 200 mg/l based on 1973 averages). Lake water Chloride concentrations averaged about 20 mg/l, and concentrations at Lockport averaged about 96 mg/l during 1973. In the Des Plaines System, average 1973 Chloride concentration at County Line Road was 74 mg/l, while the 1973 average at Lemont was 100 mg/l. The principal source of this increase was from Salt Creek. The overall changes in annual averages during the period 1971 - 1973 at respective stations appear to be the result of storm patterns, typical for a given year.

Sulfate (Figure B-21)

No overall significant trends during the period 1971-1973 were evident. The average annual concentrations of Sulfate in the Des Plaines System were between 87 mg/l and 95 mg/l throughout the Des Plaines main stem during 1973, while 1973 average concentrations in the Salt Creek Tributaries ranged up to 123 mg/l.

Highest concentrations of Sulfate were recorded in the Calumet System, and may be attributed to pollution from tributaries (high concentrations were evident in the North Creek, Thorn Creek, and Little Calumet Tributaries), as well as from the Calumet Treatment Plant outfall, which averaged 246 mg/l of Sulfate during 1973. Water leaving the Cal-Sag Channel in 1973 averaged 106 mg/l at Highway 83.

The lowest overall concentrations of Sulfate were observed to occur in the Chicago River System. Lake water entering the North Shore Channel at Central Road averaged about 30 mg/l of Sulfate, and the average 1973 concentration downstream at Highway 83 in the Sanitary and Ship Canal was about 70 mg/l of Sulfate. Principal sources of Sulfate were the tributaries to the North Branch as well as the treatment plant effluents.

Cyanide (Figure B-22)

Due to the paucity of sampling locations which were assayed for Cyanide during the period 1971 - 1973, obviously a complete description regarding Cyanide concentration patterns in the District Waterways can not be made.

Very high annual maximums occurred in each of the three river systems, principally during the years 1972, and 1973, with only one very high annual peak concentration occurring during 1971. Evidently, Cyanide extremes can not be ascribed primarily to severe weather conditions since the most intense storms took place during 1971 - 1972. It is interesting to note that some high yearly maximums occurred at locations adjacent to lake water inlets: 0.66 mg/l during 1973 at Central Road in the North Shore Channel (the highest value observed in the waterways during 1973); and 0.32 mg/l at Ewing Avenue during 1971 in the Calumet River.

The lowest annual averages for the period 1971-1973 occurred in the Des Plaines River System. During the year 1973, all averages were less than 0.02 mg/l. Annual averages during 1973 for the Chicago River System varied between 0.02 mg/l and 0.08 mg/l. The range of averages for the Calumet System for Cyanide

during 1973, was 0.02 mg/l to 0.03 mg/l, with 0.05 mg/l in the Grand Calumet River.

MBAS (Figure B-6)

MBAS (Methylene Blue Active Substances) is an analytical procedure used to estimate the concentrations of biodegradeable surfactants, or detergents, as related to a standard (LAS, or linear alkylate sulfonate).

Averages for 1973 were in the range 0.1 mg/l - 0.2 mg/l for the stations in the main stems of the three river systems, with values of 0.05 mg/l - 0.1 mg/l at the lake inlets. The lowest values occurred in the main stem of the Calumet System. The highest 1973 averages were noted in the tributaries to the Calumet System, where annual 1973 averages of up to 0.5 mg/l were recorded. High annual maximum concentrations of 1 mg/l to 2 mg/l, occurred in all three river systems during the period. 1971 - 1973, with the largest incidence of yearly maximum evident in the Calumet System tributaries to the main stem. These annual maximums were recorded during all years in the period 1971 - 1973, but most occurred during the years 1971 and 1973. Based on annual averages one cannot say that any overall change has occurred in water quality for synthetic detergents during the period 1971 - 1973.

Phenols (Figure B-14)

Relatively few of the sampling stations were assayed for Phenols during the period 1971 - 1973.

Decided improvement in concentrations of Phenols in the Des Plaines River System was noted in 1972 and 1973. Average 1973 concentration of Phenols was 2.5 ug/l, except at Roosevelt Road (3.8 ug/l). Highest concentrations of Phenols in the Chicago River System occurred downstream of the West-Southwest treatment plant (yearly averages in 1973 were in the range 21 ug/l - 28 ug/l). This increase can not be accounted for by the treatment plant effluent from West-Southwest, which averaged 6.1 ug/l during 1973. No improvement in the Chicago River System during the period 1971 - 1973 was evident.

An improvement was noted in the concentrations of Phenols entering the Calumet System from the Grand Calumet River during the period 1971 - 1973. The 1973 average concentration in the Cal-Sag Channel at Highway 83 was 10 ug/l of Phenols, up a little from 1972.

Hexane Solubles (Figure B-16)

Emulsified oils and greases as well as light petroleum fractions in solution, may be present in the waterways as a result of industrial and domestic pollution or as a result of oil spills from boat and barge traffic, or from oil storage depots. These dissolved or emulsified oils and greases are extracted by a solvent (Hexane) and the residue after distillation and drying at 103°C is reported as Hexane Solubles.

During the period 1971 - 1973 no overall improvement can be noted for any of the waterways systems. The high ranges which occurred during all years and in all river systems (though primarily in the Calumet tributaries) may be ascribed to extreme storm conditions, fluctuations in waste loads, and spills. In spite of the extreme annual variations, the annual means in the main stems of the three river systems were fairly close for the years 1971, 1972 and 1973, at respective sampling stations. Annual averages for 1973 in the main stems of the three river systems were in the following ranges: 13 mg/l - 20 mg/l in the Chicago system; 10 mg/l - 17 mg/l in the Calumet system; and 10 mg/l - 13 mg/l in the Des Plaines system.

Arsenic (Figure B-33)

Highly significant improvement in Arsenic water quality was evident for the years 1972 and 1973, as compared to 1971 data. This is attributed to the pattern of intense storms occurring during 1971. Very low concentrations of Arsenic (in most cases Arsenic was not detectable at any given location) were recorded throughout the waterways during 1972 and 1973. The ranges of the 1973 annual averages for the river systems were as follows: 0.01 mg/l for the Chicago System, 0.01 mg/l to 0.02 mg/l for the Calumet System, and 0.00 mg/l to 0.01 mg/l for the Des Plaines system.

Barium (Figure B-35)

Only very low concentrations of Barium have been detected in the waterways during the period 1971-1973. Values of 0.0 mg/l, 0.1 mg/l, 0.2 mg/l, and 0.3 mg/l were recorded with the vast preponderance of samples showing no detectable concentrations of Barium. The results have been essentially the same for each year of the three-year period. The question arises as to why Barium concentrations were not much higher during the abnormal storm intensities occurring in 1971 and 1972. An answer would be that there just are not appreciable concentrations of Barium in the combined sewer systems within the District and adjacent areas.

Cadmium (Figure B-26)

With relatively few exceptions Cadmium was not detectable in waterways samples during the years 1972 and 1973. The detectable concentrations during these two years were in the range of 0.01 mg/l to 0.03 mg/l with the exception of one sample in 1972 at Wheeling Drainage Ditch (Des Plaines River System) which had a concentration of 0.07 mg/l.

Total Chromium (Figure B-30)

Total Chromium (hexavalent plus trivalent) concentrations were predominantly below detectable limits for most samples taken at most stations in the waterways during the period 1971-1973. Principal exceptions were noted at stations immediately downstream of sewage treatment plants and in the tributaries: Thorn Creek, Little Calumet River and Salt Creek (First Avenue). With these exceptions, main stem maximum annual concentrations for the year 1973 were in the range of 0.00 mg/l to 0.05 mg/l (Chicago River), 0.00 mg/l to 0.04 mg/l (Calumet System) and 0.00 mg/l to 0.03 mg/l (Des Plaines System).

During the period 1971-1973 some overall improvement was evident for 1973 as compared to 1972 and for 1972 as compared to 1971.

Copper (Figure B-27)

The results for copper during the period 1971-1973 are unique when compared to the bar charts for the other metals. In all waterways sectors the annual maximum concentrations were significantly higher during the year 1972 than they were during the years 1971 and 1973. Concentrations greater than 0.6 mg/l. were recorded during 1972 at several stations in the Des Plaines system, while maximum concentrations of 0.3 mg/l to 0.4 mg/l occurred at stations in the Chicago River system, and 1972 maximum concentrations of the order of 0.2 mg/l were observed throughout the Calumet River system (a maximum of 0.3 mg/l was recorded at Highway 83 in the Cal-Sag Channel). By contrast, the annual maximum concentrations recorded during 1973 were, with few exceptions, less than 0.05 mg/l, with most samples containing non-detectable concentrations, at all stations. The annual ranges and averages observed during 1971 were very similar to those observed during 1973.

The consistently high 1972 maximums, which occurred during the summer months, may have resulted from surface runoff. Precipitation recorded (see Table 1) indicate that storm frequencies and total precipitation during 1972 were conducive to runoff.

Iron (Figure B-28)

During the year 1973, some Iron was detected in all samples, the minimum reported concentrations were 1 mg/l throughout the waterways. In the Chicago River System only three values of mg/l were recorded with no higher values reported. A similar situation existed in the Des Plaines River System with only a relatively few values of 2 mg/l reported, as well as two values of 3 mg/l recorded. The main stem of the Calumet System showed a similar pattern, however, the tributaries showed a higher incidence of values greater then 1 mg/l (a maximum 1973 value of 7 mg/l being reported at North Creek).

The 1973 results overall were an improvement over those for 1972, and a distinct improvement over 1971 results.

Since extremely few samples were assayed for soluble Iron (the preponderance of results being reported as Total Iron), no statements can be made regarding the soluble and insoluble species of this parameter.

Lead (Figure B-31)

During 1973, all stations recorded annual minimum values of zero within the sensitivity of the analytical method. Annual maximums ranged between 0.02 mg/l and 0.19 mg/l (Chicago River System), 0.02 mg/l and 0.14 mg/l (Calumet River System), and 0.02 mg/l and 0.15 mg/l (Des Plaines River System). Annual averages for 1973 were low throughout the waterways system, with a range of 0.00 mg/l to 0.02 mg/l, except at Damen Avenue in the Sanitary and Ship Canal, where the 1973 average was 0.05 mg/l.

Progressive improvement was observed for the years 1971, 1972, and 1973. This was especially evident when comparing the latter two years with 1971 data.

Mercury (Figure B-32)

During 1973 annual minimum concentrations were zero (undetectable) at all measured stations. Annual maximums recorded during 1973 which were above 0.5 ug/l occurred at half the sampling locations in the Chicago River System, at one-third of the stations in the Calumet System, and at about three-fourths of the sampling points in the Des Plaines System. The highest single reported concentration was 3 ug/l at North Creek in the Calumet System.

The Mercury concentrations found do not appear to follow any pattern with regard to sampling station location. Yearly averages during 1973 ranged between 0.1 ug/l and 0.3 ug/l in the Chicago System, between 0.0 ug/l and an 0.2 ug/l in the Calumet System (except at North Creek, where the average was 0.5 ug/l) and 0.0 ug/l to 0.2 ug/l in the Des Plaines System.

The overall improvement which occurred during the years 1972 and 1973 as compared to 1971 is striking.

Nickel (Figure B-29)

During 1973, most recorded values were 0.0 mg/l with a sprinkling of concentrations of 0.1 mg/l, 0.2 mg/l, 0.3 mg/l, and one value of 0.4 mg/l (at Harlem Avenue in the Sanitary and Ship Canal).

In general, during the 1971 - 1973 period, 1971 annual averages were higher than 1972, or 1973 averages, especially in the Calumet, and Des Plaines Systems.

Selenium (Figure B-34)

No Selenium was detected in any of the waterways samples during 1972 or during 1973. This is in startling contrast to the results reported for the year 1971 when appreciable concentrations of Selenium were reported throughout the waterways.

· Silver (Figure B-24)

During the year 1973, only one non-zero concentration was reported for Silver in the entire waterways system (0.06 mg/l at Central Road, North Shore Channel). During 1972, only three samples were found to have detectable amounts of Silver: 0.01 mg/l each, at Wolf Lake, Burnham Avenue; at Wilson Avenue, North Branch; and at Dempster Street, North Shore Channel. During the year 1971 maximum concentrations of 0.01 mg/l (one station - Mid Fork - North Branch had 0.02 mg/l) were reported at most of the waterways stations.

Zinc (Figure B-23)

Relatively few non-zero concentrations were detected in the waterways during the year 1973. Only three stations in the Des Plaines System showed any values greater than zero, the annual 1973 maximum being 0.1 mg/l, at these three stations. This was a distinct improvement over 1971 and 1972 results.

Maximum 1973 values at stations in the Chicago River System were either 0.0 mg/l, 0.1 mg/l, or 0.2 mg/l, with the greatest incidence of non-zero values occurring at Touhy Avenue, downstream of the North Side treatment plant, the remaining stations having at most one, or two, non-zero values occurring during 1973. Mostly higher values were observed in the Chicago System during 1971.

In the Calumet System during 1973, most of the stations showed no detectable concentrations of Zinc. The only stations showing appreciable Zinc were located in Thorn Creek and North Creek. The results for 1973 were somewhat better than in 1972, and significantly better than in 1971.

IV. DISCUSSION OF CORRELATIONS

Scatter plots of some variable pairs cited in the Waterways Data Compendiums (6), (7), (8) indicated high linear correlation. Unfortunately, some of the more potentially useful pairs did not indicate highly significant linear correlations. In all cases, the variable-pairs are constituents at given sampling stations for a year's period. The stations investigated were those possessing sufficient frequency of sampling to warrant investigation, thus ruling out the monthly bridge run data. The stations investigated were at: Lockport, Lemont (Des Plaines and Main Channel), the Automatic Monitoring stations, and the effluents from the three major treatment plants.

Fifteen variable pairs were investigated at each station to the extent that data were available at the respective sampling locations. The constituents reported at the automatic monitoring stations with the exception of Lockport were limited to 5-day BOD, Total Suspended Solids, and in some instances, Inorganic Suspended Solids and Organic Suspended Solids. The automatic monitoring station samples at Lockport were quite intensively analyzed, as were the samples at Lemont and Lockport, 16th Street Bridge.

Scatter plots of nine variable pairs did not demonstrate sufficient promise to pursue regression analysis. These variable pairs were as follows:

1) 5-day BOD vs. Organic Suspended Solids
2) 5-day BOD vs. COD
3) Total Suspended Solids vs. Turbidity
4) Chloride Ion vs. Temperature
5) Total Dissolved Solids vs. Temperature
6) Dissolved Oxygen vs. Temperature
7) Ammonia Nitrogen vs. Temperature
8) Total Solids vs. Total Volatile Solids
9) Nitrate Nitrogen vs. Nitrite Nitrogen

The scatter plots of the remaining six variable pairs showed patterns warranting linear regression anlyses to arrive at equations for purposes of estimation of one variable with respect to another. These paired variables were:

1) Total Suspended Solids vs. Inorganic Suspended Solids
2) Chloride Ion vs. Conductivity. The scatter plot pattern for this case indicated that polynomial regression analysis would be indicated.
3) Total Dissolved Solids vs. Conductivity
4) Ammonia Nitrogen vs. Total Nitrogen
5) Conductivity vs. Temperature
6) COD vs. Conductivity

Comparison of 1971 and 1972 regression statistics (15) showed that of these six sets of paired variables, only the following three sets showed reproducible regression coefficients for 1972 data as compared with 1971 data: (1) Total Suspended Solids and Inorganic Suspended Solids; (2) Total Dissolved Solids and Conductivity; and, (3) Ammonia Nitrogen and Total Nitrogen. Tables C-1, C-2, and C,3 show the tabulated regression statistics for these sets for the years 1971-1973. The symbols used in these tables are defined on page C-1, Appendix C.

Note that prior to application of these estimating equations a switch between the dependent and independent variables would be in order for sets (1) and (3), above.

(1) Total Suspended Solids vs. Inorganic Suspended Solids (Table C-1)

Very high linear correlation coefficients existed between these variables, at all stations with the relevant data, being greater than 0.9 in most instances (1.0 represents perfect positive correlation). There is no doubt that one variable can be estimated from the other with relatively small errors of estimation. The statistics cited in Table C-1 are based on linear regression of Total Suspended Solids (dependent variable) on Inorganic Suspended Solids (independent variable). Rather striking differences were evident in the regression

coefficients for the treatment plant effluents as compared to the waterways, ranging between 1.7 and 3.6 for the plant effluents, and ranging between 1.0 to 1.3 for the stream sampling locations. Only marginal changes between the years 1971, 1972, 1973 except at the North Side and Southwest plants.

The practical implications of all this are as follows: (a) The organic and inorganic fractions of suspended solids can be estimated quite well in those instances where only Total Suspended Solids data exist; (b) The overhead of laboratory analyses for the assays of the organic and inorganic fractions of suspended solids could, in many cases, be eliminated and estimated by using appropriate estimating equations for the plants and stream stations, respectively; (c) These types of estimating equations should be useful in any future modeling attempts for the plants or waterways; (d) These regression statistics are good summary indicators of annual changes.

(2) Total Dissolved Solids vs. Conductivity (Table C-2)

The correlations for this variable pair were not quite as good as those for Total Suspended Solids and Inorganic Suspended Solids, discussed above, although they were still highly significant, being 0.8 and above in most instances, with several correlations in the 0.6 to 0.7 range.

The regression coefficients at Lemont, Des Plaines River (0.74 in 1971, 0.75 in 1972, 0.66 in 1973) were uniquely different from the regression coefficients at Lemont, Chicago Sanitary and Ship Canal (0.56 in 1971, 0.62 in 1972, 0.67 in 1973). The reproducibility of the regression coefficients from independent annual sampling sets is shown at Lockport, 16th Street (0.57 in 1971, 0.65 in 1972, 0.60 in 1972) and at Lockport powerhouse (0.58 in 1971, 0.66 in 1972, 0.67 in 1973).

The regression coefficients for Calumet treated effluent were quite similar for the years 1971-1973, varying between 0.53 and 0.58, while more variability was noticeable for North Side and Southwest, where the regression coefficients were similar and varied, during the period 1971-1973, between 0.43 and 0.59. Conductivity could be extremely useful since it is so readily measured. It is felt that further refinement is possible by including another independent variable, Chloride Ion, and arriving at estimating equations for Total Dissolved Solids in terms of Conductivity and Chloride Ion by means of multiple linear regressions. This has yet to be investigated.

(3) Ammonia Nitrogen vs. Total Nitrogen (Table C-3)

Correlation coefficients were in the range 0.83 to 0.98 for the stations at Lockport, the major treatment plant effluents, and at Lemont Sanitary and Ship Canal. The correlation coefficients were considerably lower, however, at Lemont in the Des Plaines River (0.45-0.56). It appears that the estimating equations are very good, however, for secondary treatment plant effluents and their receiving waters, indicating perhaps, the absence of appreciable nitrification in these waters.

(4) Relative Standard Errors of Estimate

The percent standard errors of estimate (i.e., standard errors of estimate expressed as percents of annual averages) were as follows, for the years 1971-1973:

(a) Total Suspended Solids

7% - 35% for waterways samples with most errors less than 20%. Plant effluent errors were of the order of 30%, except at Northside, where the errors were higher.

(b) Total Dissolved Solids

Relative errors were in the range of 7% to 20%.

(c) Ammonia Nitrogen

Relative errors were in the range of 7% to 19% at Lockport, Lemont (Main Channel) and for treatment plant effluents. Errors at Lemont (Des Plaines River) were large: 200% in 1972, and 55% in 1973.

V. COMPARISON OF WATER QUALITY WITH STATE OF ILLINOIS STANDARDS

Water Use Designations

The relevant criteria used are those published by the State of Illinois Pollution Control Board in its Rules and Regulations, Chapter 3: Water Pollution (9). Part 3 of chapter 3 contains the rules for Water Use Designations: General Use Waters (Rule 301), and Secondary Contact and Indigenous Aquatic Life Waters (Rule 302). Secondary Contact Waters do not, at present, meet the more stringent requirements of the General Use Waters. All State of Illinois waters are designated for general use except those designated for Secondary Contact.

The sectors within the Metropolitan Sanitary District defined as Secondary Contact waters are, as follows (Rule 302):

(a) The Chicago Sanitary and Ship Canal

(b) The Calumet-Sag Channel

(c) The Little Calumet River from its junction with the Grand Calumet River to the Calumet-Sag Channel

(d) The Grand Calumet River

(e) The Calumet River

(f) Lake Calumet

(g) The South Branch of the Chicago River

(h) The North Branch of the Chicago River from its confluence with the North Shore Channel to its confluence with the South Branch.

(i) The Des Plaines River from its confluence with the Chicago Sanitary and Ship Canal to the Interstate 55 bridge.

(j) The North Shore Channel, except that dissolved oxygen in said channel shall be not less than 5 mg/l during 16 hours of any 24-hour period, nor less than 4 mg/l at any time.

(k) All waters in which, by reason of low flow or other conditions, a diversified aquatic biota cannot be satisfactorily maintained even in the absence of contaminants.

Water Quality Standards

The General Use Water Quality Standards are set forth in Part II, Rule 203, while the standards for Secondary Contact waters are stated in Rule 205 (for pH, Dissolved Oxygen, Fecal Coliform, Temperature), and also in Part IV, Effluent Standards, for other applicable constituents (Rules 406, 407, and 408).

A summary of the relevant criteria for the Sanitary District Waterways is shown in Table 5. In most

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TABLE 5

WATER QUALITY STANDARDS (1, 2,)

	General Use Waters	Secondary Contact and Indigenous Aquatic Life Waters
Dissolved Oxygen	6.0	3.0 (5.0 for North Shore Channel)
Temperature	32.2°C, April - Nov. 15.6°C, other months	34.0°C
pH	6.5-9.0	6.0 - 9.0
Total Dissolved Solids	1000	3500
Oil (Hexane Solubles)	-	15.0
Phenols	100 ug/l	300 ug/l
Ammonia N	1.5	2.5 April - October 4.0 other months
Total Phosphorus	0,05 (Applies only at Wolf) (Lake, Burnham Ave.)	1.0
Cyanide	0.025	0.025
Fecal Coliform	200 counts/100 ml	1000 counts/100 ml
Chloride	500	-
Sulfate	500	-
Arsenic, Total	1.0	0.25
Barium, Total	5.0	2.0
Chromium (hexavalent +trivalent)	0.05	0.3
Cadmium, Total	0.05	0.15
Copper, Total	0.02	1.0
Iron, Total	1.0	2.0
Lead, Total	0.1	0.1
Mercury, Total	0.5 ug/l	0.5 ug/l
Nickel, Total	1.0	1.0
Selenium, Total	1.0	1.0
Silver, Total	0.005	0.1
Zinc	1.0	1.0

(1) Concentration units are mg/l., unless otherwise indicated

(2) Standards are those delineated in Reference (1), and as discussed in this report

cases the standards are unambiguous. However, the conditions for defining several standards required some interpretation:

(a) Regulations for Dissolved Oxygen are specified for waters in the State of Illinois, as follows: Rule 203(d), for General Use waters states that, "Dissolved Oxygen shall not be less than 6.0 mg/l during at least 16 hours of any 24-hour period, nor less than 5.0 mg/l at any time." Rule 205(c) similarly, states limits of 3.0 mg/l and 2.0 mg/l for Secondary Use waters (except, in the North Shore Channel, where the respective standards for D.O. are 5 mg/l and 4 mg/l, according to Rule 302(j)). Since the bulk of samples taken in the waterways were taken at a nominal once/month frequency, the more stringent standard in each case, was adopted: 6 mg/l for General Use waters; 3 mg/l for Secondary Contact waters (5 mg/l for the North Shore Channel).

(b) By analagous reasoning, the more stringent standards were adopted for Bacteria (Fecal Coliform) for both General Use and Secondary Contact waters: 200 counts/100 ml and 1000 counts/100 ml., respectively, according to Rules 203 (g) and 205 (d).

(c) Rules 203(f) and 408(a) respectively for General Use and Secondary Contact waters each specify separate standards for hexavalent chromium and for trivalent chromium. Since the District, except in rare instances, has analyzed samples only for total chromium (hexavalent plus trivalent), results for chromium are reported as such, using the more stringent standards - those for hexavalent chromium.

(d) Temperature standards as interpreted on the most stringent basis are: 34°C for Secondary Contact water (Rule 205(f), and as follows, for General Use waters (Rule 203 (i)):

January - March	60°F	(15.6°C)
April - November	90°F	(32.2°C)
December	60°F	(15.6°C)

(e) The following constituents were not reported because of either infrequent or no assays: Radioactivity, Manganese, Boron, and Flouride.

(f) Total Phosphorus for General Use Waters (Rule 203(c) applies only to reservoirs, lakes, or in any stream at the point where it enters any reservoir or lake. Specifically, for the District's sampling scheme this criterion refers only to the sampling station at

Wolf Lake, Burnham Avenue, in the Calumet River system.

(g) Total Dissolved Solids, Rule 408 (b), which is primarily a sewage treatment plant effluent standard does not serve as an adequate Secondary Contact stream standard. The rule states that Total Dissolved Solids shall not be increased by more than 750 mg/l, above background concentration, and in no event shall the concentration exceed 3500 mg/l at any time. The definition of a "background" concentration within a stream becomes somewhat nebulous. Consequently, the unambiguous (though too liberal) standard of 3500 mg/l has been used for this evaluation. A better stream standard for this parameter in Secondary contact waters is required.

Results of Water Quality Compared to State Standards

The proportions of observations in 1973 exceeding the relevant State standards (shown in Table 5) as well as the extreme violations (shown in parentheses) for the relevant constituents and sampling locations are shown in Appendix D, Table D1 through Table D3 for the Calumet River System, Table D4 through Table D6 for the Chicago River System, and

Table D7 through Table D9 for the Des Plaines River System. The sampling locations included in these tabulations are those included in the nominal monthly bridge runs, as well as the sampling points at Lemont (Main Channel and Des Plaines River), Lockport at 16the Street Bridge, and the powerhouse at Lockport.

Discussion of Results

The following eleven constituents showed no values violating standards for either General Use waters or Secondary Contact waters throughout the Sanitary District's waterways during the year 1973:

Temperature

pH

Phenols

Chloride

Sulfate

Arsenic

Barium

Cadmium

Selenium

Silver

Zinc

Three standards were violated only infrequently, or marginally, as follows during 1973, in the District's waterways:

(a) Total chromium (hexavalent plus trivalent) standards for both General Use waters (0.05 mg/l) and Secondary Contact waters (0.3 mg/l) were met in both the Chicago River and Des Plaines River Systems. The standards were also met in those waters of the Calumet System designated as Secondary

Contact water. However, two violations occurred (the maximum individual annual concentration being 0.13 mg/l) at Joe Orr Road, Thorn Creek.

(b) Lead standards (0.1 mg/l) were met in the designated General Use waters of both the Chicago and Des Plaines River Systems, as well as in the waters designated for for Secondary Contact in the Calumet System. Two marginal violations were noted in the Calumet System, one each at Burnham Avenue, Wolf Lake, and at Joe Orr Road, Thorn Creek. Three violations occurred in the Chicago River System during 1973, one recorded, oddly enough, at Central Road, upstream in the North Shore Channel, and two violations (out of 12 observations) at Damen Avenue on the South Branch of the Chicago River where the maximum concentration was 0.19 mg/l . Two marginal violations (out of eleven observations) occurred in the lower Des Plaines River at Willow Springs Road with the maximum annual recorded concentration being 0.15 mg/l.

(c) The standard for Nickel (0.1 mg/l for both General Use and Secondary Contact waters) was violated only once in the Des Plaines River System at Belmont Avenue, where a value of 0.3 mg/l was recorded. No other violations were detected within District waterways during 1973.

Seven parameters were found to be in compliance with State standards, or essentially so, in some sectors of the waterways while exhibiting quite heavy violations in other sectors.

(a) Total Dissolved Solids concentrations recorded during 1973 exceeded standards for General Use waters (1000 mg/l) markedly at two tributaries to the main stem of the Calumet River System: Thorn Creek at Joe Orr Road (six out of eleven samples), and at the Little Calumet River at 135th and Ashland (four out of twelve samples). Some marginal violations of the General Use water standards were noted in the Salt Creek tributary to the Des Plaines River.

(b) The standards for Ammonia Nitrogen were frequently exceeded in all sectors of the District waterways during 1973, except in the lower Des Plaines River, and near the mouth of the Calumet River, where the incidence of violations was quite low.

(c) Phosphorus standards were violated heavily during 1973 in both the Calumet and Chicago River Systems and least heavily in the lower Des Plaines River, where one marginal violation out of eleven observations occurred at Willow Springs Road.

(d) The standard for copper in waters designated for Secondary Contact (1.0 mg/l) was met in these sectors throughout the waterways during 1973. The General Use water standard for Copper of 0.02 mg/l, however, was exceeded approximately one-quarter of the time in the upper tributaries of the Chicago River System, and only marginally in the Calumet and Des Plaines Systems. Maximum Copper concentrations of 0.07 mg/l to 0.09 mg/l were observed coming into the Chicago River System from the north at County Line Road.

(e) Significant frequencies (about 25% to 40%) and severities of violations for Iron (standard of 1.0 mg/l) during 1973 occurred in the designated General Use waters of the Calumet System, essentially in the tributaries to the main stem at Thorn Creek, North Creek, and the Little Calumet River. Other sectors of the waterways contained only marginal violations with complete compliance in the Secondary Contact waters of the Chicago River System (standard of 2.0 mg/l).

(f) The State standard for Mercury is 0.5 ug/l for both General Use as well as waters designated for Secondary Contact. This standard was essentially met in the Des Plaines and Calumet Systems with relatively few records of concentrations above 0.5 ug/l. An occasional record of violation was noted in the Chicago River System, with maximum

concentrations of Mercury of 1.6 ug/l being reported in the North Shore Channel, both upstream and downstream of the North Side treatment plant outfall.

(g) The Cyanide standard of 0.025 mg/l applies to all waters within the District's jurisdiction. No data for this parameter were avilable for the General Use waters of the Calumet System. Concentrations of Cyanide in the lower Des Plaines River were mostly below the standard with maximum concentrations only slightly above the standard. However, the remaining sectors of the waterways showed a number of violations for Cyanide. The Calumet River System showed sampling locations with frequencies varying from 3 out of 12 to 8 out of 12 exceeding the standard. Similarly, the Chicago River System had 3 out of 12 to 7 out of 12 which exceeded the standard.

Finally, the three remaining parameters, Dissolved Oxygen, Oil (Hexane Solubles), and Bacteria (as indicated by Fecal Coliform) were in heavy violation of their respective standards throughout the waterways during 1973.

(a) Dissolved Oxygen concentrations were below standards, primarily during the summer months, downstream of the major treatment plants and in sectors receiving quite heavy industrial waste loads, as for example, in the Calumet tributary system and in the lower Des Plaines River.

(b) The Hexane Solubles standard of 15 mg/l which applies only to Secondary Contact waters, was violated in all three river systems at all locations where this parameter was measured. Frequencies of violations varied from 2 out of 12 to 9 out of 12 observations.

(c) Fecal Coliform standards of 200 c/100 ml, and 1000 c/100 ml respectively for General Use, and Secondary Contact water designations were violated throughout the waterways. In general, the levels of the counts increased downstream of confluences with tributaries and treatment plant outfalls, with the storm overflows from combined sewers systems and any treatment plant bypassed playing a significant though largely unknown role. Yearly maximums of the order of 500,000 c/100 ml were attained during 1973 in both the Calumet and Chicago River Systems, while the yearly maximums in the Des Plaines system were considerably lower than this value, except at Roosevelt Road in the lower Des Plaines River, where a yearly maximum of about 1,000,000 c/100 ml was recorded.

In summary, the District water quality during 1973 as related to State of Illinois standards was very similar to the results previously observed for the year 1972 (12). Only borderline differences as to extent and incidence of violations were noted for the respective parameters when comparing 1972 and 1973 data.

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APPENDIX A

WATERWAYS DATA MANAGEMENT SYSTEM DESCRIPTION

DESCRIPTION OF WATERWAYS COMPUTER DATA MANAGEMENT SYSTEM

An information management system for handling waterways data was devised in 1970. Commercially available time-sharing computing services were leased and communication with the remotely located computer was via low-speed asychronous terminals (a teletype with paper tape for off-line data, and program entry and retrieval, and an IBM 2741 for wide carriage printouts). All relevant analytical data from the Quality Control Laboratories relating to waterways samples (including major treatment plant effluents and daily composite samples from the automatic monitoring stations) were entered. Annual compendiums including monthly and yearly summary statistics, time-series plots, scatter plots, bivariate regressions, and data listings have been issued annually for the years 1970 through 1973.

Numerically coded constituent and station directories were defined (see Table A-1 and A-2, respectively). Sampling locations corresponding to the station numbers are shown in Figure 1. Stations 1 through 8 are the automatic monitoring stations. Some ambiguity exists at Lockport. The present monitoring station is located in the powerhouse at Lockport and utilizes a "Trebler" automatic sampler for the

daily composite sample. This station is coded as 8.2. The sampling location in the powerhouse forebay (8.1) is no longer in use. The solenoid sampler formerly used in the powerhouse (8.3) has been superceded by the Trebler sampler. Sampling location 8.4 is located in Lockport at the 16th Street bridge and is a manual sampling point (several daily grab samples were composited prior to analysis).

Stations 9,10, 11 are daily composite sample points for the secondary effluents at the three major treatment plants: Northside, Southwest and Calumet, respectively.

Lemont has two sampling stations at Stephens Street, one in the Des Plaines River System (station 29), and one in the Chicago River System (station 48).. Both locations composite several grab samples to yield a daily composite sample prior to analysis.

The remainder of the station codes are assigned to the grab samples taken in each of the three river systems on a nominal once-a-month sampling frequency.

Data entry was accomplished by coding the laboratory data sheets directly on paper tape. No special data coding restrictions were demanded of laboratory personnel. Two types of data tables were entered: (1) all stations data taken for a given date, as for example, a bridge run; and, (2) all data for a

given station for a given time period, usually one month. These coded data were periodically entered into the computing system through the paper reader of the teletype communications terminal. A family of programs were written and are resident in the computing system. They accomplish the following functions:

(1) Calculation of derived parameters from primary data. Examples of such calculations are: Total Dissolved Solids as the difference between Total Solids and Total Suspended Solids; Total Dissolved Volatile Solids as the difference between Total Volatile Solids and Total Suspended Volatile Solids; Nitrate and Nitrate Nitrogen as the sum of Nitrate Nitrogen and Nitrite Nitrogen, etc.

(2) Range checking for preliminary highlighting of possible erroneous data.

(3) Data listing by constituent for all stations for the bridge runs.

(4) Data listing by month for a given station.

(5) Summary yearly tally of the numbers of analyses at each station for all constituents measured.

(6) Summary yearly statistics for all stations and all measured constituents.

(7) Monthly and yearly summary statistics for those stations having daily composite samples.

(8) Graphical output at the 2741 terminal using IBM's high prevision plotting head. This includes both time-series plots and scatter plots.

(9) Data updating and editing capabilities.

(10) The building of data subset suitable as input to statistical analysis application packages such as simple Linear Regression Analysis, Multiple Linear Regression Analysis, and Polynomial Regressions.

(11) Year-end dumping of data base to magnetic tape in an industry compatible format suitable for subsequent entry into the same computing system, or any other desired computing system.

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TABLE A-1

WATERWAYS DATA MANAGEMENT SYSTEM

CONSTITUENT DIRECTORY

Code No.	Constituent	Label	Units
1	5-Day BOD	BOD	mg/l
2	Total Suspended Solids	TSS	mg/l
3	Organic Suspended Solids	ORGS	mg/l
4	Inorganic Suspended Solids	INGS	mg/l
5	Dissolved Oxygen	D.O.	mg/l
6	Temperature	TEMP	^{o}C
7	Conductivity	COND	imhos/em
8	pH	PH	
9	(1) Oxidation Reduction Potential	O.R.P.	mv.
10	Chloride Ion	CL^{-}	mg/l
11	Turbidity	TURB	J.C.U.
12	(1) Solar Radiation Intensity	S.R.I.	$cal./cm^2/min$
13	Total Alkalinity	AlKY	mg/l as $CaCO_3$
14	Chemical Oxygen Demand	COD	mg/l
15	Total Nitrogen	TOT N	mg/l
16	Ammonia Nitrogen	NH^3-N	mg/l

(1) Not used, to date, in system

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE A-1 (continued)

WATERWAYS DATA MANAGEMENT SYSTEM

CONSTITUENT DIRECTORY

Code No.	Constituent	Label	Units
17	Total Solids	TS	mg/l
18	Total Volatile Solids	TVS	mg/l
19	Hexane Solubles	HEXS	mg/l
20	Organic Nitrogen	ORG.N	mg/l
21	Total Dissolved Solids	TDS	mg/l
22	Total Dissolved Volatile Solids	TDVS	mg/l
23	Phenol	PHEN	ug/l
24	Sulfate Ion	SO^4	mg/l
25	Phosphate as P	PO^4	mg/l
26	Cyanide Ion	CN^-	mg/l
27	Nitrate plus Nitrite, as N	N2N3	mg/l
28	MBAS	MBAS	mg/l
29	Zinc	Zn	mg/l
30	Cadmium	CD	mg/l
31	Copper	CU	mg/l
32	Total Chromium (hexavalent & trivalent)	T.CR	mg/l

(1) Not used, to date, in system

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE A-1 (continued)

WATERWAYS DATA MANAGEMENT SYSTEM

CONSTITUENT DIRECTORY

Code No.	Constituent	Label	Units
33	Chromium (hexavalent)	HEXC	mg/l
34	Iron	FE	mg/l
35	Nickel	NI	mg/l
36	Lead	PB	mg/l
37	Mercury	HG	ug/l
38	Boron (1)	B	mg/l
39	Arsenci	AS	mg/l
40	Selenium	SE	mg/l
41	Barium	BA	mg/l
42	Silver	AG	mg/l
43	Total Coliform	TC	counts/100ml
44	Fecal Coliform	FC	counts/100ml
45	Fecal Streptococcus	FS	counts/100ml
46	Flow Rate	Flow	C.F.S.
47	Water Surface Elevation (C.C.D.) (1)	ELEV	Feet
48	Nitrite Nitrogen	NO^2	mg/l
49	Nitrate Nitrogen	NO^3	mg/l

(1) Not used, to date, in system

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE A-1 (continued)

WATERWAYS DATA MANAGEMENT SYSTEM

CONSTITUENT DIRECTORY

Code No.	Constituent	Label	Units
50	Total Organic Carbon	TOC	mg/l
51	Daily Precipitation	RAIN	inches
52	Dissolved Iron	SOLFE	mg/l
53	Manganese	MN	mg/l
54	Fluoride Ion	FL^-	mg/l

(1) Not used, to date, in system

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE A-2

WATERWAYS DATA MANAGEMENT SYSTEM
STATION DIRECTORY

Code	Station Location		Type Sample
1	Wilmette Harbor		24-hour composite
2	Outer Drive Bridge		" "
3	So. Dist. Water Filtration Plant		" "
4	O'Brien Locks		" "
5	Ohio Street		" "
6	Willow Springs Road		" "
7	Hwy 83 & Archer		" "
8.1	Lockport Forebay		" (Discontinued in '72)
8.2	Lockport Trebler		" Composite
8.3	Lockport Solenoid		" (Obsolete)
8.4	Lockport 16th St. Bridge (1)		" Composite
9.	Northside Treatment Plant Outfall		" "
10	Southwest Treatment Plant Outfall		" "
11	Calumet Treatment Plant Outfall		" "
12	County Line Rd.	Buffalo Creek	Grab
13	County Line Rd.	DesPlaines River	"
14	Hintz Rd. Wheeling Drain.	Ditch	"
15	Palatine Rd.	DesPlaines River	"
16	Central Road	DesPlaines River	"
17	Oakton St.	DesPlaines River	"
18	Devon Ave.	Salt Creek	"
19	Belmont Ave.	DesPlaines River	"
20	Roosevelt Road	DesPlaines River	"
21	First Ave.	Salt Creek	"
22	Ogden Ave.	DesPlaines River	"
23	Willow Springs Rd.	DesPlaines River	"
24	Wolf Road	Salt Creek	"
25	Grand Ave.	DesPlaines River	"
26	Lawrence Ave.	DesPlaines River	"
27	York Road	Salt Creek	"
28	Hwy 83	DesPlaines River	"
29	Lemont Stephens St.	DesPlaines River (1)	24-hour Composite
30	County Line Rd.	W. Fork N. Branch	Grab

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE A-2 (Continued)

WATERWAYS DATA MANAGEMENT SYSTEM
STATION DIRECTORY

Code	Station Location		Type Sample
31	County Line Rd.	Md. Fork N. Branch	Grab
32	County Line Rd.	E. Fork N. Branch	"
33	East Lake Ave.	Md.Fork N. Branch	"
34	Dempster St. N.B.	Chicago River	"
35	Central Road	N. Shore Channel	"
36	Touhy Avenue	N. Shore Channel	"
37	Wilson Ave. N.S.	Chicago River	"
38	Ohio Street N.S.	Chicago River	"
39	Madison St. N.B.	Chicago River	"
40	Damen Ave. S.B.	Chicago River	"
41	Harlem Ave. Chgo.	San. & Ship Canal	"
42	Hwy 83 & Chicago	San. & Ship Canal	"
43	Hwy 83 & Cal Sag Channel		"
44	Howard Street	N. Shore Channel	"
45	Lawrence Ave. N.B.	Chicago River	"
46	Grand Ave. N.B.	Chicago River	"
47	Randolph Ave. S.B.	Chicago River	"
48	Lemont Bridge	Stephens Street(1)	24-hour Composite
49	92nd & Ewing Ave.	Calumet River	Grab
50	Wolf Lake Burnham Ave.		"
51	IHB R.R. Bridge	Grand Calumet River	"
52	Wentworth Ave.	Little Calumet River	"
53	Wentworth Ave.	North Creek	"
54	Joe Orr Road	Thorn Creek	"
55	130th Street	Calumet River	"
56	Indiana Ave.	Calumet River	"
57	135th & Ashland	Little Calumet River	"
58	Ashland Ave.	Calumet River	"
59	Cicero Ave.	Cal. Sag Channel	"
60	Crawford Ave.	Cal. Sag Channel	" (Discontinued)
61	Ashland Ave.	S.E. Chicago River	"

(1) Composite of several grab samples

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

1973 YEARLY FREQUENCIES OF ANALYSES FOR MSD WATERWAYS DAILY COMPOSITE SAMPLES

TABLE A-3

STA.#	STATION NAME	BOD	TSS	ORGS	INGS	D.O.	TEMP	COND	PH	CL-	TURB	ALKY	COD	TOTN	NH3N	TS	TVS
1	WILMETTE HARBOR	195	194	193	193	0	0	0	0	0	0	0	0	0	0	0	0
2	OUTER DRIVE BRIDGE	117	118	118	118	0	0	0	0	0	0	0	0	0	0	0	0
	SO. DIST. WATER FILTRATION PLANT	127	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	O BRIEN LOCKS	138	140	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	OHIO STREET	129	130	130	131	0	0	0	0	0	0	0	0	0	0	0	0
6	WILLOW SPRINGS ROAD	189	191	190	190	0	0	0	0	0	0	0	0	0	0	0	0
7	HWY 83 & ARCHER	190	191	190	190	0	0	0	0	0	0	0	0	0	0	0	0
8.2	LOCKPORT TREBLER	354	353	352	352	0	0	328	354	328	328	324	305	49	49	353	350
8.4	LOCKPORT 16TH. ST. BRIDGE	75	75	75	75	75	75	75	75	75	75	75	59	0	0	75	74
9	NORTHSIDE TREATMENT PLANT OUTFALL	365	365	281	281	0	309	364	365	365	0	0	360	365	365	364	0
10	SOUTHWEST TREATMENT PLANT OUTFALL	364	365	364	364	0	309	357	357	296	0	0	365	365	365	365	0
11	CALUMET TREATMENT PLANT OUTFALL	363	363	363	363	250	271	363	363	363	0	0	363	363	363	363	363
29	LEMONT STEPHENS ST DESPLAINES RIVER	229	229	227	227	229	229	218	229	218	218	218	195	47	47	228	223
48	LEMONT BRIDGE STEPHENS STREET (COMP)	231	231	230	230	231	231	220	231	220	220	220	192	45	45	231	220

