Mississippi River Phosphorus Study

Section 2

Quality Assurance / Quality Control Report

Study Cooperators

Metropolitan Waste Control Commission
Minnesota Pollution Control Agency
U.S. Corps of Engineers
Wisconsin Department of Natural Resources

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INTRODUCTION

In 1991, a river phosphorus study was undertaken by the Metropolitan Waste Control Commission (MWCC), Minnesota Pollution Control Agency (MPCA) and the Wisconsin Department of Natural Resources (WDNR) to evaluate the impact of phosphorus loads to Spring Lake (Pool 2) and Lake Pepin (Pool 4) in the Upper Mississippi River. Additional assistance in these studies was provided by the Minnesota Department of Natural Resources (MDNR), the US Corps of Engineers (USCOE) and the Minnesota-Wisconsin Boundary Area Commission.

Historically, MWCC, MPCA and WDNR have conducted concurrent water quality monitoring programs on similar sections of the Mississippi River for about 15 years. Although the agencies have frequently shared water quality information through monitoring reports or utilized joint data bases (ie. MPCA and WDNR via USEPA's STORET system), there has not been a concerted effort to compare laboratory results. The river phosphorus study provided an opportunity for the study cooperators to directly evaluate laboratory results through a split sampling program during the two-year study period.

The river study cooperators felt a laboratory comparison was important because of the joint monitoring program required to conduct this study by participating agencies. The primary reason for this effort was to determine if laboratory results were comparable and to assess the relative variability between laboratories during the study period. This comparison may also provide some insight to the evaluation of historical data compiled by participating agencies. Further, the results of this initial quality assurance effort may provide an incentive to reassess specific laboratory methods or conduct more detailed quality assurance/quality control procedures where warranted.

This report is intended as an addendum to the Mississippi River Phosphorus Study Plan (Section 2 of the River Phosphorus Study) prepared by MPCA (1992). The study plan provided a brief summary of the split sample results. The purpose of the this report is to provide more detailed information on this quality assurance effort and to provide recommendations for future joint monitoring programs on the river.

METHODS

Sixteen surface water samples were collected by MWCC from the Mississippi River at Lock and Dam 3 between June 1992 and August 1992 for a split sampling program. Water samples were placed in a large volume plastic carboy prior to splitting. Sufficient water was collected in order to split the sample with 3 to 4 participating laboratories. Each laboratory provided the

appropriate bottles for the analyses of interest. The composite sample was mixed prior to distributing the sample to all laboratory bottles. MWCC mailed or delivered the samples to the appropriate laboratory on days when participating agency staff could not be present during sample splits. Shipping of samples had to follow proper procedures to ensure samples were received refrigerated and within the proper holding time (normally less than 24 hrs).

The primary laboratories involved in the program included: MWCC's Metro Plant Laboratory, the Minnesota Department of Health (MDH) Chemical Laboratory in St. Paul (for MPCA), and the Wisconsin State Laboratory of Hygiene (WSLOH) in Madison (for WDNR). In 1992, the US Corps of Engineers (USCOE) laboratory at Eau Galle, Wisconsin also participated, but their analyses did not include all of the desired water quality parameters. The USCOE lab is providing analytical services for the federal Long Term Resource Monitoring Program on the Mississippi River.

The primary parameter list of interest included: total P, dissolved ortho-P, total Kjeldahl nitrogen (TKN), ammonia-N, nitrite + nitrate-N, total suspended solids, corrected chlorophyll a, and chloride. In addition, the laboratories provided analysis of total ortho-P and total chlorophyll a, but these analyses were only done by two of the participating labs. References for the test methods utilized by each lab are provided in Table 1. A more complete description with precision and accuracy estimates is provided in Appendices 1-3.

Some of the measured water quality parameters were combined to yield additional water quality variables of interest. These included: inorganic N (ammonia-N + nitrite + nitrate-N), total N (TKN + nitrite + nitrate-N), organic nitrogen (TKN - ammonia-N) and particulate P (total P - dissolved ortho-P).

Evaluation of the laboratory data was conducted by plotting concentration-time plots and regression analysis using Lotus 123. This program was also utilized to compute basic statistics. The coefficient of variation (standard deviation/mean x 100) was used to evaluate the relative precision in each set of split sample results. The use of this approach allowed a comparison to reported measurements of laboratory precision based on information provided by MDH and WSLOH (Appendices 1 & 3). Regression analysis was used to assess how well the results from the three primary laboratories compared to each other. The use of split samples does not allow a determination of accuracy, and can only be done with reference samples or sample spiking with known quantities of the analyte of interest (ie. determination of % recovery).

If a laboratory value was reported below the limit of detection, the detection limit was selected as the assumed concentration for statistical calculations and plotting.

RESULTS and DISCUSSION

A statistical summary of the split sample results for the three primary laboratories is provided in Table 2. Only those days when all three laboratories provided results for a particular parameter were included in this table. The data obtained from the USCOE laboratory was not included since they only participated in 5 of 16 split samples and did not analyze for the complete parameter list. The listing of data in Table 2 was ranked from high to low precision based on the average coefficient of variation determined from the set of split sample results for a particular parameter.

Concentration-time plots of all laboratory data are included in Figures 1a to 14a. Regression plots were prepared using MWCC's laboratory as the dependent variable and are included in Figures 1b to 14b. A listing of all laboratory data and statistical information is provided on the back of each set of plots (Tables 3 to 16).

Total Phosphorus

Total phosphorus results were generally comparable between the three primary labs. The MDH laboratory generally yielded the highest concentrations (Figure 1a). The USCOE laboratory participated in 4 sample splits in 1992 and their results were in general agreement with the other three laboratories. The average coefficient of variation on 14 split samples with the three primary labs was 9.8% (Table 2). This value is slightly above reported laboratory precision estimates of approximately 4 to 7% (MDH and WSLOH, Appendices 1 and 3). Regression analysis indicated fair correlations between the three primary laboratories with r-squared values ranging from 76 to 89% (Table 2, and Figure 1B).

Dissolved Ortho-Phosphorus

In general, the split sample results for dissolved ortho-P were fair due to a relatively high average coefficient of variation on 12 split samples (18.5%, Table 2). This value is considerably greater than the reported laboratory precision estimate of approximately 4% by the WSLOH (Appendix 3). Dissolved ortho-P results for the MDH laboratory varied substantially from the other two primary labs (Figure 2a and 2b). Regression analysis indicated a very high correlation (r-squared = 99%) between the MWCC and WSLOH. In contrast, correlations with these

laboratories and the MDH laboratory were noticeably lower (69 to 71% r-squared).

Total Ortho-Phosphorus

Total ortho-P was only measured by MDH and MWCC. This method is very similar to dissolved ortho-P with the exception that the samples are not filtered prior to analysis. In general, total ortho-P results were very similar with the exception of 3 days when substantial differences were noted (Figure 3a and 3b). The average coefficient of variation between the two participating labs was 14.1% based on 13 split samples (Table 2). However, regression analysis indicated a lack of a significant correlation (P = 95%) between the two labs.

Particulate Phosphorus

Particulate phosphorus was an estimated value determined by subtracting dissolved ortho-P from total P. This may yield a high estimate of particulate P since total dissolved P was not measured. The split sample results for particulate P is dependent upon the two measured forms. Since the split sample results for total P and dissolved ortho-P were fair, the laboratory comparisons for particulate P were not expected to be any better. This was born out by a substantial variation in the results (Figure 4a). The average coefficient of variation on 12 split samples was 21% (Table 2). Regression analysis yielded r-squared values ranging from 38 to 80% with the highest correlation between MWCC and WSLOH (Table 2 and Figure 4b).

Total Kjeldahl Nitrogen

Total Kjeldahl nitrogen (TKN) results for the MDH laboratory were usually noticeably greater than the other two primary labs (Figure 5a and 5b). However, one value in 1991 was substantially lower. The average coefficient of variation on 13 split samples was 15% (Table 2). The reported laboratory precision estimates for this form of nitrogen ranged from 7 to 20% (MDH and WSLOH, Appendices 1 and 3). Regression analysis between MWCC and WSLOH was fair and yielded an r-squared value of 82%. Correlations with MDH were not statistically significant and were likely influenced by the single low value reported by MDH in 1991.

Ammonia Nitrogen

Ammonia-N levels were generally found at relatively low concentrations and at times were near or below the limit of detection (approximately 0.02 mg/l, Figure 6a and Table 8). The average coefficient of variation on 14 split samples with the primary labs was 25.4% (Table 2). Reported laboratory precision estimates for ammonia-N are about 4% (MDH and WSLOH, Appendices 1 and 3). It is likely that the poor precision measurement on

split samples was due to relatively low concentrations found during the study period (ie. a small change at low concentrations can result in a large percent difference). The ammonia-N levels between the three primary labs were generally similar (Figure 6a). Regression analysis indicated fair to good correlations between the three primary labs (83-94% r-squared). However, the correlations were likely influenced by a clustering of data at low and moderately high concentrations (Figure 6b).

The USCOE participated in the analysis of 5 split samples for ammonia-N in 1992. Their results were noticeably higher than the primary labs on 4 occasions. This was particular noted on the last sample split in 1992 when USCOE lab reported a relatively high ammonia-N level of 0.71 mg/l (Table 8).

Nitrite + Nitrate - Nitrogen

Nitrite + Nitrate-N split sample results were very comparable (Figure 7a and 7b). The average coefficient of variation on 14 split samples was 5.3% (Table 2). Reported laboratory precision estimates for this parameter by MDH and WSLOH are approximately 1% (Appendices 1 and 3). Regression analysis indicated the results from the three laboratories were highly correlated (r-squared > 95%). The high correlation was partially due to the large range in nitrite + nitrate-N concentrations encountered during the two year period (1-6 mg/l).

Inorganic Nitrogen

This was an estimated value determined by combining the measurements for ammonia-N and nitrite + nitrate-N. Inorganic nitrogen split sample results were very comparable (Figure 8a and 8b) and yielded an average coefficient of variation of 5.1% (Table 2). Since nitrite + nitrate-N was present at substantially higher concentrations than ammonia-N, the inorganic N split sample data was mainly dependent upon the former type of nitrogen.

Organic Nitrogen

Organic N was an estimated value by subtracting ammonia-N from TKN. Organic nitrogen data is largely influenced by TKN since ammonia-N levels were present at low concentrations. As a result, the split samples results for organic N are essentially similar to the previous discussion for TKN. The average coefficient of variation on 14 split samples for organic N was 16.4% (Table 2). Regression analysis between MWCC and WSLOH yielded an r-squared value of 86%. Correlations with MDH were not significant, but this was likely due to a single low TKN value reported by MDH in 1991 (Figure 9a and 9b).

Total Nitrogen

Total nitrogen was an estimated value based on combining data for TKN and nitrite + nitrate-N. The interpretation of the split sample results for total N was largely influenced by nitrite + nitrate-N since it normally accounted for the majority of the nitrogen in the samples. Total N levels between the three primary labs were normally similar (Figure 10a and 10b). The average coefficient of variation on split 13 samples was 5.7% (Table 2). Regression analysis indicated fair to good correlations (81-93% r-squared) between labs. MDH's data for TKN were noticeably different than MWCC and WSLOH which likely lowered the correlations in comparison to those calculated for nitrite + nitrate-N.

Total Chlorophyll a

Total chlorophyll a was only measured by two primary labs (MWWC and WSLOH). The average coefficient of variation between these two labs was 15.9% based on 13 split samples (Table 2). The WSLOH reported an average laboratory precision estimate of approximately 10-15% for typical chlorophyll a concentrations found in the split samples (Appendix 3). Regression analysis indicated a poor correlation between the two labs (57% r-squared, Table 2 and Figure 11b). Both labs report the use of different analytical methods, including trichromatic equations and pigment extraction techniques (ie. WSLOH used sonification and MWCC used tissue grinding). This may account for some of the observed differences in lab results.

Corrected Chlorophyll a

Corrected Chlorophyll a is a measure of the viable chlorophyll pigments and does not include pheophytin a. All 3 primary labs and the USCOE lab provided data for this parameter. The USCOE lab only analyzed 4 split samples in 1992. The average coefficient of variation on 12 split samples with the primary labs was 42%. This exceeded typical laboratory precision estimates of 30% reported by the WSLOH (Appendix 3). Regression analysis indicated poor to fair correlations between the three labs with r-squared values ranging from 53 to 77% (Table 2, and Figure 12b). The results provided by the USCOE lab in 1992 were generally consistent with data provided by the three primary labs (Figure 12a).

Corrected chlorophyll a data provided by the WSLOH were very low on several occasions in comparison to the MDH and MWCC and contributed to the poor correlations and low precision estimates. The problem was traced to an over estimation of the pheophytin a concentration by the WSLOH. Specifically, insufficient acidification of the acetone extracts resulted in incomplete conversion of viable chlorophyll to pheophytin. Unfortunately,

this problem was not resolved until very late in the split sampling program.

Total Suspended Solids

Total Suspended Solids (TSS) analysis was conducted by all three primary labs and the USCOE lab in 1992. The average coefficient of variation of 14 split samples with the primary labs was 10.7% (Table 2) which is very near reported laboratory precision estimates provided by MDH and WSLOH (5 to 10 %, Appendices 1 and 3). Regression analysis indicated a very good agreement between the primary labs with r-squared values ranging from 95 to 97% (Table 2 and Figure 13b).

Chloride

Chloride results for the three primary laboratories were the most comparable of all parameters tested based on precision estimates. The average coefficient of variation on 10 split samples was 3.5% and is very near reported laboratory precision estimates by MDH and WSLOH (2 to 3%, Appendices 1 and 3). The high precision estimate for chloride may be due to relatively stable chloride levels during the study period. This would have also contributed to lowered correlation coefficients due to the moderately low range in concentrations (16 to 26 mg/l, Table 16, and Figure 14a). Regression analysis indicated good correlations (r-squared > 90%) among the three primary labs (Table 2 and Figure 14b).

SUMMARY AND RECOMMENDATIONS

The Metropolitan Waste Control Commission (MWCC), Minnesota Department of Health Chemical Laboratory (MDH) and the Wisconsin State Laboratory of Hygiene (WSLOH) participated in a joint split sample monitoring program during 1991 and 1992. Water samples were analyzed for nutrients, suspended matter, algae pigments and chloride as part of a quality assurance program for a joint river phosphorus study. The US Corps of Engineers lab at Eau Galle, Wisconsin was an additional participant in 1992, but did not analyze the full compliment of the designated parameters.

A comparison of the lab results was accomplished by calculating the average precision (coefficient of variation) on all sets of replicate samples. Direct comparison between labs was accomplished by regression and correlation analysis.

In general, the results can be categorized into three groupings. Parameter group one include: nitrite + nitrate-N, inorganic nitrogen, and chloride. Group one parameters had high precision (CV < 6%) with strong correlations between the primary labs (r-squared > 90%). Group two parameters included: Total P, Total N and total suspended solids and were characterized as having good

precision (CV < 10%) and relatively good correlations between labs (r-squared > 80%). Group three parameters included: total ortho-P, dissolved ortho-P, particulate phosphorus, total Kjeldahl N, ammonia-N, organic-N, corrected chlorophyll a and total chlorophyll a. This latter group had either medium to low precision (15-45%, CV) or poor correlations between labs (0-80%, r-squared).

In general, data from the MDH lab yielded higher results for total P, total Kjeldahl N and organic N when compared to MWCC and WSLOH. Corrected chlorophyll a data from WSLOH were normally lower than the other two primary labs. Ammonia-N data from the USCOE were noticeably greater than the three primary labs. MWCC and the WSLOH results showed significant correlations for all parameters evaluated.

As a result of this split sampling program and follow-up investigations, WSLOH has modified their procedure for corrected chorophyll a. Similar investigations at other laboratories may be warranted for other parameters, especially where there appears to be a consistent bias or the data show considerable variation in comparison to other laboratories.

It is recommended that a future split sampling program continue at Lock and Dam 3 at reduced frequency (3-4 samples/year). This information will continue to be valuable if agencies plan to rely on each other's data for assessing water quality trends/problems or for making management decisions on border waters. It will be important to have greater participation from the federal Long Term Resource Monitoring Program (USCOE, Eau Galle Lab) in this effort because of their interest in monitoring Pool 4, including Lock and Dam 3 and Lake Pepin. Continued inter-laboratory comparisons will foster communications between field and laboratory staff and will led to a greater degree of confidence in joint water quality monitoring efforts on the river.

REFERENCES

Minnesota Pollution Control Agency. 1992. Mississippi River Phosphorus study. Study Plan. Water Quality Division, MPCA. St. Paul, MN.

Table 1. Reference to laboratory methods used by the Minnesota Department of Health Chemical Laboratory (MDH), Metropolitan Waste Control Commission (MWCC), Wisconsin State Laboratory of Hygiene (WSLOH) and the US Corps of Engineers Laboratory (USCOE) at Eau Galle, Wisconsin.

