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QUALITY ASSURANCE PLAN

LAKES SALLIE AND DETROIT

PELICAN RIVER WATERSHED DISTRICT

April 5, 1988

By

LARSON-PETERSON & ASSOCIATES, INC.
Consulting Engineers
Detroit Lakes, Minnesota

I hereby certify that this plan, report or specification was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

By Gary L. Nansen Reg. No. 14529
Gary L. Nansen, P.E.

QUALITY ASSURANCE PLAN

LAKES SALLIE AND DETROIT

PELICAN RIVER WATERSHED DISTRICT

I N D E X

ATTACHMENTS

QUALITY ASSURANCE PLAN

WATER DATA ACQUISITION

LAKES SALLIE AND DETROIT
PELICAN RIVER WATERSHED

I. SCOPE

The Quality Assurance Plan details the methods to be utilized for quantitative and qualitative documentation of water data for Lakes Sallie and Detroit. This plan includes sampling techniques, laboratory analysis methods and documentation of data for the monitoring plan.

A. Surface Water

1. Introduction

The collection of surface water data will require measurements of the major inflow and discharge point to each study lake and upstream stations of significance for watershed contributions. The purpose of this measurement is to establish annual surface water volume contributions to each study lake.

2. Data Acquisition

Flow monitoring stations will be observed as defined in the monitoring plan. The Department of Natural Resources, Pelican River Watershed Board members and volunteers will be recording direct staff gauge readings on Form PR-2 Observation of Gauge Height. The observations will be taken by the following personnel:

Location	Observer	
S1 - Sallie Outlet	Gary Nansen	- PRWS
S2 - Fox Lake	Charlie Roper	- PRWS
S3 - Monson Lake	Morris Estenson	- PRWS
S4 - ~~Rearing Ponds~~ HATCHERY	Morris Estenson	- PRWS
D1 - Detroit Lake Outlet	Don Beck	- Volunteer
D2 - Detroit Lake Inlet	Rober Hesby	- PRWS
D3 - East Shore Drive	James Ramstad	- Volunteer
D4 - Sucker Creek	Dr. John Emery	- Volunteer
C1 - St. Clair Outlet	Gary Nansen	- PRWS
L1 - Long Lake Outlet	Dr. Dave Fihn	- PRWS
P1 - Pelican River #34	Pete Caron	- PRWS
F1 - Floyd Lake	Brian Lund	- Volunteer
F2 - Campbell Creek	Don Klomstad	- PRWS

C-2 - COUNTY DITCH 14 @ HWY 59

The data sheets will be collected at two month intervals and the gauge reading converted to flow rates based upon stage-discharge relationships.

3. Field Measurements

The flow monitoring stations are open channel flow conditions for which stage discharge relationships are necessary to determine flows. The stations are located at dams, culverts and in stream channels. The stations have been surveyed to sea level datum utilizing information obtained from the Minnesota Department of Transportation and the U.S. Geological Survey office.

A survey was conducted at each station which consists of staff gauge elevations, channel cross-sections, structure elevations and size.

4. Measurement of Stages

Stage measurements will be based upon surface water elevation data. Staff Gauges have been installed at each station for recording surface elevations. The gauges are enamel coated metal graduated to 0.02'. They are mounted on 1" x 6" treated boards and bolted to steel sign posts or secured to a structure. A description of the mounting and gauge specifications are attached to this report.

5. Stage/Discharge Relationship

The open channel discharge computations will be based upon rating curves for the flow monitoring stations. Measurements of area and velocity will be made for discharge computations. The area calculations can be determined from the cross-sections. Velocity measurements will be made with a current flow meter as described in the attached literature. The velocity measurements in the major channels will consist of several readings across the channel. Results of field velocity measurements will be recorded in field notes.

B. BIOLOGICAL SAMPLING

1. Introduction

Biological sampling for phytoplankton, zooplankton and chlorophyll a will be analyzed. A comparison of lake quality factors and biological changes will be made attempting to determine the parameters which influence zooplankton and phytoplankton concentrations.

2. Sample Acquisition

Concentrations of zooplankton and phytoplankton will be made at the lake sampling sites in Sallie and Detroit Lakes.

Phytoplankton will be collected using a two meter surface sampler to obtain samples. The samples will be collected in a manner to minimize disturbance to surrounding water. The sample will be transferred to a sample bottle for transporting to the testing laboratory.

Zooplankton will be collected utilizing a plankton net. The net will be lowered to the bottom of the lake and raised to the surface, collecting the zooplankton in a vertical column of the lake.

Chlorophyll a samples will be collected with a two meter surface sampler. The sample will be filtered and stored in a dark location at 1°C or less for transporting to a lab for analysis.

3. Data Reporting

The concentration of phytoplankton in the sample will be calculated as the number of units per millileter. Zooplankton will be reported as a density of organisms per cubic liter. Chlorophyll a will be reported in milligrams per square meter.

C. CHEMICAL AND SEDIMENT SAMPLING

1. Introduction

The monitoring of chemical and sediment concentrations will be conducted in streams, groundwater and lakes. The purpose of the sampling will be to quantify parameter concentrations for analysis of lake reactions to external influences.