		HEXS	OPGN	TDS	TDVS	PHEN	SO4	PO4	CN-	N2N3	MBAS	FLOW	NO2	NO3	RAIN	FL-
1	WILMETTE HARBOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	OUTER DRIVE BRIDGE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	SO. DIST. WATER FILTRATION PLANT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	O BRIEN LOCKS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	OHIO STREET	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	WILLOW SPRINGS ROAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	HWY 83 & ARCHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.2	LOCKPORT TREBLER	0	49	353	349	0	0	0	0	0	0	0	0	0	0	0
8.4	LOCKPORT 16TH ST. BRIDGE	0	0	75	74	0	0	0	0	0	0	0	0	0	0	0
9	NORTHSIDE TREATMENT PLANT OUTFALL	362	365	364	0	0	52	365	0	362	0	365	365	362	365	365
10	SOUTHWEST TREATMENT PLANT OUTFALL	360	365	365	0	363	47	355	305	256	46	365	256	256	365	349
11	CALUMET TREATMENT PLANT OUTFALL	363	363	363	363	363	52	363	252	363	0	356	363	363	356	363
29	LEMONT STEPHENS ST DESPLAINES RIVER	0	47	226	221	0	0	0	0	0	0	0	0	0	0	0
48	LEMONT BRIDGE STEPHENS STREET (COMP)	0	45	231	230	0	0	0	0	0	0	0	0	0	0	0

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

1973 YEARLY FREQUENCIES OF ANALYSES FOR MSD WATERWAYS DAILY GRAB SAMPLES

TABLE A-4

STA.#	STATION NAME	BOD	TSS	ORGS	INGS	D.O.	TEMP	PH	CL-	COD	NH3N	TS	HEXS	TDS	PHEN
CHICAGO RIVER RUN STATIONS															
30	COUNTY LINE RD. W. FORK N. BRANCH	12	12	12	12	12	9	12	12	12	12	12	12	12	0
31	COUNTY LINE RD. MD.FORK N. BRANCH	11	11	11	11	12	9	11	11	11	11	11	12	11	0
32	COUNTY LINE RD. E. FORK N. BRANCH	12	12	12	12	11	9	12	12	12	12	12	11	12	0
33	EAST LAKE AVE. MD.FORK N. BRANCH	12	12	12	12	12	9	12	12	12	12	12	12	12	0
34	DEMPSTER ST. N.B. CHICAGO RIVER	12	12	12	12	11	9	12	12	12	12	12	12	12	11
35	CENTRAL ROAD N. SHORE CHANNEL	9	9	9	9	8	7	9	9	9	9	9	9	9	9
36	TOUHY AVE. N. SHORE CHANNEL	12	12	12	12	12	9	12	12	12	12	12	12	12	12
37	WILSON AVE. N.B. CHICAGO RIVER	12	12	12	12	11	9	12	12	12	12	12	12	12	0
38	OHIO STREET N.B. CHICAGO RIVER	12	12	12	12	12	9	12	12	12	12	12	12	12	12
39	MADISON ST. N.B. CHICAGO RIVER	12	12	12	12	11	9	12	12	12	12	12	12	12	0
40	DAMEN AVE. S.B. CHICAGO RIVER	12	12	12	12	12	9	12	11	12	12	12	12	12	0
41	HARLEM AV. CHGO. SAN. & SHIP CANAL	12	12	12	12	12	9	11	11	12	12	12	12	12	12
42	HWY 83 & CHICAGO SAN. & SHIP CANAL	23	23	23	23	23	18	23	23	23	23	23	22	23	12
62	LEMONT BRIDGE STEPHENS STREET (GPAB)	2	2	2	2	1	1	2	2	2	2	2	2	2	2
DESPLAINES RIVER RUN STATIONS															
12	COUNTY LINE RD. BUFFALO CREEK	11	11	11	11	11	7	11	11	11	11	11	11	11	0
13	COUNTY LINE RD. DESPLAINES RIVER	11	11	11	11	11	7	11	11	11	11	11	11	11	0
14	HINTZ RD. WHEELING DRAIN. DITCH	11	11	11	11	11	7	11	11	11	11	11	11	11	0
15	PALATINE RD. DESPLAINES RIVER	11	11	11	11	11	7	11	11	11	11	11	11	11	11
16	CENTRAL ROAD DESPLAINES RIVER	11	11	11	11	10	7	11	11	11	11	11	11	11	0
17	OAKTON ST. DESPLAINES RIVER	11	11	11	11	11	7	11	11	11	11	11	11	11	0
18	DEVON AVE. SALT CREEK	7	7	7	7	7	5	7	7	7	7	7	7	7	0
19	BELMONT AVE. DESPLAINES RIVER	11	11	11	11	11	7	11	11	11	11	11	11	11	11
20	ROOSEVELT ROAD DESPLAINES RIVER	11	11	11	11	11	7	11	11	11	11	11	11	11	11
21	FIRST AVE. SALT CREEK	11	11	11	11	10	7	11	11	11	11	11	11	11	11
22	OGDEN AVE. DESPLAINES RIVER	11	11	11	11	11	7	11	11	11	11	11	11	11	0
23	WILLOW SPRINGS RD. DESPLAINES RIVER	11	11	11	11	11	7	11	11	11	11	11	11	11	11
24	WOLF ROAD SALT CREEK	11	11	11	11	11	7	11	11	11	11	11	11	11	0
CALUMET RIVER RUN STATIONS															
43	HWY 83 & CAL SAG CHANNEL	23	23	23	23	23	18	23	23	23	23	23	23	23	12
49	92ND & EWING AVE. CALUMET RIVER	12	12	12	12	12	9	12	12	12	12	12	12	12	11
50	WOLF LAKE BURNHAM AVE.	12	12	12	12	12	9	12	12	12	12	12	12	12	0
51	IHB R.R. BRIDGE GRAND CALUMET RIVER	12	12	12	12	12	9	12	12	12	12	12	12	12	11
52	WENTWORTH AVE. LITTLE CALUMET RIVER	11	11	11	11	11	8	11	11	11	11	11	11	11	0
53	WENTWORTH AVE. NORTH CREEK	7	7	7	7	7	4	7	7	7	7	7	7	7	0
54	JOE ORR ROAD THORN CREEK	12	11	11	11	12	9	12	11	12	12	11	12	11	0
55	130TH STREET CALUMET RIVER	12	12	12	12	12	9	12	12	12	12	12	12	12	12
56	INDIANA AVE. CALUMET RIVER	12	12	12	12	12	9	12	12	12	12	12	12	12	0
57	135TH & ASHLAND LITTLE CALUMET RIVER	12	12	12	12	12	9	12	12	12	12	12	12	12	0
58	ASHLAND AVE. CAL SAG CHANNEL	12	12	12	12	12	9	12	12	12	12	12	12	12	12
59	CICERO AVE. CAL SAG CHANNEL	12	12	12	12	12	9	12	12	12	12	12	12	12	0

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

1973 YEARLY FREQUENCIES OF ANALYSES FOR MSD WATERWAYS DAILY GRAB SAMPLES

TABLE A-4 (Continued)

STA.#	STATION NAME	SO4	PO4	CN-	N2N3	MBAS	ZN	CD	CU	T.CR	HEXC	FE	NI	PB	HG
CHICAGO RIVER RUN STATIONS															
30	COUNTY LINE RD. W. FORK N. BRANCH	12	12	0	12	12	12	12	12	12	0	12	12	12	12
31	COUNTY LINE RD. MD.FORK N. BRANCH	11	11	0	11	11	12	12	12	12	0	12	12	12	12
32	COUNTY LINE RD. E. FORK N. BRANCH	12	12	0	12	12	12	12	12	12	0	12	12	12	12
33	EAST LAKE AVE. MD.FORK N. BRANCH	12	12	0	12	11	12	12	12	12	0	12	12	12	12
34	DEMPSTER ST. N.B. CHICAGO RIVER	12	12	12	12	12	12	12	12	12	0	12	12	12	12
35	CENTRAL ROAD N. SHORE CHANNEL	9	9	9	9	9	9	9	9	9	0	9	9	9	9
36	TOUHY AVE. N. SHORE CHANNEL	12	12	12	12	12	12	12	12	12	0	12	12	12	12
37	WILSON AVE. N.B. CHICAGO RIVER	12	12	0	12	12	12	12	12	12	0	12	12	12	12
38	OHIO STREET N.B. CHICAGO RIVER	12	12	12	12	12	12	12	12	12	0	12	12	12	12
39	MADISON ST. N.B. CHICAGO RIVER	12	12	0	12	12	12	12	12	12	0	12	12	12	12
40	DAMEN AVE. S.B. CHICAGO RIVER	11	12	0	12	11	12	12	12	12	0	12	12	12	12
41	HARLEM AV. CHGO. SAN. & SHIP CANAL	11	12	12	12	11	12	12	12	12	0	12	12	12	12
42	HWY 83 & CHICAGO SAN. & SHIP CANAL	23	23	12	23	23	23	23	23	23	0	23	23	23	23
62	LEMONT BRIDGE STEPHENS STREET (GRAB)	2	2	2	2	2	2	2	2	2	0	2	2	2	2
DESPLAINES RIVER RUN STATIONS															
12	COUNTY LINE RD. BUFFALO CREEK	11	11	0	11	10	11	11	11	11	1	11	11	11	11
13	COUNTY LINE RD. DESPLAINES RIVER	11	11	0	11	10	11	11	11	11	1	11	11	11	11
14	HINTZ RD. WHEELING DRAIN. DITCH	11	11	0	11	10	11	11	11	11	1	11	11	11	11
15	PALATINE RD. DESPLAINES RIVER	11	11	10	11	10	11	11	11	11	1	11	11	11	11
16	CENTRAL ROAD DESPLAINES RIVER	11	11	0	11	10	11	11	11	11	1	11	11	11	11
17	OAKTON ST. DESPLAINES RIVER	11	11	0	11	10	11	11	11	11	1	11	11	11	11
18	DEVON AVE. SALT CREEK	7	7	0	7	6	7	7	7	7	1	7	7	7	7
19	BELMONT AVE. DESPLAINES RIVER	11	11	11	11	10	11	11	11	11	1	11	11	11	11
20	ROOSEVELT ROAD DESPLAINES RIVER	11	11	11	11	10	11	11	11	11	1	11	11	11	11
21	FIRST AVE. SALT CREEK	11	11	11	11	10	11	11	11	11	1	11	11	11	11
22	OGDEN AVE. DESPLAINES RIVER	11	11	0	11	10	11	11	11	11	1	11	11	11	11
23	WILLOW SPRINGS RD. DESPLAINES RIVER	11	11	10	11	10	11	11	11	11	1	11	11	11	11
24	WOLF ROAD SALT CREEK	11	11	0	11	10	11	11	11	11	1	11	11	11	11
CALUMET RIVER RUN STATIONS															
43	HWY 83 & CAL SAG CHANNEL	23	23	12	23	22	23	23	23	23	0	23	23	23	23
49	92ND & EWING AVE. CALUMET RIVER	12	12	12	12	12	12	12	12	12	0	12	12	12	12
50	WOLF LAKE BURNHAM AVE.	12	12	0	12	11	12	12	12	12	0	12	12	12	12
51	IHB R.R. BRIDGE GRAND CALUMET RIVER	12	12	12	12	12	12	12	12	12	0	12	12	12	12
52	WENTWORTH AVE. LITTLE CALUMET RIVER	11	11	0	11	11	11	11	11	11	0	11	11	11	11
53	WENTWORTH AVE. NORTH CREEK	7	7	0	7	7	7	7	7	7	0	7	7	7	7
54	JOE ORR ROAD THORN CREEK	11	12	0	12	12	12	12	12	12	0	12	12	12	12
55	130TH STREET CALUMET RIVER	12	12	12	12	12	12	12	12	12	0	12	12	12	12
56	INDIANA AVE. CALUMET RIVER	12	12	0	12	12	12	12	12	12	0	12	12	12	12
57	135TH & ASHLAND LITTLE CALUMET RIVER	12	12	0	12	12	12	12	12	12	0	12	12	12	12
58	ASHLAND AVE. CAL SAG CHANNEL	12	12	12	12	12	12	12	12	12	0	12	12	12	12
59	CICERO AVE. CAL SAG CHANNEL	12	12	0	12	12	12	12	12	12	0	12	12	12	12

1973 YEARLY FREQUENCIES OF ANALYSES FOR MSD WATERWAYS DAILY GRAB SAMPLES

TABLE A-4 (Continued)

STA.#	STATION NAME	AS	SE	BA	AC	TC	FC	FS	TOC	SLFE	MN
CHICAGO RIVER RUN STATIONS											
30	COUNTY LINE RD. W. FORK N. BRANCH	12	12	12	12	12	12	12	6	0	10
31	COUNTY LINE RD. MD.FORK N. BRANCH	12	12	12	12	12	12	12	6	0	10
32	COUNTY LINE RD. E. FORK N. BRANCH	12	12	12	12	12	12	12	6	0	10
33	EAST LAKE AVE. MD.FORK N. BRANCH	12	12	12	12	12	12	12	6	0	10
34	DEMPSTER ST. N.B. CHICAGO RIVER	12	12	12	12	12	12	12	6	0	10
35	CENTRAL ROAD N. SHORE CHANNEL	9	9	9	9	9	9	9	4	0	9
36	TOUHY AVE. N. SHORE CHANNEL	12	12	12	12	12	12	12	6	0	10
37	WILSON AVE. N.B. CHICAGO RIVER	12	12	12	12	12	12	12	6	0	10
38	OHIO STREET N.B. CHICAGO RIVER	12	12	12	12	12	12	12	6	0	10
39	MADISON ST. N.B. CHICAGO RIVER	12	12	12	12	12	12	12	6	0	10
40	DAMEN AVE. S.B. CHICAGO RIVER	12	12	12	12	12	12	12	6	0	10
41	HARLEM AV. CHGO. SAN. & SHIP CANAL	12	12	12	12	12	12	12	6	0	10
42	HWY 83 & CHICAGO SAN. & SHIP CANAL	23	23	23	23	21	21	21	11	1	19
62	LEMONT BRIDGE STEPHENS STREET (GRAB)	2	2	2	2	2	2	2	1	1	2
DESPLAINES RIVER RUN STATIONS											
12	COUNTY LINE RD. BUFFALO CREEK	11	11	11	11	11	10	11	7	1	9
13	COUNTY LINE RD. DESPLAINES RIVER	11	11	11	11	11	10	11	7	1	9
14	HINTZ RD. WHEELING DRAIN. DITCH	11	11	11	11	11	10	11	7	1	9
15	PALATINE RD. DESPLAINES RIVER	11	11	11	11	11	10	11	7	1	9
16	CENTRAL ROAD DESPLAINES RIVER	11	11	11	11	11	10	11	7	1	9
17	OAKTON ST. DESPLAINES RIVER	11	11	11	11	11	10	11	7	1	9
18	DEVON AVE. SALT CREEK	7	7	7	7	7	6	7	5	1	5
19	BELMONT AVE. DESPLAINES RIVER	11	11	11	11	11	10	11	7	1	9
20	ROOSEVELT ROAD DESPLAINES RIVER	11	11	11	11	11	10	11	7	1	9
21	FIRST AVE. SALT CREEK	11	11	11	11	11	10	11	7	1	9
22	OGDEN AVE. DESPLAINES RIVER	11	11	11	11	10	9	10	7	1	9
23	WILLOW SPRINGS RD. DESPLAINES RIVER	11	11	11	11	11	10	11	7	1	9
24	WOLF ROAD SALT CREEK	11	11	11	11	11	10	11	7	1	9
CALUMET RIVER RUN STATIONS											
43	HWY 83 & CAL SAG CHANNEL	23	23	23	23	20	20	20	11	1	19
49	92ND & EWING AVE. CALUMET RIVER	12	12	12	12	10	10	10	5	0	10
50	WOLF LAKE BURNHAM AVE.	12	12	12	12	10	10	10	5	0	10
51	IHB R.R. BRIDGE GRAND CALUMET RIVER	12	12	12	12	10	10	10	5	0	10
52	WENTWORTH AVE. LITTLE CALUMET RIVER	11	11	11	11	9	9	9	4	0	10
53	WENTWORTH AVE. NORTH CREEK	7	7	7	7	7	7	7	3	0	5
54	JOE ORR ROAD THORN CREEK	12	12	12	12	10	10	10	5	0	10
55	130TH STREET CALUMET RIVER	12	12	12	12	10	10	10	5	0	10
56	INDIANA AVE. CALUMET RIVER	12	12	12	12	10	10	10	5	0	10
57	135TH & ASHLAND LITTLE CALUMET RIVER	12	12	12	12	10	10	10	5	0	10
58	ASHLAND AVE. CAL SAG CHANNEL	12	12	12	12	10	9	9	5	0	10
59	CICERO AVE. CAL SAG CHANNEL	12	12	12	12	10	10	10	5	1	10

APPENDIX B.

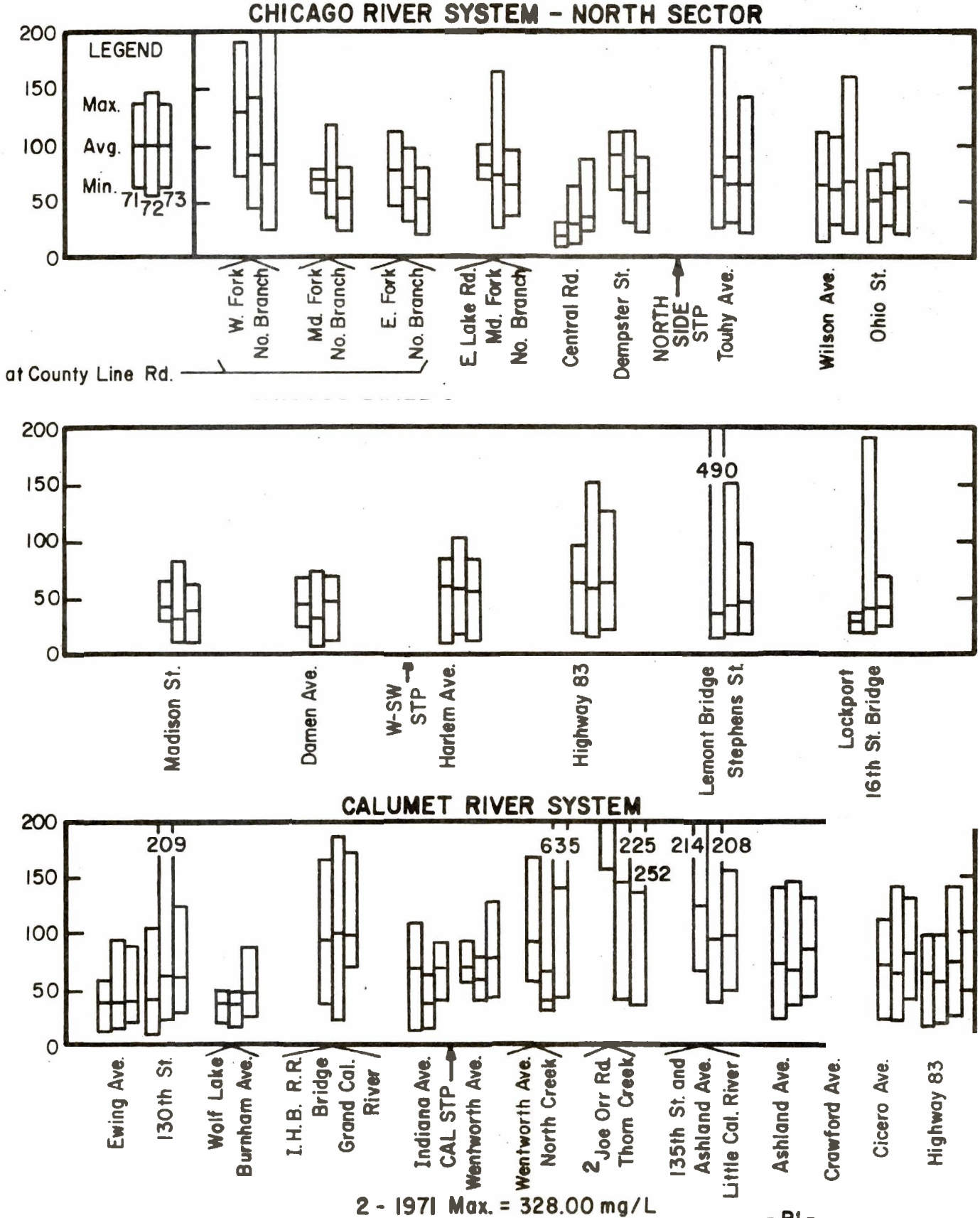
WATER QUALITY RESULTS

BAR CHARTS SHOWING MEANS AND RANGES FOR WATERWAYS GRAB SAMPLES FOR 1971, 1972, and 1973

COD LEVELS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum COD Levels in mg/L

Figure B1



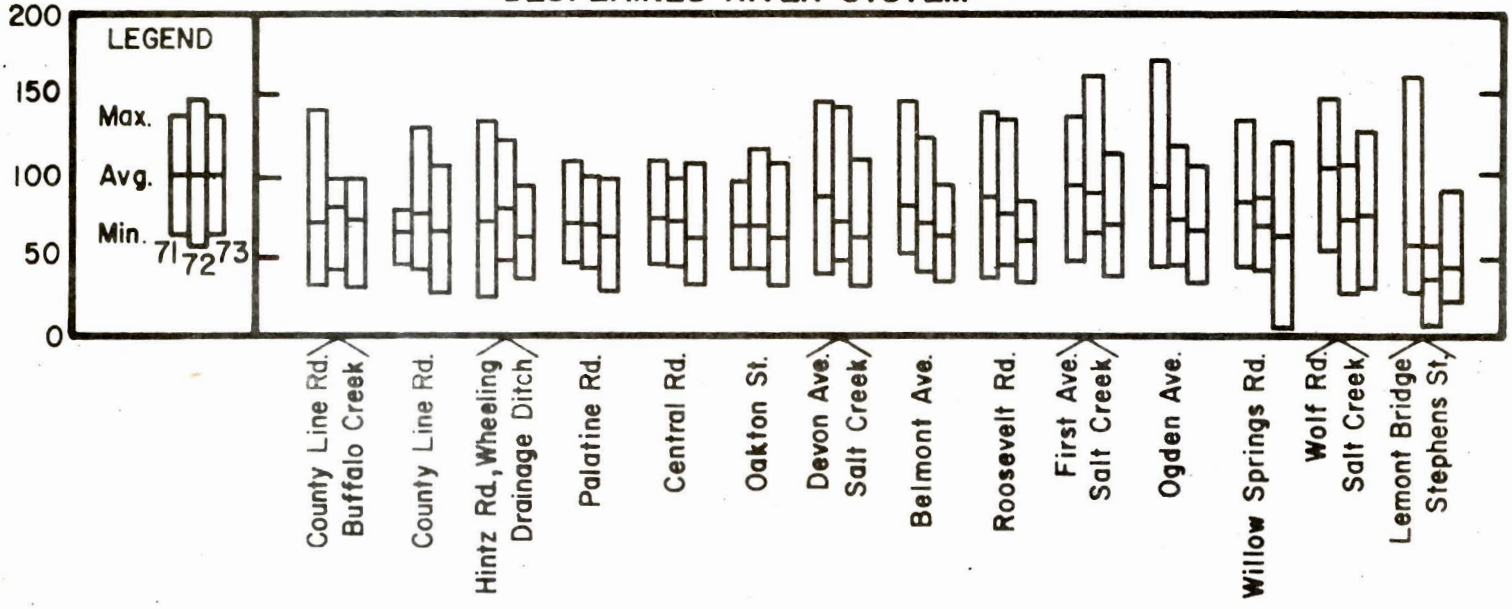
2 - 1971 Max. = 328.00 mg/L
Avg. = 242.62 mg/L

COD LEVELS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum COD Levels in mg/L

Figure B1 (cont'd.)

DESPLAINES RIVER SYSTEM

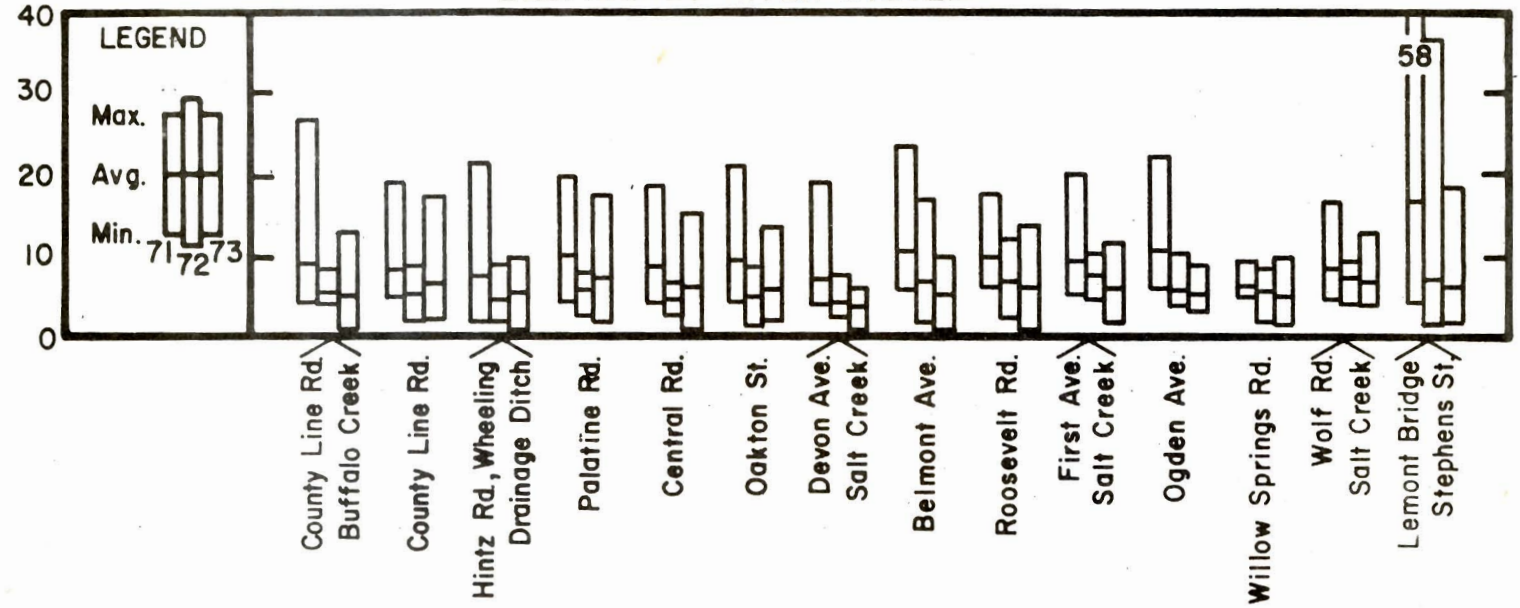


BOD LEVELS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum BOD Levels in mg/L

Figure B2

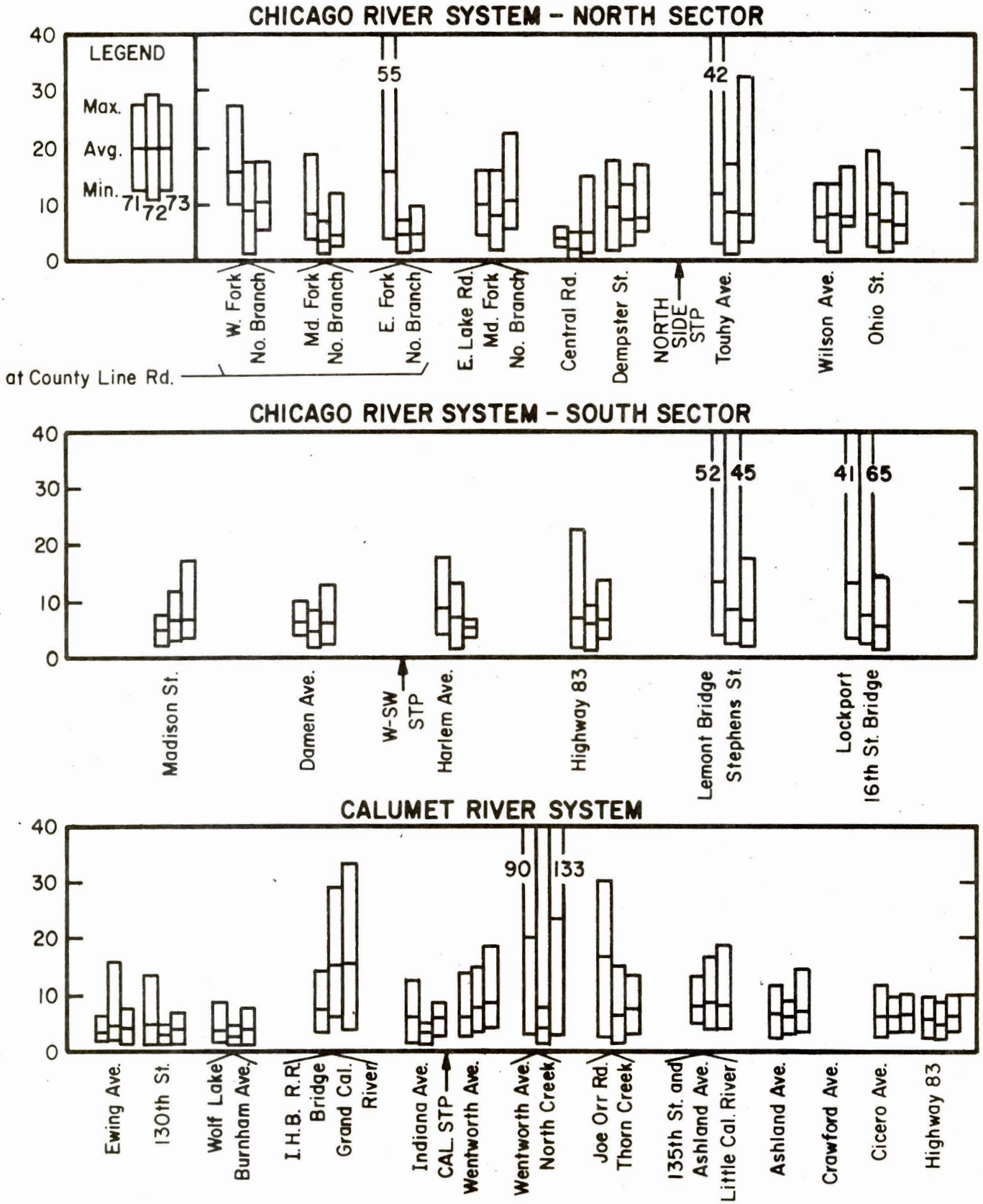
DESPLAINES RIVER SYSTEM



BOD LEVELS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum BOD Levels in mg/L

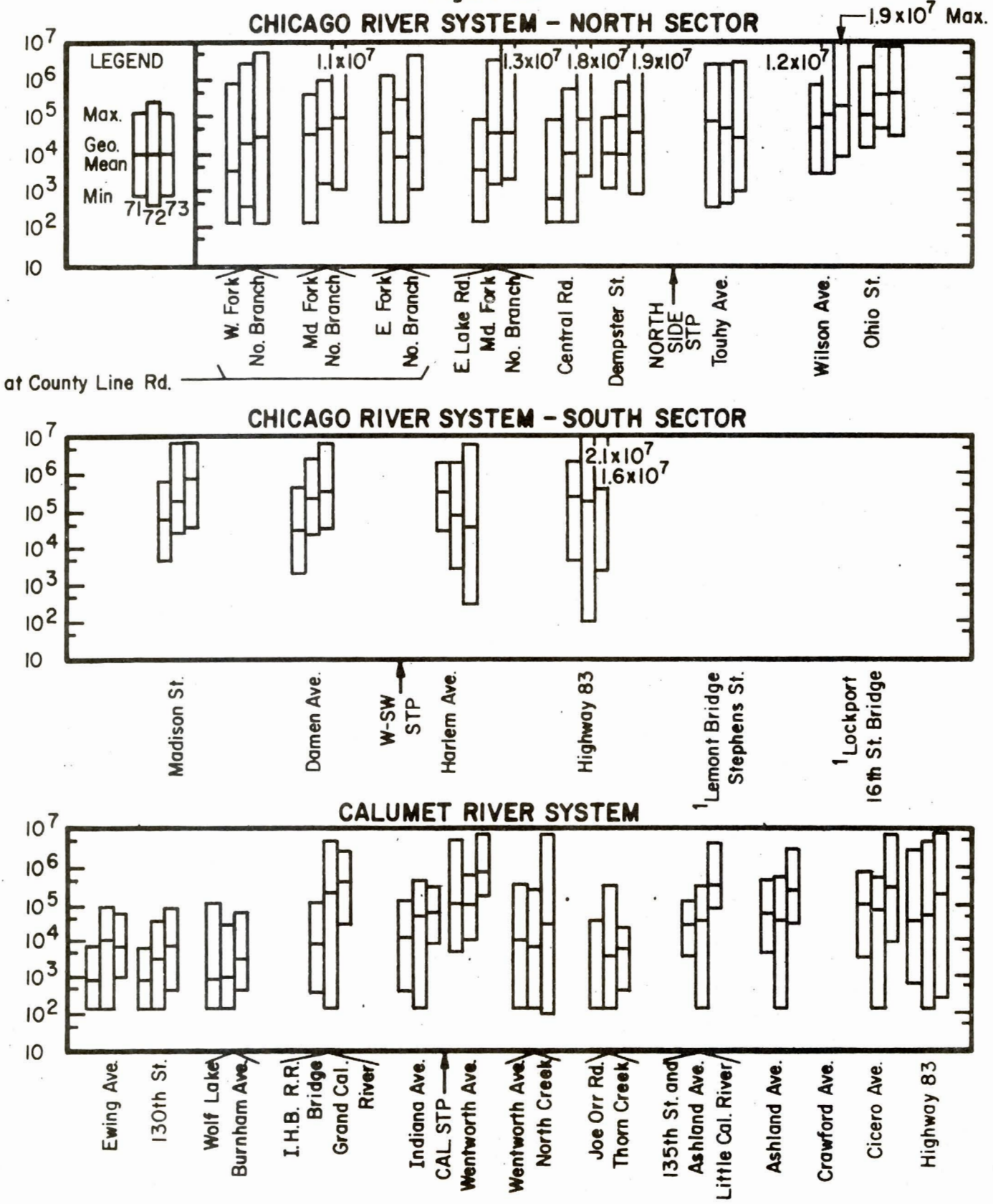
Figure B2 (cont'd.)



TOTAL COLIFORM COUNTS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Geometric Mean and Minimum Counts/100ml.

Figure B3



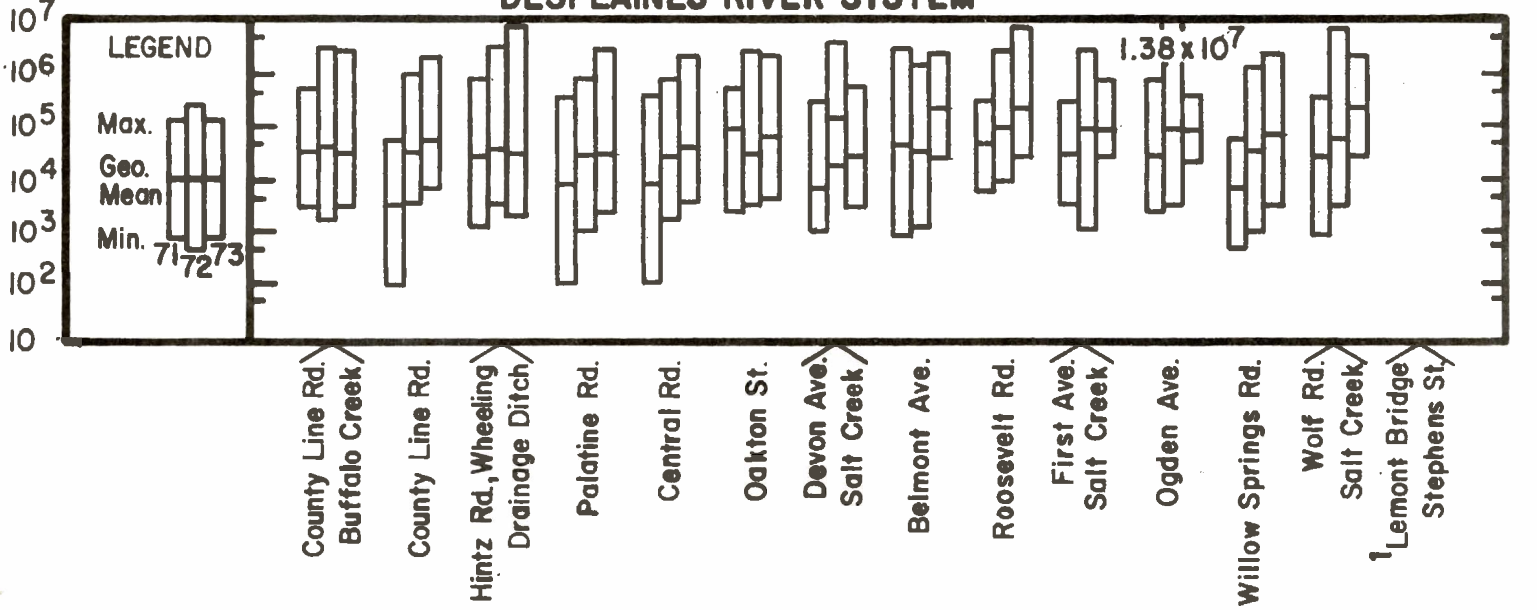
1 - Data not available

TOTAL COLIFORM COUNTS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Geometric Mean and Minimum Counts/100ml.

Figure B3 (cont'd.)

DESPLAINES RIVER SYSTEM

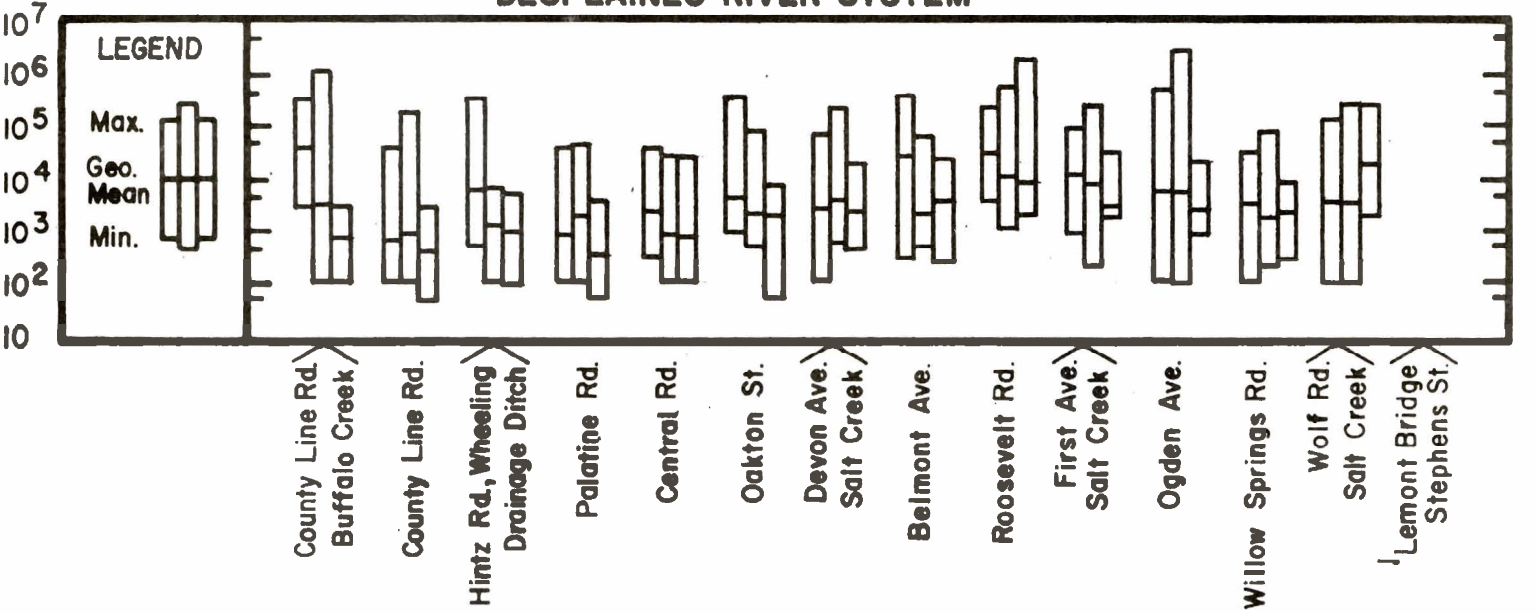


FECAL COLIFORM COUNTS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Geometric Mean and Minimum Counts/100 ml.

Figure B4

DESPLAINES RIVER SYSTEM

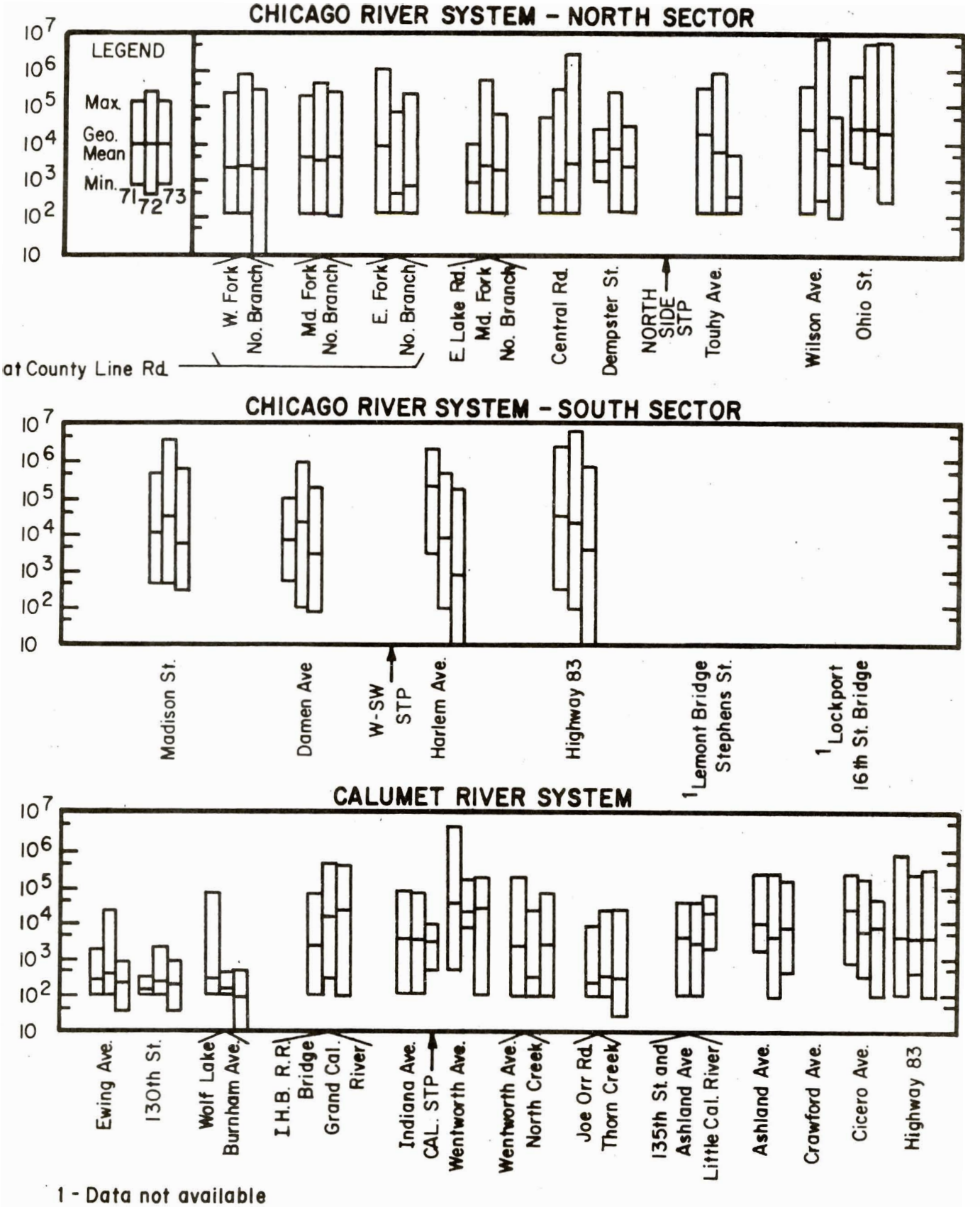


1 - Data not available

FECAL COLIFORM COUNTS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Geometric Mean and Minimum Counts/100 ml.

