PHASE I
DIAGNOSTIC FEASIBILITY STUDY
FINAL REPORT

LAKE POINSETT

HAMLIN COUNTY, SOUTH DAKOTA

SOUTH DAKOTA CLEAN LAKES PROGRAM
DIVISION OF FINANCIAL AND TECHNICAL ASSISTANCE
SOUTH DAKOTA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES
NETTIE H. MYERS, SECRETARY

January 1996

ACKNOWLEDGEMENTS

The cooperation of the following organizations and individuals is gratefully appreciated. The assessment of Lake Poinsett and its watershed could not have been completed without their assistance.

Lake Poinsett Water Project District
Lake Poinsett Area Development Association
Lake Poinsett Sanitary District
Brookings County ASCS office
Brookings County Natural Resources Conservation Service
Karen Cameron-Howell
Hamlin County ASCS office
Hamlin County Natural Resources Conservation Service
Rodger Mueller
Kingsbury ASCS office
Kingsbury Natural Resources Conservation Service
Steve Maras
SD DENR - Geological Survey
SD DENR - Water Rights
SD Game, Fish, and Parks
US EPA Clean Lakes Program

A special thanks goes to Martin Hieb (Project Coordinator) and other personnel from the Lake Poinsett Water Project District for their aid in the collection of all scientific data.

LAKE IDENTIFICATION AND LOCATION

Lake Name: Lake Poinsett

State: South Dakota

County: Hamlin and Brookings

Size: 3,184.1 ha (7,868 acres)

Nearest Municipality: Estelline, South Dakota

Latitude: North 44° 33' 47"

Longitude: West 97° 04' 46"

EPA Region: 8

EPA Major Basin: Missouri River Code: 09

EPA Minor Basin: Big Sioux River Code: 07

Major Tributary: Big Sioux River

Receiving Water Body: Big Sioux River

Water Quality Standards:

Designated Uses

1) Warm Water Semipermanent Fish Life Propagation

2) Immersion Recreation

3) Limited Contact Recreation

4) Wildlife Propagation and Stock Watering

Criteria of Parameters for Lake Poinsett's Designated Uses

1) Total chlorine residual must be less than 0.02 mg/l[1].

2) Un-ionized ammonia nitrogen may not exceed 0.04 mg/l (as N)[2].

3) Dissolved Oxygen must be greater than 5.0 mg/l[1].

4) pH must be greater than 6.5 units and less than 9.0[1].

5) Suspended Solids may not exceed 90 mg/l[2].

6) Temperature may not exceed 90° F[1].

7) Fecal Colifrom organisms from May 1 to September 30 may not exceed a concentration of 200 per 100 milliliters as a geometric mean based on a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period, and they may not exceed this value in more than 20 percent of the samples examined in this 30-day period. They may not exceed 400 per 100 milliliters in any one sample from May 1 to September 30.

8) Total alkalinity may not exceed 750 mg/l (as calcium carbonate).[2]

9) Total dissolved solids may not exceed 2500 mg/l.[2]

10) Conductivity may not exceed 4000 micromhos/cm at 25°C.[2]

11) Nitrates may not exceed 50 mg/l (as N).[2]

Variations allowed in parameters found in samples:

[1] - The applicable criterion is to be maintained at all times, without exception.

[2] - The applicable criterion is to be maintained at all times based on the results of a 24-hour representative composited sample. The numerical value of a parameter found in any one grab sample collected during any 24-hour period may not exceed 1.75 times the applicable criterion.

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LAKE POINSETT PHASE I DIAGNOSTIC/FEASIBILITY STUDY

Lake Poinsett is a 7,868 acre lake originating from glacial activity. It is one of the largest natural lakes in South Dakota with a contributing watershed of approximately 720,382 acres (291,539 ha). This includes approximately 470,000 acres of the Big Sioux River Basin via the Boswell Diversion which was constructed in 1929 (DWNR, 1985). The Boswell Diversion was constructed so that Dry Lake and Lake Poinsett could be used for off-stream storage of river floodwater. In addition to the construction of the Boswell Diversion, an outlet for Lake Poinsett was constructed in 1989 to prevent backflow from the Big Sioux River during flooding events. Lake Poinsett is a highly developed lake used for both recreational and commercial purposes. Approximately 622 cabins and businesses are located around the lake.

The excessive algal blooms observed on Lake Poinsett have consistently hampered recreation during the higher use periods of the year. These algal blooms are caused by excessive nutrients delivered annually from several sources within the watershed. Most of the investigatory work on Lake Poinsett has indicated a hypereutrophic system. Skille (1971) reported that the nutrient levels in Lake Poinsett had reached a state of super saturation.

In May of 1993, the South Dakota Department of Environment and Natural Resources (SD DENR) began a Phase I Diagnostic/Feasibility Study at the request of the Lake Poinsett Water Project District (LPWPD). The objective was to determine the extent and location of nutrient and sediment inputs to the lake and delineate their effect on the current trophic status of Lake Poinsett. After identifying the nutrient and sediment inputs to the lake, a series of lake and watershed management options were to be developed to alleviate the identified problems.

Monitoring began in June of 1993 with the installation of stage recording equipment and the collection of water samples at 6 tributary sites. In addition to these tributary sites, 3 in-lake sites were established and water samples were collected on a bimonthly basis from May through September and monthly from October through April. Water quality data were combined with the stage/discharge data to determine loadings for nutrients and sediment. Watershed analysis also included the Agricultural Nonpoint Source (AGNPS) computer model which was used to:

1) Evaluate and quantify the loadings from each subwatershed and their net loading to the lake.
2) Define critical cells within each subwatershed containing high sediment, nitrogen, phosphorus delivery.
3) Quantify the nutrient loadings from each feedlot and priority rank each feedlot.

Land use data for the entire watershed was also collected using data from the Agricultural Stabilization and Conservation Service (ASCS). Water quality monitoring was terminated in

November, 1994.

Watershed analysis revealed high concentrations of nutrients (phosphorus and nitrogen), sediment, and fecal coliform bacteria from the Big Sioux River and the monitoring station on the Lake Thisted to Lake Albert drainage area. Loading results indicated that 73.2% and 23.9% of the phosphorus delivered to Lake Poinsett came from the Lake Albert system and Stonebridge/Dry Lake system, respectively. However, due to flooding events and the complex relationship between Dry Lake and Lake Poinsett, an underestimate of phosphorus loading occurred. Of the total phosphorus delivered to Lake Albert 68.7% and 30.0% came from Lake St. Johns and the Lake Thisted area, respectively. The Boswell Diversion was closed during the investigation and loading estimates were not available. Therefore, it was necessary to extrapolate Big Sioux River water quality, discharge and loading data to the diversion had it been opened during the project. This estimate revealed that the diversion would deliver an estimated 16 tons of phosphorus to Dry Lake, in comparison, to only 6 tons delivered to Lake Poinsett from Lake Albert for the same time period.

Water quality results were confirmed by the AGNPS computer model which identified critical areas within the Thisted area. It also identified a high sediment and nutrient yielding area north of Dry Lake. In addition to these critical areas animal waste-management systems were recommended for 5 feedlots within the watershed.

As part of the Phase I analysis, a sediment survey of the Lake Poinsett basin was conducted revealing that a sediment removal project on Lake Poinsett would not be required. However, loading results did indicate that Lake Poinsett is accumulating both sediment and nutrients. In-lake sampling results were used to determine the trophic state for Lake Poinsett which fluctuated between hypereutrophic and eutrophic during the course of the investigation. A strong relationship was indicated between in-lake total phosphorus and chlorophyll-a concentrations. To reduce the in-lake chlorophyll-a concentrations (blue-green algal blooms) it would be necessary to reduce the inflow of total phosphorus concentrations. To accomplish a reduction in the inflow of total phosphorus, the following alternatives were suggested:

<u>Watershed Activities.</u>

1. Installation of a Centralized Sanitary Sewer System
2. Reduce or Eliminate Nutrient and Sediment Loadings from the Big Sioux River into Lake Poinsett through Proper Operation of the Boswell Diversion and Lake Poinsett Outlet Gates.
3. Reduction of the Use of Lawn Fertilizers
4. Construction of Animal Waste Management Systems
5. Install Vegetative Buffer Strips in Identified Critical Areas
6. Riparian Area Management in Identified Critical Areas
7. Residue Management in Identified Critical Areas
8. Critical Area Grass Seedings.

INTRODUCTION

INTRODUCTION

Lake Poinsett, a 7,868 acre (3,184.1 ha) lake originating from glacial activity, is one of the largest natural lakes in South Dakota. It has a contributing watershed of approximately 720,382 acres (291,539 ha) which encompasses a portion of the Big Sioux River Basin (approximately 470,000 acres) (Figure 2) (DWNR, 1985). The maximum depth in Lake Poinsett is 19.5 ft. (5.9 m) and the mean depth is 9.5 ft. (2.9 m). It has an estimated volume of 74,746 acre-feet (92 million cubic meters). To the north of Lake Poinsett is a 1,960 acre (793.2 ha) portion of the Lake Poinsett Basin named Dry Lake. Both lakes are part of the same lake basin, however, a dike/road separates the two and they are connected by Stonebridge. The combined surface area of these two water bodies is 9,828.6 acres (3977.6 ha).

In 1929, the Boswell Dam was constructed to divert water from the Big Sioux River into Dry Lake and Lake Poinsett. The purpose of the diversion is to relieve downstream flooding during periods when the Big Sioux River reached flood stage using Dry Lake and Lake Poinsett as a reservoir for the excess water. Although used for flood control, the diversion also became a major contributor of nutrients and sediment to the Dry Lake-Lake Poinsett system. Prior to 1955, the diversion channel had a maximum capacity of 500 cubic feet per second (cfs). During 1955, the channel was modified which increased its maximum capacity to 1500 cfs. (Water Right No. 119-3A).

The natural outlet of Lake Poinsett is located in the northeast section of the lake (Figure 3) and delivers lake water to the Big Sioux River. After flooding occurred in 1986, a control structure was built on the outlet to prevent backflow from the Big Sioux River during flooding events. This structure was completed in 1989. The control structure was built to an elevation 1.0 foot (1650.5 msl) below the ordinary high water mark on the outlet of Lake Poinsett (1651.5 msl).

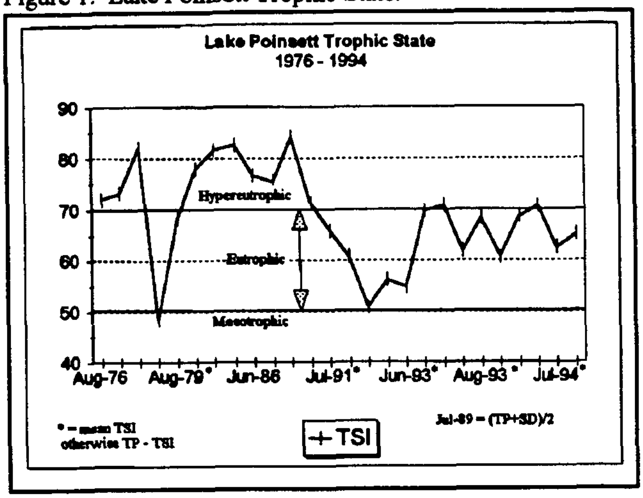
Lake Poinsett is a highly developed lake used for recreational and commercial purposes. As of 1994 there were approximately 603 residents and 6 businesses located around the lake (Pederson, 1994). The South Dakota Game, Fish, and Parks (SDGF&P) encourages commercial removal of rough fish species to maintain the game fishery. The SDGF&P also maintains the four developed public access areas around the lake.

Lake Poinsett has fluctuated dramatically between hypereutrophic (extreme productivity) to eutrophic (excessive productivity) (Figure 1). The productivity of the lake is caused by the hydrological and excessive nutrient input from the watershed.

Excessive nutrient input to shallow lakes such as Lake Poinsett can greatly accelerate aquatic plant growth and increase the intensity of blue-green algal blooms. These blooms cause a higher biological oxygen demand for the entire aquatic ecosystem and negatively impact the plant and animal life. The product of these conditions is a state of anoxia (lack of oxygen) which can result in fish kills and unpleasant odors due to decomposing algae. Recreational boating and swimming may be limited to a few short weeks during the most productive period of the year (June - August) due to these nuisance algal blooms.

Even though shallow, well-mixed lakes such as Lake Poinsett have shorter hydraulic residence times (amount of time required to completely refill the lake), a tremendous amount of phosphorus can be tied up in the sediments and can remain in the ecosystem for an extended period of time. The sediments can act as a sink holding phosphorus from the water column until anoxic conditions allow a significant quantity to be released into the water column. This can increase the amount of available phosphorus to plants and cyanobacteria (blue-green algae) such as Aphanizomenon spp.. Most of the studies completed on the Lake Poinsett system have indicated a hypereutrophic system. Skille (1971) reported an advanced degree of eutrophication that was attributed to the large annual nutrient load. A significant portion (70%) of the phosphorus load was retained by the lake. Skille also reported that 63% of the annual phosphorus load was contributed to the Lake Poinsett from the Big Sioux-Dry Lake system through the Boswell Diversion.

Figure 1. Lake Poinsett Trophic State.



The objective of the Lake Poinsett Phase I Diagnostic Feasibility study was to determine the extent and location of nutrient and sediment inputs and delineate their affect on the current trophic status or condition of the lake. From the data collected, a series of lake management options were developed to alleviate the problems identified in the Phase I investigation.

STUDY SITE DESCRIPTION

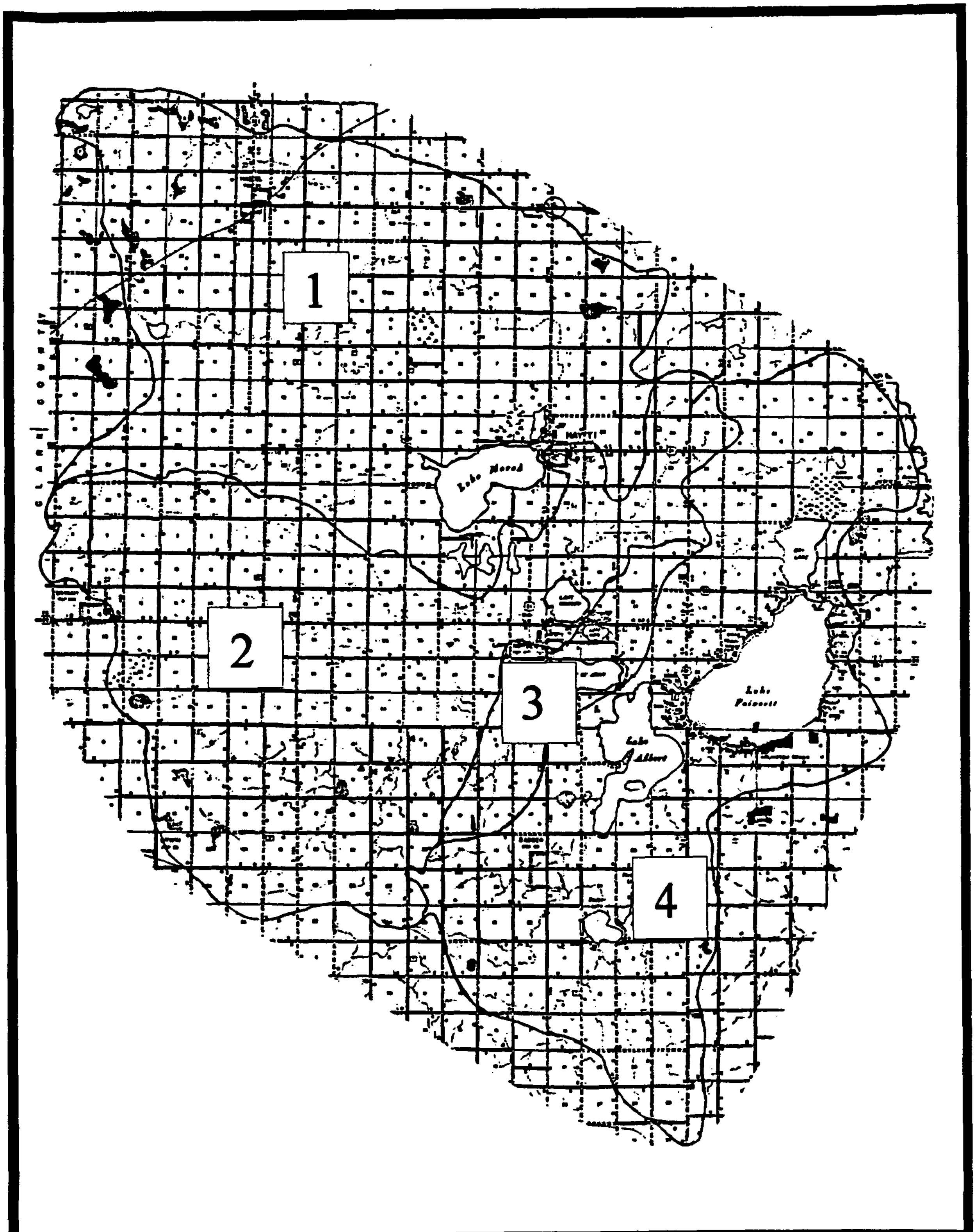


Figure 2. Lake Poinsett Watershed delineated into 4 main subwatersheds.

TABLE 1. LANDUSE FOR THE LAKE POINSETT WATERSHED

PERCENTAGE OF TOTAL ACREAGE	MARSH LAKE	LAKE NORDEN	LAKE ST JOHNS	LAKE ALBERT/ POINSETT		
SUBWATERSHED→	1	2	3	4	TOTAL	TOTAL ACREAGE
CROP-LAND	65.89%	62.77%	39.57%	36.73%	55.01%	158,249.4
PASTURE	10.01%	11.78%	31.53%	21.38%	14.92%	42,903.5
HEL* CROPLAND	3.32%	6.03%	2.21%	9.65%	6.02%	17,315.4
HEL PASTURE	0.00%	0.00%	0.00%	0.00%	0.00%	0
CRP	1.38%	2.10%	1.76%	2.46%	1.95%	5,597.8
FARMSTEAD	2.43%	2.40%	2.18%	1.85%	2.24%	6,438.3
FOREST	0.00%	0.00%	0.00%	0.00%	0.00%	0
WATER**	11.45%	10.03%	19.39%	22.21%	14.58%	41,947.5
TRANSPORTATION#	2.23%	2.42%	2.28%	1.87%	2.18%	6,277.0
WILDLIFE	3.14%	2.12%	0.55%	3.55%	2.83%	8,144.4
LOW DEN. POPULATION	0.13%	0.36%	0.52%	0.28%	0.26%	755.0
TOTAL ACREAGE	98,830.9	89,893.1	12,486.0	36,442.3	100.0%	287,652.4

*- Highly Erodible Lands

**- All wetlands listed on NRCS Wetlands maps were considered water unless listed in the sportsman atlas as a wildlife area.

#- An average of 16 acres of roadway per section unless otherwise indicated on the S.D. Dept. of Transportation County Highway maps.

Table 2. Approximated Phosphorus Export Rates for various land uses (P-lbs/acre/yr)

Land Use	Total Phosphorus
Forest	0.1784
Nonrow Crops	0.6244
Pasture	0.7136
Mixed Agriculture	0.9812
Row Crops	1.9624
Feedlot, manure storage	227.46
Atmospheric Input rates (P-lbs/acre/yr)	
Forest	0.2319
Agricultural/Rural	0.2498
Urban industrial	0.9009

Source: Reckhow et al. 1980 in EPA Lake and Reservoir Restoration Guidance Manual 2nd Edition, 1990 (EPA-440/4-90-006).

GEOLOGY OF HAMLIN COUNTY AND LAKE POINSETT WATERSHED

Physiography and Topography

Hamlin County and the watershed of Lake Poinsett are located within the Coteau des Prairies. This division of the Central Lowland Province is a massive highland approximately 200 miles long. It is characterized by a glacial-moraine topography which has a "general hummocky appearance". This topography was formed by the action of glaciers during the Wisconsin period as they moved through the area and melted. Hamlin County's topographical features follow a northwest to southeast trend which parallels that of the Coteau des Prairie (Beissel and Gilbertson, 1987).

The topographical features of the immediate Lake Poinsett area ranges from a flat appearance in the North to gently undulating knob and kettle expressions to the east and northwest. Maximum relief is estimated at 165 feet where the variations in elevations in the Lake Poinsett area range from a maximum of 1800 feet in the northwest to a minimum of 1635 feet southeast of the lake (Barrari, 1971).

Geology

The glacial drift deposited during the Pleistocene epoch can be divided into till and outwash. Till typically consists of boulders, pebbies and sand mixed with clay deposited by ice, whereas outwash deposits consists of sand and gravel with small amounts of clay that were deposited by the streams produced from the melting glaciers (Barrari, 1971).

The Big Sioux River and tributaries have deposited alluvium in the Lake Poinsett area which consists of a mixture of sand, gravel, and clay. Most of the subsurface areas in the Lake Poinsett area consist of Pierre Shale, Niobrara Marl, Carlile Shale, Greenhorn Limestone, Graneros Shale, and the Dakota Formation of which Pierre Shale is the most extensive. The Pleistocene age deposits (unconsolidated glacial deposits) that have an average depth of 500 feet, overlie the bedrock and consist of till, outwash, lake sediments, and loess.

Hydrology

The drainage area, both surface and subsurface, is controlled by the Big Sioux River. The Big Sioux aquifer and other minor surficial aquifers are connected with the Big Sioux River or other streams and lakes within the area. They can be recharged from these lakes and streams and can discharge to them depending on the hydrologic conditions (Kume, 1985). Kume (1985) also estimated that 8.4 million acre-feet of water is stored within the Big Sioux aquifer, the Prairie Couteau aquifer, and the Altamont aquifer, along with several minor aquifers.

More detailed discussions of the physiography, topography, geology, and hydrology for Hamlin and Kingsbury counties can be found in publications listed in the "literature cited" section of the report.

Soils

The soil associations described below were taken from the 1993 South Dakota Lakes Assessment Final Report (Stewart and Stueven, 1993). Soil associations within the 292,197 acre (118,252 ha) watershed consist of the following:

Associations	Area (acres)	% of Total
KN-BN-VS	213,304	73
BY	20,454	7
VS-LP	20,454	7
LD	14,610	5
FS-ES	14,610	5
PN-BY	5,844	2
RL-FS	2,133	1

KN-BN-VS - Kranzburg-Brookings-Vienna: Deep, nearly level to gently undulating silty soils on uplands and in slight swales.

BY - Buse: Well-drained, undulating to hilly, loamy soils.

VS-LP - Vienna-Lismore: Well-drained through somewhat poorly drained nearly level to undulating, silty soils.

LD - Lamour: Loamy to clayey soils on moderately well to poorly drained bottom lands.

FS-ES - Fordville-Estelline: Loamy and silty soils with gravelly and sandy subsoils on terraces and uplands.

PN-BY - Poinsett-Buse: Deep, undulating to rolling silty and loamy soils on uplands.

RL-FS - Renshaw-Fordville: Loamy and sandy soils with gravelly and sandy subsoils.

The soils within these associations described above have all been rated for septic tank absorption fields and sewage lagoon areas. Most of these have been classified for septic tank absorption fields as being severe (flooding, wetness, percs slowly) to being moderate (percs slowly, slope). Ratings for use of soils with sewage lagoon areas ranged from severe (wetness, slope, flooding) to moderate (slope, seepage to slight). The only soil type given a slight rating for sewage lagoon areas was Vienna. For further description and location of specific soil types see the Hamlin County Soil Survey, 1992.

Lake Poinsett Development and Tax Valuations

Lake Poinsett is well-developed lake with development still occurring. New cabins are being built and the property values are increasing in the immediate surrounding area. Lake Poinsett has 622 cabins of various sizes with 153 cabins being served by a centralized sewer system. An estimated 6 business are also located on the lake serving the people throughout the year.

Total property tax valuations for the entire county for 1995 was $219,616,275. The property within 1000 feet of Lake Poinsett in Hamlin County was placed into agricultural and non-agricultural property valued at $9,911 and $22,773,274, respectively. The total property within 1000 feet of Lake Poinsett constitutes 10.4% of the total tax valuations for Hamlin County.

METHODS AND MATERIALS

METHODS AND MATERIALS

TASK 1. LAKE SAMPLING

Samples were collected on a monthly basis throughout the duration of the project at the three sites described below and found on Figure 3. Sampling sites were located within the lake basin so as to best characterize trends in the water quality of Lake Poinsett. These data were also used to delineate any affects that the quality of the water from the watershed was having on the lake.

Sampling was conducted on a monthly basis from October through March except for periods of unsafe ice. During the most productive periods (April through September) sampling was conducted on a bimonthly basis. The final in-lake sample was collected on September 26, 1994.

Site Descriptions

Site	Location	Storet Number
4	Lat. 44° 34' 57" Long. 97° 3' 47"	46PO12
	In-lake site located in the north central area of the lake.	
5	Lat. 44° 33' 47" Long. 97° 4' 46"	46PO13
	In-lake site located in the central area of the lake.	
6	Lat. 44° 33' 12" Long. 97° 6' 26"	46PO14
	In-lake site located in the south central area of the lake.	

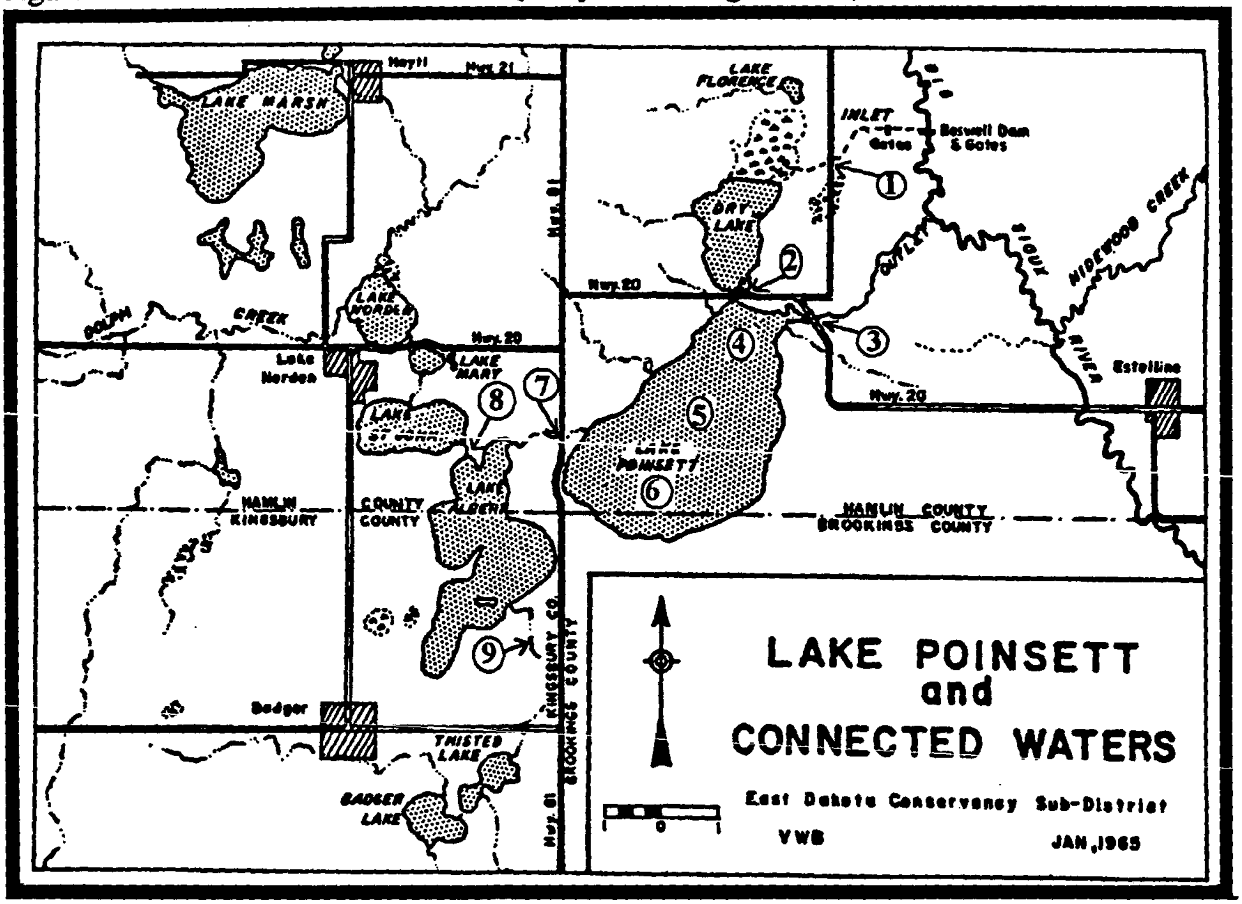
In-lake samples were collected from both surface (0.5 meters below the surface of the lake) and bottom (0.5 meters above the sediment/water interface) using a Van Dorn sampling device. All sample bottles were filled from the water collected in one Van Dorn sample.

The following physical, chemical, and biological parameters were measured using EPA approved methods to determine the current condition of the lake and overall health of the Lake Poinsett ecosystem:

Physical	Chemical	Biological
Air Temperature	Total Alkalinity	Chlorophyll-a
Water Temperature	Total Solids	Fecal Coliform
Secchi Depth	Dissolved Oxygen	Aquatic Macrophytes
Depth	Field pH	
Visual Observations	Total Dissolved Solids	
	Total Suspended Solids	
	Ammonia	
	Un-ionized Ammonia	

Chemical Parameters cont.
Nitrate-Nitrite
Total Kjeldahl Nitrogen
Organic Nitrogen
Total Nitrogen
Total Phosphorus
Total Dissolved Phosphorus

Figure 3. Lake Poinsett Phase I Water Quality Monitoring Stations, 1993-94



After collection, samples were sent to the South Dakota State Health Laboratory for analysis using EPA approved methods. Please refer to the South Dakota Clean Lakes Program Standard Operating Procedures manual for specific chemical extraction methodologies.

At each sampling station dissolved oxygen and temperature profiles were meausred using a Yellow Springs dissolved oxygen meter (model 51B). Dissolved oxygen and temperature were measured at 3 foot (0.91 meters) intervals beginning with 0.5 meters below the surface and ending approximately 0.5 meters above the sediment/water interface.

Chlorophyll-a samples were collected from the surface at each site and a minimum of 100 mls of surface water was filtered using a glass fiber filter (1.0 µm porosity, 47 mm diameter). The filter was then folded and wrapped in cellophane and aluminum foil, labeled and stored in a freezer to be analyzed at a later date. The chlorophyll-a pigment was extracted using the method described by Lind (1985) and concentration was determined by a spectrophotometer (EPA Water and Wastewater, 1984). Equations used to determine biomass of chlorophyll in milligrams per cubic meter (mg/m^3) are discussed in the South Dakota Clean Lakes Standard Operating Procedures Manual. Chlorophyll-a biomass (mg/m^3) was converted to algal biomass (standing crop) by multiplying chlorophyll-a (mg/m^3) by 67 described in EPA Water and Wastewater method 1002 H (EPA Water and Wastewater, 1984).

An aquatic plant survey was conducted for Lake Poinsett during the summer of 1994 to estimate the coverage of aquatic macrophytes in the Lake Poinsett lake basin. This was conducted by running 58 transects perpendicular to the shoreline with approximately 0.25 miles (402.25 meters) between each transect. The boat was positioned perpendicular to shore and was placed in reverse. A plant grapple was thrown over each side to retrieve any aquatic macrophytes which would be used to estimate their relative density (density rating ranged from 0 for nonexistent to 5 for extremely dense). The transect length was dependent upon the extent of the littoral zone or the point where aquatic plant growth ended. The transects typically ended at approximately 100 meters from shore. However, if an aquatic plant bed was identified, the end of the plant bed was used as the end point for that transect. The area between transects was visually inspected to ensure that the extent of aquatic macrophyte coverage was properly characterized.

Several parameters listed previously were determined using the equations listed below:

Table 3. Equations used in analysis.

Parameter	Formula
Total Dissolved Solids	Total Solids - Total Suspended Solids
Organic Nitrogen	Total Kjeldahl - Ammonia Nitrogen
Total Nitrogen	Total Kjeldahl Nitrogen + Nitrate-Nitrate
Nitrogen to Phosphorus Ratio	Total Nitrogen ÷ Total Phosphorus
Unionized Ammonia	$\%(\frac{unionized\ ammonia}{100})\ X\ Ammonia Concentration$
	$\%\ Unionized\ Ammonia = \frac{100}{1 + antilog(pKa - pH)}$
	$pKa = 0.09018 + \frac{2729.92}{T}$ T = °C + 27

The South Dakota Watershed Protection Program uses Carlsons trophic state index as a method of classification of lakes. It is a series of equations incorporated together to form a mean trophic index characterizing the current nature or status of a lake. Individual equations used to derive the index are scaled from 0 to 100 and incorporate the following three parameters: 1) secchi depth, 2) chlorophyll-a, and 3) total phosphorus concentrations (Table 4). The trophic state of a lake may be classified into 4 subcategories: 1) oligotrophic, 2) mesotrophic, 3) eutrophic, and 4) hypereutrophic. The numerical scale range of 65-100 indicates a hypereutrophic or very nutrient (phosphorus and nitrogen) enriched lake.

Table 4. Carlsons Trophic State Index Formulas

$Secchi\ Disk\ TSI = 10\ X\ (6 - \frac{\ln SD}{\ln 2})$
$Total\ Phosphorus\ TSI = 10\ X\ (6 - \frac{\ln \frac{48}{TPO4P}}{\ln 2})$
$Chlorophyll\text{-}a\ TSI = 10\ X\ (6 - \frac{2.04(0.68\ X \ln Chl\text{-}a)}{\ln 2})$

TASK 4. WATERSHED SAMPLING

Six sampling stations were located within the Lake Poinsett watershed (Figure 3).

Site Descriptions

Site	Location		Storet Number
1	Lat.	44° 31' 35"	46DIV1
	Long.	97° 0' 22"	

Control structure on the Boswell Diversion ditch to Dry Lake.

Site	Location		Storet Number
2	Lat.	44° 36' 7"	46STBR2
	Long.	97° 3' 45"	

Located on the Stone Bridge, between Dry Lake and Lake Poinsett.

Site	Location		Storet Number
3	Lat.	44° 35' 52"	46OUT3
	Long.	97° 2' 32"	

Located on outlet channel to Big Sioux River.

Site	Location		Storet Number
7	Lat.	44° 33' 37"	46INL7
	Long.	97° 7' 52"	

Inlet to Lake Poinsett from Lake Albert.

8	Lat.	44° 33' 39"	46STJ8
	Long.	97° 9' 52"	

Inlet to Lake Albert from Lake St. John.

9	Lat.	44° 30' 51"	46ALB9
	Long.	97° 30' 51"	

Inlet to Lake Albert from Lake Thisted.

Parameters measured to determine the water quality and overall loadings of nutrients and sediment delivered to Lake Poinsett were the following:

Physical	Chemical	Biological
Air Temperature	Total Alkalinity	Fecal Coliform
Water Temperature	Total Solids	
Discharge	Dissolved Oxygen	
Depth	Field pH	
Visual Observations	Total Dissolved Solids	
	Total Suspended Solids	
	Ammonia	
	Un-ionized Ammonia	
	Nitrate-Nitrite	
	Total Kjeldahl Nitrogen	
	Organic Nitrogen	
	Total Nitrogen	
	Total Phosphorus	
	Total Dissolved Phosphorus	

To determine the water quality in addition to the hydrologic, nutrient, and sediment loadings to Lake Poinsett, it was necessary to monitor the Lake Thisted, Lake St. Johns, and Lake Albert subwatersheds during the project period. Sampling was conducted preferably during high flows (storm events) to gather as much information as possible to determine nutrient and sediment loading trends from each subwatershed. All sites were sampled twice during the first week of snowmelt and once a week thereafter until runoff stopped. However, water sampling frequency for gaging stations was primarily flow based and dependent upon prevailing weather conditions. Due to 1993 flooding conditions the overall flow was relatively constant for 5 of the sampling stations (Sites 2,3,7,8, and 9). These stations were sampled approximately every 3-4 weeks depending on the level of stage and discharge. Each sample was a grab sample and was usually collected with a Van Dorn sampler depending upon the depth of channel. The depth at Station 9 (Thisted inlet into Lake Albert) did not allow the use of a Van Dorn and therefore a simple grab sample was obtained from the middle of the channel. In addition to the samples collected from the tributary sites there were several discretionary samples taken from different sites within the watershed. The results of these discretionary samples will be discussed in subsequent sections.

Gaging stations were placed at each of the watershed sites described above and Omnidata Datapod II data loggers were used to collect stage data from June to November, 1993 and April to November, 1994. Data was downloaded approximately every 2-4 weeks to reduce the chance of data loss. Discharge measurements were collected with a Marsh-McBirney 201 digital current velocity meter at 60% of the channel depth. Discreet discharge (ft^3/sec) measurements were determined by the product of the depth (ft), width(ft), and current velocity (feet/sec) of the channel. In addition to baseline discharge data, several measurements during extreme runoff events were collected to accurately describe the hydrologic conditions. A rating curve (equation) through regression analysis was produced to estimate the average daily discharge from each of the tributary monitoring sites using these discreet measurements. R-square values, and regression equations produced from actual field measurements for each gaging station can be found in the Appendix I.

After discharge was calculated for each monitoring station, the concentrations for all chemical parameters, including the nutrients (phosphorus and nitrogen) and sediment (total suspended solids), were averaged between successive sampling periods for an estimate of daily concentration levels (mg/l). The daily discharge (liters/day) was then multiplied by the daily concentration to produce a daily loading (Kg/day) for each monitoring station. Further discussion for this method can be found in the South Dakota Clean Lakes Standard Operating Procedures Manual.

Agricultural Nonpoint Source Computer Model (AGNPS)

Due to the large size of the Lake Poinsett watershed, the associated amount of data that needed to be collected, the limitations of the computer model, and the time constraints it became necessary to limit the area of the watershed to be analyzed with the AGNPS program. Water quality data became the factor used to determine the areas to be analyzed by the AGNPS program. After analyzing water quality data collected in 1993 it was decided that the AGNPS computer model would be used to characterize the immediate Lake Poinsett and Lake Albert subwatersheds. These two subwatersheds had to be analyzed separately due to their large size (approximately total land surface area = 100,000 acres). Time constraints and the other reasons given above did not allow the Lake St. John, Lake Mary, Lake Norden, and Lake Marsh subwatersheds to be analyzed using this computer model.

The AGNPS final report for the Lake Poinsett watershed was printed as a separate document. An excerpt from this document containing sediment, phosphorus, and nitrogen yields from several subwatersheds, in addition to feedlot information, is discussed in subsequent sections of this document. Locations of critical areas identified within the watersheds described in this excerpt can be identified using maps provided in the AGNPS final report in Appendix II.

RESULTS
AND
DISCUSSION

WATERSHED SAMPLING, TRENDS, AND LOADINGS

WATER QUALITY and LOADING DATA

Sampling sites, protocols, and calculations of loadings were described previously in the methods and materials sections. Figure 3 (page 16) shows the locations of the sampling stations used in this investigation.

Nutrient loadings are a product of the nutrient concentration (mg/l) and the average daily discharge (cubic feet per day). Daily concentrations were calculated by averaging between two successive sampling dates. Daily loadings were then summed to provide a total loading from each tributary (Kg/year and lbs/year) for each of the parameters.

The annual loading for Lake Poinsett was calculated for 1993-94 to provide an overall estimate of the accumulation of nutrients in the lake. Loadings from each of the 6 monitoring stations were compared to determine which subwatersheds (Figure 2) provided more nutrients and sediment. In addition to these 6 stations, daily and annual loadings were calculated for the Big Sioux River. The United States Geological Survey gaging station located on the Big Sioux River at Castlewood, SD, approximately 8 miles upstream from the Boswell Diversion inlet on the river, provided the discharge data that was used for the average daily discharge. Daily concentrations were developed using the data collected from the 106 Fixed Ambient Monitoring Program monitoring stations at Watertown and Brookings. This program is funded through section 106 of the Clean Water Act and is used by the Department of Environment and Natural Resources (DENR) to document historical information, natural background conditions, possible runoff events, and acute or chronic water quality problems. The average between two successive sampling dates was used for the average daily concentration for both 106 stations. Loadings were calculated for each of the monitoring stations for comparison purposes.

Table 5. Beneficial Use Criteria assigned to the tributaries within the Lake Poinsett Watershed.

Parameter	Criteria (Standard)
Total Alkalinity	>750 mg/l@
Total Dissolved Solids	≤2500 mg/l@
Conductivity	≤2500micromhos/ cm @ 25°C@
Nitrates	≤50 mg/l@
pH	≥6.0 to≤9.5units@
Sodium absorption	≤10:1@

@ = with a variation allowed under subdivision 74:03:02:32(2)

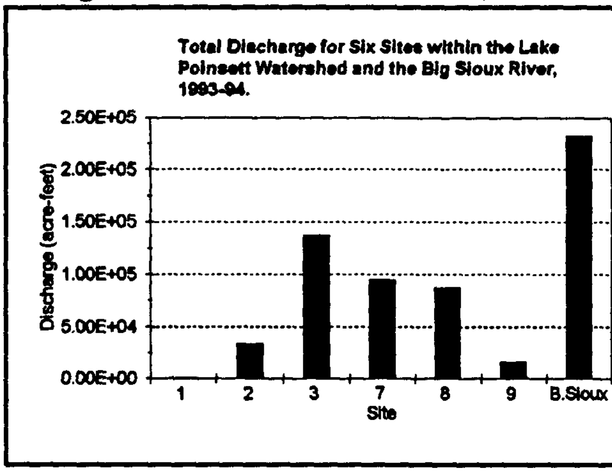
Beneficial Uses

All surface waters within the state of South Dakota have been assigned one or more of the beneficial uses discussed in the Surface Water Quality Standards, Article 74:03, Administrative Rules of South Dakota. The tributaries discussed in this report have had the following beneficial uses assigned to them: (9) Wildlife Propagation and Stock Water; and (10) Irrigation Waters. Each of these beneficial uses are subject to the criteria presented in Table 5.

Surface Hydrology

Discharge calculations for each of the tributaries are shown in comparison to the Big Sioux River (Figure 4). The Lake Albert drainage provided 74% of the water delivered to Lake Poinsett from the watershed. Discharge is a very important component to the behavior of nutrient and sediment loadings to the lake. During storm events, a certain chemical parameter can initially increase in concentration followed by a gradual dilution as the discharge for a specific tributary increases. The water discharge from the Big Sioux River is considerably larger than the other tributaries that were examined. Figure 5 indicates the monthly discharge rates in acre-feet for each of the monitoring stations. Each sampling station exhibited an increase in discharge during the months of July and August in 1993. Increases in discharge also occurred during the spring of 1994 during the annual spring runoff. This was also exhibited by the Big Sioux River (Figure 5). The Boswell Diversion was not opened during the course of the investigation and therefore provided minimal hydrologic loadings to the Dry Lake - Lake Poinsett System. A minimal amount of water (seepage) was discharged around the gates during the 1993 flood in the months of June and July. Other than this, the instantaneous velocity readings measured weekly and sometimes daily, indicated no discharge from the station.

Figure 4. Total Discharge for all sites including the Big Sioux River for Lake Poinsett, 1993-94.



The relationship between Dry Lake and Lake Poinsett was very difficult to characterize due to the unusually high water levels. An estimated 33,340.1 acre-feet was discharged from Dry Lake to Lake Poinsett. As levels in Dry Lake increased so did Lake Poinsett levels. Regression analysis between the two stages revealed an r-square value of 0.93, where a value of 1 would have indicated a perfect relationship between the two. However, with the increased water levels a constant backflow was occurring from Lake Poinsett into Dry Lake resulting in a reduction in the discharge estimate between Dry Lake into Poinsett. As a result of this relationship, a reduced discharge between Dry Lake and Lake Poinsett probably occurred. However, with the loading estimates gained from concentrations and discharge rates from Stonebridge and the other sites it is still apparent where possible restoration activities should take place.

Total Phosphorus

Phosphorus is a key nutrient required for plant and algal growth. Total Phosphorus (TP) is a measure of all the chemical states or species of phosphorus present in a water sample. There are two basic types or categories of phosphorus which constitute the TP present in the environment. Particulate phosphorus is that phosphorus which is sorbed or bound to soil particles and is unavailable for uptake by plants. The second type of phosphorus is that which is dissolved and very reactive in the

Figure 5. 1993-94 Monthly discharges from 6 sites within the Lake Poinsett Watershed and the Big Sioux River.

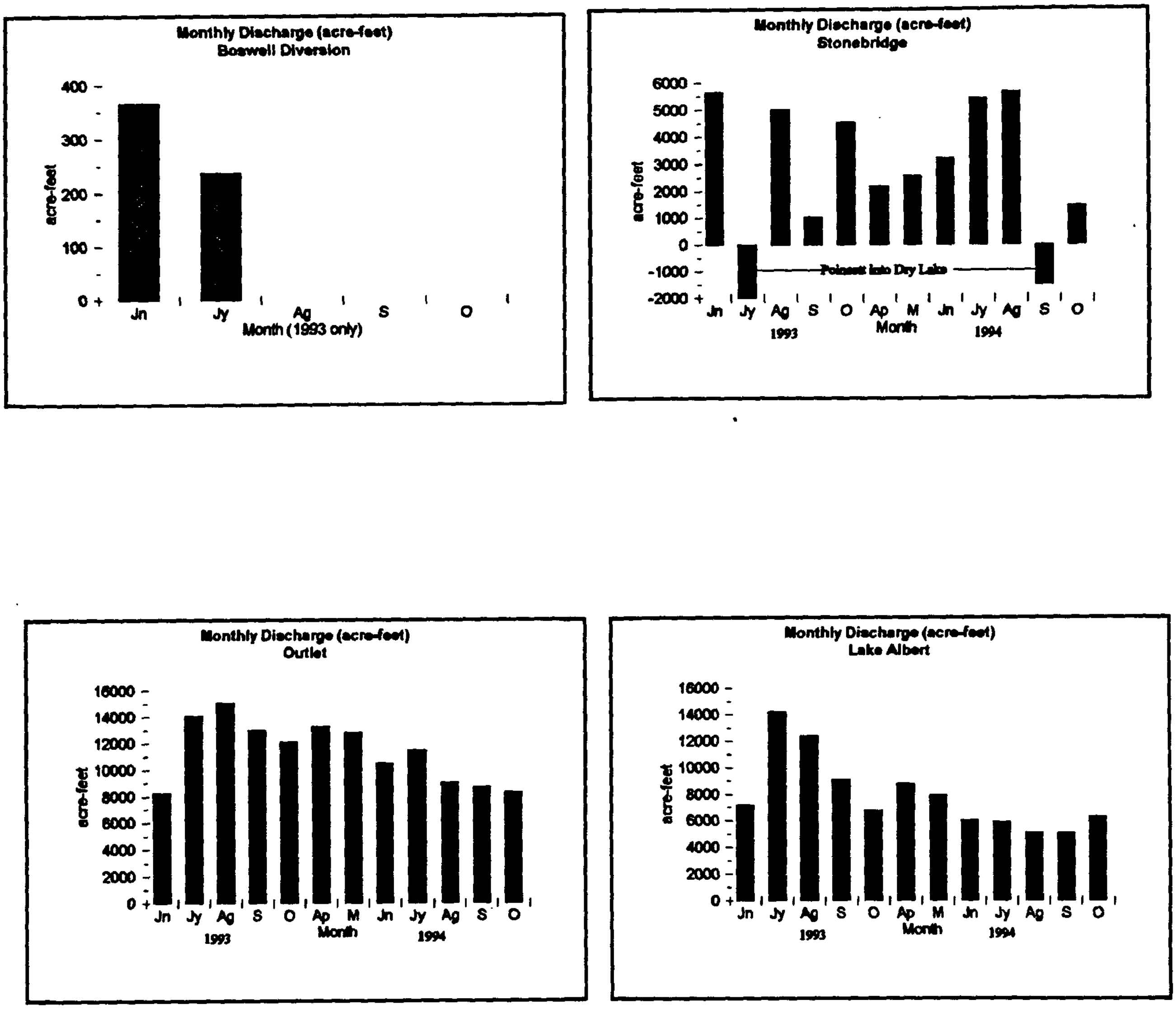
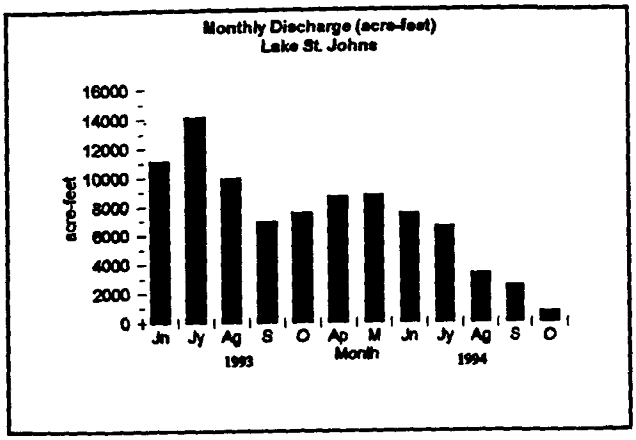
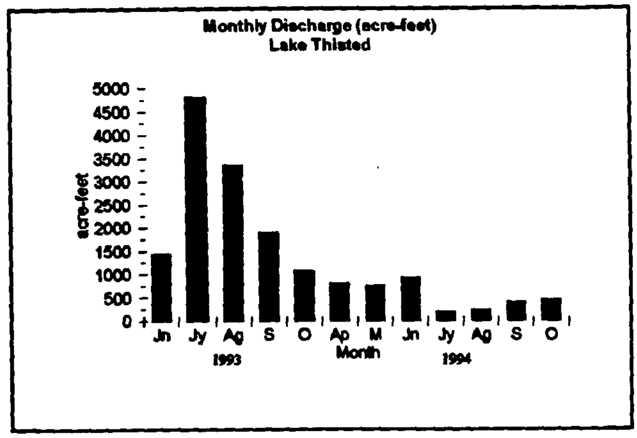
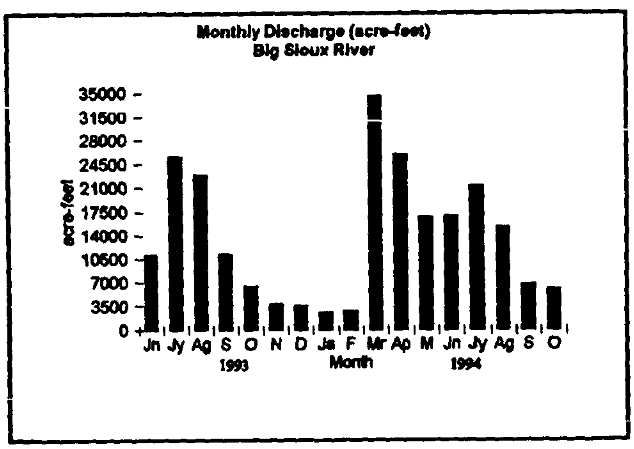


Figure 5 cont. 1993-94 Monthly discharges for Lake Poinsett.







environment. The second type, termed total dissolved phosphorus, is immediately available for uptake by plants and algae (bioavailable).

TP concentrations ranged from a minimum of 0.03 mg/l sampled from the outlet (site 3) on May 25, 1994, to a maximum of 0.91 mg/l sampled from Big Sioux River at the Watertown water quality monitoring (WQM) station on February 14, 1994 (Table 6). The highest TP concentration observed from sites 1-3 and 7-9 was 0.724 mg/l. This sample was collected from Thisted (site 9) on June 14, 1993 (Table 6). Thisteds (site 9) minimum TP concentration, collected on May 2, 1994, was 0.223 mg/l. All other minimum TP concentrations from the remaining sites, including the WQM stations at Brookings and Watertown, were at a much lower level than the 0.223 mg/l observed from Thisted (site 9). The Thisted station (site 9) also exhibited the highest mean concentration for TP followed by the two WQM stations located on the Big Sioux River (Table 6). The Boswell station (site 1) was also important and was quite similar to the Big Sioux River. The samples taken from each of the sites were usually sampled on the same day. The WQM stations on the Big Sioux River are sampled monthly through the EPA Section 106 Fixed Station Ambient Monitoring program.

Table 6. Total phosphorus concentrations (mg/l) for 8 monitoring stations in the Lake Poinsett Watershed 1993-94.

Location (Site)	n	$\bar{x} \pm$ SD (range in parenthesis)
Boswell (1)	16	0.212 ± 0.0593 (0.13 to 0.313)
Stonebridge (2)	16	0.165 ± 0.092 (0.05 to 0.362)
Outlet (3)	16	0.100 ± 0.0526 (0.03 to 0.223)
Albert (7)	16	0.177 ± 0.0501 (0.08 to 0.270)
St.Johns (8)	16	0.204 ± 0.0899 (0.057 to 0.405)
Thisted (9)	16	0.472 ± 0.1524 (0.223 to 0.724)
Brookings*	14	0.251 ± 0.13 (0.10 to 0.590)
Watertown*	14	0.282 ± 0.19 (0.12 to 0.91)

Seasonal trends for TP concentration values were exhibited at each site including the two monitoring

Figure 6. Total phosphorus concentrations for the Lake Poinsett system through Stonebridge and in-lake Site 4, 1993-94..

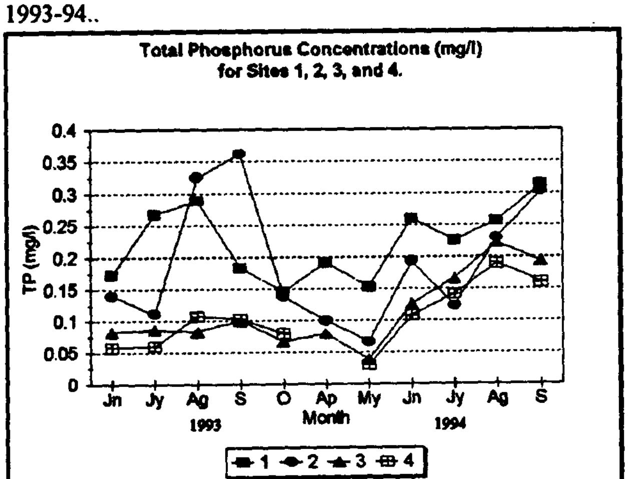
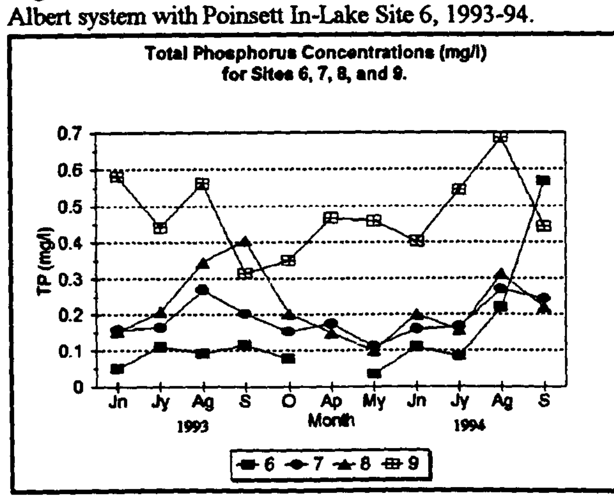


Figure 7. Total phosphorus concentrations for the Lake Albert system with Poinsett In-Lake Site 6, 1993-94.



stations on the Big Sioux River. A gradual increase in concentrations occurred during the late spring and summer months (Figure 6 and 7). Thisteds (9) two largest concentrations occurred on June 14, 1993 (0.724 mg/l) and May 25, 1994 (0.693 mg/l). These high TP values were accompanied by high concentrations of total suspended solids, fecal coliforms and nitrates. Following the trend towards increased monthly concentrations in the summer, a decline then occurred (Figure 6 and 7). Most of the variability in the concentrations occurred from the stations which exhibited the highest mean values i.e. Thisted (site 9) (Table 6).

Stonebridge was typically lower in concentration than Boswell during most of the project. However, during the summer of 1993 there was a peak in concentration levels to 0.312 mg/l at Boswell. Approximately 45 days later Stonebridge exhibited a very similar peak suggesting that this phosphorus was working through the system.

The monitoring station at the outlet of Lake St.John (Site 8) and the outlet of Lake Albert (Site 7) were very similar in seasonal trends as well. Lake Poinsett Site 6 also followed the same general trend indicating a possible influence from the outlet of Lake Albert, Site 7, (Figure 7). As discussed previously, Lake Thisted (site 9) was considerably higher throughout most of the project period.

Total Phosphorus Loadings

Total phosphorus loadings for each of the sites, including the Big Sioux River, were calculated using the concentration data described previously. Total phosphorus loadings were summed for the entire project period for each site (Table 7). As mentioned previously, the Boswell Diversion was closed during the project so the minimal amount of phosphorus loading that did occur was due to some seepage from around the diversion gates. As a result of the closed gates, the largest contributor of phosphorus to Lake Poinsett was Lake Albert. Lake Albert provided an estimated 24 tons of total phosphorus to Lake Poinsett. In comparison, Site 2 (Stonebridge) delivered only an estimated 8 tons to the lake. Included with the calculated loadings for each monitoring station is an estimate of the phosphorus loadings that occurred on the Big Sioux River. These stations, which are presented here for **comparison purposes only**, are used to collect ambient water quality data on the Big Sioux River. The Big Sioux River transported almost three times more phosphorus than Lake Albert (site 7) delivered to Lake Poinsett (Table 7). Note that none of this phosphorus load was actually delivered to Lake Poinsett due to the diversion gates being closed. The station that provided the largest amount of phosphorus per unit of

Table 7. Total phosphorus loadings (kilograms) from 6 sites within the Lake Poinsett Watershed and the Big Sioux River 1993-94.

Site	TP-Kilograms (tons)
1	153.2 (0.17)
2	7277.9 (8.02)
3	17620.8 (19.43)
7	22336.8 (24.63)
8	22179.0 (24.45)
9	9676.9 (10.67)
B.SIOUX-WTN*	78659.2 (86.72)
B.SIOUX-BRKGS*	75070.5 (82.76)

*- Watertown and Brookings 106 Fixed Ambient Monitoring Stations.

Figure 8. Monthly total phosphorus loadings from 6 sites within the Lake Poinsett Watershed and 2 106 Water Quality Monitoring Stations (Watertown and Brookings) on the Big Sioux River.

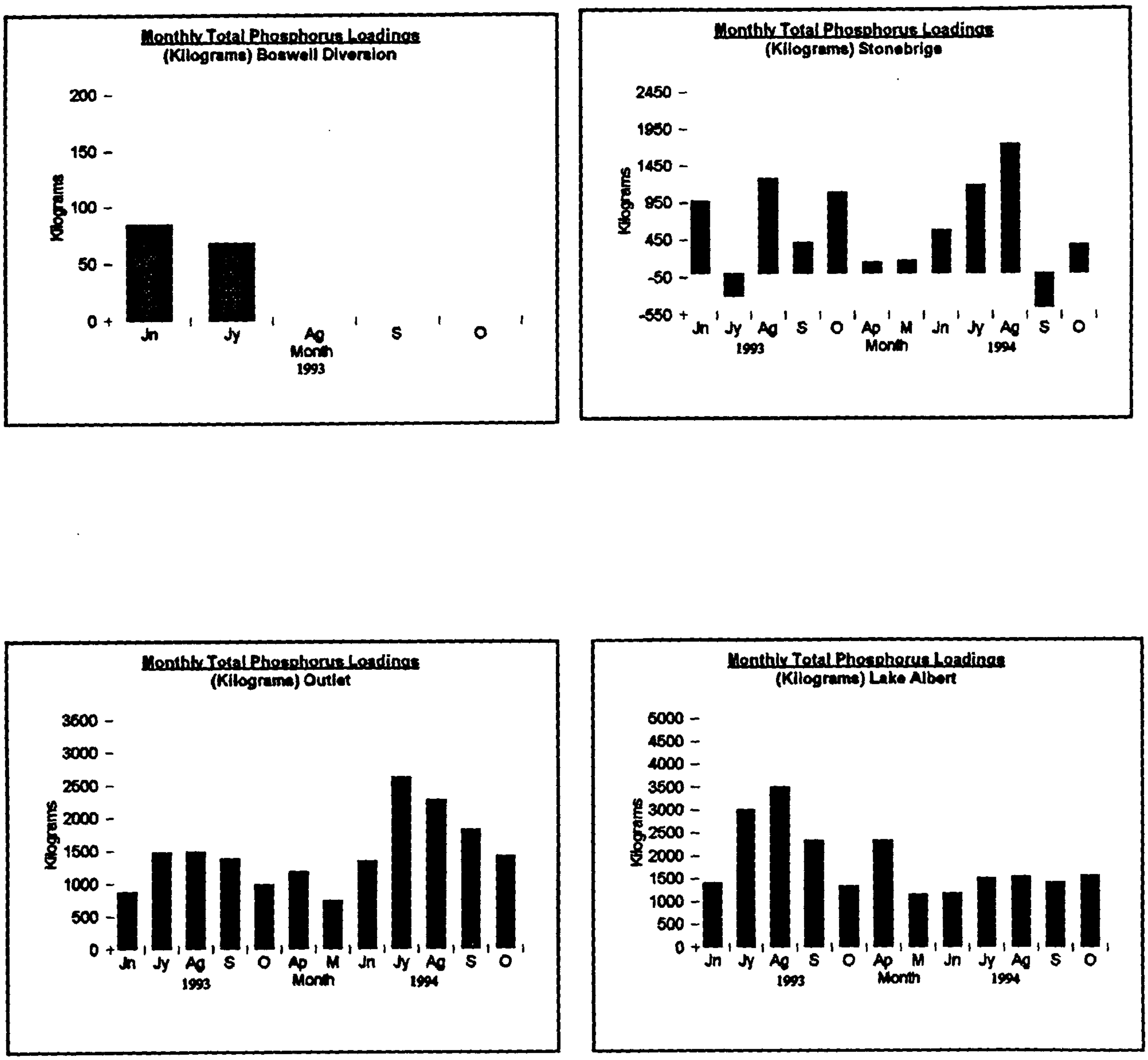
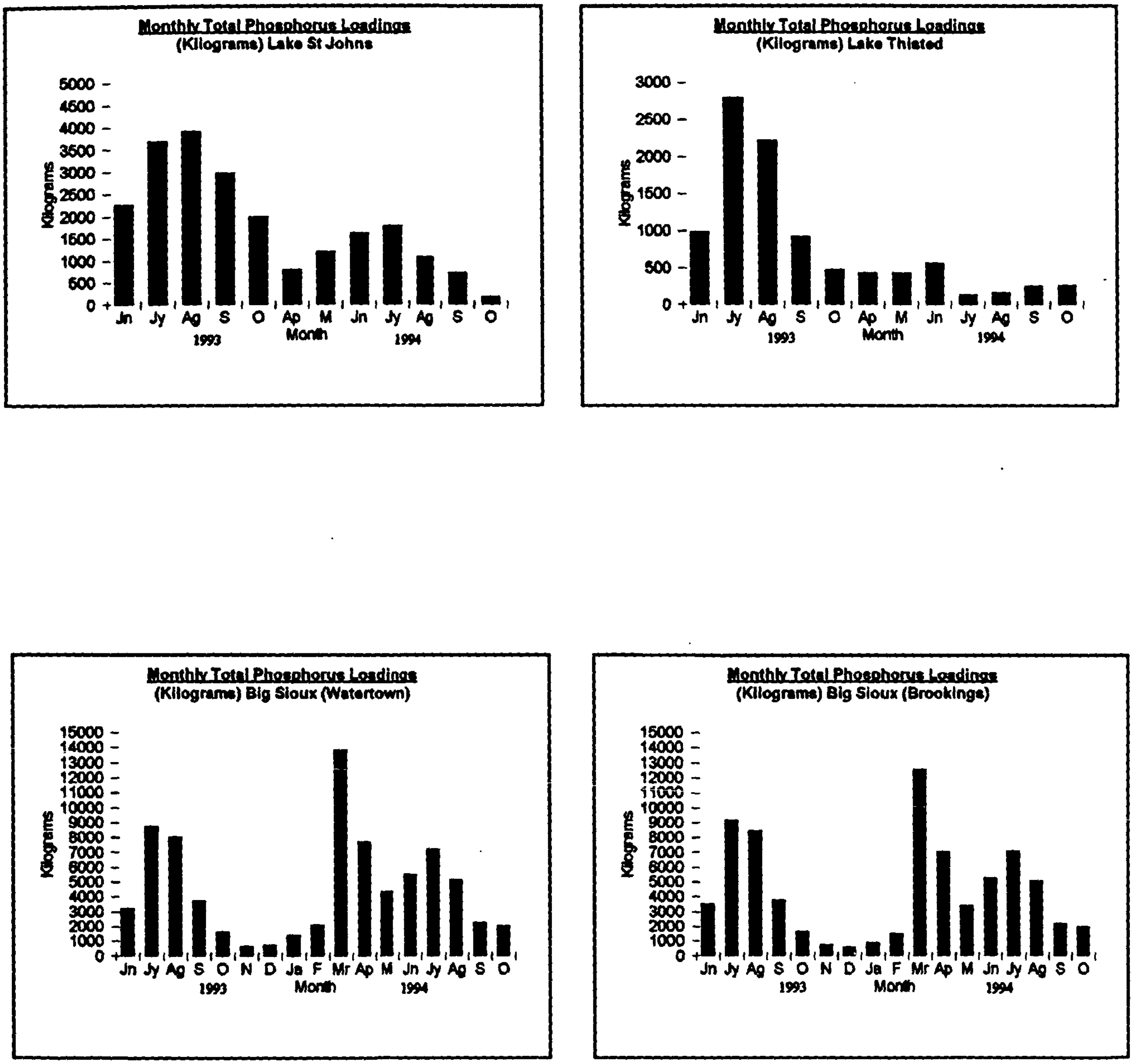


Figure 8 cont. Monthly total phosphorus loadings.



drainage area was Lake Thisted as was indicated by the Agricultural Nonpoint Source (AGNPS) computer model. AGNPS results will be discussed in later sections.

In 1993, the highest total phosphorus load delivered to Lake Albert from St. Johns (site 8) and Thisted (site 9) occurred during the months of July and August when most of the 1993 flooding took place. St. Johns (site 9) delivered 27.5% of its total hydrologic load and 34.2% of its total phosphorus load to Lake Albert in this two month period. Thisted (site 9) delivered 49.7% of its total hydrologic load and 51.8% of the total phosphorus load during this period as well.

These significant hydrologic and phosphorus loadings were due to: 1) the large amount of water discharged in July and August of 1993; and 2) high concentrations of TP. During July and August of 1993, concentrations of 0.259 mg/l and 0.345 mg/l were observed for St. Johns (site 8) and 0.551 mg/l and 0.561 mg/l were observed for Thisted (site 9). Lake Albert (site 7) also delivered 15.7% of its total phosphorus load to Poinsett during August of 1993. This was the largest monthly load delivered from site 7 during the entire project period (1993-94).

During 1994, the largest monthly load for Thisted (site 9) and St. Johns (site 8) occurred in June (5.9%) and July (8.1%), respectively, primarily due to higher phosphorus concentrations. Lake Albert transported its largest monthly phosphorus load for 1994 in April (10.2%). This can be attributed to the larger discharge rates during the month of April i.e. annual spring runoff. (Refer to Figure 9. Lake Chain Diagram for the Lake Poinsett system.)

Table 8. Mean total dissolved phosphorus concentrations for 6 site within the Lake Poinsett Watershed.

Site	X ± SD (Range in Parenthesis)
1	0.082 ± 0.071 (0.013 to 0.229)
2	0.082 ± 0.060 (0.030 to 0.243)
3	0.045 ± 0.034 (0.013 to 0.133)
7	0.095 ± 0.043 (0.040 to 0.163)
8	0.126 ± 0.077 (0.033 to 0.295)
9	0.277 ± 0.093 (0.120 to 0.459)
Wtn*	0.141 ± 0.058 (0.047 to 0.232)
Brks*	0.119 ± 0.080 (0.030 to 0.290)

* = Orthophosphorus

Total Dissolved Phosphorus

This phosphorus fraction includes soluble (dissolved) phosphorus or those species which are immediately available for uptake by plants (bioavailable). The mean total dissolved for Thisted (9) was larger than the other six sites (Table 8). The monitoring stations within the Lake Albert subwatershed (sites 7, 8, and 9) exhibited higher mean concentrations when compared to stations 1, 2, and 3. Wetzel (1983) has suggested that the minimum amount of total phosphorus required to initiate a nuisance algal bloom is approximately 0.02 mg/l. Although there are many variables involved in blue-green algal blooms such as the concentration of phosphorus, temperature, turbidity, and light; the necessary amount of phosphorus is available for a blue-green algal bloom. The 1993-94 mean dissolved phosphorus concentrations from each tributary site, including the outlet (site 3), were well above the estimated 0.02 mg/l requirement for certain algal species (Table 8). The 106 Fixed Ambient Monitoring Plan does not include total dissolved phosphorus so information was not available for this parameter from the Big Sioux River. Orthophosphorus values were used instead (Table 8).

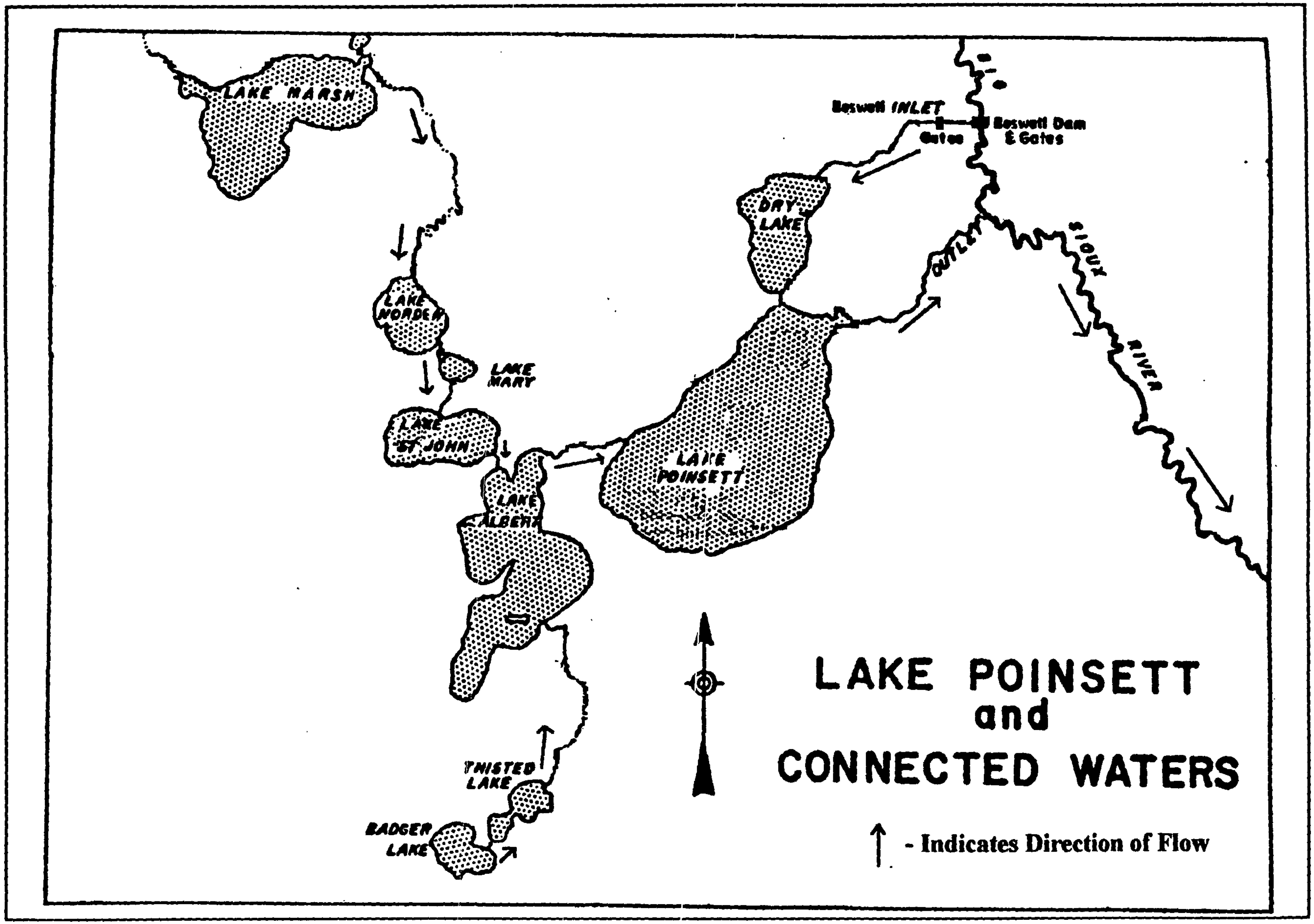


Figure 9. Lake Chain Diagram for Lake Poinsett and Connected Waters.

Particulate/Dissolved Phosphorus

The percentage of the particulate and dissolved fractions of total phosphorus can aid in identifying which subwatersheds are exporting the larger amounts of bioavailable phosphorus. A higher percentage of dissolved phosphorus may indicate which area of the watershed is providing more bioavailable phosphorus either through fertilizers, animal waste material, or by other means. St. Johns (site 8) and Thisted (site 9) exhibited the highest percentages of the total dissolved fraction (Table 9). Although a slightly higher dissolved phosphorus fraction was observed at St. Johns (site 8), the fecal coliform mean for this site was only 34 colonies/100ml (Table 11). In comparison, Thisted (site 9) exhibited slightly less dissolved phosphorus (Table 9) but had the highest fecal coliform mean (759 colonies/100ml). The larger fraction of dissolved phosphorus may primarily be due to the animal waste material which is indicated by the larger fecal coliform counts. However, the St. Johns site may be receiving decaying plant (algae) and animal material from the lake which resulted in the higher dissolved phosphorus fraction.

Table 9. Total dissolved and particulate phosphorus percentages of total phosphorus for all tributary sites.

SITE	TDP%	PP%
1	35.8	64.2
2	47.8	52.2
3	44.6	55.4
7	54.2	45.8
8	60.8	39.2
9	59.6	40.4
BRKS*	46.3	53.7
WTN*	55.4	44.6

* - Orthophosphorus

Total Dissolved Phosphorus Loadings

Methods used to derive loadings for each parameter were described previously. Loadings for each site were summed for the entire project period and are presented in Table 10. The Boswell diversion (site 1) was closed during the project resulting in minimal loadings and the Brookings (BRKS) and Watertown (WTN) monitoring stations on the Big Sioux River are, again, presented here for **comparison purposes only**.

Table 10. Total dissolved phosphorus loadings (kilograms) from 6 sites within the Lake Poinsett Watershed and the Big Sioux River 1993-94.

Site	TDP-Kilograms (tons)
1	80.3 (0.09)
2	3600.5 (4.0)
3	8304.9 (9.2)
7	12555.9 (13.8)
8	14586.9 (16.1)
9	5841.8 (6.4)
B.SIOUX-WTN*	44028.2 (48.5)
B.SIOUX-BRKGS*	39236.8 (43.3)

*- Watertown and Brookings 106 Fixed Ambient Monitoring Stations. Orthophosphorus loadings.

St. Johns (site 8) exhibited the highest loadings for **total dissolved phosphorus** (Table 10). In contrast, Lake Albert (site 7) discharged a higher **total phosphorus** load as was previously discussed (Table X). This difference can be attributed to the higher dissolved phosphorus concentrations (mg/l) observed from St. Johns (site 8) as was explained in Particulate/Dissolved Phosphorus section.

All other trends in dissolved phosphorus loadings are the same as those described in the Total Phosphorus Loading section. For example, the highest 1993 monthly **total phosphorus** loading for Lake Albert (site 7) occurred during August. In 1993, Lake Albert's (site 7) highest monthly loading for **total dissolved phosphorus** also occurred in the month of August. Dissolved phosphorus loading trends exhibited by St. Johns (site 8) and Thisted (site 9) were similar to their total phosphorus loadings as well.

The amount of dissolved phosphorus entering Lake Poinsett via Lake Albert (site 7) totaled 12,555.9 kilograms (13.8 tons). This large amount of bioavailable phosphorus entering the Lake Poinsett system is an integral part of the blue-green algal problem. Attempts should be made to curtail this particular parameter through remedial measures on the St. Johns (site 8) and Thisted (site 9) subwatersheds.

Table 11. Mean Total Nitrogen concentrations (mg/l) for 6 monitoring stations in the Lake Poinsett Watershed 1993-94.

Location (Site)	n	$\bar{X}$ ± SD (Range in Parenthesis)
Boswell (1)	16	1.336 ± 0.483 (0.74 to 2.45)
Stonebridge (2)	16	2.015 ± 0.574 (1.26 to 3.33)
Outlet (3)	16	1.885 ± 0.610 (1.13 to 3.12)
Albert (7)	16	2.518 ± 0.647 (1.59 to 3.67)
St. Johns (8)	16	1.970 ± 0.569 (1.11 to 3.15)
Thisted (9)	16	2.497 ± 0.617 (1.65 to 3.78)

Nitrogen

Total Nitrogen (inorganic + organic) is comprised of several chemical species of which nitrates and ammonia (NO_3 and NH_3) are the most available for uptake by algae and plants. These inorganic constituents of total nitrogen can also be an indicator of some types of pollution (animal and human waste and fertilizers). Total nitrogen ranged from 0.74 mg/l (site 1) to maximum of 3.78 (site 9) observed on October 26, 1993. The highest mean concentration of 2.518 mg/l was observed from the Lake Albert Outlet (site 7) followed by Thisted (site 9) at 2.497 mg/l (Table 11). These two stations also exhibited the largest amount of variability in their respective sample standard deviations (measure of the dispersion of data) (Table 11).

Figures 10 and 11 indicate similar trends for both subwatersheds although concentrations from the Albert subwatershed are slightly larger (Table 11). In general, 1993 total nitrogen concentrations were more variable between sites. This can be attributed to the 1993 flooding events and the varying quantities of water discharged from each subwatershed. A clear trend is evident in 1994 where total

Figure 10. Total Nitrogen Concentrations for the Lake Poinsett monitoring stations including in-lake site 4 for 1993-94.

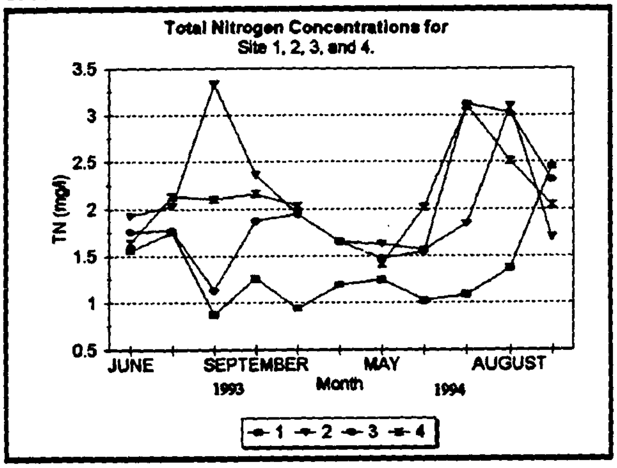
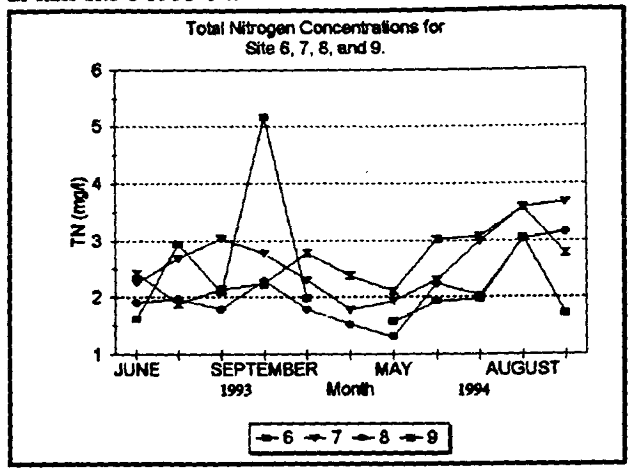


Figure 11. Total Nitrogen concentrations for the Lake Albert subwatershed monitoring stations including Poinsett in-lake site 6 1993-94.



concentrations increased as the summer progressed. Large concentrations were observed in August and September for all of the sites. This is due to the increased presence of organic nitrogen. More plant matter (algae) became present as the spring months (April and May) moved into the summer months.

With the exception of the Big Sioux River, mean concentrations for each of the components of total nitrogen were higher at locations within the Lake Albert subwatershed (sites 7,8, and 9) than found at Boswell Diversion (site 1), Stonebridge (site 2), and the outlet (site 3) (Table 12).

Nitrates + Nitrite (NO_{3+2}^-) which is predominantly found in the nitrate (NO_3^-) form, can be used as an indicator of fertilizers (agricultural and lawn), feedlots, and wastewater inputs within a watershed. Ambient monitoring of the Big Sioux River exhibited high levels of nitrates, which were higher at the Brookings station in comparison to the Watertown station. These mean nitrate concentrations of 0.750 mg/l (Brks) and 0.643 mg/l (WTN) were much higher than any of the other six tributary sites monitored during the project (Table 12). Between the six tributary sites in the Poinsett watershed, the Thisted station (site 9) exhibited the largest mean (0.238 mg/l). Boswell Diversion (site 1) had a large mean as well (0.188 mg/l) but was not excessive in comparison to the sites previously discussed. The lowest observed mean concentration was from the outlet (Site 3) at 0.106 mg/l, which is largely influenced by the concentration levels within Lake Poinsett.

Ammonia (NH_4^+) is a byproduct of the decomposition of organic matter. Excessive inputs of organic matter or waste material would result in excessive levels of ammonia and potentially the release of the more toxic unionized ammonia (NH_4OH). Unionized ammonia can be toxic to fish and other organisms, depending on its concentration. The concentration of unionized ammonia is dependent upon the pH and temperature of the water. Usually in well oxygenated waters ammonia is not a problem unless organic inputs are excessive. Concentration values for ammonia ranged from a minimum of 0.02 mg/l found at all sites (detection limits) to a maximum of 0.860 mg/l sampled from the Watertown Station (January 10,1994). The highest concentration observed from the six tributary sites in the Lake Poinsett watershed was 0.660 mg/l sampled from station 8 (St. Johns) on September 13, 1994. Mean values ranged from a minimum value of 0.020 exhibited by site 1 (Boswell) to 0.245 mg/l collected from the Watertown sampling station (Table 12). Thisted (site 9) at 0.125 mg/l and Lake Albert's outlet (site 7) at 0.153 mg/l exhibited the highest mean concentration of the sites within Poinsett's immediate watershed (sites 1-3 and 7-9).

Table 12. Mean concentrations for 4 nitrogen parameters for 8 monitoring stations in the Lake Poinsett watershed including the Big Sioux River, 1993-94.

Site	Ammonia	Unionized Ammonia	NO_{3+2}	TKN-N
1	0.020	0.00054	0.188	1.156
2	0.078	0.01158	0.119	1.896
3	0.042	0.00696	0.106	1.779
7	0.153	0.00571	0.119	2.399
8	0.099	0.01063	0.113	1.858
9	0.125	0.00308	0.238	2.259
BRKS	0.098	0.00079	0.750	NA
WTN	0.245	0.00291	0.643	NA

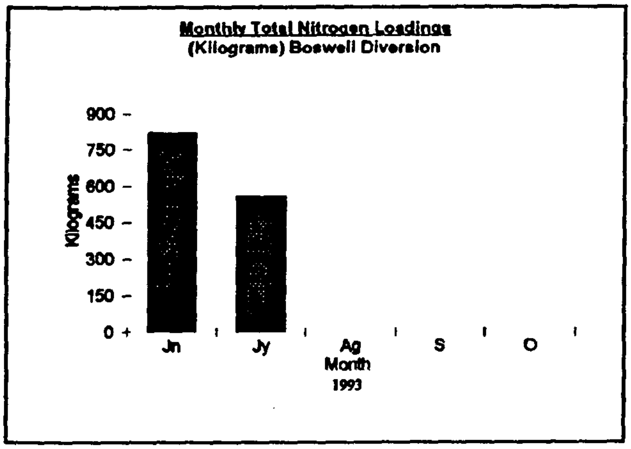
NA = parameter was not monitored during current period with 106 program.

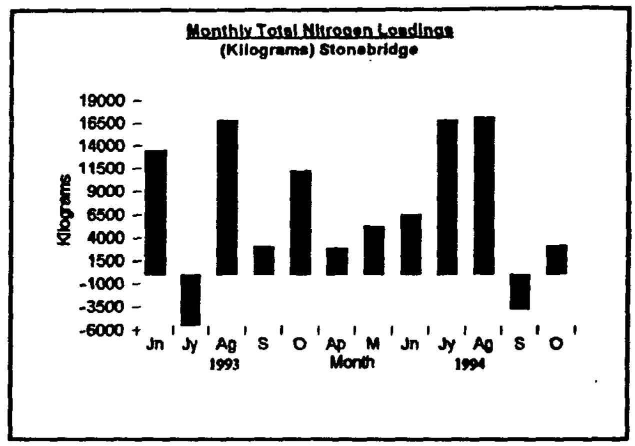
Maximum concentration values for unionized-ammonia ranged from 0.003 mg/l (site 1) to 0.059 mg/l at Site 3 (outlet). This maximum value of unionized ammonia collected on August 24, 1993, occurred with the maximum temperature (24°C) and maximum pH (9.3 su) from this same site. The Lake St. Johns outlet (Site 8) also exhibited a large concentration of 0.057 mg/l, which occurred in conjunction with the maximum pH of 8.9 and a temperature of 16°C.

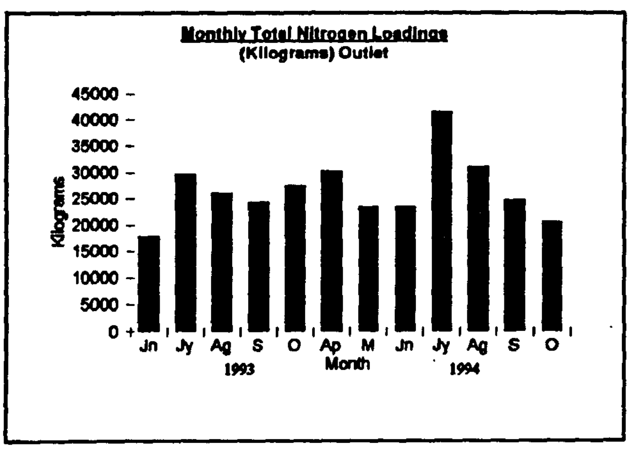
Total Kjeldahl Nitrogen is an analysis technique which measures the amount of ammonia nitrogen plus the organic nitrogen compounds. This can be used as another indicator of excessive organic inputs. Total Kjeldahl nitrogen can also be used for quality assurance and quality control by comparing the amount of Kjeldahl nitrogen to ammonia. Ammonia levels should not exceed total Kjeldahl (TKN).

The highest mean concentration of TKN of 2.399 mg/l was recorded from Site 7 (Lake Albert's Outlet) where the highest ammonia (Table 12) and total nitrogen means (Table 12) were also recorded. These concentrations can be attributed to the organic input from the marsh area located at the Lake Albert outlet. The process of decomposition in which ammonia is an end-product and the decaying plant matter (marsh plants), which contain chemical forms of organic nitrogen, are the

Figure 12. 1993-94 Monthly total nitrogen loadings for 6 sites within the Lake Poinsett Watershed and monthly nitrate loadings for two 106 Water Quality Monitoring Stations (Watertown and Brookings) on the Big Sioux River.







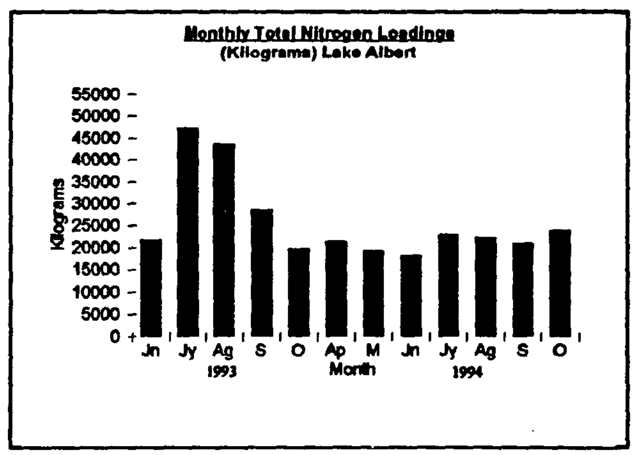
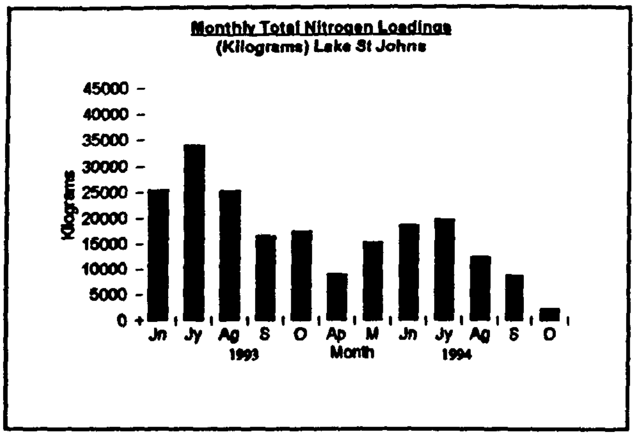
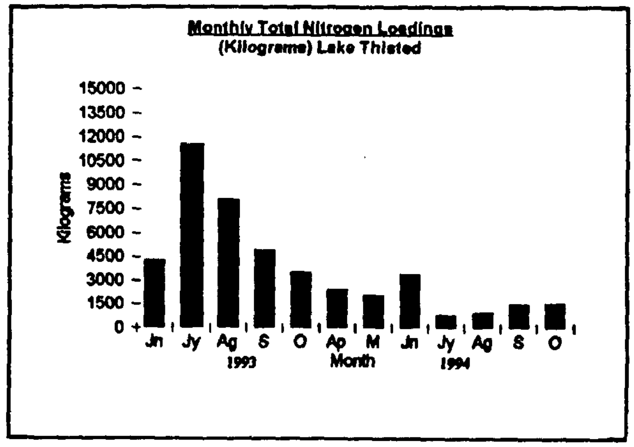
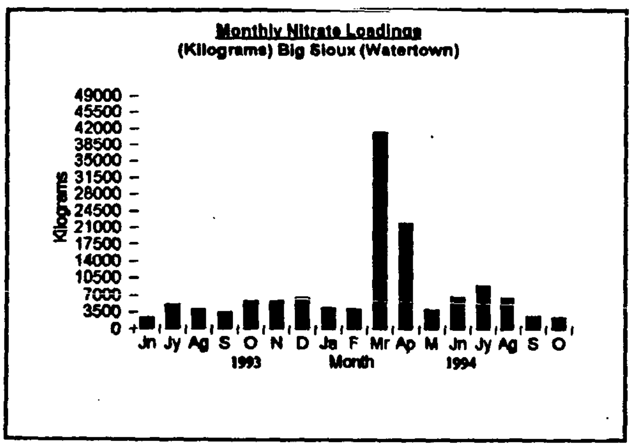
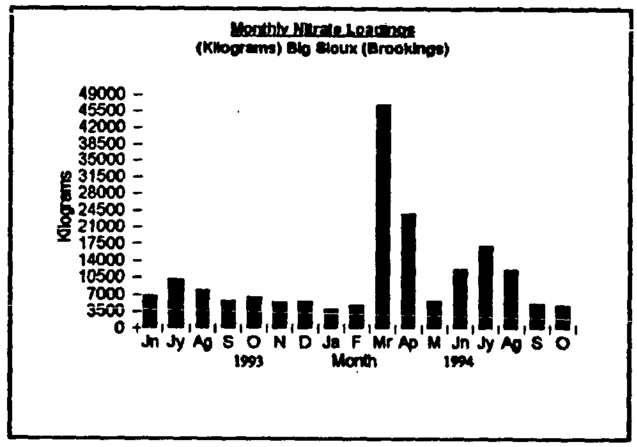


Figure 12 cont. 1993-94 Monthly total nitrogen loadings.









primary cause of the increased concentrations from site 7. High concentrations were also observed from Thisted (site 9) (Table 12). However, these concentrations can be attributed to the organic inputs associated with livestock. High fecal coliform counts, which are used as an indicator of organic waste inputs, were observed throughout the project period from Thisted (site 9) (Figure 3). The mean fecal coliform bacteria count was much lower at Lake Albert (site 7) than the mean count observed from Thisted (site 9) (Table 13).

Fecal Coliform bacteria are a form of bacteria found in the digestive tract of warm-blooded organisms and is an indicator of fecal contaminants that can be used to detect organic waste inputs. Throughout the project period, high counts occurred (# of coliform colonies/100ml) in the samples collected from the Thisted station (Site 9). The maximum value observed from Site 9 was 3800 colonies/100 ml. During August, 1994, Site 9 was sampled and a site two miles south was also sampled. Results indicated an increase of fecal coliforms from 900 colonies/100ml at Site 9 to 10,000 colonies/100 ml two miles south. Both samples exhibited high levels of phosphorus as well. There were consistently high fecal counts from this station (Site 9) which were accompanied with high concentrations of total suspended solids, total phosphorus and periodic spikes of ammonia (NH_4^+) (Appendix I). The mean count for fecal coliform bacteria of 759 colonies/100ml was much higher than any other mean recorded from the 8 other monitoring stations (Table 13). The 106 Fixed Ambient Water Quality Monitoring Station on the Big Sioux River in Watertown exhibited the next highest mean count of 442 colonies/100ml (Table 13). The samples used to calculate means were those collected during the period of the project (5/10/93 - 6/13/94, n = 14). One exceedance for fecal counts/100ml under AR 74:03:02 beneficial use (8) Limited Contact Recreation Waters occurred during this period. One sample exceeded the maximum number of 2000 colonies/100ml during May/1 to September/30. On May 10, 1993, a recorded count of 2400 /100 ml was collected from Watertown. No other

Table 13. Lake Poinsett mean concentrations (mg/l) for eight parameters for all tributary sites and two monitoring stations on the Big Sioux River 1993-94.

PARAMETER								
Site	WTEMP	D.OXY	pH	FECAL	TALKA	TSOLID	TDSOLI	TSSOLI D
1	14.6	7.30	7.83	168	262	609	586	23
2	15.4	9.26	7.99	36	196	825	792	33
3	15.5	8.90	8.62	48	191	974	960	14
7	15.8	6.68	7.93	338	181	991	976	15
8	16.0	8.46	8.38	34	215	1104	1074	31
9	16.0	8.69	8.00	759	205	1199	1132	67
BRKS	10.2	7.65	7.78	118	244	754	690	64
WTN	10.8	9.28	7.88	442	264	536	519	17

exceedances were recorded during this period.

The maximum value of 4000 fecal colonies/100ml for all samples collected, excluding those from the Big Sioux River, was observed from Site 7 (Lake Albert outlet). This large observance was a one time occurrence and a duplicate sample for quality assurance and quality control purposes was also collected at the same time and exhibited only 200 colonies/100 ml count. However, during this same time period, it was reported that due to the flood and high water tables, a septic tank was overflowing and subsequent sampling revealed concentrations well in excess of this number (4000). The mean count of Lake Albert was 338 which was largely influenced by this large one time occurrence (Table 13).

Dissolved Oxygen- For the 6 monitoring stations used in this investigation there is no criteria or standard specifically mentioned in their beneficial use designations. However, the beneficial use designation assigned to the Big Sioux River for Limited Contact Recreation (8) states that the dissolved oxygen must be greater than 5.0 mg/l without exception. Two instances were recorded during the sampling period May 10, 1993 through June 13, 1994 at the Brookings monitoring station where the dissolved oxygen levels dropped to 2.9 mg/l (2/14/94) and 4.7 mg/l (7/12/93). Exceedances were not recorded for the Watertown monitoring station.

Sites 1-3, and 7-9 exhibited low levels of oxygen (<5.0 mg/l) during June, July, August, and September. These lower levels usually correlated with warmer temperatures, increased suspended solids, total phosphorus, and ammonia concentrations. In this 4 month period for 1993 and 1994, Boswell (site 1) and Lake Albert (site 7) each exhibited 5 different measurements of dissolved oxygen which fell below 5.0 mg/l.

pH- is a measure of the activity of the Hydrogen ion (H^+) in water. The range of pH in lakes and rivers can range from 6 to 9. pH can be effected from many variables found in the aquatic ecosystem such as temperature, algal blooms, total alkalinity, soils, aquatic plants, and the presence of excessive amounts of dissolved organic matter etc.. Throughout the project period only one exceedance was observed based on the beneficial uses (9) Wildlife Propagation and Stock Watering and (10) Irrigation Waters. The criteria for these beneficial uses state that the pH must be greater than 6.5 units and less than 9.0 units. A pH value of 9.3 was observed at the Lake Poinsett Outlet (site 3) on August 24, 1993.

Ranges were quite similar and differences were not significant between stations. As discussed previously, the maximum pH value of 9.3 was recorded at Station 3 (Outlet of Lake Poinsett) and was involved with creating the maximum observed concentration of unionized ammonia. All other pH values from all other sites, including the Big Sioux River, ranged from a minimum value of 7.07 standard units (su) recorded from Site 7, to 8.94 su recorded from Site 8 (Outlet of Lake St. Johns). These values are well-within the range set by the beneficial uses.

Total Alkalinity is the capacity of water to accept protons (H^+) and serves as a pH buffer. It is expressed in units of mg/l of Calcium Carbonate ($CaCO_3$) equivalents/l. The primary basic species responsible for this buffering capacity are the bicarbonate ion (HCO_3^-), carbonate ion (CO_3^{2-}), and the hydroxide ion (OH^-). The particular species involved with the buffering capacity is dependent upon the pH. In the pH range discussed previously (7.07 to 8.94), the dominant chemical form would be found as the bicarbonate ion (HCO_3^-). Lethal effects of alkalinity to aquatic life usually do not begin until pH levels are above 9.5 (Manahan, 1990). All monitoring stations including those on the Big Sioux River (Brookings and Watertown) fall under the criteria for the beneficial use (9) Wildlife Propagation and Stock Watering found on Table 5, page 22. Exceedances of 750 mg/l were not observed at any of the stations.

The highest mean concentrations were exhibited at Big Sioux River monitoring stations (Brookings and Watertown) at 244.1 mg/l and 263.5 mg/l, respectively and the Boswell Diversion at 262.0 mg/l. Major differences in concentrations for alkalinity between monitoring stations were not exhibited. The minimum value was 142 mg/l (Site 7) and the maximum value of 319 mg/l was collected from the Watertown Station on the Big Sioux River.

Total Solids- include both dissolved and suspended solids. Total suspended solids are subtracted from total solids to give a quantity which constitutes total dissolved solids. Both of these parameters and their associated trends will be discussed below rather than discussing the total solids.

Total Dissolved Solids - consists of inorganic salts, organic residue and dissolved material which are able to pass through a filter during analysis of a sample (Cole, 1983). Criteria for the beneficial use (9) Wildlife Propagation and Stock Watering Waters states that total dissolved solids may not exceed 2500 mg/l with a variation allowed under subdivision 74:03:02:32 (2). Exceedances were not observed from any of the samples collected from all of the sites used in this investigation. Dissolved solids ranged from a minimum value of 408 mg/l recorded from the Watertown Station on the Big Sioux River to a maximum value of 1713 mg/l at Site 9 (Thisted). Means ranged from 518.5 mg/l (Watertown Station) to 1132.3 mg/l, which was calculated from the samples taken from the Thisted Station (site 9). The Big Sioux River is designated as (1) Commerce and Industry waters and the criteria for this use requires that the total dissolved solids fall below 1000 mg/l, which was not exceeded during the course of this investigation.

Total Suspended Solids - is that material which is retained on the filter described in the previous paragraph. Suspended solids consist of volatile and nonvolatile constituents. Volatile solids are combustible and are burned off during analysis. These solids contain carbon and were a part of an organic molecule (biomass). Both volatile and nonvolatile suspended solids can accumulate in a lake basin, forming sediment. This parameter is used as an estimate of sediment delivered from each stream. However, suspended solids concentrations does not accurately describe the bed load (those sediment particles >0.062millimeters in diameter) of a stream delivered to another body of water. Guy (1970) reported that when the velocity is low ($V<2.0$ ft/sec) and no sand is being transported

Figure 13. 1993-94 Lake Poinsett total suspended solids concentrations for Stations 1, 2, and 3.

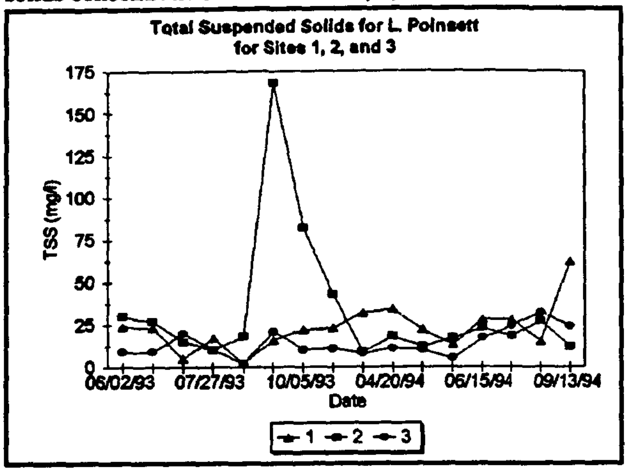
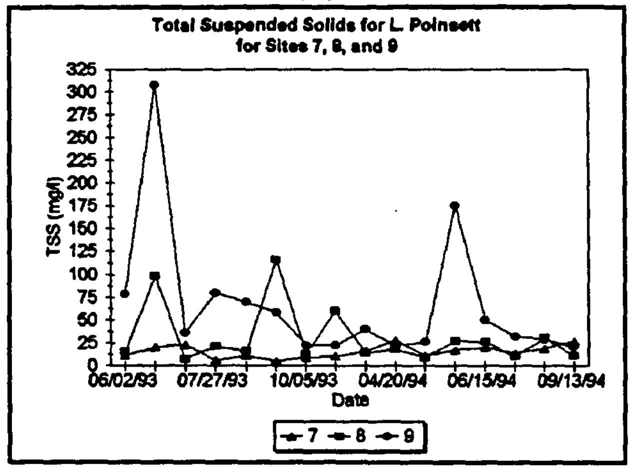
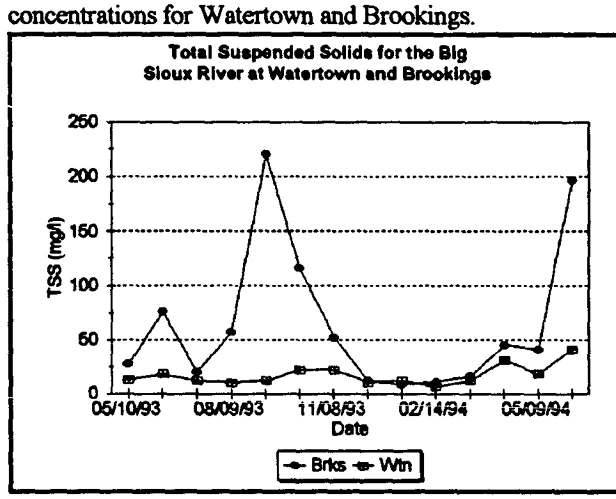


Figure 14. 1993-94 Lake Poinsett total suspended solids concentrations for Stations 7, 8, and 9.



as suspended sediment, the rest of the sediment (clay and silt particles i.e. < 0.062mm in diameter) is uniformly distributed throughout the water column. High suspended solids concentrations can overtax an aquatic system and smother fish eggs and fry (EPA, 1993) as well as deprive the aquatic ecosystem from the required amount of oxygen necessary to maintain aquatic life. The Big Sioux River Water Quality monitoring stations (Watertown and Brookings) have a Beneficial Use designation for (5) Warmwater Semipermanent Fish Life Propagation which requires that total suspended solids concentrations fall below 90 mg/l with a variation under subdivision 74:03:02:32 (2). The Brookings monitoring station exhibited the highest number (n=3) of observations which were greater than 90 mg/l. The maximum suspended solids concentration from this station was 220 mg/l, which is a significant concentration (Figure 15).

Figure 15. 1993-94 Big Sioux total suspended solids concentrations for Watertown and Brookings.



The maximum concentration observed from all the sites for the entire project period was collected from Site 9 (Thisted) (Figure 14). The sample collected on 6/14/93 exhibited 308 mg/l of suspended solids. The maximum phosphorus concentration was also observed from this sample. These high concentrations were one time occurrences and it should be noted that they were followed by concentrations below 90 mg/l (Figures 13 and 14). However, Site 9 (Thisted) exhibited higher concentrations throughout the project period. In fact, the largest mean suspended solid concentration was calculated from samples collected from Site 9 (Thisted) followed closely by Brookings Water Quality station on the Big Sioux River (Table 13).

Suspended Solid Loadings -

Loadings from the Big Sioux River were considerably larger than any of the other sites within the Lake Poinsett and Lake Albert Watersheds. The Big Sioux River gained almost four times as much suspended solids going from Watertown to Brookings where an estimated 24,350.6 tons were transported. However, the Boswell Diversion was not opened during this period and, consequently, no suspended solid load was delivered into Lake Poinsett. In comparison, the largest load transported from Poinsett's immediate watershed was St. Johns. Although Thisted (9) exhibited higher concentrations, the larger discharge rates (hydrologic load - Figures 4 and 5) from St. Johns resulted in a larger suspended solid load. Much of this load, however, was accumulated in the Lake Albert lake basin and was reduced by half before transporting an estimated 1921.1 tons to Lake Poinsett (Table 14). The complex relationship that exists between Dry Lake and Lake Poinsett may have resulted in a underestimation of the amount of total suspended solids that are transported from one lake to the other.

Table 14. Total suspended solid loadings (kilograms) from 6 sites within the Lake Poinsett Watershed and the Big Sioux River 1993-94.

Site	TSS (Kilograms)	TSS (Tons)
1	11847.4	13.1
2	1331763.8	1468.3
3	2455987.0	2707.7
7	1742493.3	1921.1
8	3260473.6	3594.7
9	1478459.3	1630.0
Brks	22086686.4	24350.6

During June 1993, 23.2% of the total suspended solids load was delivered from Lake St. Johns (site 8) to Lake Albert. Due to the extent of discharge that occurred from the 1993 flooding, an estimated 75% of the total (1993-94) suspended solids load was transported from St. Johns (site 8) to Lake Albert during 1993 (Figure 16).

Loadings for all the parameters collected during the project are located in Appendix I. Table 13 shows the total amount of phosphorus, nitrogen (nitrates only for the Big Sioux River) and suspended solids and their mean concentrations from each of the monitoring stations. It also shows their accumulations for Lake Albert and Lake Poinsett. A water balance error of 23,888.3 acre-feet was calculated for Lake Poinsett. This was due primarily to the underestimate of discharge from Stonebridge as well as ungaged runoff from several smaller intermittent streams and groundwater.

Figure 16. 1993-94 Monthly total suspended solid loadings (kilograms) for 6 sites within the Lake Poinsett Watershed and 2 water quality monitoring stations (Watertown and Brookings) on the Big Sioux River.

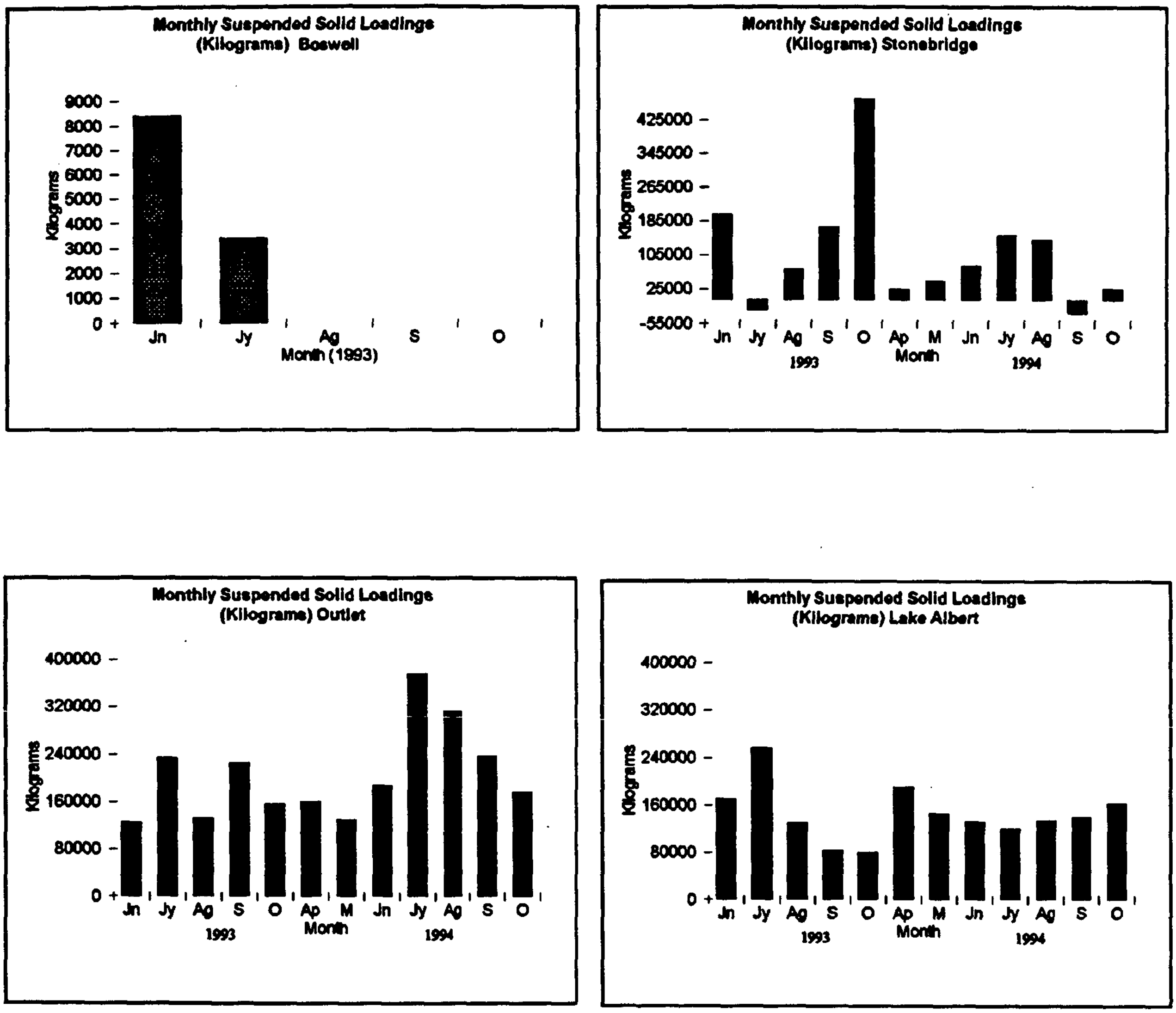
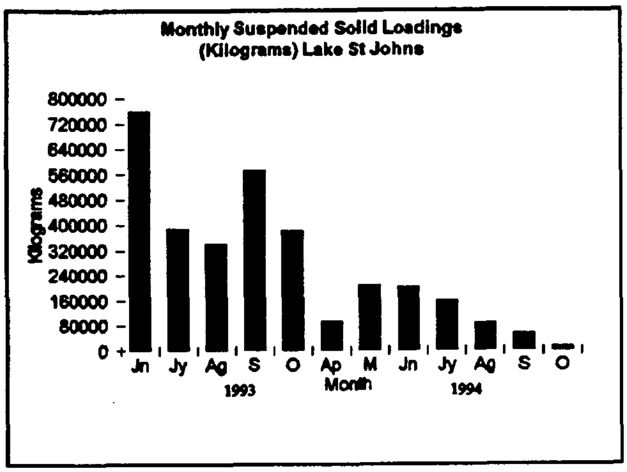
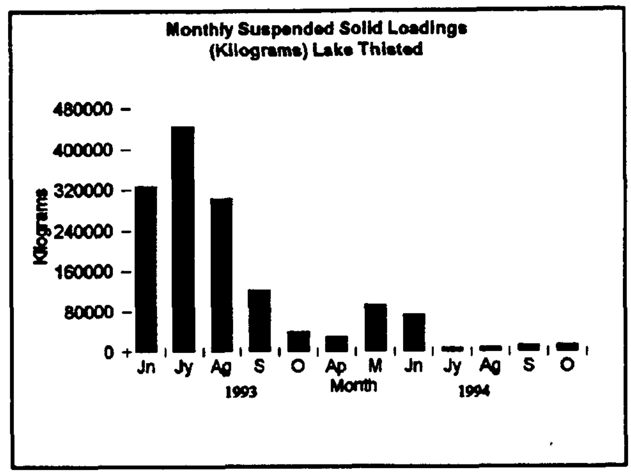
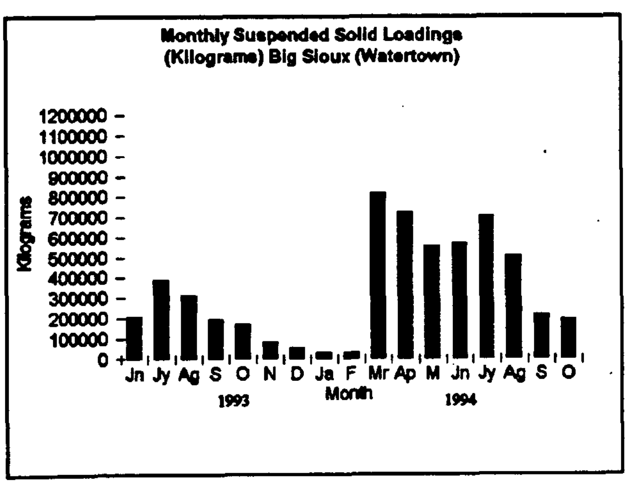


Figure 16 cont. 1993-94 Monthly total suspended solid loadings (kilograms) for 6 sites within the Lake Poinsett Watershed and 2 water quality monitoring stations (Watertown and Brookings) on the Big Sioux River.







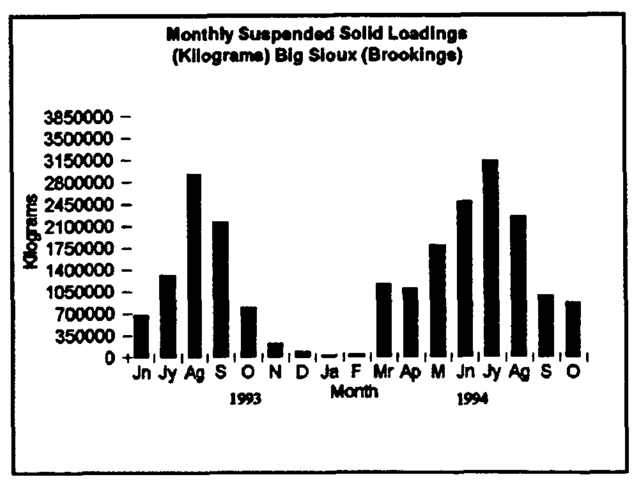


Table 15. Water, Total Suspended Solids, Total Phosphorus, and Total Nitrogen Budgets for Lake Poinsett, South Dakota

Lake Poinsett, South Dakota

June 1, 1993 through Nov 4, 1994

Item	Mean Flow (ac-ft/yr)	Total P Loading (lbs/yr)	Mean Conc. TP (mg/l)	Total N Loading (lbs/yr)	Mean Conc. TN (mg/l)	TSS Loading (lbs/yr)	Mean Conc TSS (mg/l)
Site 1 - Boswell Diversion	604.6	337.81	0.212	3040.03	1.34	26123.30	22.88
Lake Poinsett Accumulation							
Site 2 - Stonebridge	33340.1	16047.75	0.165	191678.89	2.02	2936539.62	33.10
Site 7 - Lake Albert	94810.3	49252.64	0.177	685288.20	2.52	3842197.07	15.44
Site 3 - Outlet	136749.3	38853.80	0.100	706086.86	1.89	5415451.34	13.90
Ungaged Direct Runoff							
Atmospheric	24567.8	1965.10		91939.20			
Total Inflow	152718.2	67265.49		968906.29		6778736.69	
Evaporation	39857.2						
Outflow	136749.3	38853.80		706086.86		5415451.34	
Water Balance Error[1]	-23888.3						
Net Sedimentation[2]		28411.69		262819.42		1363285.35	
Lake Albert Accumulation							
Site 8 - Lake St. Johns	87831.3	48904.63	0.204	451152.26	1.97	7189345.17	30.75
Site 9 - Lake Thisted	16441.6	21337.56	0.472	99032.79	2.50	3260002.10	66.81
Site 7 - Lake Albert	94810.3	49252.62	0.177	685288.20	2.52	3842197.07	15.44
Ungaged Direct Runoff							
Atmospheric	11272.2	901.63		42183.57			
Total Inflow	115545.1	71143.82		592368.62		10449347.27	
Evaporation	18287.3						
Outflow	94810.3	49252.62		685288.20		3842197.07	
Water Balance Error[1]	2447.5						
Net Sedimentation[2]		21891.20		-92919.58		6607150.20	

[1]= Water Balance Equation: Water Balance Error Total Inflow - Evaporation - Outflow

[2]= Phosphorous Balance Equation: Net Sedimentation Total Inflow - Outflow

Big Sioux River (BRKS)	233309	170652.2	0.269	408958.70*	0.75*	4601142.63	64.10
Big Sioux River (WTN)	233309	179345.9	0.306	306013.21*	0.64*	12746494.22	17.07

*Big Sioux River Total Nitrogen = Nitrate (NO_{3+2}), Total Nitrogen not available

Boswell Diversion

The Boswell Diversion is a manmade structure used to divert water from the Big Sioux River to Dry Lake and Lake Poinsett during periods of flooding. This structure was designed to divert up to 500 cubic feet per second (cfs) when the Boswell Dam gates on the Big Sioux River were closed and the diversion gates were opened. The canal was modified in 1955 to increase the amount of water that could be diverted to 1500 cfs (Water Right No. 119-3).

In order to determine what impact the loadings from the Big Sioux River would have on the water quality of Lake Poinsett it was necessary to estimate the loadings via the diversion structure. As stated previously, the diversion gates were closed during the period of study and therefore, it was necessary to extrapolate the loadings from the Big Sioux River to the Boswell Diversion if the gates had been opened and water was diverted to the Dry Lake/Lake Poinsett system.

Samples were taken during the summer of 1994 at the Boswell Dam gates on the Big Sioux River to determine the water quality of the river at this specific point. These samples were used to estimate the total suspended solids, total nitrogen, and total phosphate loadings from the diversion. Discharge at this specific point on the river was not collected during the study. However, the U.S. Geological Survey gaging station (USGS Gaging Station No. 06479525) near Castlewood was used as an estimate of the discharge at the Boswell Dam on the Big Sioux River. This station is approximately 8 miles upstream of the Boswell Dam gates and therefore, the discharge estimates of this station are less than they would be at the dam due to the larger drainage area at this point (Boswell Dam) on the Big Sioux River. The larger discharge rates would also increase the loadings from those that are estimated here.