	Laboratory			
Parameter	MDH	MWCC	WSLOH	USCOE
Total Phosphorus	EPA 365.4	EPA 365.4	EPA 365.1	Technicon 1978
Diss. Ortho-Phosphorus	EPA 365.2	EPA 365.1	EPA 365.1	No Data
Total Ortho-Phosphorus	EPA 365.2	EPA 365.1	No Data	No Data
Total Kjeldahl N	EPA 351.2	EPA 351.2	EPA (a)	No Data
Ammonia Nitrogen	EPA 350.1	EPA 350.1	EPA 350.1 (f)	Technicon 1978
Nitrite + Nitrate - N	EPA 353.2	EPA 353.1	EPA 353.2 (f)	No Data
Total Suspended Solids	EPA 160.2	STD. Meth. 17th ED. 2540 D	EPA 160.2	STD. Meth. 14 th ED.
Total Chlorophyll - a	No Data	ASTM D3731	STD Meth. 14th Ed.	No Data
Corr. Chlorophyll - a	STD Meth. 17th Ed.	STD Meth. 17th Ed.	STD Meth. 17th Ed.	STD. Meth. 14 th ED.
Chloride	EPA 325.1	STD Meth. 17th Ed. 4500-CL C.	EPA 325.1	No Data

(a) Alternative test procedure approved by EPA.

(f) Filtered sample.

Table 2. Summary of split sample results for samples analyzed by the Metropolitan Waste Control Commission (MWCC), Minnesota Department of Health (MDH), and the Wisconsin State Laboratory of Hygiene (WSLOH). Samples represent surface grab samples collected at Lock and Dam 3 between June 1991 to August 1992. For sampling days when all three laboratories reported data for the specified parameter.

Parameter	Coefficient of Variation %				Regression Analysis - R Squared		
	N	Min	Max	Avg	MDH x MWCC	WSLOH x MWCC	WSLOH x MDH
Chloride	10	0.0	7.5	3.5	.912	.907	.914
Inorganic Nitrogen *	14	0.8	9.8	5.1	.923	.936	.992
Nitrite + Nitrate - N	14	1.4	10.4	5.3	.951	.958	.992
Total Nitrogen *	13	2.0	16.2	5.7	.814	.913	.929
Total Phosphorus	14	2.8	25.5	9.8	.760	.886	.885
Total Suspended Solids	14	1.6	35.5	10.7	.962	.966	.951
Total Ortho-Phosphorus	13	2.1	61.0	14.1	.290 (a)	(b)	(b)
Total Kjeldahl N	13	1.1	43.8	15.2	.049 (a)	.816	.000 (a)
Total Chlorophyll - a	13	1.3	80.0	15.9	(c)	.567	(c)
Organic Nitrogen *	13	3.3	47.2	16.4	.121 (a)	.858	.033 (a)
Diss. Ortho-Phosphorus	12	1.7	70.7	18.5	.713	.990	.694
Particulate Phosphorus *	12	6.4	53.3	21.1	.381	.798	.579
Ammonia Nitrogen	14	4.8	64.6	25.4	.826	.940	.896
Corr. Chlorophyll - a	12	4.8	94.1	42.7	.527	.770	.662

(a) Corresponding Pearson product correlation coefficient not significant at P = 95 %.

(b) WSLOH did not measure total ortho-phosphorus.

(c) MDH did not measure total chlorophyll - a.

* Estimated form measured parameters.

FIGURE 1a. TOTAL PHOSPHORUS SPLIT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

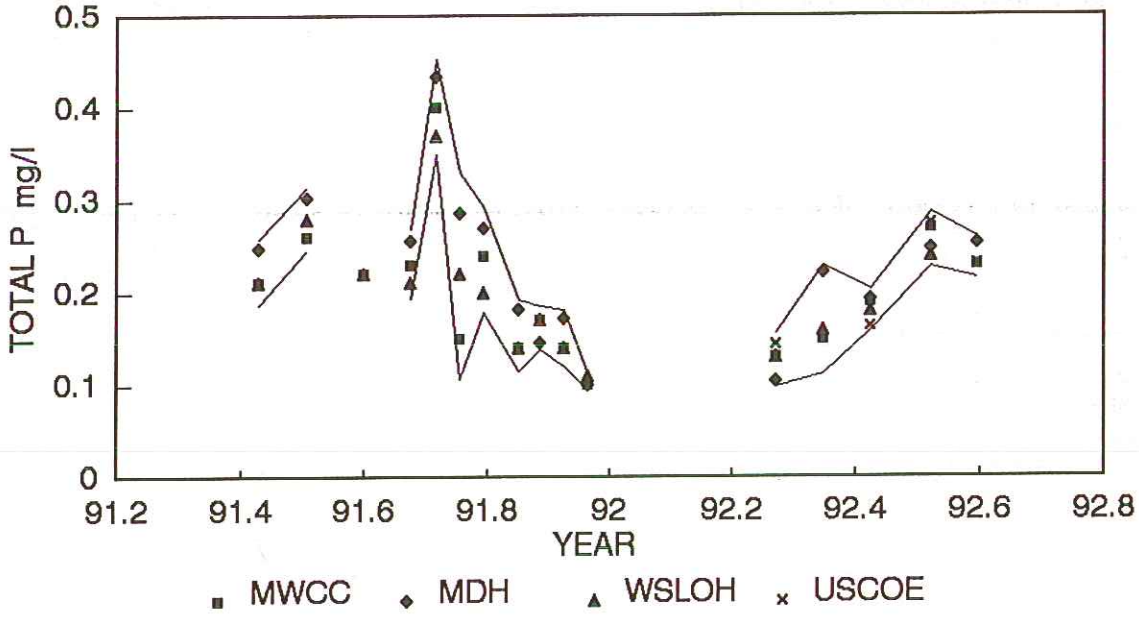

FIGURE 1b. TOTAL PHOSPHORUS mg/l
REGRESSION ANALYSIS OF SPLIT SAMPLES

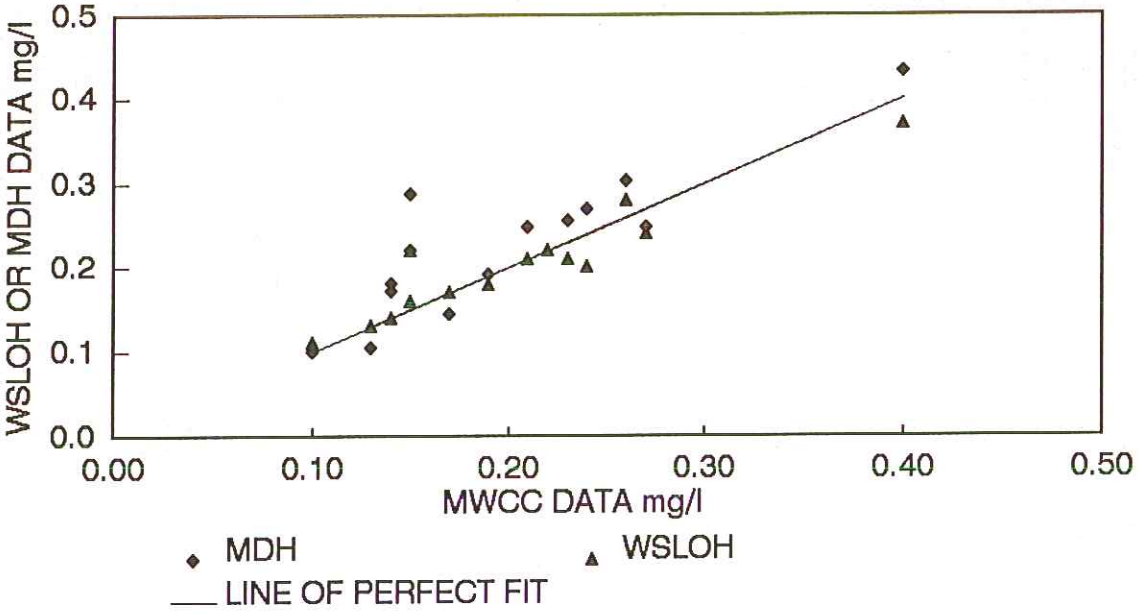

TABLE 3. TOTAL PHOSPHORUS SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			TOTAL P mg/l								JOINT TP DATA			
Mo	Dy	Yr	MWCC	MDH	WSLOH	USCOE	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91	0.21	0.248	0.21		0.22	0.02	8.0	0.26	0.19	0.21	0.248	0.21	8.0
7	2	91	0.26	0.303	0.28		0.28	0.02	6.3	0.32	0.25	0.26	0.303	0.28	6.3
8	6	91	0.22		0.22		0.22		0.0			0.23	0.256	0.21	8.1
9	3	91	0.23	0.256	0.21		0.23	0.02	8.1	0.27	0.19	0.40	0.433	0.37	6.4
9	18	91	0.4	0.433	0.37		0.40	0.03	6.4	0.45	0.35	0.15	0.287	0.22	25.5
10	2	91	0.15	0.287	0.22		0.22	0.06	25.5	0.33	0.11	0.24	0.27	0.20	12.1
10	16	91	0.24	0.27	0.2		0.24	0.03	12.1	0.29	0.18	0.14	0.181	0.14	12.6
11	7	91	0.14	0.181	0.14		0.15	0.02	12.6	0.19	0.12	0.17	0.145	0.17	7.3
11	20	91	0.17	0.145	0.17		0.16	0.01	7.3	0.19	0.14	0.14	0.172	0.14	10.0
12	4	91	0.14	0.172	0.14		0.15	0.02	10.0	0.18	0.12	0.10	0.10	0.11	4.6
12	18	91	0.1	0.1	0.11		0.10	0.00	4.6	0.11	0.09	0.13	0.104	0.13	10.1
												0.15	0.221	0.16	17.7
4	8	92	0.13	0.104	0.13	0.144	0.13	0.01	11.4	0.16	0.10	0.19	0.192	0.18	2.8
5	6	92	0.15	0.221	0.16	0.152	0.17	0.03	17.1	0.23	0.11	0.27	0.248	0.24	5.0
6	3	92	0.19	0.192	0.18	0.164	0.18	0.01	6.1	0.20	0.16				
7	8	92	0.27	0.248	0.24	0.276	0.26	0.01	5.8	0.29	0.23			N	14
8	5	92	0.23	0.254		0.231	0.24	0.01	4.7	0.26	0.22			MIN CV	2.8
														MAX CV	25.5
														AVG CV	9.8

TOTAL P
REGRESSION ANALSYIS OF JOINT DATA

MDH VS MWCC

Regression Output:		
Constant		0.031
Std Err of Y Est		0.045
R Squared		0.760
No. of Observations		14
Degrees of Freedom		12
X Coefficient(s)	0.979	
Std Err of Coef.	0.159	

WSLOH VS MWCC

Regression Output:		
Constant		0.034
Std Err of Y Est		0.024
R Squared		0.886
No. of Observations		14
Degrees of Freedom		12
X Coefficient(s)	0.823	
Std Err of Coef.	0.085	

WSLOH VS MDH

Regression Output:		
Constant		0.032
Std Err of Y Est		0.024
R Squared		0.885
No. of Observations		14
Degrees of Freedom		12
X Coefficient(s)	0.733	
Std Err of Coef.	0.076	

FIGURE 2a. DISSOLVED ORTHO–P SPLIT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

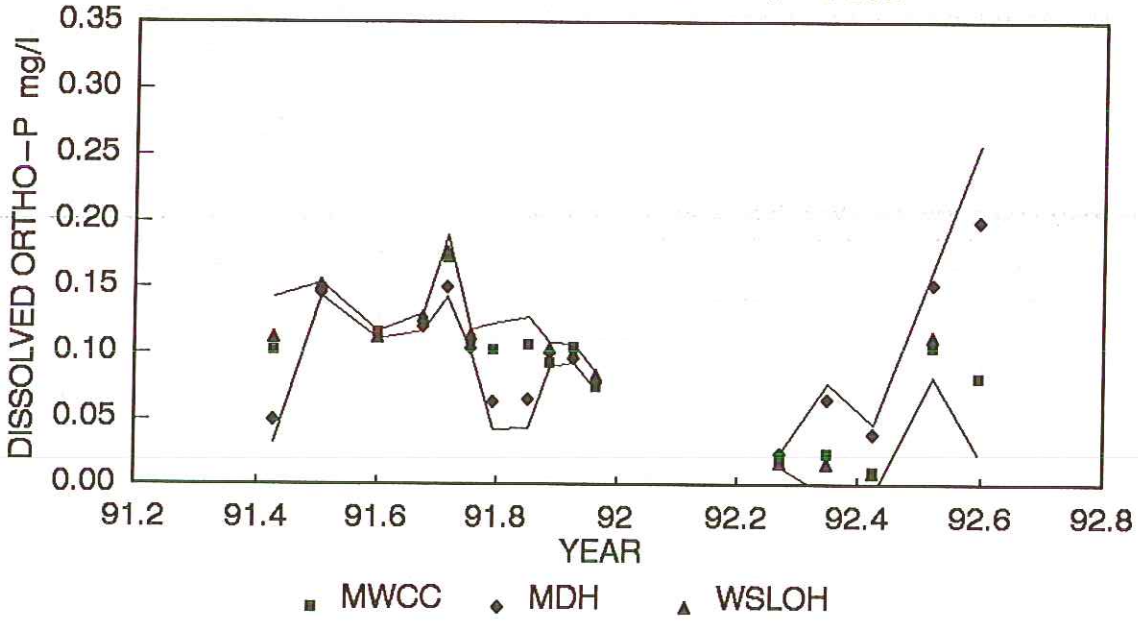

FIGURE 2b. DISSOLVED ORTHO–PHOSPHORUS mg/l
REGRESSION ANALYSIS OF SPLIT SAMPLES

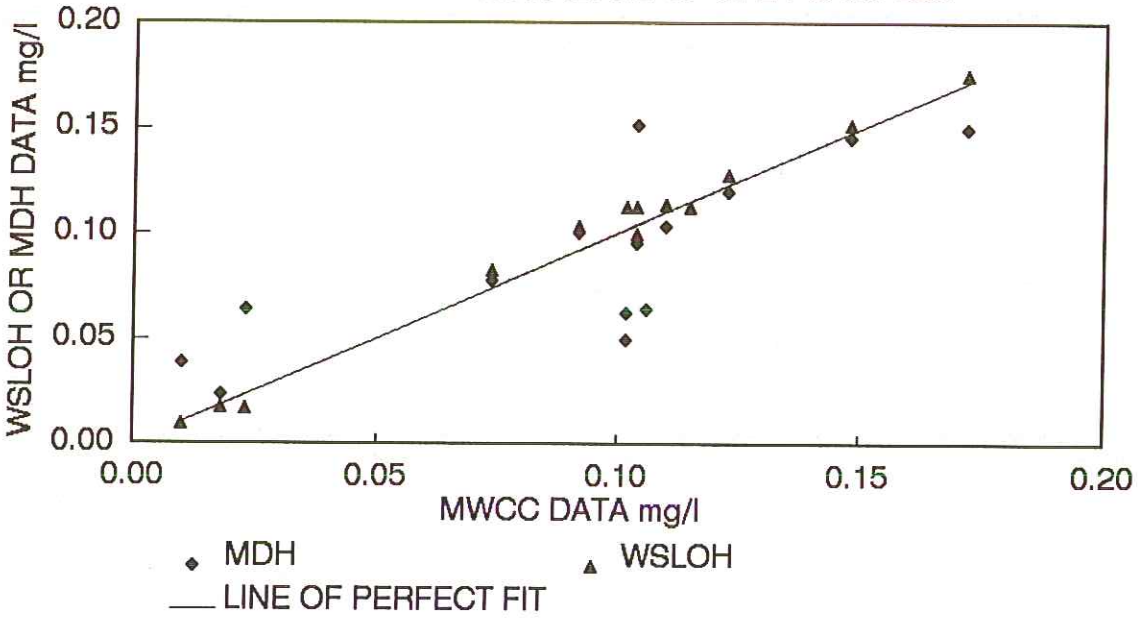

TABLE 4. DISSOLVED ORTHO-PHOSPHORUS SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			DISS ORTHO-P mg/l								JOINT DISS ORTHO-P			
Mo	Dy	Yr	MWCC	MDH	WSLOH	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91	0.102	0.049	0.112	0.088	0.028	31.5	0.143	0.032	0.102	0.049	0.112	31.5
7	2	91	0.148	0.145	0.151	0.148	0.002	1.7	0.153	0.143	0.148	0.145	0.151	1.7
8	6	91	0.115		0.112	0.114	0.002	1.3	0.117	0.111	0.123	0.119	0.127	2.7
9	3	91	0.123	0.119	0.127	0.123	0.003	2.7	0.130	0.116	0.172	0.149	0.175	7.0
9	18	91	0.172	0.149	0.175	0.165	0.012	7.0	0.189	0.142	0.11	0.103	0.113	3.9
10	2	91	0.11	0.103	0.113	0.109	0.004	3.9	0.117	0.100	0.092	0.1	0.103	4.7
10	16	91	0.102	0.062		0.082	0.020	24.4	0.122	0.042	0.104	0.095	0.099	3.7
11	7	91	0.106	0.064		0.085	0.021	24.7	0.127	0.043	0.074	0.077	0.082	4.2
11	20	91	0.092	0.1	0.103	0.098	0.005	4.7	0.108	0.089	0.018	0.023	0.017	13.6
12	4	91	0.104	0.095	0.099	0.099	0.004	3.7	0.107	0.092	0.023	0.064	0.016	61.7
12	18	91	0.074	0.077	0.082	0.078	0.003	4.2	0.084	0.071	0.01	0.038	0.009	70.7
											0.104	0.151	0.112	16.8
4	8	92	0.018	0.023	0.017	0.019	0.003	13.6	0.025	0.014				
5	6	92	0.023	0.064	0.016	0.034	0.021	61.7	0.077	-0.008			N	12
6	3	92	0.01	0.038	0.009	0.019	0.013	70.7	0.046	-0.008			MIN CV	1.7
7	8	92	0.104	0.151	0.112	0.122	0.021	16.8	0.163	0.081			MAX CV	70.7
8	5	92	0.081	0.199		0.140	0.059	42.1	0.258	0.022			AVG CV	18.5

