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A LIMNOLOGICAL COMPILATION OF WATER QUALITY OF THE MINNESOTA RIVER WATERSHED, IN MINNESOTA

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FOREWORD

This bulletin is published in furtherance of the purposes of the Federal Water Research and Development Act of 1978, P.L. 95-467. The purpose of the Act is to stimulate, sponsor, provide for, and supplement present programs for the conduct of research, investigations, experiments, and the training of scientists in the field of water and resources which affect water. The Act is promoting a more adequate national program of water resources research by furnishing financial assistance to non-Federal research.

The Act provides for establishment of Water Resources Research Centers at Universities throughout the Nation. On September 1, 1964, a Water Resources Research Center was established (under the Water Resources Research Act of 1964, P.L. 88-379) in the Graduate School as an Interdisciplinary component of the University of Minnesota. The Center has the responsibility for unifying and stimulating University research with water resources programs of local, State and Federal agencies and private organizations throughout the State; and assisting in training additional scientists for work in the field of water resources through research.

This Bulletin is number 107 in a series of publications designed to present information bearing on water resources research in Minnesota and the results of some of the research sponsored by the Center.

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Abstract:

This work is a compilation of water quality data taken from monitoring records of the Minnesota River System from 1957 through 1975 by the Minnesota Pollution Control Agency. The data is grouped and presented in a format (seasonal and downstream) so that it can be utilized directly for water quality interpretation in relation to changes in land-use, soils, and geomorphology, as well as isolating the effects of various tributaries. T-tests to compare means in selected pairs of monitoring locations are presented and reveal a surprising equilibrium from the upper to the lower reach, in levels of parameters of water quality.

INTRODUCTION

"Sky-blue or not, the Minnesota River is a stream that has been put to trial and has emerged almost unscathed. The soil, trees, wildlife, and muddy waters of the Minnesota Valley sustained the men and women of central Minnesota for more than a century, and when representatives of a government cadre of engineers demanded that hills and homesteads be buried beneath dammed waters, they were met with the resistance of a people whose values are rooted in their land.

No stream in Minnesota--perhaps in the nation--has had its future so threatened, its natural character so marked for destruction, its existence made so uncertain by serious development proposals, and yet has emerged to symbolize an awakened ethic of land stewardship, as has the Minnesota River."

Thomas F. Waters
The Streams and Rivers of Minnesota, 1977,
p. 324.

The Minnesota River is rich in history, both of Native American and European man, and there has been a great deal of scholary study concerning it. Limnologically, however, very little is known. Data has been collected by State and Federal Agencies, as well as universities, but little interpretation exists. The purpose of this paper is to compile stored data on water quality monitoring of the Minnesota River System, in a format that can be utilized for interpretation of the relationships of changes in biota, sources, land use, soils, and geomorphology to water quality. The initial purpose of this study was to assemble water quality data for the Minnesota River which could be compared to data from those agricultural drainage ditches which we studied that constitute a major water source for it. This topic will be discussed in a forthcoming publication.

METHODS

The original data for all Minnesota Pollution Control Agency water quality monitoring stations within the Minnesota River watershed were obtained from volumes 1-8 of the Division of Water Quality, Section of Surface and Groundwaters (1957-1975). The MPCA data was hand transferred to our data sheets and analyzed by month. A Wang computer was used for the determination of means, standard deviations, and variances. The high, low and median were calculated by hand. Only one reading was allowed for any one month (in the case of multiple readings the mean was used). In case a less-than value was indicated, a value half-way between zero and the recorded number was arbitrarily used for the reading. Values which were preceded by a greater-than sign were used without consideration of the sign (this happened only occasionally with the Coliform data). Monthly columns which contained less than 3 years of readings, and monthly columns containing more than one less-than value, were not analyzed. Quarterly data was obtained from the accumulation of the respective monthly compilations.

The computer used for all data processing was the UNIVAC 1106 located on the campus of Mankato State University, Mankato, MN. Most analysis was done using the FORTRAN programming language, it being a highly flexible and powerful procedural language oriented to scientific programming. A small part of the programming involved the SPSS language (a statisical package), which was particularly useful for quick listings of frequency tables. From the above data we obtained 5617 monthly records, including for each the month number, station number, parameter number, and, for the month-station, the mean, variance, standard deviation, median, maximum and minimum. A record was included only if there were at least three month-station recordings available (some stations and parameters ended up being completely excluded from the study). The resulting 23 stations and 44 parameters will not be listed here, but can be seen in the data section of this paper.

Frequency tables were obtained on total records present for each parameter and each station. A more detailed breakdown was done by determining the frequency of records for parameters analyzed station by station.

A monthly statistical summary was made. For each of the 44 parameters three tables were printed including the following statistics, broken down by displaying month vs. station:

1. means
2. medians
3. sample sizes, means, standard deviations, medians, maximums, minimums

A quarter statistical summary was made, with the four quarters defined as:

Quarter No.	Months Included
1	March, April, May
2	June, July, August
3	September, October, November
4	December, January, February

For each of the 44 parameters two tables were printed displaying the following statistics, broken down by month vs. station.

1. means
2. sample sizes, means, standard deviations, maximums, minimums

T-tests were used to compare means inferentially. Forty-three selected pairs of stations were compared for differences in means in each of the 44 parameters for each of the months and quarters. A two-tailed alternative was tested in all cases. Variance of the difference in means was estimated by pooling the variances of the two samples involved. This was feasible due to the availability of the sample sizes and standard deviations of the individual monthly reports. For each T-test the output includes the two means, two sample sizes, degrees of freedom and the T-value. Next to the T-value was printed, if appropriate, the symbol $, *, or ** if the T was significant for a two-tailed test at significance levels of .20, 0.05, .01, respectively.

RESULTS

The locations of the water quality monitoring stations are shown in Figure 1. This map represents the present monitoring sites used by the Minnesota Pollution Control Agency. Some of the stations in our inventory and data presentation are not shown on this map because they have been dropped or changed. One can interpolate the locations, however, from Figure 1.

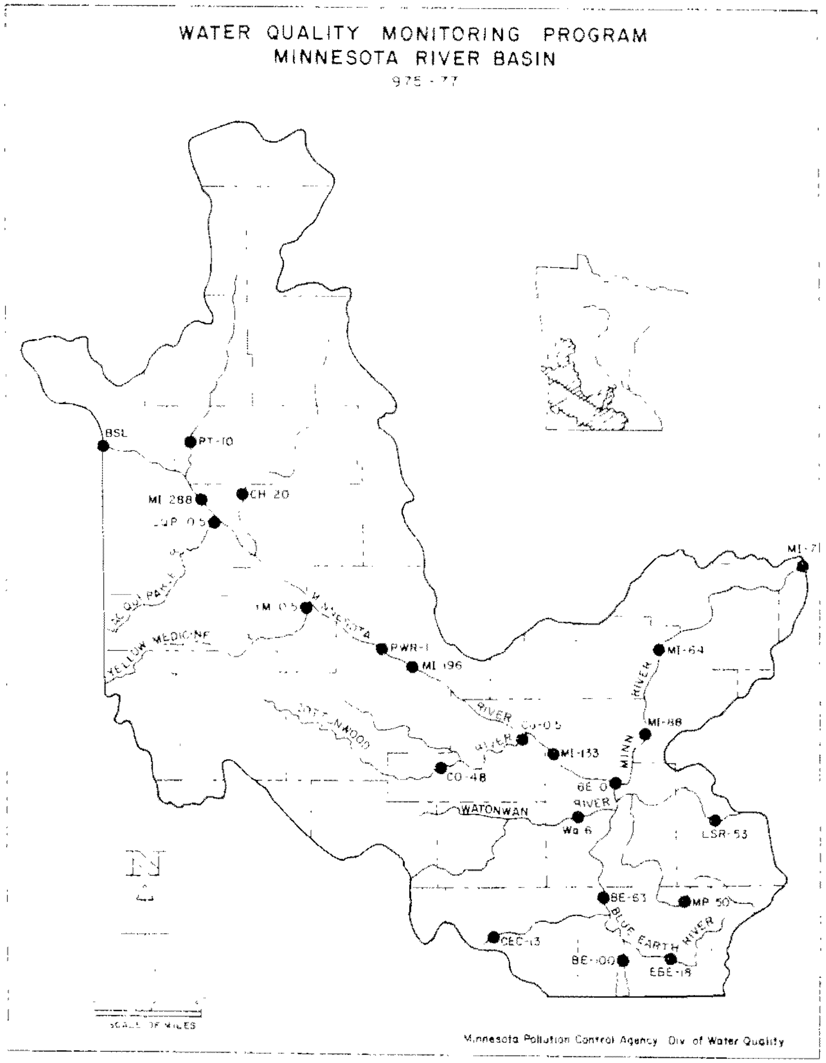
The data presented in this paper is an abbreviation of the total information generated; only quarterly results are presented. Copies of this data can be viewed at the Department of Biological Sciences, Mankato State University, and at the Division of Water Quality, Minnesota Pollution Control Agency.

The results are prefaced by an inventory of each of the 23 stations utilized, relative to the years of data available for each of the 44 parameters. Storet parameter retrieval numbers are given for each parameter.

Following the inventory are tables of quarterly (seasonal) means, also including the number of readings used to determine the mean. Each of these 37 tables is arranged from upstream to downstream to allow visual limnological interpretation.

Finally, results of T-tests of selected pairs of monitoring locations (stations) are presented. Pairs were selected so as to compare means of locations related geographically and hydrologically, as well as to make some overall comparisons of the upper and lower reaches of the Minnesota River. For general survey work (such as this), typically a low significance level is used. We used eighty percent.

Figure 1. Minnesota Pollution Control Agency Water Quality Monitoring Sites. (From MPCD, 1975)



INVENTORY OF MINNESOTA RIVER VALLEY WATER QUALITY SITES UTILIZED.