Van Den Berg (1967) reported that the closed gates on the Big Sioux River leaked an estimated 100 cfs when the discharge for the river was greater than 100 cfs. Consequently, he assumed that water could be diverted through the Boswell Diversion to Dry Lake only when the flow on the river was greater than 100 cfs. He also determined that during an average year, the flow on the Big Sioux River exceeded 100 cfs only 46 days a year. After flow measurements were made in the Boswell Diversion during a period of high river stage and normal lake elevation, Van Den Berg (1967) determined that the maximum capacity of the present system was approximately 500 cfs.

The time period used to compare loadings from the diversion to the Stonebridge (site 2) and Lake Albert Outlet (site 7) was the same period in which the samples were collected from the Big Sioux River (5/25 - 9/13/94). These samples were averaged between successive sampling periods to derive daily concentrations. The discharge in the diversion was estimated by taking the daily discharge (cfs) from the Castlewood gaging station and subtracting 100 cfs as Van Den Berg did in 1967. However, in contrast to what Van Den Berg used in 1967, it was assumed that the maximum capacity of this canal is 1500 cfs (1955) as stated in Water Right No. 119-3. During the period of 5/25 to 9/13/94 the Big Sioux River's average daily discharge exceeded 100 cfs and there were 8 days in this time period in which the discharge exceeded 500 cfs. After subtracting 100 cfs from the average daily discharge rates and converting cubic feet per second to liters per day, the daily discharge and the daily concentrations were multiplied to determine the daily loadings from the diversion. The loadings for the last week in May (5/25 - 5/31/94) were added to the month of June and the two weeks in September (9/1 - 9/13/94) were added to the month of August. These loadings were then compared to the loadings calculated from the Lake Albert Outlet and Stonebridge data. Total loadings for this period can be found on Table 16 and monthly loadings are located in Figure 17.

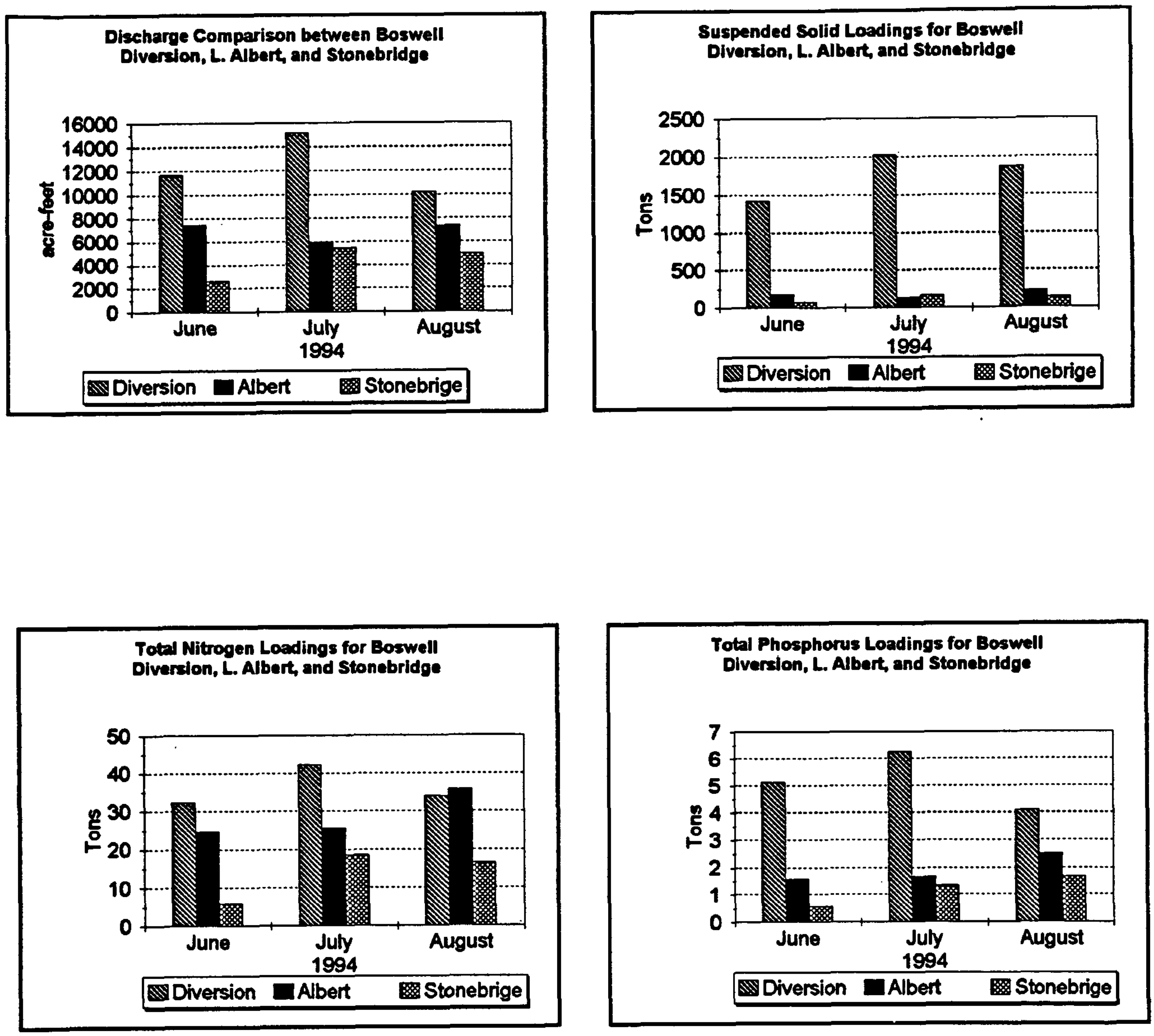
As discussed previously, the discharge would increase if actual flow measurements on the Boswell Dam were used. The 8 miles between the Castlewood gaging station and the dam would result in a larger drainage area, i.e. increased drainage area - increased discharge rates. Sediment (TSS) and nutrient (TN and TP) loadings would also increase due to the larger discharge rates as well.

Table 16. Estimated Total Discharge and Loadings for the Boswell Diversion compared Lake Albert and Stonebridge Sites.

Site	Water (acre-feet)	TSS (tons)	TN (tons)	TP (tons)
Diversion	37,131	5,311	108	16
Albert	20,725	533	86	6
Stonebridge	13,019	379	41	4

In comparison to Lake Albert and Stonebridge, the diversion's potential loadings for all three parameters are considerably larger for the 3-month monitoring period during the summer of 1994. The potential amount of phosphorus diverted into the Dry Lake/Lake Poinsett system from the Big Sioux River via the diversion is significantly larger than that of the other sites (Table 16 and Figure 17). It should be noted that Stonebridge loadings would also increase as loadings for the diversion increased. In order to improve the water quality of Lake Poinsett, it is necessary to limit or eliminate this source of phosphorus and suspended solids.

Figure 17. Comparison of the estimated loadings for Four Parameters for the Boswell Diversion to the Outlet of Lake Albert and Stonebridge Gaging Stations



SPECIAL SAMPLES

Throughout the investigation there were samples which were collected from sites around the lake to determine the water quality of these specific areas. These intermittent streams drained agricultural areas and then pooled in a ditch until the depth became sufficient to allow flow across a road into the lake.

Results from this sampling indicated that high phosphorus concentrations are periodically entering via the smaller tributaries which is mentioned in the AGNPS discussion. An intermittent pool/stream was sampled in August of 1994 from the East Lake Drive section of Lake Poinsett. This sample contained high total phosphate (0.506 mg/l), total dissolved phosphate (0.260 mg/l), ammonia (0.510 mg/l), and nitrate (0.300 mg/l) concentrations.

Another sample was taken from a pipe near the Prestrude boat landing area on the east side of the lake (Figure 3, pg 16). This pipe was used to drain a marsh/slough during flooding conditions. This sample also contained high phosphate (0.516 mg/l) and total dissolved phosphate (0.493 mg/l) concentrations.

Samples were also collected from the Big Sioux River at the Boswell Dam (Figure 3, pg 16). The river was sampled monthly during the summer of 1994 to determine the water quality at this point (Table 17).

Table 17. SAMPLE DATA FOR LAKE POINSETT FOR 1993-94
Site - 10, Big Sioux River, Directly located at the gates

DATE		5-25-94	6-15-94	8-9-94	9-13-94	Mean
WTEMP	C	19	21	16	21	19.25
ATEMP	C	16	22	12	28	19.5
DISOX	mg/l	7.25	8.00	5.40	6.20	6.71
FPH	su	7.98	8.01	7.84	8.53	8.09
FECAL	/100 mL	80	310	160	570	280
TALKAL	mg/l	278	251	242	284	263.75
TSOL	mg/l	838	687	634	696	713.75
TDSOL	mg/l	798	621	504	692	653.75
TSSOL	mg/l	40	66	130	144	95
AMMON	mg/l	0.02	0.02	0.02	0.02	0.02
UNIONIZEDAMMONIA	mg/l	0.0007	0.0008	0.0004	0.0025	0.0011
NO3+2	mg/l	0.8	1	1.1	0.6	0.875
TKN-N	mg/l	1.15	1.02	0.96	2.28	1.3525
ORGANIC NITROGEN	mg/l	1.13	1	0.94	2.26	1.3325
TOTAL NITROGEN	mg/l	1.95	2.02	2.06	2.88	2.2275
TPO4P	mg/L	0.529	0.283	0.323	0.263	0.3495
TOTAL DISS. PO4P	mg/L	0.143	0.096	0.133	0.126	0.1245

The mean phosphate levels for this site are considerably higher than other sites already discussed. Nitrates also exhibited higher concentrations.

LAKE POINSETT WATERSHED AGNPS ANALYSIS

An analysis of the Lake Poinsett watershed was performed utilizing a computer model. The model selected was the Agricultural Nonpoint Source Pollution Model (AGNPS) (version 3.65.5). This model was developed by the Agricultural Research Service to analyze the water quality of runoff events from watersheds. The model predicts runoff volume and peak rate, eroded and delivered sediment, nitrogen, phosphorus, and chemical oxygen demand (COD) concentrations in the runoff and sediment for a single storm event for all points in the watershed. Proceeding from the headwaters to the outlet, the pollutants are routed in a step-wise fashion so the flow at any point may be examined. This model was developed to estimate subwatershed or tributary loadings to a water body. The AGNPS model is intended to be used as a tool to **objectively** compare different subwatershed within a watershed and watersheds throughout the state. This model is intended for watersheds up to 76,000 acres (1900 cells @ 40 acres/ cell).

The size of the Lake Poinsett watershed and area modeled was approximately 96,920 acres. Due to large size of the watershed and the associated limitations imposed by the AGNPS program, the Lake Poinsett watershed was divided into a upper (52,040 acres) and lower (44,880 acres) watershed components (Figures 18 and 19). Each of these watershed components was than divided into subwatersheds based on flow and drainage patterns. This resulted in the upper watershed being divided into 14 subwatersheds, and the lower watershed being divided into 9 subwatersheds. The selection criteria for determining what comprises a "subwatershed" was also based upon an aerial drainage restriction. If a subwatershed drained less than 2% (approximately 800 acres) of the non-lake watershed area, then it was not analyzed for NPS loadings. Normally, direct overland flow from areas adjacent to the lake is not analyzed since the aerial drainage from these areas is generally small. For this watershed, this constituted an area of less than 800 acres. Nonpoint Source (NPS) loadings, feedlot contributions and hydrology were computed for each subwatershed in order to determine the loadings to Lakes Albert, Poinsett and Dry. The amount of NPS loadings deposited in Lakes Albert, Poinsett and Dry and the amount transported out of the lake was **not** calculated. The AGNPS model cannot accurately route and calculate the in-lake deposition and transport of NPS pollutants. For this study, it was assumed that the effect of the smaller lakes found within the watershed on the transport of NPS pollutants was negligible.

AGNPS GOALS

The primary objectives of running AGNPS on the Poinsett Lake watershed was to:

1.) Evaluate and quantify the loadings from each subwatershed and their net loading to the lake.
2.) Define critical cells within each subwatershed (high sediment, nitrogen, phosphorous).
3.) Quantify the nutrient loadings from each feedlot and priority rank each feedlot.

The following is a brief overview of each objective.

OBJECTIVE 1 - AGNPS SUBWATERSHED LOADINGS

SEDIMENT YIELDS

The AGNPS data indicates that subwatersheds #2 and #7 (Lake Albert) and #7 (Dry Lake) have the largest per acre impact on sediment loadings to the Lake Poinsett watershed (≥+1 σ (sample standard deviation)). The subwatersheds for Dry Lake #7 and Lake Albert #7 are designated on Figures 18 and 19 by the use of their outlet cell#. Dry Lake's outlet cell # for subwatershed #7 is #466 (subwatershed #466) (Figure 18, pg 56). Lake Albert's outlet cell # for subwatershed #7 is #686 (subwatershed #686) (Figure 19, pg 57).

Subwatershed #2 (Lake Albert) appears to be contributing extremely high sediment amounts to Lake Albert (.41 tons/acre/avg.year, 1.01 tons/acre/25yr.event). The location of this subwatershed is from the outlet of Lake Thisted to the inlet of Lake Albert (Figure 19, pg 57). The boundaries of this watershed can be found in the AGNPS final report in Appendix II.

SUBWATERSHED	SEDIMENT YIELD % OF TOTAL LOAD	AERIAL DRAINAGE % OF TOTAL AREA
#2 LAKE ALBERT	18.7%	8.7%
#7 LAKE ALBERT	6.4%	3.5%
#7 DRY LAKE	31.1%	18.0%

NITROGEN YIELDS

The AGNPS data indicates that subwatersheds #2 and #7 (Lake Albert) and #5 (Dry Lake) have the largest per acre impact on nitrogen loadings to the Lake Poinsett watershed (≥+1 σ (sample standard deviation)). Dry Lake's outlet cell # for subwatershed #5 is #383 (subwatershed #383) (Figure 18, pg 55).

SUBWATERSHED	NITROGEN YIELD % OF TOTAL LOAD	AERIAL DRAINAGE % OF TOTAL AREA
#2 LAKE ALBERT	15.8%	8.7%
#5 DRY LAKE	27.3%	21.1%
#7 LAKE ALBERT	5.6%	3.5%

PHOSPHOROUS YIELDS

The AGNPS data indicates that subwatersheds #2 and #7 (Lake Albert) and #5 (Dry Lake) have the largest per acre impact on phosphorous loadings to the Lake Poinsett watershed (≥+1 σ (sample standard deviation)).

SUBWATERSHED	PHOSPHOROUS YIELD % OF TOTAL LOAD	AERIAL DRAINAGE % OF TOTAL AREA
#2 LAKE ALBERT	17.6%	8.7%
#7 LAKE ALBERT	6.4%	3.5%
#5 DRY LAKE	31.3%	21.1%

Best Management Practices should be targeted to these four subwatersheds and selected critical cells as identified in the AGNPS final report in Appendix II in order to achieve the highest benefit/cost ratio. **It is recommended these areas be "Field Verified" prior to the installation of any Best Management Practices (BMP's).**

Comparing AGNPS loading data to other watersheds (expected critical range), the NPS loadings appear to be low except for the sediment yields from Lake Albert subwatersheds # 2 and #7 and nutrient yields from the Lake Albert subwatershed #2 and Dry Lake subwatershed #5. The extremely high sediment and nutrient yields from the Lake Albert subwatershed #2 can be partially attributed to the fact that as the size of the subwatersheds decrease, the distance from the NPS source to the lake decrease, thereby resulting in higher mean values. The Lake Albert #2 subwatershed should be the primary target of BMP's. Based upon this analysis, it is recommended that conservation practices should be targeted to control erosion concentrated in subwatersheds #2 and #7 (Lake Albert) and #7 (Dry Lake) and that nutrient management practices should be concentrated in subwatershed #2 and #7 of Lake Albert and #5 of Dry Lake.

An analysis of the Lake Poinsett watershed indicates that there are approximately 214 non-water cells which have greater than 3.9 tons/ acre of sediment yield. This is approximately 13 % of the non-water cells found within the watershed. The model also estimated that there are 26 non-water cells which have nitrogen yields of > 5 ppm and 29 cells which have phosphorous yields > 1.0 ppm. This is approximately 1.6 % of the non-water cells within the watershed. Location and yields for each of these cells are listed in the Poinsett-AGNPS final report. Due to the length of this document, it was printed as a separate document. These cells should be given high priority when installing any future Best Management Practices (BMP's). The model indicated that sub-watersheds #2 & #7 (Lake Albert) and #5 & #7 (Dry Lake) have the largest sediment and or nutrient yields per acre. Therefore initial BMP's should be concentrated in these four critical subwatersheds.

OBJECTIVE 3 - FEEDLOT RANKINGS (25 YEAR EVENT)

FEEDLOT SELECTION CRITERIA AND STATISTICS (NOT WEIGHTED FOR DISTANCE FACTORS)

1.) Animal feedlot ranking	25 year event
2.) Range of feedlot rankings	0 - 55

3.) Mean 27.5

4.) Sample standard deviation (σ) 15.3

5.) Feedlots with rating $\geq +1\ \sigma$ are : Cell 742, 186

A total of 11 feedlots were identified as potential NPS sources during the AGNPS data acquisition phase of the project. Below is Table 18 a listing of the AGNPS analysis of the feedlots:

FEEDLOT (CELL,#)	SUBWATERSHED LOCATION	AGNPS RATING (25 YR.EVT)	RANKING PRIORITY	VARIANCE FROM MEAN OF 33.7	VARIANCE FROM 1 STD.DEV. (σ=19.1) FROM MEAN	PRIORITY RANK BASED ON AGNPS RANK AND DISTANCE FACTORS ♦		
						C.FACT.	C.RATE	C.RANK
499	Dry Lake #5	8	10	- 19.5	- 1.27	1.00	8	10
742	Poinsett #1	55	1	+ 27.5	+ 1.79	.64	35	1
859	U.P.-Direct	24	8	- 3.5	- 0.23	1.00	24	6
1077	U.P.-Direct	17	9	- 10.5	- 0.68	1.00	17	9
1126	U.P.-Direct	31	5	+ 3.5	+ 0.23	.72	22	7
1247	Poinsett #7	0	11	- 27.5	- 1.80	.42	0	11
186	Albert #1	43	2	+ 15.5	+ 1.01	.48	21	8
284	Albert #2	28	7	+ 0.5	- .03	.90	25	5
411	Albert #1	33	4	+ 5.5	+ 0.36	.80	26	4
691	L.P.-Direct	30	6	+ 2.5	+ 0.16	1.00	30	2
889	Albert #9	34	3	+ 6.5	+ 0.43	.80	27	3

♦ - PRIORITY RANK = AGNPS 25 YEAR FEEDLOT RATING X DISTANCE TO STREAM X DISTANCE TO LAKE

<u>DISTANCE TO STREAM FACTORS</u>

Adjacent to stream	= 1.0
Within 1 cell (1300 feet)	= .8
Within 2 cells (2600 feet)	= .6
Within 3 cells (3900 feet)	= .4
Within 4 cells (5200 feet)	= .2

<u>DISTANCE TO LAKE FACTORS</u>

Adjacent to lake	= 1.0
Within 4 cells (5200 feet)	= .9
Within 8 cells (10400 feet)	= .8
Within 16 cells (15600 feet)	= .7
Within 20 cells (20800 feet)	= .6

Mean value	= 27.5	
Median value	= 30.0	
STDS	= 15.3	
Mean + 1STDS	= 42.8	

Cell # 742 000		
Nitrogen concentration (ppm)	65.563	
Phosphorus concentration (ppm)	15.068	
COD concentration (ppm)	1160.682	
Nitrogen mass (lbs)	357.528	
Phosphorus mass (lbs)	82.166	
COD mass (lbs)	6329.441	
Animal feedlot rating number	55	(+1.79σ)

Cell # 186 000		
Nitrogen concentration (ppm)	15.541	
Phosphorus concentration (ppm)	5.708	
COD concentration (ppm)	256.065	
Nitrogen mass (lbs)	144.474	
Phosphorus mass (lbs)	53.064	
COD mass (lbs)	2380.490	
Animal feedlot rating number	43	(+1.01σ)

Feedlots located in cells 742 (Lake Poinsett #1) and 186 (Lake Albert #1) appear to be contributing excessive nutrients to the watershed (>1 σ). The feedlots located in cells 889 (Lake Albert #9), 411 (Lake Albert #1) and 1126 (Upper Poinsett - Direct) appear to be contributing moderate to high levels of nutrients and should also be considered for treatment due to their AGNPS ranking and to their proximity to major streams and the lake. If nutrient contributions from these 5 feedlots were eliminated, the model estimated that the nitrogen and phosphorous loadings to Lake Poinsett would respectively be reduced by 17% (9.9 tons/ year, 25 year event) and 5% (.9 tons/ year, 25 year event). All other feedlots in the watershed appear to have very little impact on nutrient loading. Another possible source of nutrient loading is from septic systems and from livestock depositing fecal material directly into the lake or adjacent streams. Overall, the nutrients being deposited from the watershed into Lake Poinsett appear to be fairly low.

CONCLUSIONS

Based upon a comparison of other watersheds in Eastern South Dakota, the sediment and nutrient loadings to Lake Poinsett appear to be low. However, when a subwatershed analysis is performed, above normal (>+1 σ) sediment loadings were found in subwatersheds #2 & #7 of Lake Albert and #7 of Dry Lake (10.6% watershed area, 20.9% sediment), and high nutrient loadings were found in subwatersheds #2 & #7 of Lake Albert and #5 of Dry Lake (11.0% watershed area, 17.6% total nitrogen, 18.4% total phosphorous. The implementation of appropriate Best Management Practices targeted to the identified critical watershed cells and critical feedlots should produce the most cost effective treatment plan in reducing sediment and nutrient loadings to Lake Poinsett.

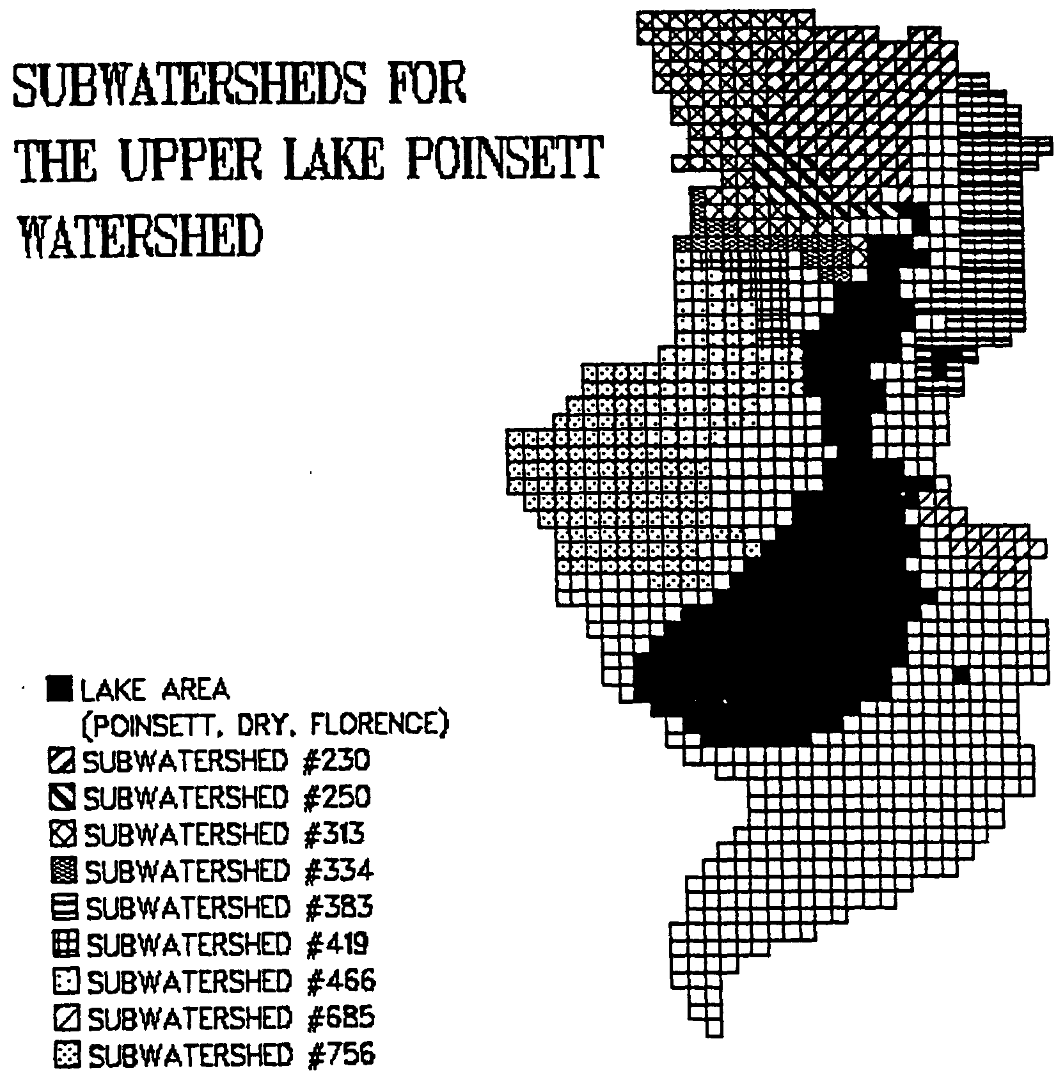


Figure 18. AGNPS Upper Lake Poinsett Subwatersheds.
Each Subwatershed is desingated by the outlet cell #.

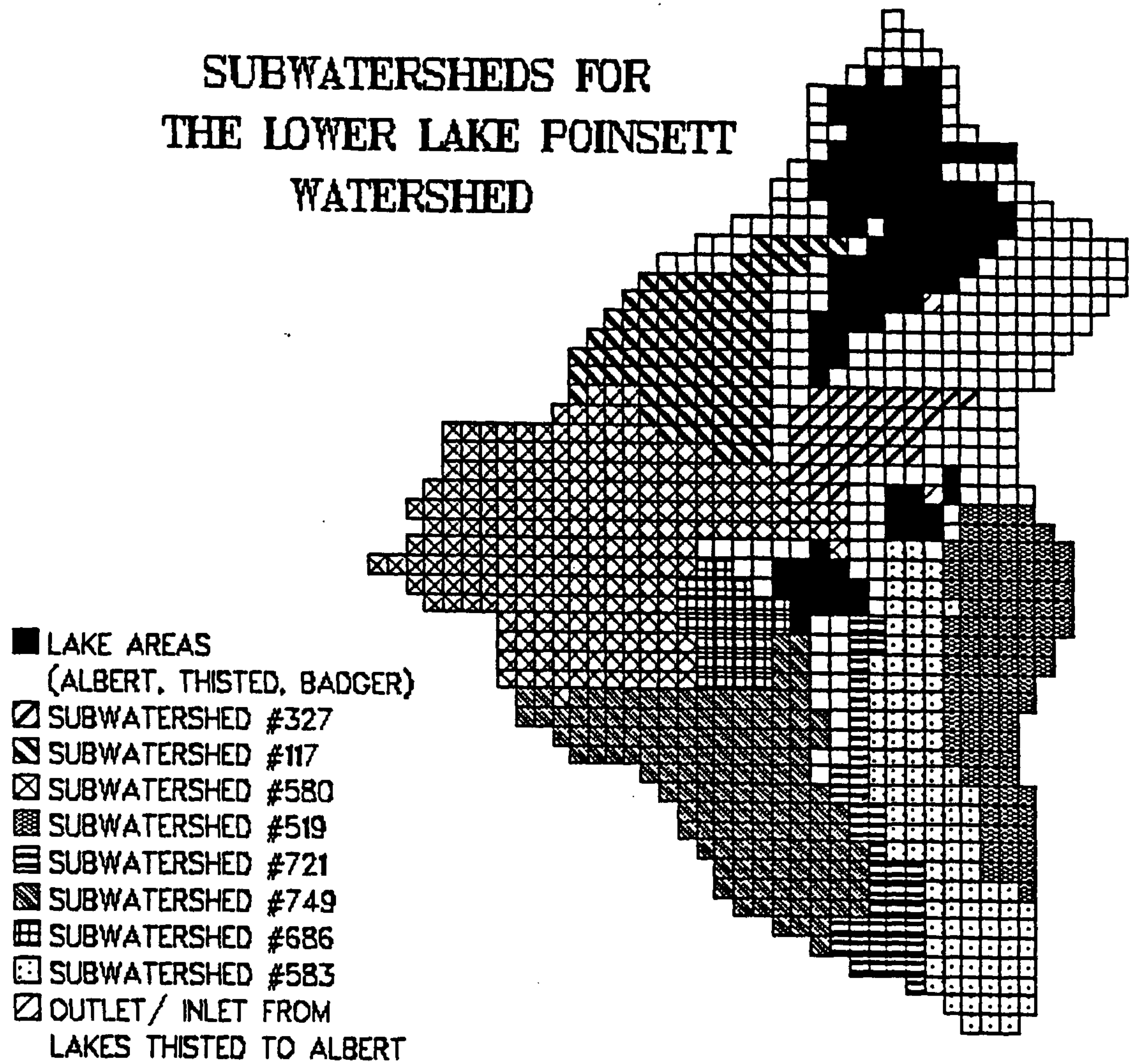


Figure 19. AGNPS Lower Lake Poinsett (Lake Albert) Subwatersheds.
Each Subwatershed is designated by the outlet cell #.

Onsite Wastewater-Disposal Systems

The influence of onsite wastewater-disposal systems (septic systems) effluent on the nutrient load to a lake can be relatively important. Septic-system effluent can contain about 1000 times the concentration of phosphorus as in lakes. Some research has indicated that the potential nutrient input from groundwater containing septic system effluent into a lake may be significant. It is important to consider septic systems as a potentially significant source of nutrients to lakes. High water tables in areas containing failing septic systems can contaminate groundwater and increase the transport of phosphorus through soils to certain surface waters. Sawhney and Starr (1977) reported that concentrations of 2.5 mg/l were observed in soil solutions removed from a 30-cm depth below a trench used in an onsite septic system. They suggested that shallow soils located in high or perched water tables could potentially deliver high concentrations of phosphorus to groundwater.

An estimate of the possible influence of onsite waste-disposal systems on phosphorus loadings to Lake Poinsett was determined by the following methods:

There are 622 cabins around Lake Poinsett of which 153 are now served by an existing centralized sanitary sewer system. This leaves 469 individual onsite wastewater-disposal systems of various ages and conditions. Rodiek (1978) used the following method to calculate phosphorus loading potentials to Lobdell Lake in Michigan from septic systems. Various assumptions were made for the lake residences and loading rates of phosphorus to the septic systems which will be used to derive an estimate for Lake Poinsett.

Table 19. Copied from Table 2, Rodiek (1978).

	Lake Residences	
Assumptions	Loading rates to septic systems	
4 people per residence	without detergent	0.50 kg x capita^{-1} x yr^{-1}
50% occupancy of residences	detergent only	1.60 kg x capita^{-1} x yr^{-1}
50% use of phosphorus detergent	detergent only	1.10 kg x capita^{-1} x yr^{-1}

Phosphorus Export for **Permanent** Residence:

$$[(0.50\frac{kgP}{capita\ xyr}x\frac{4capita}{residence})+(1.1\frac{kgP}{capita\ xyr.}x\frac{4capita}{residence}x0.50Pdetergent\ )]\text{-}4.2\frac{kgP}{residence\ xyr}$$

Phosphorus Export for **Temporary** Residence (assumed 50% of a year occupance):

$$[(0.50\frac{kgP}{capita\ xyr}x\frac{4capita}{residence})+(1.1\frac{kgP}{capita\ xyr.}x\frac{4capita}{residence}x0.50Pdetergent\ )]x0.50occupancy\ \text{-}2.1\frac{kgP}{residence\ xyr}$$

In 1983 a lake side property survey was conducted. From this survey it was determined that 15.7% of cabins surveyed were used as a permanent residence and 84.3% were used as a temporary residence. Using these percentages a number of total cabins on the lake used as permanent and temporary homes can then be estimated. Of the 469 cabins which are not hooked to a central sanitary sewer system 73.6 (0.157 x 469) are permanent and 395.4 (0.843 x 469) are temporary residences.

$$4.2\frac{kgP}{residence}x73.6residence = 309.12kgP$$

$$2.1\frac{kgP}{residence}x395.4residence = 830.3kgP$$

An estimated total of 1139.42 kg of phosphorus could be delivered to the septic systems. This estimate, however, does not take into consideration the ability of the surrounding soil to immobilize the phosphorus contributions. Retention of phosphorus for certain soil types can range up to an estimated 95% (Gilliom and Patmont, 1983). Rodiek (1978) estimated the soil retention of phosphorus for the soils where the septic tanks were located on Lobdell Lake. These efficiency ratings ranged from very poor (25% of phosphorus retained by the soil) to good (75% of the phosphorus would be retained). Using these figures an estimated **284.90 kg P (628.1 lbs) to 854.57 kg P (1884.33 lbs)** could potentially be delivered to Lake Poinsett over a 1 year period.

Many of the soils rated for use as septic tank absorption fields in the Hamlin County Soil Survey were given ratings ranging to severe (percolates slowly) (Hamlin County Soil Survey, unpublished). These soils are comprised of a higher clay content, which allows less water to percolate between the soil particles. This forces the water to follow a different pathway and can result in septage contamination of the lake if the less restrictive pathway through the soils leads to the lake. Those soils with a lower clay content would constitute this pathway. High or perched water tables would greatly increase the movement of phosphorus through the soil particles. The adsorptive capacity of the soils would be severely impaired if the soils became saturated with phosphorus, which may be the case for those cabins used as a permanent residence. Sawhney and Starr (1977) reported that the soil solution surrounding a trench in a septic system drainfield that was monitored for phosphorus exhibited similar concentrations of phosphorus as the wastewater.

Continuing efforts should be made to secure funding for an expansion of the centralized sanitary sewer system on Lake Poinsett. Every opportunity to limit the amount of phosphorus delivered to the lake should be pursued so that the inlake concentrations of phosphorus will be lowered and consequently, limit the growth of the algae.

SHORELINE EROSION SURVEY

A shoreline survey was conducted on September 8, 1995, to document the extent and severity of shoreline erosion on Lake Poinsett. Shoreline areas classified as severe were videotaped earlier in the summer by personnel from the Lake Poinsett Water Project District and were also photographed during the survey conducted in September. This was a subjective survey and is a general estimate of the severity of the erosion located on the lake. Figure 20 shows the locations of the erosion which were documented on the September survey.

During the survey, the identified areas of erosion were classified into the following three categories:

1) Moderate
2) Intermediate
3) Severe

and the length (feet) was estimated for each category. The categories were then summed to determine the overall length of shoreline undergoing erosion (percentage) relative to the total length of the shoreline (Table 20).

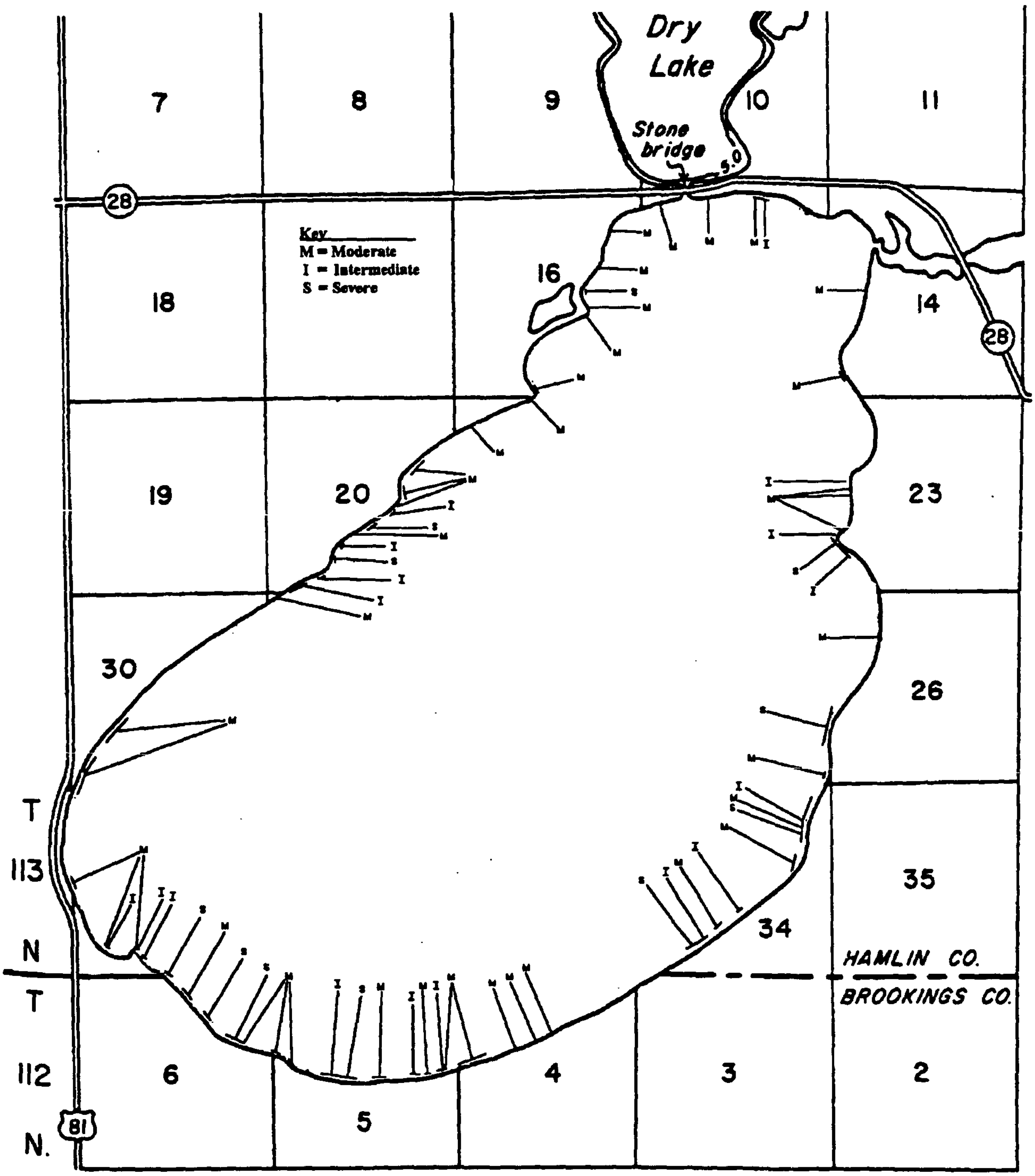
Table 20. Estimated length of shoreline erosion for Lake Poinsett.

Total Shoreline Length	Moderate	Intermediate	Severe
78,672 (feet)	5,660	1,895	2,755
Percentage of Total →	7%	2%	4%

Most of the areas classified as undergoing severe erosion were cliff embankments located in several regions around the lake. A limited amount of vegetation was present reducing some of the erosional action, however, these areas are very susceptible to wind and wave action and necessary precautions should be taken to prevent further damage.

The intermediate sections were located in these cliff areas as well but there were also areas along the riprapped sections which were partially damaged and should be repaired to prevent further degradation. There were many areas of the lake which were categorized as moderate. These usually consisted of damaged areas or margins above the riprap along the lawn/riprap margin for many cabins around the lake.

Figure 20. Lake Poinsett Shoreline Erosion Map



Aquatic Plant Survey

On September 9 and 10, 1994, an aquatic plant survey was conducted on Lake Poinsett to determine their extent and distribution. During the survey there were no plants (submergent or emergent vegetative types) located within the immediate shoreline area nor along the shoreline margin. This has been a consistent phenomena associated with Lake Poinsett. Koth (1981) also reported less than 5% of the shoreline margin was covered with cattail (typha spp.) and bullrush. Koth did identify a few specimens of Potamogeton pectinatus which is a submergent perennial herb and can be found at depths to 15 feet (Eggers and Reed, 1987). The South Dakota Game, Fish, and Parks fisheries survey conducted on Lake Poinsett also recorded a lack of aquatic vegetation (SDGF&P, 1993).

Aquatic vegetation serves several purposes in lakes. They can serve as a food source for waterfowl and invertebrates as well as breeding and nursery areas for certain fish species (EPA, 1990). Aquatic macrophytes can also absorb phosphorus from the water and sediment as well as anchor the sediment in place (Mulligan, 1969). Wetzel (1983) discussed the results of several investigations which demonstrated an inhibition of algal growth in emergent and submergent aquatic plant beds by reducing available nutrients (phosphorus and nitrogen) as well as light.

The lack of aquatic plant beds within Lake Poinsett have been attributed to: 1) the exposed nature of the lake, 2) the substrate which is not conducive to aquatic plant growth or the larger particles (sand) which are disturbed by wind and wave action sheering off new plant stems as they grow, 3) light attenuation which is a result of the large algal mats produced in the summer, and 4) the action of rough fish disturbing the substrate as they feed. The root cause is probably a combination of all the factors listed above. However, several lakes such as Lake Herman in Lake County, SD have exhibited a similar phenomenon but have had the disappearance of aquatic plant beds attributed to turbidity and light attenuation produced by algal blooms. A potential benefit of phosphorus reduction may be the production of an aquatic plant bed which may also help to regulate in-lake phosphorus concentrations as well.

Sediment Survey

A sediment survey was conducted from October 25 through November 19, 1994 on Lake Poinsett to determine the volume and distribution of sediment in Lake Poinsett. From this survey it was revealed that the total volume of accumulated sediment was estimated at 8,969,037 $yards^3$. This equates to approximately 8.50 inches of sediment on the entire surface area of Lake Poinsett (7,872 acres). There is not enough sediment to warrant any type of removal project. However, the results do indicate that areas of accumulation are located near Stonebridge and the Lake Albert inlet into Lake Poinsett.

Cross sections were spaced 1,200 feet apart and the average end area volume for these sections indicated that most of the sediment was in the northern half of the lake (Table 21). Cross section 0 is located on the southwest corner of Lake Poinsett. The last cross section was placed near the northeast section of the lake. Between cross section 84 and 96 an increase in sediment volume occurred. These two cross sections are near the area in which the Lake Albert inlet enters Lake Poinsett. A continuing trend of larger volumes of sediment occurs as the cross sections progress to the northeast part of the lake.

Although a sediment removal project is not warranted within Lake Poinsett, an investigation to determine the volume of sediment located on the southern half of Dry Lake should be considered. The benefit of a sediment removal project immediately north of Stonebridge could potentially remove some phosphorus laden sediment as well as reducing sediment discharge rates from Stonebridge.

Table 21. Average end area volume for each cross section used in the Lake Poinsett Sediment Survey.

Cross Section	Sediment Volume
0	196105
12+00	195640
24	2005
36	1966
48	164833
60	206167
72	48242
84	572710
96	1090201
108	525150
120	1690
132	351201
144	838026
156	851305
168	638767
180	582342
192	535279
204	483415
216	459218
228	392455
240	338312
252	259077
264	172184
276	62747
Total $yards^3$	8,969,037 .0

Fisheries Information

One of the beneficial uses for Lake Poinsett is to maintain the water quality for warmwater semipermanent fish life propagation. Lake Poinsett and Lake Albert are both managed for walleye, yellow perch, and northern pike. The primary and secondary species for both lakes are similar and are listed in Table 22.

Table 22. Primary (game and forage) and secondary fish species found in Lake Poinsett and Lake Albert.[1]

Lake Poinsett		Lake Albert	
Primary	**Secondary**	**Primary**	**Secondary**
Walleye	Carp	Northern Pike	Walleye
Yellow Perch	Northern Pike	Yellow Perch	Largemouth Buffalo
White Bass	Black Crappie	Black Bullhead	Carp
Small-mouth Bass	Johnny Darter		White Sucker
Spottail Shiner	Bigmouth Buffalo		
Fathead Minnow	Channel Catfish		
White Sucker			

1 = based on 1993 South Dakota Statewide Fisheries Survey.

Both lakes are highly eutrophic with the potential of maintaining a high fishery yield. Typically, as water quality improves the bioproductivity has a tendency to decrease which may have an impact on the fishery yield per unit area (EPA, 1990). However, a fishery yield is highly varied depending not only on water quality but also spawning habitat, weather conditions, morphology of the lake, and presence of aquatic macrophytes. Although improvements in water quality may impact the fishery yield (rough fish), this shallow prairie lake would still maintain it's high level of productivity and a significant reduction in fishery yield would not be likely.

The following recommendations are excerpts from the 1993 South Dakota Statewide Fisheries Survey conducted on Lake Poinsett and Lake Albert by the South Dakota Department of Game, Fish, and Parks. Fisheries data is collected annually on Lake Poinsett and approximately every 3 years for Lake Albert. 1993 surveys for Lake Poinsett and Lake Albert are located in Appendix III.

Recommendations for Lake Poinsett

1. Continue to manage primarily for walleye, yellow perch, and white bass.
2. Stock walleye fry (2000/ac) in 1994.
3. Continue to encourage commercial removal of bigmouth buffalo and common carp.
4. Consider the removal of white bass from the commercial fishing list.

5. Electrofish to assess smallmouth bass population.

6. Resurvey annually.

7. Creel survey to further assess 35.6 cm (14 in) length limit, angler success, and harvest for walleye.

<u>Recommendations for Lake Albert</u>

1. Encourage commercial fishing for the rough fish populations.

2 Continue with an alternate year stocking strategy with walleye fry. This will allow biologists to monitor natural reproduction as well as maintain the walleye fishery.

3. Develop a plan for managing the panfishery in the lake.

4. Lake Albert should be contour mapped.

Table 23 indicates the commercial fish catch from Lake Poinsett and Lake Albert. Also located in Appendix III are the results of an ongoing creel survey of Lake Poinsett which contains the estimated fishing pressure for various fish species as well as the estimated catch rate.

Table 23. South Dakota Total Commercial Fish Catch (pounds) for Fiscal Year 1992, 1993, and 1994.

Year	Lake Poinsett	Lake Albert
1992	347,300 (95.9%)[1]	304,000 (100%)
1993	597,305 (99.1%)	185,100 (100%)
1994	248,990 (98.4%)	NA

1 = Percentage of carp and buffalo fish of the total commercial harvest.

LAKE SAMPLING

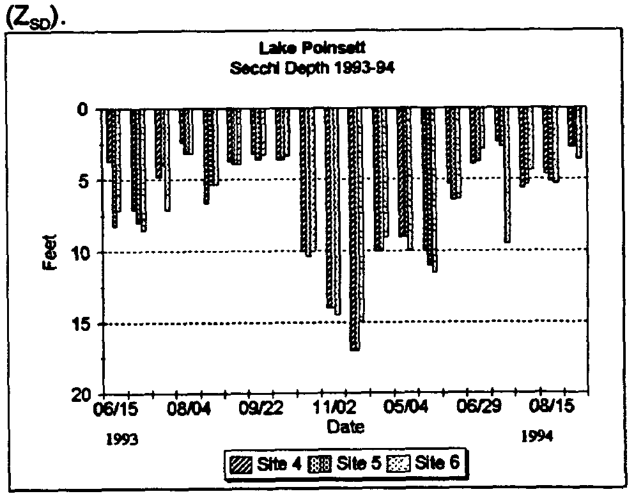
The objective of this task was to determine the current condition of the lake including the trophic state and to delineate any trends in the water quality data. The inlake sampling results were then used to determine the effect of the nutrient and sediment inputs from the watershed on the water quality of Lake Poinsett. A reduction response model involving the lake's hydraulic residence time (time required to completely replace the lake's water volume), total phosphorus concentration, and chlorophyll a was developed. This reduction response model was used to predict the potential effects on the lake's phosphorus and chlorophyll a concentrations if a reduction would occur in the total phosphorus input from the watershed.

WATER QUALITY RESULTS

The current condition of the lake determined from the data collected during this project is a reflection of the 100-year flood that occurred in 1993. As a result, this overall condition of Lake Poinsett may not be a condition exhibited during a typical year with average precipitation rates and land uses. The expanse of time required to replace the entire volume of Lake Poinsett (hydraulic residence time) calculated from the data collected during this 314 Clean Lakes project would be shorter than the time calculated during an average precipitation year. This faster rate of replacement or greater volume of water entering Lake Poinsett would have a dilution effect on many of the parameters measured during the course of this investigation. It would also reduce the residence time for the in-lake phosphorus.

Beneficial uses for Lake Poinsett are listed in the front on page i. The criteria or standards associated with these beneficial uses will be discussed in subsequent sections as they pertain to the individual parameters and their concentrations.

Figure 21. 1993-94 Lake Poinsett Secchi Depths (Z_{SD}).



Secchi Depth (Z_{SD}) - is a general measurement of water quality within a lake. A 20 centimeter round white/black disk is lowered into the water. The distance that you can see the disk below the water surface, just at the point that it disappears, is the point that is measured. It is a measure of light transparency within the lake. A inverse relationship is usually exhibited between secchi depth and algal biomass. As one variable increases the other decreases (EPA, 1990). Site 6 exhibited the largest mean (7.18 feet) among the 3 in-lake sites. However, mean secchi depths were quite similar. Site 4 and site 5 exhibited means of 6.47 feet and 6.85, respectively. The minimum secchi depth occurred at site 4 with a value of 2.33 feet. This value was recorded on 7/13/94 (Figure 21). In contrast, the maximum secchi depth of 17 feet was recorded both from site 4 and 5. The maximum value from site 6 was only slightly less at 15 feet. All three maximum values were recorded on 1/4/94 (Figure 20) when algal blooms or any other organic or suspended solids inputs from the watershed were not occurring. The minimal snow cover on the ice during this sample collection period allowed sunlight to penetrate the ice increasing the secchi depth.

Temperature and Dissolved Oxygen

The beneficial use (5) Warmwater Semipermanent Fish Life Propagation states that the temperature may not exceed 90°F (32.2°C) without exception. There were no exceedances of this criteria. The maximum temperature was 27.5°C recorded at station 5 (middle bay) on 7/20/93. Temperature profiles were conducted each time a sample was collected from each station (Figure 22). Bottom and surface samples were then compared to determine if a significant difference existed between them. The statistical analysis (one-way Analysis of Variance or ANOVA) detected no significant differences between surface and bottom measurements (Probability >0.05). This indicates that thermal stratification is not occurring, which is typical for shallow prairie lakes such as Lake Poinsett.

Table 24. Mean Surface Temperatures °C.

Site	$\bar{x}$ Temp°C
4	15.24
5	15.36
6	15.32

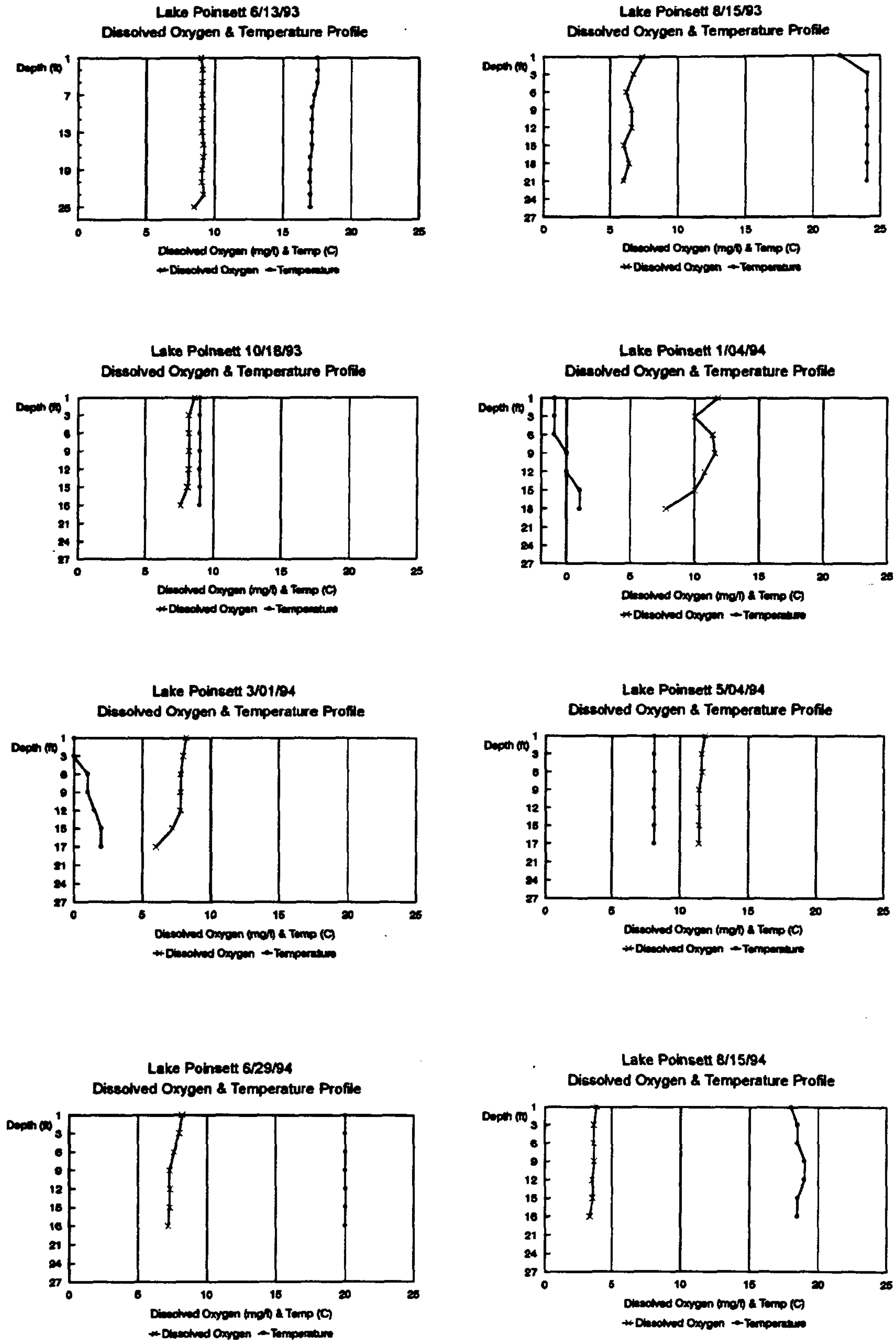
Dissolved oxygen concentrations (mg/l) for each sampling station were very similar throughout the project. The minimum value of 3.3 mg/l was observed from station 5 -Bottom and the maximum value of 11.8 mg/l was observed from stations 5 and 6-surface. All minimum values for each site occurred on 8/15/94 and maximum values occurred on 5/4/94. An Analysis of Variance (ANOVA) was conducted to determine if dissolved oxygen values were statistically different between sampling stations (sites 4,5, and 6) and between sampling depths (surface and bottom). Significant differences were not detected between the stations or depths (P>0.05). The trends in the dissolved oxygen data indicate that lower oxygen levels occurred during the summer periods when chlorophyll-a (blue-green algal blooms) concentrations were higher. Biodegradation of the excessive organic inputs in the lake due to the blue-green algal blooms may sometimes use a significant amount of the oxygen in the ecosystem causing the levels to drop and adding stress to the other aquatic life in the lake (Figure 22).

Table 25. Lake Poinsett in-lake mean dissolved oxygen concentrations

Site	$\bar{x}$ - D.O. (mg/l)
4-S	8.02
4-B	7.18
5-S	8.18
5-B	7.49
6-S	8.27
6-B	6.91

The lower levels of oxygen were measured on the bottom (at the sediment water interface) where it was consumed at a slightly faster rate than it could be replaced through the actions of wind and waves and the introduction of water (high oxygen content) from the

Figure 22. 1993-94 Lake Poinsett Dissolved Oxygen Profiles for In-Lake Site 5.



tributaries. A number of exceedances were recorded for the beneficial use (5) Warmwater Semipermanent Fish Life Propagation which states that the oxygen levels must be greater than 5.0 mg/l without exception. Site 6 bottom exhibited 4 exceedances where the oxygen level was less than the recommended level of 5.0 mg/l. Every other site (4S, 4B, 5S, 5B, and 6S) exhibited two violations ($O_2 < 5.0$ mg/l). Although statistical differences were not detected between sampling stations, the lower mean concentration recorded at site 6 (bottom) may be influenced by large organic inputs from the nearest tributary, site 7 (Lake Albert Outlet), where large phosphorus and sediment loads were recorded. Since significant differences were not observed between sites or depths, only site 5 (middle Bay) was used to show the annual trends in dissolved oxygen and temperature profiles (Figure 22). As was previously discussed the distribution of oxygen was fairly uniform between surface and bottom sampling sites. This can be seen in Figure 22 where the oxygen concentrations were constant in the entire water column for most sampling dates. During the late summer (8/15/93 and 8/15/94) oxygen deficits did develop as the temperatures increased.

Table 26. Mean in-lake pH values for Lake Poinsett.

Site	$\bar{X}$ - pH s.u.
4S	8.38
4B	8.41
5S	8.47
5B	8.46
6S	8.30
6B	8.22

pH - as described in previous sections, pH is the measure of the activity of the hydrogen proton (H^+). A normal pH range for a South Dakota lake will usually lie between 6 and 9 su. pH is also a determining factor in effecting concentrations of unionized ammonia (NH_4OH) which can be highly toxic to organisms in greater quantities (Wetzel, 1983). The beneficial use criteria for Lake Poinsett states that the pH must be greater than 6.5 su and less than 9.0 su with a variation allowed under subdivision 74:03:02:32 (2). As with the other parameters pH did not differ significantly between depths or between sites ($P>0.05$) (Table 24). pH ranged from a minimum of 6.99 (site 4-surface) recorded on 1/4/94 to a maximum value of 9.25 (Site 5-bottom) recorded on 7/15/93. Site 4 and 5 exhibited all 5 values exceeding the pH standard of 9.0 su.

Table 27. Mean concentrations and ranges for total alkalinity, total solids, total dissolved solids, and total suspended solids for all Lake Poinsett in-lake sites (1993-94).

Site	TALK	TSOL	TDSOL	TSSOL
4S	189 (160-237)	974 (884-1218)	963 (876-1211)	10.25 (1-33)
4B	184 (100-228)	985 (883-1284)	966 (875-1277)	19.45 (2-106)
5S	187 (102-248)	976 (891-1209)	968 (885-1202)	8.55 (2-19)
5B	190 (160-232)	978 (892-1212)	962 (887-1204)	15.80 (4-47)
6S	184 (104-237)	979 (889-1223)	971 (885-1214)	7.85 (2-23)
6B	184 (100-204)	980 (887-1219)	956 (877-1204)	23.65 (3-132)

Fecal Coliforms - in-lake fecal coliform counts had two occurrences exceeding 10 /100ml. Fecal Coliform counts ranged from a minimum of 10/100ml to a maximum of 100/100ml. Fecal coliform values were consistently 10/100ml or below. This parameter did not pose a human health threat through any part of the investigation. Significant differences were not observed between sites or between depths ($P>0.05$).

Total Alkalinity and its chemical role in water quality has been discussed in the tributary sections of this report. Total alkalinity ranged from 100 mg/l to a maximum value of 248 mg/l observed at site 5S on 6/15/93. However, the largest mean concentration for total alkalinity under the criteria for the Wildlife Propagation and Stock Watering waters may not exceed 750 mg/l (as calcium carbonate) with a variation allowed under subdivision 74:03:02:32(2). At no time during the project was this particular criteria compromised.

Total Solids are not subject to any specific standards or criteria. Total solids are comprised of total dissolved and total suspended solids. Means were very similar from each sampling station (Table 27). The largest mean of 985 mg/l was observed from site 4B whereas the smallest mean of 974 mg/l was observed from Site 4S. No significant differences were observed between sites or between depths (P>0.05). The maximum concentration observed during the project (1284 mg/l) occurred at site 4B on 7/25/94.

Total Dissolved Solids are comprised of minerals and ions that, during analysis, pass through a filter retaining the suspended solids portion of the total solids. Those particular constituents that constitute dissolved solids were discussed in the tributary section. The beneficial use Wildlife Propagation and Stock Watering states that total dissolved solids may not exceed 2500 mg/l with a variation allowed under subdivision 74:03:02:32 (2). Most freshwaters have total dissolved solid levels between 10 and 500mg/l (Wetzel, 1983). Total dissolved solids can also effect the density of the water but, at average concentrations, have little effect (EPA, 1993). TDS values did not exceed 2500 mg/l during 1993 or 1994. Values ranged from a minimum of 875 mg/l to a maximum of 1277 mg/l which was recorded from site 4B. Higher total alkalinities often result in elevated pH levels as well as increased dissolved solids concentrations (Manahan, 1990). All sites exhibited a spike in total dissolved solids (>1200 mg/l) on 7/25/94. There were no significant differences detected between sites or depths (P>0.05).

Total suspended solids are comprised of the particulate matter suspended in the water column . Suspended solids in-lake concentrations can be greatly effected by the suspended solid load delivered

Figure 23. 1993-94 Lake Poinsett Total Suspended Solid Concentrations for 3 In-Lake Surface Sites.

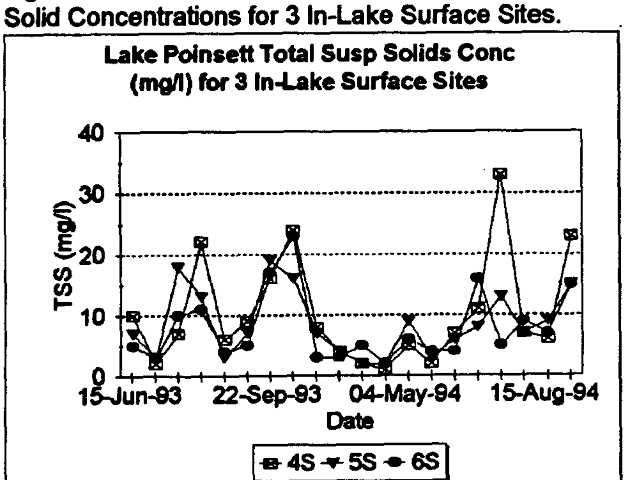
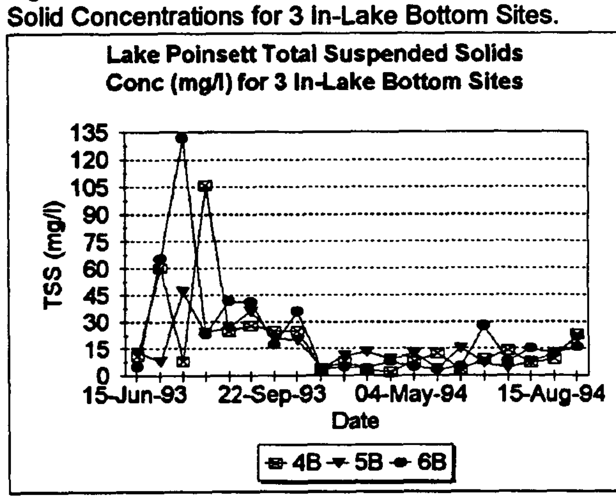


Figure 24. 1993-94 Lake Poinsett Total Suspended Solid Concentrations for 3 In-Lake Bottom Sites.



from the watershed. The criteria for warmwater semipermanent fish life propagation states that suspended solids may not exceed 90 mg/l without exception. High suspended solids and sedimentation rates can have a detrimental effect on fish species which deposit eggs on the bottom substrate (EPA, 1993). Values ranged from 1 mg/l (site 4S) to a maximum value of 132 mg/l, which was recorded at site 6B on 7/20/93 (Figure 23). In 1993, the sediment load delivered from the Stonebridge (site 2) and Lake Albert (site 7) in June and July, in addition to the large discharges that occurred during this same time period, may have influenced these peaks in TSS concentrations that occurred in the bottom sites (Figure 24). The total number of violations that occurred for total suspended solids was 2. In addition to the maximum value of 132 mg/l at site 6B, a concentration of 106 mg/l was recorded at site 4B. These were the only instances in which the 90 mg/l standard was exceeded.

Surface sites also exhibited increased concentrations during the same periods as the bottom sites (Figure 24). However, the maximum value of 33 mg/l, which was 7/13/94 from site 4S, was significantly lower than the maximum concentration collected from the bottom (Figure 23 and 24). The higher concentrations were observed at the bottom sites where the suspended solids would settle to the bottom.

Nutrients

Nutrients (phosphorus) are the primary cause of blue-green algal blooms. The duration and severity of the bloom is dependent upon how much phosphorus is available for uptake within the aquatic system. The severity of the blue-green algae within a lake, however, can also be influenced upon the lakes residence time, turbidity, photoperiod, and temperature. Most of these factors are impossible to control or manage. Consequently, where blue-green algae is the principal problem, a reduction in the amount of nutrients available for algal uptake should be the focus of a lake management project.

Table 28. Mean concentrations for 6 nitrogen containing parameters for all Lake Poinsett in-lake sites 1993-94.

Site	NH_4^+	NH_4OH Unionized	NO_{3+2}	TKN-N	Organic Nitrogen	Total Nitrogen
4S	0.079	0.0041	0.11	1.978	1.900	2.088
4B	0.082	0.0045	0.11	1.814	1.732	1.924
5S	0.090	0.0044	0.11	2.041	1.951	2.153
5B	0.087	0.0055	0.11	1.768	1.681	1.878
6S	0.090	0.0036	0.11	2.069	1.979	2.174
6B	0.082	0.0032	0.11	1.885	1.803	1.995

Between the two nutrients, nitrogen is much more difficult to reduce since some species of blue-green algae can fix nitrogen (N_2) when it is in short supply. Therefore, since phosphorus is the key nutrient used to control the severity of blue-green algal blooms, management decisions will be based on the amount of phosphorus entering the lake.

Ammonia (NH_4^+) concentrations ranged from 0.02 mg/l to 0.54 mg/l. The designated beneficial uses assigned to Lake Poinsett do not have a specific criteria for ammonia. However, ammonia can be taken up almost immediately by plants and blue-green algae. There were no significant differences exhibited between depths or sites for ammonia which characterizes a very well-mixed lake. Maximum concentrations for all sites were observed on the same day (8/15/94) and ranged from 0.52 to 0.54 mg/l.

Unionized ammonia (NH_4OH) ranged up to a maximum value of 0.0329 mg/l which was measured at site 4B. Beneficial use designation for Warmwater Semipermanent fish life propagation states that un-ionized ammonia nitrogen may not exceed 0.04 mg/l (as N) with a variation allowed under subdivision 74:03:02:32(2). In order for concentrations of un-ionized ammonia to increase, the pH and water temperature must also increase. Although slight increases did occur, there were no violations of the criteria specified by Lake Poinsett's beneficial use designations. Sites were very similar in their concentrations of un-ionized ammonia and significant differences were not detected using statistical analysis for, reasons discussed in previous sections.

Nitrate (NO_{3+2}) were very similar between sites and depths and statistical analysis detected no differences between them. Values ranged from 0.1 mg/l to the maximum value of 0.3 mg/l which was measured at site 6B on 3/1/94. In fact, there were only 10 observations (total n = 120) which were greater than 0.1 mg/l. Peaks in nitrate concentrations may occur during snowfall or during snow runoff. Wetzel (1983) reported that snow can contain much higher levels of nitrogen than rain and up to half of the nitrogen influx to a lake can be delivered during snowmelt runoff. However, in very well oxygenated systems, as Lake Poinsett was during this investigation, most of the nitrogen chemical species will not create high toxic levels of un-ionized ammonia which will cause problems for the other aquatic life. Mean levels of nitrates were the same from each site both bottom and surface (Table 28).

Total Kjeldahl Nitrogen (TKN-N) has no set standard or criteria used in defining critical levels. However, TKN-N is used in determining organic nitrogen in each sample. Ammonia is subtracted from TKN-N to arrive at the amount of organic nitrogen. As with the other nitrogen containing parameters there were no significant differences between sites or depths ($P>0.05$). TKN-N would be influenced by the amount of the other parameters (ammonia and organic nitrogen) and a direct relationship would be observed between their respective concentrations. Means were very similar resulting in no significant differences. The minimum mean was calculated from samples collected from site 5B at 1.768 mg/l to the maximum mean observed from site 6S at 2.069 (Table 28). The minimum and maximum values were 1.00 mg/l (site 4S) to a maximum value of 5.06 mg/l from site 6S.

Organic nitrogen is an estimate of how much nitrogen may be contained in biomass or organic molecules. Calculated means were remarkably similar between sites and depths (Table 28). The largest mean observed was recorded from site 6S (1.979 mg/l). The smallest mean was observed from site 5B (1.681 mg/l).

Total nitrogen (TN) is an estimate of all the nitrogen found in a water sample. It is calculated by summing the concentration of total Kjeldahl nitrogen (organic) and nitrate + nitrite in a water sample. The ratio of in-lake total nitrogen (TN) to in-lake total phosphorus (TP) (TN:TP) can be used to determine which of these two nutrients is more likely to limit the growth of algal populations. A ratio of less than 10 to 1 (10:1) usually indicates that nitrogen is limiting the plant and algal growth in the lake. The highest total nitrogen mean (2.174 mg/l) was calculated from samples collected at site 6s (Table 28). Site 5B exhibited the smallest mean at 1.878 mg/l (Table 28). However, no significant differences were observed between sites or depths after statistical analysis was conducted ($P>0.05$). The maximum value of TN observed during the project also occurred at site 6S with a concentration of 5.16 mg/l on 9/22/93. Although the site 4S and 5S both exhibited increases in TN concentration on this date they were considerably lower. The concentration of 5.16 mg/l was primarily in the form of organic nitrogen (5.04 mg/l) due to the algal concentration at this site. Site 6S exhibited a much higher chlorophyll-a concentration on 9/22/93 compared to the other two surface sites (site 6S - 135.83 mg/m^3, site 5S - 112.71 mg/m^3, site 4S - 62.14 mg/m^3). The smallest value of 1.10 mg/l occurred at site 4S approximately 1 month previous to the maximum concentration (8/31/93) (Table 28 and Appendix I).

Total Dissolved Phosphorus

Dissolved phosphorus (soluble reactive phosphorus) is that portion of phosphorus unattached to soil particles or complexed in proteins in plant and animal material. Total dissolved phosphorus is the non-particulate portion of the total phosphorus that is available for uptake by plants and algae. Wetzel (1983) has reported that an estimated 0.02 mg/l of total phosphorus is necessary to initiate nuisance blue-green algal blooms in addition to several other factors already discussed.

Total dissolved phosphorus ranged from a minimum concentration of 0.013 mg/l at Site 4 Bottom to maximum value of 0.18 mg/l observed at Site 5 Bottom. However, statistical analysis detected no significant differences between site or depth samples (surface and bottom) concentrations ($P>0.05$) (Table 29). The seasonal trends for dissolved phosphorus indicate increased concentrations occurring at two periods; one in the spring of 1994 and the other in late summer of 1994 (Figure 25). The melt-water from snowfall in the spring would result in increased phosphorus loadings to the lake causing higher in-lake dissolved phosphorus concentrations. The peak in concentrations for late summer may have been due to some phosphorus transported from the tributaries. Samples collected from the tributaries during this time period exhibited elevated dissolved phosphorus concentrations. All of these factors contributed to the increased phosphorus concentrations in 1994. All

Table 29. Lake Poinsett In-Lake Mean Total Dissolved and Total Phosphorus Concentrations 1993-94.

Site	$TDPO_4P$	TPO_4P
4S	0.056	0.096
4B	0.051	0.109
5S	0.057	0.094
5B	0.058	0.097
6S	0.058	0.112
6B	0.052	0.098

Figure 25. Lake Poinsett In-Lake Total Dissolved Phosphorus Concentrations vs Chlorophyll-a.

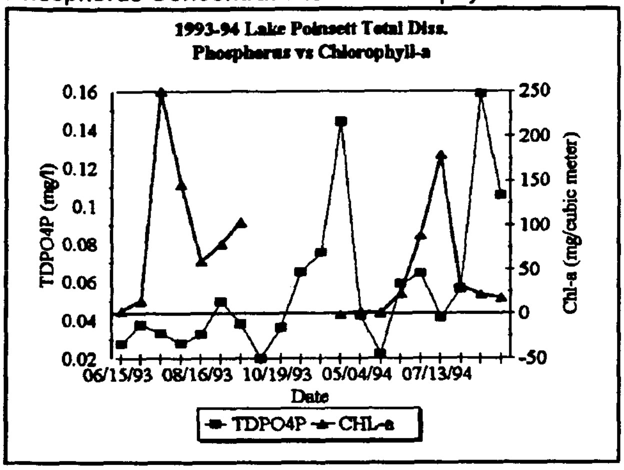
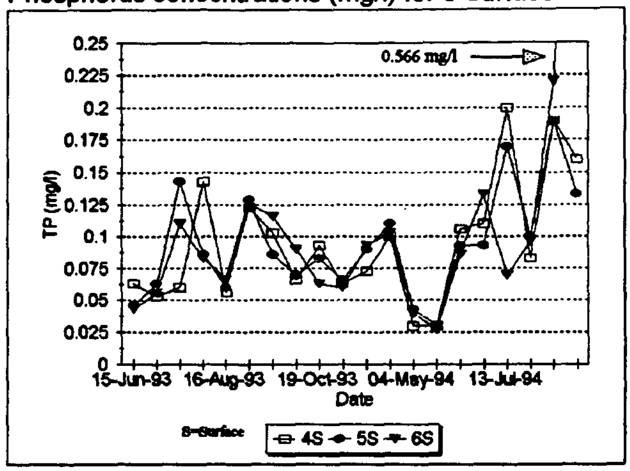
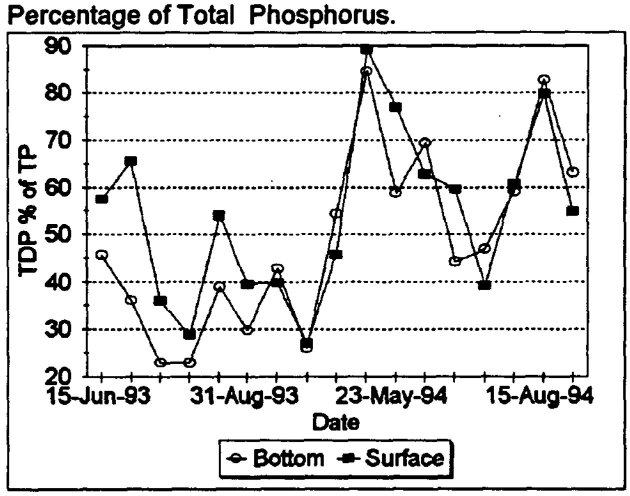


Figure 26. 1993-94 Lake Poinsett In-Lake Total Phosphorus concentrations (mg/l) for 3 Surface Sites.



minimum concentrations occurred in 1993 whereas all maximum concentrations occurred in 1994.

Figure 27. 1993-94 Lake Poinsett Average Surface and Bottom In-Lake Total Dissolved Phosphorus Percentage of Total Phosphorus.



Total phosphorus is comprised of both particulate and nonparticulate fractions. It is a measurement of the overall concentration of all the phosphorus within a water sample. Increases in the in-lake phosphorus concentrations can be caused by inputs from the watershed, precipitation, and internal loading from phosphorus released from the sediment during anoxic conditions (lack of oxygen). Mean concentrations for the project ranged from 0.0942 mg/l at site 5S to 0.112 mg/l at site 6S. Total phosphorus concentrations were statistically analyzed between all three sites and between surface and bottom and no significant differences were detected (P>0.05). The maximum concentration observed during the project occurred on September 20, 1994 (0.566 mg/l) at site 6 Surface. Minimum concentrations from all sites both surface and bottom ranged from 0.027 to 0.037 mg/l. All minimum concentrations occurred during the month of May, 1994, in comparison to the maximum concentrations which occurred during July, August, and September of 1994 with the exception of site 5 which occurred in July of 1993. Referring to Figure 7 pg 26 (total phosphorus concentrations for the tributaries) where total phosphorus concentrations from site 6 Surface were plotted with site 7 (Lake Albert Outlet) the trends are very similar indicating a possible influence of site 7 loadings on the concentrations of in-lake site 6. There is a similar trend for site 2 and site 4 Surface (Figure 6, pg 26). As the tributaries (site 2 and 7) increase in concentrations so do the in-lake sites 4 and 6. The largest monthly loadings from site 7 occurred during July and August of 1993. There were also higher in-lake total phosphorus concentrations during these months. Seasonal trends in the phosphorus data show the higher concentrations occurring during the more productive periods of the year when higher loadings occurred (Figure 26).

The percentage of total dissolved phosphorus to total phosphorus is used to determine any trends related to the overall export of phosphorus from areas that may have contributed more bioavailable phosphorus. These trends are then related back to landuse to determine the cause of the increased amounts of dissolved phosphorus. TDP/TP X 100 gives the percentage of the dissolved phosphorus.

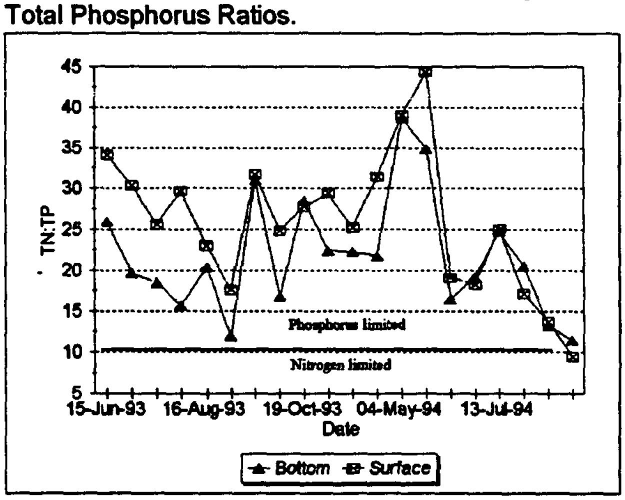
The trends in Figure 25 and 27 indicate that less dissolved phosphorus (bioavailable) is available during the months of June through September due to the increase in algal populations. This is demonstrated by the increase in chlorophyll-a in (Figure 25).

<u>Total Nitrogen to Total Phosphorus Ratio</u>

Wetzel (1983) has stated that biomass or primary production (photosynthesis) is limited by the availability of certain chemicals or factors that may exist in smaller amounts as compared to other resources, such as nitrogen, which may go unused. This phenomenon can be applied to the overall production of algal biomass and its immediate uptake of the available nitrogen and phosphorus. A ratio of 10:1 is typically used to determine which is the limiting nutrient for the production of algae (EPA, 1990).

During the course of this investigation Lake Poinsett maintained a phosphorus limitation (Figure 28). Maximum values (average surface and bottom) for this ratio reached 44.4. In most shallow prairie lakes the limiting agent for algal growth may be turbidity, which would affect light transmissivity. This lack of light would then slow or limit the growth of the blue green algae. However, turbidity is not a problem on Lake Poinsett (secchi depths > 6 feet). Algal blooms may limit their own growth by limiting the amount of light that penetrates to the lower level of the algal bloom or mat. The limiting factor in this lake is strongly dependent upon the amount of phosphorus available for uptake by blue-green algae. However, this is based on current data. Situations may change with improvements or degradation within the watershed.

Figure 28. 1993-94 Lake Poinsett Total Nitrogen to Total Phosphorus Ratios.



Chlorophyll-a

Chlorophyll-a is used as an estimate of the amount of algae found at the surface of a lake and is expressed in milligrams per cubic meter (mg/m^3) or micrograms per liter ($\mu g/l$) (EPA, 1990). Maximum values ranged from 141.6$\mu g/l$ to 317.9 $\mu g/l$ collected from site 6 and site 5, respectively. All maximum chlorophyll-a occurred during the summer of 1994 (Figure 25). Peak summer concentrations for typical eutrophic lakes usually range from 10 to 275 $\mu g/l$. Incidently, peak summer chlorophyll-a concentrations for oligotrophic lakes (lakes lacking nutrients) may range from 1.5 to 10.5 $\mu g/l$. The mean concentrations for chlorophyll-a in Table 30 include chlorophyll-a samples collected from March through September. Chlorophyll-a concentrations that were collected during March, April, and May exhibited extremely low levels thereby decreasing the overall mean chlorophyll-a concentrations. However, mean chlorophyll-a concentrations with spring chlorophyll-a used to derive the mean values still rank in the high eutrophic range. The maximum value of 317.9 $\mu g/l$ indicates a hypereutrophic (very productive) aquatic ecosystem.

Table 30. 1993-94 Lake Poinsett Mean Chl-a values

Site	$\bar{x}$ Chl-a
4	62.6
5	65.0
6	45.9
Avg	60.8

Trophic State

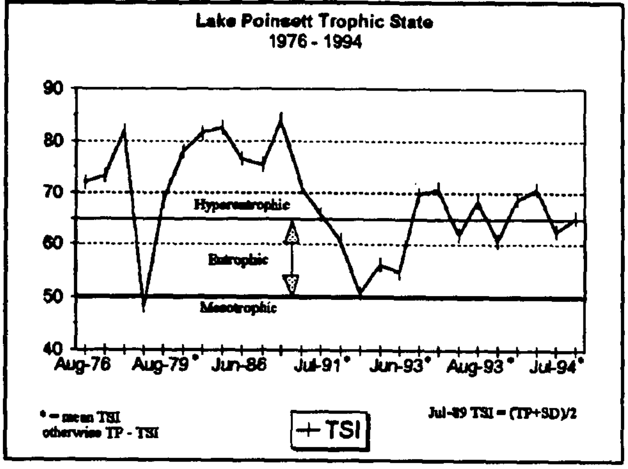
The trophic state of a lake is essentially an estimate of the nutritional state of the aquatic ecosystem. Trophic classification ranges from a lake low in nutrients and organic matter which is classified as oligotrophic, to a lake with excessive amounts of nutrients and organic matter classified as hypereutrophic. The South Dakota Watershed Protection Program currently uses Carlsons Trophic State Index (TSI) to classify the lakes as oligotrophic, mesotrophic, eutrophic, and hypereutrophic. Carlsons TSI uses three variables in its determination of trophic state: (1)total phosphorus (TP) concentrations, (2) secchi disk (Z_{SD}) depth, and (3) chlorophyll-a (Chl-a) concentrations. Each one of these variables is used in a specific equation to derive an individual trophic classification. The equations used in this determination were presented in the methods and materials sections on page 13 (Table 3). Each of the individual trophic classifications are then combined for an average trophic state. Summer values (June, July, and August) for total phosphorus, secchi disk, and chlorophyll-a were used to calculate the overall trophic state for Lake Poinsett (Figure 29).

Table 31. Trophic State Criteria for Carlson's Index

Parameter	Eutrophic	Hypereutrophic
TSI-TP	>50	≥65
TSI-Z_{SD}	>50	≥65
TSI-Chl-a	>50	≥65

Lake Poinsett has exhibited a hypereutrophic state for a large period of time. However, the mean trophic state in June of 1979 was 48.3. TSI values for secchi depth, chlorophyll-a, and total phosphorus were 39.07, 33.14, and 72.61, respectively. Algal blooms had not initiated which would effect the secchi depth and chlorophyll-a concentrations resulting in a lower trophic state (Figure 28). In August of 1979, all TSI values for these parameters increased which indicates a relationship between these three variables. During the project mean TSI values fluctuated between eutrophic and hypereutrophic. However, there were large volumes of water entering the lake during 1993 and 1994 (see Figure 4 and 5 pg 23). This large volume of water may have diluted the total phosphorus concentrations as well as decreasing the residence time in the lake for phosphorus and water. A reduction in residence time essentially would have flushed the entire lake volume out at a faster rate reducing the amount of time allowed for an algal bloom to initiate.

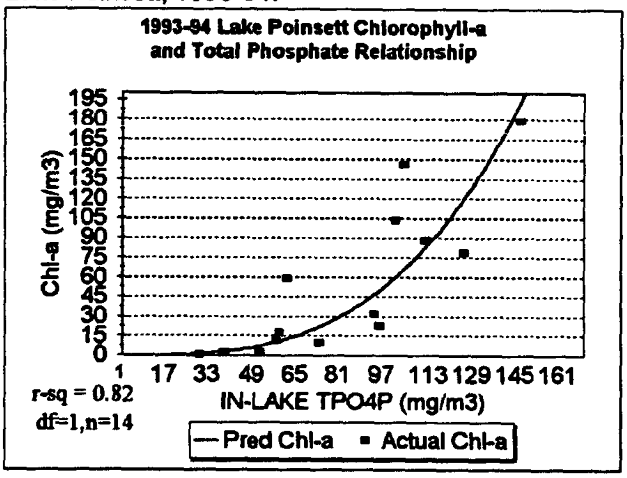
Figure 29. Historical and Present Trophic Status Index for Lake Poinsett, Hamlin County.



<u>Chlorophyll-a / Total Phosphorus Relationship</u>

Chlorophyll-a is a common indicator of algal biomass. Blue-green algae (chlorophyll-a) are dependent upon the concentration of total phosphorus i.e. as total phosphorus increases so does the concentration of chlorophyll-a. To determine how summer chlorophyll-a (mg/m^3) values are effected by the concentration of summer in-lake total phosphorus concentrations, a regression analysis was conducted between these two variables. This analysis revealed that there is a strong relationship between summer total phosphorus and chlorophyll-a (R^2=0.82, df=1, n=14) (Figure 30). The relationship between these two variables can be explained by Equation 1:

Figure 30. Regression analysis between summer chlorophyll-a and In-Lake total phosphorus values for Lake Poinsett, 1993-94.



$$\text{Log}_{10}Y = -4.456 + 3.110(\text{Log}_{10}X)$$
{Equation 1}

where Y = chlorophyll-a concentrations and X = total phosphorus concentrations. The values of total phosphorus used in this analysis ranged from 0.029 mg/l to 0.146 mg/l. Chlorophyll-a ranged from 0.960 mg/m^3 to 179.18 mg/m^3 (Figure 30 and Appendix I). Application of this equation in predicting chlorophyll-a concentrations using total phosphorus values should be kept within the range of total phosphorus values given. Entire regression analysis and related values can be found in Appendix I. Variability of chlorophyll-a concentrations are also dependent on several other factors such as wind, photoperiod and water temperatures. This equation may be used to indicate potential yield of chlorophyll-a based on the inlake total phosphorus concentration.

A regression analysis was also conducted on the total dissolved phosphorus to characterize its relationship with chlorophyll-a. This analysis revealed an inverse relationship between dissolved phosphorus and chlorophyll-a (R^2=0.10). This demonstrates that dissolved phosphorus is taken up quickly by the vegetation (algae) in the lake. This relationship is plotted on Figure 25, pg67.

<u>Reduction Response Model</u>

In-lake total phosphorus concentrations are a function of the total phosphorus load delivered to the lake via the watershed through surface water, groundwater and atmospheric inputs. Vollenweider and Kerekes (1980) developed a mathematical relationship which assumed steady state conditions (change in one direction is balanced by change in another). The variables used in this relationship are (1) the in-lake total phosphorus concentrations, (2) the average inflow concentrations, (3) the average residence time of total phosphorus within the lake before it is exported out of the lake, and (4) the hydraulic residence time of the lake or the amount of time required to theoretically completely replace the volume of water contained within the lake. Each of these variables could potentially have an impact on the average in-lake phosphorus concentration and, in turn, effect the quantity of blue-green algae present in the lake at any specific time. The relationship between these four variables is as follows:

$\overline{[P]}_\lambda$ = average total lake concentration
$\overline{[P]}_I$ = average inflow concentration of total phosphorus
$\overline{T}_p$ = average residence time of phosphorus
$\overline{T}_w$ = average residence time of water

Data collected during the Phase I investigation of Lake Poinsett provided estimates for $\overline{[P]}_\lambda$, $\overline{[P]}_I$, and $\overline{T}_w$. In order to determine the residence time of phosphorus ($\overline{T}_p$), it is necessary to back calculate Equation 2 below and solve for $\overline{T}_p$ forming Equation 3:

$$\overline{[P]}_\lambda = \left[\frac{(\overline{T}_p)}{(\overline{T}_w)}\right]\overline{[P]}_I \quad \textbf{\{Equation 2\}}$$

$$(\overline{T}_p) = \frac{\overline{[P]}_\lambda}{\overline{[P]}_I}(\overline{T}_w) \quad \textbf{\{Equation 3\}}$$

Values for $\overline{[P]}_\lambda$, $\overline{[P]}_I$ and $\overline{T}_w$ were determined in the following manner:

Water samples collected from Station 2 (Stonebridge) and Station 7 (Outlet of Lake Albert) over the duration of project period (1993-94) were averaged to produce an average inflow total phosphorus concentration ($\overline{[P]}_i$) of 0.1713 mg/l (n=32). All in-lake samples for both surface and bottom were used to determine the average in-lake total phosphorus concentration ($\overline{[P]}_\lambda$) of 0.1240 mg/l.

Hydraulic residence time ($\overline{T}_w$) was calculated by dividing the total volume of Lake Poinsett (74,746 acre-feet) by the total volume discharged in a 12 month period (136,749.3 acre-feet).

$$T_w = \frac{LakeVolume(acre\text{-}feet)}{MeanOutflow(acre\text{-}ft/yr)}$$

$$\overline{T}_w = 74746/136749.3 = 0.5466 \text{ year.}$$

By putting the numbers discussed above into Equation 3 the total phosphorus residence time ($\overline{T}_p$) would be:

$$\overline{T}_p = [0.1240/0.1713] \times [0.5466] = 0.3958 \text{ years}$$

Final values for all variables are:

$$\overline{[P]}_\lambda = 0.1240 \text{ mg/l}$$
$$\overline{[P]}_i = 0.1713 \text{ mg/l}$$
$$\overline{T}_p = 0.3958 \text{ yrs}$$
$$\overline{T}_w = 0.5466 \text{ yrs}$$

To estimate the effect that a reduction of inflow total phosphorus ($\overline{[P]}_i$) would have on the in-lake total phosphorus concentrations and the potential impact on chlorophyll-a (blue-green algal production), equations 1 and 2 can now be used. The results of a 10%, 20%, 30%, 40%, and 50% reduction of the inflowing total phosphorus ($\overline{[P]}_i$) value of 0.1713 mg/l can be found in Figure 31 and Table 32. A 10% reduction in the inflow total phosphorus has the potential of reducing the standing crop of algae from 773.77 tons to 557.55 tons (27.9% reduction).

As seen in Figure 32, Skille (1971) reported a considerably higher concentration of in-flow total phosphorus concentration than that which is recorded from this project (0.780 mg/l - 1971 to 0.171 mg/l- 1994). As discussed previously, Skille (1971) also reported that 63% of the total phosphorus load delivered to Lake Poinsett originated from the Big Sioux River through the Boswell Diversion. This higher total phosphorus load and longer total water residence time resulted in a longer residence time for the in-lake total phosphorus (0.3 years - 1993-94 to 2.06 years - 1970-71).

Lake Poinsett has fluctuated between a hypereutrophic state and eutrophic state. Although it is impossible to completely eliminate blue-green algal blooms, the duration and intensity of these blooms can be reduced allowing the full beneficial use of Lake Poinsett to be attained.

Table 32. Estimated effect of a reduction of total phosphorus inflow on inlake total phosphorus concentration and algal biomass for Lake Poinsett using Vollenweider and Kerekes Reduction Response Model (1980).

% TPO_4P REDUCTION FOR INFLOW	TPO_4P INFLOW (mg/l)	TPO_4P INLAKE (mg/l)	TPO_4P INLAKE (mg/m^3)	LOG OF TPO_4P (mg/m^3)	PREDICTED Chl-a[1] (mg/m^3)	Algal Biomass[2] kg/acre-foot	Algal Biomass[3] (Tons)
Average	0.17125	0.1240	124.0	2.0934	113.601	9.3896	773.77
10%	0.15413	0.1116	111.6	2.0477	81.856	6.7658	557.55
20%	0.1370	0.0992	99.20	1.9965	56.746	4.6903	386.52
30%	0.1199	0.0868	86.80	1.9385	37.457	3.0961	255.14
40%	0.0744	0.0744	74.40	1.8716	23.190	1.9168	157.96
50%	0.0620	0.0620	62.00	1.7924	13.153	1.0871	89.59

1 = Predicted Chl-a was determined using equation 1 and Log of TPO_4P (in-lake). 1000 l = 1 m^3.

2 = Algal biomass was determined by multiplying predicted chlorophyll-a (mg/m^3) by 67 (EPA Method 1002 H.1, EPA Water and Wastewater Methods, 1984) and converting mg/m^3 to kg/acre-foot.

3 = Kg/acre-foot was converted to lbs/acre-foot. This value was then multiplied by the volume of Lake Poinsett (74,746 acre-feet) cancelling acre-feet leaving an estimate for algal standing crop. Lbs were converted to tons.

Figure 31. Estimated impact of an inflow total phosphorus reduction on the in-lake total phosphorus concentration for Lake Poinsett 1993-94.

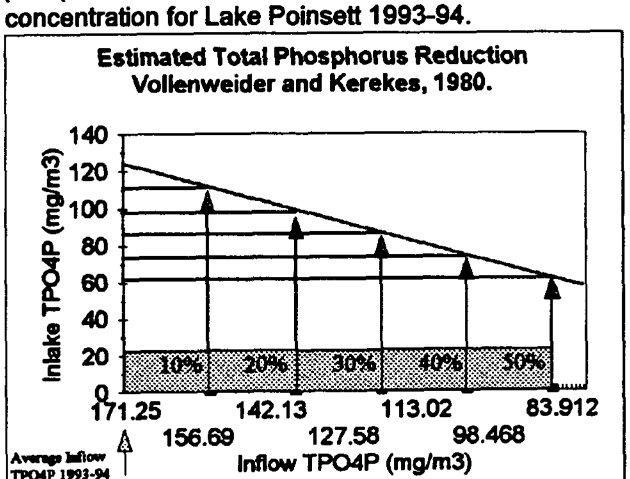
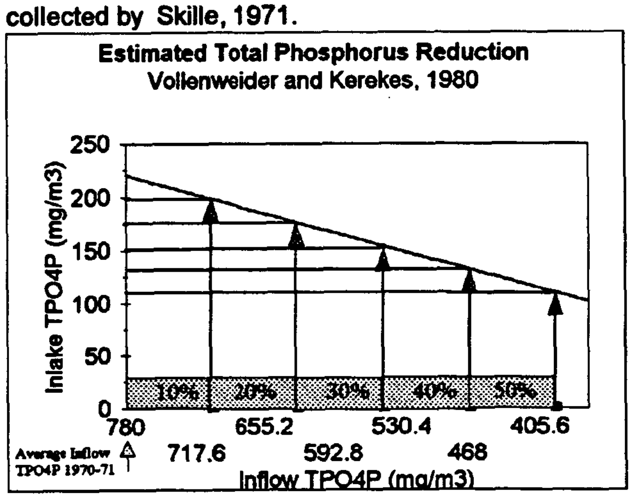


Figure 32. Estimated impact of an inflow total phosphorus reduction on the in-lake total phosphorus concentration for Lake Poinsett, 1970-71. Data collected by Skille, 1971.



QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance and quality control samples are collected to determine and maintain the accuracy and precision of the sampling protocols and scientific instruments used in collection of all scientific data. Approved QA/QC procedures were used on all sampling and field data collection on the Lake Poinsett Project. These procedures are outlined in the South Dakota Clean Lakes Program Standard Operating Procedures manual. Please refer to this manual for further discussion of sampling protocols.

Table 33 shows the results of the QA/QC sampling. Duplicate and blank samples were taken after every 10th regular water sample was collected. At the beginning of the project two sites were established as regular QA/QC sampling stations: 1) In-lake station 4 Bottom - north central bay, and 2) Tributary station 7 - outlet of Lake Albert.

Duplicate samples were taken at each QA/QC station to determine the variability in the sampling procedure and sample site. To determine percent difference between the duplicate sample and the regular water sample the following calculation was used:

$$\left[\frac{(Maximum Value)-(Minimum Value)}{(Maximum Value)}\right]\bullet 100$$

Larger percent differences were observed between samples with smaller concentrations where the concentrations actually approached detection limits of the laboratory equipment. Larger variability was observed between nitrogen and phosphorus duplicate samples in comparison to other parameters such as total alkalinity and total solids, which typically have larger concentrations (>100 mg/l) (Table 33). All duplicate samples can be located in Appendix I.

Blank samples using distilled water were taken to determine the cleanliness of the sampling equipment and sampling procedures (EPA, 1990). Blank samples taken throughout the project were at or below the detection limits of the laboratory equipment with few exceptions. When phosphorus or nitrogen concentration were detected in the blank samples, cleaning procedures were reevaluated. However, this was not a problem during the investigation (Table 31).

Based on the QA/QC results the quality of data collected during this project is within an acceptable range of accuracy.

Table 33. QUALITY ASSURANCE/QUALITY CONTROL SAMPLE DATA FOR LAKE POINSETT FOR 1993-94
for Site - 4, INLAKE NORTH CENTRAL BAY and Site 7 - OUTLET OF LAKE ALBERT
Percent Difference between Duplicate Samples = [(Maximum value - Minimum value)/Maximum value] * 100

DATE	TIME	SITE	SAMP	DEPTH	WTEMP C	ATEMP C	DISOX mg/L	FPH su	FECAL /100 mL	TALKAL mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMON mg/L	UNIONIZ AMMON mg/l	NO3+2 mg/L	TKN-N mg/L	ORGANC NITROG mg/L	TOTAL NITROG mg/L	TPO4P mg/L	TOTAL DISS. PO4P mg/L
16-Jun-93	1120	7	PERCENT	DIFFER	0.00	0.00	0.00	0.64	11.54	0.52	2.83	2.35	20.00	16.67	6.69	33.33	12.44	13.24	15.06	7.65	0.85
30-Jun-93	925	4	PERCENT	DIFFER	0.00	0.00	0.00	0.00	0.00	2.58	2.63	2.91	93.33	0.00	0.00	0.00	5.11	5.17	4.84	39.78	10.81
27-Jul-93	1330	7	PERCENT	DIFFER	0.00	0.00	0.00	0.00	95.00	0.62	1.43	1.33	14.29	5.00	5.00	0.00	5.90	6.75	5.69	7.65	0.00
04-Aug-93	855	4	PERCENT	DIFFER	0.00	0.00	0.00	0.00	0.00	2.04	16.37	1.95	69.54	0.00	0.00	0.00	32.92	33.20	31.62	63.62	18.92
31-Aug-93	820	4	PERCENT	DIFFER	0.00	0.00	0.00	0.00	50.00	1.03	14.65	2.35	87.50	0.00	0.00	0.00	0.62	0.64	0.58	25.90	6.98
15-Sep-93	1355	7	PERCENT	DIFFER	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00	54.55	27.78	27.78	0.00	4.49	2.81	4.33	6.90	12.82
04-Oct-93	1120	4	PERCENT	DIFFER	0.00	0.00	0.00	0.00	0.00	2.44	1.75	1.35	13.79	0.00	0.00	0.00	20.93	21.18	19.78	32.04	0.00
26-Oct-93	1310	7	PERCENT	DIFFER	0.00	0.00	0.00	0.00	0.00	1.96	3.48	3.52	0.00	0.00	0.00	0.00	1.45	1.58	1.35	0.00	24.14
02-Nov-93	1120	4	PERCENT	DIFFER	0.00	16.67	0.00	0.00	0.00	1.09	1.49	1.07	50.00	6.25	6.25	0.00	3.47	4.43	3.28	34.96	7.94
01-Mar-94	1350	4	PERCENT	DIFFER	0.00	0.00	0.00	0.00	0.00	0.94	0.19	0.38	75.00	3.57	3.57	0.00	1.55	2.40	1.40	19.17	21.14
20-Apr-94	1305	7	PERCENT	DIFFER	0.00	0.00	0.00	0.00	0.00	1.00	1.93	2.70	25.00	0.00	0.00	0.00	2.38	2.41	2.25	10.00	6.00
23-May-94	935	4	PERCENT	DIFFER	0.00	0.00	0.00	0.00	0.00	1.08	0.67	0.11	58.33	0.00	0.00	0.00	30.34	30.68	28.72	50.57	0.00
25-May-94	1320	7	PERCENT	DIFFER	0.00	0.00	0.00	0.00	4.35	3.03	1.49	1.72	10.53	13.64	13.64	0.00	5.65	4.81	5.42	15.88	3.23
29-Jun-94	820	4	PERCENT	DIFFER	0.00	0.00	0.00	0.00	0.00	1.07	1.06	1.18	10.00	0.00	0.00	0.00	1.90	1.91	1.81	0.00	0.00
06-Jul-94	1320	7	PERCENT	DIFFER	0.00	0.00	0.00	0.00	85.71	0.35	1.02	1.29	17.65	24.32	24.32	0.00	17.66	16.88	17.17	12.63	14.89
25-Jul-94	810	4	PERCENT	DIFFER	0.00	0.00	0.00	0.00	100.00	0.00	6.93	7.28	36.36	14.29	14.29	0.00	3.83	4.52	3.63	0.00	0.00
13-Sep-94	1425	7	PERCENT	DIFFER	0.00	0.00	0.00	0.00	11.11	3.21	0.44	0.18	10.00	3.03	3.03	0.00	15.97	17.28	15.53	0.00	6.41
20-Sep-94	1120	4	PERCENT	DIFFER	5.00	3.85	2.50	0.92	0.00	0.56	0.32	0.11	8.00	0.00	9.06	0.00	1.04	1.05	0.99	8.81	9.09

Blank Samples collected from Site 4 and Site 7, Lake Poinsett, 1993-94.

DATE	TIME	SITE	SAMP	DEPTH	WTEMP C	ATEMP C	DISOX mg/L	FPH su	FECAL /100 mL	TALKAL mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMON mg/L	UNIONIZ AMMON mg/l	NO3+2 mg/L	TKN-N mg/L	ORGANC NITROG mg/L	TOTAL NITROG mg/L	TPO4P mg/L	TOTAL DISS. PO4P mg/L
16-Jun-93	1045	7B	Grab	BLANK	20.00	24.00	6.20	3.10	10	11	7	3	4	0.02	0.00000	0.1	0.24	0.22	0.34	0.005	0.005
30-Jun-93	1230	4BB	Grab	BLANK	18.00	17.00	6.30	8.26	10	18.5	0	-1	1	0.02	0.00117	0.1	0.13	0.11	0.23	0.005	0.005
27-Jul-93	1330	7B	Grab	BLANK	22.00	25.00	5.70	6.98	10	5.3	0	-1	1	0.02	0.00009	0.1	0.1	0.08	0.2	0.005	0.005
04-Aug-93	855	4BB	Grab	BLANK	20.10	16.00	6.50	8.90	NA	5.7	0	-1	1	0.02	0.00482	0.1	0.1	0.08	0.2	0.005	0.005
31-Aug-93	1100	4BB	Grab	BLANK	20.50	13.00	5.80	8.90	10	NA	NA	0	NA	0.02	0.00493	0.1	0.1	0.08	0.2	0.01	0.005
15-Sep-93	1200	7B	Grab	BLANK	16.00	16.00	4.70	8.50	10	4	0	-2	2	0.02	0.00171	<.1	0.1	0.08	0.1	0.005	0.017
04-Oct-93	1330	4BB	Grab	BLANK	14.00	16.00	11.00	9.90	10	4	9	8	1	0.02	0.01337	0.1	0.1	0.08	0.2	0.005	0.005
26-Oct-93	1000	7B	Grab	BLANK	6.00	3.00	7.80	8.40	10	4	0	-1	1	0.02	0.00066	0.1	0.69	0.67	0.79	0.005	0.005
02-Nov-93	1530	4BB	Grab	BLANK	6.00	3.00	9.10	8.83	10	4	13	12	1	0.02	0.00168	0.1	0.1	0.08	0.2	0.007	0.005
01-Mar-94	1115	4BB	Grab	BLANK	2.00	1.00	8.30	7.50	10	3	5	4	1	0.02	0.00006	0.1	0.1	0.08	0.2	0.01	0.01
20-Apr-94	1100	7B	Grab	BLANK	12.00	7.00	8.90	7.30	10	2.6	4	3	1	0.02	0.00009	0.1	0.1	0.08	0.2	0.005	0.005
23-May-94	840	4BB	Grab	BLANK	22.00	18.00	10.40	11.10	10	3	1	0	1	0.02	0.01966	0.1	0.1	0.08	0.2	0.005	0.005
25-May-94	830	7B	Grab	BLANK	19.00	23.00	9.40	8.70	10	3	1	0	1	0.02	0.00312	0.1	0.1	0.08	0.2	0.005	0.005
29-Jun-94	950	4BB	Grab	BLANK	21.00	19.00	8.30	9.10	10	2.6	1	0	1	0.02	0.00700	0.1	0.17	0.15	0.27	0.005	0.016
06-Jul-94	1130	7B	Grab	BLANK	24.00	29.00	8.72	9.31	10	3.5	10	9	1	0.02	0.01040	0.1	0.1	0.08	0.2	0.005	0.005
25-Jul-94	930	4BB	Grab	BLANK	22.00	18.00	7.00	8.68	10	3	7	6	1	0.02	0.00360	0.1	0.1	0.08	0.2	0.005	0.013
13-Sep-94	1460	7B	Grab	BLANK	21.00	27.00	4.60	8.02	10	3.1	4	3	1	0.02	0.00086	0.1	0.1	0.08	0.2	0.005	0.007
20-Sep-94	1000	4BB	Grab	BLANK	18.00	17.00	4.80	7.80	10	3	6	4	2	0.03	0.00064	0.1	0.1	0.07	0.2	0.005	0.005

CONCLUSION

CONCLUSIONS

In 1929, the Boswell Diversion was constructed to divert water from the Big Sioux River into Dry Lake and Lake Poinsett. In addition to the 292,197 acre (118,522 ha) watershed, the Boswell Diversion increased the contributing watershed by an estimated 470,000 acres (190,209 ha). This addition to the Lake Poinsett watershed increased the amount of area contributing nutrients and sediment to the lake.

The Boswell Diversion was modified in 1955, increasing its maximum capacity from 500 cubic feet per second (cfs) to 1500 cfs. The natural outlet of Lake Poinsett (Figure 2) was modified and a control structure was built to prevent the backflow of water from the Big Sioux River into Lake Poinsett. This outlet was completed in 1989 and was closed during the 1993 flooding conditions to prevent the nutrient laden Big Sioux River water from entering Lake Poinsett. The Boswell Diversion was not opened during the course of the investigation. However, seepage does take place and during the 1993 flood and estimated 604 acre-feet of water was discharged from this site carrying 337.8 lbs of phosphorus to Dry Lake.

The data collected during the Phase I Diagnostic/Feasibility study indicates that Lake Poinsett is a hypereutrophic lake which is near eutrophic conditions. This trophic state is driven by phosphorus loadings delivered to Lake Poinsett from the Lake Albert system and Stonebridge. The limiting nutrient throughout the investigation within the Lake Poinsett system was determined to be phosphorus. The Lake Albert drainage provided an estimated 49,253 lbs of total phosphorus (73.2% of the total phosphorus loadings) in comparison to the Stonebridge station which provided 16,047.75 lbs of total phosphorus (23.9% of the total phosphorus loadings). The mean concentration of total phosphorus from Lake Albert (0.177 mg/l) was also higher than the mean recorded from Stonebridge (0.165 mg/l). Lake Poinsett accumulated an estimated 28,411 lbs of phosphorus during the investigation.

Two stations were monitored within the Lake Albert drainage. Station 8 (outlet of Lake St. Johns) provided 48,904.6 lbs of phosphorus (68.7% of total phosphorus delivered to Lake Albert) to Lake Albert in comparison to Station 9(Lake Thisted Creek) which provided 21,337.56 lbs of phosphorus (30% of the total phosphorus load) to Lake Albert. The mean concentration of total phosphorus recorded at Station 9 was much higher than any other monitoring station during the course of the investigation. These high concentrations were also accompanied with high fecal coliform counts, total suspended solid and ammonia concentrations indicating the presence of livestock. Lake Albert trapped an estimated 21,891.2 lbs of phosphorus which remained in Albert and was not transported to Lake Poinsett.

The Big Sioux River total phosphorus load was much larger than any of the tributaries monitored during the Phase I investigation. Total phosphorus concentrations collected from the 106 Fixed Ambient Monitoring program for the Big Sioux River indicated that mean concentrations at the Watertown and Brookings stations were 0.306 mg/l and 0.269 mg/l, respectively. These concentrations were higher than those recorded from any other monitoring station within the Lake

Poinsett watershed with the exception of the Thisted Site (Site 9). Based on these concentrations, the total phosphorus load carried by the Big Sioux River was 179,345.9 lbs and 170,652.2 lbs for the Watertown and Brookings stations, respectively. The Big Sioux River carried almost 3.5 times as much phosphorus as the Lake Albert outlet did during the study period. **However, the diversion gates were not opened during the project**. To determine the potential phosphorus loadings from the Big Sioux River via the Boswell diversion if the gates had been opened, an estimate of phosphorus loadings for 3 months in 1994 from the Boswell Diversion was calculated. This estimate revealed that the diversion would carry 16 tons of phosphorus to Dry Lake in comparison to only 6 tons delivered to Lake Poinsett from the Lake Albert Outlet for the same time period.

The watershed of Lake Poinsett consists of 55.01% cropland, 14.92% pasture, and 14.58% water, respectively. An estimated 6.02% of the total watershed consists of highly erodible lands (HEL). The remaining watershed consists of the Conservation Reserve Program (CRP), farmstead, transportation, wildlife areas, and low density population areas.

The Agricultural Nonpoint Source (AGNPS) computer model was used to determine the areas of potential nutrient and sediment yield for 96,920 acres of the Lake Poinsett and Lake Albert subwatersheds. AGNPS revealed that sediment and nutrient loadings to Lake Poinsett are low in comparison to other lakes in eastern South Dakota. AGNPS analysis identified several critical areas in the Thisted monitoring station and north of Dry Lake that are potentially delivering excessive amounts of sediment (10.6% watershed area, 20.9% of total sediment) and nutrients (11.0% watershed area, 17.6% total nitrogen, and 18.4% total phosphorus) to Lake Poinsett, in agreement with the tributary water quality/loading results.

Feedlots identified in this 96,920 acre area were ranked by AGNPS. A ranking of 100 indicates that the feedlot would be contributing extremely excessive levels of nutrients to the watershed. Two feedlots ranked above 40, indicating they appear to be contributing excessive levels of nutrients to the watershed. In addition to these 2, 3 more feedlots were identified as potentially delivering moderate to high levels of nutrients and should also be considered for treatment. Locations of critical cells in the watershed for implementation of Best Management Practices are identified in the AGNPS report for the Lake Poinsett Watershed. AGNPS should be conducted on the remaining watershed area to determine high nutrient and sediment yielding areas to Marsh Lake, Lake Norden, and Lake St. John.

In addition to the direct inputs of phosphorus from the Lake Albert and Stonebridge stations, an estimated 628.1 to 1884.33 lbs of phosphorus is potentially delivered to Lake Poinsett through failing onsite wastewater disposal systems (septic systems). Of the 622 residents located around Lake Poinsett, only 153 actual cabins or businesses are connected to a centralized sanitary sewer system. This leaves 469 cabins that are providing this estimated load of phosphorus to Lake Poinsett.

Although Lake Poinsett is hypereutrophic, there is not a problem with sedimentation. A sediment survey conducted during October/November of 1994 revealed that there only an estimated 8,969,037 yds^3. This equates to approximately 8.5 inches of sediment covering the entire surface area (7,868 acres) of Lake Poinsett. Most of the sediment is located within the northern half of the lake. This indicates the influence of the Lake Albert outlet and the Stonebridge areas. Based on the results of the survey there is not enough sediment in Lake Poinsett to warrant an extensive sediment removal project. However, the Dry Lake/Stonebridge area should be considered for a sediment survey to determine the volume of sediment contained within the extreme southern half of Dry Lake. This information would determine if a sediment removal project is warranted in Dry Lake. Removal of sediment could reduce discharge rates of the phosphorus laden sediment from Dry Lake into Lake Poinsett.

An aquatic plant survey was also conducted on Lake Poinsett in August-1994. This survey revealed that Lake Poinsett has very little to no submergent and emergent aquatic vegetation. This is primarily a result of the substrate and the attenuating light conditions caused by severe blue-green algal blooms. A reduction in the length and duration of these blooms may allow an aquatic plant foothold. These plants will aid in the reduction of in-lake phosphorus concentrations as well as provide sheltered areas for fish and waterfowl.

The severe blue-green algal problems are limited to the amount of phosphorus available within Lake Poinsett as was indicated by the relationship between in-lake total phosphorus and chlorophyll-a concentrations. A reductions in phosphorus loadings from the various sources identified within this report could have a significant impact on these algal blooms. After using the Vollenweider and Kerekes method to determine the relationship between inflow and in-lake total phosphorus concentrations, it was revealed that an estimated 40% reduction in the total inflow phosphorus concentrations would reduce the algal biomass (standing crop) from 773.77 tons to an estimated 157.7 tons.

RESTORATION ALTERNATIVES

RESTORATION ALTERNATIVES

Specific areas or critical cells of potentially high yielding areas of nutrients and sediments are addressed in the document produced from the Agricultural Nonpoint Source (AGNPS) computer model. This document can be used to determine which cells or area within each subwatershed are in need of conservation measures. Based on the data collected with AGNPS and the Phase I Diagnostic/Feasibility study, the following activities are suggested to reduce the phosphorus and sediment loadings to Lake Poinsett.

1. Continuing efforts should be made to secure funding for an expansion of the centralized sanitary sewer system on Lake Poinsett. This is a direct input of phosphorus to the lake which can be immediately reduced. However, until this is obtained, on-site septic systems should be examined to determine their condition. Upgrading or improving failing septic systems will aid in the reduction of phosphorus loadings.

2. Reduce the use of lawn fertilizers on areas adjacent close to the shoreline. Every reduction in the availability of phosphorus that is delivered to the lake will aid in the reduction of blue-green algal blooms. Continuing education in the use of lawn fertilizers and the use of phosphorus laden detergent needs to take place for individuals living near or on the lake.

3. To maintain or improve the quality of water in Lake Poinsett it is necessary to decrease inputs of phosphorus. Phosphorus loadings provided to Lake Poinsett via the Boswell Diversion can also be eliminated. As discussed in previous sections, the Big Sioux River carried almost 3.5 times as much phosphorus as did the Lake Albert outlet. If opened, the diversion could deliver a tremendous amount of phosphorus to the lake. Phosphorus has the potential of spending a significant amount time within the Lake Poinsett system before being flushed out. The residence time is dependent upon the volume of water entering and leaving Lake Poinsett. The phosphorus residence time in the lake was estimated to be 0.3958 years based on data collected during this investigation. Using Skille's data collected in 1970 and 1971 the phosphorus residence time in the lake was 2.06 years. This data suggests that phosphorus could be assimilated by blue-green algae even 2 years after it has entered the lake. Therefore, it is necessary to control or eliminate the Boswell input since it can provide a tremendous phosphorus loading to Lake Poinsett. As stated previously, Skille (1971) determined that 63% of the phosphorus delivered to Lake Poinsett came through the Boswell Diversion.

4. Closure of the Lake Poinsett outlet during periods of reverse-flow from the Big Sioux River must also be continued for the same reasons stated in item 3.

5. A total of 11 feedlots were identified in the 96,920 acres analyzed with AGNPS. Of these, 5 were given rankings of greater than 30 by the AGNPS computer program. Animal waste management systems should be considered for these 5 feedlots and, if funding is available, the remaining 6 should also be considered. In addition to these 11 feedlots another 103 feeding areas were located outside of this 96,920 acres (within the remaining

watershed). All of these feeding areas contained greater than 10 animal units. These should also be examined with AGNPS to determine their status. To ensure proper disposal of wastes, follow-up monitoring should be considered.

6. The following Best Management Practices were identified by the District Conservationists within Brookings, Kingsbury, and Hamlin Counties as being the most salable to individual operators within the watershed:

   a. Vegetative Buffer Strips
   b. Riparian Area Management
   c. Residue Management
   d. Critical Area Grass Seedings.
   e. Filter strips (strips of permanent vegetation 1.0 to 1.5 chains wide on either side of seasonal or permanent linear flows).

7. AGNPS also identified several critical areas of high nutrient and sediment yield between the outlet of Lake Thisted and Lake Albert (see AGNPS final report for specific areas). Water quality data also indicated this area as critical. BMPs identified in item 6 should be used in this area to reduce the nutrient and sediment loadings.

8. Another priority area identified by AGNPS was located in the upper part of the Dry Lake subwatershed (see AGNPS final report for specific areas). BMPs identified in item 6 should also be used in this area to reduce the nutrient and sediment loadings to Dry Lake.

9. Complete AGNPS on the remaining watershed to identify other priority areas which may effect Marsh Lake, Lake Norden, and Lake St. John.

10. Continued rough fish removal from Lake Albert and Lake Poinsett should be encouraged. This will aid in the enhancement of the game fishery and may permit some submergent vegetation growth. Removal of rough fish will have an impact on the water quality of Lake Poinsett.

11. To further determine potential areas of nonpoint source pollution a Phase I Diagnostic/Feasibility Study should be undertaken for Lake Norden in Hamlin County. Lake Poinsett would benefit from the improvement of water quality discharged from this lake.

12. Selective dredging on Dry Lake.

13. Continued use of the CRP program.

14. Construction of small ponds/check dams on the creek between the Lake Thisted outlet and Lake Albert Creek to reduce the velocity of the water. This will prevent some phosphorus laden sediment from entering Lake Albert.

15. Appropriate measures should be taken to prevent further degradation of those shoreline areas identified as highly erodible (severe) in the survey. The shoreline should be continuously monitored to identify other areas that may become susceptible to erosion.

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APPENDIX I

APPENDIX I:

The following tables contain the raw water quality data for each monitoring stations (sites 1-9). This includes all in-lake samples, both surface and bottom, and samples collected from the Big Sioux River (Watertown and Brookings). The Big Sioux River water quality data was collected and funded through the EPA Section 106 Fixed Ambient Monitoring Program. Each table contains the following:

1. Concentrations from all chemical and biological parameters and the results from all other physical measurements for each date that a sample was collected.