2. Sample Acquisition

a. Streams

Stream sampling will be taken at regular frequences and subsequent to significant rainfall events. The sampling will be done by a designated watershed employee at or near flow monitoring stations. Samples will be collected in bottles supplied by the testing laboratory. Collection of the stream samples will be by grab sample at a single location.

b. Lakes

The monitoring plan details the location and frequency of the inlake sampling for each lake. Collection of water samples will be required throughout the vertical column of the lake at designated intervals. The samples will be taken with a 2.2 liter vertical Van Dorn water samples and transferred to containers provided by the testing laboratory. The location, date

and time of the samples will be documented and the sample prepared for shipping. Specific procedures for preservation and testing are described in the quality assurance information from the laboratory, which are attached.

Dissolved Oxygen (DO) will be field analyzed using a Yellow Springs Instrument DO meter with a probe and 100 foot cable. The probe will be lowered to the desired depth and the DO concentration documented as indicated on the DO meter. Temperature measurements will also be taken with the YSI meter throughout the vertical column.

pH measurements will be conducted with a portable pH meter from samples taken with the Van Dorn samples.

II. SAMPLING REQUIRMENTS

The parameters to be sampled are defined in the Lake Sallie and Detroit Monitoring Plan. A summary of the sampling requirements is as follows:

Description	Method of Collection	Testing Lab
Streams		
Total P	Grab sample	Twin City Testing
TSS	Grab sample	Twin City Testing
Lakes		
Total P	2m sample, Van Dorn	Twin City Testing
Ortho P	2m sample, Van Dorn	Twin City Testing
TKN	2m sample, Van Dorn	Twin City Testing
Nitrate, Nitrite	2m sample, Van Dorn	Twin City Testing
TSS	2m sample, Van Dorn	Twin City Testing
Coliform	2m sample, Van Dorn	Twin City Testing
Chlorophyll a	2m sample	Twin City Testing
Conductivity	Van Dorn	Twin City Testing
Phytoplankton	2m sample, Van Dorn	Biology Lab Loras College Dubuque, Iowa
Zooplankton	Zooplankton Net	U.M.D. Biology Lab Duluth, Minnesota
Dissolved Oxygen (DO)	Field Tests	YSI DO Meter with probe
pH	Zm sample, Van Dorn	pH Meter
Temperature	Field tests	YSI Meter
Clarity	Visual observation	Secchi Disk

Description	Method of Collection	Testing Lab
Groundwater		
Total P	Pump from monitoring well	Twin City Testing
Nitrate, Nitrite	Pump from monitoring well	Twin City Testing

III. EQUIPMENT

Several items of equipment will be utilized to assist in the collection of field data. The items are as follows:

Equipment	Description	Application
YSI DO Meter	Portable probe type DO meter	In-lake tests for DO and temperature.
2m Surface Sampler	PVC tube with stoppers	Surface sampling.
2.2 l. Alpha Water Bottle	Vertical PVC water sampler	Sample depths in Lakes Sallie and Detroit.
Stevens Staff Gauge	Enamel coated graduated to 0.02 feet	Stream and lake monitoring.
Gurley Current Meter	Pygmy type velocity meter	Velocity measurements in streams.
Wildco Plankton Net	Net and bucket type sampler	Vertical column collection of zooplankton.
Fischer pH Meter	Portable pH meter	pH testing immediately after sampling.

Literature on the equipment to be used is attached to this report.

IV. SAMPLING PROCEDURE

Sampling and testing will follow a documented procedure to assure consistent results. The sampling will be done according to a step by step procedure.

A. General

1. Lake Sampling

a. Read and record levels of DO and temperature at meter intervals from surface to bottom. Record on form PR-1.

b. Collect a surface sample with 2 meter vertical sampler. Record on form PR-6.

c. Collect depth samples at the thermocline, in the mid-hypolimnion (half way between the thermocline and the bottom), and approximately one meter from the bottom. These three samples shall be collected with the Van Dorn sampler. Record on form PR-6.

d. Collect vertical column zooplankton sample from bottom to surface. Record on form PR-9.

e. Read Secchi disk. Record on form PR-1.

f. Filter chlorophyll a sample.

g. pH analysis. Record on PR-7.

h. Prepare samples for shipping.

2. Stream Sampling

a. Label bottles for total phosphorus and total suspended solids collection.

b. Identify location in the stream which flowing.

c. Enter the channel at a downstream location and move upstream to the sample location.

d. Lower sample bottle with the opening down one third the stream depth below the surface and turn upright to fill.

e. Cap sample and place in cooler. Record on PR-3.

3. Groundwater Sample

a. Remove sample well cap and lower suction line into the well. Purge the well by pumping.

b. Obtain sample from well and fill sample bottle.

c. Seal bottle, label and place in cooler. Record on form PR-4.

B. Detailed Procedures

1. Dissolved Oxygen/Temperature

a. Calibrate instrument.

b. Read at meter intervals, allowing meter reading to stabilize.

c. Record values to nearest 0.1.

d. If DO/temp. readings below the thermocline do not change, readings may be spaced to four meter intervals to confirm constant conditions. If four meter interval conditions change, profile intermediate one meter depths.