Figure B4 (cont'd)

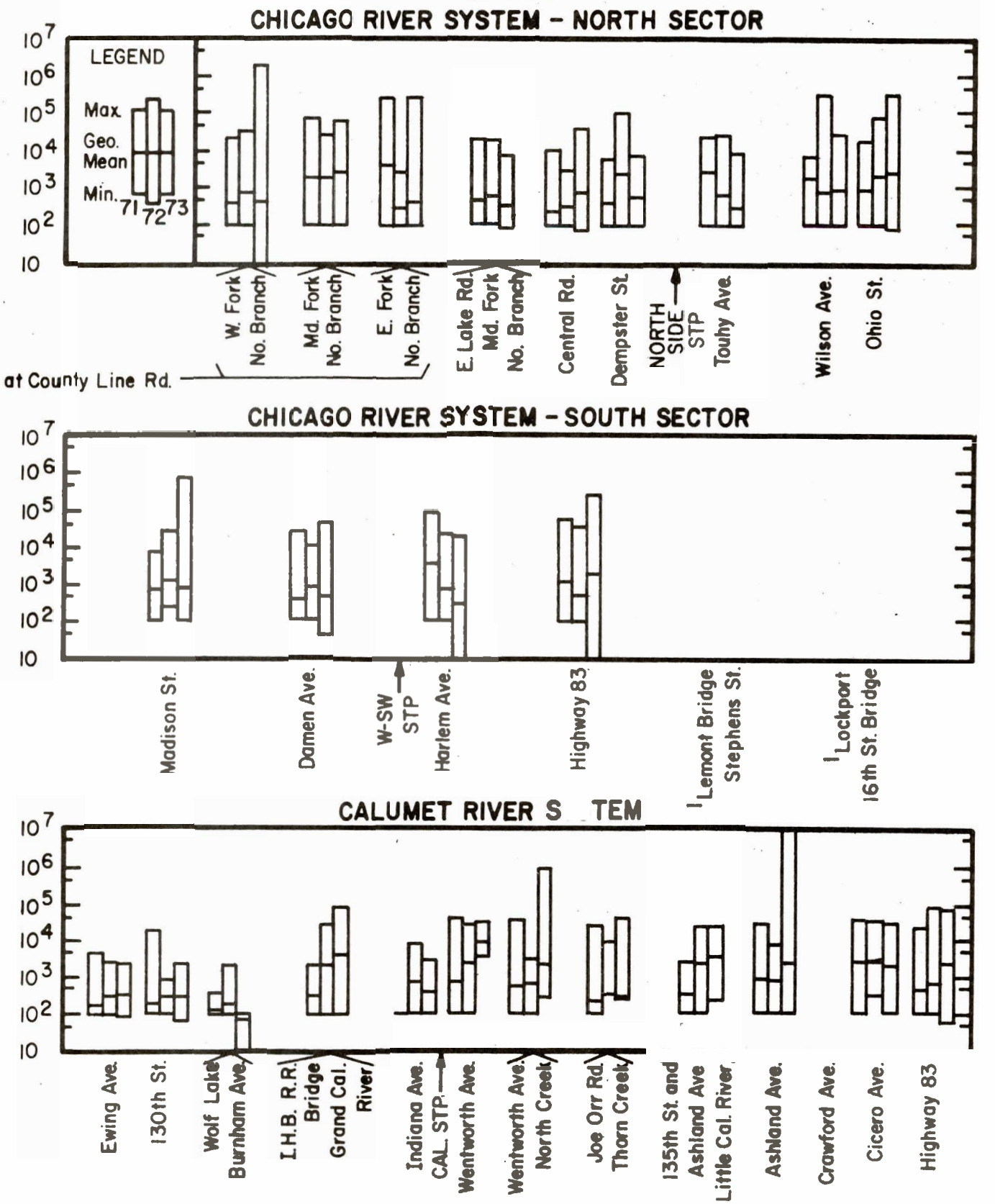


1 - Data not available

FECAL STREP COUNTS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Geometric Mean and Minimum Counts/100ml.

Figure B5



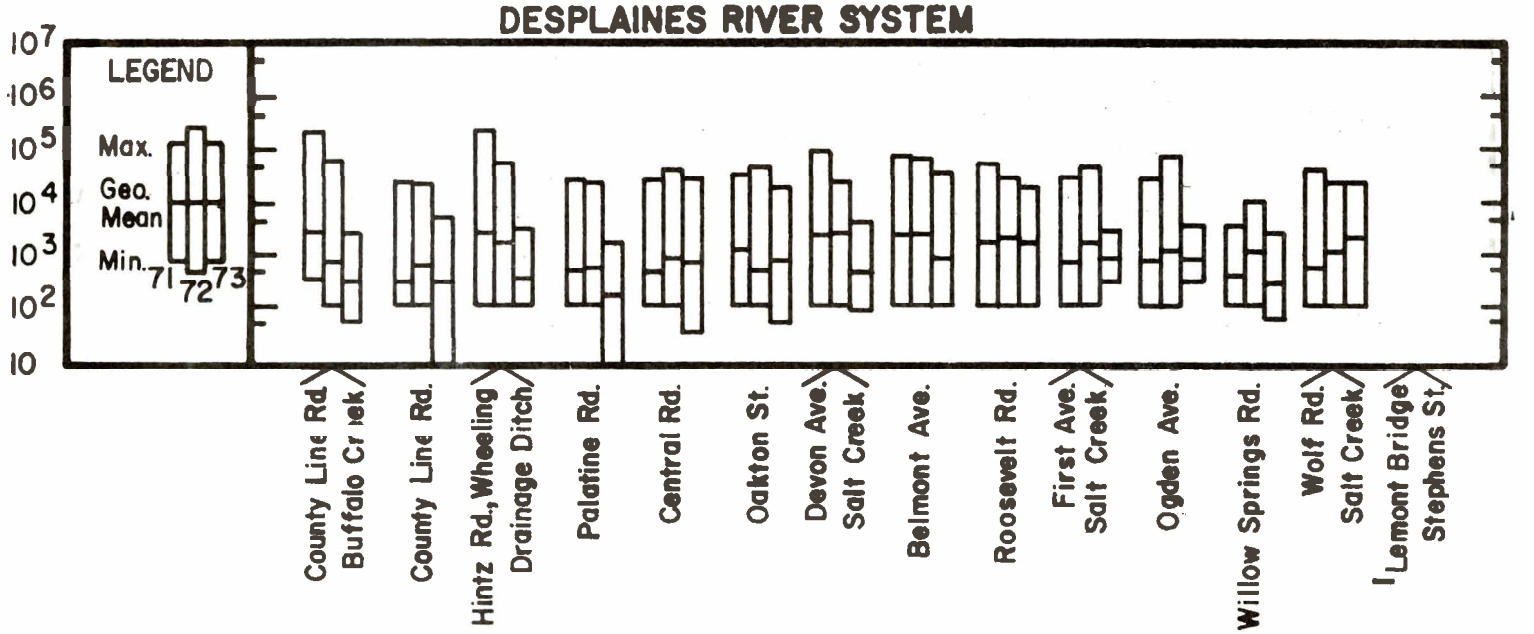
1 - Data not available

FECAL STREP COUNTS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Geometric Mean and Minimum Counts/100ml.

Figure B5 (cont'd)

DESPLAINES RIVER SYSTEM

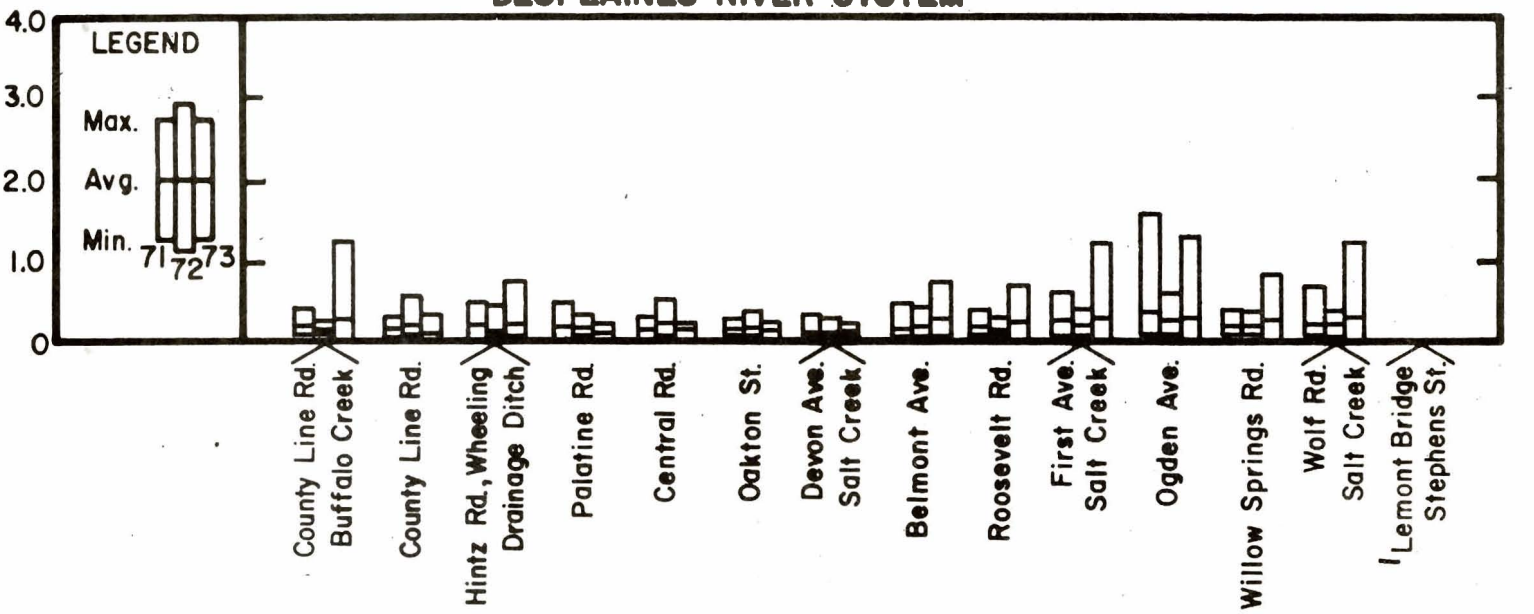


MBAS LEVELS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum MBAS Levels in mg/L

Figure B6

DESPLAINES RIVER SYSTEM

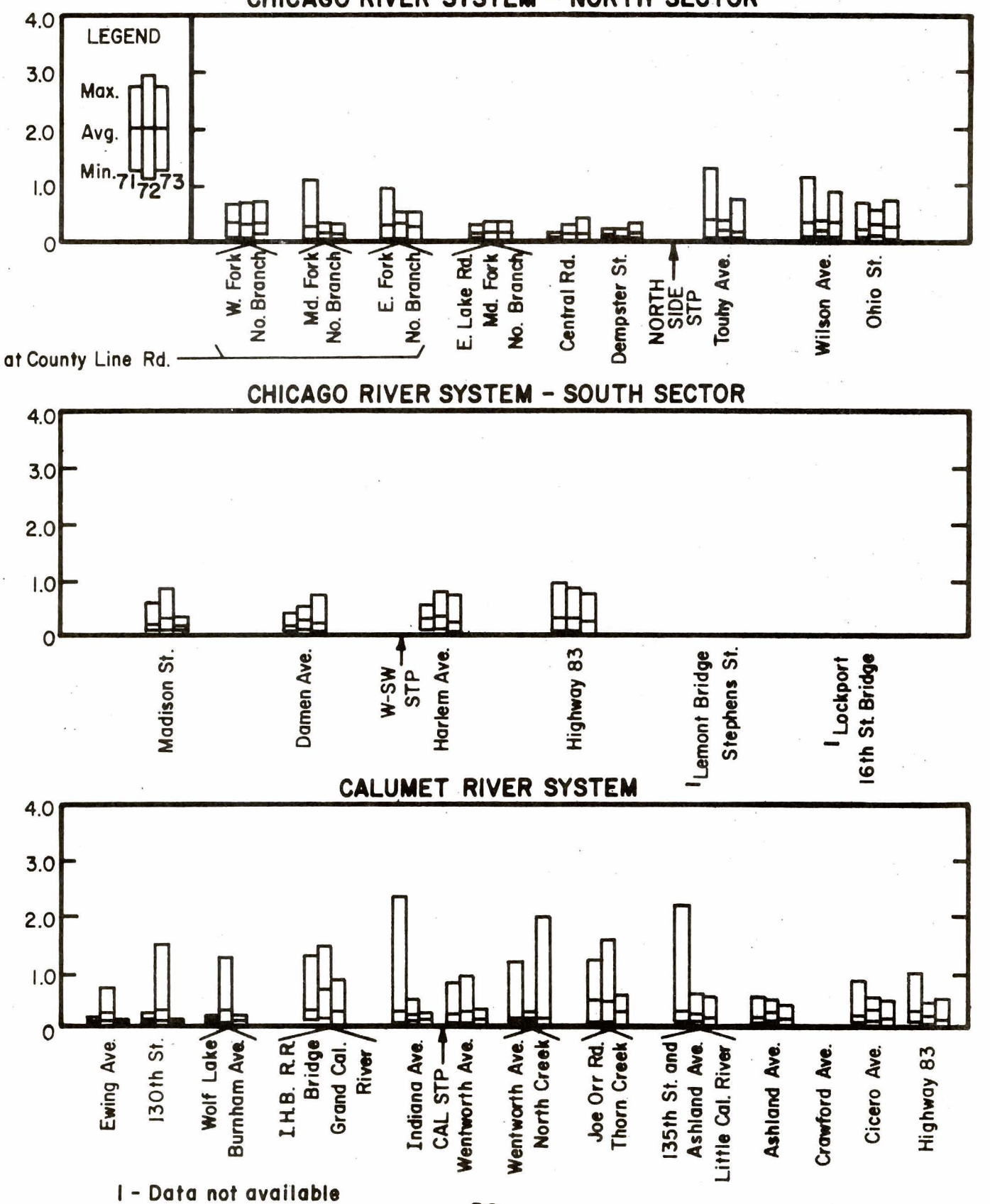


I - Data not available

MBAS LEVELS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Levels in mg/L

Figure B6(cont'd.)

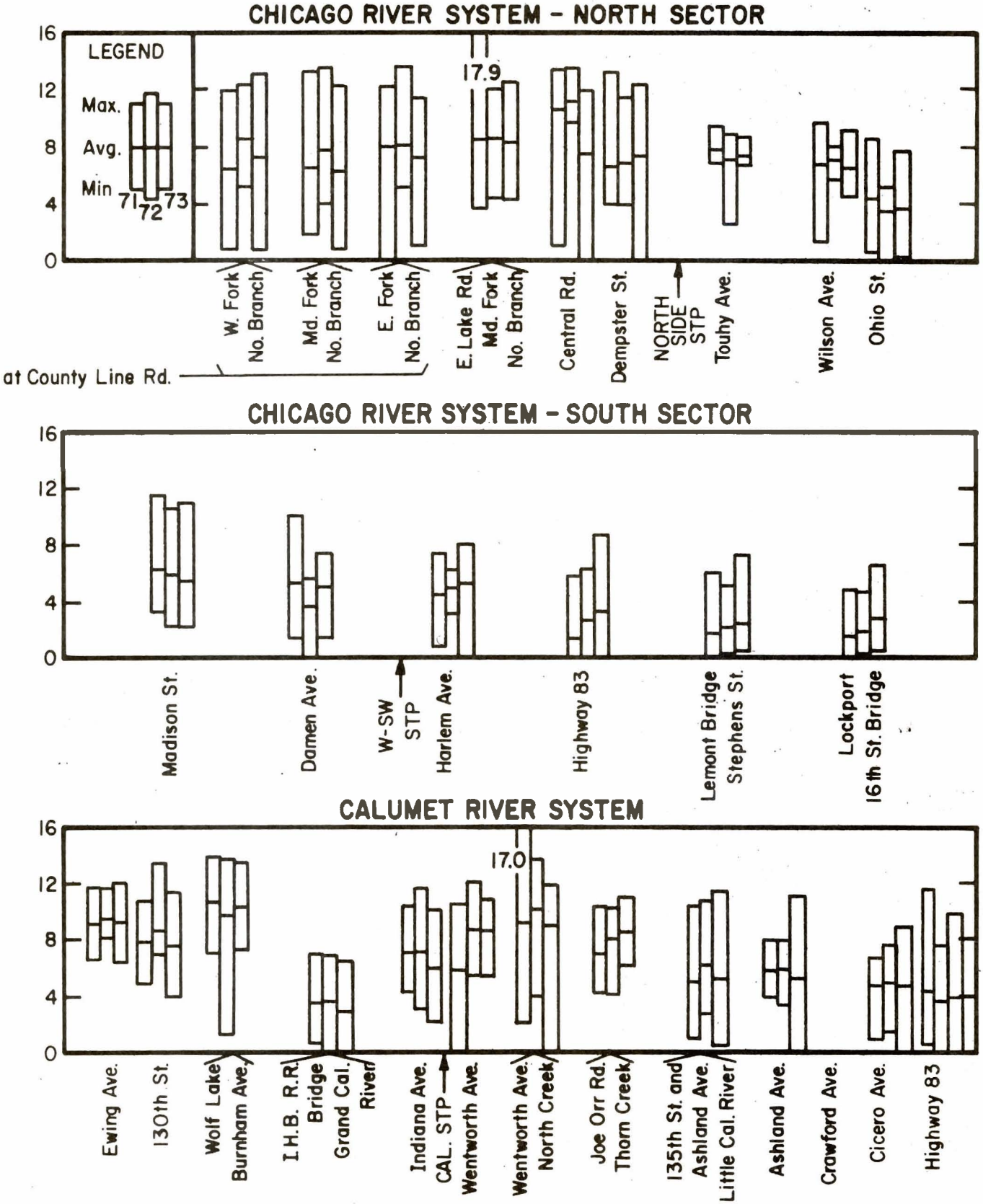


I - Data not available

DISSOLVED OXYGEN CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B7

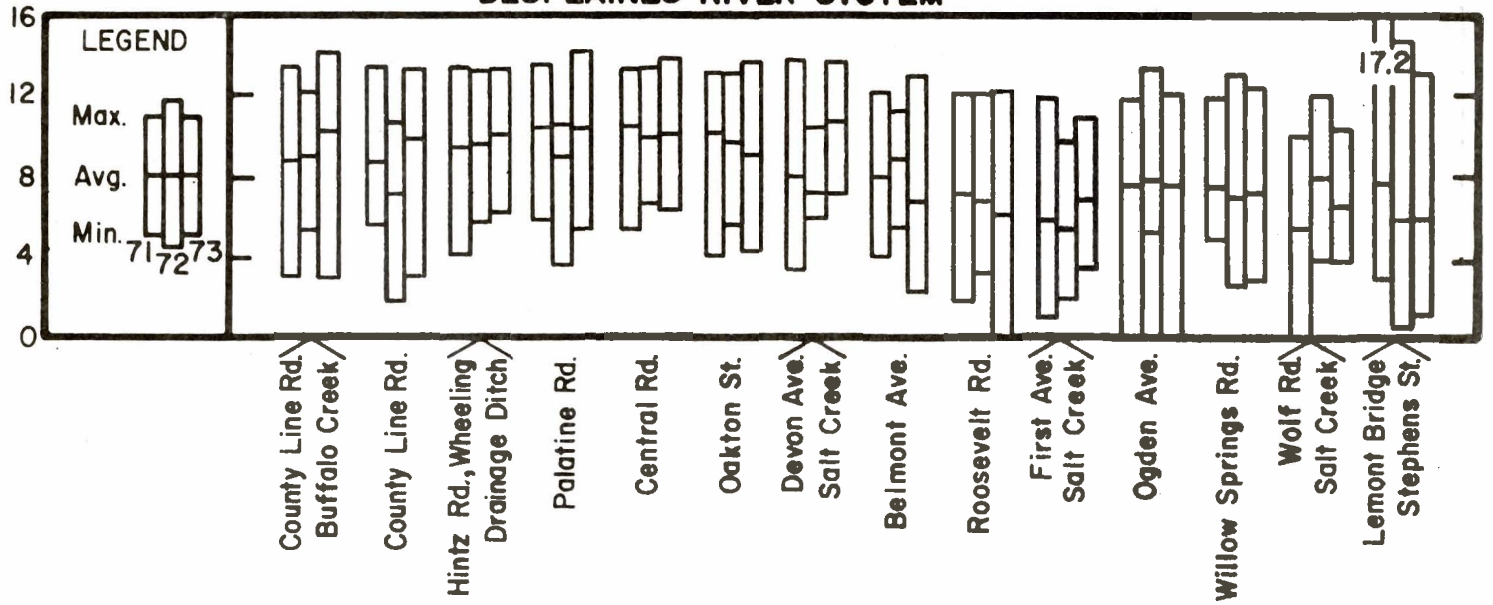


DISSOLVED OXYGEN CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in mg/L

Figure B7 (cont'd.)

DESPLAINES RIVER SYSTEM

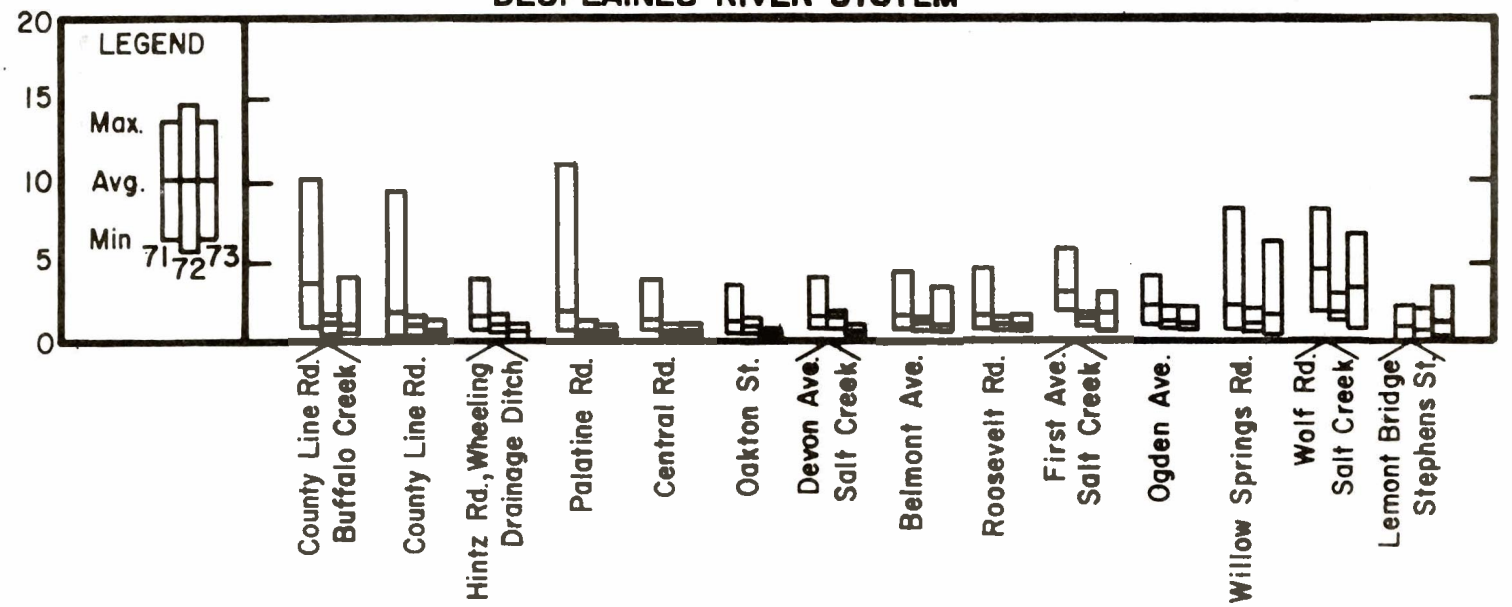


AMMONIA NITROGEN LEVELS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B8

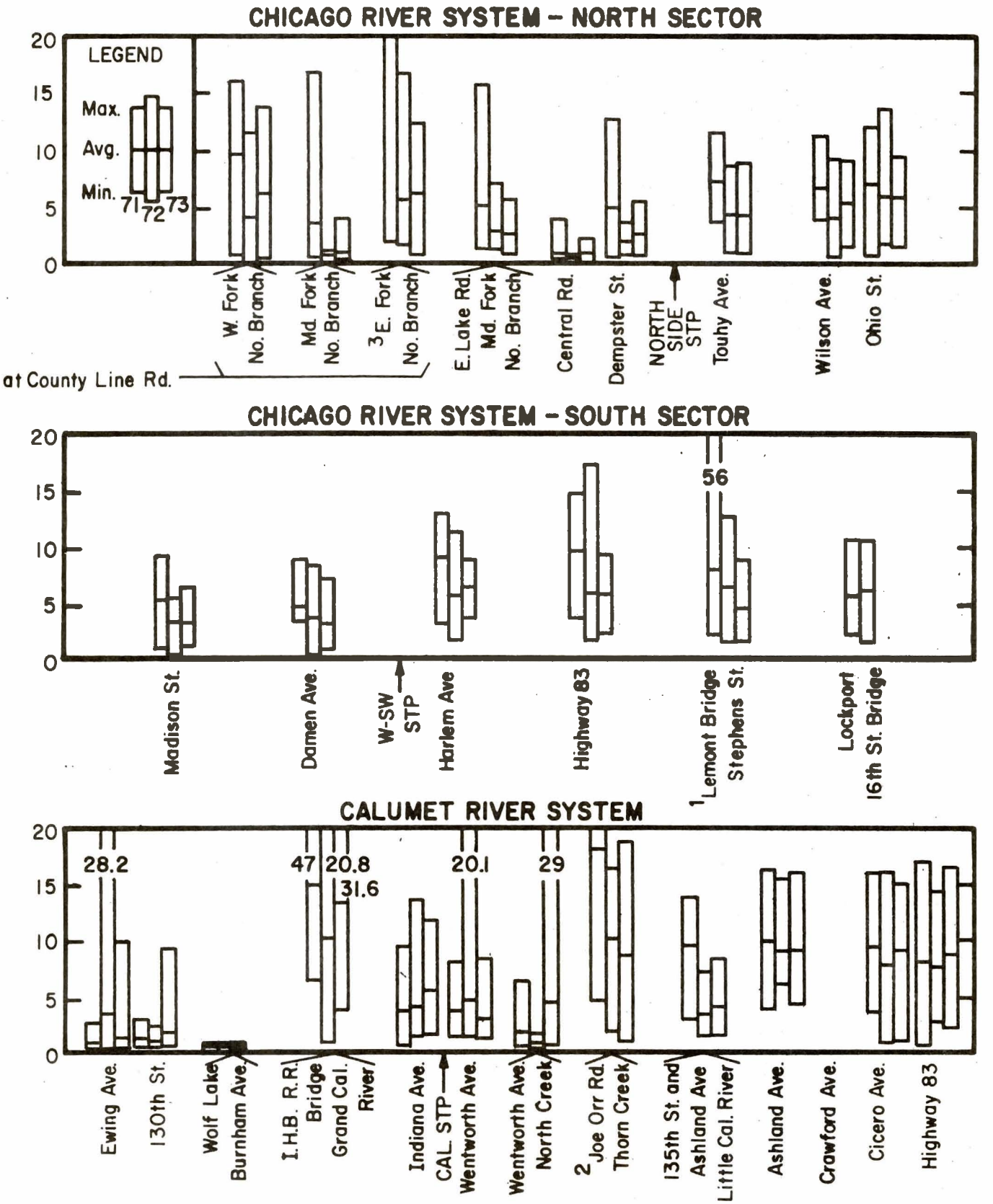
DESPLAINES RIVER SYSTEM



AMMONIA NITROGEN LEVELS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B8 (cont'd.)



1 - 1971 & 1972 Data Only

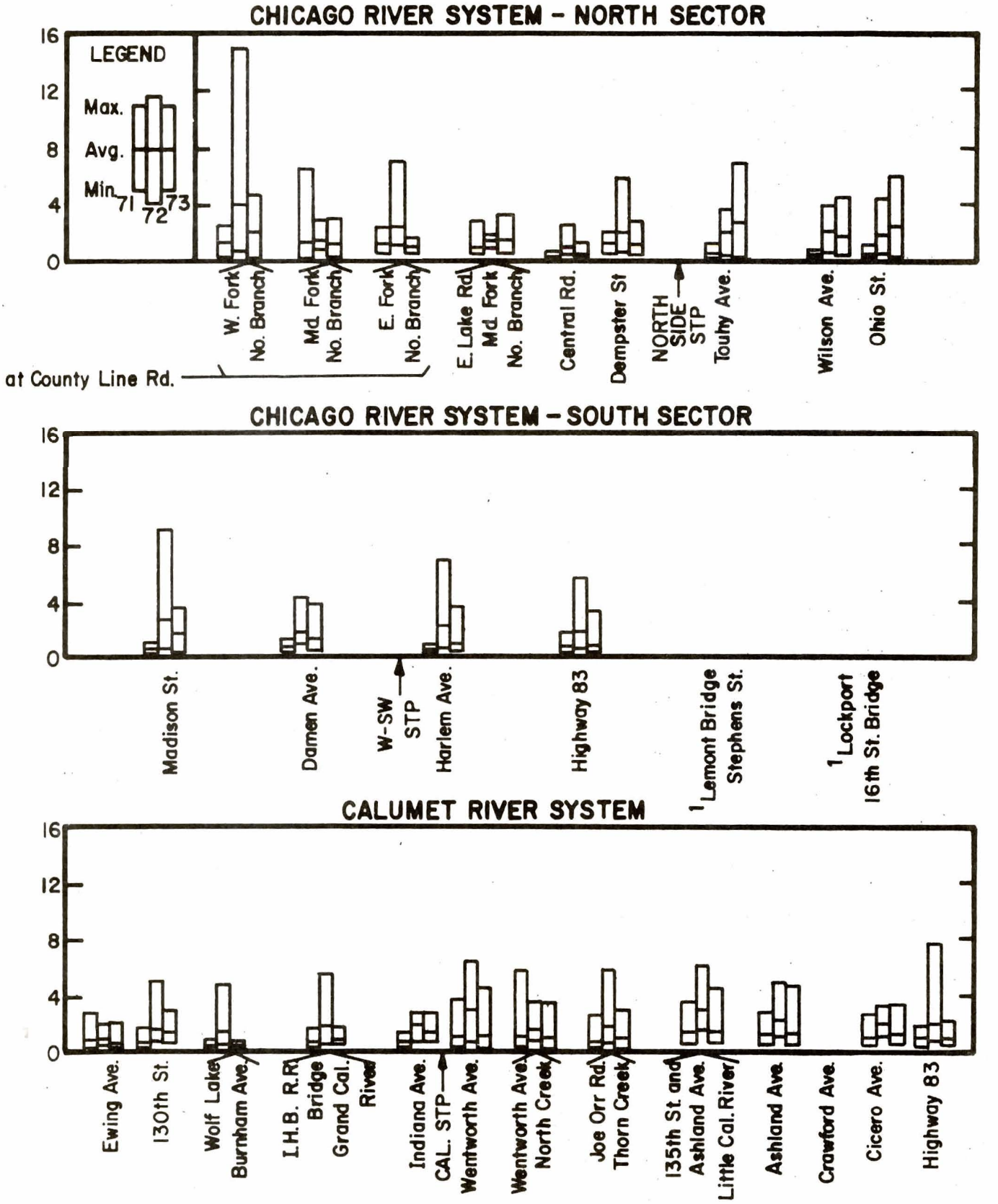
2 - 1971 Max. = 25.4 mg/L

3 - 1971 Max. = 92.00 mg/L
Avg. = 20.91 mg/L

NITRITE-NITRATE CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B9



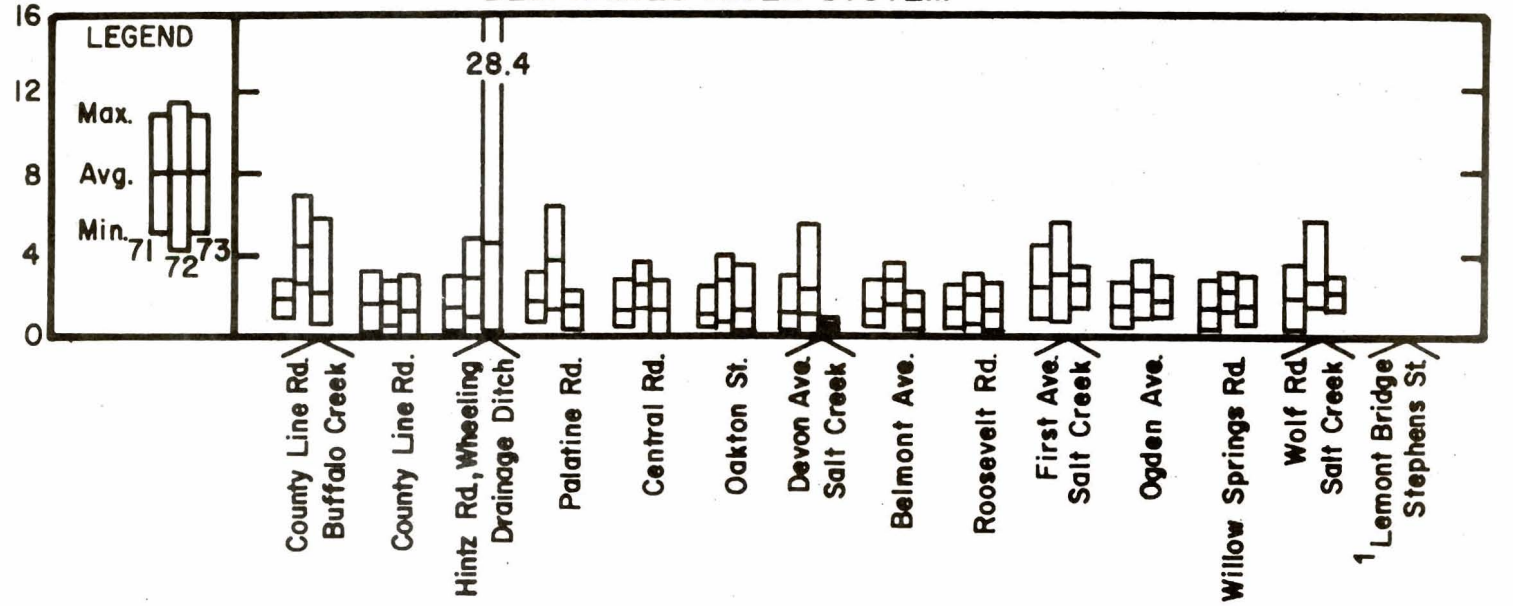
1 - Data not available

NITRITE-NITRATE CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B9 (cont'd.)

DESPLAINES RIVER SYSTEM

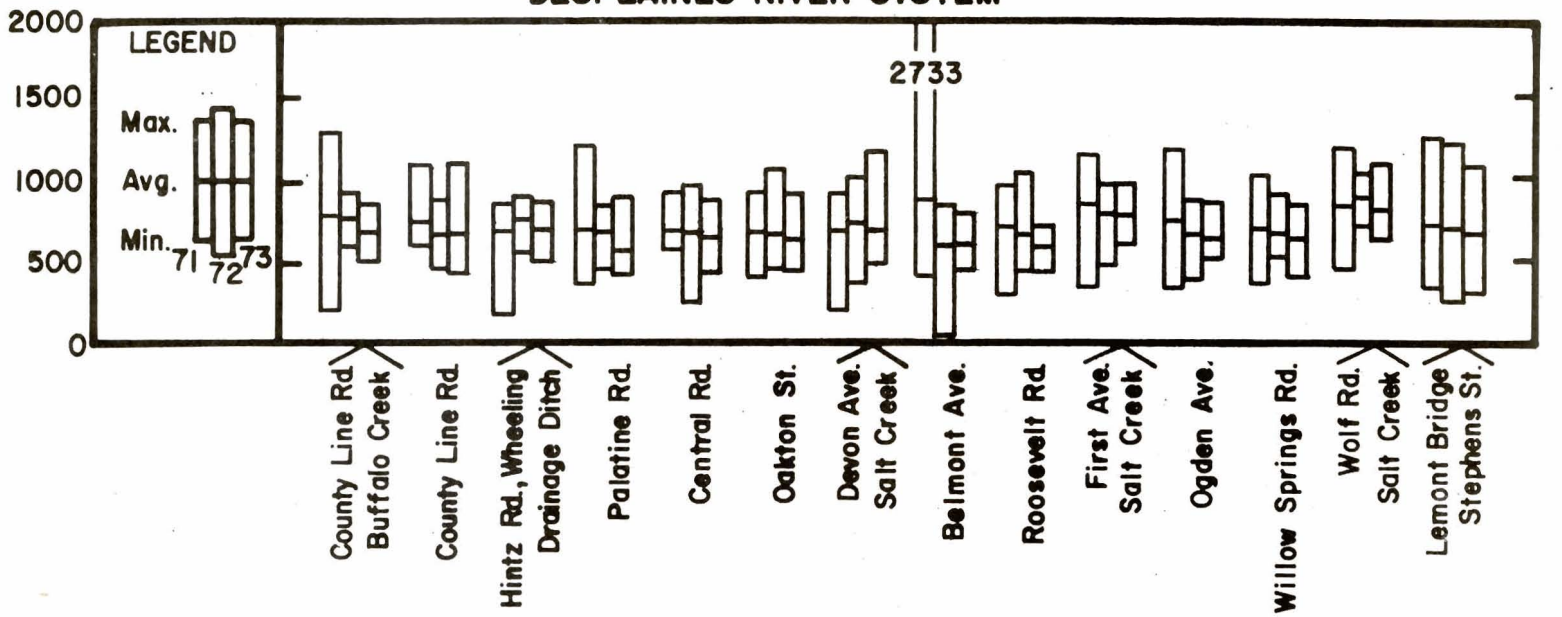


TOTAL DISSOLVED SOLIDS CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in mg/L

Figure B10

DESPLAINES RIVER SYSTEM

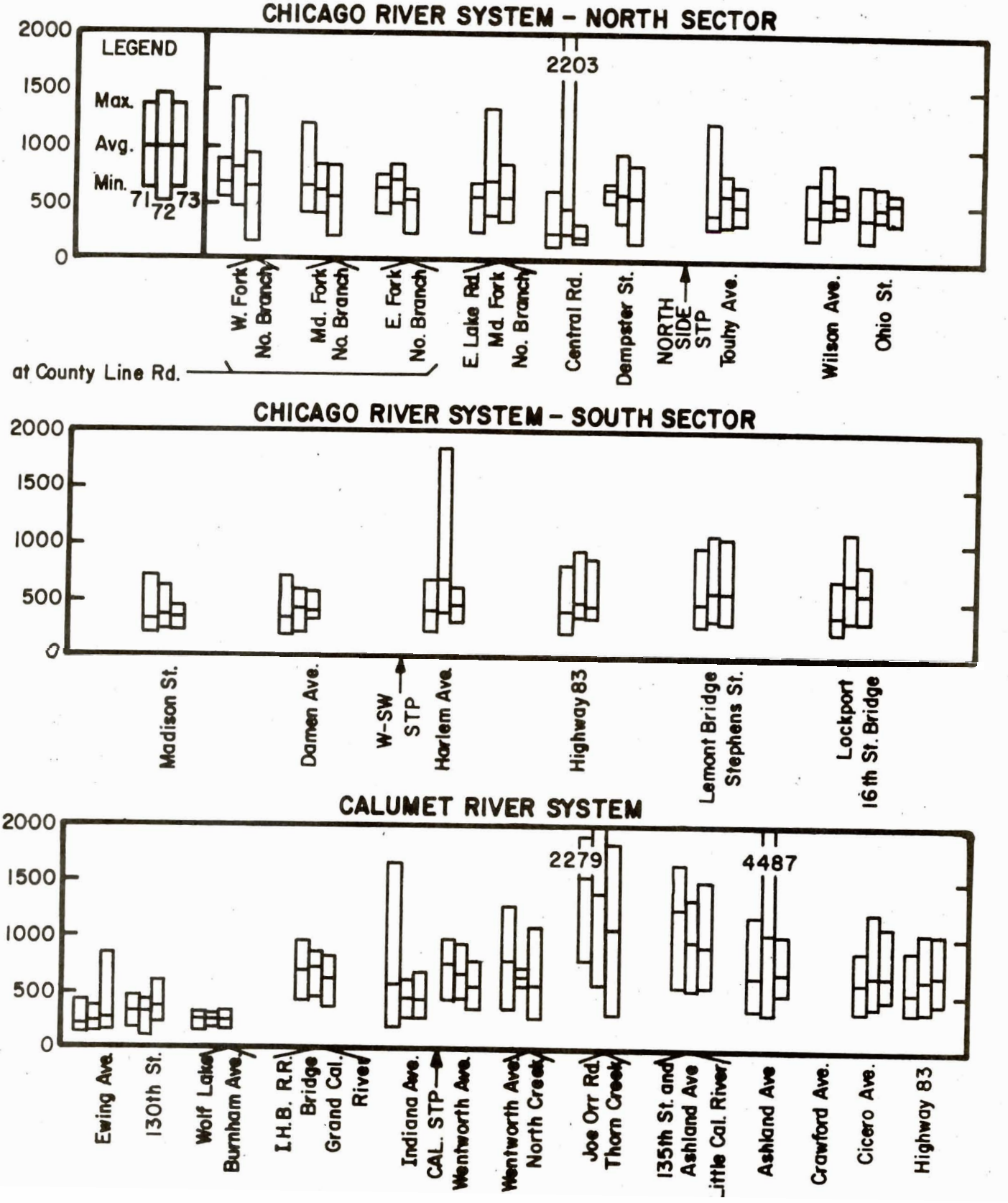


1 - Data not available

TOTAL DISSOLVED SOLIDS CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

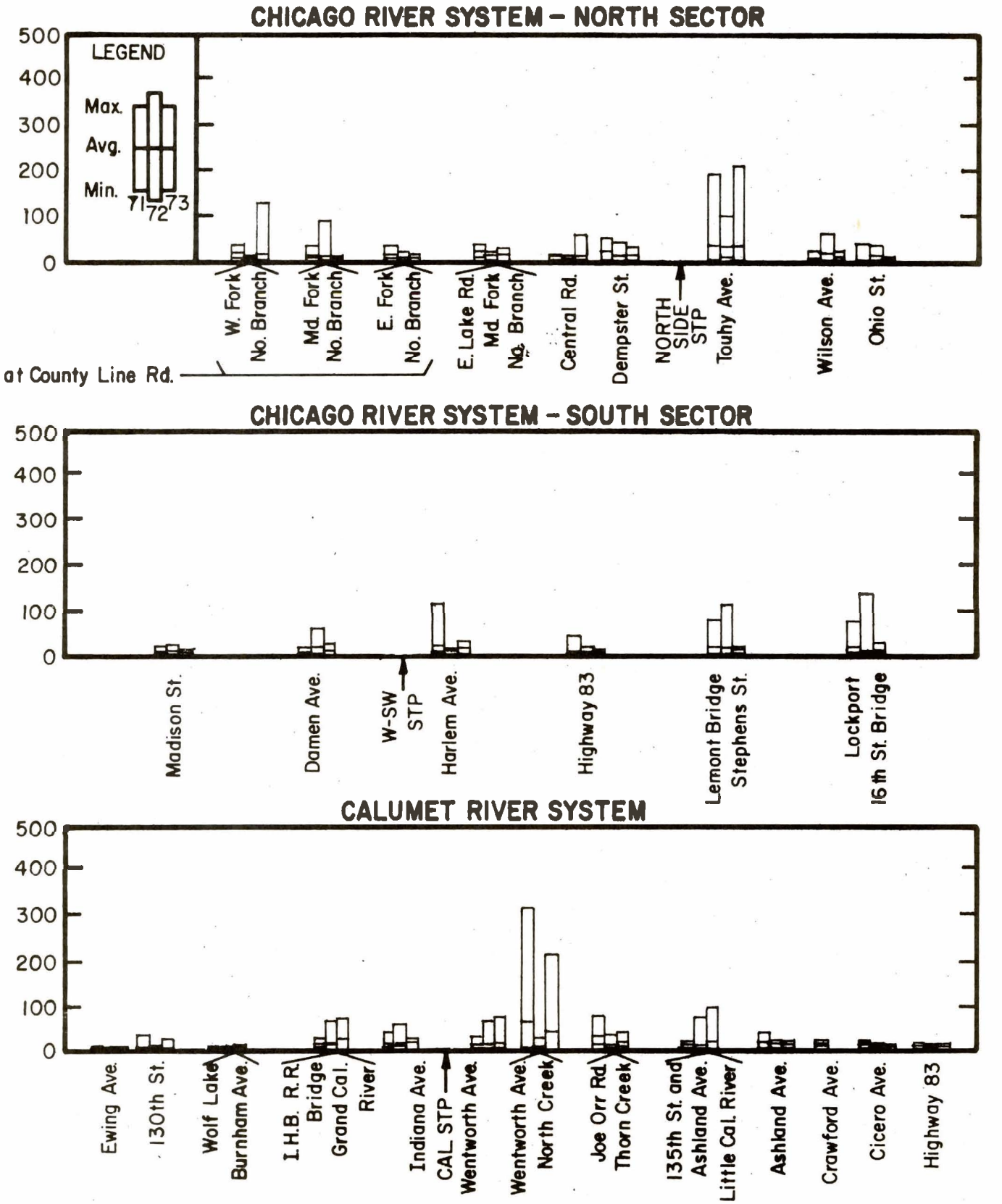
Figure B10 (cont'd.)