2. A set of descriptive statistics for data collected at each site during the project period.

SAMPLE DATA FOR LAKE POINSETT FOR 1993

Site - 1, BOSWELL DIVERSION, COUNTY HIWAY BRIDGE

PROJECT	DATE	TIME	SITE	SAMP	DEPTH	WTEMP C	ATEMP C	DISOX mg/L	FPH su	LABPH su	FECAL /100 mL	TALKAL mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMO mg/L	UNIONIZ AMMONI mg/l	PERCEN UNIONIZ	PKA	NO3+2 mg/L	TKN-N mg/L	ORGANI NITROGE mg/L	TOTAL NITROGE mg/L	TPO4P mg/L	TOTAL DISS. PO4 mg/L
Lake Poinsett	02-Jun-93	1225	1	Grab	Surface	11.2	NA	7.85	7.74	8.24	360	300	692	668	24	0.02	0.00022	1.111959	9.69	0.1	0.85	0.83	0.95	0.166	0.033
Lake Poinsett	16-Jun-93	1420	1	Grab	Surface	16.2	30	5.8	8.03	8.41	270	285	678	655	23	0.02	0.00062	3.112115	9.52	1	1.16	1.14	2.16	0.179	0.086
Lake Poinsett	06-Jul-93	1105	1	Grab	Surface	17.8	25	4.5	7.59	7.23	120	227	566	561	5	0.02	0.00026	1.297124	9.47	0.3	1.63	1.61	1.93	0.222	0.13
Lake Poinsett	27-Jul-93	1100	1	Grab	Surface	21.5	30	2.5	7.35	NA	120	201	438	421	17	0.04	0.00039	0.982081	9.35	0.3	1.28	1.24	1.58	0.312	0.226
Lake Poinsett	24-Aug-93	1415	1	Grab	Surface	21	34	2.4	7.68	NA	100	260	538	536	2	0.02	0.00040	2.004004	9.37	0.1	0.77	0.75	0.87	0.289	0.229
Lake Poinsett	13-Sep-93	1330	1	Grab	Surface	13.5	6	3.8	7.33	NA	480	260	600	584	16	0.02	0.00010	0.519622	9.61	0.1	1.16	1.14	1.26	0.183	0.113
Lake Poinsett	05-Oct-93	1355	1	Grab	Surface	10.5	23	8.2	8.15	NA	70	280	656	634	22	0.02	0.00053	2.664001	9.71	0.1	0.64	0.62	0.74	0.149	0.037
Lake Poinsett	26-Oct-93	1155	1	Grab	Surface	6	5	8.8	7.6	NA	10	308	694	671	23	0.02	0.00011	0.536824	9.87	0.1	1.12	1.1	1.13	0.143	0.013
Lake Poinsett	13-Apr-94	1030	1	Grab	Surface	5	10	15.1	8.83	NA	10	243	517	485	32	0.02	0.00156	7.794368	9.90	0.1	1.33	1.31	1.43	0.206	0.027
Lake Poinsett	20-Apr-94	1200	1	Grab	Surface	10	5	10.6	7.98	NA	10	260	582	548	34	0.02	0.00035	1.748285	9.73	0.1	0.85	0.83	0.95	0.176	0.017
Lake Poinsett	02-May-94	805	1	Grab	Surface	7	5	12.4	8.09	NA	10	272	634	612	22	0.02	0.00036	1.775355	9.83	0.1	0.98	0.96	1.08	0.13	0.02
Lake Poinsett	25-May-94	1215	1	Grab	Surface	17.5	16.5	7	7.63	NA	60	287	625	612	13	0.02	0.00028	1.38961	9.48	0.1	1.3	1.28	1.4	0.176	0.043
Lake Poinsett	15-Jun-94	1045	1	Grab	Surface	19	18	5.3	7.31	NA	230	264	688	660	28	0.02	0.00015	0.748027	9.43	0.1	0.92	0.9	1.02	0.26	0.05
Lake Poinsett	06-Jul-94	1235	1	Grab	Surface	21	30	10.1	7.69	NA	160	252	598	570	28	0.02	0.00041	2.049726	9.37	0.2	0.88	0.86	1.08	0.226	0.11
Lake Poinsett	09-Aug-94	1030	1	Grab	Surface	16	12	3.8	7.69	NA	250	273	617	602	15	0.03	0.00043	1.425694	9.53	0.1	1.27	1.24	1.37	0.256	0.15
Lake Poinsett	13-Sep-94	1330	1	Grab	Surface	21	27	8.6	8.52	NA	420	220	623	561	62	0.02	0.00248	12.39431	9.37	0.1	2.35	2.33	2.45	0.313	0.033
					Column 1																				
					ALL DATA																				
					Mean	14.6375	17.281	7.29688	7.8256	1.4925	167.5	262	609.13	586.25	22.875	0.0219	0.000541	2.597069	9.577935	0.1875	1.1556	1.13375	1.3375	0.21163	0.0823125
					Standard Error	1.42539	2.8225	0.90453	0.1057	0.804305	38.139	7.20127	17.558	17.197	3.4094	0.0014	0.000154	0.781632	0.047323	0.056917	0.102	0.101849	0.120691	0.01483	0.0178255
					Median	16.1	17.25	7.425	7.69	0	120	262	620	593	22.5	0.02	0.000374	1.586989	9.526476	0.1	1.14	1.12	1.195	0.1945	0.0465
					Mode	21	5	0	7.69	0	10	260	0	561	22	0.02	0	0	9.36931	0.1	0.85	0.83	0.95	0.176	0.033
					Standard Deviation	5.70156	11.29	3.61812	0.4226	3.217221	152.556	28.8051	70.234	68.788	13.638	0.0054	0.000618	3.126528	0.189294	0.227669	0.408	0.407396	0.482763	0.05932	0.0713019
					Variance	32.5078	127.47	13.0908	0.1786	10.35051	23273.33	829.733	4932.8	4731.8	185.98	3E-05	3.82E-07	9.775176	0.035832	0.051833	0.1664	0.165972	0.23306	0.00352	0.005084
					Kurtosis	-1.24186	-1.5785	-0.18507	0.8467	1.416269	-0.42297	0.04832	0.8968	0.8057	3.9982	9.0934	6.769063	6.729701	-1.19762	12.49067	4.2318	4.316468	0.615393	-0.94429	0.1541947
					Skewness	-0.39356	-0.0147	0.5245	1.0149	1.793507	0.800695	-0.5217	-0.9086	-0.8759	1.3671	3.0297	2.592179	2.598404	0.434216	3.429532	1.7184	1.73995	1.116819	0.49797	1.0806543
					Range	16.5	34	12.7	1.52	8.41	470	107	256	250	60	0.02	0.002375	11.87469	0.54941	0.9	1.71	1.71	1.71	0.183	0.216
					Minimum	5	0	2.4	7.31	0	10	201	438	421	2	0.02	0.000104	0.519622	9.353566	0.1	0.64	0.62	0.74	0.13	0.013
					Maximum	21.5	34	15.1	8.83	8.41	480	308	694	671	62	0.04	0.002479	12.39431	9.902977	1	2.35	2.33	2.45	0.313	0.229
					Sum	234.2	276.5	116.75	125.21	23.88	2680	4192	9746	9380	366	0.35	0.00865	41.55311	153.247	3	18.49	18.14	21.4	3.386	1.317
					Count	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
					Confidence Level(0.	2.79372	5.532	1.77285	0.2071	1.57641	74.75107	14.1142	34.414	33.706	6.6823	0.0027	0.000303	1.53197	0.092752	0.111556	0.1999	0.19962	0.236549	0.02907	0.0349373

SAMPLE DATA FOR LAKE POINSETT FOR 1993

Site - 2, STONEBRIDGE

PROJECT	DATE	TIME	SITE	SAMP	DEPTH	WTEM C	ATEM C	DISOX mg/L	FPH su	LABPH su	FECAL /100 mL	TALKA mg/L	TSOL mg/L	TDSO mg/L	TSSOL mg/L	AMM mg/L	UNIONI AMMO mg/l	PERCEN UNIONI	PKA	NO3+2 mg/L	TKN- mg/L	ORGANI NITROG mg/L	TOTAL NITROG mg/L	TPO4P mg/L	TOTAL DISS. PC mg/L
Lake Poinsett	02-Jun-93	1145	2	Grab	Surface	13	NA	9.9	8.85	7.84	80	224	30	0	30	0.02	0.00285	14.2707	9.63	0.2	1.7	1.68	1.9	0.133	0.03
Lake Poinsett	16-Jun-93	1230	2	Grab	Surface	16.9	25	7.6	8.78	7.83	30	208.4	788	761	27	0.02	0.00320	15.9909	9.50	0.1	1.85	1.83	1.95	0.146	0.08
Lake Poinsett	06-Jul-93	935	2	Grab	Surface	19	20.5	7.6	7.23	7.93	30	216.2	886	871	15	0.02	0.00012	0.62297	9.43	0.1	1.79	1.77	1.89	0.113	0.06
Lake Poinsett	26-Jul-93	1100	2	Grab	Surface	21	24	8.9	8.71	NA	200	195	872	862	10	0.04	0.00719	17.9739	9.37	0.1	2.07	2.03	2.17	0.11	0.0
Lake Poinsett	24-Aug-93	1245	2	Grab	Surface	24	32	5.2	8.69	NA	10	209	823	805	18	0.47	0.09687	20.6116	9.28	0.1	3.23	2.76	3.33	0.325	0.16
Lake Poinsett	13-Sep-93	1230	2	Grab	Surface	16	8	7.8	8.54	NA	20	216	1021	853	168	0.2	0.01858	9.2881	9.53	0.3	2.06	1.86	2.36	0.362	0.14
Lake Poinsett	07-Oct-93	1145	2	Grab	Surface	11	16	10.6	NA	NA	10	166	942	860	82	0.02	0.00000	2E-08	9.70	0.01	1.25	1.23	1.26	0.133	0.0
Lake Poinsett	26-Oct-93	1045	2	Grab	Surface	7	5	10.2	8.63	NA	20	228	825	782	43	0.02	0.00118	5.89747	9.83	0.1	2.53	2.51	2.63	0.143	0.06
Lake Poinsett	13-Apr-94	1100	2	Grab	Surface	3	12.5	17.2	8.72	NA	10	183	875	866	9	0.02	0.00106	5.27742	9.97	0.1	1.58	1.56	1.68	0.09	0.03
Lake Poinsett	20-Apr-94	1220	2	Grab	Surface	7	6	8.6	8.37	NA	10	185	906	888	18	0.02	0.00067	3.32935	9.83	0.1	1.52	1.5	1.62	0.11	0.06
Lake Poinsett	02-May-94	825	2	Grab	Surface	7	6	11.8	8.65	NA	10	179	927	915	12	0.02	0.00123	6.1583	9.83	0.1	1.53	1.51	1.63	0.05	0.0
Lake Poins	25-May-94	1255	2	Grab	Surface	19	17	8.5	8.34	NA	100	181	813	796	17	0.02	0.00149	7.47223	9.43	0.1	1.52	1.5	1.62	0.083	0.03
Lake Poinsett	15-Jun-94	1115	2	Grab	Surface	21	23	8.6	8.18	NA	10	192	804	781	23	0.07	0.00425	6.07402	9.37	0.1	1.46	1.39	1.56	0.193	0.10
Lake Poinsett	06-Jul-94	1250	2	Grab	Surface	23	30	14.3	8.78	NA	10	171	875	857	18	0.02	0.00458	22.9229	9.31	0.1	1.74	1.72	1.84	0.123	0.05
Lake Poinsett	09-Aug-94	1105	2	Grab	Surface	18	11	6.3	8.56	NA	20	164	1092	1065	27	0.11	0.01218	11.0699	9.46	0.1	3	2.89	3.1	0.23	0.11
Lake Poinsett	13-Sep-94	1405	2	Grab	Surface	21	26	5	8.73	NA	10	215	720	708	12	0.16	0.02986	18.6629	9.37	0.2	1.5	1.34	1.7	0.303	0.24

Column 1

	WTEM	ATEM	DISOX	FPH	LABPH	FECAL	TALKA	TSOL	TDSO	TSSOL	AMM	UNIONI AMMO	PERCEN UNIONI	PKA	NO3+2	TKN-	ORGANI NITROG	TOTAL NITROG	TPO4P	TOTAL DISS. PC
Mean	15.431	16.375	9.2563	7.985	1.475	36.25	195.79	824.94	791.88	33.063	0.0781	0.01158	10.3514	9.55302	0.11938	1.8956	1.8175	2.015	0.1654	0.08
Standard Error	1.5121	2.2503	0.7269	0.497	0.72753	11.7242	4.8374	52.859	51.767	9.2051	0.0272	0.00554	1.65451	0.05017	0.01476	0.13	0.11416	0.13166	0.0211	0.01372
Median	17.45	16.5	8.6	8.64	0	15	193.5	873.5	855	18	0.02	0.00303	8.38016	9.48268	0.1	1.72	1.7	1.865	0.133	0.06
Mode	7	6	7.6	8.78	0	10	NA	875	NA	18	0.02	NA	NA	9.36931	0.1	1.52	1.5	1.62	0.11	0.03
Standard Deviation	6.5911	9.809	3.1686	2.164	3.17122	51.1045	21.086	230.4	225.65	40.124	0.1187	0.02414	7.21186	0.21867	0.06434	0.5665	0.49761	0.57389	0.0922	0.05983
Variance	43.442	96.217	10.04	4.685	10.0566	2611.67	444.61	53086	50917	1609.9	0.0141	0.00058	52.011	0.04782	0.00414	0.321	0.24762	0.32935	0.0085	0.0035
Kurtosis	-0.9956	-1.217	1.5998	14.76	1.28594	7.14715	-1.3921	10.659	11.637	9.3086	8.3079	11.8916	-1.12707	-0.92921	3.81325	1.2485	0.48812	0.88038	0.1635	2.33895
Skewness	-0.5664	-0.017	1.1177	-3.8	1.7721	2.61197	-0.0089	-2.948	-3.13	2.9587	2.7565	3.33781	0.31519	0.61613	1.58636	1.4143	1.18044	1.22777	1.1066	1.58599
Range	21	32	12.2	8.85	7.93	190	64	1062	1065	159	0.45	0.09687	22.9229	0.69839	0.29	1.98	1.66	2.07	0.312	0.21
Minimum	3	0	5	0	0	10	164	30	0	9	0.02	4E-12	2E-08	9.27564	0.01	1.25	1.23	1.26	0.05	0.0
Maximum	24	32	17.2	8.85	7.93	200	228	1092	1065	168	0.47	0.09687	22.9229	9.97403	0.3	3.23	2.89	3.33	0.362	0.24
Sum	246.9	262	148.1	127.8	23.6	580	3132.6	13199	12670	529	1.25	0.18532	165.623	152.848	1.91	30.33	29.08	32.24	2.647	1.31
Count	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	1
Confidence Level(0.9	3.2296	4.8063	1.5526	1.061	1.55387	25.0407	10.332	112.9	110.56	19.66	0.0582	0.01183	3.53375	0.10715	0.03153	0.2776	0.24383	0.2812	0.0452	0.02931

SAMPLE DATA FOR LAKE POINSETT FOR 1993

Site - 3, OUTLET

PROJECT	DATE	TIME	SITE	SAMP	DEPTH	WTEMP C	ATEMP C	DISOX mg/L	FPH su	LABPH su	FECAL /100 mL	TALKAL mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMO mg/L	UNIONIZ AMMONI mg/l	PERCEN UNIONIZ	PKA	NO3+2 mg/L	TKN-N mg/L	ORGANI NITROGE mg/L	TOTAL NITROGE mg/L	TPO4P mg/L	TOTAL DISS. PO. mg/L
Lake Poinsett	02-Jun-93	1145	3	Grab	Surface	13.4	NA	8.85	8.92	8.5	250	236	998	989	9	0.02	0.00336	16.78205	9.62	0.1	1.58	1.56	1.68	0.093	0.02
Lake Poinsett	16-Jun-93	1330	3	Grab	Surface	17.5	25	8.6	8.82	8.36	30	203	947	938	9	0.02	0.00358	17.91559	9.48	0.1	1.74	1.72	1.84	0.073	0.0
Lake Poinsett	06-Jul-93	1225	3	Grab	Surface	19.5	21	5.4	7.88	8.55	10	239.3	1018	998	20	0.02	0.00056	2.822937	9.42	0.1	1.8	1.78	1.9	0.103	0.0
Lake Poinsett	26-Jul-93	1200	3	Grab	Surface	21.1	30	5.2	8.39	NA	40	200	980	970	10	0.02	0.00191	9.55494	9.37	0.1	1.53	1.51	1.63	0.07	0.03
Lake Poinsett	24-Aug-93	1540	3	Grab	Surface	24	32	8.1	9.26	NA	10	197	974	972	2	0.12	0.05892	49.09954	9.28	0.1	1.03	0.91	1.13	0.083	0.05
Lake Poinsett	13-Sep-93	1300	3	Grab	Surface	16	6	8	8.64	NA	18	192	1168	1147	21	0.02	0.00228	11.41842	9.53	0.1	1.77	1.75	1.87	0.1	0.0
Lake Poinsett	05-Oct-93	1440	3	Grab	Surface	11	22	9.4	8.93	NA	10	164	897	887	10	0.02	0.00293	14.63722	9.70	0.1	1.03	1.01	1.13	0.063	0.02
Lake Poinsett	26-Oct-93	1530	3	Grab	Surface	7.5	5	7.9	8.49	NA	10	184	882	871	11	0.1	0.00451	4.511989	9.82	0.1	2.65	2.55	2.75	0.07	0.02
Lake Poinsett	13-Apr-94	950	3	Grab	Surface	3	10	14.6	8.66	NA	10	185	931	923	8	0.02	0.00093	4.627952	9.97	0.1	1.62	1.6	1.72	0.077	0.03
Lake Poinsett	20-Apr-94	1135	3	Grab	Surface	7	5	10.8	8.41	NA	10	188	904	893	11	0.02	0.00073	3.638871	9.83	0.1	1.47	1.45	1.57	0.083	0.0
Lake Poinsett	02-May-94	750	3	Grab	Surface	8	12	12	8.59	NA	10	181	923	913	10	0.02	0.00117	5.829443	9.80	0.1	1.39	1.37	1.49	0.047	0.02
Lake Poinsett	25-May-94	1200	3	Grab	Surface	18	16	7.8	8.51	NA	70	183	894	889	5	0.02	0.00200	9.986274	9.46	0.1	1.36	1.34	1.46	0.03	0.01
Lake Poinsett	19-Jun-94	1030	3	Grab	Surface	21	24	7.6	8.23	NA	260	183	1001	984	17	0.02	0.00135	6.765019	9.37	0.1	1.44	1.42	1.54	0.126	0.04
Lake Poinsett	06-Jul-94	1225	3	Grab	Surface	22	26	16.4	8.77	NA	10	170	970	946	24	0.02	0.00426	21.28914	9.34	0.1	3.02	3	3.12	0.166	0.02
Lake Poinsett	09-Aug-94	1015	3	Grab	Surface	18	12	4.6	8.47	NA	10	167	1141	1109	32	0.19	0.01746	9.188326	9.46	0.2	2.82	2.63	3.02	0.223	0.13
Lake Poinsett	13-Sep-94	1320	3	Grab	Surface	21	25	7.2	8.94	NA	10	178	951	927	24	0.02	0.00542	27.1204	9.37	0.1	2.21	2.19	2.31	0.193	0.1
					median	17.75	18.5	8.05	8.615	0	10	184.5	960.5	942	10.5	0.02	0.002606	9.770607	9.472967	0.1	1.6	1.58	1.7	0.083	0.03

Column 1

	WTEMP	ATEMP	DISOX	FPH	LABPH	FECAL	TALKAL	TSOL	TDSOL	TSSOL	AMMO	UNIONIZ AMMONI	PERCEN UNIONIZ	PKA	NO3+2	TKN-N	ORGANI NITROGE	TOTAL NITROGE	TPO4P	TOTAL DISS. PO.
Mean	15.5	16.938	8.90313	8.6194	1.588125	48	190.644	973.69	959.75	13.938	0.0419	0.00696	13.44926	9.550485	0.10625	1.7788	1.736875	1.885	0.1	0.04487
Standard Error	1.59755	2.4924	0.80357	0.0819	0.853639	20.61149	5.34433	20.435	19.192	2.0361	0.0125	0.003605	2.937406	0.053006	0.00625	0.1494	0.145062	0.152398	0.01316	0.008447
Median	17.75	18.5	8.05	8.615	0	10	184.5	960.5	942	10.5	0.02	0.002606	9.770607	9.472967	0.1	1.6	1.58	1.7	0.083	0.03
Mode	18	5	NA	NA	0	10	183	NA	NA	10	0.02	NA	NA	9.36931	0.1	1.03	NA	1.13	0.07	0.02
Standard Deviation	6.3902	9.9697	3.21426	0.3278	3.414556	82.44594	21.3773	81.738	76.768	8.1443	0.0501	0.014421	11.74962	0.212023	0.025	0.5976	0.58025	0.60959	0.05265	0.033789
Variance	40.8347	99.396	10.3315	0.1074	11.65919	6797.333	456.991	6681.2	5893.4	66.329	0.0025	0.000208	138.0536	0.044954	0.000625	0.3571	0.33669	0.3716	0.00277	0.001141
Kurtosis	-0.87104	-1.2891	0.97092	0.8313	1.287786	4.284838	1.49686	1.6344	1.6607	-0.0658	4.724	13.13097	5.152495	-0.78868	16	0.0968	0.221321	0.126779	0.95217	3.489531
Skewness	-0.61346	-0.1659	1.05229	-0.274	1.772395	2.338294	1.29643	1.3725	1.3561	0.7666	2.2951	3.551528	2.066836	0.665024	4	0.9696	0.866547	0.998457	1.21721	2.032209
Range	21	32	11.8	1.38	8.55	250	75.3	286	276	30	0.17	0.058355	46.2766	0.698388	0.1	1.99	2.09	1.99	0.193	0.1
Minimum	3	0	4.6	7.88	0	10	164	882	871	2	0.02	0.000565	2.822937	9.275644	0.1	1.03	0.91	1.13	0.03	0.01
Maximum	24	32	16.4	9.26	8.55	260	239.3	1168	1147	32	0.19	0.058919	49.09954	9.974032	0.2	3.02	3	3.12	0.223	0.13
Sum	248	271	142.45	137.91	25.41	768	3050.3	15579	15356	223	0.67	0.111367	215.1881	152.8078	1.7	28.46	27.79	30.16	1.6	0.71
Count	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	1
Confidence Level(0.	3.13114	4.8851	1.57496	0.1606	1.673101	40.39777	10.4747	40.051	37.616	3.9906	0.0245	0.007066	5.757209	0.103889	0.01225	0.2928	0.284317	0.298694	0.0258	0.016556

SAMPLE DATA FOR LAKE POINSETT FOR 1993-94
Site - 4,5,and6 INLAKE SITES FOR LAKE POINSETT

WTEMP AND ATEMP IN CELSIUS
FECAL COLIFORM colonies/100ml and ph in su's
ALL OTHER PARAMETERS IN mg/l

TPO4P=TOTAL PHOSPHORUS
TDPO4P=TOTAL DISSOLVED PHOSPHORUS
SECCHI IN FEET

PROJECT	DATE	TIME	SITE	SAMP	DEPTH	SECCHI FEET	WTEMP C	ATEMP C	DISOX mg/L	FPH su	FECAL /100ml	TALKAL mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMON mg/L	UNIONIZ AMMON mg/L	NO3+2 mg/L	TKN-N mg/L	ORGANI NITROGE mg/L	TOTAL NITROG mg/L	TPO4P mg/L	TOTAL DISS.PO4P mg/L
Lake Poinsett	15-Jun-93	1410	4	Grab	BOTTOM	NA	17.00	16.25	7.20	8.20	10	227.6	1045	1034	11	0.02	0.0010	0.10	1.54	1.52	1.64	0.066	0.027
Lake Poinsett	30-Jun-93	925	4	Grab	BOTTOM	NA	18.00	17.00	6.30	8.26	10	207.6	1027	967	60	0.02	0.0012	0.10	1.67	1.65	1.77	0.093	0.037
Lake Poinsett	20-Jul-93	1200	4	Grab	BOTTOM	NA	21.00	26.50	5.80	8.75	10	207	1011	1003	8	0.02	0.0039	0.10	1.32	1.30	1.42	0.056	0.013
Lake Poinsett	04-Aug-93	855	4	Grab	BOTTOM	NA	20.10	16.00	6.20	8.78	10	192	1134	1028	106	0.02	0.0039	0.10	2.43	2.41	2.53	0.203	0.030
Lake Poinsett	16-Aug-93	830	4	Grab	BOTTOM	NA	22.00	23.00	6.30	8.01	10	193	947	922	25	0.02	0.0009	0.10	1.54	1.52	1.64	0.066	0.030
Lake Poinsett	31-Aug-93	820	4	Grab	BOTTOM	NA	20.50	13.00	5.80	8.61	10	193	1008	980	28	0.04	0.0057	0.10	1.61	1.57	1.71	0.166	0.040
Lake Poinsett	22-Sep-93	920	4	Grab	BOTTOM	NA	13.10	13.00	8.00	9.01	10	100	935	910	25	0.02	0.0039	0.10	1.70	1.68	1.80	0.073	0.027
Lake Poinsett	04-Oct-93	1120	4	Grab	BOTTOM	NA	11.00	12.00	9.75	8.97	10	160	900	875	25	0.02	0.0032	0.10	1.72	1.70	1.82	0.103	0.020
Lake Poinsett	19-Oct-93	1020	4	Grab	BOTTOM	NA	9.00	12.00	7.40	8.49	10	168	920	917	3	0.04	0.0020	0.10	1.56	1.52	1.66	0.070	0.037
Lake Poinsett	02-Nov-93	1120	4	Grab	BOTTOM	NA	2.80	6.00	9.30	7.95	10	184	939	931	8	0.15	0.0014	0.10	1.73	1.58	1.83	0.123	0.058
Lake Poinsett	04-Jan-94	1255	4	Grab	BOTTOM	NA	1.50	10.00	6.40	7.02	10	188	977	974	3	0.2	0.0002	0.20	1.75	1.55	1.95	0.086	0.076
Lake Poinsett	01-Mar-94	1350	4	Grab	BOTTOM	NA	2.00	1.00	8.00	8.07	10	211	1063	1061	2	0.28	0.0032	0.20	1.91	1.63	2.11	0.097	0.097
Lake Poinsett	04-May-94	1055	4	Grab	BOTTOM	NA	8.10	11.00	11.20	8.55	10	186	883	875	8	0.02	0.0011	0.10	1.48	1.46	1.58	0.033	0.023
Lake Poinsett	23-May-94	935	4	Grab	BOTTOM	NA	19.00	22.00	9.10	8.73	10	183	894	882	12	0.02	0.0033	0.10	1.78	1.76	1.88	0.087	0.023
Lake Poinsett	13-Jun-94	840	4	Grab	BOTTOM	NA	18.00	18.00	3.80	7.73	10	191	1001	998	3	0.1	0.0018	0.10	1.31	1.21	1.41	0.093	0.067
Lake Poinsett	29-Jun-94	820	4	Grab	BOTTOM	NA	20.00	18.00	7.40	8.66	10	185	939	930	9	0.02	0.0031	0.10	2.07	2.05	2.17	0.113	0.050
Lake Poinsett	13-Jul-94	815	4	Grab	BOTTOM	NA	22.00	NA	NA	8.75	10	177	904	890	14	0.02	0.0041	0.10	3.19	3.17	3.29	0.146	0.043
Lake Poinsett	25-Jul-94	810	4	Grab	BOTTOM	NA	22.00	18.00	7.00	8.68	NA	178	1284	1277	7	0.06	0.0108	0.10	1.83	1.77	1.93	0.100	0.057
Lake Poinsett	15-Aug-94	805	4	Grab	BOTTOM	NA	18.50	15.00	3.60	8.27	10	171	964	955	9	0.53	0.0329	0.10	2.22	1.69	2.32	0.213	0.153
Lake Poinsett	20-Sep-94	1120	4	Grab	BOTTOM	NA	19.00	26.00	7.80	8.68	10	177	928	905	23	0.02	0.0030	0.10	1.91	1.89	2.01	0.193	0.110
Lake Poinsett	15-Jun-93	1400	4	Grab	SURFACE	3.68	17.50	16.25	8.80	7.64	10	236.8	1049	1039	10	0.02	0.0003	0.10	1.48	1.46	1.58	0.063	0.023
Lake Poinsett	30-Jun-93	850	4	Grab	SURFACE	7.08	18.00	17.00	7.00	8.44	10	210.9	965	963	2	0.02	0.0017	0.10	1.60	1.58	1.70	0.053	0.033
Lake Poinsett	20-Jul-93	1200	4	Grab	SURFACE	4.75	25.50	26.50	8.40	8.55	10	199	1018	1011	7	0.02	0.0035	0.10	2.03	2.01	2.13	0.060	0.030
Lake Poinsett	04-Aug-93	855	4	Grab	SURFACE	2.33	20.10	16.00	6.80	8.62	10	204	1048	1026	22	0.02	0.0029	0.10	3.17	3.15	3.27	0.143	0.027
Lake Poinsett	16-Aug-93	815	4	Grab	SURFACE	6.67	22.00	23.00	6.20	8.21	10	194	926	920	6	0.02	0.0014	0.10	1.84	1.82	1.94	0.056	0.037
Lake Poinsett	31-Aug-93	810	4	Grab	SURFACE	3.75	20.00	13.00	6.60	8.48	10	197	992	983	9	0.02	0.0021	0.10	1.00	0.98	1.10	0.123	0.053
Lake Poinsett	22-Sep-93	900	4	Grab	SURFACE	3.17	13.00	13.00	9.80	9.15	100	184	943	927	16	0.02	0.0050	0.10	2.06	2.04	2.16	0.103	0.027
Lake Poinsett	04-Oct-93	1100	4	Grab	SURFACE	3.58	11.00	12.00	11.00	9.06	10	160	909	885	24	0.02	0.0038	0.10	1.58	1.56	1.68	0.066	0.017
Lake Poinsett	19-Oct-93	1005	4	Grab	SURFACE	10.00	9.00	12.00	9.00	8.58	20	168	927	919	8	0.05	0.0031	0.10	2.28	2.23	2.38	0.093	0.037
Lake Poinsett	02-Nov-93	1100	4	Grab	SURFACE	14.00	2.50	5.00	10.40	8.14	10	184	930	926	4	0.17	0.0024	0.10	1.77	1.60	1.87	0.063	0.110
Lake Poinsett	04-Jan-94	1230	4	Grab	SURFACE	17.00	-1.00	10.00	6.80	6.99	10	192	999	997	2	0.19	0.0001	0.20	1.83	1.64	2.03	0.073	0.073
Lake Poinsett	01-Mar-94	1325	4	Grab	SURFACE	10.00	0.00	1.00	9.20	7.63	10	216	1079	1078	1	0.28	0.0010	0.20	2.12	1.84	2.32	0.100	0.136
Lake Poinsett	04-May-94	1045	4	Grab	SURFACE	9.00	8.10	11.00	11.40	8.68	10	183	884	879	5	0.02	0.0014	0.10	1.37	1.35	1.47	0.030	0.023
Lake Poinsett	23-May-94	925	4	Grab	SURFACE	10.00	19.00	22.00	9.40	8.71	10	178.5	893	891	2	0.02	0.0032	0.10	1.26	1.24	1.36	0.030	0.020
Lake Poinsett	13-Jun-94	830	4	Grab	SURFACE	5.33	18.00	18.00	4.40	7.80		187	960	953	7	0.03	0.0006	0.10	1.69	1.66	1.79	0.106	0.057
Lake Poinsett	29-Jun-94	815	4	Grab	SURFACE	3.92	20.00	18.00	7.80	8.52	10	187	935	924	11	0.02	0.0023	0.10	2.14	2.12	2.24	0.110	0.070
Lake Poinsett	13-Jul-94	805	4	Grab	SURFACE	2.33	22.00	NA		8.89	10	173	909	876	33	0.02	0.0053	0.10	4.19	4.17	4.29	0.200	0.040
Lake Poinsett	25-Jul-94	800	4	Grab	SURFACE	5.58	22.00	18.00	7.00	8.68	10	174	1218	1211	7	0.06	0.0108	0.10	1.80	1.74	1.90	0.083	0.053
Lake Poinsett	15-Aug-94	755	4	Grab	SURFACE	4.58	18.00	15.00	4.00	8.21	10	174	959	953	6	0.53	0.0279	0.10	2.41	1.88	2.51	0.190	0.153
Lake Poinsett	20-Sep-94	1115	4	Grab	SURFACE	2.75	20.00	26.00	8.40	8.69	10	178	928	905	23	0.02	0.0033	0.10	1.94	1.92	2.04	0.160	0.100
					Statistics																		
					Mean	6.48	15.23	14.66	7.40	8.40	12.31	186.49	979.35	964.50	14.85	0.08	0.00	0.11	1.90	1.82	2.01	0.10	0.05
					Standard Error	0.90	1.15	1.12	0.36	0.08	2.31	3.46	13.72	13.54	2.96	0.02	0.00	0.00	0.09	0.09	0.09	0.01	0.01
					Median	5.04	18.00	15.50	7.30	8.55	10.00	185.50	953.00	942.00	8.50	0.02	0.00	0.10	1.78	1.67	1.89	0.09	0.04
					Mode	10.00	22.00	18.00	7.00	8.68	10.00	184.00	909.00	875.00	2.00	0.02	0.01	0.10	1.48	1.52	1.58	0.07	0.02
					Standard Deviati	4.04	7.30	7.07	2.30	0.50	14.59	21.89	86.78	85.62	18.72	0.13	0.01	0.03	0.58	0.57	0.58	0.05	0.04
					Variance	16.28	53.33	50.05	5.29	0.25	212.96	479.20	7530.39	7331.13	350.54	0.02	0.00	0.00	0.33	0.33	0.33	0.00	0.00
					Kurtosis	1.13	-0.32	-0.06	1.65	1.31	36.96	5.69	3.67	4.56	14.68	6.83	13.18	5.98	6.13	7.30	5.92	-0.11	1.25
					Skewness	1.26	-0.96	-0.37	-0.97	-1.16	5.96	-1.11	1.75	1.87	3.45	2.63	3.57	2.77	2.09	2.39	2.03	0.80	1.40
					Range	14.67	26.50	26.50	11.40	2.16	100.00	136.80	401.00	402.00	105.00	0.51	0.03	0.10	3.19	3.19	3.19	0.18	0.14
					Minimum	2.33	-1.00	0.00	0.00	6.99	0.00	100.00	883.00	875.00	1.00	0.02	0.00	0.10	1.00	0.98	1.10	0.03	0.01
					Maximum	17.00	25.50	26.50	11.40	9.15	100.00	236.80	1284.00	1277.00	106.00	0.53	0.03	0.20	4.19	4.17	4.29	0.21	0.15
					Sum	129.51	609.30	586.50	288.75	335.84	480.00	7459.40	39174.00	38580.00	594.00	3.21	0.17	4.40	75.83	72.62	80.23	4.09	2.14
					Count	20.00	40.00	40.00	39.00	40.00	39.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
					Confidence Leve	1.77	2.26	2.19	0.72	0.15	4.58	6.78	26.89	26.53	5.80	0.04	0.00	0.01	0.18	0.18	0.18	0.02	0.01

SAMPLE DATA FOR LAKE POINSETT FOR 1993-94
Site - 4,5,and6 INLAKE SITES FOR LAKE POINSETT

WTEMP AND ATEMP IN CELSIUS
FECAL COLIFORM colonies/100ml and ph in su's
ALL OTHER PARAMETERS IN mg/l

TPO4P=TOTAL PHOSPHORUS
TDPO4P=TOTAL DISSOLVED PHOSPHORUS
SECCHI IN FEET

PROJECT	DATE	TIME	SITE	SAMP	DEPTH	SECCHI FEET	WTEMP C	ATEMP C	DISOX mg/L	FPH su	FECAL /100ml	TALKAL mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMON mg/L	UNIONIZ AMMON mg/L	NO3+2 mg/L	TKN-N mg/L	ORGANI NITROGE mg/L	TOTAL NITROG mg/L	TPO4P mg/L	TOTAL DISS.PO4P mg/L
Lake Poinsett	15-Jun-93	1435	5	Grab	BOTTOM	NA	17.00	20.00	8.50	9.25	10	232.4	1065	1052	13	0.02	0.0072	0.10	1.44	1.42	1.54	0.056	0.023
Lake Poinsett	30-Jun-93	1015	5	Grab	BOTTOM	NA	18.00	16.50	6.75	8.16	10	219.3	1011	1003	8	0.02	0.0009	0.10	1.62	1.60	1.72	0.093	0.033
Lake Poinsett	20-Jul-93	1305	5	Grab	BOTTOM	NA	22.20	30.00	9.30	8.50	10	202	1047	1000	47	0.02	0.0026	0.10	1.41	1.39	1.51	0.080	0.027
Lake Poinsett	04-Aug-93	925	5	Grab	BOTTOM	NA	20.10	19.00	5.50	8.40	10	196	1037	1013	24	0.02	0.0018	0.10	1.78	1.76	1.88	0.113	0.033
Lake Poinsett	16-Aug-93	900	5	Grab	BOTTOM	NA	24.00	24.00	6.00	7.96	20	199	947	920	27	0.02	0.0009	0.10	1.59	1.57	1.69	0.090	0.037
Lake Poinsett	31-Aug-93	910	5	Grab	BOTTOM	NA	20.50	13.00	6.50	8.29	10	197	1022	986	36	0.07	0.0052	0.10	2.11	2.04	2.21	2.060	0.066
Lake Poinsett	22-Sep-93	945	5	Grab	BOTTOM	NA	13.20	13.10	9.20	9.01	10	184	941	920	21	0.02	0.0039	0.10	1.92	1.90	2.02	0.066	0.060
Lake Poinsett	04-Oct-93	1200	5	Grab	BOTTOM	NA	11.00	13.00	8.50	9.15	10	160	907	887	20	0.02	0.0044	0.10	1.09	1.07	1.19	0.060	0.023
Lake Poinsett	19-Oct-93	1055	5	Grab	BOTTOM	NA	9.00	11.00	7.60	8.77	10	160	928	924	4	0.04	0.0037	0.10	1.48	1.44	1.58	0.056	0.030
Lake Poinsett	02-Nov-93	1200	5	Grab	BOTTOM	NA	3.00	6.00	10.00	8.75	10	184	939	928	11	0.18	0.0101	0.10	1.86	1.68	1.96	0.066	0.050
Lake Poinsett	04-Jan-94	1355	5	Grab	BOTTOM	NA	1.00	9.00	7.80		10	189	987	974	13	0.17	0.0000	0.20	2.12	1.95	2.32	0.110	0.076
Lake Poinsett	01-Mar-94	1310	5	Grab	BOTTOM	NA	17.00	-1.00	6.00	7.80	10	212	1046	1037	9	0.31	0.0061	0.20	2.04	1.73	2.24	0.106	0.166
Lake Poinsett	04-May-94	1030	5	Grab	BOTTOM	NA	8.10	11.00	11.40	8.45	10	183	900	888	12	0.09	0.0039	0.10	1.73	1.64	1.83	0.063	0.027
Lake Poinsett	23-May-94	1015	5	Grab	BOTTOM	NA	19.00	19.00	9.20	8.77	10	180	892	888	4	0.02	0.0036	0.10	1.44	1.42	1.54	0.037	0.033
Lake Poinsett	13-Jun-94	900	5	Grab	BOTTOM	NA	18.00	18.00	4.20	8.33	10	214	962	947	15	0.03	0.0020	0.10	1.43	1.40	1.53	0.090	0.060
Lake Poinsett	29-Jun-94	850	5	Grab	BOTTOM	NA	20.00	19.00	7.20	8.63	10	185	926	919	7	0.05	0.0072	0.10	1.90	1.85	2.00	0.090	0.053
Lake Poinsett	13-Jul-94	835	5	Grab	BOTTOM	NA	22.00	21.00	NA	8.73	10	180	912	908	4	0.02	0.0040	0.10	2.56	2.54	2.66	0.116	0.037
Lake Poinsett	25-Jul-94	830	5	Grab	BOTTOM	NA	22.00	18.00	6.75	8.51	10	179	1212	1204	8	0.08	0.0104	0.10	1.84	1.76	1.94	0.090	0.060
Lake Poinsett	15-Aug-94	750	5	Grab	BOTTOM	NA	18.50	14.00	3.30	8.26	10	172	965	953	12	0.52	0.0316	0.10	2.27	1.75	2.37	0.183	0.180
Lake Poinsett	20-Sep-94	1135	5	Grab	BOTTOM	NA	18.00	25.00	8.56	7.00	10	176	919	898	21	0.025	0.0001	0.10	1.73	1.71	1.83	0.146	0.093
Lake Poinsett	15-Jun-93	1425	5	Grab	SURFACE	8.23	17.50	20.00	9.00	8.45	10	248	1043	1036	7	0.02	0.0017	0.10	1.53	1.51	1.63	0.046	0.023
Lake Poinsett	30-Jun-93	955	5	Grab	SURFACE	7.92	18.00	16.50	7.20	8.25	10	221.9	1002	999	3	0.02	0.0011	0.10	1.45	1.43	1.55	0.063	0.043
Lake Poinsett	20-Jul-93	1305	5	Grab	SURFACE	3.96	27.50	30.00	7.00	8.60	10	210	1047	1029	18	0.02	0.0043	0.10	3.79	3.77	3.89	0.143	0.023
Lake Poinsett	04-Aug-93	915	5	Grab	SURFACE	3.17	20.00	19.00	6.70	8.31	10	202	1040	1027	13	0.02	0.0015	0.10	2.21	2.19	2.31	0.086	0.030
Lake Poinsett	16-Aug-93	845	5	Grab	SURFACE	5.33	22.00	24.00	7.40	8.17	20	194	937	934	3	0.02	0.0013	0.10	1.79	1.77	1.89	0.060	0.030
Lake Poinsett	31-Aug-93	850	5	Grab	SURFACE	3.92	20.00	13.00	6.60	8.24	10	197	993	986	7	0.06	0.0039	0.10	1.85	1.79	1.95	0.129	0.046
Lake Poinsett	22-Sep-93	935	5	Grab	SURFACE	3.58	13.10	13.10	9.60	8.93	10	102	932	913	19	0.02	0.0034	0.10	2.08	2.06	2.18	0.086	0.060
Lake Poinsett	04-Oct-93	1145	5	Grab	SURFACE	3.58	11.00	13.00	11.00	8.93	10	160	921	905	16	0.02	0.0029	0.10	1.55	1.53	1.65	0.070	0.023
Lake Poinsett	19-Oct-93	1035	5	Grab	SURFACE	10.33	9.00	11.00	8.60	8.63	10	168	932	925	7	0.05	0.0034	0.10	2.11	2.06	2.21	0.083	0.040
Lake Poinsett	04-Nov-93	1145	5	Grab	SURFACE	14.00	3.00	6.00	10.20	8.62	10	162	930	926	4	0.25	0.0106	0.25	1.75	1.50	2.00	0.066	0.040
Lake Poinsett	04-Jan-94	1320	5	Grab	SURFACE	17.00	-1.00	9.00	11.80		10	194	1001	999	2	0.19	0.0000	0.10	2.53	2.34	2.63	0.090	0.083
Lake Poinsett	01-Mar-94	1300	5	Grab	SURFACE	10.00	0.00	-1.00	8.20	7.95	10	211	1072	1070	2	0.34	0.0025	0.20	2.41	2.07	2.61	0.110	0.123
Lake Poinsett	04-May-94	1020	5	Grab	SURFACE	9.00	8.10	11.00	11.80	8.47	NA	183	894	885	9	0.02	0.0009	0.10	1.33	1.31	1.43	0.043	0.060
Lake Poinsett	23-May-94	1005	5	Grab	SURFACE	11.00	19.00	19.00	9.30	8.74	10	185	891	888	3	0.02	0.0034	0.10	1.61	1.59	1.71	0.030	0.027
Lake Poinsett	13-Jun-94	845	5	Grab	SURFACE	6.42	18.00	18.00	4.60	8.29	10	188	953	947	6	0.03	0.0019	0.10	1.60	1.57	1.70	0.093	0.057
Lake Poinsett	29-Jun-94	840	5	Grab	SURFACE	3.75	20.00	19.00	8.20	8.61	10	181	932	924	8	0.06	0.0084	0.10	1.44	1.38	1.54	0.093	0.070
Lake Poinsett	13-Jul-94	825	5	Grab	SURFACE	2.67	22.00	21.00	NA	8.63	10	180	912	899	13	0.02	0.0033	0.10	3.71	3.69	3.81	0.170	0.027
Lake Poinsett	25-Jul-94	825	5	Grab	SURFACE	5.33	22.00	18.00	6.50	8.49	10	176	1209	1202	7	0.08	0.0099	0.10	1.81	1.73	1.91	0.100	0.063
Lake Poinsett	15-Aug-94	740	5	Grab	SURFACE	5.08	18.00	14.00	3.80	8.08	10	180	957	948	9	0.52	0.0206	0.10	2.67	2.15	2.77	0.190	0.163
Lake Poinsett	20-Sep-94	1130	5	Grab	SURFACE	2.75	20.00	25.00	8.00	8.60	10	179	925	910	15	0.02	0.0027	0.10	1.59	1.57	1.69	0.133	0.110

Column 1

	SECCHI	WTEMP	ATEMP	DISOX	FPH	FECAL	TALKAL	TSOL	TDSOL	TSSOL	AMMON	UNIONIZ AMMON	NO3+2	TKN-N	ORGANI NITROGE	TOTAL NITROG	TPO4P	TOTAL DISS.PO4P
Mean	6.85	15.72	15.93	7.44	8.47	10.25	188.64	977.20	965.03	12.18	0.09	0.00	0.11	1.90	1.82	2.02	0.14	0.06
Standard Error	0.90	1.13	1.10	0.42	0.06	0.44	3.76	12.06	12.04	1.49	0.02	0.00	0.01	0.09	0.08	0.09	0.05	0.01
Median	5.33	18.00	17.25	7.70	8.48	10.00	184.50	950.00	940.50	9.00	0.02	0.00	0.10	1.79	1.72	1.90	0.09	0.04
Mode	3.58	18.00	19.00	0.00	8.63	10.00	180.00	932.00	888.00	7.00	0.02	NA	0.10	1.44	1.57	1.54	0.09	0.02
Standard Deviation	4.01	7.12	6.93	2.68	0.41	2.76	23.78	76.28	76.13	9.41	0.13	0.01	0.03	0.56	0.54	0.56	0.31	0.04
Variance	16.04	50.72	47.98	7.16	0.16	7.63	565.54	5818.06	5796.18	88.56	0.02	0.00	0.00	0.31	0.29	0.32	0.10	0.00
Kurtosis	0.69	0.09	0.58	1.50	15.59	11.72	4.06	2.51	2.97	4.18	5.09	11.50	8.02	4.35	6.80	4.01	38.78	2.77
Skewness	1.11	-0.98	-0.35	-0.94	-4.00	0.99	-0.66	1.48	1.59	1.79	2.35	3.06	3.00	1.86	2.36	1.78	6.18	1.78
Range	14.33	28.50	31.00	11.80	9.25	20.00	146.00	321.00	319.00	45.00	0.50	0.03	0.15	2.70	2.70	2.70	2.03	0.16
Minimum	2.67	-1.00	-1.00	0.00	7.00	0.00	102.00	891.00	885.00	2.00	0.02	0.00	0.10	1.09	1.07	1.19	0.03	0.02
Maximum	17.00	27.50	30.00	11.80	9.25	20.00	248.00	1212.00	1204.00	47.00	0.52	0.03	0.25	3.79	3.77	3.89	2.06	0.18
Sum	137.02	628.80	637.20	297.76	321.71	410.00	7545.60	39088.00	38601.00	487.00	3.55	0.20	4.45	76.17	72.63	80.62	5.68	2.31
Count	20.00	40.00	40.00	40.00	38.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Confidence Level(0.	1.76	2.21	2.15	0.83	0.13	0.86	7.37	23.64	23.59	2.92	0.04	0.00	0.01	0.17	0.17	0.17	0.10	0.01

SAMPLE DATA FOR LAKE POINSETT FOR 1993-94
Site - 4,5,and6 INLAKE SITES FOR LAKE POINSETT

WTEMP AND ATEMP IN CELSIUS
FECAL COLIFORM colonies/100ml and ph in su's
ALL OTHER PARAMETERS IN mg/l

TPO4P=TOTAL PHOSPHORUS
TDPO4P=TOTAL DISSOLVED PHOSPHORUS
SECCHI IN FEET

PROJECT	DATE	TIME	SITE	SAMP	DEPTH	SECCHI FEET	WTEMP C	ATEMP C	DISOX mg/L	FPH su	FECAL /100ml	TALKAL mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMON mg/L	UNIONIZ AMMON mg/L	NO3+2 mg/L	TKN-N mg/L	ORGANI NITROGE mg/L	TOTAL NITROG mg/L	TPO4P mg/L	TOTAL DISS.PO4P mg/L
Lake Poinsett	15-Jun-93	1455	6	Grab	BOTTOM	NA	16.60	24.00	8.00	8.02	10	197	1065	1060	5	0.02	0.0006	0.10	1.43	1.41	1.53	0.060	0.033
Lake Poinsett	30-Jun-93	1055	6	Grab	BOTTOM	NA	18.20	15.80	5.90	8.18	10	223.9	1009	944	65	0.02	0.0010	0.10	2.05	2.03	2.15	0.100	0.033
Lake Poinsett	20-Jul-93	1400	6	Grab	BOTTOM	NA	21.10	31.00	4.90	7.34	10	200	1009	877	132	0.02	0.0002	0.10	1.50	1.48	1.60	0.143	0.017
Lake Poinsett	04-Aug-93	950	6	Grab	BOTTOM	NA	20.20	18.00	4.50	8.07	10	204	1009	986	23	0.02	0.0009	0.10	1.57	1.55	1.67	0.093	0.023
Lake Poinsett	16-Aug-93	935	6	Grab	BOTTOM	NA	22.00	24.00	6.40	8.10	10	194	1009	967	42	0.02	0.0011	0.10	1.65	1.63	1.75	0.100	0.030
Lake Poinsett	31-Aug-93	930	6	Grab	BOTTOM	NA	20.50	16.00	5.80	7.88	10	100	1029	988	41	0.09	0.0027	0.10	1.79	1.70	1.89	0.129	0.043
Lake Poinsett	22-Sep-93	1010	6	Grab	BOTTOM	NA	13.20	14.00	9.00	8.92	10	188	938	921	17	0.02	0.0033	0.10	4.66	4.64	4.76	0.106	0.023
Lake Poinsett	04-Oct-93	1230	6	Grab	BOTTOM	NA	11.00	17.00	8.50	8.76	10	164	938	902	36	0.02	0.0021	0.10	1.19	1.17	1.29	0.100	0.020
Lake Poinsett	19-Oct-93	1120	6	Grab	BOTTOM	NA	8.90	13.00	7.90	8.58	10	164	928	925	3	0.02	0.0012	0.10	1.68	1.66	1.78	0.053	0.030
Lake Poinsett	02-Nov-93	1230	6	Grab	BOTTOM	NA	3.20	6.50	9.30	8.04	10	182	933	928	5	0.02	0.0002	0.10	1.70	1.68	1.80	0.080	0.043
Lake Poinsett	05-Jan-94	1535	6	Grab	BOTTOM	NA	2.00	8.00	8.00		10	190	958	954	4	0.19	0.0000	0.10	1.81	1.62	1.91	0.083	0.060
Lake Poinsett	01-Mar-94	1250	6	Grab	BOTTOM	NA	2.00	0.00	5.20	7.45	10	217	1076	1068	8	0.25	0.0007	0.30	2.00	1.75	2.30	0.103	0.170
Lake Poinsett	04-May-94	950	6	Grab	BOTTOM	NA	8.20	10.00	11.60	8.36	10	181	887	882	5	0.02	0.0007	0.10	1.46	1.44	1.56	0.040	0.023
Lake Poinsett	23-May-94	1040	6	Grab	BOTTOM	NA	19.00	24.00	9.00	8.65	10	181	893	890	3	0.02	0.0028	0.10	1.27	1.25	1.37	0.033	0.020
Lake Poinsett	13-Jun-94	915	6	Grab	BOTTOM	NA	18.00	17.00	4.20	8.33	10	183	964	959	5	0.06	0.0041	0.10	1.38	1.32	1.48	0.066	0.060
Lake Poinsett	29-Jun-94	910	6	Grab	BOTTOM	NA	20.00	21.00	6.30	8.74	10	187	930	902	28	0.02	0.0036	0.10	2.10	2.08	2.20	0.136	0.040
Lake Poinsett	13-Jul-94	850	6	Grab	BOTTOM	NA	22.00	21.00	NA	8.47	10	184	915	907	8	0.16	0.0191	0.10	1.82	1.66	1.92	0.067	0.053
Lake Poinsett	25-Jul-94	840	6	Grab	BOTTOM	NA	22.00	18.00	6.80	8.54	10	179.8	1219	1204	15	0.1	0.0137	0.10	2.09	1.99	2.19	0.106	0.057
Lake Poinsett	15-Aug-94	735	6	Grab	BOTTOM	NA	19.00	14.00	3.50	7.11	10	178	950	938	12	0.53	0.0025	0.10	2.97	2.44	3.07	0.193	0.150
Lake Poinsett	20-Sep-94	1155	6	Grab	BOTTOM	NA	19.00	26.00	6.50	8.60	NA	177	931	915	16	0.02	0.0026	0.10	1.57	1.55	1.67	0.146	0.100
Lake Poinsett	15-Jun-93	1445	6	Grab	SURFACE	7.13	17.50	24.00	9.45	8.23	10	236.8	1047	1042	5	0.02	0.0011	0.10	1.40	1.38	1.50	0.043	0.037
Lake Poinsett	30-Jun-93	1030	6	Grab	SURFACE	8.50	18.50	15.80	6.60	8.29	10	218.1	1009	1006	3	0.02	0.0013	0.10	1.64	1.62	1.74	0.056	0.037
Lake Poinsett	20-Jul-93	1400	6	Grab	SURFACE	7.13	24.00	31.00	8.80	8.32	10	208	1009	999	10	0.02	0.0020	0.10	2.84	2.82	2.94	0.110	0.046
Lake Poinsett	04-Aug-93	940	6	Grab	SURFACE	3.17	20.00	18.00	6.60	7.96	10	203	1009	998	11	0.02	0.0007	0.10	2.18	2.16	2.28	0.083	0.027
Lake Poinsett	16-Aug-93	920	6	Grab	SURFACE	5.33	24.00	24.00	6.80	7.14	10	194	1009	1005	4	0.02	0.0001	0.10	1.78	1.76	1.88	0.066	0.030
Lake Poinsett	31-Aug-93	920	6	Grab	SURFACE	3.92	20.00	16.00	6.70	7.93	10	194	1001	996	5	0.09	0.0029	0.10	2.00	1.91	2.10	0.126	0.050
Lake Poinsett	22-Sep-93	1000	6	Grab	SURFACE	3.25	13.20	14.00	9.50	8.95	10	172	940	923	17	0.02	0.0035	0.10	5.06	5.04	5.16	0.116	0.027
Lake Poinsett	04-Oct-93	1220	6	Grab	SURFACE	3.33	11.50	17.00	10.75	8.90	10	160	924	901	23	0.02	0.0029	0.10	2.18	2.16	2.26	0.090	0.020
Lake Poinsett	19-Oct-93	1100	6	Grab	SURFACE	10.00	9.00	13.00	8.80	8.49	10	168	931	928	3	0.11	0.0056	0.10	1.60	1.49	1.70	0.063	0.031
Lake Poinsett	02-Nov-93	1220	6	Grab	SURFACE	14.50	3.50	6.50	10.00	8.52	10	184	925	922	3	0.02	0.0007	0.10	1.70	1.68	1.80	0.060	0.046
Lake Poinsett	04-Jan-94	1520	6	Grab	SURFACE	15.00	-1.00	8.00	11.00		10	192	1002	997	5	0.2	0.0000	0.10	2.07	1.87	2.17	0.093	0.070
Lake Poinsett	01-Mar-94	1220	6	Grab	SURFACE	9.00	0.00	0.00	9.00	8.12	10	212	1067	1065	2	0.34	0.0037	0.20	2.03	1.69	2.23	0.103	0.173
Lake Poinsett	04-May-94	930	6	Grab	SURFACE	10.00	8.20	10.00	11.80	8.24	10	183	894	888	6	0.02	0.0005	0.10	1.44	1.42	1.54	0.040	0.043
Lake Poinsett	23-May-94	1030	6	Grab	SURFACE	11.50	19.00	24.00	9.20	8.77	10	181	889	885	4	0.02	0.0036	0.10	1.50	1.48	1.60	0.027	0.020
Lake Poinsett	13-Jun-94	905	6	Grab	SURFACE	6.33	18.00	17.00	4.40	8.22	10	185	970	966	4	0.05	0.0027	0.10	1.51	1.46	1.61	0.086	0.063
Lake Poinsett	29-Jun-94	900	6	Grab	SURFACE	2.83	20.00	21.00	9.30	8.66	10	185	930	914	16	0.02	0.0031	0.10	2.14	2.12	2.24	0.133	0.053
Lake Poinsett	13-Jul-94	840	6	Grab	SURFACE	9.50	22.00	21.00	NA	8.54	10	179	904	899	5	0.15	0.0208	0.10	1.99	1.84	2.09	0.070	0.057
Lake Poinsett	25-Jul-94	835	6	Grab	SURFACE	4.33	22.00	18.00	6.80	8.52	10	174	1223	1214	9	0.08	0.0106	0.10	1.74	1.66	1.84	0.096	0.053
Lake Poinsett	15-Aug-94	725	6	Grab	SURFACE	5.25	18.00	14.00	4.00	7.27	10	174	984	977	7	0.54	0.0034	0.10	2.96	2.42	3.06	0.220	0.160
Lake Poinsett	20-Sep-94	1150	6	Grab	SURFACE	3.58	19.00	26.00	7.60	8.63	10	174	917	902	15	0.02	0.0027	0.10	1.62	1.60	1.72	0.566	0.107

Statistics

	SECCHI	WTEMP	ATEMP	DISOX	FPH	FECAL	TALKAL	TSOL	TDSOL	TSSOL	AMMON	UNIONIZ AMMON	NO3+2	TKN-N	ORGANI NITROGE	TOTAL NITROG	TPO4P	TOTAL DISS.PO4P
Mean	7.18	15.32	16.92	7.21	8.26	9.75	184.04	979.35	963.60	15.75	0.09	0.00	0.11	1.98	1.89	2.08	0.11	0.05
Standard Error	0.83	1.14	1.15	0.43	0.08	0.25	4.02	12.10	12.30	3.65	0.02	0.00	0.01	0.12	0.12	0.12	0.01	0.01
Median	6.73	18.35	17.00	7.20	8.31	10.00	183.50	961.00	941.00	7.50	0.02	0.00	0.10	1.76	1.67	1.86	0.09	0.04
Mode	10.00	19.00	24.00	9.00	0.00	10.00	174.00	1009.00	902.00	5.00	0.02	NA	0.10	1.50	1.48	1.60	0.10	0.02
Standard Deviation	3.73	7.21	7.24	2.70	0.49	1.58	25.42	76.52	77.77	23.11	0.13	0.00	0.03	0.79	0.77	0.79	0.08	0.04
Variance	13.92	51.98	52.49	7.31	0.24	2.50	646.08	5854.64	6047.73	533.88	0.02	0.00	0.00	0.62	0.59	0.62	0.01	0.00
Kurtosis	-0.34	-0.30	0.16	0.87	14.80	40.00	4.34	3.24	3.25	16.69	6.43	7.26	25.61	8.16	10.36	7.98	22.94	2.52
Skewness	0.71	-0.97	-0.34	-0.75	-3.86	-6.32	-1.32	1.57	1.66	3.73	2.54	2.72	4.98	2.71	3.08	2.66	4.32	1.81
Range	12.17	25.00	31.00	11.80	8.95	10.00	136.80	336.00	337.00	130.00	0.52	0.02	0.20	3.87	3.87	3.87	0.54	0.16
Minimum	2.83	-1.00	0.00	0.00	7.11	0.00	100.00	887.00	877.00	2.00	0.02	0.00	0.10	1.19	1.17	1.29	0.03	0.02
Maximum	15.00	24.00	31.00	11.80	8.95	10.00	236.80	1223.00	1214.00	132.00	0.54	0.02	0.30	5.06	5.04	5.16	0.57	0.17
Sum	143.59	612.70	676.60	288.40	313.84	390.00	7361.60	39174.00	38544.00	630.00	3.44	0.13	4.30	79.07	75.63	83.37	4.20	2.20
Count	20.00	40.00	40.00	40.00	38.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Confidence Level(0.	1.64	2.23	2.25	0.84	0.15	0.49	7.88	23.71	24.10	7.16	0.04	0.00	0.01	0.24	0.24	0.24	0.03	0.01

SAMPLE DATA FOR LAKE POINSETT FOR 1993

Site - 7, LAKE ALBERT WQ DATA

PROJECT	DATE	TIME	SITE	SAMP	DEPTH	SECCHI FEET	WTEMP C	ATEMP C	DISOX mg/L	FPH su	LABPH su	FECAL /100 mL	TALKAL mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMO mg/L	UNIONIZ AMMONI mg/l	PERCEN UNIONIZ	PKA	NO3+2 mg/L	TKN-N mg/L	ORGANI NITROGE mg/L	TOTAL NITROGE mg/L	TPO4P mg/L	TOTAL DISS. PO4 mg/L
Lake Poinsett	02-Jun-93		7	Grab	SURFAC	NA	12.1	12.2	6	7.07	8.58	40	204	945	934	11	0.02	0.00005	0.257103	9.66	0.1	2.02	2	2.12	0.146	0.1
Lake Poinsett	16-Jun-93	1120	7	Grab	SURFAC	NA	17.2	24	5.8	7.77	8.41	230	192	892	872	20	0.05	0.00093	1.866746	9.49	0.3	2.09	2.04	2.39	0.169	0.116
Lake Poinsett	06-Jul-93	1310	7	Grab	SURFAC	NA	20	25	8.9	8.01	8.43	80	183.4	934	911	23	0.02	0.00078	3.906055	9.40	0.1	2.62	2.6	2.72	0.146	0.053
Lake Poinsett	27-Jul-93	1330	7	Grab	SURFAC	NA	22.5	26	3.1	7.94	NA	4000	161	895	889	6	0.2	0.00796	3.982105	9.32	0.1	2.55	2.35	2.65	0.183	0.073
Lake Poinsett	25-Aug-93	1200	7	Grab	SURFAC	NA	25	32	4.4	8.09	NA	70	162	877	866	11	0.3	0.01963	6.54291	9.24	0.1	2.94	2.64	3.04	0.269	0.156
Lake Poinsett	15-Sep-93	1355	7	Grab	SURFAC	NA	13	16	6.9	8.03	NA	10	172	867	862	5	0.18	0.00442	2.457587	9.63	0.1	2.67	2.49	2.77	0.203	0.136
Lake Poinsett	07-Oct-93	1030	7	Grab	SURFAC	NA	11.5	24	5.6	8.37	NA	20	192	910	901	9	0.22	0.01030	4.67998	9.68	0.1	1.56	1.34	1.66	0.159	0.116
Lake Poinsett	26-Oct-93	1310	7	Grab	SURFAC	NA	7	4	5.8	7.69	NA	10	204	888	878	10	0.23	0.00164	0.714416	9.83	0.2	2.76	2.53	2.96	0.146	0.11
Lake Poinsett	13-Apr-94	1215	7	Grab	SURFAC	NA	5	11	16	7.99	NA	10	190	976	960	16	0.02	0.00024	1.207116	9.90	0.1	1.67	1.65	1.77	0.15	0.04
Lake Poinsett	20-Apr-94	1305	7	Grab	SURFAC	NA	10	5	7.6	8.19	NA	10	201	965	937	28	0.02	0.00056	2.804894	9.73	0.1	1.68	1.66	1.78	0.2	0.047
Lake Poinsett	02-May-94	905	7	Grab	SURFAC	NA	7	6	9.4	8.29	NA	10	188	940	929	11	0.11	0.00306	2.784831	9.83	0.1	1.49	1.38	1.59	0.08	0.067
Lake Poinsett	25-May-94	1320	7	Grab	SURFAC	NA	20	16.5	6.25	7.69	NA	230	198	1005	988	17	0.19	0.00363	1.908421	9.40	0.1	2.17	1.98	2.27	0.143	0.09
Lake Poinsett	15-Jun-94	1200	7	Grab	SURFAC	NA	22	23	4.8	7.82	NA	110	168	1121	1101	20	0.02	0.00059	2.945369	9.34	0.1	2.21	2.19	2.31	0.16	0.057
Lake Poinsett	06-Jul-94	1320	7	Grab	SURFAC	NA	21	32	9.7	7.48	NA	10	142	1181	1167	14	0.28	0.00357	1.273862	9.37	0.1	2.89	2.61	2.99	0.166	0.04
Lake Poinsett	09-Aug-94	1150	7	Grab	SURFAC	NA	17	12	2.2	8.39	NA	400	159	1335	1316	19	0.26	0.01884	7.246382	9.50	0.1	3.49	3.23	3.59	0.27	0.163
Lake Poinsett	13-Sep-94	1425	7	Grab	SURFAC	NA	22	28	4.4	8.02	NA	160	181	1132	1105	27	0.33	0.01514	4.589039	9.34	0.1	3.57	3.24	3.67	0.243	0.156

Column 1

Mean	15.7688	18.544	6.67813	7.928	1.58875	337.5	181.088	991.44	976	15.438	0.1531	0.00571	3.072926	9.541686	0.11875	2.3988	2.245625	2.5175	0.17706	0.095
Standard Error	1.60376	2.3551	0.81493	0.085	0.85397	245.7548	4.6281	33.219	32.479	1.7511	0.0286	0.00168	0.497621	0.052793	0.013598	0.1617	0.143855	0.161628	0.01253	0.0107498
Median	17.1	19.75	5.9	8	0	55	185.7	942.5	931.5	15	0.185	0.003315	2.794862	9.49397	0.1	2.38	2.27	2.52	0.163	0.095
Mode	7	24	4.4	7.69	0	10	192	NA	NA	11	0.02	NA	NA	9.337876	0.1	NA	NA	NA	0.146	0.04
Standard Deviation	6.41506	9.4204	3.2597	0.342	3.415876	983.0192	18.5124	132.87	129.92	7.0045	0.1144	0.006719	1.990485	0.211172	0.054391	0.6469	0.575418	0.646514	0.05012	0.0429992
Variance	41.153	88.744	10.6257	0.117	11.66823	966326.7	342.709	17656	16878	49.063	0.0131	4.5E-05	3.962031	0.044594	0.002958	0.4184	0.331106	0.41798	0.00251	0.0018489
Kurtosis	-1.3156	-1.299	3.65946	1.372	1.287495	15.5005	-0.5436	1.6202	1.837	-0.785	-1.621	0.22383	-0.01487	-1.27922	9.093434	-0.733	-0.55299	-0.75713	0.38476	-1.319047
Skewness	-0.3067	-0.156	1.54132	-0.943	1.772346	3.914406	-0.5777	1.4588	1.5253	0.3392	-0.004	1.245293	0.696199	0.35192	3.02973	0.2993	0.113598	0.222677	0.49602	0.243715
Range	20	28	13.8	1.32	8.58	3990	62	468	454	23	0.31	0.019577	6.989279	0.658135	0.2	2.08	1.9	2.08	0.19	0.123
Minimum	5	4	2.2	7.07	0	10	142	867	862	5	0.02	5.1E-05	0.257103	9.244841	0.1	1.49	1.34	1.59	0.08	0.04
Maximum	25	32	16	8.39	8.58	4000	204	1335	1316	28	0.33	0.019629	7.246382	9.902977	0.3	3.57	3.24	3.67	0.27	0.163
Sum	252.3	296.7	106.85	126.8	25.42	5400	2897.4	15863	15616	247	2.45	0.091354	49.16682	152.667	1.9	38.38	35.93	40.28	2.833	1.52
Count	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Confidence Level(0.	3.14332	4.6159	1.59722	0.167	1.67375	481.6705	9.07091	65.107	63.658	3.4321	0.056	0.003292	0.97532	0.103473	0.026651	0.317	0.28195	0.316786	0.02456	0.0210692

SAMPLE DATA FOR LAKE POINSETT FOR 1993

Site - 8, LAKE ST. JOHN

PROJECT	DATE	TIME	SITE	SAMP	DEPTH	WTEMP C	ATEMP C	DISOX mg/L	FPH su	LABPH su	FECAL /100 mL	TALKAL mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMO mg/L	UNIONIZ AMMONI mg/l	PERCEN UNIONIZ	PKA	NO3+2 mg/L	TKN-N mg/L	ORGANIC NITROGE mg/L	TOTAL NITROGE mg/L	TPO4P mg/L	TOTAL DISS. PO mg/L
Lake Poinsett	02-Jun-93	1115	8	Grab	Surface	12.8	12.4	9	7.69	8.26	10	204.8	900	885	15	0.02	0.00022	1.121367	9.64	0.1	1.71	1.69	1.81	0.113	0.076
Lake Poinsett	14-Jun-93	1110	8	Grab	Surface	18	14.5	8.6	7.6	NA	300	244.4	1012	914	98	0.02	0.00027	1.346503	9.46	0.2	1.81	1.79	2.01	0.193	0.08
Lake Poinsett	07-Jul-93	1306	8	Grab	Surface	19.8	16.5	9.3	8.13	8.58	10	219.9	906	901	7	0.02	0.00100	5.015779	9.41	0.1	1.5	1.48	1.6	0.156	0.146
Lake Poinsett	27-Jul-93	1230	8	Grab	Surface	21.2	28	5.6	8.16	NA	10	214	917	896	21	0.19	0.01120	5.896569	9.36	0.1	2.24	2.05	2.34	0.259	0.206
Lake Poinsett	25-Aug-93	1100	8	Grab	Surface	24	30	5.2	8.69	NA	10	244	970	954	16	0.07	0.01443	20.61164	9.28	0.1	1.69	1.62	1.79	0.345	0.295
Lake Poinsett	13-Sep-93	1415	8	Grab	Surface	16	6	7.6	8.94	NA	30	244	1170	1054	116	0.28	0.05728	20.45785	9.53	0.1	2.19	1.91	2.29	0.405	0.256
Lake Poinsett	06-Oct-93	1130	8	Grab	Surface	12.5	25	10.1	8.73	NA	10	248	1048	1035	13	0.02	0.00217	10.83473	9.65	0.2	1.15	1.13	1.35	0.226	0.103
Lake Poinsett	26-Oct-93	1235	8	Grab	Surface	7	3	9.4	8.72	NA	10	220	1069	1009	60	0.02	0.00143	7.15827	9.83	0.1	2.13	2.11	2.23	0.179	0.126
Lake Poinsett	13-Apr-94	1130	8	Grab	Surface	5	12	14.2	8.49	NA	10	201	1048	1034	14	0.02	0.00074	3.720137	9.90	0.1	1.47	1.45	1.57	0.15	0.053
Lake Poinsett	20-Apr-94	1240	8	Grab	Surface	9.5	6	8.4	8.54	NA	10	195	1007	989	18	0.02	0.00117	5.848572	9.75	0.1	1.37	1.35	1.47	0.15	0.033
Lake Poinsett	02-May-94	845	8	Grab	Surface	7	6	11.2	8.71	NA	10	203	1012	1003	9	0.02	0.00140	7.006744	9.83	0.1	1.01	0.99	1.11	0.057	0.04
Lake Poinsett	25-May-94	1310	8	Grab	Surface	19.5	17.5	8	8.21	NA	70	214	1137	1110	27	0.02	0.00117	5.847488	9.42	0.1	1.4	1.38	1.5	0.14	0.05
Lake Poinsett	15-Jun-94	1145	8	Grab	Surface	21	23	8.2	8.05	NA	10	214	1426	1400	26	0.02	0.00091	4.57461	9.37	0.1	2.14	2.12	2.24	0.2	0.093
Lake Poinsett	06-Jul-94	1310	8	Grab	Surface	22	32	11.8	8.41	NA	10	212	1363	1353	10	0.06	0.00634	10.55981	9.34	0.1	1.93	1.87	2.03	0.156	0.13
Lake Poinsett	09-Aug-94	1130	8	Grab	Surface	18	12	4.8	8.71	NA	30	160	1392	1361	31	0.13	0.01944	14.95374	9.46	0.1	2.93	2.8	3.03	0.313	0.15
Lake Poinsett	13-Sep-94	1420	8	Grab	Surface	22	29	4	8.26	NA	10	201	1290	1279	11	0.66	0.05091	7.713667	9.34	0.1	3.05	2.39	3.15	0.22	0.166

Column 1

Mean	15.9563	17.056	8.4625	8.378	1.0525	34.375	214.944	1104.3	1073.6	30.75	0.0994	0.010631	8.291717	9.535237	0.1125	1.8575	1.758125	1.97	0.20388	0.1264
Standard Error	1.5417	2.4117	0.6749	0.097	0.719143	18.14223	5.68674	43.805	44.119	8.1289	0.0419	0.004486	1.474558	0.050915	0.008539	0.1441	0.118171	0.142168	0.02246	0.0193
Median	18	15.5	8.5	8.45	0	10	214	1048	1021.5	17	0.02	0.001417	6.451657	9.464905	0.1	1.76	1.74	1.91	0.186	0.1145
Mode	7	6	NA	8.71	0	10	214	1012	NA	NA	0.02	NA	NA	9.337876	0.1	NA	NA	NA	0.15	NA
Standard Deviation	6.16679	9.6466	2.6996	0.387	2.876571	72.56893	22.747	175.22	176.47	32.516	0.1676	0.017945	5.89823	0.203662	0.034157	0.5764	0.472683	0.568671	0.08986	0.0774
Variance	38.0293	93.057	7.28783	0.15	8.27466	5266.25	517.424	30703	31143	1057.3	0.0281	0.000322	34.78912	0.041478	0.001167	0.3323	0.22343	0.323387	0.00807	0.0060
Kurtosis	-1.096	-1.3669	0.09921	-0.298	4.915126	14.19681	1.03673	-0.7191	-0.6109	2.9945	8.9497	3.459292	0.638293	-1.0464	4.897959	0.1693	0.174127	0.190183	0.51258	0.0417
Skewness	-0.5656	0.1717	0.21527	-0.642	2.511527	3.710751	-0.4596	0.7527	0.8943	1.9677	2.8757	2.091725	1.136971	0.607079	2.509457	0.7076	0.452486	0.715592	0.80859	0.8412
Range	19	29	10.2	1.34	8.58	290	88	526	515	109	0.64	0.057058	19.49027	0.627332	0.1	2.04	1.81	2.04	0.348	0.2620
Minimum	5	3	4	7.6	0	10	160	900	885	7	0.02	0.000224	1.121367	9.275644	0.1	1.01	0.99	1.11	0.057	0.0330
Maximum	24	32	14.2	8.94	8.58	300	248	1426	1400	116	0.66	0.057282	20.61164	9.902977	0.2	3.05	2.8	3.15	0.405	0.2950
Sum	255.3	272.9	135.4	134	16.84	550	3439.1	17669	17177	492	1.59	0.170094	132.6675	152.5638	1.8	29.72	28.13	31.52	3.262	2.0230
Count	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16.0000
Confidence Level(0.9	3.02167	4.7268	1.32278	0.19	1.409494	35.55812	11.1458	85.857	86.471	15.932	0.0821	0.008793	2.89008	0.099792	0.016736	0.2825	0.231611	0.278644	0.04403	0.0379

SAMPLE DATA FOR LAKE POINSETT FOR 1993

Site - 9, LAKE THISTED

PROJECT	DATE	TIME	SITE	SAMP	DEPTH	WTEMP C	ATEMP C	DISOX mg/L	FPH su	LABPH su	FECAL /100 mL	TALKAL mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMO mg/L	UNIONIZ AMMONI mg/l	PERCEN UNIONIZ	PKA	NO3+2 mg/L	TKN-N mg/L	ORGANI NITROGE mg/L	TOTAL NITROGE mg/L	TPO4P mg/L	TOTAL DISS. PO4 mg/L
Lake Poinsett	02-Jun-93	945	9	Grab	Surface	10.8	12	8.15	7.46	7.9	1300	194	1172	1094	78	0.02	0.00011	0.568785	9.70	0.2	2.04	2.02	2.24	0.438	0.219
Lake Poinsett	14-Jun-93	940	9	Grab	Surface	16.5	20	6.25	7.19	NA	1300	248.8	1430	1122	308	0.29	0.00137	0.472604	9.51	0.2	2.4	2.11	2.6	0.724	0.365
Lake Poinsett	07-Jul-93	1350	9	Grab	Surface	20	15	5	7.69	8.02	580	196.7	888	852	36	0.05	0.00095	1.908421	9.40	0.1	2.01	1.96	2.11	0.332	0.212
Lake Poinsett	27-Jul-93	1440	9	Grab	Surface	25.8	28	4.9	8.02	NA	1100	196	945	865	80	0.02	0.00119	5.930632	9.22	0.1	1.55	1.53	1.65	0.551	0.315
Lake Poinsett	25-Aug-93	1330	9	Grab	Surface	27	34	3.8	7.79	NA	500	246	897	827	70	0.09	0.00349	3.881126	9.18	0.1	2.04	1.95	2.14	0.561	0.362
Lake Poinsett	15-Sep-93	1520	9	Grab	Surface	15	16	11.9	8.58	NA	650	184	949	891	58	0.08	0.00754	9.429642	9.56	0.2	2.04	1.96	2.24	0.315	0.236
Lake Poinsett	06-Oct-93	1245	9	Grab	Surface	15	31	13.2	8.63	NA	120	226	1001	979	22	0.02	0.00209	10.45988	9.56	0.1	1.68	1.66	1.78	0.395	0.242
Lake Poinsett	26-Oct-93	1230	9	Grab	Surface	5	4	12.6	8.37	NA	20	268	1099	1077	22	0.44	0.01253	2.847587	9.90	1	2.78	2.34	3.78	0.305	0.232
Lake Poinsett	13-Apr-94	1300	9	Grab	Surface	7.5	17	17.8	8.77	NA	10	190	992	952	40	0.02	0.00165	8.259963	9.82	0.1	2.5	2.48	2.6	0.576	0.183
Lake Poinsett	20-Apr-94	1325	9	Grab	Surface	9.5	5	9.4	8.32	NA	180	162	1014	992	22	0.02	0.00072	3.607979	9.75	0.1	2.05	2.03	2.15	0.356	0.163
Lake Poinsett	02-May-94	915	9	Grab	Surface	7	6	10.1	7.87	NA	100	169	1084	1058	26	0.02	0.00022	1.077359	9.83	0.2	1.66	1.64	1.86	0.223	0.12
Lake Poinsett	25-May-94	1330	9	Grab	Surface	19	16	7	7.78	NA	1200	191	1366	1190	176	0.33	0.00718	2.175826	9.43	0.2	2.15	1.82	2.35	0.693	0.406
Lake Poinsett	15-Jun-94	1000	9	Grab	Surface	20	24	6.5	7.43	NA	3800	153	1515	1465	50	0.41	0.00434	1.057849	9.40	0.9	2.12	1.71	3.02	0.403	0.28
Lake Poinsett	06-Jul-94	1200	9	Grab	Surface	24	24	12.4	7.62	NA	280	184	1517	1485	32	0.13	0.00281	2.162037	9.28	0.1	2.97	2.84	3.07	0.543	0.343
Lake Poinsett	09-Aug-94	1200	9	Grab	Surface	13	12	4	7.92	NA	900	215	1742	1713	29	0.04	0.00077	1.918243	9.63	0.1	3.48	3.44	3.58	0.686	0.459
Lake Poinsett	13-Sep-94	1305	9	Grab	Surface	21	25	6	8.48	NA	110	248	1574	1554	20	0.02	0.00229	11.42838	9.37	0.1	2.68	2.66	2.78	0.443	0.29

Column 1

	WTEMP	ATEMP	DISOX	FPH	LABPH	FECAL	TALKAL	TSOL	TDSOL	TSSOL	AMMO	UNIONIZ AMMONI	PERCEN UNIONIZ	PKA	NO3+2	TKN-N	ORGANI NITROGE	TOTAL NITROGE	TPO4P	TOTAL DISS. PO4
Mean	16.0063	18.063	8.6875	7.995	0.995	759.375	204.469	1199.1	1132.3	66.813	0.125	0.003078	4.199145	9.53449	0.2375	2.2594	2.134375	2.496875	0.4715	0.2766875
Standard Error	1.71006	2.2812	1.00042	*******	0.679736	234.6122	8.50902	69.907	68.943	18.814	0.0378	0.000843	0.926364	0.055901	0.070637	0.1291	0.127043	0.154256	0.0381	0.0232479
Median	15.75	16.5	7.575	7.895	0	540	195	1091.5	1067.5	38	0.045	0.001872	2.511707	9.537968	0.1	2.085	1.99	2.295	0.4405	0.261
Mode	15	12	NA	NA	0	1300	184	NA	NA	22	0.02	NA	NA	9.400958	0.1	2.04	NA	2.24	NA	NA
Standard Deviation	6.84022	9.1248	4.00169	*******	2.718946	938.4489	34.0361	279.63	275.77	75.257	0.1512	0.003371	3.705454	0.223604	0.282548	0.5164	0.508173	0.617022	0.15241	0.0929916
Variance	46.7886	83.263	16.0135	*******	7.392667	880686.3	1158.45	78192	76050	5663.6	0.0229	1.14E-05	13.73039	0.049999	0.079833	0.2667	0.25824	0.380716	0.02323	0.0086474
Kurtosis	-1.05992	-0.8442	-0.05359	-1.104	4.900662	7.469589	-0.79494	-1.0843	-0.2889	7.3203	0.0813	3.169151	-0.56529	-1.06424	4.637561	0.6218	1.573288	-0.07822	-1.00651	-0.506657
Skewness	-0.016	0.0699	0.74004	*******	2.509783	2.450288	0.43751	0.6209	0.9278	2.6357	1.2832	1.797561	0.94961	0.083393	2.399663	0.8755	1.275445	0.753523	0.22987	0.2920487
Range	22	30	14	1.58	8.02	3790	115	854	886	288	0.42	0.012416	10.95578	0.719126	0.9	1.93	1.91	2.13	0.501	0.339
Minimum	5	4	3.8	7.19	0	10	153	888	827	20	0.02	0.000114	0.472604	9.183851	0.1	1.55	1.53	1.65	0.223	0.12
Maximum	27	34	17.8	8.77	8.02	3800	268	1742	1713	308	0.44	0.012529	11.42838	9.902977	1	3.48	3.44	3.78	0.724	0.459
Sum	256.1	289	139	*******	15.92	12150	3271.5	19185	18116	1069	2	0.049253	67.18632	152.5518	3.8	36.15	34.15	39.95	7.544	4.427
Count	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Confidence Level(0.9	3.35165	4.4711	1.96079	*******	1.332259	459.8315	16.6774	137.02	135.13	36.875	0.0741	0.001652	1.815639	0.109564	0.138446	0.253	0.249	0.302335	0.07468	0.045565

BIG SIOUX RIVER 1993-94 DATA POINTS AND MEANS 5/10/93 - 6/13/94 FOR WATERTOWN AND BROOKINGS

DATE	TIME	SITE	00010 TEMP CENT	00020 AI TEMP CENT	00095 CN AT 25C MICROMH	00300 MG/L	00400 SU	00410 CACO3 MG/L	00500 RESIDUE TOTAL MG/L	TDSOL MG/L	TSS 00530 RESI TOT NFLT MG/L	00610 NH3 N TOTAL MG/L	00612 UN-I NH3-N MG/L	00619 UN NH3-NH3 MG/L	00630 N N-TOTAL MG/L	00665 PHO MG/L P	00671 P ORTHO MG/L P	31616 FEC CO MFM-FCBR /100ML
05/10/93	1115	BRKS	13.90	15.0	735	6.6	7.85	192	603	576	27.00000	0.02000	0.00030	0.00040	0.60000	0.21300	0.10600	200.00000
06/14/93	1120	BRKS	17.80	15.0	972	7.0	8.04	290	829	753	76.00000	0.02000	0.00070	0.00090	0.60000	0.25600	0.14100	360.00000
07/12/93	1115	BRKS	20.60	22.2	848	4.7	7.77	269	704	684	20.00000	0.02000	0.00050	0.00060	0.30000	0.28900	0.21300	120.00000
08/09/93	1200	BRKS	22.80	30.6	825	5.5	7.76	249	629	572	57.00000	0.02000	0.00050	0.00070	0.20000	0.30500	0.22500	90.00000
09/13/93	1230	BRKS	13.90	3.9	624	6.5		220	971	751	220.00000	0.02000	0.00080	0.00100	0.40000	0.28900	0.03900	200.00000
10/05/93	1200	BRKS	9.40	16.1	972	9.0	8.30	226	859	743	116.00000	0.02000	0.00070	0.00080	0.60000	0.22900	0.10500	50.00000
01/08/93	1145	BRKS	0.00	-2.2	1045	12.6	7.78	244	860	808	52.00000	0.08000	0.00040	0.00050	1.20000	0.16300	0.04000	50.00000
02/14/93	1200	BRKS	0.00	-2.8	1100	10.7	7.55	255	741	729	12.00000	0.10000	0.00030	0.00040	1.20000	0.12000	0.06300	30.00000
01/10/94	1100	BRKS	0.00	-3.9	1124	5.7	8.22	274	865	857	8.00000	0.19000	0.00300	0.00300	1.50000	0.14600	0.08000	220.00000
02/14/94	1115	BRKS	0.00	-2.8	1100	2.9	7.79	285	740	729	11.00000	0.41000	0.00200	0.00300	1.10000	0.59300	0.16700	120.00000
03/14/94	1150	BRKS	2.80		642	8.5	7.42	173	449	433	16.00000	0.39000	0.00100	0.00100	1.90000	0.36300	0.28700	20.00000
04/19/94	1115	BRKS	7.20		880	10.5	7.50	247	687	642	45.00000	0.02000	0.00009	0.00010	0.10000	0.15000	0.02600	20.00000
05/09/94	1115	BRKS	13.30		954	10.4	7.78	256	698	657	41.00000	0.02000	0.00030	0.00030	0.10000	0.10000	0.03100	20.00000
06/13/94	1115	BRKS	20.60	24.44	1030	6.5	7.35	237	921	725	196.00000	0.04000	0.00040	0.00040	0.70000	0.29600	0.14600	150.00000
		Column 1																
		Mean	10.16	10.50	917.93	7.65	7.78	244.07	754.00	689.93	64.07143	0.09786	0.00079	0.00094	0.75000	0.25086	0.11921	117.85714
		Standard Error	2.29	3.35	44.20	0.73	0.08	8.87	37.59	28.99	18.14910	0.03657	0.00021	0.00024	0.14741	0.03382	0.02172	26.72980
		Median	11.35	1.95	963.00	6.80	7.78	248.00	740.50	727.00	43.00000	0.02000	0.00050	0.00065	0.60000	0.24250	0.10550	105.00000
		Mode	0.00	0.00	972.00	6.50	7.78	NA	NA	729.00	NA	0.02000	0.00030	0.00040	0.60000	0.28900	NA	20.00000
		Standard Deviation	8.55	12.54	165.39	2.72	0.29	33.18	140.64	108.48	67.90770	0.13684	0.00079	0.00091	0.55157	0.12656	0.08127	100.01374
		Variance	73.11	157.31	27352.23	7.38	0.08	1101.15	19778.92	11767.46	4611.45604	0.01873	0.00000	0.00000	0.30423	0.01602	0.00661	10002.74725
		Kurtosis	-1.58	-1.12	-0.75	-0.60	13.41	0.38	0.19	1.23	1.55703	2.14603	4.59723	2.67968	-0.31265	3.30292	-0.38990	1.07170
		Skewness	0.04	0.63	-0.58	0.19	-3.63	-0.76	-0.50	-0.92	1.57426	1.82654	2.16246	1.89568	0.69953	1.47109	0.68846	1.10062
		Range	22.80	34.50	500.00	9.70	8.30	117.00	522.00	424.00	212.00000	0.39000	0.00291	0.00290	1.80000	0.49300	0.26100	340.00000
		Minimum	0.00	-3.90	624.00	2.90	7.35	173.00	449.00	433.00	8.00000	0.02000	0.00009	0.00010	0.10000	0.10000	0.02600	20.00000
		Maximum	22.80	30.60	1124.00	12.60	8.30	290.00	971.00	857.00	220.00000	0.41000	0.00300	0.00300	1.90000	0.59300	0.28700	360.00000
		Sum	142.30	115.54	12851.00	107.10	101.11	3417.00	10556.00	9659.00	897.00000	1.37000	0.01099	0.01310	10.50000	3.51200	1.66900	1650.00000
		Count	14.00	11.00	14.00	14.00	13.00	14.00	14.00	14.00	14.00000	14.00000	14.00000	14.00000	14.00000	14.00000	14.00000	14.00000
		Confidence Level(0.	4.48	7.41	86.63	1.42	0.16	17.38	73.67	56.82	35.57158	0.07168	0.00041	0.00048	0.28893	0.06629	0.04257	52.38944

DATE	TIME	SITE	00010 TEMP CENT	00020 AI TEMP CENT	00095 CN AT 25C MICROMH	00300 MG/L	00400 SU	00410 CACO3 MG/L	00500 RESIDUE TOTAL MG/L	TDSOL MG/L	TSS 00530 RESI TOT NFLT MG/L	00610 NH3 N TOTAL MG/L	00612 UN-I NH3-N MG/L	00619 UN NH3-NH3 MG/L	00630 N N-TOTAL MG/L	00665 PHO MG/L P	00671 P ORTHO MG/L P	31616 FEC CO MFM-FCBR /100ML
05/10/93	1400	WTN	15.60	18.3	735	9.5	8.14	264	600	587	13.00000	0.02000	0.00080	0.00090	0.10000	0.20900	0.09900	2400.00000
06/15/93	1500	WTN	16.70	12.2	756	9.6	8.43	280	569	551	18.00000	0.02000	0.00200	0.00200	0.20000	0.22200	0.14300	190.00000
07/12/93	1530	WTN	20.00	21.1	742	6.5	7.71	291	541	529	12.00000	0.03000	0.00060	0.00070	0.20000	0.28200	0.20400	220.00000
08/09/93	1500	WTN	24.40	31.1	605	6.4	7.76	240	442	432	10.00000	0.02000	0.00060	0.00070	0.10000	0.29500	0.22200	120.00000
09/13/93	1500	WTN	11.70	4.4	676	5.4		224	484	472	12.00000	0.14000	0.00300	0.00300	0.20000	0.26600	0.13000	540.00000
10/05/93	1445	WTN	10.60	19.4	756	13.0	8.34	264	528	506	22.00000	0.24000	0.01000	0.01200	0.50000	0.26200	0.09700	1900.00000
01/08/93	1430	WTN	0.00	-1.1	803	13.6	7.83	288	582	560	22.00000	0.41000	0.00200	0.00300	1.20000	0.11900	0.09700	100.00000
02/14/93	1400	WTN	0.00	-1.7	770	11.4	8.04	292	528	518	10.00000	0.31000	0.00300	0.00300	1.50000	0.14600	0.10000	70.00000
01/10/94	1515	WTN	0.00	-12.2	963	7.4	7.67	319	680	668	12.00000	0.86000	0.00300	0.00400	1.80000	0.24600	0.12600	80.00000
02/14/94	1530	WTN	0.00	0	880	5.8	8.17	292	575	569	6.00000	0.58000	0.00700	0.00800	0.90000	0.90900	0.19700	200.00000
03/14/94	1430	WTN	1.70		535	9.0	7.41	177	420	408	12.00000	0.46000	0.00100	0.00100	1.60000	0.33600	0.23200	40.00000
04/19/94	1440	WTN	13.90		715	11.0	7.35	254	504	473	31.00000	0.05000	0.00030	0.00030	0.20000	0.19300	0.04700	20.00000
05/09/94	1430	WTN	14.40		795	10.9	7.77	254	481	463	18.00000	0.03000	0.00050	0.00060	0.10000	0.17300	0.08700	10.00000
06/13/94	1415	WTN	21.70	28.333333	714	10.4	7.80	250	564	523	41.00000	0.26000	0.00700	0.00900	0.40000	0.29600	0.18800	300.00000
		Column 1																
		Mean	10.76	10.89	746.07	9.28	7.88	263.50	535.57	518.50	17.07143	0.24500	0.00291	0.00344	0.64286	0.28243	0.14064	442.14286
		Standard Error	2.37	3.72	28.02	0.71	0.09	9.46	18.09	18.11	2.52344	0.06881	0.00080	0.00098	0.16763	0.05093	0.01547	198.58062
		Median	12.80	2.20	749.00	9.55	7.79	264.00	534.50	520.50	12.50000	0.19000	0.00200	0.00250	0.30000	0.25400	0.12800	155.00000
		Mode	0.00	0.00	756.00	NA	NA	254.00	528.00	NA	12.00000	0.02000	0.00300	0.00300	0.20000	NA	0.09700	NA
		Standard Deviation	8.85	13.94	104.84	2.64	0.33	35.40	67.67	67.75	9.44184	0.25747	0.00300	0.00365	0.62722	0.19058	0.05789	743.02064
		Variance	78.39	194.21	10991.92	6.98	0.11	1253.19	4579.80	4589.50	89.14835	0.06629	0.00001	0.00001	0.39341	0.03632	0.00335	552079.67033
		Kurtosis	-1.48	-0.97	1.18	-1.10	13.24	1.66	0.44	0.55	2.15846	0.95136	1.08783	1.05211	-0.92244	10.58039	-1.19471	3.93823
		Skewness	-0.09	0.40	0.02	0.00	-3.60	-0.95	0.23	0.44	1.49167	1.16888	1.39111	1.40774	0.87337	3.06684	0.25670	2.22424
		Range	24.40	43.30	428.00	8.20	8.43	142.00	260.00	260.00	35.00000	0.84000	0.00970	0.01170	1.70000	0.79000	0.18500	2390.00000
		Minimum	0.00	-12.20	535.00	5.40	7.35	177.00	420.00	408.00	6.00000	0.02000	0.00030	0.00030	0.10000	0.11900	0.04700	10.00000
		Maximum	24.40	31.10	963.00	13.60	8.43	319.00	680.00	668.00	41.00000	0.86000	0.01000	0.01200	1.80000	0.90900	0.23200	2400.00000
		Sum	150.70	119.83	10445.00	129.90	102.42	3689.00	7498.00	7259.00	239.00000	3.43000	0.04080	0.04820	9.00000	3.95400	1.96900	6190.00000
		Count	14.00	11.00	14.00	14.00	13.00	14.00	14.00	14.00	14.00000	14.00000	14.00000	14.00000	14.00000	14.00000	14.00000	14.00000
		Confidence Level(0.	4.64	8.24	54.92	1.38	0.18	18.54	35.45	35.49	4.94585	0.13487	0.00157	0.00191	0.32855	0.09983	0.03033	389.21086

APPENDIX I:

Chlorophyll-a concentrations (mg/m^3) were composite samples from three in-lake sites (sites 4, 5, and 6) during June and July of 1993. After this period, a separate sample was collected from each site. Chlorophyll-a was collected from the surface sites only. The uncorrected and corrected sites used in the following table refer to the concentrations of pheophytin in each sample. Pheophytin is degradation product of chlorophyll-a. During subsequent analysis of the chlorophyll-a sample in the lab, the concentration of pheophytin must be determined so that it can be subtracted from the overall chlorophyll-a concentration. The corrected chlorophyll-a concentrations were used with Carlson's Trophic Status Index and to determine the relationship chlorophyll-a has with total phosphorus.

Chlorophyll-a Concentrations
PROJECT NAME:
Poinsett Phase I (1993-94)

	Uncorrected Sites				Corrected Sites			
Sample Date	4	5	6	AVG	4	5	6	AVG
06/15/93			Composite	9.38			Composite	2.89
06/30/93			Composite	17.42			Composite	11.56
06/30/93			Composite	18.76			Composite	17.34
07/20/93			Composite	284.75			Composite	249.985
08/04/93	213.06	151.42	136.68	167.053	187.85	131.495	118.49	145.945
08/16/93	83.75	77.72	40.2	67.2233	73.695	69.36	34.68	59.245
08/31/93	91.12	104.52	77.72	91.12	78.03	91.035	66.47	78.5117
09/22/93	69.68	125.96	160.13	118.59	62.135	112.71	135.83	103.558
09/22/93			162.14	Duplic			138.72	Duplic
03/01/94	0	-1.34	0	-0.4467	0	-2.89	0	-0.963
05/04/94	5.36	5.36	2.68	4.46667	5.78	2.89	0	2.89
05/23/94	2.68	1.34	4.02	2.68	2.89	0	2.0053E-14	0.9633
06/13/94	36.18	25.46	12.06	24.5667	34.68	21.675	11.56	22.638
06/29/94	93.8	37.52	136.68	89.3333	89.59	34.68	141.61	88.627
07/13/94	202.34	325.62	18.76	182.24	202.3	317.9	17.34	179.18
07/25/94	37.52	25.46	36.18	33.0533	34.68	26.01	34.68	31.79
08/15/94	6.7	29.48	32.16	22.78	2.89	28.9	33.235	21.675
09/20/94	41.54	9.38	6.70	19.2067	39.015	11.56	2.89	17.822

APPENDIX I:

The following table contains the raw quality assurance/quality control (QA/QC) sample data for Lake Poinsett collected during 1993 and 1994. Sites for QA/QC monitoring were in-lake bottom site 4 and tributary site 7 (Lake Albert). Blank and duplicate samples were collected from each of these sites every 10th sample. The percent difference between duplicate samples was discussed in the QA/QC section of the report on page 80. Please refer to this section for further explanation of these sampling results.

QUALITY ASSURANCE/QUALITY CONTROL SAMPLE DATA FOR LAKE POINSETT FOR 1993
for Site - 4, INLAKE NORTH CENTRAL BAY and Site 7 - OUTLET OF LAKE ALBERT

PROJECT	DATE	TIME	SITE	SAMP	DEPTH	SECC FEET	WTEMP C	ATEMP C	DISOX mg/L	FPH su	FECAL /100 mL	TALKAL mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMO mg/L	UNIONIZ AMMONI mg/l	NO3+2 mg/L	TKN-N mg/L	ORGANI NITROGE mg/L	TOTAL NITROGE mg/L	TPO4P mg/L	TOTAL DISS. PO4 mg/L
Poinsett	16-Jun-93	1120	7	Grab	SURFACE	NA	17.20	24.00	5.80	7.77	230	192	892	872	20	0.05	0.00093	0.3	2.09	2.04	2.39	0.169	0.116
Poinsett	16-Jun-93	1155	7D	Grab	DUPLICATE	NA	17.20	24.00	5.80	7.72	260	191	918	893	25	0.06	0.00100	0.2	1.83	1.77	2.03	0.183	0.117
				PERCEN	**DIFFEREN**	-->	**0.00**	**0.00**	**0.00**	**0.64**	**11.54**	**0.52**	**2.83**	**2.35**	**20.00**	**16.67**	**6.69**	**33.33**	**12.44**	**13.24**	**15.06**	**7.65**	**0.85**
Poinsett	30-Jun-93	925	4	Grab	BOTTOM	7.08	18.00	17.00	6.30	8.26	10	207.6	1027	967	60	0.02	0.00117	0.1	1.67	1.65	1.77	0.093	0.037
Poinsett	30-Jun-93	940	4BD	Grab	DUPLICATE	7.08	18.00	17.00	6.30	8.26	10	213.1	1000	996	4	0.02	0.00117	0.1	1.76	1.74	1.86	0.056	0.033
				PERCEN	**DIFFEREN**	-->	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.58**	**2.63**	**2.91**	**93.33**	**0.00**	**0.00**	**0.00**	**5.11**	**5.17**	**4.84**	**39.78**	**10.81**
Poinsett	27-Jul-93	1330	7	Grab	SURFACE	NA	22.50	26.00	3.10	7.94	4000	161	895	889	6	0.2	0.00796	0.1	2.55	2.35	2.65	0.183	0.073
Poinsett	27-Jul-93	1345	7D	Grab	DUPLICATE	NA	22.50	26.00	3.10	7.94	200	160	908	901	7	0.19	0.00757	0.1	2.71	2.52	2.81	0.169	0.073
				PERCEN	**DIFFEREN**	-->	**0.00**	**0.00**	**0.00**	**0.00**	**95.00**	**0.62**	**1.43**	**1.33**	**14.29**	**5.00**	**5.00**	**0.00**	**5.90**	**6.75**	**5.69**	**7.65**	**0.00**
Poinsett	04-Aug-93	855	4	Grab	BOTTOM	2.33	20.10	16.00	6.20	8.78	10	192	1134	1028	106	0.02	0.00389	0.1	2.43	2.41	2.53	0.203	0.03
Poinsett	04-Aug-93	855	4BD	Grab	DUPLICATE	2.33	20.10	16.00	6.20	8.78	10	196	1356	1008	348	0.02	0.00389	0.1	1.63	1.61	1.73	0.558	0.037
				PERCEN	**DIFFEREN**	-->	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.04**	**16.37**	**1.95**	**69.54**	**0.00**	**0.00**	**0.00**	**32.92**	**33.20**	**31.62**	**63.62**	**18.92**
Poinsett	31-Aug-93	820	4	Grab	BOTTOM	3.75	20.50	13.00	5.80	8.61	10	193	1008	980	28	0.04	0.00575	0.1	1.61	1.57	1.71	0.166	0.04
Poinsett	31-Aug-93	830	4BD	Grab	DUPLICATE	3.75	20.50	13.00	5.80	8.61	20	195	1181	957	224	0.04	0.00575	0.1	1.6	1.56	1.7	0.123	0.043
				PERCEN	**DIFFEREN**	-->	**0.00**	**0.00**	**0.00**	**0.00**	**50.00**	**1.03**	**14.65**	**2.35**	**87.50**	**0.00**	**0.00**	**0.00**	**0.62**	**0.64**	**0.58**	**25.90**	**6.98**
Poinsett	15-Sep-93	1355	7	Grab	SURFACE	NA	13.00	16.00	6.90	8.03	10	172	867	862	5	0.18	0.00442	0.1	2.67	2.49	2.77	0.203	0.136
Poinsett	15-Sep-93	1425	7D	Grab	DUPLICATE	NA	13.00	16.00	6.90	8.03	10	172	873	862	11	0.13	0.00319	0.1	2.55	2.42	2.65	0.189	0.156
				PERCEN	**DIFFEREN**	-->	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.69**	**0.00**	**54.55**	**27.78**	**27.78**	**0.00**	**4.49**	**2.81**	**4.33**	**6.90**	**12.82**
Poinsett	04-Oct-93	1120	4	Grab	BOTTOM	3.58	11.00	12.00	9.75	8.97	10	160	900	875	25	0.02	0.00317	0.1	1.72	1.7	1.82	0.103	0.02
Poinsett	04-Oct-93	1130	4BD	Grab	DUPLICATE	3.58	11.00	12.00	9.75	8.97	10	164	916	887	29	0.02	0.00317	0.1	1.36	1.34	1.46	0.07	0.02
				PERCEN	**DIFFEREN**	-->	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.44**	**1.75**	**1.35**	**13.79**	**0.00**	**0.00**	**0.00**	**20.93**	**21.18**	**19.78**	**32.04**	**0.00**
Poinsett	26-Oct-93	1310	7	Grab	SURFACE	NA	7.00	4.00	5.80	7.69	10	204	888	878	10	0.23	0.00164	0.2	2.76	2.53	2.96	0.146	0.11
Poinsett	26-Oct-93	1320	7D	Grab	DUPLICATE	NA	7.00	4.00	5.80	7.69	10	200	920	910	10	0.23	0.00164	0.2	2.72	2.49	2.92	0.146	0.145
				PERCEN	**DIFFEREN**	-->	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.96**	**3.48**	**3.52**	**0.00**	**0.00**	**0.00**	**0.00**	**1.45**	**1.58**	**1.35**	**0.00**	**24.14**
Poinsett	02-Nov-93	1120	4	Grab	BOTTOM	14.00	2.80	6.00	9.30	7.95	10	184	939	931	8	0.15	0.00138	0.1	1.73	1.58	1.83	0.123	0.058
Poinsett	02-Nov-93	1130	4BD	Grab	DUPLICATE	14.00	2.80	5.00	9.30	7.95	10	182	925	921	4	0.16	0.00148	0.1	1.67	1.51	1.77	0.08	0.063
				PERCEN	**DIFFEREN**	-->	**0.00**	**16.67**	**0.00**	**0.00**	**0.00**	**1.09**	**1.49**	**1.07**	**50.00**	**6.25**	**6.25**	**0.00**	**3.47**	**4.43**	**3.28**	**34.96**	**7.94**
Poinsett	01-Mar-94	1350	4	Grab	BOTTOM	10.00	2.00	1.00	8.00	8.07	10	211	1063	1061	2	0.28	0.00318	0.2	1.91	1.63	2.11	0.097	0.097
Poinsett	01-Mar-94	1355	4BD	Grab	DUPLICATE	10.00	2.00	1.00	8.00	8.07	10	213	1065	1057	8	0.27	0.00307	0.2	1.94	1.67	2.14	0.12	0.123
				PERCEN	**DIFFEREN**	-->	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.94**	**0.19**	**0.38**	**75.00**	**3.57**	**3.57**	**0.00**	**1.55**	**2.40**	**1.40**	**19.17**	**21.14**
Poinsett	20-Apr-94	1305	7	Grab	SURFACE	NA	10.00	5.00	7.60	8.19	10	201	965	937	28	0.02	0.00056	0.1	1.68	1.66	1.78	0.2	0.047
Poinsett	20-Apr-94	1315	7D	Grab	DUPLICATE	NA	10.00	5.00	7.60	8.19	10	199	984	963	21	0.02	0.00056	0.1	1.64	1.62	1.74	0.18	0.05
				PERCEN	**DIFFEREN**	-->	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.00**	**1.93**	**2.70**	**25.00**	**0.00**	**0.00**	**0.00**	**2.38**	**2.41**	**2.25**	**10.00**	**6.00**
Poinsett	23-May-94	935	4	Grab	BOTTOM	10.00	19.00	22.00	9.10	8.73	10	183	894	882	12	0.02	0.00331	0.1	1.78	1.76	1.88	0.087	0.023
Poinsett	23-May-94	940	4BD	Grab	DUPLICATE	10.00	19.00	22.00	9.10	8.73	10	185	888	883	5	0.02	0.00331	0.1	1.24	1.22	1.34	0.043	0.023
				PERCEN	**DIFFEREN**	-->	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.08**	**0.67**	**0.11**	**58.33**	**0.00**	**0.00**	**0.00**	**30.34**	**30.68**	**28.72**	**50.57**	**0.00**
Poinsett	25-May-94	1320	7	Grab	SURFACE	NA	20.00	16.50	6.25	7.69	230	198	1005	988	17	0.19	0.00363	0.1	2.17	1.98	2.27	0.143	0.09
Poinsett	25-May-94	1320	7D	Grab	DUPLICATE	NA	20.00	16.50	6.25	7.69	220	192	990	971	19	0.22	0.00420	0.1	2.3	2.08	2.4	0.17	0.093

QUALITY ASSURANCE/QUALITY CONTROL SAMPLE DATA FOR LAKE POINSETT FOR 1993
for Site - 4, INLAKE NORTH CENTRAL BAY and Site 7 - OUTLET OF LAKE ALBERT

PROJECT	DATE	TIME	SITE	SAMP	DEPTH	SECC FEET	WTEMP C	ATEMP C	DISOX mg/L	FPH su	FECAL /100 mL	TALKAL mg/L
				PERCEN	**DIFFEREN**	—>	**0.00**	**0.00**	**0.00**	**0.00**	**4.35**	**3.03**
Poinsett	29-Jun-94	820	4	Grab	BOTTOM	3.92	20.00	18.00	7.40	8.66	10	185
Poinsett	29-Jun-94	830	4BD	Grab	DUPLICATE	3.92	20.00	18.00	7.40	8.66	10	187
				PERCEN	**DIFFEREN**	—>	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.07**
Poinsett	06-Jul-94	1320	7	Grab	SURFACE	NA	21.00	32.00	9.70	7.48	10	142
Poinsett	06-Jul-94	1325	7D	Grab	DUPLICATE	NA	21.00	32.00	9.70	7.48	70	142.5
				PERCEN	**DIFFEREN**	—>	**0.00**	**0.00**	**0.00**	**0.00**	**85.71**	**0.35**
Poinsett	25-Jul-94	810	4	Grab	BOTTOM	5.58	22.00	18.00	7.00	8.68	NA	178
Poinsett	25-Jul-94	820	4BD	Grab	DUPLICATE	5.58	22.00	18.00	7.00	8.68	10	178
				PERCEN	**DIFFEREN**	—>	**0.00**	**0.00**	**0.00**	**0.00**	**100.00**	**0.00**
Poinsett	13-Sep-94	1425	7	Grab	SURFACE	NA	22.00	28.00	4.40	8.02	160	181
Poinsett	13-Sep-94	1425	7D	Grab	DUPLICATE	NA	22.00	28.00	4.40	8.02	180	187
				PERCEN	**DIFFEREN**	—>	**0.00**	**0.00**	**0.00**	**0.00**	**11.11**	**3.21**
Poinsett	20-Sep-94	1120	4	Grab	BOTTOM	2.75	19.00	26.00	7.80	8.68	10	177
Poinsett	20-Sep-94	1125	4BD	Grab	DUPLICATE	2.75	20.00	25.00	8.00	8.60	10	178
				PERCEN	**DIFFEREN**	—>	**5.00**	**3.85**	**2.50**	**0.92**	**0.00**	**0.56**
Poinsett	16-Jun-93	1045	7B	Grab	BLANK	NA	20.00	24.00	6.20	3.10	10	11
Poinsett	30-Jun-93	1230	4BB	Grab	BLANK	7.08	18.00	17.00	6.30	8.26	10	18.5
Poinsett	27-Jul-93	1330	7B	Grab	BLANK	NA	22.00	25.00	5.70	6.98	10	5.3
Poinsett	04-Aug-93	855	4BB	Grab	BLANK	2.33	20.10	16.00	6.50	8.90	NA	5.7
Poinsett	31-Aug-93	1100	4BB	Grab	BLANK	3.75	20.50	13.00	5.80	8.90	10	NA
Poinsett	15-Sep-93	1200	7B	Grab	BLANK	NA	16.00	16.00	4.70	8.50	10	4
Poinsett	04-Oct-93	1330	4BB	Grab	BLANK	3.08	14.00	16.00	11.00	9.90	10	4
Poinsett	26-Oct-93	1000	7B	Grab	BLANK	NA	6.00	3.00	7.80	8.40	10	4
Poinsett	02-Nov-93	1530	4BB	Grab	BLANK	12.00	6.00	3.00	9.10	8.83	10	4
Poinsett	01-Mar-94	1115	4BB	Grab	BLANK	9.00	2.00	1.00	8.30	7.50	10	3
Poinsett	20-Apr-94	1100	7B	Grab	BLANK	NA	12.00	7.00	8.90	7.30	10	2.6
Poinsett	23-May-94	840	4BB	Grab	BLANK	17.00	22.00	18.00	10.40	11.10	10	3
Poinsett	25-May-94	830	7B	Grab	BLANK	NA	19.00	23.00	9.40	8.70	10	3
Poinsett	29-Jun-94	950	4BB	Grab	BLANK	4.42	21.00	19.00	8.30	9.10	10	2.6
Poinsett	06-Jul-94	1130	7B	Grab	BLANK	NA	24.00	29.00	8.72	9.31	10	3.5
Poinsett	25-Jul-94	930	4BB	Grab	BLANK	5.58	22.00	18.00	7.00	8.68	10	3
Poinsett	13-Sep-94	1460	7B	Grab	BLANK	NA	21.00	27.00	4.60	8.02	10	3.1
Poinsett	20-Sep-94	1000	4BB	Grab	BLANK	9.00	18.00	17.00	4.80	7.80	10	3

DATE	SITE	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMO mg/L	UNIONIZ AMMONI mg/l	NO3+2 mg/L	TKN-N mg/L	ORGANI NITROGE mg/L	TOTAL NITROGE mg/L	TPO4P mg/L	TOTAL DISS. PO4 mg/L
		1.49	**1.72**	**10.53**	**13.64**	**13.64**	**0.00**	**5.65**	**4.81**	**5.42**	**15.88**	**3.23**
29-Jun-94	4	939	930	9	0.02	0.00307	0.1	2.07	2.05	2.17	0.113	0.05
29-Jun-94	4BD	929	919	10	0.02	0.00307	0.1	2.11	2.09	2.21	0.113	0.05
		1.06	**1.18**	**10.00**	**0.00**	**0.00**	**0.00**	**1.90**	**1.91**	**1.81**	**0.00**	**0.00**
06-Jul-94	7	1181	1167	14	0.28	0.00357	0.1	2.89	2.61	2.99	0.166	0.04
06-Jul-94	7D	1169	1152	17	0.37	0.00471	0.1	3.51	3.14	3.61	0.19	0.047
		1.02	**1.29**	**17.65**	**24.32**	**24.32**	**0.00**	**17.66**	**16.88**	**17.17**	**12.63**	**14.89**
25-Jul-94	4	1284	1277	7	0.06	0.01081	0.1	1.83	1.77	1.93	0.1	0.057
25-Jul-94	4BD	1195	1184	11	0.07	0.01262	0.1	1.76	1.69	1.86	0.1	0.057
		6.93	**7.28**	**36.36**	**14.29**	**14.29**	**0.00**	**3.83**	**4.52**	**3.63**	**0.00**	**0.00**
13-Sep-94	7	1132	1105	27	0.33	0.01514	0.1	3.57	3.24	3.67	0.243	0.156
13-Sep-94	7D	1137	1107	30	0.32	0.01468	0.1	3	2.68	3.1	0.243	0.146
		0.44	**0.18**	**10.00**	**3.03**	**3.03**	**0.00**	**15.97**	**17.28**	**15.53**	**0.00**	**6.41**
20-Sep-94	4	928	905	23	0.02	0.00300	0.1	1.91	1.89	2.01	0.193	0.11
20-Sep-94	4BD	931	906	25	0.02	0.00273	0.1	1.93	1.91	2.03	0.176	0.1
		0.32	**0.11**	**8.00**	**0.00**	**9.06**	**0.00**	**1.04**	**1.05**	**0.99**	**8.81**	**9.09**
16-Jun-93	7B	7	3	4	0.02	0.00000	0.1	0.24	0.22	0.34	0.005	0.005
30-Jun-93	4BB	0	-1	1	0.02	0.00117	0.1	0.13	0.11	0.23	0.005	0.005
27-Jul-93	7B	0	-1	1	0.02	0.00009	0.1	0.1	0.08	0.2	0.005	0.005
04-Aug-93	4BB	0	-1	1	0.02	0.00482	0.1	0.1	0.08	0.2	0.005	0.005
31-Aug-93	4BB	NA	0	NA	0.02	0.00493	0.1	0.1	0.08	0.2	0.01	0.005
15-Sep-93	7B	0	-2	2	0.02	0.00171	<.1	0.1	0.08	0.1	0.005	0.017
04-Oct-93	4BB	9	8	1	0.02	0.01337	0.1	0.1	0.08	0.2	0.005	0.005
26-Oct-93	7B	0	-1	1	0.02	0.00066	0.1	0.69	0.67	0.79	0.005	0.005
02-Nov-93	4BB	13	12	1	0.02	0.00168	0.1	0.1	0.08	0.2	0.007	0.005
01-Mar-94	4BB	5	4	1	0.02	0.00006	0.1	0.1	0.08	0.2	0.01	0.01
20-Apr-94	7B	4	3	1	0.02	0.00009	0.1	0.1	0.08	0.2	0.005	0.005
23-May-94	4BB	1	0	1	0.02	0.01966	0.1	0.1	0.08	0.2	0.005	0.005
25-May-94	7B	1	0	1	0.02	0.00312	0.1	0.1	0.08	0.2	0.005	0.005
29-Jun-94	4BB	1	0	1	0.02	0.00700	0.1	0.17	0.15	0.27	0.005	0.016
06-Jul-94	7B	10	9	1	0.02	0.01040	0.1	0.1	0.08	0.2	0.005	0.005
25-Jul-94	4BB	7	6	1	0.02	0.00360	0.1	0.1	0.08	0.2	0.005	0.013
13-Sep-94	7B	4	3	1	0.02	0.00086	0.1	0.1	0.08	0.2	0.005	0.007
20-Sep-94	4BB	6	4	2	0.03	0.00064	0.1	0.1	0.07	0.2	0.005	0.005

APPENDIX I:

The following tables contain the monthly loading data (kilograms/month) and the percent of the total loadings for each month, 1993-94. The loadings from each site were calculated from the water quality and stage/discharge data collected from each monitoring station. This includes the Big Sioux River monitoring stations (Watertown and Brookings). Included in each table are monthly loadings for the following paramters:

water	total alkalinity
total solids	total dissolved solids
total suspended solids	ammonia
unionized ammonia	nitrates
total Kjeldahl nitrogen	organic nitrogen
total nitrogen	total phosphorus
total dissolved phosphorus	

Orthophosphorus instead of total dissolved phosphorus was collected from the Big Sioux River monitoring stations (Watertown and Brookings).