2. Lake Surface Sampling

a. Sample will be collected with a 2 meter PVC tube which can be plugged at each end for storage.

b. Clean PVC tube with a brush, using lake water to rinse the tube. Inspect the tube for dust or contaminants.

c. Insert sampler vertically into the lake, slowly lowering the tube to collect a column of water from the upper two meters of the lake.

d. Cap the top of the tube, remove from the lake and drain the tube into a 2 l. acid washed bottle, making sure that no water from the sample is wasted.

e. Split the surface sample into the following bottles:

Bottle	Parameters
1000 ml glass	Total P TKN
500 ml PVC	TSS Ortho P NO_2 - NO_3

Bottle	Parameters
1l	Phytoplankton
100 ml Whirlpac	Coliform

f. Empty the 2 l. bottle, obtain another surface sample, fill the 2 l. bottle for chlorophyll a sample.

g. All bottles shall be capped and properly labeled for location, date and name of sampler. The samples shall be placed in a cooler for storage until shipping.

3. Lake Depth Sampling

a. Make sure the Van Dorn bottle is clean and the location of sampling is approximately 15 feet away from the DO/Temp. sampling.

b. Lower sampler to the thermocline sample depth utilizing measured increment markings on the rope to obtain the proper depth.

c. Trip Van Dorn sampler with messenger. If there is a possibility that the sampler closed at a depth other than the required depth, sample should be discarded and re-done.

d. Transfer the water from the sampler to the following sample bottles:

Bottle	Parameters	Preservative
1000 ml glass	Total P TKN	Yes
500 ml PVC	TSS Ortho P NO_2 - NO_3	No

e. Label bottles and place in storage until shipping.

f. Repeat procedure in hypoliminion and near bottom.

4. Zooplankton Sampling

a. Inspect zooplankton net to assure that there are no holes and the net is clean.

b. Lower net so the bucket just touches the bottom of the lake.

c. Slowly, raise the net at a rate of 1 m/sec.

d. Rinse the net with distilled water to wash the zooplankton into the bucket.

e. Disconnect the bucket from the net and rinse the bucket squirting distilled water on the screen, obtaining a 100 ml sample.

f. Add 5 ml of 95% ethanol solution.

g. Add 3-5 ml of full strength formaldehyde.

h. Fill 100 ml PVC bottle to the top.

i. Cap and label bottle for shipping to lab. Record on PR-9.

5. Phytoplankton

a. A minimum of 1 liter has been sampled from the surface.

b. Add 4 ml formalin to 196 ml of sample.

c. Concentrate the sample to 20 ml.

d. Split the sample and send 10 ml to lab and retain 10 ml.

e. Document the initial volume and concentrate volume for each sample on PR-8.

6. Secchi Disk Reading

a. Lower Secchi disk into water at the back of the boat to avoid wave action.

b. Lower Secchi disk until it cannot be seen.

c. Slowly raise disk until it can be seen.

d. Record depth of observation on PR-1.

7. Filter Chlorophyll a Sample

a. Transport 2 liter bottle to Detroit Lakes laboratory for filtering.

b. Set up filtering unit consisting of a flask, vacuum pump with pressure gauge, filter holder and filtering bowl.

c. Rinse filtering bowl and insert filter.

d. Pour sample into filtering bowl and vacuuming sample through filter at 5 psi vacuum.

e. Filter sample noting the volume of sample filter. Note collection of biomass on the filter. Filter 1000 ml, if possible. If filter plugs, the volume can be reduced to a minimum of 250 ml. If filter does not turn green, filter up to 2 l. before stopping.

f. Add 1 ml of $MgCO_3$ preservative (1 dropper).

g. Using tweezers, fold filter in half to protect sample and place in petri dish.

h. Label petri dish, freeze and store in a dark location prior to transporting.

8. pH Analysis

a. Calibrate pH meter at Detroit Lakes laboratory.

b. Rinse plastic cup to be used for sample.

c. Fill cup with sample from unpreserved lake sample bottle.

d. Place probe in cup and turn on pH meter.

e. Allow meter to stabilize and record value.

f. Read pH and record for surface, thermocline, hypoliminion and bottom for each lake sample location.

V. SAMPLE STORAGE AND SHIPPING

A. General

All samples shall be labeled with the sample I.D., date and initials of the sampler as minimum information. A sampling sheet summary sheet shall be completed and one copy retained. The other copy shall accompany the samples.

B. Chemical and Sediment Samples

Lab: Twin City Testing & Engineering Laboratory
2105 7th Avenue North
Fargo, North Dakota 58102

Container: Insulated PVC cooler, packed with ice and sealed with tape.

Storage: Deliver to lab within 24 hours.

Transport: By bus or car to lab.

Contents: 1. Lake Samples

Lake Sallie

4 glass 1000 ml bottles (1 depth each)
4 PVC 500 ml bottles (1 depth each)
1 petri dish
1 100 ml whirlpac

Detroit Lake

4 glass 1000 ml bottles (1 depth sample)
4 PVC 500 ml bottles (1 depth sample)
1 petri dish
2 glass 1000 ml bottles (2 surface sites)
2 PVC 500 ml bottles (2 surface sites)
1 100 ml whirlpac

2. Stream Samples (Per Station)

500 ml PVC bottle. Preservative
500 ml PVC bottle. No preservative
If 14 stations, total will be 28 bottles.

3. Groundwater Samples

500 ml PVC bottles. Preservative
500 ml PVC bottles. No preservative

C. Biological Samples

1. Zooplankton

Lab: University of Minnesota - Duluth
221 Life Science Building
10 University Drive
Duluth, Minneosta 55812-2496
Attn: Mr. Mel Whiteside

Storage: Up to one year.