DISS ORTHO-P
REGRESSION ANALSYIS OF JOINT DATA

MDH VS MWCC

Regression Output:		
Constant		0.027
Std Err of Y Est		0.025
R Squared		0.713
No. of Observations		12
Degrees of Freedom		10
X Coefficient(s)	0.725	
Std Err of Coef.	0.146	

WSLOH VS MWCC

Regression Output:		
Constant		-0.001
Std Err of Y Est		0.005
R Squared		0.990
No. of Observations		12
Degrees of Freedom		10
X Coefficient(s)	1.045	
Std Err of Coef.	0.033	

WSLOH VS MDH

Regression Output:		
Constant		-0.002
Std Err of Y Est		0.031
R Squared		0.694
No. of Observations		12
Degrees of Freedom		10
X Coefficient(s)	1.019	
Std Err of Coef.	0.214	

FIGURE 3a. TOTAL ORTHO–P SPLIT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

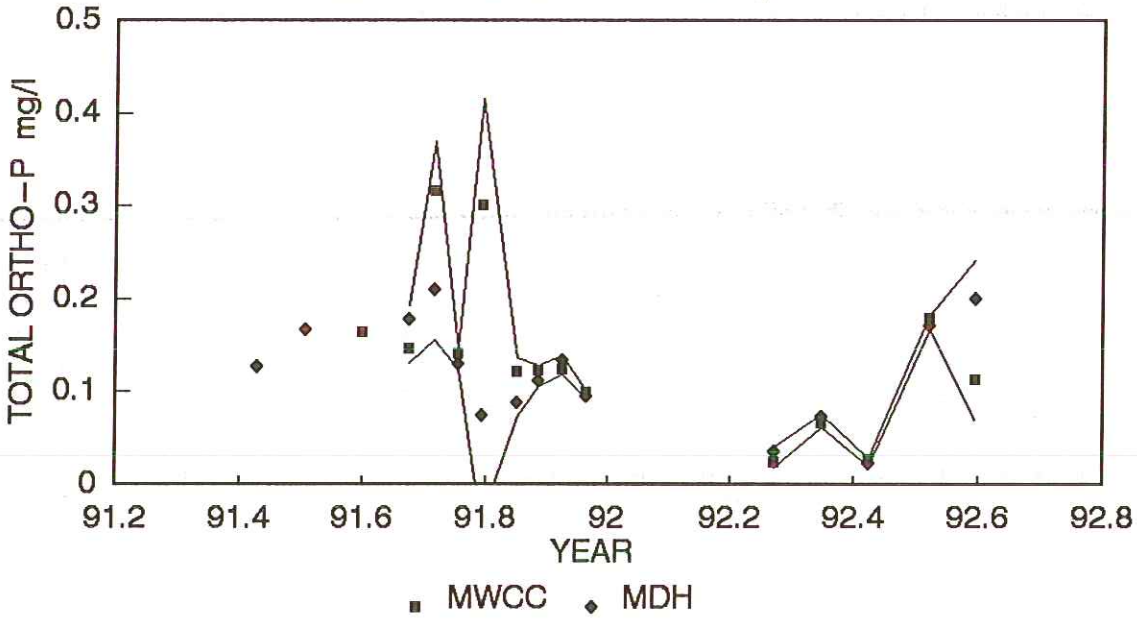

FIGURE 3b. TOTAL ORTHO–P mg/l
REGRESSION ANALYSIS OF SPLIT SAMPLES

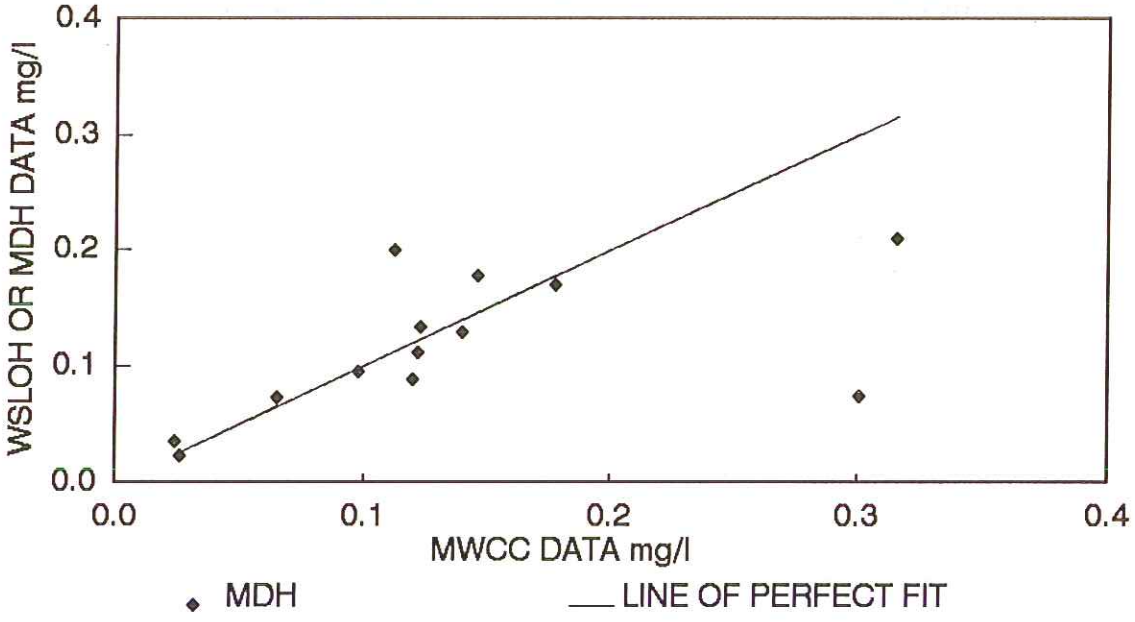

TABLE 5. TOTAL ORTHO-PHOSPHORUS SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			TOTAL ORTHO-PHOSPHORUS mg/l							JOINT TOTAL ORTHO-P			
Mo	Dy	Yr	MWCC	MDH	WSLOH	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91		0.126		0.126					0.146	0.177		9.6
7	2	91		0.166		0.166					0.316	0.209		20.4
8	6	91	0.164			0.164					0.14	0.129		4.1
9	3	91	0.146	0.177		0.162	0.015	9.6	0.193	0.131	0.301	0.073		61.0
9	18	91	0.316	0.209		0.263	0.054	20.4	0.370	0.156	0.12	0.088		15.4
10	2	91	0.14	0.129		0.135	0.005	4.1	0.146	0.124	0.122	0.111		4.7
10	16	91	0.301	0.073		0.187	0.114	61.0	0.415	-0.041	0.123	0.133		3.9
11	7	91	0.12	0.088		0.104	0.016	15.4	0.136	0.072	0.098	0.094		2.1
11	20	91	0.122	0.111		0.117	0.005	4.7	0.128	0.106	0.024	0.035		18.6
12	4	91	0.123	0.133		0.128	0.005	3.9	0.138	0.118	0.065	0.072		5.1
12	18	91	0.098	0.094		0.096	0.002	2.1	0.100	0.092	0.026	0.022		8.3
											0.178	0.170		2.3
4	8	92	0.024	0.035		0.030	0.006	18.6	0.041	0.019	0.112	0.199		28.0
5	6	92	0.065	0.072		0.069	0.004	5.1	0.076	0.062				
6	3	92	0.026	0.022		0.024	0.002	8.3	0.028	0.020			N	13
7	8	92	0.178	0.170		0.174	0.004	2.3	0.182	0.166			MIN CV	2.1
8	5	92	0.112	0.199		0.156	0.044	28.0	0.243	0.069			MAX CV	61.0
													AVG CV	14.1

TOTAL ORTHO-P
REGRESSION ANALYSIS

MDH VS MWCC

Regression Output:	
Constant	0.067
Std Err of Y Est	0.053
R Squared	0.290
No. of Observations	13
Degrees of Freedom	11
X Coefficient(s)	0.365
Std Err of Coef.	0.172

WSLOH VS MWCC

NO DATA FROM WSLOH

WSLOH VS MDH

DO DATA FROM WSLOH

FIGURE 4a. PARTICULATE P SPLIT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

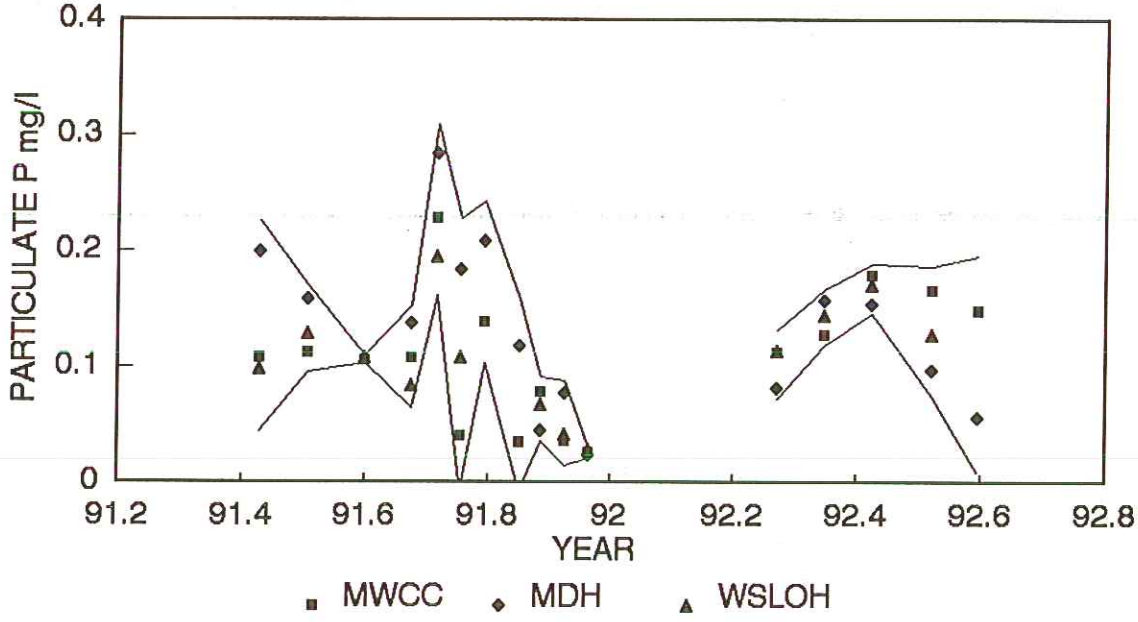

FIGURE 4b. PARTICULATE PHOSPHORUS mg/l
REGRESSION ANALYSIS OF SPLIT SAMPLES

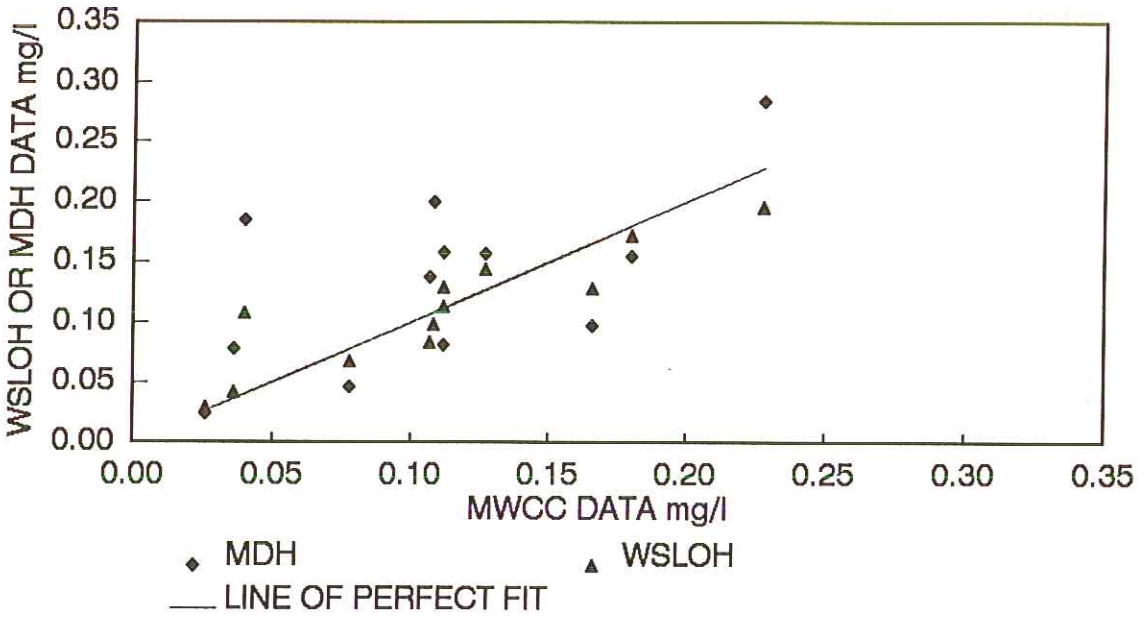

TABLE 6. PARTICULATE PHOSPHORUS SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			PARTICULATE P mg/l								JOINT PART. P			
Mo	Dy	Yr	MWCC	MDH	WSLOH	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91	0.11	0.20	0.10	0.14	0.05	33.7	0.23	0.04	0.11	0.20	0.10	33.7
7	2	91	0.11	0.16	0.13	0.13	0.02	14.3	0.17	0.10	0.11	0.16	0.13	14.3
8	6	91	0.11		0.11	0.11	0.00	1.4	0.11	0.10	0.11	0.14	0.08	20.3
9	3	91	0.11	0.14	0.08	0.11	0.02	20.3	0.15	0.06	0.23	0.28	0.20	15.6
9	18	91	0.23	0.28	0.20	0.24	0.04	15.6	0.31	0.16	0.04	0.18	0.11	53.3
10	2	91	0.04	0.18	0.11	0.11	0.06	53.3	0.23	-0.01	0.08	0.05	0.07	21.7
10	16	91	0.14	0.21		0.17	0.04	20.2	0.24	0.10	0.04	0.08	0.04	35.6
11	7	91	0.03	0.12		0.08	0.04	55.0	0.16	-0.01	0.03	0.02	0.03	8.0
11	20	91	0.08	0.05	0.07	0.06	0.01	21.7	0.09	0.04	0.11	0.08	0.11	14.6
12	4	91	0.04	0.08	0.04	0.05	0.02	35.6	0.09	0.01	0.13	0.16	0.14	8.6
12	18	91	0.03	0.02	0.03	0.03	0.00	8.0	0.03	0.02	0.18	0.15	0.17	6.4
											0.17	0.10	0.13	21.7
4	8	92	0.11	0.08	0.11	0.10	0.01	14.6	0.13	0.07				
5	6	92	0.13	0.16	0.14	0.14	0.01	8.6	0.17	0.12			N	12
6	3	92	0.18	0.15	0.17	0.17	0.01	6.4	0.19	0.15			MIN CV	6.4
7	8	92	0.17	0.10	0.13	0.13	0.03	21.7	0.19	0.07			MAX CV	53.3
8	5	92	0.15	0.06		0.10	0.05	46.1	0.20	0.01			AVG CV	21.1

PARTICULATE PHOSPHORUS
REGRESSION ANALSYIS OF JOINT DATA

MDH VS MWCC

Regression Output:		
Constant		0.052
Std Err of Y Est		0.060
R Squared		0.381
No. of Observations		12
Degrees of Freedom		10
X Coefficient(s)	0.739	
Std Err of Coef.	0.298	

WSLOH VS MWCC

Regression Output:		
Constant		0.029
Std Err of Y Est		0.023
R Squared		0.798
No. of Observations		12
Degrees of Freedom		10
X Coefficient(s)	0.727	
Std Err of Coef.	0.116	