Monthly Loadings and the percent of the total loadings for each month, 1993-94
All Sampling Stations including the Big Sioux River (Watertown and Brookings)

		Water CF/ month	Water CF/ %bymonth	TALKAL Kg/month	TALKAL %bymonth	TSOL Kg/month	TSOL %bymonth	TDSOL Kg/month	TDSOL %bymonth	TSSOL Kg/month	TSSOL %bymonth	AMMON Kg/month	AMMON %bymonth
Boswell	Site 1												
1993	June	15987613.90	60.71	123838.77	64.41	295345.74	64.27	286934.21	64.09	8411.53	71.00	9.06	55.59
	July	10347004.80	39.29	68426.07	35.59	164196.67	35.73	160760.77	35.91	3435.90	29.00	7.23	44.41
	August												
	September												
	October												
	Total	26334618.70	100.00	192264.84	100.00	459542.41	100.00	447694.98	100.00	11847.43	100.00	16.29	100.00
	acrefeet	604.56											
Stonebridg	Site 2												
1993	June	247209580.80	17.02	1513812.89	19.64	2845322.96	8.62	2645522.54	8.35	199800.42	15.00	140.02	3.84
	July	-88453209.60	-6.09	-506010.51	-6.56	-2221699.49	-6.73	-2197099.23	-6.94	-24600.26	-1.85	-169.51	-4.65
	August	218567462.40	15.05	1246255.96	16.17	5241630.86	15.89	5169492.14	16.32	72138.72	5.42	1493.26	40.99
	September	44977075.20	3.10	266121.38	3.45	1247477.42	3.78	1077607.76	3.40	169869.66	12.76	283.57	7.78
	October	199357804.80	13.73	1139348.00	14.78	5177105.91	15.69	4710930.96	14.87	476101.73	35.75	368.92	10.13
1994	April	94560048.00	6.51	326510.38	4.24	1615591.62	4.90	1590002.41	5.02	25589.21	1.92	35.71	0.98
	May	112257619.20	7.73	569483.14	7.39	2819489.37	8.55	2776578.13	8.77	42911.23	3.22	53.90	1.48
	June	140849107.20	9.70	738528.72	9.58	3263497.83	9.89	3182571.34	10.05	80926.49	6.08	183.80	5.04
	July	236866982.40	16.31	1119505.52	14.52	6645364.93	20.14	6493525.96	20.50	151838.97	11.40	445.10	12.22
	August	247321900.80	17.03	1295863.22	16.81	6471463.10	19.62	6329969.56	19.99	141493.54	10.62	854.33	23.45
	September	-65510553.60	-4.51	-361866.18	-4.69	-1565253.29	-4.74	-1535983.25	-4.85	-31161.21	-2.34	-209.66	-5.75
	October	64290240.00	4.43	361408.87	4.69	1452007.93	4.40	1428794.01	4.51	26855.32	2.02	163.86	4.50
	Total	1452294057.60	100.00	7708961.39	100.00	32991999.14	100.00	31671912.34	100.00	1331763.81	100.00	3643.30	100.00
	acre-feet	33340.08											
Outlet	Site 3												
1993	June	360268213.47	6.05	2241919.04	7.12	9971330.11	6.06	9845992.74	6.08	125337.38	5.10	204.06	2.59
	July	613575907.67	10.30	3766063.78	11.96	17264600.10	10.50	17030056.52	10.51	234543.58	9.55	502.43	6.38
	August	657521000.03	11.04	3678958.67	11.68	18576553.56	11.29	18444659.91	11.39	131893.65	5.37	1333.42	16.92
	September	568143779.19	9.54	2981742.58	9.47	16942765.77	10.30	16717140.19	10.32	225625.58	9.19	655.83	8.32
	October	529039449.88	8.88	2502444.87	7.94	12944535.29	7.87	12788261.00	7.90	156274.29	6.36	771.74	9.79
1994	April	578962399.96	9.72	3033970.50	9.63	14949808.07	9.09	14788651.61	9.13	161156.45	6.56	590.38	7.49
	May	558482566.49	9.38	2882696.37	9.15	14483483.49	8.81	14353164.42	8.86	130319.07	5.31	316.32	4.01
	June	457611742.80	7.68	2340193.84	7.43	12462794.47	7.58	12274337.50	7.58	188456.97	7.67	259.19	3.29
	July	498912410.50	8.38	2400240.46	7.62	14709018.78	8.94	14332872.62	8.85	376146.16	15.32	1244.26	15.79
	August	392258992.75	6.59	1901482.40	6.04	11685240.51	7.10	11372712.87	7.02	312527.64	12.73	1197.91	15.20
	September	379470809.09	6.37	1906966.09	6.05	10678381.66	6.49	10418407.89	6.43	236592.09	9.63	600.19	7.62
	October	362552352.44	6.09	1860981.23	5.91	9813146.52	5.97	9594962.51	5.92	177114.08	7.21	205.35	2.61
	Total	5956799624.28	100.00	31497659.84	100.00	164481658.35	100.00	161961219.79	100.00	2455986.95	100.00	7881.10	100.00
total	acre-feet	136749.30											
Albert	Site 7												
1993	June	315240265.10	7.63	1713712.55	8.27	8164039.25	7.09	7993923.75	7.05	170115.50	9.76	317.07	1.51
	July	619766148.08	15.01	3032502.04	14.64	15979305.13	13.83	15723213.56	13.87	256091.57	14.70	2091.83	9.98
	August	539377576.41	13.06	2482589.30	11.99	13490119.31	11.72	13360434.59	11.78	129684.73	7.44	3815.71	18.20
	September	394176551.48	9.54	1944724.27	9.39	9818859.24	8.53	9735907.36	8.59	82951.88	4.76	2447.23	11.67
	October	294935201.70	7.14	1616814.04	7.81	7521068.41	6.53	7444618.21	6.57	80249.12	4.61	1798.10	8.58
1994	April	382126822.21	9.25	2118682.72	10.23	10271517.22	8.92	10081370.89	8.89	190146.33	10.91	832.07	3.97
	May	345768275.14	8.37	1874595.14	9.05	9650440.75	8.33	9504864.32	8.38	145576.42	8.35	1365.66	6.51

Monthly Loadings and the percent of the total loadings for each month, 1993-94
All Sampling Stations including the Big Sioux River (Watertown and Brookings)

		Water CF/ month	Water CF/ %bymonth	TALKAL Kg/month	TALKAL %bymonth	TSOL Kg/month	TSOL %bymonth	TDSOL Kg/month	TDSOL %bymonth	TSSOL Kg/month	TSSOL %bymonth	AMMON Kg/month	AMMON %bymonth
	June	261654570.15	6.34	1246073.98	6.02	8224900.85	7.15	8093196.49	7.14	131704.36	7.56	930.66	4.44
	July	257937666.93	6.25	1103001.52	5.33	9034330.57	7.85	8913781.52	7.86	120549.05	6.92	1822.10	8.69
	August	221716609.58	5.37	1034292.89	4.99	7804174.68	6.78	7670869.92	6.77	133304.76	7.65	1805.68	8.61
	September	223291165.75	5.41	1124172.67	5.43	7089434.70	6.16	6957275.19	6.14	139197.62	7.99	1740.44	8.30
	October	273947381.87	6.63	1422464.11	6.87	8047182.43	6.99	7899776.82	6.97	162921.99	9.35	1997.73	9.53
	Total	4129938234.40	100.00	20713625.23	100.00	115095372.54	100.00	113379232.61	100.00	1742493.34	100.00	20964.29	100.00
	acre-feet	94810.34											
St Johns	Site 8												
1993	June	484405012.52	12.66	3140407.08	13.82	13159220.23	11.61	12400591.59	11.27	758628.64	23.27	274.37	2.91
	July	616467144.77	16.11	3863782.55	17.00	16155356.49	14.25	15767687.56	14.33	387668.94	11.89	1574.42	16.70
	August	433861716.20	11.34	2856024.96	12.57	11908913.06	10.51	11567948.63	10.51	340964.43	10.46	1681.55	17.83
	September	302586419.08	7.91	2099672.32	9.24	9366670.76	8.26	8794459.96	7.99	572210.80	17.55	1417.69	15.03
	October	328801298.13	8.59	2171072.83	9.55	9840360.97	8.68	9405795.64	8.55	382207.83	11.72	343.37	3.64
1994	April	377158356.45	9.86	1270599.15	5.59	6511547.35	5.74	6418010.86	5.83	93536.49	2.87	127.99	1.36
	May	381142161.92	9.96	2258128.89	9.94	11988263.50	10.58	11778640.83	10.70	209622.66	6.43	215.88	2.29
	June	326145120.82	8.52	1971681.96	8.68	12430211.92	10.97	12227348.70	11.11	202863.22	6.22	283.01	3.00
	July	286293144.64	7.48	1559744.18	6.86	11191365.51	9.87	11032485.15	10.03	158880.36	4.87	670.60	7.11
	August	146611679.54	3.83	752849.30	3.31	5606292.07	4.95	5518721.39	5.02	87570.68	2.69	1337.44	14.18
	September	110651718.69	2.89	597234.94	2.63	4072729.34	3.59	4016508.77	3.65	54158.82	1.66	1197.69	12.70
	October	31807655.28	0.83	181509.75	0.80	1127567.38	0.99	1114055.49	1.01	12160.70	0.37	306.27	3.25
	Total	3825931428.05	100.00	22722707.92	100.00	113358498.58	100.00	110042254.57	100.00	3260473.56	100.00	9430.27	100.00
	acre-feet	87831.30											
Thisted	Site 9												
1993	June	63322770.84	8.84	400157.11	9.48	2174918.48	10.00	1846785.16	9.13	328133.32	22.19	303.06	15.82
	July	210116485.34	29.34	1208558.53	28.62	5638756.10	25.92	5193897.56	25.68	444858.54	30.09	324.86	16.96
	August	146402113.98	20.44	915509.52	21.68	3816691.13	17.55	3514088.83	17.37	302602.29	20.47	253.73	13.24
	September	82516025.23	11.52	489314.59	11.59	2214644.52	10.18	2091266.52	10.34	123377.99	8.35	160.74	8.39
	October	47623692.28	6.65	317714.41	7.52	1388291.37	6.38	1350996.07	6.68	39918.48	2.70	252.40	13.17
1994	April	35848426.04	5.01	179915.65	4.26	1116661.94	5.13	1069972.11	5.29	30714.35	2.08	22.24	1.16
	May	33274800.00	4.65	168185.58	3.98	1172699.60	5.39	1078947.32	5.33	93752.28	6.34	181.59	9.48
	June	40594176.00	5.67	194237.36	4.60	1715725.82	7.89	1642360.40	8.12	73365.42	4.96	352.83	18.41
	July	8266192.96	1.15	45662.54	1.08	377311.51	1.73	369842.33	1.83	7469.18	0.51	25.81	1.35
	August	10432391.41	1.46	67096.70	1.59	489390.05	2.25	481898.14	2.38	7491.91	0.51	10.97	0.57
	September	17842874.80	2.49	113463.87	2.69	795454.46	3.66	771754.83	3.82	12506.29	0.85	13.63	0.71
	October	19954673.35	2.79	122912.81	2.91	851771.62	3.92	814191.38	4.03	14269.19	0.97	14.13	0.74
	Total	716194622.23	100.00	4222728.67	100.00	21752316.58	100.00	20226000.65	100.00	1478459.25	100.00	1915.99	100.00
	acre-feet	16441.57											
Big Sioux River Watertown		CF/ month		TALK Kg/day		TSOL Kg/day		TDSOL Kg/day		TSSOL Kg/day		AMMONIA Kg/day	
1993	June	479952000.00	4.72	3819688.77	5.30	7677363.64	5.20	7470376.20	5.27	206987.44	3.58	316.35	0.58
	July	1121644800.00	11.03	8661987.51	12.02	16312437.04	11.05	15920625.72	11.23	391811.32	6.78	798.13	1.47
	August	1003795200.00	9.87	6910251.10	9.59	13401533.31	9.08	13089853.81	9.23	311679.50	5.39	1708.98	3.15

Monthly Loadings and the percent of the total loadings for each month, 1993-94
All Sampling Stations including the Big Sioux River (Watertown and Brookings)

	Water CF/ month	Water CF/ %bymonth	TALKAL Kg/month	TALKAL %bymonth	TSOL Kg/month	TSOL %bymonth	TDSOL Kg/month	TDSOL %bymonth	TSSOL Kg/month	TSSOL %bymonth	AMMON Kg/month	AMMON %bymonth
September	485222400.00	4.77	3275360.52	4.55	6696159.24	4.54	6499232.02	4.58	196927.22	3.41	1955.99	3.60
October	280972800.00	2.76	2148821.91	2.98	4341136.55	2.94	4172918.20	2.94	168218.35	2.91	2376.05	4.38
November	168912000.00	1.66	1369774.87	1.90	2659449.73	1.80	2574558.78	1.82	84890.94	1.47	1687.71	3.11
December	155088000.00	1.52	1308209.73	1.82	2541793.04	1.72	2483435.72	1.75	58357.32	1.01	2070.40	3.81
1994 January	110592000.00	1.09	958301.90	1.33	1948088.62	1.32	1917613.13	1.35	30475.49	0.53	2138.30	3.94
February	121305600.00	1.19	898888.76	1.25	1877062.74	1.27	1846452.67	1.30	30610.07	0.53	2038.71	3.75
March	1506470400.00	14.81	9304244.73	12.91	19936310.69	13.50	19114637.11	13.48	821673.58	14.21	12907.93	23.77
April	1131321600.00	11.12	7253906.01	10.07	15088977.56	10.22	14367211.23	10.13	721766.33	12.49	6226.98	11.47
May	727574400.00	7.15	5209368.75	7.23	10502176.25	7.11	9942260.35	7.01	559915.90	9.69	2090.16	3.85
June	732931200.00	7.21	5309792.29	7.37	11284109.35	7.64	10700271.84	7.55	571879.76	9.89	4319.25	7.95
July	929923200.00	9.14	6768204.23	9.39	14464732.19	9.80	13740508.01	9.69	704472.62	12.19	5925.47	10.91
August	665366400.00	6.54	4842696.35	6.72	10349614.66	7.01	9831427.31	6.93	504054.97	8.72	4239.71	7.81
September	289958400.00	2.85	2110386.83	2.93	4510233.32	3.05	4284413.72	3.02	219660.89	3.80	1847.61	3.40
October	260496000.00	2.56	1895952.41	2.63	4051952.76	2.74	3849078.48	2.71	197341.35	3.41	1659.88	3.06
Total	10171526400.00	100.00	72045836.67	100.00	147643130.69	100.00	141804874.29	100.00	5780723.05	100.00	54307.62	100.00
acre-feet	233506.12											
Big Sioux River Brookings	CF/ month		TALK Kg/day		TSOL Kg/day		TDSOL Kg/day		TSSOL Kg/day		AMMONIA Kg/day	
1993 June	479952000.00	4.72	3633309.91	5.26	10215862.00	4.82	9539583.80	4.99	676278.20	3.06	271.84	1.17
July	1121644800.00	11.03	8464299.32	12.25	22319726.60	10.53	21004414.89	10.99	1315311.71	5.96	635.30	2.74
August	1003795200.00	9.87	6905518.89	10.00	21344094.90	10.07	18406345.57	9.63	2937749.33	13.30	568.55	2.46
September	485222400.00	4.77	3129358.32	4.53	11934371.44	5.63	9773903.75	5.12	2160467.69	9.78	274.83	1.19
October	280972800.00	2.76	1850830.08	2.68	6914933.14	3.26	6122085.88	3.20	792847.26	3.59	347.87	1.50
November	168912000.00	1.66	1174836.94	1.70	3911489.62	1.84	3691420.11	1.93	220069.51	1.00	379.90	1.64
December	155088000.00	1.52	1129740.31	1.64	3512652.17	1.66	3423596.69	1.79	89055.48	0.40	518.14	2.24
1994 January	110592000.00	1.09	860097.66	1.24	2520773.40	1.19	2490695.52	1.30	30077.88	0.14	775.77	3.35
February	121305600.00	1.19	854609.38	1.24	2313281.91	1.09	2272084.33	1.19	41197.58	0.19	1252.10	5.41
March	1506470400.00	14.81	9070587.88	13.13	24343441.17	11.48	23173253.25	12.13	1170187.93	5.30	10261.42	44.31
April	1131321600.00	11.12	7100982.90	10.28	19323536.75	9.11	18231121.89	9.54	1092414.86	4.95	4888.61	21.11
May	727574400.00	7.15	5125315.86	7.42	15693876.31	7.40	13893107.52	7.27	1800768.80	8.15	533.49	2.30
June	732931200.00	7.21	5049917.46	7.31	17174291.54	8.10	14910913.09	7.80	2498547.45	11.31	625.66	2.70
July	929923200.00	9.14	6386340.57	9.24	21878154.34	10.32	19119518.57	10.01	3147083.29	14.25	790.06	3.41
August	665366400.00	6.54	4569470.29	6.61	15653968.83	7.38	13680146.10	7.16	2251759.59	10.20	565.30	2.44
September	289958400.00	2.85	1991318.31	2.88	6821804.88	3.22	5961637.49	3.12	981288.82	4.44	246.35	1.06
October	260496000.00	2.56	1788982.33	2.59	6128647.71	2.89	5355881.12	2.80	881580.98	3.99	221.32	0.96
Total	10171526400.00	100.00	69085516.40	100.00	212004906.71	100.00	191049709.55	100.00	22086686.35	100.00	23156.50	100.00

Monthly Loadings and the percent of the total loadings for each month, 1993-94
All Sampling Stations including the Big Sioux River (Watertown and Brookings)

		UNIONIZE AMMONIA Kg/month	UNIONIZE AMMONIA %bymonth	NO3+2 Kg/month	NO3+2 %bymonth	TKN-N Kg/month	TKN-N %bymonth	Organic Nitrogen Kg/month	Organic Nitrogen %bymonth	Total Nitrogen Kg/month	Total Nitrogen %bymonth	TPO4P Kg/month	TPO4P %bymonth	TOTAL DISS. PO4 Kg/month	TOTAL DISS. PO4 %bymonth
Boswell	Site 1														
1993	June	0.20	64.50	275.19	67.50	547.34	56.37	538.28	56.38	822.52	59.66	84.70	55.29	38.46	47.87
	July	0.11	35.50	132.50	32.50	423.66	43.63	416.42	43.62	556.16	40.34	68.49	44.71	41.88	52.13
	August														
	September														
	October														
	Total	0.31	100.00	407.68	100.00	971.00	100.00	954.71	100.00	1378.68	100.00	153.20	100.00	80.35	100.00
	acrefeet														
Stonebridg	Site 2														
1993	June	21.23	3.74	1052.31	21.38	12424.53	15.15	12284.51	15.70	13476.84	15.50	976.93	13.42	394.83	10.97
	July	-29.64	-5.22	-250.50	-5.09	-5222.40	-6.37	-5052.90	-6.46	-5472.90	-6.30	-304.43	-4.18	-130.47	-3.62
	August	306.14	53.96	602.30	12.23	16210.20	19.77	14716.94	18.81	16812.49	19.34	1289.36	17.72	616.45	17.12
	September	37.10	6.54	296.80	6.03	2744.28	3.35	2460.71	3.14	3041.08	3.50	418.81	5.75	174.72	4.85
	October	31.27	5.51	683.94	13.89	10633.17	12.97	10164.98	12.99	11322.62	13.03	1094.97	15.05	440.73	12.24
1994	April	1.62	0.29	178.53	3.63	2742.41	3.34	2706.70	3.46	2920.94	3.36	158.69	2.18	84.60	2.35
	May	3.65	0.64	317.91	6.46	4863.95	5.93	4810.05	6.15	5181.86	5.96	177.76	2.44	86.83	2.41
	June	13.66	2.41	398.88	8.10	6077.64	7.41	5893.84	7.53	6476.52	7.45	585.27	8.04	292.47	8.12
	July	57.60	10.15	670.81	13.63	16158.68	19.71	15713.58	20.08	16829.49	19.36	1193.32	16.40	563.21	15.64
	August	130.07	22.93	980.44	19.92	16026.03	19.55	15171.70	19.39	17006.47	19.56	1748.63	24.03	1109.83	30.82
	September	-35.22	-6.21	-281.79	-5.72	-3424.48	-4.18	-3214.82	-4.11	-3720.45	-4.28	-443.32	-6.09	-308.47	-8.57
	October	29.80	5.25	273.10	5.55	2753.81	3.36	2589.95	3.31	3054.22	3.51	381.89	5.25	275.84	7.66
	Total	567.31	100.00	4922.74	100.00	81987.80	100.00	78245.23	100.00	86929.18	100.00	7277.89	100.00	3600.59	100.00
	acre-feet														
Outlet	Site 3														
1993	June	26.95	1.85	1020.28	5.62	17643.97	5.82	17583.04	5.95	17805.50	5.56	872.66	4.95	430.45	5.18
	July	113.40	7.78	1737.65	9.57	28055.73	9.26	27575.97	9.34	29657.36	9.26	1485.10	8.43	680.33	8.19
	August	584.20	40.08	1862.10	10.26	24177.41	7.98	22843.99	7.73	26039.51	8.13	1489.94	8.46	849.88	10.23
	September	228.78	15.70	1608.98	8.86	22724.59	7.50	22068.76	7.47	24333.57	7.60	1388.07	7.88	639.37	7.70
	October	48.15	3.30	1419.36	7.82	25934.76	8.56	25163.02	8.52	27354.12	8.54	989.82	5.62	408.01	4.91
1994	April	26.62	1.83	1639.62	9.03	28582.95	9.43	27992.57	9.48	30222.57	9.44	1188.07	6.74	501.66	6.04
	May	24.92	1.71	1581.62	8.71	21848.76	7.21	21532.43	7.29	23430.38	7.32	736.05	4.18	317.97	3.83
	June	27.17	1.86	1295.96	7.14	22153.75	7.31	21894.56	7.41	23449.71	7.32	1339.41	7.60	387.03	4.66
	July	131.42	9.02	1978.61	10.90	39685.65	13.10	38441.39	13.02	41664.27	13.01	2620.98	14.87	970.69	11.69
	August	127.47	8.74	1684.84	9.28	29341.85	9.68	28143.94	9.53	31026.69	9.69	2273.17	12.90	1253.15	15.09
	September	77.32	5.30	1301.29	7.17	23349.57	7.70	22749.38	7.70	24650.86	7.70	1820.59	10.33	1070.62	12.89
	October	41.22	2.83	1026.75	5.65	19559.55	6.45	19354.20	6.55	20586.30	6.43	1416.91	8.04	795.73	9.58
	Total	1457.63	100.00	18157.06	100.00	303058.55	100.00	295343.24	100.00	320220.85	100.00	17620.77	100.00	8304.91	100.00
total	acre-feet														
Albert	Site 7														
1993	June	6.38	0.76	1816.24	13.57	19874.75	6.69	19557.68	7.09	21690.99	6.98	1409.63	6.31	847.75	6.75
	July	91.00	10.91	1987.28	14.85	45212.00	15.21	43120.16	15.62	47199.28	15.19	3016.96	13.51	1277.53	10.17
	August	208.69	25.02	1527.52	11.41	42195.51	14.20	38379.81	13.90	43723.03	14.07	3501.62	15.68	1857.88	14.80
	September	106.97	12.82	1116.31	8.34	27645.06	9.30	25197.83	9.13	28761.36	9.25	2333.93	10.45	1521.26	12.12
	October	46.33	5.55	1152.64	8.61	18670.76	6.28	16943.89	6.14	19861.38	6.39	1332.35	5.96	948.89	7.56
1994	April	11.69	1.40	1299.54	9.71	20155.71	6.78	18630.41	6.75	21401.65	6.89	2346.72	10.51	1473.76	11.74
	May	30.29	3.63	979.22	7.32	18345.46	6.17	16979.80	6.15	19324.68	6.22	1159.52	5.19	752.19	5.99

Monthly Loadings and the percent of the total loadings for each month, 1993-94
All Sampling Stations Including the Big Sioux River (Watertown and Brookings)

		UNIONIZE AMMONIA Kg/month	UNIONIZE AMMONIA %bymonth	NO3+2 Kg/month	NO3+2 %bymonth	TKN-N Kg/month	TKN-N %bymonth	Organic Nitrogen Kg/month	Organic Nitrogen %bymonth	Total Nitrogen Kg/month	Total Nitrogen %bymonth	TPO4P Kg/month	TPO4P %bymonth	TOTAL DISS. PO4 Kg/month	TOTAL DISS. PO4 %bymonth
	June	15.17	1.82	741.01	5.54	17603.66	5.92	16673.00	6.04	18344.67	5.90	1168.31	5.23	445.77	3.55
	July	68.35	8.19	730.48	5.46	22414.16	7.54	20592.06	7.46	23144.64	7.45	1509.66	6.76	658.85	5.25
	August	97.87	11.73	627.90	4.69	21617.18	7.27	19811.50	7.18	22245.08	7.16	1552.12	6.95	910.11	7.25
	September	79.77	9.56	632.36	4.72	20377.18	6.86	18768.71	6.80	21079.92	6.78	1431.06	6.41	888.27	7.07
	October	71.60	8.58	775.82	5.80	23080.61	7.77	21373.81	7.74	24011.60	7.73	1574.91	7.05	973.65	7.75
	Total	834.11	100.00	13386.30	100.00	297192.04	100.00	276028.65	100.00	310788.28	100.00	22336.79	100.00	12555.91	100.00
	acre-feet														
St Johns	Site 8														
1993	June	6.16	0.60	2072.12	17.52	23413.57	12.15	23139.21	12.63	25485.70	12.46	2262.97	10.20	1318.97	9.04
	July	99.48	9.63	1921.65	16.24	32040.20	16.63	30465.77	16.62	33961.85	16.60	3679.20	16.59	2988.05	20.48
	August	213.74	20.69	1228.70	10.39	23971.73	12.44	22290.18	12.16	25200.43	12.32	3904.38	17.60	3156.33	21.64
	September	286.02	27.68	1076.32	9.10	15505.70	8.05	14088.01	7.69	16582.02	8.10	2960.32	13.35	1934.42	13.26
	October	49.99	4.84	1258.61	10.64	16157.94	8.38	15814.57	8.63	17484.55	8.55	1998.75	9.01	1190.12	8.16
1994	April	7.29	0.71	639.93	5.41	8272.76	4.29	8144.77	4.44	8912.68	4.36	795.27	3.59	252.16	1.73
	May	13.39	1.30	1079.39	9.12	14128.97	7.33	13913.09	7.59	15208.37	7.43	1207.56	5.44	535.63	3.67
	June	22.29	2.16	923.64	7.81	17749.13	9.21	17466.12	9.53	18672.77	9.13	1617.49	7.29	862.69	5.91
	July	87.50	8.47	810.78	6.85	18908.21	9.81	18237.61	9.95	19718.99	9.64	1785.55	8.05	1086.02	7.45
	August	123.90	11.99	415.20	3.51	11886.45	6.17	10549.01	5.76	12301.66	6.01	1080.56	4.87	669.87	4.59
	September	99.86	9.67	313.37	2.65	8532.35	4.43	7320.92	3.99	8845.72	4.32	718.93	3.24	475.95	3.26
	October	23.51	2.28	90.08	0.76	2139.38	1.11	1824.11	1.00	2229.46	1.09	168.00	0.76	116.65	0.80
	Total	1033.12	100.00	11829.80	100.00	192706.39	100.00	183253.37	100.00	204604.19	100.00	22178.97	100.00	14586.87	100.00
	acre-feet														
Thisted	Site 9														
1993	June	1.86	3.35	300.40	8.65	3973.82	9.63	3670.75	9.33	4274.22	9.52	988.23	10.21	523.69	8.96
	July	7.50	13.53	632.25	18.20	10912.72	26.44	10587.86	26.92	11544.97	25.71	2790.68	28.84	1650.84	28.26
	August	12.08	21.78	449.50	12.94	7646.58	18.53	7392.84	18.79	8096.07	18.03	2223.59	22.98	1379.10	23.61
	September	12.30	22.19	354.39	10.20	4574.30	11.08	4413.56	11.22	4928.69	10.97	925.11	9.56	629.56	10.78
	October	8.88	16.03	608.36	17.51	2914.56	7.06	2660.52	6.76	3522.92	7.84	477.29	4.93	320.09	5.48
1994	April	1.20	2.16	118.70	3.42	2218.64	5.38	2188.66	5.56	2388.66	5.32	439.01	4.54	188.44	3.23
	May	3.60	6.50	226.81	6.53	1819.27	4.41	1637.68	4.16	2046.08	4.56	435.63	4.50	252.53	4.32
	June	4.93	8.89	611.56	17.60	2758.85	6.68	2406.02	6.12	3370.40	7.50	567.36	5.86	367.92	6.30
	July	0.48	0.87	35.60	1.02	732.68	1.78	706.86	1.80	768.27	1.71	139.10	1.44	90.79	1.55
	August	0.46	0.82	29.54	0.85	918.16	2.22	907.19	2.31	947.70	2.11	169.49	1.75	112.22	1.92
	September	0.95	1.71	50.53	1.45	1392.78	3.37	1373.72	3.49	1479.26	3.29	256.97	2.66	164.18	2.81
	October	1.20	2.17	56.51	1.63	1414.20	3.43	1388.77	3.53	1545.59	3.44	264.47	2.73	162.47	2.78
	Total	55.43	100.00	3474.14	100.00	41276.55	100.00	39334.44	100.00	44912.83	100.00	9676.93	100.00	5841.82	100.00
	acre-feet														
Big Sioux River Watertown		UNIONIZE AMMONIA Kg/day		NO3+2 Kg/day								TPO4P Kg/day		ORTHO-P Kg/day	
1993	June	18.32	2.49	2499.09	1.80							3256.01	4.14	2118.67	4.81
	July	26.34	3.59	5324.71	3.84							8779.43	11.16	6347.98	14.42
	August	38.95	5.30	4212.98	3.04							8062.03	10.25	5389.24	12.24

Monthly Loadings and the percent of the total loadings for each month, 1993-94
All Sampling Stations including the Big Sioux River (Watertown and Brookings)

		UNIONIZE AMMONIA Kg/month	UNIONIZE AMMONIA %bymonth	NO3+2 Kg/month	NO3+2 %bymonth	TKN-N Kg/month	TKN-N %bymonth	Organic Nitrogen Kg/month	Organic Nitrogen %bymonth	Total Nitrogen Kg/month	Total Nitrogen %bymonth	TPO4P Kg/month	TPO4P %bymonth	TOTAL DISS. PO4 Kg/month	TOTAL DISS. PO4 %bymonth
	September	60.76	8.27	3593.93	2.59							3723.68	4.73	1926.75	4.38
	October	49.62	6.75	5975.20	4.31							1637.71	2.08	794.41	1.80
	November	16.16	2.20	5820.81	4.19							702.50	0.89	469.10	1.07
	December	12.16	1.65	6613.46	4.77							724.08	0.92	464.84	1.06
1994	January	13.48	1.84	4571.32	3.29							1398.82	1.78	454.43	1.03
	February	15.28	2.08	4381.33	3.16							2112.58	2.69	669.86	1.52
	March	51.90	7.06	41360.05	29.80							13889.50	17.66	6548.49	14.87
	April	18.47	2.51	22070.57	15.90							7743.24	9.84	3793.78	8.62
	May	48.99	6.67	4261.55	3.07							4387.23	5.58	2253.54	5.12
	June	90.76	12.35	6827.93	4.92							5531.35	7.03	3195.83	7.26
	July	118.51	16.13	9217.40	6.64							7242.24	9.21	4161.00	9.45
	August	84.79	11.54	6595.11	4.75							5181.87	6.59	2977.22	6.76
	September	36.95	5.03	2874.07	2.07							2258.20	2.87	1297.44	2.95
	October	33.20	4.52	2582.04	1.86							2028.74	2.58	1165.60	2.65
	Total	734.64	100.00	138781.55	100.00							78659.22	100.00	44028.19	100.00
	acre-feet														
Big Sioux River Brookings		UNIONIZE AMMONIA Kg/day		NO3+2 Kg/day								TPO4P Kg/day		ORTHO-P Kg/day	
1993	June	7.75	4.76	6820.10	3.68							3532.17	4.71	2160.19	5.51
	July	17.00	10.45	10219.02	5.51							9153.75	12.19	6481.61	16.52
	August	16.95	10.42	7967.92	4.30							8451.14	11.26	4644.55	11.84
	September	9.75	5.99	5676.20	3.06							3790.64	5.05	1321.24	3.37
	October	4.69	2.88	6524.76	3.52							1655.62	2.21	585.91	1.49
	November	1.93	1.18	5373.28	2.90							747.18	1.00	270.11	0.69
	December	4.40	2.70	5601.57	3.02							599.56	0.80	272.02	0.69
1994	January	7.05	4.33	4142.51	2.23							901.18	1.20	331.11	0.84
	February	6.44	3.95	4865.80	2.62							1520.39	2.03	646.28	1.65
	March	30.38	18.67	46830.22	25.25							12596.05	16.78	7266.72	18.52
	April	14.19	8.72	23869.00	12.87							7046.18	9.39	3849.96	9.81
	May	5.99	3.68	5702.13	3.07							3440.21	4.58	1317.72	3.36
	June	8.87	5.45	12377.38	6.67							5274.81	7.03	2447.89	6.24
	July	11.85	7.28	17118.03	9.23							7090.81	9.45	3311.68	8.44
	August	8.48	5.21	12248.06	6.60							5073.53	6.76	2369.53	6.04
	September	3.70	2.27	5337.55	2.88							2210.98	2.95	1032.61	2.63
	October	3.32	2.04	4795.21	2.59							1986.32	2.65	927.69	2.36
	Total	162.74	100.00	185468.75	100.00							75070.54	100.00	39236.82	100.00

APPENDIX I:

The following tables contain the average daily stages (feet) and average daily discharges (cubic feet per second or cfs) for each monitoring station including the USGS gaging station at Castlewood. These stages and discharges were those used to calculate the average daily and monthly loadings for each tributary site. As discussed previously the average daily discharge for each site was calculated through regression analysis between stage (depth) and instantaneous discharge measurements (cfs). Omnidata Datapod II dataloggers were used to collect the daily stages at each monitoring station.

Also contained in the following tables are the periodic measurements of the lake elevation at site 3 (outlet) and the lake elevation measured at the well near Pier 81 (Pier 81 elev) on the west side of the lake. These two measurements were used to aid in the determination of the discharge from site 3 (outlet of Lake Poinsett).

Date	Site 1 Boswell Avg Daily Stage (ft)	Avg Daily CFS	Site 2 DrylakeSouth Avg Daily Stage	Avg Daily CFS	Site 3 Outlet Avg Daily Stage	Avg Daily CFS	Site 3 Outlet msl Elev	Pier81 Well Elev	Site 7 Albert Avg Daily Stage	Avg Daily CFS	Site 8 StJonsOutlet Avg Daily Stage	Avg Daily CFS	Site 9 Thisted Avg Daily Stage	Avg Daily CFS	USGS Castlewood Gaging Avg Daily CFS
06/01/93															144
06/02/93		4.93													149
06/03/93		4.93													146
06/04/93		4.93	4.09	157.56					4.45	100.14	5.78	224.60	4.45	23.54	143
06/05/93		4.93	4.08	157.56					4.45	99.97	13.99	607.25	4.45	23.49	138
06/06/93		4.93	4.04	157.56					4.42	98.94	15.77	641.91	4.42	23.15	136
06/07/93		4.93	4.02	157.56					4.48	101.22	10.73	489.38	4.48	23.88	123
06/08/93	4.72	4.93	4.02	157.56	6.31	194.12			4.45	100.14	3.05	107.83	4.45	23.54	127
06/09/93	4.48	4.93	4.01	288.59	6.22	190.55		1652.10	4.42	99.18	2.98	105.11	4.42	23.23	156
06/10/93	4.54	4.93	4.01	142.54	6.18	189.12			4.42	99.18	2.97	104.60	4.42	23.23	142
06/11/93	4.53	7.80	3.97	-3.51	6.16	188.18			4.41	98.61	2.93	102.89	4.41	23.04	135
06/12/93	4.47	7.42	3.94	95.51	6.13	186.95			4.42	98.98	2.91	102.19	4.42	23.16	128
06/13/93	4.44	7.42	3.95	95.51	6.20	189.91			4.44	99.64	2.94	103.24	4.44	23.38	126
06/14/93	4.44	7.42	3.96	95.51	6.22	190.35			4.41	98.73	3.29	117.45	4.41	23.08	124
06/15/93	4.49	7.42	3.88	95.51	6.14	187.29			4.44	99.76	3.66	132.81	4.44	23.42	109
06/16/93	4.50	7.42	3.99	95.51	6.26	191.98			4.54	103.11	3.79	138.44	4.54	24.47	100
06/17/93	4.45	7.04	4.07	194.53	6.32	194.66			4.59	105.23	3.92	143.62	4.59	25.10	116
06/18/93	4.51	0.49	4.14	60.22	6.37	196.50			4.67	108.46	4.04	148.88	4.67	26.01	141
06/19/93	4.85	4.19	4.25	12.62	6.49	201.39			4.78	113.37	4.23	156.86	4.78	27.31	214
06/20/93	4.95	4.19	4.31	12.62	6.56	203.90			4.84	115.98	4.40	164.26	4.84	27.96	366
06/21/93	5.00	4.19	4.35	-34.98	6.59	205.36			4.91	119.68	4.58	171.64	4.91	28.85	395
06/22/93	4.88	4.19	4.33	-120.25	6.61	206.21			4.99	123.62	4.81	181.71	4.99	29.75	271
06/23/93	4.89	7.89	4.41	99.56	6.66	207.98			5.08	128.77	4.91	186.21	5.08	30.87	256
06/24/93	4.99	9.08	4.45	-44.05	6.74	211.16		1653.31	5.13	132.19	5.08	193.60	5.13	31.59	265
06/25/93	5.03	9.08	4.45	-187.67	6.75	211.61			5.16	134.08	5.21	198.89	5.16	31.97	279
06/26/93	4.93	9.08	4.45	-117.53	6.71	210.20			5.19	135.53	5.52	212.83	5.19	32.26	256
06/27/93	4.88	9.08	4.45	-110.98	6.68	209.04			5.22	138.00	5.55	214.16	5.22	32.74	213
06/28/93	4.86	9.08	4.44	-104.43	6.67	208.53			5.25	139.78	5.55	214.16	5.25	33.08	165
06/29/93	5.02	9.08	4.47	331.02	6.73	210.80			5.34	146.16	5.62	217.20	5.34	34.27	189
06/30/93	5.33	9.08	4.63	119.33	6.90	217.81		1653.72	5.51	159.42	5.78	224.84	5.51	36.54	283
07/01/93	5.40	9.08	4.69	-92.36	6.99	221.33			5.55	163.05	5.83	227.19	5.55	37.13	350
07/02/93	5.30	10.26	4.79	-142.50	7.06	224.51			5.67	173.74	5.91	231.78	5.67	38.77	442
07/03/93	5.44	10.91	4.76	-158.94	7.16	228.57			5.78	184.67	6.02	237.20	5.78	44.47	412
07/04/93	5.82	10.91	5.20	-158.94	7.31	234.82			5.96	204.40	6.18	246.01	5.96	56.45	512
07/05/93	5.82	10.91	5.45	-175.39	7.39	237.88			6.02	211.71	6.19	246.48	6.02	61.36	589
07/06/93	5.76	11.55	5.53	-11.51	7.42	239.18			6.07	218.06	6.23	248.44	6.07	65.85	500
07/07/93	5.75	13.21	5.58	-25.24	7.45	240.69		1654.00	6.14	228.58	6.27	250.53	6.14	73.74	384
07/08/93	5.82	13.21	5.64	-158.94	7.51	243.04			6.21	238.48	6.31	252.76	6.21	81.69	359
07/09/93	5.88	14.86	5.71	-38.96	7.56	245.13		1654.05	6.24	242.89	6.30	252.22	6.24	85.41	357
07/10/93	6.03	7.43	5.72	-49.41	7.58	246.13			6.26	245.89	6.33	253.84	6.26	87.99	345
07/11/93	6.05	7.43	5.75	-49.41	7.62	247.65			6.28	247.98	6.23	248.64	6.28	89.82	327
07/12/93	6.19		5.79	-59.86	7.62	247.54			6.30	251.63	6.23	248.77	6.30	93.09	310
07/13/93	6.19		5.79	-29.08	7.63	248.12			6.31	253.00	6.16	245.07	6.31	94.33	299
07/14/93	6.20		5.84	-28.74	7.65	248.80			6.30	251.63	6.07	240.06	6.30	93.09	298
07/15/93	6.25		5.85	-131.46	7.66	249.38			6.30	252.02	6.10	241.59	6.30	93.44	291
07/16/93	6.28		5.87	-131.46	7.68	250.06			6.24	242.70	6.01	236.94	6.24	85.25	286
07/17/93	6.29		5.91	-131.46	7.72	251.90			6.26	245.32	6.01	236.80	6.26	87.50	312
07/18/93	6.32		5.94	-131.46	7.75	252.96			6.27	246.08	5.96	234.02	6.27	88.16	354
07/19/93	6.27		5.95	-131.46	7.79	254.59		1654.47	6.29	250.28	5.85	228.56	6.29	91.87	393
07/20/93	6.24		6.01	-131.46	7.78	254.43			6.26	245.89	5.84	227.65	6.26	87.99	356
07/21/93	6.22		5.96	-131.46	7.77	253.80			6.25	244.01	5.76	223.54	6.25	86.37	324
07/22/93	6.30		6.01	-131.46	7.76	253.32			6.21	237.57	5.75	223.41	6.21	80.94	305
07/23/93	6.31		5.98	-234.17	7.76	253.54			6.15	228.75	5.71	221.24	6.15	73.87	303
07/24/93	6.32		5.96	-69.07	7.78	254.33			6.10	223.16	5.68	219.91	6.10	69.60	308
07/25/93	6.30		6.05	-69.07	7.91	259.67			6.18	233.11	5.56	214.49	6.18	77.31	562
07/26/93	6.31		6.14	96.04	7.94	261.21		1654.47	6.18	233.99	5.57	215.04	6.18	78.02	899
07/27/93	6.57		6.14	109.67	8.02	264.50			6.26	245.51	5.67	219.13	6.26	87.66	757
07/28/93	6.45		6.15	123.30	7.99	263.33			6.25	243.08	5.36	205.57	6.25	85.57	560
07/29/93	6.34		6.16	-43.55	7.96	261.90		1654.57	6.23	240.49	5.40	207.39	6.23	83.37	511
07/30/93	6.41		6.15	81.23	7.94	260.99			6.24	242.33	5.53	213.17	6.24	84.93	490
07/31/93	6.40		6.03	14.45	7.96	262.16			6.26	244.57	3.77	137.60	6.26	86.85	487
08/01/93	6.51		6.08	14.45	7.98	262.96			6.23	240.12	4.11	151.67	6.23	83.06	488
08/02/93	6.32		6.05	-52.33	7.94	261.10		1654.72	6.13	226.19	4.89	185.23	6.13	71.89	489
08/03/93	6.27		6.02	184.08	7.91	259.67			6.06	217.58	4.48	167.68	6.06	65.50	485
08/04/93	6.25		5.98	110.31	7.87	258.34		1654.72	6.04	214.86	8.61	164.72	6.04	63.56	477
08/05/93	6.21		5.95	110.31	7.84	256.76			5.97	206.35	8.51	158.97	5.97	57.73	471
08/06/93	6.17		5.93	110.31	7.81	255.65		1654.64	5.98	207.71	8.53	159.89	5.98	58.64	457
08/07/93	6.17		5.90	110.31	7.77	254.01			5.90	198.00	8.41	153.41	5.90	52.36	445
08/08/93	6.19		5.87	110.31	7.75	252.96			5.86	193.92	8.35	150.73	5.86	49.86	432

Date	Site 1 Boswell Avg Daily Stage (ft)	Avg Daily CFS	Site 2 DrylakeSouth Avg Daily Stage	Avg Daily CFS	Site 3 Outlet Avg Daily Stage	Avg Daily CFS	Site 3 Outlet msl Elev	Pier81 Well Elev	Site 7 Albert Avg Daily Stage	Avg Daily CFS	Site 8 StJonsOutlet Avg Daily Stage	Avg Daily CFS	Site 9 Thisted Avg Daily Stage	Avg Daily CFS	USGS Castlewood Gaging Avg Daily CFS
08/09/93	6.28		5.82	110.31	7.72	251.90		1654.56	5.83	189.69	8.30	147.96	5.83	47.34	418
08/10/93	6.28		5.79	36.54	7.69	250.64		1654.47	5.81	187.95	8.27	146.84	5.81	46.33	402
08/11/93	6.26		5.77	-167.93	7.66	249.17			5.78	184.54	8.23	144.63	5.78	44.40	384
08/12/93	6.18		5.74	253.96	7.62	247.65			5.75	181.98	8.19	142.98	5.75	42.97	372
08/13/93	6.16		5.70	211.45	7.59	246.28			5.72	178.35	8.14	140.67	5.72	41.01	358
08/14/93	6.21		5.79	211.45	7.72	251.95		1654.47	5.83	190.63	8.31	148.58	5.83	47.90	390
08/15/93	6.32		5.86	211.45	7.76	253.59			5.93	201.90	8.46	156.00	5.93	54.82	512
08/16/93	6.32		5.85	211.45	7.76	253.43			5.95	204.11	8.49	157.47	5.95	56.25	547
08/17/93	6.34		5.85	168.95	7.76	253.32		1654.64	5.96	205.00	8.59	163.10	5.96	56.84	434
08/18/93	6.33		5.85	263.69	7.74	252.85			5.97	206.65	8.67	167.80	5.97	57.93	383
08/19/93	6.31		5.83	-136.48	7.73	252.11			5.99	208.17	8.75	172.94	5.99	58.95	356
08/20/93	6.28		5.81	-47.76	7.70	250.90			6.00	209.85	8.80	176.44	6.00	60.09	337
08/21/93	6.29		5.80	-47.76	7.67	249.80			6.01	211.09	8.85	179.81	6.01	60.93	321
08/22/93	6.27		5.78	-47.76	7.65	248.96			6.01	210.47	8.85	179.81	6.01	60.51	308
08/23/93	6.24		5.74	-47.76	7.37	237.00			5.98	206.80	8.82	177.36	5.98	58.03	298
08/24/93	6.19		5.72	40.95		248.59		1654.39	5.96	204.85	8.77	174.07	5.96	56.74	288
08/25/93	6.20		5.70	-15.48		248.60			5.95	203.22	8.64	166.15	5.95	55.68	276
08/26/93	5.96		5.66	-15.48		243.80			5.92	199.72	8.64	166.07	5.92	53.44	268
08/27/93	5.85		5.64	-15.48		241.64			5.89	196.58	8.64	166.30	5.89	51.48	260
08/28/93	5.85		5.61	-15.48		240.98			5.87	194.34	8.61	164.30	5.87	50.11	251
08/29/93	5.81		5.59	-15.48		239.87			5.84	190.77	8.56	161.79	5.84	47.98	244
08/30/93	5.81		5.47	-15.48		237.92			5.75	182.10	8.61	164.38	5.75	43.04	237
08/31/93	5.76		5.42	-15.48		235.76		1654.31	5.68	174.70	8.60	163.80	5.68	39.10	230
09/01/93	5.76		5.38	-15.48		235.09			5.64	171.27	8.57	162.21	5.64	38.40	223
09/02/93	5.82		5.35	-15.48		235.03			5.55	163.27	8.38	152.04	5.55	37.16	217
09/03/93	5.78		5.30	-71.91		233.59			5.51	159.42	8.28	146.88	5.51	36.54	211
09/04/93	5.61		5.26	-29.70		230.07		1654.22	5.48	156.83	8.16	141.70	5.48	36.12	208
09/05/93	5.45		5.23	-29.70		226.75	1653.85		5.45	154.40	8.08	138.13	5.45	35.71	202
09/06/93	5.41		5.19	-29.70		225.29	1653.83		5.39	149.81	7.93	132.54	5.39	34.92	197
09/07/93	5.37		5.16	12.51		224.15			5.37	148.48	7.85	129.71	5.37	34.68	193
09/08/93	5.41		5.12	119.98		224.12			5.35	147.26	7.83	128.84	5.35	34.47	189
09/09/93	5.37		5.03	227.44		222.11			5.31	143.71	7.54	119.85	5.31	33.82	187
09/10/93	5.44		5.02	234.70		222.88		1653.97	5.28	142.11	7.39	116.07	5.28	33.52	181
09/11/93	5.42		4.98	234.70		222.01	1653.58		5.28	142.20	7.46	117.74	5.28	33.54	175
09/12/93	5.37		4.95	234.70		220.45			5.22	137.58	7.35	115.04	5.22	32.66	172
09/13/93	5.20		5.02	234.70		218.34			5.18	135.28	7.01	108.08	5.18	32.21	172
09/14/93	5.25		5.09	234.70		219.93			5.15	133.29	6.92	106.52	5.15	31.81	172
09/15/93	5.31		5.07	234.70		220.48			5.13	132.03	7.08	109.43	5.13	31.55	169
09/16/93	5.20		4.99	241.96		217.29		1653.89	5.08	128.77	7.11	109.95	5.08	30.87	164
09/17/93	4.95		4.95	21.80		212.42			5.02	125.22	6.84	105.42	5.02	30.11	159
09/18/93	4.93		4.93	-85.02		211.63			5.00	124.10	6.86	105.72	5.00	29.86	151
09/19/93	4.90		4.94	-85.02		211.73			5.06	127.67	6.99	107.80	5.06	30.64	149
09/20/93	4.98		4.99	-85.02		213.71			5.06	127.67	7.02	108.19	5.06	30.64	167
09/21/93	4.98		4.94	-191.84		212.94			5.02	125.72	7.02	108.23	5.02	30.22	192
09/22/93	4.96		4.93	0.96		212.17			5.00	124.38	7.01	108.01	5.00	29.92	253
09/23/93	4.94		4.95	0.96		212.04			4.98	123.07	6.78	104.60	4.98	29.63	257
09/24/93	4.94		4.94	0.96		211.63	1653.46		4.96	121.92	6.93	106.70	4.96	29.37	222
09/25/93	4.91		4.92	0.96		210.78			4.93	120.46	6.86	105.66	4.93	29.03	198
09/26/93	4.91		4.83	0.96		209.43			4.87	117.58	6.49	101.31	4.87	28.35	185
09/27/93	4.86		4.84	0.96		208.40			4.84	115.92	6.53	101.66	4.84	27.95	176
09/28/93	4.93		4.75	193.75		208.13			4.79	113.83	6.37	100.37	4.79	27.43	167
09/29/93	4.98		4.79	-18.87		209.24			4.77	112.68	6.43	100.81	4.77	27.13	157
09/30/93	4.90		4.72	-18.87		207.06	1653.29		4.74	111.38	6.65	102.93	4.74	26.79	151
10/01/93	4.89		4.67	-18.87	6.49	201.29			4.74	111.44	6.11	99.01	4.74	26.81	148
10/02/93	4.88		4.68	-18.87	6.45	199.79			4.67	108.41	5.87	98.65	4.67	26.00	144
10/03/93	4.85		4.65	-18.87	6.42	198.35		1653.72	4.64	107.28	6.12	99.04	4.64	25.68	136
10/04/93	4.56		4.60	-18.87	6.38	196.85			4.59	105.23	5.89	98.65	4.59	25.10	131
10/05/93	4.61		4.59	-231.49	6.35	195.66	1653.83		4.57	104.37	5.86	98.66	4.57	24.84	122
10/06/93	4.51		4.56	-33.81	6.33	194.81			4.53	102.97	5.91	98.65	4.53	24.43	119
10/07/93	4.45		4.48	-33.81	6.27	192.53			4.51	102.24	5.80	98.71	4.51	24.20	115
10/08/93	4.50		4.47	-33.81	6.25	191.78			4.53	102.69	5.45	100.06	4.53	24.34	104
10/09/93	4.45		4.43	-33.81	6.27	192.53			4.37	97.39	5.42	100.28	4.37	22.62	100
10/10/93	4.42		4.43	-33.81	6.25	191.83			3.74	84.13	5.44	100.15	3.74	16.45	110
10/11/93	4.45		4.40	163.88	6.22	190.35			3.74	84.06	5.40	100.43	3.74	16.39	114
10/12/93	4.53		4.37	84.69	6.18	189.07			3.61	82.84	5.25	101.70	3.61	15.28	109
10/13/93	4.53		4.35	84.69	6.16	188.13	1652.88		3.60	82.72	5.25	101.66	3.60	15.14	100
10/14/93	4.48		4.32	84.69	6.13	187.14			3.69	83.49	5.21	102.12	3.69	15.92	100
10/15/93	4.47		4.30	84.69	6.13	186.90			3.66	83.27	5.14	102.85	3.66	15.72	99
10/16/93	4.45		4.19	84.69	6.11	186.16			3.02	84.14	5.06	103.77	3.02	10.57	100

Date	Site 1 Boswell Avg Daily Stage (ft)	Avg Daily CFS	Site 2 DrylakeSouth Avg Daily Stage	Avg Daily CFS	Site 3 Outlet Avg Daily Stage	Avg Daily CFS	Site 3 Outlet msl Elev	Pier81 Well Elev	Site 7 Albert Avg Daily Stage	Avg Daily CFS	Site 8 StJonsOutlet Avg Daily Stage	Avg Daily CFS	Site 9 Thisted Avg Daily Stage	Avg Daily CFS	USGS Castlewood Gaging. Avg Daily CFS
10/17/93	4.45		4.18	84.69	6.10	185.67			3.13	82.96	5.02	104.27	3.13	11.33	100
10/18/93	4.42		4.16	5.50	6.08	184.83		1653.05	3.12	83.06	4.97	105.01	3.12	11.26	102
10/19/93	4.42		4.14	52.84	6.06	184.19	1652.75		3.31	81.95	4.94	105.42	3.31	12.72	100
10/20/93	4.28		4.11	52.84	6.05	183.85			2.98	84.77	4.83	107.01	2.98	10.26	103
10/21/93	4.23		4.13	100.17	6.02	182.80			3.01	84.28	4.73	108.82	3.01	10.49	103
10/22/93	4.08		4.10	63.35	5.98	180.71			3.31	81.95	4.67	109.77	3.31	12.71	100
10/23/93	4.06		4.09	63.35	5.97	179.69			3.54	82.36	4.66	110.12	3.54	14.66	92
10/24/93	4.04		4.07	63.35	5.95	178.45			3.67	83.37	4.62	110.86	3.67	15.81	92
10/25/93	4.02		4.04	63.35	5.95	178.52			4.18	92.20	4.55	112.14	4.18	20.69	91
10/26/93	4.00		4.07	63.35	5.91	176.46			3.27	82.05	4.37	116.17	3.27	12.44	97
10/27/93	4.00		4.10	63.35	5.90	175.72	1652.58		2.92	85.82	4.41	115.15	2.92	9.83	89
10/28/93	4.01		4.04	63.35	5.86	173.54			3.11	83.17	4.31	117.45	3.11	11.17	92
10/29/93	3.96		4.01	63.35	5.82	171.05			2.90	86.28	4.08	123.29	2.90	9.67	88
10/30/93	4.00		4.00	63.35	5.79	169.21			2.92	85.75	4.04	124.18	2.92	9.86	76
10/31/93	4.05		4.01	63.35	5.77	167.90			2.90	86.28	4.06	123.85	2.90	9.67	76
11/01/93	4.05		3.99	63.35	5.75	166.89			2.85	87.26	4.02	124.78	2.85	9.35	71
11/02/93	4.00		3.97	63.35	5.75	166.66	1652.46		2.87	86.75	3.94	127.06	2.87	9.51	72
11/03/93	4.00		3.95	63.35	5.72	164.79		1653.00	3.23	82.23	3.92	127.57	3.23	12.12	72
11/04/93									2.67	92.28	3.89	128.23	2.67	8.16	72
11/05/93															72
11/06/93															72
11/07/93															69
11/08/93															69
11/09/93															69
11/10/93															70
11/11/93															70
11/12/93															70
11/13/93															68
11/14/93															67
11/15/93								1652.72							65
11/16/93															65
11/17/93															65
11/18/93															66
11/19/93															70
11/20/93															72
11/21/93															72
11/22/93															70
11/23/93															60
11/24/93															55
11/25/93															50
11/26/93															50
11/27/93															50
11/28/93															52
11/29/93															55
11/30/93															55
12/01/93								1652.47							58
12/02/93															58
12/03/93															60
12/04/93															60
12/05/93															60
12/06/93															62
12/07/93															65
12/08/93															68
12/09/93							1652.33								73
12/10/93															73
12/11/93															69
12/12/93															65
12/13/93															62
12/14/93															60
12/15/93															60
12/16/93															60
12/17/93															60
12/18/93															58
12/19/93															58
12/20/93															55
12/21/93															55
12/22/93															52
12/23/93															50
12/24/93															47

Date	Site 1 Boswell Avg Daily Stage (ft)	Avg Daily CFS	Site 2 DrylakeSouth Avg Daily Stage	Avg Daily CFS	Site 3 Outlet Avg Daily Stage	Avg Daily CFS	Site 3 Outlet msl Elev	Pier81 Well Elev	Site 7 Albert Avg Daily Stage	Avg Daily CFS	Site 8 StJonsOutlet Avg Daily Stage	Avg Daily CFS	Site 9 Thisted Avg Daily Stage	Avg Daily CFS	USGS Castlewood Gaging Avg Daily CFS
12/25/93															45
12/26/93															45
12/27/93															45
12/28/93															47
12/29/93															50
12/30/93															55
12/31/93															60
01/01/94															55
01/02/94															50
01/03/94															45
01/04/94															45
01/05/94															45
01/06/94															42
01/07/94															40
01/08/94															38
01/09/94															40
01/10/94															45
01/11/94															45
01/12/94															42
01/13/94															40
01/14/94															35
01/15/94															32
01/16/94															32
01/17/94															30
01/18/94															28
01/19/94															30
01/20/94															35
01/21/94															40
01/22/94															45
01/23/94															50
01/24/94															50
01/25/94															47
01/26/94															45
01/27/94															45
01/28/94															42
01/29/94															40
01/30/94															40
01/31/94															42
02/01/94								1652.40							42
02/02/94															42
02/03/94															45
02/04/94															45
02/05/94															42
02/06/94															40
02/07/94															35
02/08/94															32
02/09/94															30
02/10/94															33
02/11/94															37
02/12/94															40
02/13/94															40
02/14/94															42
02/15/94															47
02/16/94															47
02/17/94															50
02/18/94															60
02/19/94															65
02/20/94															60
02/21/94															55
02/22/94															50
02/23/94															55
02/24/94															55
02/25/94															60
02/26/94															70
02/27/94															85
02/28/94															100
03/01/94							1652.48								95
03/02/94															90
03/03/94															90

Date	Site 1 Boswell Avg Daily Stage (ft)	Avg Daily CFS	Site 2 DrylakeSouth Avg Daily Stage	Avg Daily CFS	Site 3 Outlet Avg Daily Stage	Avg Daily CFS	Site 3 Outlet msl Elev	Pier81 Well Elev	Site 7 Albert Avg Daily Stage	Avg Daily CFS	Site 8 StJonsOutlet Avg Daily Stage	Avg Daily CFS	Site 9 Thisted Avg Daily Stage	Avg Daily CFS	USGS Castlewood Gaging Avg Daily CFS
03/04/94															90
03/05/94															100
03/06/94															200
03/07/94															300
03/08/94															500
03/09/94							1652.63								450
03/10/94							1652.67	1652.47							300
03/11/94															250
03/12/94															225
03/13/94															230
03/14/94															270
03/15/94															500
03/16/94							1652.83								920
03/17/94															1200
03/18/94							1653.83								1000
03/19/94															900
03/20/94															1150
03/21/94							1653.25								1170
03/22/94															935
03/23/94								1653.05							843
03/24/94															757
03/25/94															714
03/26/94															721
03/27/94															710
03/28/94							1653.58								702
03/29/94								1653.57							689
03/30/94															673
03/31/94															662
04/01/94			4.92	33.53	6.86	216.21			4.90		3.08	145.84		10.77	655
04/02/94			4.97	33.53	6.91	218.08			4.95		3.11	145.66		10.36	652
04/03/94			5.01	33.53	6.95	219.72			5.00		3.12	145.57		10.41	642
04/04/94			5.11	33.53	7.03	223.29			5.11		3.11	145.64		14.08	613
04/05/94			5.12	33.53	7.04	223.62			5.13		3.11	145.67		14.08	585
04/06/94			5.18	33.53	7.10	225.89			5.20		3.10	145.71		14.08	566
04/07/94			5.12	33.53	7.05	223.86			5.13		3.09	145.78		14.08	557
04/08/94			5.05	33.53	6.98	221.18			5.05		3.10	145.75		14.08	540
04/09/94			5.09	33.53	7.01	222.49		1653.47	5.09		3.06	146.00		14.08	544
04/10/94	5.40		5.07	33.53	7.07	224.68			5.07		3.04	146.07		14.08	510
04/11/94			5.06	33.53	7.07	224.61			5.06	124.10	3.02	146.12		14.08	482
04/12/94			5.02	33.53	7.06	224.35			5.01	117.94	2.98	146.12		14.08	450
04/13/94			5.03	33.53	7.07	224.76			5.03	117.94	2.98	146.12		14.08	420
04/14/94			5.05	33.53	7.06	224.20			5.04	117.94	2.96	146.07		14.08	409
04/15/94			5.07	33.53	7.16	228.52			5.07	117.94	2.99	146.13		14.08	456
04/16/94			5.15	33.53	7.14	227.49			5.16	117.94	2.99	146.13		14.08	489
04/17/94			5.19	33.53	7.11	226.30			5.21	117.94	2.99	146.13		14.08	427
04/18/94			5.11	33.53	7.10	225.94			5.11	117.94	2.96	146.07		17.76	387
04/19/94			5.11	33.53	7.08	225.33			5.12	117.94	2.94	145.97		14.04	358
04/20/94			5.08	40.54	7.03	223.23			5.08	117.94	2.92	145.84		14.04	336
04/21/94			5.06	95.34	7.02	222.61			5.06	111.77	2.90	145.68		14.04	317
04/22/94			5.04	95.34	7.01	222.15			5.04	116.14	2.89	145.61		14.04	316
04/23/94			5.00	95.34	6.99	221.33			4.98	116.14	2.89	145.56		14.04	315
04/24/94			4.96	95.34	6.92	218.57			4.95	116.14	2.81	144.39		14.04	297
04/25/94			4.92	95.34	6.86	216.33			4.89	116.14	2.77	143.53		14.04	252
04/26/94			4.98	95.34	6.91	218.06			4.96	116.14	2.80	144.27		14.04	255
04/27/94			4.98	95.34	6.91	218.37		1653.47	4.96	116.14	2.79	144.09		14.04	293
04/28/94			4.98	95.34	6.90	217.76			4.96	116.14	2.79	144.09		14.04	300
04/29/94			5.01	95.34	6.95	219.70			5.00	116.14	2.83	144.84		14.04	315
04/30/94			5.00	95.34	6.92	218.68			4.99	116.14	2.83	144.78		14.04	356
05/01/94			4.99	95.34	6.91	218.22			4.98	116.14	2.82	144.63		14.04	383
05/02/94			4.97	95.34	6.91	218.22			4.95	116.14	2.84	144.90		14.04	397
05/03/94			4.97	95.34	6.91	218.11	1653.56		4.95	116.14	2.85	145.09		14.04	391
05/04/94			4.94	95.34	6.88	217.20	1653.54		4.92	116.14	2.81	144.54		14.04	399
05/05/94			4.93	95.34	6.87	216.59			4.91	116.14	2.81	144.42		14.04	391
05/06/94			4.92	95.34	6.87	216.69			4.90	116.14	2.81	144.49		14.04	381
05/07/94			4.92	95.34	6.88	216.84			4.89	116.14	2.82	144.65		14.04	387
05/08/94			4.90	95.34	6.85	215.87			4.88	116.14	2.81	144.49		14.04	379
05/09/94			4.86	95.34	6.84	215.26		1653.31	4.83	116.14	2.77	143.68		14.04	352
05/10/94			4.86	95.34	6.81	214.35	1653.46		4.83	116.14	2.77	143.53		14.04	332
05/11/94			4.84	150.14	6.78	212.83			4.80	116.14	2.72	142.24		10.32	320

Date	Site 1 Boswell Avg Daily Stage (ft)	Avg Daily CFS	Site 2 DrylakeSouth Avg Daily Stage	Avg Daily CFS	Site 3 Outlet Avg Daily Stage	Avg Daily CFS	Site 3 Outlet msl Elev	Pier81 Well Elev	Site 7 Albert Avg Daily Stage	Avg Daily CFS	Site 8 StJonsOutlet Avg Daily Stage	Avg Daily CFS	Site 9 Thisted Avg Daily Stage	Avg Daily CFS	USGS Castlewood Gaging Avg Daily CFS
05/12/94			4.83	4.96	6.71	210.30	1653.42		4.79	116.14	2.70	141.49		13.19	291
05/13/94			4.81	4.96	6.64	207.22			4.77	116.14	2.70	141.57		13.19	279
05/14/94			4.89	4.96	6.78	213.08	1653.54		4.86	116.14	2.78	143.76		13.19	300
05/15/94			4.89	4.96	6.78	212.88			4.86	116.14	2.79	144.04		13.19	294
05/16/94			4.87	4.96	6.74	211.26			4.83	116.14	2.81	144.47		13.19	278
05/17/94			4.79	4.96	6.70	209.64			4.74	116.14	2.83	144.78		13.19	263
05/18/94			4.72	4.96	6.67	208.33			4.67	116.14	2.80	144.20		13.19	251
05/19/94			4.81	4.96	6.64	207.42			4.76	116.14	2.77	143.59		13.19	236
05/20/94			4.78	-140.23	6.60	205.71			4.73	120.51	2.75	143.12		16.07	223
05/21/94			4.75	-26.38	6.58	204.90			4.69	107.04	2.76	143.28		13.21	210
05/22/94			4.74	-26.38	6.56	204.05			4.69	107.04	2.77	143.62		13.21	199
05/23/94			4.70	-26.38	6.52	202.30	1653.28		4.63	107.04	2.81	144.51		13.21	191
05/24/94			4.68	-26.38	6.50	201.74			4.24	93.56	2.77	143.53		13.21	189
05/25/94			4.62	-26.38	6.47	200.59			3.87	85.80	2.72	142.24		13.21	182
05/26/94			4.61	87.47	6.45	199.49	1653.17		4.11	90.41	2.66	140.37		10.35	170
05/27/94			4.58	82.13	6.41	198.05			4.10	90.33	2.67	140.56		7.28	163
05/28/94			4.56	82.13	6.37	196.60			4.10	90.24	2.65	139.84		7.28	158
05/29/94			4.49	82.13	6.32	194.66	1653.42		4.03	88.66	2.57	136.38		7.28	153
05/30/94			4.34	82.13	6.29	193.37			4.03	88.82	2.51	132.95		7.28	142
05/31/94			4.10	82.13	6.24	191.44			3.66	83.25	2.42	126.43		7.28	137
06/01/94			4.09	76.79	6.20	189.71	1652.88		3.16	82.69	2.41	125.75		4.22	125
06/02/94	4.62		4.05	70.28	6.16	188.13			3.93	86.83	2.36	121.53		3.89	118
06/03/94	4.61		4.01	31.98	6.13	187.05			3.87	85.84	2.32	118.16		3.89	113
06/04/94	4.69		4.12	31.98	6.10	185.91			3.85	85.61	2.31	116.75		3.89	112
06/05/94	4.72		4.29	31.98	6.23	191.04	1652.92		3.97	87.53	2.40	125.36		3.89	191
06/06/94	4.60		4.26	31.98	6.23	190.84	1652.92		3.96	87.39	2.40	124.76		3.89	203
06/07/94	4.60		4.38	31.98	6.24	191.14			4.02	88.46	2.38	123.02		3.89	195
06/08/94	4.58		4.36	31.98	6.21	190.15			3.91	86.47	2.33	119.42		3.56	179
06/09/94	4.62		4.33	31.98	6.23	190.75			3.95	87.12	2.35	120.77		19.23	170
06/10/94	4.58		4.30	31.98	6.18	189.12			3.91	86.57	2.29	115.05		19.23	162
06/11/94	4.59		4.25	31.98	6.15	187.69	1652.85		3.84	85.46	2.26	112.29		19.23	147
06/12/94	4.65		4.27	31.98	6.10	185.62			3.84	85.37	2.24	110.60		19.23	131
06/13/94	4.69		4.35	31.98	6.13	187.09			3.85	85.59	2.23	109.27		19.23	121
06/14/94	4.60		4.31	31.98	6.12	186.60	1652.79		3.85	85.48	2.29	115.05		19.23	116
06/15/94	4.66		4.27	31.98	6.13	187.00			3.65	83.17	2.23	108.73		19.23	115
06/16/94	4.61		4.27	31.98	6.05	183.86			2.67	92.40	2.20	105.70		19.23	111
06/17/94	4.62		4.35	31.98	6.14	187.42	1652.96		3.08	83.46	2.26	112.54		19.23	241
06/18/94	4.59		4.40	31.98	6.19	189.30			3.34	81.89	2.37	122.28		19.23	779
06/19/94	4.65		4.46	31.98	6.34	195.48	1653.42		4.06	89.39	2.49	131.22		19.23	718
06/20/94	4.68		4.47	31.98	6.36	196.21			4.08	89.72	2.55	135.33		19.23	444
06/21/94	4.74		4.51	-6.32	6.40	197.80	1653.17		4.11	90.35	2.62	138.53		19.23	359
06/22/94	4.81		4.52	-19.61	6.44	199.22			4.13	90.93	2.65	139.94		19.23	326
06/23/94	4.78		4.53	-19.61	6.43	198.84			4.15	91.50	2.69	141.32		19.23	405
06/24/94	4.89		4.53	-19.61	6.47	200.68			4.16	91.71	2.72	142.32		19.23	482
06/25/94	4.89		4.53	-19.61	6.48	200.80	1653.19		4.16	91.71	2.70	141.53		19.23	452
06/26/94	4.70		4.52	-19.61	6.40	197.56			4.15	91.41	2.67	140.61		19.23	430
06/27/94	4.89		4.52	-19.61	6.47	200.31			4.13	90.96	2.71	141.93		19.23	407
06/28/94	4.72		4.50	-19.61	6.39	197.23			4.09	89.99	2.63	138.86		19.23	416
06/29/94	4.61		4.51	-19.61	6.35	195.63			4.08	89.72	2.60	137.79		19.23	376
06/30/94	4.64		4.51	-32.91	6.36	195.99			4.06	89.31	2.62	138.42		34.90	339
07/01/94	4.58		4.47	76.94	6.32	194.62	1653.00	1653.00	4.07	89.58	2.55	135.06	1.54	2.63	318
07/02/94	4.56		4.45	76.94	6.30	193.72			4.04	88.87	2.48	130.81	1.52	2.55	284
07/03/94	4.58		4.48	76.94	6.32	194.37			4.01	88.26	2.48	131.14	1.48	2.40	257
07/04/94	4.55		4.45	76.94	6.29	193.26			3.97	87.55	2.49	131.38	1.45	2.32	245
07/05/94	4.57		4.42	76.94	6.28	192.96			3.95	87.16	2.47	130.31	1.52	2.54	231
07/06/94	4.66		4.40	76.94	6.31	193.92			3.92	86.72	2.45	128.47	1.51	2.52	218
07/07/94	4.61		4.41	76.94	6.30	193.82			4.02	88.44	2.47	130.31	1.51	2.50	342
07/08/94	4.57		4.43	76.94	6.25	191.56			3.71	83.74	2.41	125.85	1.53	2.57	435
07/09/94	4.55		4.42	76.94	6.22	190.61	1653.00		3.62	82.88	2.41	125.85	1.54	2.62	575
07/10/94	4.58		4.43	76.94	6.30	193.58			3.99	87.93	2.42	126.33	1.54	2.62	468
07/11/94	4.58		4.36	186.79	6.27	192.52			3.96	87.36	2.43	127.47	1.53	2.57	427
07/12/94	4.54		4.40	125.26	6.27	192.35			3.95	87.12	2.41	125.75	1.52	2.55	411
07/13/94	4.55		4.39	125.26	6.27	192.35			3.96	87.30	2.41	125.56	1.55	2.66	387
07/14/94	4.62		4.37	125.26	6.28	192.87			3.91	86.43	2.39	124.06	1.58	2.76	429
07/15/94	4.67		4.34	125.26	6.29	193.26			3.89	86.18	2.36	122.07	1.67	3.10	631
07/16/94	4.68		4.35	125.26	6.29	193.43	1653.00		3.87	85.90	2.31	117.58	1.66	3.05	533
07/17/94	4.69		4.34	125.26	6.29	193.23			3.86	85.71	2.30	115.91	1.80	3.63	456
07/18/94	4.60		4.36	125.26	6.26	192.18	1652.92		3.85	85.54	2.27	113.05	1.81	3.65	419
07/19/94	4.65		4.33	125.26	6.27	192.38			3.83	85.28	2.20	105.84	1.77	3.49	410

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07/20/94	4.65		4.30	125.26	6.26	191.94			3.80	84.86	2.16	100.65	1.78	3.54	386
07/21/94	4.62		4.29	125.26	6.23	191.08			3.77	84.45	2.09	92.36	1.81	3.66	378
07/22/94	4.58		4.27	125.26	6.21	189.97			3.75	84.15	2.05	87.68	1.80	3.64	335
07/23/94	4.56		4.22	125.26	6.18	188.82	1652.79		3.70	83.66	2.06	88.17	1.92	4.15	307
07/24/94	4.49		4.19	125.26	6.14	187.34			3.69	83.50	2.05	87.36	2.04	4.70	289
07/25/94	4.29		4.16	125.26	6.04	183.64			3.67	83.29	2.01	82.55	2.02	4.60	271
07/26/94	4.24		4.12	125.26	6.01	182.02			3.63	82.97	1.92	71.42	2.03	4.64	253
07/27/94	4.20		4.07	63.74	5.97	179.81			3.59	82.67	1.87	67.70	2.02	4.60	239
07/28/94	4.19		4.05	89.56	5.96	179.08		1652.77	3.56	82.47	1.87	67.70	1.45	2.31	222
07/29/94	4.18		4.02	89.56	5.94	178.14			3.54	82.33	1.86	66.43	1.45	2.30	213
07/30/94	4.17		3.94	89.56	5.91	176.10			3.50	82.14	1.85	65.55	1.49	2.43	202
07/31/94	4.28		3.87	89.56	5.92	176.82			3.46	82.00	1.82	63.22	1.46	2.34	192
08/01/94	4.24		3.86	89.56	5.90	175.57			3.43	81.93	1.73	56.55	1.42	2.21	180
08/02/94	4.24		3.84	89.56	5.88	174.80			3.41	81.90	1.72	55.88	1.37	2.07	170
08/03/94	4.22		3.81	89.56	5.86	173.69	1652.38		3.39	81.88	1.74	57.03	1.34	1.95	166
08/04/94	4.02		3.75	89.56	5.76	167.42			3.35	81.88	1.60	46.66	1.28	1.80	158
08/05/94	4.02		3.75	89.56	5.75	166.82	1652.29	1652.72	3.31	81.94	1.56	44.09	1.28	1.79	145
08/06/94	4.07		3.70	89.56	5.75	166.80			3.27	82.05	1.57	44.82	1.28	1.79	142
08/07/94	3.90		3.60	89.56	5.65	160.20			3.22	82.26	1.54	42.20	1.27	1.76	137
08/08/94	3.80		3.44	89.56	5.55	153.96			3.19	82.44	1.43	34.53	1.26	1.72	126
08/09/94	3.81		3.45	89.56	5.57	154.98			3.24	82.16	1.43	34.53	1.62	2.89	151
08/10/94	4.44		3.75	115.38	5.94	178.20			3.45	81.99	1.68	52.55	2.09	4.95	1010
08/11/94	4.36		3.56	68.10	5.85	173.06	1652.75		3.49	82.12	1.70	54.54	1.72	3.29	1160
08/12/94	4.26		3.54	68.10	5.81	170.65	1652.75		3.52	82.27	1.76	58.86	1.72	3.28	584
08/13/94	4.23		3.55	68.10	5.81	170.40	1652.75		3.55	82.38	1.75	57.89	1.72	3.28	398
08/14/94	4.22		3.62	68.10	5.83	171.86	1652.79		3.59	82.64	1.75	58.09	1.69	3.16	323
08/15/94	4.23		3.67	68.10	5.85	172.95			3.58	82.57	1.81	62.54	1.74	3.39	280
08/16/94	4.21		3.69	20.81	5.85	172.69			3.55	82.42	1.66	66.43	1.76	3.47	253
08/17/94	4.19		3.66	-3.89	5.83	171.34			3.53	82.30	1.88	68.29	1.85	3.81	234
08/18/94	4.18		3.66	-3.89	5.82	171.06	1652.58		3.52	82.26	1.90	69.66	1.85	3.84	214
08/19/94	4.22		3.57	-3.89	5.81	170.09			3.50	82.17	1.86	66.53	1.81	3.67	203
08/20/94	4.30		3.49	-3.89	5.81	170.20			3.48	82.09	1.81	62.44	1.95	4.25	188
08/21/94	4.29		3.46	-3.89	5.79	169.32			3.47	82.04	1.80	62.05	2.05	4.72	171
08/22/94	4.28		3.53	-3.89	5.81	170.53			3.47	82.03	1.84	64.97	2.13	5.10	162
08/23/94	4.23		3.56	-3.89	5.79	169.37			3.40	81.89	1.82	63.12	2.14	5.17	156
08/24/94	4.23		3.54	-3.89	5.78	168.53			3.37	81.88	1.74	57.03	2.19	5.42	148
08/25/94	4.19		3.51	-3.89	5.75	166.86			3.36	81.88	1.73	56.55	2.24	5.68	136
08/26/94	4.04		3.48	-3.89	5.68	162.15			3.33	81.91	1.71	54.64	2.27	5.85	128
08/27/94	4.08		3.44	-3.89	5.68	162.41			3.31	81.95	1.71	55.21	2.28	5.91	124
08/28/94	3.90		3.42	-3.89	5.60	156.88			3.27	82.06	1.59	46.20	2.26	5.81	122
08/29/94	3.89		3.38	-28.60	5.58	155.64			3.25	82.12	1.61	47.12	2.23	5.64	111
08/30/94	3.90		3.46	-3.67	5.62	158.34			3.34	81.89	1.65	50.10	2.43	6.73	113
08/31/94	3.88		3.43	-3.67	5.58	156.17			3.22	82.27	1.59	45.83	2.36	6.34	108
09/01/94	3.87		3.41	-3.67	5.41	145.01		1652.81	2.19	119.83	1.57	44.82	2.40	6.57	104
09/02/94	3.91		3.44	-3.67	5.47	148.73			2.39	105.45	1.66	51.13	2.62	7.84	119
09/03/94	4.00		3.47	-3.67	5.60	157.02			2.93	85.61	1.74	57.61	2.56	7.51	138
09/04/94	4.21		3.49	-3.67	5.76	167.36			3.40	81.89	1.81	62.83	2.67	8.17	177
09/05/94	4.20		3.47	-3.67	5.72	164.72			3.21	82.32	1.73	56.64	2.59	7.67	204
09/06/94	4.13		3.46	-3.67	5.72	164.63			3.37	81.88	1.71	54.92	2.57	7.58	188
09/07/94	3.94		3.45	-3.67	5.64	159.58			3.36	81.88	1.69	53.78	2.55	7.45	161
09/08/94	3.93		3.44	-3.67	5.62	158.74			3.34	81.89	1.69	53.68	2.54	7.39	148
09/09/94	3.92		3.43	-3.67	5.62	158.15			3.33	81.90	1.71	55.02	2.52	7.28	140
09/10/94	3.94		3.43	-3.67	5.63	158.80			3.33	81.90	1.74	57.51	2.50	7.14	132
09/11/94	4.01		3.42	-3.67	5.65	160.09			3.31	81.95	1.76	59.05	2.47	6.95	128
09/12/94	3.91		3.35	-3.67	5.58	155.83			3.27	82.06	1.74	57.22	2.48	7.04	119
09/13/94	3.87		3.34	-3.67	5.55	154.17			3.24	82.18	1.71	54.73	2.48	7.02	110
09/14/94	3.85		3.33	-3.67	5.55	153.65			3.25	82.15	1.73	56.45	2.47	6.94	107
09/15/94	3.86		3.32	-3.67	5.54	153.41			3.22	82.28	1.68	52.64	2.46	6.91	109
09/16/94	3.81		3.26	-3.67	5.50	150.48			3.19	82.48	1.53	41.75	2.45	6.85	109
09/17/94	3.85		3.25	-3.67	5.48	149.36			3.00	84.43	1.49	39.09	2.44	6.76	94
09/18/94	3.92		3.23	-3.67	5.52	152.02			3.12	83.06	1.46	36.91	2.42	6.65	88
09/19/94	3.91		3.21	-3.67	5.51	151.14			3.11	83.12	1.46	36.48	2.39	6.53	83
09/20/94	3.89		3.17	-3.67	5.48	149.51			3.07	83.50	1.44	35.20	2.37	6.37	80
09/21/94	3.86		3.17	-3.67	5.46	148.21			3.02	84.23	1.39	31.87	2.37	6.39	97
09/22/94	3.77		3.15	-3.67	5.42	145.55			3.01	84.27	1.35	29.53	2.41	6.60	105
09/23/94	3.63		3.09	-3.67	5.35	140.45			3.02	84.20	1.35	29.37	2.41	6.60	89
09/24/94	3.55		3.08	-3.67	5.28	136.06			2.82	87.88	1.34	28.97	2.40	6.58	86
09/25/94	3.52		3.07	-3.67	5.29	136.37			2.96	85.11	1.32	27.80	2.40	6.55	84
09/26/94	3.50		3.03	21.26	5.26	134.77			2.93	85.55	1.32	27.41	2.38	6.47	76

Date	Site 1 Boswell Avg Daily Stage (ft)	Avg Daily CFS	Site 2 DrylakeSouth Avg Daily Stage	Avg Daily CFS	Site 3 Outlet Avg Daily Stage	Avg Daily CFS	Site 3 Outlet msl Elev	Pier81 Well Elev	Site 7 Albert Avg Daily Stage	Avg Daily CFS	Site 8 StJonsOutlet Avg Daily Stage	Avg Daily CFS	Site 9 Thisted Avg Daily Stage	Avg Daily CFS	USGS Castlewood Gaging Avg Daily CFS
09/27/94	3.49		3.01	23.89	5.25	133.99			2.91	85.94	1.30	26.11	2.37	6.38	76
09/28/94	3.46		2.99	23.89	5.20	130.67			2.72	90.70	1.23	22.30	2.34	6.25	74
09/29/94	3.45		2.97	23.89	5.21	131.12			2.82	87.97	1.21	21.11	2.32	6.11	68
09/30/94	3.46		2.96	23.89	5.21	131.42			2.85	87.35	1.17	18.76	2.29	5.97	63
10/01/94	3.52		2.93	23.89	5.22	131.87			2.83	87.82	1.14	17.16	2.26	5.78	53
10/02/94	3.50		2.92	23.89	5.21	131.43			2.85	87.29	1.15	18.11	2.28	5.89	58
10/03/94	3.40		2.93	23.89	5.18	129.07			2.84	87.38	1.14	17.54	2.44	6.80	71
10/04/94	3.39		2.92	23.89	5.17	128.38			2.83	87.79	1.11	16.05	2.46	6.91	73
10/05/94	3.40		2.90	23.89	5.16	128.17		1652.56	2.84	87.58	1.13	16.78	2.47	6.96	76
10/06/94	3.47		2.87	23.89	5.19	129.90			2.88	86.54	1.19	19.95	2.49	7.05	82
10/07/94	3.52		2.96	23.89	5.23	132.60			2.83	87.82	1.19	20.15	2.49	7.06	92
10/08/94	3.45		2.91	23.89	5.19	129.64			2.81	88.24	1.09	14.98	2.47	6.98	92
10/09/94	3.41		2.89	23.89	5.15	127.42		1652.47	2.76	89.57	1.05	13.06	2.46	6.88	83
10/10/94	3.42		2.88	23.89	5.16	128.12			2.81	88.31	1.05	13.00	2.44	6.79	75
10/11/94	3.41		2.86	23.89	5.15	126.94			2.77	89.12	1.06	13.39	2.42	6.68	72
10/12/94	3.40		2.89	23.89	5.15	126.98			2.74	90.21	1.03	12.20	2.39	6.51	70
10/13/94	3.41		2.92	23.89	5.15	127.32			2.68	91.98	0.98	10.24	2.37	6.38	65
10/14/94	3.42		2.89	23.89	5.15	127.22			2.70	91.45	0.97	9.82	2.36	6.32	62
10/15/94	3.47		2.89	23.89	5.17	128.46			2.70	91.33	1.00	10.88	2.36	6.35	61
10/16/94	3.45		2.95	23.89	5.18	129.54			2.72	90.55	1.02	12.04	2.50	7.11	71
10/17/94	3.50		3.03	23.89	5.23	132.68			2.73	90.29	1.04	12.68	2.60	7.74	87
10/18/94	3.82		2.97	23.89	5.35	140.60			2.80	88.40	1.10	15.57	2.63	7.95	123
10/19/94	3.70		3.08	23.89	5.32	138.68			2.69	91.61	1.02	11.78	2.59	7.69	160
10/20/94	3.57		3.09	23.89	5.23	132.75			2.46	101.35	0.98	10.15	2.56	7.50	122
10/21/94	3.66		3.11	23.89	5.27	135.28			2.42	103.26	0.98	10.20	2.55	7.46	105
10/22/94	3.78		3.13	23.89	5.36	141.44			2.65	92.97	0.99	10.78	2.55	7.45	99
10/23/94	3.75		3.12	23.89	5.34	139.95	1651.50		2.62	93.98	0.91	7.76	2.54	7.37	114
10/24/94	3.68		3.06	23.89	5.30	137.15			2.64	93.37	0.88	6.97	2.53	7.30	90
10/25/94	3.48		2.74	23.89	5.11	124.17			2.57	96.01	0.84	5.81	2.51	7.22	82
10/26/94	3.48		2.75	23.89	5.12	125.19			2.65	93.10	0.86	6.27	2.51	7.20	76
10/27/94	3.48		2.72	23.89	5.10	124.09			2.60	95.04	0.88	6.71	2.51	7.19	77
10/28/94	3.42		2.69	23.89	5.07	121.53			2.56	96.43	0.86	6.19	2.51	7.20	75
10/29/94	3.35		2.68	23.89	5.04	119.49			2.59	95.09	0.82	5.28	2.50	7.13	76
10/30/94	3.15		2.65	23.89	4.90	110.21			2.29	112.14	0.78	4.19	2.49	7.05	78
10/31/94	3.12		2.63	23.89	4.87	108.25			2.22	117.24	0.76	3.81	2.48	7.00	71
11/01/94	3.11		2.61	23.89	4.92	111.42			2.57	96.27	0.78	4.22	2.48	7.01	70
11/02/94	3.10		2.64	23.89	4.93	112.14			2.60	94.74	0.79	4.44	2.48	7.02	73
11/03/94				23.89											70
11/04/94				23.89											69
11/05/94															71
11/06/94															71
11/07/94															71

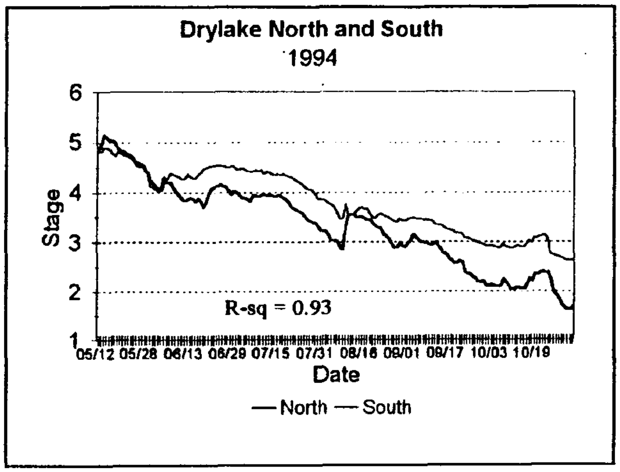
APPENDIX I:

The following tables contain the actual stage and instantaneous discharge measurements used in the regression analysis to determine daily discharge from each site (1-3 and 7-9). Following this table are graphs showing the relationship between these two variables (stage and discharge). On these graphs are the r-square values which indicate the strength of the relationship between the dependent variable (discharge) and the independent variable (stage). There is also a graph showing the relationship that exists between the Lake Poinsett and Dry Lake elevations (r-sq = 0.93).

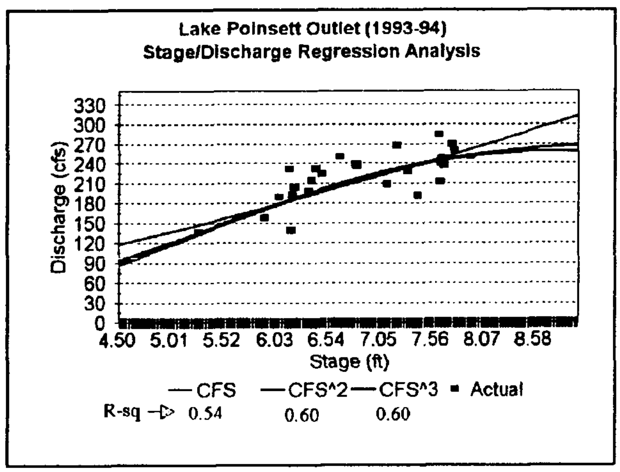
Instaneous Discharge Measurements for all Six Monitoring Stations used In Regression Analysis

Site 1 Boswell			Site 2 Stonebridge (-) = *Poinsett discharging into Dry Lake (reverse flow)*			Site 3 OUTLET			Site 7 - Lake Albert Outlet			Site 8 ST. JOHN Outlet			Site 9 Thisted		
Date	Stage	CFS	Date	Stage	CFS	Date	Stage	CFS	Date	Stage	CFS	Date	Stage	CFS	Date	Stage	CFS
06/11/93	4.55	7.802	06/09/93	4	288.59	06/11/93	6.16	139.33	05/27/93	4.65	115.527	06/07/93	3.4	0	05/26/93	3.4	19.873
06/17/93	4.45	7.036	06/11/93	3.98	-3.508	06/17/93	6.33	198.248	06/07/93	4.53	83.488	06/09/93	2.98	113.232	06/02/93	3.6	14.595
06/18/93	4.52	0.49	06/17/93	3.96	194.528	06/21/93	6.59	0	06/09/93	4.42	96.226	06/17/93	3.95	121.708	06/07/93	4.5	13.2596
06/21/93	5	0	06/18/93	4.15	60.224	06/24/93	6.75	117.528	06/11/93	4.41	83.689	06/22/93	4.82	215.32	06/18/93	4.65	80.221
06/23/93	4.88	7.894	06/21/93	4.35	-34.978	06/25/93	6.76	128.41	06/18/93	4.65	105.81	06/24/93	5.12	247.51	06/22/93	4.99	211.944
06/24/93	4.95	0	06/22/93	4.32	-120.246	06/28/93	6.67	150.842	06/21/93	4.91	141.416	06/28/93	5.57	262.11	06/24/93	5.14	185.798
06/25/93	5.21	0	06/23/93	4.42	99.56	07/01/93	6.96	0	06/23/93	5.07	143.177	07/02/93	5.9	156.754	07/01/93	5.54	103.693
06/28/93	4.85	0	06/25/93	4.45	-187.67	07/07/93	7.43	112.464	06/28/93	5.25	219.203	07/05/93	6.18	299.766	07/02/93	5.67	118.042
07/02/93	5.29	10.264	06/26/93	4.46	-117.528	07/12/93	7.62	211.364	07/01/93	5.53	275.434	07/07/93	6.19	298.88	07/05/93	6.02	140.088
07/06/93	5.74	11.552	06/28/93	4.42	-104.43	07/13/93	7.63	247.566	07/06/93	6.06	368.574	07/09/93	6.29	289.458	07/07/93	6.15	140.955
07/09/93	5.89	14.862	06/29/93	4.4	331.022	07/26/93	8	0	07/09/93	6.24	366.806	07/12/93	6.25	156.398	07/09/93	6.24	110.842
07/12/93	6.19	0	07/01/93	4.7	-92.356	07/28/93	8	128.056	07/12/93	6.3	366.889	07/14/93	5.99	174.684	07/12/93	6.3	79.186
07/13/93	6.18	0	07/02/93	4.79	-142.498	08/03/93	7.92	250.328	07/14/93	6.31	347.187	07/23/93	5.7	174.484	07/14/93	6.29	58.792
07/23/93	6.3	0	07/05/93	5.42	-175.386	08/11/93	7.66	237.006	07/23/93	6.15	241.665	07/27/93	5.58	191.89	07/23/93	6.14	28.594
07/30/93	6.37	0	07/06/93	5.54	-11.514	08/12/93	7.62	240.246	07/27/93	6.26	223.544	07/29/93	5.28	90.742	07/27/93	6.26	55.191
08/02/93	6.32	0	07/09/93	5.71	-38.96	08/17/93	7.76	259.586	07/28/93	6.25	192.599	08/03/93	4.88	75.364	07/29/93	6.23	44.906
08/11/93	6.27	0	07/12/93	5.79	-59.862	08/18/93	7.74	268.836	07/29/93	6.21	227.377	08/10/93	5.2	57.904	08/05/93	5.97	39.886
08/18/93	6.32	0	07/13/93	5.85	-29.076	08/24/93	7.61	283.39	08/05/93	5.97	151.056	08/11/93	4.9	0	08/11/93	5.78	19.962
08/19/93	6.33	0	07/14/93	5.83	-28.738	09/03/93	6.4	294.734	08/10/93	5.81	123.175	08/12/93	4.3	150.26	08/17/93	5.93	99.923
08/24/93	6.18	0	07/23/93	5.97	-234.172	09/09/93	7.2	267.078	08/17/93	5.95	178.61	08/13/93	4.7	0	08/18/93	5.98	104.571
09/03/93	5.79	0	07/26/93	6.14	96.036	09/16/93	6.8	236.632	08/19/93	5.98	198.801	08/19/93	8.76	205.276	09/03/93	5.5	18.176
09/09/93	5.41	0	07/28/93	6.15	123.304	09/17/93	7.3	227.444	09/03/93	6.05	148.364	09/03/93	8.28	10.01	09/07/93	5.37	12.629
09/16/93	5.28	0	07/29/93	6.16	-43.554	09/21/93	6.4	232.77	09/07/93	5.9	131.156	09/07/93	7.89	105.112	09/09/93	5.3	10.143
09/17/93	4.95	0	07/30/93	6.14	81.23	09/29/93	7.4	190.6	09/09/93	5.82	117.263	09/13/93	6.94	75.384	09/15/93	5.14	8.397
09/21/93	4.99	0	08/02/93	6.02	-52.332	10/05/93	6.36	213.934	09/15/93	5.14	105.764	10/06/93	5.72	74.798	09/16/93	5.05	5.652
10/05/93	4.65	0	08/03/93	5.99	184.076	10/13/93	6.17	191.776	09/17/93	5.01	102.851	10/11/93	5.38	102.448	09/17/93	5.01	5.459
10/13/93	4.55	0	08/10/93	5.79	36.538	10/21/93	6.04	189.176	10/06/93	4.53	100.689	10/21/93	4.7	88.162	10/06/93	4.53	2.79
			08/11/93	5.8	-167.932	04/18/94	7.1	207.598	10/13/93	4.4	92.917	04/18/94	2.95	162.944	10/13/93	4.37	3.968
			08/12/93	5.73	253.956	05/11/94	6.79	239.676	10/21/93	2.96	87.914	05/11/94	2.72	201.208	10/21/93	2.96	1.104
			08/17/93	5.87	168.946	05/20/94	6.63	250.38	05/25/94	3.12	97.262	05/20/94	2.76	0	10/25/93	4.12	0
			08/18/93	5.88	263.688	05/26/94	6.46	223.71	06/01/94	2.59	104.805	05/26/94	2.65	126.508	04/18/94	NA	17.758
			08/19/93	5.85	-136.48	06/03/94	6.14	231.676	06/08/94	4.01	84.28	06/01/94	2.38	74.743	05/11/94	NA	10.32
			08/24/93	5.72	40.952	06/08/94	6.19	203.066	06/21/94	4.11	119.49	06/10/94	2.28	109.566	05/20/94	NA	16.065
			09/03/93	5.29	-71.908	07/11/94	6.27	121.71	06/30/94	4.06	137.227	06/21/94	2.66	153.002	05/26/94	NA	10.35
			09/07/93	5.16	12.514	08/01/94	5.9	157.6	07/11/94	3.95	117.462	06/30/94	2.63	136.964	06/01/94	NA	4.219
			09/09/93	5.05	227.442	08/10/94	5.94	0	07/18/94	3.86	102.482	07/18/94	2.26	0	06/08/94	NA	3.558
			09/16/93	5.04	241.962	09/26/94	5.26	135.818	07/27/94	3.59	70.234	08/01/94	1.7	40.27	06/30/94	1.84	34.902
			09/17/93	4.95	21.802				08/10/94	3.44	64.02	08/16/94	1.86	71.044	07/18/94	2.61	12.127
			09/21/93	4.99	-191.836				08/16/94	3.54	54.144	08/22/94	1.81	0	07/27/94	1.46	2.08
			09/28/93	4.72	193.754				08/22/94	3.47	80.649	08/29/94	1.6	0	08/01/94	1.41	1.346
			10/05/93	4.58	-231.492				09/26/94	2.93	75.208	09/26/94	1.33	0	08/10/94	2.1	8.68
			10/11/93	4.4	163.88										08/16/94	1.77	9.317
			10/18/93	4.16	-3.056										08/22/94	2.14	1.881
			10/21/93	4.14	100.172										09/13/94	2.48	0
			04/20/94	5.08	40.535										09/26/94	2.39	0
			05/11/94	4.85	150.143												
			05/20/94	4.78	-140.228												
			05/26/94	4.62	87.468												
			06/01/94	4.1	76.79												
			06/02/94	4.05	70.276												
			06/21/94	4.5	-6.32												
			06/30/94	4.51	-32.908												
			07/11/94	4.39	186.792												
			07/27/94	4.08	63.736												
			08/10/94	3.72	115.382												
			08/16/94	3.68	20.814												
			08/29/94	3.4	-28.598												
			09/26/94	3.03	21.26												

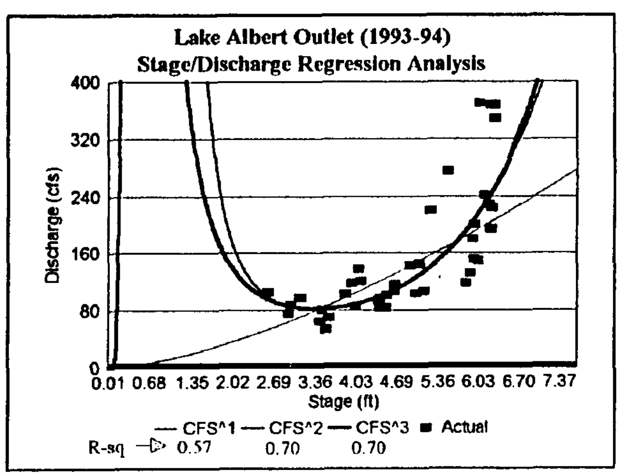
During 1994 measurments there was no discharge from at Site 1



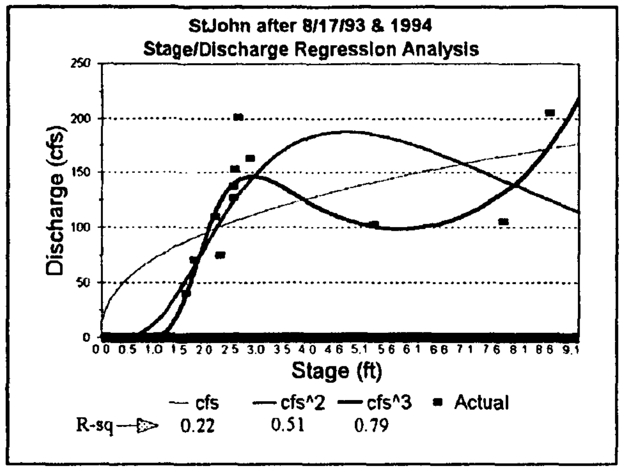
Drylake North and South
1994
Stage
R-sq = 0.93
Date
— North — South

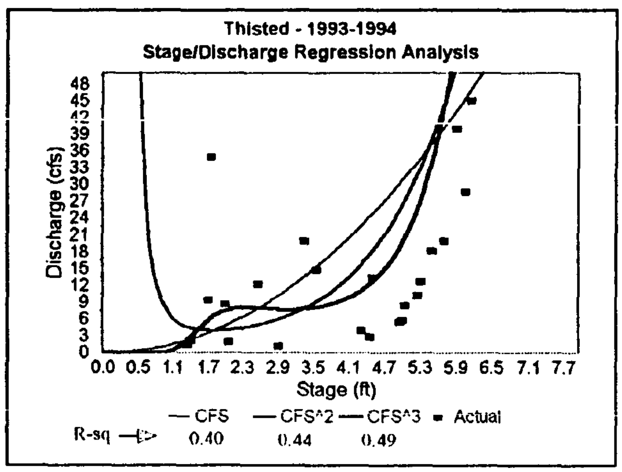


Lake Poinsett Outlet (1993-94)
Stage/Discharge Regression Analysis
Discharge (cfs)
Stage (ft)
— CFS — CFS^2 — CFS^3 ▪ Actual
R-sq → 0.54 0.60 0.60



Lake Albert Outlet (1993-94)
Stage/Discharge Regression Analysis
Discharge (cfs)
Stage (ft)
— CFS^1 — CFS^2 — CFS^3 ▪ Actual
R-sq → 0.57 0.70 0.70

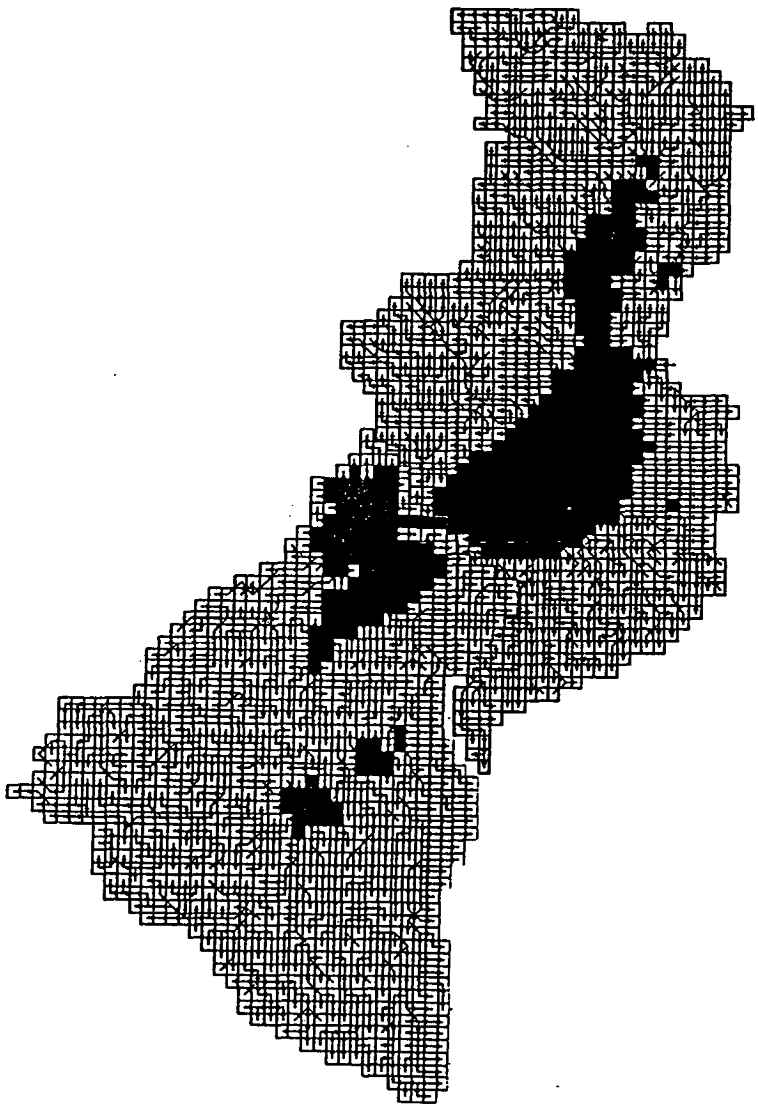

StJohn after 8/17/93 & 1994
Stage/Discharge Regression Analysis
Discharge (cfs)
250
200
150
100
50
0
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.6 5.1 5.6 6.1 6.6 7.1 7.6 8.1 8.6 9.1
Stage (ft)
cfs
cfs^2
cfs^3
Actual
R-sq
0.22
0.51
0.79


Thisted - 1993-1994
Stage/Discharge Regression Analysis
Discharge (cfs)
48
45
42
39
36
33
30
27
24
21
18
15
12
9
6
3
0
0.0 0.5 1.1 1.7 2.3 2.9 3.5 4.1 4.7 5.3 5.9 6.5 7.1 7.7
Stage (ft)
CFS
CFS^2
CFS^3
Actual
R-sq
0.40
0.44
0.49

APPENDIX II

PRELIMINARY REPORT ON THE

AGRICULTURAL NONPOINT SOURCE (AGNPS) ANALYSIS OF THE LAKE POINSETT WATERSHED BROOKINGS/ KINGSBURY COUNTIES, SOUTH DAKOTA



SOUTH DAKOTA WATERSHED PROTECTION PROGRAM
DIVISION OF ASSESSMENT AND FINANCIAL ASSISTANCE
SOUTH DAKOTA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES

AUGUST 1995

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LAKE POINSETT WATERSHED AGNPS ANALYSIS

An analysis of the Lake Poinsett watershed was performed utilizing a computer model. The model selected was the Agricultural Nonpoint Source Pollution Model (AGNPS) (version 3.65.5). This model was developed by the Agricultural Research Service to analyze the water quality of runoff events from watersheds. The model predicts runoff volume and peak rate, eroded and delivered sediment, nitrogen, phosphorous, and chemical oxygen demand (COD) concentrations in the runoff and sediment for a single storm event for all points in the watershed. Proceeding from the headwaters to the outlet, the pollutants are routed in a step-wise fashion so the flow at any point may be examined. This model was developed to estimate subwatershed or tributary loadings to a water body. The AGNPS model is intended to be used as a tool to objectively compare different subwatershed within a watershed and watersheds throughout the state. This model is intended for watersheds up to 76,000 acres (1900 cells @ 40 acres/ cell).

The size of the Lake Poinsett watershed and area modeled was approximately 96,920 acres. Due to large size of the watershed and the associated limitations imposed by the AGNPS program, the Lake Poinsett watershed was divided into a upper (52,040 acres) and lower (44,880 acres) watershed components. Each of these watershed components was than divided into subwatersheds based on flow and drainage patterns. This resulted in the upper watershed being divided into 14 subwatersheds, and the lower watershed being divided into 9 subwatersheds. The selection criteria for determining what comprises a "subwatershed" was based upon aerial drainage. If a subwatershed drained less than 2% of the non-lake watershed area, than it was not analyzed for NPS loadings. Normally, direct overland flow from areas adjacent to the lake are not analyzed since this aerial drainage is generally small, and for this watershed this related to an area less than 800 acres. As part of the AGNPS analysis of the Lake Poinsett watershed, Nonpoint Source (NPS) loadings, feedlot contributions and hydrology were computed for each subwatershed in order to determine the loadings to Lakes Albert, Poinsett and Dry. The amount of NPS loadings deposited in Lakes Albert, Poinsett and Dry and the amount transported out of the lake was not calculated. One of the limitations of the AGNPS model is that it cannot accurately route and calculate the in-lake deposition and transport of NPS pollutants. For this study, it was assumed that the effect of the smaller lakes (i.e. - Thisted, Badger) found within the watershed on the transport of NPS pollutants was negligible.

AGNPS GOALS

The primary objectives of running AGNPS on the Lake Poinsett watershed was to:

1.) Evaluate and quantify the loadings from each subwatershed and their net loading to the lake;
2.) Define critical cells within each subwatershed (high sediment, nitrogen, phosphorous); and
3.) Priority rank each feedlot and quantify the nutrient loadings from each feedlot .

The following is a brief overview of each objective.

OBJECTIVE 1 - EVALUATE AND QUANTIFY SUBWATERSHED NPS LOADINGS

DELINEATION AND LOCATION OF SUBWATERSHED

DRY LAKE SUBWATERSHED CROSS REFERENCE (SEE MAPS ON PAGES 55-58)

SUBWATERSHED	DRAINAGE AREA	OUTLET CELL #
1	3640	230
2	960	250
3	3640	313
4	840	334
5	3440	383
6	800	419
7	2920	466
TOTAL 7	16,240	N.A.

LAKE POINSETT SUBWATERSHED CROSS REFERENCE (SEE MAPS ON PAGES 55-58)

SUBWATERSHED	DRAINAGE AREA	OUTLET CELL #
1	1000	685
2	4960	756
3	960	897
4	3320	1023
5	1600	1065
6	2600	1103
7	1720	1104
TOTAL 7	16,160	N.A.

LAKE ALBERT SUBWATERSHED CROSS REFERENCE (SEE MAPS ON PAGE 91)

SUBWATERSHED	DRAINAGE AREA	OUTLET CELL #
1	3560	117
2	2960	200
3	1440	327
4	3840	519
5	9200	580
6	4560	583
7	1200	686
8	1720	721
9	5520	749
TOTAL 9	34,000	N.A.

SUBWATERSHED TRIBUTARY LOADING FOR DRY LAKE - PER ACRE

SUB WATER SHED	DRAINAGE AREA (ACRES)	♣ SEDIMENT TON/AC/EVT (ANN.+1YR)	SEDIMENT TON/AC/EVT (25YR.EVT)	TOT.NITRO. TON/AC/EVT (ANN.+1YR)	TOT.NITRO. TON/AC/EVT (25YR.EVT)	TOT.PHOS. TON/AC/EVT (ANN.+1YR)	TOT.PHOS. TON/AC/EVT (25YR.EVT)
1 (230)	3640	.09	.18	.0017	.0013	.00042	.00042
2 (250)	960	.14	.50	.0016	.0019	.00051	.00068
3 (313)	3640	.07	.31	.0013	.0015	.00048	.00050
4 (334)	840	.03	.16	.0011	.0011	.00025	.00035
5 (383)	3440	.12	.39	.0029	.0022	.00075	.00072
6 (419)	800	.13	.55	.0015	.0019	.00039	.00071
7 (466)	2920	.15	.65	.0016	.0020	.00052	.00079
MEAN		.10	.39	.0017	.0017	.00047	.00060
MEDIAN		.12	.39	.0016	.0019	.00048	.00068
♥STDS		.04	.19	.0006	.0004	.00015	.00017
MEAN + 1STDS(σ)		.14	.58	.0023	.0021	.00062	.00077
♠EXP.CRITICAL RANGE		.10 ⇒ .18	.40 ⇒ .89	.002⇒ .003	.002⇒ .003	.0005⇒.0008	.0008⇒.0012

SUBWATERSHED TRIBUTARY LOADINGS FOR DRY LAKE - TOTAL LOADINGS

SUB WATER SHED	DRAINAGE AREA (ACRES)	♣ SEDIMENT TON/YR (ANN.+1YR)	SEDIMENT TON/YR (25YR.EVT)	TOT.NITRO. TON/YR (ANN.+1YR)	TOT.NITRO. TON/YR (25YR.EVT)	TOT.PHOS. TON/YR (ANN.+1YR)	TOT.PHOS. TON/YR (25YR.EVT)
1 (230)	3640	328	656	6.2	4.7	1.5	1.5
2 (250)	960	134	480	1.5	1.8	.5	.7
3 (313)	3640	255	1140	4.7	5.5	1.7	1.8
4 (334)	840	25	131	.9	.9	.2	.3
5 (383)	3440	413	1340	10.0	7.6	2.6	2.5
6 (419)	800	104	437	1.2	1.5	.3	.6
7 (466)	2920	438	1891	4.7	5.8	1.5	2.3
TOTAL LOADINGS	16240	1697	6075	29.2	27.8	8.3	9.7

♣ - Annual loadings are estimated by calculating the NPS loadings for a 1 year 24 hour event and assuming that there are 12 small rainfall events of .8" (E.I. = 3.0) in a normal year. Rainfall events of less than .8" were modeled and found to produce insignificant amounts of sediment and nutrient loadings.

♥ - In order to have any "statistical significant", the value of the sample standard deviation (STDS) should be at least 50% of the mean value.

♠ - Values for smaller watersheds will be higher than larger watersheds because of the inverse relationship of loadings to distance from a nonpoint source to the lake.

SUBWATERSHED TRIBUTARY LOADING FOR LAKE POINSETT - PER ACRE

SUB WATER SHED	DRAINAGE AREA (ACRES)	♣ SEDIMENT TON/AC/EVT (ANN.+1YR)	SEDIMENT TON/AC/EVT (25YR.EVT)	TOT.NITRO. TON/AC/EVT (ANN.+1YR)	TOT.NITRO. TON/AC/EVT (25YR.EVT)	TOT.PHOS. TON/AC/EVT (ANN.+1YR)	TOT.PHOS. TON/AC/EVT (25YR.EVT)
1 (685)	1000	.12	.49	.0015	.0019	.00044	.00070
2 (756)	4960	.13	.47	.0016	.0018	.00045	.00065
3 (897)	960	.07	.16	.0011	.0010	.00029	.00030
4(1023)	3320	.09	.41	.0012	.0015	.00034	.00056
5(1065)	1600	.06	.24	.0007	.0010	.00022	.00035
6(1103)	2600	.07	.29	.0012	.0013	.00034	.00047
7(1104)	1720	.12	.46	.0015	.0017	.00044	.00064
MEAN		.09	.36	.0013	.0015	.00036	.00052
MEDIAN		.09	.41	.0012	.0015	.00034	.00056
♥STDS		.03	.13	.0003	.0004	.00009	.00016
MEAN + 1STDS(σ)		.12	.49	.0016	.0019	.00045	.00068
♠EXP.CRITICAL RANGE		.10 ⇒ .18	.40 ⇒ .89	.002⇒ .003	.002⇒ .003	.0005⇒.0008	.0008⇒.0012

SUBWATERSHED TRIBUTARY LOADINGS FOR LAKE POINSETT - TOTAL LOADINGS

SUB WATER SHED	DRAINAGE AREA (ACRES)	♣ SEDIMENT TON/YR (ANN.+1YR)	SEDIMENT TON/YR (25YR.EVT)	TOT.NITRO. TON/YR (ANN.+1YR)	TOT.NITRO. TON/YR (25YR.EVT)	TOT.PHOS. TON/YR (ANN.+1YR)	TOT.PHOS. TON/YR (25YR.EVT)
1 (685)	1000	117	486	1.5	1.9	.4	.7
2 (756)	4960	620	2354	7.9	8.9	2.2	3.2
3 (897)	960	69	156	1.1	1.0	.3	.3
4(1023)	3320	312	1359	4.0	5.0	1.1	1.9
5(1065)	1600	91	378	1.1	1.6	.4	.6
6(1103)	2600	177	748	3.1	3.4	.9	1.2
7(1104)	1720	205	794	2.6	2.9	.8	1.1
TOTAL LOADINGS	16160	1591	6275	21.3	24.7	6.1	9.0

♣ - Annual loadings are estimated by calculating the NPS loadings for a 1 year 24 hour event and assuming that there are 12 small rainfall events of .8" (E.I. = 3.0) in a normal year. Rainfall events of less than .8" were modeled and found to produce insignificant amounts of sediment and nutrient loadings.

♥ - In order to have any "statistical significant", the value of the sample standard deviation (STDS) should be at least 50% of the mean value.

♠ - Values for smaller watersheds will be higher than larger watersheds because of the inverse relationship of loadings to distance from a nonpoint source to the lake.

SUBWATERSHED TRIBUTARY LOADING FOR LAKE ALBERT - PER ACRE

SUB WATER SHED	DRAINAGE AREA (ACRES)	♣ SEDIMENT TON/AC/EVT (ANN.+1YR)	SEDIMENT TON/AC/EVT (25YR.EVT)	TOT.NITRO. TON/AC/EVT (ANN.+1YR)	TOT.NITRO. TON/AC/EVT (25YR.EVT)	TOT.PHOS. TON/AC/EVT (ANN.+1YR)	TOT.PHOS. TON/AC/EVT (25YR.EVT)
1 (117)	3560	.05	.26	.0011	.0013	.00031	.00043
2 (200)	2960	.41	1.01	.0027	.0029	.00107	.00122
3 (327)	1440	.10	.40	.0011	.0013	.00031	.00051
4 (519)	3840	.14	.55	.0014	.0018	.00043	.00068
5 (580)	9200	.11	.41	.0014	.0015	.00041	.00056
6 (583)	4560	.05	.22	.0008	.0011	.00018	.00036
7 (686)	1200	.19	.86	.0014	.0022	.00046	.00091
8 (721)	1720	.14	.50	.0011	.0016	.00035	.00060
9 (749)	5520	.13	.47	.0010	.0015	.00035	.00058
MEAN		.15	.52	.0013	.0017	.00043	.00065
MEDIAN		.13	.47	.0014	.0017	.00044	.00067
♥STDS		.11	.26	.0005	.0006	.00025	.00027
MEAN + 1STDS(σ)		.26	.78	.0018	.0023	.00068	.00092
♠EXP.CRITICAL RANGE		.10 ⇒ .18	.40 ⇒ .89	.002⇒ .003	.002⇒ .003	.0005⇒.0008	.0008⇒.0012

SUBWATERSHED TRIBUTARY LOADINGS FOR LAKE ALBERT - TOTAL LOADINGS

SUB WATER SHED	DRAINAGE AREA (ACRES)	♣ SEDIMENT TON/YR (ANN.+1YR)	SEDIMENT TON/YR (25YR.EVT)	TOT.NITRO. TON/YR (ANN.+1YR)	TOT.NITRO. TON/YR (25YR.EVT)	TOT.PHOS. TON/YR (ANN.+1YR)	TOT.PHOS. TON/YR (25YR.EVT)
1 (117)	3560	178	932	3.9	4.6	1.1	1.5
2 (200)	2960	1214	2988	8.0	8.6	3.2	3.6
3 (327)	1440	144	581	1.6	1.9	.4	.7
4 (519)	3840	538	2123	5.4	6.9	1.6	2.6
5 (580)	9200	1012	3798	12.9	13.8	3.8	5.2
6 (583)	4560	228	1022	3.6	5.0	.8	1.6
7 (686)	1200	228	1027	1.7	2.6	.6	1.1
8 (721)	1720	241	860	1.9	2.7	.6	1.0
9 (749)	5520	718	2620	5.5	8.3	1.9	3.2
TOTAL LOADINGS	34000	4501	15951	44.5	54.4	14.0	20.5

♣ - Annual loadings are estimated by calculating the NPS loadings for a 1 year 24 hour event and assuming that there are 12 small rainfall events of .8" (E.I. = 3.0) in a normal year. Rainfall events of less than .8" were modeled and found to produce insignificant amounts of sediment and nutrient loadings.

♥ - In order to have any "statistical significant", the value of the sample standard deviation (STDS) should be at least 50% of the mean value.

♠ - Values for smaller watersheds will be higher than larger watersheds because of the inverse relationship of loadings to distance from a nonpoint source to the lake.

SEDIMENT YIELDS

The AGNPS data indicates that subwatersheds #2 and #7 (Lake Albert) and #7 (Dry Lake) have the largest per acre impact on sediment loadings to the Lake Poinsett watershed (≥+1 σ (sample standard deviation)). Subwatershed #2 (Lake Albert) appears to be contributing extremely high sediment amounts to Lake Albert (.41 tons/acre/avg. year, 1.01 tons/acre/25 yr. event). The location of this subwatershed is from the outlet of Lake Thisted to the inlet of Lake Albert.

SUBWATERSHED	SEDIMENT YIELD % OF TOTAL LOAD	AERIAL DRAINAGE % OF TOTAL AREA
#2 LAKE ALBERT	18.7%	8.7%
#7 LAKE ALBERT	6.4%	3.5%
#7 DRY LAKE	31.1%	18.0%

NITROGEN YIELDS

The AGNPS data indicates that subwatersheds #2 and #7 (Lake Albert) and #5 (Dry Lake) have the largest per acre impact on nitrogen loadings to the Lake Poinsett watershed (≥+1 σ).

SUBWATERSHED	NITROGEN YIELD % OF TOTAL LOAD	AERIAL DRAINAGE % OF TOTAL AREA
#2 LAKE ALBERT	15.8%	8.7%
#5 DRY LAKE	27.3%	21.1%
#7 LAKE ALBERT	5.6%	3.5%

PHOSPHOROUS YIELDS

The AGNPS data indicates that subwatersheds #2 and #7 (Lake Albert) and #5 (Dry Lake) have the largest per acre impact on phosphorous loadings to the Lake Poinsett watershed (≥+1).