Transport: UPS

Contents: 1 - 100 ml PVC bottle per sample

2. Phytoplankton

Lab: Loras College
Department of Biology
St. Joseph's Hall of Science
Dubuque, Iowa 52004-0178
Attn: David Czarnecki, Associate Professor

Storage: Up to one year.

Transport: UPS

Contents: 10 ml sample

VI. LABORATORY ANALYSIS

Bottles for chemical analysis will be prepared by Twin City Testing for sampling. The standard method for bottle washing will be as follows:

- Wash each bottle with laboratory soap.
- Rinse five times with tap water.
- Rinse three times with deionized water.
- For phosphorus sample bottles, rinse with an HCl solution.
- Rinse in deionized water.

If capped glass bottles are used, the cap shall not be re-used.

The methods for analyzing the samples are based upon Standard Methods for the Examination for Water and Wastewater in conjunction with discussions with the Minnesota Pollution Control Agency (MPCA). The methods for analysis are included in the attachment to this plan.

VI. DOCUMENTATION OF DATA

A. Sample Identification

1. Lakes

Lake samples will be identified by the lake, number of samples per month and location of sample. The format shall be as follows:

$$\underset{a}{\lfloor LS \rfloor} - \underset{b}{\lfloor A \rfloor} - \underset{c}{\lfloor 1S \rfloor}$$

a. Lake I.D.

LS = Lake Sallie
LD = Lake Detroit deepest location
LDI = Lake Detroit near inlet
LDO = Lake Detroit near outlet

b. Number of Samples Per Month

A = First monthly sample all year
B = May-August second sample

c. Container Number and Depth

1 = Preserved bottle
2 = Unpreserved bottle
3 = Petri dish
4 = Zooplankton
5 = Phytoplankton

S = Surface
T = Thermocline
H = Midhypolimiun
B = Bottle Bottom

Label each container with a sample I.D., date and initials of sampler. Complete form PR-6 and send a copy with container.

2. Streams

Stream samples shall be identified as follows:

$$\underset{a}{\lfloor S1 \rfloor} - \underset{b}{\lfloor 1A \rfloor}$$

a. Sample location I.D.

b. Container: Type and number of samples (A, B, C, etc.)
1 - Preservative
2 - No Preservative

The samples shall be labeled with I.D. number, date and initials of sampler. Record on sheet 3.

3. Groundwater

Groundwater shall be identified as follows:

$$\underset{a}{\lfloor PC \rfloor} - \underset{b}{\lfloor 27 \rfloor} - \underset{c}{\lfloor A \rfloor}$$

a. PC is the identifier for inplace wells.

b. Well No.

c. Samples per month A, B, C, etc.

Samples shall be labeled with I.D. number, date and initials of the sampler. Record on sheet 4.