WSLOH VS MDH

Regression Output:		
Constant		0.040
Std Err of Y Est		0.034
R Squared		0.579
No. of Observations		12
Degrees of Freedom		10
X Coefficient(s)	0.517	
Std Err of Coef.	0.139	

FIGURE 5a. TKN SPLIT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

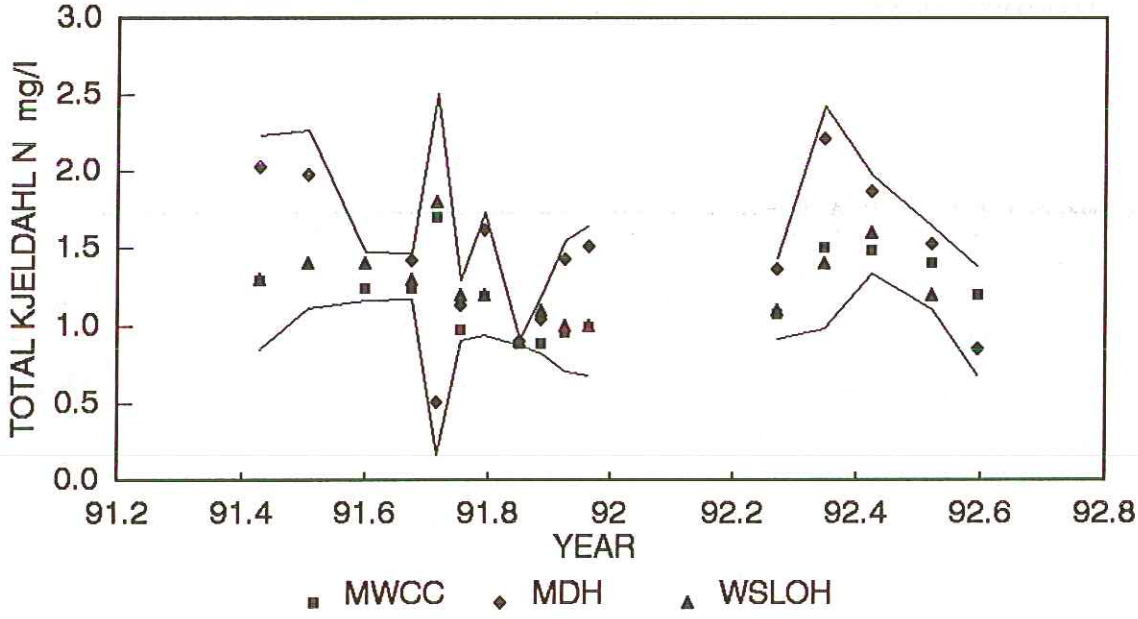

FIGURE 5b. TOTAL KJELDAHL NITROGEN mg/l
REGRESSION ANALYSIS OF SPLIT SAMPLES

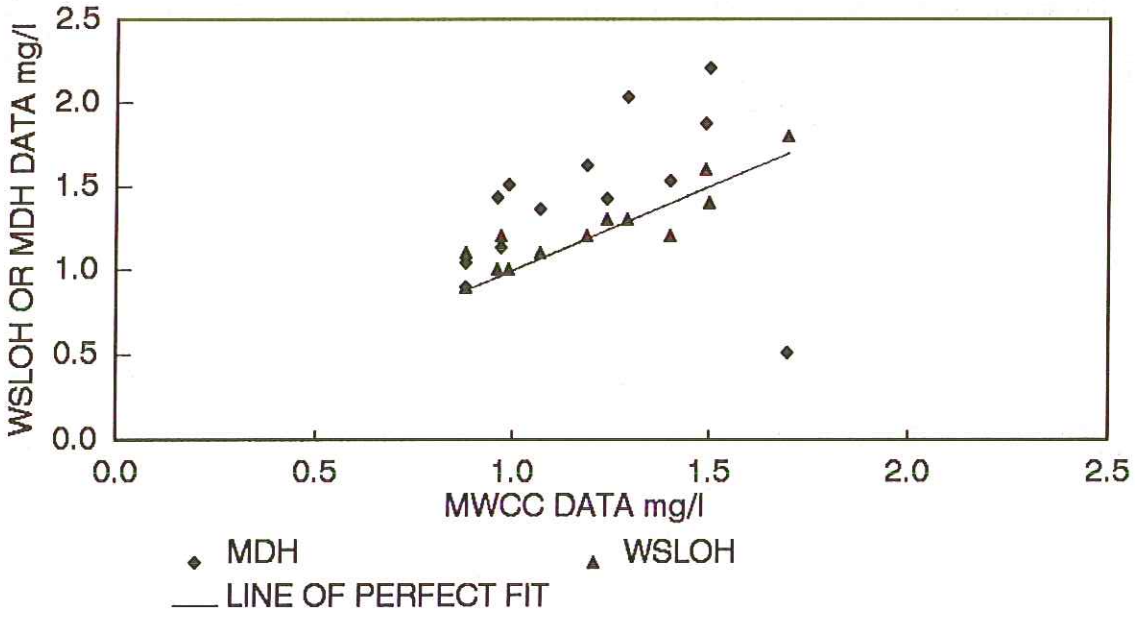

TABLE 7. TOTAL KJELDAHL NITROGEN SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			TOTAL KJELDAHL N mg/l								JOINT TKN			
Mo	Dy	Yr	MWCC	MDH	WSLOH	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91	1.29	2.03	1.3	1.5	0.3	22.5	2.2	0.8	1.29	2.03	1.3	22.5
7	2	91		1.98	1.4	1.7	0.3	17.2	2.3	1.1	1.24	1.42	1.3	5.7
8	6	91	1.24		1.4	1.3	0.1	6.1	1.5	1.2	1.70	0.51	1.8	43.8
9	3	91	1.24	1.42	1.3	1.3	0.1	5.7	1.5	1.2	0.97	1.13	1.2	8.8
9	18	91	1.70	0.51	1.8	1.3	0.6	43.8	2.5	0.2	1.19	1.62	1.2	15.0
10	2	91	0.97	1.13	1.2	1.1	0.1	8.8	1.3	0.9	0.88	0.90	0.9	1.1
10	16	91	1.19	1.62	1.2	1.3	0.2	15.0	1.7	0.9	0.88	1.04	1.1	9.2
11	7	91	0.88	0.90	0.9	0.9	0.0	1.1	0.9	0.9	0.96	1.43	1.0	18.8
11	20	91	0.88	1.04	1.1	1.0	0.1	9.2	1.2	0.8	0.99	1.51	1.0	20.8
12	4	91	0.96	1.43	1.0	1.1	0.2	18.8	1.6	0.7	1.07	1.36	1.1	11.1
12	18	91	0.99	1.51	1.0	1.2	0.2	20.8	1.7	0.7	1.50	2.21	1.4	21.2
											1.49	1.87	1.6	9.7
4	8	92	1.07	1.36	1.1	1.2	0.1	11.1	1.4	0.9	1.40	1.53	1.2	9.9
5	6	92	1.50	2.21	1.4	1.7	0.4	21.2	2.4	1.0				
6	3	92	1.49	1.87	1.6	1.7	0.2	9.7	2.0	1.3			N	13
7	8	92	1.40	1.53	1.2	1.4	0.1	9.9	1.6	1.1			MIN CV	1.1
8	5	92	1.20	0.85		1.0	0.2	17.1	1.4	0.7			MAX CV	43.8
													AVG CV	15.2

TOTAL KJELDAHL N
REGRESSION ANALSYIS OF JOINT DATA

MDH VS MWCC

Regression Output:		
Constant		0.965
Std Err of Y Est		0.473
R Squared		0.049
No. of Observations		13
Degrees of Freedom		11
X Coefficient(s)	0.387	
Std Err of Coef.	0.513	

WSLOH VS MWCC

Regression Output:		
Constant		0.223
Std Err of Y Est		0.112
R Squared		0.816
No. of Observations		13
Degrees of Freedom		11
X Coefficient(s)	0.849	
Std Err of Coef.	0.122	

WSLOH VS MDH

Regression Output:		
Constant		1.222
Std Err of Y Est		0.261
R Squared		0.000
No. of Observations		13
Degrees of Freedom		11
X Coefficient(s)	0.011	
Std Err of Coef.	0.162	

FIGURE 6a. AMMONIA NITROGEN SPLIT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

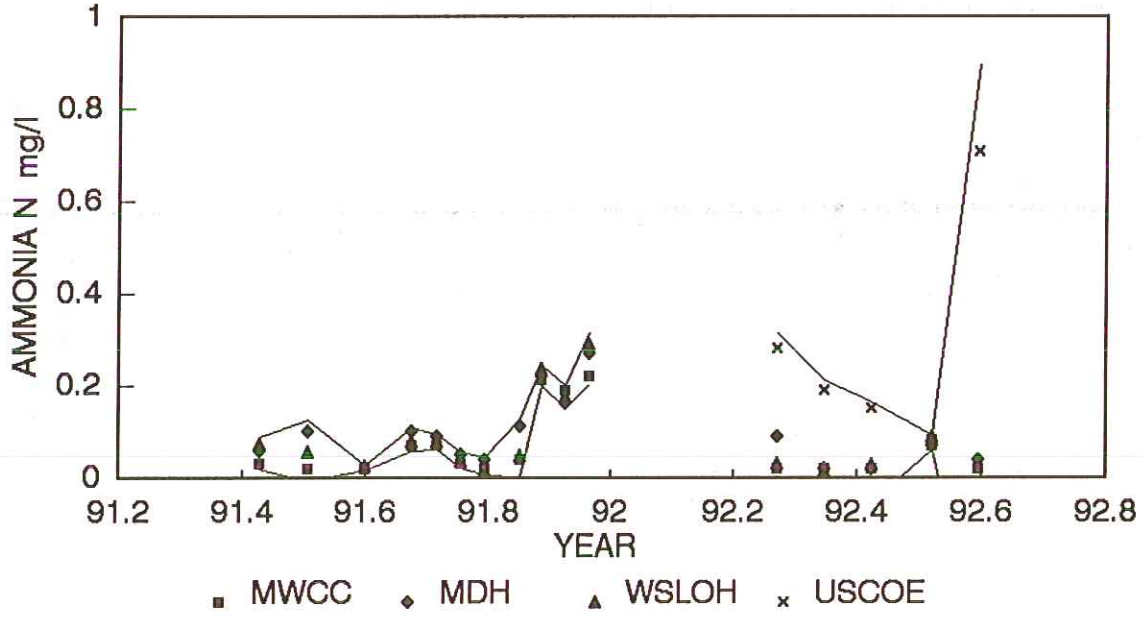

FIGURE 6b. AMMONIA NITROGEN mg/l
REGRESSION ANALYSIS OF LAB DATA

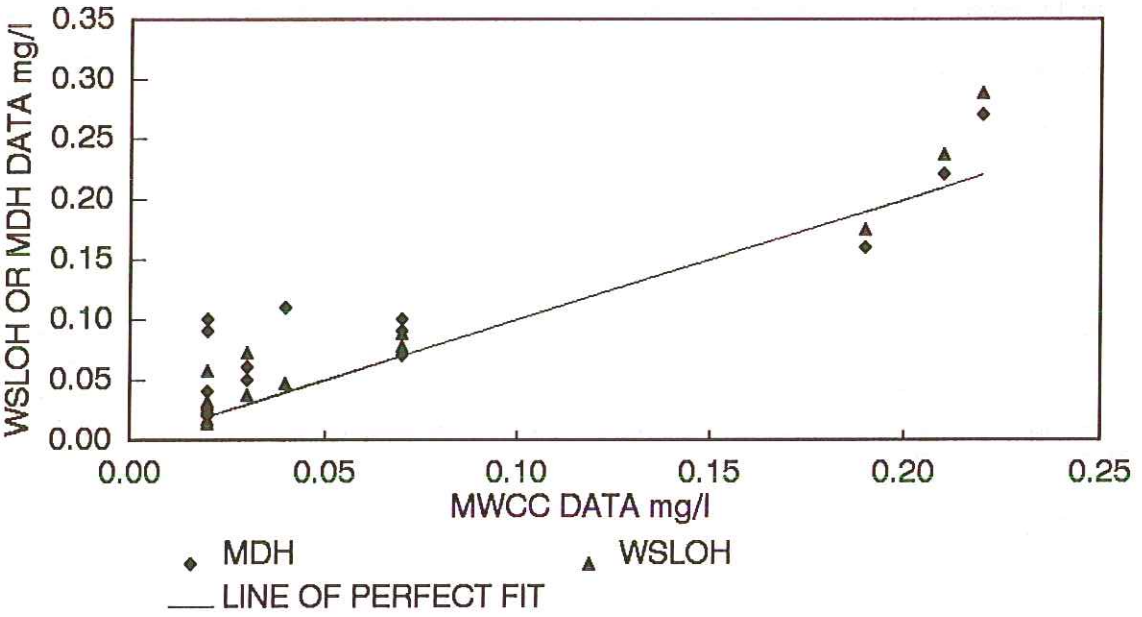

TABLE 8. AMMONIA NITROGEN SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			AMMONIA N mg/l									JOINT AMMONIA N			
Mo	Dy	Yr	MWCC	MDH	WSLOH	USCOE	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91	0.03	0.06	0.072		0.054	0.018	32.7	0.089	0.019	0.03	0.06	0.072	32.7
7	2	91 <	0.02	0.10	0.057		0.059	0.033	55.4	0.124	-0.006	0.02	0.10	0.057	55.4
8	6	91	0.02		0.026		0.023	0.003	13.0	0.029	0.017	0.07	0.10	0.078	15.3
9	3	91	0.07	0.10	0.078		0.083	0.013	15.3	0.108	0.057	0.07	0.09	0.077	10.5
9	18	91	0.07	0.09	0.077		0.079	0.008	10.5	0.096	0.062	0.03	0.05	0.037	21.2
10	2	91	0.03	0.05	0.037		0.039	0.008	21.2	0.056	0.022	0.02	0.04	0.017	39.8
10	16	91	0.02	0.04	0.017		0.026	0.010	39.8	0.046	0.005	0.04	0.11	0.047	47.9
11	7	91	0.04	0.11	0.047		0.066	0.031	47.9	0.129	0.003	0.21	0.22	0.236	4.8
11	20	91	0.21	0.22	0.236		0.222	0.011	4.8	0.243	0.201	0.19	0.16	0.175	7.0
12	4	91	0.19	0.16	0.175		0.175	0.012	7.0	0.199	0.151	0.22	0.27	0.288	11.1
12	18	91	0.22	0.27	0.288		0.259	0.029	11.1	0.317	0.202	0.02	0.09	0.032	64.6
												0.02	0.02	0.014	15.7
4	8	92 <	0.02	0.09	0.032	0.28	0.11	0.10	98.7	0.31	-0.10	0.02	0.02	0.029	18.4
5	6	92 <	0.02	0.02	0.014	0.19	0.06	0.07	122.2	0.21	-0.09	0.07	0.07	0.088	11.2
6	3	92 <	0.02 <	0.02	0.029	0.15	0.05	0.06	100.7	0.16	-0.06				
7	8	92	0.07	0.07	0.088	0.08	0.08	0.01	9.8	0.09	0.06			N	14
8	5	92	0.02	0.04		0.71	0.26	0.32	124.9	0.90	-0.38			MIN CV	4.8
														MAX CV	64.6
														AVG CV	25.4

AMMONIA N
REGRESSION ANALSYIS OF JOINT DATA

MDH VS MWCC

Regression Output:	
Constant	0.035
Std Err of Y Est	0.031
R Squared	0.826
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	0.882
Std Err of Coef.	0.117

WSLOH VS MWCC

Regression Output:	
Constant	0.009
Std Err of Y Est	0.021
R Squared	0.940
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	1.091
Std Err of Coef.	0.079

WSLOH VS MDH

Regression Output:	
Constant	-0.021
Std Err of Y Est	0.028
R Squared	0.896
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	1.098
Std Err of Coef.	0.108

FIGURE 7a. N02 + NO3 – N SPLIT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