SUBWATERSHED	PHOSPHOROUS YIELD % OF TOTAL LOAD	AERIAL DRAINAGE % OF TOTAL AREA
#2 LAKE ALBERT	17.6%	8.7%
#7 LAKE ALBERT	6.4%	3.5%
#5 DRY LAKE	31.3%	21.1%

Best Management Practices should be targeted to these four subwatersheds and selected critical cells as identified on pages 12-14 in order to achieve the highest benefit/ cost ratio. **It is recommended these areas be "Field Verified" prior to the installation of any Best Management Practices (BMP's).**

Comparing AGNPS loading data to other watersheds (expected critical range), the NPS loadings appear to be low except for the sediment yields from Lake Albert subwatersheds # 2 and #7 and nutrient yields from the Lake Albert subwatershed #2 and Dry Lake subwatershed #5. The extremely high sediment and nutrient yields from the Lake Albert subwatershed #2 can be partially attributed to the fact that as the size of the subwatersheds decrease, the distance from the NPS source to the lake decrease, thereby resulting in higher mean values. The Lake Albert #2 subwatershed should be the primary target for the implementation of any future BMP's. Based upon this analysis, it is recommended that conservation practices should be targeted to erosion control practices concentrated in subwatersheds #2 and #7 (Lake Albert) and #7 (Dry Lake) and that nutrient management practices should be concentrated in subwatershed #2 and #7 of Lake Albert and #5 of Dry Lake. The most probable source of the high nutrient yields found within the subwatersheds is from management and landuse practices rather than from feedlots.

OBJECTIVE 2 - IDENTIFICATION OF CRITICAL NPS CELLS (25 YEAR EVENT)

DRY LAKE SUBWATERSHEDS

SUB WATERSHED	DRAINAGE AREA (ACRES)	NUM. CELLS WITH EROSION > 3.9 TON/AC.	%	NUM. CELLS WITH TOTAL NIT. >5.0 ppm	%	NUM. CELLS WITH TOTAL PHOS. >1.0 ppm	%	NUM. OF FEEDLOTS IN SUB WATERSHED
1	3640	18	20	1	1	1	1	0
2	960	7	29	0	0	0	0	0
3	3640	10	11	0	0	0	0	0
4	840	1	5	0	0	0	0	0
5	3440	3	3	17	20	17	20	1
6	800	1	5	0	0	0	0	0
7	2920	16	22	0	0	0	0	0

Priority erosion cells

8	3.94	tons/acre
9	3.94	"
10	3.94	"
11	3.94	"
20	3.94	"
21	3.94	"
24	3.94	"
25	3.94	"
36	3.94	"
37	3.94	"
38	3.94	"
49	6.05	"
60	3.94	"
78	3.94	"
79	3.94	"
80	3.94	"
86	3.94	"
98	3.94	"
101	3.94	"
106	3.94	"
107	3.94	"

Priority feedlots

499 (#10 out of 11) 8

Priority nitrogen cells

161	8.32	ppm
365	5.08	"
366	5.83	"
367	5.83	"
386	5.49	"
387	5.83	"
388	5.83	"
389	5.83	"
407	8.86	"
408	5.16	"
409	7.44	"
410	8.86	"
411	8.86	"
428	8.86	"
430	8.86	"
431	8.86	"
432	8.86	"
499	5.52	"

Priority phosphorous cells

161	1.83	ppm
365	1.05	"
366	1.24	"
367	1.24	"
386	1.29	"
387	1.24	"
388	1.24	"
389	1.24	"
407	2.00	"
408	1.22	"
409	1.64	"
410	2.00	"
411	2.00	"
428	2.00	"
430	2.00	"
431	2.00	"
432	2.00	"
499	1.05	"

CONTINUED (DRY LAKE SUBWATERSHEDS - CRITICAL CELLS)

Priority erosion cells	Priority feedlots	Priority nitrogen cells	Priority phosphorous cells
117 3.94 tons/acre	# 499 (#10 out of 11) 8		
118 3.94 "			
120 3.94 "			
136 3.94 "			
139 3.94 "			
140 3.94 "			
141 3.94 "			
157 3.94 "			
158 3.94 "			
181 3.94 "			
182 3.94 "			
185 3.94 "			
200 3.94 "			
201 3.94 "			
202 3.94 "			
222 3.94 "			
330 3.94 "			
346 3.94 "			
347 3.94 "			
414 3.94 "			
416 3.94 "			
435 3.94 "			
436 3.94 "			
437 3.94 "			
460 3.94 "			
462 4.22 "			
463 3.94 "			
464 3.94 "			
487 3.94 "			
488 3.94 "			
510 3.94 "			
511 3.94 "			
512 3.94 "			

LAKE POINSETT SUBWATERSHEDS

SUB WATERSHED	DRAINAGE AREA (ACRES)	NUM. CELLS WITH EROSION > 3.9 TON/AC.	%	NUM. CELLS WITH TOTAL NIT. >5.0 ppm	%	NUM. CELLS WITH TOTAL PHOS. >1.0 ppm	%	NUM. OF FEEDLOTS IN SUB WATERSHED
1	1000	0	0	2	8	2	8	1
2	4960	18	15	0	0	0	0	0
3	960	0	0	0	0	0	0	0
4	3320	8	10	0	0	0	0	0
5	1600	0	0	0	0	0	0	0
6	2600	1	1	2	3	4	6	0
7	1720	0	0	1	2	1	2	1

CONTINUED (LAKE POINSETT SUBWATERSHEDS - CRITICAL CELLS)

Priority erosion cells

454	3.94	tons/acre
455	3.94	"
456	3.94	"
477	3.94	"
478	3.94	"
480	3.94	"
551	3.94	"
552	3.94	"
553	3.94	"
579	3.94	"
580	3.94	"
581	3.94	"
612	3.94	"
640	3.94	"
722	3.94	"
748	3.94	"
749	3.94	"
752	3.94	"
1069	3.94	"
1070	3.94	"
1093	3.94	"
1094	3.94	"
1096	3.94	"
1097	3.94	"
1156	3.94	"
1157	3.94	"
1287	3.94	"

Priority feedlots

742 (#1 out of 11) 55
1126 (#5 out of 11) 31
859 (#8 out of 11) 24
1077 (#9 out of 11) 17
1247 (#11 out of 11) 0

Priority nitrogen cells

741	8.92	ppm
742	11.78	"
1260	5.83	"
1269	5.53	"
1280	6.05	"

Priority phosphorous cells

741	1.91	ppm
742	2.57	"
1260	1.24	"
1269	1.15	"
1270	1.08	"
1280	1.28	"
1281	1.63	"

LAKE ALBERT SUBWATERSHEDS

SUB WATERSHED	DRAINAGE AREA (ACRES)	NUM. CELLS WITH EROSION > 3.9 TON/AC.	%	NUM. CELLS WITH TOTAL NIT. >4.0 ppm	%	NUM. CELLS WITH TOTAL PHOS. >.75 ppm	%	NUM. OF FEEDLOTS IN SUB WATERSHED
1	3560	17	19	2	2	5	6	2
2♦	2960	13	17	15	20	16	22	1
3	1440	1	3	0	0	0	0	0
4	3840	12	13	1	1	2	2	0
5	9200	31	14	4	2	5	2	0
6	4560	21	18	0	0	0	0	0
7	1200	10	33	0	0	0	0	0
8	1720	2	5	0	0	0	0	0
9	5520	23	17	2	2	2	2	1

♦ Lake Albert subwatershed #2 is comprised of the drainage area from the outlet of Lake Thisted to the inlet of Lake Albert.

CONTINUED (LAKE ALBERT SUBWATERSHEDS - CRITICAL CELLS)

Priority erosion cells

159	3.94	tons/acre
177	3.94	"
186	3.94	"
187	3.94	"
200	3.94	"
202	3.94	"
203	3.94	"
204	3.94	"
242	3.94	"
244	3.94	"
245	3.94	"
261	3.94	"
265	3.94	"
266	3.94	"
268	3.94	"
272	3.94	"
284	3.94	"
285	3.94	"
292	3.94	"
293	3.94	"
294	3.94	"
298	3.94	"
308	3.94	"
309	3.94	"
310	3.94	"
311	3.94	"
323	4.22	"
324	3.94	"
349	3.94	"
417	3.94	"
460	3.94	"
498	3.94	"
499	3.94	"
500	3.94	"
505	3.94	"
506	3.94	"
507	3.94	"
508	3.94	"
530	3.94	"
531	3.94	"
533	3.94	"
538	3.94	"
539	3.94	"
565	3.94	"
596	3.94	"
604	3.94	"
646	3.94	"
647	3.94	"
648	3.94	"
682	3.94	"

Priority feedlots

186 (#2 ranked) 43
889 (#3 ranked) 34
411 (#4 ranked) 33
691 (#6 ranked) 30
284 (#7 ranked) 28

Priority nitrogen cells

113	4.40	ppm
130	4.03	"
131	4.35	"
132	4.35	"
156	4.35	"
157	4.35	"
181	4.35	"
182	4.35	"
183	4.35	"
207	4.00	"
208	4.35	"
209	4.35	"
234	4.35	"
235	4.35	"
261	4.35	"
284	5.69	"
411	5.94	"
461	4.59	"
462	4.59	"
540	4.59	"
558	4.59	"
699	4.21	"
882	4.59	"
889	6.06	"

Priority phosphorous cells

113	.91	ppm
130	.78	"
131	.86	"
132	.86	"
137	.89	"
		"
156	.86	"
157	.86	"
181	.86	"
182	.86	"
183	.86	"
186	.76	"
206	.75	"
207	.78	"
208	.86	"
209	.86	"
380	1.06	"
411	1.80	"
430	.76	"
461	.94	"
462	.94	"
540	.94	"
558	.94	"
698	.78	"
699	.84	"
822	.94	"
889	1.37	"
234	.86	"
235	.86	"
261	.86	"
284	1.52	"

CRITICAL CELLS ADJACENT TO SUBWATERSHED LA #2

107	5.08	"	107	1.05	"
108	5.83	"	108	1.24	"
109	5.83	"	109	1.24	"
128	4.04	"	128	.81	"
175	4.59	"	153	.75	"
			175	.94	"

CONTINUED (LAKE ALBERT SUBWATERSHEDS - CRITICAL CELLS)

Priority erosion cells

683	3.94	tons/ acre
684	3.94	"
709	3.94	"
710	3.94	"
711	3.94	"
712	3.94	"
746	3.94	"
747	3.94	"
733	3.94	"
740	3.94	"
741	3.94	"
742	3.94	"
766	3.94	"
770	3.94	"
771	3.94	"
772	3.94	"
773	3.94	"
776	3.94	"
788	3.94	"
789	3.94	"
798	3.94	"
800	3.94	"
801	3.94	"
817	3.94	"
818	3.94	"
819	3.94	"
823	3.94	"
832	3.94	"
833	3.94	"
850	3.94	"
851	3.94	"
860	3.94	"
861	3.94	"
877	3.94	"
878	3.94	"
885	3.94	"
886	3.94	"
887	3.94	"
888	3.94	"
897	3.94	"
898	3.94	"
902	3.94	"
909	3.94	"
911	3.94	"
912	3.94	"
921	3.94	"
922	3.94	"
942	3.94	"
943	3.94	"

CONTINUED (LAKE ALBERT SUBWATERSHEDS - CRITICAL CELLS)

Priority erosion cells

943	3.94	tons/ acre
944	3.94	"
960	3.94	"
961	3.94	"
962	3.94	"
963	3.94	"
977	3.94	"
978	3.94	"
979	3.94	"
980	3.94	"
998	3.94	"
999	3.94	"
1004	3.94	"
1005	3.94	"
1018	3.94	"
1019	3.94	"
1022	3.94	"
1033	3.94	"
1034	3.94	"
1035	3.94	"
1036	3.94	"
1039	3.94	"
1046	3.94	"
1047	3.94	"
1062	3.94	"
1063	3.94	"
1115	3.94	"
1117	3.94	"
1120	3.94	"
1121	3.94	"

CRITICAL EROSION CELLS IN SUBWATERSHEDS #5 & 7 (DRY), #2 & #7 (ALBERT)

DRY LAKE SUBWATERSHED 7 (HIGH SEDIMENT YIELD, ABOVE AVERAGE NUTRIENT YIELD)

Cell	Sediment (tons/ acre)	Nitrogen (ppm)	Phosphorous (ppm)
346	3.94	----------	----------
347	3.94	----------	----------
414	3.94	----------	----------
416	3.94	----------	----------
435	3.94	----------	----------
437	3.94	----------	----------
460	3.94	----------	----------
462	3.94	----------	----------
463	3.94	----------	----------
464	3.94	----------	----------
487	3.94	----------	----------
488	3.94	----------	----------
510	3.94	----------	----------
511	3.94	----------	----------
512	3.94	----------	----------

DRY LAKE SUBWATERSHED 5 (AVERAGE SEDIMENT YIELD, HIGH NUTRIENT YIELD)

Cell	Sediment (tons/ acre)	Nitrogen (ppm)	Phosphorous (ppm)
86	3.94	----------	----------
106	3.94	----------	----------
107	3.94	----------	----------
365	----------	5.08	1.05
366	----------	5.82	1.24
367	----------	5.83	1.24
386	----------	5.49	1.24
387	----------	5.83	1.24
388	----------	5.83	1.24
389	----------	5.83	1.24
407	----------	8.86	2.00
408	----------	5.16	1.22
409	----------	7.44	1.64
410	----------	8.86	2.00
411	----------	8.86	2.00
428	----------	8.86	2.00
430	----------	8.86	2.00
431	----------	8.86	2.00
432	----------	8.86	2.00
499	----------	5.22	1.05

LAKE ALBERT SUBWATERSHED 2 (HIGH SEDIMENT & NUTRIENT YIELD)

Cell	Sediment (tons/ acre)	Nitrogen (ppm)	Phosphorous (ppm)
157	3.94	----------	----------
177	3.94	----------	----------
200	3.94	----------	----------
202	3.94	----------	----------
203	3.94	----------	----------
204	3.94	----------	----------
261	3.94	----------	----------
284	3.94	----------	----------
285	3.94	----------	----------
308	3.94	----------	----------
309	3.94	----------	----------
310	3.94	----------	----------
311	3.94	----------	----------
130	----------	4.03	.78
131	----------	4.35	.86
132	----------	4.35	.86
156	----------	4.35	.86
157	----------	4.35	.86
181	----------	4.35	.86
182	----------	4.35	.86
183	----------	4.35	.86
206	----------	----------	.75
207	----------	4.00	.86
208	----------	4.35	.86

CONTINUED FROM PREVIOUS PAGE

LAKE ALBERT SUBWATERSHED 2 (HIGH SEDIMENT & NUTRIENT YIELD)

Cell	Sediment (tons/ acre)	Nitrogen (ppm)	Phosphorous (ppm)
209	----------	4.35	.86
234	----------	4.35	.86
235	----------	4.35	.86
261	----------	4.35	.86
284	----------	5.69	1.52

LAKE ALBERT SUBWATERSHED 7 (HIGH SEDIMENT YIELD, ABOVE AVERAGE NUTRIENT YIELD)

Cell	Sediment (tons/ acre)	Nitrogen (ppm)	Phosphorous (ppm)
646	3.94	---------	----------
647	3.94	---------	----------
648	3.94	---------	----------
682	3.94	---------	----------
683	3.94	---------	----------
684	3.94	---------	----------
712	3.94	---------	----------
746	3.94	---------	----------
747	3.94	---------	----------
776	3.94	---------	----------

An analysis of the Lake Poinsett watershed indicates that there are approximately 214 non-water cells which have greater than 3.9 tons/ acre of sediment yield. This is approximately 13 % of the non-water cells found within the watershed. The model also estimated that there are 26 cells which have nitrogen yields of > 5 ppm and 29 cells which have phosphorous yields > 1.0 ppm. This is approximately 1.6 % of the non-water cells within the watershed. The location and yields for each of these cells are listed on pages 7-14, maps on pages 68-89 and 101-120. These cells should be given high priority when installing any future Best Management Practices (BMP's). The model indicated that sub-watersheds #2 & #7 (Lake Albert) and #5 & #7 (Dry Lake) have the largest sediment and or nutrient yields per acre. Therefore initial BMP's should be concentrated in these four critical subwatersheds. If additional watershed BMP's outside of these four subwatersheds are implemented, than the cells listed on pages 7-14 should be targeted for the implementation of appropriate BMP's. It is recommended these areas be "Field Verified" prior to the installation of any Best Management Practices.

OBJECTIVE 3 - PRIORITY RANKING OF FEEDLOTS (25 YEAR EVENT)

A total of 11 feedlots were identified as potential NPS sources during the AGNPS data acquisition phase of the project. Below is a listing of the AGNPS analysis of the feedlots:

FEEDLOT (CELL,#)	SUBWATERSHED LOCATION	AGNPS RATING (25 YR.EVT)	RANKING PRIORITY	VARIANCE FROM MEAN OF 27.5	VARIANCE FROM 1 STD.DEV. (σ=15.3) FROM MEAN	PRIORITY RANK BASED ON AGNPS RANK AND DISTANCE FACTORS ♦		
						C.FACT.	C.RATE	C.RANK
499	Dry Lake #5	8	10	- 19.5	- 1.27	1.00	8	10
742	Poinsett #1	55	1	+ 27.5	+ 1.79	.64	35	1
859	Poin.-Direct	24	8	- 3.5	- 0.23	1.00	24	6
1077	Poin.-Direct	17	9	- 10.5	- 0.68	1.00	17	9
1126	Poin.-Direct	31	5	+ 3.5	+ 0.23	.72	22	7
1247	Poinsett #7	0	11	- 27.5	- 1.80	.42	0	11
186	Albert #1	43	2	+ 15.5	+ 1.01	.48	21	8
284	Albert #2	28	7	+ 0.5	- .03	.90	25	5
411	Albert #1	33	4	+ 5.5	+ 0.36	.80	26	4
691	Badger-Dir.	30	6	+ 2.5	+ 0.16	1.00	30	2
889	Albert #9	34	3	+ 6.5	+ 0.43	.80	27	3

♦ - PRIORITY RANK = AGNPS 25 YEAR FEEDLOT RATING X DISTANCE TO STREAM X DISTANCE TO LAKE

DISTANCE TO STREAM FACTORS

```
Adjacent to stream            = 1.0
Within 1 cell  (1300 feet) =  .8
Within 2 cells (2600 feet) =  .6
Within 3 cells (3900 feet) =  .4
Within 4 cells (5200 feet) =  .2
```

DISTANCE TO LAKE FACTORS

```
Adjacent to lake                  = 1.0
Within  4 cells (5200 feet)  =  .9
Within  8 cells (10400 feet) =  .8
Within 16 cells (15600 feet) =  .7
Within 20 cells (20800 feet) =  .6
```

```
Mean value    = 27.5
Median value  = 30.0
STDS          = 15.3
Mean + 1STDS  = 42.8
```

1.) Animal feedlot ranking	25 year event
2.) Range of feedlot rankings	0 - 55
3.) Mean	27.5
4.) Sample standard deviation (σ)	15.3
5.) Feedlots with rating $\geq +1\ \sigma$ are :	Cells 742, 186

Cell # 742 000		
Nitrogen concentration (ppm)	65.563	
Phosphorus concentration (ppm)	15.068	
COD concentration (ppm)	1160.682	
Nitrogen mass (lbs)	357.528	
Phosphorus mass (lbs)	82.166	
COD mass (lbs)	6329.441	
Animal feedlot rating number	55	(+1.79σ)

Cell # 186 000		
Nitrogen concentration (ppm)	15.541	
Phosphorus concentration (ppm)	5.708	
COD concentration (ppm)	256.065	
Nitrogen mass (lbs)	144.474	
Phosphorus mass (lbs)	53.064	
COD mass (lbs)	2380.490	
Animal feedlot rating number	43	(+1.01σ)

FEEDLOTS WITH ELEVATED NUTRIENT RUNOFF LEVELS

Cell # 889 000		
Nitrogen concentration (ppm)	53.184	
Phosphorus concentration (ppm)	13.690	
COD concentration (ppm)	997.721	
Nitrogen mass (lbs)	83.982	
Phosphorus mass (lbs)	21.617	
COD mass (lbs)	1575.488	
Animal feedlot rating number	34	(+0.43σ)

Cell # 411 000		
Nitrogen concentration (ppm)	34.154	
Phosphorus concentration (ppm)	12.872	
COD concentration (ppm)	581.504	
Nitrogen mass (lbs)	81.595	
Phosphorus mass (lbs)	30.752	
COD mass (lbs)	1389.227	
Animal feedlot rating number	33	(+0.36σ)

Cell # 1126 000		
Nitrogen concentration (ppm)	13.405	
Phosphorus concentration (ppm)	3.998	
COD concentration (ppm)	167.912	
Nitrogen mass (lbs)	98.858	
Phosphorus mass (lbs)	29.483	
COD mass (lbs)	1238.317	
Animal feedlot rating number	31	(+0.23σ)

Feedlots located in cells 742 (Lake Poinsett #1) and 186 (Lake Albert #1) appear to be contributing excessive nutrients to the watershed (> +1σ), while all other feedlots in the watershed appear to have very little impact on nutrient loading. However, feedlots located in cells 889 (Lake Albert #9), 411 (Lake Albert #1) and 1126 (Upper Poinsett - Direct) appear to be contributing moderate to high levels of nutrients and should also be considered for treatment due to their AGNPS ranking and to their proximity to major streams and lakes. Another possibly source of nutrient loading is from septic systems and from livestock depositing fecal material directly into the lake or adjacent streams. Overall, the nutrients being deposited from the watershed into Lake Poinsett appear to be fairly low.

CONCLUSIONS

Based upon a comparison of other watersheds in Eastern South Dakota, the overall sediment and nutrient loadings to Lake Poinsett appear to be low. However, when a subwatershed analysis is performed, above normal (> +1σ) sediment loadings were found in subwatersheds #2 & #7 of Lake Albert and #7 of Dry Lake (10.6% watershed area, 20.9% sediment), and high nutrient loadings were found in subwatersheds #2 & #7 of Lake Albert and #5 of Dry Lake (11.0% watershed area, 17.6% total nitrogen, 18.4% total phosphorous). The implementation of appropriate Best Management Practices targeted to critical cells found within subwatersheds #2 & #7 of Lake Albert and #5 and #7 of Dry Lake, critical feedlots and critical watershed cells found throughout the entire Lake Poinsett watershed should produce the most cost effective treatment plan in reducing sediment and nutrient loadings to Lake Poinsett.

If you have any questions concerning this study , please contact the Department of Environment and Natural Resources at 605-773-4216.

OVERVIEW OF AGNPS DATA INPUTS

OVERVIEW

Agricultural Nonpoint Source Pollution Model (AGNPS) is a computer simulation model developed to analyze the water quality of runoff from watersheds. The model predicts runoff volume and peak rate, eroded and delivered sediment, nitrogen, phosphorous, and chemical oxygen demand concentrations in the runoff and the sediment for a single storm event for all points in the watershed. Proceeding from the headwaters to the outlet, the pollutants are routed in a step-wise fashion so the flow at any point may be examined. AGNPS is intended to be used as a tool to objectively evaluate the water quality of the runoff from agricultural watersheds and to present a means of objectively comparing different watersheds throughout the state.The model is intended for watersheds up to about 76,000 acres
(1900 cells @ 40 acres/cell).

The model works on a cell basis. These cells are uniform square areas which divide up the watershed (figure 1). This division makes it possible to analyze any area, down to 1.0 acres, in the watershed. The basic components of the model are hydrology, erosion, sediment transport, nitrogen (N), phosphorous (P), and chemical oxygen demand (COD) transport. In the hydrology portion of the model, calculations are made for runoff volume and peak concentration flow. Total upland erosion, total channel erosion, and a breakdown of these two sources into five particle size classes (clay, silt, small aggregates, large aggregates, and sand) for each of the cells are calculated in the erosion portion. Sediment transport is also calculated for each of the cells in the five particle classes as well as the total. The pollutant transport portion is subdivided into one part handling soluble pollutants and another part handling sediment attached pollutants (figure 2).

PRELIMINARY EXAMINATION

A preliminary investigation of the watershed is necessary before the input file can be established. The steps to this preliminary examination are:

1) Detailed topographic map of the watershed (USGS map 1:24,000) (figure 3).
2) Establish the drainage boundaries (figure 4).
3) Divide watershed up into cells (40 acre, 1320 X 1320). Only those cells with greater than 50% of their area within the watershed boundary should be included (figure 5).
4) Number the cells consecutively from one to the number of cells (begin at NW corner of watershed and precede west to east then north to south (figure 5).
5) Establish the watershed drainage pattern from the cells (figure 5).

DATA FILE

Once the preliminary examination is completed, the input data file can be established. The data file is composed of the following 21 inputs per cell (table 1):

Data input for watershed (attachment 1)
1) a) Area of each cell (acres)
   b) Total number of cells in watershed
   c) Precipitation for a ___ year, 24 hour rainfall
   d) Energy intensity value for storm event previously selected

Data input for each cell

1) **Cell number** (figure 6)
2) **Receiving cell number** (figure 6)
3) **SCS number**: runoff curve number (tables 2-4), (use antecedent moisture condition II)
4) **Land slope** (topographic maps) (figure 7), average slope if irregular, water or marsh = 0
5) **Slope shape factor** (figure 8), water or marsh = 1 (uniform)
6) **Field slope length** (figure 9), water or marsh = 0, for S.D. assume slope length area 1
7) **Channel slope** (average), topo maps, if no definable channel, channel slope = 1/2 land slope, water or marsh = 0
8) **Channel sideslope**, the average sideslope (%), assume 10% if unknown, water or marsh=0 9)
9) **Manning roughness coefficient for the channel** (table 5), If no channel exists within the cell, select a roughness coefficient appropriate for the predominant surface condition within the cell
10) **Soil erodibility factor** (attachment 2),water or marsh = 0
11) **Cropping factor** (table 6), assume conditions at storm or worst case condition (fallow or seedbed periods), water or marsh = .00, urban or residential = .01
12) **Practice factor** (table 7), worst case = 1.0, water or marsh = 0 ,urban or residential = 1.0
13) **Surface condition constant** (table 8), a value based on land use at the time of the storm to make adjustments for the time it takes overland runoff to channelize.
14) **Aspect** (figure 10), a single digit indicating the principal direction of drainage from the cell (if no drainage = 0)
15) **Soil texture**, major soil texture and number to indicate each are:

Texture	Input Parameter
Water	0
Sand	1
Silt	2
Clay	3
Peat	4

16) **Fertilization level**, indication of the level of fertilization on the field.

Level	Assume Fertilization (lb./acre) N	P	Input
No fertilization	0	0	0
Low Fertilization	50	20	1
Average Fertilization	100	40	2
High Fertilization	200	80	3

avg. manure - low fertilization
high manure - avg.fertilization
water or marsh = 0
urban or residential = 0 (for normal practices)

17) **Availability factor**, (table 9) the percent of fertilizer left in the top half inch of soil at the time of the storm. Worst case 100%, water or marsh = 0, urban or residential = 100%.

18) **Point source indicator**: indicator of feedlot within the cell (0 = no feedlot, 1 = feedlot) (attachment 3).
19) **Gully source level**: tons of gully erosion occurring in the cell or input from a sub-watershed (attachment 4).
20) **Chemical oxygen demand (COD) demand,** (table 10) a value of COD for the land use in the cell.
21) **Impoundment factor**: number of impoundments in the cell (max. 13) (attachment 5)
   a) Area of drainage into the impoundment
   b) Outlet pipe (inches)
22) **Channel indicator**: number which designates the type of channel found in the cell (Table 11)

DATA OUTPUT AT THE OUTLET OF EACH CELL

Hydrology
Runoff volume
Peak runoff rate
Fraction of runoff generated within the cell

Sediment Output
Sediment yield
Sediment concentration
Sediment particle size distribution
Upland erosion
Amount of deposition
Sediment generated within the cell
Enrichment ratios by particle size
Delivery ratios by particle size

Chemical Output
Nitrogen
Sediment associated mass
Concentration of soluble material
Mass of soluble material

Phosphorus
Sediment associated mass
Concentration of soluble material
Mass of soluble material

Chemical Oxygen Demand
Concentration
Mass

PARAMETER SENSITIVITY ANALYSIS
The most sensitive parameters affecting sediment and chemical yields are:
Land slope (LS)
Soil erodibility (K)
Cover-management factor (C)
Curve number (CN)
Practice factor (P)

RAINFALL SPECS FOR THE LAKE POINSETT WATERSHED STUDY

EVENT	RAINFALL	ENERGY INTENSITY
Monthly	.8	3.0
1 year	2.2	27.0
5 year	3.3	65.0
10 year	3.9	93.0
25 year	4.5	127.0
50 year	5.1	167.0
100 year	5.6	205.0

UPPER LAKE POINSETT WATERSHED SUMMARY (25 YEAR EVENT)

Watershed Studied	LAKE POINSETT WATERSHED
The area of the watershed is	52040.00 acres
The area of each cell is	40.00 acres
Type of event modeled	**25 year, 24 hr.**
The characteristic storm precipitation is	4.50 inches
The storm energy-intensity value is	127.00

VALUES AT THE WATERSHED OUTLET (LAKE POINSETT OUTLET)

Cell number	659 000
Runoff volume	2.62 inches
Peak runoff rate	11358.13 cfs
Total Nitrogen in sediment	0.31 lbs/acre
Total soluble Nitrogen in runoff	1.42 lbs/acre
Soluble Nitrogen concentration in runoff	2.38 ppm
Total Phosphorus in sediment	0.15 lbs/acre
Total soluble Phosphorus in runoff	0.27 lbs/acre
Soluble Phosphorus concentration in runoff	0.45 ppm
Total soluble Chemical Oxygen Demand in runoff	54.02 lbs/acre
Soluble Chemical Oxygen Demand concentration in runoff	90.95 ppm

FEEDLOT ANALYSIS (25 YEAR EVENT)

Cell # A (499)	
Nitrogen concentration (ppm)	6.194
Phosphorus concentration (ppm)	1.390
COD concentration (ppm)	51.417
Nitrogen mass (lbs)	42.461
Phosphorus mass (lbs)	9.527
COD mass (lbs)	352.486
Animal feedlot rating number	8

Cell #B (742)	
Nitrogen concentration (ppm)	65.563
Phosphorus concentration (ppm)	15.068
COD concentration (ppm)	1160.682
Nitrogen mass (lbs)	357.528
Phosphorus mass (lbs)	82.166
COD mass (lbs)	6329.441
Animal feedlot rating number	55

Cell #C (859)	
Nitrogen concentration (ppm)	12.083
Phosphorus concentration (ppm)	4.495
COD concentration (ppm)	202.334
Nitrogen mass (lbs)	39.535
Phosphorus mass (lbs)	14.706
COD mass (lbs)	662.021
Animal feedlot rating number	24

FEEDLOT ANALYSIS (25 YEAR EVENT), continued

Cell #D (1077)	
Nitrogen concentration (ppm)	8.357
Phosphorus concentration (ppm)	3.467
COD concentration (ppm)	155.776
Nitrogen mass (lbs)	20.927
Phosphorus mass (lbs)	8.682
COD mass (lbs)	390.067
Animal feedlot rating number	17

Cell #E (1126)	
Nitrogen concentration (ppm)	13.405
Phosphorus concentration (ppm)	3.998
COD concentration (ppm)	167.912
Nitrogen mass (lbs)	98.858
Phosphorus mass (lbs)	29.483
COD mass (lbs)	1238.317
Animal feedlot rating number	31

Cell #F (1247)	
Nitrogen concentration (ppm)	0.851
Phosphorus concentration (ppm)	0.241
COD concentration (ppm)	7.297
Nitrogen mass (lbs)	6.115
Phosphorus mass (lbs)	1.733
COD mass (lbs)	52.413
Animal feedlot rating number	0

SEDIMENT ANALYSIS AT OUTLET (CELL #659, 25 YEAR EVENT)

Particle type	Area Weighted Erosion Upland (t/a)	Area Weighted Erosion Channel (t/a)	Delivery Ratio (%)	Enrichment Ratio	Mean Conc. (ppm)	Area Weighted Yield (t/a)	Yield (tons)
CLAY	0.16	0.00	27	10	150.40	0.04	2324.36
SILT	0.10	0.00	1	0	2.64	0.00	40.78
SAGG	0.93	0.00	0	0	0.34	0.00	5.23
LAGG	0.41	0.00	0	0	0.14	0.00	2.24
SAND	0.03	0.00	0	0	0.05	0.00	0.70
TOTAL	1.64	0.00	3	1	153.57	0.05	2373.31

HYDROLOGY OF PRIMARY SUBWATERSHEDS (25 YEAR EVENT)

-HYDR- Cell Num Div	Drainage Area (acres)	Overland Runoff (in.)	Upstream Runoff (in.)	Peak Flow Upstream (cfs)	Downstream Runoff (in.)	Peak Flow Downstream (cfs)
230 000	3640.00	2.29	2.37	1796.24	2.37	1768.60
250 000	960.00	0.90	2.11	586.14	2.06	578.22
313 000	3640.00	0.90	2.10	1520.48	2.09	1501.67
334 000	840.00	2.91	2.00	338.43	2.05	350.32
383 000	3440.00	2.91	2.56	2010.76	2.57	1991.86
419 000	800.00	2.05	2.23	599.10	2.22	598.95
466 000	2920.00	0.90	2.03	2064.72	2.02	2017.17
685 000	1000.00	2.91	2.26	526.71	2.29	534.92
756 000	4960.00	2.29	2.20	2520.29	2.20	2489.98
897 000	960.00	2.05	1.95	647.34	1.95	643.55
1023 000	3320.00	0.90	1.89	1629.75	1.88	1586.64
1065 000	1600.00	1.97	1.67	750.19	1.67	746.15
1103 000	2600.00	2.05	2.06	1437.30	2.06	1433.14
1104 000	1720.00	2.29	2.17	1010.32	2.17	1004.67

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (25 YEAR EVENT)

-SED- Cell Num Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Within (tons)	Yield (tons)	Deposition (%)
230 000	CLAY	0.21	475.70	8.29	483.38	0
	SILT	0.12	0.91	4.97	16.05	-63
	SAGG	1.18	1.14	47.23	57.54	-16
	LAGG	0.52	3.86	20.71	75.06	-67
	SAND	0.04	1.21	1.66	23.78	-88
	TOTL	2.07	482.84	82.85	655.80	-14
250 000	CLAY	0.00	252.01	0.00	251.34	0
	SILT	0.00	92.65	0.00	86.56	7
	SAGG	0.00	187.55	0.00	135.16	28
	LAGG	0.00	5.32	0.00	5.62	-5
	SAND	0.00	1.67	0.00	1.76	-5
	TOTL	0.00	539.20	0.00	480.44	11
313 000	CLAY	0.00	650.73	0.00	649.66	0
	SILT	0.00	153.68	0.00	147.41	4
	SAGG	0.00	398.21	0.00	325.83	18
	LAGG	0.00	13.06	0.00	13.39	-2
	SAND	0.00	4.09	0.00	4.20	-3
	TOTL	0.00	1219.76	0.00	1140.49	6
334 000	CLAY	0.00	171.92	0.00	127.83	26
	SILT	0.00	64.73	0.00	0.36	99
	SAGG	0.00	222.57	0.00	0.44	100
	LAGG	0.00	6.73	0.00	1.49	78
	SAND	0.00	1.80	0.00	0.47	74
	TOTL	0.00	467.74	0.00	130.59	72

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (25 YEAR EVENT), continued

-SED- Cell Num	Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
383	000	CLAY	0.16	590.81	6.26	596.38	0
		SILT	0.09	191.87	3.76	190.02	3
		SAGG	0.89	568.86	35.68	527.11	13
		LAGG	0.39	20.54	15.65	20.84	42
		SAND	0.03	5.48	1.25	5.57	17
		TOTL	1.56	1377.55	62.60	1339.92	7
419	000	CLAY	0.16	193.64	6.30	198.98	0
		SILT	0.09	77.08	3.78	71.58	11
		SAGG	0.90	252.52	35.89	164.59	43
		LAGG	0.39	1.77	15.74	1.54	91
		SAND	0.03	0.17	1.26	0.20	86
		TOTL	1.57	525.19	62.97	436.89	26
466	000	CLAY	0.00	691.70	0.00	691.10	0
		SILT	0.00	290.96	0.00	284.51	2
		SAGG	0.00	1010.48	0.00	908.05	10
		LAGG	0.00	7.75	0.00	5.78	25
		SAND	0.00	2.25	0.00	1.81	19
		TOTL	0.00	2003.14	0.00	1891.25	6
685	000	CLAY	0.00	253.24	0.00	251.00	1
		SILT	0.00	115.99	0.00	92.05	21
		SAGG	0.00	488.01	0.00	142.29	71
		LAGG	0.00	16.87	0.00	0.17	99
		SAND	0.00	2.29	0.00	0.05	98
		TOTL	0.00	876.40	0.00	485.56	45
756	000	CLAY	0.30	997.94	11.81	1008.94	0
		SILT	0.18	324.02	7.08	324.52	2
		SAGG	1.68	992.02	67.30	963.41	9
		LAGG	0.74	46.70	29.52	45.63	40
		SAND	0.06	11.90	2.36	11.96	16
		TOTL	2.95	2372.58	118.07	2354.46	5
897	000	CLAY	0.08	103.45	3.31	106.50	0
		SILT	0.05	17.77	1.99	18.66	6
		SAGG	0.47	2.65	18.89	18.69	13
		LAGG	0.21	0.14	8.29	9.43	-11
		SAND	0.02	0.04	0.66	2.78	-75
		TOTL	0.83	124.05	33.14	156.06	1
1023	000	CLAY	0.00	576.63	0.00	575.72	0
		SILT	0.00	231.30	0.00	222.14	4
		SAGG	0.00	664.54	0.00	547.54	18
		LAGG	0.00	24.06	0.00	10.46	57
		SAND	0.00	6.30	0.00	3.28	48
		TOTL	0.00	1502.83	0.00	1359.13	10
1065	000	CLAY	0.15	149.63	5.89	155.13	0
		SILT	0.09	44.48	3.53	45.16	6
		SAGG	0.84	188.55	33.57	166.93	25
		LAGG	0.37	15.19	14.72	8.33	72
		SAND	0.03	3.65	1.18	2.14	56
		TOTL	1.47	401.50	58.90	377.68	18

SEDIMENT ANALYSIS AT THE PRIMARY SUBWATERSHEDS (25 YEAR EVENT), continued

-SED- Cell Num	Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
1103	000	CLAY	0.17	344.96	6.67	351.25	0
		SILT	0.10	63.34	4.00	65.57	3
		SAGG	0.95	319.90	38.05	315.27	12
		LAGG	0.42	14.29	16.69	13.01	58
		SAND	0.03	3.10	1.33	3.02	32
		TOTL	1.67	745.60	66.75	748.12	8
1104	000	CLAY	0.30	274.93	11.89	286.32	0
		SILT	0.18	100.70	7.14	103.25	4
		SAGG	1.70	403.61	67.80	385.60	18
		LAGG	0.74	14.60	29.74	15.20	66
		SAND	0.06	3.35	2.38	3.46	40
		TOTL	2.97	797.20	118.95	793.84	13

CONDENSED SOIL LOSS (25 YEAR EVENT)

Cell Num	Div	Drainage Area (acres)	RUNOFF Vol. (in.)	RUNOFF Generated Above (%)	RUNOFF Peak Rate (cfs)	SEDIMENT Cell Erosion (t/a)	SEDIMENT Generated Above (tons)	SEDIMENT Generated Within (tons)	SEDIMENT Yield (tons)	SEDIMENT Depc (%)
230	000	3640.00	2.29	98.9	1768.60	2.07	482.84	82.85	655.80	-14
250	000	960.00	0.90	98.2	578.22	0.00	539.20	0.00	480.44	11
313	000	3640.00	0.90	99.5	1501.67	0.00	1219.76	0.00	1140.49	6
334	000	840.00	2.91	93.2	350.32	0.00	467.74	0.00	130.59	72
383	000	3440.00	2.91	98.7	1991.86	1.56	1377.55	62.60	1339.92	7
419	000	800.00	2.05	95.4	598.95	1.57	525.19	62.97	436.89	26
466	000	2920.00	0.90	99.4	2017.17	0.00	2003.14	0.00	1891.25	6
685	000	1000.00	2.91	94.9	534.92	0.00	876.40	0.00	485.56	45
756	000	4960.00	2.29	99.2	2489.98	2.95	2372.58	118.07	2354.46	5
897	000	960.00	2.05	95.6	643.55	0.83	124.05	33.14	156.06	1
1023	000	3320.00	0.90	99.4	1586.64	0.00	1502.83	0.00	1359.13	10
1065	000	1600.00	1.97	97.1	746.15	1.47	401.50	58.90	377.68	18
1103	000	2600.00	2.05	98.5	1433.14	1.67	745.60	66.75	748.12	8
1104	000	1720.00	2.29	97.5	1004.67	2.97	797.20	118.95	793.84	13

NUTRIENT ANALYSIS (25 YEAR EVENT)

NITROGEN

Cell Num	Div	Drainage Area (acres)	Sediment Within Cell (lbs/a)	Sediment Cell Outlet (lbs/a)	Water Soluble Within Cell (lbs/a)	Water Soluble Cell Outlet (lbs/a)	Water Soluble Conc (ppm)
230	000	3640.00	6.51	0.92	2.26	1.77	3.30
250	000	960.00	0.00	2.09	0.17	1.63	3.49
313	000	3640.00	0.00	1.44	0.17	1.46	3.09
334	000	840.00	0.00	0.82	0.82	1.47	3.18
383	000	3440.00	5.21	1.71	3.84	2.70	4.64
419	000	800.00	5.23	2.24	1.04	1.56	3.10
466	000	2920.00	0.00	2.57	0.17	1.52	3.33
685	000	1000.00	0.00	2.04	0.82	1.93	3.71
756	000	4960.00	8.65	2.00	2.26	1.62	3.25
897	000	960.00	3.13	0.85	1.04	1.06	2.40
1023	000	3320.00	0.00	1.78	0.17	1.24	2.91
1065	000	1600.00	4.96	1.15	0.94	0.82	2.15
1103	000	2600.00	5.48	1.34	1.20	1.32	2.83
1104	000	1720.00	8.70	1.96	1.65	1.45	2.95

NUTRIENT ANALYSIS (25 YEAR EVENT)

PHOSPHORUS

Cell Num	Div	Drainage Area (acres)	Sediment Within Cell (lbs/a)	Sediment Cell Outlet (lbs/a)	Water Soluble Within Cell (lbs/a)	Water Soluble Cell Outlet (lbs/a)	Water Soluble Conc (ppm)
230	000	3640.00	3.26	0.46	0.45	0.37	0.68
250	000	960.00	0.00	1.05	0.01	0.31	0.66
313	000	3640.00	0.00	0.72	0.01	0.28	0.60
334	000	840.00	0.00	0.41	0.27	0.28	0.61
383	000	3440.00	2.60	0.86	0.81	0.57	0.99
419	000	800.00	2.62	1.12	0.17	0.29	0.57
466	000	2920.00	0.00	1.29	0.01	0.28	0.62
685	000	1000.00	0.00	1.02	0.16	0.37	0.72
756	000	4960.00	4.32	1.00	0.45	0.31	0.62
897	000	960.00	1.57	0.43	0.17	0.16	0.37
1023	000	3320.00	0.00	0.89	0.01	0.22	0.53
1065	000	1600.00	2.48	0.57	0.15	0.14	0.37
1103	000	2600.00	2.74	0.67	0.21	0.26	0.57
1104	000	1720.00	4.35	0.98	0.31	0.30	0.61

NUTRIENT ANALYSIS (25 YEAR EVENT)

CHEMICAL OXYGEN DEMAND

Cell Num Div	Drainage Area (acres)	---- Sediment ---- Within Cell (lbs/a)	Cell Outlet (lbs/a)	---- Water Soluble ----- Within Cell (lbs/a)	Cell Outlet (lbs/a)	Conc (ppm)
230 000	3640.00			88.00	71.93	133.97
250 000	960.00			12.00	75.62	161.95
313 000	3640.00			12.00	65.10	137.66
334 000	840.00			16.00	67.96	146.62
383 000	3440.00			112.00	89.50	154.04
419 000	800.00			37.00	72.95	145.06
466 000	2920.00			12.00	68.53	150.13
685 000	1000.00			16.00	85.24	164.44
756 000	4960.00			88.00	77.45	155.08
897 000	960.00			37.00	50.66	114.64
1023 000	3320.00			12.00	57.48	135.25
1065 000	1600.00			36.00	43.47	114.63
1103 000	2600.00			79.00	60.57	129.97
1104 000	1720.00			88.00	66.47	135.15

UPPER LAKE POINSETT WATERSHED SUMMARY (1 YEAR EVENT)

Watershed Studied	LAKE POINSETT WATERSHED
The area of the watershed is	52040.00 acres
The area of each cell is	40.00 acres
Type of event modeled	**1 year, 24 hr.**
The characteristic storm precipitation is	2.20 inches
The storm energy-intensity value is	27.00

VALUES AT THE WATERSHED OUTLET (LAKE POINSETT OUTLET)

Cell number	659 000
Runoff volume	0.89 inches
Peak runoff rate	3915.00 cfs
Total Nitrogen in sediment	0.04 lbs/acre
Total soluble Nitrogen in runoff	0.84 lbs/acre
Soluble Nitrogen concentration in runoff	4.15 ppm
Total Phosphorus in sediment	0.02 lbs/acre
Total soluble Phosphorus in runoff	0.17 lbs/acre
Soluble Phosphorus concentration in runoff	0.82 ppm
Total soluble Chemical Oxygen Demand in runoff	14.02 lbs/acre
Soluble Chemical Oxygen Demand concentration in runoff	69.47 ppm

FEEDLOT ANALYSIS (1 YEAR EVENT)

Cell #A (499)	
Nitrogen concentration (ppm)	6.194
Phosphorus concentration (ppm)	1.390
COD concentration (ppm)	51.417
Nitrogen mass (lbs)	11.121
Phosphorus mass (lbs)	2.495
COD mass (lbs)	92.320
Animal feedlot rating number	0

Cell #B (742)	
Nitrogen concentration (ppm)	65.563
Phosphorus concentration (ppm)	15.068
COD concentration (ppm)	1160.682
Nitrogen mass (lbs)	93.641
Phosphorus mass (lbs)	21.520
COD mass (lbs)	1657.757
Animal feedlot rating number	35

Cell #C (859)	
Nitrogen concentration (ppm)	12.083
Phosphorus concentration (ppm)	4.495
COD concentration (ppm)	202.334
Nitrogen mass (lbs)	10.355
Phosphorus mass (lbs)	3.852
COD mass (lbs)	173.391
Animal feedlot rating number	6

Cell #D (1077)	
Nitrogen concentration (ppm)	8.357
Phosphorus concentration (ppm)	3.467
COD concentration (ppm)	155.776
Nitrogen mass (lbs)	6.795
Phosphorus mass (lbs)	2.819
COD mass (lbs)	126.654
Animal feedlot rating number	2

Cell #E (1126)	
Nitrogen concentration (ppm)	13.405
Phosphorus concentration (ppm)	3.998
COD concentration (ppm)	167.912
Nitrogen mass (lbs)	25.892
Phosphorus mass (lbs)	7.722
COD mass (lbs)	324.330
Animal feedlot rating number	12

Cell #F (1247)	
Nitrogen concentration (ppm)	0.851
Phosphorus concentration (ppm)	0.241
COD concentration (ppm)	7.297
Nitrogen mass (lbs)	1.985
Phosphorus mass (lbs)	0.563
COD mass (lbs)	17.019
Animal feedlot rating number	0

SEDIMENT ANALYSIS AT OUTLET (CELL #659, 1 YEAR EVENT)

Particle type	Area Weighted Erosion Upland (t/a)	Area Weighted Erosion Channel (t/a)	Delivery Ratio (%)	Enrichment Ratio	Mean Conc. (ppm)	Area Weighted Yield (t/a)	Yield (tons)
CLAY	0.03	0.00	11	10	38.03	0.00	199.68
SILT	0.02	0.00	0	0	0.72	0.00	3.76
SAGG	0.20	0.00	0	0	0.47	0.00	2.48
LAGG	0.09	0.00	0	0	0.24	0.00	1.29
SAND	0.01	0.00	0	0	0.08	0.00	0.40
TOTAL	0.35	0.00	1	1	39.54	0.00	207.62

HYDROLOGY OF PRIMARY SUBWATERSHEDS (1 YEAR EVENT)

-HYDR- Cell Num Div	Drainage Area (acres)	Overland Runoff (in.)	Upstream Runoff (in.)	Peak Flow Upstream (cfs)	Downstream Runoff (in.)	Peak Flow Downstream (cfs)
230 000	3640.00	0.60	0.65	528.74	0.65	520.26
250 000	960.00	0.07	0.53	164.07	0.51	159.82
313 000	3640.00	0.07	0.53	416.88	0.53	410.34
334 000	840.00	0.94	0.49	92.34	0.51	97.45
383 000	3440.00	0.94	0.77	645.34	0.77	639.80
419 000	800.00	0.48	0.57	170.77	0.57	169.98
466 000	2920.00	0.07	0.50	552.48	0.49	537.46
685 000	1000.00	0.94	0.59	151.24	0.60	155.29
756 000	4960.00	0.60	0.57	700.00	0.57	691.52
897 000	960.00	0.48	0.53	194.13	0.53	191.81
1023 000	3320.00	0.07	0.44	414.06	0.44	401.53
1065 000	1600.00	0.45	0.36	180.15	0.36	179.32
1103 000	2600.00	0.48	0.52	396.09	0.52	394.42
1104 000	1720.00	0.60	0.57	289.94	0.57	288.17

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (1 YEAR EVENT)

-SED- Cell Num Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
230 000	CLAY	0.04	62.95	1.76	64.55	0
	SILT	0.03	0.46	1.06	6.60	-77
	SAGG	0.25	0.57	10.04	15.48	-31
	LAGG	0.11	1.93	4.40	40.24	-84
	SAND	0.01	0.61	0.35	12.89	-93
	TOTL	0.44	66.52	17.61	139.75	-40
250 000	CLAY	0.00	52.43	0.00	52.12	1
	SILT	0.00	11.94	0.00	10.32	14
	SAGG	0.00	9.51	0.00	4.85	49
	LAGG	0.00	2.51	0.00	2.64	-5
	SAND	0.00	0.79	0.00	0.83	-5
	TOTL	0.00	77.16	0.00	70.77	8
313 000	CLAY	0.00	116.21	0.00	115.79	0
	SILT	0.00	21.82	0.00	19.97	8
	SAGG	0.00	24.69	0.00	16.26	34
	LAGG	0.00	6.27	0.00	6.44	-3
	SAND	0.00	1.97	0.00	2.02	-3
	TOTL	0.00	170.97	0.00	160.49	6
334 000	CLAY	0.00	35.76	0.00	18.00	50
	SILT	0.00	9.59	0.00	0.17	98
	SAGG	0.00	19.06	0.00	0.21	99
	LAGG	0.00	2.67	0.00	0.70	74
	SAND	0.00	0.80	0.00	0.22	73
	TOTL	0.00	67.88	0.00	19.30	72

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (1 YEAR EVENT), continued

-SED- Cell Num Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
383 000	CLAY	0.03	118.47	1.33	119.53	0
	SILT	0.02	30.66	0.80	29.75	5
	SAGG	0.19	57.96	7.59	50.58	23
	LAGG	0.08	9.23	3.33	9.40	25
	SAND	0.01	2.80	0.27	2.85	7
	TOTL	0.33	219.12	13.31	212.10	9
419 000	CLAY	0.03	40.41	1.34	41.31	1
	SILT	0.02	11.23	0.80	9.24	23
	SAGG	0.19	19.90	7.63	8.87	68
	LAGG	0.08	0.27	3.35	0.31	91
	SAND	0.01	0.06	0.27	0.07	78
	TOTL	0.33	71.87	13.39	59.81	30
466 000	CLAY	0.00	142.68	0.00	142.40	0
	SILT	0.00	44.68	0.00	42.47	5
	SAGG	0.00	81.90	0.00	64.28	22
	LAGG	0.00	3.33	0.00	2.72	18
	SAND	0.00	1.02	0.00	0.85	17
	TOTL	0.00	273.62	0.00	252.72	8
685 000	CLAY	0.00	53.30	0.00	52.28	2
	SILT	0.00	18.84	0.00	11.29	40
	SAGG	0.00	55.51	0.00	0.02	100
	LAGG	0.00	3.71	0.00	0.08	98
	SAND	0.00	0.82	0.00	0.03	97
	TOTL	0.00	132.18	0.00	63.69	52
756 000	CLAY	0.06	187.71	2.51	189.89	0
	SILT	0.04	47.53	1.51	47.04	4
	SAGG	0.36	94.21	14.31	89.40	18
	LAGG	0.16	18.69	6.28	18.77	25
	SAND	0.01	5.54	0.50	5.65	6
	TOTL	0.63	353.68	25.10	350.75	7
897 000	CLAY	0.02	20.86	0.70	21.45	1
	SILT	0.01	0.95	0.42	1.29	6
	SAGG	0.10	0.02	4.02	3.72	8
	LAGG	0.04	0.07	1.76	4.50	-59
	SAND	0.00	0.02	0.14	1.41	-88
	TOTL	0.18	21.92	7.05	32.37	-11
1023 000	CLAY	0.00	119.61	0.00	119.17	0
	SILT	0.00	32.26	0.00	29.40	9
	SAGG	0.00	49.89	0.00	31.88	36
	LAGG	0.00	9.24	0.00	4.79	48
	SAND	0.00	2.77	0.00	1.50	46
	TOTL	0.00	213.76	0.00	186.74	13
1065 000	CLAY	0.03	27.50	1.25	28.58	1
	SILT	0.02	7.34	0.75	7.04	13
	SAGG	0.18	20.03	7.14	14.57	46
	LAGG	0.08	5.15	3.13	3.00	64
	SAND	0.01	1.53	0.25	0.89	50
	TOTL	0.31	61.54	12.52	54.08	27

SEDIMENT ANALYSIS AT PRIMARY SUBWATERSHEDS (1 YEAR EVENT), continued

-SED- Cell Num Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
1103 000	CLAY	0.04	55.25	1.42	56.54	0
	SILT	0.02	12.28	0.85	12.40	6
	SAGG	0.20	42.99	8.09	39.02	24
	LAGG	0.09	4.80	3.55	4.67	44
	SAND	0.01	1.36	0.28	1.35	18
	TOTL	0.35	116.67	14.19	113.97	13
1104 000	CLAY	0.06	51.26	2.53	53.59	0
	SILT	0.04	17.21	1.52	17.11	9
	SAGG	0.36	39.68	14.41	36.56	32
	LAGG	0.16	5.26	6.32	5.43	53
	SAND	0.01	1.54	0.51	1.56	24
	TOTL	0.63	114.93	25.29	114.25	19

CONDENSED SOIL LOSS (1 YEAR EVENT)

Cell Num Div	Drainage Area (acres)	RUNOFF Vol. (in.)	RUNOFF Generated Above (%)	RUNOFF Peak Rate (cfs)	SEDIMENT Cell Erosion (t/a)	SEDIMENT Generated Above (tons)	SEDIMENT Generated Within (tons)	SEDIMENT Yield (tons)	SEDIMENT Depo (%)
230 000	3640.00	0.60	99.0	520.26	0.44	66.52	17.61	139.75	-40
250 000	960.00	0.07	99.4	159.82	0.00	77.16	0.00	70.77	8
313 000	3640.00	0.07	99.9	410.34	0.00	170.97	0.00	160.49	6
334 000	840.00	0.94	91.2	97.45	0.00	67.88	0.00	19.30	72
383 000	3440.00	0.94	98.6	639.80	0.33	219.12	13.31	212.10	9
419 000	800.00	0.48	95.7	169.98	0.33	71.87	13.39	59.81	30
466 000	2920.00	0.07	99.8	537.46	0.00	273.62	0.00	252.72	8
685 000	1000.00	0.94	93.7	155.29	0.00	132.18	0.00	63.69	52
756 000	4960.00	0.60	99.2	691.52	0.63	353.68	25.10	350.75	7
897 000	960.00	0.48	96.2	191.81	0.18	21.92	7.05	32.37	-11
1023 000	3320.00	0.07	99.8	401.53	0.00	213.76	0.00	186.74	13
1065 000	1600.00	0.45	96.9	179.32	0.31	61.54	12.52	54.08	27
1103 000	2600.00	0.48	98.6	394.42	0.35	116.67	14.19	113.97	13
1104 000	1720.00	0.60	97.5	288.17	0.63	114.93	25.29	114.25	19

NUTRIENT ANALYSIS (1 YEAR EVENT)

NITROGEN

Cell Num	Div	Drainage Area (acres)	Sediment Within Cell (lbs/a)	Sediment Cell Outlet (lbs/a)	Water Soluble Within Cell (lbs/a)	Water Soluble Cell Outlet (lbs/a)	Conc (ppm)
230	000	3640.00	1.89	0.27	1.46	1.10	7.49
250	000	960.00	0.00	0.45	0.01	1.01	8.74
313	000	3640.00	0.00	0.30	0.01	0.89	7.44
334	000	840.00	0.00	0.18	0.40	0.90	7.79
383	000	3440.00	1.51	0.39	2.32	1.66	9.50
419	000	800.00	1.52	0.46	0.60	0.95	7.45
466	000	2920.00	0.00	0.51	0.01	0.94	8.38
685	000	1000.00	0.00	0.40	0.40	1.05	7.72
756	000	4960.00	2.51	0.44	1.46	1.00	7.73
897	000	960.00	0.91	0.24	0.60	0.62	5.17
1023	000	3320.00	0.00	0.36	0.01	0.73	7.37
1065	000	1600.00	1.44	0.24	0.53	0.44	5.36
1103	000	2600.00	1.59	0.30	0.72	0.79	6.67
1104	000	1720.00	2.52	0.42	1.01	0.87	6.73

NUTRIENT ANALYSIS (1 YEAR EVENT)

PHOSPHORUS

Cell Num	Div	Drainage Area (acres)	Sediment Within Cell (lbs/a)	Sediment Cell Outlet (lbs/a)	Water Soluble Within Cell (lbs/a)	Water Soluble Cell Outlet (lbs/a)	Conc (ppm)
230	000	3640.00	0.94	0.13	0.28	0.23	1.57
250	000	960.00	0.00	0.23	0.00	0.19	1.68
313	000	3640.00	0.00	0.15	0.00	0.18	1.50
334	000	840.00	0.00	0.09	0.17	0.18	1.53
383	000	3440.00	0.75	0.20	0.46	0.34	1.95
419	000	800.00	0.76	0.23	0.11	0.18	1.41
466	000	2920.00	0.00	0.26	0.00	0.18	1.60
685	000	1000.00	0.00	0.20	0.10	0.20	1.50
756	000	4960.00	1.25	0.22	0.28	0.20	1.52
897	000	960.00	0.45	0.12	0.11	0.10	0.85
1023	000	3320.00	0.00	0.18	0.00	0.14	1.39
1065	000	1600.00	0.72	0.12	0.10	0.08	1.02
1103	000	2600.00	0.79	0.15	0.13	0.16	1.39
1104	000	1720.00	1.26	0.21	0.19	0.18	1.42

NUTRIENT ANALYSIS (1 YEAR EVENT)

CHEMICAL OXYGEN DEMAND

		---- Sediment ----		----- Water Soluble ------		
Cell Num Div	Drainage Area (acres)	Within Cell (lbs/a)	Cell Outlet (lbs/a)	Within Cell (lbs/a)	Cell Outlet (lbs/a)	Conc (ppm)
230 000	3640.00			23.00	18.96	129.05
250 000	960.00			1.00	19.43	167.47
313 000	3640.00			1.00	16.67	139.30
334 000	840.00			5.00	17.37	150.26
383 000	3440.00			36.00	25.62	146.99
419 000	800.00			9.00	18.81	146.93
466 000	2920.00			1.00	17.45	155.95
685 000	1000.00			5.00	22.26	163.73
756 000	4960.00			23.00	20.13	155.47
897 000	960.00			9.00	13.16	110.46
1023 000	3320.00			1.00	14.15	142.98
1065 000	1600.00			8.00	10.26	125.07
1103 000	2600.00			19.00	15.45	130.97
1104 000	1720.00			23.00	17.38	134.85

UPPER LAKE POINSETT WATERSHED SUMMARY (MONTHLY EVENT)

Watershed Studied	LAKE POINSETT WATERSHED
The area of the watershed is	52040.00 acres
The area of each cell is	40.00 acres
Type of event modeled	**MONTHLY EVENT**
The characteristic storm precipitation is	0.80 inches
The storm energy-intensity value is	3.00

VALUES AT THE WATERSHED OUTLET (LAKE POINSETT OUTLET)

Cell number	659 000
Runoff volume	0.18 inches
Peak runoff rate	825.33 cfs
Total Nitrogen in sediment	0.00 lbs/acre
Total soluble Nitrogen in runoff	0.11 lbs/acre
Soluble Nitrogen concentration in runoff	2.69 ppm
Total Phosphorus in sediment	0.00 lbs/acre
Total soluble Phosphorus in runoff	0.02 lbs/acre
Soluble Phosphorus concentration in runoff	0.40 ppm
Total soluble Chemical Oxygen Demand in runoff	0.49 lbs/acre
Soluble Chemical Oxygen Demand concentration in runoff	11.84 ppm

SEDIMENT ANALYSIS AT OUTLET (CELL #659, MONTHLY EVENT)

Particle type	Area Weighted Erosion Upland (t/a)	Area Weighted Erosion Channel (t/a)	Delivery Ratio (%)	Enrichment Ratio	Mean Conc. (ppm)	Area Weighted Yield (t/a)	Yield (tons)
CLAY	0.00	0.00	3	7	5.40	0.00	5.86
SILT	0.00	0.00	1	2	0.98	0.00	1.06
SAGG	0.02	0.00	0	0	0.51	0.00	0.56
LAGG	0.01	0.00	0	0	0.53	0.00	0.57
SAND	0.00	0.00	0	1	0.17	0.00	0.18
TOTAL	0.04	0.00	0	1	7.59	0.00	8.22

HYDROLOGY OF PRIMARY SUBWATERSHEDS (MONTHLY EVENT)

-HYDR- Cell Num Div	Drainage Area (acres)	Overland Runoff (in.)	Upstream Runoff (in.)	Peak Flow Upstream (cfs)	Downstream Runoff (in.)	Peak Flow Downstream (cfs)
230 000	3640.00	0.02	0.03	29.67	0.03	29.08
250 000	960.00	0.00	0.02	6.41	0.02	6.20
313 000	3640.00	0.00	0.02	18.64	0.02	18.32
334 000	840.00	0.09	0.01	3.49	0.02	4.37
383 000	3440.00	0.09	0.07	69.49	0.07	68.88
419 000	800.00	0.01	0.01	5.93	0.01	5.75
466 000	2920.00	0.00	0.01	20.21	0.01	19.61
685 000	1000.00	0.09	0.02	5.62	0.02	6.55

HYDROLOGY OF PRIMARY SUBWATERSHEDS (MONTHLY EVENT), continued

-HYDR- Cell Num Div	Drainage Area (acres)	Overland Runoff (in.)	Upstream Runoff (in.)	Peak Flow Upstream (cfs)	Downstream Runoff (in.)	Peak Flow Downstream (cfs)
756 000	4960.00	0.02	0.02	28.98	0.02	28.59
897 000	960.00	0.01	0.03	13.40	0.03	12.84
1023 000	3320.00	0.00	0.01	15.67	0.01	15.16
1065 000	1600.00	0.00	0.01	7.42	0.01	7.20
1103 000	2600.00	0.01	0.02	20.21	0.02	19.91
1104 000	1720.00	0.02	0.03	16.40	0.03	16.16

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (MONTHLY EVENT)

-SED- Cell Num Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
230 000	CLAY	0.00	0.26	0.20	1.32	-66
	SILT	0.00	0.09	0.12	1.19	-82
	SAGG	0.03	0.11	1.12	1.93	-36
	LAGG	0.01	0.38	0.49	8.56	-90
	SAND	0.00	0.12	0.04	2.70	-94
	TOTL	0.05	0.96	1.96	15.69	-81
250 000	CLAY	0.00	4.42	0.00	4.23	4
	SILT	0.00	0.13	0.00	0.10	20
	SAGG	0.00	0.11	0.00	0.11	-4
	LAGG	0.00	0.37	0.00	0.39	-6
	SAND	0.00	0.12	0.00	0.12	-6
	TOTL	0.00	5.14	0.00	4.95	4
313 000	CLAY	0.00	7.27	0.00	7.09	2
	SILT	0.00	0.46	0.00	0.36	21
	SAGG	0.00	0.32	0.00	0.33	-2
	LAGG	0.00	1.08	0.00	1.11	-3
	SAND	0.00	0.34	0.00	0.35	-3
	TOTL	0.00	9.46	0.00	9.23	2
334 000	CLAY	0.00	3.01	0.00	0.03	99
	SILT	0.00	0.20	0.00	0.03	87
	SAGG	0.00	0.28	0.00	0.03	88
	LAGG	0.00	0.37	0.00	0.11	70
	SAND	0.00	0.12	0.00	0.03	70
	TOTL	0.00	3.97	0.00	0.23	94
383 000	CLAY	0.00	10.26	0.15	10.31	1
	SILT	0.00	1.74	0.09	1.57	14
	SAGG	0.02	1.63	0.84	1.51	39
	LAGG	0.01	2.53	0.37	2.54	12
	SAND	0.00	0.79	0.03	0.80	3
	TOTL	0.04	16.95	1.48	16.73	9
419 000	CLAY	0.00	3.49	0.15	3.34	8
	SILT	0.00	0.10	0.09	0.05	75
	SAGG	0.02	0.17	0.85	0.14	87
	LAGG	0.01	0.03	0.37	0.03	93
	SAND	0.00	0.01	0.03	0.01	77
	TOTL	0.04	3.80	1.49	3.57	33

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (MONTHLY EVENT), continued

-SED- Cell Num Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
466 000	CLAY	0.00	13.01	0.00	12.81	2
	SILT	0.00	0.79	0.00	0.56	29
	SAGG	0.00	0.23	0.00	0.13	46
	LAGG	0.00	0.48	0.00	0.41	14
	SAND	0.00	0.15	0.00	0.13	14
	TOTL	0.00	14.67	0.00	14.03	4
685 000	CLAY	0.00	5.07	0.00	4.37	14
	SILT	0.00	0.52	0.00	0.00	99
	SAGG	0.00	1.41	0.00	0.00	100
	LAGG	0.00	0.36	0.00	0.01	97
	SAND	0.00	0.11	0.00	0.00	96
	TOTL	0.00	7.47	0.00	4.39	41
756 000	CLAY	0.01	15.16	0.28	15.25	1
	SILT	0.00	1.37	0.17	1.32	14
	SAGG	0.04	2.04	1.59	1.89	48
	LAGG	0.02	2.94	0.70	3.02	17
	SAND	0.00	0.92	0.06	0.95	2
	TOTL	0.07	22.43	2.79	22.43	11
897 000	CLAY	0.00	1.28	0.08	1.32	2
	SILT	0.00	0.00	0.05	0.15	-66
	SAGG	0.01	0.00	0.45	0.34	24
	LAGG	0.00	0.01	0.20	0.94	-78
	SAND	0.00	0.00	0.02	0.29	-93
	TOTL	0.02	1.30	0.78	3.05	-32
1023 000	CLAY	0.00	9.26	0.00	9.00	3
	SILT	0.00	0.61	0.00	0.38	38
	SAGG	0.00	0.96	0.00	0.22	77
	LAGG	0.00	1.31	0.00	0.74	43
	SAND	0.00	0.41	0.00	0.23	43
	TOTL	0.00	12.55	0.00	10.58	16
1065 000	CLAY	0.00	1.97	0.14	2.02	4
	SILT	0.00	0.29	0.08	0.21	45
	SAGG	0.02	0.72	0.79	0.33	78
	LAGG	0.01	0.76	0.35	0.44	60
	SAND	0.00	0.24	0.03	0.14	48
	TOTL	0.03	3.98	1.39	3.13	42
1103 000	CLAY	0.00	2.91	0.16	3.03	1
	SILT	0.00	0.61	0.09	0.54	23
	SAGG	0.02	0.79	0.90	0.69	59
	LAGG	0.01	0.77	0.39	0.77	33
	SAND	0.00	0.24	0.03	0.24	10
	TOTL	0.04	5.31	1.58	5.27	23
1104 000	CLAY	0.01	4.72	0.28	4.90	2
	SILT	0.00	0.61	0.17	0.56	28
	SAGG	0.04	0.88	1.60	0.92	63
	LAGG	0.02	0.93	0.70	0.93	43
	SAND	0.00	0.29	0.06	0.29	17
	TOTL	0.07	7.43	2.81	7.59	26

CONDENSED SOIL LOSS (MONTHLY EVENT)

Cell Num	Div	Drainage Area (acres)	RUNOFF Vol. (in.)	RUNOFF Generated Above (%)	RUNOFF Peak Rate (cfs)	Cell Erosion (t/a)	SEDIMENT Generated Above (tons)	SEDIMENT Generated Within (tons)	SEDIMENT Yield (tons)	SEDIMENT Depo (%)
230	000	3640.00	0.02	99.3	29.08	0.05	0.96	1.96	15.69	-81
250	000	960.00	0.00	100.0	6.20	0.00	5.14	0.00	4.95	4
313	000	3640.00	0.00	100.0	18.32	0.00	9.46	0.00	9.23	2
334	000	840.00	0.09	75.5	4.37	0.00	3.97	0.00	0.23	94
383	000	3440.00	0.09	98.5	68.88	0.04	16.95	1.48	16.73	9
419	000	800.00	0.01	98.2	5.75	0.04	3.80	1.49	3.57	33
466	000	2920.00	0.00	100.0	19.61	0.00	14.67	0.00	14.03	4
685	000	1000.00	0.09	81.5	6.55	0.00	7.47	0.00	4.39	41
756	000	4960.00	0.02	99.3	28.59	0.07	22.43	2.79	22.43	11
897	000	960.00	0.01	99.2	12.84	0.02	1.30	0.78	3.05	-32
1023	000	3320.00	0.00	100.0	15.16	0.00	12.55	0.00	10.58	16
1065	000	1600.00	0.00	99.4	7.20	0.03	3.98	1.39	3.13	42
1103	000	2600.00	0.01	99.6	19.91	0.04	5.31	1.58	5.27	23
1104	000	1720.00	0.02	98.4	16.16	0.07	7.43	2.81	7.59	26

NUTRIENT ANALYSIS (MONTHLY EVENT)

Cell Num	Div	Drainage Area (acres)	NITROGEN Sediment Within Cell (lbs/a)	NITROGEN Sediment Cell Outlet (lbs/a)	Water Soluble Within Cell (lbs/a)	Water Soluble Cell Outlet (lbs/a)	Water Soluble Conc (ppm)
230	000	3640.00	0.33	0.05	0.14	0.12	17.83
250	000	960.00	0.00	0.05	0.00	0.09	27.18
313	000	3640.00	0.00	0.03	0.00	0.09	19.75
334	000	840.00	0.00	0.01	0.15	0.09	21.73
383	000	3440.00	0.26	0.05	0.50	0.27	16.40
419	000	800.00	0.26	0.05	0.02	0.08	23.94
466	000	2920.00	0.00	0.05	0.00	0.09	25.68
685	000	1000.00	0.00	0.05	0.15	0.09	20.46
756	000	4960.00	0.43	0.05	0.14	0.10	21.36
897	000	960.00	0.16	0.04	0.02	0.08	12.12
1023	000	3320.00	0.00	0.04	0.00	0.07	23.82
1065	000	1600.00	0.25	0.02	0.01	0.04	16.32
1103	000	2600.00	0.27	0.03	0.03	0.09	17.38
1104	000	1720.00	0.43	0.05	0.09	0.10	17.07

NUTRIENT ANALYSIS (MONTHLY EVENT)

PHOSPHORUS

Cell Num	Div	Drainage Area (acres)	Sediment: Within Cell (lbs/a)	Sediment: Cell Outlet (lbs/a)	Water Soluble: Within Cell (lbs/a)	Water Soluble: Cell Outlet (lbs/a)	Water Soluble: Conc (ppm)
230	000	3640.00	0.16	0.02	0.03	0.02	3.15
250	000	960.00	0.00	0.03	0.00	0.02	5.26
313	000	3640.00	0.00	0.02	0.00	0.02	3.64
334	000	840.00	0.00	0.00	0.02	0.02	4.06
383	000	3440.00	0.13	0.03	0.10	0.05	3.25
419	000	800.00	0.13	0.02	0.00	0.01	4.62
466	000	2920.00	0.00	0.03	0.00	0.02	4.86
685	000	1000.00	0.00	0.02	0.01	0.02	3.79
756	000	4960.00	0.22	0.02	0.03	0.02	4.01
897	000	960.00	0.08	0.02	0.00	0.01	1.42
1023	000	3320.00	0.00	0.02	0.00	0.01	4.50
1065	000	1600.00	0.12	0.01	0.00	0.01	2.77
1103	000	2600.00	0.14	0.01	0.00	0.02	3.39
1104	000	1720.00	0.22	0.02	0.02	0.02	3.66

NUTRIENT ANALYSIS (MONTHLY EVENT)

CHEMICAL OXYGEN DEMAND

Cell Num	Div	Drainage Area (acres)	Sediment: Within Cell (lbs/a)	Sediment: Cell Outlet (lbs/a)	Water Soluble: Within Cell (lbs/a)	Water Soluble: Cell Outlet (lbs/a)	Water Soluble: Conc (ppm)
230	000	3640.00			1.00	0.65	93.80
250	000	960.00			0.00	0.58	170.00
313	000	3640.00			0.00	0.51	115.58
334	000	840.00			1.00	0.53	133.20
383	000	3440.00			3.00	1.61	98.26
419	000	800.00			0.00	0.52	160.31
466	000	2920.00			0.00	0.51	155.14
685	000	1000.00			1.00	0.67	151.47
756	000	4960.00			1.00	0.62	137.60
897	000	960.00			0.00	0.46	72.32
1023	000	3320.00			0.00	0.45	148.63
1065	000	1600.00			0.00	0.29	111.89
1103	000	2600.00			0.00	0.50	102.81
1104	000	1720.00			1.00	0.65	110.07

LOWER LAKE POINSETT WATERSHED SUMMARY (25 YEAR EVENT)

Watershed Studied	LOWER LAKE POINSETT WATERSHED
The area of the watershed is	44880.00 acres
The area of each cell is	40.00 acres
Type of event modeled	**25 year, 24 hr.**
The characteristic storm precipitation is	4.50 inches
The storm energy-intensity value is	127.00

VALUES AT THE WATERSHED OUTLET (LAKE ALBERT OUTLET)

Cell number	13 000
Runoff volume	2.49 inches
Peak runoff rate	12640.73 cfs
Total Nitrogen in sediment	0.47 lbs/acre
Total soluble Nitrogen in runoff	1.11 lbs/acre
Soluble Nitrogen concentration in runoff	1.97 ppm
Total Phosphorus in sediment	0.24 lbs/acre
Total soluble Phosphorus in runoff	0.19 lbs/acre
Soluble Phosphorus concentration in runoff	0.33 ppm
Total soluble Chemical Oxygen Demand in runoff	66.12 lbs/acre
Soluble Chemical Oxygen Demand concentration in runoff	117.04 ppm

FEEDLOT ANALYSIS (25 YEAR EVENT)

Cell #A (186)	
Nitrogen concentration (ppm)	15.541
Phosphorus concentration (ppm)	5.708
COD concentration (ppm)	256.065
Nitrogen mass (lbs)	144.474
Phosphorus mass (lbs)	53.064
COD mass (lbs)	2380.490
Animal feedlot rating number	43

Cell #B (284)	
Nitrogen concentration (ppm)	20.952
Phosphorus concentration (ppm)	7.211
COD concentration (ppm)	317.486
Nitrogen mass (lbs)	64.200
Phosphorus mass (lbs)	22.095
COD mass (lbs)	972.835
Animal feedlot rating number	28

Cell #C (411)	
Nitrogen concentration (ppm)	34.154
Phosphorus concentration (ppm)	12.872
COD concentration (ppm)	581.504
Nitrogen mass (lbs)	81.595
Phosphorus mass (lbs)	30.752
COD mass (lbs)	1389.227
Animal feedlot rating number	33

FEEDLOT ANALYSIS (25 YEAR EVENT), continued

Cell #D (691)	
Nitrogen concentration (ppm)	8.197
Phosphorus concentration (ppm)	2.258
COD concentration (ppm)	91.658
Nitrogen mass (lbs)	104.794
Phosphorus mass (lbs)	28.867
COD mass (lbs)	1171.728
Animal feedlot rating number	30

Cell #E (889)	
Nitrogen concentration (ppm)	53.184
Phosphorus concentration (ppm)	13.690
COD concentration (ppm)	997.721
Nitrogen mass (lbs)	83.982
Phosphorus mass (lbs)	21.617
COD mass (lbs)	1575.488
Animal feedlot rating number	34

SEDIMENT ANALYSIS AT OUTLET (CELL #13, 25 YEAR EVENT)

Particle type	Upland (t/a)	Area Erosion Channel (t/a)	Weighted Delivery Ratio (%)	Enrichment Ratio	Mean Conc. (ppm)	Area Weighted Yield (t/a)	Yield (tons)
CLAY	0.22	0.00	33	10	266.09	0.08	3373.31
SILT	0.13	0.00	0	0	1.18	0.00	14.96
SAGG	1.26	0.00	0	0	1.46	0.00	18.51
LAGG	0.55	0.01	0	0	4.92	0.00	62.34
SAND	0.04	0.00	1	0	1.69	0.00	21.48
TOTAL	2.21	0.01	4	1	275.34	0.08	3490.61

HYDROLOGY OF PRIMARY SUBWATERSHEDS (25 YEAR EVENT)

-HYDR- Cell Num Div	Drainage Area (acres)	Overland Runoff (in.)	Upstream Runoff (in.)	Peak Flow Upstream (cfs)	Downstream Runoff (in.)	Peak Flow Downstream (cfs)
117 000	3560.00	2.29	2.38	1806.68	2.38	1788.30
200 000	31880.00	2.29	2.33	8886.91	2.33	8854.01
327 000	1440.00	0.90	2.04	972.82	2.01	952.40
483 000	28920.00	2.91	2.33	6319.74	2.33	6272.30
519 000	3840.00	2.29	2.24	1754.98	2.24	1740.35
580 000	9200.00	2.05	2.35	3586.03	2.35	3556.36
583 000	4560.00	2.91	2.13	1207.93	2.13	1210.94
686 000	1200.00	2.05	2.31	1002.78	2.31	990.19
721 000	1720.00	2.29	2.27	897.14	2.27	899.78
749 000	5520.00	2.29	2.18	2154.93	2.19	2134.19

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (25 YEAR EVENT)

-SED- Cell Num Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
117 000	CLAY	0.30	557.85	11.89	568.83	0
	SILT	0.18	49.06	7.14	54.13	4
	SAGG	1.70	279.54	67.80	291.22	16
	LAGG	0.74	13.84	29.74	14.99	66
	SAND	0.06	3.18	2.38	3.29	41
	TOTL	2.97	903.46	118.95	932.47	9
200 000	CLAY	0.39	5312.21	15.74	5326.55	0
	SILT	0.24	355.43	9.45	362.68	1
	SAGG	2.24	1657.61	89.74	1694.47	3
	LAGG	0.98	206.81	39.36	188.31	24
	SAND	0.08	64.04	3.15	50.72	25
	TOTL	3.94	7596.09	157.43	7622.73	2
327 000	CLAY	0.00	276.16	0.00	275.78	0
	SILT	0.00	101.74	0.00	98.23	3
	SAGG	0.00	235.04	0.00	198.65	15
	LAGG	0.00	10.54	0.00	6.25	41
	SAND	0.00	3.69	0.00	1.96	47
	TOTL	0.00	627.18	0.00	580.87	7
483 000	CLAY	0.00	4632.15	0.00	4619.73	0
	SILT	0.00	9.54	0.00	8.93	6
	SAGG	0.00	5.17	0.00	3.84	26
	LAGG	0.00	17.41	0.00	1.48	91
	SAND	0.00	5.46	0.00	0.46	91
	TOTL	0.00	4669.72	0.00	4634.44	1
519 000	CLAY	0.30	955.10	11.89	965.42	0
	SILT	0.18	341.18	7.14	334.06	4
	SAGG	1.70	910.09	67.80	805.17	18
	LAGG	0.74	19.08	29.74	15.18	69
	SAND	0.06	3.90	2.38	3.37	46
	TOTL	2.97	2229.35	118.95	2123.20	10
580 000	CLAY	0.16	2265.55	6.30	2268.25	0
	SILT	0.09	678.62	3.78	655.13	4
	SAGG	0.90	1015.26	35.89	868.15	17
	LAGG	0.39	6.10	15.74	5.16	76
	SAND	0.03	0.92	1.26	0.86	60
	TOTL	1.57	3966.45	62.97	3797.56	6
583 000	CLAY	0.00	1113.59	0.00	1013.11	9
	SILT	0.00	292.04	0.00	1.11	100
	SAGG	0.00	449.53	0.00	1.38	100
	LAGG	0.00	16.27	0.00	4.64	71
	SAND	0.00	4.74	0.00	1.45	69
	TOTL	0.00	1876.17	0.00	1021.70	46
686 000	CLAY	0.16	371.17	6.30	376.53	0
	SILT	0.09	168.88	3.78	162.04	6
	SAGG	0.90	618.06	35.89	485.63	26
	LAGG	0.39	7.55	15.74	2.48	89
	SAND	0.03	1.77	1.26	0.26	91
	TOTL	1.57	1167.42	62.97	1026.94	17

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (25 YEAR EVENT), continued

-SED- Cell Num Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
721 000	CLAY	0.30	436.51	11.89	447.41	0
	SILT	0.18	123.74	7.14	123.81	5
	SAGG	1.70	284.92	67.80	276.25	22
	LAGG	0.74	12.70	29.74	10.34	76
	SAND	0.06	2.37	2.38	2.16	54
	TOTL	2.97	860.23	118.95	859.99	12
749 000	CLAY	0.16	1490.90	6.26	1494.96	0
	SILT	0.09	433.42	3.76	421.03	4
	SAGG	0.89	767.31	35.68	673.34	16
	LAGG	0.39	5.12	15.65	23.26	-11
	SAND	0.03	0.72	1.25	7.38	-73
	TOTL	1.56	2697.47	62.60	2619.98	5

CONDENSED SOIL LOSS (25 YEAR EVENT)

		RUNOFF			SEDIMENT				
Cell Num Div	Drainage Area (acres)	Vol. (in.)	Generated Above (%)	Peak Rate (cfs)	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Depo (%)
117 000	3560.00	2.29	98.9	1788.30	2.97	903.46	118.95	932.47	9
200 000	31880.00	2.29	99.9	8854.01	3.94	7596.09	157.43	7622.73	2
327 000	1440.00	0.90	98.8	952.40	0.00	627.18	0.00	580.87	7
483 000	28920.00	2.91	99.8	6272.30	0.00	4669.72	0.00	4634.44	1
519 000	3840.00	2.29	98.9	1740.35	2.97	2229.35	118.95	2123.20	10
580 000	9200.00	2.05	99.6	3556.36	1.57	3966.45	62.97	3797.56	6
583 000	4560.00	2.91	98.8	1210.94	0.00	1876.17	0.00	1021.70	46
686 000	1200.00	2.05	97.0	990.19	1.57	1167.42	62.97	1026.94	17
721 000	1720.00	2.29	97.6	899.78	2.97	860.23	118.95	859.99	12
749 000	5520.00	2.29	99.2	2134.19	1.56	2697.47	62.60	2619.98	5

NUTRIENT ANALYSIS (25 YEAR EVENT)

NITROGEN

Cell Num	Div	Drainage Area (acres)	Sediment: Within Cell (lbs/a)	Sediment: Cell Outlet (lbs/a)	Water Soluble: Within Cell (lbs/a)	Water Soluble: Cell Outlet (lbs/a)	Water Soluble: Conc (ppm)
117	000	3560.00	8.70	1.25	1.05	1.27	2.36
200	000	31880.00	10.89	1.16	1.35	1.16	2.20
327	000	1440.00	0.00	1.76	0.82	0.85	1.87
483	000	28920.00	0.00	0.84	0.82	1.13	2.14
519	000	3840.00	8.70	2.26	1.05	1.31	2.58
580	000	9200.00	5.23	1.79	0.71	1.24	2.33
583	000	4560.00	0.00	1.10	0.82	1.03	2.12
686	000	1200.00	5.23	3.21	0.71	1.20	2.31
721	000	1720.00	8.70	2.09	1.05	1.03	2.01
749	000	5520.00	5.21	2.00	1.05	1.01	2.04

NUTRIENT ANALYSIS (25 YEAR EVENT)

PHOSPHORUS

Cell Num	Div	Drainage Area (acres)	Sediment: Within Cell (lbs/a)	Sediment: Cell Outlet (lbs/a)	Water Soluble: Within Cell (lbs/a)	Water Soluble: Cell Outlet (lbs/a)	Water Soluble: Conc (ppm)
117	000	3560.00	4.35	0.62	0.17	0.23	0.43
200	000	31880.00	5.44	0.58	0.24	0.20	0.38
327	000	1440.00	0.00	0.88	0.01	0.13	0.28
483	000	28920.00	0.00	0.42	0.17	0.19	0.36
519	000	3840.00	4.35	1.13	0.17	0.23	0.46
580	000	9200.00	2.62	0.90	0.10	0.21	0.40
583	000	4560.00	0.00	0.55	0.07	0.17	0.35
686	000	1200.00	2.62	1.61	0.10	0.20	0.39
721	000	1720.00	4.35	1.04	0.17	0.16	0.32
749	000	5520.00	2.60	1.00	0.17	0.16	0.33

NUTRIENT ANALYSIS (25 YEAR EVENT)

CHEMICAL OXYGEN DEMAND

Cell Num	Div	Drainage Area (acres)	Sediment: Within Cell (lbs/a)	Sediment: Cell Outlet (lbs/a)	Water Soluble: Within Cell (lbs/a)	Water Soluble: Cell Outlet (lbs/a)	Water Soluble: Conc (ppm)
117	000	3560.00			88.00	79.02	146.68
200	000	31880.00			88.00	74.45	141.31
327	000	1440.00			12.00	55.35	121.50
483	000	28920.00			16.00	74.23	140.49
519	000	3840.00			88.00	75.01	147.95
580	000	9200.00			37.00	82.15	154.54
583	000	4560.00			16.00	74.31	153.76
686	000	1200.00			37.00	87.38	167.33
721	000	1720.00			88.00	80.52	156.75
749	000	5520.00			88.00	69.76	140.91

LOWER LAKE POINSETT WATERSHED SUMMARY (1 YEAR EVENT)

Watershed Studied	LOWER POINSETT WATERSHED
The area of the watershed is	44880.00 acres
The area of each cell is	40.00 acres
Type of event modeled	1 year, 24 hr.
The characteristic storm precipitation is	2.20 inches
The storm energy-intensity value is	27.00

VALUES AT THE WATERSHED OUTLET (LAKE ALBERT OUTLET)

Cell number	13 000
Runoff volume	0.77 inches
Peak runoff rate	3973.35 cfs
Total Nitrogen in sediment	0.07 lbs/acre
Total soluble Nitrogen in runoff	0.61 lbs/acre
Soluble Nitrogen concentration in runoff	3.50 ppm
Total Phosphorus in sediment	0.03 lbs/acre
Total soluble Phosphorus in runoff	0.11 lbs/acre
Soluble Phosphorus concentration in runoff	0.64 ppm
Total soluble Chemical Oxygen Demand in runoff	17.50 lbs/acre
Soluble Chemical Oxygen Demand concentration in runoff	100.39 ppm

SEDIMENT ANALYSIS AT OUTLET (CELL #13, 1 YEAR EVENT)

Particle type	Area Weighted Erosion Upland (t/a)	Area Weighted Erosion Channel (t/a)	Delivery Ratio (%)	Enrichment Ratio	Mean Conc. (ppm)	Area Weighted Yield (t/a)	Yield (tons)
CLAY	0.05	0.00	11	7	59.35	0.01	232.19
SILT	0.03	0.00	1	0	2.09	0.00	8.17
SAGG	0.27	0.00	0	0	2.58	0.00	10.10
LAGG	0.12	0.01	1	1	10.62	0.00	41.53
SAND	0.01	0.00	2	2	3.58	0.00	14.01
TOTAL	0.47	0.01	1	1	78.22	0.01	306.00

HYDROLOGY OF PRIMARY SUBWATERSHEDS (1 YEAR EVENT)

-HYDR- Cell Num	Div	Drainage Area (acres)	Overland Runoff (in.)	Upstream Runoff (in.)	Peak Flow Upstream (cfs)	Downstream Runoff (in.)	Peak Flow Downstream (cfs)
117	000	3560.00	0.60	0.65	532.35	0.65	526.58
200	000	31880.00	0.60	0.64	2526.13	0.64	2516.55
327	000	1440.00	0.07	0.50	261.26	0.48	253.60
483	000	28920.00	0.94	0.65	1805.34	0.65	1792.25
519	000	3840.00	0.60	0.58	492.24	0.58	488.06
580	000	9200.00	0.48	0.64	1031.22	0.64	1022.09
583	000	4560.00	0.94	0.54	329.52	0.54	331.32
686	000	1200.00	0.48	0.61	292.65	0.61	287.90
721	000	1720.00	0.60	0.59	255.47	0.59	256.14
749	000	5520.00	0.60	0.55	583.97	0.55	578.40

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (1 YEAR EVENT)

-SED- Cell Num Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
117 000	CLAY	0.06	72.91	2.53	75.18	0
	SILT	0.04	9.72	1.52	10.44	7
	SAGG	0.36	36.78	14.41	36.24	29
	LAGG	0.16	5.13	6.32	5.32	54
	SAND	0.01	1.48	0.51	1.52	24
	TOTL	0.63	126.02	25.29	128.69	15
200 000	CLAY	0.08	734.20	3.35	737.13	0
	SILT	0.05	63.48	2.01	64.82	1
	SAGG	0.48	193.77	19.08	200.51	6
	LAGG	0.21	103.45	8.37	83.55	25
	SAND	0.02	31.26	0.67	25.36	21
	TOTL	0.84	1126.17	33.47	1111.37	4
327 000	CLAY	0.00	57.39	0.00	57.21	0
	SILT	0.00	13.13	0.00	12.16	7
	SAGG	0.00	13.65	0.00	9.52	30
	LAGG	0.00	5.48	0.00	2.89	47
	SAND	0.00	1.91	0.00	0.91	53
	TOTL	0.00	91.56	0.00	82.69	10
483 000	CLAY	0.00	597.23	0.00	593.73	1
	SILT	0.00	2.13	0.00	1.86	13
	SAGG	0.00	2.63	0.00	1.36	48
	LAGG	0.00	8.87	0.00	0.76	91
	SAND	0.00	2.78	0.00	0.24	91
	TOTL	0.00	613.64	0.00	597.95	3
519 000	CLAY	0.06	196.19	2.53	198.00	0
	SILT	0.04	45.56	1.52	43.01	9
	SAGG	0.36	77.94	14.41	61.75	33
	LAGG	0.16	6.14	6.32	5.31	57
	SAND	0.01	1.70	0.51	1.51	31
	TOTL	0.63	327.53	25.29	309.59	12
580 000	CLAY	0.03	464.45	1.34	464.18	0
	SILT	0.02	75.93	0.80	70.24	8
	SAGG	0.19	52.15	7.63	40.32	33
	LAGG	0.08	1.53	3.35	1.42	71
	SAND	0.01	0.37	0.27	0.36	43
	TOTL	0.33	594.42	13.39	576.52	5
583 000	CLAY	0.00	223.54	0.00	180.62	19
	SILT	0.00	29.80	0.00	0.54	98
	SAGG	0.00	32.86	0.00	0.66	98
	LAGG	0.00	7.25	0.00	2.24	69
	SAND	0.00	2.38	0.00	0.70	71
	TOTL	0.00	295.83	0.00	184.76	38
686 000	CLAY	0.03	78.16	1.34	79.07	1
	SILT	0.02	26.94	0.80	24.20	13
	SAGG	0.19	47.19	7.63	29.58	46
	LAGG	0.08	2.75	3.35	0.43	93
	SAND	0.01	0.89	0.27	0.08	93
	TOTL	0.33	155.93	13.39	133.36	21

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (1 YEAR EVENT), continued

-SED- Cell Num Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
721 000	CLAY	0.06	89.29	2.53	91.38	0
	SILT	0.04	13.97	1.52	13.81	11
	SAGG	0.36	32.68	14.41	29.05	38
	LAGG	0.16	3.72	6.32	3.38	66
	SAND	0.01	1.02	0.51	0.95	38
	TOTL	0.63	140.68	25.29	138.58	17
749 000	CLAY	0.03	306.67	1.33	306.98	0
	SILT	0.02	49.43	0.80	46.25	8
	SAGG	0.19	44.18	7.59	36.17	30
	LAGG	0.08	1.17	3.33	11.96	-62
	SAND	0.01	0.27	0.27	3.84	-86
	TOTL	0.33	401.72	13.31	405.20	2

CONDENSED SOIL LOSS (1 YEAR EVENT)

Cell Num Div	Drainage Area (acres)	RUNOFF Vol. (in.)	RUNOFF Generated Above (%)	RUNOFF Peak Rate (cfs)	SEDIMENT Cell Erosion (t/a)	SEDIMENT Generated Above (tons)	SEDIMENT Generated Within (tons)	SEDIMENT Yield (tons)	SEDIMENT Depo (%)
117 000	3560.00	0.60	99.0	526.58	0.63	126.02	25.29	128.69	15
200 000	31880.00	0.60	99.9	2516.55	0.84	1126.17	33.47	1111.37	4
327 000	1440.00	0.07	99.6	253.60	0.00	91.56	0.00	82.69	10
483 000	28920.00	0.94	99.8	1792.25	0.00	613.64	0.00	597.95	3
519 000	3840.00	0.60	98.9	488.06	0.63	327.53	25.29	309.59	12
580 000	9200.00	0.48	99.7	1022.09	0.33	594.42	13.39	576.52	5
583 000	4560.00	0.94	98.5	331.32	0.00	295.83	0.00	184.76	38
686 000	1200.00	0.48	97.4	287.90	0.33	155.93	13.39	133.36	21
721 000	1720.00	0.60	97.6	256.14	0.63	140.68	25.29	138.58	17
749 000	5520.00	0.60	99.2	578.40	0.33	401.72	13.31	405.20	2

NUTRIENT ANALYSIS (1 YEAR EVENT)

NITROGEN

Cell Num Div	Drainage Area (acres)	Sediment Within Cell (lbs/a)	Sediment Cell Outlet (lbs/a)	Water Soluble Within Cell (lbs/a)	Water Soluble Cell Outlet (lbs/a)	Water Soluble Conc (ppm)
117 000	3560.00	2.52	0.26	0.57	0.69	4.65
200 000	31880.00	3.15	0.25	0.79	0.64	4.42
327 000	1440.00	0.00	0.37	0.40	0.44	4.02
483 000	28920.00	0.00	0.16	0.40	0.62	4.26
519 000	3840.00	2.52	0.49	0.57	0.76	5.78
580 000	9200.00	1.52	0.40	0.35	0.69	4.75
583 000	4560.00	0.00	0.28	0.40	0.56	4.55
686 000	1200.00	1.52	0.63	0.35	0.68	4.94
721 000	1720.00	2.52	0.49	0.57	0.56	4.18
749 000	5520.00	1.51	0.45	0.57	0.54	4.30

NUTRIENT ANALYSIS (1 YEAR EVENT)

PHOSPHORUS

Cell Num	Div	Drainage Area (acres)	Sediment: Within Cell (lbs/a)	Sediment: Cell Outlet (lbs/a)	Water Soluble: Within Cell (lbs/a)	Water Soluble: Cell Outlet (lbs/a)	Water Soluble: Conc (ppm)
117	000	3560.00	1.26	0.13	0.10	0.13	0.88
200	000	31880.00	1.58	0.12	0.15	0.12	0.81
327	000	1440.00	0.00	0.18	0.00	0.07	0.68
483	000	28920.00	0.00	0.08	0.10	0.11	0.78
519	000	3840.00	1.26	0.24	0.10	0.14	1.09
580	000	9200.00	0.76	0.20	0.06	0.13	0.87
583	000	4560.00	0.00	0.14	0.04	0.10	0.81
686	000	1200.00	0.76	0.31	0.06	0.12	0.89
721	000	1720.00	1.26	0.24	0.10	0.10	0.73
749	000	5520.00	0.75	0.23	0.10	0.09	0.76

NUTRIENT ANALYSIS (1 YEAR EVENT)

CHEMICAL OXYGEN DEMAND

Cell Num	Div	Drainage Area (acres)	Sediment: Within Cell (lbs/a)	Sediment: Cell Outlet (lbs/a)	Water Soluble: Within Cell (lbs/a)	Water Soluble: Cell Outlet (lbs/a)	Water Soluble: Conc (ppm)
117	000	3560.00			23.00	21.47	145.58
200	000	31880.00			23.00	19.71	135.28
327	000	1440.00			1.00	13.84	126.07
483	000	28920.00			5.00	19.67	134.17
519	000	3840.00			23.00	19.61	148.54
580	000	9200.00			9.00	22.47	155.19
583	000	4560.00			5.00	19.29	156.70
686	000	1200.00			9.00	23.09	167.62
721	000	1720.00			23.00	21.09	157.99
749	000	5520.00			23.00	18.00	143.53

LOWER LAKE POINSETT WATERSHED SUMMARY (NORMAL MONTHLY EVENT)

Watershed Studied	LOWER POINSETT WATERSHED
The area of the watershed is	44880.00 acres
The area of each cell is	40.00 acres
Type of event modeled	**Monthly Event**
The characteristic storm precipitation is	0.80 inches
The storm energy-intensity value is	3.00

VALUES AT THE WATERSHED OUTLET (LAKE ALBERT OUTLET)

Cell number	13 000
Runoff volume	0.11 inches
Peak runoff rate	589.42 cfs
Total Nitrogen in sediment	0.01 lbs/acre
Total soluble Nitrogen in runoff	0.08 lbs/acre
Soluble Nitrogen concentration in runoff	3.05 ppm
Total Phosphorus in sediment	0.01 lbs/acre
Total soluble Phosphorus in runoff	0.01 lbs/acre
Soluble Phosphorus concentration in runoff	0.47 ppm
Total soluble Chemical Oxygen Demand in runoff	0.66 lbs/acre
Soluble Chemical Oxygen Demand concentration in runoff	26.28 ppm

SEDIMENT ANALYSIS AT OUTLET (CELL #13, MONTHLY EVENT)

Particle type	Area Weighted Erosion Upland (t/a)	Area Weighted Erosion Channel (t/a)	Delivery Ratio (%)	Enrichment Ratio	Mean Conc. (ppm)	Area Weighted Yield (t/a)	Yield (tons)
CLAY	0.01	0.00	1	1	5.52	0.00	3.11
SILT	0.00	0.00	2	1	5.34	0.00	3.01
SAGG	0.03	0.00	0	0	6.61	0.00	3.72
LAGG	0.01	0.00	3	2	33.18	0.00	18.68
SAND	0.00	0.00	7	9	10.71	0.00	6.03
TOTAL	0.05	0.00	1	1	61.36	0.00	34.55

HYDROLOGY OF PRIMARY SUBWATERSHEDS (MONTHLY EVENT)

-HYDR- Cell Num	Div	Drainage Area (acres)	Overland Runoff (in.)	Upstream Runoff (in.)	Peak Flow Upstream (cfs)	Downstream Runoff (in.)	Peak Flow Downstream (cfs)
117	000	3560.00	0.02	0.03	29.93	0.03	29.49
200	000	31880.00	0.02	0.05	194.45	0.05	193.57
327	000	1440.00	0.00	0.01	8.08	0.01	7.80
483	000	28920.00	0.09	0.05	142.88	0.05	141.92
519	000	3840.00	0.02	0.02	20.45	0.02	20.24
580	000	9200.00	0.01	0.03	55.36	0.03	54.73
583	000	4560.00	0.09	0.02	13.25	0.02	13.67
686	000	1200.00	0.01	0.02	12.69	0.02	12.25
721	000	1720.00	0.02	0.02	9.76	0.02	9.78
749	000	5520.00	0.02	0.01	18.63	0.01	18.46

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (MONTHLY EVENT)

-SED- Cell Num Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
117 000	CLAY	0.01	2.24	0.28	2.47	2
	SILT	0.00	0.58	0.17	0.56	25
	SAGG	0.04	0.84	1.60	0.97	60
	LAGG	0.02	0.91	0.70	0.94	42
	SAND	0.00	0.28	0.06	0.30	13
	TOTL	0.07	4.86	2.81	5.24	32
200 000	CLAY	0.01	16.79	0.37	17.13	0
	SILT	0.01	6.34	0.22	6.46	2
	SAGG	0.05	9.12	2.12	10.03	11
	LAGG	0.02	25.57	0.93	20.75	22
	SAND	0.00	8.01	0.07	6.48	20
	TOTL	0.09	65.84	3.72	60.84	13
327 000	CLAY	0.00	4.51	0.00	4.39	3
	SILT	0.00	0.16	0.00	0.12	22
	SAGG	0.00	0.14	0.00	0.11	22
	LAGG	0.00	0.80	0.00	0.38	53
	SAND	0.00	0.25	0.00	0.12	53
	TOTL	0.00	5.87	0.00	5.12	13
483 000	CLAY	0.00	1.75	0.00	1.70	3
	SILT	0.00	0.53	0.00	0.27	49
	SAGG	0.00	0.66	0.00	0.06	91
	LAGG	0.00	2.21	0.00	0.20	91
	SAND	0.00	0.69	0.00	0.06	91
	TOTL	0.00	5.84	0.00	2.29	61
519 000	CLAY	0.01	16.35	0.28	16.21	3
	SILT	0.00	0.75	0.17	0.59	36
	SAGG	0.04	1.21	1.60	0.84	70
	LAGG	0.02	0.87	0.70	0.79	50
	SAND	0.00	0.27	0.06	0.24	25
	TOTL	0.07	19.45	2.81	18.67	16
580 000	CLAY	0.00	37.93	0.15	37.27	2
	SILT	0.00	0.52	0.09	0.39	36
	SAGG	0.02	0.52	0.85	0.43	69
	LAGG	0.01	0.23	0.37	0.22	62
	SAND	0.00	0.07	0.03	0.07	30
	TOTL	0.04	39.27	1.49	38.38	6
583 000	CLAY	0.00	15.36	0.00	1.82	88
	SILT	0.00	0.44	0.00	0.09	80
	SAGG	0.00	0.60	0.00	0.11	82
	LAGG	0.00	1.26	0.00	0.37	70
	SAND	0.00	0.40	0.00	0.12	71
	TOTL	0.00	18.06	0.00	2.51	86
686 000	CLAY	0.00	7.49	0.15	7.35	4
	SILT	0.00	0.35	0.09	0.18	58
	SAGG	0.02	0.42	0.85	0.26	80
	LAGG	0.01	0.46	0.37	0.04	95
	SAND	0.00	0.14	0.03	0.01	93
	TOTL	0.04	8.86	1.49	7.84	24

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (MONTHLY EVENT), continued

-SED- Cell Num Div	Particle Type	Cell Erosion (t/a)	Generated Above (tons)	Generated Within (tons)	Yield (tons)	Deposition (%)
721 000	CLAY	0.01	6.31	0.28	6.36	4
	SILT	0.00	0.36	0.17	0.31	42
	SAGG	0.04	0.91	1.60	0.61	76
	LAGG	0.02	0.49	0.70	0.45	62
	SAND	0.00	0.15	0.06	0.14	34
	TOTL	0.07	8.22	2.81	7.86	29
749 000	CLAY	0.00	21.73	0.15	21.26	3
	SILT	0.00	0.30	0.09	0.33	14
	SAGG	0.02	0.57	0.84	0.61	57
	LAGG	0.01	0.14	0.37	1.88	-73
	SAND	0.00	0.04	0.03	0.59	-88
	TOTL	0.04	22.78	1.48	24.67	-2

CONDENSED SOIL LOSS (MONTHLY EVENT)

Cell Num Div	Drainage Area (acres)	RUNOFF Vol. (in.)	RUNOFF Generated Above (%)	RUNOFF Peak Rate (cfs)	SEDIMENT Cell Erosion (t/a)	SEDIMENT Generated Above (tons)	SEDIMENT Generated Within (tons)	SEDIMENT Yield (tons)	SEDIMENT Depo (%)
117 000	3560.00	0.02	99.3	29.49	0.07	4.86	2.81	5.24	32
200 000	31880.00	0.02	100.0	193.57	0.09	65.84	3.72	60.84	13
327 000	1440.00	0.00	100.0	7.80	0.00	5.87	0.00	5.12	13
483 000	28920.00	0.09	99.7	141.92	0.00	5.84	0.00	2.29	61
519 000	3840.00	0.02	99.1	20.24	0.07	19.45	2.81	18.67	16
580 000	9200.00	0.01	99.9	54.73	0.04	39.27	1.49	38.38	6
583 000	4560.00	0.09	95.8	13.67	0.00	18.06	0.00	2.51	86
686 000	1200.00	0.01	99.2	12.25	0.04	8.86	1.49	7.84	24
721 000	1720.00	0.02	97.6	9.78	0.07	8.22	2.81	7.86	29
749 000	5520.00	0.02	99.1	18.46	0.04	22.78	1.48	24.67	-2

NUTRIENT ANALYSIS (MONTHLY EVENT)

NITROGEN

Cell Num Div	Drainage Area (acres)	Sediment Within Cell (lbs/a)	Sediment Cell Outlet (lbs/a)	Water Soluble Within Cell (lbs/a)	Water Soluble Cell Outlet (lbs/a)	Water Soluble Conc (ppm)
117 000	3560.00	0.43	0.02	0.05	0.08	12.18
200 000	31880.00	0.54	0.02	0.07	0.07	6.60
327 000	1440.00	0.00	0.04	0.15	0.04	13.58
483 000	28920.00	0.00	0.00	0.15	0.07	6.27
519 000	3840.00	0.43	0.05	0.05	0.07	16.21
580 000	9200.00	0.26	0.05	0.01	0.09	12.46
583 000	4560.00	0.00	0.01	0.15	0.06	12.97
686 000	1200.00	0.26	0.07	0.01	0.06	13.97
721 000	1720.00	0.43	0.05	0.05	0.05	12.03
749 000	5520.00	0.26	0.05	0.05	0.04	12.95

NUTRIENT ANALYSIS (MONTHLY EVENT)

PHOSPHORUS

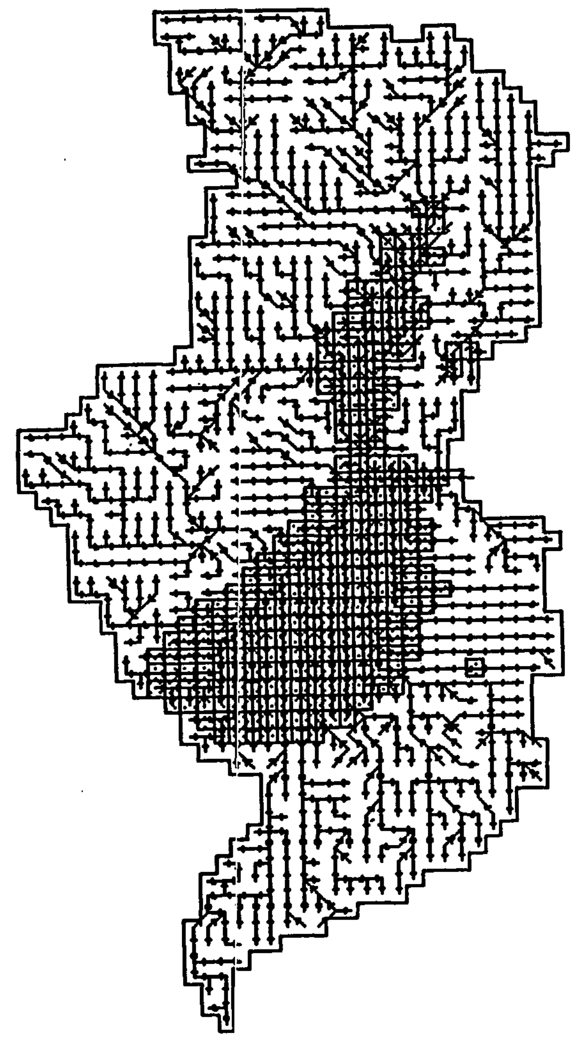
Cell Num Div	Drainage Area (acres)	Sediment Within Cell (lbs/a)	Sediment Cell Outlet (lbs/a)	Water Soluble Within Cell (lbs/a)	Water Soluble Cell Outlet (lbs/a)	Water Soluble Conc (ppm)
117 000	3560.00	0.22	0.01	0.01	0.02	2.17
200 000	31880.00	0.27	0.01	0.01	0.01	1.15
327 000	1440.00	0.00	0.02	0.00	0.01	2.23
483 000	28920.00	0.00	0.00	0.01	0.01	1.08
519 000	3840.00	0.22	0.03	0.01	0.01	3.05
580 000	9200.00	0.13	0.02	0.00	0.02	2.29
583 000	4560.00	0.00	0.00	0.00	0.01	2.29
686 000	1200.00	0.13	0.03	0.00	0.01	2.62
721 000	1720.00	0.22	0.02	0.01	0.01	2.23
749 000	5520.00	0.13	0.02	0.01	0.01	2.42

NUTRIENT ANALYSIS (MONTHLY EVENT)

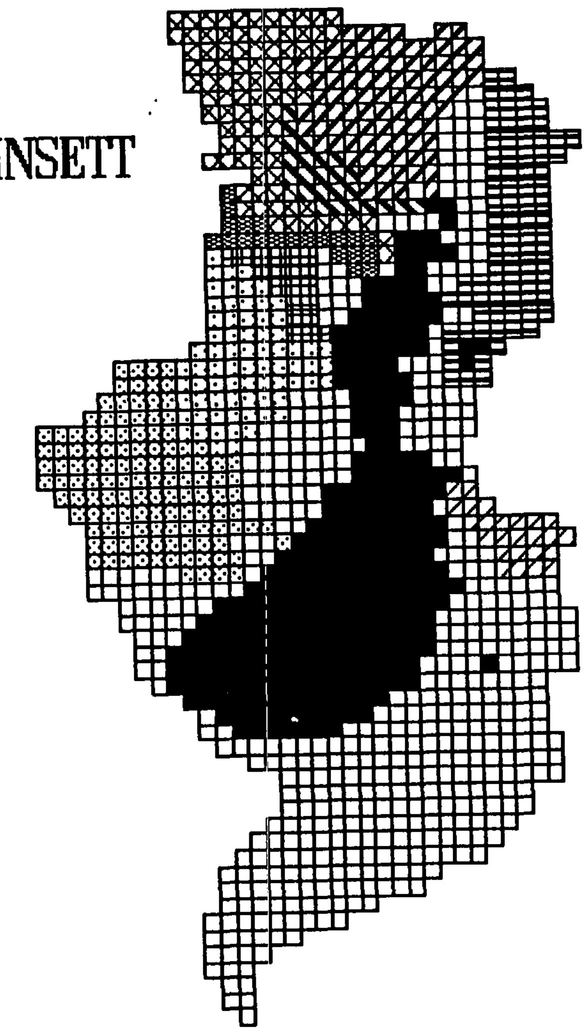
CHEMICAL OXYGEN DEMAND

Cell Num Div	Drainage Area (acres)	Sediment Within Cell (lbs/a)	Sediment Cell Outlet (lbs/a)	Water Soluble Within Cell (lbs/a)	Water Soluble Cell Outlet (lbs/a)	Water Soluble Conc (ppm)
117 000	3560.00			1.00	0.94	135.46
200 000	31880.00			1.00	0.73	68.75
327 000	1440.00			0.00	0.36	139.58
483 000	28920.00			1.00	0.73	66.92
519 000	3840.00			1.00	0.64	140.43
580 000	9200.00			0.00	1.05	153.21
583 000	4560.00			1.00	0.64	150.16
686 000	1200.00			0.00	0.77	169.24
721 000	1720.00			1.00	0.67	165.77
749 000	5520.00			1.00	0.53	157.27