ORGANIC SUSPENDED SOLIDS CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971-1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B11

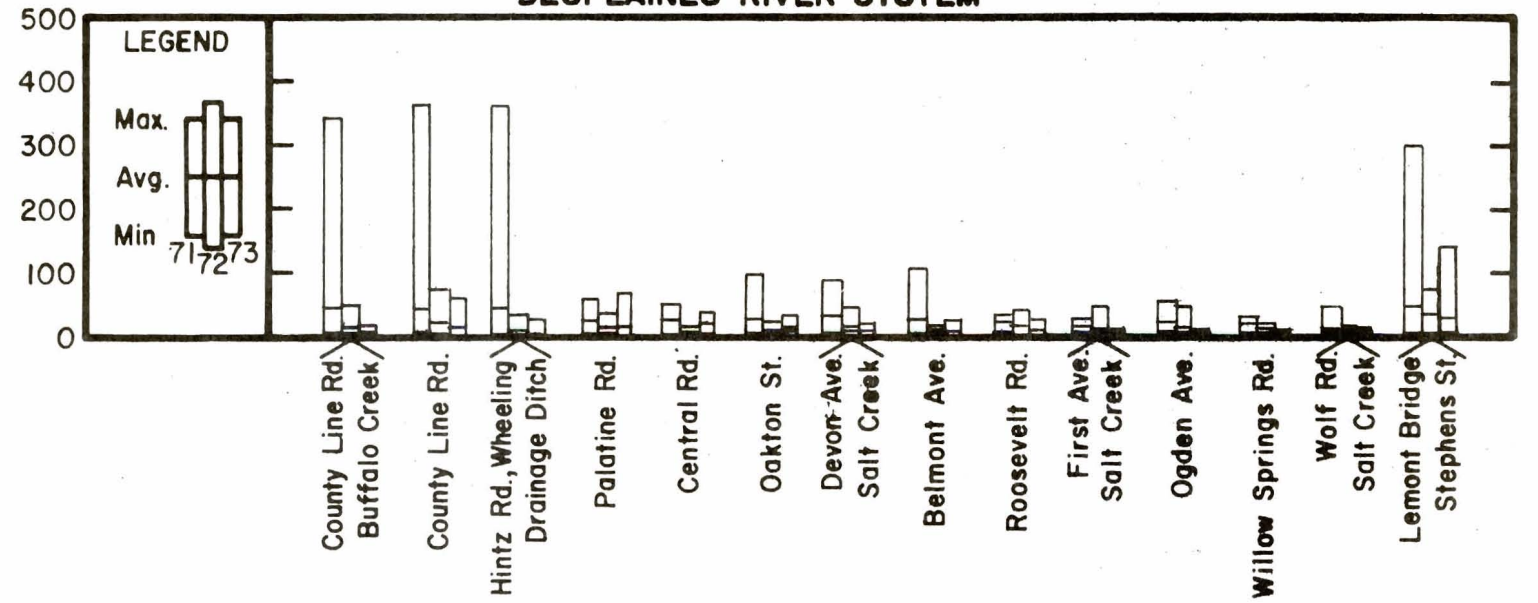


ORGANIC SUSPENDED SOLIDS CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B11 (cont'd.)

DESPLAINES RIVER SYSTEM

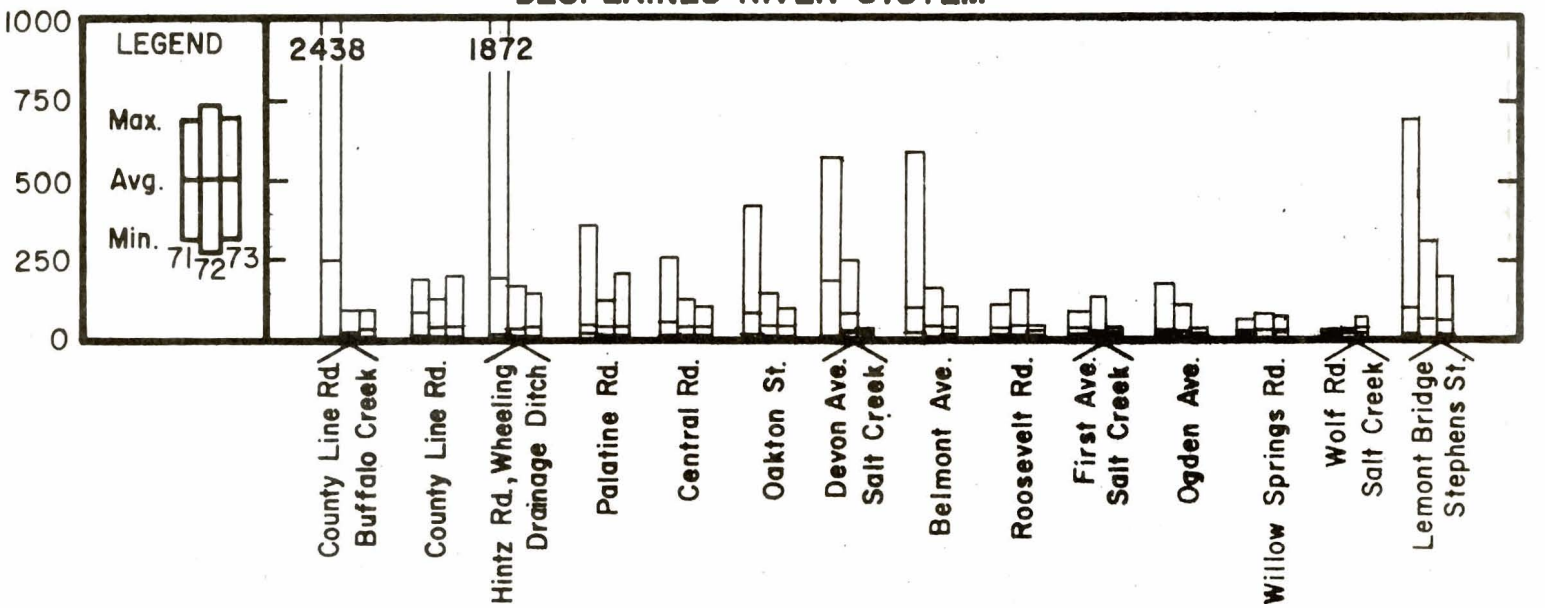


INORGANIC SUSPENDED SOLIDS CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B12

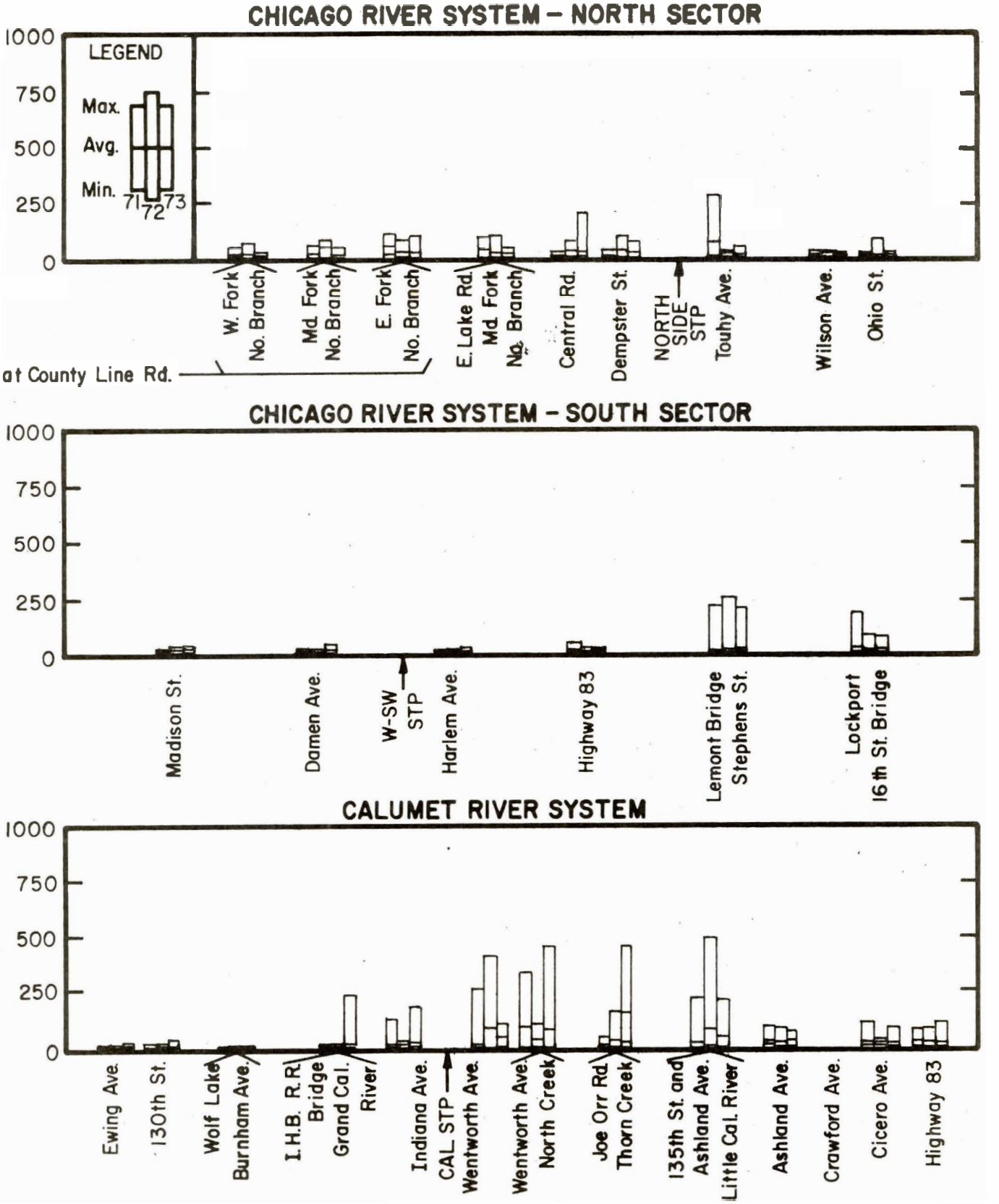
DESPLAINES RIVER SYSTEM



INORGANIC SUSPENDED SOLIDS CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in mg/L

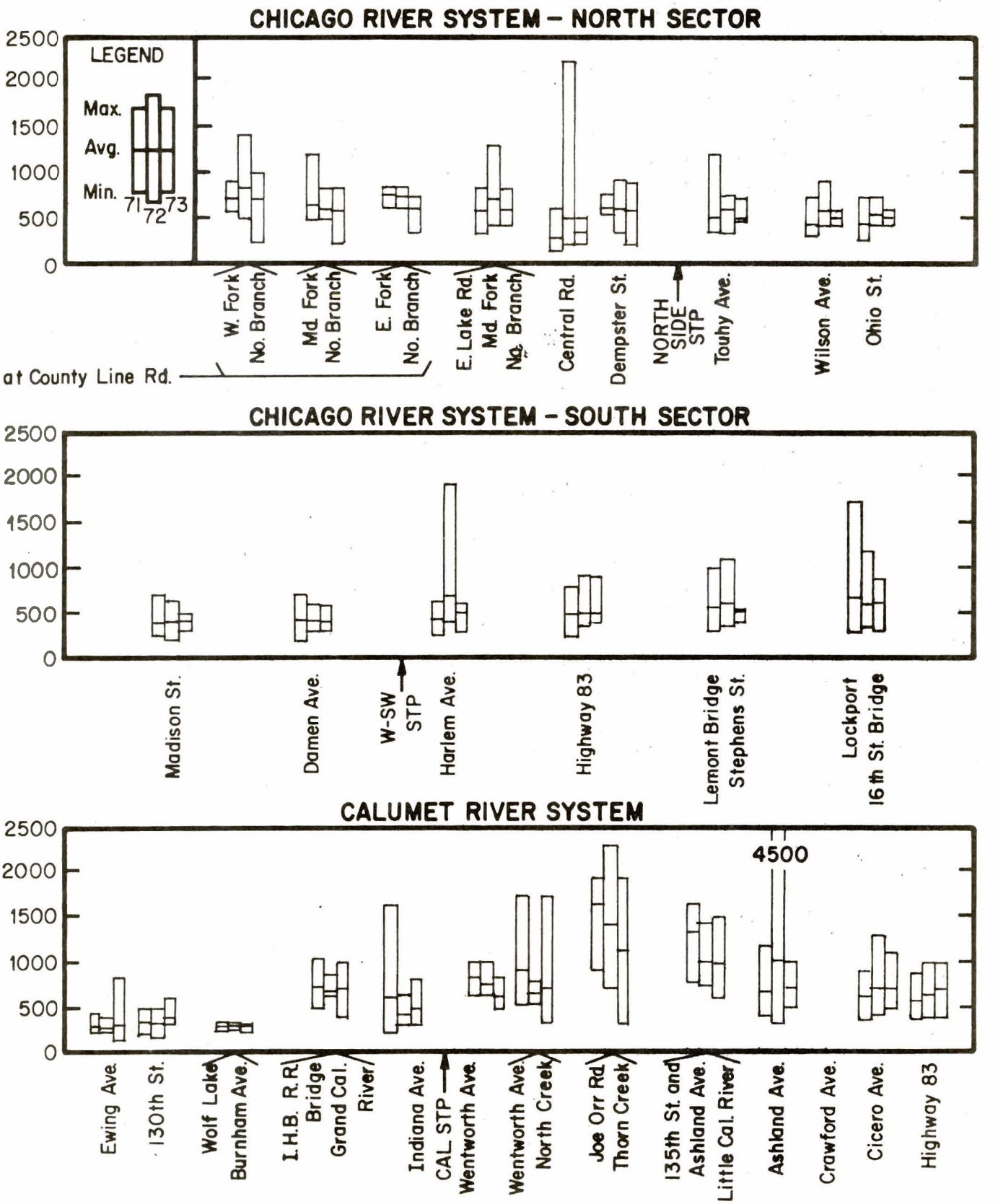
Figure B12 (cont'd)



TOTAL SOLIDS CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in mg/L

Figure B13



TOTAL SOLIDS CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Concentration in mg/L

Figure B13 (cont'd.)

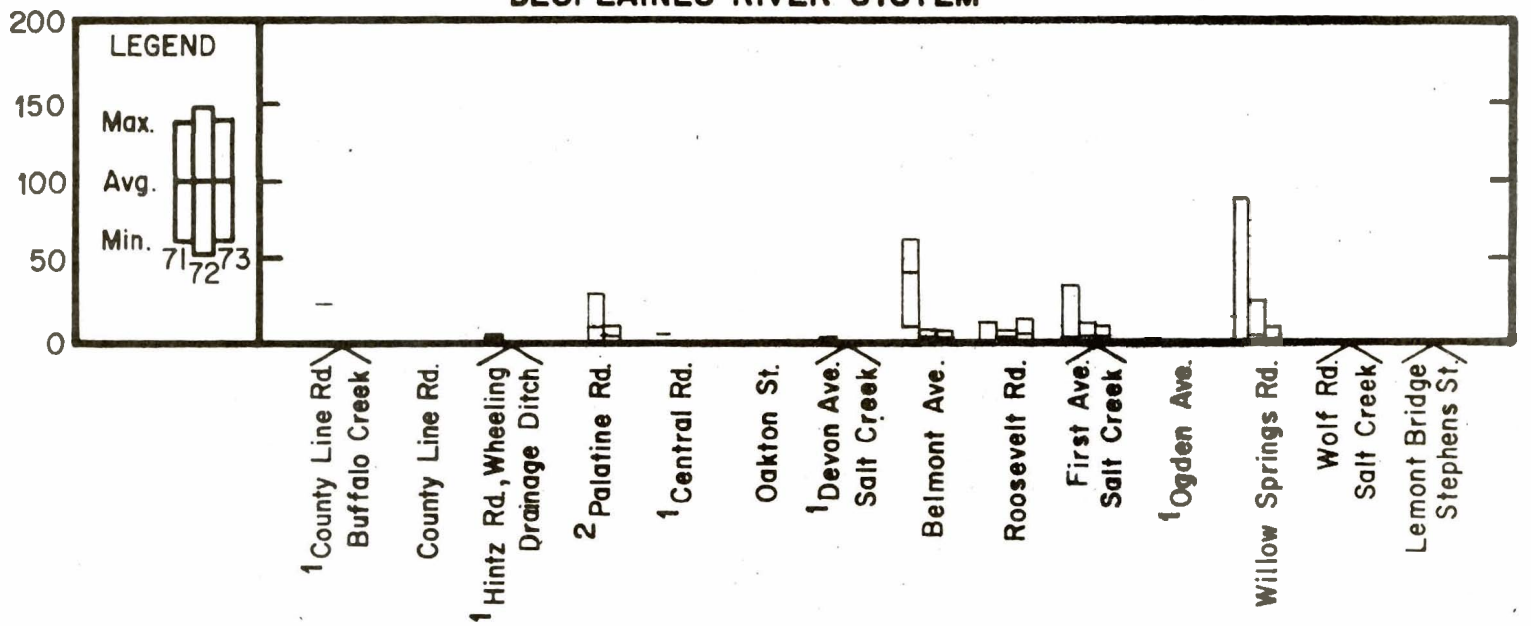
DESPLAINES RIVER SYSTEM

PHENOL CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in µg/L

Figure B14

DESPLAINES RIVER SYSTEM



Data shown above is only data available

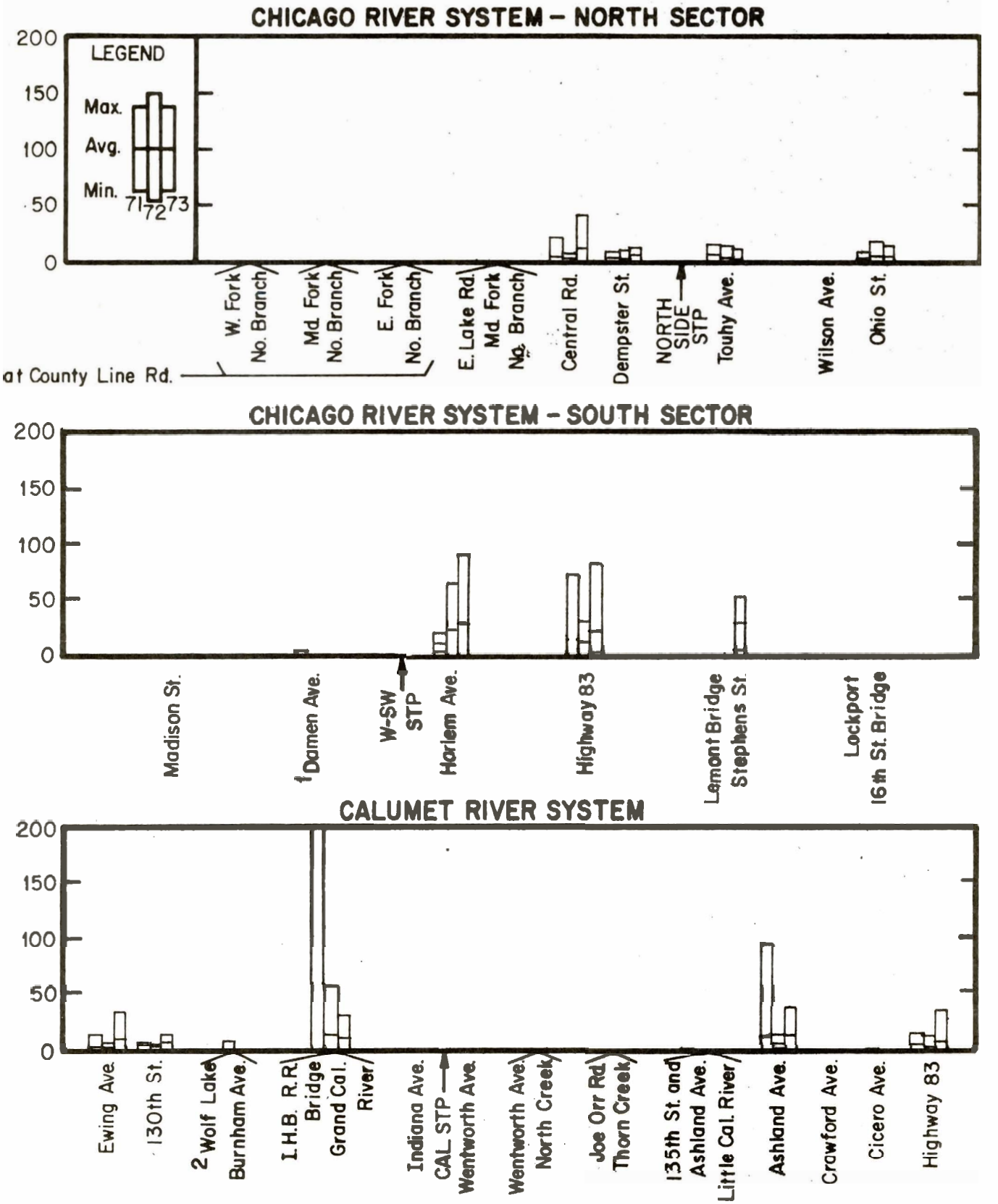
1 - 1971 data only

2 - 1971 data unavailabe

PHENOL CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in µg/L

Figure B14 (cont'd)



Data shown above is only data available

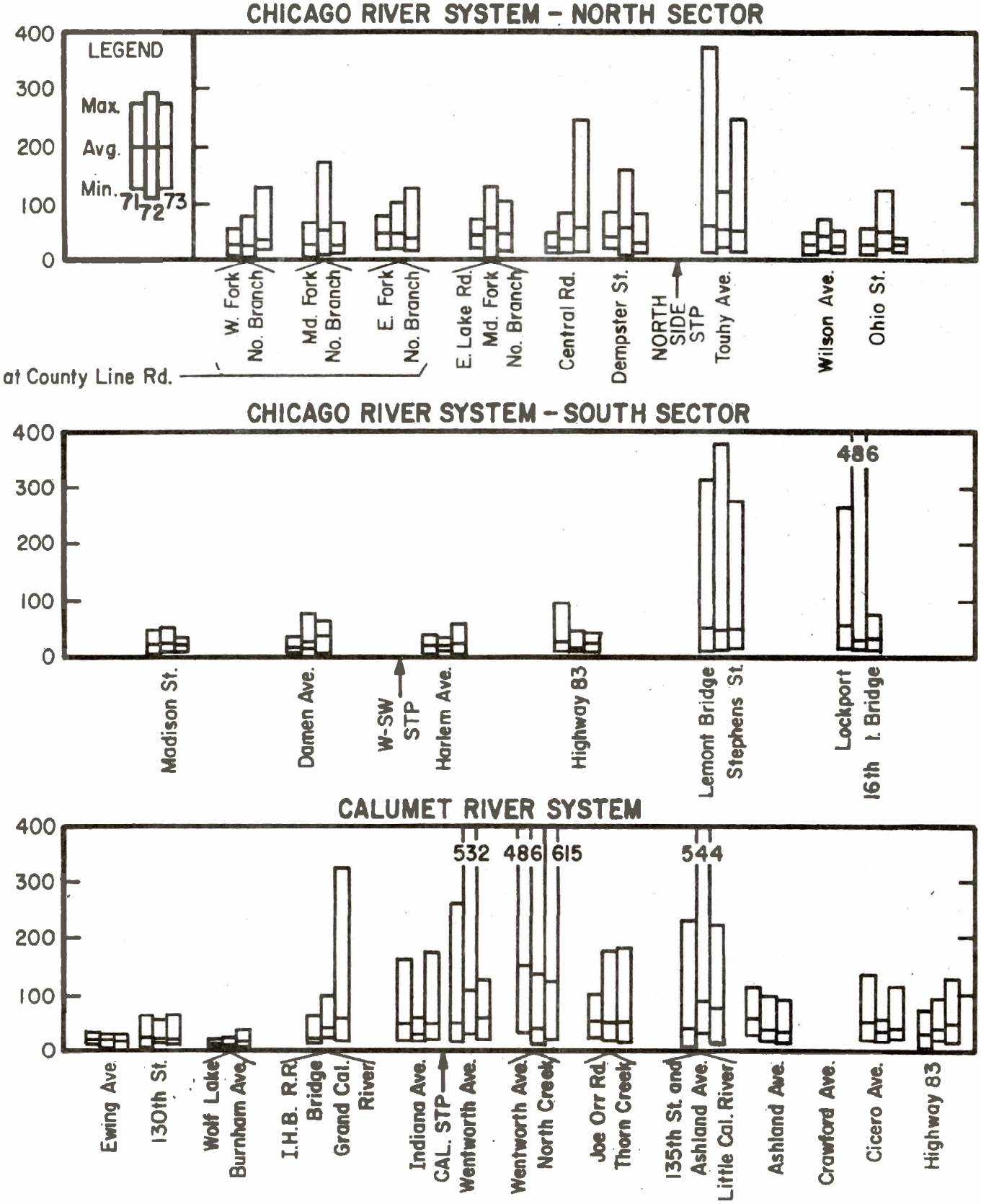
1 - 1971 data only

2 - 1972 data only

TOTAL SUSPENDED SOLIDS CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B15

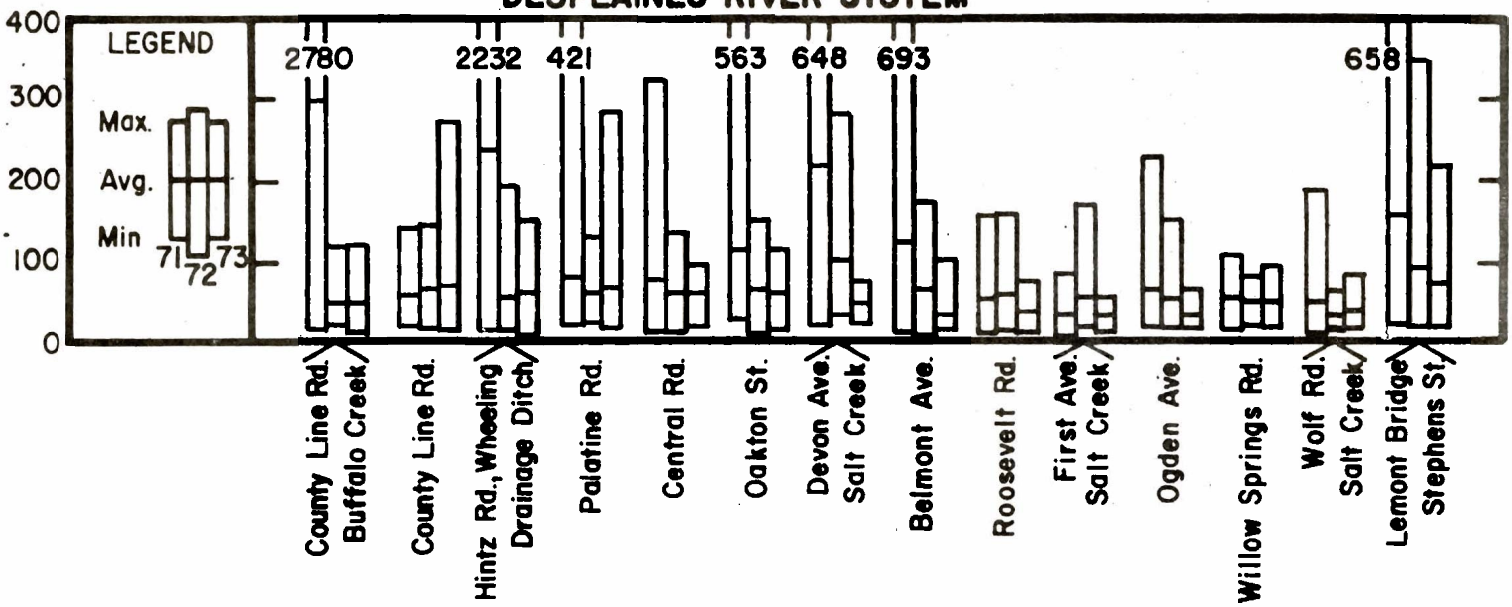


TOTAL SUSPENDED SOLIDS CONCENTRATIONS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B15 (cont'd.)

DESPLAINES RIVER SYSTEM

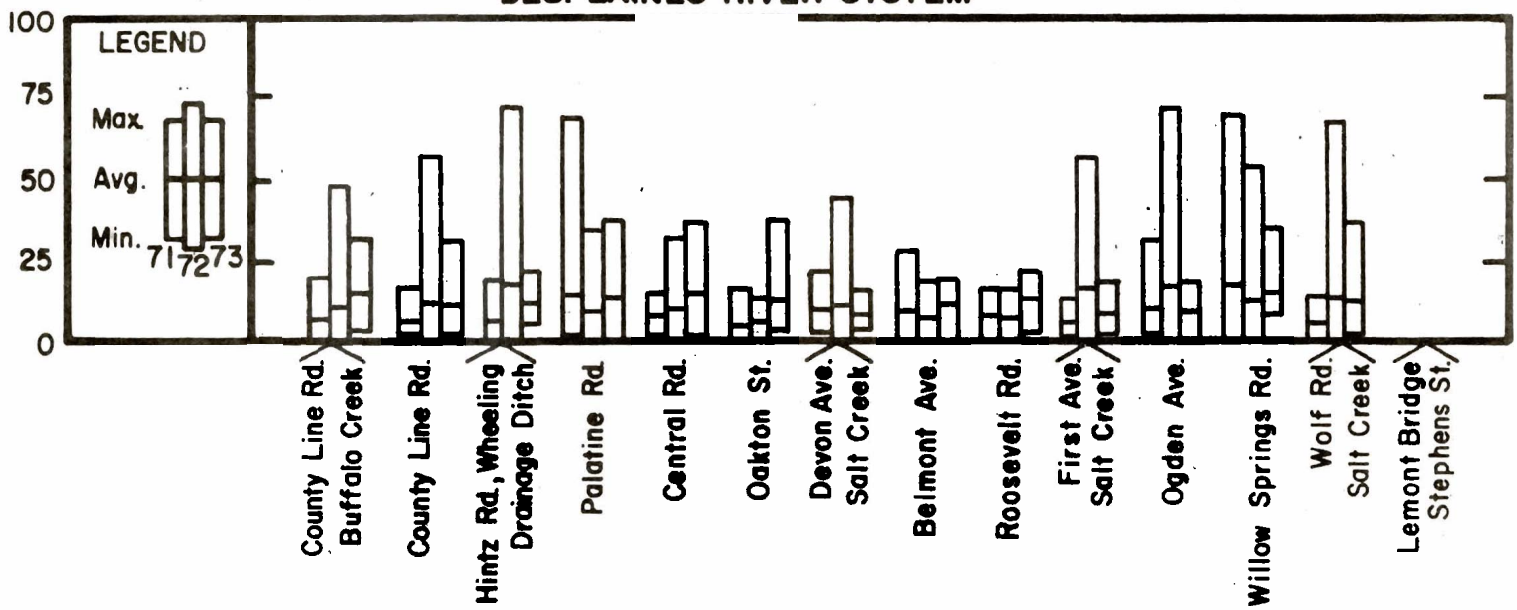


HEXANE SOLUBLE LEVELS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B16

DESPLAINES RIVER SYSTEM

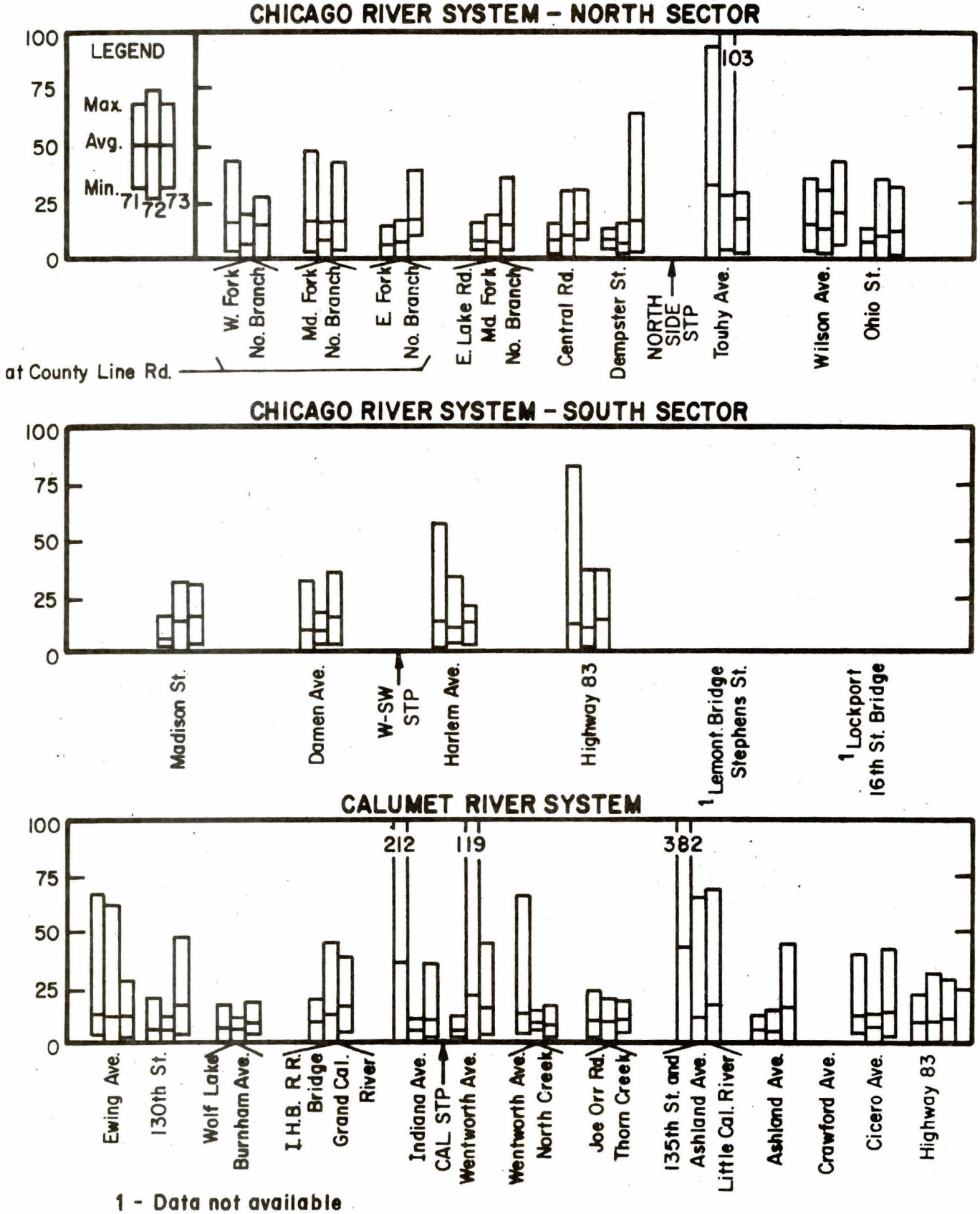


1 - Data not available

HEXANE SOLUBLE LEVELS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B16 (cont'd.)

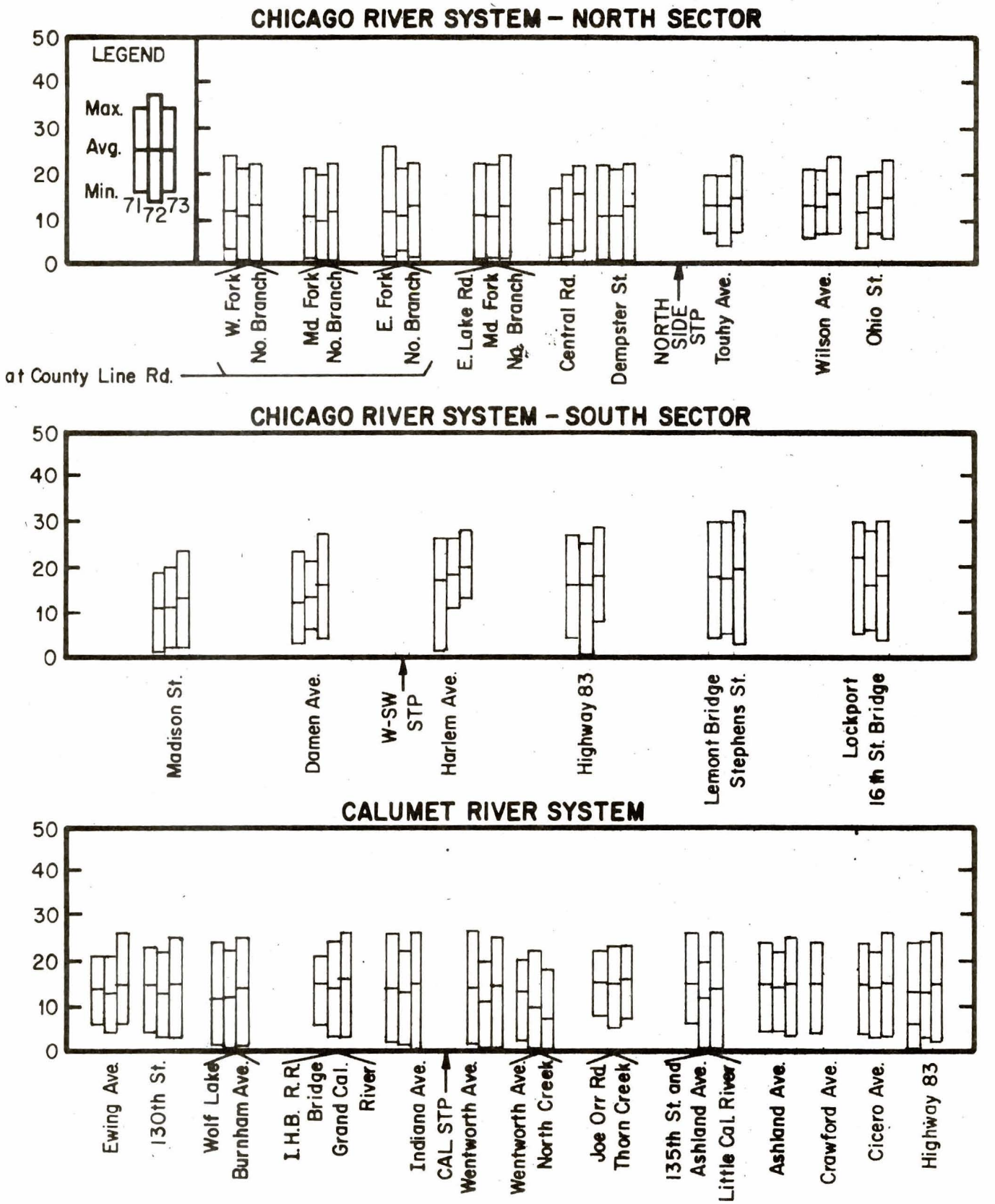


1 - Data not available

TEMPERATURE LEVELS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Temperature in °C

Figure B17

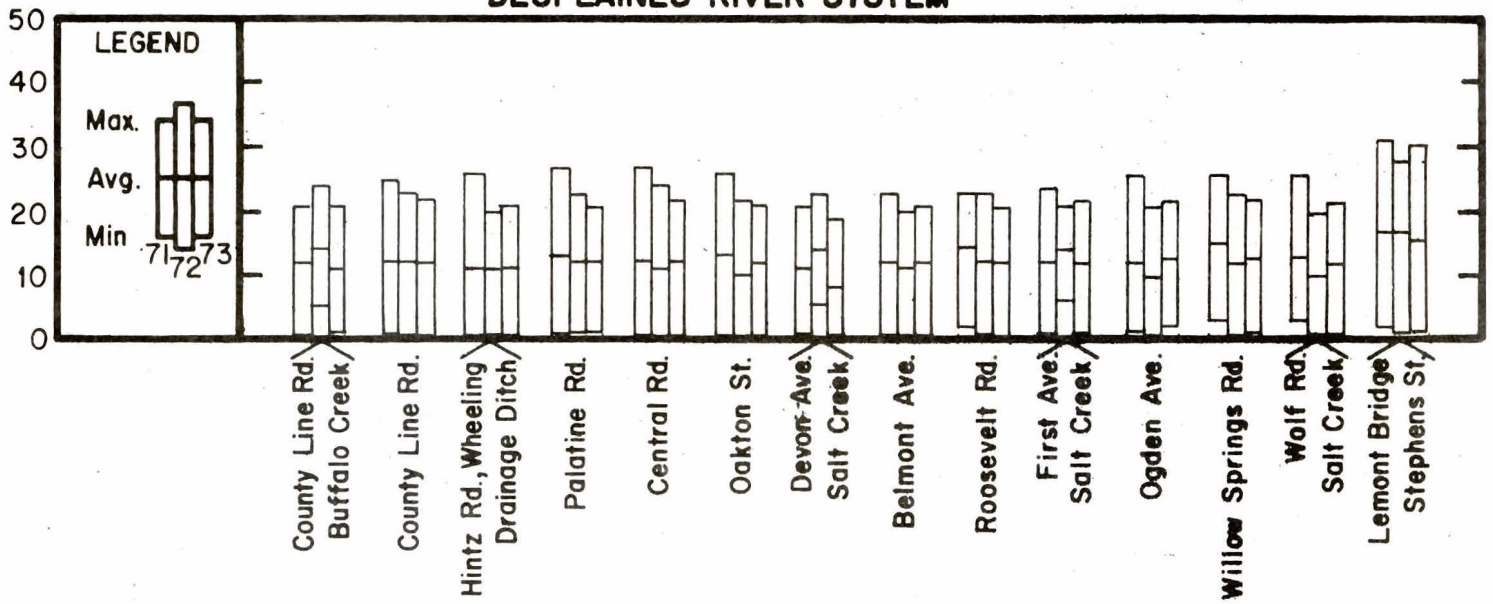


TEMPERATURE LEVELS IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Temperature in °C

Figure B17 (cont'd.)