		BSL ... Big Stone Lake ... Bridge on ... 75 ... Ortonville ... Big Stone County	BE ... Blue Earth River ... at confluence with ... Minnesota River ... Sibley Park ... Mankato ... Blue Earth County	BE ... Blue Earth River ... Bridge on ... miles north of ... Winnebago ... Faribault County
[illegible]	WATER TEMP.	1958-65 1967-75	1967-75	1954-65 1967-75
[illegible]	FLOW	1958-65		1960-64
[illegible]	DO	1958-65 1967-75	1967-75	1957-65 1967-75
[illegible]	COLOR	1967-72	1967-72	1967-72
[illegible]	TURBIDITY	1967-72	1967-75	1967-75
[illegible]	BOD	1958-65 1967-72	1967-75	1957-65 1967-75
[illegible]	COD	1958-65 1967-75	1967-75	1957-65 1967-75
[illegible]	pH	1958-65 1967-75	1967-75	1957-65 1967-75
[illegible]	ALKALINITY	1967-75	1967-75	1967-75
[illegible]	TOT. RESIDUE	1958-59 1967-75	1967-75	1957-59 1967-75
[illegible]	T. NONFILT. RESIDUE	1967-72	1967-72	1967-72
[illegible]	TOT. SOLIDS	1960-65 1967-75	1967-75	1960-65 1967-75
[illegible]	VOL. SOLIDS	1961-65 1967-72	1967-72	1960-65 1967-72
[illegible]	OIL & GREASE	1969-72	1969-73 1974	1970-72 1974
[illegible]	ORG. N	1967-75	1967-75	1967-75
[illegible]	NH_3-N	1961-65 1967-75	1967-75	1961-65 1967-75
[illegible]	NO_2-N	1967-75	1967-75	1967-75
[illegible]	NO_3-N	1958-59 1967-75	1967-75	1958-59 1967-75
[illegible]	PHOS TOT	1958-59 1962-65 1967-75	1967-75	1958-59 1962-65 1967-75
[illegible]	TOT. HARD.	1967-75	1967-75	1967-75
[illegible]	CALCIUM	1969-75	1969-75	1969-75
[illegible]	MAGNESIUM		1969-72	1969-72
[illegible]	SODIUM	1967 1969-75	1967 1969-75	1967 1969-75
[illegible]	POTASSIUM	1967 1969-75	1967 1969-75	1967-75
[illegible]	CHLORIDE	1959-65 1967-75	1967-75	1960-65 1967-75
[illegible]	SULFATE	1968-75	1968-72	1968-75
[illegible]	FLUORIDE	1968-75	1968-72	1968-75
[illegible]	SILICA	1967 1969-72 1974	1967 1969-72	1967 1969-72 1974
[illegible]	BORON	1967 1969-72	1967 1969-72	1969-72
[illegible]	IRON	1967-75	1967-75	1967-75
[illegible]	LEAD	1967-75	1967-72	1967-75
[illegible]	MANGANESE	1967-75	1967-72	1967-75
[illegible]	NICKEL	1967-75	1967-72	1967-75
[illegible]	ZINC	1967-75	1967-75	1967-75
[illegible]	ALPHA-T	1969-72	1970-72	1969-72 1974
[illegible]	ALPHA-T PREC.	1969-70	1971-72	1969-70
[illegible]	BETA-T	1969-72	1970-72	1969-72 1974
[illegible]	BETA-T PREC.	1969-72	1970-72	1969-72 1974
31505	TOT. COLI	1959-65 1967-75	1967-75	1957-65 1967-75
31615	FEC. COLI	1961-65 1967-75	1967-75	1963-65 1967-75
31679	FEC. STREP	1969-72 1975	1968-69 1972 1974-75	1968 1970 1972 1974-75
[illegible]	PHENOLS	1969-72 1974	1968-72 1974	1968-72 1974
[illegible]	MBAS	1962-65 1967-74	1967-74	1962-65 1967-75
[illegible]	OIL DRY	1970-75	1970-75	1970-75

		BE-84 Blue Earth River Bridge on golf course, 5 miles north of Blue Earth Faribault County	BE-102 Blue Earth River Bridge on CSAH-4, 4 miles south of Blue Earth Faribault County	EBE-18 Blue Earth River East Fork Bridge on SH-253, 2 miles north of Bricelyn Faribault County
00011	WATER TEMP.	1957-65	1967-75	1967-75
00060	FLOW	1960-61		
00076	TURB.	1957-65	1967-75	1967-75
00080	COLOR		1967-72	1967-72
00095	CONDCTY		1967-75	1967-75
00300	DO	1957-65	1967-75	1967-75
00310	BOD	1957-65	1967-75	1967-75
00400	pH	1957-65	1967-75	1967-75
00410	ALKALINITY		1967-75	1967-75
00500	TOT. RESIDUE	1957-59	1967-75	1967-75
00505	T. VOLUME RESIDUE		1967-72	1967-72
00530	TOT. NFLT	1960-65	1967-75	1967-75
00535	VOL. NFLT	1960-65	1967-72	1967-72
00556	OIL & GREASE		1969-72	1969-72 1974
00606	ORG. N		1967-75	1967-75
00610	NH_3-N	1960-65	1967-75	1967-75
00615	NO_2-N		1967-75	1967-75
00620	NO_3-N	1958-59	1967-75	1967-75
00665	PHOS TOT	1958-59 1962-65	1967-75	1967-75
00900	TOT. HARD	1960-65	1967-75	1967-75
00910	CALCIUM		1969-75	1969-75
00920	MAGNSIUM		1969-72	1969-72
00930	SODIUM		1967 1969-75	1967 1969-75
00935	POTASSIUM		1967 1969-75	1967 1969-75
00940	CHLORIDE		1967-75	1967-75
00945	SULFATE		1968-75	1967 1969-75
00950	FLOURIDE		1969-75	1969-75
00955	SILICA		1967 1969-72	1967 1969-72 1974
01022	BORON		1967 1969-72	1967 1969-72
01045	IRON		1967-75	1967-75
01051	LEAD		1967-75	1967-75
01055	MANGANESE		1967-75	1967-75
01667	NICKEL		1967-75	1967-75
01092	ZINC		1967-75	1967-75
01501	ALPHA-T		1968-72	1969-72 1974
01502	ALPHA-T ERR.		1968-72	1969-70 1972
03501	BETA-T	1958	1968-72	1969-72 1974
03502	BETA-T ERR.		1969-72	1969-72 1974
31505	TOT. COLI	1957-65	1967-75	1967-75
31615	FEC. COLI	1963-65	1967-75	1967-75
31679	FEC. STREP		1968 1970-72 1974-75	1970-72 1975
32730	PHENOLS		1968-72 1974	1969-72 1974
38260	MBAS	1962-65	1967-74	1967-75
71900	MERCURY		1970-75	1970-75

		CC-2 Center Creek Bridge on CSAH-7, ½ mile east of Huntley Faribault County	[illegible] Chippewa River Bridge on SH-7, at Montevideo Chippewa County	[illegible] Cottonwood River Bridge on SH-15 at New Ulm Brown County
00011	WATER TEMP.	1968-74	1971-74	1967-75
00060	FLOW			
00076	TURB.	1968-71	1971-74	1967-75
00080	COLOR	1969-72	1971-72	1967-72
00095	CONDCTY	1968-74	1971-74	1967-75
00300	DO	1968-74	1971-74	1967-75
00310	BOD	1968-74	1971-74	1967-75
00400	pH	1968-74	1971-74	1967-75
00410	ALKALINITY	1968-74	1971-74	1967-75
00500	TOT. RESIDUE	1968-74	1972-74	1967-75
00505	T. VOLUME RESIDUE	1968-72	1972	1967-72
00530	TOT. NFLT	1968-74	1971-74	1967-75
00535	VOL. NFLT	1968-72	1972	1967-72
00556	OIL & GREASE	1969-72	1971-72	1969-72 1974
00606	ORG. N	1968-74	1972-74	1967-75
00610	NH_3-N	1968-74	1971-74	1967-75
00615	NO_2-N	1968-74	1972-74	1967-75
00620	NO_3-N	1968-74	1971-74	1967-75
00665	PHOS TOT.	1968-74	1971-74	1967-75
00900	TOT. HARD	1968-74	1971-74	1967-75
00910	CALCIUM	1969-74	1971-74	1969-75
00920	MAGNSIUM	1969-72	1971-72	1969-72
00930	SODIUM	1969-74	1971-74	1967 1969-75
00935	POTASSIUM	1969-74	1971-74	1967 1969-75
00940	CHLORIDE	1968-74	1971-74	1967-75
00945	SULFATE	1969-74	1971-74	1969-75
00950	FLOURIDE	1969-74	1971-74	1969-75
00955	SILICA	1969-72	1971-72	1967 1969-72 1974
01022	BORON	1969-72	1971-72	1967 1969-72
01045	IRON	1968-74	1971-74	1967-75
01051	LEAD	1968-74	1972-74	1967-75
01055	MANGANESE	1968-74	1971-74	1967-75
01667	NICKEL	1968-74	1971-74	1967-75
01092	ZINC	1968-74	1971-74	1967-75
01501	ALPHA-T	1969-72	1971-72	1970-72
01502	ALPHA-T ERR.	1970 1972	1971	1970
03501	BETA-T	1969-72	1971-72	1971-72 1974
03502	BETA-T ERR.	1969-72	1971-72	1970-72 1974
31505	TOT. COLI	1968-74	1971-74	1967-75
31615	FEC. COLI	1968-74	1971-74	1967-75
31679	FEC. STREP	1970 1972	1971-72	1968-69 1972 1975
32730	PHENOLS	1969-72	1971-72	1968-72 1974
38260	MBAS	1968-74	1971-74	1967-74
71900	MERCURY	1970-74	1971-74	1970-75

		CO-3 Cottonwood River Bridge on CSAH-3 (Center St.) near New Ulm Brown County	LQP-11 Lac qui Parle River Bridge on CSAH-33 near Lac qui Park Lac qui Parle County	MI-17 Minnesota River Bridge on CR-16, 6 miles northeast of Shakopee Scott County
00011	WATER TEMP.	1957-65	1967-75	1957-61
00060	FLOW	1960 1962-65		1957-61
00076	TURB.	1957-65	1967-75	1957-61
00080	COLOR		1967-72	
00095	CONDCTY		1967-75	
00300	DO	1957-65	1967-75	1957-61
00310	BOD	1957-65	1967-75	1957-61
00400	pH	1957-65	1967-75	1957-60
00410	ALKALINITY	1957	1967-75	
00500	TOT. RESIDUE	1957-59	1967-75	1957-59
00505	T. VOLATIL. RESIDUE	1957	1967-72	
00530	TOT. NFLT	1960-65	1967-75	1960-61
00535	VOL. NFLT	1960-65	1967-72	1960-61
00556	OIL & GREASE		1969-72 1974	
00606	ORG. N.		1967-75	
00610	NH_3-N	1960-65	1967-75	1960-61
00615	NO_2-N	1958-59	1967-75	
00620	NO_3-N		1967-75	1958-59
00665	PHOS TOT.	1958-59 1962-65	1967-75	1958-59
00900	TOT. HARD		1967-75	
00910	CALCIUM		1969-75	
00920	MAGNSIUM		1969-72	
00930	SODIUM		1967 1969-75	
00935	POTASSIUM		1967 1969-75	
00940	CHLORIDE	1957 1960-65	1967-75	1960-61
00945	SULFATE		1967 1969-75	
00950	FLOURIDE		1969-75	
00955	SILICA		1967 1969-72 1974	
01022	BORON		1967 1969-72	
01045	IRON		1967-75	
01051	LEAD		1967-75	
01055	MANGANESE		1967-75	
01667	NICKEL		1967-75	
01092	ZINC		1967-75	
01501	ALPHA-T		1969-72	
01502	ALPHA-T ERR.		1969-70	
03501	BETA-T	1958	1968 1969-72	1958
03502	BETA-T ERR.		1969-72	
31505	TOT. COLI	1957-65	1967-75	1957-61
31615	FEC. COLI	1963-65	1967-75	
31679	FEC. STREP		1967 1970-72 1975	
32730	PHENOLS		1967 1969-72 1974	
38260	MBAS	1963-65	1967-74	
71900	MERCURY		1970-75	