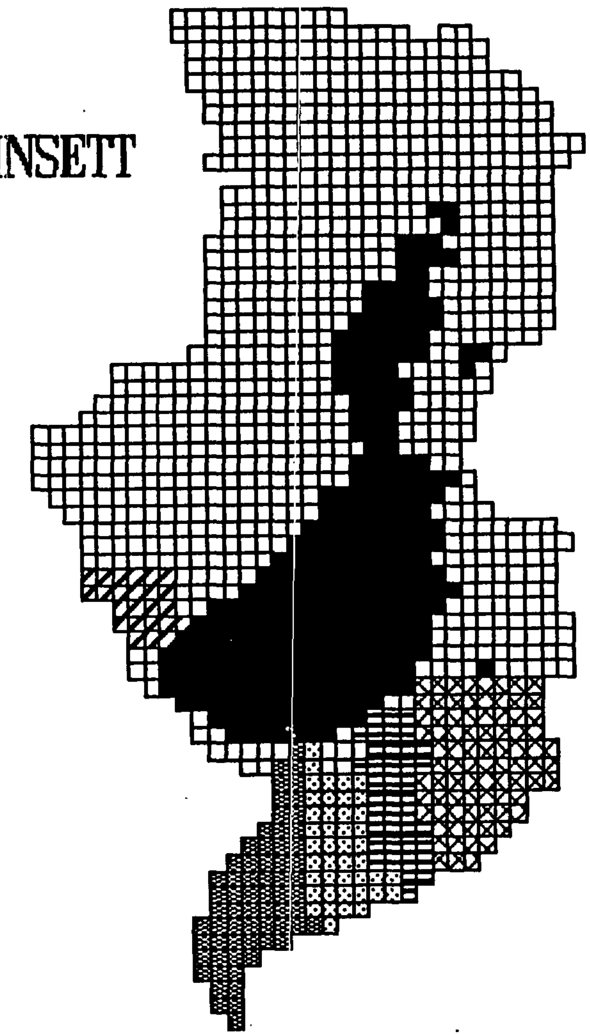
UPPER POINSETT WATERSHED



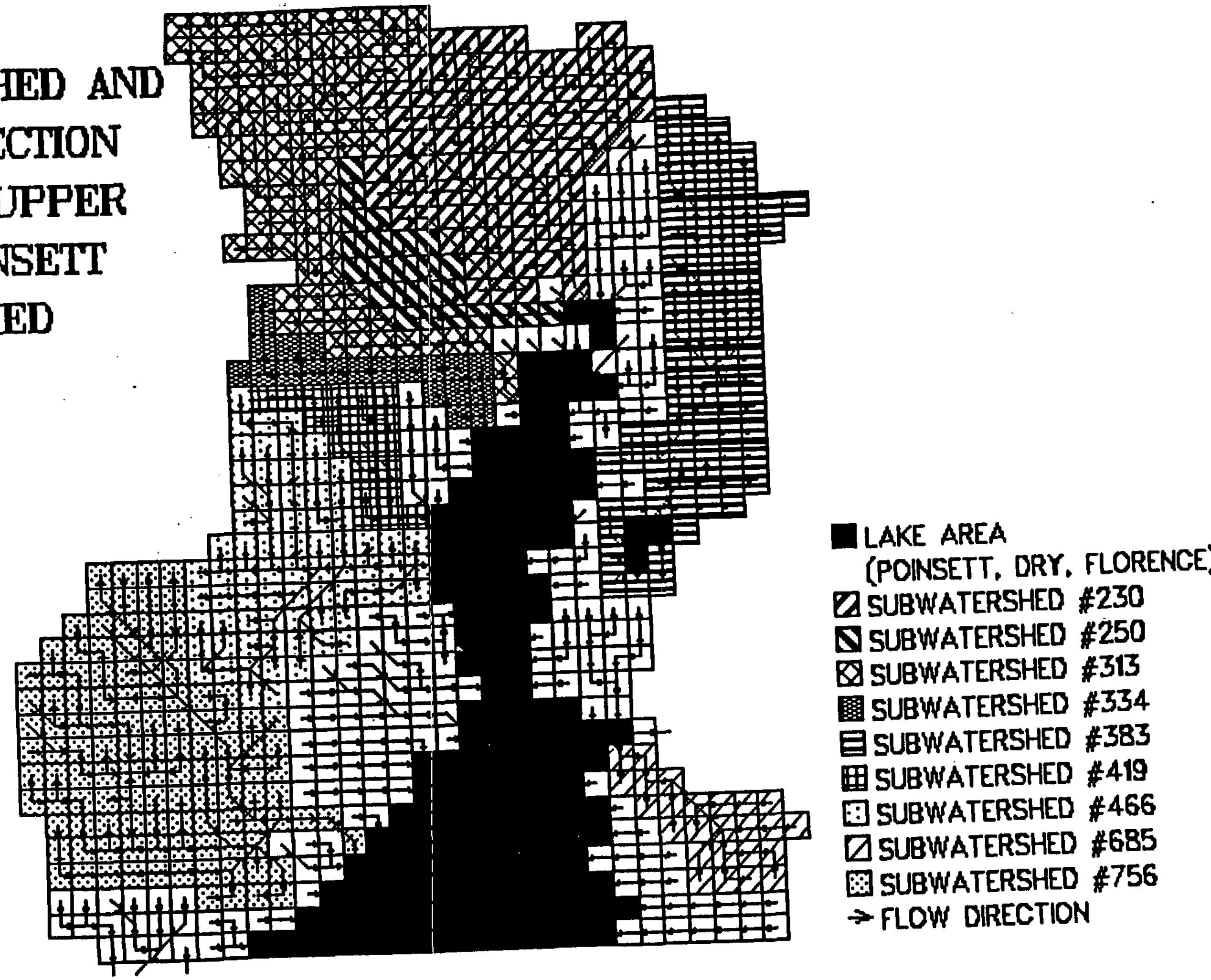
SUBWATERSHEDS FOR
THE UPPER LAKE POINSETT
WATERSHED



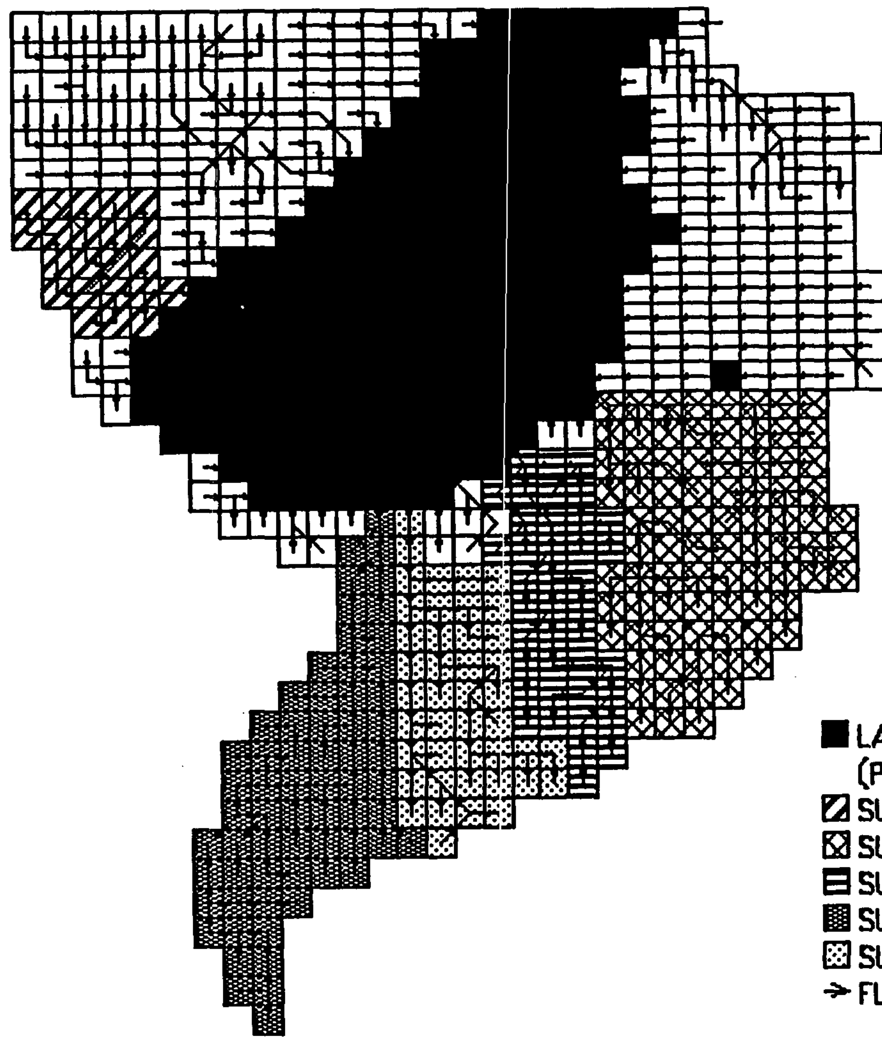
SUBWATERSHEDS FOR THE UPPER LAKE POINSETT WATERSHED



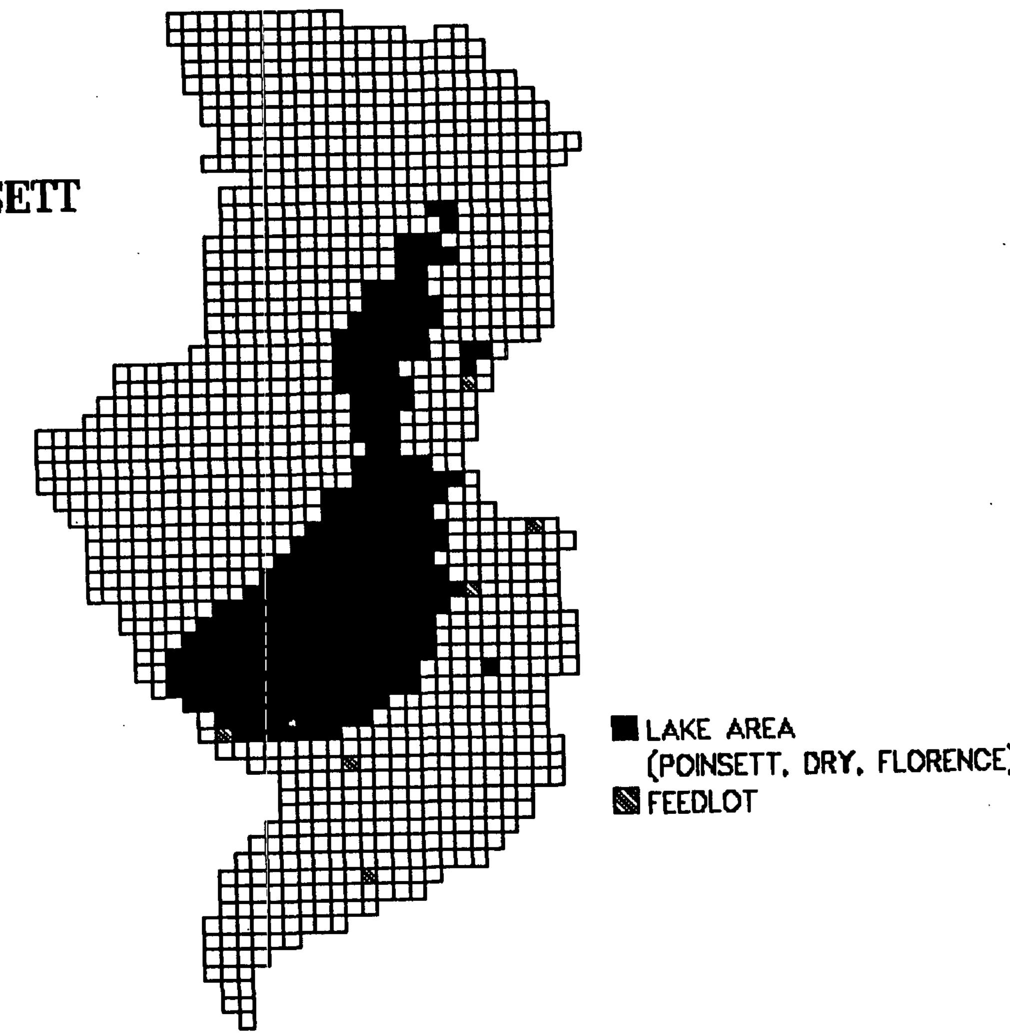
SUBWATERSHED AND
FLOW DIRECTION
FOR THE UPPER
LAKE POINSETT
WATERSHED



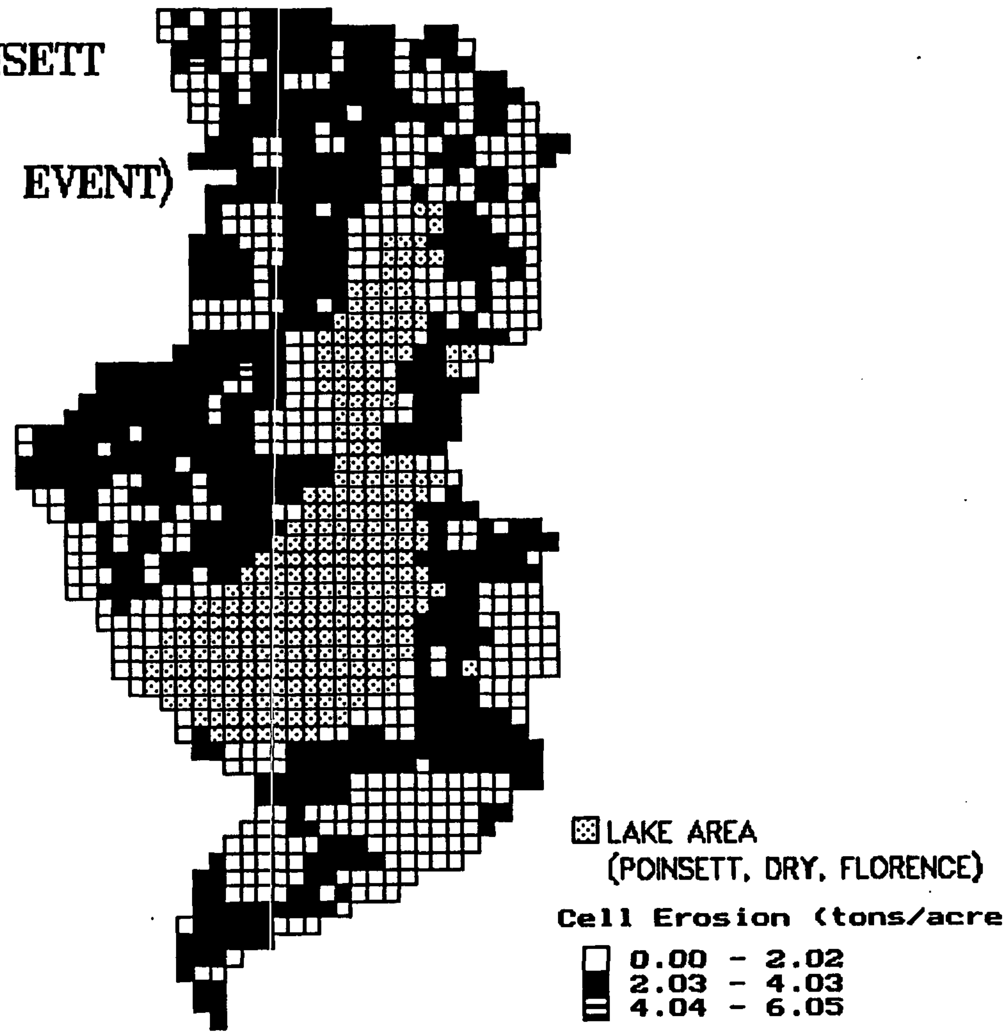
SUBWATERSHED AND
FLOW DIRECTION
FOR THE UPPER
LAKE POINSETT
WATERSHED



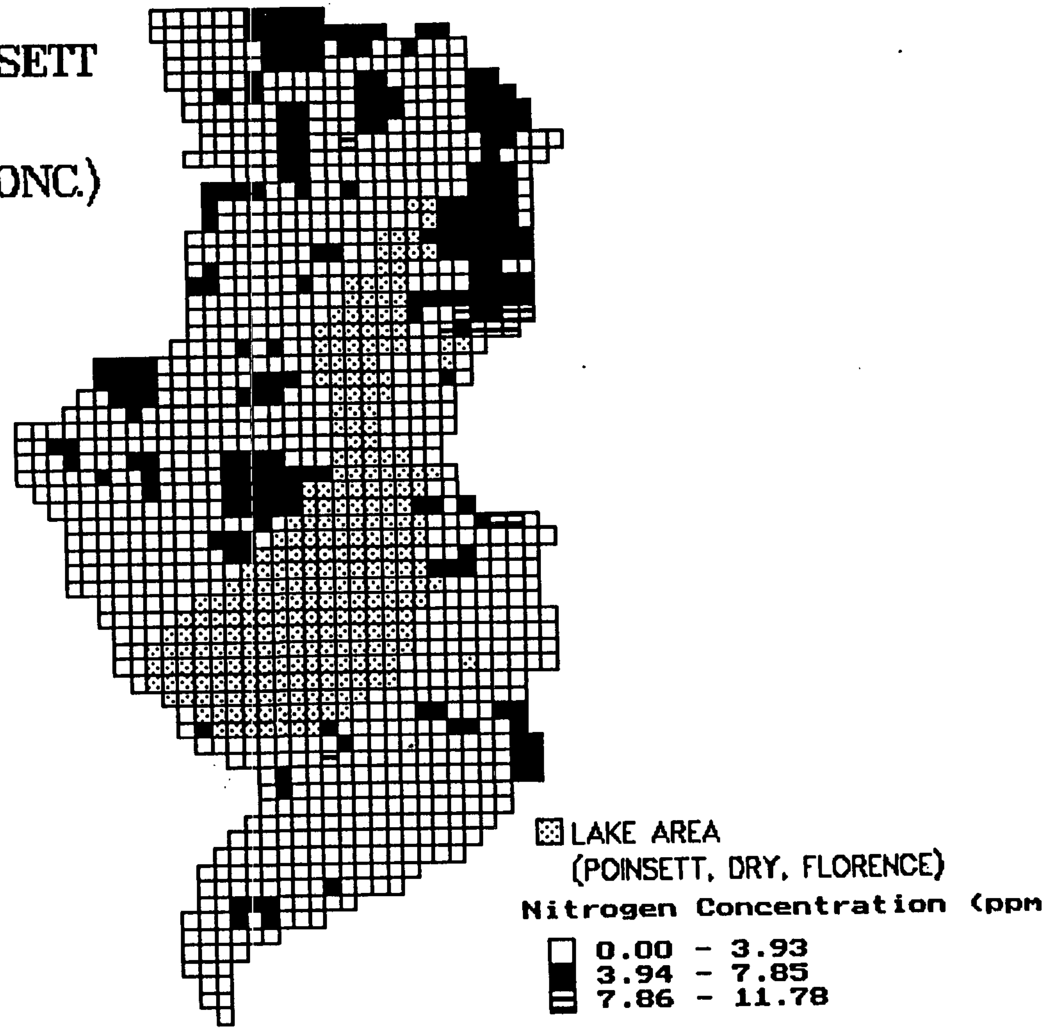
LOCATION OF
FEEDLOTS IN THE
UPPER LAKE POINSETT
WATERSHED



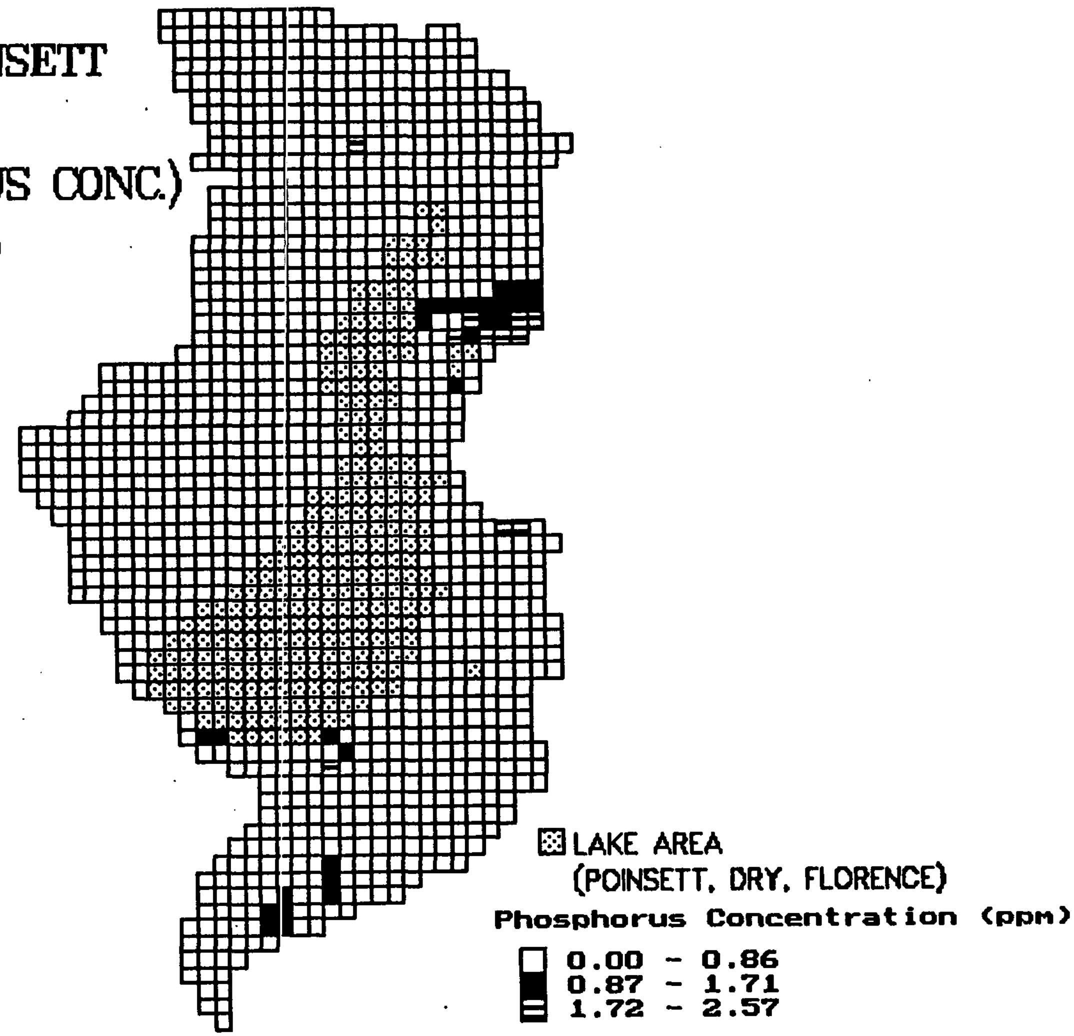
UPPER LAKE POINSETT WATERSHED
(CELL EROSION, 25 YR. EVENT)



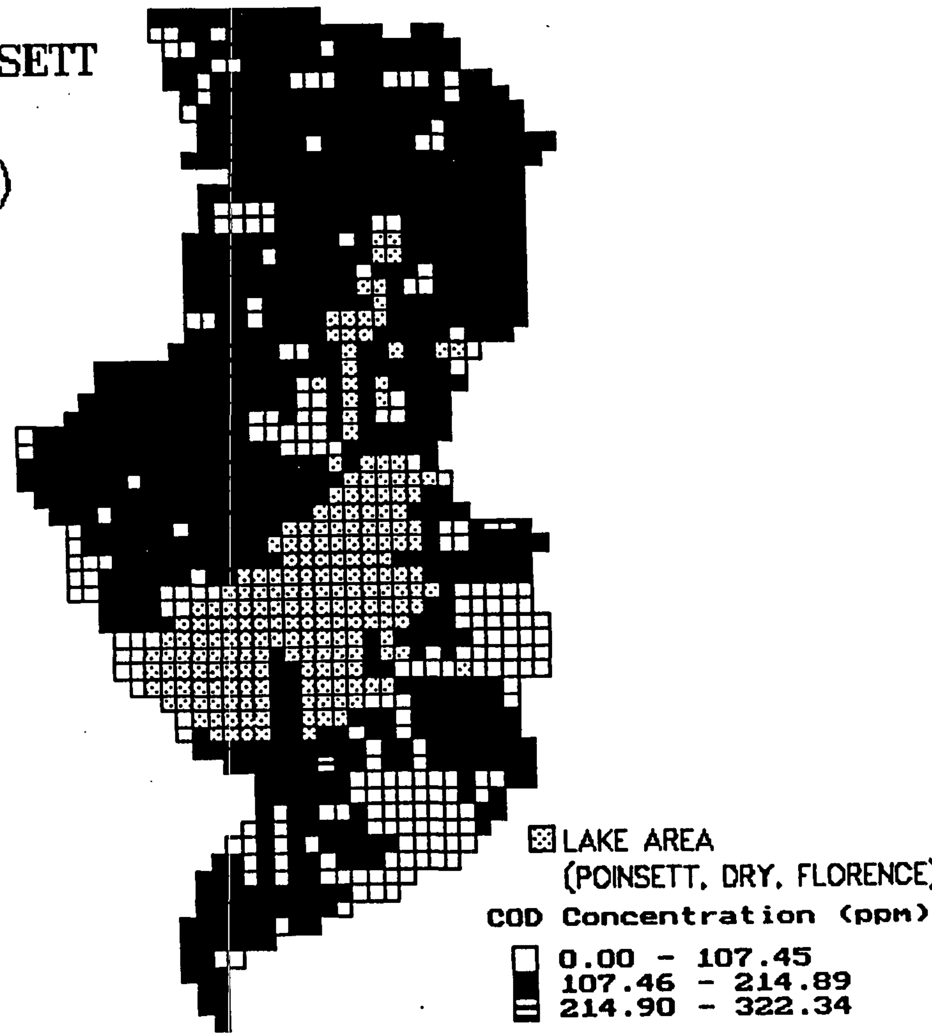
UPPER LAKE POINSETT
WATERSHED
(CELL NITROGEN CONC.)
(25 YR. EVENT)



UPPER LAKE POINSETT
WATERSHED
(CELL PHOSPHOROUS CONC.)
(25 YR. EVENT)

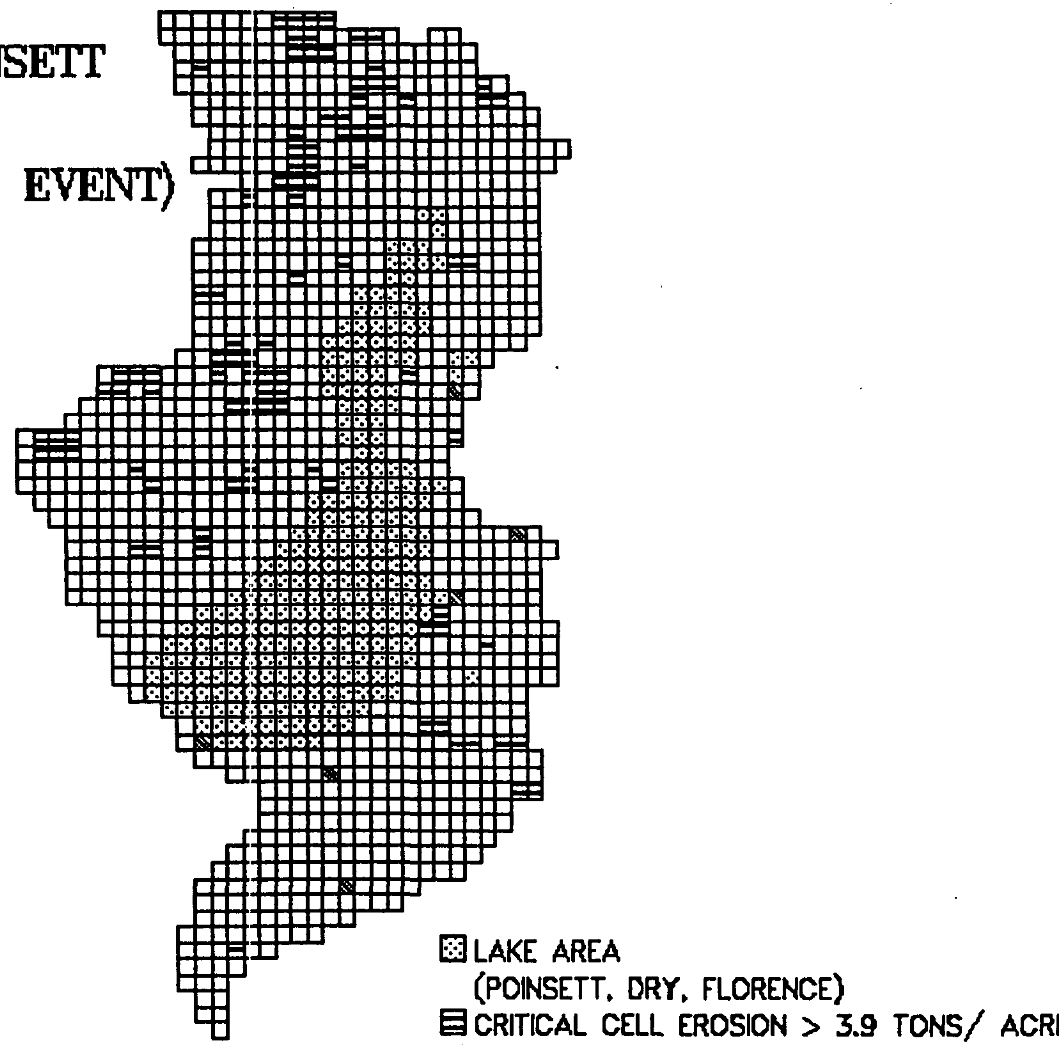


UPPER LAKE POINSETT
WATERSHED
(CELL COD CONC.)
(25 YR. EVENT)

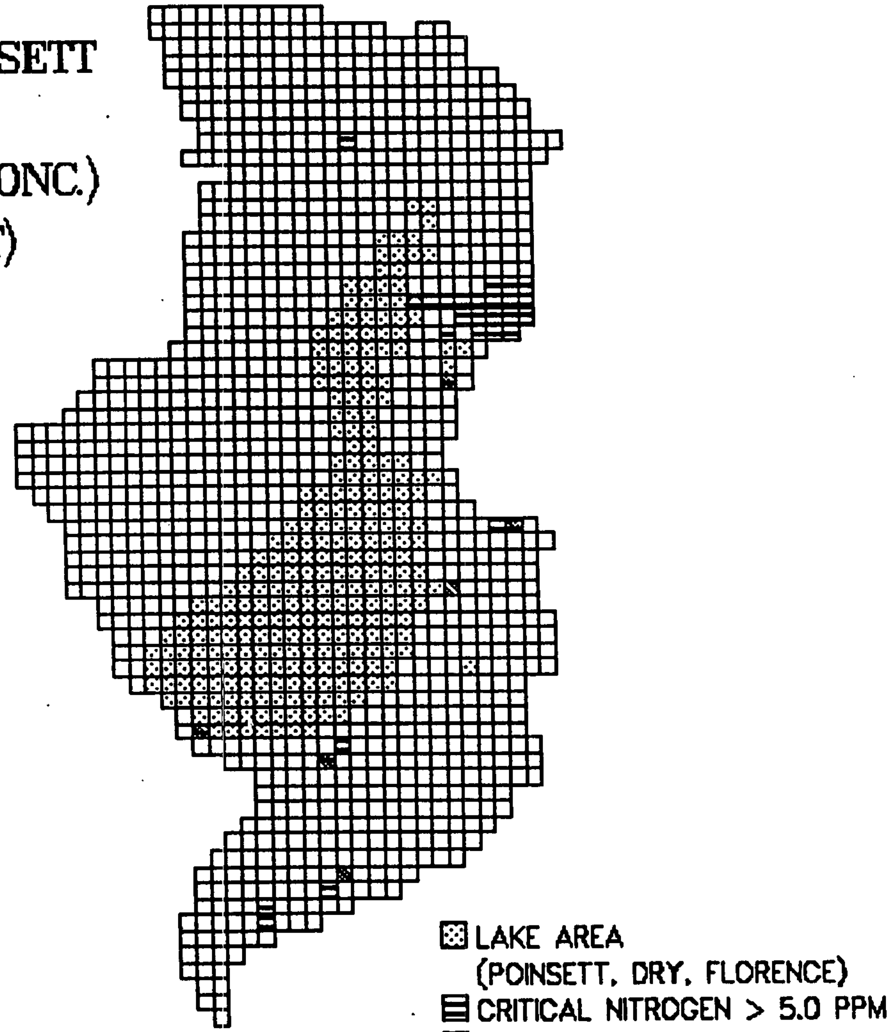


UPPER LAKE POINSETT WATERSHED

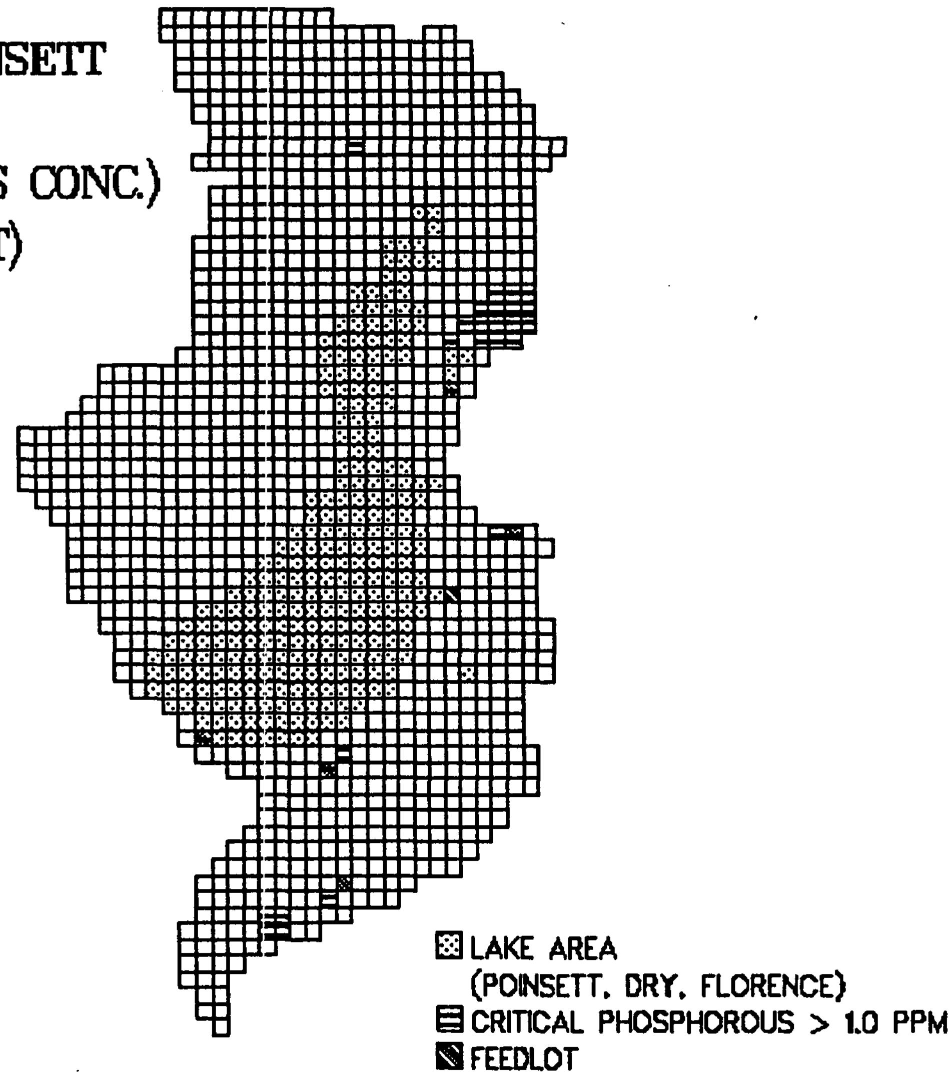
(CELL EROSION, 25 YR. EVENT)



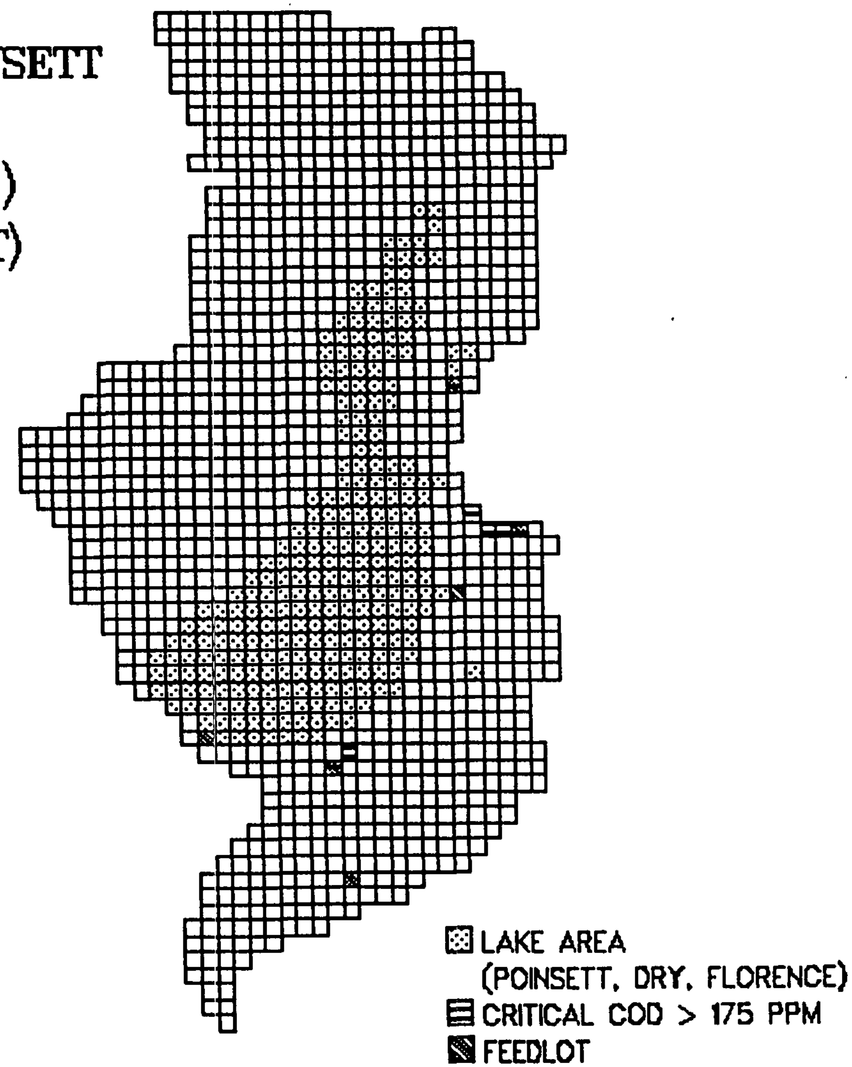
UPPER LAKE POINSETT WATERSHED (CELL NITORGEN CONC.) (25 YEAR EVENT)

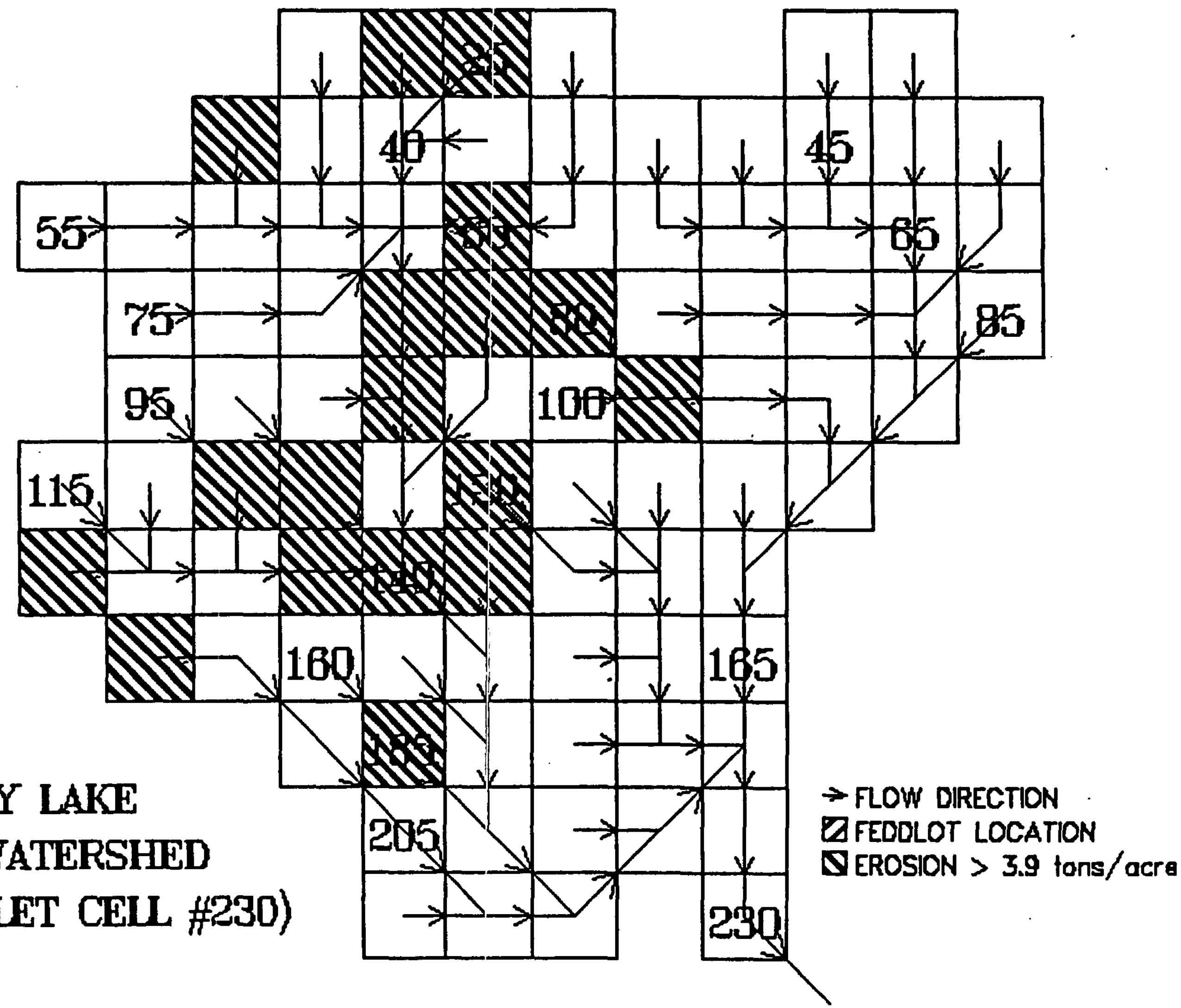


UPPER LAKE POINSETT
WATERSHED
(CELL PHOSPHOROUS CONC.)
(25 YEAR EVENT)

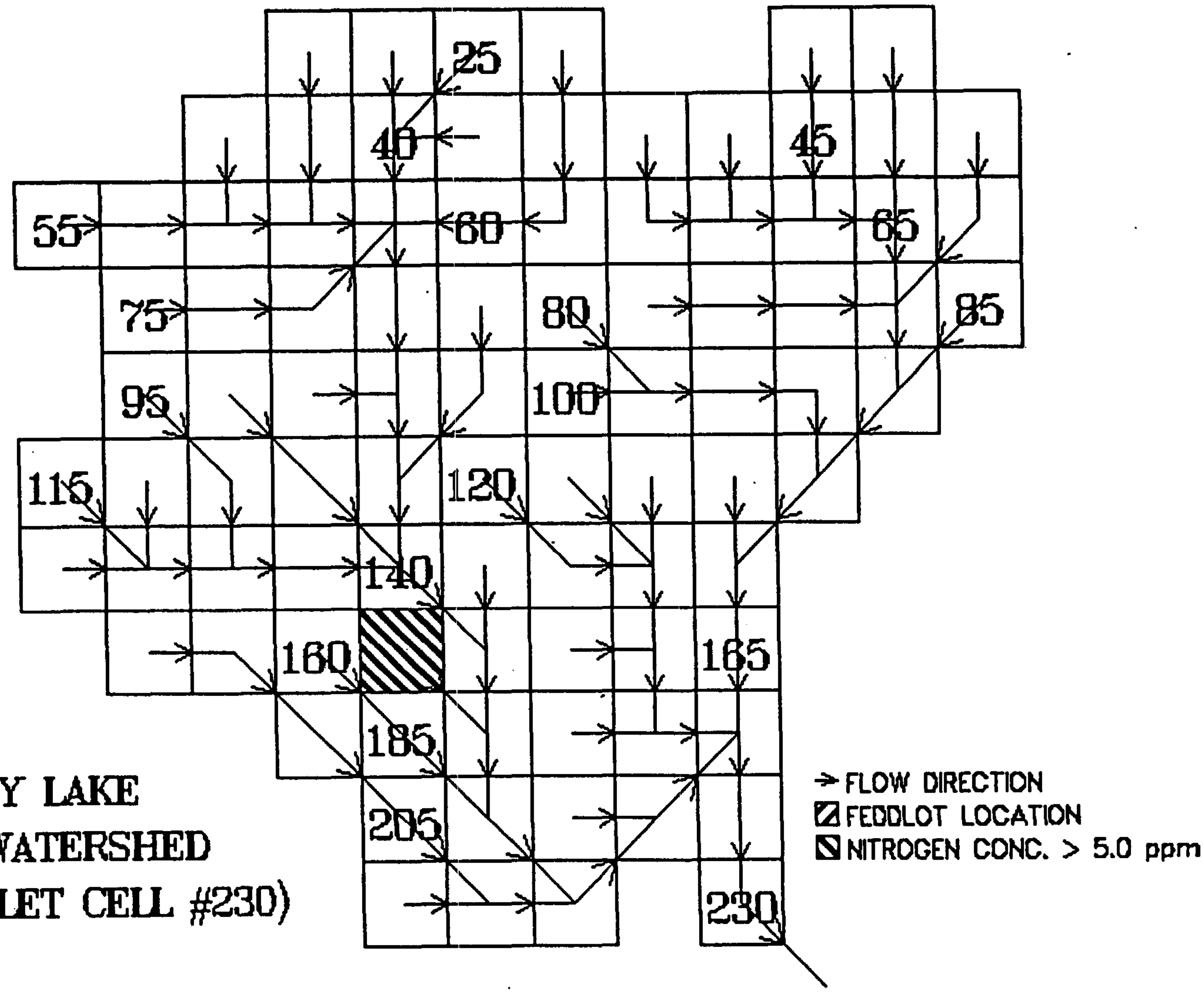


UPPER LAKE POINSETT
WATERSHED
(CELL COD CONC.)
(25 YEAR EVENT)

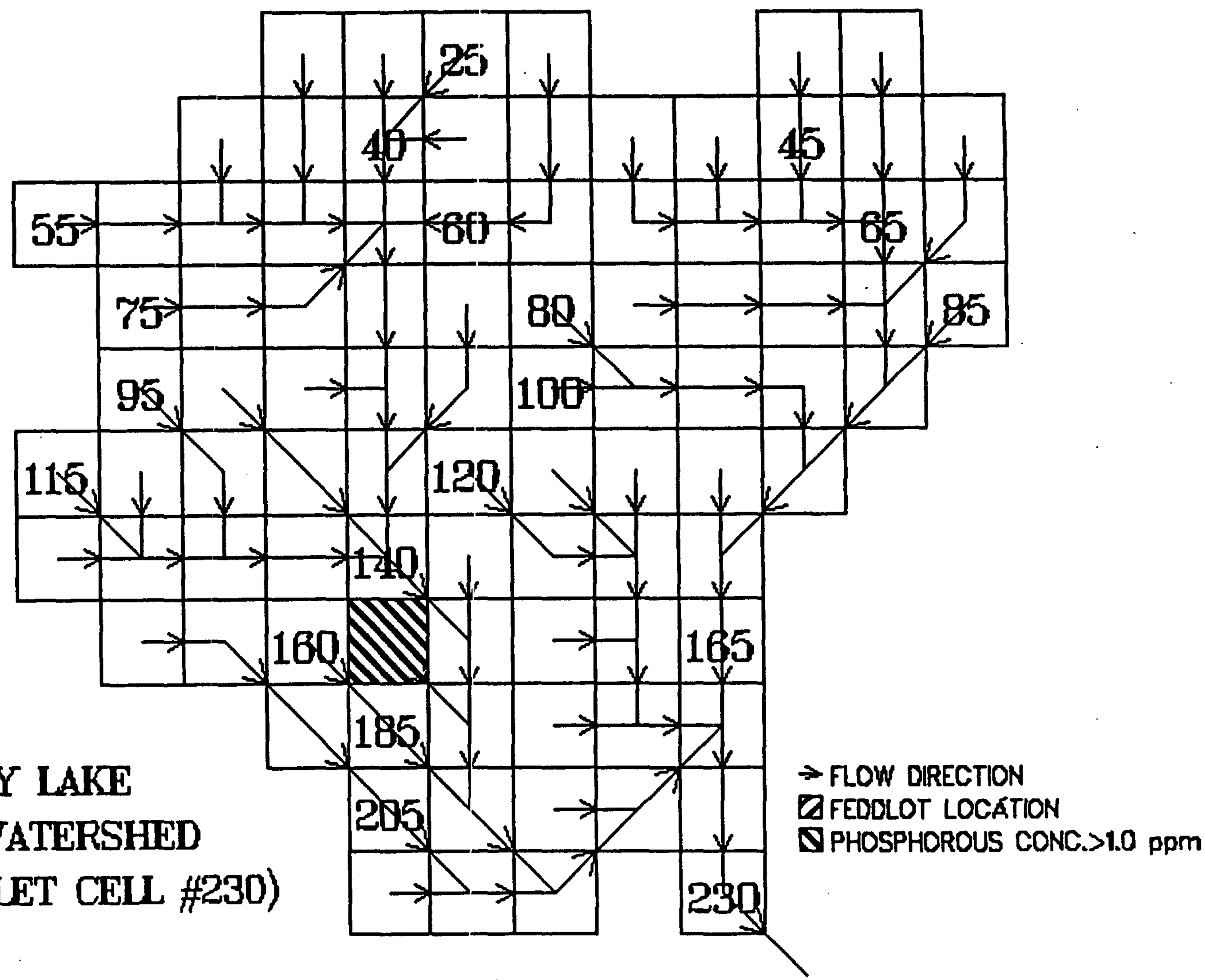




DRY LAKE
SUBWATERSHED
#1 (OUTLET CELL #230)

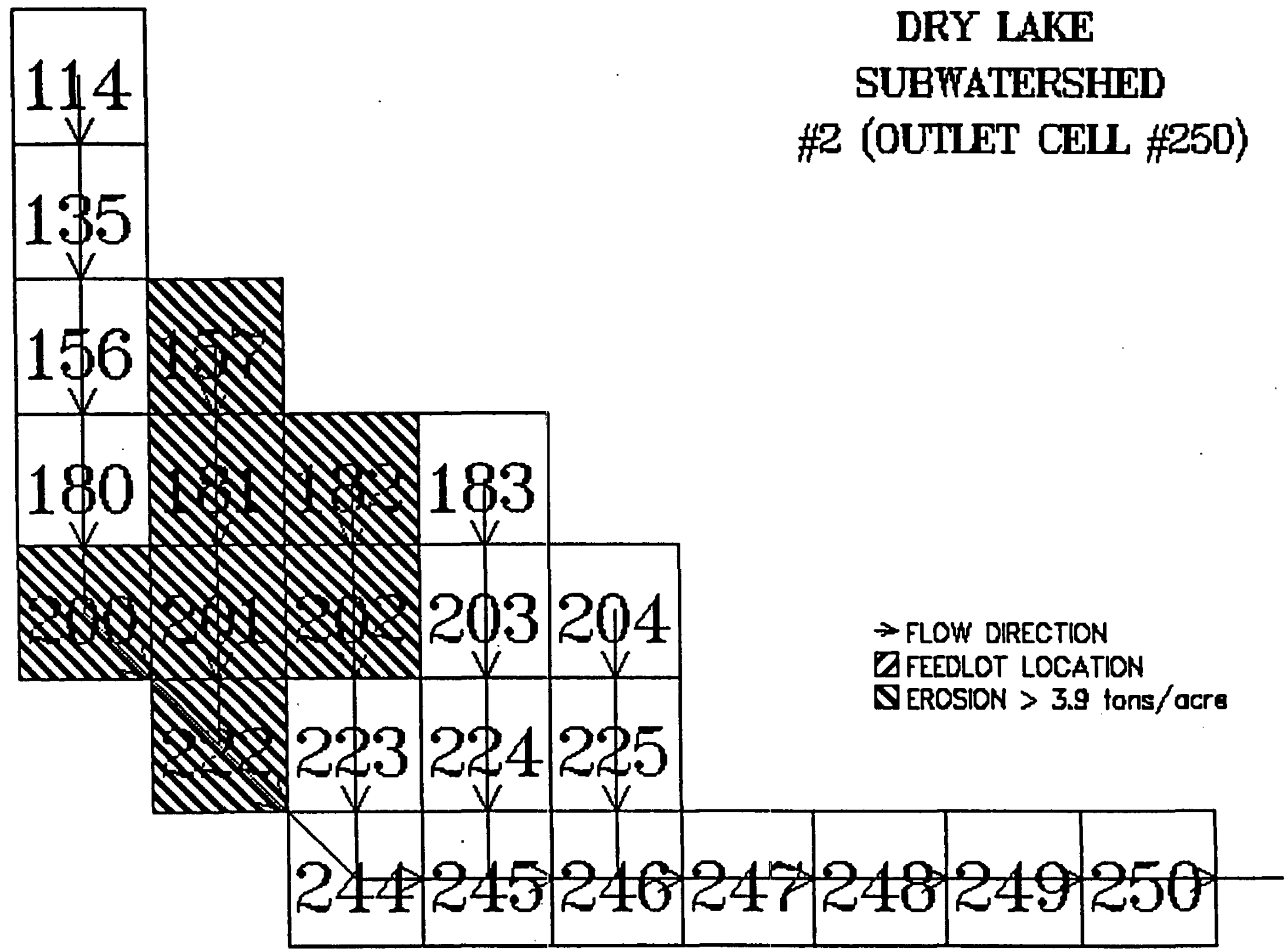


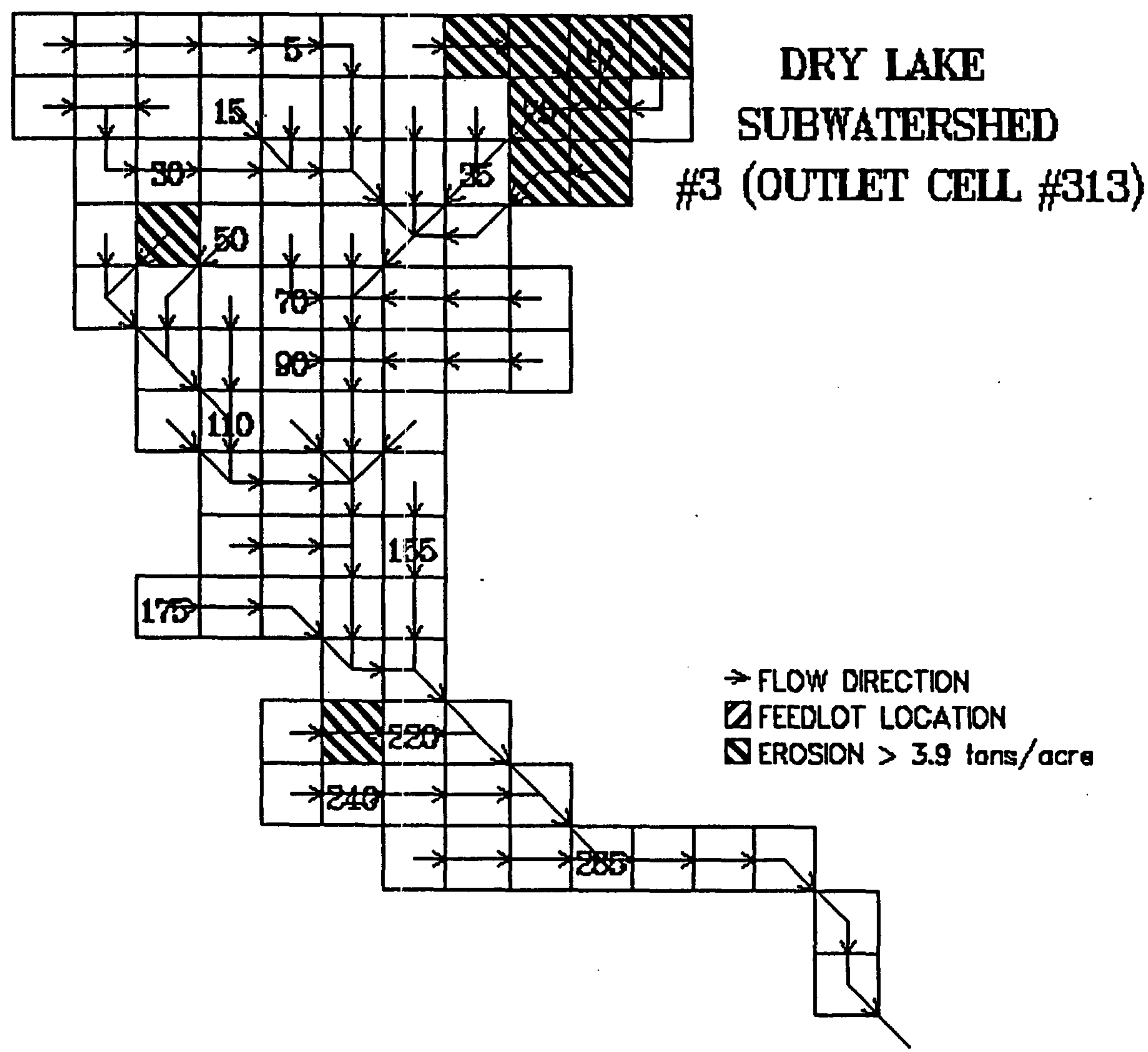
DRY LAKE
SUBWATERSHED
#1 (OUTLET CELL #230)



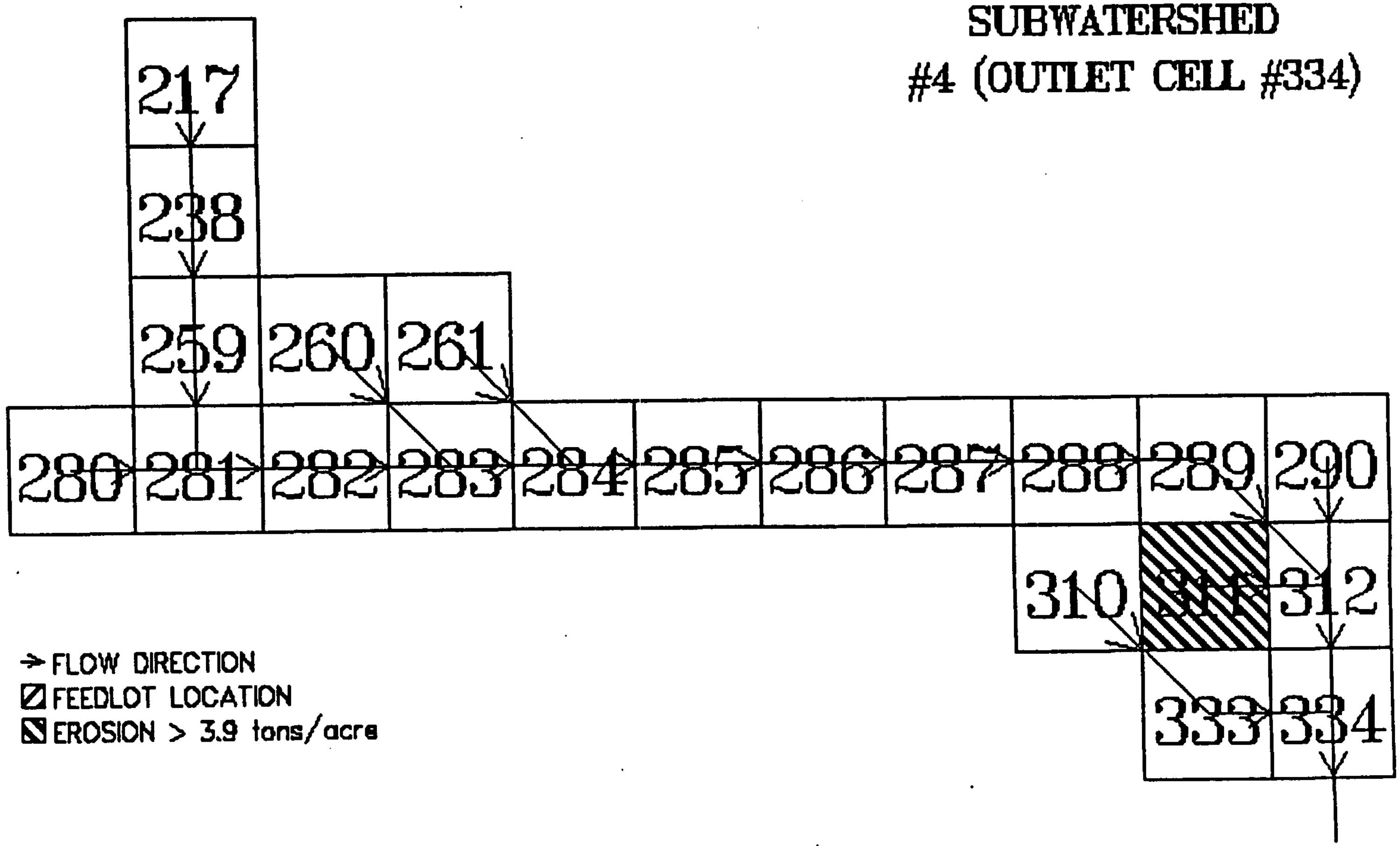
DRY LAKE
SUBWATERSHED
#1 (OUTLET CELL #230)

DRY LAKE SUBWATERSHED #2 (OUTLET CELL #250)

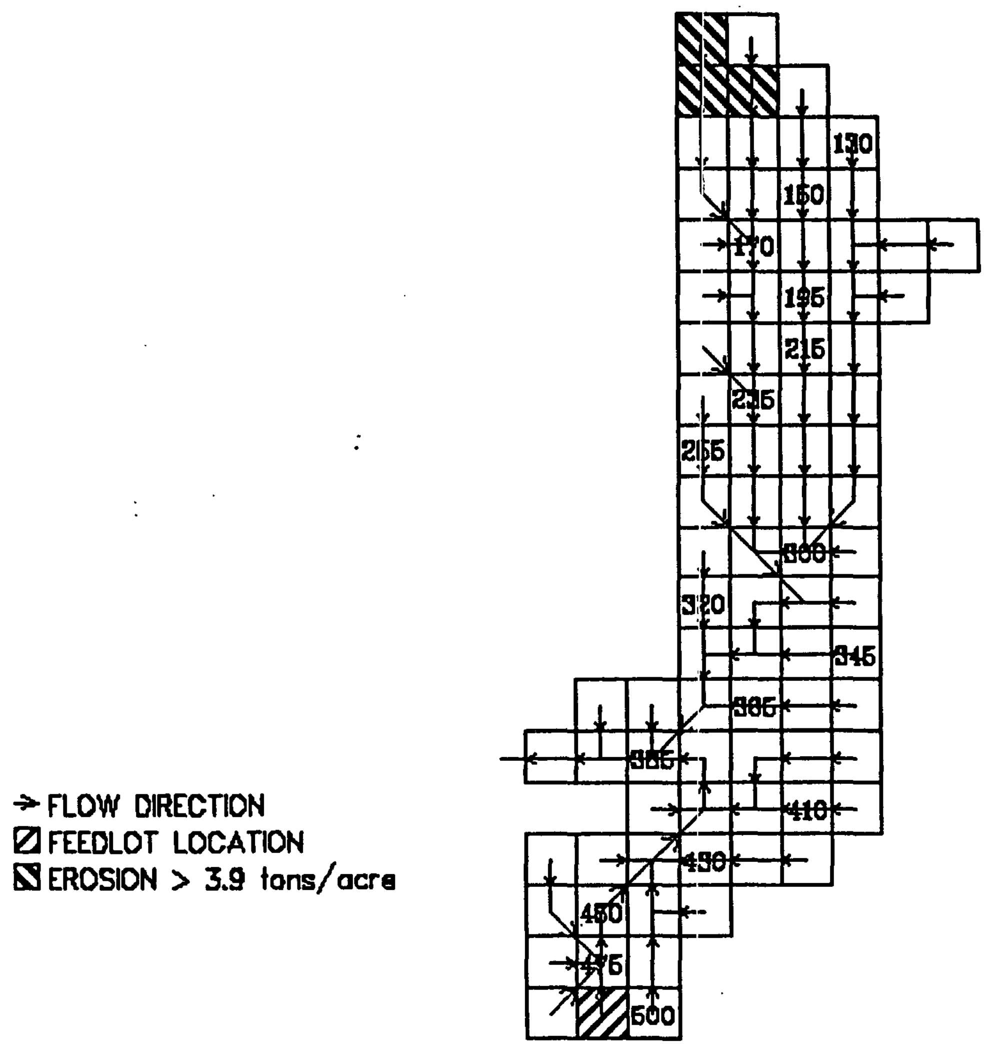



DRY LAKE
SUBWATERSHED
#3 (OUTLET CELL #313)
5
15
30
35
50
70
90
110
155
175
220
240
285
FLOW DIRECTION
FEEDLOT LOCATION
EROSION > 3.9 tons/acre

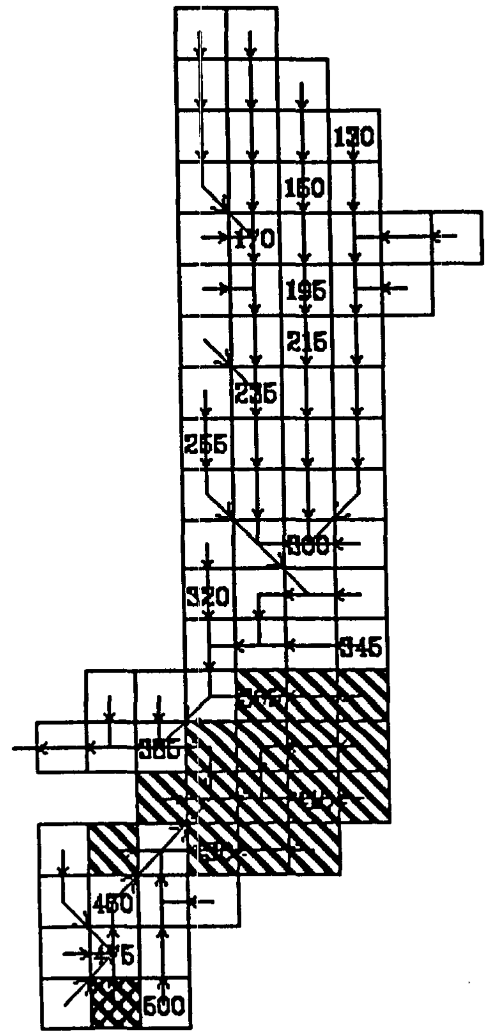
DRY LAKE
SUBWATERSHED
#4 (OUTLET CELL #334)



DRY LAKE SUBWATERSHED #5 (OUTLET CELL #383)

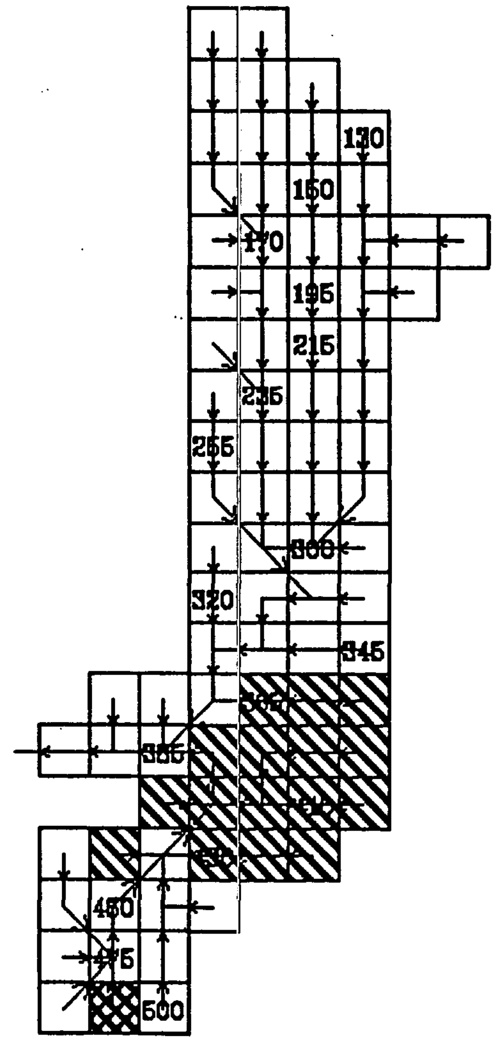


DRY LAKE
SUBWATERSHED
#5 (OUTLET CELL #383)



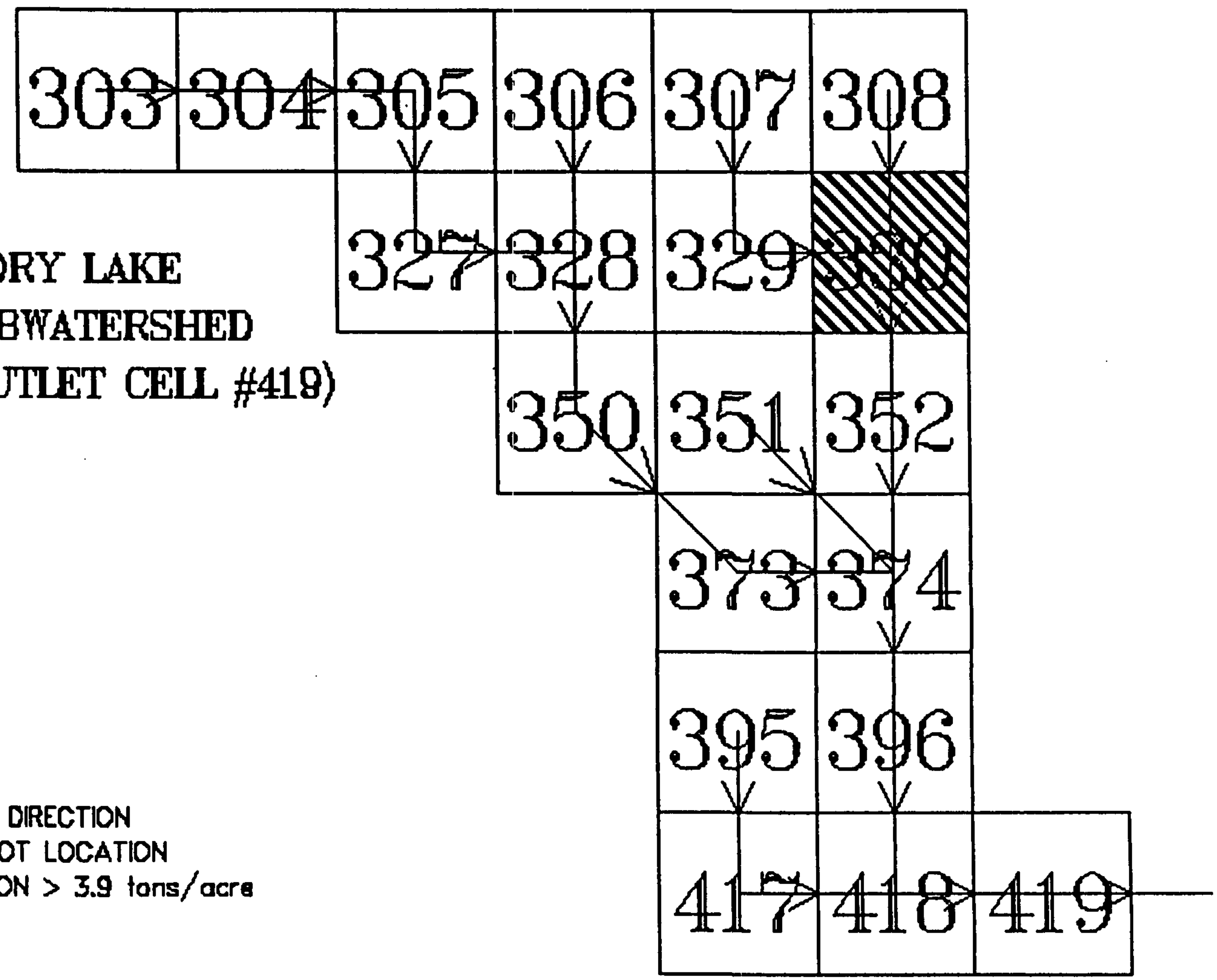
- → FLOW DIRECTION
- ▨ FEEDLOT LOCATION
- ▧ NITROGEN CONC. > 5.0 ppm

DRY LAKE SUBWATERSHED #5 (OUTLET CELL #383)



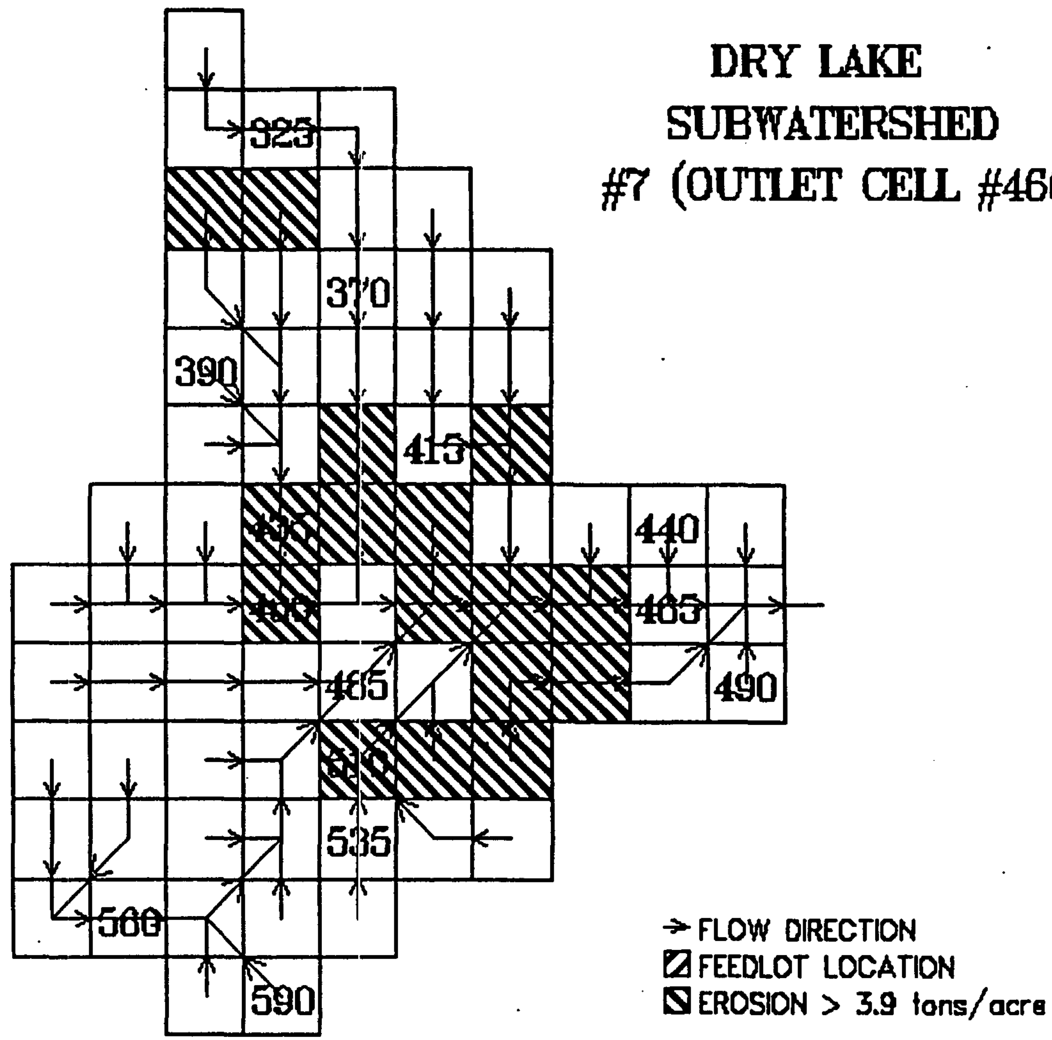
→ FLOW DIRECTION
▨ FEEDLOT LOCATION
▧ PHOSPHOROUS CONC.>1.0 ppm

DRY LAKE SUBWATERSHED #6 (OUTLET CELL #419)

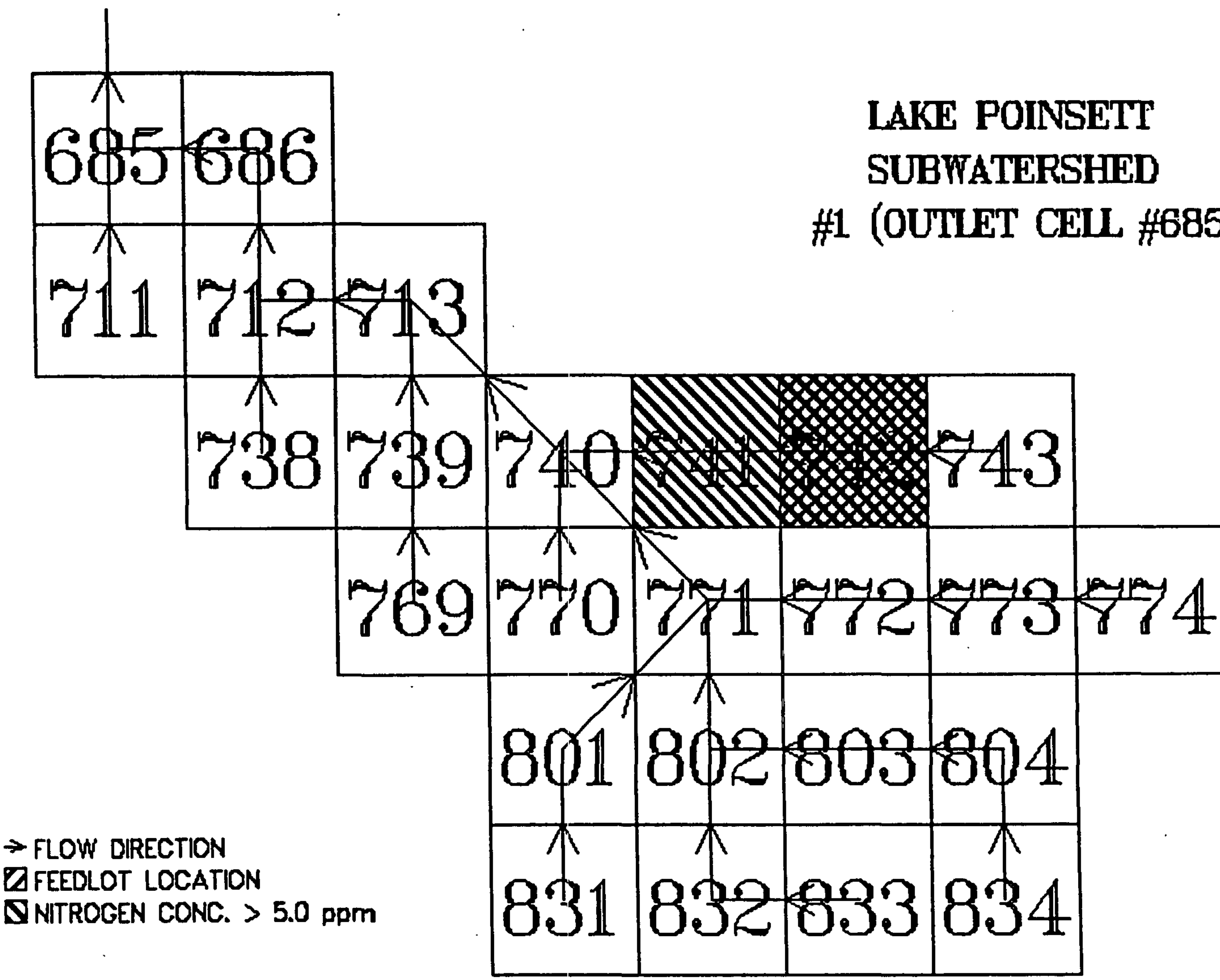


→ FLOW DIRECTION
▨ FEEDLOT LOCATION
▧ EROSION > 3.9 tons/acre

DRY LAKE
SUBWATERSHED
#7 (OUTLET CELL #466)

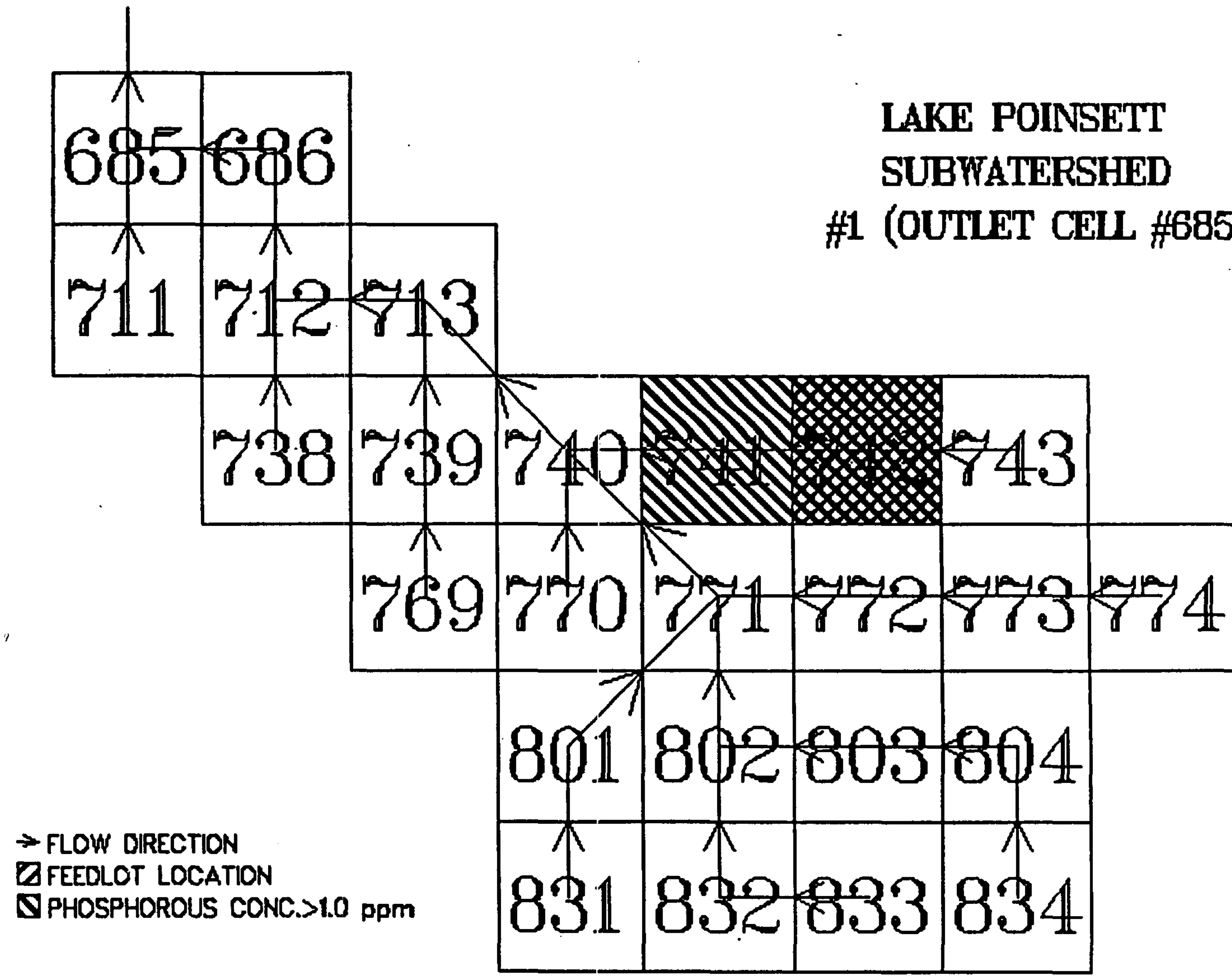


LAKE POINSETT
SUBWATERSHED
#1 (OUTLET CELL #685)

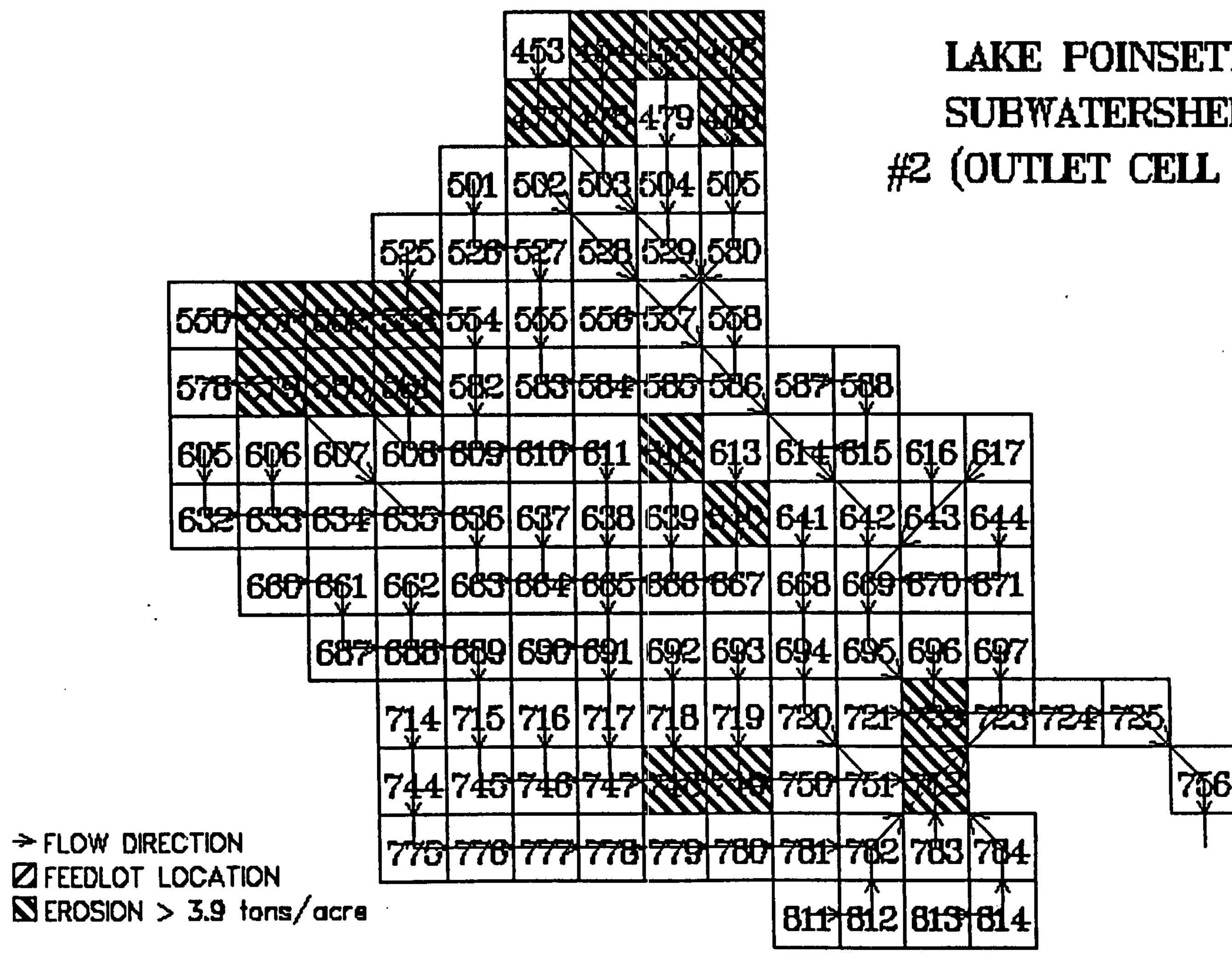


→ FLOW DIRECTION
▨ FEEDLOT LOCATION
▧ NITROGEN CONC. > 5.0 ppm

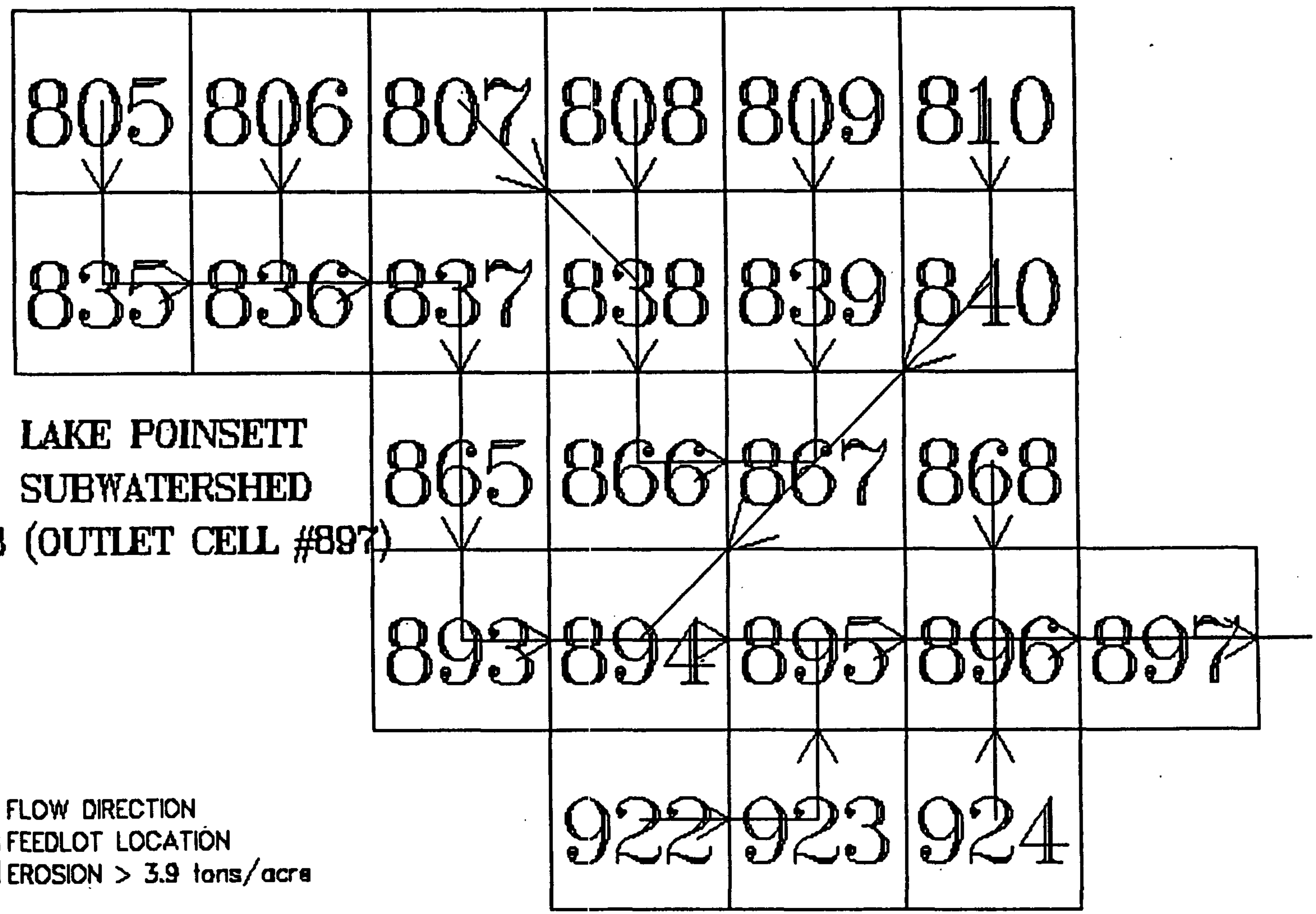
LAKE POINSETT
SUBWATERSHED
#1 (OUTLET CELL #685)



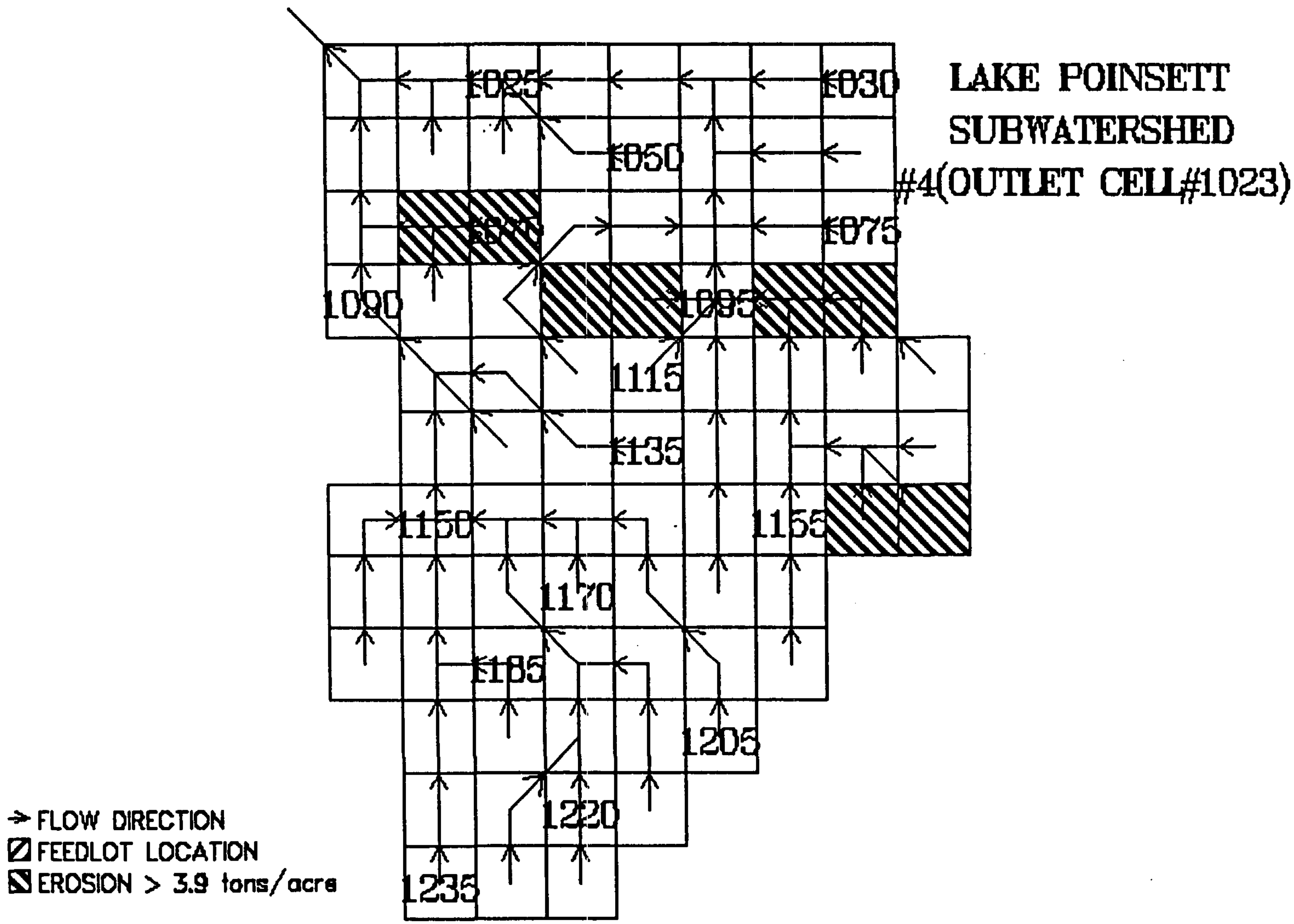
LAKE POINSETT SUBWATERSHED #2 (OUTLET CELL #756)



LAKE POINSETT
SUBWATERSHED
#3 (OUTLET CELL #897)

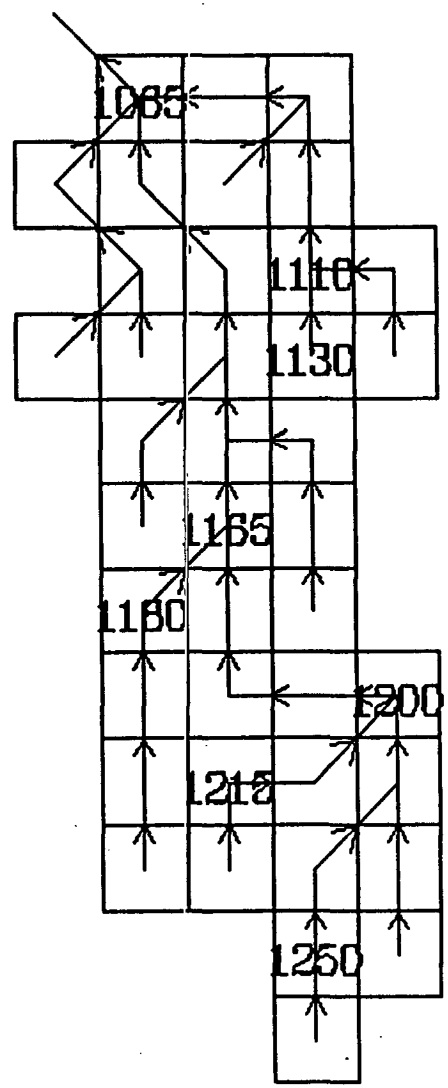


→ FLOW DIRECTION
▨ FEEDLOT LOCATION
▧ EROSION > 3.9 tons/acre



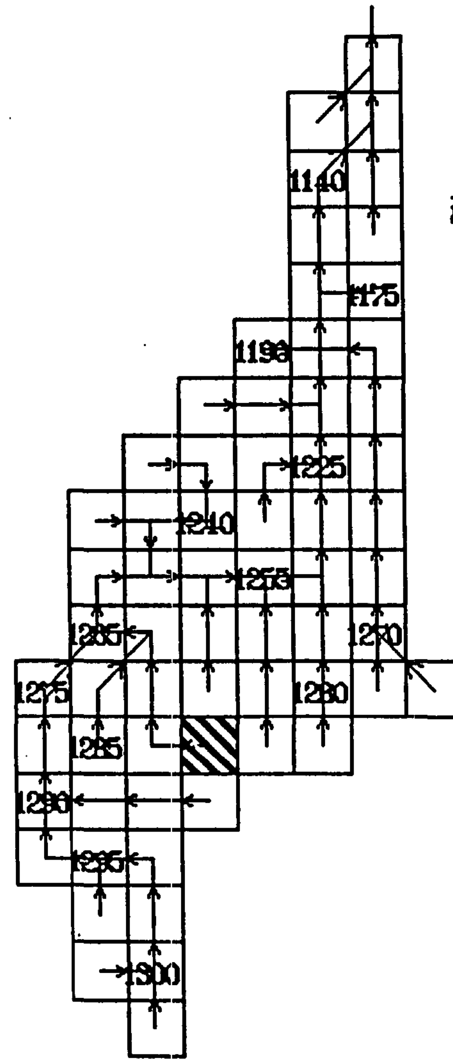
LAKE POINSETT
SUBWATERSHED
#4(OUTLET CELL#1023)
1025
1030
1050
1075
1090
1095
1115
1135
1150
1155
1170
1185
1205
1220
1235
FLOW DIRECTION
FEEDLOT LOCATION
EROSION > 3.9 tons/acre

LAKE POINSETT
SUBWATERSHED
#5 (OUTLET CELL #1065)

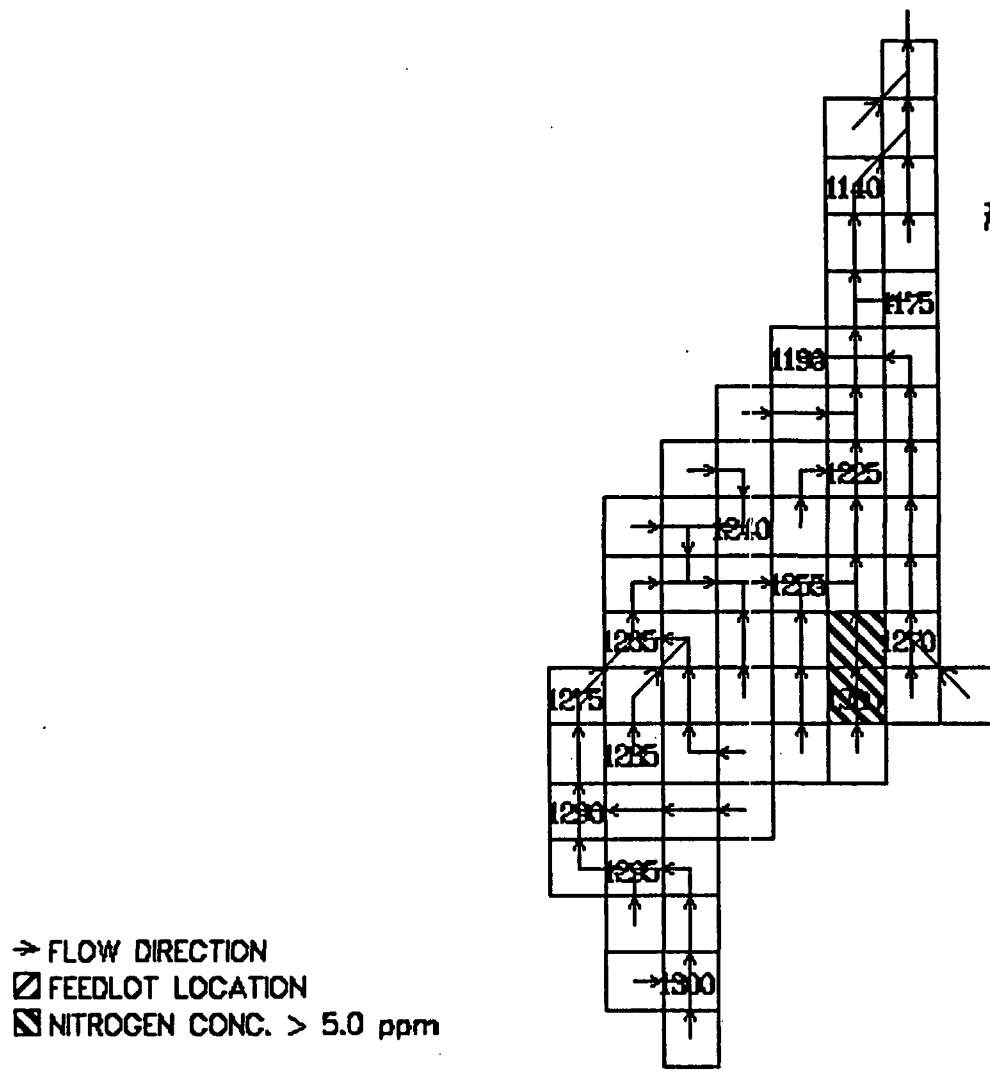


→ FLOW DIRECTION
▨ FEEDLOT LOCATION
▧ EROSION > 3.9 tons/acre

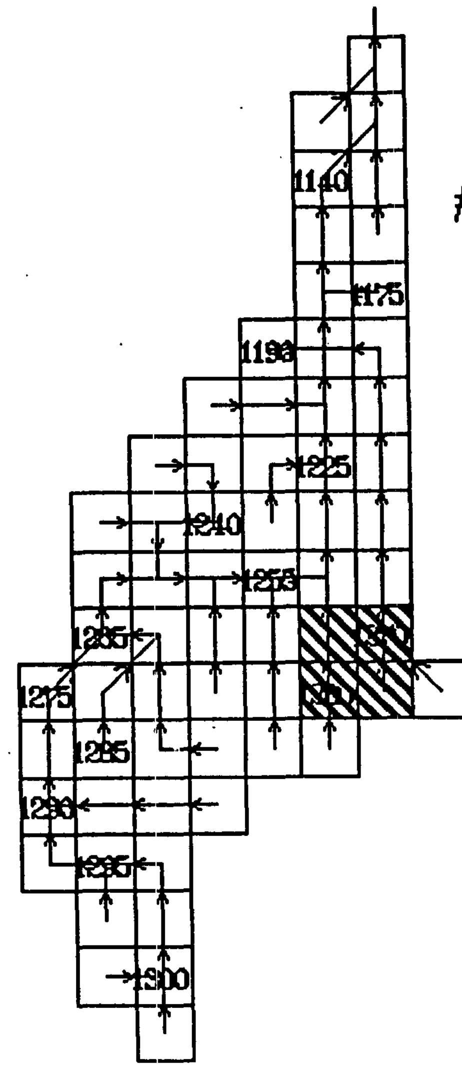
LAKE POINSETT SUBWATERSHED #6 (OUTLET CELL #1103)



LAKE POINSETT SUBWATERSHED #6 (OUTLET CELL #1103)

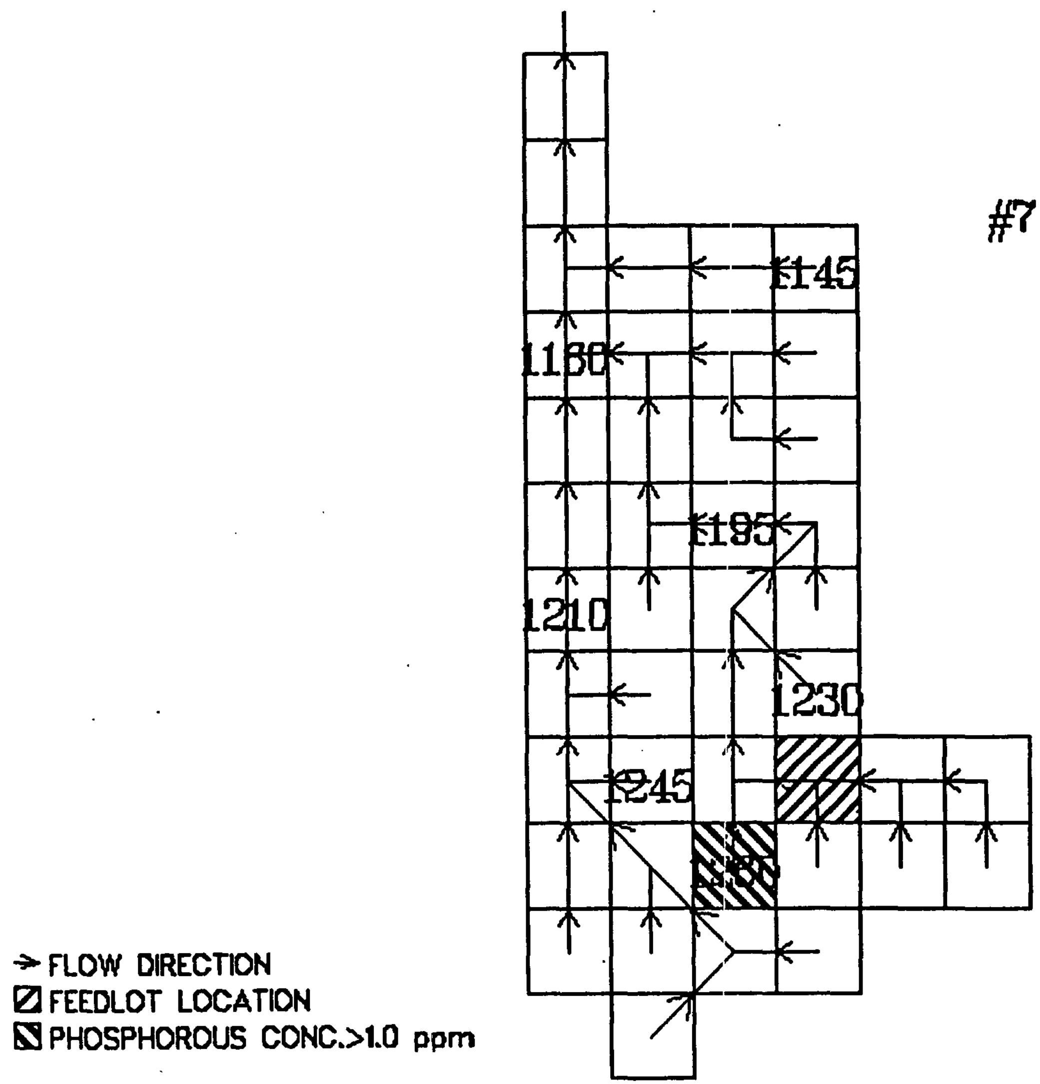


LAKE POINSETT
SUBWATERSHED
#6 (OUTLET CELL #1103)

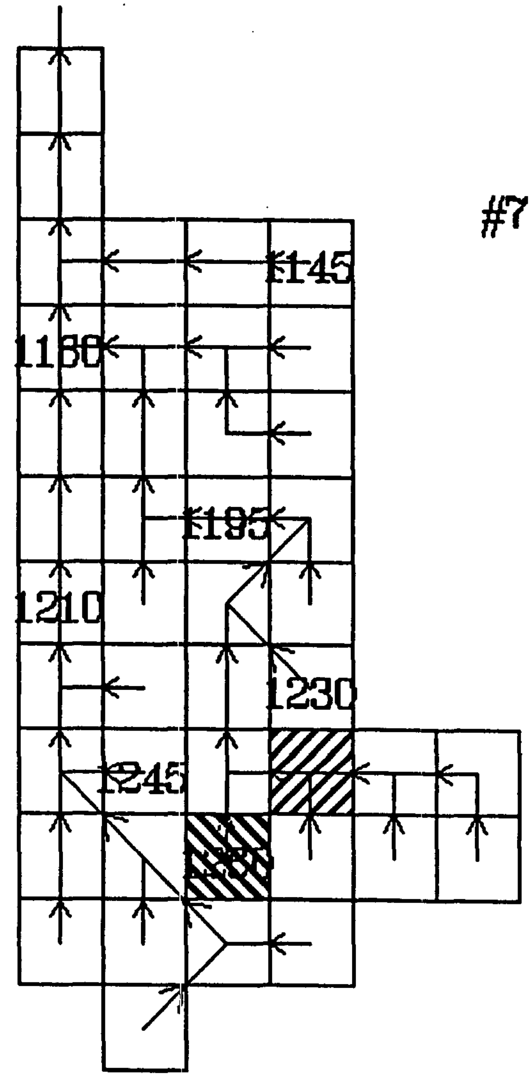


→ FLOW DIRECTION
▨ FEEDLOT LOCATION
▧ PHOSPHOROUS CONC.>1.0 ppm

LAKE POINSETT
SUBWATERSHED
#7 (OUTLET CELL #1104)

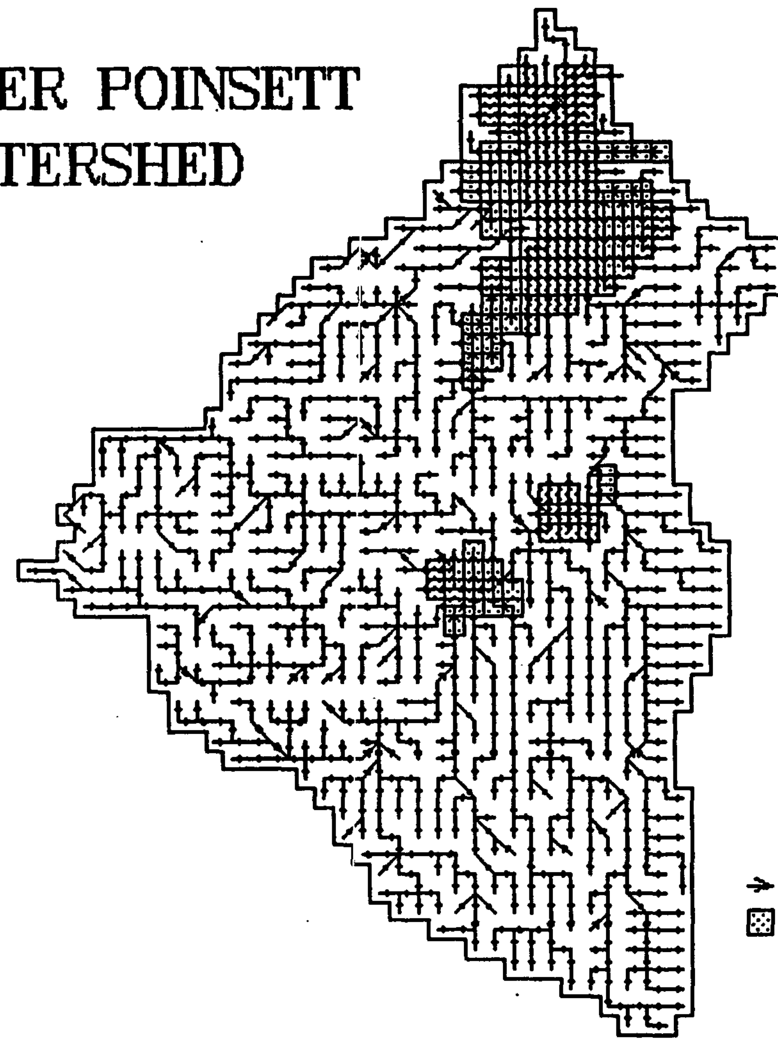


LAKE POINSETT SUBWATERSHED
#7 (OUTLET CELL #1104)

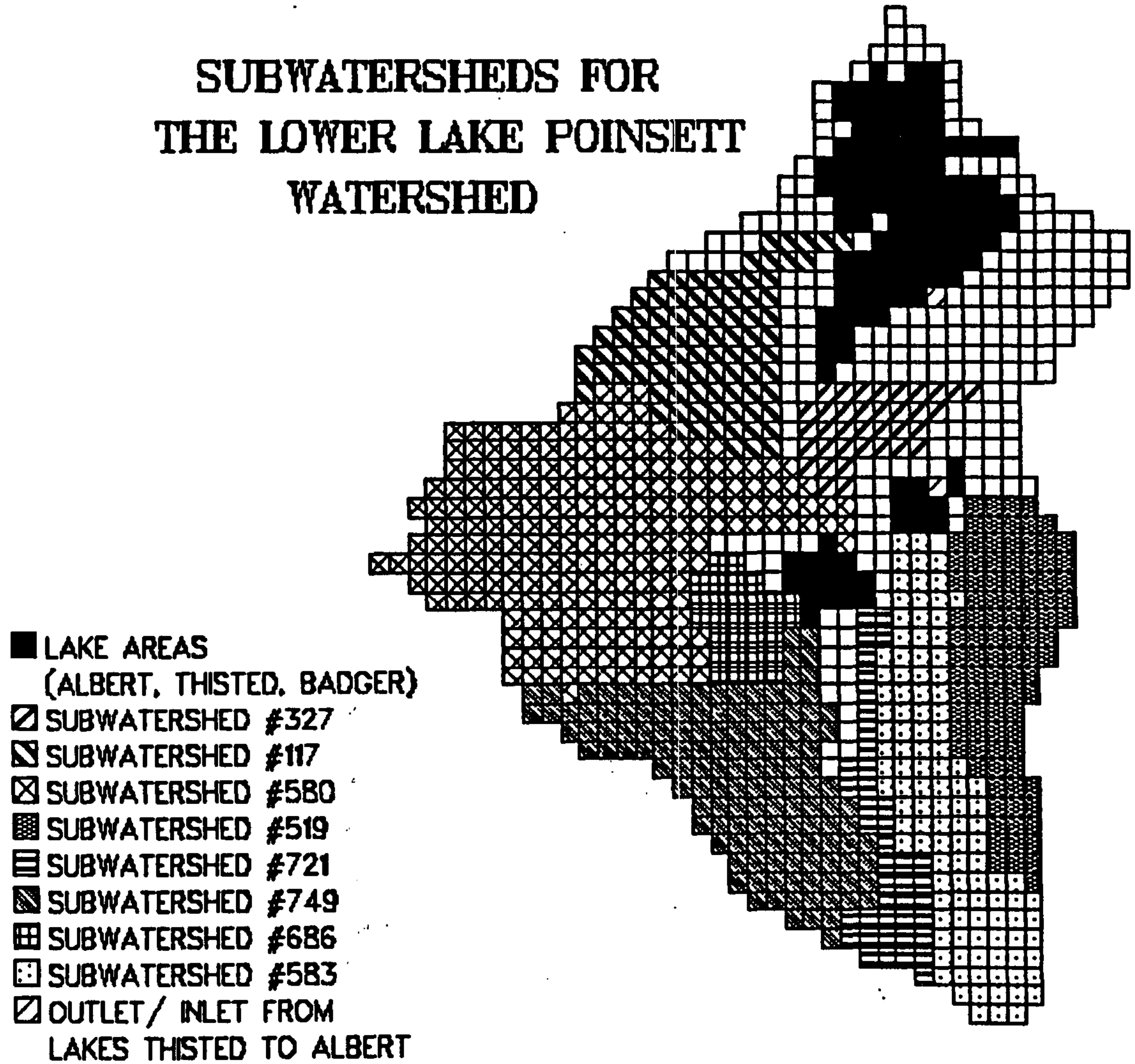


→ FLOW DIRECTION
▨ FEEDLOT LOCATION
▧ NITROGEN CONC. > 5.0 ppm

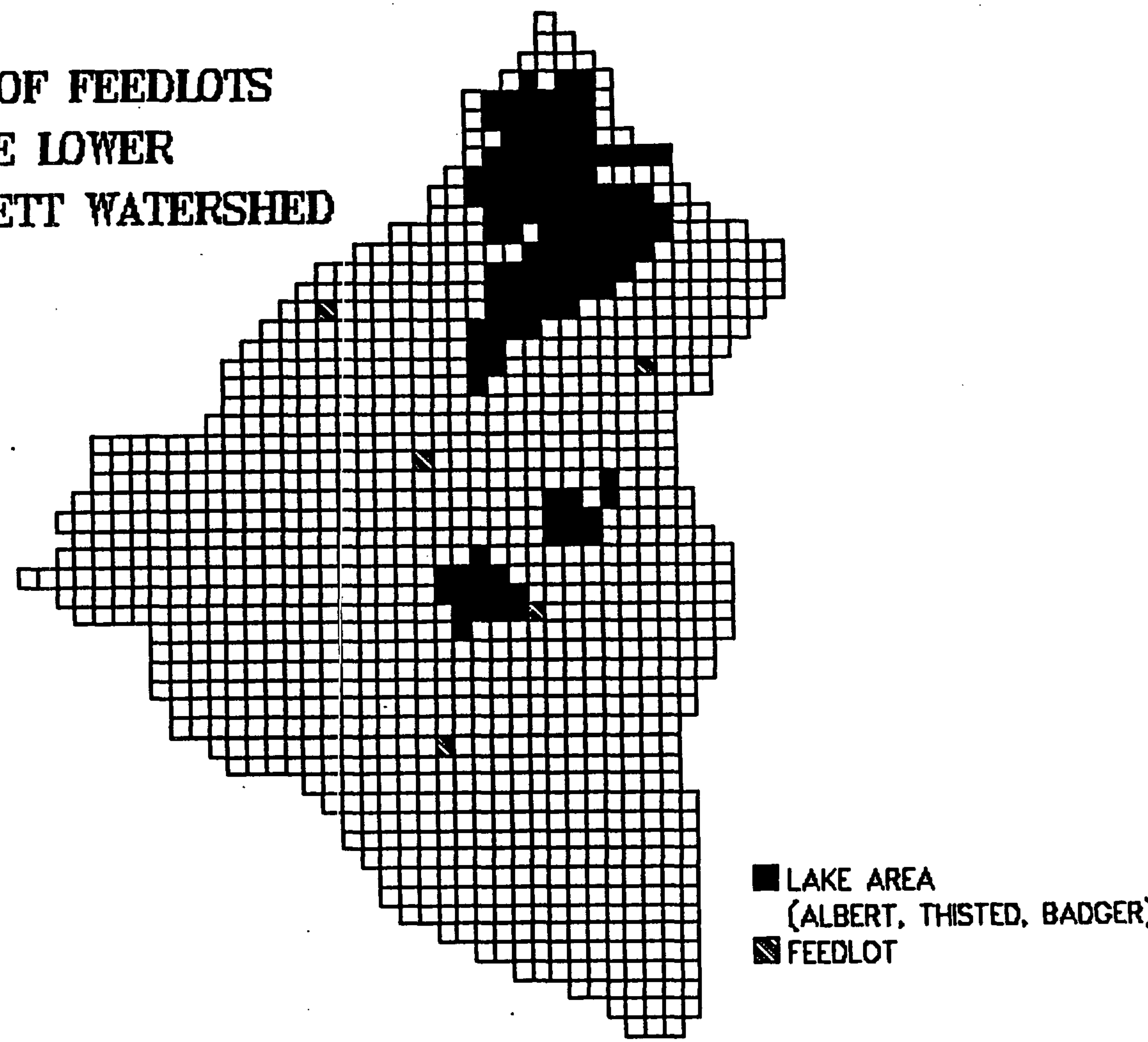
LOWER POINSETT WATERSHED

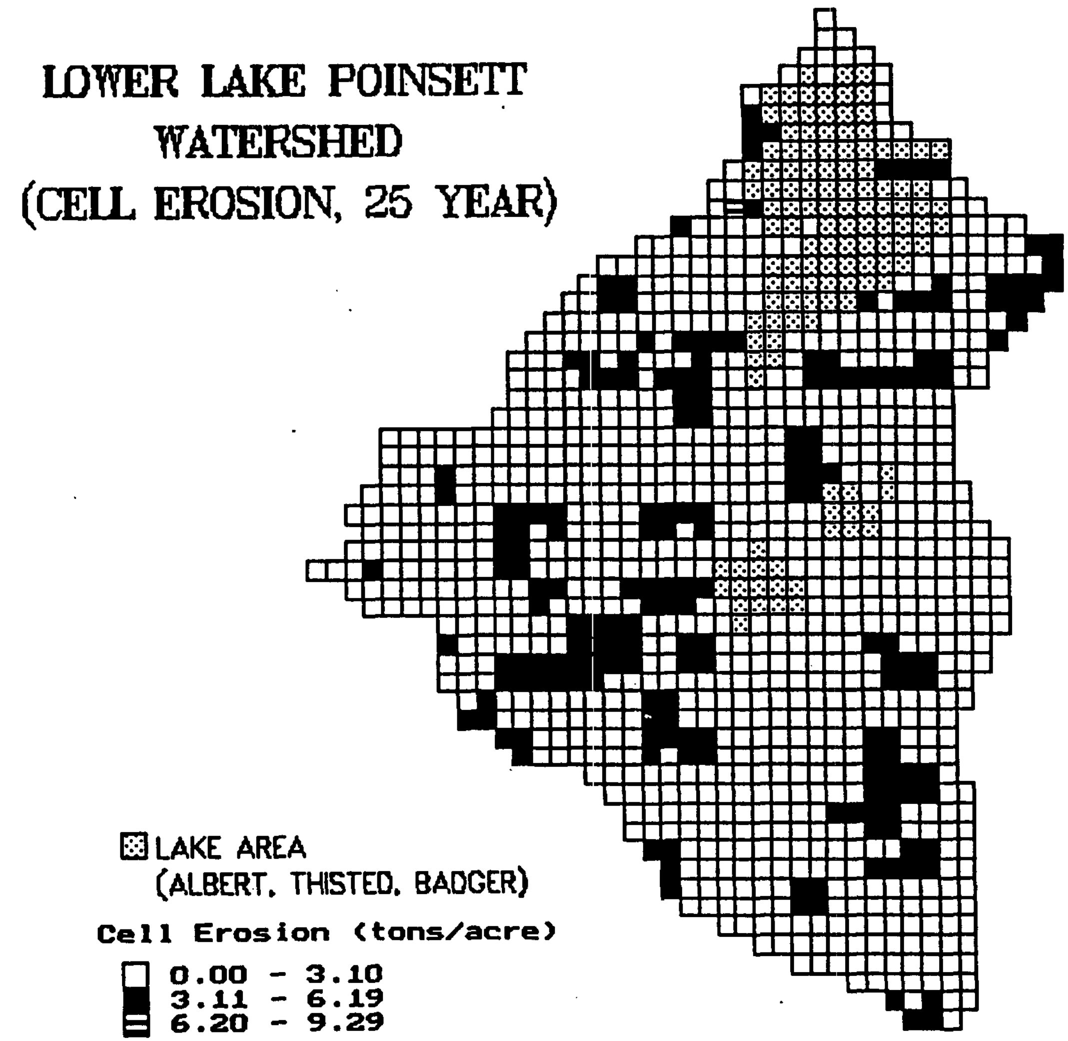


SUBWATERSHEDS FOR THE LOWER LAKE POINSETT WATERSHED

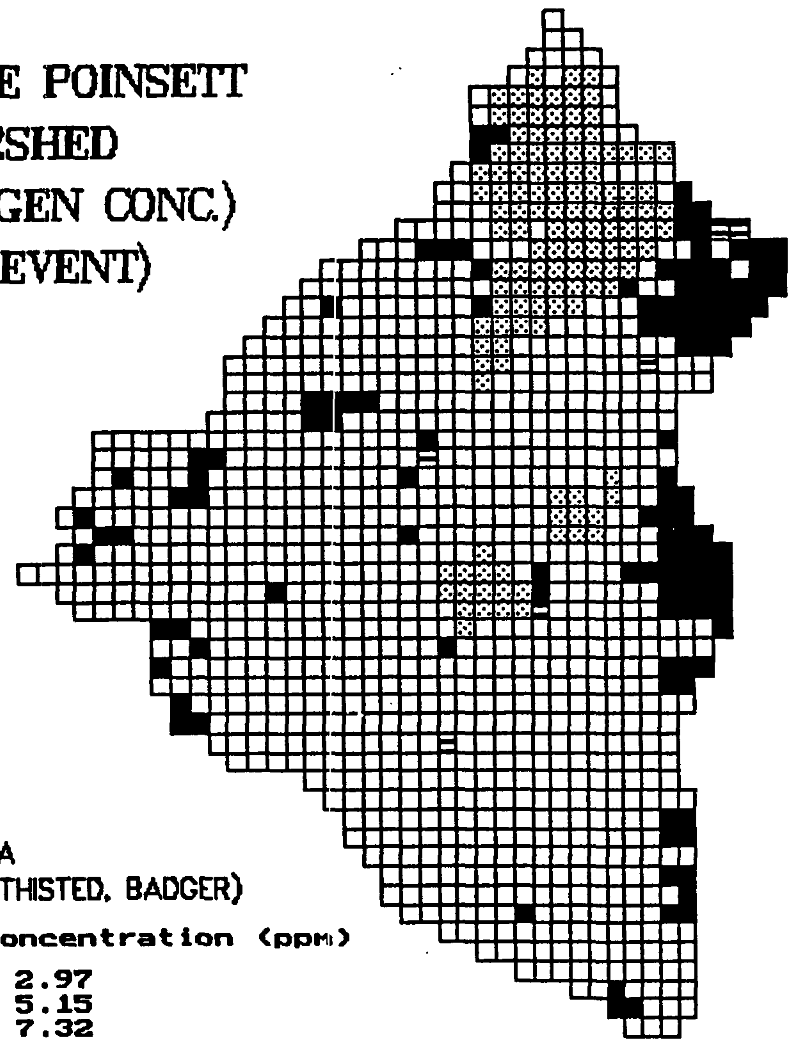


LOCATION OF FEEDLOTS IN THE LOWER LAKE POINSETT WATERSHED




LOWER LAKE POINSETT
WATERSHED
(CELL EROSION, 25 YEAR)
LAKE AREA
(ALBERT, THISTED, BADGER)
Cell Erosion (tons/acre)
0.00 - 3.10
3.11 - 6.19
6.20 - 9.29