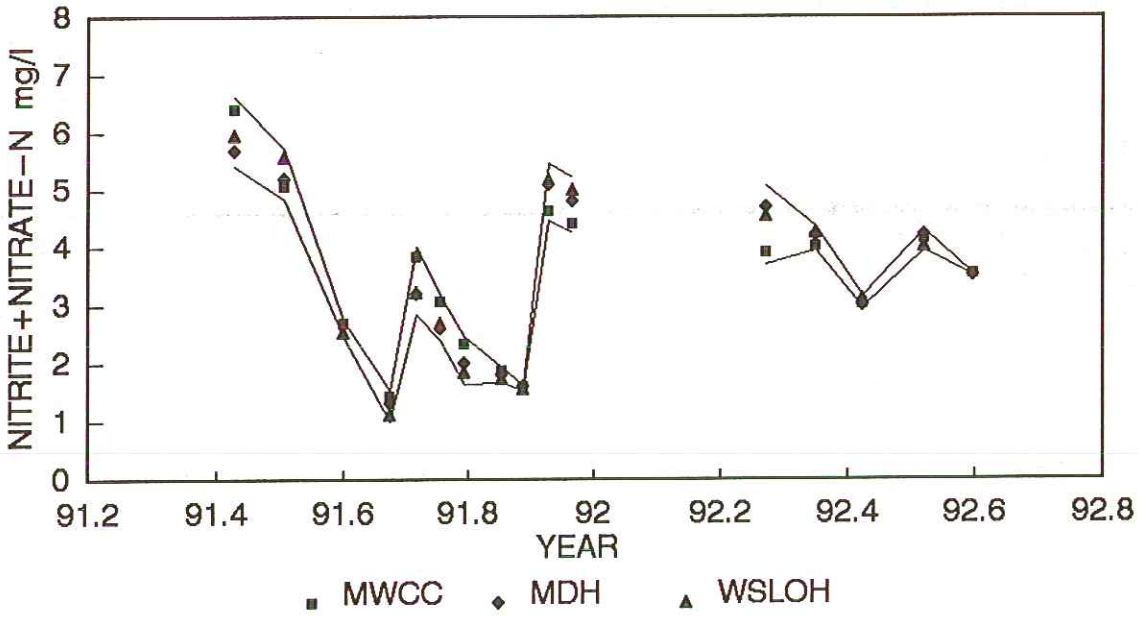

FIGURE 7b. NO2 + NO3 – N mg/l
REGRESSION ANALYSIS OF SPLIT SAMPLES

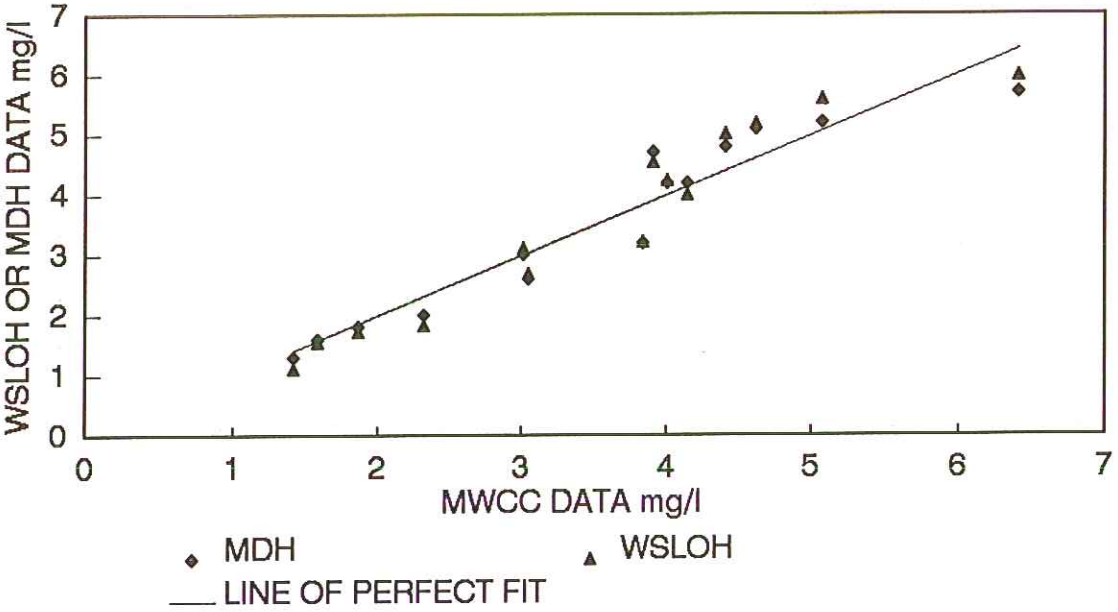

TABLE 9. NITRITE + NITRATE NITROGEN SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			NITRITE + NITRATE - N mg/l							JOINT NO2+NO3-N			
Mo	Dy	Yr	MWCC	MDH	WSLOH	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91	6.41	5.7	5.96	6.0	0.3	4.9	6.6	5.4	6.41	5.7	5.96	4.9
7	2	91	5.08	5.2	5.59	5.3	0.2	4.1	5.7	4.9	5.08	5.2	5.59	4.1
8	6	91	2.68		2.53	2.6	0.1	2.9	2.8	2.5	1.42	1.3	1.10	10.4
9	3	91	1.42	1.3	1.10	1.3	0.1	10.4	1.5	1.0	3.84	3.2	3.22	8.7
9	18	91	3.84	3.2	3.22	3.4	0.3	8.7	4.0	2.8	3.05	2.6	2.69	7.0
10	2	91	3.05	2.6	2.69	2.8	0.2	7.0	3.2	2.4	2.32	2	1.83	9.9
10	16	91	2.32	2	1.83	2.1	0.2	9.9	2.5	1.6	1.87	1.8	1.72	3.4
11	7	91	1.87	1.8	1.72	1.8	0.1	3.4	1.9	1.7	1.59	1.6	1.55	1.4
11	20	91	1.59	1.6	1.55	1.6	0.0	1.4	1.6	1.5	4.62	5.1	5.18	5.0
12	4	91	4.62	5.1	5.18	5.0	0.2	5.0	5.5	4.5	4.41	4.8	5.00	5.2
12	18	91	4.41	4.8	5.00	4.7	0.2	5.2	5.2	4.2	3.91	4.7	4.54	7.8
											4.01	4.2	4.25	2.5
4	8	92	3.91	4.7	4.54	4.4	0.3	7.8	5.1	3.7	3.01	3	3.11	1.6
5	6	92	4.01	4.2	4.25	4.2	0.1	2.5	4.4	3.9	4.15	4.2	4.00	2.1
6	3	92	3.01	3	3.11	3.0	0.0	1.6	3.1	2.9				
7	8	92	4.15	4.2	4.00	4.1	0.1	2.1	4.3	3.9			N	14
8	5	92	3.52	3.5		3.5	0.0	0.3	3.5	3.5			MIN CV	1.4
													MAX CV	10.4
													AVG CV	5.3

NITRITE + NITRATE N
REGRESSION ANALSYIS OF JOINT DATA

MDH VS MWCC

Regression Output:	
Constant	-0.418
Std Err of Y Est	0.345
R Squared	0.951
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	1.134465
Std Err of Coef.	0.074441

WSLOH VS MWCC

Regression Output:	
Constant	-0.711
Std Err of Y Est	0.344
R Squared	0.958
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	1.225758
Std Err of Coef.	0.074124

WSLOH VS MDH

Regression Output:	
Constant	-0.230
Std Err of Y Est	0.151
R Squared	0.992
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	1.072
Std Err of Coef.	0.028

FIGURE 8a. INORGANIC NITROGEN RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

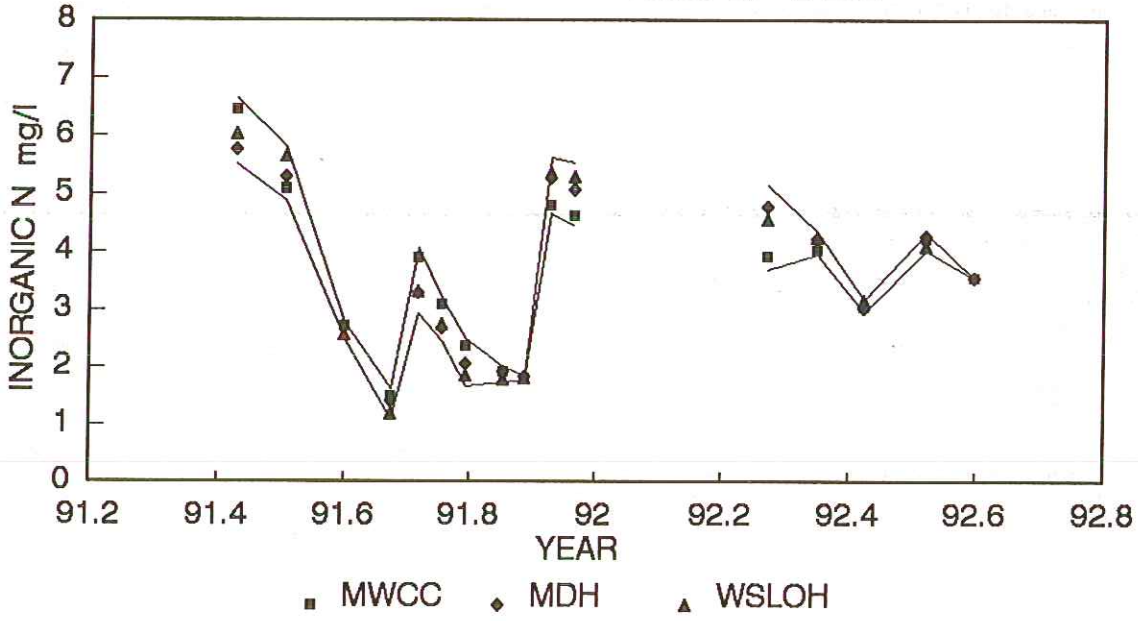

FIGURE 8b. INORGANIC NITROGEN mg/l
REGRESSION ANALSYIS OF SPLIT SAMPLES

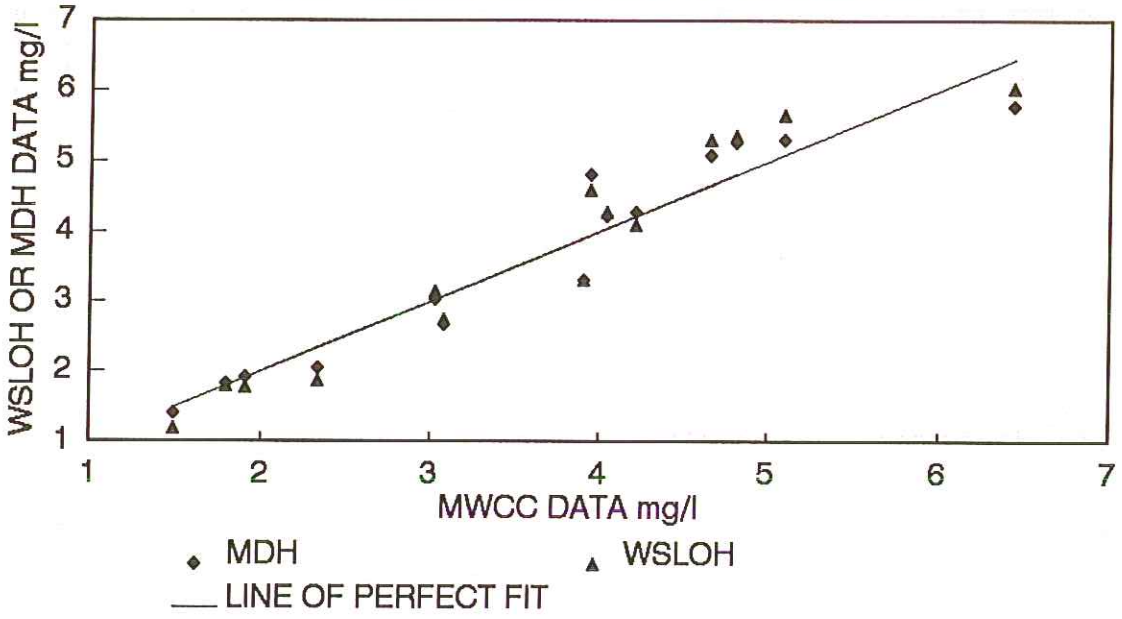

TABLE 10. INORGANIC NITROGEN SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			TOTAL INORGANIC N mg/l								JOINT INORG. N			
Mo	Dy	Yr	MWCC	MDH	WSLOH	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91	6.44	5.76	6.03	6.08	0.28	4.6	6.64	5.52	6.44	5.76	6.03	4.6
7	2	91	5.10	5.30	5.65	5.35	0.23	4.2	5.80	4.90	5.10	5.30	5.65	4.2
8	6	91	2.70		2.56	2.63	0.07	2.7	2.77	2.48	1.49	1.40	1.18	9.7
9	3	91	1.49	1.40	1.18	1.36	0.13	9.7	1.62	1.09	3.91	3.29	3.30	8.3
9	18	91	3.91	3.29	3.30	3.50	0.29	8.3	4.08	2.92	3.08	2.65	2.73	6.6
10	2	91	3.08	2.65	2.73	2.82	0.19	6.6	3.19	2.44	2.34	2.04	1.85	9.8
10	16	91	2.34	2.04	1.85	2.08	0.20	9.8	2.48	1.67	1.91	1.91	1.77	3.6
11	7	91	1.91	1.91	1.77	1.86	0.07	3.6	2.00	1.73	1.80	1.82	1.79	0.8
11	20	91	1.80	1.82	1.79	1.80	0.01	0.8	1.83	1.77	4.81	5.26	5.36	4.6
12	4	91	4.81	5.26	5.36	5.14	0.24	4.6	5.62	4.67	4.66	5.07	5.29	5.2
12	18	91	4.63	5.07	5.29	5.00	0.27	5.5	5.54	4.45	3.95	4.79	4.57	8.0
											4.05	4.22	4.26	2.2
4	8	92	3.93	4.79	4.57	4.43	0.37	8.2	5.16	3.70	3.03	3.02	3.14	1.8
5	6	92	4.03	4.22	4.26	4.17	0.10	2.4	4.37	3.97	4.22	4.27	4.09	1.8
6	3	92	3.03	3.02	3.14	3.06	0.05	1.8	3.17	2.96				
7	8	92	4.22	4.27	4.09	4.19	0.08	1.8	4.35	4.04			N	14
8	5	92	3.54	3.54		3.54	0.00	0.0	3.54	3.54			MIN CV	0.8
													MAX CV	9.8
													AVG CV	5.1

TOTAL INORGANIC NITROGEN
REGRESSION ANALSYIS OF JOINT DATA OF JOINT DATA

MDH VS MWCC

Regression Output:	
Constant	-0.043
Std Err of Y Est	0.435
R Squared	0.923
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	1.012
Std Err of Coef.	0.085

WSLOH VS MWCC

Regression Output:	
Constant	-0.355
Std Err of Y Est	0.429
R Squared	0.936
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	1.102
Std Err of Coef.	0.083

WSLOH VS MDH

Regression Output:	
Constant	-0.264
Std Err of Y Est	0.155
R Squared	0.992
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	1.076
Std Err of Coef.	0.029

FIGURE 9a. ORGANIC NITROGEN SPILT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