		MI-25 Minnesota River Bridge on USH-169 at Shakopee Scott County	MI-37 Minnesota River Bridge on CSAH-[illegible] 1½ miles north of Jordan Scott County	MI-44 Minnesota River Bridge on SH-19 at Henderson Sibley County
00011	WATER TEMP.	1961-65 1967-71 1973	1957 1961-65	1957-65 1967-75
00060	FLOW		1957 1961-65	1958 1960-65
00076	TURB.	1961-65 1967-71 1973	1957 1961-65	1957-65 1967-75
00080	COLOR	1967-71		1967-72
00095	CONDCTY	1967-71 1973		1967-75
00300	DO	1961-65 1967-71 1973	1957 1961-65	1957-65 1967-75
00310	BOD	1961-65 1967-71 1973	1957 1961-65	1957-65 1967-75
00400	pH	1961-65 1967-71 1973	1957 1961-65	1957-65 1967-75
00410	ALKALINITY	1967-71 1973		1967-75
00500	TOT. RESIDUE	1967-71 1973	1957	1957-59 1967-75
00505	T. VOLATIL. RESIDUE	1967-71		1967-72
00530	TOT. NFLT	1961-65 1967-71 1973	1961-63	1960-65 1967-75
00535	VOL. NFLT	1961-65 1967-71	1961-65	1960-65 1967-75
00556	OIL & GREASE	1970		1969-72 1974
00606	ORG. N.	1967-71 1973		1967-75
00610	NH_3-N	1961-65 1967-71 1973	1961-65	1960-65 1967-75
00615	NO_2-N	1967-71 1973		1967-75
00620	NO_3-N	1967-71 1973		1958-59 1967-75
00665	PHOS TOT.	1962-65 1967-71 1973	1962-65	1958-59 1962-65 1967-75
00900	TOT. HARD	1967-71 1973		1967-75
00910	CALCIUM	1969-70 1973		1969-75
00920	MAGNSIUM	1969-70		1969-72
00930	SODIUM	1967 1969-70 1973		1967 1969-75
00935	POTASSIUM	1967 1969-70 1973		1967 1969-75
00940	CHLORIDE	1961-65 1967-71 1973	1961-65	1960-65 1967-75
00945	SULFATE	1968-70 1973		1968-75
00950	FLOURIDE	1969-70 1973		
00955	SILICA	1967 1969-70		1967 1969-72 1974
01022	BORON	1967 1969		1967 1969-72
01045	IRON	1967-71 1973		1967-75
01051	LEAD	1967-71 1973		1967-75
01055	MANGANESE	1967-71 1973		1967-75
01667	NICKEL	1969-71 1973		1967-75
01092	ZINC	1967-71 1973		1967-75
01501	ALPHA-T	1968-71 1973		1968-75
01502	ALPHA-T ERR.	1969-71 1973		1970 1972
03501	BETA-T	1968-71 1973		1968-72 1974
03502	BETA-T ERR.	1969-71 1973		1969-72 1974
31505	TOT. COLI	1961-65 1967-71 1973	1957 1961-65	1957-65 1967-75
31615	FEC. COLI	1963-65 1967-71 1973	1963-65	1963-65 1967-75
31679	FEC. STREP	1968-69		1968 1972 1974-75
32730	PHENOLS	1968-70		1969-72 1974
38260	MBAS	1962-65 1967-71 1973	1962-65	1963-65 1967-74
71900	MERCURY	1970-71 1973		1970-75

		MI-38 Minnesota River Bridge on SH-22 at St. Peter Nicollet County	MI-97 Minnesota River Bridge on USH-14, south of St. Peter Nicollet County	MI-133 Minnesota River Bridge on CSAH-24 at Courtland Nicollet County
00011	WATER TEMP.	1971-75	1957-61	1957-65 1967-75
00060	FLOW		1958 1960	1958 1960 1962-65
00076	TURB.	1971-75	1957-61	1957-65 1967-75
00080	COLOR	1971-72		1967-72
00095	CONDCTY	1971-75		1967-75
00300	DO	1971-75	1957-61	1957-65 1967-75
00310	BOD	1971-75	1957-61	1957-65 1967-75
00400	pH	1971-75	1957-61	1957-65 1967-75
00410	ALKALINITY	1971-75		1967-75
00500	TOT. RESIDUE	1971-75	1957-59	1957-59 1967-75
00505	T. VOLUME RESIDUE	1971-72		1967-72
00530	TOT. NFLT	1971-75	1960-61	1960-65 1967-75
00535	VOL. NFLT	1971-75	1960-61	1960-65 1967-72
00556	OIL & GREASE	1971-72 1974		1969 1974
00606	ORG. N.	1971-75		1967-75
00610	NH_3-N	1971-75	1960-61	1960-65 1967-75
00615	NO_2-N	1971-75		1967-75
00620	NO_3-N	1971-75	1958-1959	1958-59 1967-75
00665	PHOS TOT.	1971-75	1958-59	1958-59 1962-65 1967-75
00900	TOT. HARD	1971-75		1967-75
00910	CALCIUM	1971-75		1969-75
00920	MAGNSIUM	1971-72		1969-72
00930	SODIUM	1971-75		1967 1969-75
00935	POTASSIUM	1971-75		1967 1969-75
00940	CHLORIDE	1971-75	1960-61	1960-65 1967-75
00945	SULFATE	1971-75		1968-75
00950	FLOURIDE	1971-75		1969-75
00955	SILICA	1971-72 1974		1967 1969-72 1974
01022	BORON	1971-72		1967 1969-72
01045	IRON	1971-75		1967-75
01051	LEAD	1972-75		1967-75
01055	MANGANESE	1971-75		1967-75
01667	NICKEL	1971-75		1967-75
01092	ZINC	1971-75		1967-75
01501	ALPHA-T	1971-72		1969-74
01502	ALPHA-T ERR.	1971		1969-74
03501	BETA-T	1971-72 1974	1958	1969-74
03502	BETA-T ERR.	1971-72		1969-74
31505	TOT. COLI	1971-75	1957-61	1957-65 1967-75
31615	FEC. COLI	1971-75		1963-65 1967-75
31679	FEC. STREP	1972 1974-75		1968-69 1972
32730	PHENOLS	1971-72 1974		1968-72 1974
38260	MBAS	1971-74		1963-65 1967-74
71900	MERCURY	1971-75		1970-75

		MI-136 Minnesota River Bridge on SH-19 and USH-71 at Morton Renville County	MI-[illegible] Minnesota River Bridge on [illegible] at Milan Chippewa County	PT-1[illegible] Pomme de Terre River Bridge on SH-[illegible] at Appleton Swift County
00011	WATER TEMP.	1967-75	1967-75	1971-75
00060	FLOW			
00076	TURB.	1967-75	1967-75	1971-75
00080	COLOR	1967-72	1967-72	1971-72
00095	CONDCTY	1967-75	1967-75	1971-75
00300	DO	1967-75	1967-75	1971-75
00310	BOD	1967-75	1967-75	1971-75
00400	pH	1967-75	1967-75	1971-75
00410	ALKALINITY	1967-75	1967-75	1971-75
00500	TOT. RESIDUE	1967-75	1967-75	1972-75
00505	T. VOLUME RESIDUE	1967-72	1967-72	1972
00530	TOT. NFLT	1967-75	1967-75	1971-75
00535	VOL. NFLT	1967-72	1967-72	1972
00556	OIL & GREASE	1969-72	1970-72 1974	1970-72 1974
00606	ORG. N.	1967-75	1967-75	1972-75
00610	NH_3-N	1967-75	1967-75	1971-75
00615	NO_2-N	1967-75	1967-75	1972-75
00620	NO_3-N	1967-75	1967-75	1971-75
00665	PHOS TOT.	1967-75	1967-75	1971-75
00900	TOT. HARD	1967-75	1967-75	1971-75
00910	CALCIUM	1969-75	1969-75	1971-75
00920	MAGNSIUM	1969-72	1969-72	
00930	SODIUM	1967 1969-75	1967 1969-75	1971-75
00935	POTASSIUM	1967 1969-75	1967 1969-75	1971-75
00940	CHLORIDE	1967-75	1967-75	1971-75
00945	SULFATE	1968-75	1968-75	1971-75
00950	FLOURIDE	1969-75	1969-75	1971-75
00955	SILICA	1967 1969-72 1974	1967 1969-72 1974	1971-72 1974
01022	BORON	1967 1969-72	1967 1969-72	1971-72
01045	IRON	1967-75	1967-75	1971-75
01051	LEAD	1967-75	1970-75	1972-75
01055	MANGANESE	1967-75	1967-75	1971-75
01667	NICKEL	1967-75	1970-75	1971-75
01092	ZINC	1967-75	1967-75	1971-75
01501	ALPHA-T	1969-72 1974	1970-72 1974	1971-72
01502	ALPHA-T ERR.	1969-70 1974	1970-72 1974	
03501	BETA-T	1969-72 1974	1968-72 1974	1971-72
03502	BETA-T ERR.	1969-72 1974	1969-73	1971-72
31505	TOT. COLI	1967-75	1967-75	1971-75
31615	FEC. COLI	1967-75	1967-75	1971-75
31679	FEC. STREP	1968-72 1975	1970-72 1975	1971-72 1975
32730	PHENOLS	1968-72 1974	1970-72 1974	1971-72 1974
38260	MBAS	1967-74	1967-74	1971-74
71900	MERCURY	1970-75	1970-75	1971-75

		WA-6 Watonwan River Bridge on CSAH-13, 1 mile west of Garden City Blue Earth County	YM-[illegible] Yellow Medicine River Bridge on SH-[illegible], [illegible] miles southeast of Granite Falls Yellow Medicine County
00011	WATER TEMP	1968-75	1967-75
00061	FLOW		
00076	TURB.	1968-75	1967-75
00080	COLOR	1968-72	1967-72
00095	CONDUCTY	1968-75	1967-75
00300	DO	1968-75	1967-75
00310	BOD	1968-75	1967-75
00400	pH	1968-75	1967-75
00410	ALKALINITY	1968-75	1967-75
00500	TOT. RESIDUE	1968-75	1967-75
00505	T. VOLATILE RESIDUE	1968-72	1967-72
00530	TOT. NFLT	1968-75	1967-75
00535	VOL. NFLT	1969-72	1967-72
00556	OIL & GREASE	1969-72 1974	1974
00605	ORG. N	1968-75	1967-75
00610	NH_3-N	1968-75	1967-75
00615	NO_2-N	1968-75	1967-75
00620	NO_3-N	1968-75	1967-75
00665	PHOS TOT.	1968-75	1967-75
00900	TOT. HARD	1968-75	1967-75
00910	CALCIUM	1969-75	1969-75
00920	MAGNSIUM	1969-72	1969
00930	SODIUM	1969-75	1967 1969-75
00935	POTASSIUM	1969-75	1967 1969-75
00940	CHLORIDE	1968-75	1967-75
00945	SULFATE	1969-75	1968-69 1973-75
00950	FLOURIDE	1969-75	1969-75
00955	SILICA	1969-72 1974	1967 1969 1973-74
01022	BORON	1969-72	1967 1969
01045	IRON	1968-75	1967-1969
01051	LEAD	1968-75	1967-1969
01055	MANGANESE	1968-75	1967-1975
01067	NICKEL	1968-75	1967-75
01092	ZINC	1968-75	1967-75
01501	ALPHA-T	1970-72	1969-72
01502	ALPHA-T ERR.	1970-72 1974	1969-70
03501	BETA-T	1970-72 1974	1969-72 1974
03502	BETA-T ERR.		1969-72 1974
31505	TOT. COLI	1968-75	1967-75
31615	FEC. COLI	1968-75	1967-75
31679	FEC. STREP	1969 1972 1974-75	1975
32730	PHENOLS	1969-72 1974	1974
38260	MBAS	1968-74	1967-74
71900	MERCURY	1970-75	1970-75