DESPLAINES RIVER SYSTEM

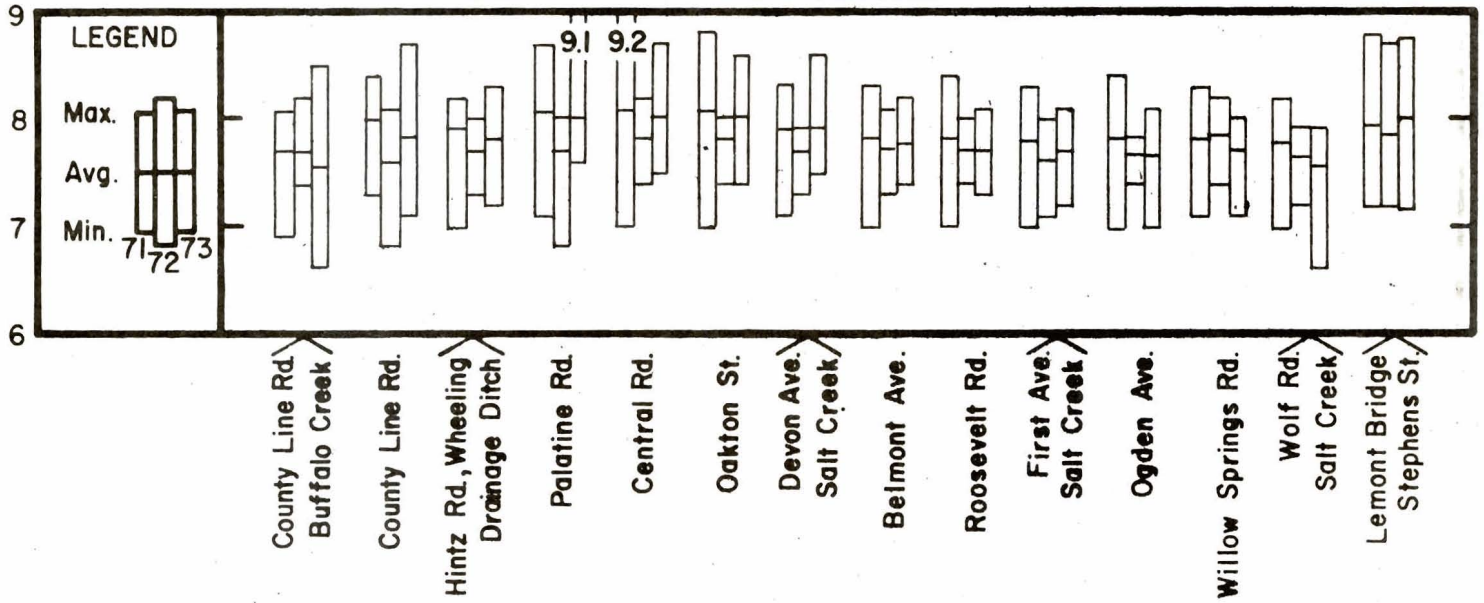


pH VALUES IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum pH Values

Figure B18

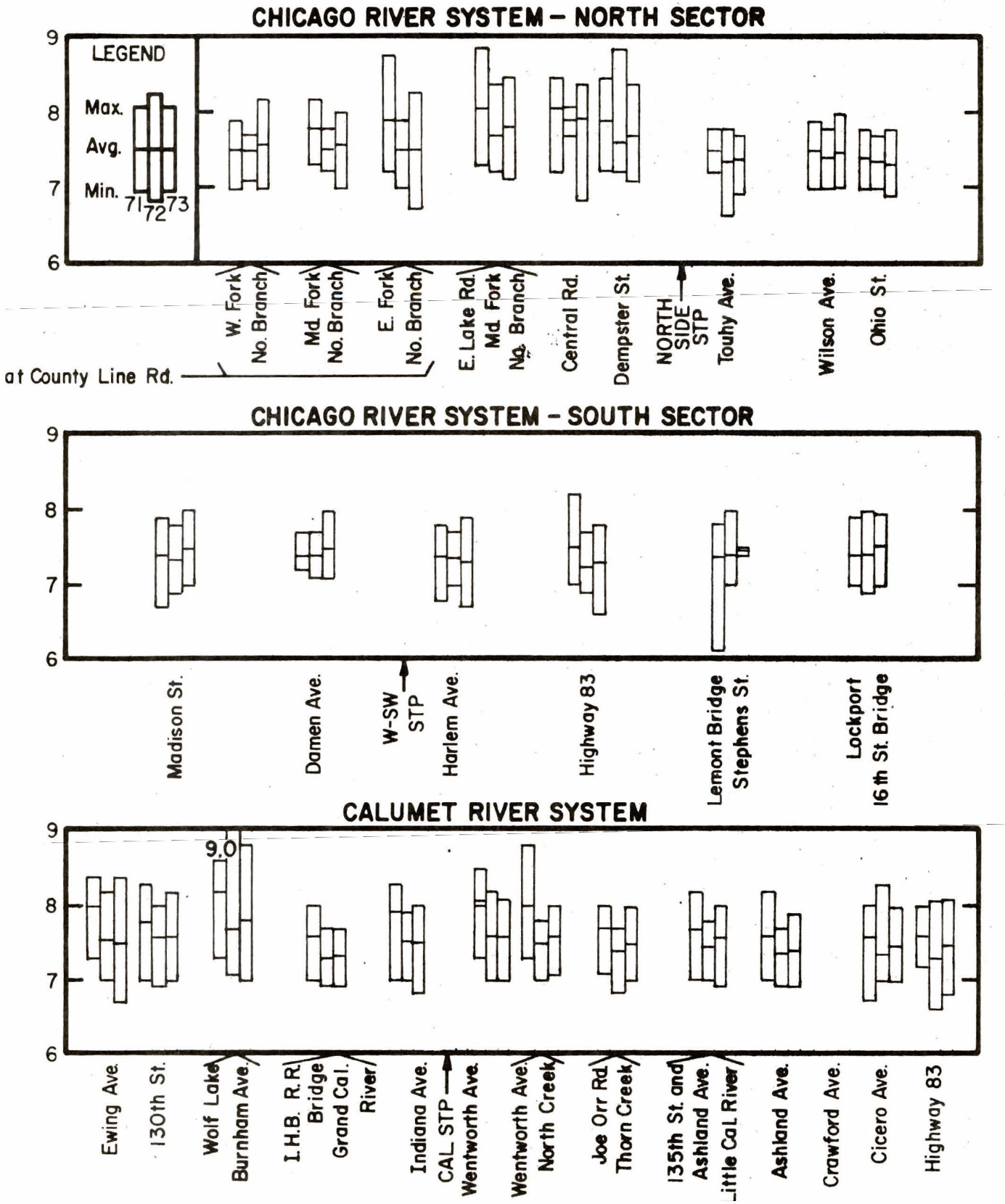
DESPLAINES RIVER SYSTEM



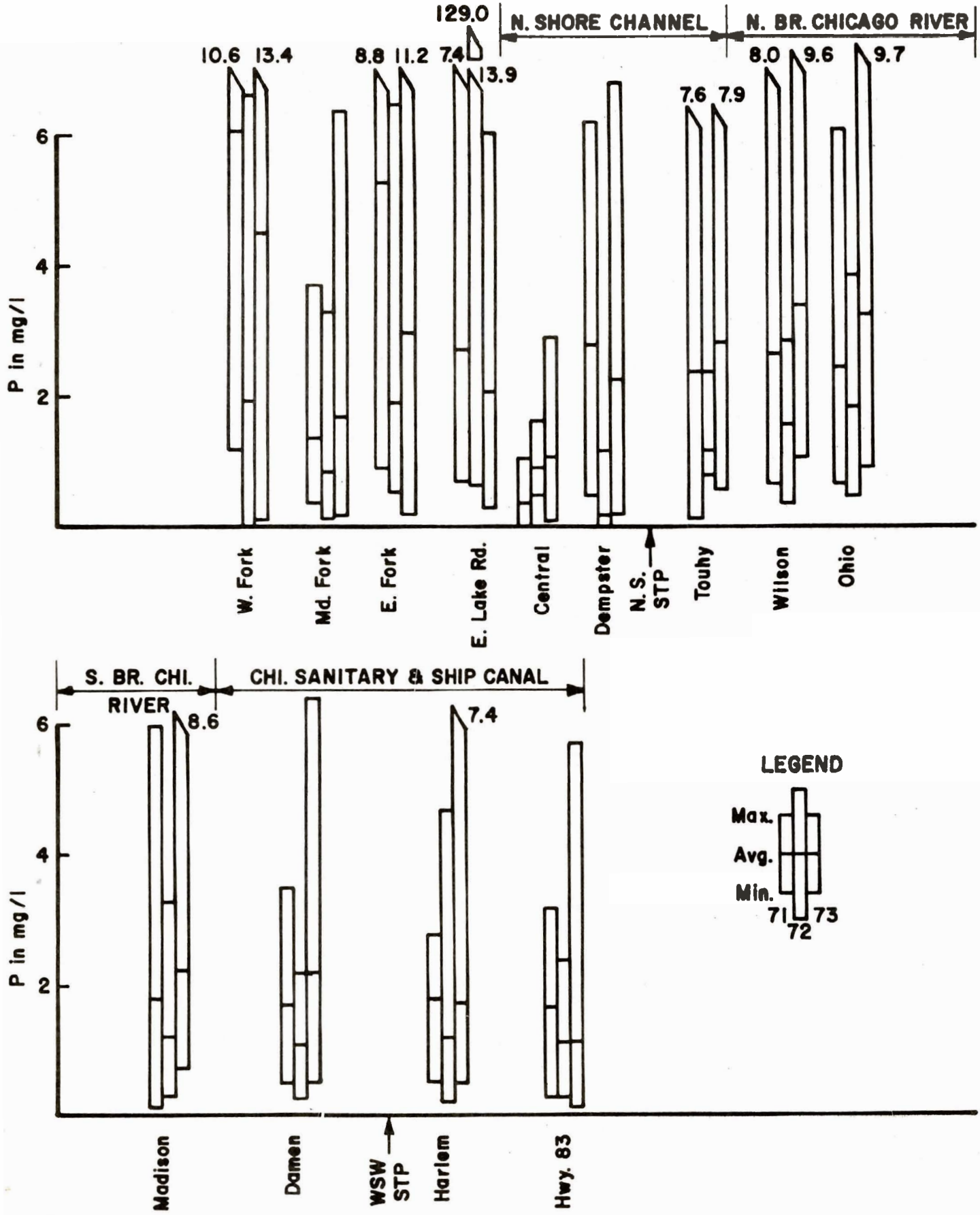
pH VALUES IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum pH Values

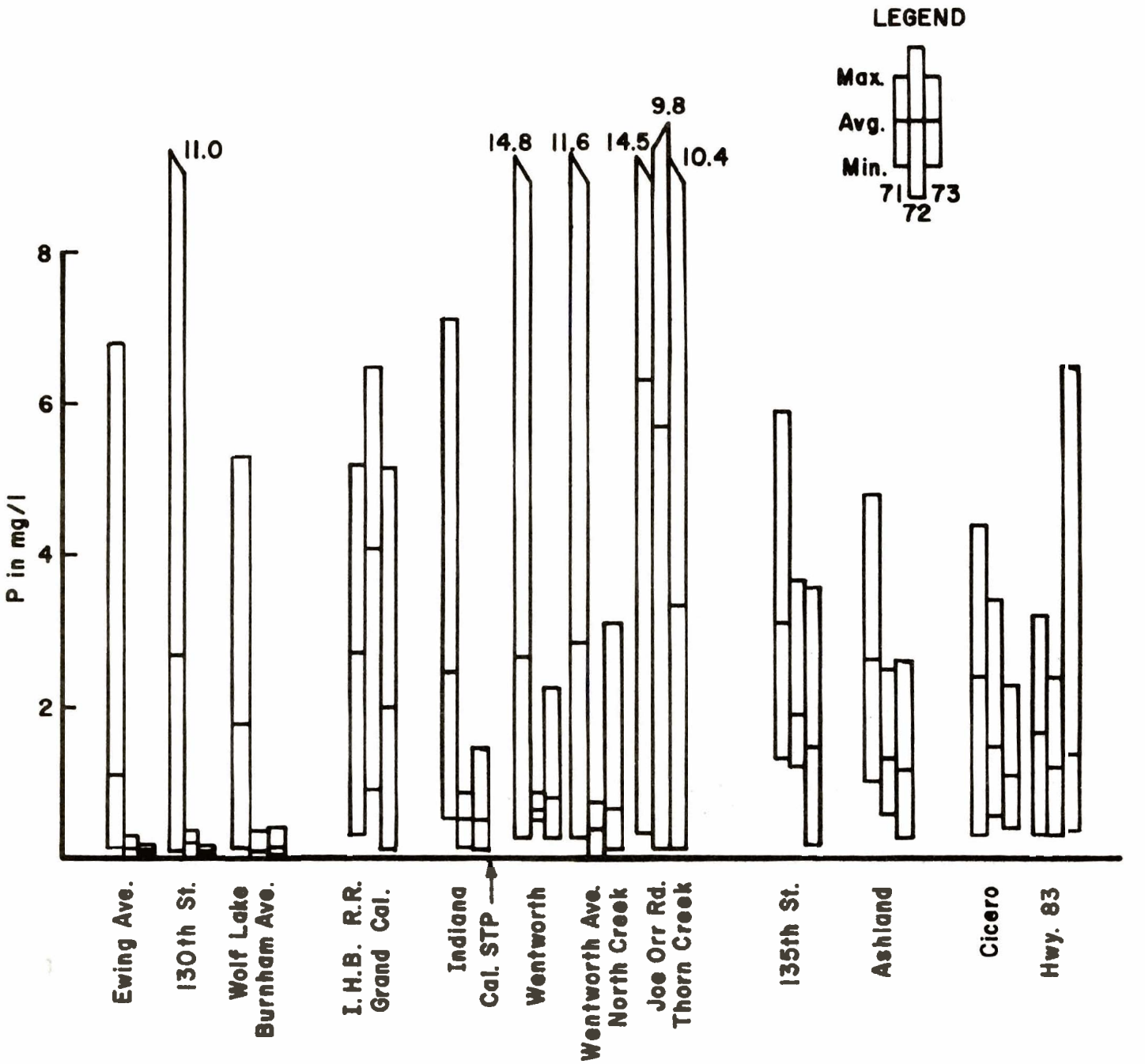
Figure B18 (cont'd)



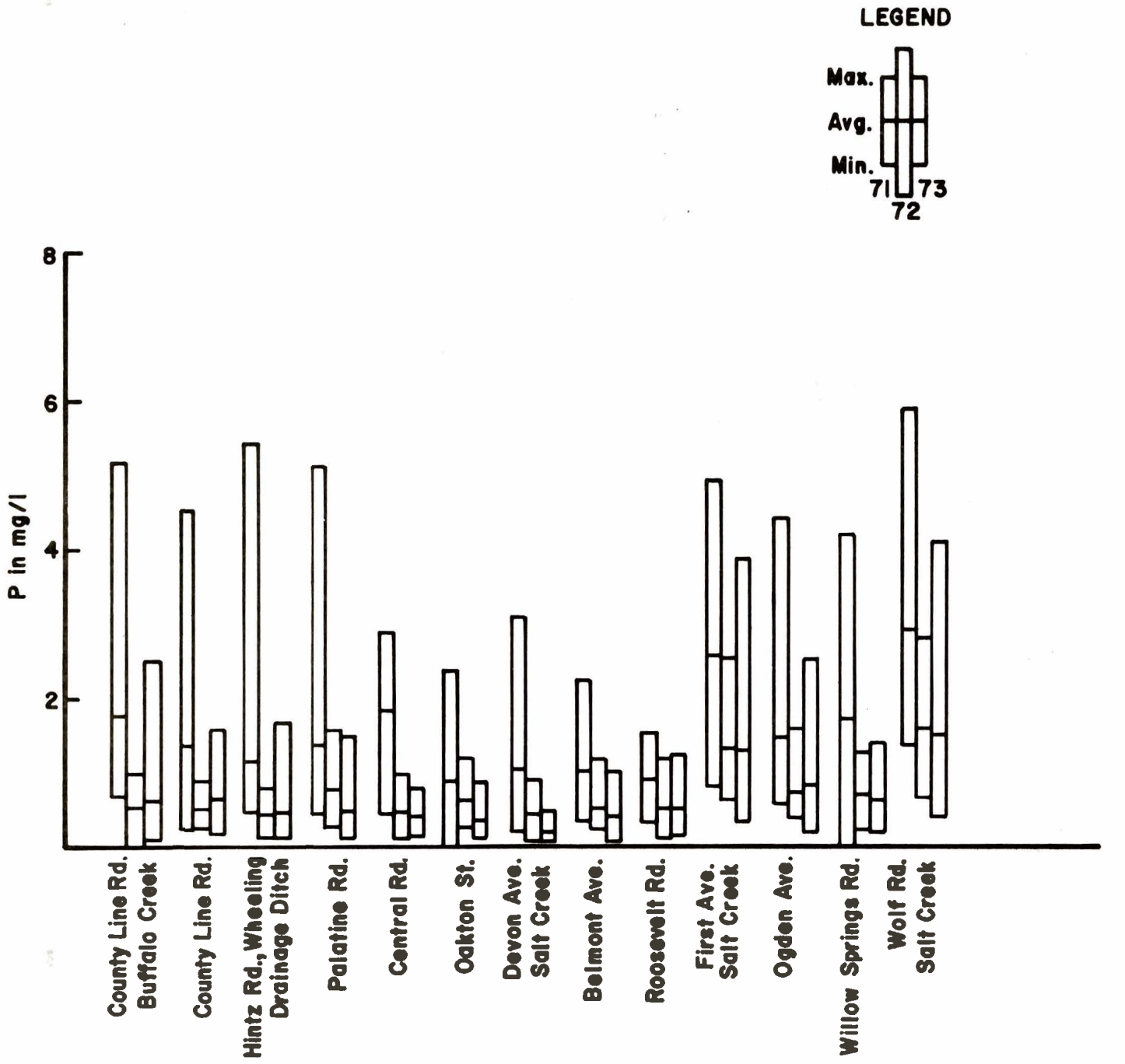
TOTAL PHOSPHORUS LEVELS IN THE CHICAGO RIVER SYSTEM
1971 THRU 1973
Maximum, Average & Minimum Concentrations in mg/l
Figure B19



TOTAL PHOSPHORUS LEVELS IN THE CALUMET RIVER SYSTEM
1971 THRU 1973
Maximum, Average & Minimum Concentrations in mg/l
Figure B19 (cont'd.)



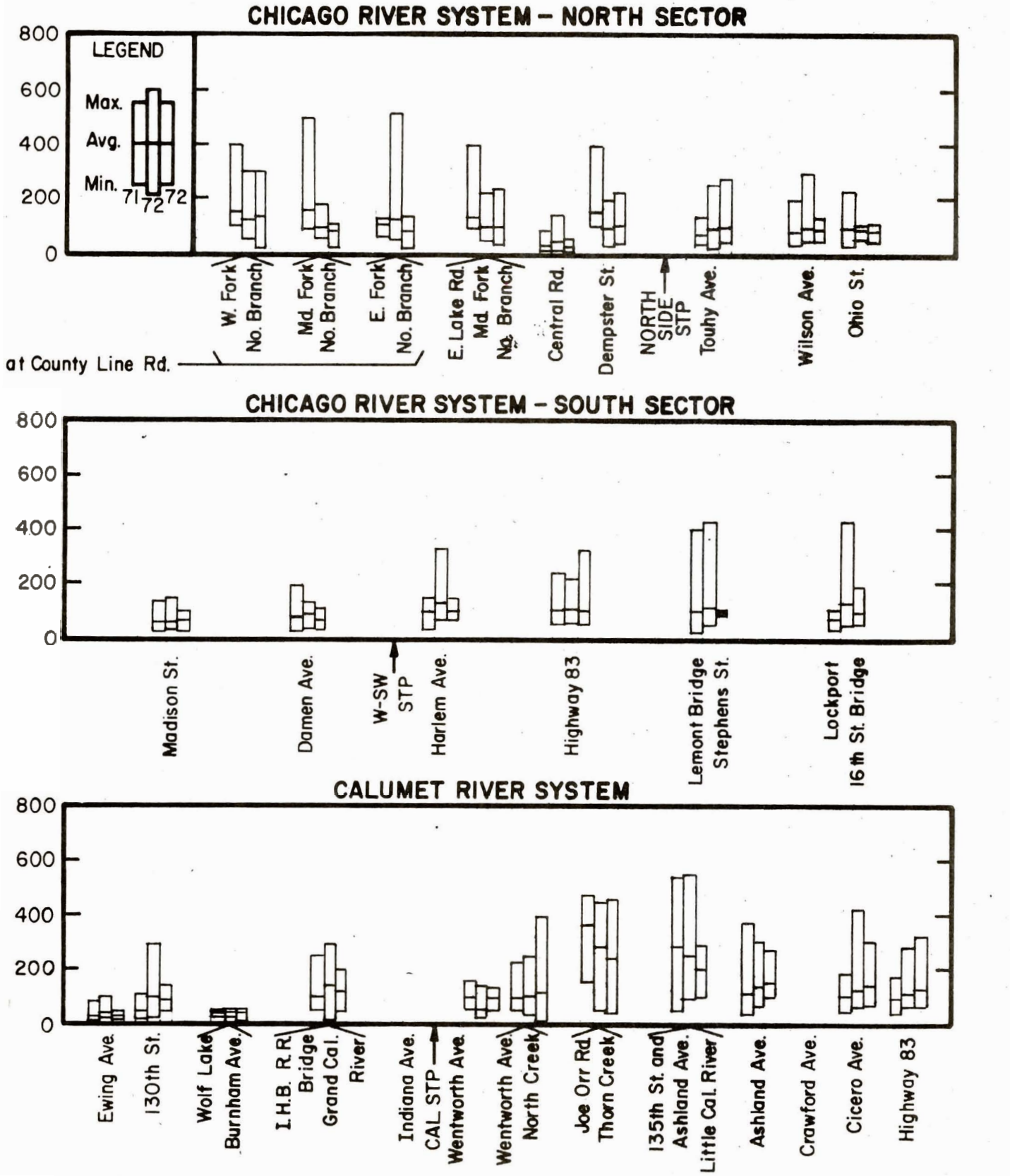
TOTAL PHOSPHORUS LEVELS IN THE DESPLAINES RIVER SYSTEM
1971 - 1973
Maximum, Average & Minimum Concentrations in mg/l
Figure B19 (cont'd.)



CHLORIDE CONCENTRATION IN THE MSDGC RIVER SYSTEM DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in mg/L

Figure B20

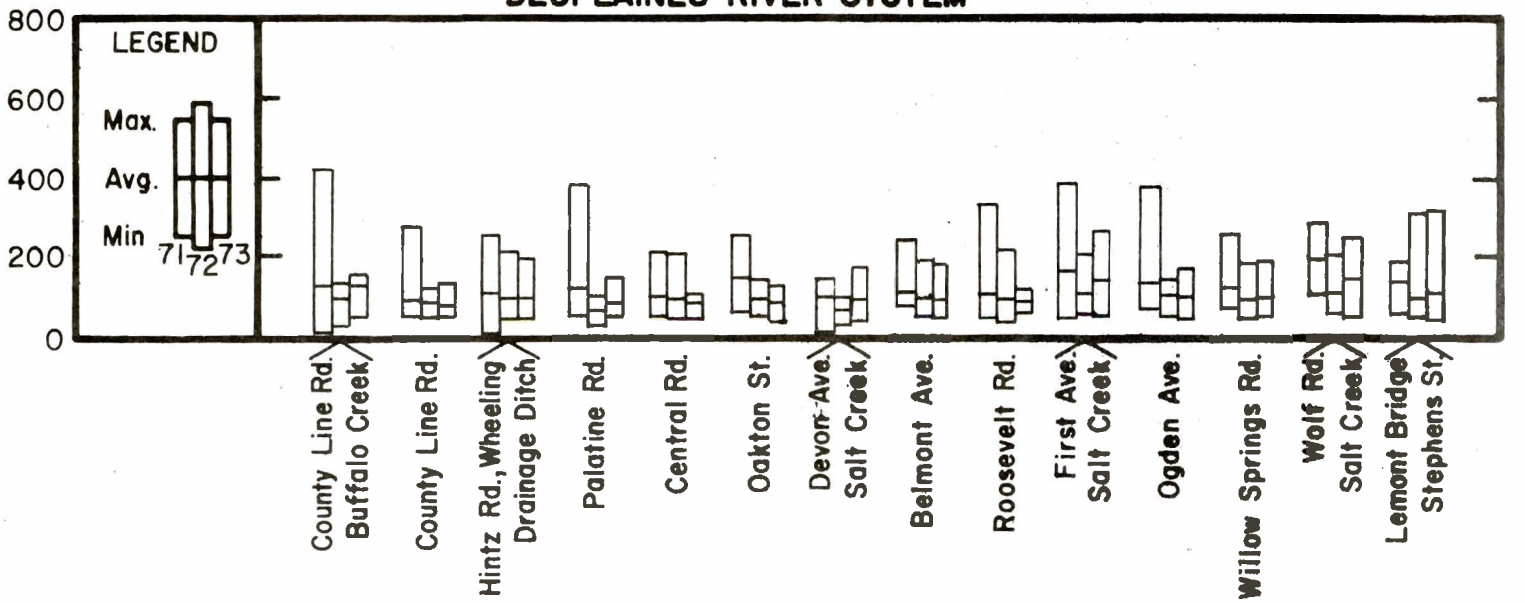


CHLORIDE CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in mg/L

Figure B20 (cont'd.)

DESPLAINES RIVER SYSTEM

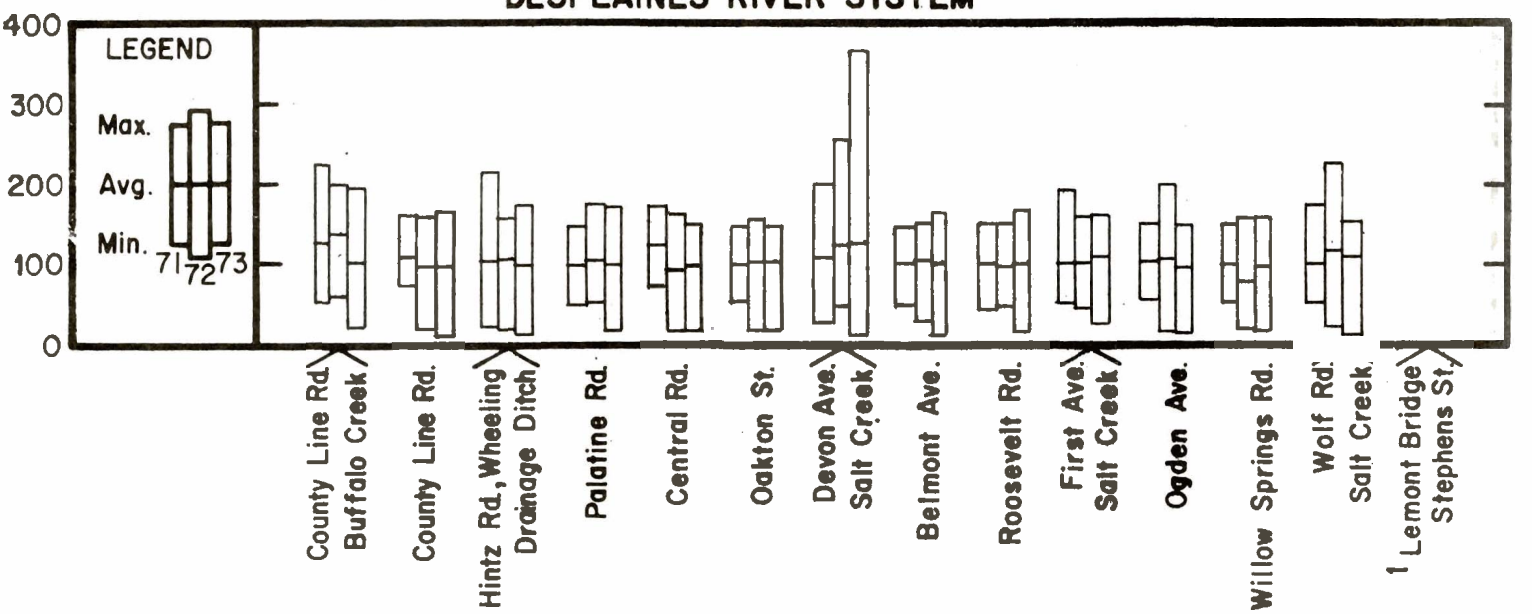


SULFATE CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in mg/L

Figure B21

DESPLAINES RIVER SYSTEM

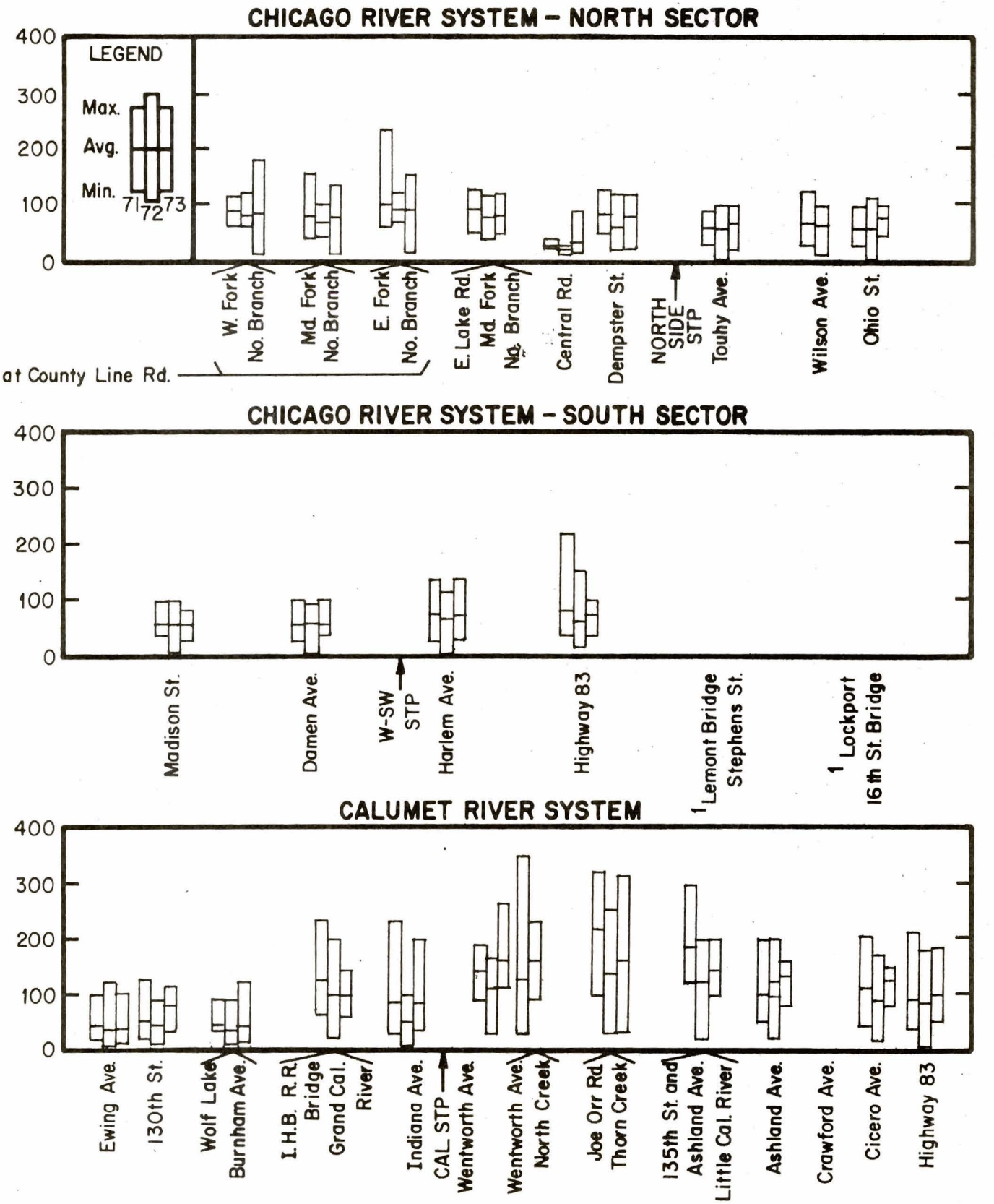


1 - Data not available

SULFATE CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in mg/L

Figure B21 (cont'd.)

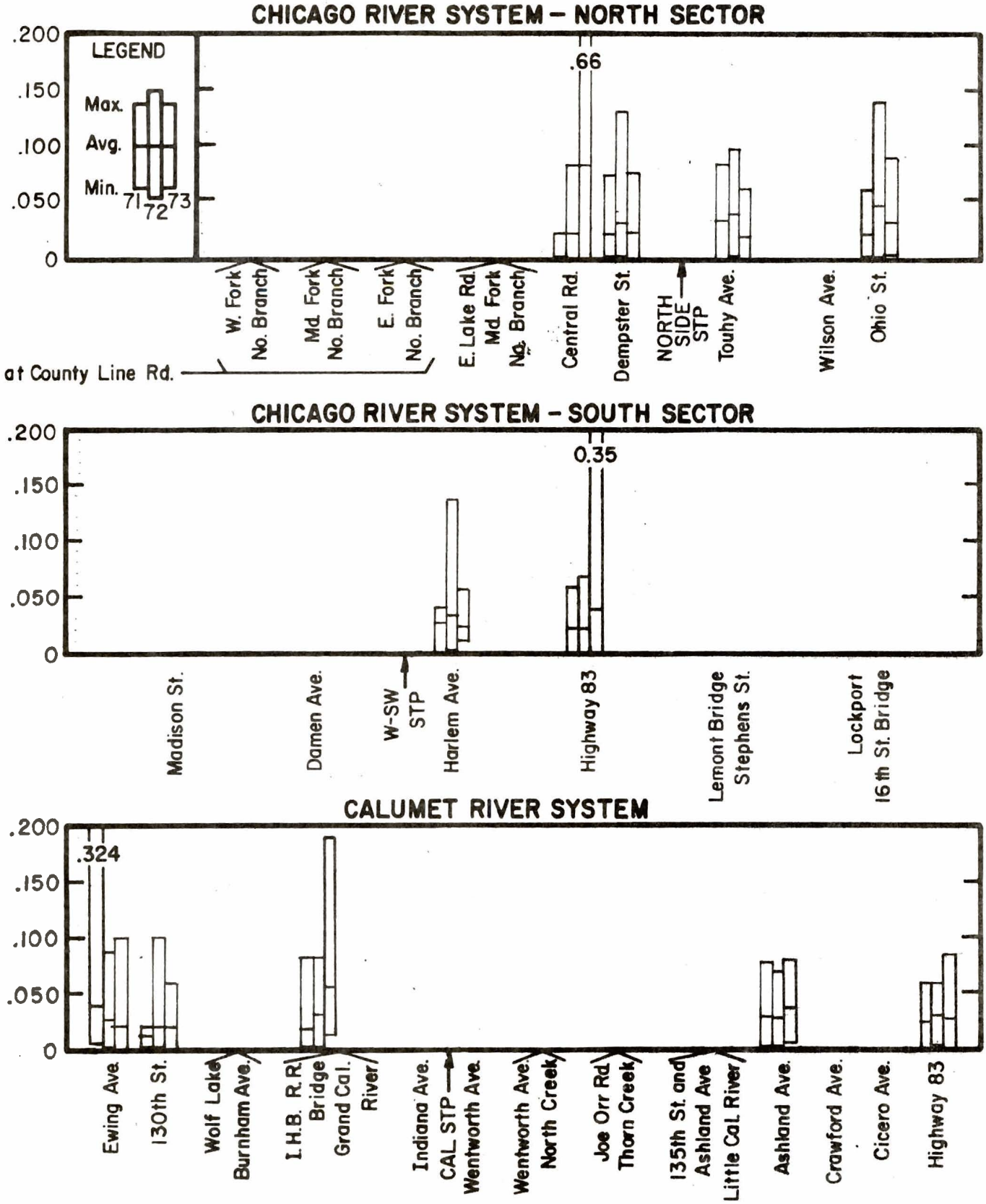


1 - Data not available

CYANIDE CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B22



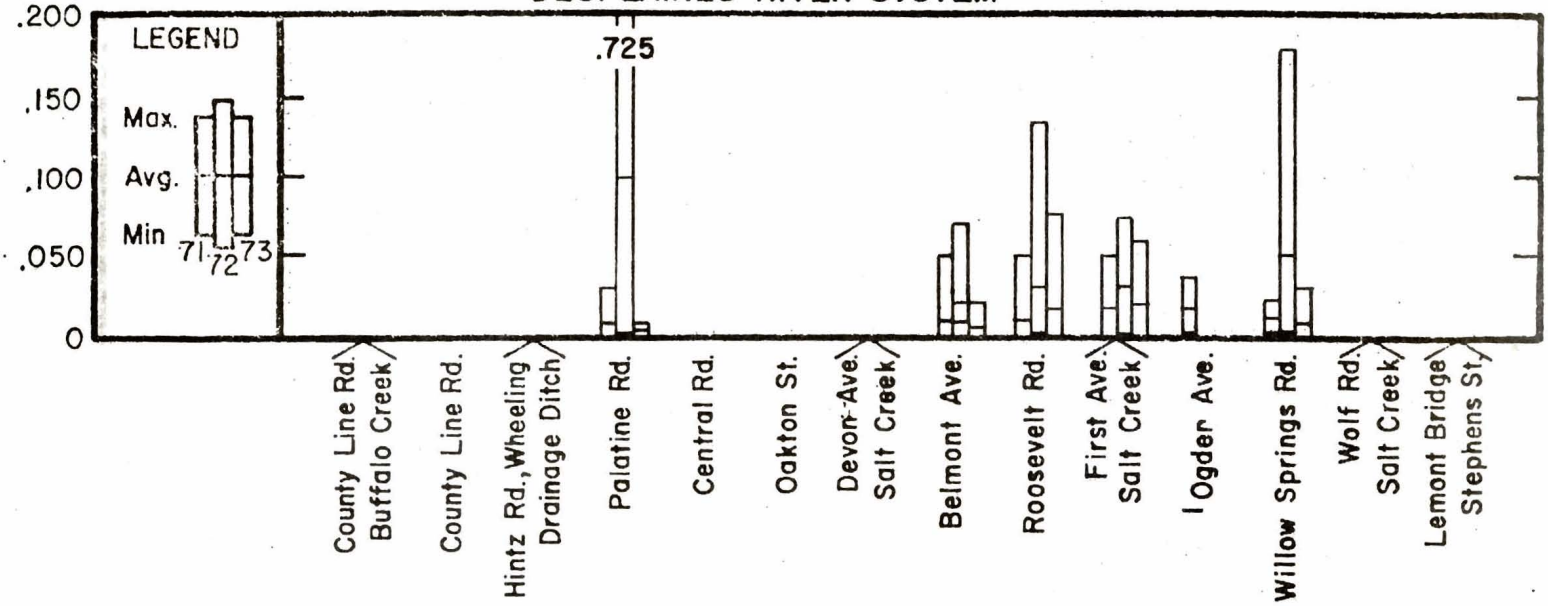
Data shown above is only data available

CYANIDE CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B22 (cont'd.)

DESPLAINES RIVER SYSTEM

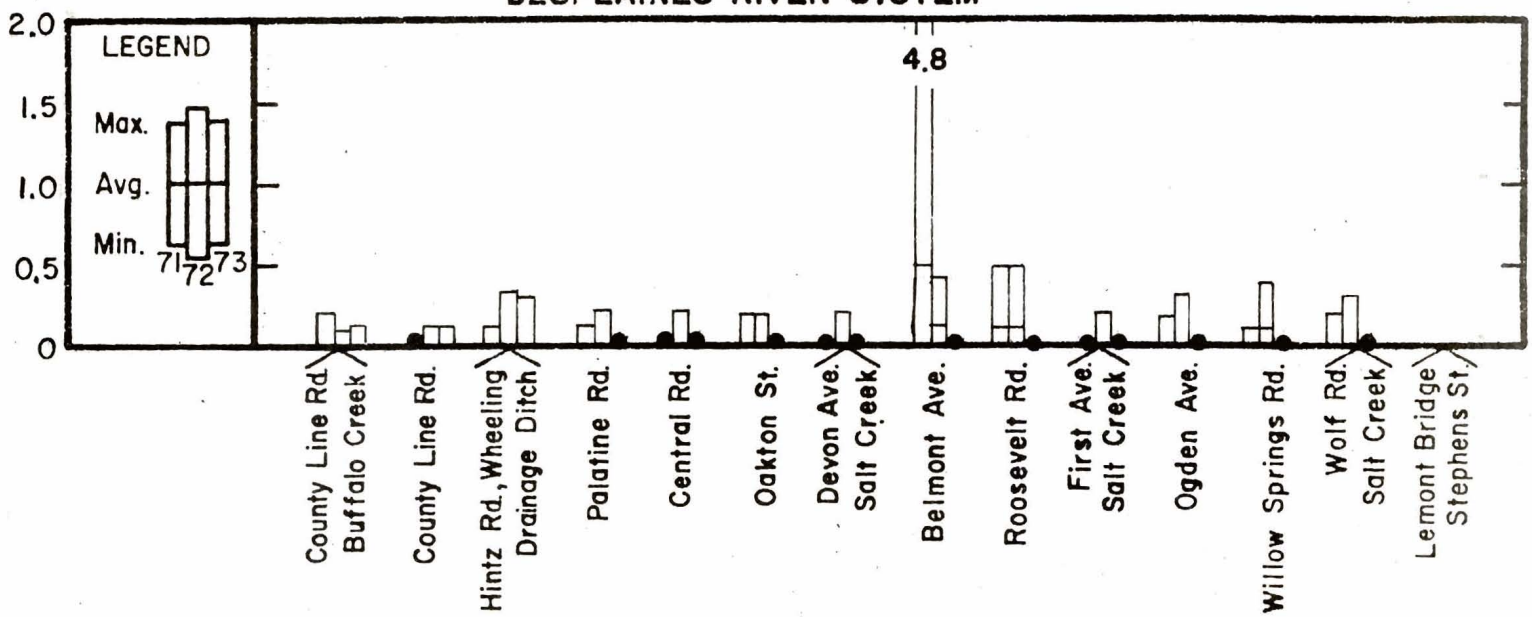


ZINC CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B23

DESPLAINES RIVER SYSTEM



Data shown above is only data available

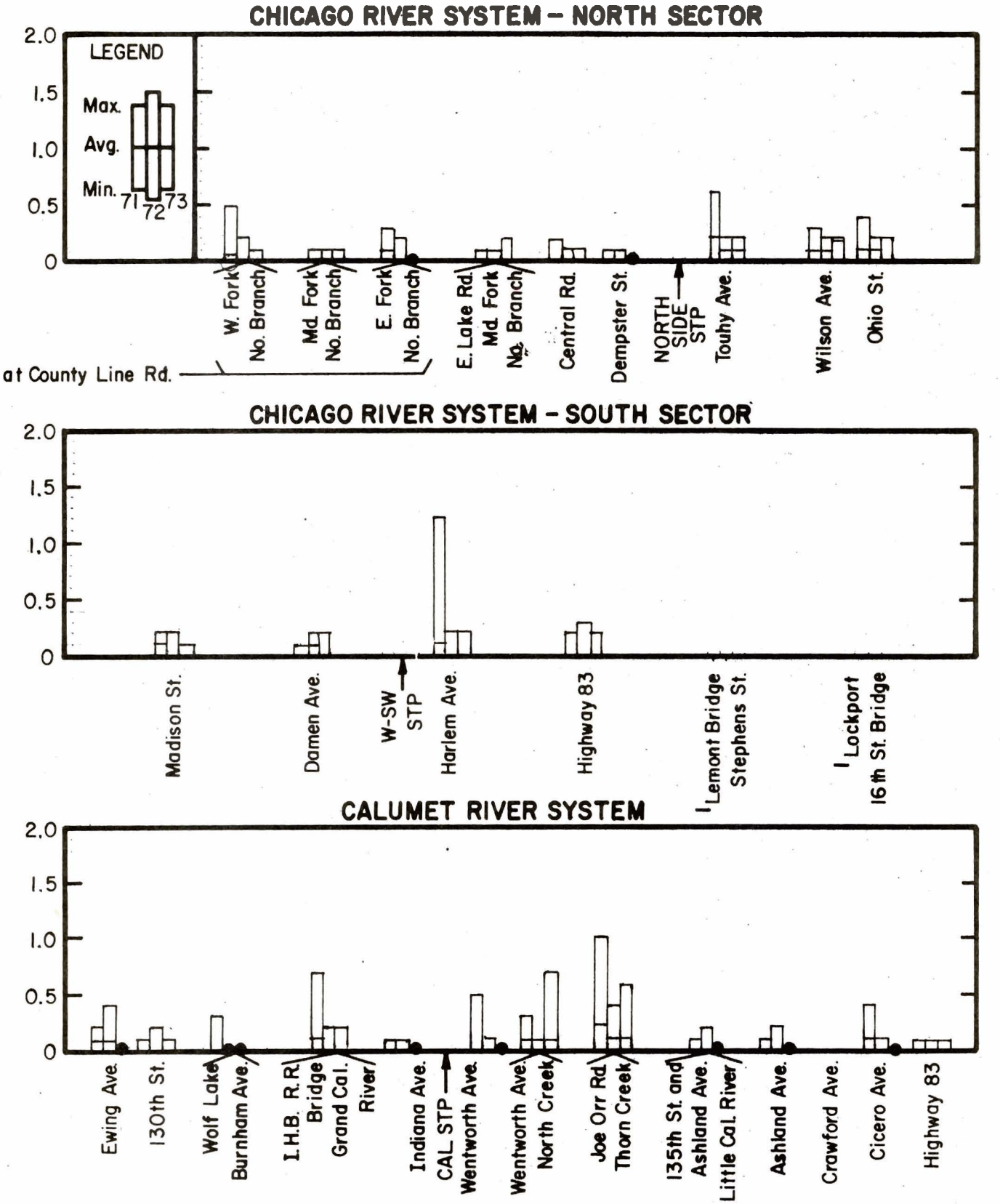
1 - 1971 Data Only

● Max., Avg. & Min. Concentrations = 0.0

ZINC CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 – 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B23 (cont'd.)