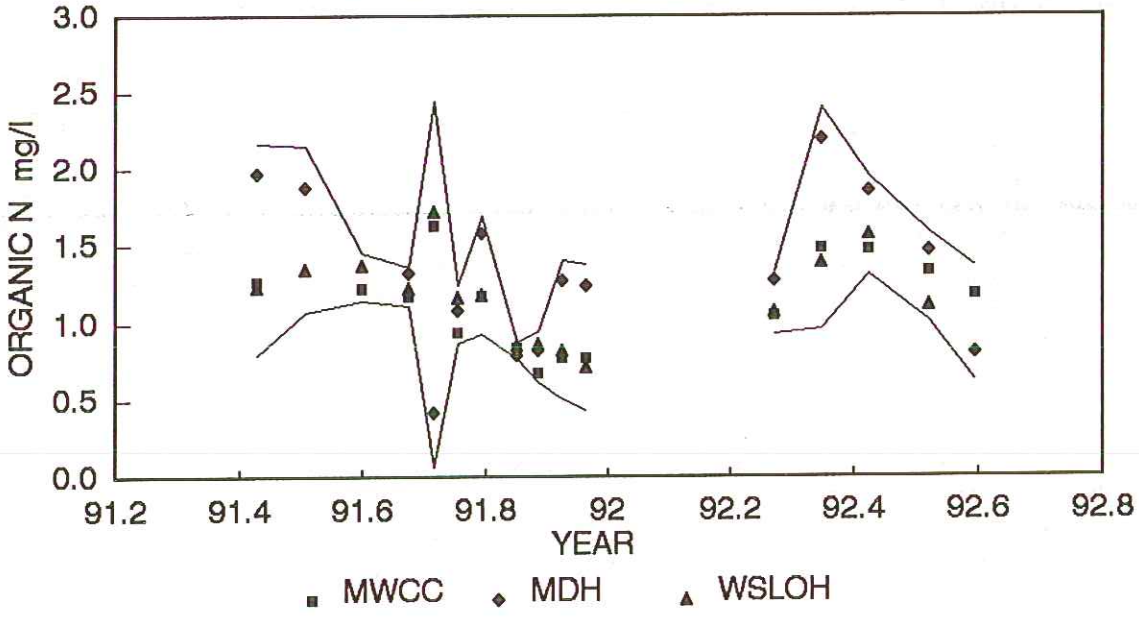

FIGURE 9b. ORGANIC NITROGEN mg/l
REGRESSION ANALYSIS OF LAB DATA

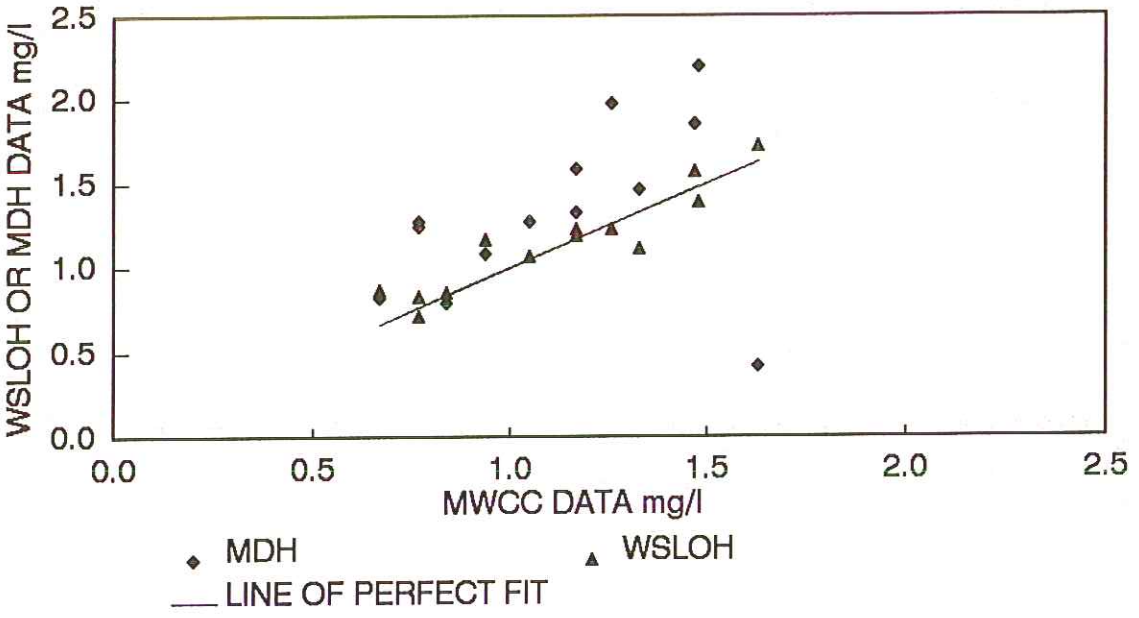

TABLE 11. ORGANIC NITROGEN SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			ORGANIC NITROGEN mg/l								JOINT ORGANIC N			
Mo	Dy	Yr	MWCC	MDH	WSLOH	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91	1.26	1.97	1.23	1.49	0.34	23.0	2.17	0.80	1.26	1.97	1.23	23.0
7	2	91		1.88	1.34	1.61	0.27	16.7	2.15	1.07	1.17	1.32	1.22	5.0
8	6	91	1.22		1.37	1.30	0.08	5.9	1.45	1.14	1.63	0.42	1.72	47.2
9	3	91	1.17	1.32	1.22	1.24	0.06	5.0	1.36	1.11	0.94	1.08	1.16	8.7
9	18	91	1.63	0.42	1.72	1.26	0.59	47.2	2.44	0.07	1.17	1.58	1.18	14.5
10	2	91	0.94	1.08	1.16	1.06	0.09	8.7	1.25	0.88	0.84	0.79	0.85	3.3
10	16	91	1.17	1.58	1.18	1.31	0.19	14.5	1.69	0.93	0.67	0.82	0.86	10.6
11	7	91	0.84	0.79	0.85	0.83	0.03	3.3	0.88	0.77	0.77	1.27	0.83	23.4
11	20	91	0.67	0.82	0.86	0.78	0.08	10.6	0.95	0.62	0.77	1.24	0.71	26.1
12	4	91	0.77	1.27	0.83	0.96	0.22	23.4	1.40	0.51	1.05	1.27	1.07	8.8
12	18	91	0.77	1.24	0.71	0.91	0.24	26.1	1.38	0.43	1.48	2.19	1.39	21.3
											1.47	1.85	1.57	9.9
4	8	92	1.05	1.27	1.07	1.13	0.10	8.8	1.33	0.93	1.33	1.46	1.11	11.0
5	6	92	1.48	2.19	1.39	1.69	0.36	21.3	2.40	0.97				
6	3	92	1.47	1.85	1.57	1.63	0.16	9.9	1.95	1.31			N	13
7	8	92	1.33	1.46	1.11	1.30	0.14	11.0	1.59	1.01			MIN CV	3.3
8	5	92	1.18	0.81		1.00	0.19	18.6	1.37	0.62			MAX CV	47.2
													AVG CV	16.4

ORGANIC NITROGEN
REGRESSION ANALYSIS OF JOINT DATA

MDH VS MWCC

Regression Output:	
Constant	0.703
Std Err of Y Est	0.486
R Squared	0.121
No. of Observations	13
Degrees of Freedom	11
X Coefficient(s)	0.558
Std Err of Coef.	0.455

WSLOH VS MWCC

Regression Output:	
Constant	0.154
Std Err of Y Est	0.116
R Squared	0.858
No. of Observations	13
Degrees of Freedom	11
X Coefficient(s)	0.887
Std Err of Coef.	0.109

WSLOH VS MDH

Regression Output:	
Constant	1.003
Std Err of Y Est	0.304
R Squared	0.033
No. of Observations	13
Degrees of Freedom	11
X Coefficient(s)	0.108
Std Err of Coef.	0.177

FIGURE 10a. TOTAL NITROGEN SPLIT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

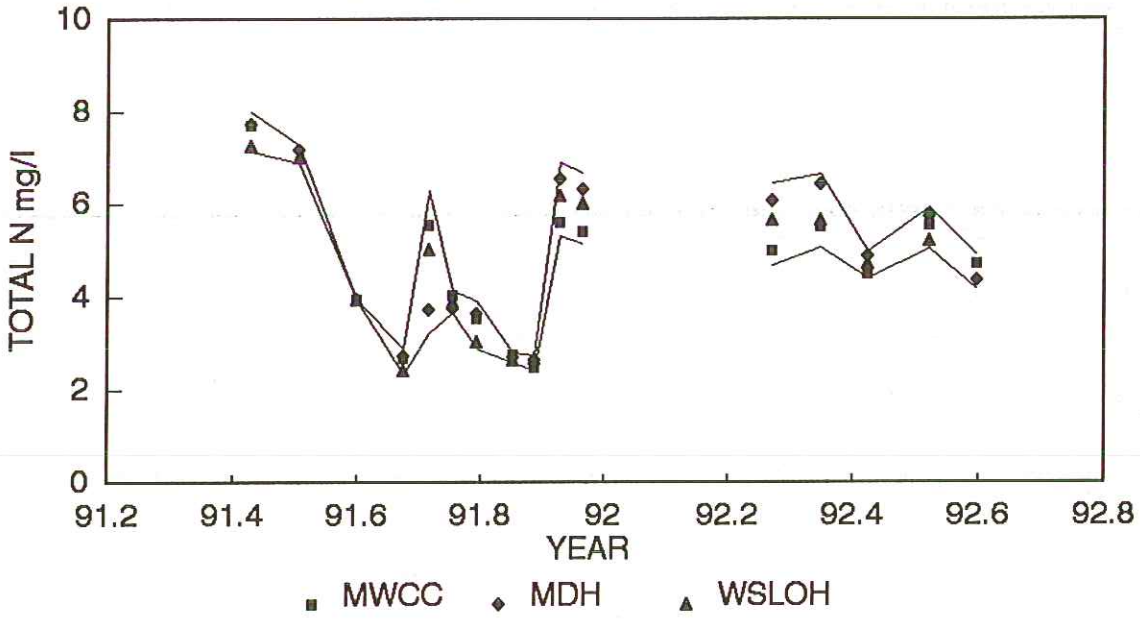

FIGURE 10b. TOTAL NITROGEN mg/l
REGRESSION ANALYSIS OF SPLIT SAMPLES

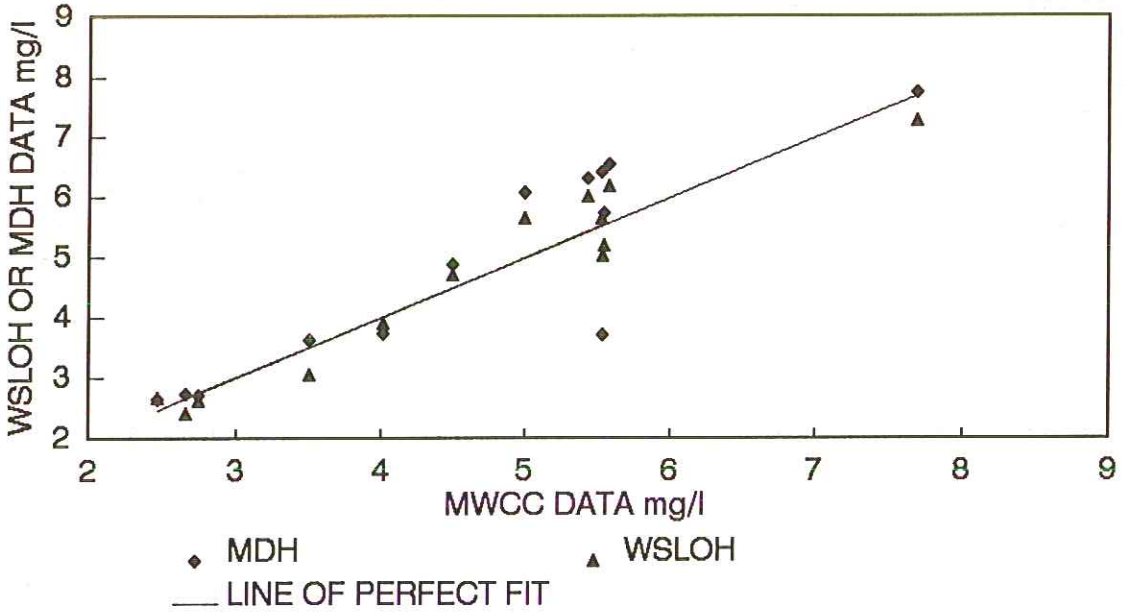

TABLE 12. TOTAL NITROGEN SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			TOTAL NITROGEN mg/l								JOINT TOTAL N			
Mo	Dy	Yr	MWCC	MDH	WSLOH	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91	7.70	7.73	7.26	7.56	0.21	2.8	7.99	7.13	7.70	7.73	7.26	2.8
7	2	91		7.18	6.99	7.09	0.09	1.3	7.28	6.90	2.66	2.72	2.40	5.4
8	6	91	3.92		3.93	3.93	0.00	0.0	3.93	3.93	5.54	3.71	5.02	16.2
9	3	91	2.66	2.72	2.40	2.59	0.14	5.4	2.87	2.32	4.02	3.73	3.89	3.1
9	18	91	5.54	3.71	5.02	4.76	0.77	16.2	6.30	3.22	3.51	3.62	3.03	7.6
10	2	91	4.02	3.73	3.89	3.88	0.12	3.1	4.12	3.64	2.75	2.70	2.62	2.0
10	16	91	3.51	3.62	3.03	3.39	0.26	7.6	3.90	2.87	2.47	2.64	2.65	3.2
11	7	91	2.75	2.70	2.62	2.69	0.05	2.0	2.80	2.58	5.58	6.53	6.18	6.4
11	20	91	2.47	2.64	2.65	2.59	0.08	3.2	2.75	2.42	5.43	6.31	6.00	6.2
12	4	91	5.58	6.53	6.18	6.10	0.39	6.4	6.88	5.31	5.00	6.06	5.64	7.8
12	18	91	5.40	6.31	6.00	5.90	0.38	6.4	6.66	5.15	5.53	6.41	5.65	6.6
											4.50	4.87	4.71	3.2
4	8	92	4.98	6.06	5.64	5.56	0.44	8.0	6.45	4.67	5.55	5.73	5.20	4.0
5	6	92	5.51	6.41	5.65	5.86	0.40	6.8	6.65	5.07				
6	3	92	4.50	4.87	4.71	4.69	0.15	3.2	5.00	4.39			N	13
7	8	92	5.55	5.73	5.20	5.49	0.22	4.0	5.93	5.05			MIN CV	2.0
8	5	92	4.72	4.35		4.54	0.19	4.1	4.91	4.16			MAX CV	16.2
													AVG CV	5.7

TOTAL NITROGEN
REGRESSION ANALSYIS OF JOINT DATA

MDH VS MWCC

Regression Output:		
Constant		0.026
Std Err of Y Est		0.781
R Squared		0.814
No. of Observations		13
Degrees of Freedom		11
X Coefficient(s)	1.036	
Std Err of Coef.	0.149	

WSLOH VS MWCC

Regression Output:		
Constant		0.441
Std Err of Y Est		0.486
R Squared		0.913
No. of Observations		13
Degrees of Freedom		11
X Coefficient(s)	0.869	
Std Err of Coef.	0.081	

WSLOH VS MDH

Regression Output:		
Constant		-0.030
Std Err of Y Est		0.437
R Squared		0.929
No. of Observations		13
Degrees of Freedom		11
X Coefficient(s)	1.007	
Std Err of Coef.	0.084	

FIGURE 11a. TOTAL CHLOROPHYLL SPLIT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