Water Temperature (Fahrenheit) 00011

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-1	46	22	73	33	51	30	35	23
PT-10	48	10	71	13	47	15	32	10
MI-288	45	16	71	26	49	23	33	20
LQP-0.5	45	16	70	26	48	23	32	20
CH-0.5	47	3	71	6	49	9	-	-
YM-0.5	45	16	71	26	49	23	32	20
MI-196	42	13	72	26	49	23	32	19
CO-5.3	55	12	72	13	49	3	-	-
CO-0.5	48	18	72	25	50	24	32	17
MI-133	51	27	73	37	51	31	32	27
BE-100	44	18	68	26	51	22	33	19
EBE-18	46	16	69	26	51	22	32	20
BE-84	51	12	75	14	38	3	32	3
CEC-2	46	12	71	17	54	15	33	13
BE-63	47	30	71	40	51	29	32	25
WA-6	47	17	72	22	52	23	32	19
BE-0	48	19	73	25	53	24	32	20
MI-97	53	3	69	3	51	3	34	3
MI-88	50	11	71	14	50	15	32	10
MI-64	50	30	71	37	51	31	32	27
MI-39	50	3	73	12	56	6	-	-
MI-25	47	13	73	21	53	18	32	10
MI-17	-	-	68	3	49	3	-	-

Turbidity (Hach FTU) 00076

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	23	22	19	33	26	30	8	23
PT-10	19	10	29	13	13	15	4	10
MI-288	43	16	35	26	27	23	5	20
LQP-0.5	40	16	39	26	13	24	5	20
CH-0.5	31	3	38	6	19	9	-	-
YM-0.5	34	16	48	26	20	23	5	2-
MI-196	29	16	53	26	18	23	4	19
CO-5.3	68	12	105	13	31	6	-	-
CO-0.5	30	18	59	25	22	24	6	18
MI-133	39	27	66	37	26	32	6	27
BE-100	26	18	37	26	20	23	5	20
EBE-18	13	16	33	26	19	23	14	20
BE-84	46	12	42	14	13	6	9	3
CEC-2	24	13	27	17	12	16	5	13
BE-63	35	30	60	40	18	31	6	25
WA-6	19	17	42	23	21	23	4	19
BE-0	44	19	75	26	32	24	6	20
MI-97	55	3	133	3	27	3	10	3
MI-88	39	11	44	14	19	15	4	10
MI-64	47	30	98	38	33	32	9	27
MI-39	39	3	101	12	53	6	-	-
MI-25	49	13	98	23	49	18	12	11
MI-17	-	-	84	3	35	3	-	-

Color (PT-CO Units) 00080

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	23	4	20	12	18	9	21	10
PT-10	-	-	-	-	-	-	-	-
MI-288	27	4	27	12	21	9	20	10
LQP-0.5	25	4	32	12	22	9	18	10
CH-0.5	-	-	-	-	-	-	-	-
YM-0.5	21	4	31	12	20	9	14	10
MI-196	34	4	35	12	24	9	22	9
CO-5.3	-	-	-	-	-	-	-	-
CO-0.5	27	4	27	11	23	9	14	10
MI-133	35	4	32	12	25	9	21	10
BE-100	31	6	26	12	27	9	18	9
EBE-18	38	3	37	12	33	9	21	10
BE-84	-	-	-	-	-	-	-	-
CEC-2	-	-	23	9	29	7	17	6
BE-63	29	6	27	12	25	8	17	9
WA-6	-	-	36	9	28	7	16	9
BE-0	26	7	40	12	27	9	16	10
MI-97	-	-	-	-	-	-	-	-
MI-88	-	-	-	-	-	-	-	-
MI-64	26	7	31	12	29	9	17	10
MI-39	-	-	-	-	-	-	-	-
MI-25	26	7	36	11	22	7	19	10
MI-17	-	-	-	-	-	-	-	-

Conductivity (Microhos/centimeter at 25 C) 00095

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	805	16	756	23	869	19	982	19
PT-10	683	10	697	13	805	15	808	10
MI-288	737	16	714	25	773	23	914	20
LQP-0.5	889	16	953	25	1080	23	1294	20
CH-0.5	660	3	611	6	617	6	-	-
YM-0.5	930	16	915	26	979	23	1153	20
MI-196	749	16	709	26	850	23	1002	19
CO-5.3	-	-	-	-	-	-	-	-
CO-0.5	843	18	815	25	809	23	1010	18
MI-133	735	17	740	25	826	24	995	20
BE-100	686	18	637	26	753	22	794	19
EBE-18	566	17	507	26	608	23	757	20
BE-84	-	-	-	-	-	-	-	-
CEC-2	578	13	701	16	4677	16	906	13
BE-63	617	17	589	26	810	23	811	19
WA-6	625	17	660	23	741	22	806	19
BE-0	573	19	566	26	674	24	783	20
MI-97	-	-	-	-	-	-	-	-
MI-88	656	11	651	14	716	15	879	10
MI-64	649	19	612	25	726	24	862	20
MI-39	-	-	-	-	-	-	-	-
MI-25	671	7	583	13	737	11	857	10
MI-17	-	-	-	-	-	-	-	-

Dissolved Oxygen (Mg/L) 00300

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	8.9	22	7.7	32	9.4	26	9.1	22
PT-10	10.7	10	7.2	13	10.6	14	9.5	10
MI-288	10.0	16	7.5	26	10.2	22	10.0	20
LQP-0.5	10.1	16	7.0	26	9.2	22	9.6	20
CH-0.5	11.9	3	7.6	6	10.8	9	-	-
YM-0.5	10.7	16	8.5	26	10.7	23	12.2	20
MI-196	10.6	16	8.1	26	10.7	23	11.0	19
CO-5.3	9.8	12	8.1	13	9.7	6	-	-
CO-0.5	10.8	16	9.1	26	10.3	24	10.1	18
MI-133	10.1	25	7.1	37	9.8	31	9.1	26
BE-100	9.9	17	8.1	25	9.7	23	9.6	19
EBE-18	9.3	17	6.5	25	8.5	23	8.3	20
BE-84	9.4	12	8.8	14	12.3	6	6.8	3
CEC-2	9.9	13	9.0	16	10.3	16	7.3	13
BE-63	9.5	28	8.7	39	10.7	31	8.3	25
WA-6	9.8	17	8.6	23	10.8	23	8.5	19
BE-0	11.1	17	8.9	26	10.9	24	11.5	20
MI-97	8.9	3	6.2	3	9.1	3	5.6	3
MI-88	10.0	11	8.2	14	10.5	15	10.2	10
MI-64	10.0	28	7.7	38	10.3	31	8.7	28
MI-39	11.3	3	6.6	11	8.5	6	-	-
MI-25	8.7	10	7.5	23	9.8	18	8.0	10
MI-17	-	-	5.1	3	6.0	3	-	-

Biochemical Oxygen Demand (5 day, Mg/L) 00310

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#
BS-L	6.0	21	6.0	33	17.7	30	24.9	23
PT-10	6.1	10	4.5	13	2.9	15	4.5	10
MI-288	5.2	16	5.7	26	6.7	23	3.9	20
LQP-0.5	4.3	16	4.0	26	3.3	24	3.4	20
CH-0.5	3.9	3	3.9	6	2.6	9	-	-
YM-0.5	4.7	16	5.1	26	2.9	23	2.4	20
MI-196	4.3	16	5.5	26	4.0	23	3.7	19
CO-5.3	8.5	12	7.3	13	8.6	6	-	-
CO-0.5	4.8	18	6.7	25	5.4	24	3.8	17
MI-133	5.7	27	5.8	37	4.5	32	4.4	27
BE-100	3.4	18	3.6	26	3.0	23	2.9	19
EBE-18	4.1	17	4.7	26	3.1	23	4.1	20
BE-84	7.5	12	7.2	14	5.0	3	3.1	4
CEC-2	5.9	13	5.4	17	5.1	16	8.1	13
BE-63	5.6	30	39.1	40	6.8	31	3.0	25
WA-6	4.1	17	5.4	23	4.7	24	4.3	19
BE-0	4.7	19	5.5	26	6.0	24	4.5	20
MI-97	5.9	3	5.0	3	5.6	3	4.1	3
MI-88	4.4	11	4.7	13	5.3	15	3.8	10
MI-64	5.5	30	5.8	38	5.5	32	3.5	27
MI-39	6.3	3	5.7	12	4.2	6	-	-
MI-25	5.1	13	5.8	23	5.9	18	5.7	7
MI-17	-	-	6.3	3	7.8	3	-	-

pH 00400

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#
BS-L	7.9	22	7.9	33	7.9	30	7.7	23
PT-10	7.9	10	8.0	13	8.0	15	7.7	10
MI-288	7.8	16	8.0	26	8.2	23	7.9	20
LQP-0.5	7.8	16	7.9	26	7.9	23	7.8	20
CH-0.5	7.9	3	7.9	6	8.0	9	-	-
YM-0.5	7.9	16	8.0	26	8.0	23	7.9	20
MI-196	7.9	16	8.1	26	8.1	23	7.8	19
CO-5.3	7.9	11	7.8	13	7.9	6	-	-
CO-0.5	7.9	18	8.0	25	8.0	24	7.8	18
MI-133	7.9	26	7.9	38	8.0	32	7.8	26
BE-100	7.8	18	8.0	26	8.0	23	7.8	19
EBE-18	7.9	17	7.8	26	7.9	23	7.8	19
BE-84	7.9	12	7.8	13	7.7	6	7.5	3
CEC-2	7.7	13	7.9	17	7.9	16	7.8	13
BE-63	7.9	30	7.9	40	7.9	31	7.7	25
WA-6	7.9	17	7.9	23	8.0	23	7.8	19
BE-0	7.9	19	8.1	25	8.0	24	7.9	20
MI-97	7.9	3	8.0	3	7.6	3	7.7	3
MI-88	8.0	11	8.0	14	8.0	15	8.0	10
MI-64	7.9	30	7.8	38	7.9	32	7.7	26
MI-39	8.1	3	7.8	12	7.9	6	-	-
MI-25	7.8	13	7.8	24	8.0	17	7.6	11
MI-17	-	-	7.7	3	7.7	3	-	-

Alkalinity (Total $CaCO_3$-Mg/L) 00410

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#
BS-1	181	16	177	24	174	20	215	19
PT-10	234	10	253	13	263	15	306	10
MI-288	226	16	216	26	226	23	295	20
LQP-0.5	207	16	221	26	236	23	300	20
CH-0.5	217	3	250	6	253	9	-	-
YM-0.5	211	16	209	26	241	23	284	20
MI-196	222	16	222	26	243	23	303	19
CO-5.3	-	-	-	-	-	-	-	-
CO-0.5	215	18	181	25	213	24	268	18
MI-133	223	17	227	25	236	24	312	20
BE-100	253	18	252	26	258	23	300	19
EBE-18	231	17	245	26	267	22	349	20
BE-84	-	-	-	-	-	-	-	-
CEC-2	225	13	242	17	290	16	288	13
BE-63	247	18	236	26	271	23	326	19
WA-6	240	17	232	23	232	23	295	19
BE-0	236	19	227	26	229	23	297	20
MI-97	-	-	-	-	-	-	-	-
MI-88	241	11	239	14	243	15	291	10
MI-64	223	19	215	25	239	24	315	20
MI-39	-	-	-	-	-	-	-	-
MI-25	240	7	209	13	234	12	310	10
MI-17	-	-	-	-	-	-	-	-