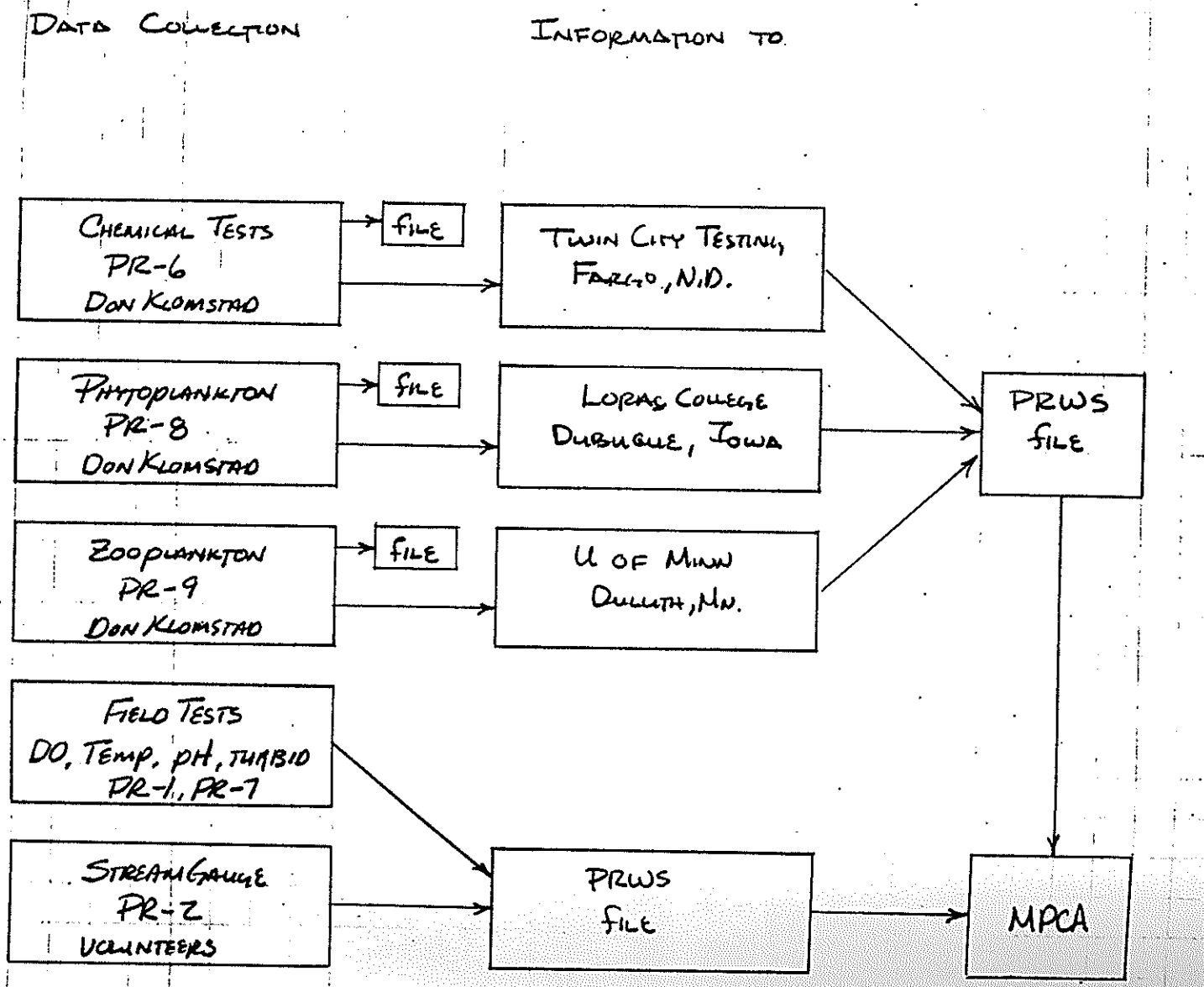
B. Data Flow Chart

The data will be collected by representatives of the Pelican River Watershed. Data will be recorded on the following forms:

Form No.	Title	Description
PR-1	Dissolved Oxygen Temperature	Profile of lake DO and temp.
PR-2	Observation of gauge height	Daily record of gauge height readings.
PR-3	Stream Sampling	Record of samples taken for lab and file.
PR-4	Groundwater Sampling	Record of samples taken for lab and file.
PR-5	Gauging Station Streams	Descriptive summary of each stream gauging station.
PR-6	Lake Sampling	
	A. Sallie	Monthly sampling.
	B. Sallie	Second monthly sampling, May - August.
	C. Detroit	Monthly sampling.
	D. Detroit	Second monthly sampling, May - August
PR-7	pH Testing	Record of field pH tests.
PR-8	Phytoplankton	Summary of sample.
PR-9	Zooplankton	Summary of sample.

The data collection will be compiled and recorded as shown on the data flow chart.

DATA FLOW CHART



PELICAN RIVER WATERSHED
(PRWS)

ANALYTICAL METHODS

twin city testing
corporation
2105 7TH AVENUE NO.
FARGO, ND 58102
PHONE 701/235-4256

TOTAL PHOSPHORUS

Methods:

1. Standard Methods for the Examination for Water and Wastewater 15th Edition, Methods 424C and F
2. Methods for Chemical Analysis of Water and Wastes EPA - 600/4-79-020, Method 365.2

Degree of Accuracy

0.01 mgP/Liter

Sampling Procedure:

Sample Size (ml)	Type of Container	Preservation	Holding Time
50	Plastic or Glass	H_2SO_4 to pH<2 Cool to 4°C	28 Days

Remarks:

Detection limits; accuracy and precession of the data are based on inter-laboratory studies as well as previous experience. It is anticipated that the data generated during this program will fall within these ranges, however; it must be recognized that unique sample matrix problems, which may effect the analytical data, can occur.

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corporation
2105 7TH AVENUE NO.
FARGO, ND 58102
PHONE 701/235-4256

ORTHO PHOSPHORUS

Methods:

1. Standard Methods for the Examination for Water and Wastewater 15th Edition, Methods 424C and F

2. Methods for Chemical Analysis of Water and Wastes EPA - 600/4-79-020, Method 365.2

Degree of Accuracy

0.01 mgP/Liter

Sampling Procedure:

Sample Size (ml)	Type of Container	Preservation	Holding Time
50	Plastic or Glass	Cool to 4°C	48 Hours

Remarks:

Detection limits; accuracy and precession of the data are based on inter-laboratory studies as well as previous experience. It is anticipated that the data generated during this program will fall within these ranges, however; it must be recognized that unique sample matrix problems, which may effect the analytical data, can occur.

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TOTAL KJELDAHL NITROGEN

Methods:

1. Standard Methods for the Examination for Water and Wastewater 15th Edition, 1980, Method 417 A, B, D, E and Method 420A

2. Methods for Chemical Analysis of Water and Wastes EPA - 600/4-79-20, March 1979, Methods 350.2., 351.3

Degree of Accuracy

0.05 mgN/Liter

Sampling Procedure:

Sample Size (ml)	Type of Container	Preservation	Holding Time
500	Plastic or Glass	H_2SO_4 to pH<2 Cool to 4°C	28 Days

Remarks:

Detection limits; accuracy and precession of the data are based on inter-laboratory studies as well as previous experience. It is anticipated that the data generated during this program will fall within these ranges, however; it must be recognized that unique sample matrix problems, which may effect the analytical data, can occur.

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NITRATE/NITRITE

Methods:

1. Standard Methods for the Examination for Water and Wastewater 15th Edition, 1980, Method 418C
2. Methods for Chemical Analysis of Water and Wastes EPA - 600/4-84-020, Method 353.3

Degree of Accuracy

0.05 mgN/Liter

Sampling Procedure:

Sample Size (ml)	Type of Container	Preservation	Holding Time
100	Plastic or Glass	Cool to 4°C	48 Hours
100	Plastic or Glass	H_2SO_4 to pH<2 Cool to 4°C	28 Days

Remarks:

Detection limits; accuracy and precession of the data are based on inter-laboratory studies as well as previous experience. It is anticipated that the data generated during this program will fall within these ranges, however; it must be recognized that unique sample matrix problems, which may effect the analytical data, can occur.