LOWER LAKE POINSETT
WATERSHED
(CELL NITROGEN CONC.)
(25 YEAR EVENT)

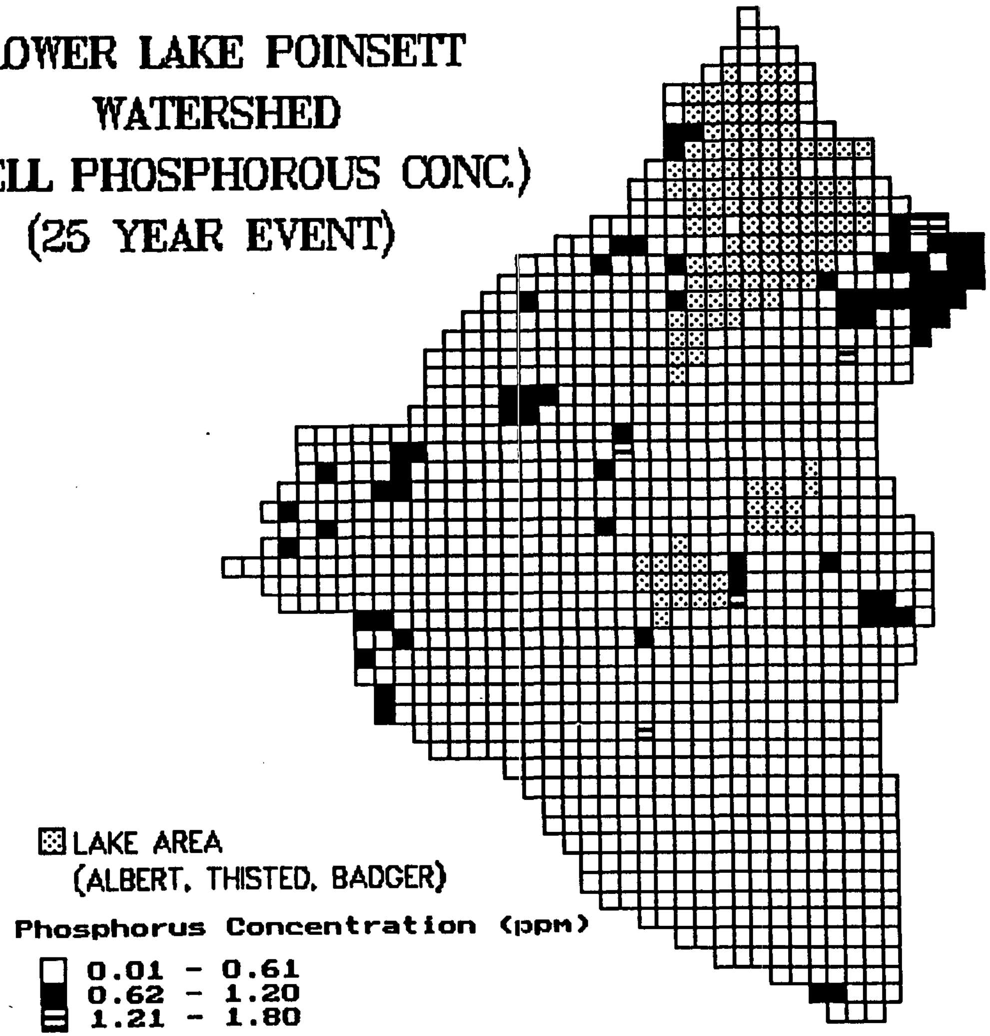


LAKE AREA
(ALBERT, THISTED, BADGER)

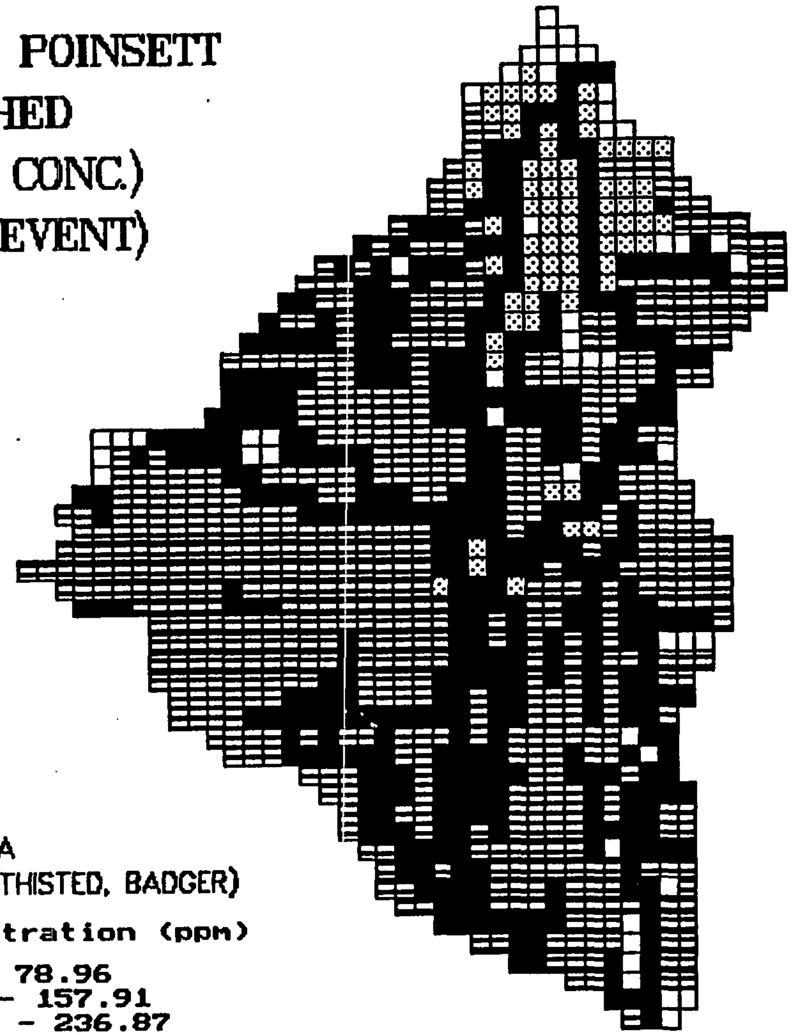
Nitrogen Concentration (ppm)

0.80 - 2.97
2.98 - 5.15
5.16 - 7.32

LOWER LAKE POINSETT WATERSHED
(CELL PHOSPHOROUS CONC.)
(25 YEAR EVENT)



LOWER LAKE POINSETT
WATERSHED
(CELL COD CONC.)
(25 YEAR EVENT)

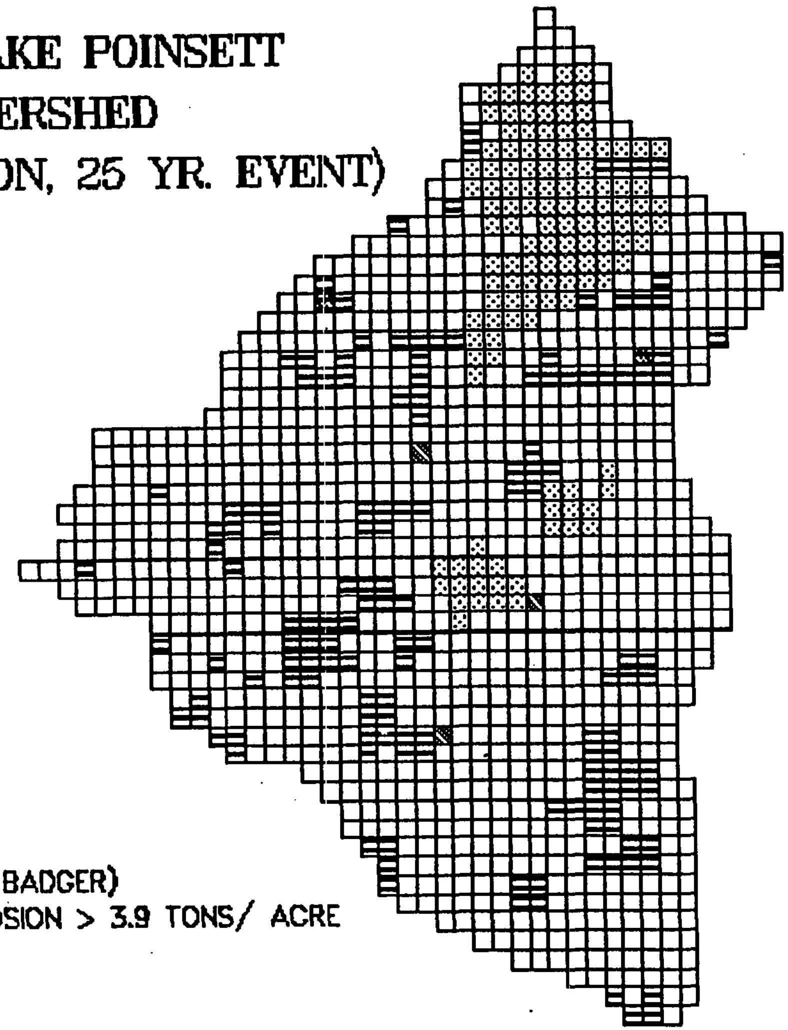


LAKE AREA
(ALBERT, THISTED, BADGER)

COD Concentration (ppm)

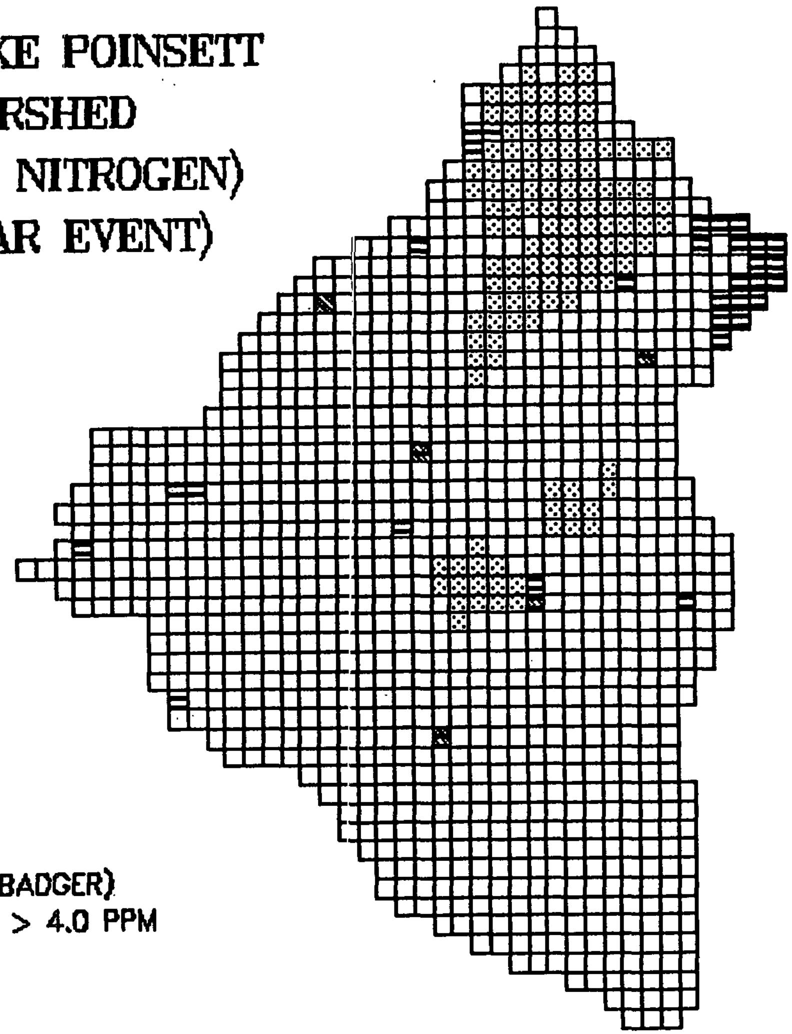
- 0.00 - 78.96
- 78.97 - 157.91
- 157.92 - 236.87

LOWER LAKE POINSETT
WATERSHED
(CELL EROSION, 25 YR. EVENT)



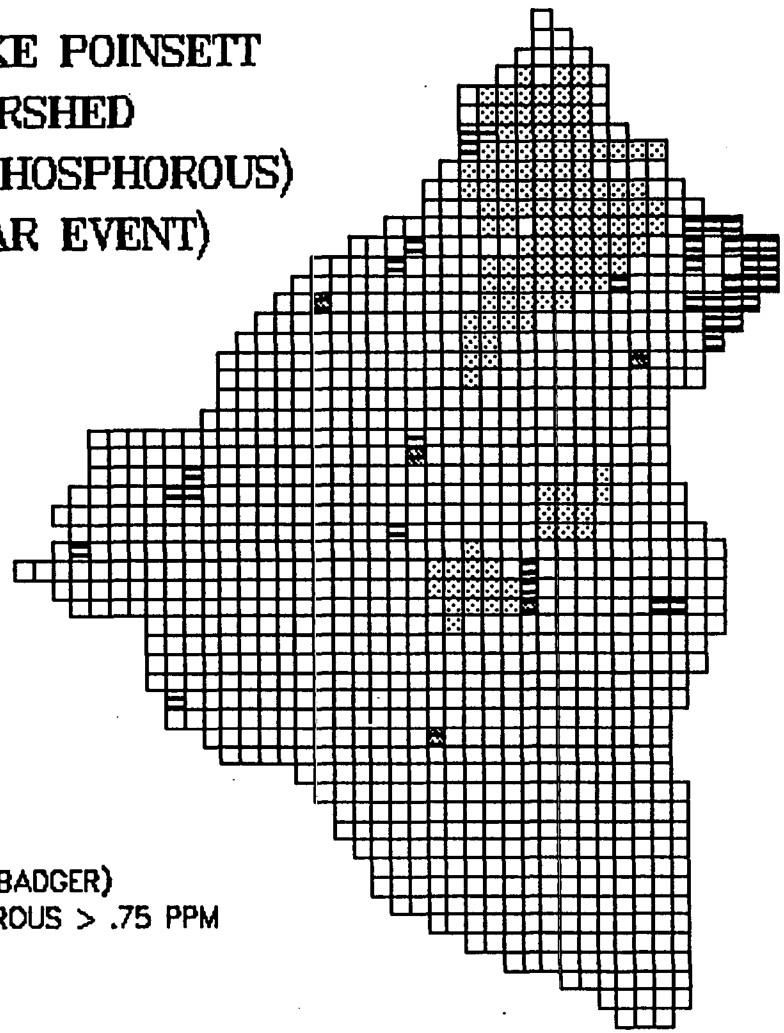
LAKE AREA
(ALBERT, THISTED, BADGER)
CRITICAL CELL EROSION > 3.9 TONS/ ACRE
FEEDLOT

LOWER LAKE POINSETT WATERSHED (CRITICAL NITROGEN) (25 YEAR EVENT)

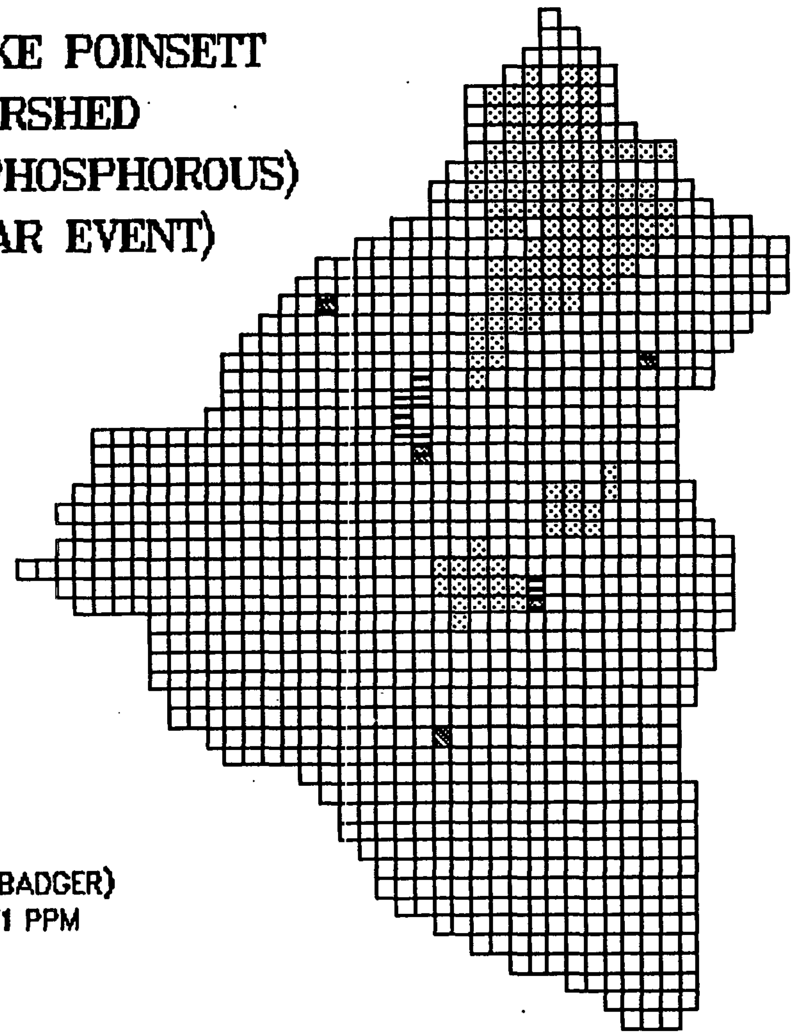


- LAKE AREA (ALBERT, THISTED, BADGER)
- CRITICAL NITROGEN > 4.0 PPM
- FEEDLOT

LOWER LAKE POINSETT WATERSHED (CRITICAL PHOSPHOROUS) (25 YEAR EVENT)

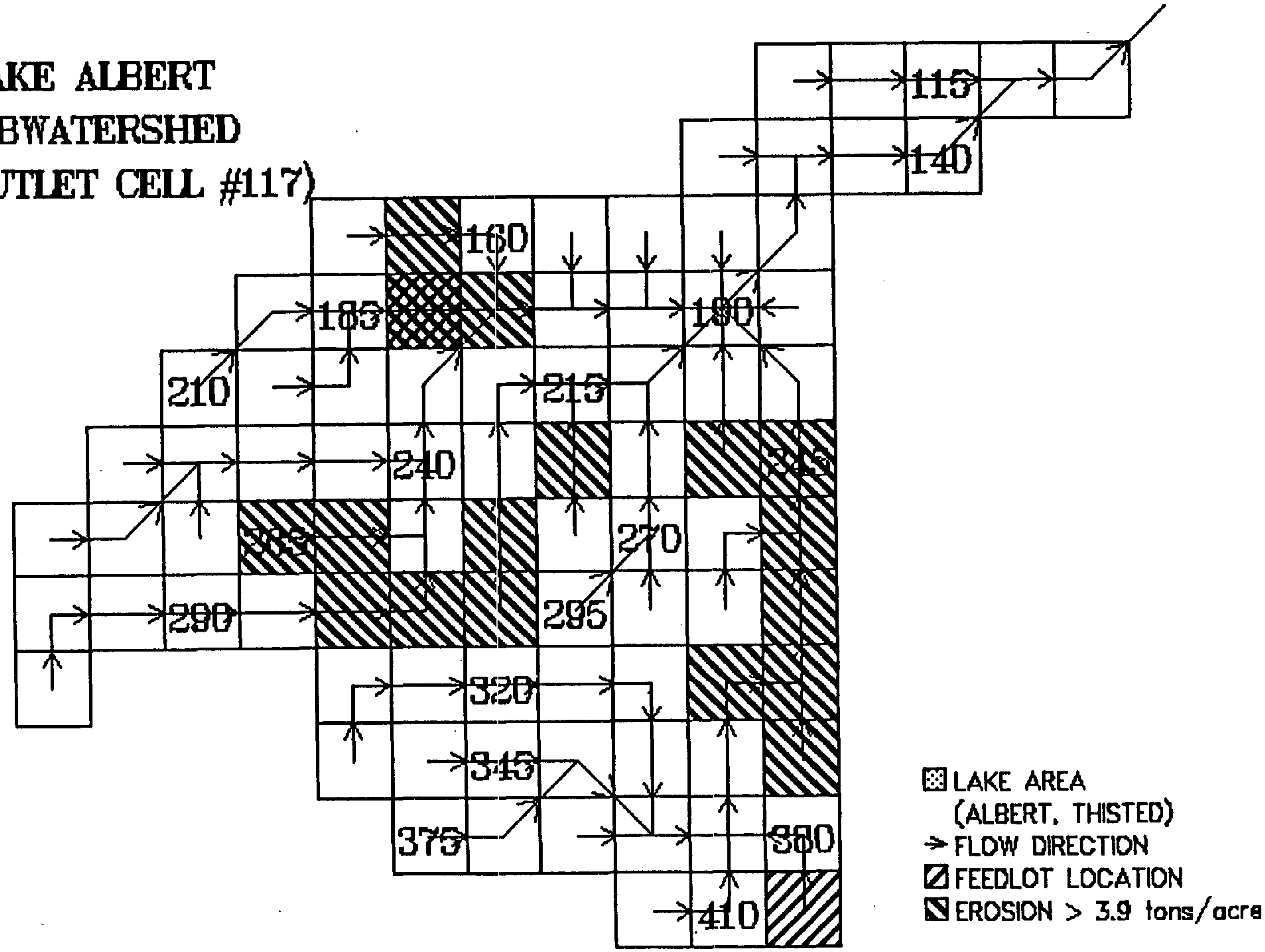


LOWER LAKE POINSETT WATERSHED (CRITICAL PHOSPHOROUS) (25 YEAR EVENT)

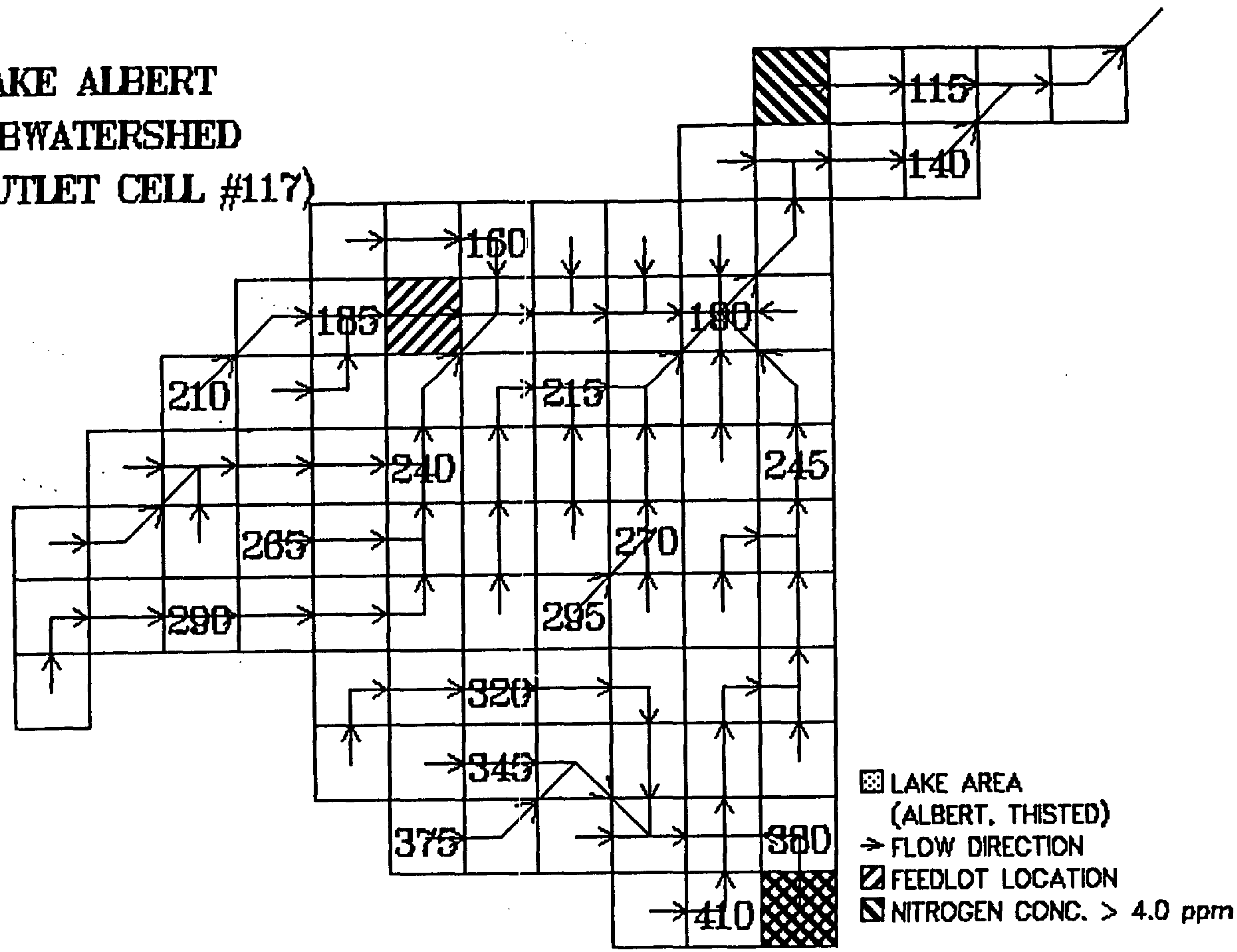


LAKE AREA (ALBERT, THISTED, BADGER)
CRITICAL COD > 171 PPM
FEEDLOT

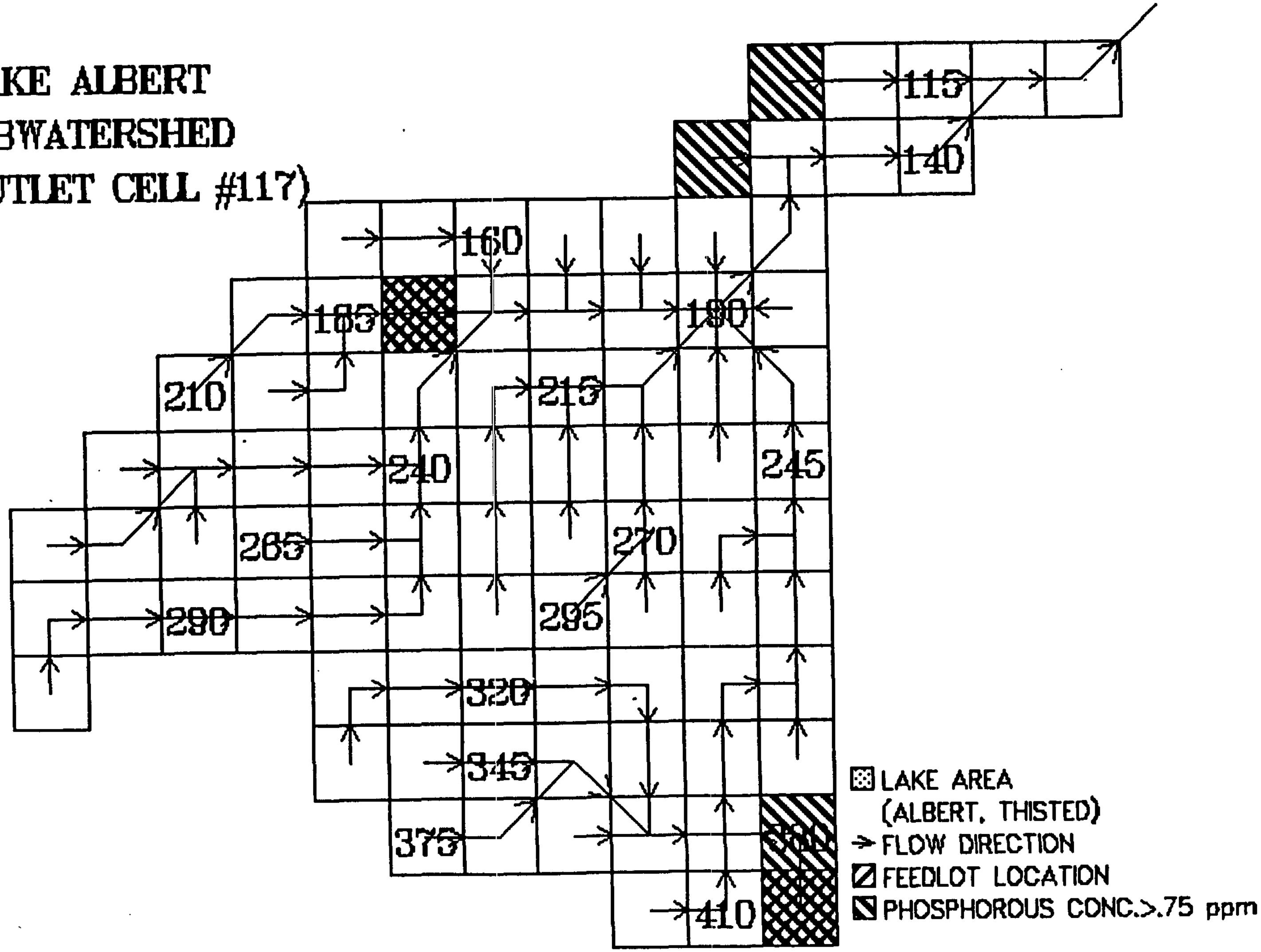
LAKE ALBERT SUBWATERSHED #1 (OUTLET CELL #117)



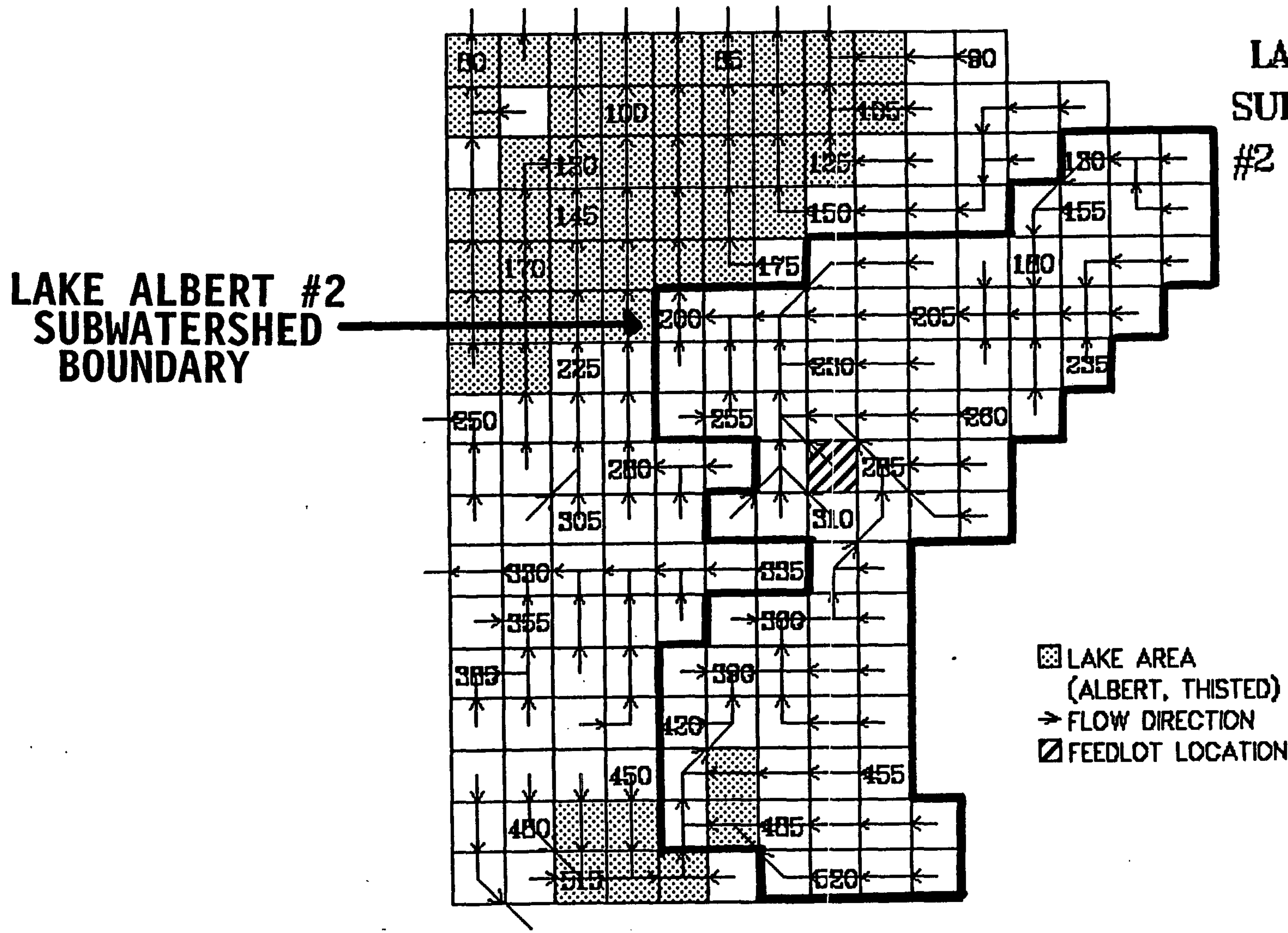
LAKE ALBERT SUBWATERSHED #1 (OUTLET CELL #117)



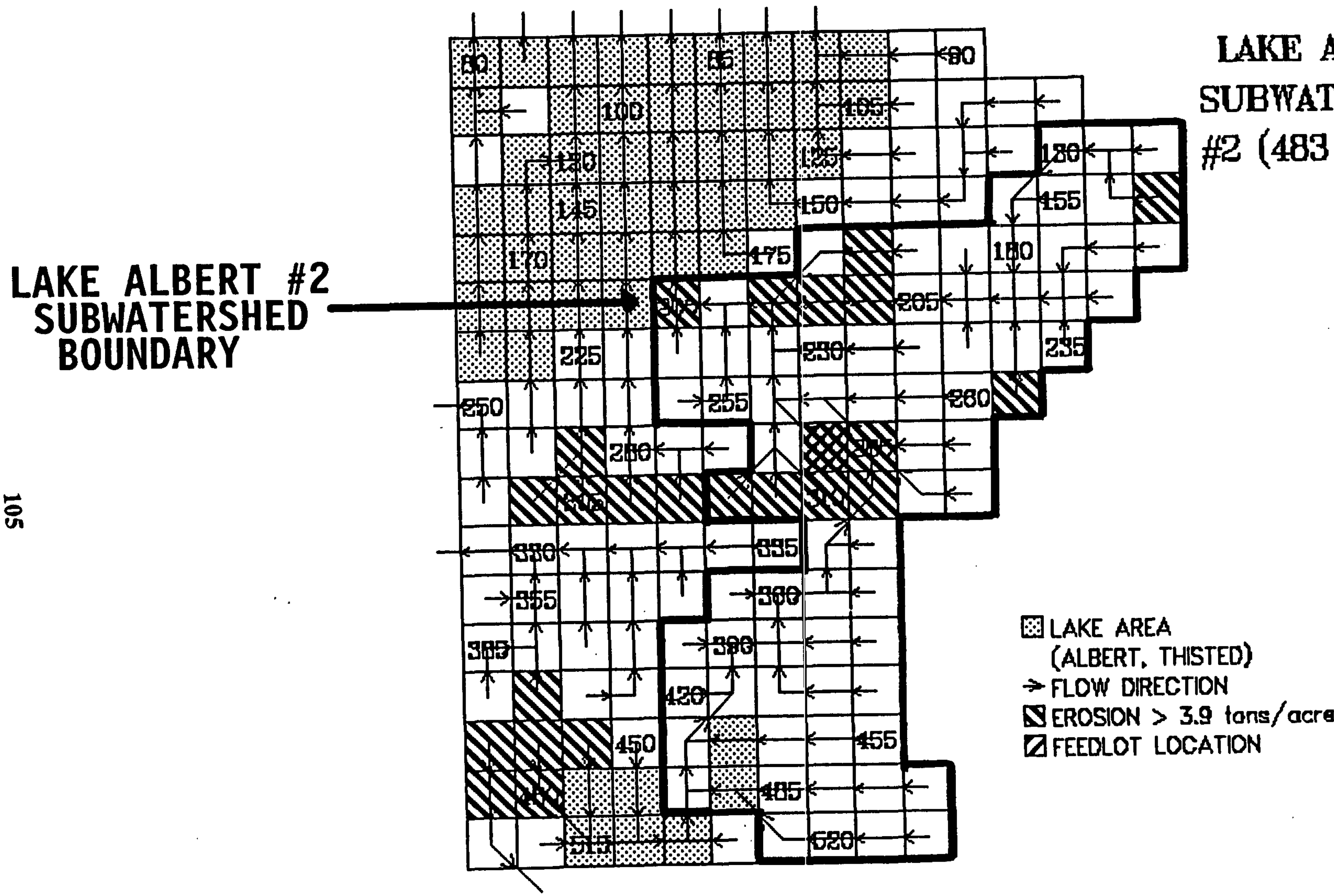
LAKE ALBERT SUBWATERSHED #1 (OUTLET CELL #117)



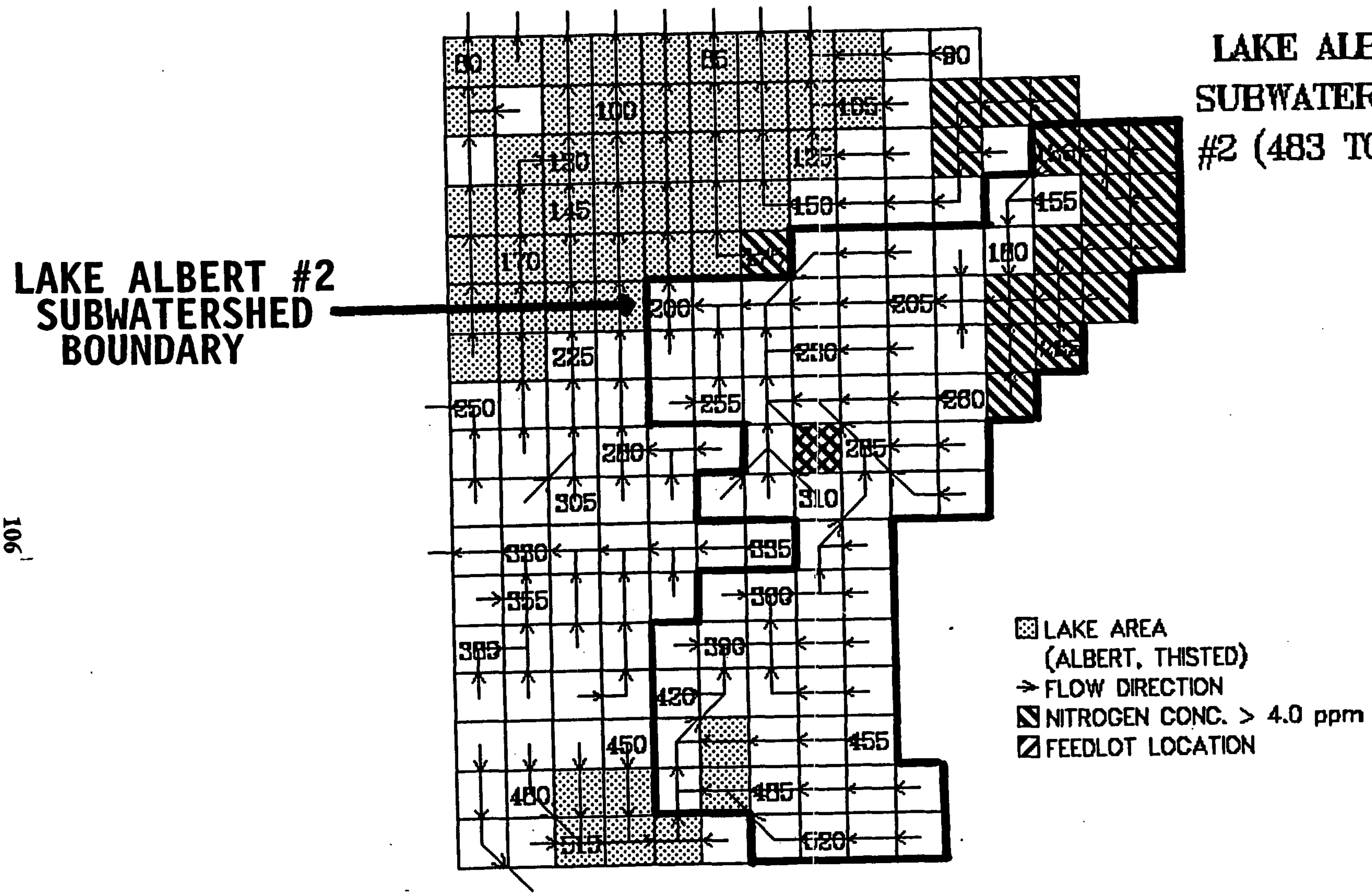
LAKE ALBERT SUBWATERSHED #2 (483 TO 200)



LAKE ALBERT SUBWATERSHED #2 (483 TO 200)

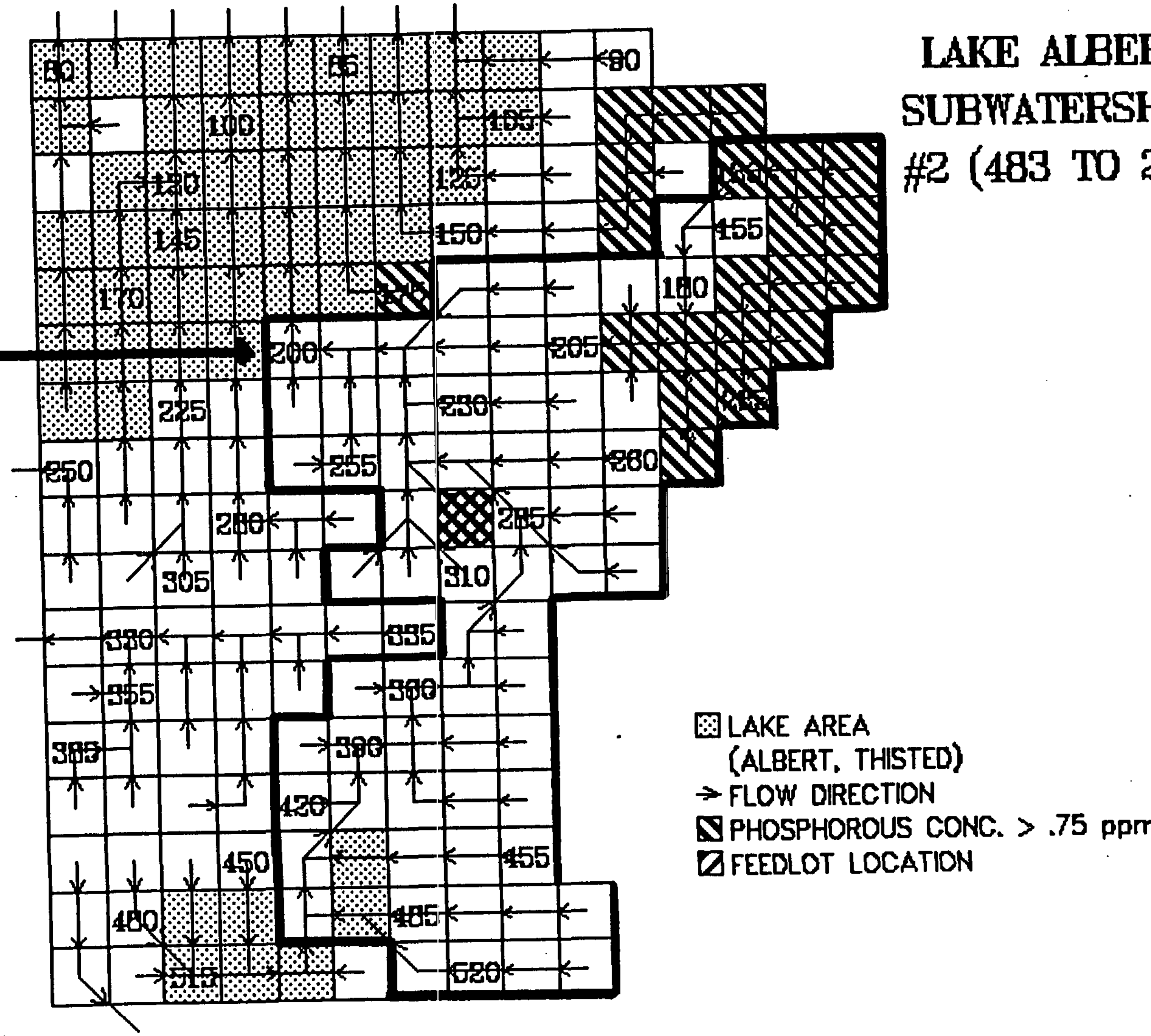


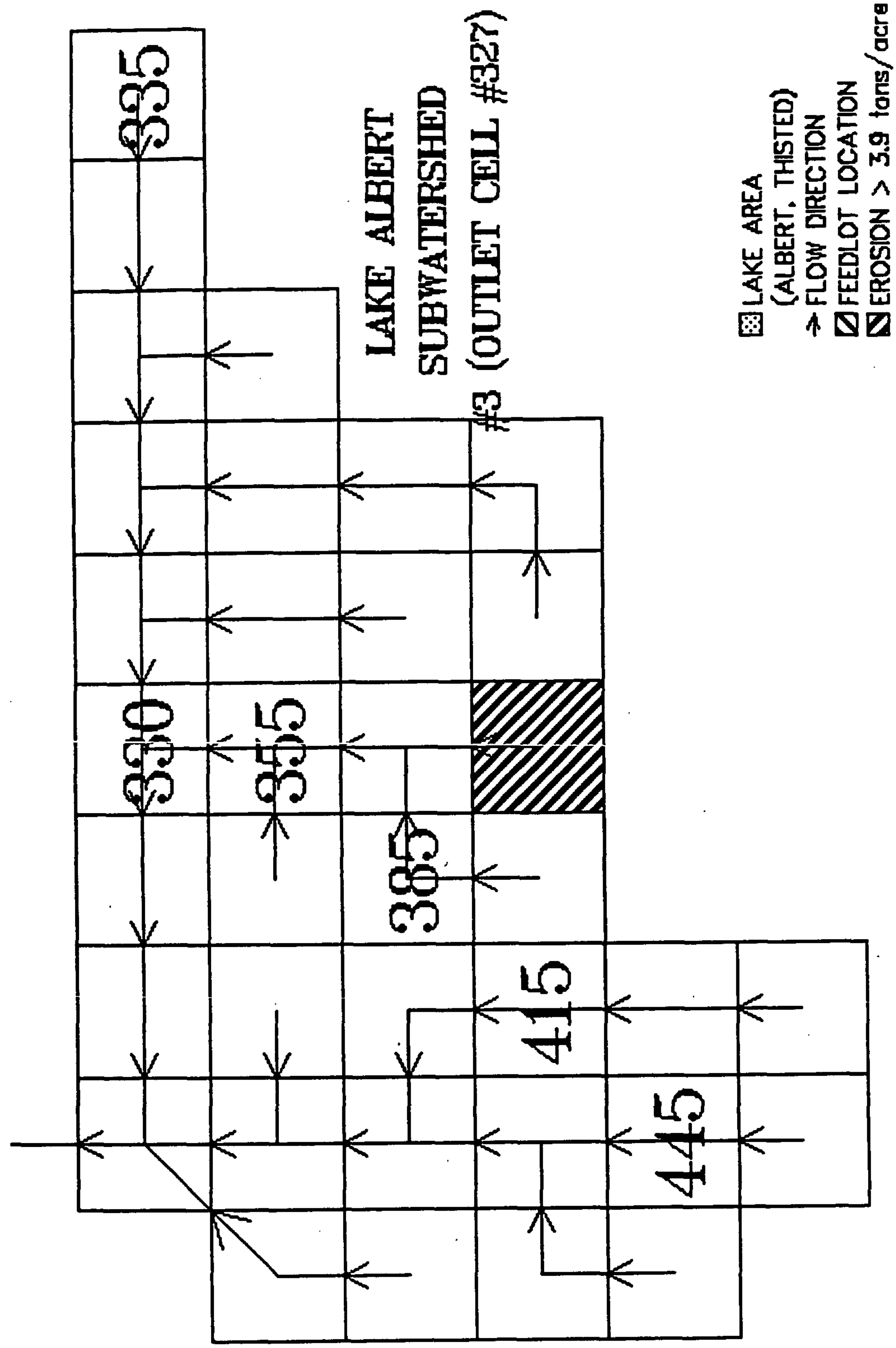
LAKE ALBERT SUBWATERSHED #2 (483 TO 200)



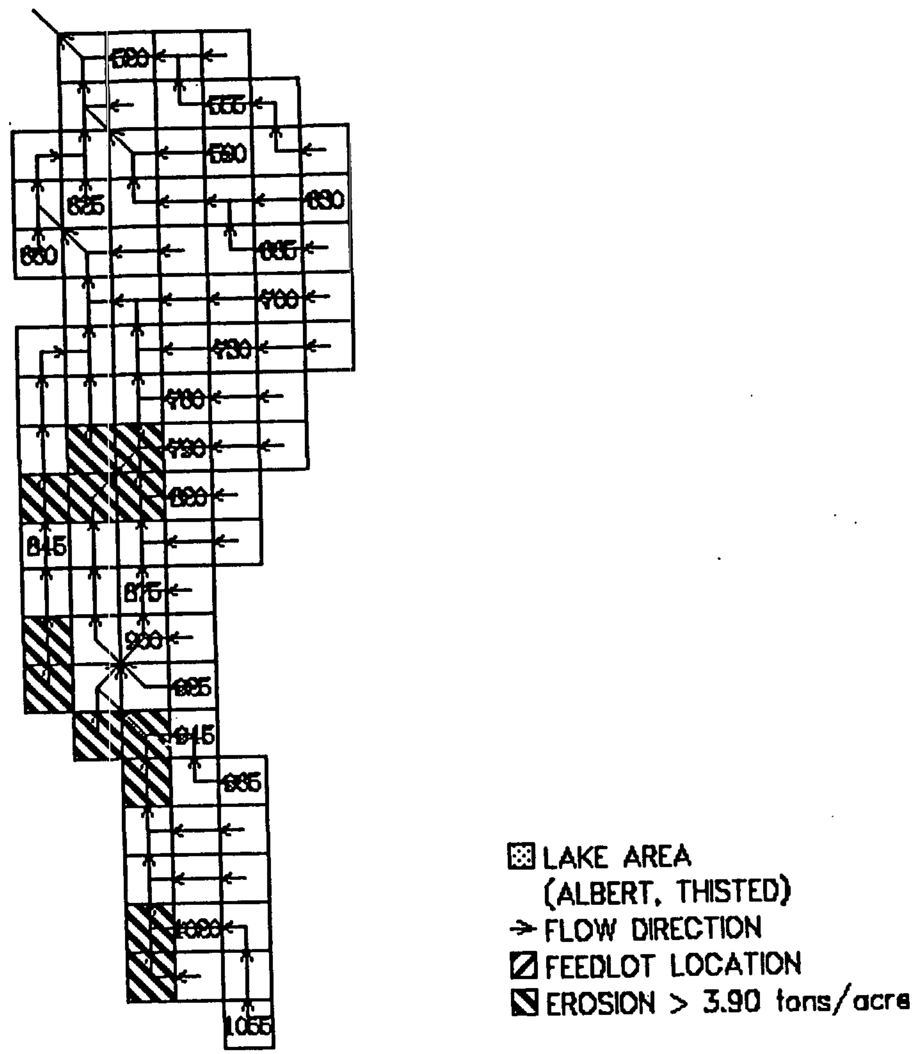
LAKE ALBERT SUBWATERSHED #2 (483 TO 200)

LAKE ALBERT #2 SUBWATERSHED BOUNDARY

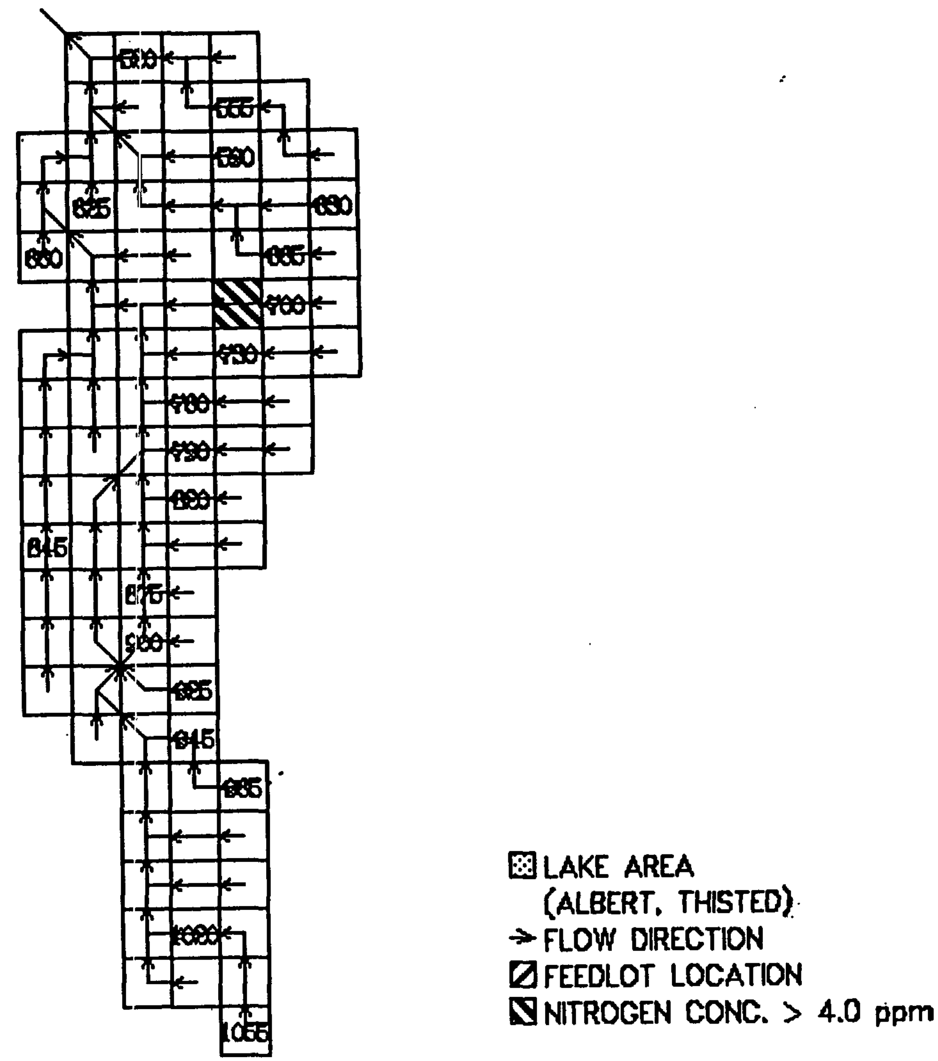



LAKE ALBERT
SUBWATERSHED
#3 (OUTLET CELL #327)
LAKE AREA
(ALBERT, THISTED)
FLOW DIRECTION
FEEDLOT LOCATION
EROSION > 3.9 tons/acre
335
330
355
385
415
445

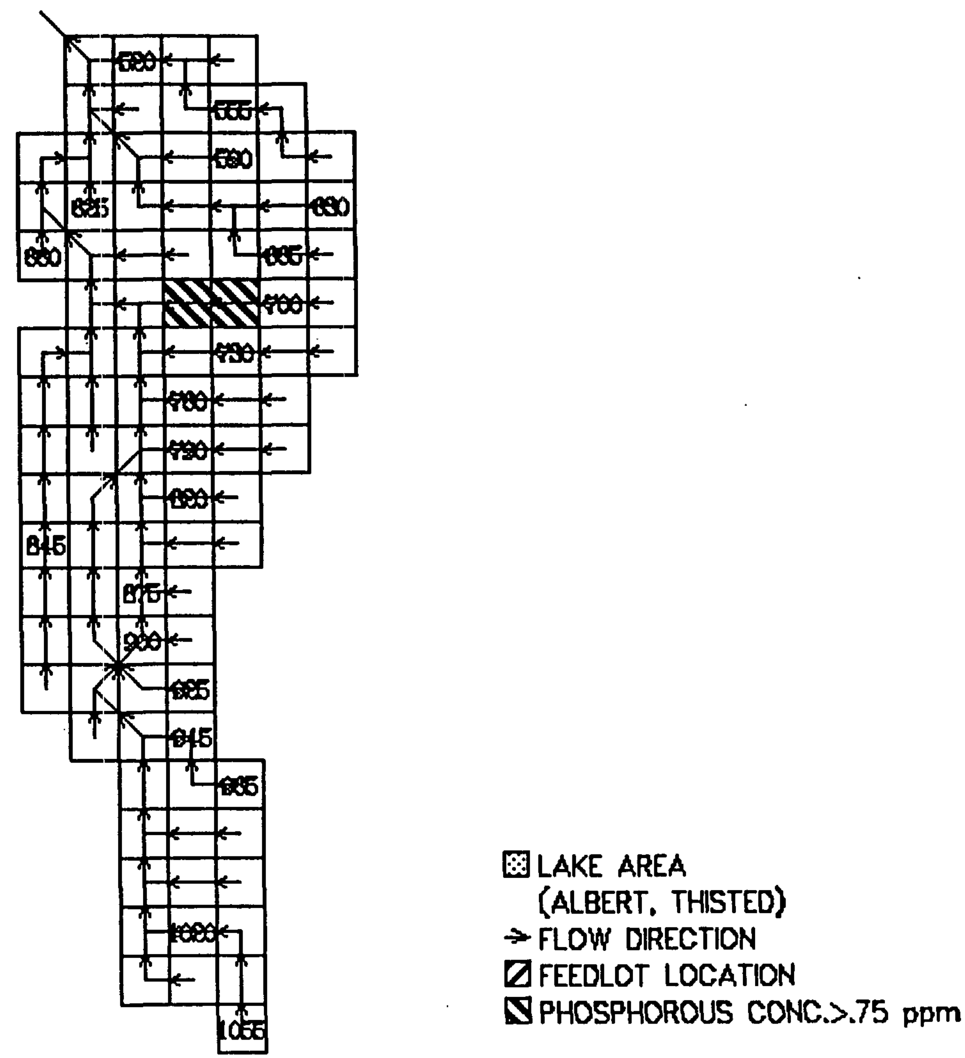
LAKE ALBERT SUBWATERSHED #4 (OUTLET CELL #519)



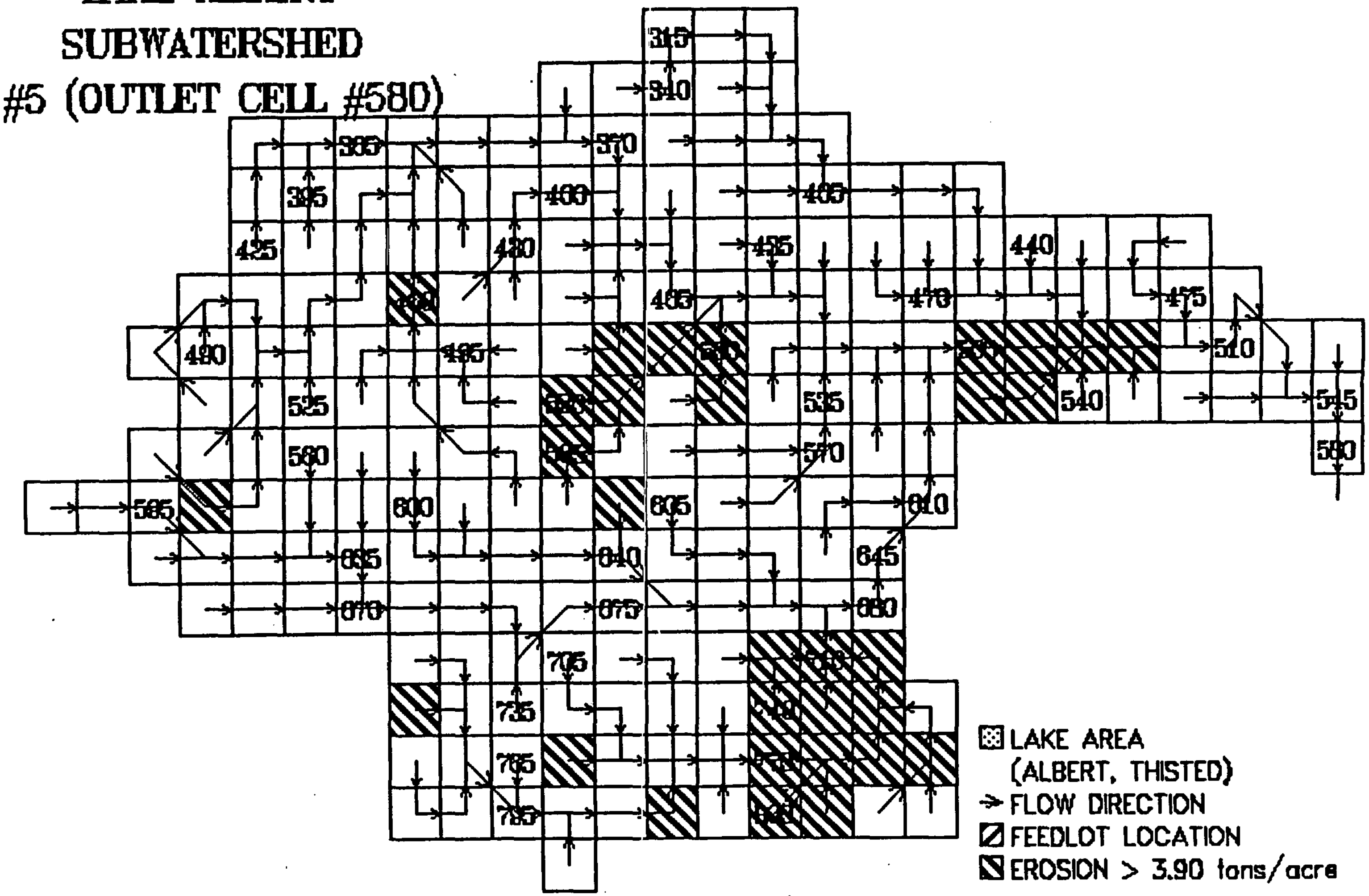
LAKE ALBERT
SUBWATERSHED
#4 (OUTLET CELL #519)



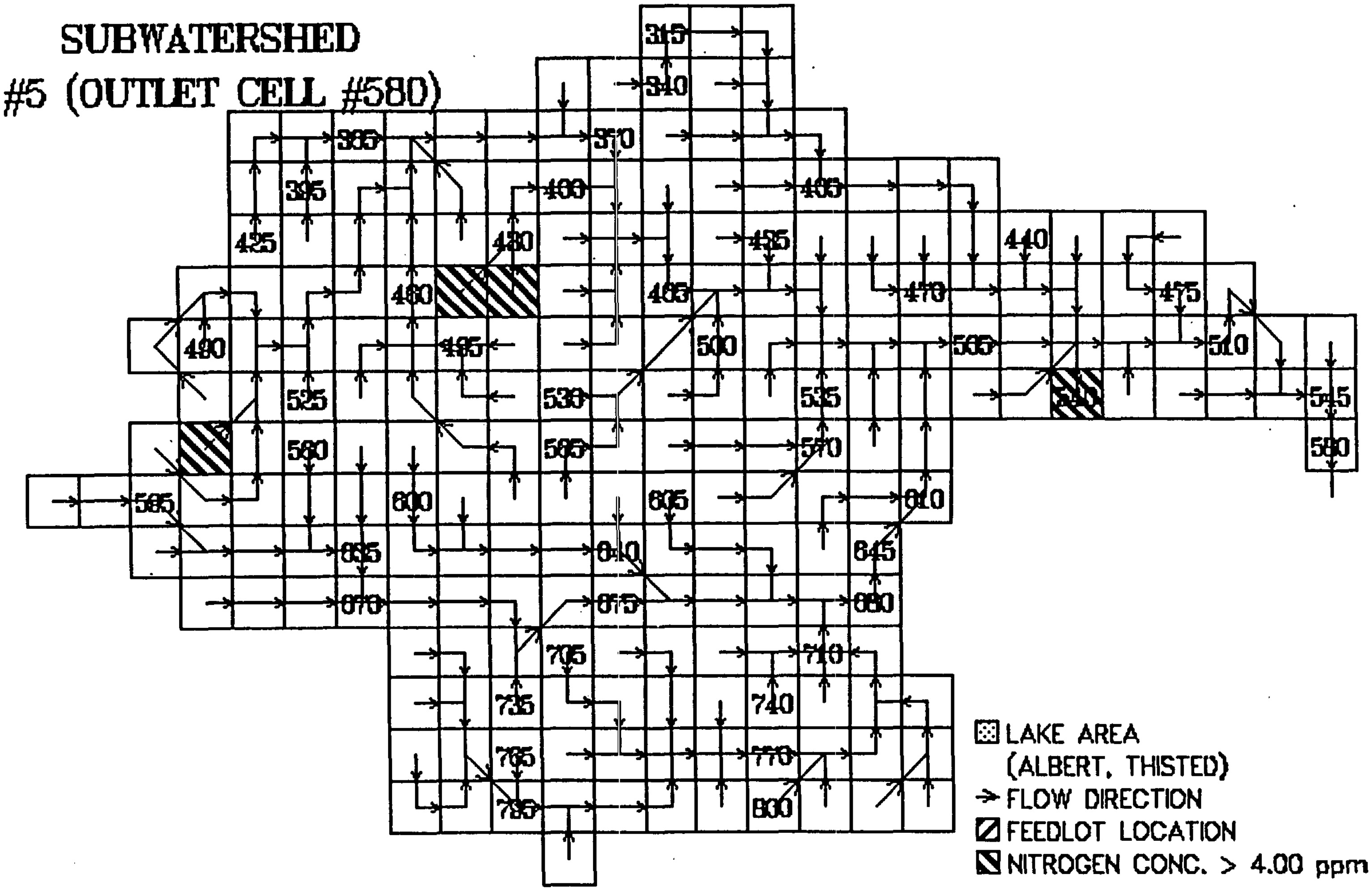
LAKE ALBERT SUBWATERSHED
#4 (OUTLET CELL #519)



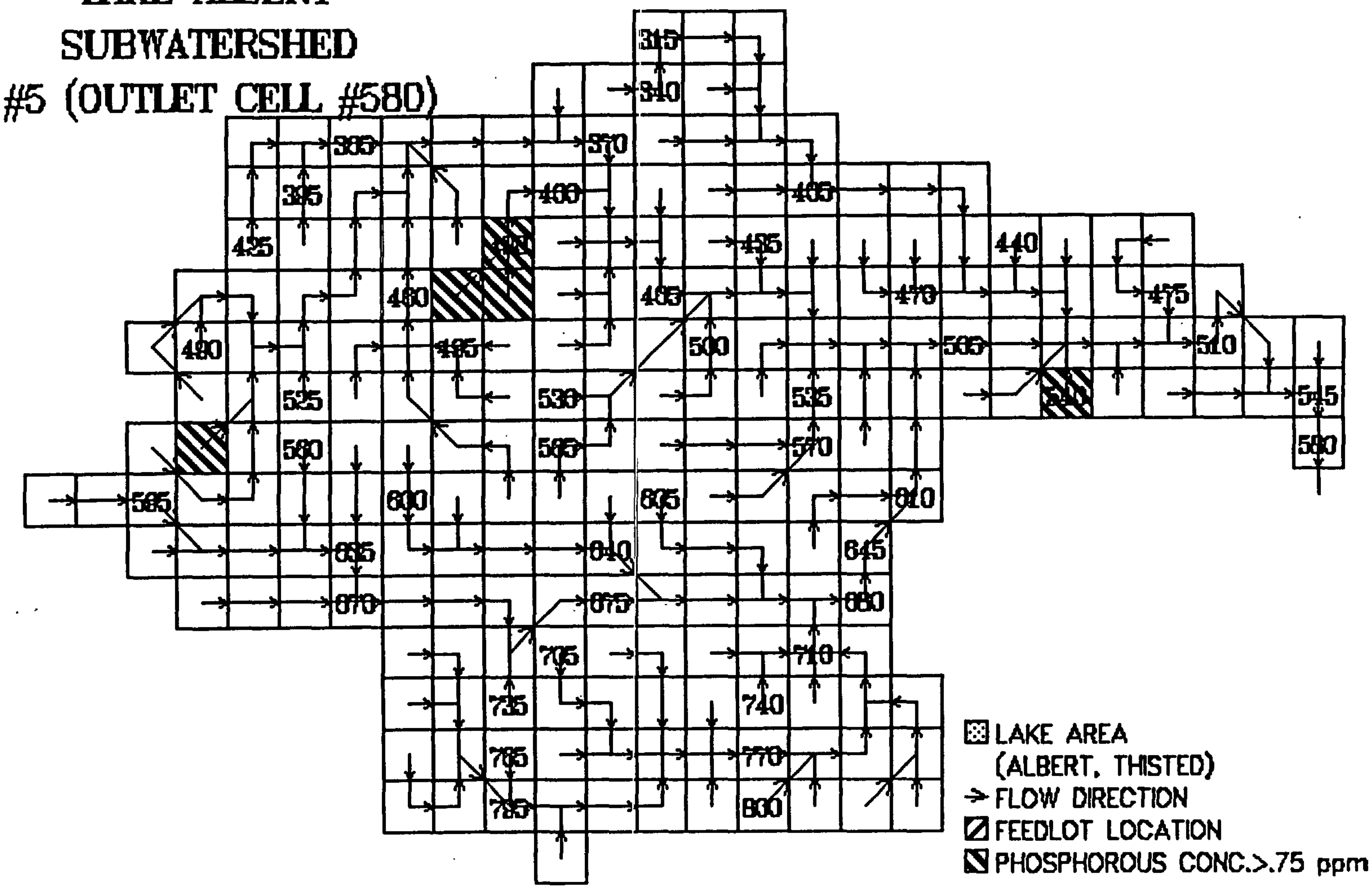
LAKE ALBERT SUBWATERSHED #5 (OUTLET CELL #580)



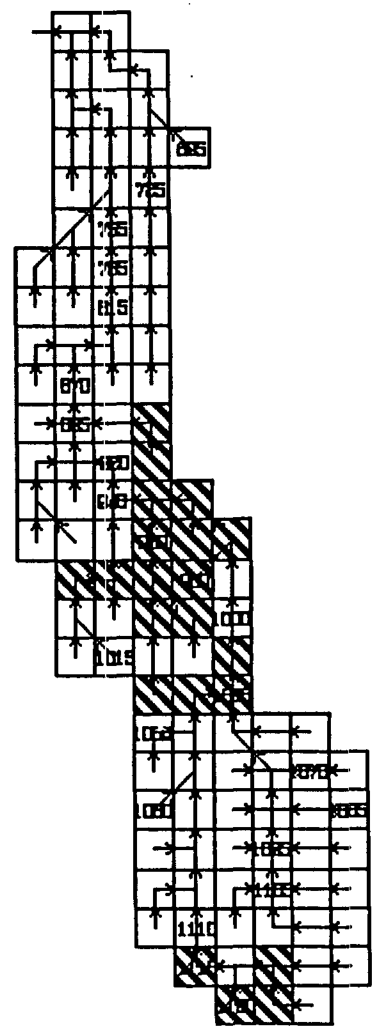
LAKE ALBERT SUBWATERSHED #5 (OUTLET CELL #580)



LAKE ALBERT SUBWATERSHED #5 (OUTLET CELL #580)

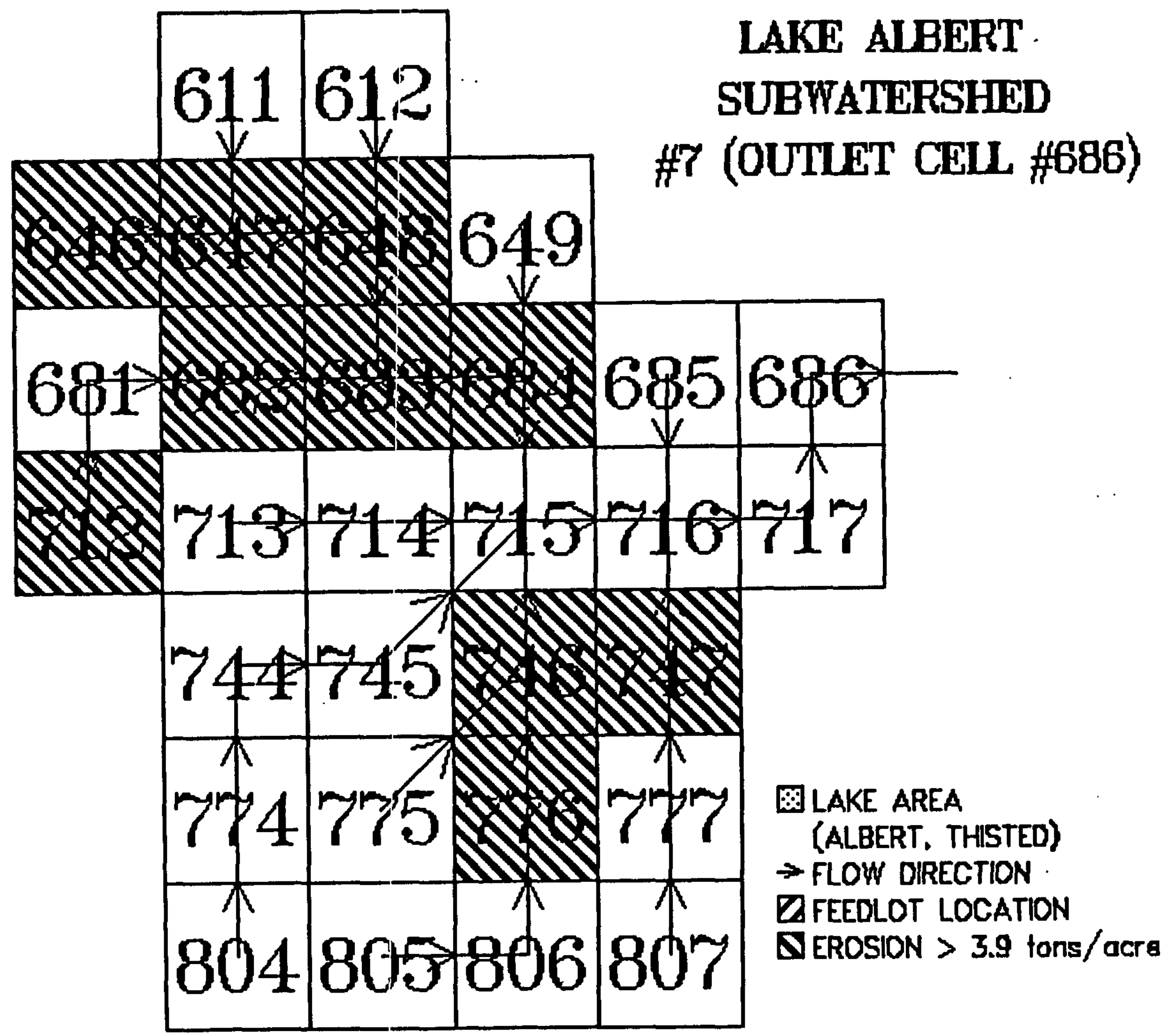


LAKE ALBERT SUBWATERSHED #6 (OUTLET CELL #583)

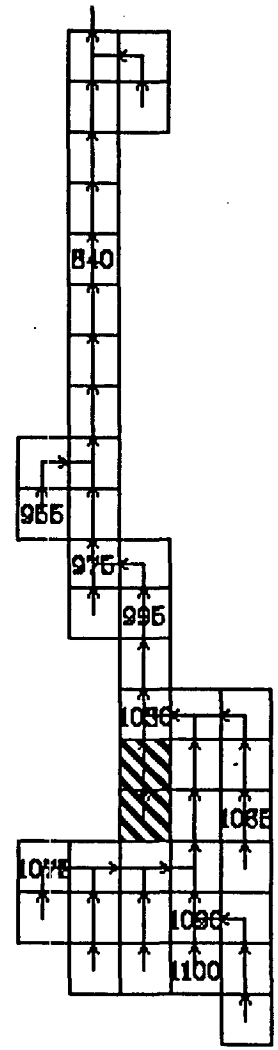


- LAKE AREA (ALBERT, THISTED)
- → FLOW DIRECTION
- FEEDLOT LOCATION
- EROSION > 3.9 tons/acre

LAKE ALBERT
SUBWATERSHED
#7 (OUTLET CELL #686)

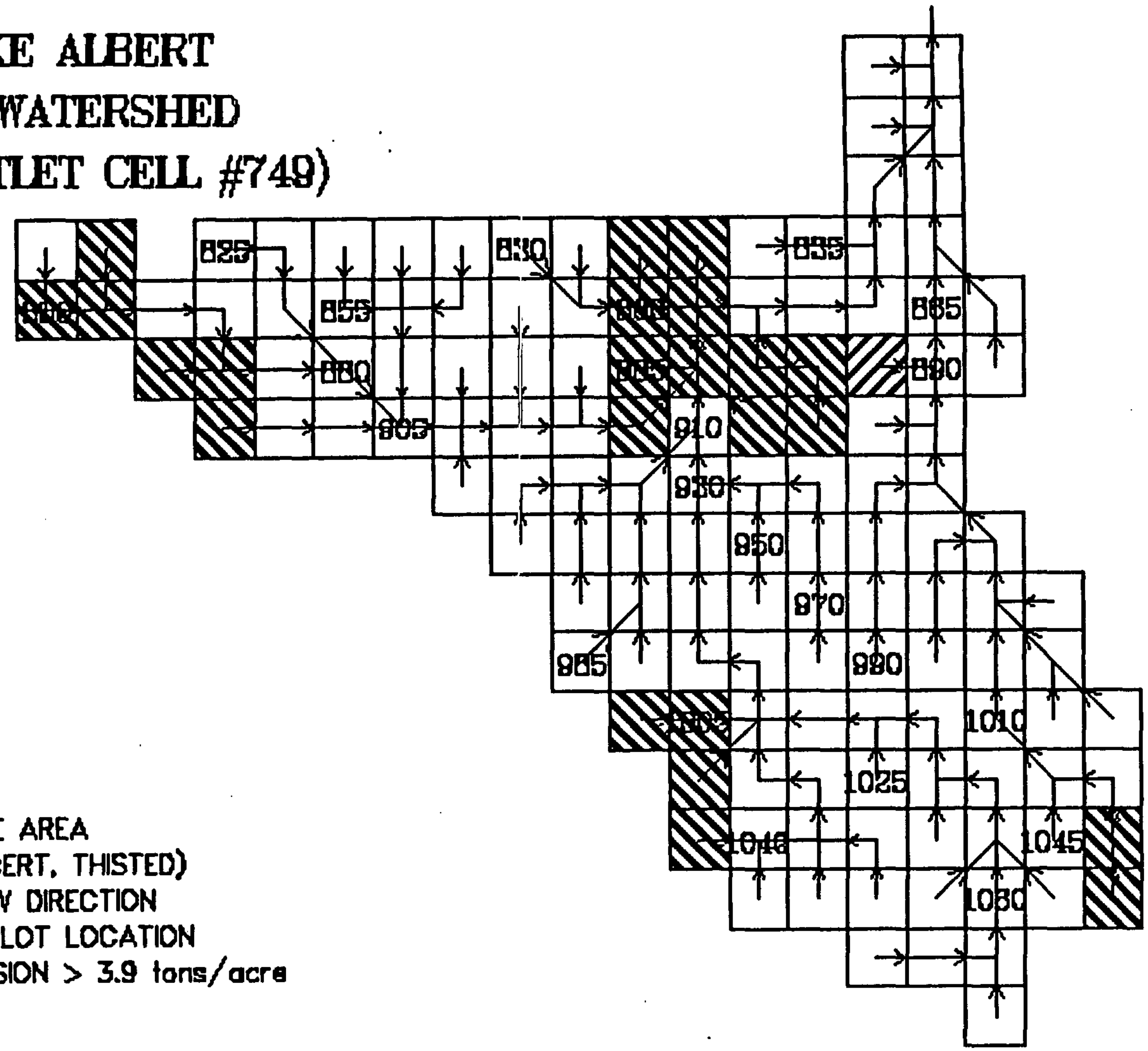


LAKE ALBERT SUBWATERSHED #8 (OUTLET CELL #721)



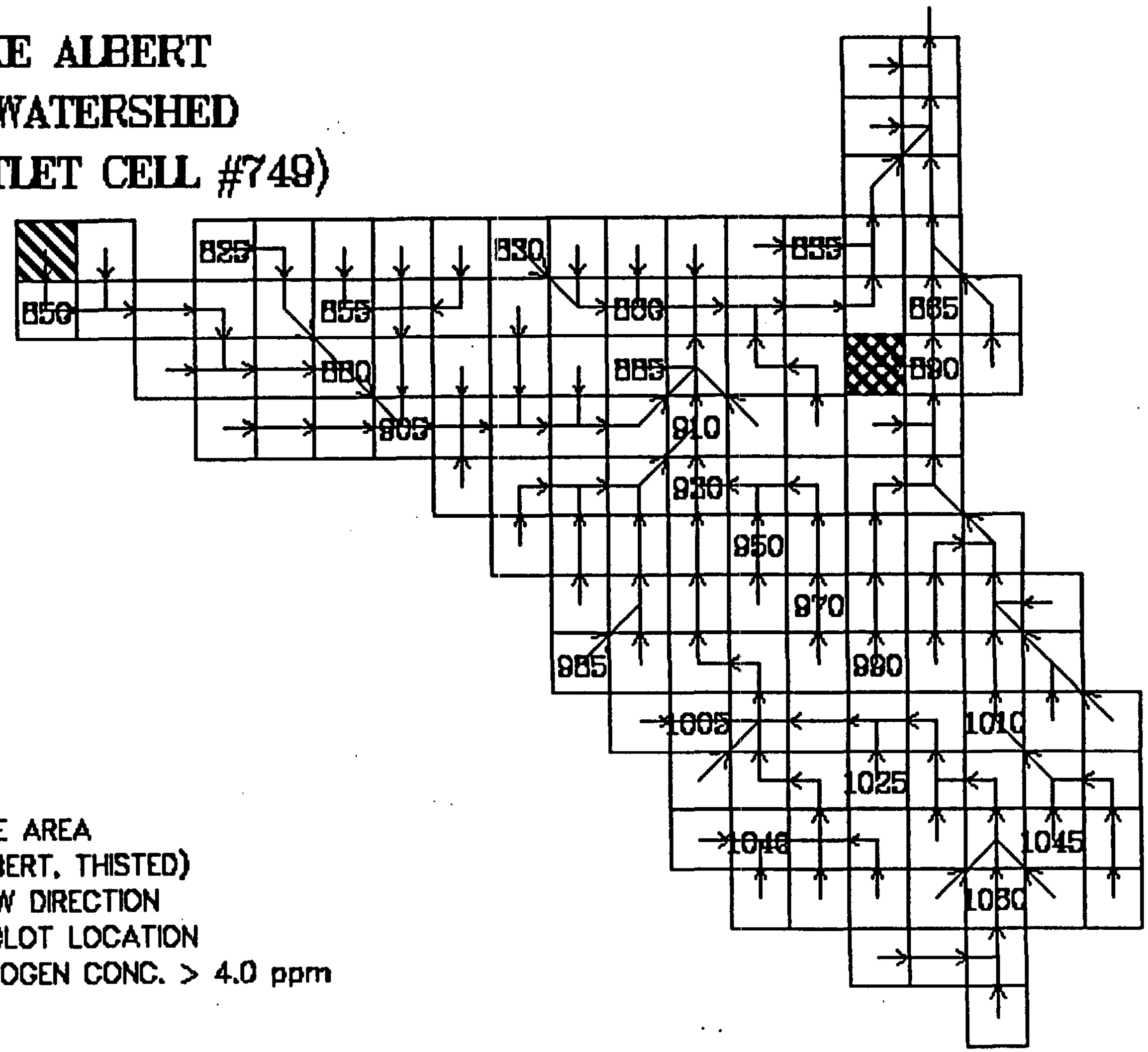
▩ LAKE AREA (ALBERT, THISTED)
→ FLOW DIRECTION
▨ FEEDLOT LOCATION
▧ EROSION > 3.9 tons/acre

LAKE ALBERT SUBWATERSHED #9 (OUTLET CELL #749)



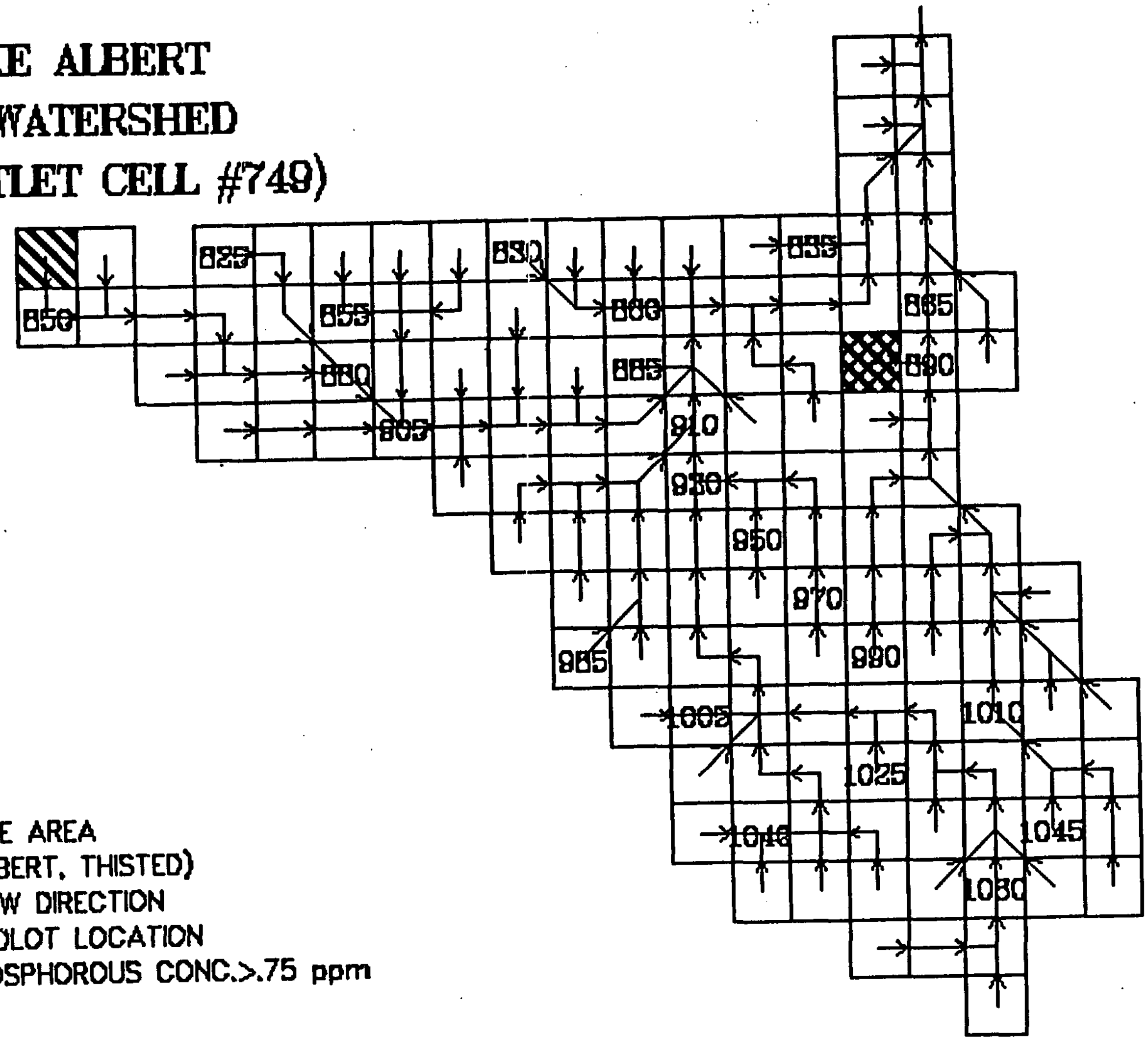
▩ LAKE AREA (ALBERT, THISTED)
→ FLOW DIRECTION
▨ FEEDLOT LOCATION
▧ EROSION > 3.9 tons/acre

LAKE ALBERT SUBWATERSHED #9 (OUTLET CELL #749)



LAKE AREA (ALBERT, THISTED)
→ FLOW DIRECTION
FEEDLOT LOCATION
NITROGEN CONC. > 4.0 ppm

LAKE ALBERT SUBWATERSHED #9 (OUTLET CELL #749)



- LAKE AREA (ALBERT, THISTED)
- → FLOW DIRECTION
- FEEDLOT LOCATION
- PHOSPHOROUS CONC.>.75 ppm

APPENDIX III

DEPARTMENT OF GAME, FISH AND PARKS
District Office
603 East 8th Avenue
Webster, South Dakota 57274

South Dakota
GREAT FACES. GREAT PLACES.

To: Mr. Al Wittmuss
Fr: Matt Hubers
Sub: Lake Poinsett survey information
Date: Jan. 11,1995

Dear Mr. Wittmuss,

As requested per your telephone conversation with Ron Meester and Dave Lucchessi I have enclosed the lake survey reports for 1992-1993 and survey results from 1994 as well as commercial fishing reports.

I have not yet written the survey report for 1994. As you can ascertain from the 1994 tables the most noteworthy changes have occurred in regards to the walleye CPUE's. The increase in catch from 1993 to 1994 can, in part, be attributed to the more efficient recruitment of the relatively strong 1992 and 1991 year classes to our gear. A very good increase in yellow perch catch also occurred. This can be attributed to the high water levels and we hope to our stocking efforts. Should you require the completed lake survey report please notify me so I can supply this to you as soon as I have it completed.

I have enclosed the commercial fishing reports. Please note that these are calculated by fiscal year (July 1-June 30). We have proposed a slight change in the contract for Lake Poinsett. We have lowered the allowable catch of white bass from 20,000 lbs to 10,000 lbs. This was done in response to concerns about the sport fishing catch and in light that commercial catch has declined since 1991. The commercial contracts for white bass on Poinsett are maintained as an incentive for the commercial fishermen to continue removal efforts for carp and buffalo.

Should your require any additional information please contact me.

Sincerely,

Matthew J. Hubers
Resource Biologist-Fisheries
Dept. Game, Fish and Parks

Phone: (605) 345-3381 FAX: (605) 345-4924

CREEL SURVEY ANALYSIS PROGRAM
Open Water - Aerial Count Format

(Two standard errors in parentheses.)

ERROR DUE TO NO ~~WEEKDAY~~ WEEKEND COUNTS

LAKE POINSETT (CATCH)
MAY 1993

6596 (WEEKENDS ONLY)

Total fishing pressure % 1.701412E+38 (% 2.608764E+19) angler hours

% 4.592046E+37 (% 7.123556E+18) angler days

% 2.162445E+34 (%3,315,663,000,000,000) ang h/acre

Percent weekday pressure	100.0 %
Percent weekend and holiday pressure	0.0 %
Percent boat angler pressure	100.0 %
Percent shore angler pressure	0.0 %
Percent South Dakota residents	93.8 %
Mean completed trip length	3.71 hours
Mean number of anglers per boat	2.75 anglers
Number of parties interviewed	16 parties
Number of aerial counts	4 flights

	Catch	Catch/acre	Catch/hour
WALLEYE	3034 % 7.865953E+37 (% 1.393861E+19)	% 9.997398E+33	0.46 (0.54)
YELLOW PERCH	0 (0)	0.00 (0.00)	0.00 (0.00)
WHITE BASS	395 % 9.699334E+36 (% 1.742084E+18)	% 1.232757E+33	0.06 (0.07)
NORTHERN PIKE	0 (0)	0.00 (0.00)	0.00 (0.00)
BLACK BULLHEAD	0 (0)	0.00 (0.00)	0.00 (0.00)
SMALLMOUTH BASS	0 (0)	0.00 (0.00)	0.00 (0.00)
CHANNEL CATFISH	0 (0)	0.00 (0.00)	0.00 (0.00)
BLACK CRAPPIE	0 (0)	0.00 (0.00)	0.00 (0.00)
Totals	% 8.835886E+37 (% 1.404705E+19) 3429	% 1.123016E+34	0.52 (0.54)

CREEL SURVEY ANALYSIS PROGRAM
Open Water - Aerial Count Format

(Two standard errors in parentheses.)

LAKE POINSETT (CATCH)
JUNE 1993

Total fishing pressure	11,909	(3,629)	angler hours
	3,607	(1,225)	angler days
	2	(0)	ang h/acre

Percent weekday pressure	47.5 %
Percent weekend and holiday pressure	52.5 %
Percent boat angler pressure	51.0 %
Percent shore angler pressure	49.0 %
Percent South Dakota residents	96.9 %
Mean completed trip length	3.30 hours
Mean number of anglers per boat	2.34 anglers
Number of parties interviewed	96 parties
Number of aerial counts	14 flights

	Catch	Catch/acre	Catch/hour
WALLEYE	4,021 (1,912)	0.51 (0.24)	0.34 (0.12)
YELLOW PERCH	54 (93)	0.01 (0.01)	0.00 (0.01)
WHITE BASS	3,451 (2,431)	0.44 (0.31)	0.29 (0.18)
NORTHERN PIKE	30 (47)	0.00 (0.01)	0.00 (0.00)
BLACK BULLHEAD	0 (0)	0.00 (0.00)	0.00 (0.00)
SMALLMOUTH BASS	36 (57)	0.00 (0.01)	0.00 (0.00)
CHANNEL CATFISH	7 (14)	0.00 (0.00)	0.00 (0.00)
BLACK CRAPPIE	0 (0)	0.00 (0.00)	0.00 (0.00)
Totals	7,599 (3,095)	0.97 (0.39)	0.64 (0.22)

CREEL SURVEY ANALYSIS PROGRAM
Open Water - Aerial Count Format

(Two standard errors in parentheses.)

LAKE POINSETT (CATCH)
JULY 1993

Total fishing pressure	7,235	(1,816)	angler hours
	2,118	(701)	angler days
	1	(0)	ang h/acre

Percent weekday pressure	55.7	%
Percent weekend and holiday pressure	44.3	%
Percent boat angler pressure	51.7	%
Percent shore angler pressure	48.3	%
Percent South Dakota residents	95.7	%
Mean completed trip length	3.42	hours
Mean number of anglers per boat	2.41	anglers
Number of parties interviewed	94	parties
Number of aerial counts	22	flights

	Catch	Catch/acre	Catch/hour
WALLEYE	1,387 (740)	0.18 (0.09)	0.19 (0.09)
YELLOW PERCH	16 (33)	0.00 (0.00)	0.00 (0.00)
WHITE BASS	4,097 (1,974)	0.52 (0.25)	0.57 (0.23)
NORTHERN PIKE	83 (98)	0.01 (0.01)	0.01 (0.01)
BLACK BULLHEAD	0 (0)	0.00 (0.00)	0.00 (0.00)
SMALLMOUTH BASS	100 (137)	0.01 (0.02)	0.01 (0.02)
CHANNEL CATFISH	0 (0)	0.00 (0.00)	0.00 (0.00)
BLACK CRAPPIE	0 (0)	0.00 (0.00)	0.00 (0.00)
Totals	5,683 (2,115)	0.72 (0.27)	0.79 (0.25)

CREEL SURVEY ANALYSIS PROGRAM
Open Water - Aerial Count Format

(Two standard errors in parentheses.)

LAKE POINSETT (CATCH)
AUGUST 1993

Total fishing pressure	3,092	(695)	angler hours
	965	(284)	angler days
	0	(0)	ang h/acre

Percent weekday pressure	67.4 %
Percent weekend and holiday pressure	32.6 %
Percent boat angler pressure	59.8 %
Percent shore angler pressure	40.2 %
Percent South Dakota residents	96.0 %
Mean completed trip length	3.21 hours
Mean number of anglers per boat	2.27 anglers
Number of parties interviewed	50 parties
Number of aerial counts	18 flights

	Catch	Catch/acre	Catch/hour
WALLEYE	501	0.06	0.16
	(338)	(0.04)	(0.10)
YELLOW PERCH	25	0.00	0.01
	(36)	(0.00)	(0.01)
WHITE BASS	388	0.05	0.13
	(316)	(0.04)	(0.10)
NORTHERN PIKE	15	0.00	0.01
	(31)	(0.00)	(0.01)
BLACK BULLHEAD	10	0.00	0.00
	(19)	(0.00)	(0.01)
SMALLMOUTH BASS	309	0.04	0.10
	(501)	(0.06)	(0.16)
CHANNEL CATFISH	0	0.00	0.00
	(0)	(0.00)	(0.00)
BLACK CRAPPIE	0	0.00	0.00
	(0)	(0.00)	(0.00)
Totals	1,249	0.16	0.40
	(684)	(0.09)	(0.22)

CREEL SURVEY ANALYSIS PROGRAM
Open Water - Aerial Count Format

(Two standard errors in parentheses.)

LAKE POINSETT (CATCH)
SEPTEMBER 1993

Total fishing pressure	5,970	(2,088)	angler hours
	1,766	(1,141)	angler days
	1	(0)	ang h/acre

Percent weekday pressure	53.2 %
Percent weekend and holiday pressure	46.8 %
Percent boat angler pressure	51.1 %
Percent shore angler pressure	48.9 %
Percent South Dakota residents	93.5 %
Mean completed trip length	3.38 hours
Mean number of anglers per boat	2.05 anglers
Number of parties interviewed	31 parties
Number of aerial counts	6 flights

	Catch	Catch/acre	Catch/hour
WALLEYE	569 (600)	0.07 (0.08)	0.10 (0.09)
YELLOW PERCH	0 (0)	0.00 (0.00)	0.00 (0.00)
WHITE BASS	582 (570)	0.07 (0.07)	0.10 (0.09)
NORTHERN PIKE	20 (41)	0.00 (0.01)	0.00 (0.01)
BLACK BULLHEAD	0 (0)	0.00 (0.00)	0.00 (0.00)
SMALLMOUTH BASS	408 (783)	0.05 (0.10)	0.07 (0.13)
CHANNEL CATFISH	0 (0)	0.00 (0.00)	0.00 (0.00)
BLACK CRAPPIE	0 (0)	0.00 (0.00)	0.00 (0.00)
Totals	1,579 (1,140)	0.20 (0.14)	0.26 (0.18)

CREEL SURVEY ANALYSIS PROGRAM
Open Water - Aerial Count Format

(Two standard errors in parentheses.)

LAKE POINSETT (CATCH)
MAY 1994

Total fishing pressure	11,942	(3,161)	angler hours
	3,793	(1,128)	angler days
	2	(0)	ang h/acre

Percent weekday pressure	39.4 %
Percent weekend and holiday pressure	60.6 %
Percent boat angler pressure	63.9 %
Percent shore angler pressure	36.1 %
Percent South Dakota residents	92.9 %
Mean completed trip length	3.15 hours
Mean number of anglers per boat	2.27 anglers
Number of parties interviewed	70 parties
Number of aerial counts	12 flights

	Catch	Catch/acre	Catch/hour
WALLEYE	2,477 (1,411)	0.31 (0.18)	0.21 (0.10)
YELLOW PERCH	0 (0)	0.00 (0.00)	0.00 (0.00)
WHITE BASS	3,590 (2,796)	0.46 (0.36)	0.30 (0.22)
NORTHERN PIKE	1,219 (1,515)	0.15 (0.19)	0.10 (0.12)
BLACK BULLHEAD	0 (0)	0.00 (0.00)	0.00 (0.00)
SMALLMOUTH BASS	0 (0)	0.00 (0.00)	0.00 (0.00)
CHANNEL CATFISH	57 (115)	0.01 (0.01)	0.00 (0.01)
BLACK CRAPPIE	195 (393)	0.02 (0.05)	0.02 (0.03)
Totals	7,538 (3,503)	0.96 (0.45)	0.63 (0.28)

CREEL SURVEY ANALYSIS PROGRAM
Open Water - Aerial Count Format

(Two standard errors in parentheses.)

LAKE POINSETT (CATCH)
JUNE 1994

Total fishing pressure	12,455	(2,166)	angler hours
	2,583	(479)	angler days
	2	(0)	ang h/acre

Percent weekday pressure	47.2 %
Percent weekend and holiday pressure	52.8 %
Percent boat angler pressure	80.5 %
Percent shore angler pressure	19.5 %
Percent South Dakota residents	95.5 %
~~Mean completed trip length~~	4.82 hours
Mean number of anglers per boat	2.25 anglers
Number of parties interviewed	157 parties
Number of aerial counts	22 flights

	Catch	Catch/acre	Catch/hour
WALLEYE	5,921	0.75	0.48
	(1,623)	(0.21)	(0.10)
YELLOE PERCH	41	0.01	0.00
	(50)	(0.01)	(0.00)
WHITE BASS	1,162	0.15	0.09
	(784)	(0.10)	(0.06)
NORTHERN PIKE	435	0.06	0.03
	(202)	(0.03)	(0.01)
BLACK BULLHEAD	24	0.00	0.00
	(48)	(0.01)	(0.00)
SMALLMOUTH BASS	36	0.00	0.00
	(39)	(0.00)	(0.00)
CHANNEL CATFISH	54	0.01	0.00
	(90)	(0.01)	(0.01)
BLACK CRAPPIE	0	0.00	0.00
	(0)	(0.00)	(0.00)
Totals	7,673	0.98	0.62
	(1,817)	(0.23)	(0.12)

CREEL SURVEY ANALYSIS PROGRAM
Open Water - Aerial Count Format

(Two standard errors in parentheses.)

LAKE POINSETT (CATCH)
JULY 1994

Total fishing pressure	6,944	(1,653)	angler hours
	1,947	(562)	angler days
	1	(0)	ang h/acre

Percent weekday pressure	24.0 %
Percent weekend and holiday pressure	76.0 %
Percent boat angler pressure	80.4 %
Percent shore angler pressure	19.6 %
Percent South Dakota residents	97.7 %
Mean completed trip length	3.57 hours
Mean number of anglers per boat	2.08 anglers
Number of parties interviewed	86 parties
Number of aerial counts	22 flights

	Catch	Catch/acre	Catch/hour
WALLEYE	1,964	0.25	0.28
	(1,115)	(0.14)	(0.15)
YELLOW PERCH	0	0.00	0.00
	(0)	(0.00)	(0.00)
WHITE BASS	662	0.08	0.10
	(722)	(0.09)	(0.10)
NORTHERN PIKE	196	0.02	0.03
	(188)	(0.02)	(0.03)
BLACK BULLHEAD	0	0.00	0.00
	(0)	(0.00)	(0.00)
SMALLMOUTH BASS	133	0.02	0.02
	(195)	(0.02)	(0.03)
CHANNEL CATFISH	0	0.00	0.00
	(0)	(0.00)	(0.00)
BLACK CRAPPIE	0	0.00	0.00
	(0)	(0.00)	(0.00)
Totals	2,955	0.38	0.43
	(1,356)	(0.17)	(0.18)

CREEL SURVEY ANALYSIS PROGRAM
Open Water - Aerial Count Format

(Two standard errors in parentheses.)

LAKE POINSETT (CATCH)
AUGUST 1994

Total fishing pressure	4,881	(904)	angler hours
	1,328	(360)	angler days
	1	(0)	ang h/acre

Percent weekday pressure	45.2	%
Percent weekend and holiday pressure	54.8	%
Percent boat angler pressure	83.4	%
Percent shore angler pressure	16.6	%
Percent South Dakota residents	98.4	%
Mean completed trip length	3.68	hours
Mean number of anglers per boat	1.98	anglers
Number of parties interviewed	63	parties
Number of aerial counts	24	flights

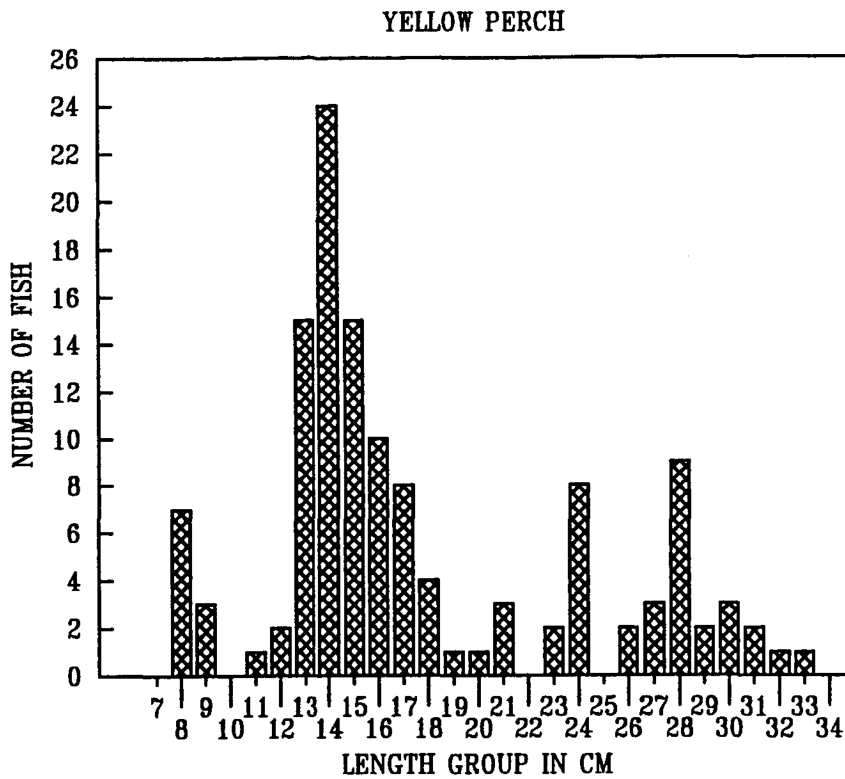
	Catch	Catch/acre	Catch/hour
WALLEYE	2,293	0.29	0.47
	(1,030)	(0.13)	(0.19)
YELLOW PERCH	112	0.01	0.02
	(128)	(0.02)	(0.03)
WHITE BASS	786	0.10	0.16
	(851)	(0.11)	(0.17)
NORTHERN PIKE	119	0.02	0.02
	(101)	(0.01)	(0.02)
BLACK BULLHEAD	45	0.01	0.01
	(90)	(0.01)	(0.02)
SMALLMOUTH BASS	81	0.01	0.02
	(150)	(0.02)	(0.03)
CHANNEL CATFISH	0	0.00	0.00
	(0)	(0.00)	(0.00)
BLACK CRAPPIE	0	0.00	0.00
	(0)	(0.00)	(0.00)
Totals	3,436	0.44	0.70
	(1,357)	(0.17)	(0.26)

Table 1. Total catch of 8/150 ft. experimental gill net sets in Lake Poinsett, Hamlin County, Aug. 2–5, 1994.

SPECIES	%COMP	N	CPUE 80%C.I	PAST 3 YEAR MEAN CPUE	PSD	WR
WAE	36.19	173	21.63+–5.22	12.38	43	138
YEP	46.86	224	28.00+–6.30	14.42	32	118
COC	0.42	2	0.25+–0.23	3.04	–	–
WHB	4.39	21	2.63+–1.13	3.09	100	107
WHS	6.69	32	4.00+–1.17	2.02	–	–
SMB	0.21	1	0.13+–0.18	–	–	–
BLB	3.77	18	2.25+–2.22	–	–	–
CCF	1.46	7	0.88+–1.05	0.22	–	–

Table 2. Total catch of twenty 3/4 in. mesh frame net sets in Lake Poinsett, Hamlin County, Aug. 2–5, 1994.

SPECIES	%COMP	N	CPUE 80%C.I	PSD	WR
COC	5.23	119	5.95+–2.20	95	–
BLB	90.24	2053	102.65+–69.02	3	–
BLC	0.13	3	0.15+–0.15	–	–
NOP	1.58	36	1.80+–0.63	47	86
WAE	0.92	21	1.05+–0.53	55	94
SAB	0.31	7	0.35+–0.28	–	–
WHS	0.31	7	0.35+–0.20	–	–
SMB	1.27	29	1.45+–1.22	8	109



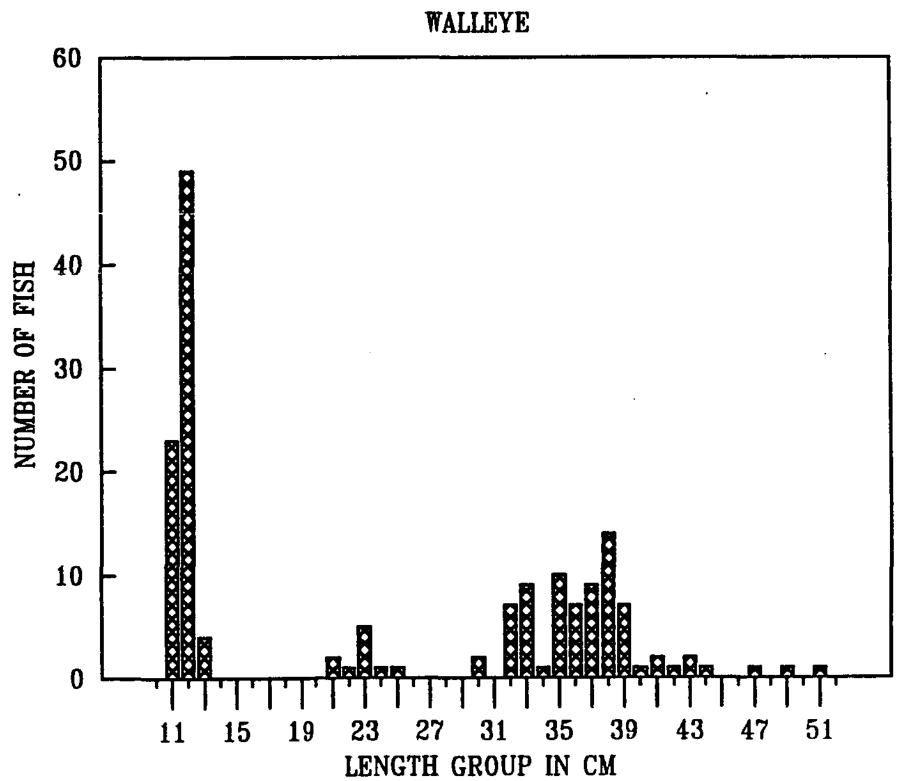


FIGURE 2.
LENGTH FREQUENCY FOR YELLOW PERCH AND WALLEYE FROM 150 FT. EXPERIMENTAL GILL NET SETS IN LAKE POINSETT, 1994.

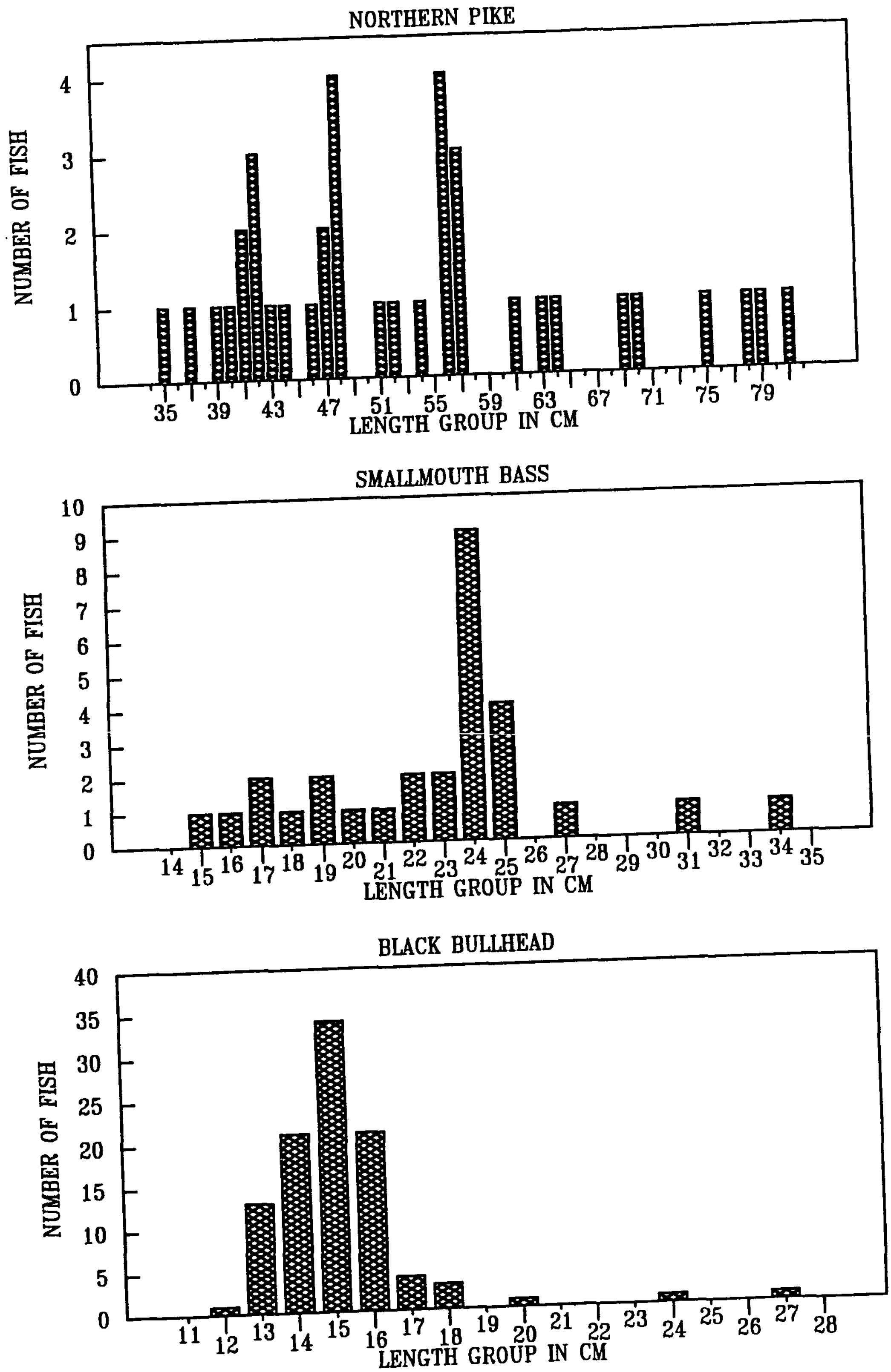


FIGURE 1.
LENGTH FREQUENCY FOR SELECTED SPECIES FROM 3/4 INCH FRAME NET SETS IN LAKE POINSETT, 1994.

Stockings conducted in 1994

Record#	WATER	SPECIES	SIZE	NUM_STOKED	YEAR
112	POINSETT	WAE	SFG	338300	1994
113	POINSETT	WAE	SFG	350000	1994
114	POINSETT	WAE	SFG	285000	1994
115	POINSETT	WAE	SFG	275000	1994
116	POINSETT	YEP	FGL	231975	1994

AMERICAN EEL	AEL
BANDED KILLIFISH	BAK
BIGMOUTH BUFFALO	BIB
BIGMOUTH SHINER	BIS
BLACK BULLHEAD	BLB
BLACK CRAPPIE	BLC
BLACKCHIN SHINER	BLS
BLACKNOSE DACE	BLD
BLACKNOSE SHINER	BES
BLACKSIDE DARTER	BED
BLUE CATFISH	BCF
BLUE SUCKER	BSR
BLUEGILL	BLG
BLUEGILL-GREEN SUNFISH HYBRID	BGH
BLUNTNOSE MINNOW	BLM
BOWFIN	BON
BRASSY MINNOW	BRM
BROOK STICKLEBACK	BRS
BROOK TROUT	BKT
BROWN BULLHEAD	BNB
BROWN TROUT	BNT
BURBOT	BUR
CENTRAL MUDMINNOW	CEM
CHANNEL CATFISH	CCF
COHO SALMON	COS
COMMON CARP	COC
COMMON SHINER	CNS
CREEK CHUB	CRC
CUTTHROAT TROUT	CUT
EMERALD SHINER	EMS
EUROPEAN RUDD	EUR
FALL CHINOOK SALMON	FCS
FATHEAD MINNOW	FHM
FINESCALE DACE	FID
FLATHEAD CATFISH	FCF
FLATHEAD CHUB	FLC
FRESHWATER DRUM	FRD
GIZZARD SHAD	GZD
GOLDEN REDHORSE	GOR
GOLDEN SHINER	GOS
GOLDEYE	GOE
GOLDFISH	GOF
GRASS CARP	GRC
GREEN SUNFISH	GSF
HORNYHEAD CHUB	HOC
IOWA DARTER	IOD
JOHNNY DARTER	JOD
KOKANEE SALMON	KOS
LAKE CHUB	LAC
LAKE HERRING	LAH
LAKE TROUT	LAT
LAKE WHITEFISH	LAW
LARGEMOUTH BASS	LMB
LOGPERCH	LOP
LONGNOSE DACE	LOD
LONGNOSE GAR	LOG
LONGNOSE SUCKER	LOS
MOUNTAIN SUCKER	MOS
MUSKELLUNGE	MUE
NORTHERN HOG SUCKER	NHS
NORTHERN PIKE	NOP
NORTHERN REDBELLY DACE	NRD
ORANGESPOTTED SUNFISH	OSF
PADDLEFISH	PAH
PALLID STURGEON	PAS
PEARL DACE	PED
PLAINS KILLIFISH	PLK
PLAINS MINNOW	PLM
PLAINS TOPMINNOW	PLT
PUMPKINSEED	PUS
QUILLBACK SUCKER	QUS
RAINBOW SMELT	RBS
RAINBOW TROUT	RBT
RED SHINER	RES
RIVER CARPSUCKER	RIC
RIVER SHINER	RIS
ROCK BASS	ROB
ROSYFACE SHINER	ROS
SAND SHINER	SAS
SAUGER	SAR
SAUGEYE	SXW
SHORTHEAD REDHORSE	SHR
SHORTNOSE GAR	SHG
SHOVELNOSE STURGEON	SHS
SICKLEFIN CHUB	SIC
SILVER CHUB	SRC
SILVER LAMPREY	SIL
SILVERBAND SHINER	SIS
SILVERY MINNOW	SIM
SKIPJACK HERRING	SKH
SLENDERHEAD DARTER	SLD
SMALLMOUTH BASS	SMB
SMALLMOUTH BUFFALO	SAB
SPLAKE TROUT	SPT
SPOTTAIL SHINER	SPS
STEELHEAD TROUT	STT
STONECAT	STC
STONEROLLER	STR
STURGEON CHUB	SNC
SUCKERMOUTH MINNOW	SUM
TADPOLE MADTOM	TAM
TIGER MUSKIE	TMU
TOPEKA SHINER	TOS
TROUT-PERCH	TRP
WALLEYE	WAE
WHITE BASS	WHB
WHITE CRAPPIE	WHC
WHITE SUCKER	WHS
YELLOW BULLHEAD	YEB
YELLOW PERCH	YEP
OTHER	OTH

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-27

Name: Lake Poinsett County(ies): Hamlin
Legaldescription: Sec.14-16,20-22T113N,R52W.Sec.23,26-33,T112,R52W
Location from nearest town: Seven miles west of Estelline
Dates of present survey: August 4-8, 1993
Date last surveyed: August 4-7, 1992
Most recent lake management plan: F21-R-27 Date: 1994
Management classification: Warm water semi-permanent
Contour mapped: Date: 1964
Report prepared by: Matthew J. Hubers

Primary Species: (game & forage)	Secondary and other species:
1. Walleye	1. Common Carp
2. Yellow Perch	2. Northern Pike
3. White Bass	3. Black Crappie
4. Smallmouth Bass	4. Johnny Darter
5. Spottail Shiner	5. Bigmouth Buffalo
6. Fathead Minnow	6. Channel Catfish
7. White Sucker	7.