Total Residue (Mg/L) 00500

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#
BS-L	735	13	712	18	766	20	938	17
PT-10	-	-	670	3	699	10	813	3
MI-288	721	10	655	19	685	18	815	17
LQP-0.5	753	10	997	18	951	19	1241	17
CH-0.5	-	-	-	-	-	-	-	-
YM-0.5	797	10	951	19	847	17	1040	17
MI-196	659	10	793	19	513	18	895	16
CO-5.3	-	-	-	-	-	-	-	-
CO-0.5	764	13	885	20	701	20	922	15
MI-133	690	14	774	23	735	22	907	22
BE-100	636	13	671	18	616	19	651	15
EBE-18	446	12	490	19	458	19	634	17
BE-84	-	-	-	-	-	-	-	-
CEC-2	531	6	706	10	702	10	750	11
BE-63	586	16	637	21	659	22	739	20
WA-6	542	12	719	17	594	19	700	16
BE-0	585	14	690	19	559	20	652	16
MI-97	-	-	-	-	-	-	-	-
MI-88	-	-	666	9	623	11	687	3
MI-64	641	15	738	22	652	23	746	22
MI-39	-	-	-	-	-	-	-	-
MI-25	603	7	745	12	668	12	753	10
MI-17	-	-	-	-	-	-	-	-

Total Volume Residue (Mg/L) 00505

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#
BS-L	153	4	150	12	147	8	168	10
PT-10	-	-	-	-	-	-	-	-
MI-288	140	4	169	12	159	8	180	10
LQP-0.5	177	4	211	12	187	8	266	10
CH-0.5	-	-	-	-	-	-	-	-
YM-0.5	176	4	210	12	190	8	258	10
MI-196	151	4	191	13	191	8	201	9
CO-5.3	-	-	-	-	-	-	-	-
CO-0.5	187	4	215	11	175	9	207	10
MI-133	151	4	197	12	180	9	204	10
BE-100	164	6	191	12	163	9	163	9
EBE-18	138	3	149	12	146	9	170	10
BE-84	-	-	-	-	-	-	-	-
CEC-2	-	-	181	9	159	8	181	6
BE-63	141	6	176	12	159	9	170	9
WA-6	-	-	194	9	151	8	176	9
BE-0	151	7	179	12	145	9	166	10
MI-97	-	-	-	-	-	-	-	-
MI-88	-	-	-	-	-	-	-	-
MI-64	146	7	186	12	161	9	169	10
MI-39	-	-	-	-	-	-	-	-
MI-25	139	7	179	12	151	7	182	10
MI-17	-	-	-	-	-	-	-	-

Residue Total Nonfiltrable--Suspended (Mg/L) 00530

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#
BS-L	40	21	41	31	46	25	11	22
PT-10	51	10	78	13	30	15	8	10
MI-288	53	16	49	26	40	23	8	20
LQP-0.5	77	16	56	26	19	23	8	20
CH-0.5	60	3	95	6	51	9	-	-
YM-0.5	63	16	95	26	34	23	6	20
MI-196	65	16	117	26	36	23	8	19
CO-5.3	205	3	206	4	-	-	-	-
CO-0.5	102	18	170	25	39	24	9	18
MI-133	101	23	131	32	49	27	11	23
BE-100	85	18	117	26	47	23	9	19
EBE-18	31	17	84	26	40	23	49	20
BE-84	137	3	128	4	-	-	-	-
CEC-2	96	13	100	17	47	16	10	13
BE-63	109	25	150	33	49	26	9	21
WA-6	70	17	135	23	41	23	8	19
BE-0	126	19	179	26	67	24	11	20
MI-97	-	-	-	-	-	-	-	-
MI-88	116	11	143	14	56	15	9	10
MI-64	123	26	199	32	80	27	17	22
MI-39	-	-	143	10	-	-	-	-
MI-25	116	13	159	23	87	18	14	11
MI-17	-	-	-	-	-	-	-	-

Volume Nonfiltrable--Suspended (Mg/L) 00535

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	10	11	9	19	15	14	11	12
PT-10	–	–	–	–	–	–	–	–
MI-288	24	4	16	12	17	8	3	10
LQP-0.5	15	4	11	13	8	8	3	10
CH-0.5	–	–	–	–	–	–	–	–
YM-0.5	14	4	22	12	13	8	2	10
MI-196	18	4	27	12	12	8	3	9
CO-0.3	35	3	35	4	–	–	–	–
CO-0.5	22	4	48	11	14	9	4	10
MI-133	29	14	25	18	14	14	4	11
BE-100	9	6	23	12	13	9	3	9
EBE-18	12	3	24	12	13	9	13	10
BE-84	23	3	22	4	–	–	–	–
CEC-2	–	–	23	9	12	8	3	6
BE-63	35	14	44	19	19	11	4	10
WA-6	–	–	26	9	20	8	3	9
BE-0	15	7	32	12	22	9	5	10
MI-97	–	–	–	–	–	–	–	–
MI-88	–	–	–	–	–	–	–	–
MI-64	29	15	33	19	22	14	5	11
MI-39	–	–	26	10	–	–	–	–
MI-25	18	13	26	22	18	15	4	11
MI-17	–	–	–	–	–	–	–	–

Oil & Grease (Mg/L) 00556

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	–	–	–	–	1.33	4	–	–
PT-10	–	–	–	–	–	–	–	–
MI-288	–	–	–	–	–	–	–	–
LQP-0.5	–	–	–	–	3.25	3	–	–
CH-0.5	–	–	–	–	–	–	–	–
YM-0.5	–	–	–	–	–	–	–	–
MI-196	–	–	–	–	1.83	3	–	–
CO-0.3	–	–	–	–	–	–	–	–
CO-0.5	–	–	–	–	.74	3	–	–
MI-133	–	–	–	–	–	–	–	–
BE-100	–	–	–	–	1.26	4	–	–
EBE-18	–	–	1.61	4	–	–	–	–
BE-84	–	–	–	–	–	–	–	–
CEC-2	–	–	–	–	–	–	–	–
BE-63	–	–	–	–	.78	3	–	–
WA-6	–	–	.73	3	–	–	–	–
BE-0	–	–	–	–	1.35	3	–	–
MI-97	–	–	–	–	–	–	–	–
MI-88	–	–	–	–	–	–	–	–
MI-64	–	–	–	–	.70	3	–	–
MI-39	–	–	–	–	–	–	–	–
MI-25	–	–	–	–	–	–	–	–
MI-17	–	–	–	–	–	–	–	–

Organic Nitrogen (Mg/L) 00605

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	1.6	10	1.4	17	1.6	15	1.2	16
PT-10	-	-	2.0	3	1.1	10	1.5	3
MI-288	1.4	10	1.7	19	2.0	18	1.2	17
LQP-0.5	1.1	10	1.3	20	1.1	17	0.8	17
CH-0.5	-	-	-	-	-	-	-	-
YM-0.5	1.2	10	1.5	20	0.8	17	0.6	12
MI-196	1.3	10	1.9	19	1.2	18	1.1	16
CO-5.3	-	-	-	-	-	-	-	-
CO-0.5	1.3	13	1.7	19	1.2	20	0.7	15
MI-133	1.5	10	1.6	19	1.4	20	0.9	17
BE-100	1.5	13	1.6	19	1.1	19	0.9	16
EBE-18	1.7	12	1.7	13	1.3	19	1.3	17
BE-84	-	-	-	-	-	-	-	-
CEC-2	1.8	6	1.9	10	1.6	10	1.2	11
BE-63	1.5	13	1.8	19	1.4	19	0.9	16
WA-6	1.2	12	1.8	16	2.1	19	0.9	16
BE-0	1.3	14	1.9	19	1.3	20	0.9	17
MI-97	-	-	-	-	-	-	-	-
MI-88	-	-	2.0	6	1.5	11	1.3	3
MI-64	1.6	14	1.9	20	1.6	20	1.0	17
MI-39	-	-	-	-	-	-	-	-
MI-25	1.4	7	1.7	12	1.8	12	0.9	10
MI-17	-	-	-	-	-	-	-	-

Ammonia Nitrogen (Mg/L) 00610

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	1.6	10	-	-	-	-	0.6	21
PT-10	0.9	3	-	-	-	-	0.5	11
MI-288	0.5	5	0.4	9	-	-	0.6	13
LQP-0.5	0.6	5	-	-	-	-	0.5	20
CH-0.5	0.2	3	-	-	-	-	-	-
YM-0.5	0.4	5	-	-	-	-	0.4	13
MI-196	0.5	5	-	-	-	-	0.5	19
CO-5.3	0.1	3	0.1	4	-	-	-	-
CO-0.5	0.4	5	-	-	-	-	0.6	11
MI-133	0.6	6	-	-	-	-	0.7	13
BE-100	0.5	6	-	-	-	-	0.4	12
EBE-18	-	-	0.2	7	-	-	0.6	13
BE-84	0.1	3	0.1	4	-	-	-	-
CEC-2	0.7	4	-	-	0.8	4	2.8	13
BE-63	0.9	8	-	-	-	-	0.5	20
WA-6	-	-	-	-	-	-	0.9	6
BE-0	0.5	6	-	-	-	-	2.9	13
MI-97	-	-	-	-	-	-	-	-
MI-88	-	-	-	-	-	-	0.8	6
MI-64	0.6	8	-	-	-	-	0.7	13
MI-39	-	-	-	-	-	-	-	-
MI-25	0.8	4	-	-	-	-	0.7	11
MI-17	-	-	-	-	-	-	-	-

Nitrite Nitrogen (Mg/L) 00615

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	.01	4	.01	11	.1	9	.1	5
PT-10	-	-	.01	3	.01	7	.1	3
MI-288	.01	4	.01	12	.01	4	.01	6
LQP-0.5	.01	4	.01	12	-	-	.01	5
CH-0.5	-	-	-	-	-	-	-	-
YM-0.5	.01	4	.1	12	.01	4	.1	6
MI-196	.01	4	.1	13	.1	4	.01	16
CO-5.3	-	-	-	-	-	-	-	-
CO-0.5	.01	7	.1	5	.1	5	.1	9
MI-133	.01	7	.01	20	.1	5	.1	17
BE-100	.1	12	.1	19	.1	12	.1	16
EBE-18	.1	12	.1	19	.01	4	.1	17
BE-84	-	-	-	-	-	-	-	-
CEC-2	.1	6	.1	10	.2	11	.1	11
BE-63	.1	13	.01	20	.01	4	.1	16
WA-6	.1	12	.1	11	.1	5	.1	16
BE-0	.01	14	.01	13	.01	5	.1	17
MI-97	-	-	-	-	-	-	-	-
MI-88	-	-	.01	7	.1	6	.01	3
MI-64	.01	14	.1	20	.1	5	.01	17
MI-39	-	-	-	-	-	-	-	-
MI-25	.1	7	.1	12	.01	7	.01	10
MI-17	-	-	-	-	-	-	-	-