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TOTAL SUSPENDED SOLIDS

Methods:

1. Standard Methods for the Examination for Water and Wastewater 16th Edition, 1985, Method 209

2. Methods for Chemical Analysis of Water and Wastes EPA - 600/4-79-20, 1979, Section 160.2

Degree of Accuracy

4 mg/Liter

Sampling Procedure:

Sample Size (ml)	Type of Container	Preservation	Holding Time
100	Plastic or Glass	Cool to 4°C	7 Days

Remarks:

Detection limits; accuracy and precession of the data are based on inter-laboratory studies as well as previous experience. It is anticipated that the data generated during this program will fall within these ranges, however; it must be recognized that unique sample matrix problems, which may effect the analytical data, can occur.

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2105 7TH AVENUE NO.
FARGO, ND 58102
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CHLOROPHYLL a

Methods:

1. Standard Methods for the Examination for Water and Wastewater
   16th Edition, Method 1002G
   "Spectophotonetric Determination of Chlorophyll"

   Note: Correction will be made for pheophytin content.

Degree of Accuracy

Reproducibility of readings for the sample sample is the limiting factor for detection (1.2 mg/m^3). Other measures of accuracy and precision are not applicable.

Sampling Procedure:

Sample Size (ml)	Type of Container	Preservation	Holding Time
Glass Fiber Filter	Whirlpak	Kept in the Dark	24 Hours

Remarks:

Detection limits; accuracy and precession of the data are based on inter-laboratory studies as well as previous experience. It is anticipated that the data generated during this program will fall within these ranges, however; it must be recognized that unique sample matrix problems, which may effect the analytical data, can occur.

LORAS COLLEGE

DEPARTMENT OF BIOLOGY
ST. JOSEPH'S HALL OF SCIENCE
DUBUQUE, IA 52004-0178

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MAR 2 1 1988
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18 March, 1988

Mr. Gary L. Nansen, P. E.
Larson-Peterson & Associates, Inc.
522 W. Main Street
Box 150
Detroit Lakes, MN 56501

Dear Gary,

Enclosed, please find a recent resume of mine for your files, as well as a brief explanation of the preserving/fixing solution I mentioned.

I would suggest that you use the following format in your phytoplankton sampling program:

=> Collect whole-water samples, i.e., not net collected using a wide-mouth container of a minimum 1 liter vol.
=> Add 2ml iodine to each 98 ml of sample you wish to have me analyze.
=> Concentrate the treated sample to a small vol., e.g. 20 ml.
=> Send me half of the sample and retain half for backup.
=> Indicate the initial volume and concentrate volume for each sample so that I can calculate numbers/original.

I would be responsible for qualitative and quantitative phytoplankton anyalses which would involve identification to the lowest possible level of resolution, i.e., species and variety level where appropriate. In most cases, counting-cell techniques would suffice. These services would cost $25.00/sample analyzed.

If you have any questions regarding this type of analysis, please don't hesitate to let me know.

Sincerely,

David B. Czarnecki
Associate Professor

Chairman
Edward T. Cawley, Ph.D.
319-588-7128

David B. Czarnecki, Ph.D.
319-588-7231

Gerald W. Eagleson, Ph.D.
319-588-7767

Joseph F. Kapler, Ph.D.
319-588-7767

Gerald W. Kaufmann, Ph.D.
319-588-7231

FIXATION AND PRESERVATION OF PHYTOPLANKTON USING M_3 IODINE (MODIFIED) SOLUTION

Quantitative and qualitative phytoplankton analyses require sample fixation and preservation which are (1) relatively inexpensive, (2) effective for long duration and (3) non-destructive for a variety of cellular constituents. The use of modified M_3 solution appears to satisfy these requirements. In addition, when whole-water samples are employed, cellular incorporation of this solution provides a suitable density gradient for cell settling; in most instances, treated samples can be concentrated to specified volumes in less than eight hours when removal of excess volume is performed under aspiration.

The M_3 solution (Meyer 1971) as modified (Ngo *et al.* 1987) has the following formulation:

> DISSOLVE COMPLETLY 0.5g KI & 0.5g KF IN 100ml DISTILLED WATER. IN THIS SOLUTION DISSOLVE COMPLETLY 1.0g I_2. TO THIS SOLUTION ADD 25 ml COMMERCIAL FORMALIN AND 5ml GLACIAL ACETIC ACID. STORE TIGHTLY CAPPED, IN THE DARK, IN AN AMBER GLASS BOTTLE.

This solution should be used at a final sample concentration of 2% (vol/vol). This level has been shown to be effective in previous Clean Lakes studies (Czarnecki & Meyer 1981).

REFERENCES

Czarnecki, D. B. & R. L. Meyer [eds.]. 1981. *Classification and ranking of selected Arkansas lakes.* Report. Ark. Dept. Poll. Control & Ecol., Little Rock.