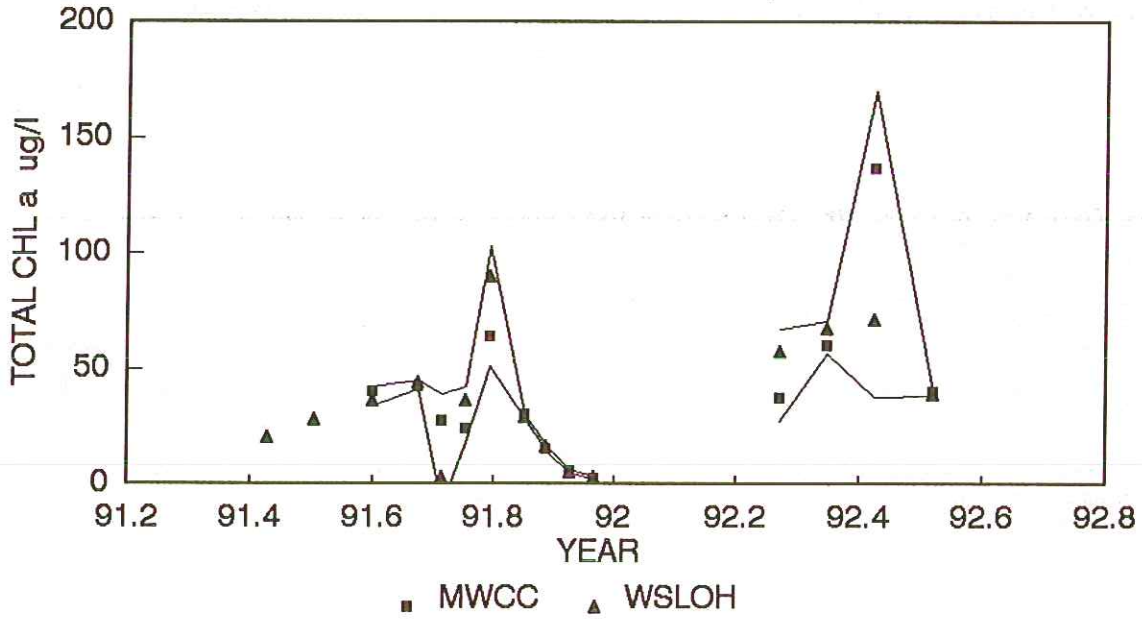

FIGURE 11b. TOTAL CHLOROPHYLL – a ug/l
REGRESSION ANALYSIS OF SPLIT SAMPLES

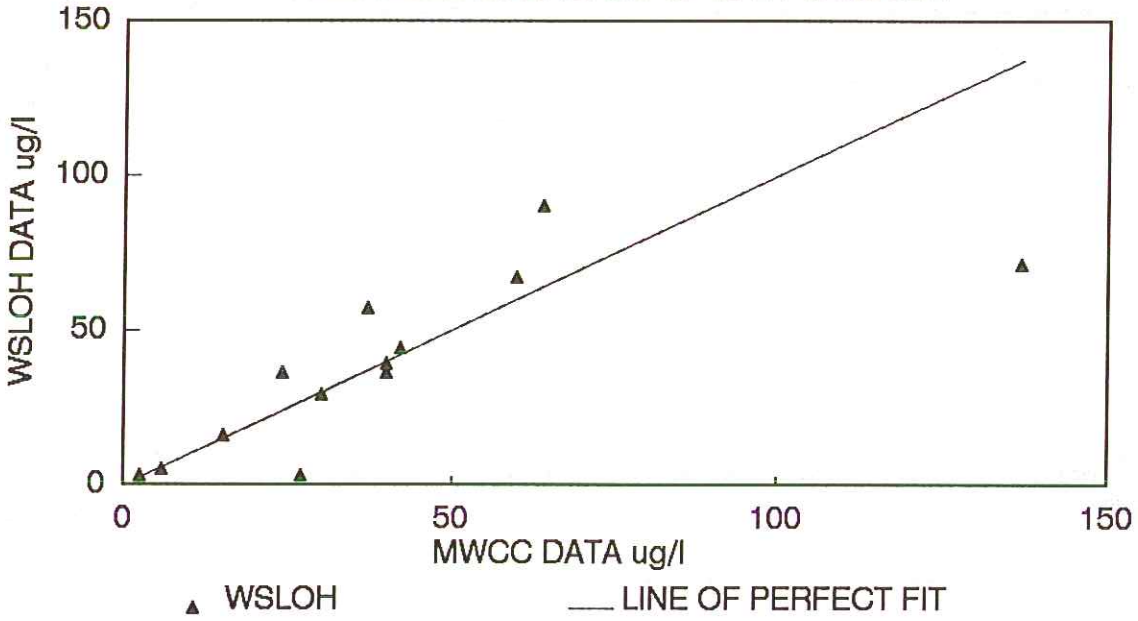

TABLE 13. TOTAL CHLOROPHYLL a SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			TOTAL CHLA ug/l							JOINT TOTAL CHLA			
Mo	Dy	Yr	MWCC	MDH	WSLOH	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91			20	20.0					40		36	5.3
7	2	91			28	28.0					42		44	2.3
8	6	91	40		36	38.0	2.0	5.3	42.0	34.0	27		3	80.0
9	3	91	42		44	43.0	1.0	2.3	45.0	41.0	24		36	20.0
9	18	91	27		3	15.0	12.0	80.0	39.0	-9.0	64		90	16.9
10	2	91	24		36	30.0	6.0	20.0	42.0	18.0	30		29	1.7
10	16	91	64		90	77.0	13.0	16.9	103.0	51.0	15		16	3.2
11	7	91	30		29	29.5	0.5	1.7	30.5	28.5	5.7		5	6.5
11	20	91	15		16	15.5	0.5	3.2	16.5	14.5	2.4		3	11.1
12	4	91	5.7		5	5.4	0.3	6.5	6.1	4.7	37		57	21.3
12	18	91	2.4		3	2.7	0.3	11.1	3.3	2.1	60		67	5.5
											137		71	31.7
4	8	92	37		57	47.0	10.0	21.3	67.0	27.0	40		39	1.3
5	6	92	60		67	63.5	3.5	5.5	70.5	56.5				
6	3	92	137		71	104.0	33.0	31.7	170.0	38.0			N	13
7	8	92	40		39	39.5	0.5	1.3	40.5	38.5			MIN CV	1.3
													MAX CV	80.0
													AVG CV	15.9

TOTAL CHLA CHLOROPHYLL A
REGRESSION ANALSYIS OF JOINT DATA

MDH VS MWCC

NO DATA FROM MDH

WSLOH VS MWCC

Regression Output:

Constant	13.748
Std Err of Y Est	18.980
R Squared	0.567
No. of Observations	13
Degrees of Freedom	11
X Coefficient(s)	0.605
Std Err of Coef.	0.160

WSLOH VS MDH

NO DATA FROM MDH

FIGURE 12a. CORRECTED CHL a SPLIT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

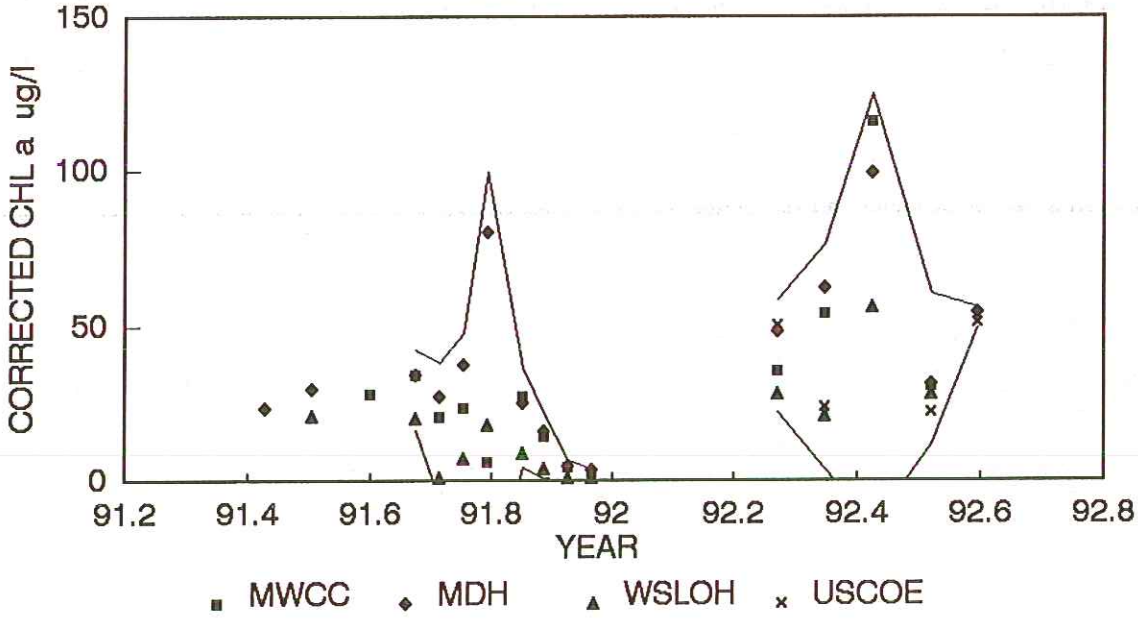

FIGURE 12b. CORRECTED CHLOROPYLL – a ug/l
REGRESSION ANALYSIS OF SPLIT SAMPLES

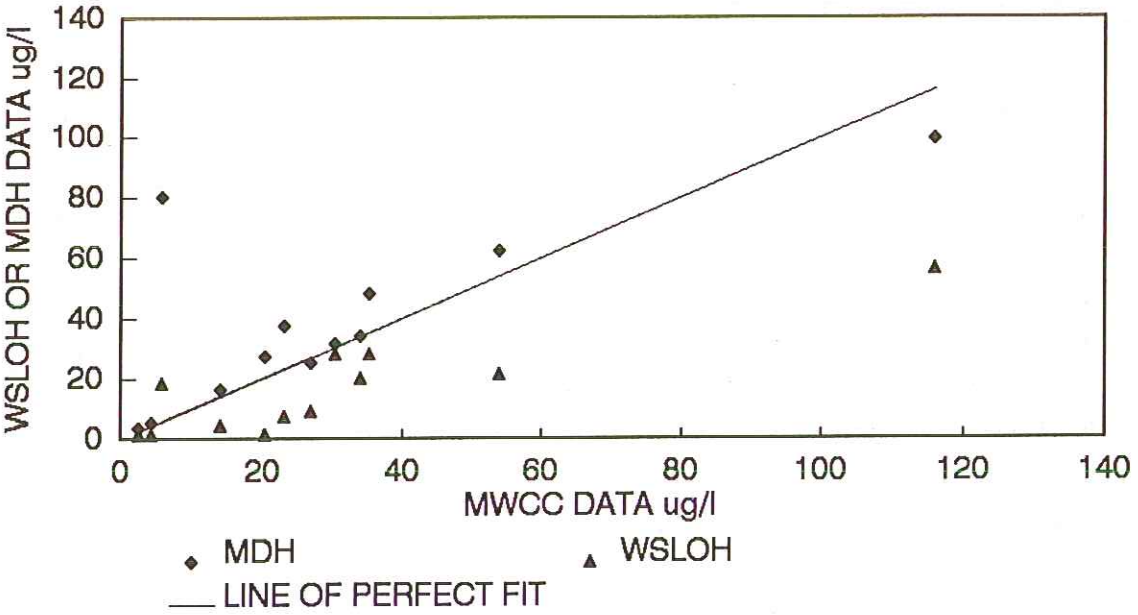

TABLE 14. CORRECTED CHLOROPHYLL a SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			CORR. CHLA ug/l								JOINT CORR. CHLA			
Mo	Dy	Yr	MWCC	MDH	WSLOH	USCOE	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91		23.2			23.2					34	34.0	20	22.5
7	2	91		29.6	21		25.3	4.3	17.0	33.9	16.7	20.4	27.2	1	68.5
8	6	91	28				28.0					23.2	37.6	7	55.3
9	3	91	34	34.0	20		29.3	6.6	22.5	42.5	16.1	5.7	80.1	18	94.1
9	18	91	20.4	27.2	1		16.2	11.1	68.5	38.4	-6.0	27	25.0	9	39.6
10	2	91	23.2	37.6	7		22.6	12.5	55.3	47.6	-2.4	14	16.0	4	46.3
10	16	91	5.7	80.1	18		34.6	32.6	94.1	99.7	-30.5	4.3	4.8	1	50.1
11	7	91	27	25.0	9		20.3	8.1	39.6	36.4	4.2	2.4	3.2	1	41.3
11	20	91	14	16.0	4		11.3	5.2	46.3	21.8	0.8	35.2	48.1	28	22.4
12	4	91	4.3	4.8	1		3.4	1.7	50.1	6.7	-0.0	54	62.2	21	38.9
12	18	91	2.4	3.2	1		2.2	0.9	41.3	4.0	0.4	116	99.3	56	28.0
												30.4	31.4	28	4.8
4	8	92	35.2	48.1	28	50.3	40.4	9.2	22.8	58.8	22.0				
5	6	92	54	62.2	21	23.7	40.2	18.1	45.1	76.5	4.0			N	12
6	3	92	116	99.3	56		54.7	35.2	64.3	125.1	-15.7			MIN CV	4.8
7	8	92	30.4	31.4	28	21.9	36.3	12.2	33.6	60.6	11.9			MAX CV	94.1
8	5	92		54.5		51.3	52.9	1.6	3.0	56.1	49.7			AVG CV	42.7

CORRECTED CHLOROPHYLL A
REGRESSION ANALSYIS OF JOINT DATA

MDH VS MWCC

Regression Output:		
Constant		18.076
Std Err of Y Est		21.024
R Squared		0.527
No. of Observations		12
Degrees of Freedom		10
X Coefficient(s)	0.687	
Std Err of Coef.	0.206	

WSLOH VS MWCC

Regression Output:		
Constant		2.071
Std Err of Y Est		8.135
R Squared		0.770
No. of Observations		12
Degrees of Freedom		10
X Coefficient(s)	0.461	
Std Err of Coef.	0.080	

WSLOH VS MDH

Regression Output:		
Constant		-1.483
Std Err of Y Est		9.873
R Squared		0.662
No. of Observations		12
Degrees of Freedom		10
X Coefficient(s)	0.452	
Std Err of Coef.	0.102	

FIGURE 13a. TSS SPLIT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

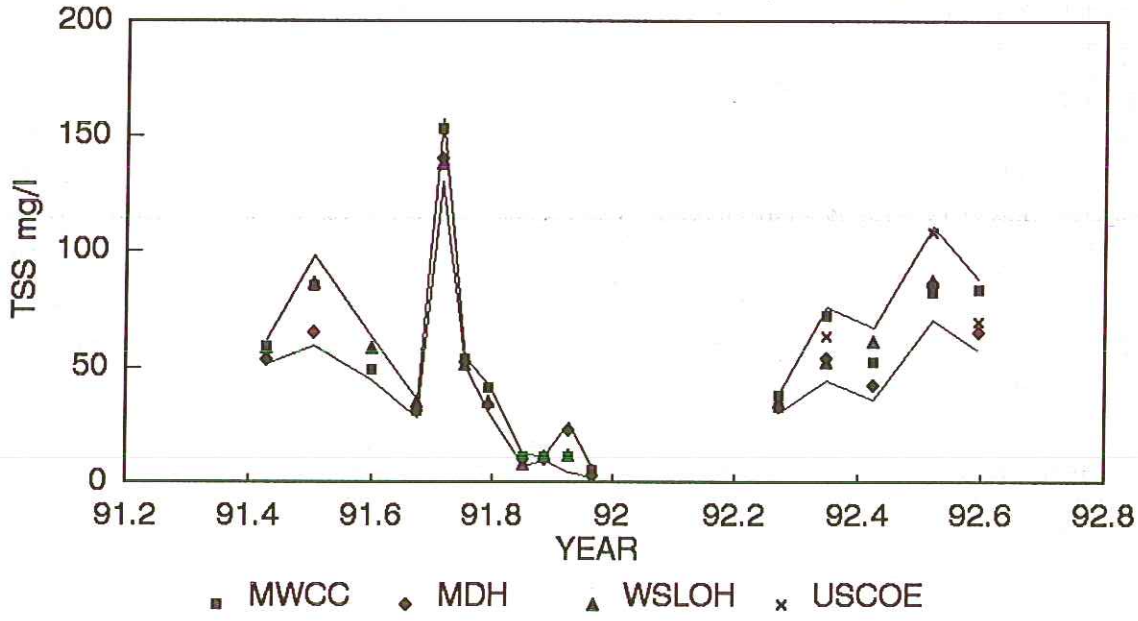

FIGURE 13b. TOTAL SUSPENDED SOLIDS mg/l
REGRESSION ANALYSIS OF SPLIT SAMPLES

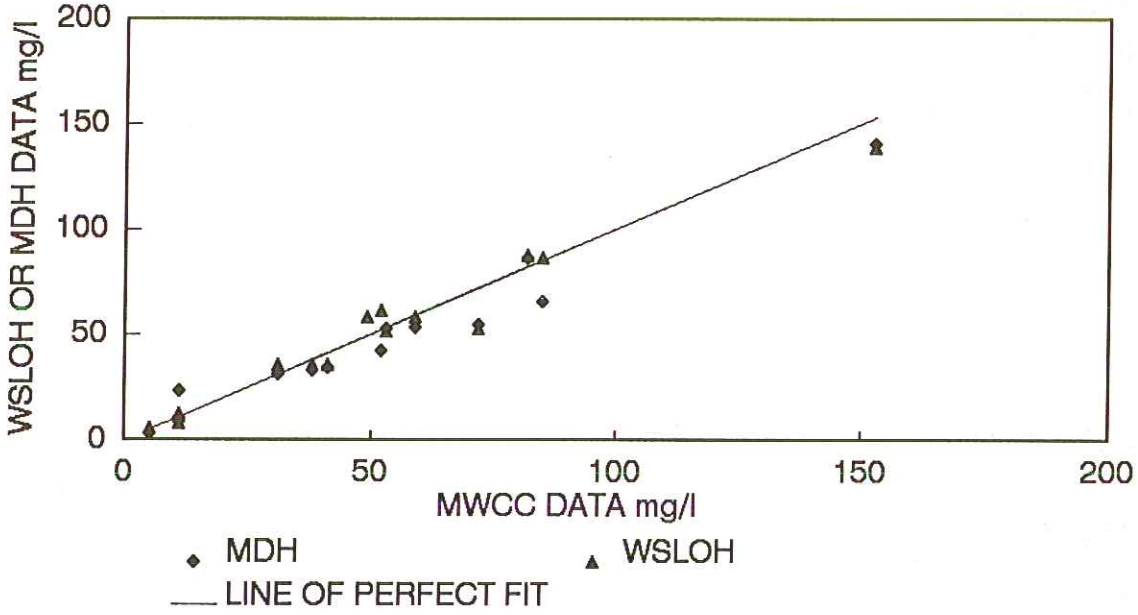

TABLE 15. TOTAL SUSPENDED SOLIDS SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			TOTAL SUSPENDED SOLIDS mg/l									JOINT TSS			
Mo	Dy	Yr	MWCC	MDH	WSLOH	USCOE	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91	59	53	58		56.7	2.6	4.6	61.9	51.4	59	53	58	4.6
7	2	91	85	65	86		78.7	9.7	12.3	98.0	59.3	85	65	86	12.3
8	6	91	49		58		53.5	4.5	8.4	62.5	44.5	31	31	35	5.8
9	3	91	31	31	35		32.3	1.9	5.8	36.1	28.6	153	140	138	4.6
9	18	91	153	140	138		143.7	6.6	4.6	157.0	130.4	53	52	51	1.6
10	2	91	53	52	51		52.0	0.8	1.6	53.6	50.4	41	34	35	8.4
10	16	91	41	34	35		36.7	3.1	8.4	42.8	30.5	11	9.8	8	12.8
11	7	91	11	9.8	8		9.6	1.2	12.8	12.1	7.1	11	10	11	4.4
11	20	91	11	10	11		10.7	0.5	4.4	11.6	9.7	11	23	12	35.5
12	4	91	11	23	12		15.3	5.4	35.5	26.2	4.5	5	3	5	21.8
12	18	91	5	3	5		4.3	0.9	21.8	6.2	2.4	38	33	35	5.8
												72	54	52	15.2
4	8	92	38	33	35	33	34.8	2.0	5.9	38.8	30.7	52	42	61	15.0
5	6	92	72	54	52	63	60.3	7.9	13.2	76.1	44.4	82	86	87	2.5
6	3	92	52	42	61		51.7	7.8	15.0	67.2	36.1				
7	8	92	82	86	87	108	90.8	10.1	11.2	111.0	70.5			N	14
8	5	92	83	65		69	72.3	7.7	10.7	87.8	56.9			MIN CV	1.6
														MAX CV	35.5
														AVG CV	10.7