Nitrate Nitrogen (Mg/L) 00620

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	X	#	X	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	0.3	5	-	-	0.2	12	0.4	12
PT-10	1.6	7	0.4	8	0.5	5	0.4	10
MI-288	0.7	5	-	-	0.2	6	0.3	20
LQP-0.5	0.9	13	-	-	-	-	0.7	13
CH-0.5	3.1	3	0.5	6	0.6	6	-	-
YM-0.5	1.4	13	-	-	1.3	6	1.0	20
MI-196	1.4	16	1.5	18	1.0	6	1.2	19
CO-5.3	-	-	-	-	-	-	-	-
CO-0.5	2.4	18	2.1	16	0.9	15	1.6	18
MI-133	1.6	18	1.3	19	1.9	8	1.1	22
BE-100	8.8	18	7.5	26	6.6	6	5.9	19
EBE-18	5.9	17	3.5	26	3.3	23	5.1	20
BE-84	-	-	-	-	-	-	-	-
CEC-2	4.8	13	3.5	11	2.4	16	2.7	13
BE-63	5.8	20	4.2	28	4.2	7	4.3	21
WA-6	4.8	17	3.7	23	1.7	15	1.9	18
BE-0	5.8	19	4.3	26	2.5	15	3.7	20
MI-97	-	-	-	-	-	-	-	-
MI-88	5.2	11	3.6	14	2.1	15	4.1	10
MI-64	4.0	20	3.7	19	3.1	16	2.5	22
MI-39	-	-	-	-	-	-	-	-
MI-25	1.4	7	2.3	13	2.9	12	1.5	10
MI-17	-	-	-	-	-	-	-	-

Total Phosphate (Mg/L) 00665

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	0.40	20	0.22	31	0.40	26	0.37	22
PT-10	0.44	10	0.30	13	0.19	15	0.13	10
MI-288	0.31	16	0.25	26	0.24	23	0.19	20
LQP-0.5	0.30	16	0.25	26	0.18	23	0.23	20
CH-0.5	0.36	3	0.36	6	0.25	9	-	-
YM-0.5	0.24	16	0.25	26	0.14	23	0.11	20
MI-196	0.27	16	0.32	26	0.23	23	0.18	19
CC-5.3	0.41	3	0.28	6	-	-	-	-
CO-0.5	0.27	18	0.25	25	0.19	24	0.18	18
MI-133	0.33	22	0.35	33	0.28	28	0.30	22
BE-100	0.35	18	0.27	26	0.23	23	0.21	19
EBE-18	0.27	17	0.32	26	0.35	23	0.30	20
BE-84	0.34	3	0.39	6	-	-	-	-
CEC-2	0.72	13	0.75	17	1.18	16	1.51	13
BE-63	0.43	24	0.35	34	0.40	27	0.37	21
WA-6	0.30	17	0.38	23	0.29	23	0.85	19
BE-0	0.38	14	0.36	26	0.29	24	0.25	20
MI-97	-	-	-	-	-	-	-	-
MI-88	0.40	11	0.47	14	0.32	14	0.31	10
MI-64	0.35	24	0.42	33	0.31	28	0.29	22
MI-39	-	-	0.32	6	-	-	-	-
MI-25	0.34	11	0.35	20	0.29	17	0.25	11
MI-17	-	-	-	-	-	-	-	-

Total Hardness (Mg/L) 00900

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	421	16	394	24	402	20	507	19
PT-10	399	10	415	13	443	15	452	10
MI-288	429	16	407	26	415	23	543	20
LQP-0.5	514	16	570	26	547	23	685	20
CH-0.5	430	3	348	6	355	9	-	-
YM-0.5	591	16	552	26	529	23	652	20
MI-196	425	16	431	26	448	23	575	19
CO-5.3	-	-	-	-	-	-	-	-
CO-0.5	514	18	452	25	419	24	578	18
MI-133	432	17	435	25	439	24	565	20
BE-100	383	18	381	26	382	23	446	19
EBE-18	328	17	289	25	333	22	428	20
BE-84	-	-	-	-	-	-	-	-
CEC-2	335	13	366	17	446	16	449	13
BE-63	363	17	342	26	388	23	455	19
WA-6	407	17	376	23	369	23	455	19
BE-0	350	19	317	26	329	23	416	20
MI-97	-	-	-	-	-	-	-	-
MI-88	378	10	362	14	378	15	480	10
MI-64	373	19	365	26	366	23	487	20
MI-39	-	-	-	-	-	-	-	-
MI-25	371	7	358	13	353	12	496	10
MI-17	-	-	-	-	-	-	-	-

Calcium (Mg/L) 00910

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	221	10	200	11	205	14	282	9
PT-10	194	10	184	13	224	15	215	10
MI-288	211	10	198	14	196	17	251	10
LQP-0.5	261	10	272	14	265	17	326	10
CH-0.5	227	3	183	6	158	9	-	-
YM-0.5	304	10	284	14	207	16	304	10
MI-196	204	10	222	14	209	17	291	10
CO-5.3	-	-	-	-	-	-	-	-
CO-0.5	291	11	233	14	208	17	325	4
MI-133	220	8	238	13	219	17	266	10
BE-100	250	11	229	13	212	17	291	10
EBE-18	225	11	196	12	192	17	280	7
BE-84	-	-	-	-	-	-	-	-
CEC-2	258	6	207	6	295	11	-	-
BE-63	248	10	211	14	228	17	308	10
WA-6	240	11	205	14	212	17	293	10
BE-0	217	11	180	14	191	17	246	10
MI-97	-	-	-	-	-	-	-	-
MI-88	225	11	218	10	204	15	268	10
MI-64	251	11	204	13	205	17	274	10
MI-39	-	-	-	-	-	-	-	-
MI-25	-	-	-	-	-	-	-	-
MI-17	-	-	-	-	-	-	-	-

Magnesium (Mg/L) 00920

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	X	#	$\bar{X}$	#
BS-L	-	-	-	-	-	-	-	-
PT-10	-	-	-	-	-	-	-	-
MI-288	-	-	-	-	213	3	-	-
LQP-0.5	-	-	-	-	313	3	-	-
CH-0.5	-	-	-	-	-	-	-	-
YM-0.5	-	-	-	-	-	-	-	-
MI-196	-	-	-	-	230	3	-	-
CO-5.3	-	-	-	-	-	-	-	-
CO-0.5	-	-	-	-	183	3	-	-
MI-133	-	-	-	-	207	3	-	-
BE-100	-	-	-	-	205	4	-	-
EBE-18	-	-	-	-	155	4	-	-
BE-84	-	-	-	-	-	-	-	-
CEC-2	-	-	-	-	150	4	-	-
BE-63	-	-	-	-	127	4	-	-
WA-6	-	-	-	-	153	3	-	-
BE-0	-	-	-	-	127	3	-	-
MI-97	-	-	-	-	-	-	-	-
MI-88	-	-	-	-	-	-	-	-
MI-64	-	-	-	-	197	3	-	-
MI-39	-	-	-	-	-	-	-	-
MI-25	-	-	-	-	-	-	-	-
MI-17	-	-	-	-	-	-	-	-

Sodium (Mg/L) 00930

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	-	-	-	-	-	-	-	-
PT-10	41.3	9	39.0	11	43.7	14	66.0	9
MI-288	23.9	9	22.7	13	32.5	14	31.6	10
LQP-0.5	25.7	6	25.8	13	27.6	17	39.4	10
CH-0.5	44.5	6	39.2	13	49.6	17	75.9	10
YM-0.5	-	-	15.7	3	25.9	9	-	-
MI-196	41.0	6	38.5	13	45.3	17	49.3	10
CO-5.3	25.8	10	24.9	13	30.3	18	42.9	10
CO-0.5	-	-	-	-	-	-	-	-
MI-133	25.3	11	30.4	13	33.4	18	37.7	4
BE-100	24.4	8	27.0	12	34.1	18	37.6	10
EBE-18	16.9	11	21.5	12	41.1	18	29.9	10
BE-84	12.3	11	12.1	13	29.2	18	17.2	10
CEC-2	-	-	-	-	-	-	-	-
BE-63	19.0	3	48.0	3	66.2	11	-	-
WA-6	18.5	10	25.2	13	46.7	18	34.6	10
BE-0	18.9	11	21.0	13	33.9	17	30.3	10
MI-97	14.5	10	17.1	13	34.3	18	29.9	10
MI-88	-	-	-	-	-	-	-	-
MI-64	23.2	11	21.1	13	30.6	15	37.6	10
MI-39	22.3	11	21.9	12	31.1	18	35.7	10
MI-25	-	-	-	-	-	-	-	-
MI-17	-	-	-	-	36.0	3	-	-

Potassium (Mg/L) 00935

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	-	-	-	-	-	-	-	-
PT-10	10.9	9	10.8	11	12.6	14	11.1	9
MI-288	8.3	9	8.0	13	8.8	14	7.7	10
LQP-0.5	8.8	6	8.3	13	9.6	17	9.0	10
CH-0.5	9.5	6	7.8	13	9.7	17	10.6	10
YM-0.5	-	-	10.0	3	9.5	6	-	-
MI-196	13.6	6	8.6	13	8.7	16	10.0	10
CO-5.3	10.9	10	8.5	13	6.4	17	8.8	10
CO-0.5	-	-	-	-	-	-	-	-
MI-133	9.3	11	5.2	13	5.6	17	16.8	4
BE-100	9.3	8	6.3	12	6.5	17	10.1	10
EBE-18	3.9	10	3.8	11	5.6	17	4.6	10
BE-84	2.8	10	3.7	12	5.0	16	3.7	10
CEC-2	-	-	-	-	-	-	-	-
BE-63	8.3	3	7.0	3	15.0	11	-	-
WA-6	5.1	10	4.4	13	5.4	18	4.9	10
BE-0	6.0	11	4.5	13	5.3	17	6.0	10
MI-97	4.1	10	4.1	13	5.3	18	4.7	10
MI-88	-	-	-	-	-	-	-	-
MI-64	7.5	11	6.0	13	5.9	14	6.5	10
MI-39	7.5	11	5.8	12	5.6	17	7.0	10
MI-25	-	-	-	-	-	-	-	-
MI-17	-	-	-	-	4.0	3	-	-

Chloride (Mg/L) 00940

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#
BS-L	–	–	–	–	–	–	–	–
PT-10	19	21	14	31	20	25	24	21
MI-288	14	10	8	13	25	15	13	10
LQP-0.5	12	16	11	26	12	23	17	20
CH-0.5	15	16	15	26	27	23	38	20
YM-0.5	14	3	10	6	12	6	–	–
MI-196	12	16	11	26	13	23	18	20
CO-5.3	15	16	15	26	19	23	26	19
CO-0.5	13	6	7	4	–	–	–	–
MI-133	18	18	17	25	25	24	35	18
BE-100	14	23	14	32	21	27	25	21
EBE-18	25	18	23	26	28	23	31	19
BE-84	28	16	21	26	27	23	32	20
CEC-2	14	3	15	4	–	–	–	–
BE-63	30	12	40	17	73	16	54	13
WA-6	23	24	25	33	35	26	33	20
BE-0	23	17	23	23	29	23	29	19
MI-97	22	19	21	26	26	23	27	20
MI-88	–	–	–	–	–	–	–	–
MI-64	21	11	31	13	28	15	34	10
MI-39	19	25	17	32	24	27	30	21
MI-25	–	–	15	10	–	–	–	–
MI-17	15	13	18	23	24	18	29	11