Meyer, R. L. 1971. *A study of phytoplankton dynamics in Lake Fayetteville as a means of assessing water quality.* Publ. 10. Univ. Ark. Water Resources Res. Center, Fayetteville.

Ngo, H., G. W. Prescott & D. B. Czarnecki. 1987. Additions and confirmations to the algal flora of Itasca State Park. I. Desmids and diatoms from North Deming Pond. *J. Minn. Acad. Sci.* 52(2):14-26.

87-P-3

UNIVERSITY OF MINNESOTA
DULUTH

College of Science and Engineering

Department of Biology
221 Life Science Building
10 University Drive
Duluth, Minnesota 55812-2495
(218) 726-7264

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March 21, 1988

Mr. Gary L. Nansen
Larson-Peterson & Associates, Inc.
522 W. Main Street
Box 150
Detroit Lakes, MN 56501

Dear Mr. Nansen,

In reference to your letter of 15 March 1988, my laboratory could provide you with the services you request.

We would perform the following on zooplankton samples provided by your firm:

1) Identify, measure, and count all zooplankton species larger than 0.25 mm total length.

2) Provide computer summaries of the above information for each sample.

3) Provide a summary of collections for each sampling data.

The cost per sample would be $50.00, however, interpretation of data, report writing, etc. would not be included in this fee.

If you decide to contact us for the work, I will send you information regarding how our account should be set up.

Sincerely,

M. C. Whiteside

M.C. Whiteside

P.S. You referred to a type of net sampler in your letter, indicating some information was included in the letter; I found none, but I will be happy to comment on equipment and methods.

REPORTING FORMS

FORM PR-1

PELICAN RIVER WATERSHED

DISSOLVED OXYGEN/TEMPERATURE PROFILES

LAKE _____
LOCATION _____
DATE _____
TIME _____
REMARKS:

Secchi Disk Reading _____ ft.

Sample Taken By: _____

Depth Meters	DO	T °C
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		
21.		
22.		
23.		
24.		
25.		

FORM PR-2

PELICAN RIVER WATERSHED

OBSERVATIONS OF GAUGE HEIGHT

Sta. No. _____

Month _____ 198__

Gauging For _____

DATE	TIME	GAUGE HEIGHT	REMARKS
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

FORM PR-3

PELICAN RIVER WATERSHED

Date: _____

STREAM SAMPLING

STATION NO.	SAMPLE TAKEN	TIME	GAUGE HEIGHT	NO. OF BOTTLES
S1				
S2				
S3				
S4				
D1				
D2				
D3				
D4				
C1				
C2				
L1				
P1				
F1				
F2				

SAMPLE TAKEN BY: _____

LAB TEST FOR:		Yes	No
	Total Phosphorus	___	___
	TSS	___	___
	Other	___	___

FORM PR-4

Date: _____

PELICAN RIVER WATERSHED

GROUNDWATER MONITORING

SAMPLE LOCATION	SAMPLE TAKEN	DEPTH TO GROUNDWATER	TIME
PC-18			
PC-27			
PC-30			

SAMPLED BY: _____

		Yes	No
LAB TEST FOR:	Total Phosphorus	___	___
	NO_2 - NO_3	___	___

FORM PR-5

PELICAN RIVER WATERSHED

STREAM FLOW MONITORING

GAUGING STATION

IDENTIFICATION NO.: F1

LOCATION: Floyd Lake outlet.

DESCRIPTION: Dam structure at the outlet of Little Floyd Lake.

GAUGE: Staff gauge located on the headwall of the dam.

CHANNEL AND CONTROL: Channel downstream from the dam.

METHOD OF FLOW DETERMINATION: Rating curve from channel measurements. Staff gauge readings taken twice a week.

VERTICAL CONTROL: _____

OBSERVER: Don Klomstad

PR-5

PELICAN RIVER WATERSHED

STREAM FLOW MONITORING

GAUGING STATION

IDENTIFICATION NO.:	F1
LOCATION:	Floyd Lake outlet.
DESCRIPTION:	Dam structure at the outlet of Little Floyd Lake.
GAUGE:	Staff gauge located on the headwall of the dam.
CHANNEL AND CONTROL:	Channel downstream from the dam.
METHOD OF FLOW DETERMINATION:	Rating curve from channel measurements. Staff gauge readings taken twice a week.
VERTICAL CONTROL:	
OBSERVER:	Don Klomstad

FORM PR-6A

LAKE SAMPLING INVENTORY

TWIN CITY TESTING

LAKE SALLIE

LOCATION _____

DATE _____

TIME _____

MONTHLY SAMPLE

SAMPLE	SAMPLE I.D.	TOTAL P.	ORTHO P.	TKN	NITRATE-NITRITE	TSS	COLIFORM	CHLOROPHYLL a
Surface								
1. Preserved	LS-A-1S	Yes		Yes				
2. Unpreserved	LS-A-2S		Yes		Yes			
3. Petri Dish	LS-A-3S							Yes
4. Water Pail	LS-A-4S						Yes	
Thermocline								
1. Preserved	LS-A-1T	Yes		~~Yes~~				
2. Unpreserved	LS-A-2T		Yes			Yes		
Hypoliminion								
1. Preserved	LS-A-1H	Yes		~~Yes~~				
2. Unpreserved	LS-A-2H		Yes		Yes			
Bottom								
1. Preserved	LS-A-1B	Yes		Yes				
2. Unpreserved	LS-A-2B		Yes					