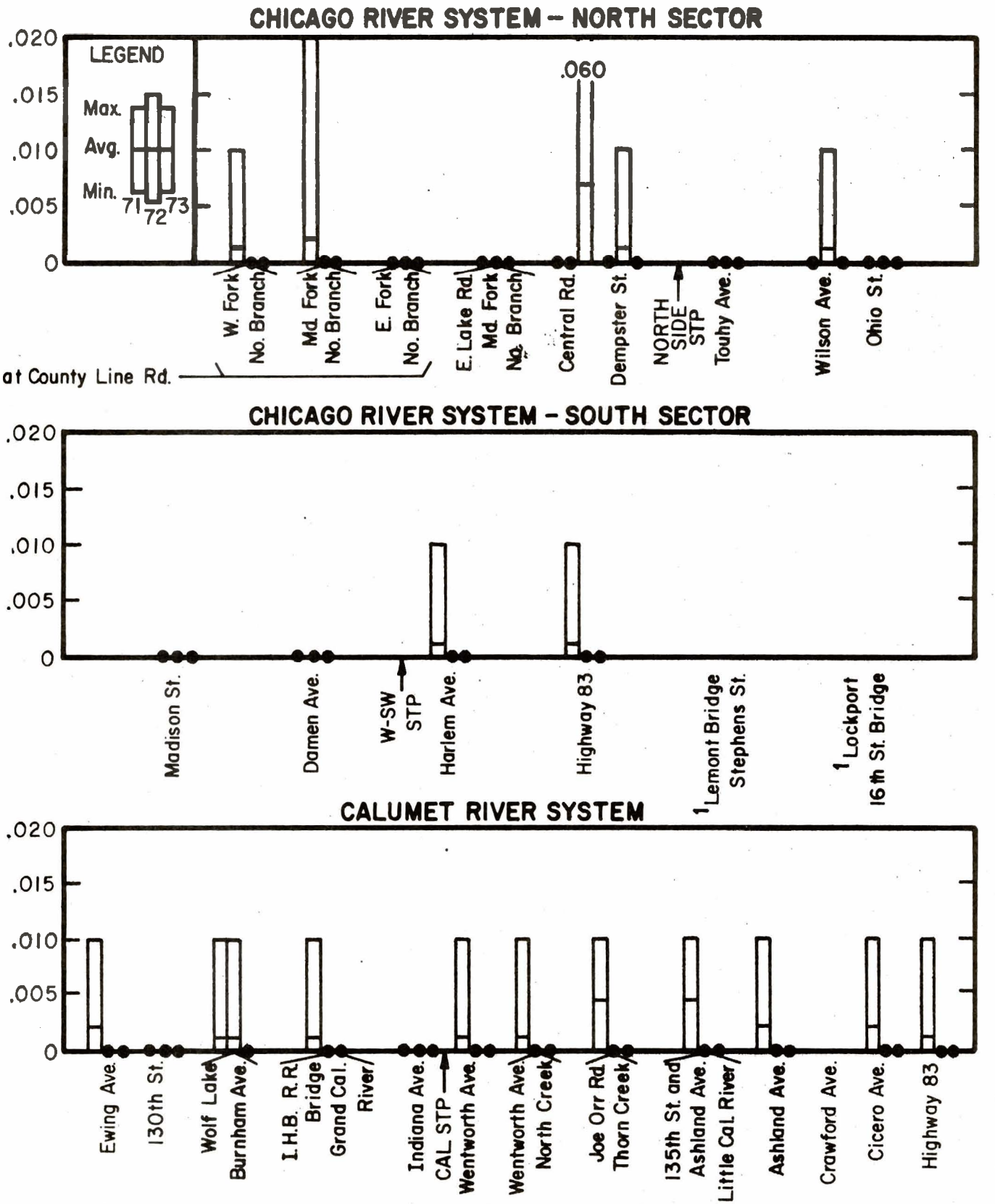
● Max., Avg. & Min. Concentrations = 0.0

I - Data not available

SILVER CONCENTRATION IN THE MSDGC RIVER SYSTEM DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in mg/L

Figure B 24



● Max., Avg. & Min. Concentrations = 0.0

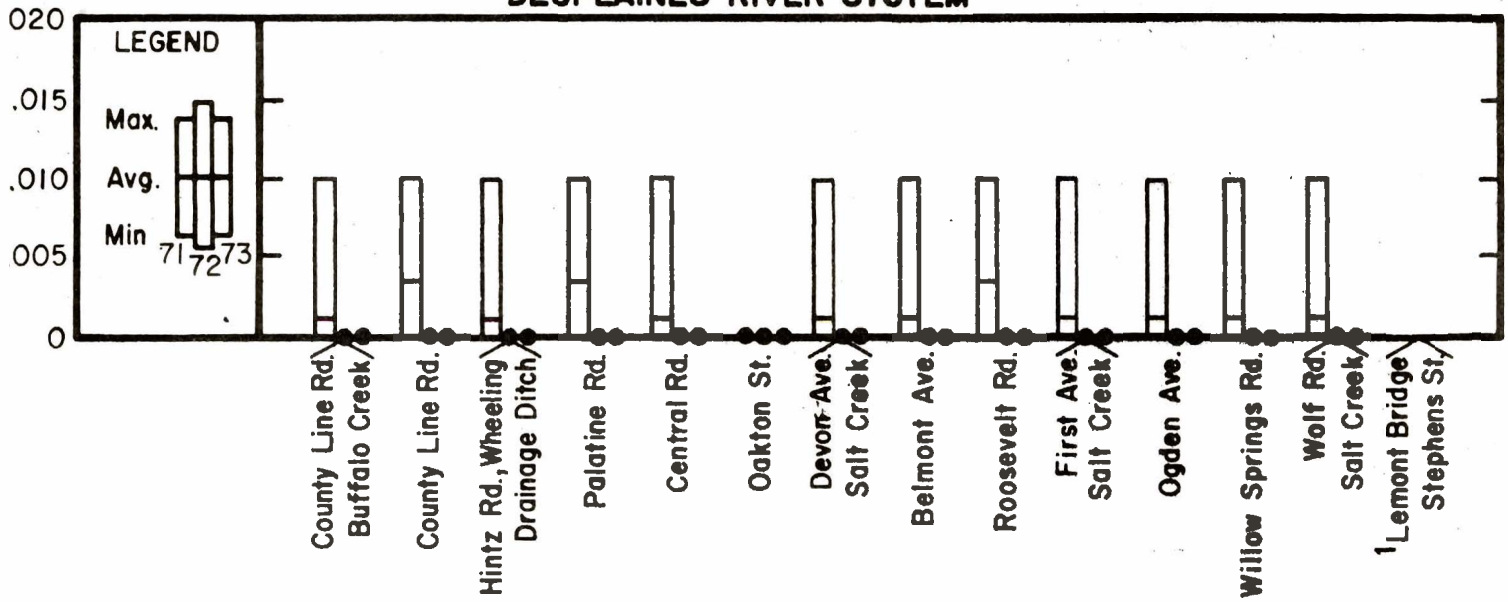
1 - Data not available

SILVER CONCENTRATION IN THE MSDGC RIVER SYSTEM DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in mg/L

Figure B24 (cont'd.)

DESPLAINES RIVER SYSTEM



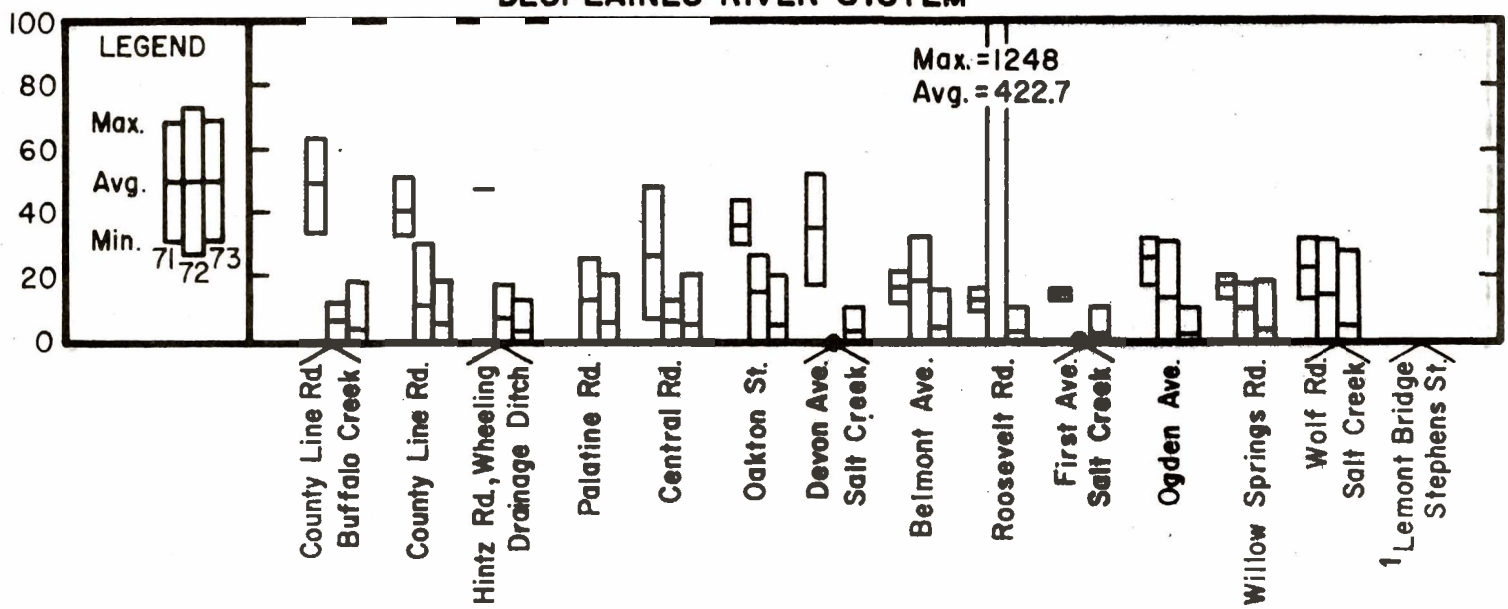
1 - Data not available

TOTAL ORGANIC CARBON CONCENTRATION IN THE MSDGC RIVER SYSTEM DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in mg/L

Figure B25

DESPLAINES RIVER SYSTEM



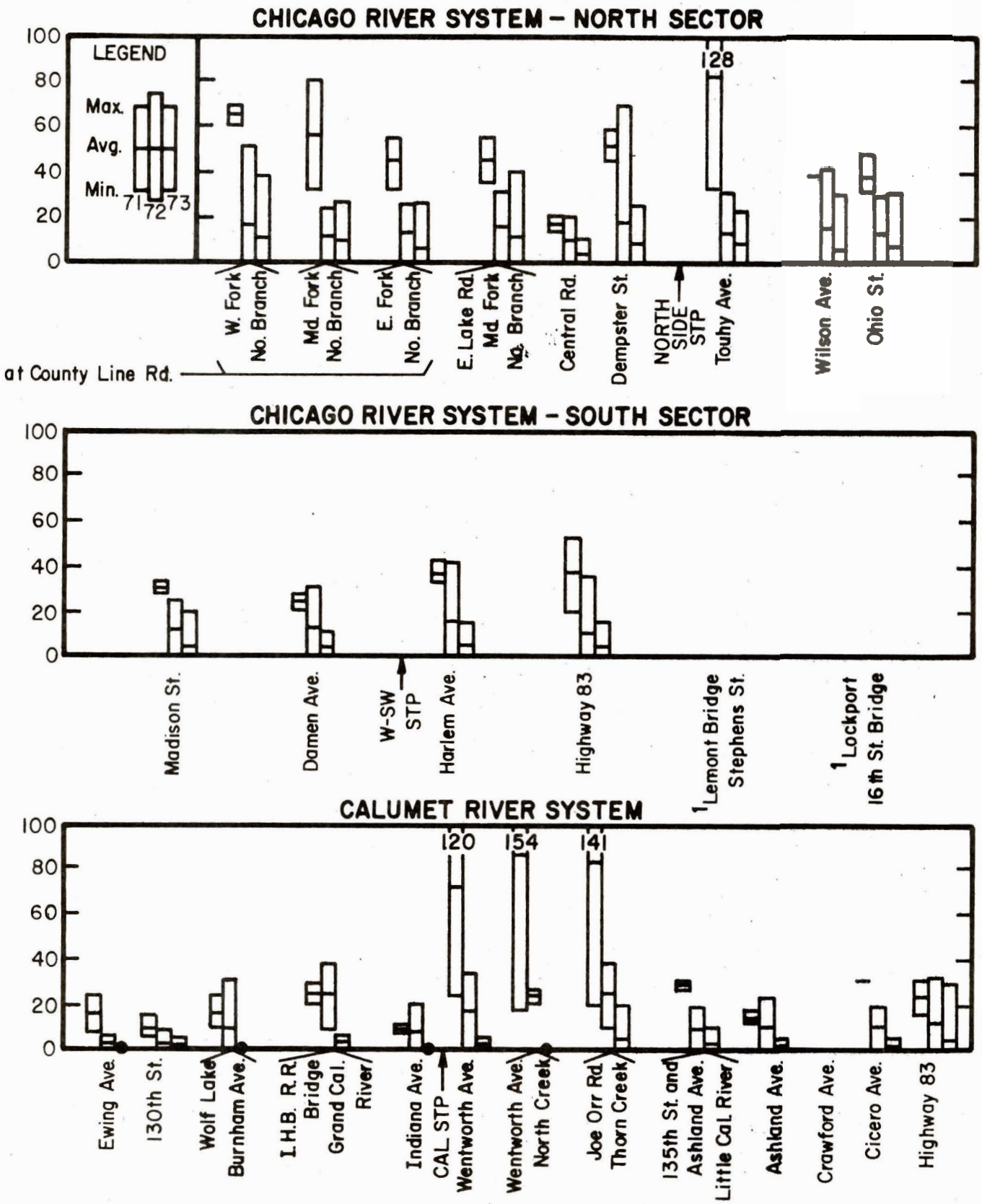
1 - Data not available

● Max., Avg. & Min. Concentrations = 0.0

TOTAL ORGANIC CARBON CONCENTRATION IN THE MSDGC RIVER SYSTEM DURING 1971 - 1973

Maximum, Average and Minimum Concentrations in mg/L

Figure B25 (cont'd)



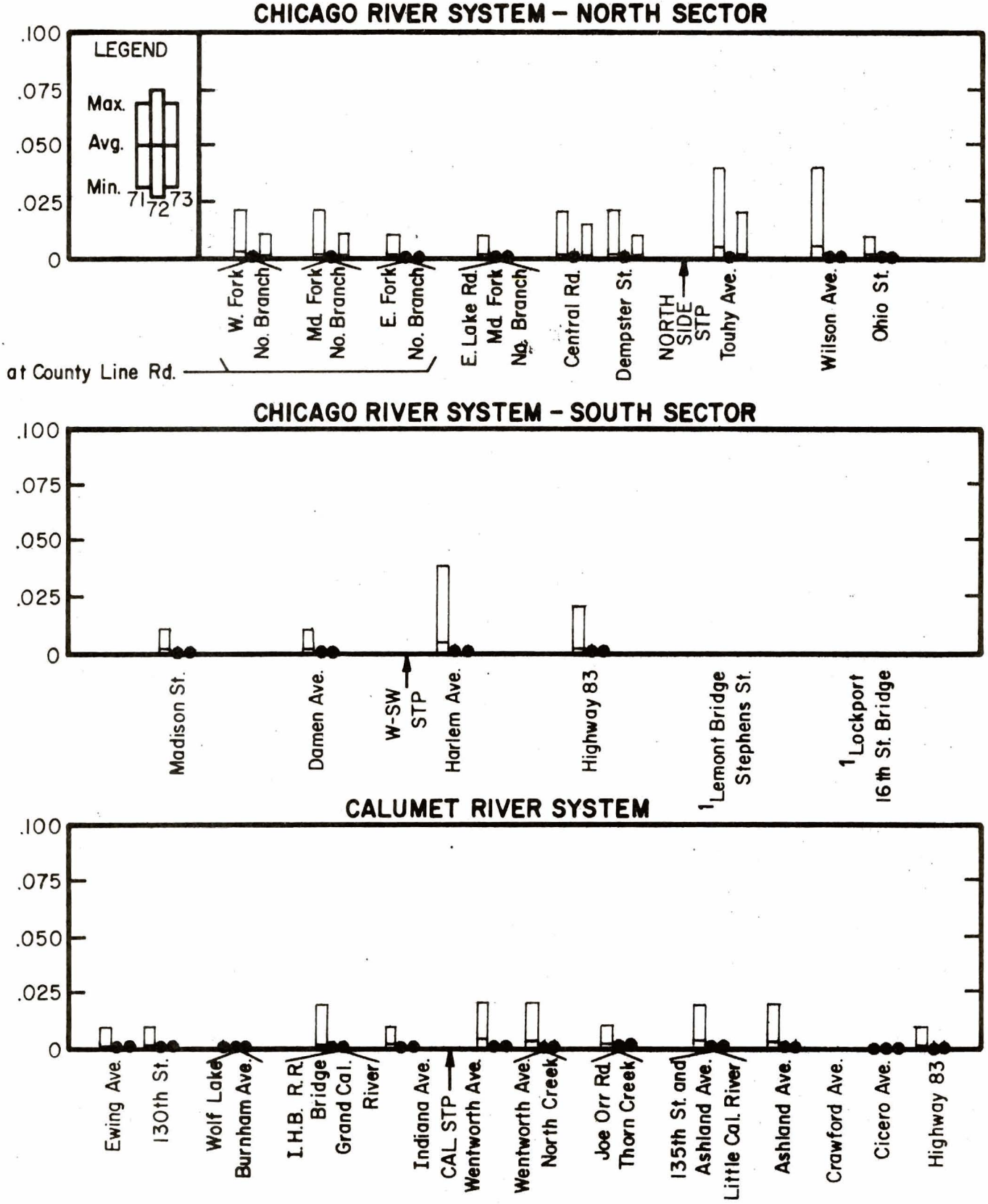
1 - Data not available

● Max., Avg. & Min. Concentrations = 0.0

CADMIUM CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 – 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B26



● Max., Avg. & Min. Concentrations = 0.0

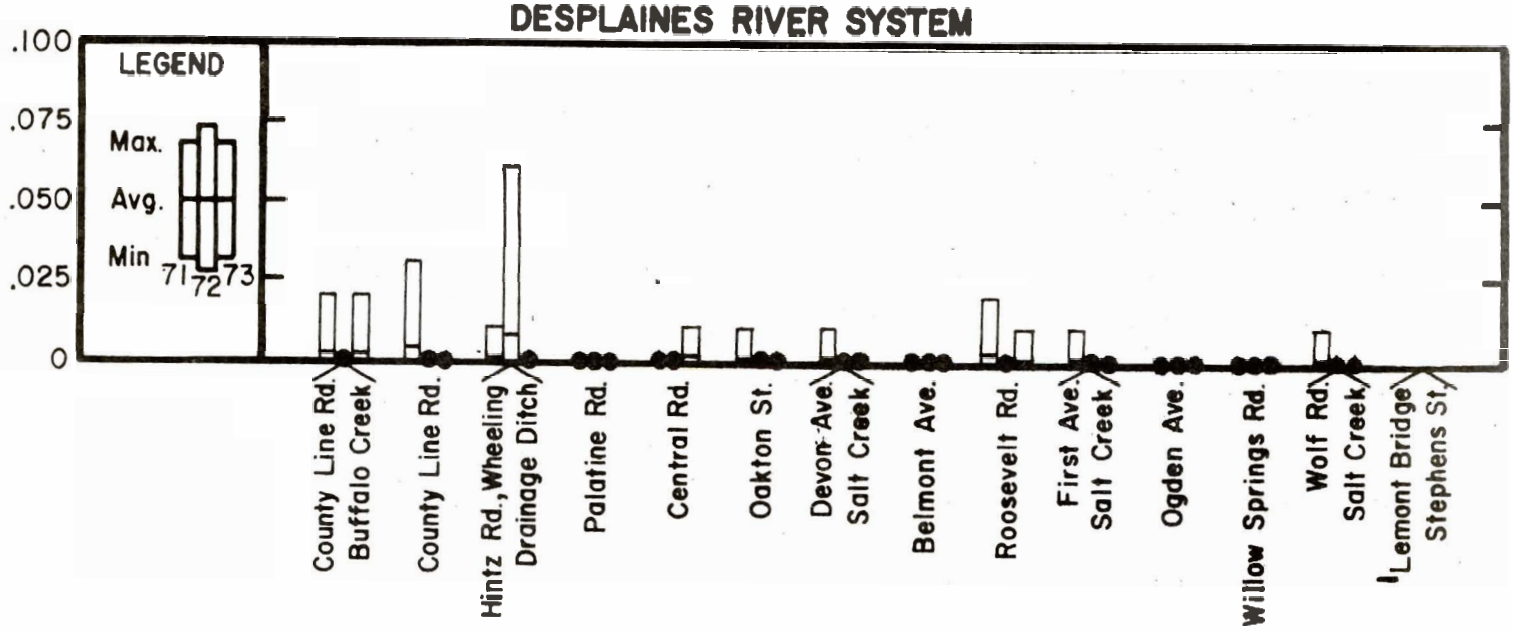
1 – Data not available

CADMIUM CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B26 (cont'd.)

DESPLAINES RIVER SYSTEM

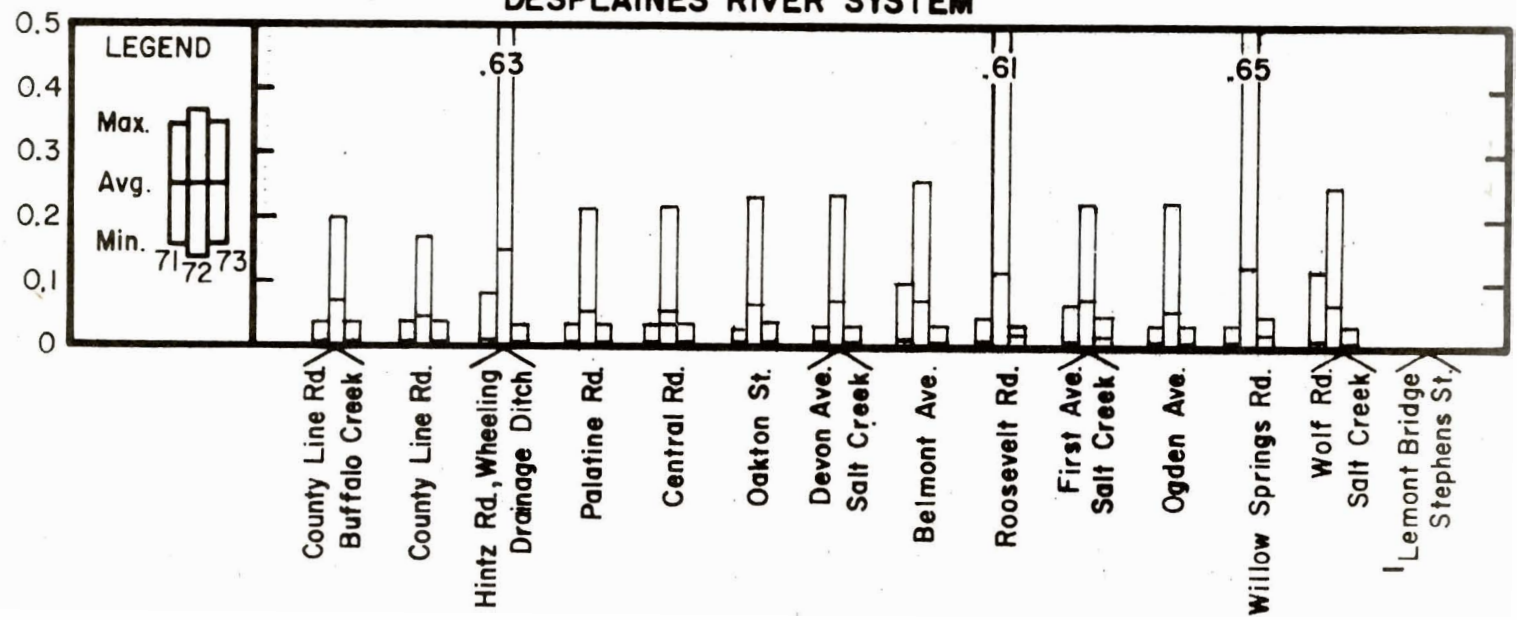


COPPER CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B27

DESPLAINES RIVER SYSTEM



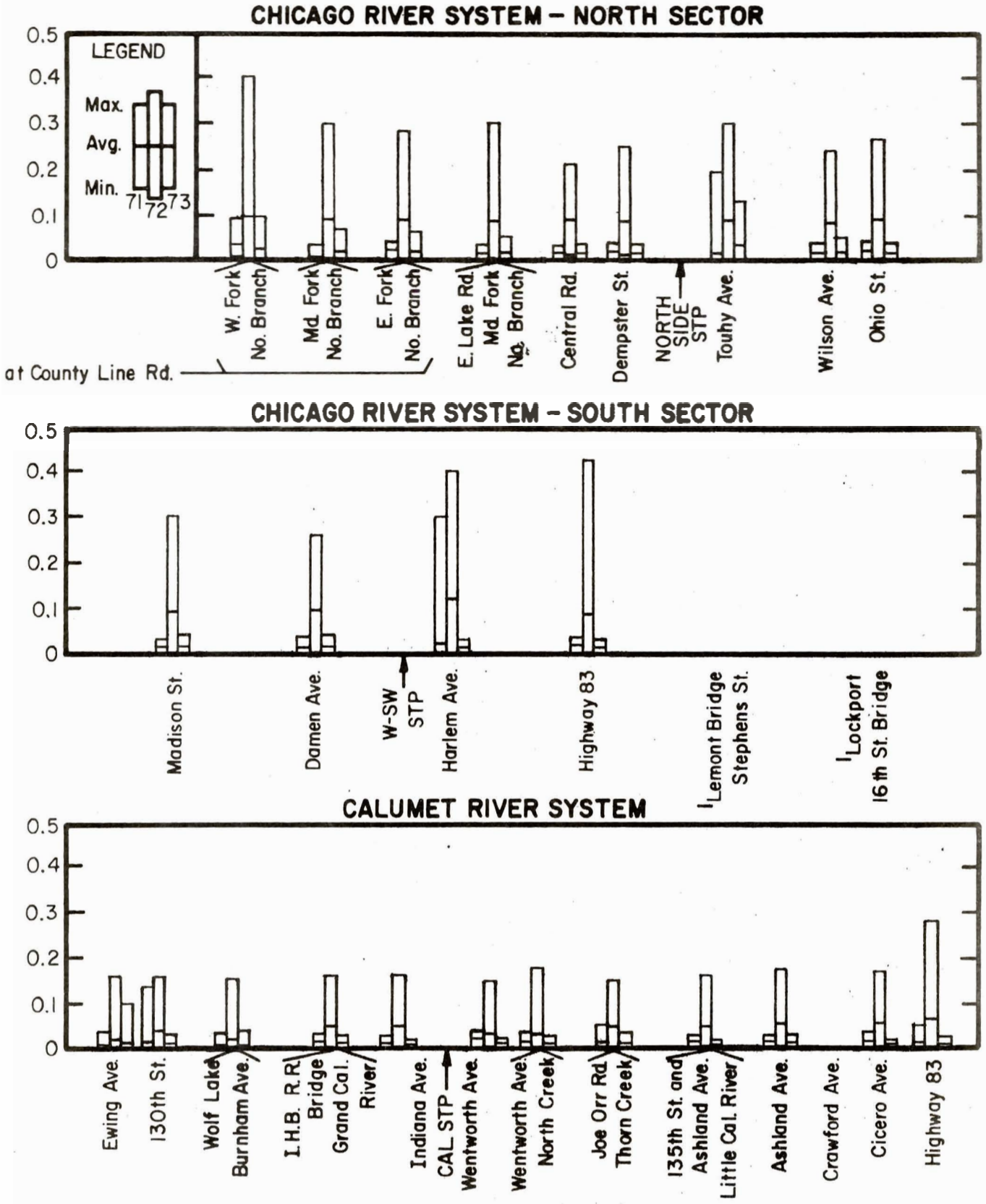
● Max., Avg. & Min. Concentrations = 0.0

1 - Data not available

COPPER CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B27 (cont'd.)

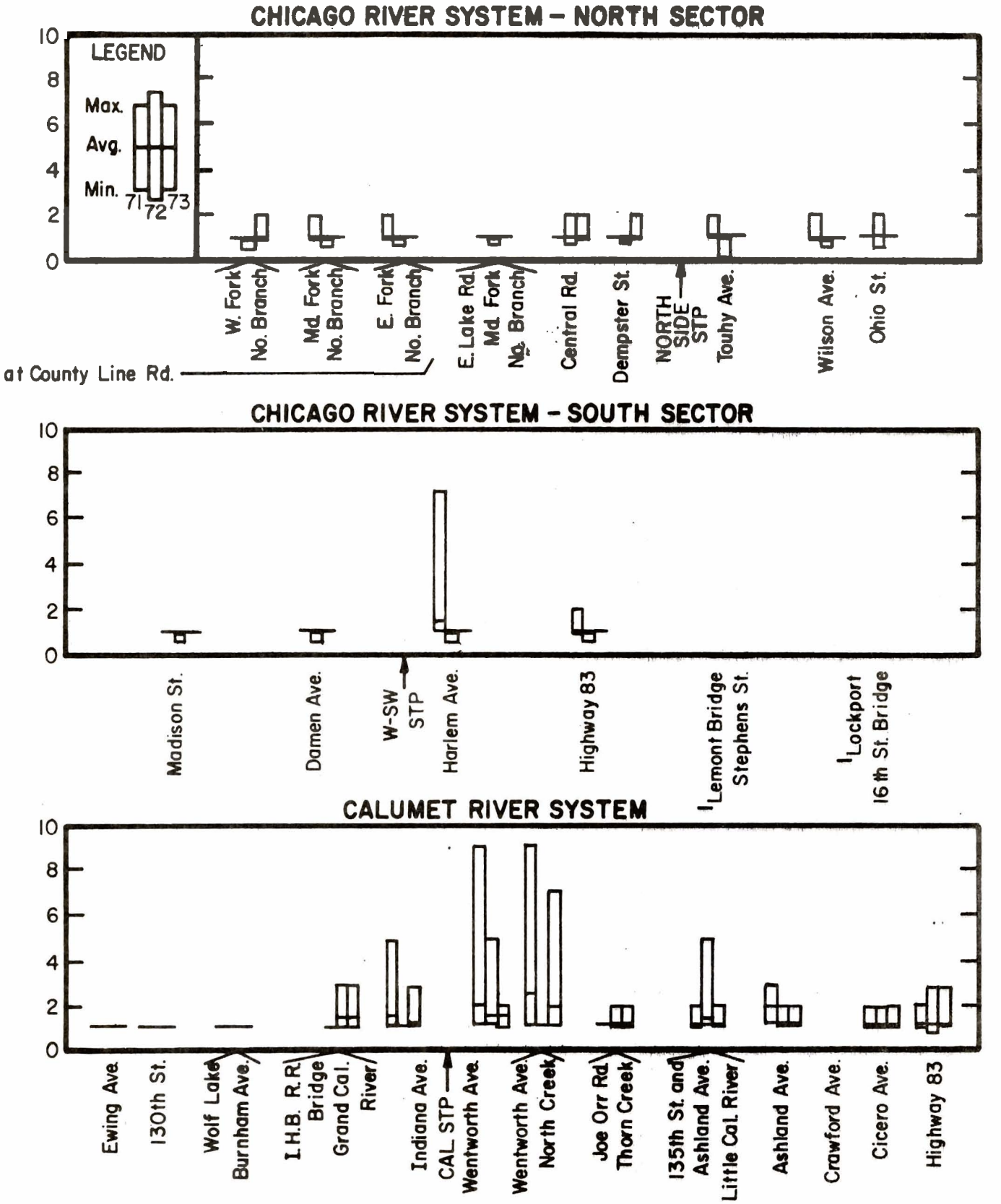


I - Data not available

IRON CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B28



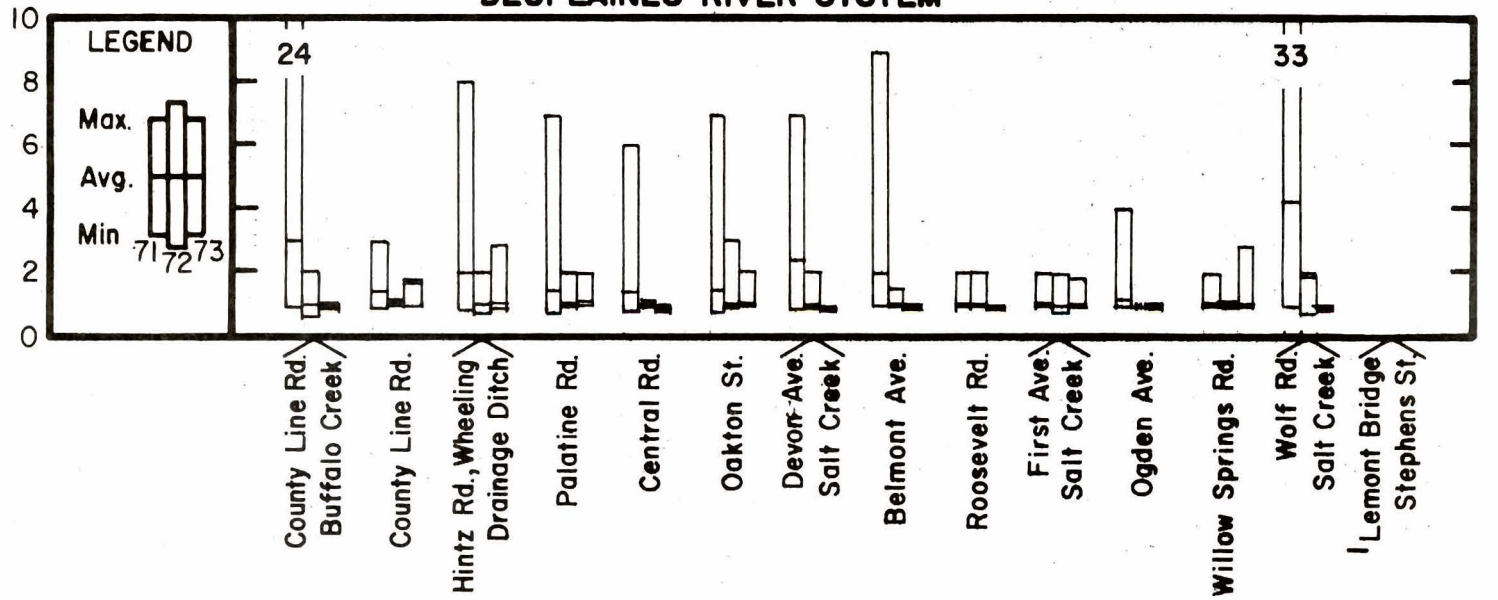
I - Data not available

IRON CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B28 (cont'd.)

DESPLAINES RIVER SYSTEM

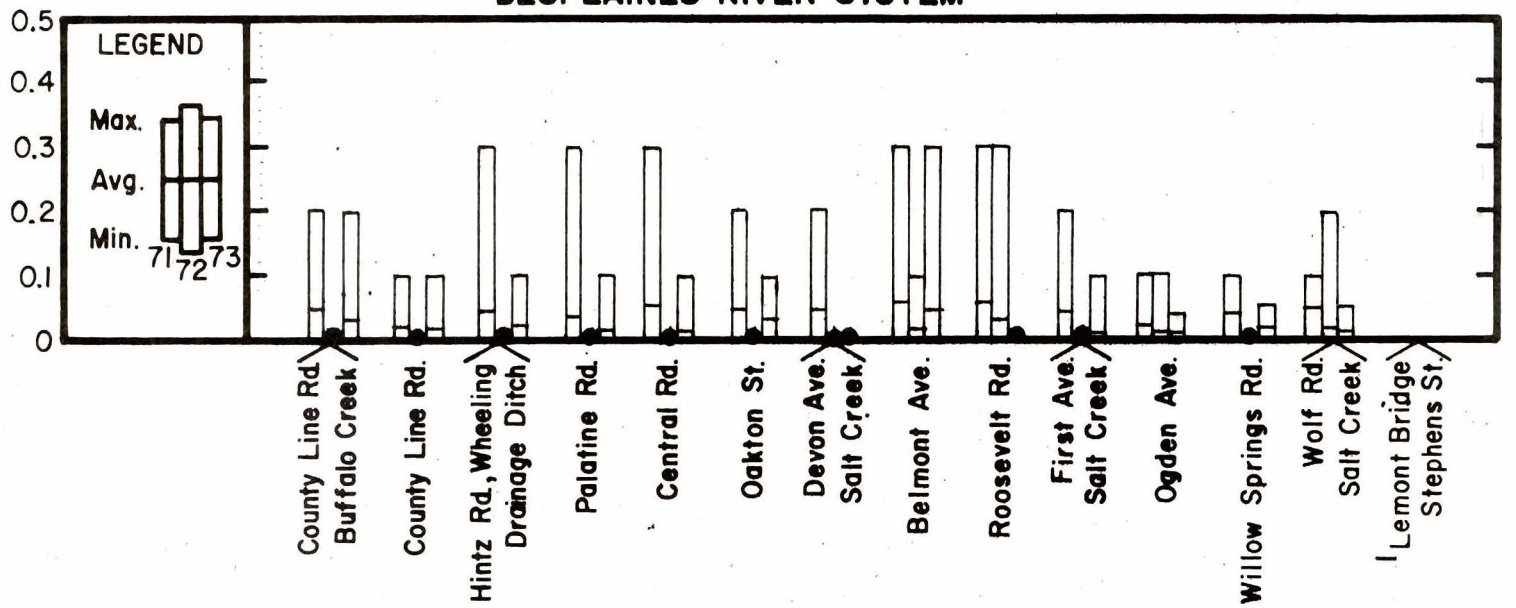


NICKEL CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B29

DESPLAINES RIVER SYSTEM



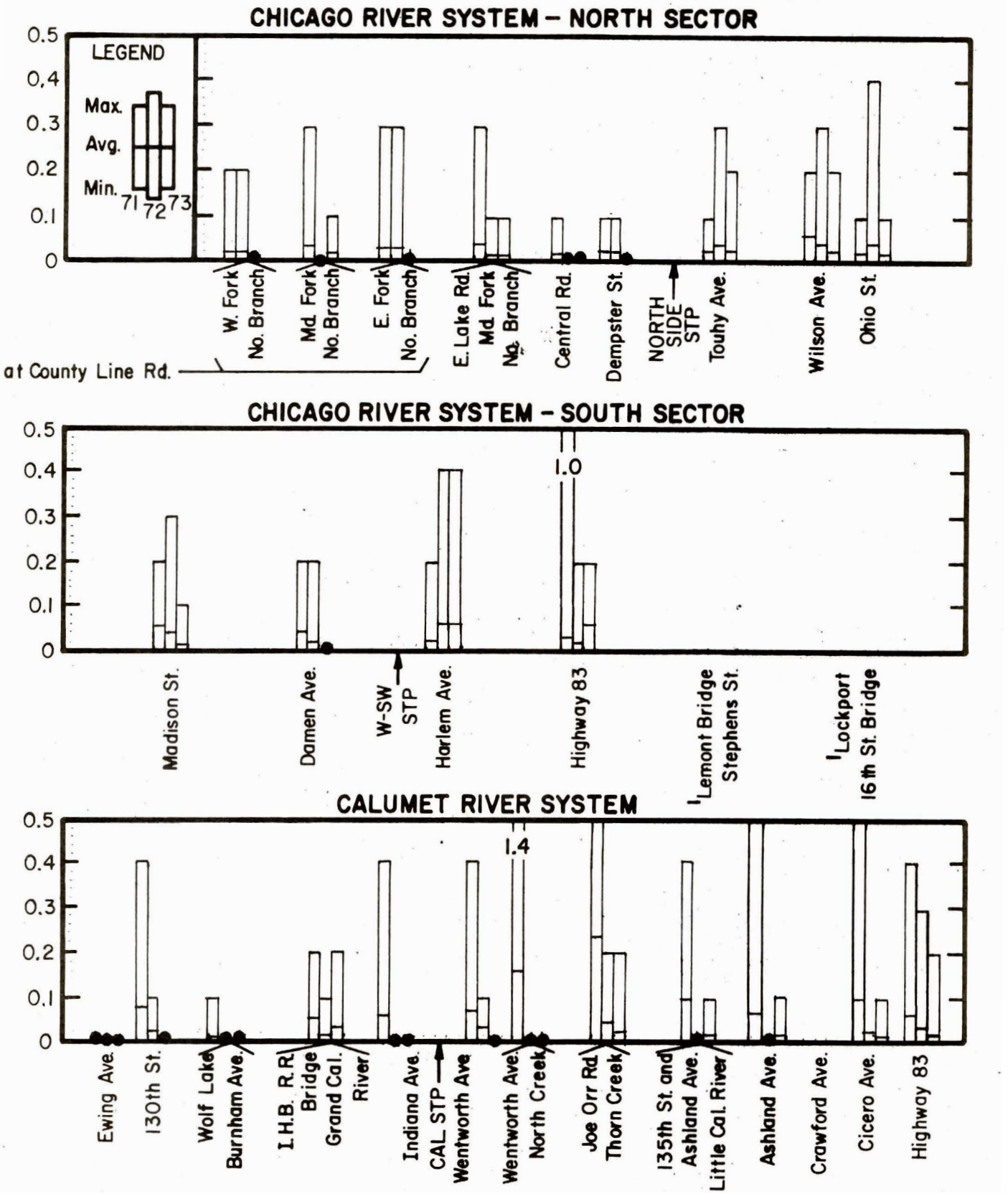
● Max., Avg. & Min. Concentrations = 0.0

I - Data not available

NICKEL CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B29 (cont'd.)