Sulfate (Mg/L) 00945

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#
BS-L	–	–	–	–	–	–	–	–
PT-10	327	3	–	–	331	8	–	–
MI-288	–	–	183	3	220	11	223	3
LQP-0.5	260	3	233	3	227	13	273	3
CH-0.5	330	3	393	3	302	13	514	3
YM-0.5	–	–	–	–	119	3	–	–
MI-196	333	3	300	3	211	10	410	3
CO-5.3	253	3	227	3	209	13	340	3
CO-0.5	–	–	–	–	–	–	–	–
MI-133	240	3	257	6	196	13	287	3
BE-100	257	3	214	6	211	13	292	3
EBE-18	101	3	157	3	144	12	158	3
BE-84	38	3	48	3	61	12	67	3
CEC-2	–	–	–	–	–	–	–	–
BE-63	–	–	–	–	179	5	–	–
WA-6	102	3	136	3	180	13	173	3
BE-0	–	–	127	3	149	13	230	3
MI-97	82	3	83	3	111	13	155	3
MI-88	–	–	–	–	–	–	–	–
MI-64	–	–	123	6	147	11	190	3
MI-39	127	3	133	6	142	13	170	3
MI-25	–	–	–	–	–	–	–	–
MI-17	–	–	–	–	–	–	–	–

Flouride (Mg/L) 00950

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	-	-	-	-	-	-	-	-
PT-10	.19	10	.27	10	.21	13	.25	9
MI-288	.23	10	.28	12	.18	14	.22	10
LQP-0.5	.19	10	.31	12	.20	16	.27	10
CH-0.5	.29	10	.41	11	.31	16	.35	10
YM-0.5	.23	3	-	-	.20	6	-	-
MI-196	.27	10	.38	12	.24	16	.25	10
CO-5.3	.28	10	.30	12	.25	17	.27	10
CO-0.5	-	-	-	-	-	-	-	-
MI-133	.37	11	.44	12	.28	17	.31	4
BE-100	.31	8	.32	12	.25	17	.27	10
EBE-18	.41	11	.46	12	.33	16	.35	10
BE-84	.41	11	.35	12	.31	16	.33	10
CEC-2	-	-	-	-	-	-	-	-
BE-63	.55	6	-	-	.71	11	-	-
WA-6	.43	11	.42	12	.37	17	.38	10
BE-0	.35	11	.41	12	.32	17	.35	10
MI-97	.35	11	.43	12	.29	17	.33	10
MI-88	-	-	-	-	-	-	-	-
MI-64	.30	11	.32	12	.27	15	.33	10
MI-39	.33	11	.31	11	.26	17	.34	10
MI-25	-	-	-	-	-	-	-	-
MI-17	-	-	-	-	-	-	-	-

Silica (Mg/L) 00955

	Spring		Summer		Fall		Winter	
	March - May		June - Aug.		Sept. - Nov.		Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	-	-	-	-	-	-	-	-
PT-10	-	-	-	-	13.3	3	-	-
MI-288	-	-	-	-	-	-	-	-
LQP-0.5	-	-	-	-	21.3	3	-	-
CH-0.5	-	-	-	-	20.0	3	-	-
YM-0.5	-	-	-	-	-	-	-	-
MI-196	-	-	-	-	-	-	-	-
CO-5.3	-	-	-	-	16.0	3	-	-
CO-0.5	-	-	-	-	-	-	-	-
MI-133	-	-	-	-	13.5	3	-	-
BE-100	-	-	-	-	12.3	3	-	-
EBE-18	-	-	-	-	21.0	4	-	-
BE-84	-	-	-	-	19.0	4	-	-
CEC-2	-	-	-	-	-	-	-	-
BE-63	-	-	-	-	10.0	4	-	-
WA-6	-	-	-	-	15.0	4	-	-
BE-0	-	-	-	-	11.4	4	-	-
MI-97	-	-	-	-	10.9	3	-	-
MI-88	-	-	-	-	-	-	-	-
MI-64	-	-	-	-	-	-	-	-
MI-39	-	-	-	-	12.8	3	-	-
MI-25	-	-	-	-	-	-	-	-
MI-17	-	-	-	-	-	-	-	-

Boron (Ug/L) 01022

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#
BS-L	–	–	–	–	–	–	–	–
PT-10	–	–	–	–	150	3	–	–
MI-288	–	–	–	–	–	–	–	–
LQP-0.5	–	–	–	–	130	3	–	–
CH-0.5	–	–	–	–	133	3	–	–
YM-0.5	–	–	–	–	–	–	–	–
MI-196	–	–	–	–	–	–	–	–
CO-0.3	–	–	–	–	85	3	–	–
CO-0.5	–	–	–	–	–	–	–	–
MI-133	–	–	–	–	83	3	–	–
BE-100	–	–	–	–	87	3	–	–
EBE-18	–	–	–	–	6	4	–	–
BE-84	–	–	–	–	53	4	–	–
CEC-2	–	–	–	–	–	–	–	–
BE-63	–	–	–	–	150	4	–	–
WA-6	–	–	–	–	81	4	–	–
BE-0	–	–	–	–	57	3	–	–
MI-97	–	–	–	–	77	3	–	–
MI-88	–	–	–	–	–	–	–	–
MI-64	–	–	–	–	–	–	–	–
MI-39	–	–	–	–	187	3	–	–
MI-25	–	–	–	–	–	–	–	–
MI-17	–	–	–	–	–	–	–	–

Iron (Ug/L) 01045

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#	$\overline{X}$	#
BS-L	–	–	–	–	–	–	–	–
PT-10	–	–	–	–	–	–	–	–
MI-288	1.61	10	2.20	12	.94	14	.50	10
LQP-0.5	.68	16	1.18	22	.85	20	.19	18
CH-0.5	1.74	16	2.14	21	.53	20	.19	19
YM-0.5	1.50	3	–	–	1.35	6	–	–
MI-196	1.21	16	2.44	21	.76	20	.21	20
CO-0.3	1.90	16	3.39	21	.84	20	.34	19
CO-0.5	–	–	–	–	–	–	–	–
MI-133	1.69	18	4.89	20	.83	21	.31	18
BE-100	2.29	17	2.99	21	1.07	21	.26	20
EBE-18	2.07	18	3.08	21	1.33	21	.26	18
BE-84	.92	17	2.38	21	1.09	20	.79	19
CEC-2	–	–	–	–	–	–	–	–
BE-63	2.55	13	3.26	14	.55	13	.29	13
WA-6	2.72	18	3.21	20	.89	20	.27	19
BE-0	1.93	17	2.37	19	.59	21	.31	19
MI-97	2.45	19	3.46	21	1.20	21	.33	20
MI-88	–	–	–	–	–	–	–	–
MI-64	2.45	11	3.36	11	1.44	14	.23	10
MI-39	3.09	19	3.36	19	1.39	20	.94	20
MI-25	–	–	–	–	–	–	–	–
MI-17	1.96	7	3.35	8	1.94	10	.41	10

Manganese (Ug/L) 01055

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	-	-	-	-	-	-	-	-
PT-10	.21	15	.18	19	.11	11	.11	19
MI-288	.14	10	.15	12	.16	14	.19	10
LQP-0.5	.20	16	.11	21	.10	20	.10	19
CH-0.5	.25	15	.19	21	.18	20	.16	19
YM-0.5	-	-	-	-	.16	6	-	-
MI-196	.16	15	.26	21	.15	13	.10	20
CO-5.3	.18	15	.21	21	.15	20	.10	19
CO-0.5	-	-	-	-	-	-	-	-
MI-133	.19	17	.17	20	.17	14	.11	18
BE-100	.27	16	.17	21	.18	21	.15	20
EBE-18	.17	18	.15	21	.15	21	.15	12
BE-84	.10	17	.14	21	.14	21	.30	19
CEC-2	-	-	-	-	-	-	-	-
BE-63	.20	13	.14	14	.23	13	.34	13
WA-6	.20	18	.18	20	.13	13	.15	19
BE-0	.22	17	.13	19	.10	13	.16	19
MI-97	.19	18	.14	21	.12	14	.17	20
MI-88	-	-	-	-	-	-	-	-
MI-64	.17	11	.21	11	.21	14	.14	10
MI-39	.22	18	.19	19	.17	20	.19	20
MI-25	-	-	-	-	-	-	-	-
MI-17	.61	6	.16	8	.13	10	.19	10

Zinc (Ug/L) 01092

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	-	-	-	-	-	-	-	-
PT-10	.07	16	-	-	.03	11	.03	13
MI-288	.05	10	.04	9	.01	5	.07	10
LQP-0.5	.04	16	.03	8	.02	7	.04	6
CH-0.5	.04	11	-	-	.02	7	.01	12
YM-0.5	.02	3	.08	6	.03	9	-	-
MI-196	.05	11	-	-	-	-	-	-
CO-5.3	.08	16	.04	17	.02	6	.02	6
CO-0.5	-	-	-	-	-	-	-	-
MI-133	.06	18	.05	15	.02	7	-	-
BE-100	.03	17	.04	17	.03	14	.02	20
EBE-18	.04	18	.05	8	.03	6	-	-
BE-84	.02	17	.07	8	.03	13	.05	12
CEC-2	-	-	-	-	-	-	-	-
BE-63	.07	13	.07	16	.03	9	.02	13
WA-6	.07	18	-	-	.02	6	.02	7
BE-0	.07	17	.03	6	.03	14	.22	13
MI-97	.05	19	.04	16	.02	7	.03	7
MI-88	-	-	-	-	-	-	-	-
MI-64	.33	11	.04	13	.02	10	.02	10
MI-39	.04	19	.05	7	.02	13	.03	13
MI-25	-	-	-	-	-	-	-	-
MI-17	.06	7	.04	12	.02	10	.02	10

Beta Total (PC/L) 03501

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	X̄	#	X̄	#	X̄	#	X̄	#
BS-L	-	-	-	-	-	-	-	-
PT-10	-	-	-	-	25.0	4	-	-
MI-288	-	-	-	-	-	-	-	-
LQP-0.5	-	-	-	-	22.0	4	-	-
CH-0.5	-	-	-	-	17.0	4	-	-
YM-0.5	-	-	-	-	-	-	-	-
MI-196	-	-	-	-	15.0	4	-	-
CO-5.3	-	-	-	-	19.0	4	-	-
CO-0.5	-	-	-	-	-	-	-	-
MI-133	-	-	-	-	13.0	3	-	-
BE-100	15.9	7	19.9	14	16.2	12	14.5	10
EBE-18	-	-	-	-	13.0	4	-	-
BE-84	-	-	-	-	13.0	4	-	-
CEC-2	-	-	-	-	-	-	-	-
BE-63	-	-	-	-	15.0	4	-	-
WA-6	-	-	-	-	13.0	4	-	-
BE-0	-	-	-	-	11.0	3	-	-
MI-97	-	-	-	-	13.0	3	-	-
MI-88	-	-	-	-	-	-	-	-
MI-64	-	-	-	-	-	-	-	-
MI-39	-	-	-	-	16.0	3	-	-
MI-25	-	-	-	-	-	-	-	-
MI-17	-	-	-	-	-	-	-	-