TOTAL SUSPENDED SOLIDS
REGRESSION ANALSYIS OF JOINT DATA

MDH VS MWCC

Regression Output:	
Constant	1.311
Std Err of Y Est	7.227
R Squared	0.962
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	0.877
Std Err of Coef.	0.050

WSLOH VS MWCC

Regression Output:	
Constant	1.972
Std Err of Y Est	7.105
R Squared	0.966
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	0.918
Std Err of Coef.	0.049

WSLOH MDH

Regression Output:	
Constant	1.878
Std Err of Y Est	8.550
R Squared	0.951
No. of Observations	14
Degrees of Freedom	12
X Coefficient(s)	1.019
Std Err of Coef.	0.067

FIGURE 14a. CHLORIDE SPLIT SAMPLE RESULTS FOR L/D 3
LINES INDICATE AVERAGE +/– 2 STD

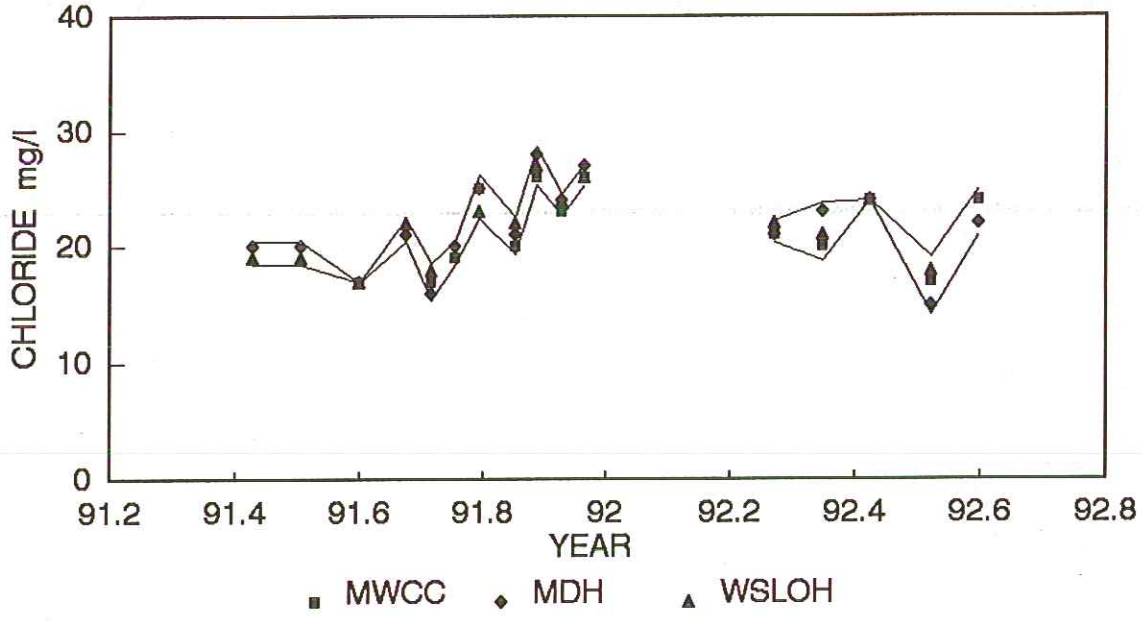

FIGURE 14b. CHLORIDE mg/l
REGRESSION ANALYSIS OF SPLIT SAMPLES

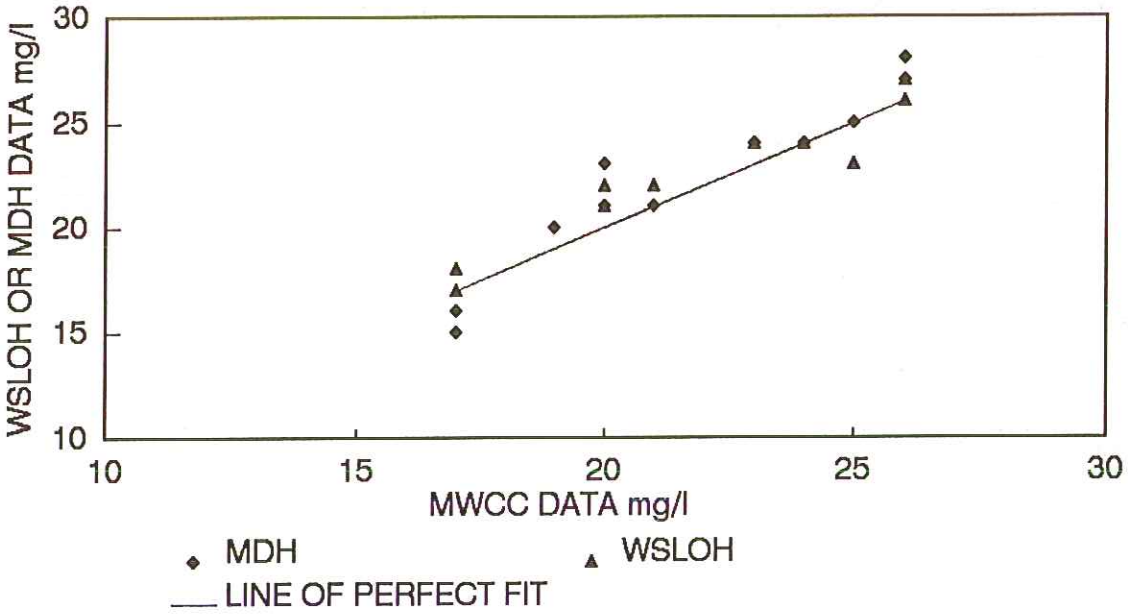

TABLE 16. CHLORIDE SPLIT SAMPLE RESULTS FOR LOCK AND DAM 3, REDWING MINNESTOA

DATE			CHLORIDE mg/l								JOINT Cl DATA			
Mo	Dy	Yr	MWCC	MDH	WSLOH	AVG.	STD	CV %	AVG + 2*STD	AVG - 2*STD	MWCC	MDH	WSLOH	CV %
6	4	91		20	19	19.5	0.5	2.6	20.5	18.5	17	16	18	4.8
7	2	91		20	19	19.5	0.5	2.6	20.5	18.5	25	25	23	3.9
8	6	91	17		17	17.0	0.0	0.0	17.0	17.0	20	21	22	3.9
9	3	91		21	22	21.5	0.5	2.3	22.5	20.5	26	28	27	3.0
9	18	91	17	16	18	17.0	0.8	4.8	18.6	15.4	23	24	24	2.0
10	2	91	19	20		19.5	0.5	2.6	20.5	18.5	26	27	26	1.8
10	16	91	25	25	23	24.3	0.9	3.9	26.2	22.4	21	21	22	2.2
11	7	91	20	21	22	21.0	0.8	3.9	22.6	19.4	20	23	21	5.8
11	20	91	26	28	27	27.0	0.8	3.0	28.6	25.4	24	24	24	0.0
12	4	91	23	24	24	23.7	0.5	2.0	24.6	22.7	17	15	18	7.5
12	18	91	26	27	26	26.3	0.5	1.8	27.3	25.4				
													N	10
4	8	92	21	21	22	21.3	0.5	2.2	22.3	20.4			MIN CV	0
5	6	92	20	23	21	21.3	1.2	5.8	23.8	18.8			MAX CV	7.5
6	3	92	24	24	24	24.0	0.0	0.0	24.0	24.0			AVG CV	3.5
7	8	92	17	15	18	16.7	1.2	7.5	19.2	14.2				
8	5	92	24	22		23.0	1.0	0.5	25.0	21.0				

CHLORIDE
REGRESSION ANALSYIS OF JOINT DATA

WSLOH VS MWCC

Regression Output:	
Constant	-3.780
Std Err of Y Est	1.346
R Squared	0.912
No. of Observations	10
Degrees of Freedom	8
X Coefficient(s)	1.195
Std Err of Coef.	0.131

WSLOH VS MWCC

Regression Output:	
Constant	4.233
Std Err of Y Est	0.969
R Squared	0.907
No. of Observations	10
Degrees of Freedom	8
X Coefficient(s)	0.834
Std Err of Coef.	0.095

WSLOH VS MDH

Regression Output:	
Constant	7.512
Std Err of Y Est	0.929
R Squared	0.914
No. of Observations	10
Degrees of Freedom	8
X Coefficient(s)	0.669
Std Err of Coef.	0.072

APPENDIX 1

Minnesota Department of Health
Chemistry Laboratory

QC/QA Data for FY91

MDH Code	Parameter	Storet	Reference Method	Report Limit	Duplicates Precision Ave%RSD	EPA QC Check Stds Accuracy %RSD
1	Tot. Solids	500	EPA Meth 160.3, 1983	0.5 mg/L	1.92	none
3	Sus. Solids	530	EPA Meth 160.2, 1983	0.5 mg/L	5.50	none
4	S.Vol.Solids	535	EPA Meth 160.4, 1983	0.5 mg/L	6.96	none
11	Turbidity	76	EPA Manual, 1974	0.2 NTU	1.64	none
12	Color	80	EPA Manual, 1974	5	none	none
14	Spec. Cond.	95	EPA Meth 120.1, 1983	0.1 us/cm	0.14	1.85
22	Alkalinity	410	EPA Meth 310.1, 1983	10 mg/L	1.18	5.92
23	Chloride	940	EPA Meth 325.1, 1983	0.5 mg/L	2.24	3.54
30	Reac. Silc.	955	Std. Meth, 1976	0.5 mg/L	0.73	none
59	Tot. Phs.	665	EPA Meth 365.4, 1983	0.01 mg/L	6.70	4.86
63	T.Orth.Phos.	70507	EPA Meth 365.2, 1983	0.001 mg/L	1.99	3.35
64	Ammonia-N	610	EPA Meth 350.1, 1983	0.02 mg/L	4.43	8.56
68	Tot. KJN	625	EPA Meth 351.2, 1983	0.1 mg/L	7.95	12.2
69	NO2+NO3-N	630	EPA Meth 353.2, 1983	0.01 mg/L	1.35	2.95
450	Chloro-a	32211	Std. Meth, 1985	0.16 ug/L	none	none
451	Pheo-a	32218	Std. Meth, 1985	0.27 ug/L	none	none

Appendix 2

Metropolitan Waste Control Commission (MWCC) Sample Handling Procedures
And Quality Assurance

Parameter	Sample Container/ Preparation	Sample Volume Submitted for Analysis	Sample Filtration/ Preservation	Analytical Method	Detection Limit	Precision
Total Phosphorus	50 ml Disposable plastic tube	50 ml	Acidified H2SO4	Automated, using TRAACS continuous flow instrument. Ascorbic Acid for color development. Digestion - Sulfuric acid, potassium sulfate and mercuric sulfate solution.	0.01 mg P/L	Standard Deviation Effluent 0.15 mg P/
Ortho Phosphorous	250 ml plastic container, acid washed, rinsed distilled water.	250 ml	Filtered with Gelman-Metricel Membrane filter, 0.45 um.	Spectrophotometric procedure, Ascorbic Acid Method.		
Dissolved Phosphorus	50 ml Disposable plastic tube	50 ml	Filtered with Gelman-Metricel Membrane filter,	Automated, using TRAACS continuous flow instrument. Ascorbic acid for color development.	0.01 mg P/L	Standard Deviation Effluent 0.15 mg P/
Particulate	½ Gal plastic container, detergent washed and distilled rinsed, transported to lab for filtering.	200 ml filtered	Gelman type A/E glass fiber filter 0.45 um.	Automated, using TRAACS continuous flow instrument. Ascorbic Acid for development. Digestion - Sulfuric acid, potassium sulfate and mercuric sulfate solution.	0.01 mg P/L	Standard Deviation Effluent 0.15 mg P/
Total Kjedahl	50 ml Disposable plastic tube.	50 ml	Acidified H2SO4	Automated, using TRAACS continuous flow instrument. Digestion - Sulfuric acid, potassium sulfate and mercuric sulfate solution. Color development by the formation of ammonia-salicylate complex.	0.1 mg N/L	Standard Deviation Effluent 0.61 mg N/

Metropolitan Waste Control Commission (MWCC) Sample Handling Procedures
And Quality Assurance (Continued)

Parameter	Sample Container/ Preparation	Sample Volume Submitted for Analysis	Sample Filtration/ Preservation	Analytical Method	Detection Limit	Precision
Nitrite-Nitrogen	15 ml disposable culture tubes	15 ml	4 deg C	Colormetric-diazotization method.	0.1 mg/L	
Nitrate-Nitrogen	15 ml disposable culture tubes	15 ml	4 deg C	Colormetric Hydrazine Reduction - diazotation method.	0.05 mg/L	
Ammonia-	15 ml disposable culture tubes	15 ml	Acidified H2S04	Automated Phenate Method	0.02 mg/L	0.01 mg/L a concentration of 0.32 mg/L.
Chlorophyll-A Viable Chlorophyll-A	½ Gal plastic container, detergent washed and distilled rinsed, used for all chlorophyll samples	50-500 ml filtered dependent on suspended sediments.	Gelman type A/E glass fiber filter.	Spectrophotometric method. Monochromate equation for percent viable a. Trichromatic equation for chlorophyll, a, b and c.		
Chloride	250 ml plastic	250 ml		Mercuric Nitrate Method	0.1 mg/L	

Samples are collected 1 meter below the surface with a LabLine polypro water sampler. Nitrite, nitrate, ammonia and chloride are poured into listed containers. Other samples are poured into ½ gal plastic containers, that were detergent washed and rinsed with distilled water. Filtering is done in the lab.

Appendix 3
Wisconsin State Lab of Hygiene Sample Handling and Quality Assurance

SLOH TEST NO.	STORET NO.	PARAMETER	TEST METHOD	CONCENTRATION RANGE	PRECISION UCL	A
I110ALT	410	Alkalinity	Titrimetric, pH 4.5	0-100 mg/L 100-500 mg/L	1.2 2.0	
I240ALT I240BLT	940	CL, Low Range CL, High Range	Automated, Ferricyanide	0.1-10 mg/L 10-50 mg/L	0.12 0.77	90 94
I250ALT	32210	Chloro A, Uncorrected	Trichromatic Std Method 15th Ed.	0-25 µg/L 25-100 µg/L > 100 µg/L	2.6 5.1 15%	
I250BLT	32211	Chloro A, Corrected	Std Method 15th Ed.	All	30%	
I300BLT	95	Conductivity, 25C		All	4.4%	
I440ALD	608	*NH3-N, Diss.,Low R. *NH3-N, Diss.,High Range	Auto. Colorimetric Phenate	0.02-1.00 mg/L 0.2-10.0 mg/L	0.013 0.085	88 85
I460ALD I460BLD	631	*NO2+NO3-N, Diss.,Low R. *NO2+NO3-N, Diss.,High R.	Auto Color Cadmium Reduction	0.02-2.00 mg/L 0.3-30.0 mg/L	0.013 0.131	91 90
I470ALT	625	Total Kjeldahl-N	Semi Auto., Color Phenate	0.2-10.0 mg/L	0.4	83
1520ALT 1520BLT	665	Total P Total P, Low Range	Semi Auto., Ascorbic Acid Semi Auto., Ascorbic Acid	0.02-2.00 mg/L 0.002-0.200 mg/L	0.05 0.005	88 86
1530ALD 1530BLD	671	*Diss. Ortho-P,Low Range *Diss. Ortho-P,High Range	Automated, Ascorbic Acid	0.002-0.200 mg/L 0.20-2.00 mg/L	0.004 0.044	94 95
	403	pH				
1560ALD 1560BLD	955	*Silica, Diss.,Low Range *Silica, Diss.,High Range	Auto, Colorimetric Colorimetric	0.1-10.0 mg/L	0.09	92 95

Appendix 3
Wisconsin State Lab of Hygiene Sample Handling and Quality Assurance

SLOH TEST NO.	STORET NO.	PARAMETER	TEST METHOD	CONCENTRATION RANGE	PRECISION UCL	A
1650CLT	530	Residue TNFLT (TSS)	Gravimetric, 103-105 C	0-25 mg/L	2.7	
				25-100 mg/L	5.3	
				> 100 mg/L	14.3%	
1660ALT	76	Turbidity	Nephelometric, Formazine STDS	0-5 FTU	0.3	
				5-15 FTU	0.7	
				> 15 FTU	6.7%	

LCL = Lower Control Limits
UCL = Upper Control Limits
NA = Not Available
* Samples filtered in lab within 24 hrs of collection (0.45 µ membrane fil