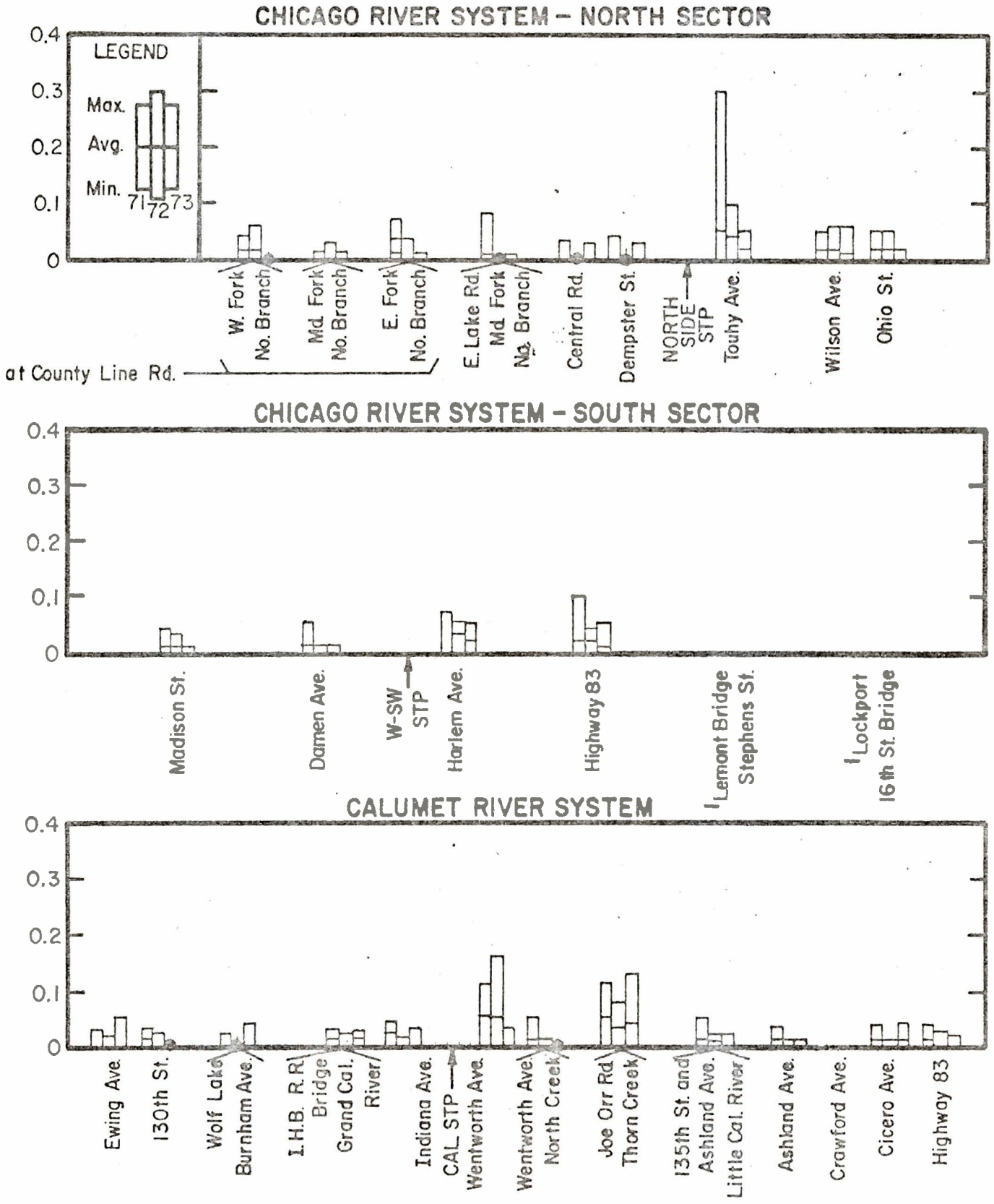
● Max., Avg. & Min. Concentrations = 0.0

I - Data not available

TOTAL CHROMIUM CONCENTRATION IN THE MSDGC RIVER SYSTEM DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B30



● Max., Avg. & Min. Concentrations = 0.0

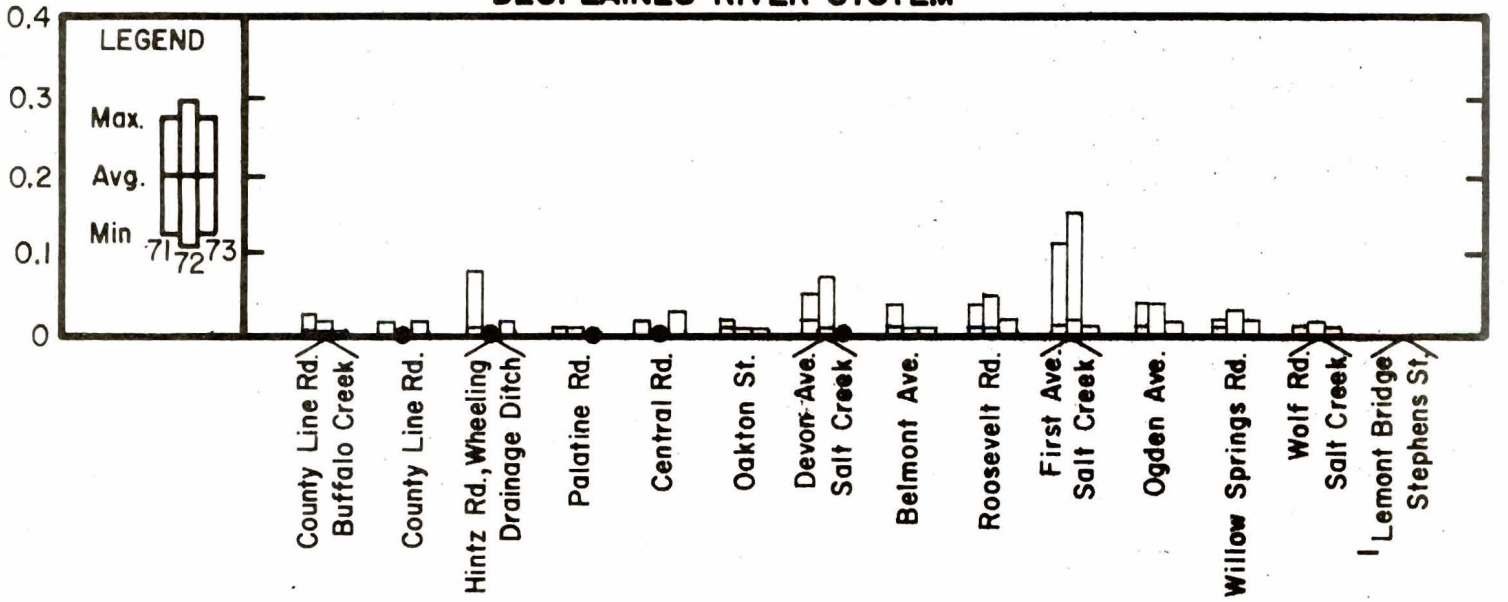
I - Data not available

TOTAL CHROMIUM CONCENTRATION IN THE MSDGC RIVER SYSTEM DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B30 (cont'd.)

DESPLAINES RIVER SYSTEM

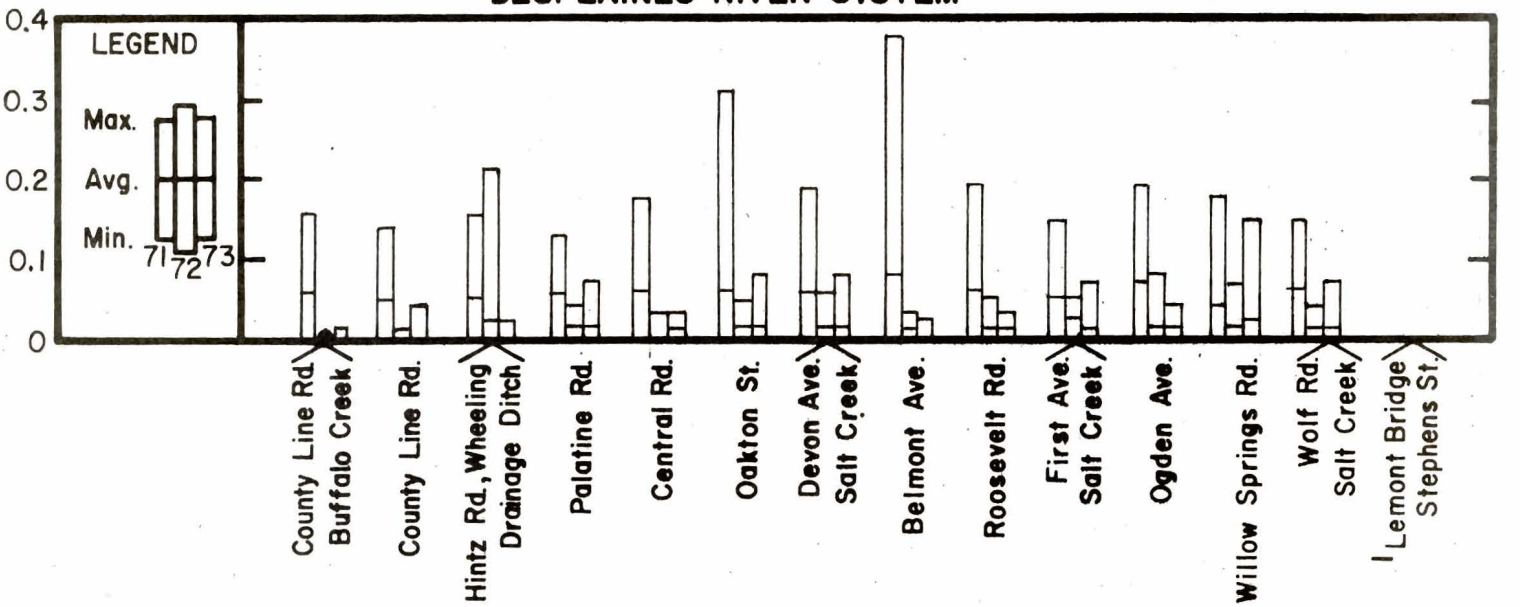


LEAD CONCENTRATION IN THE MSDGC RIVER SYSTEM DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B31

DESPLAINES RIVER SYSTEM



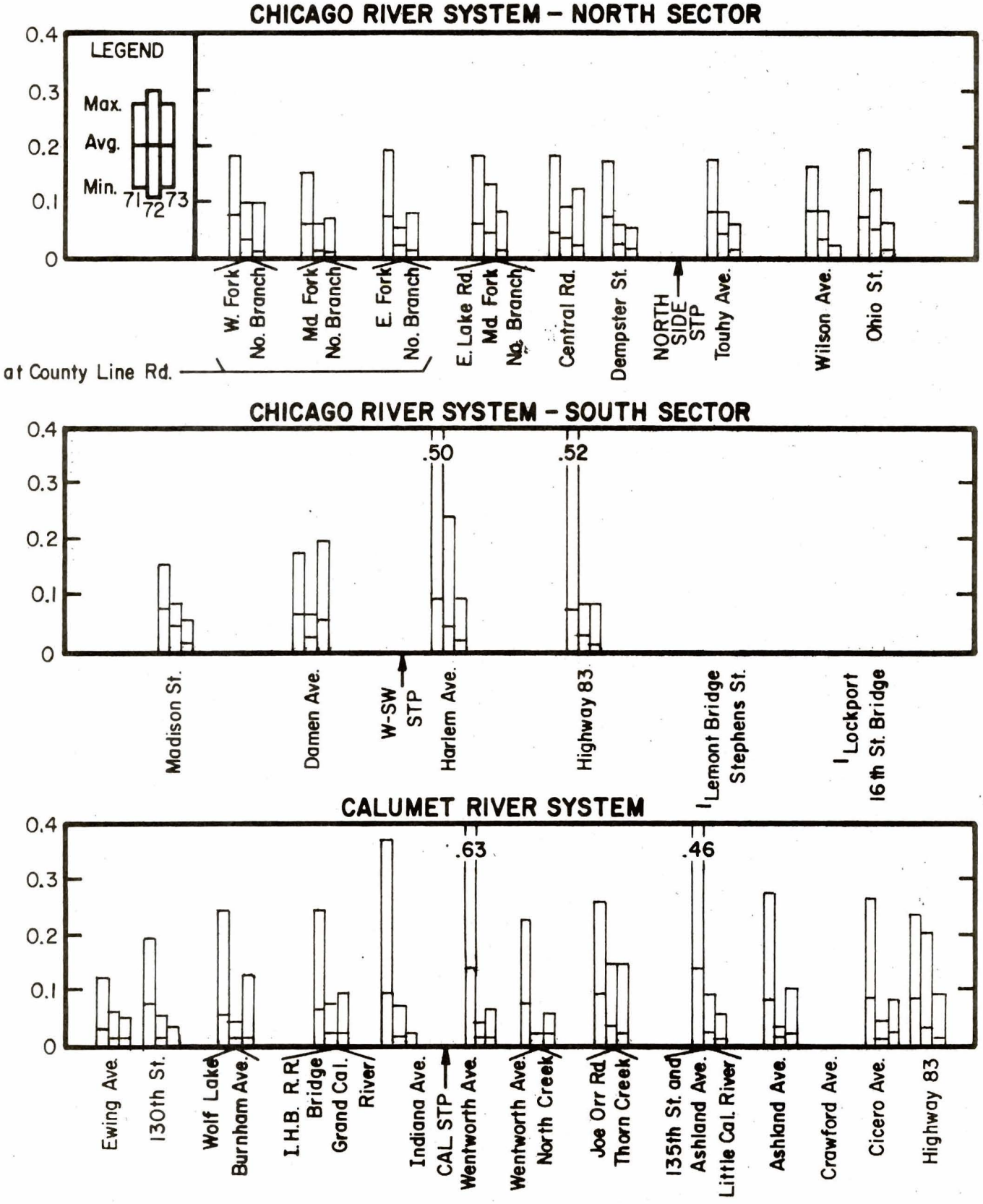
● Max., Avg. & Min. Concentrations = 0.0

I - Data not available

LEAD CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B31 (cont'd.)

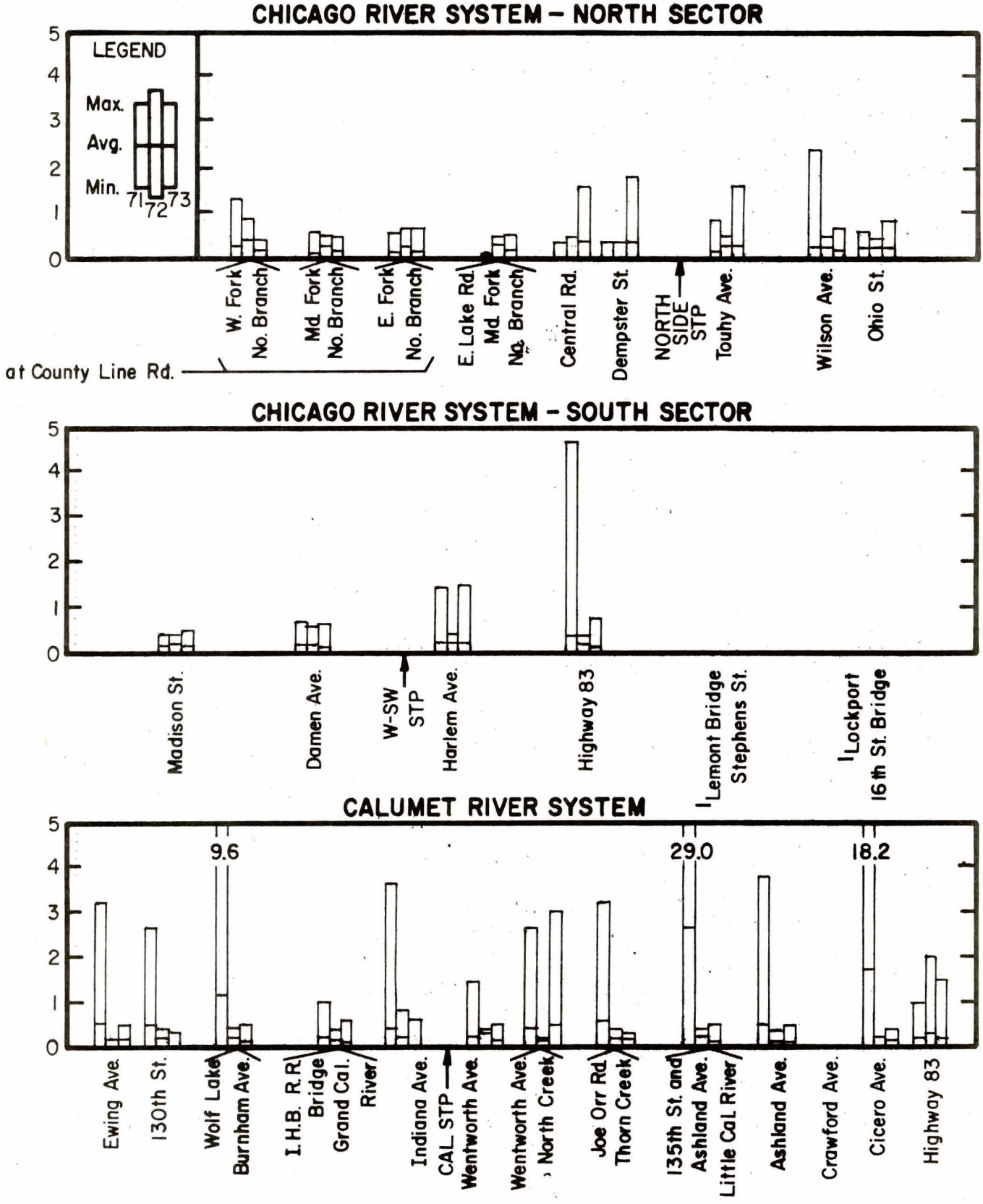


I - Data not available

MERCURY CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 – 1973

Maximum, Average & Minimum Concentrations in µg/L

Figure B32



● Max., Avg. & Min. Concentrations = 0.0

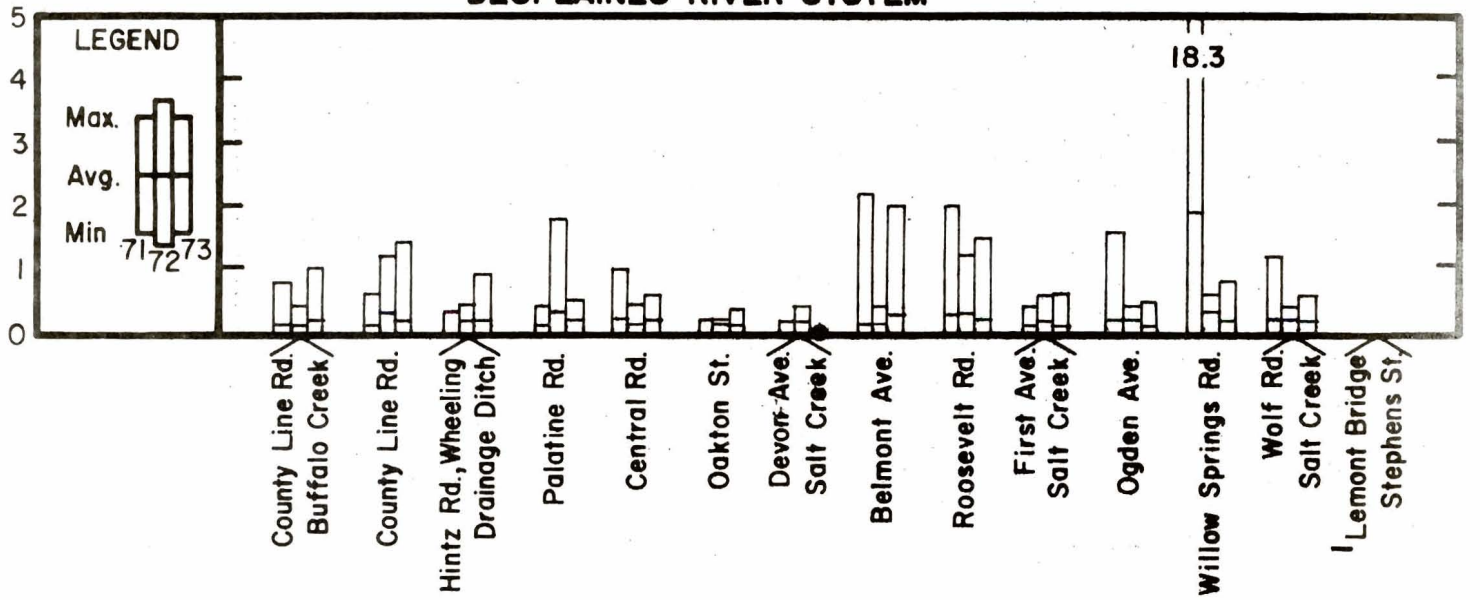
I – Data not available

MERCURY CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentration in µg/L

Figure B32 (cont'd.)

DESPLAINES RIVER SYSTEM

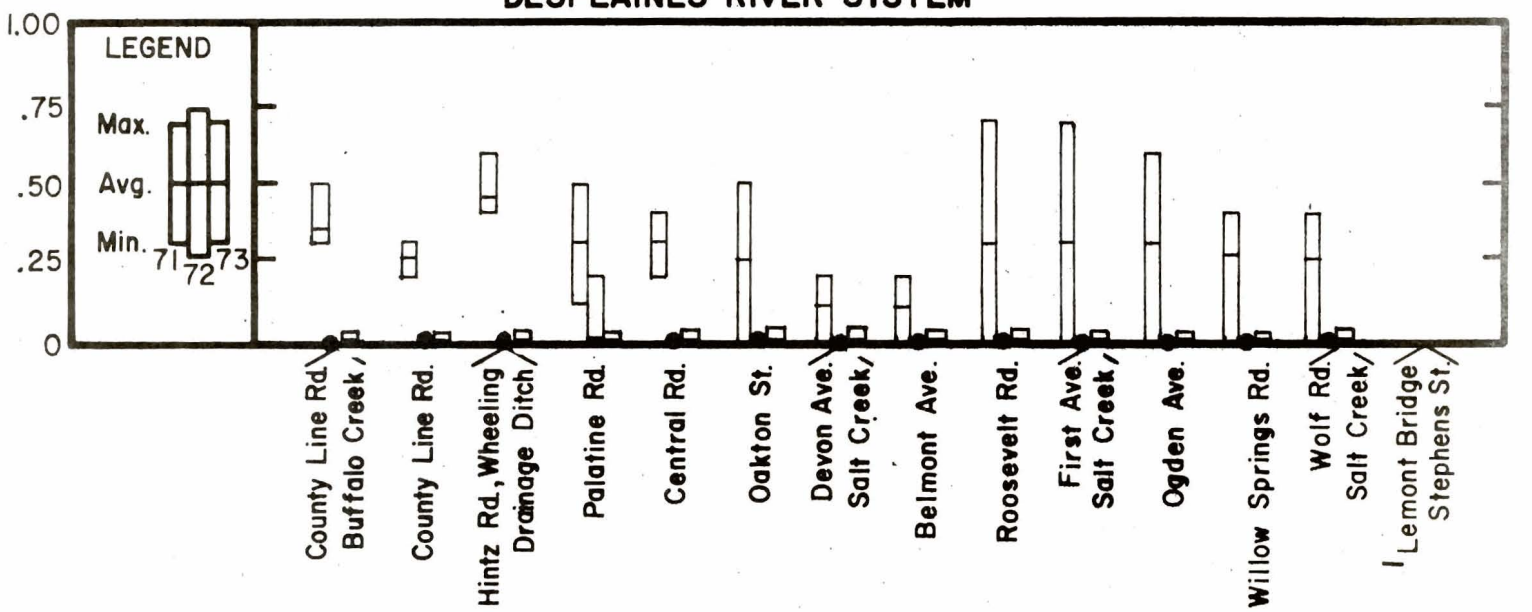


ARSENIC CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B33

DESPLAINES RIVER SYSTEM



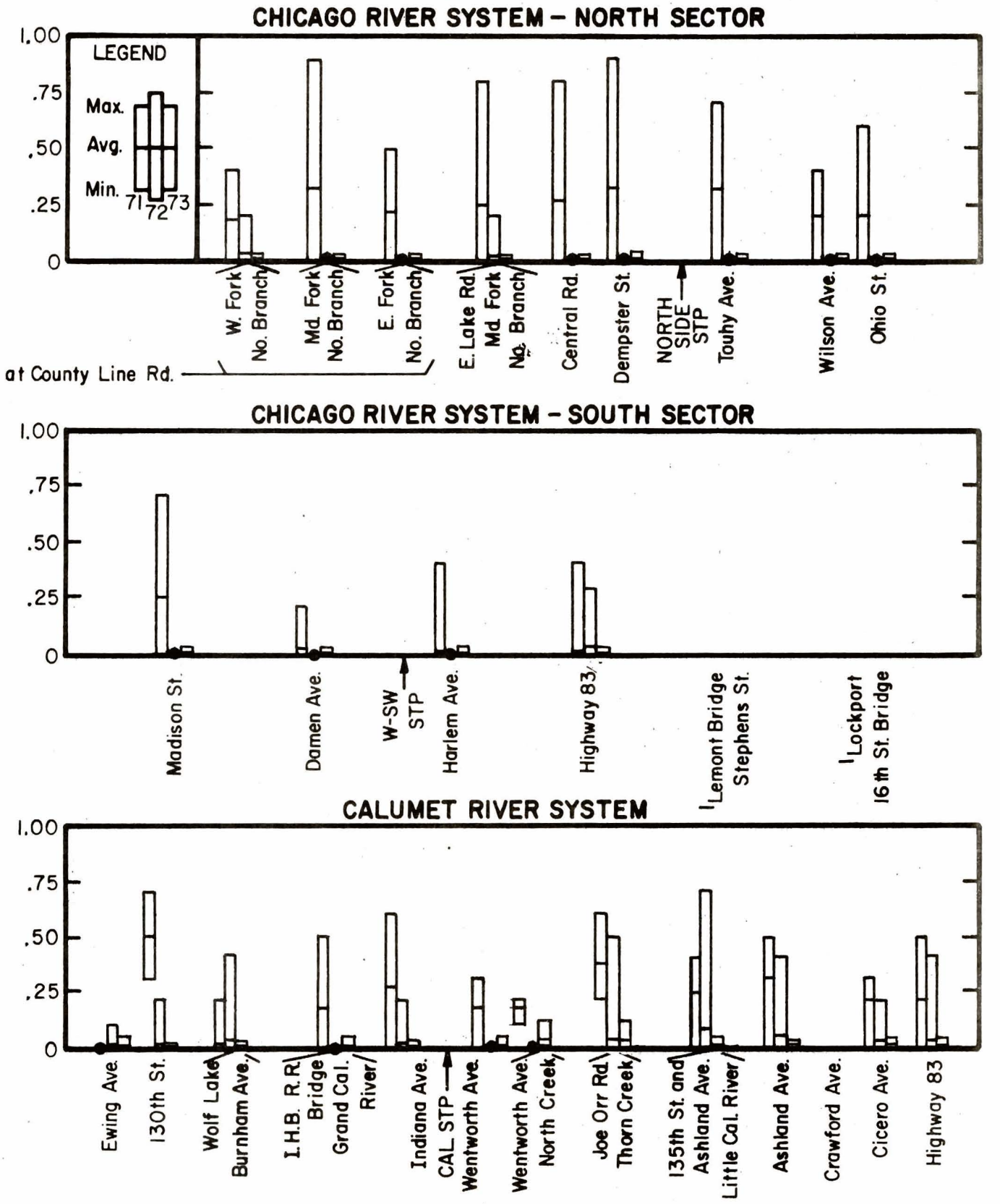
● Max., Avg. & Min. Concentrations = 0.0

I - Data not available

ARSENIC CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 – 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B33 (cont'd.)



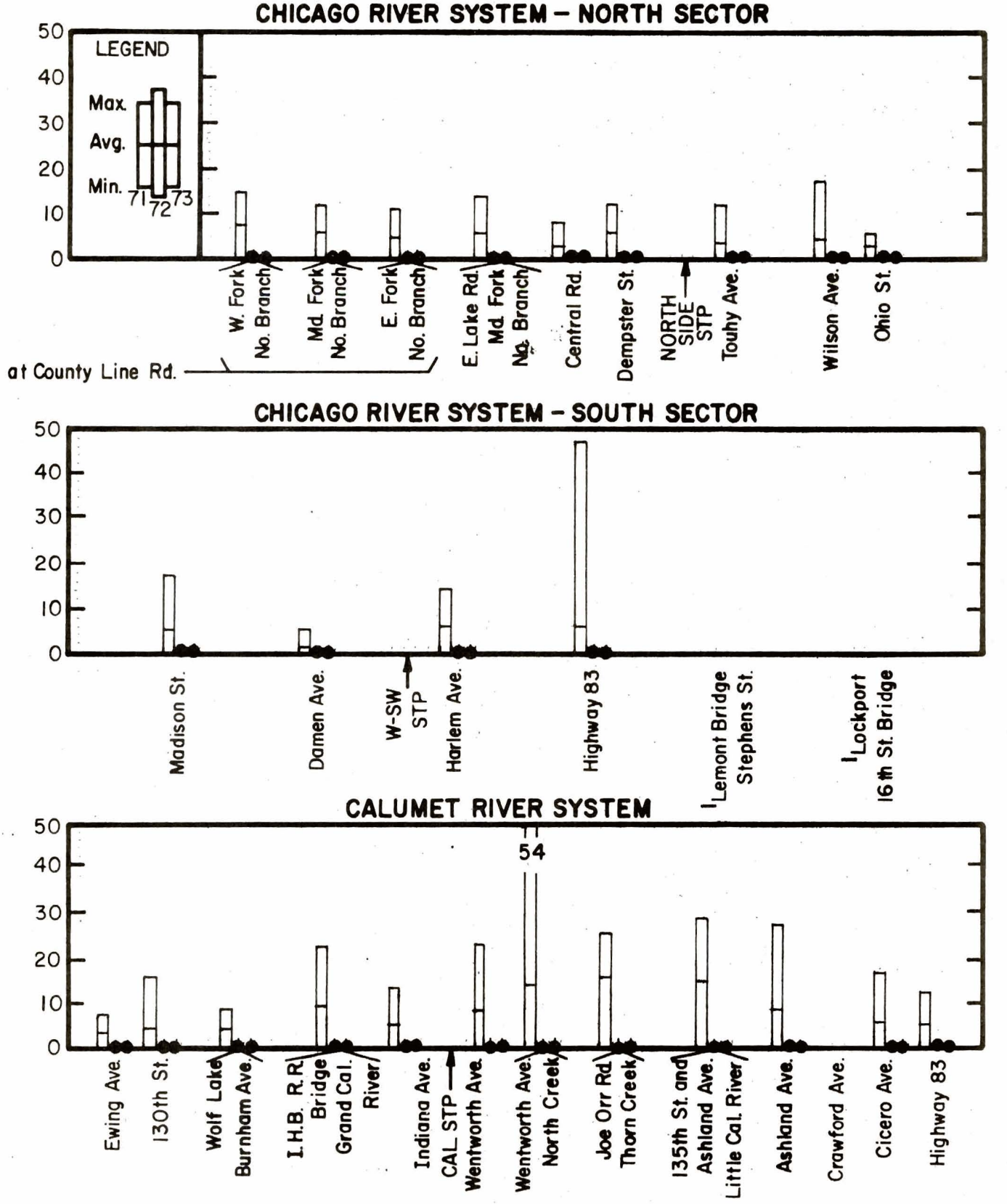
● Max., Avg. & Min Concentrations = 0.0

I – Data not available

SELENIUM CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B34



● Max., Avg. & Min. Concentrations = 0.0

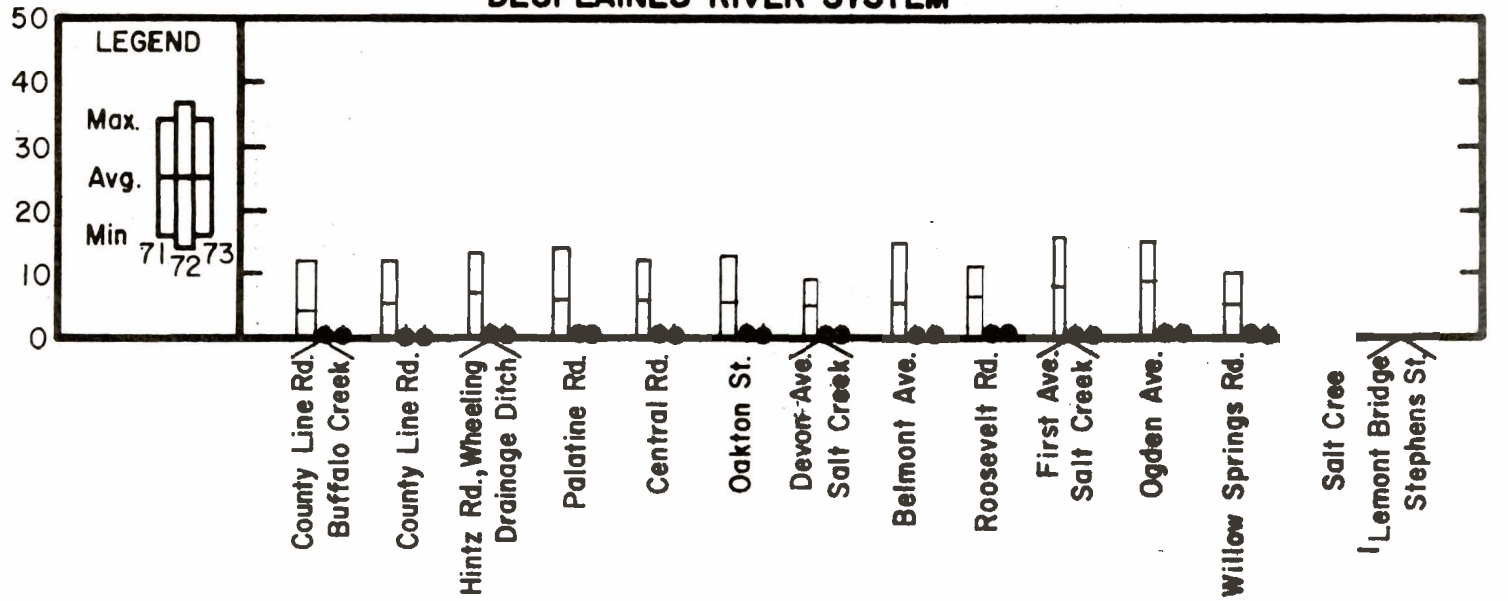
I - Data not available

SELENIUM CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B34 (cont'd.)

DESPLAINES RIVER SYSTEM

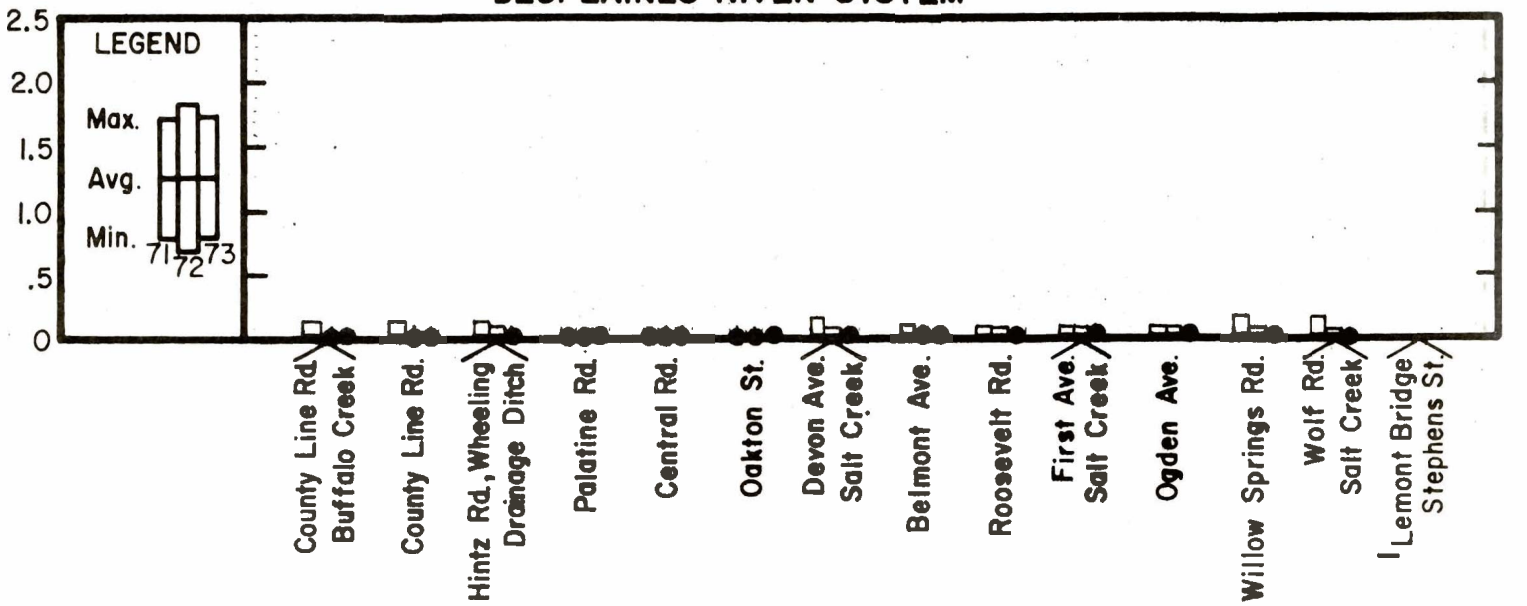


BARIUM CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentration in mg/L

Figure B35

DESPLAINES RIVER SYSTEM



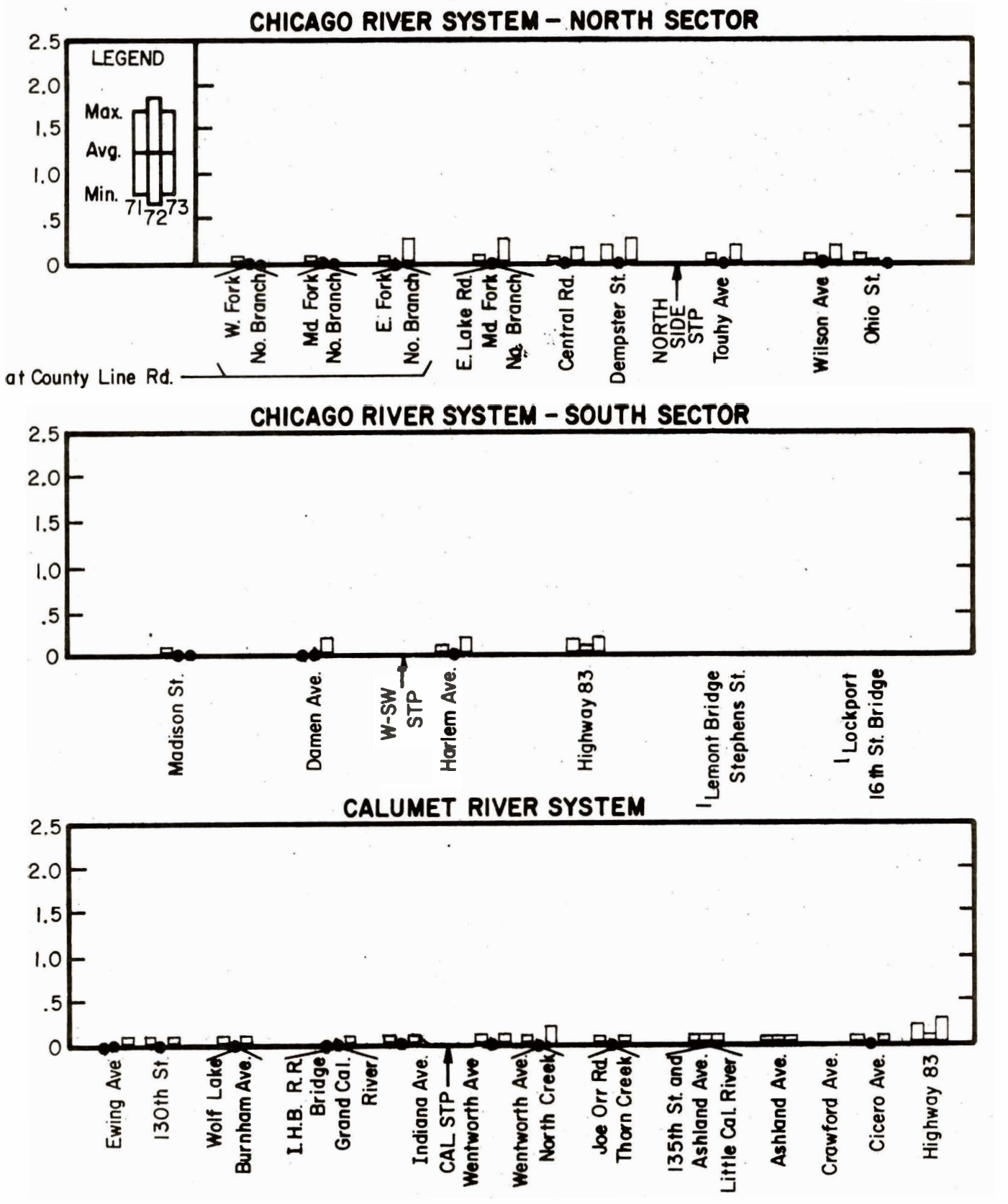
● Max., Avg. & Min. Concentrations = 0.0

I - Data not available

BARIUM CONCENTRATION IN THE MSDGC RIVER SYSTEMS DURING 1971 - 1973

Maximum, Average & Minimum Concentrations in mg/L

Figure B35



● Max., Avg. & Min. Concentrations = 0.0

I - Data not available

APPENDIX C

LINEAR REGRESSION ANALYSES

LINEAR REGRESSION STATISTICS

Regression statistics are presented in Tables C1 through C-3 for the indicated paired variables, stations, and years. The following statistics are presented for the estimating equation:

$$\hat{y} = A + BX$$

Where, $\hat{y}$ = Dependent variable

x = Independent variable

and,

N = Number of paired observations

r = Linear correlation coefficient

A = Intercept

B = Regression Coefficient

Sy.x = Standard Error of Estimate for dependent variable

% Confidence = % probability that correlation is not due to chance.