Total Coliform (MPN Conf/100 ML) 31505

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	X̄	#	X̄	#	X̄	#	X̄	#
BS-L	-	-	-	-	120000	3	[illegible]	3
PT-10	3059	22	280100	31	40200	31	[illegible]	15
MI-288	85508	10	31165	13	22559	15	251300	10
LQP-0.5	298	5	316	26	253	6	-	-
CH-0.5	8087	13	14138	26	1128	24	9113	19
YM-0.5	27820	3	4500	6	11469	9	-	-
MI-196	170600	13	7538	26	1459	23	1328	19
CO-5.3	4345	15	3109	26	4123	23	1525	19
CO-0.5	16991	12	34726	13	7463	6	-	-
MI-133	5408	18	14677	26	10131	24	[illegible]	18
BE-100	11549	27	40119	37	73607	29	[illegible]	25
EBE-18	15023	17	20697	25	10093	24	[illegible]	19
BE-84	58937	17	17794	26	11479	23	[illegible]	18
CEC-2	55791	11	457600	13	13033	6	[illegible]	3
BE-63	22250	13	4963	17	6965	16	[illegible]	13
WA-6	10762	30	72018	38	21675	30	[illegible]	25
BE-0	6535	17	11253	23	10180	23	[illegible]	19
MI-97	23971	18	137900	26	37730	24	[illegible]	17
MI-88	23300	3	-	-	210000	3	[illegible]	3
MI-64	12035	11	3268	10	9996	15	[illegible]	10
MI-39	7040	30	19610	37	24426	32	11925	26
MI-25	9333	3	16377	11	10600	6	-	-
MI-17	-	-	-	-	-	-	-	-

Fecal Coliform (MPN, EC Medium/100 ML) 31615

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	-	-	-	-	-	-	-	-
PT-10	234	9	-	-	-	-	-	-
MI-288	33625	10	1868	13	749	15	80059	6
LQP-0.5	-	-	-	-	-	-	-	-
CH-0.5	841	16	2018	26	287	8	541	7
YM-0.5	3080	3	1343	6	3749	9	-	-
MI-196	1182	13	1226	20	1162	26	237	13
CO-5.3	370	15	1152	26	1714	23	352	19
CO-0.5	-	-	4067	3	-	-	-	-
MI-133	426	18	5461	26	1961	24	857	18
BE-100	4116	19	10103	32	19813	25	15495	20
EBE-18	3029	18	5205	26	2414	24	4508	19
BE-84	2431	17	5819	26	2669	22	1713	20
CEC-2	-	-	110000	3	-	-	-	-
BE-63	1569	13	975	17	1898	16	2050	13
WA-6	940	20	5930	32	2044	24	1617	19
BE-0	1594	17	2458	22	4145	15	1886	12
MI-97	1659	19	29555	26	19904	15	5790	13
MI-88	-	-	-	-	-	-	-	-
MI-64	769	11	564	14	1255	15	9226	10
MI-39	778	20	1770	21	936	17	1498	20
MI-25	-	-	-	-	-	-	-	-
MI-17	11740	25	18006	38	20286	34	135200	17

Fecal Streptococcal Group
(Membrane Filter, M-Enterococcus medium/100 ML) 31679

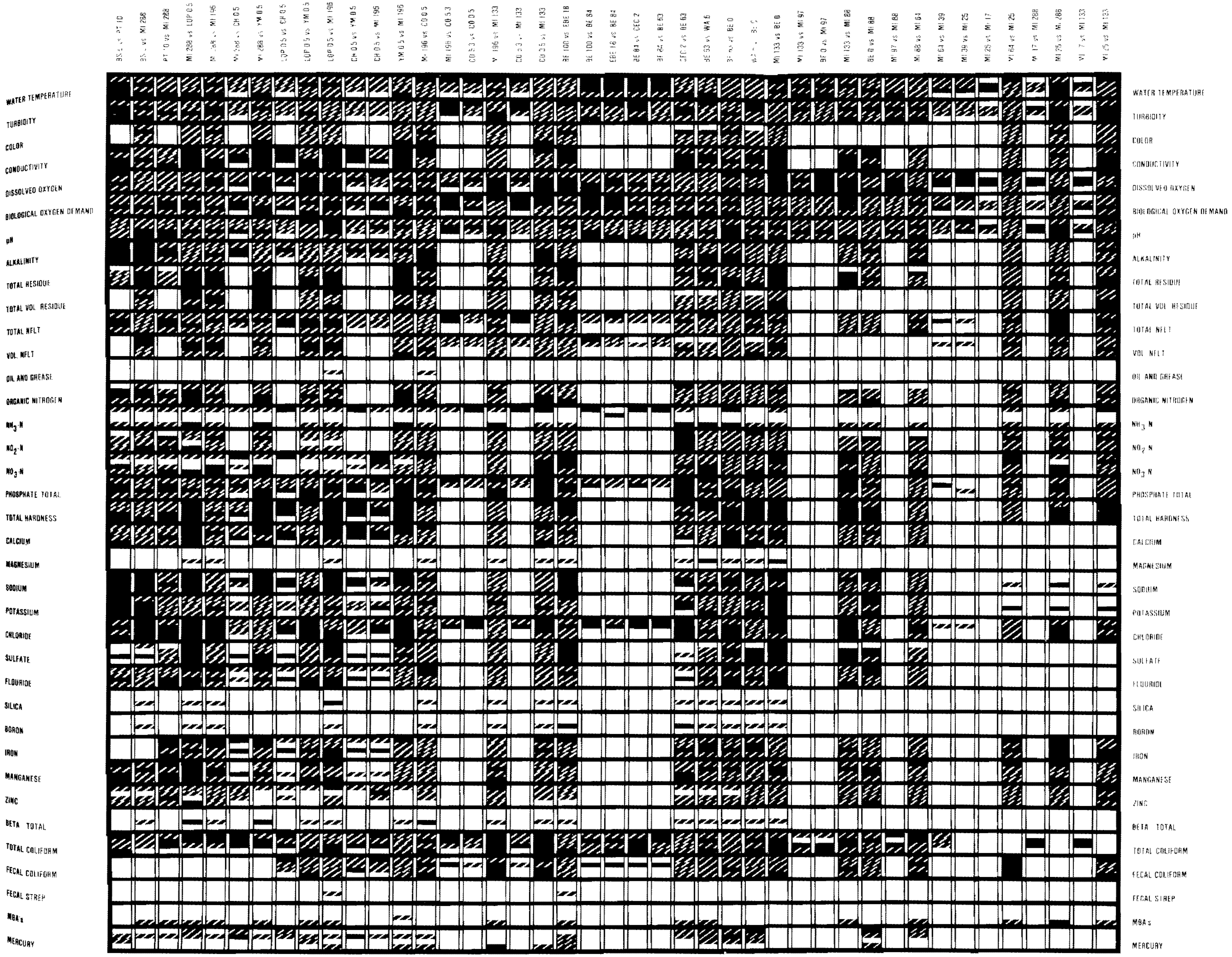
	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	-	-	-	-	-	-	-	-
PT-10	-	-	-	-	-	-	-	-
MI-288	-	-	-	-	-	-	-	-
LQF-0.5	-	-	-	-	-	-	-	-
CH-0.5	-	-	-	-	78	3	-	-
YM-0.5	-	-	-	-	-	-	-	-
MI-196	-	-	-	-	-	-	-	-
CO-5.3	-	-	-	-	110	3	-	-
CO-0.5	-	-	-	-	-	-	-	-
MI-133	-	-	-	-	-	-	-	-
BE-100	-	-	-	-	-	-	-	-
EBE-18	-	-	-	-	1827	4	-	-
BE-84	-	-	-	-	3753	3	-	-
CEC-2	-	-	-	-	-	-	-	-
BE-63	-	-	-	-	-	-	-	-
WA-6	-	-	-	-	-	-	-	-
BE-0	-	-	-	-	-	-	-	-
MI-97	-	-	-	-	-	-	-	-
MI-88	-	-	-	-	-	-	-	-
MI-64	-	-	-	-	-	-	-	-
MI-39	-	-	-	-	-	-	-	-
MI-25	-	-	-	-	-	-	-	-
MI-17	-	-	-	-	-	-	-	-

Methylene Blue Active Substances, surfactants (Mg/L) 38260

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-1	-	-	-	-	-	-	-	-
PT-10	-	-	.31	12	.20	3	.20	3
MI-288	-	-	.31	10	.26	7	-	-
LQP-0.5	.40	3	.20	3	-	-	-	-
CH-0.5	.30	3	.30	3	-	-	.40	3
YM-0.5	.30	3	.40	3	-	-	-	-
MI-196	-	-	.20	4	-	-	.60	3
CO-5.3	-	-	.40	4	-	-	.20	3
CO-0.5	-	-	-	-	-	-	-	-
MI-133	.24	7	.29	13	-	-	.35	6
BE-100	-	-	-	-	-	-	.50	6
EBE-18	1.00	8	.96	17	.20	4	.60	4
BE-84	.45	6	.30	10	.20	3	-	-
CEC-2	-	-	-	-	-	-	-	-
BE-63	.30	3	.32	11	-	-	.45	6
WA-6	.40	8	.20	4	.20	3	-	-
BE-0	.20	4	.40	8	.30	4	.20	3
MI-97	.70	4	.50	6	.20	5	-	-
MI-88	-	-	-	-	-	-	-	-
MI-64	.25	6	.30	6	.26	10	-	-
MI-39	.30	4	.30	4	-	-	.57	7
MI-25	-	-	-	-	-	-	-	-
MI-17	-	-	-	-	-	-	-	-

Mercury (Ug/L) 71900

	Spring March - May		Summer June - Aug.		Fall Sept. - Nov.		Winter Dec. - Feb.	
	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#	$\bar{X}$	#
BS-L	-	-	-	-	-	-	-	-
PT-10	-	-	-	-	-	-	.24	5
MI-288	-	-	-	-	-	-	.24	3
LQP-0.5	-	-	-	-	-	-	.21	11
CH-0.5	-	-	-	-	-	-	.24	11
YM-0.5	-	-	-	-	-	-	-	-
MI-196	-	-	-	-	-	-	.23	5
CO-5.3	-	-	-	-	-	-	.25	16
CO-0.5	-	-	-	-	-	-	-	-
MI-133	-	-	-	-	-	-	-	-
BE-100	-	-	-	-	-	-	.31	11
EBE-18	-	-	-	-	-	-	.60	16
BE-84	.43	4	-	-	-	-	.65	11
CEC-2	-	-	-	-	-	-	-	-
BE-63	.30	4	-	-	.25	4	.40	13
WA-6	-	-	-	-	-	-	.37	12
BE-0	.40	9	-	-	-	-	.37	10
MI-97	-	-	-	-	-	-	-	-
MI-88	-	-	-	-	-	-	-	-
MI-64	-	-	-	-	-	-	.26	3
MI-39	-	-	-	-	-	-	.37	11
MI-25	-	-	-	-	-	-	-	-
MI-17	.30	4	-	-	-	-	.34	7



Survey of water quality for select MPCA station pairs, by season, of the Minnesota River Watershed (based on 80% significance of T-tests)

by

Teresa Feind
Duane Braaten
Henry Quade

September, 1980
Department of Biology
Mankato State University

KEY

- — insufficient data
- ▬▬ (hatched) — data present, but not a significant difference at .20 level
- ▬▬ (solid) — significant at the .20 level—80% sure the two means are different

Row 1 Spring
Row 2 Summer
Row 3 Fall
Row 4 Winter