SAMPLED BY _____

FORM PR-6B

LAKE SAMPLING INVENTORY

TWIN CITY TESTING

LAKE SALLIE
LOCATION _____
DATE _____
TIME _____

SECOND MONTHLY SAMPLE

MAY - AUGUST

SAMPLE	SAMPLE I.D.	TOTAL P.	ORTHO P.	TKN	NITRATE-NITRITE	TSS	COLIFORM	CHLOROPHYLL a
Surface								
1. Preserved	LS-B-1S	Yes		Yes				
2. Unpreserved	LS-B-2S		Yes					
3. Petri Dish	LS-B-3S							Yes
4. Water Pail	LS-B-4S							
Thermocline								
1. Preserved	LS-B-1T	Yes		Yes		Yes		
2. Unpreserved	LS-B-2T		Yes					
Hypoliminion								
1. Preserved	LS-B-1H	Yes		Yes				
2. Unpreserved	LS-B-2H		Yes					
Bottom								
1. Preserved	LS-B-1B	Yes		Yes				
2. Unpreserved	LS-B-2B		Yes					

SAMPLED BY _____

FORM PR-6C

LAKE SAMPLING INVENTORY

TWIN CITY TESTING

LAKE DETROIT
LOCATION _____
DATE _____
TIME _____

MONTHLY SAMPLE

SAMPLE	SAMPLE I.D.	TOTAL P.	ORTHO P.	TKN	NITRATE-NITRITE	TSS	COLIFORM	CHLOROPHYLL a
Surface								
1. Preserved	LD-A-1S	Yes		Yes				
2. Unpreserved	LD-A-2S		Yes		Yes			
3. Petri Dish	LD-A-3S							Yes
4. Water Pail	LD-A-4S						Yes	
Thermocline								
1. Preserved	LD-A-1T	Yes		Yes				
2. Unpreserved	LD-A-2T		Yes					
Hypoliminion								
1. Preserved	LD-A-1H	Yes		Yes				
2. Unpreserved	LD-A-2H		Yes		Yes	Yes		
Bottom								
1. Preserved	LD-A-1B	Yes		Yes				
2. Unpreserved	LD-A-2B		Yes					

SAMPLED BY _____

FORM PR-6D

LAKE SAMPLING INVENTORY

TWIN CITY TESTING

LAKE DETROIT
LOCATION _____
DATE _____
TIME _____

SECOND MONTHLY SAMPLE

MAY - AUGUST

SAMPLE	SAMPLE I.D.	TOTAL P.	ORTHO P.	TKN	NITRATE-NITRITE	TSS	COLIFORM	CHLOROPHYLL a
Surface								
1. Preserved	LD-B-1S	Yes		Yes				
2. Unpreserved	LD-B-2S		Yes					
3. Petri Dish	LD-B-3S							Yes
4. Water Pail	LD-B-4S							
Thermocline								
1. Preserved	LD-B-1T	Yes		Yes		Yes		
2. Unpreserved	LD-B-2T		Yes					
Hypoliminion								
1. Preserved	LD-B-1H	Yes		Yes				
2. Unpreserved	LD-B-2H		Yes					
Bottom								
1. Preserved	LD-B-1B	Yes		Yes				
2. Unpreserved	LD-B-2B		Yes					

SAMPLED BY _____

FORM PR-7

PELICAN RIVER WATERSHED

pH TESTING

LAKE _____
LOCATION _____
DATE _____
TIME _____

	Depth (m)	pH
Surface		
Thermocline		
Hypoliminion		
Bottom		

TESTED BY _____

FORM PR-8

PELICAN RIVER WATERSHED

PHYTOPLANKTON

LAKE _____
LOCATION _____
DATE _____
TIME _____
SAMPLE I.D. _____

TOTAL VOLUME COLLECTED _____

VOLUME PRESERVED _____ ml

PRESERVATIVE ADDED 4% _____ ml

SAMPLED BY: _____

FORM PR-9

PELICAN RIVER WATERSHED

ZOOPLANKTON

LAKE _____
LOCATION _____
DATE _____
TIME _____
SAMPLE I.D. _____

TOTAL SAMPLE COLLECTED _____

5 ml 95% ETHANOL ADDED? _____

3-5 ml FORMALDEHYDE ADDED? _____

SAMPLED AND PREPARED BY: _____

COLUMN 1 VELOCITY CHECK LOCATION	COLUMN 2 GAUGE READING AT BOTTOM (Ft.)	COLUMN 3 EFFECTIVE DEPTH * Adj. Gauge - Column 2	COLUMN 4 DEPTH FROM SURFACE TO VELOCITY MEASUREMENT If Column 3 $\leq$ 2.5' then Column 4 = 0.6 x Column 3. If Column 3 > 2.5' then Column 4 = 0.2 x Column 3 and 0.8 x Column 3.	COLUMN 5 MEAN VELOCITY (Ft./Sec.)	COLUMN 6 EFFECTIVE WIDTH (Ft.)	COLUMN 7 ELEMENTAL AREA ($Ft.^2$) Column 3 x Column 6	COLUMN 8 ELEMENTAL FLOW CFS Column 5 x Column 7

* If Column 3 result is negative enter "0" in Columns 3, 4, 5, 6, 7 & 8

Sum of Column 8 = Total Flow _____ CFS