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO -

TABLE C-1

LINEAR REGRESSION STATISTICS, 1971-1973

$\hat{y} = A + Bx$

where, $\hat{y}$ = Total Suspended Solids; x = Inorganic Susp. Solids

Station	Year	N	r	A	B	Sy x	% Conf.
1	Wilmette Harbor, North Shore Channel						
	1971	179	.9709	8,665	1.078	9.607	>99.9
	1972	21	.9956	11.89	0.9965	4.994	>99.9
	1973	193	.993	5.356	1.053	3.829	> 99.9
Station 2	Outer Drive Bridge, Chicago River						
	1971	134	.8325	4.908	1.157	9.474	>99.9
	1972	127	.9691	1.19	1.2470	3.731	>99.9
	1973	118	.947	1.983	1.222	6.318	> 99.9
Station 5	Ohio Street, North Branch Chicago River						
	1971	135	.9081	18.65	1.345	41.86	>99.9
	1972	130	.9443	4.13	1.329	4.835	>99.9
	1973	130	.930	5.393	1.233	4.899	> 99.9
Station 7	Highway 83 and Archer Avenue, Cal-Sag Channel						
	1971	196	.9867	5.034	1.230	28.17	>99.9
	1972	184	.9797	4.17	1.164	10.27	>99.9
	1973	190	.994	4.379	1.166	6.799	>99.9
Station 8.2	Lockport Powerhouse						
	1971	352	.8611	10.28	1.155	6.587	>99.9
	1972	350	.9714	7.72	1.243	4.293	>99.9
	1973	352	.969	8.689	1.166	4.79	> 99.9
Station 9	North Side Treatment Plant Effluent						
	1971	311	.8160	9.090	2.979	15.71	>99.9
	1972	249	.8815	4.60	3.6330	6.913	>99.9
	1973	281	.745	9.026	1.724	5.702	>99.9
Station 10	West-Southwest Treatment Plant Effluent						
	1971	365	.9389	8.419	2.968	10.47	>99.9
	1972	358	.9195	1.50	3.117	8.323	>99.9
	1973	364	.832	4.143	1.837	3.501	>99.9

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE C-1 (Continued)

LINEAR REGRESSION STATISTICS, 1971 -1973

$\hat{y} = A + Bx$

where, $\hat{y}$ = Total Suspended Solids; x = Inorganic Suspended Solids

Station	Year	N	r	A	B	Sy x	% Conf.
11	Calumet Treatment Plant Effluent						
	1971	361	.8290	5.981	2.244	3.867	>99.9
	1972	366	.9247	6.21	2.494	4.378	>99.9
	1973	363	.798	5.373	2.076	3.862	>99.9
Station 29	Lemont, Stephens Street, DesPlaines River						
	1971	216	.9705	18.11	1.220	27.92	>99.9
	1972	178	.9882	12.11	1.150	9.434	>99.9
	1973	227	.939	16.06	1.089	13.62	>99.9
Station 48	Lemont, Stephens Street, Sanitary & Ship Canal						
	1971	251	.9440	12.19	1.211	9.309	>99.9
	1972	232	.9843	7.80	1.286	6.506	>99.9
	1973	230	.977	10.96	1.149	6.087	>99.9

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE C-2

LINEAR REGRESSION STATISTICS, 1971-1973

$\hat{y} = A + Bx$

where, $\hat{y}$ = Total Dissolved Solids; x = Conductivity

Station	Year	N	r	A	B	Sy,x	%Conf.
8.1	Lockport Forebay to Powerhouse (Discontinued in 1972)						
	1971	199	.7235	79.06	.5506	112.1	>99.9
	1972	-	-	-	-	-	-
	1973	-	-	-	-	-	-
Station 8.2	Lockport Powerhouse						
	1971	346	.9131	91.54	.5769	55.81	>99.9
	1972	328	.7868	64.92	.6626	120.7	>99.9
	1973	328	.646	27.55	.6715	117.3	>99.9
Station 8.4	Lockport, 16th Street Bridge						
	1971	98	.6869	86.71	.5663	56.44	>99.9
	1972	150	.8887	61.24	.6516	75.28	>99.9
	1973	75	.785	86.44	.6009	66.03	>99.9
Station 9	North Side Treatment Plant Effluent						
	1971	360	.8834	53.86	.5745	49.04	>99.9
	1972	366	.8016	53.59	.5378	77.12	>99.9
	1973	363	.876	141.1	.4327	46.96	>99.9
Station 10	West -Southwest Treatment Plant Effluent						
	1971	361	.6327	167.5	.5213	94.87	>99.9
	1972	340	.6397	278.8	.4309	111.5	>99.9
	1973	357	.675	49.02	.592	94.62	>99.9
Station 11	Calumet Treatment Plant Effluent						
	1971	361	.7947	129.6	.5248	84.13	>99.9
	1972	366	.9213	85.93	.5817	54.16	>99.9
	1973	363	.783	137.2	.5381	66.7	>99.9
Station 29	Lemont, Stephens Street, DesPlaines River						
	1971	212	.8326	12.22	.7378	91.52	>99.9
	1972	170	.8429	45.39	.7515	94.13	>99.9
	1973	218	.843	90.59	.6645	82.96	>99.9
Station 48	Lemont, Stephens Street, Sanitary and Ship Canal						
	1971	248	.8936	90.28	.5573	57.4	>99.9
	1972	225	.8560	79.68	.6166	79.19	>99.9
	1973	220	.790	36.31	.6738	73.07	>99.9

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE C-3

LINEAR REGRESSION STATISTICS, 1971 - 1973

$\hat{y} = A + Bx$

where, $\hat{y}$ = Ammonia Nitrogen; x = Total Nitrogen

Station	Year	N	r	A	B	Sy.x	%Conf.
	Forebay to Lockport Powerhouse (Discontinued in 1972)						
8.1	1971	29	.9436	-.5527	.7576	.9257	>99.9
	1972	-	-	-	-	-	-
	1973	-	-	-	-	-	-
Station	Lockport Powerhouse						
8.2	1971	49	.9392	-.5143	.8039	.9072	>99.9
	1972	53	.9235	-.75	.7934	.76	>99.9
	1973	49	.874	-1.03	.925	.762	> 99.9
Station	Lockport, 16th Street						
8.4	1971	21	.9218	-.8976	.8895	.7626	>99.9
	1972	23	.9305	-.55	.7899	.73	>99.9
	1973	-	-	-	-	-	-
Station	North Side Treatment Plant Effluent						
9	1971	-	-	-	-	-	-
	1972	365	.9712	-.81	.9202	.78	>99.9
	1973	365	.963	-.598	.879	.626	>99.9
Station	West-Southwest Treatment Plant Effluent						
10	1971	-	-	-	-	-	-
	1972	360	.9120	.01	.7596	1.31	>99.9
	1973	365	.827	1.087	.756	.936	>99.9
Station	Calumet Treatment Plant Effluent						
11	1971	-	-	-	-	-	-
	1972	366	.9357	-.13	.8045	1.55	>99.9
	1973	363	.941	-.20	.883	1.32	>99.9
Station	Lemont, Stephens Street, DesPlaines River						
29	1971	-	-	-	-	-	
	1972	37	.5627	-.78	.4798	.46	>99.9
	1973	47	.451	.04467	.343	.4987	> 99.9
Station	Lemont, Stephens Street, Sanitary and Ship Canal						
48	1971	47	.9196	-.3553	.7659	1.002	>99.9
	1972	56	.9767	-1.10	.8761	.68	>99.9
	1973	45	.869	-.802	.8406	.7757	>99.9

APPENDIX D

TABULATIONS OF WATER QUALITY vs STATE OF ILLINOIS STANDARDS

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 4 D-1

FRACTIONS OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
CALUMET RIVER SYSTEM, 1973

	Dissolved Oxygen	Temperature oC	pH Units	Dissolved Solids	Hexane Solubles	Phenols ug/l	Ammonia Nitrogen	Total P
General Use Standards	6.0	32.2 Apr.-Nov. 15.6 Other	Range 6.5-9.0	1000	None	100	1.5	0.05 (Wolf Lake, Burnham, Ave.
50 Wolf Lake Burnham Avenue	0/12 (7.9)	0/9 (25.0)	0/12 (7.0-8.8)	0/12 (328)	Does not apply	-	0/12 (0.80)	8/12 (0.39)
54 Thorn Creek Joe Orr Road	0/12 (6.1)	0/9 (23.3)	0/12 (7.0-8.0)	6/11 (1836)	"	- -	11/12 (18.70	Does not apply
53 North Creek Wentworth Avenue	1/7 (0.0)	0/4 (18.3)	0/7 (7.1-8.0)	1/7 (1081)	" "	- -	1/7 (29.00)	"
52 Little Calumet River Wentworth Avenue	4/11 (0.0)	0/8 (25.0)	0/11 (7.0-8.1)	0/11 (775)	" "	- -	6/11 (7.80)	"
57 Little Calumet River 135th and Ashland	7/12 (0.4)	0/9 (25.6)	0/12 (6.9-8.0)	4/12 (1500)	" "	- -	9/12 (7.80)	" "
Secondary Contact Standards	3.0	34.0	6.0 - 9.0	3500	15.0	300	2.5 Apr-Oct 4.0 other	1.0
51 Grand Calumet River I.H.B.R.R.	6/12 (0.0)	0/9 (26.1)	0/12 (6.9-7.7)	0/12 (781)	4/12 (38.)	0/11 (31.)	12/12 (31.60	10/12 (5.16)
49 Calumet River Ewing Avenue	0/12 (6.6)	0/9 (25.6)	0/12 (6.7-8.4)	0/12 (828)	3/12 (27.)	0/11 (34.)	1/12 (10.00)	1/12 (1.44)

(1) I.P.C.B. Standards as shown in Table 3 , this report
(2) Units are in mg/l, unless otherwise noted
(3) Figures in parenthesis are annual maximum values, except for Dissolved Oxygen (minimum) and pH (maximum range)

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-1 (Continued)

FRACTIONS OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
CALUMET RIVER SYSTEM, 1973

	Dissolved Oxygen	Temperature °C	pH Units	Dissolved Solids	Hexane Solubles	Phenols ug/l	Ammonia Nitrogen	Total P
Secondary Contact Standards	3.0	34.0	6.0-9.0	3500	15.0	300	2.5 Apr-Oct 4.0 other	1.0
55 Calumet River 130th St.	0/12 (4.0)	0/9 (25.0)	0/12 (7.0-8.2)	0/12 (572)	3/12 (47)	0/12 (14)	1/12 (9.40)	1/12 (1.57)
56 Little Calumet River Indiana Avenue	1/12 (2.1)	0/9 (26.1)	0/12 (6.8-8.0)	0/12 (690)	2/12 (35)	-	7/12 (11.50)	1/12 (1.42)
58 Little Calumet River Ashland Avenue	5/12 (0.0)	0/9 (25.0)	0/12 (6.9-7.9)	0/12 (1002)	5/12 (45)	0/12 (36)	12/12 (15.60)	6/12 (2.60)
59 Cal-Sag Channel Cicero Avenue	5/12 (0.0)	0/9 (25.6)	0/12 (7.0-8.0)	0/12 (1067)	2/12 (42)	- -	11/12 (15.00)	6/12 (2.28)
43 Cal-Sag Channel Highway 83	11/23 (0.0)	0/18 (25.6)	0/23 (6.8-8.1)	0/23 (1008)	3/23 (27)	0/12 (36)	22/23 (16.40)	12/23 (6.50)

(1) I.P.C.B. Stnadards as shown in Table 3, this report
(2) Units are in mg/l, unless otherwise noted.
(3) Figures in parenthesis are annual maximum values, except for Dissolved Oxygen (minimum) and pH (maximum range)

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-2

FRACTIONS OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
CALUMET RIVER SYSTEM, 1973

	Cyanide	Fecal Col. c/100 ml	Chloride	Sulfate	Total Arsenic	Total Barium	Total Cadmium	Total Chromium
General Use Standards	.025	200	500	500	1.0	5.0	0.05	0.05
50 Wolf Lake Burnham Avenue	-	1/10 (500)	9/12 (60)	0/12 (119)	0/12 (0.03)	0/12 (0.10)	0/12 (0.00)	0/12 (0.04)
54 Thorn Creek Joe Orr Road	-	3/10 (20000)	0/11 (452)	0/11 (309)	0/12 (0.17)	0/12 (0.10)	0/12 (0.00)	2/12 (0.13)
53 North Creek Wentworth Ave.	-	3/7 (73000)	0/7 (380)	0/7 (259)	0/7 (0.12)	0/7 (0.20)	0/7 (0.00)	0/7 (0.00)
52 Little Cal. River Wentworth Avenue	-	8/9 (160000)	0/11 (128)	0/11 (137)	0/11 (0.06)	0/11 0.10)	0/11 (0.00)	0/11 (0.03)
57 Little Calumet River 135th Ashland	-	9/10 (62000)	0/12 (376)	0/12 (196)	0/12 (0.05)	0/12 (0.10)	0/12 (0.00)	0/12 (0.02)
Secondary Contact Standards	.025	1000	None	None	0.25	2.0	0.15	0.3
51 Grand Calumet River I.H.B.R.R.	8/12 (0.190)	7/10 (430000)	Does not apply	Does not apply	0/12 (0.06)	0/12 (0.10)	0/12 (0.00)	0/12 (0.03)
49 Calumet River Ewing Avenue	3/12 (0.110)	0/10 (700)	"	"	0/12 (0.06)	0/12 (0.20)	0/12 (0.00)	0/12 (0.05)
55 Calumet River 130th St.	3/12 (0.056)	0/10 (1000)	"	"	0/12 (0.02)	0/12 (0.10)	0/12 (0.00)	0/12 (0.00)

(1) I.P.C.B. standards as shown in Table 3 , this report
(2) Units are in mg/l unless otherwise noted.
(3) Figures in parenthesis are annual maximum values except for Dissolved Oxygen (minimum) and pH (maximum range)

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE-D 2 (Continued)

FRACTIONS OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
CALUMET RIVER SYSTEM, 1973

	Cyanide	Fecal Col. c/100 ml	Chloride	Sulfate	Total Arsenic	Total Barium	Total Cadmium	Total Chromium
Secondary Contact Standards	.025	1000	None	None	0.25	2.0	0.15	0.3
56 Little Calumet River Indiana Ave.	-	9/10 (10000)	Does not apply	Does not apply	0/12 (0.03)	0/12 (0.10)	0/12 (0.00)	0/12 (0.03)
58 Little Calumet River Ashland Ave.	6/12 (0.077)	7/9 (110000)	"	"	0/12 (0.03)	0/12 (0.10)	0/12 (0.00)	0/12 (0.01)
59 Cal-Sag Channel Cicero Avenue	-	8/10 (53000)	"	"	0/12 (0.04)	0/12 (0.10)	0/12 (0.00)	0/12 (0.04)
43 Cal-Sag Channel Highway 83	7/12 (0.085)	17/20 (330000)	"	"	0/23 (0.04)	0/23 (0.30)	0/23 (0.00)	0/23 (0.02)

(1) I.P.C.B. Standards as shown in Table 3, this report.
(2) Units are in mg/l unless otherwise noted.
(3) Figures in parenthesis are annual maximum except for Dissolved Oxygen (minimum and pH maximum range).

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-3

FRACTIONS OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
CALUMET RIVER SYSTEM, 1973

	Total Copper	Total Iron	Total Lead	Total Mercury	Total Nickel	Total Selenium	Total Silver	Total Zinc
General Use Standards	0.02	1.0	0.1	ug/l 0.5	1.0	1.0	0.005	1.0
50 Wolf Lake Burnham Avenue	1/12 (0.04)	0/12 (1.0)	1/12 (0.12)	0/12 (0.5)	0/12 (0.0)	0/12 (0)	0/12 (0.00)	0/12 (0.00)
54 Thorn Creek Joe Orr Road	1/12 (0.03)	3/12 (2.0)	1/12 (0.14)	0/12 (0.3)	0/12 (0.2)	0/12 (0)	0/12 (0.00)	0/12 (0.60)
53 North Creek Wentworth Ave.	1/7 (0.03)	2/7 (7.0)	0/7 (0.06)	1/7 (3.0)	0/7 (0.0)	0/7 (0)	0/7 (0.00)	0/7 (0.70)
52 Little Calumet River Wentworth Avenue	0/11 (0.02)	5/11 (2.0)	0/11 (0.06)	0/11 (0.5)	0/11 (0.0)	0/11 (0)	0/11 (0.00)	0/11 (0.00)
57 Little Calumet River 135th Ashland	0/12 (0.02)	3/12 (2.0)	0/12 (0.05)	0/12 (0.5)	0/12 (0.1)	0/12 (0)	0/12 (0.00)	0/12 (0.00)
Secondary Contact Standards	1.0	2.0	0.1	0.5 ug/l	1.0	1.0	0.1	1.0
51 Grand Calumet River I.H.B.R.R.	0/12 (0.03)	1/12 (3.0)	0/12 (0.09)	1/12 (0.6)	0/12 (0.1)	0/12 (0)	0/12 (0.00)	0/12 (0.20)
49 Calumet River Ewing Ave.	0/12 (0.09)	0/12 (1.0)	0/12 (0.05)	0/12 (0.5)	0/12 (0.0)	0/12 (0)	0/12 (0.00)	0/12 (0.00)
55 Calumet River 130th Street	0/12 (0.03)	0/12 (1.0)	0/12 (0.03)	0/12 (0.3)	0/12 (0.0)	0/12 (0)	0/12 (0.00)	0/12 (0.10)
56 Little Calumet River Indiana Avenue	0/12 (0.02)	1/12 (3.0)	0/12 (0.02)	1/12 (0.6)	0/12 (0.0)	0/12 (0)	0/12 (0.00)	0/12 (0.00)

(1) I.P.C.B. Standards as shown in Table 3, this report.
(2) Units are in mg/l unless otherwise noted.
(3) Figures in parenthesis are annual maximum except for Dissolved Oxygen (minimum and pH maximum range).

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-3 (Continued)

FRACTIONS OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
CALUMET RIVER SYSTEM, 1973

	Total Copper	Total Iron	Total Lead	Total Mercury	Total Nickel	Total Selenium	Total Silver	Total Zinc
Secondary Contact Standards	1.0	2.0	0.1	0.5 ug/l	1.0	1.0	0.1	1.0
58 Little Calumet River Ashland Avenue	0/12 (0.03)	0/12 (2.0)	0/12 (0.10)	0/12 (0.5)	0/12 (0.1)	0/12 (0)	0/12 (0.00)	0/12 (0.00)
59 Cal-Sag Channel Cicero Avenue	0/12 (0.02)	0/12 (2.0)	0/12 (0.08)	0/12 (0.3)	0/12 (0.1)	0/12 (0)	0/12 (0.00)	0/12 (0.00)
43 Cal-Sag Channel Highway 83	0/23 (0.03)	1/23 (3.0)	0/23 (0.09)	1/23 (1.5)	0/23 (0.2)	0/23 (0)	0/23 (0.00)	0/23 (0.10)

(1) I.P.C.B. Standards as shown in Table 3, this report.
(2) Units are in mg/l unless otherwise noted.
(3) Figures in parenthesis are annual maximum values except for Dissolved Oxygen (minimum) and pH (maximum range).

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-4

FRACTIONS OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
CHICAGO RIVER SYSTEM, 1973

	Dissolved Oxygen	Temperature oC	pH Units	Dissolved Solids	Hexane Solubles	Phenols ug/l	Ammonia Nitrogen	Total P
General Use Standards	6.0	32.2 April Nov. 15.6	(6.5-9.0)	1000	Does not Apply	100 ug/l	1.5	None
30. No.Branch Chgo River County Line Rd. W.Fk.	4/12 (1.1)	0/9 (22.2)	0/12 (7.0-8.2)	0/12 (955)	"	--	10/12 (13.6)	Does not Apply
31 No.Branch Chgo River County Line Rd.Mid Fk.	6/12 (1.1)	0/9 (22.2)	0/11 (7.0-8.0)	0/11 (794)	"	--	1/11 (4.1)	"
32 No.Branch Chgo River County Line Rd.E. Fk.	2/11 (1.5)	0/9 (22.2)	0/12 (6.7-8.3)	0/12 (629)	"	--	10/12 (12.3)	"
33 No.Branch Chgo River East Lake Rd. E. Fk.	3/12 (4.1)	0/9 (24.4)	0/12 (7.1-8.5)	0/12 (823)	"	--	9/12 (5.6)	"
34 No.Branch Chgo River Dempster Street	5/11 (0.0)	0/9 (22.2)						
Secondary Contact Standards	3.0 (5.0 No.Shore)	34.0	6.0 - 9.0	3500	15.0	300 ug/l	2.5 Nov-Oct 4.0 Other	1.0
35 No.Shore Channel Central Road	2/8 (0.0)	0/7 (22.2)	0/9 (6.8-8.4)	0/9 (329)	4/9 (30.)	0/9 (42.)	0/9 (2.2)	4/9 (2.90)
36 No.Shore Channel Touhy Avenue	0/12 (6.7	0/9 (24.4)	0/11 (6.9-7.7)	0/12 (663)	9/12 (27)	0/12 (11.)	7/12 (9.1)	10/12 (7.90)
37 No.Branch Chgo River Wilson Avenue	0/11 (4.5)	0/9 (24.4)	0/12 (7.0-8.0)	0/12 (606)	6/12 (43)	-	8/12 (9.2)	12/12 (9.60)
38 No.Branch Chgo River Ohio Street	6/12 (1.0	0/9 (23.3)	0/12 (6.9-7.8)	0/12 (617)	2/12 (32)	0/12 (13)	10/12 (9.3)	10/12 (9.70)
39 So.Branch Chgo River Madison Street	2/11 (2.3)	0/9 (23.3)	0/12 (7.0-8.0)	0/12 (479)	6/12 (32)	-	4/12 (6.5)	6/12 (8.60)

(1) I.P.C.B. Standards as shown in Table 3, this report.
(2) Units are in mg/l, unless otherwise noted.
(3) Figures in parenthesis are annual maximum values, except for Dissolved Oxygen (minimum) and pH (maximum range).

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-4 (continued)

FRACTIONS OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
CHICAGO RIVER SYSTEM, 1973

Secondary Contact Standards	Dissolved Oxygen	Temperature oC	pH Units	Dissolved Solids	Hexane Solubles	Phenols ug/l	Ammonia Nitrogen	Total P
	3.0 North 5.0 Shore	34.0	6.0-9.0	3500	15.0	300 ug/l	2.5 Apr.Oct 4.0 Other	1.0
40. South Branch Chgo River Damen Avenue	2/12 (1.4)	0/9 (26.7)	0/12 (7.1-8.0)	0/12 (557)	5/12 (35)	-	8/12 (7.1)	9/12 (6.40)
41. Sanitary and Ship Canal Harlem Avenue	1/12 (0.0)	0/9 (27.8)	0/11 (6.7-7.9)	0/12 (601)	5/12 (21)	0/12 (89)	13/12 (8.5)	5/12 (7.40)
42 Sanitary and Ship Canal Highway 83	14/23 (0.0)	0/18 (28.9)	0/23 (6.6-7.8)	0/23 (843)	7/22 (36)	0/12 (82)	21/23 (9.2)	8/23 (5.70)
48 Sanitary and Ship Canal Lemont, Stephens St.	150/231 (0.2)	0/231 (31.00)	0/231 (7.0-8.7)	0/231 (1061)	-	-	41/45 (8.9)	-
8.4 Sanitary and Ship Canal Lockport, 16th St.	45/75 (0.2)	0/75 (30.00)	0/75 (7.0-7.9)	0/75 (804)	-	-	-	-
8.2 Sanitary and Ship Canal Lockport Powerhouse	-	-	0/354 (7.0-8.3)	0/353 (959)	-	-	33/49 (7.5)	-

(1) I.P.C.B. Standards as shown in Table 3, this report
(2) Units are in mg/l, unless otherwise noted
(3) Figures in parenthesis are annual maximum values, except for Dissolved Oxygen (minimum) and pH (maximum range)

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-5

FRACTIONS OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
CHICAGO RIVER SYSTEM, 1973

	Cyanide	Fecal Coliform c/100 ml	Chloride	Sulfate	Total Arsenic	Total Barium	Total Cadmium	Total Chromium
General Use Standards	0.025	200	500	500	1.0	5.0	0.05	0.05
30 No. Branch Chgo River County Line Rd. W.Fork	-	7/12 (380000)	0/12 (296)	0/12 (181)	0/12 (0.04)	0/12 (0.00)	0/12 (0.01)	0/12 (0.00)
31 No. Branch Chgo River County Line Rd. Mid Fork	-	11/12 (210000)	0/11 (108)	0/11 (142)	0/12 (0.02)	0/12 (0.00)	0/12 (0.01)	0/12 (0.01)
32 No.Branch Chgo River County Line Rd. E. Fork	-	5/12 (160000)	0/12 (128)	0/12 (160)	0/12 (0.02)	0/12 (0.30)	0/12 (0.00)	0/12 (0.01)
33 No.Branch Chgo River East Lake Dr. E Fork	-	8/12 (70000)	0/12 (224)	0/12 (120)	0/12 (0.03)	0/12 (0.30)	0/12 (0.00)	0/12 (0.01)
34 No.Branch Chgo River Dempster Street	4/12 (0.072)	9/12 (34000)	0/12 (220)	0/12 (120)	0/12 (0.03)	0/12 (0.30)	0/12 (0.01)	0/12 (0.03)
Secondary Contact Standards	0.025	1000	Does Not Apply	Does Not Apply	0.25	2.0	0.15	0.3
35 No.Shore Channel Central Road	1/9 (0.660)	3/9 (3000000)	"	"	0/9 (0.02)	0/9 (0.20)	0/9 (0.01)	0/9 (0.03)
36 No. Shore Channel Touhy Avenue	7/12 (0.060)	2/12 (5700)	"	"	0/12 (0.02)	0/12 (0.20)	0/12 (0.02)	0/12 (0.05)
37 No. Branch Chgo River Wilson Avenue	-	6/12 (60000)	"	"	0/12 (0.02)	0/12 (0.20)	0/12 (0.00)	0/12 (0.06)
38 No. Branch Chgo River Ohio Street	7/12 (0.088)	9/12 (6000000)	"	"	0/12 (0.03)	0/12 (0.00)	0/12 (0.00)	0/12 (0.02)

(1) I.P.C.B. Standards as shown in Table 3, this report
(2) Units are in mg/l, unless otherwise noted
(3) Figures in parenthesis are annual maximum values, except for Dissolved Oxygen (minimum) and pH (maximum range)

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-5(continued)

FRACTIONS OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
CHICAGO RIVER SYSTEM, 1973

Secondary Contact Standards	Cyanide	Fecal Coliform c/100 ml	Chloride	Sulfate	Total Arsenic	Total Barium	Total Cadmium	Total Chromium
	0.025	1000	Does not apply	Does not apply	0.25	2.0	0.15	0.3
39 South Br. Chgo River Madison Street	-	9/12 (550000)	"	"	0/12 (0.02)	0/12 (0.00)	0/12 (0.00)	0/12 (0.01)
40 South Br. Chgo River Damen Avenue	-	7/12 (130000)	"	"	0/12 (0.03)	0/12 (0.20)	0/12 (0.00)	0/12 (0.01
41 Sanitary and Ship Canal Harlem Avenue	5/12 (0.052)	5/12 (130000)	"	"	0/12 (0.03)	0/12 (0.20)	0/12 (0.00)	0/12 (0.05)
42 Sanitary and Ship Canal Highway 83	3/12 (0.354)	8/21 (690000)	"	"	0/23 (0.04)	0/23 (0.20)	0/23 (0.00)	0/23 (0.05)
48 Sanitary and Ship Canal Lemont Stephens St.	-	-	"	"	-	-	-	-
8.4 Sanitary and Ship Canal Lockport & 16th St.,	-	-	"	"	-	-	-	-
8.2 Sanitary and Ship Canal Lockport Powerhouse	-	-	"	"	-	-	-	-

(1) I.P.C.B. Standards as shown in Table 3, this report
(2) Units are in mg/l, unless otherwise noted
(3) Figures in parenthesis are annual maximum values, except for Dissolved Oxygen (minimum) and pH (maximum range)

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

D-6

TABLE

FRACTIONS OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)

CHICAGO RIVER SYSTEM, 1973

	Total Copper	Total Iron	Total Lead	Total Mercury ug/l	Total Nickel	Total Selenium	Total Silver	Total Zinc
General Use Standards	0.02	1.0	0.1	0.5 ug/l	1.0	1.0	0.005	1.0
30 No.Branch Chgo River County Line Rd. W.Fk.	4/12 (0.09)	1/12 (2.0)	0/12 (0.10)	0/12 (0.3)	0/12 (0.0)	0/12 (0.)	0/12 (0.00)	0/12 (0.10)
31 No.Branch Chgo River County Line Rd. Mid Fk.	3/12 (0.07)	0/12 (1.0)	0/12 (0.07)	0/12 (0.4)	0/12 (0.1)	0/12 (0.)	0/12 (0.00)	0/12 (0.10)
32 No.Branch Chgo River County Line Rd. E. Fk.	2/12 (0.07)	0/12 (1.0)	0/12 (0.08)	1/12 (0.6)	0/12 (0.0)	0/12 (0.)	0/12 (0.00)	0/12 (0.00)
33 No.Branch Chgo River East Lake Rd. E.Fork	2/12 (0.06)	0/12 (1.0)	0/12 (0.08)	0/12 (0.5)	0/12 (0.1)	0/12 (0.)	0/12 (0.00)	0/12 (0.20)
34 No.Branch Chgo River Dempster Street	1/12 (0.03)	1/12 (2.0)	0/12 (0.05)	2/12 (1.8)	0/12 (0.0)	0/12 (0)	0/12 (0.00)	0/12 (0.00)
Secondary Contact Standards	1.0	2.0	0.1	0.5 ug/l	1.0	1.0	1.0	1.0
35 No.Shore Channel Central Road	0/9 (0.03)	0/9 (2.0)	1/9 (0.12)	1/9 (1.6)	0/9 (0.0)	0/9 (0)	0/9 (0.06)	0/9 (0.10)
36 No.Shore Channel Touhy Avenue	0/12 (0.14)	0/12 (1.0)	0/12 (0.06)	1/12 (1.6)	0/12 (0.2)	0/12 (0)	0/12 (0.00)	0/12 (0.20)
37 No. Branch Chgo River Wilson Avenue	0/12 (0.06)	0/12 (1.0)	0/12 (0.02)	1/12 (0.6)	0/12 (0.2)	0/12 (0)	0/12 (0.00)	0/12 (0.20)
38 No. Branch Chgo River Ohio Street	0/12 (0.04)	0/12 (1.0)	0/12 (0.06)	1/12 (0.8)	0/12 (0.1)	0/12 (0)	0/12 (0.00)	0/12 (0.20)
39 So. Branch Chgo River Madison Street	0/12 (0.04)	0/12 (1.0)	0/12 (0.05)	0/12 (0.5)	0/12 (0.1)	0/12 (0)	0/12 (0.00)	0/12 (0.10)

(1) I.P.C.B. Standards as shown in Table 3, this report

(2) Units are in mg/l, unless otherwise noted

(3) Figures in parenthesis are annual maximum values, except for Dissolved Oxygen (minimum(and pH (maximum range)

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-6(continued)

FRACTIONS OF SAMPLES EXCEEDING STANDARDS (1), (2),(3)
CHICAGO RIVER SYSTEM, 1973

	Total Copper	Total Iron	Total Lead	Total Mercury ug/l	Total Nickel	Total Selenium	Total Silver	Total Zinc
Secondary Contact Standards	1.0	2.0	0.1	0.5 ug/l	1.0	1.0	0.1	1.0
40 So.Branch Chgo River Damen Avenue	0/12 (0.05)	0/12 (1.0)	2/12 (0.19)	1/12 (0.7)	0/12 (0.0)	0/12 (0)	0/12 (0.00)	0/12 (0.20)
41 Sanitary and Ship Canal Harlem Avenue	0/12 (0.03)	0/12 (1.0)	0/12 (0.09)	1/12 (1.5)	0/12 (0.4)	0/12 (0)	0/12 (0.00)	0/12 (0.20)
42 Sanitary and Ship Canal Highway 83	0/23 (0.03)	0/23 (1.0)	0/23 (0.08)	1/23 (0.8)	0/23 (0.2)	0/23 (0)	0/23 (0.00)	0/23 (0.20)
48 Sanitary and Ship Canal Lemont & Stephens St.,	-	-	-	-	-	-	-	-
8.4 Sanitary and Ship Canal Lockport, 16th St.	-	-	-	-	-	-	-	-
8.2 Sanitary and Ship Canal Lockport Powerhouse	-	-	-	-	-	-	-	-

(1) I.P.C.B. Standards as shown in Table 3, this report
(2) Units are in mg/l, unless otherwise noted
(3) Figures in parenthesis are annual maximum values, except for Dissolved Oxygen (minimum) and pH (maximum range)

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-7

FRACTION OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
DES PLAINES RIVER SYSTEM, 1973

	Dissolved Oxygen	Temperature oC	pH Units	Dissolved Solids	Hexane Solubles	Phenols ug/l	Ammonia Nitrogen	Total P
General Use Standards	6.0	32.2 Apr-Nov. 15.6 others	6.5-9.0	1000	Does not apply	100 ug/l	1.5	None
12 Buffalo Creek County Line Road	2/11 (2.7)	0/7 (21.1)	0/11 (6.6-8.5)	0/11 (824)	"	-	2/11 (4.20)	Does not apply
14 Wheeling Drainage Ditch Hintz Road	0/11 (6.0)	0/7 (21.1)	0/11 (7.2-8.3)	0/11 (856)	"	-	0/11 (0.80)	"
18 Salt Creek Devon Avenue	0/7 (7.0)	0/5 (19.0)	0/7 (7.5-8.6)	1/7 (1189)	"	-	0/7 (0.60)	"
24 Salt Creek Wolf Road	0/11 (10.3)	0/7 (21.1)	0/11 (6.6-7.9)	3/11 (1108)	"	-	9/11 (6.50)	"
21 Salt Creek First Avenue	4/10 (3.2)	0/7 (22.2)	0/11 (7.2-8.1)	2/11 (1009)	" "	0/11 (11.)	6/11 (3.00)	" "
13 Des Plaines River County Line Road	3/11 (2.7)	0/7 (22.2)	0/11 (7.1-8.7)	1/11 (1107)	" "	-	0/11 (0.90)	" "
15 Des Plaines River Palatine Road	2/11 (5.6)	0/7 (21.1)	1/11 (7.6-9.1)	0/11 (915)	" "	0/11 (11.)	0/11 (0.70)	" "
16 Des Plaines River Central Road	0/10 (6.6)	0/7 (22.2)	0/11 (7.5-8.7)	0/11 (849)	" "	-	0/11 (0.80)	"
17 Des Plaines River Oakton Street	3/11 (4.2)	0/7 (21.0)	0/11 (7.4-8.6)	0/11 (905)	" "	-	0/11 (0.50)	"
19 Des Plaines River Belmont Avenue	5/11 (2.0)	0/7 (21.1)	0/11 (7.4-8.2)	0/11 (801)	"	0/11 (9)	1/11 (3.00)	" "

(1) I.P.C.B. Standards as shown in Table 3, this report
(2) Units are in mgl, unless otherwise noted
(3) Figures in parenthesis are annual maximum values, except for Dissolved Oxygen (minimum) and pH (maximum range)

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-7 (continued)

FRACTION OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)

DES PLAINES RIVER SYSTEM, 1973

	Dissolved Oxygen	Temperature oC	pH Units	Dissolved Solids	Hexane Solubles	Phenols ug/l	Ammonia Nitrogen	Total P
General Use Standards	6.0	32.2 15.6	6.5-9.0	1000	Does not apply	100 ug/l	1.5	Does not apply
20 Des Plaines River Roosevelt Road	5/11 (0.0)	0/7 (22.2)	0/11 (7.3-8.1)	0/11 (718)	"	0/11 (15.)	0/11 (1.10)	"
22 Des Plaines River Ogden Avenue	2/11 (0.0)	0/7 (22.2)	0/11 (7.0-8.1)	0/11 (869)	"	-	6/11 (2.00)	" "
Secondary Contact Standards	3.0	34.4	6.0-9.0	3500.	15.0	300 ug/l	2.5 Apr to Nov. 4.0 other	1.0
23. Des Plaines River Willow Springs Road	1/11 (2.6)	0/7 (22.2)	0/11 (6.1-8.0)	0/11 (847)	3/11 (33.)	0/11 (9)	1/11 (6.00)	1/11 (1.40)
29 Des Plaines River Lemont, Stephens St.	105/229 (1.1)	0/229 (30.00)	0/229 (7.1-8.7)	0/228 (1058)	-	-	1/47 (2.80)	-

(1) I.P.C.B. Standards as shown in Table 3, this report
(2) Units are in mg/l, unless otherwise noted
(3) Figures in parenthesis are annual maximum values, except for Dissolved Oxygen (minimum) and pH (maximum range)

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-8

FRACTION OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
DES PLAINES RIVER SYSTEM, 1973

	Cyanide	Fecal Coliform c/100 ml	Chloride	Sulfate	Total Arsenic	Total Barium	Total Cadmium	Total Chromium
General Use Standards	0.025	200	500	500	1.0	5.0	0.05	0.05
12 Buffalo Creek County Line Road	-	9/10 (2500)	0/11 (140)	0/11 (189)	0/11 (0.02)	0/11 (0.00)	0/11 (0.02)	0/11 (0.01)
14 Wheeling Drainage Ditch Hintz Road	-	9/10 (5200)	0/11 (192)	0/11 (175)	0/11 (0.02)	0/11 (0.00)	0/11 (0.00)	0/11 (0.02)
18 Salt Creek Devon Avenue	-	6/6 (11000)	0/7 (172)	0/7 (367)	0/7 (0.01)	0/7 (0.00)	0/7 (0.00)	0/7 (0.00)
24 Salt Creek Wolf Road	-	10/10 (19000)	0/11 (252)	0/11 (150)	0/11 (0.02)	0/11 (0.00)	0/11 (0.00)	0/11 (0.01)
21 Salt Creek First Avenue	3/11 (0.060)	10/10 (23000)	0/11 (268)	0/11 (159)	0/11 (0.02)	0/11 (0.00)	0/11 (0.00)	0/11 (0.01)
13 Des Plaines River County Line Road	-	7/10 (3000)	0/11 (160)	0/11 (165)	0/11 (0.04)	0/11 (0.00)	0/11 (0.00)	0/11 (0.02)
15 Des Plaines River Palatine Road	0/11 (0.008)	7/10 (4100)	0/11 (116)	0/11 (170)	0/11 (0.04)	0/11 (0.00)	0/11 (0.00)	0/11 (0.00)
16 Des Plaines River Central Road	-	8/10 (23000)	0/11 (120)	0/11 (141)	0/11 (0.03)	0/11 (0.00)	0/11 (0.01)	0/11 (0.03)
17 Des Plaines River Oakton Street	-	9/10 (8000)	0/11 (132)	0/11 (149)	0/11 (0.02)	0/11 (0.00)	0/11 (0.00)	0/11 (0.01)
19 Des Plaines River Belmont Avenue	0/11 (0.020)	9/10 (16000)	0/11 (128)	0/11 (159)	0/11 (0.02)	0/11 (0.00)	0/11 (0.00)	0/11 (0.01)

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(3) Figures in parenthesis are annual maximum values, except for Dissolved Oxygen (minimum) and pH (maximum range)

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-8 (Continued)

FRACTION OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
DES PLAINES RIVER SYSTEM, 1973

	Cyanide	Fecal Coliform c/100 ml	Chloride	Sulfate	Total Arsenic	Total Barium	Total Cadmium	Total Chromium
General Use Standards	0.025	200	500	500	1.0	5.0	0.05	0.05
20 DesPlaines River Roosevelt Road	2/11 (0.076)	10/10 (1100000)	0/11 (128)	0/11 (165)	0/11 (0.02)	0/11 (0.00)	0/11 (0.01)	0/11 (0.02)
22 Des Plaines River Ogden Avenue	-	9/9 (15000)	0/11 (172)	0/11 (139)	0/11 (0.02)	0/11 (0.00)	0/11 (0.00)	0/11 (0.02)
Secondary Contest Standards	0.025	1000	None	None	0.25	2.0	0.15	0.3
23 Des Plaines River Willow Springs Road	2/10 (0.033)	8/10 (9000)	Does not apply	Does not apply	0/11 (0.02)	0/11 (0.00)	0/11 (0.00)	0/11 (0.02)
29 Des Plaines River Lemont, Stephens St.	-	-	"	"	-	-	-	-

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METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE D-9

FRACTION OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
DES PLAINES RIVER SYSTEM, 1973

	Total Copper	Total Iron	Total Lead	Total Mercury ug/l	Total Nickel	Total Selenium	Total Silver	Total Zinc
General Use Standards	0.02	1.0	0.1	0.5 ug/l	0.1	0.1	0.005	1.0
12 Buffalo Creek County Line Rd.	1/11 (0.03)	0/11 (1.0)	0/11 (0.02)	1/11 (1.0)	1/11 (0.2)	0/11 (0)	0/11 (0.00)	0/11 (0.10)
14 Wheeling Drainage Ditch Hintz Road	2/11 (0.03)	2/11 (3.0)	0/11 (0.02)	2/11 (0.9)	0/11 (0.1)	0/11 (0)	0/11 (0.00)	0/11 (0.30)
18 Salt Creek Devon Creek	1/7 (0.03)	0/7 (1.0)	0/7 (0.08)	0/7 (0.0)	0/7 (0.0)	0/7 (0)	0/7 (0.00)	0/7 (0.00)
24 Salt Creek Wolf Road	1/11 (0.03)	0/11 (1.0)	0/11 (0.07)	0/11 (0.6)	0/11 (0.1)	0/11 (0)	0/11 (0.00)	0/11 (0.00)
21 Salt Creek First Avenue	1/11 (0.04)	1/11 (2.0)	0/11 (.07)	1/11 (0.6)	0/11 (0.1)	0/11 (0)	0/11 (0.00)	0/11 (0.00)
13 Des Plaines River County Line Road	1/11 (0.03(	2/11 (2.0)	0/11 (0.04)	1/11 (1.4)	0/11 (0.1)	0/11 (0)	0/11 (0.00)	0/11 (0.10)
15 Des Plaines River Palatine Road	1/11 (0.03)	1/11 (2.0)	0/11 (0.07)	0/11 (0.5)	0/11 (0.1)	0/11 (0)	0/11 (0.00)	0/11 (0.00)
16 Des Plaines River Central Road	1/11 (0.03)	0/11 (1.0)	0/11 (0.03)	1/11 (0.6)	0/11 (0.1)	0/11 (0)	0/11 (0.00)	0/11 (0.00)
17 Des Plaines River Oakton Street	1/11 (0.03)	2/11 (2.0)	0/11 (0.08)	0/11 (0.3)	0/11 (0.1)	0/11 (0)	0/11 (0.00)	0/11 (0.00)
19 Des Plaines River Belmont Avenue	1/11 (0.03)	0/11 (1.0)	0/11 (0.02)	1/11 (2.0)	1/11 (0.3)	0/11 (0)	0/11 (0.00)	0/11 (0.00)
20 Des Plaines River Roosevelt Road	1/11 (0.03)	0/11 (1.0)	0/11 (0.03)	1/11 (1.5)	0/11 (0.0)	0/11 (0)	0/11 (0.00)	0/11 (0.00)

(1) I.P.C.B. Standards as shown in Table 3, this report
(2) Units are in mg/l, unless otherwise noted
(3) Figures in parenthesis are annual maximum values, except for Dissolved Oxygen (minimum) and pH (maximum range)

TABLE D-9(Continued)
FRACTION OF SAMPLES EXCEEDING STANDARDS (1), (2), (3)
DES PLAINES RIVER SYSTEM, 1973

	Total Copper	Total Iron	Total Lead	Total Mercury ug/l	Total Nickel	Total Selenium	Total Silver	Total Zine
General Use Standards	0.02	1.0	0.1	0.5 ug/l	0.1	0.1	0.005	1.0
22 DesPlaines River Ogden Ave.	1/11 (0.03)	0/11 (1.0)	0/11 (0.04)	0/11 (0.5)	0/11 (0.1)	0/11 (0)	0/11 (0.00)	0/11 (0.00)
Secondary Contract Standards	1.0	2.0	0.1	0.5 ug/l	0.1	1.0	0.1	1.0
23 Des Plaines River Willow Springs Road	0/11 (0.04)	1/11 (3.0)	2/11 (0.15)	2/11 (0.8)	0/11 (0.1)	0/11 (0)	0/11 (0.00)	0/11 (0.00)
29 Des Plaines River Lemont, Stephens St.	-	-	-	-	-	-	-	-

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