PHYSICAL CHARACTERISTICS

Surface Area: 7868 acres; Watershed: 198561 acres
Maximum depth: 22 feet; Mean depth: 9 feet
Lake elevation at survey (from known benchmark): Full feet

1. Describe ownership of lake and adjacent lakeshore property:

   Lake Poinsett is a meandered lake owned by the State of South Dakota and managed by the Dept. of Game, Fish and Parks. The lakeshore is under both private and State ownership. The Game, Fish and Parks Dept. operates a recreation area on the south side of the lake and has three additional access areas. The remainder of the lakeshore is comprised of cabin sites and agricultural land.

2. Describe watershed condition and percentages of land use:

   The land in the watershed is utilized for cropland (70%), pasture land (25%), and the remainder is woodland (5%).

3. Describe aquatic vegetative condition:

   Due to the morphology, sandy substrate, and exposed nature of Lake Poinsett, it is very difficult for both submergent and emergent vegetation to become established.

4. Describe pollution problems:

Lake Poinsett is a hyper-eutrophic lake. The major nutrient inflow is caused by the Sioux River Diversion. Agricultural run-off is also a major contributor of nutrients. The result of this high nutrient supply are extensive algal blooms that at times hamper recreation during the summer months.

5. Describe condition of all structures, i.e. spillway, level, regulators, boatramps, etc.:

The boatramps as well as the other facilities present are in good working order.

Chemical Data

1. Describe general water quality characteristics.

No water Chemistry was conducted.

BIOLOGICAL DATA

1. Methods:

Lake Poinsett was surveyed from August 4-9, 1993. Eight 150' experimental gill net sets were used to assess the fish population. (Table 1). Because of extremely high water levels no frame nets were set in 1993. Lake Poinsett was shoreline seined on May 27, June 21 and July 2, 1993 with a 1/8" X 6' X 60' bag seine (Figures 2-4). Scales were taken from all walleye sampled and analyzed using the DisBcal program (Table 2). Wr and PSD calculations were done using the FishCalc program and results incorporated into table 1. A creel survey was conducted on Lake Poinsett from May-September. The creel data was analyzed using the Dbase Creel Survey Analysis Program. The creel information will only be briefly mentioned as a separate report will be prepared.

2. Results and Discussion:

The walleye gill net CPUE of 9.75 showed a slight decline from 13.38 in 1992 and is below the three year mean of 12.38. This decrease may in part be attributed to the high water conditions. During the 1992 survey the 1991 year-class comprised approximately 75% of the gill net sample and in 1993 this percentage increased to 84% as 48 of the 57 fish sampled belonged to the 1991 year-class. The 1991 year-class ranged in length at capture from 280 to 380mm (Figure 1). The length frequency of the angler walleye harvest showed that most fish harvested ranged in length from 360-380 mm (Figure 5). These walleyes most likely belonged to the 1991 year-class.
Currently the walleye fishery in Lake Poinsett depends very heavily on the 1991 year-class. The 356mm (14 in) length limit

has effectively protected this year-class as fishermen released 89% of fish caught. Shoreline seining produced a mean catch per haul of 0.94. This is not significantly different from the 0.92 found in 1992 but is down considerably from 44.50 found in 1991.

Yellow perch displayed an increase in PSD from 31 in 1992 to 60 in 1993. This increase may be explained by the large number of stock length (130-199 mm) fish sampled in 1992 moving into the preferred and quality categories. High water in 1993 seems to have facilitated natural reproduction. Shoreline seining resulted in a mean catch per seine haul of 3.06 in 1993 compared to zero for 1992 and 1991. Stocking of yellow perch fingerlings in 1993 (Table 5) to augment the population and anticipated high water levels in 1994 should benefit the yellow perch population in Lake Poinsett.

The white bass CPUE has decreased from 3.60 in 1992 to 2.63 in 1993. The commercial harvest of white bass has declined from 19,968 lbs (1991) to 10,075 lbs (1992) to 5030 lbs (1993). The mean catch rate for May-September 1993 was 0.23/hour. This is an increase from the 0.10/hour seen in 1992 but below the 0.30 white bass/hr found in 1991. No white bass young-of-year were seen during the shoreline seining in 1993 indicating that natural reproduction was poor. The white bass population is under intense pressure from commercial harvest. During May - September the angler harvest of white bass was 6711 fish compared to 3893 walleye. White bass provide a popular and an important sport fishery on Lake Poinsett. Thought should be given to removing white bass from the commercial fishing list on Lake Poinsett since commercial removal maybe having negative effects on the sport fishery.

RECOMMENDATIONS

1. Continue to manage primarily for walleye, yellow perch and white bass.
2. Stock walleye fry (2000/ac) in 1994.
3. Continue to encourage commercial removal of bigmouth buffalo and common carp.
4. Consider the removal of white bass from the commercial fishing list.
5. Electrofish to assess smallmouth bass population.
6. Resurvey annually.
7. Creel survey to further assess 35.6 cm (14 in) length limit, angler success, and harvest.

APPENDIX

1. Length-frequency histograms, age and growth tables, tables listing samples obtained and population parameters.

2. Stocking record for prior 10 years to present or last renovation or winter-kill.

3. Attach contour map showing sampling locations.

Table 1. Total catch of 8/150 ft. experimental gill net sets in Lake Poinsett, Hamlin County, Aug. 4–6, 1993.

SPECIES	%COMP	N	CPUE 80%C.I	3 YEAR MEAN CPUE	PSD	WR
WAE	30.12	78	9.75+–2.80	12.38	1	103
YEP	47.49	123	15.38+–8.82	14.42	60	121
WHS	6.18	16	2.00+–0.89	2.02	–	–
COC	4.25	11	1.38+–1.19	3.04	–	–
WHB	8.11	21	2.63+–0.88	3.09	100	–
CCF	1.54	4	0.50+–0.38	0.22	–	–
SPS	1.54	4	0.50+–0.38	0.17	–	–
BIB	0.77	2	0.25+–0.35	0.59	–	–

Table 2. Back–calculated lengths of walleyes sampled during lake survey on Lake Poinsett, Hamlin County, August 4–6, 1993.

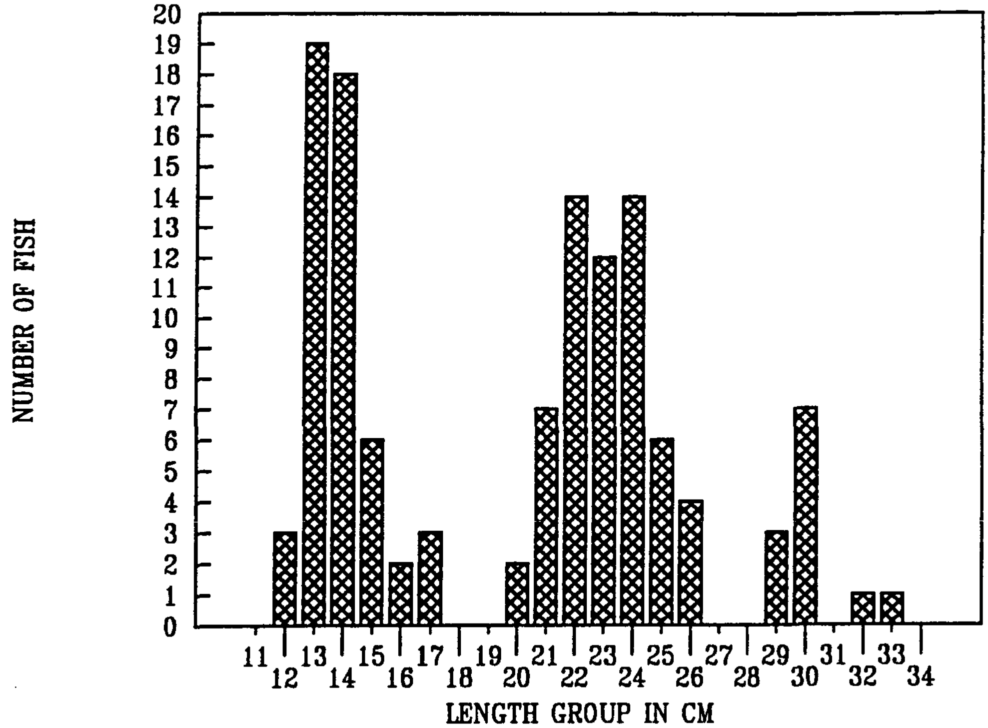
AVERAGE BACK–CALCULATED LENGTHS FOR EACH AGE CLASS

YEAR CLASS	AGE	N	Back–calculation Age 1	2	3	4
1992	1	8	129.23			
1991	2	48	150.66	263.65		
1990	3	0	0.00	0.00	0.00	
1989	4	1	121.20	243.48	344.45	459.29
ALL CLASSES			147.13	263.24	344.45	459.29
N		57	57	49	1	1

TABLE 3. STOCKING RECORD FOR LAKE POINSETT, HAMLIN COUNTY, 1983–1993.

SPECIES	SIZE	NUMBER	YEAR
NOP	FGL	10365	1983
NOP	ADT	8	1983
WAE	FGL	338700	1983
CCF	FGL	247550	1983
WHC	FGL	24200	1983
WHC	ADT	7	1983
YEP	FGL	73550	1983
MUE	FGL	138	1984
WAE	FGL	201920	1984
CCF	FGL	12000	1984
BLC	FGL	239883	1984
YEP	FGL	17700	1984
YEP	FGL	67850	1984
YEP	ADT	20229	1984
YEP	ADT	13600	1984
BLC	ADT	250	1984
WAE	FGL	150300	1985
BLC	ADT	700	1985
BLC	FGL	625000	1985
YEP	ADT	5200	1985
BLC	ADT	475	1985
BLC	ADT	249	1986
BLC	FGL	23000	1986
NOP	FGL	550	1986
TMU	FGL	135	1986
NOP	ADT	50	1987
SMB	FGL	33000	1987
YEP	FGL	4000	1987
SMB	FGL	50000	1988
WAE	FRY	13000000	1988
YEP	FGL	50000	1988
SMB	FGL	150000	1989
YEP	FGL	68000	1989
WAE	FRY	8000000	1990
WAE	LFG	109544	1990
WAE	SFG	200000	1990
YEP	FGL	5200	1990
YEP	ADT	300	1990
BLC	ADT	2340	1991
WAE	FRY	12000000	1991
WAE	SFG	266000	1991
WAE	SFG	184000	1991
YEP	ADT	41850	1991
WAE	FRY	12000000	1992
WAE	SFG	384700	1992
YEP	FGL	45600	1992
WAE	FRY	4000000	1993
WAE	FRY	4000000	1993
WAE	ADT	131	1993
BLC	ADT	2624	1993
NOP	ADT	67	1993
YEP	ADT	1112	1993
YEP	ADT	80	1993
WAE	SFG	143000	1993
WAE	SFG	103000	1993
WAE	SFG	132000	1993
YEP	FGL	258434	1993

YELLOW PERCH



WALLEYE

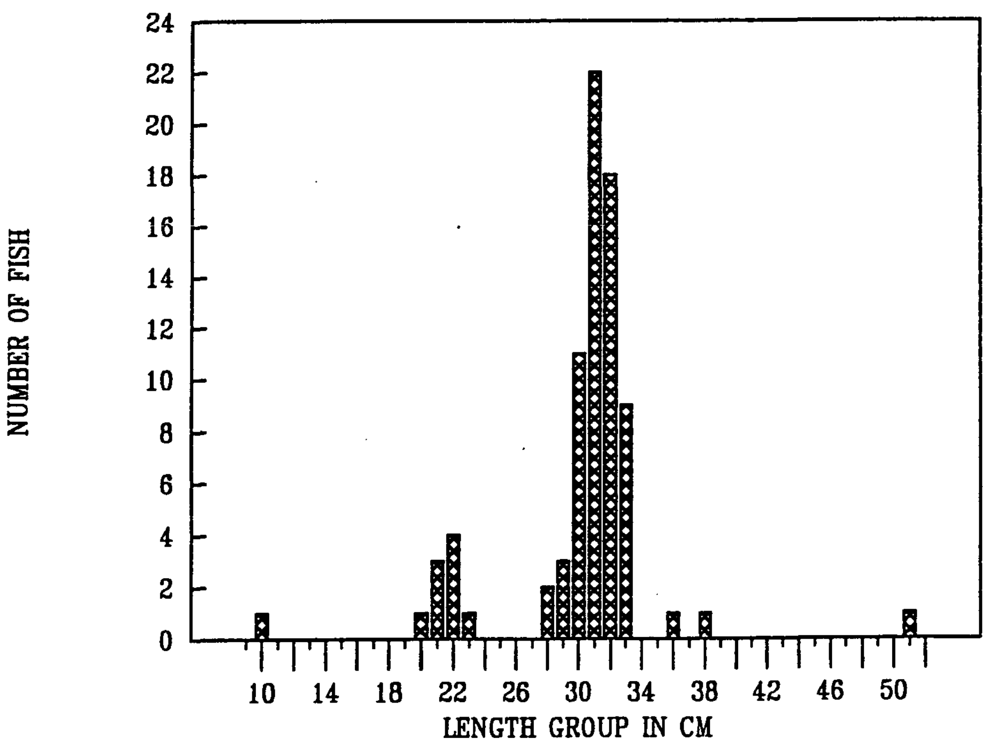


FIGURE 1.
LENGTH FREQUENCY OF YELLOW PERCH AND WALLEYE FROM 150 FT. GILL NETS IN LAKE POINSETT, 1993.

FIGURE 2. SHORELINE SEINING RESULTS OF 1993 SURVEY ON LAKE POINSETT, HAMLIN COUNTY.

LOCATION: LAKE POINSETT
DATE: 5-27-93
GEAR: 1/8" X 60' BAG SEINE
H20 TEMP: 62 F

HAUL 1

SPECIES	Y-O-Y	ADULT
FHM	0	20

HAUL 2

SPECIES	Y-O-Y	ADULT
FHM	0	39
SPS	0	10

HAUL 3

SPECIES	Y-O-Y	ADULT
FHM	0	4

HAUL 4

SPECIES	Y-O-Y	ADULT
	EMPTY	

FIGURE 3. SHORELINE SEINING RESULTS OF 1993 SURVEY ON LAKE POINSETT, HAMLIN COUNTY.

LOCATION: LAKE POINSETT
DATE: 6-21-93
GEAR: 1/8" X 60' BAG SEINE
H20 TEMP: 68 F

HAUL 1

SPECIES	Y-O-Y	ADULT
FHM	0	46
JOD	0	1
SPS	0	3
WHS	2	0
YEP	2	0
UNK	0	2

HAUL 2

SPECIES	Y-O-Y	ADULT
FHM	0	128
JOD	0	3
SPS	0	1
WHS	49	0
YEP	3	0
UNK	0	1
BRK	0	1

HAUL 3

SPECIES	Y-O-Y	ADULT
FHM	0	3
JOD	0	5
SPS	0	1
UNK	1	0
BRK	3	2

HAUL 4

SPECIES	Y-O-Y	ADULT
FHM	0	441
JOD	0	3
SPS	0	9
WHS	318	0
UNK	0	111

HAUL 5

SPECIES	Y-O-Y	ADULT
FHM	0	4
SPS	0	1
YEP	16	0
UNK	0	4
BRK	1	0
WAE	10	0

HAUL 6

SPECIES	Y-O-Y	ADULT
FHM	0	438
JOD	0	6
WHS	204	0
UNK	0	3
BRK	12	3

FIGURE 4. SHORELINE SEINING RESULTS OF 1993 SURVEY ON LAKE POINSETT, HAMLIN COUNTY.

LOCATION: LAKE POINSETT
DATE: 7-2-93
GEAR: 1/8" X 60' BAG SEINE
H20 TEMP: 68 F

HAUL 1

SPECIES	Y-O-Y	ADULT
WHS	65	0
FHM	0	263
BRK	12	25
SPS	0	14
EMS	0	18
BRM	0	36

HAUL 2

SPECIES	Y-O-Y	ADULT
YEP	1	0
WHS	119	0
FHM	12	95
BRK	2	0
SPS	0	7
EMS	2	0
BRM	0	5
JOD	0	8

HAUL 3

SPECIES	Y-O-Y	ADULT
WAE	2	0
WHS	6	0
FHM	1	79
SPS	0	7
JOD	0	2

HAUL 4

SPECIES	Y-O-Y	ADULT
WAE	2	0
YEP	23	0
WHS	63	0
FHM	0	257
SPS	0	9
EMS	0	1
BRM	0	12
JOD	0	7

HAUL 5

SPECIES	Y-O-Y	ADULT
WAE	1	0
YEP	4	0
WHS	92	0
FHM	0	54
BRK	2	0
SPS	0	2
EMS	0	2
BRM	0	10
JOD	0	2
IOD	0	1

HAUL 6

SPECIES	Y-O-Y	ADULT
WHS	7	0
FHM	0	15
BRK	2	2
BRM	0	6
JOD	0	2

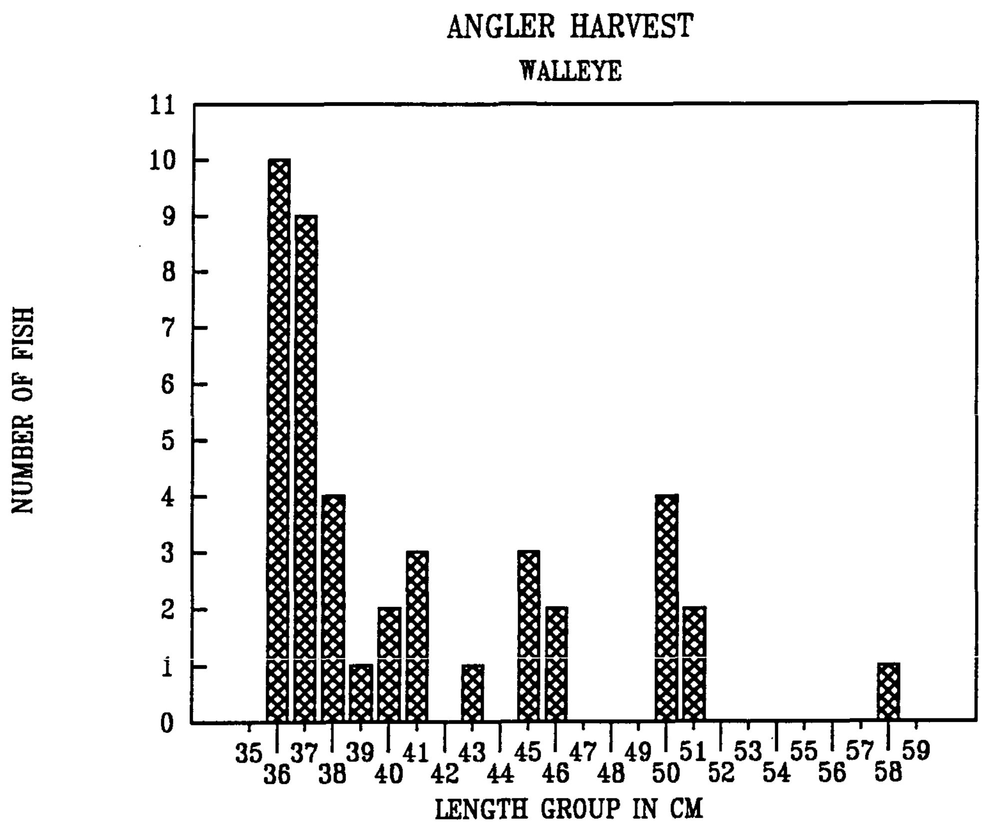


FIGURE 5. LENGTH FREQUENCY OF WALLEYES HARVESTED FROM LAKE POINSETT, MAY-SEPTEMBER, 1993.

Carp, bigmouth buffalo and black bullhead made up 80.2 percent of the frame net sample. All species contained fish large enough for commercial use but the numbers of large fish may not be great enough. Commercial harvest should be encouraged to prevent a future population explosion.

Other fish sampled during the survey included northern pike, white bass, yellow perch, white sucker and spottail shiner. Data on these species can be viewed in Tables 1 & 2.

Table 3. Average back-calculated lengths for each age class of walleyes in Lake Albert, Kingsbury County, 1993.

Year Class	Age	N	Back-calculation Age 1	2	3
1992	1	41	151.16		
1991	2	28	182.08	305.03	
1990	3	2	225.40	394.72	473.94
All Classes			165.44	311.10	473.94

RECOMMENDATIONS

1. Encourage commercial fishing for the rough fish populations. Constant control is necessary to benefit the gamefish in the lake.

2. Continue with an alternate year stocking strategy with walleye fry. This will enable us to monitor natural reproduction as well as maintain the walleye fishery. Coordinate Lake Poinsett stockings so a better reading of natural reproduction can be seen.

3. Develop a plan for managing the panfishery in the lake. Habitat development, stocking and rough fish control will be important factors to consider.

4. Lake Albert should be contour mapped. This would help in the placement of habitat that has the greatest chance to improve the panfishery.

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102 - F21-R-27

Name: Lake Albert County(ies): Kingsbury
Legal description: S1-3, 10-12, 14-15, 22, R53W, T112N
Location from nearest town: 1-1/2 mi. east, 1 mi. north of Badger, SD.

Dates of present survey: July 6-8, 1993
Date last surveyed: August 15-16, 1990
Most recent lake management plan: F21-R-24 Date: 1990
Management classification: Warmwater Marginal
Contour mapped: Date Not mapped

Primary Species: (game and forage)
1. Northern Pike
2. Yellow Perch
3. Black Bullhead
4.
5.

Secondary and other species:
1. Walleye
2. Largemouth Buffalo
3. Carp
4. White Sucker
5.

PHYSICAL CHARACTERISTICS

Surface Area: 3,500 acres; Watershed: Unknown acres
Maximum depth: 10 feet; Mean depth: 4 feet
Lake elevation at survey (from known benchmark): Full and overflowing

1. Describe ownership of lake and adjacent lakeshore property:

   Lake Albert is listed as a meandered lake and is managed by the South Dakota Department of Game, Fish, and Parks.

2. Describe watershed condition and percentages of land use:

   The watershed consists of 8% cropland, 90% pasture land, and 2% feedlot.

3. Describe aquatic vegetative condition:

   Coontail (Ceratophyllum demersum) was found in scattered groups throughout the lake. Emergent species included cattail (Typha spp.) and smartweed (Polygonum spp.).

4. Describe pollution problems:

No problems were identified.

5. Describe condition of all structures, i.e. spillway, level regulators, boatramps, etc.:

The boat ramp on the east end of the lake is in good condition.

CHEMICAL DATA

1. Describe general water quality characteristics.

The Secchi disk reading was 20 inches and there was a moderate algae bloom occurring during the survey.

BIOLOGICAL DATA

Methods:

1. Describe fish collection methods and show sampling locations by gear type (electrofishing, gill netting, frame nets, etc.) on the lake map.

Two 150 foot overnight experimental gill net sets and ten 3/4 inch overnight frame net sets were made on July 6-8, 1993. The results are shown in Tables 1 & 2. On August 24, 1993, six quarter-arc seine pulls were made with a 6x100 foot, 1/4 inch bag seine with the results being listed in Table 5. Sampling locations are listed on Figure 2.

Results and Discussion:

Table 1. Total catch of two, 24 hour, 150 ft. experimental gill net sets at Lake Albert, Kingsbury County, July 6-8, 1993.

Species	No.	%	CPUE	80% C.I.	2 YEAR CPUE Avg.	PSD	Mean Wr
Walleye	88	85.4	44.0	±15.4	*	23	80
White Bass	5	4.9	2.5	± 4.6	*	--	--
Yellow Perch	3	2.9	1.5	± 1.5	*	--	--
Carp	3	2.9	1.5	± 4.6	*	--	--
Northern Pike	2	1.9	1.0	± 3.1	*	--	--
Spottail Shiner	2	1.9	1.0	± 3.1	*	--	--

*= this is the first year of gill net data on Albert.

Table 2. Total catch of ten, 24 hour, 3/4 inch frame net sets, at Lake Albert, Kingsbury County, July 6-8, 1993.

Species	No.	%	CPUE	80% C.I.	2 YEAR CPUE Avg.	PSD	Mean Wr
Carp	79	37.3	7.9	± 1.8	6.6	--	--
Bigmouth Buffalo	73	34.4	7.3	± 4.8	10.6	--	--
Walleye	18	8.5	1.8	± 1.0	4.8	0	90
Black Bullhead	18	8.5	1.8	± 1.2	9.4	--	--
Yellow Perch	11	5.2	1.1	± 0.7	1.6	--	--
White Sucker	9	4.2	0.9	[illegible]	2.7		
Northern Pike	3	1.4	0.3	± 0.2	1.6	--	--
White Bass	1	0.5	0.1	± 0.1	0.05	--	--

2. Brief narrative describing status of fish sampled, make references to the tables.

Walleyes made up 85.4 percent of the gill net sample and the length frequency graph shows the population to be dominated by 16-20 cm. (6-8 in.) young-of-the-year (YOY) fish (Figure 1). These fish came from natural reproduction (as no walleyes were stocked in Lake Albert in 1993 - Table 4) or from the stocking of small fingerlings in Lake Poinsett in 1993. The walleyes in Albert are growing well with fish reaching 35 cm. (14 in.) during their third year of growth (Table 3). It's interesting to note that gill nets sampled forty-one Age 1 walleyes and shoreline seining only sampled one (Table 5).

Table 4. Stocking record for Lake Albert, Kingsbury County, 1983-1993.

Year	Number	Species	Size
1990	20,000	Yellow Perch	Fingerling
1991	700,000	Northern Pike	Fry
1992	1,750,000	Walleye	Fry

Table 5. Total catch from six seine pulls on Lake Albert, Kingsbury County, 1993

Lake Albert
County(ies) Kingsbury
Date 8-24-93
Collectors Crew

35. Natural Reproduction of Fish - Shoal Water Seining

Seine Measurements: Length 100 feet, Depth 6 feet,
Mesh size 1/4 inch square.

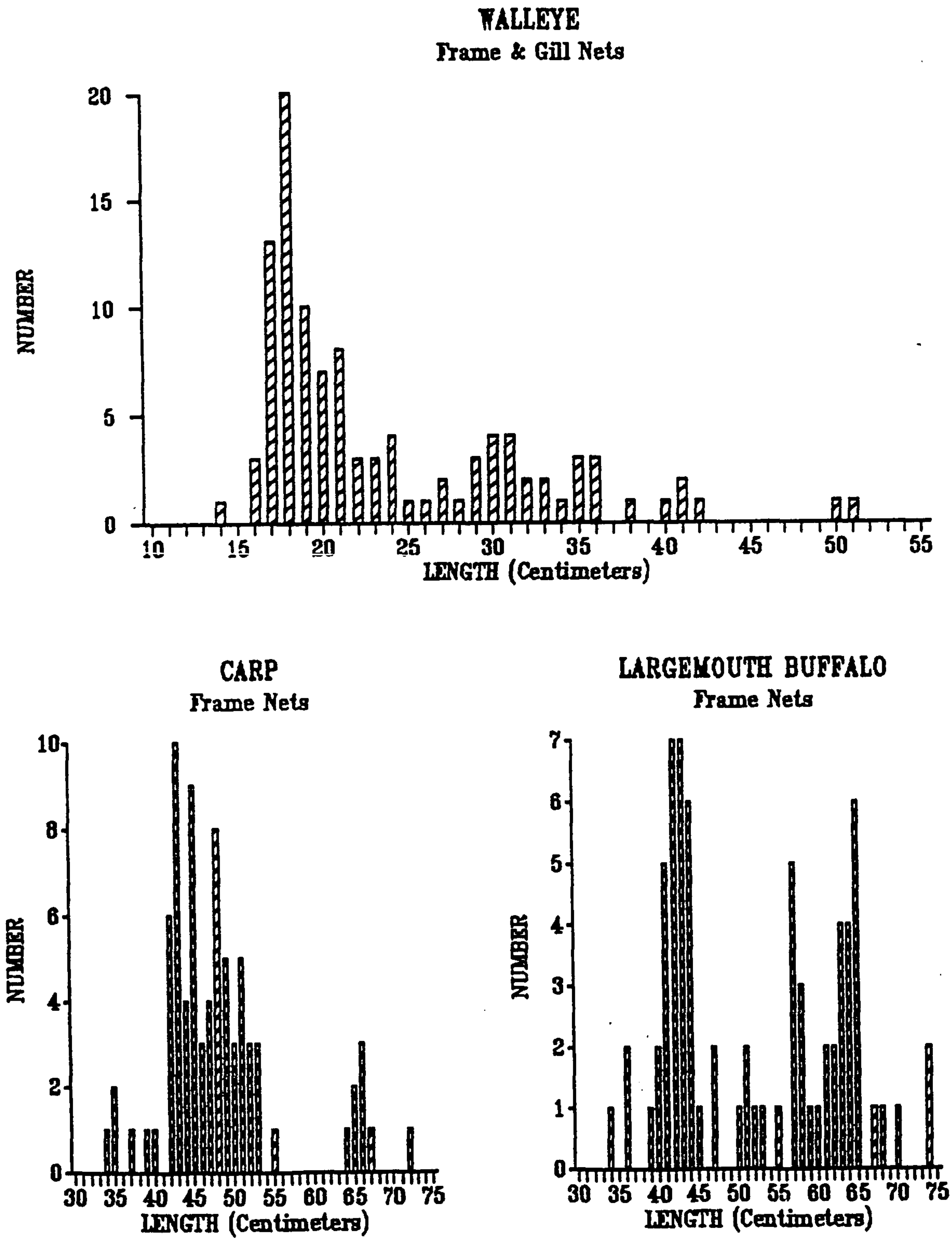
	Station Number		Show number of seine hauls made at each station in ( )				Totals
	1 ( )	2 ( )	3 ( )	4 ( )	5 ( )	6 ( )	
Total linear distance covered-feet	Quarter Arc	Quarter Arc	Quarter Arc	Quarter Arc	Quarter Arc	Quarter Arc	Linear Feet
Greatest water depth - feet							
Bottom Soil Type Amount of Vegetation ++							Acre(s)
Water Temperature-°F.							
Wind Intensity & Direction +	Calm						
Time of Day & Date							
Location on Lake	See Figure	2 map					

SIZE AND NUMBER

	Station #1		Station #2		Station #3		Station #4		Station #5		Station #6		TOTALS		
Species ***	YY**	O*	YY	O	YY	O	YY	O	YY	O	YY	O	YY	O	All
Yellow Perch	4				1				2		6		13		13
Spottail Shiner	2												2		2
White Bass	1				16		4		2		11	15	34	15	47
Fathead Minnow			5										5		5
Walleye											1		1		1
Bigmouth Buffalo												2		2	2

++ Heavy, Moderate, Light, None, etc. + Strong, Moderate, Light, Calm.
*** Group separately minnows and darters without identifying them, unless readily identifiable in field. Preserve sample for later identification in laboratory.
** YY - Young-of-year or fingerlings.
* Others, includes yearlings and adults, minnows and darters. Take scale samples from sizes of fish, especially game fish, not taken in test nets.

Figure 1. Length frequencies of selected species from Lake Albert, Kingsbury County, 1993.



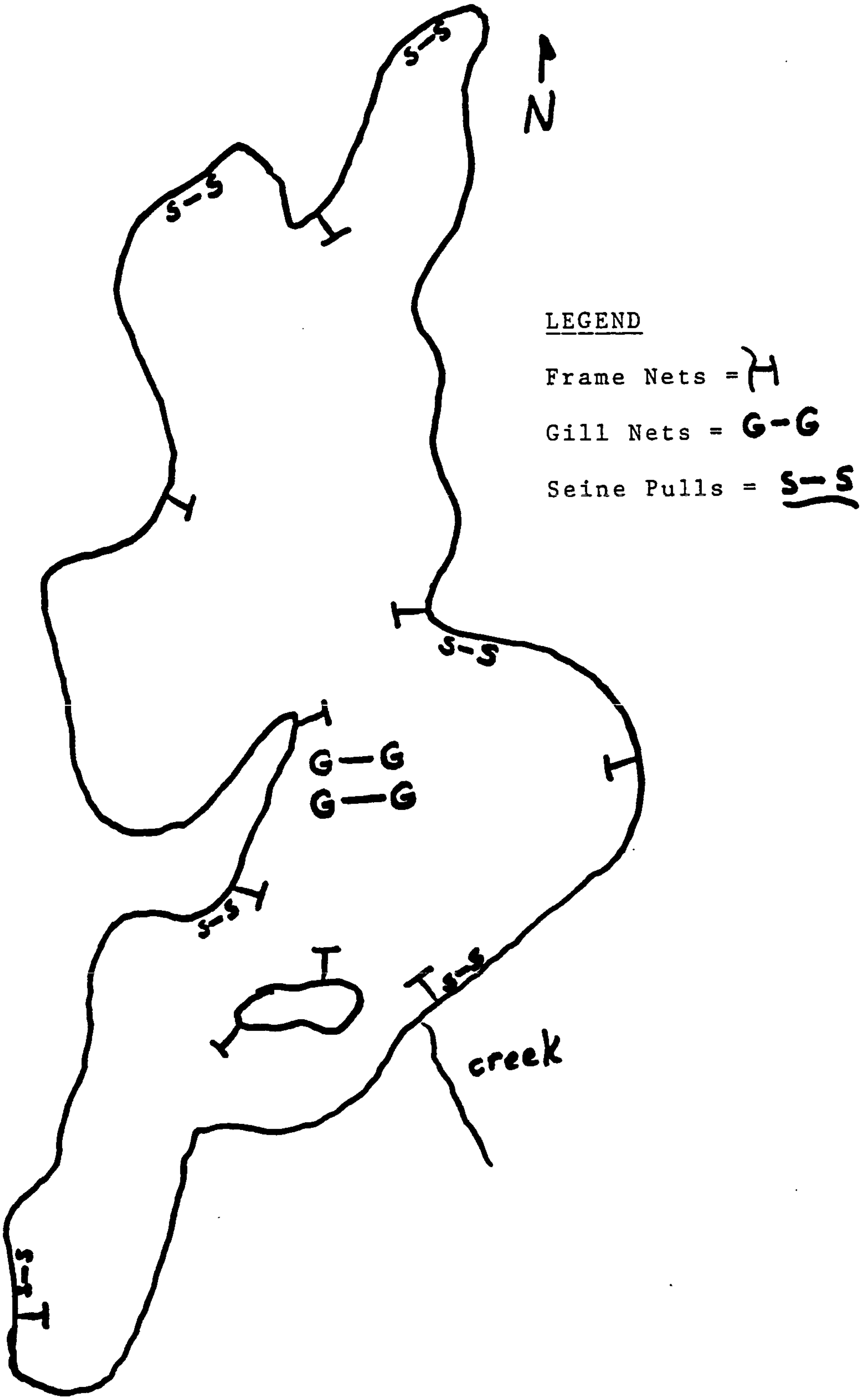


Figure 2. Sampling locations on Lake Albert, Kingsbury County, 1993.

Appendix A. A brief explanation of PSD and Wr.

Proportional Stock Density (PSD) is calculated by the following formula:

$$PSD = \frac{\text{Number of fish} \geq \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD is unitless and usually calculated to the nearest whole digit.

Size categories for selected species used in Region 3 lake surveys, in centimeters.

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25	38	51	63	76
Sauger	20	30	38	51	63
Yellow perch	13	20	25	30	38
Largemouth bass	20	30	38	51	63
Smallmouth bass	18	28	35	43	51
White crappie	13	20	25	30	38
Black crappie	13	20	25	30	38
Bluegill	8	15	20	25	30
Channel catfish	28	41	61	71	91
Black bullhead	15	23	30	38	46
Carp	28	41	53	66	84
Northern pike	35	53	71	86	112

PSD values in the 40-70 range indicate the population is balanced. Values less than 40 indicate a population dominated by small fish and values greater than 70 indicate a population comprised mainly of large fish.

Relative Weight (Wr) is a condition indice that quantifies fish condition (i.e. how much does a fish weigh for it's length). When mean Wr values are well below 100 for a size group, problems exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.

RARE, THREATENED AND ENDANGERED SPECIES DOCUMENTED IN BROOKINGS, HAMLIN, AND KINGSBURY COUNTIES, SD

South Dakota Department of Game, Fish and Parks
Natural Heritage Database
7 July 1995

Common Name Scientific name	Federal Status	State Status	Global Rank	State Rank	Last Observed	Townrange & Section	COUNTY
RED-NECKED GREBE PODICEPS GRISEGENA			G5	S1S2B,SZN	1922-06-09	110N055W	SDKING
CLARK'S GREBE AECHMOPHORUS CLARKII			G5	SUB,SZN	1987-06-30		SDKING
LEAST BITTERN IXOBRYCHUS EXILIS			G5	SUB,SZN	1981-08-09	110N054W 20	SDKING
GREAT BLUE HERON ARDEA HERODIAS			G5	S4B,SZN	1991-06-06	112N053W 02	SDKING
GREAT EGRET CASMERODIUS ALBUS			G5	S3B?,SZN	1981-08-09	110N054W 20	SDKING
GREAT EGRET CASMERODIUS ALBUS			G5	S3B?,SZN	1991-06-06	111N054W 30	SDKING
GREAT EGRET CASMERODIUS ALBUS			G5	S3B?,SZN	1991-06-06	109N055W	SDKING
GREAT EGRET CASMERODIUS ALBUS			G5	S3B?,SZN	1991-06-06	112N053W 02	SDKING
SNOWY EGRET EGRETTA THULA			G5	S2S3B,SZN	1981-08-09	110N054W	SDKING
SNOWY EGRET EGRETTA THULA			G5	S2S3B,SZN	1986-07-13	111N054W	SDKING
LITTLE BLUE HERON EGRETTA CAERULEA			G5	S2B,SZN	1981-08-09	110N054W 20	SDKING
LITTLE BLUE HERON EGRETTA CAERULEA			G5	S2B,SZN	1986-07-20	111N054W	SDKING
TRICOLORED HERON EGRETTA TRICOLOR			G5	SUB,SZN	1986-07-26	110N054W 19	SDKING
BLACK-CROWNED NIGHT-HERON NYCTICORAX NYCTICORAX			G5	S4B,SZN	1981-08-09	110N054W 20	SDKING
BLACK-CROWNED NIGHT-HERON NYCTICORAX NYCTICORAX			G5	S4B,SZN	1983-06-19	111N054W	SDKING
WHITE-FACED IBIS PLEGADIS CHIHI	C2		G5	S2B,SZN	1981-08-09	110N054W 20	SDKING
WHITE-FACED IBIS PLEGADIS CHIHI	C2		G5	S2B,SZN	1983-07-17	111N054W	SDKING
PIPING PLOVER CHARADRIUS MELODUS	LELT	ST	G3	S2B,SZN	1991-06-05	110N055W	SDKING
BROOK STICKLEBACK CULAEA INCONSTANS			G5	S4			SDMINE SDKING
REGAL FRITILLARY SPEYERIA IDALIA	C2		G3	S1	1989-07-04	112N057W 20	SDKING
MARYLAND FIGWORT SCROPHULARIA MARILANDICA			G5	SU	1959-07-13	110N053W 24	SDKING
WILD RICE ZIZANIA AQUATICA			G5	S4?	1920-08	110N056W 12	SDKING
RED-NECKED GREBE PODICEPS GRISEGENA			G5	S1S2B,SZN	1958-05-23	111N051W	SDBROO
GREAT BLUE HERON ARDEA HERODIAS			G5	S4B,SZN	1981-07-05	113N053W 34	SDHAML
GREAT BLUE HERON ARDEA HERODIAS			G5	S4B,SZN	1985-06-18	111N051W 04	SDBROO
GREAT EGRET CASMERODIUS ALBUS			G5	S3B?,SZN	1979-SUMM	110N050W 19	SDBROO
GREAT EGRET CASMERODIUS ALBUS			G5	S3B?,SZN	1981-07-04	113N053W 34	SDHAML
GREEN-BACKED HERON BUTORIDES VIRESCENS			G5	S3B,SZN	1980-07-28	112N052W 25	SDBROO
BLACK-CROWNED NIGHT-HERON NYCTICORAX NYCTICORAX			G5	S4B,SZN	1902-06-01	113N053W 27	SDHAML
BUFFLEHEAD BUCEPHALA ALBEOLA			G5	S3B,SZN	1991-07-24	111N051W 6	SDBROO
HOODED MERGANSER			G5	S2B,SZN	1991	109N050W	SDBROO

LOPHODYTES CUCULLATUS						09	
SWAINSON'S HAWK	3C		G4	S4B,SZN	1985-04-13		SDBROO
BUTEO SWAINSONI							
WHOOPING CRANE	LE	SE	G1	SZN	1890	111N051W	SDBROO
GRUS AMERICANA							
AMERICAN WOODCOCK			G5	S3B,SZN	1972-04-27	111N051W	SDBROO
SCOLOPAX MINOR							
AMERICAN WOODCOCK			G5	S3B,SZN	1980-06-23	109N050W	SDBROO
SCOLOPAX MINOR						35	
COMMON TERN	C2NL		G5	S2B,SZN	1930-08-03	113N052W	SDHAML
STERNA HIRUNDO							
BARN OWL			G5	S2B,SZN	1979	110N050W	SDBROO
TYTO ALBA						14	
LONG-EARED OWL			G5	S3B,S3N	1970-04-30	110N050W	SDBROO
ASIO OTUS						14	
HENSLOW'S SPARROW	C2		G4	SUB,SZN	1965-07-10	110N050W	SDBROO
AMMODRAMUS HENSLOWII							
CENTRAL MUDMINNOW		SE	G5	S1	1956-08-26	111N049W	SDBROO
UMBRA LIMI						32	
TOPEKA SHINER	C1		G3	S2	1958-06-18	109N050W	SDBROO
NOTROPIS TOPEKA						09	
TOPEKA SHINER	C1		G3	S2	1949-08-16	111N051W	SDBROO
NOTROPIS TOPEKA						05	
SUCKERMOUTH MINNOW			G5	S2	1970-09-26	113N051W	SDHAML
PHENACOBIUS MIRABILIS						35	
NORTHERN REDBELLY DACE		ST	G5	S2	1952-08-26	111N049W	SDBROO
PHOXINUS EOS						32	
NORTHERN REDBELLY DACE		ST	G5	S2	1952-05-07	111N048W	SDBROO
PHOXINUS EOS						17	
BROOK STICKLEBACK			G5	S4	1978	112N048W	SDBROO
CULAEA INCONSTANS						12	
BROOK STICKLEBACK			G5	S4	1952-08-26	111N049W	SDBROO
CULAEA INCONSTANS						32	
BROOK STICKLEBACK			G5	S4	1952-05-07	111N048W	SDBROO
CULAEA INCONSTANS						17	
BROOK STICKLEBACK			G5	S4	1949-08-16	111N051W	SDBROO
CULAEA INCONSTANS						05	
BROOK STICKLEBACK			G5	S4	1970		SDBROO
CULAEA INCONSTANS							
LOGPERCH			G5	S2		113N052W	SDHAML
PERCINA CAPRODES							
PYGMY SHREW			G5	S1	1972-11-09	110N050W	SDBROO
SOREX HOYI						19	
NORTHERN REDBELLY SNAKE		ST	G5T5	S3	1982-10-27	114N052W	SDHAML
STORERIA OCCIPITOMACULATA						27	
NORTHERN REDBELLY SNAKE		ST	G5T5	S3	1982-10-17	114N052W	SDHAML
STORERIA OCCIPITOMACULATA						23	
NORTHERN REDBELLY SNAKE		ST	G5T5	S3	1994-07-30	111N051W	SDBROO
STORERIA OCCIPITOMACULATA						5	
AMERICAN BURYING BEETLE	LE		G1	SH	1945	110N050W	SDBROO
NICROPHORUS AMERICANUS							
BELFRAGI'S CHLOROCHROAN BUG	C2		G?	SU	1921-08	110N050W	SDBROO
CHLOROCHROA BELFRAGII						23	
POWESHEIK SKIPPERLING			G2G3	S1	1989-07-01	114N052W	SDHAML
OARISMA POWESHEIK						06	
OTTOE SKIPPER			G3?	S2	1978-07-19	111N047W	SDBROO
HESPERIA OTTOE						22	
DAKOTA SKIPPER	C2		G2G3	S1	1990-06-30	114N052W	SDHAML
HESPERIA DACOTAE						06	
DAKOTA SKIPPER	C2		G2G3	S1	1989-07-02	114N055W	SDHAML
HESPERIA DACOTAE						21	
DAKOTA SKIPPER	C2		G2G3	S1	1911-PRE	110N051W	SDBROO
HESPERIA DACOTAE						23	
REGAL FRITILLARY	C2		G3	S1	1980-07-13	110N050W	SDBROO
SPEYERIA IDALIA						19	
REGAL FRITILLARY	C2		G3	S1	1991-07-20	114N052W	SDHAML
SPEYERIA IDALIA						06	
THREERIDGE			G5	S2	1993-SUMM	109N049W	SDBROO
AMBLEMA PLICATA						17	
RUSH ASTER			G5	S3		109N047W	SDBROO
ASTER JUNCIFORMIS						33	

FLATTOP ASTER ASTER PUBENTIOR		G?	S2	1892-08	110N050W	SDBROO
FINGER COREOPSIS COREOPSIS PALMATA		G5	S3	1911-09-06		SDBROO
ROUGH RATTLESNAKE-ROOT PRENANTHES ASPERA		G4?	SU	1893-AUG	110N050W	SDBROO
ROUGH RATTLESNAKE-ROOT PRENANTHES ASPERA		G4?	SU	1893-08-05	110N050W	SDBROO
BLUE COHOSH CAULOPHYLLUM THALICTROIDES		G5	S3	1900	112N048W 13	SDBROO
BLUE COHOSH CAULOPHYLLUM THALICTROIDES		G5	S3	1893-09-02	112N048W 36	SDBROO
BLUE COHOSH CAULOPHYLLUM THALICTROIDES		G5	S3	1893-06-17	112N047W 29	SDBROO
KALM'S LOBELIA LOBELIA KALMII		G5	S1	1896-09	112N047W 29	SDBROO
BECKWITH CLOVER TRIFOLIUM BECKWITHII		G4G5	S2	1957-06-11	109N050W	SDBROO
BECKWITH CLOVER TRIFOLIUM BECKWITHII		G4G5	S2	1965-06-21	109N049W 09	SDBROO
BECKWITH CLOVER TRIFOLIUM BECKWITHII		G4G5	S2	1906-05-30	110N050W	SDBROO
BECKWITH CLOVER TRIFOLIUM BECKWITHII		G4G5	S2	1930-06	110N050W	SDBROO
BECKWITH CLOVER TRIFOLIUM BECKWITHII		G4G5	S2	1888	114N051W	SDHAML
BECKWITH CLOVER TRIFOLIUM BECKWITHII		G4G5	S2	1990-05-09	109N049W 10	SDBROO
BECKWITH CLOVER TRIFOLIUM BECKWITHII		G4G5	S2	1985-05-31	109N049W 10	SDBROO
DOWNY GENTIAN GENTIANA PUBERULENTA		G4G5	S4?	1975-09-17	110N051W 17	SDBROO
DOWNY GENTIAN GENTIANA PUBERULENTA		G4G5	S4?	1908-09	110N050W	SDBROO
SMALL FRINGED GENTIAN GENTIANOPSIS PROCERA		G5	S2	1896-09	112N047W 29	SDBROO
SMALL FRINGED GENTIAN GENTIANOPSIS PROCERA		G5	S2	1897-09	109N047W 33	SDBROO
SMALL FRINGED GENTIAN GENTIANOPSIS PROCERA		G5	S2	1896-08-30	110N050W	SDBROO
WATER MILFOIL MYRIOPHYLLUM HETEROPHYLLUM		G5	SU	1897-08	049W111N 7	SDBROO
WATER MILFOIL MYRIOPHYLLUM HETEROPHYLLUM		G5	SU	1981-0808	111N048W 26	SDBROO
WATER MILFOIL MYRIOPHYLLUM HETEROPHYLLUM		G5	SU	1897-05	109N047W 33	SDBROO
PURPLE GIANT HYSSOP AGASTACHE SCROPHULARIIFOLIA		G4	SU	1893-09-03	112N048W 36	SDBROO
BOG BUCKBEAN MENYANTHES TRIFOLIATA		G5	S1	1924-07-09	109N047W 33	SDBROO
WAXY BOG-STAR PARNASSIA GLAUCA		G5	S1	1897-09	109N047W 33	SDBROO
SWEETFLAG ACORUS AMERICANUS		G5	S4?	1955-06-17	110N051W 13	SDBROO
SWEETFLAG ACORUS AMERICANUS		G5	S4?	1981-07-26	109N050W 16	SDBROO
TAWNY SEDGE CAREX ALOPECOIDEA		G5	S2	1980-05-31	109N050W 36	SDBROO
TAWNY SEDGE CAREX ALOPECOIDEA		G5	S2	1894-06-16		SDBROO
SLENDER COTTONGRASS ERIOPHORUM GRACILE		G5	S1	1897-06-26	109N047W 33	SDBROO
TALL COTTONGRASS ERIOPHORUM POLYSTACHION		G5	S3	1898-06-20		SDBROO
TALL COTTONGRASS ERIOPHORUM POLYSTACHION		G5	S3	1897-06-26	109N047W	SDBROO
TALL COTTONGRASS ERIOPHORUM POLYSTACHION		G5	S3	1893-06-16		SDBROO
SMALL WHITE LADY'S-SLIPPER CYPRIPEDIUM CANDIDUM	3C	G4	S1	1893-06-16		SDBROO
SMALL WHITE LADY'S-SLIPPER	3C	G4	S1	1893-06-17		SDBROO

CYPRIPEDIUM CANDIDUM						
SMALL WHITE LADY'S-SLIPPER	3C	G4	S1	1984-06-11	109N049W	SDBROO
CYPRIPEDIUM CANDIDUM					10	
WESTERN PRAIRIE FRINGED ORCHID	LT	G2	SH	1892		SDBROO
PLATANTHERA PRAECLARA						
GREAT PLAINS LADIES' TRESSES		G5	SU	1970-09-10	113N054W	SDHAML
SPIRANTHES MAGNICAMPORUM					14	
GREAT PLAINS LADIES' TRESSES		G5	SU	1984-09-07	109N049W	SDBROO
SPIRANTHES MAGNICAMPORUM					10	
WILD RICE		G5	S4?	1918-08-20	109N050W	SDBROO
ZIZANIA AQUATICA					04	
WILD RICE		G5	S4?	1978-09-15	109N049W	SDBROO
ZIZANIA AQUATICA					10	
WILD RICE		G5	S4?	1910-08-12	110N050W	SDBROO
ZIZANIA AQUATICA					13	
WILD RICE		G5	S4?	1919-08-18	113N052W	SDHAML
ZIZANIA AQUATICA					14	
LARGE-LEAF PONDWEED		G5	S3	1897-07	109N047W	SDBROO
POTAMOGETON AMPLIFOLIUS					33	
LARGE-LEAF PONDWEED		G5	S3	1891-08-17	110N050W	SDBROO
POTAMOGETON AMPLIFOLIUS						

KEY TO CODES USED IN NATURAL HERITAGE DATABASE REPORTS

FEDERAL STATUS

- LE = Listed endangered
- LT = Listed threatened
- LELT = Listed endangered in part of range, threatened in part of range
- C1 = Candidate for federal listing, information indicates that listing is justified.
- C2 = Candidate for federal listing, information to justify listing is not available.
- 3A = Former candidate, rejected because presumed extinct or habitat destroyed
- 3B = Former candidate, rejected because not recognized as a distinct taxon
- 3C = Previous candidate for federal listing, rejected because more common, widespread or protected than previously known

STATE STATUS

- SE = State Endangered
- ST = State Threatened

An endangered species is a species in danger of extinction throughout all or a significant portion of its range. (applied rangewide for federal status and statewide for state status)

A threatened species is a species likely to become endangered in the foreseeable future.

Global Rank	State Rank	Definition (applied rangewide for global rank and statewide for state rank)
G1	S1	Critically imperiled because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
G2	S2	Imperiled because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
G3	S3	Either very rare and local throughout its range, or found locally (even abundantly at some of its locations)in a restricted range, or vulnerable to extinction throughout its range because of other factors; in the range of 21 of 100 occurrences.
G4	S4	Apparently secure, though it may be quite rare in parts of its range, especially at the periphery. Cause for long term concern.
G5	S5	Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery.
GU	SU	Possibly in peril, but status uncertain, more information needed.
GH	SH	Historically known, may be rediscovered.
GX	SX	Believed extinct, historical records only.
G?	S?	Not yet ranked
_?	_?	Inexact rank
_T		Rank of subspecies or variety
_Q		Taxonomic status is questionable, rank may change with taxonomy

SZ	No definable occurrences for conservation purposes, usually assigned to migrants
SP	Potential exists for occurrence in the state, but no occurrences
SR	Element reported for the state but no persuasive documentation
SA	Accidental or casual

Bird species may have two state ranks, one for breeding (S#B) and one for nonbreeding seasons (S#N). Example: Ferruginous Hawk (S3B,SZN) indicates an S3 rank in breeding season and SZ in nonbreeding season.

APPENDIX IV

~~701 total cabins~~

306 respondents from the Lake Poinsett survey

Permanent	48	15.7 %	
Seasonal	258	84.3 %	
Respondents reported failing systems	46	15 %	
" " functioning "	260	85 %	
Systems contstructed before 1977	38	12.4 %	
" " after 1977	268	87.6 %	
with RW 35 Kgs — Lot sizing adequate	25	8.2 %	15 %
" " not adequate	146	47.7 %	85 %
unknown / didnt respond	135	44.1 %	
RW — Distance to well adequate	147	48 %	
" " " not adequate	40	13 %	
unknown / no response	119	39 %	
Distance to shore adequate	65	21 %	
" " " not adequate	61	20 %	
unknown / no response	180	59 %	
Rural water	193	63 %	
Private wells / outside source	113	37 %	
Septic tank size adequate	82	27 %	
" " " not adequate	74	24 %	

Lake Poinsett Sanitary District

RECEIVED
AUG 11 19
S.F. Regional Office
... of Environment
...ural Resources

August 4, 1994

Alan Wittmuss
State of S.D. Dept. of Environment and Natural Resources
1108 W. Bailey
Sioux Falls, S.D. 57104-1375

Dear Mr. Wittmuss:

Please find enclosed some information I thought might be helpful to you for your report.

Presently there are approximately 153 residents and 6 businesses connected to the sewer system. there are spproximately 450 residential properties not hooked up to the system.

Those residents not on the system and operating on individual septic tank and leech line systems. The Sanitary District has no way of knowing if these systems are operating properly.

We have applied for Federal and State funding to construct the balance of the system around the Lake, but it is not likely these funds will be available in the near future.

Should you need futher information, please let me hear from you.

Sincerely,

Rose M. Pedersen

Rose M. Pedersen, Clerk
LAKE POINSETT SANITARY DIST.

Lake Poinsett Sanitary District

December 2, 1992

Dear Lake Poinsett Property Owner

The Lake Poinsett Sanitary Board of Trustees has been working to provide funding to continue expansion of the Lake Poinsett Sanitary Sewer System. We are now at a point where we need your help if any actual funding is to be provided. The need to complete this project out of concern for water quality in Lake Poinsett is apparent.

The remaining part of this large project has been divided into four phases as outlined below:

	LOCATION	COST
PHASE I	ARLINGTON BEACH FACILITY, PIER 81, & STONBRIDGE FACILITY	510.000.00
PHASE II	EISELES SURROUNDING SUBDIVISION	750,000.00
PHASE III	PRESTRUDE'S SURROUNDING SUBDIVSN	1,100,000.00
PHASE IV	NITTEBERG & SURROUNDING SUBDIVSN	1,200,000.00

Phase I of our project has been placed on the State Water Plan and approved for funding.

For actual funding and construction to occur, the State Legislators must allocate money. Legislation will be submitted for this and several other water projects throughout the state for consideration during the legislative session which begins on January 12, 1993. Enclosed please find a list of the membership of the legislature. Please contact those in your area and encourage their support for funding of the State Water Plan and, therefore, continued expansion of the Lake Poinsett Sanitary Sewer System. Without your support, there will be no expansion of this project for many years.

If you no longer own property at Lake Poinsett, please forward this letter to the current owner.

Sincerely,

Lawrence Furney

Lawrence Furney, President

LF/rp

LAKE POINSETT SANITARY DISTRICT
OPINION OF ESTIMATED PROJECT COST TO
COMPLETE SANITARY SEWER SYSTEM

Banner Associates, Inc.
409 22nd Avenue South
Brookings, South Dakota

SUMMARY OF ESTIMATED PROJECT COSTS

PROJECT DESCRIPTION	OPINION OF ESTIMATED PROJECT COST
ADDITION TO PIER 81 SYSTEM	$370,000.00
NEW POND SYSTEM FOR NITTERBERG & SURROUNDING SUBDIVISIONS	$1,200,000.00
ADDITION TO STONE BRIDGE SYSTEM	$140,000.00
NEW POND SYSTEM FOR PRESTRUDES & SURROUNDING SUBDIVISIONS	$1,100,000.00
ADDITION TO GAME FISH & PARKS SYSTEM TO SERVE EISELES & SURROUNDING SUBDIV	$750,000.00
OPINION OF ESTIMATED PROJECT COST TO COMPLETE L.P.S.D.	$3,560,000.00

622 Cabins on Lake
153 Served by system Now

Lake Poinsett Sanitary District

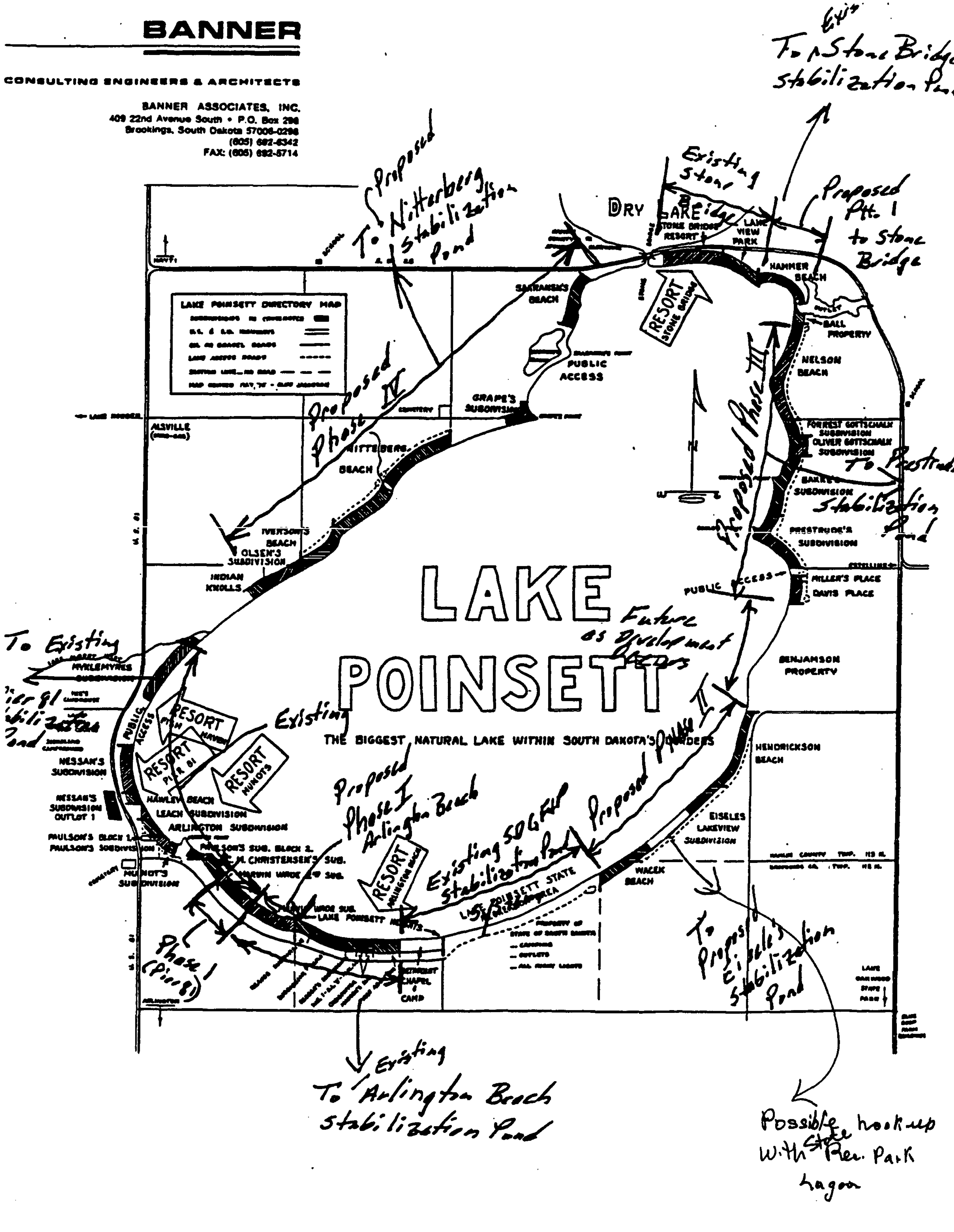
BUDGET 1994

	TOTAL	TAX SUPPORTED	SEWER
CLERK SALARY	3,000.00	1,800.00	1,200.00
OPERATOR SALARY	6,000.00	x	6,000.00
PAYROLL TAXES	1,000.00	300.00	700.00
MILEAGE CLERK	300.00	200.00	100.00
MILEAGE OPERATOR	1,000.00	x	1,000.00
HIRED SEPTIC TANK	1,000.00	x	1,000.00
HIRED BACKHOE	1,000.00	x	1,000.00
HIRED MOWING & SPRAYING	500.00	x	500.00
ADVERTISING & PUBLICATION	700.00	x	700.00
ACCOUNTING	1,125.00	500.00	625.00
ENG CONSULTING	500.00	100.00	400.00
FMHA LOAN PAYMENT	10,415.00	x	10,415.00
SEWER RESERVE FUND	1,041.60	x	1,041.60
TELEPHONE	500.00	250.00	250.00
POSTAGE	150.00	75.00	75.00
ELECTRIC SERVICE	3,800.00	x	3,800.00
PUBLIC LIAB INSURANCE	800.00	x	800.00
WORKMANS COMP	1,400.00	x	1,400.00
TRUSTEE PER DEIM	1,125.00	400.00	725.00
LEGAL SERVICES	1,900.00	700.00	1,200.00
GARBAGE HAULING	16,000.00	10,500.00	5,500.00
LIFT STATION MAINT.	2,000.00	x	2,000.00
CONTINGENCY	3,000.00	2,000.00	1,000.00
	58,256.60	16,825.00	41,431.60

BANNER

CONSULTING ENGINEERS & ARCHITECTS

BANNER ASSOCIATES, INC.
409 22nd Avenue South • P.O. Box 298
Brookings, South Dakota 57006-0298
(605) 692-6342
FAX: (605) 692-5714



SECTION 3
TREATMENT PROCESS DESCRIPTION

3.0 General.

The Lake Poinsett Sanitary District employs a small diameter gravity sewer system to collect septic tank effluent from individual residences and businesses. The septic tank effluent flows to submersible pump lift stations where the wastewater is pumped to total containment stabilization ponds. Division 1 of this section of the Manual briefly discusses the theory and operation of the septic tanks and small diameter sewer collection system. Division 2 of this Section of the Manual briefly discusses the lift stations and their function and the theory and operation of the stabilization ponds.

3.1 Division 1 - Collection System Improvements.

3.1.1 Septic Tanks: A septic tank is a watertight container that receives raw sewage from individual homes and businesses. It holds the sewage for a short time during which it undergoes primary treatment or a natural conditioning process. Three things happen while it is in the tank:

1. Solids are separated from the liquid. Baffles or special pipe fittings in each end of the tank reduce the liquid velocity and prevent the sewage from flowing directly through it. In this semi-quiet environment the heavier solids sink to the bottom. These are called "settled solids." The lighter particles, including grease and foam, rise to the surface and form a mat of partially submerged floating solids called "scum"

2. Biological action takes place. In a septic tank, anaerobic bacteria (a family of organisms that live without oxygen) digest most of the scum and settled solids. The decomposition of these solids without oxygen releases a foul, rotten egg-smelling gas, and the digestive process is termed septic - hence the name "septic tank."

Some of the solids are liquified or converted to gas; the rest settle to the bottom as an inactive mass called "sludge". The partially clarified liquid flows out of the tank, into the small diameter gravity sewer system.

3. Sludge and scum are stored. Solids and scum that are not liquified remain in the septic tank. No matter how efficient the digestive process may be, sludge will accumulate in the bottom of the tank and, in time, will have to be removed.

If the sludge material is not removed, it will accumulate until it eventually overflows into the small diameter gravity sewer system and will plug it.

A septic tank does not purify sewage; it simply stores it for further treatment. Even though the effluent looks clear, it is still sewage and contains many disease producing bacteria.

This system utilizes septic tanks with at least 500 gallons capacity to serve up to two seasonal residences or a single year-round residence. Where a seasonal and a year-round resident or three seasonal residences are served by a single tank the minimum tank size is 750 gallons. One thousand gallon septic tanks are used to serve commercial users or combinations of two seasonal and one year round or two year-round or up to five seasonal residences. Up to seven seasonal or five seasonal and two year-round residences may be served with a 1500 gallon tank.

3.1.2 Small Diameter Gravity Sewer System: Septic tank effluent is collected by four-inch PVC gravity sewer lines. Several manholes and cleanouts are located throughout the system for maintenance, inspection, and cleaning purposes. The small diameter gravity sewers discharge to submersible pump lift stations where the wastewater is pumped to the treatment sites.

3.2 Division 2 - Wastewater Treatment System.

3.2.1 Lift Station: The wastewater received at the lift stations is a combination of residential and commercial flow along with infiltration and inflow of clear water.

(1) Residential and Commercial wastewater is contributed by seasonal and year-round residences and businesses connected into the sewer system. The average daily flows from residential and commercial sources during an average summer weekend are shown in Table 3.2-1.

TABLE 3.2-1: MAXIMUM HOURLY FLOWS TO LIFT STATIONS

PROJECT	LIFT STATION	MAXIMUM HOURLY FLOW (Gallons Per Minute
Stone Bridge	A-1 A-2	19 8
Arlington Beach	B-1	25
Pier 81	C-1 C-2 C-3 C-4 C-5	49 19 8 16 8

(2) Infiltration and Inflow is clear ground water or storm water that enters the sewer lines and manholes through open joints or storm sewers. The quantity of infiltration varies directly with the level of the ground water and is higher during wet seasons. Infiltration generally dilutes wastewater, lowering the BOD but at the same time increasing the hydraulic load to the treatment facility.

The Stone Bridge project has two lift stations which pump the wastewater to the stabilization pond through a three-inch force main. The Arlington Beach project has one lift station and also pumps the wastewater through a three-inch force main. There are five lift stations at the Pier 81 project. The force main size ranges from three to four inches.

The lift stations at the Stone Bridge project and one of the stations at the Pier 81 project are simplex lift stations. That is, these lift stations have one pump. All the other lift stations are duplex stations (two pumps). The pumps in the lift stations are submersible grinder pumps.

3.2.2 Stabilization Ponds: The wastewater treatment facilities at each of the project sites consist of total containment stabilization or evaporation ponds. Organic matter in the wastewater is degraded or "stabilized" in the ponds, hence the term "stabilization pond". Properly designed and operated lagoon or pond systems usually are capable of producing high removals of organic materials, solids, and bacteria. The stabilization ponds are not designed nor intended to receive raw sewage or sludge which has been pumped from septic tanks.

A conventional stabilization pond is a shallow pond with approximately 2 to 6 feet liquid depth. The organic matter in the wastewater is degraded by bacteria that thrive in the wastewater and ponds. The bacteria which are present are of three types: (1) aerobic bacteria, which require oxygen to live and develop; (2) anaerobic bacteria, which live and develop without oxygen; and (3) facultative bacteria, which are active either with or without oxygen. Aerobes, or aerobic bacteria, degrade wastewater without producing unpleasant odors. Anaerobic bacteria, on the other hand, produce gases that are very stale and putrid smelling. Therefore, it is most desirable to maintain sufficient oxygen in the ponds so anaerobic bacteria and putrid odors do not develop.

Dissolved oxygen needed by aerobic bacteria is supplied in two ways. Oxygen can transfer directly from the air to the water at the water surface. This is termed "surface reaeration" and is greatly increased by wave action on the water surface. Surface reaeration also increases with lower water temperatures. The second and most significant way in which oxygen is produced and provided for aerobic bacteria is by green algae. The algae are a form of green plant (almost microscopic) that produce oxygen in the presence of sunlight (photosynthesis). The algae also consume the simple compounds excreted by the bacteria.

A properly functioning stabilization pond will have, during the warm months, a bright green color from the profuse growth of algae in it. During cold weather, the growth of bacteria and algae in the pond will be slowed substantially and the removals of organic matter will be reduced. The color at that time will change to brown and then to gray.

January 4 1995

Professional Engineers
Registered Surveyors

Mr. Bill Stewart
Natural Resources Scientist
Department of Environment and Natural Resources
523 East Capital, Joe Foss Building
Pierre, SD 57501-3181

RE: Lake Poinsett Sediment Survey
BEA Project No. 94103S01

Dear Bill:

I am pleased to report that the Lake Poinsett Sedimentation Survey is completed in its entirety. We have submitted all of the required drawings, computations, field notes, and data to our client, the Lake Poinsett Water Project District. As a matter of professional courtesy, I am sending you one set of inked originals of all the maps and cross sections that we prepared for the LPWPD. I am assuming that you will be interested in the results and may perhaps may want to make additional reproductions on your own.

As I had earlier reported to you by phone, the total volume of accumulated sediment was found to be a little over 8.5 million cubic yards. The average end area volume computations are found on Sheet 7 of the cross sections. As you will note by looking at the cross sections, the vast majority of the sediment is located within the north half of the lake. There is not enough sediment accumulation to warrant any type of removal, but the results of the survey would tend to indicate that the majority of the sediment is entering the lake at the connection with Dry Lake by Stone Bridge.

We appreciated the opportunity of working with you on this project once again. Lake Poinsett was an excellent opportunity to fully utilize our GPS equipment. Because of the vast size of the lake, it was a perfect candidate for taking advantage of the real time positionsing capabilities of GPS. It also allowed us the opportunity to avoid some of the high winds that we were experiencing during the daylight hours by performing our work after sundown and working throughout the night once the wind had died down. We found that by equipping our boat with a bank of flood lamps that we could easily navigate the lake at night, possible only because of the satellite positioning.

If you have any questions regarding this project, please do not hesitate to contact me. Thank you for this opportunity and I look forward to working with you again on future projects.

Respectfully,
BERNHARD, EISENBRAUN AND ASSOCIATES

Dan Eisenbraun

Daniel D. Eisenbraun, PE & RLS
Vice President of the Firm

DDE:vms
Enclosures

Bernhard, Eisenbraun and Associates
215 Walnut Street
Yankton, South Dakota 57078

605-665-8092
1-800-888-8307
FAX 605-665-0523

NATURAL RESOURCE CONSERVATION SERVICE
205 Sixth Street
Brookings, SD 57006
(605)692-8464

March 3, 1995

DENR
523 E Capital
Pierre, SD 57501

Dear Alan;

Thank you for sending me a map of the AGNPS area in Brookings County within the Lake Poinsett watershed. I'm not sure if there are any 'special' type practices that should be included in the restoration efforts besides the ususal ones (ICM, reduced tillage, etc).

I'd recommend practices similar to the RCWP --see the 10 year report or EPA's "Evaluation of the Experimental Rural Clean Water Program" to see how the practices affected surface and ground water. One land treatment measure that has been having good success in other states is the use of filter strips (strips of permanent vegetation 1.0 to 1.5 chains wide on either side of seasonal or permanent linear flows). The filter strips are of sufficient width to trap seciments and waste as they move from the field in storms greater than the 10 year intensity ones that RCWP protected.

I hope I've helped. Since the Brookings county portion is so small, it doesn't look like prioritization is necessary!.

Sincerely,

Karen Cameron-Howell

Karen Cameron-Howell
District Conservationist

South Dakota
GREAT FACES. GREAT PLACES. ©

DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES
JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3181

February 28, 1995

Mr. Steve Maras
District Conservationist
Natural Resources Conservation Service
2nd St. & Joliet Ave.
P.O.Box 137
De Smet, SD 57231-0137

Dear Mr. Maras:

Enclosed is a map showing the portion of the Lake Poinsett Watershed located in Kingsbury County. The area circled in pink is that section of the watershed in Kingsbury County that has been analyzed with the Agricultural Nonpoint Source computer model (AGNPS). We will attempt to use the Universal Soil Loss Equation to locate potential areas of erosion in the remainder of the watershed.

If a 319 watershed implementation project was considered for the Lake Poinsett Watershed, is there anything that you feel should be considered or included in the event that restoration efforts take place? Project money may be limited and prioritization of implementation efforts will be dependent on the results of the Lake Poinsett Phase I Diagnostic/Feasibility Study. Are there areas within the Kingsbury County portion of the Poinsett Watershed that should be prioritized? Would there be any land treatment measures (BMPs) which you feel may be more effective in this area? Any input as to a 319 watershed implementation project would be greatly appreciated.

Sincerely,

Alan Wittmuss
SDDENR
1108 W. Bailey
Sioux Falls, SD 57104
ph: 367-5230

LAKE POINSETT ORDINARY HIGH WATER MARK CONSIDERATION

At its September, 1972 meeting, the Commission received a letter (Attachment A) from the Department of Game, Fish and Parks requesting the Water Resources Commission to establish an ordinary high water level for Lake Poinsett. The Commission instructed its Staff to make an investigation of the Lake Poinsett water level situation and to prepare a report for the Commission to consider for public hearing purposes.

Lake Poinsett is located about midway between Watertown and Brookings. At times it is the largest natural lake entirely within the boundaries of South Dakota. There are many homes and cottages on its shores, but this development does not include the entire shoreline. The shoreline is quite definite and even at the 1972 high stage there does not appear to be much additional land covered with water. There is damage to the shoreline and trees due to wave action. Potential ice damage is a matter of concern.

Attachment B., is a portion of a general map of Hamlin, Kingsbury and Brookings Counties. Vested Water Right No. 1576-3 filed by the Department of Game, Fish and Parks indicates Lake Poinsett has a surface area of 7,868 acres. Note that most of the natural run-off into Lake Poinsett comes from the west and from the north including Marsh Lake drainage area, passing through Lakes Norden, Mary, St. John and Albert before entering Lake Poinsett.

Explanation of symbols on Map (Attachment B.)

<u>Symbol A.</u>, indicates the location of Boswell Dam. This is a bridge having four 20 foot wide electrically operated gates which can completely close the bridge opening. There is a name plate on this bridge indicating it was constructed by the Department of Game, Fish and Parks, and Hamlin County in 1929. It was reconstructed by the Department of Game, Fish and Parks in 1946-47.

<u>Symbol B.</u>, indicates the location of the inlet channel from "Boswell Dam" to Dry Lake. Prior to 1955 this channel had a maximum capacity of 500 cubic feet per second. It was reconstructed by the Department of Game, Fish and Parks in 1955 to have a maximum capacity of 1500 c.f.s. as specified in Water Right No. 119-3A.

<u>Symbol C.</u>, indicates the location of a gated bridge on the inlet channel. This bridge has five 20 foot wide gates which can completely close the bridge opening. This was constructed by the Department of Game, Fish and Parks in 1946-47.

<u>Symbol D.</u>, indicates the location of "Stone Bridge". When the water level in Dry Lake becomes high enough the water flows through this bridge into Lake Poinsett. This bridge has been reconstructed so stop-logs may be placed in the bridge opening to elevation 1652.55.

<u>Symbol E.</u>, indicates the location of the natural outlet from Lake Poinsett to the Sioux River. When the Sioux River water levels are high enough the flow of water can reverse and the water may flow from the Sioux River to Lake Poinsett through this outlet channel.

Symbol F., indicates the location of the proposed structure mentioned in Section 3., of the Department of Game, Fish and Parks letter (Attachment A.). This proposed structure would be a sheet piling weir dam with a 100 foot wide crest at elevation 1651.0.

Consulting Engineers have prepared four alternate plans for channel clean-out of the outlet channel for the Department of Game, Fish and Parks. Alternates A, B and C propose 100 foot wide, 80 foot wide and 60 foot wide channel clean-out from station 27+100 to 147+20. This is a distance of 12,020 feet (2 1/3 mile) and is the distance along the outlet channel from the site of the proposed sheet piling weir dam to the Sioux River. Alternate D., proposes a 60 foot wide channel clean-out from station 90+00 to 147+20, a distance of 5,720'(1 1/10 mile). This is indicated by red on the map (Attachment B.). The Department of Game, Fish and Parks letter (Attachment A.) states that a portion of the Alternate D., channel clean-out will be made.

The Commission has been asked to establish an ordinary high water level for Lake Poinsett. What is an ordinary high water level? The South Dakota Supreme Court in the case of Anderson vs Ray (37 SD 17) stated, "Neither high or low water mark means the highest or lowest point reached by the waters of a lake during periods of extreme and continued freshets, or periods of extreme and continued drought, but does mean the high and low points of variation of such waters under ordinary conditions, unaffected by either extreme."

From this definition it is seen that the ordinary high water level is not necessarily the most desirable outlet water level. Your attention is called to the last paragraph page 1., and the second paragraph, page 2., of "RULE NO. XII, ESTABLISHMENT OF PUBLIC MEANDERED LAKE ELEVATIONS" of the Water Resources Commission (Attachment C.).

Elevations of the water levels of Lake Poinsett have been recorded yearly or more often since 1935. To some degree these water levels have been affected by legally constructed and accepted man-made structures. See paragraph 3., page 2., of RULE NO. XII. (Attachment C.).

In South Dakota Geological Survey, Report of Investigation 102, Hydrology of Lake Poinsett,the yearly measurements are shown in graph form. Attachment D., shows this graph and the indicated annual high water marks. It should be noted that prior to 1965 the graph shows elevations connected by a dotted line which is indicative that the measured elevations were not necessarily the highest water level during each year. Since 1965 measurements were made frequently enough so that the measured elevations are actually the highest water level reached each year and the graph connects the measured points by a solid line indicating this more reliable data.

During this period of record it is apparent that the lake levels from 1935 to 1941 inclusive were comparatively very low and reflect the effect of the relatively long and severe drought period of the 1930's. Lake level measurements for the period 1941 to 1945 inclusive reflect the refilling period after the drought period. Lake level measurements for the period 1946 to 1970 inclusive reflect the effect on the lake during more normal fluctuations of precipitation and water runoff from the contributing drainage area, ground water contributions, and the influences of Big Sioux River water diversions by Boswell Dam and the channel to Dry Lake and Lake Poinsett.

Attachment E., shows,in tabular form, the high water elevation in Lake Poinsett for each year during the period of record (left hand three columns). These annual high water elevations are shown by one-foot increments identified by the years during which the lake levels occurred in each one-foot range (center three columns). Note that during twelve of the years the high water level was in the 1651.0 - 51.9 increment, that during six years the high water level was in the 1652.0-52.9 increment, and that during five years was in the 1650.0-51.9 increment. Thus during twenty-three years of a thirty-eight year record the high water level elevation was in the three-foot range 1650.0 and 1652.9. During the other fifteen years the range was from 1636.0 to 1653.8 with no particular pattern of occurence.

Pursuant to the Court's definition in Anderson vs Ray (37 SD 17), this analysis of ordinary high water mark excludes the extra-ordinary low lake levels during the period of record 1935 to 1945 inclusive. Likewise the lake levels during 1949 and 1951 were excluded as being extra-ordinarily low, due apparently to unrecorded lack of contributing inflows from the drainage area, ground water and Big Sioux River diversions. The years 1962 and 1969 and including 1972 were exceptionally large water runoff years and the high lake levels during these years were considered to be extra-ordinarily high.

Attachment E., (right hand five columns) shows the results of these analyses including the arithmetical average elevation (1651.5) for the twenty-three years when the lake level fluctuated between elevations 1650.0 and 1652.9 and the same average elevation calculated for the twelve year period during which the high lake level each year was in the 1651.0-51.9 range. Also, the mean elevation during the twenty-three year period was 1651.5 and the mean elevation during the twelve year period was 1651.6. The close relationship between the arithmetical average elevation and the mean elevation reflects a good correlation when distorting extremes, low and high, were avoided which corresponds with the Court's definition of ordinary high water mark as stated in Anderson vs. Ray (37 SD 17).

A field survey of the Lake Poinsett area was made by Commission Staff Grimes, Driscoll and Butler on October 1-2, 1972, on which dates Lake Poinsett water level elevation was 1651.8. Observations and measurements made at Lake Poinsett, Dry Lake, Boswell Dam and channel, and the lake outlet and watercourse, confirmed the conclusion that elevation 1651.5 was a reasonable ordinary high water mark. Normally, outflows occur from Lake Poinsett during high lake levels each year. The amount of flow is influenced by outlet level fluctuations caused by ample runoff year's water erosion of the outlet entrance and during drought periods, by sand bar build-up due to wave and ice action at the outlet entrance.

It is therefore the recommendation of the Commissions' technical Staff that the Commission approve elevation 1651.5 as ordinary high water mark for Lake Poinsett for public hearing purposes; that the Commission authorize the Staff to arrange for and conduct a public hearing on this question in the Lake Poinsett community if possible, otherwise at Watertown, South Dakota, prior to the scheduled Commission meeting on January 25, 1973; and; subject to transcript summary being available for Commissioner's consideration, that the Commission establish the high water mark for Lake Poinsett during the January 24, 1973 meeting, if possible.

During the field survey of the Lake Poinsett vicinity on October 1-2, 1972, the Staff evaluated the possible effects of the improvements proposed by the Department of Game, Fish and Parks. Conclusions reached were that a control structure 100 feet wide with crest at elevation 1651.0 and outlet watercourse improvement in the mile or so most downstream reach would,with reasonable operation and maintenance, stabilize the lake level within narrower limits than now occur which would benefit the recreational values at Lake Poinsett and lessen the hazards to public and private properties along the lake shore.

It was concluded, also, that such improvements would not change flooding conditions along the outlet watercourse from out-of-bank flows of the Big Sioux River nor back inflow up the outlet watercourse into the lake from high flood stages of the Big Sioux River; that the proposed overflow structure in the outlet watercourse would control,and meter,outflows from Lake Poinsett in a more uniform manner which, with the outlet watercourse improvement, would better conditions following flood conditions and at other times sustain flows over a longer period with beneficial results; that such improvements would not change existing conditions during drought periods when lake levels may be expected below elevation 1651.0; and that the structure crest at elevation 1651.0 is reasonable to maintain an ordinary high water mark at elevation 1651.5, including wind and wave effects on the lake water surface.

####

ATTACHMENT A

DEPARTMENT OF **GAME** AND **PARKS**

PIERRE, SOUTH DAKOTA

Gentlemen:

The Department of Game, Fish and Parks request that the Water Resource Commission establish an ordinary high water level for Lake Poinsett. In support of this request we submit the following data:

1. Hydrology of Lake Poinsett by Assad Barari.

2. Management Plan for Lake Poinsett, Hamlin County by Department of Game, Fish & Parks (with recommendations by East Dakota Conservancy Sub-District regarding water levels).

3. Engineer Survey and design of the outlet channel and proposed structure prepared by Banner Engineering, Brookings, South Dakota for Department of Game, Fish & Parks. (These designs will be modified slightly to reduce cost of structure and channel improvement work. These modifications would be to use a part of alternate "D" for the channel and reduce the depth of sheet piling from 13 feet to 11 feet on the structure.)

We believe that these actions follow the rules established by the Water Resources Commission and that the Commission can begin proceedings necessary to establish an ordinary high water level.

Sincerely,

R A Hodgins

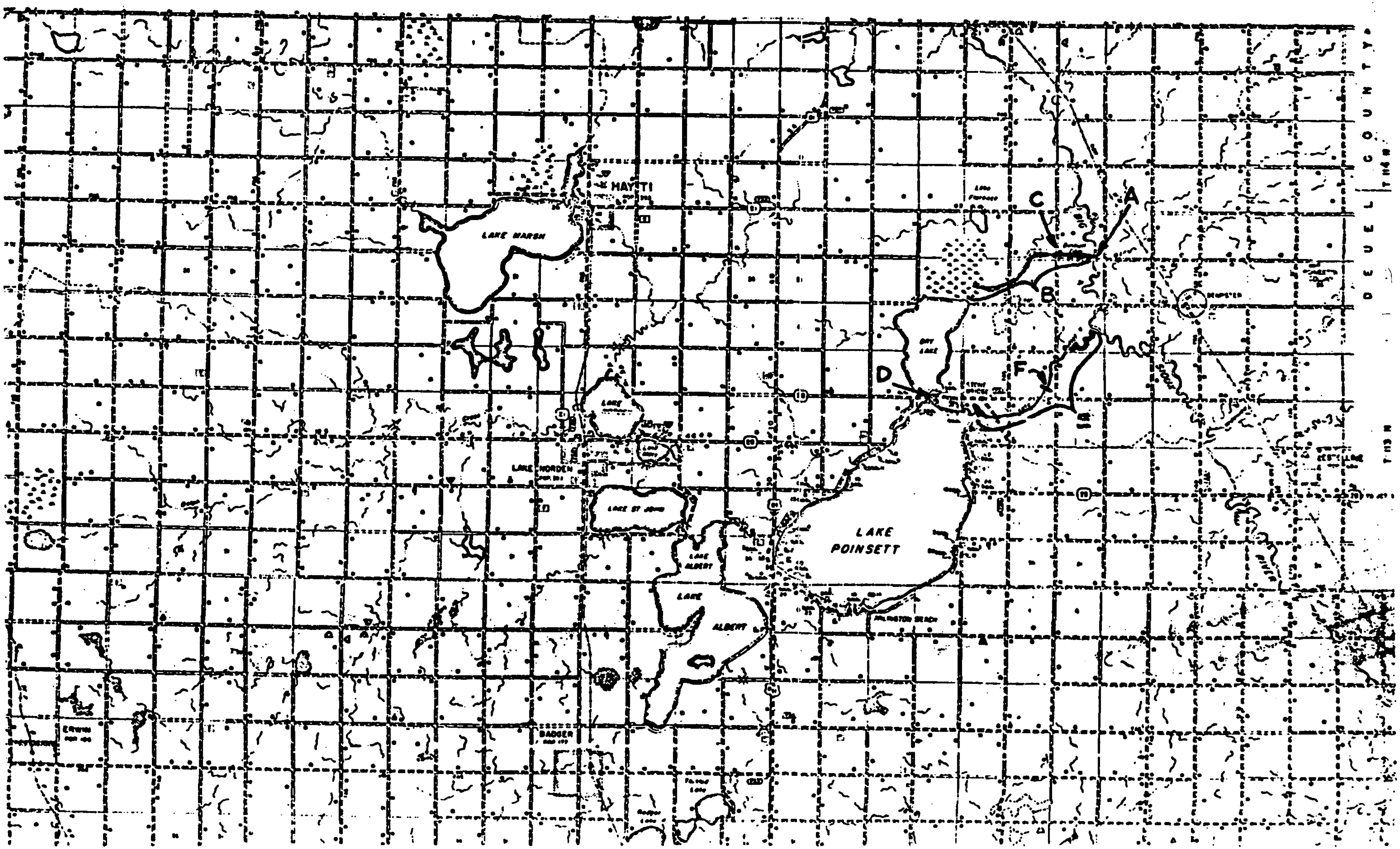
R. A. Hodgins, Director

RAH/rlh/mt

August 28, 1972

Water Resources Commission
Pierre
South Dakota

ATTACHMENT B



ATTACHMENT C

WATER RESOURCES COMMISSION

PIERRE, SOUTH DAKOTA

RULE No. XII.

PREAMBLE

This Rule, identified as No. XII, ESTABLISHMENT OF PUBLIC MEANDERED LAKE ELEVATIONS, is hereby adopted pursuant to authority provided by Section 61.0103 of the 1960 Supplement to the South Dakota Code of 1939.

POLICY

The Water Resources Commission will establish "Ordinary High Water Mark" and "Ordinary Low Water Mark" or either only in the public interest. Mere request or existing controversy in themselves do not.constitute public interest. There must also be a willingness and capability to construct reasonably permanent improvements to control the lake levels as and when established so as to enhance public use of the lake surface or so as to protect property, or both. Should these lake levels be established and the actual improvements not be forthcoming within a period of five years, such lapse of time, or lesser period of time, should significant natural changes occur in these levels, shall be sufficient cause for rescinding the establishment of "Ordinary High Water Mark", or "Ordinary Low Water Mark", or both, as the judgement of the Water Resources Commission may determine. Under no circumstances will the Commission establish either of these elevations for the express purpose of identifying, determining or locating property boundaries.

"Ordinary High Water Mark" or "Ordinary Low Water Mark" will be established only on meandered lakes which are used for public navigable (recreational) purposes (boating, fishing, swimming, skating, picnicking and similar recreational pursuits).

"Ordinary High Water Mark" or Ordinary Low Water Mark" will be established only as public interest is evident in the water surface between these elevations. These elevations will not be established for any purpose associated with the use of portions or all of the lake bed between these elevations which may not be covered with water or for the purpose of identifying the area or degree of the qualified public and private rights in such exposed or non-water covered portions of the lake bed between these elevations.

"Ordinary Low Water Mark" will be established for those lakes only from which water may be withdrawn for beneficial use under existing valid appropriative water rights that have been acquired pursuant to state law. Except for the existance of such rights, the "Ordinary Low Water Mark" is determined by natural precipitation and water runoff factors.

Any proposal advocating structural improvements providing for controlling the lake level at an elevation higher than "Ordinary High Water Mark" requires acquisition of water rights pursuant to state law for use of the additional water and appropriate rights in private property.

In establishing "Ordinary High Water Mark", natural factors will take precedence. Man-made influences, either those that have been constructed to lower this mark or those constructed to raise this mark, will be disregarded unless such influences have been lawfully constructed or have existed and been accepted for such a period of time as may be determined to be the equivalent of natural conditions.

PROCEDURE

1. Written initiating request for establishment of "Ordinary High Water Mark", or "Ordinary Low Water Mark", or both, shall be directed to the Water Resources Commission, Pierre, South Dakota, which request shall contain the following information;

a. The name and location of the lake,

b. The names and addresses of the persons and organizations initiating the request,

c. The names and addresses of other parties known to have an interest in the results of establishing "Ordinary High Water Mark" or "Ordinary Low Water Mark", or both, as the case may be,

d. Reasons why the establishment of "Ordinary High Water Mark", or "Ordinary Low Water Mark", or both, are in the public interest, either for public protection or public benefit,

e. Proposed method by which the "Ordinary High Water Mark", if established, will be preserved, including physical improvements, schedule of installation and financing arrangements.

2. Upon receipt of such request, the Water Resources Commission will;

   a. Examine the request and solicit additional information as the Commission may consider pertinent,

   b. Investigate the site,

   c. Confer with other state agencies having responsibilities in the lake or its bed,

   d. Hold such public hearings as the Commission may decide are desirable or necessary,

   e. Answer the request and, if approved, proceed with the establishment of the "Ordinary High Water Mark", "Ordinary Low Water Mark", or both, as appropriate, subject to availability of funds and staff to perform the work.

APPEAL

The Water Resources Commission will reconsider its decision or establishment of water marks as provided under 2. e. above upon appeal request therefore, provided, that such appeal is made within a period of sixty days following the Commission's answer to the initiating request or following the actual establishment of such water marks and, provided further, that additional pertinent information or data is made available to the Commission in the appeal request.

The decision on the initiating request or establishment of water marks by the Water Resources Commission, including those resulting from any appeal request, shall be final unless appeal is made in the Courts as provided by law.

EFFECTIVE DATE

This Rule No. XII shall become effective on and after January 1, 1966.

APPROVAL AND PROMULGATION

Motion made by Mr. Lester Brue, that the foregoing Rule be approved and adopted on this 17th day of November, 1965, and be promulgated pursuant to SDC 1939, 65.0106. Second be Mr. John Sutton. Passed as evidenced by the following signatures of the Commissioners present and voting "aye" on this 17th day of November, 1965:

Chairman, Lauren A. Davis

/s/ Carl Cronin
Vice Chairman, Carl Cronin

Albro Ayres

/s/ Lester K. Brue
Lester Brue

/s/ Milton E. Fischer
Milton E. Fischer

/s/ Richard Lommen
Richard Lommen

/s/ John E. Sutton
John Sutton

ATTEST:

/s/ J. W. Grimes
J. W. Grimes
Chief Engineer and
Executive Officer

(SEAL)

State of South Dakota)
)
Office of Secretary of State)

Filed in the Office of the Secretary of State on the 22nd day of November, 1965.

/s/ Alma Larson
Secretary of State

By:/s/Ann Hackworth
Assistant Secretary of State

CERTIFICATE

I hereby certify that the above and within instrument is a full, true and correct copy of rule adopted by the State Water Resources Commission at its regular meeting on November 17, 1965.

J. W. Grimes, Chief Engineer
and Executive Officer

ATTACHMENT D

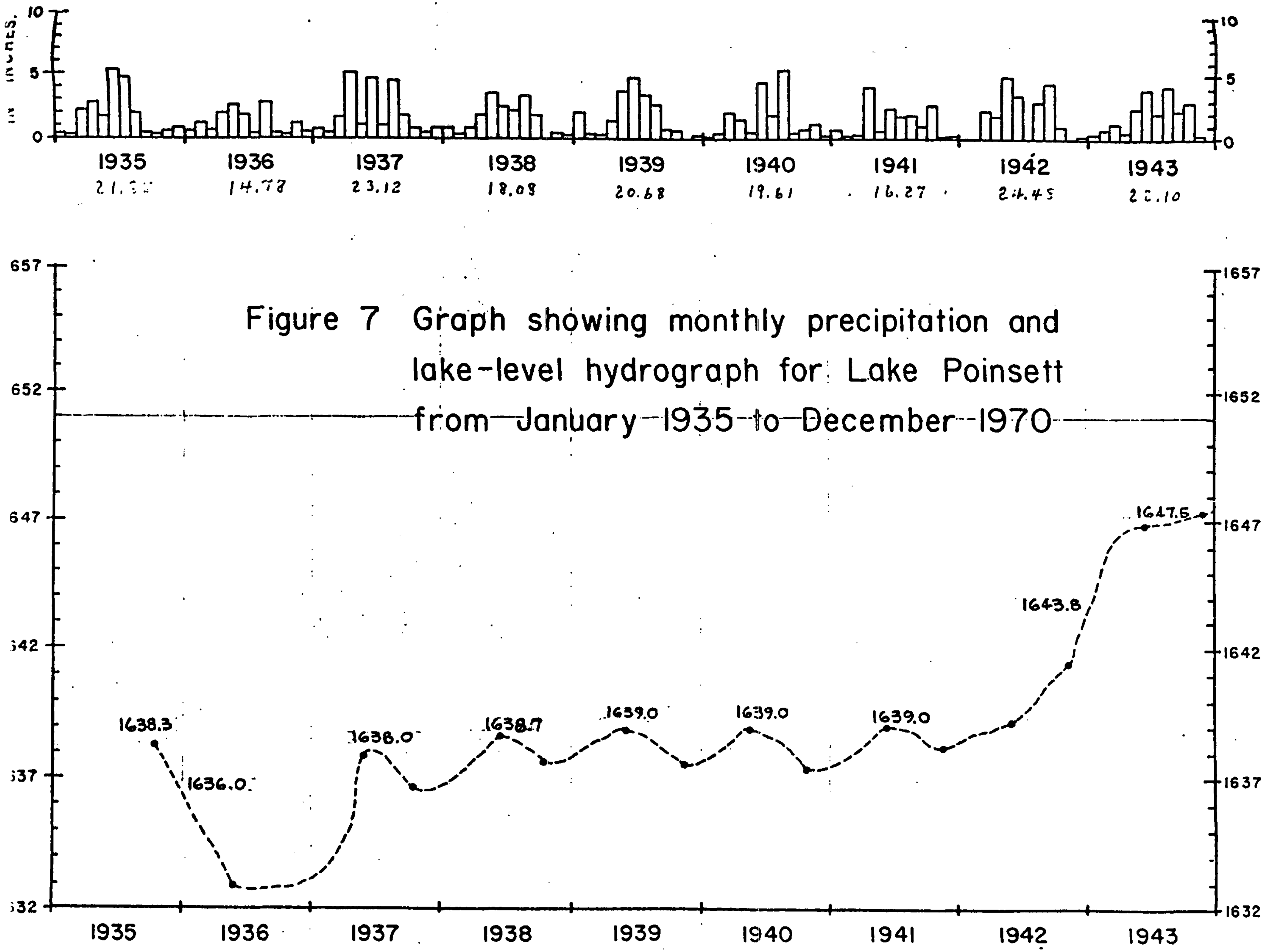


Figure 7 Graph showing monthly precipitation and lake-level hydrograph for Lake Poinsett from January 1935 to December 1970

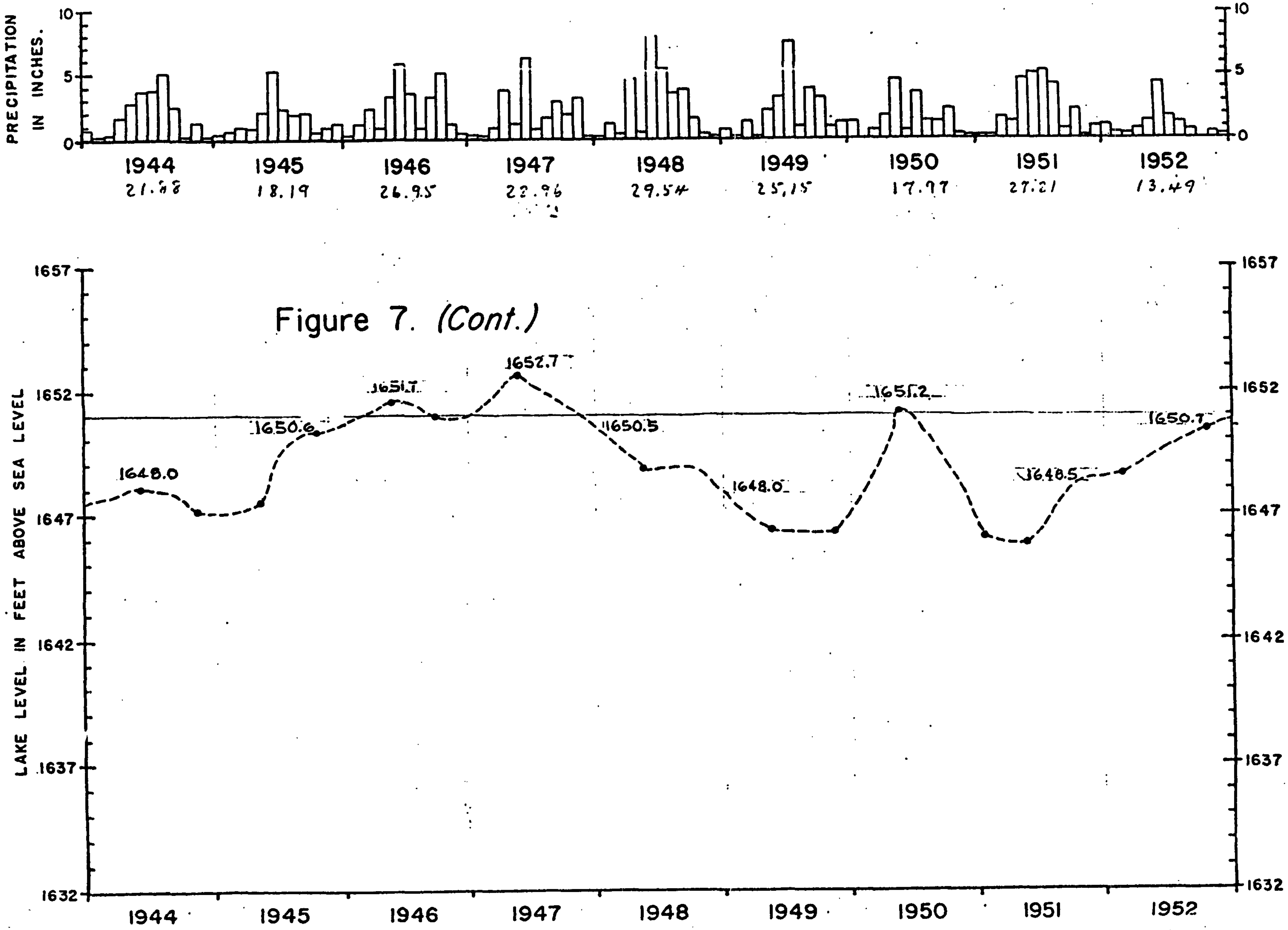


Figure 7. (Cont.)

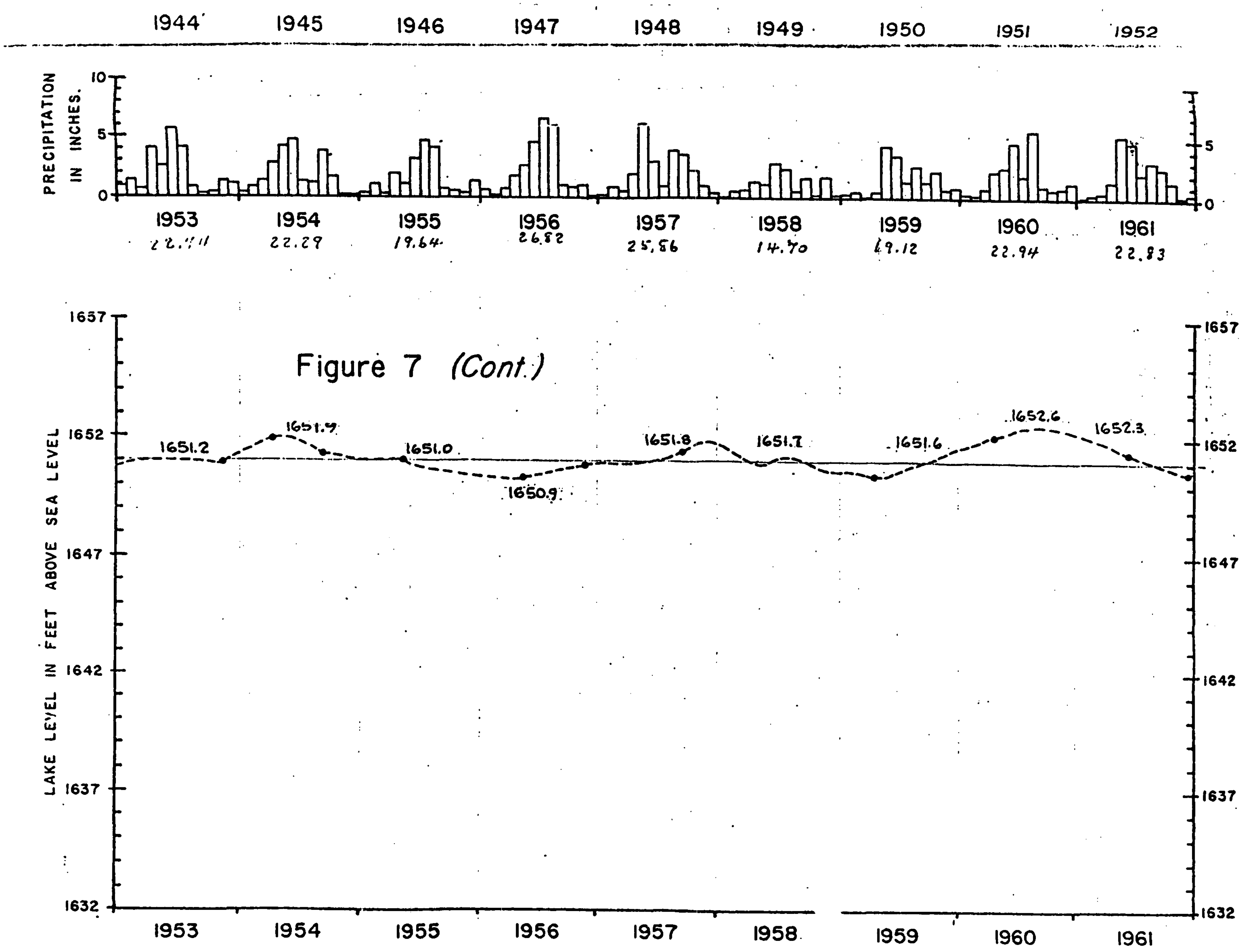
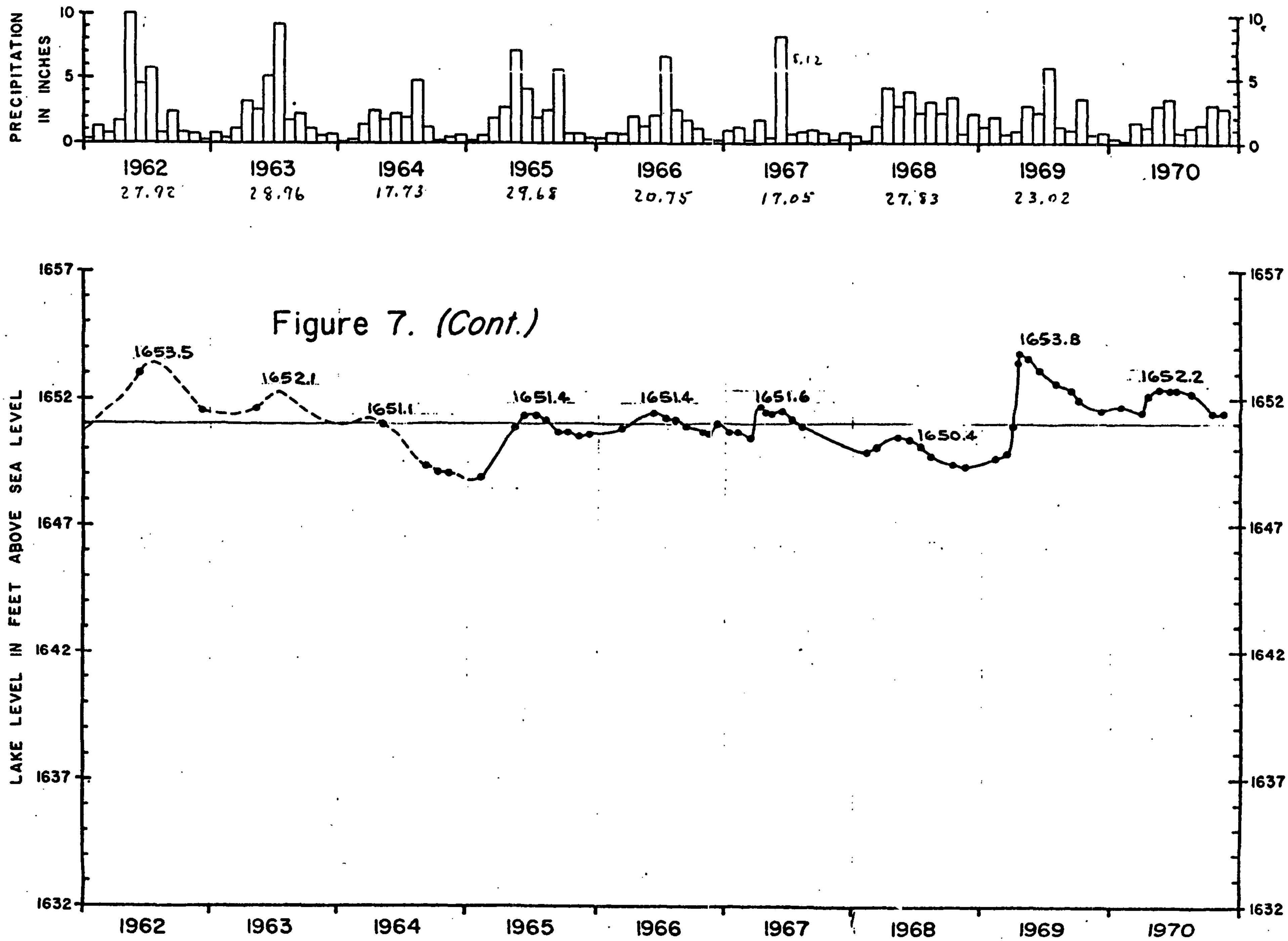


Figure 7 (Cont.)


PRECIPITATION IN INCHES
10
5
0
1962
27.92
1963
28.96
1964
17.73
1965
29.68
1966
20.75
1967
17.05
1968
27.83
1969
23.02
1970
Figure 7. (Cont.)
LAKE LEVEL IN FEET ABOVE SEA LEVEL
1657
1652
1647
1642
1637
1632
1653.5
1652.1
1651.1
1651.4
1651.4
1651.6
1650.4
1653.8
1652.2

ATTACHMENT E

LAKE POINSETT ORDINARY HIGH WATER LEVEL CALCULATIONS

Year of Record	High Water Level Elevation: Below outlet elevation	High Water Level Elevation: Above outlet elevation
1935	1638.3	
1936	36.0	
1937	38.0	
1938	38.7	
1939	39.0	
1940	39.0	
1941	39.0	
1942	43.8	
1943	47.5	
1944	48.0	
1945		1650.6
1946		51.7
1947		52.7
1948		50.5
1949	48.0	
1950		51.2
1951	48.5	
1952		50.7
1953		51.2
1954		51.9
1955		51.0
1956		50.9
1957		51.8
1958		51.7
1959		51.6
1960		52.6
1961		52.3
1962		53.5
1963		52.1
1964		51.1
1965		51.4
1966		51.4
1967		51.6
1968		50.4
1969		53.8
1970		52.2
1971		52.0
1972		53.2
Average	1,648.5	

The water level fluctuated 18 feet during the 1935-72 period. Shown are 1 foot increments of this 18 feet and the years the high water level occurred in each 1 foot increment.		Number of years in 1 foot increments
1636.0-36.9	1936	1
1637.0-37.9	None	
1638.0-38.9	1935, 37, 38	3
1639.0-39.9	1939, 40, 41	3
1640.0-40.9	None	
1641.0-41.9	None	
1642.0-42.9	None	
1643.0-43.9	1942	1
1644.0-44.9	None	
1645.0-45.9	None	
1646.0-46.9	None	
1647.0-47.9	1943	1
1648.0-48.9	1944, 49, 51	3
1649.0-49.9	None	
1650.0-50.9	1945, 48, 52, 56, 68	5
1651.0-51.9	1946, 50, 53, 54, 55, 57, 58, 59, 64, 65, 66, 67	12
1652.0-52.9	1947, 60, 61, 63, 70, 71	6
1653.0-53.9	1962, 69, 72	3

Year of Record	Annual High Water Elevation: 1650.-50.9 increment	1651.0-51.9 increment	1652.0-52.9 increment	1650.0-52.9 increments
1935				
1936				
1937				
1938				
1939				
1940				
1941				
1942				
1943				
1944				
1945	1,650.6			1,650.6
1946		1,651.7		51.7
1947			1,652.2	52.2
1948	50.5			50.5
1949				
1950		51.2		51.2
1951				
1952	50.7			50.7
1953		51.2		51.2
1954		51.9		51.9
1955		51.0		51.0
1956	50.9			50.9
1957		51.8		51.8
1958		51.7		51.7
1959		51.6		51.6
1960			52.6	52.6
1961			52.3	52.3
1962				
1963			52.1	52.1
1964		51.1		51.1
1965		51.4		51.4
1966		51.4		51.4
1967		51.6		51.6
1968	50.4			50.4
1969				
1970			52.2	52.2
1971			52.0	52.0
1972				
Average		1,651.5		1,651.5

FLOOD CONTROL PERMIT NO. FC-5

The Water Management Board hereby approves Flood Control Permit No. FC-5, Lake Poinsett Area Development Association, c/o Virgil Herriott, Lake Norden, South Dakota 57248 to construct a gated control structure on the Lake Poinsett outlet.

Approval of the permit does not increase the likelihood or severity of downstream flood damages, does not impair existing water rights or endanger human life or property. The permit authorizes construction of the proposed project to reduce flood damage, bank erosion and nutrient loading the lake with the following qualifications:

1. That the gated structure may be closed only during times when water is backed up from the Big Sioux River and may flow into the lake over the outlet.

2. That the gates may not be used to raise the water level in Lake Poinsett. The gates must remain open when the water level elevation of the lake is higher than the water level downstream of the outlet.

3. That the ordinary high water mark (High WM) elevation 1651.5 feet msl may not be affected by this Flood Control Permit and that the Board may review this permit if it appears that the High WM is being affected or a new High WM is being formed above or below the established High WM.

4. That the construction of the control structure, future maintenance and repair, and gate operation are the responsibility of the Lake Poinsett Area Development Association. *Lake Poinsett Water Project Dist. took over control, maintenance Sept 1st 1990*

5. That the gates must be capable of being locked in position so unauthorized persons may not operate or tamper with the gates.

Date of first receipt of application August 22, 1986

Approved March 4, 1987

1. The date from which the applicant may claim right is August 22, 1986

2. The whole of said work is to be completed on or before March 4, 1992.

3. The project shall be used for the purpose of flood control on Lake Poinsett

4. The prior water rights of all persons who, by compliance with the laws of the State of South Dakota, have acquired a right to the use of the water must not be unlawfully impaired by this flood control project.

WATER MANAGEMENT BOARD

John Hatch

Chief Engineer, Water Rights Division
Dept. of Water and Natural Resources

APR 30 1987

Boswell Gate

Operating Procedure
Lake Poinsett Diversion

(Revised January, 1985)

Cooperating Groups:

~~Lake Poinsett Area Development Association~~
South Dakota Department of Game, Fish and Parks
South Dakota Department of Water and Natural Resources

I. Committee Function and Membership

A. The Lake Poinsett Diversion Committee (hereafter referred to as the committee) is formed to develop an interagency agreement for operation of th Lake Poinsett Diversion and to make recommendations on its operation to the Secretary of the Department of Game, Fish and Parks (hereafter referred to as the Secretary). This recommendation will be based on all available information and to the greatest extent possible give optimum consideration to enhancement of the Lake Poinsett resource. The Secretary will make the final decision on any diversions into Lake Poirsett after careful and serious consideration of the committee recommendation. A recommendation from the committee shall be approval of a majority of its members, i.e. 4 out of 7. The Secretary, (LPADA) Wildlife Conservation Officer and committee representative from the Department of Game, Fish and Parks will be responsible for keeping the committee informed of any and all information and activity related to the Lake Poinsett Diversion. Likewise, the remaining committee members will keep Game, Fish and Parks abreast of any pertinent developments.

Responsible Agency
Committee, GF&P, DWNR

B. Upon majority vote of the committee members, or recommendation to the committee by the Secretary, this interagency agreement may be reviewed and any subsequent changes considered.

Responsible Agency
Committee, GF&P

C. The committee members and alternates will be appointed each year by July 1, and consist of:

(1) Two (2) members and one (1) alternate from the Department of Game, Fish and Parks (GF&P) appointed annually by the Secretary of GF&P.

Responsible Agency
GF&P

(2) One (1) member and alternate from the Department of Water and Natural Resources (DWNR), Office of Water Rights appointed annually by the Secretary of DWNR.

Responsible Agency
DWNR

(3) One (1) member and alternate from the Department of Water and Natural Resources (DWNR), Office of Water Quality appointed annually by the Secretary of DWNR.

Responsible Agency
DWNR

(4) Three (3) members and alternate from the Lake Poinsett Area Development Association (LPADA), appointed by the Board of Directors for 1 year terms.

Responsible Agency
LPADA

II. Lake Poinsett Diversion Operation

A. Normal operational procedures

(1) The keys to the diversion gates and Boswell Dam will be kept by the local Wildlife Conservation Officer of the Department of Game, Fish and Parks. The Wildlife Conservation Officer will also be responsible for operating the diversion gates when so directed by the Secretary.

Responsible Agency
GF&P

Boswell Dam on the Big Sioux River will be left open at all times. The channel of the Big Sioux River in the immediate area of the Lake Poinsett Diversion will be periodically inspected and cleaned by the Department of Game, Fish and Parks to permit good hydraulic capacity. It will also be the responsibility of Game, Fish and Parks to maintain Boswell Dam and the diversion gates in an efficient a working order as possible.

Responsible Agency
GF&P

(3) The diversion gates will normally be kept closed at all times except:

(a) The gates will be opened in the fall immediately prior to winter freeze-in minimizing any significant flows through the diversion.

Responsible Agency
GF&P

(b) The diversion gates will then be closed in the spring as soon as reasonable chance of freeze-in can be avoided, minimizing any significant flows occurring in the diversion ditch.

Responsible Agency
GF&P

B. Operation of the gates during low water levels.

(1) [redacted]

Responsible Agency
GF&P

(a) Any diversion will be in accordance with the existing water rights permit (i.e. 1500 cfs of flood waters).

Responsible Agency
GF&P, DWNR, Committee

(b) [redacted] is flowing into the lake. A determination of flow will be made concurrently in the diversion at the diversion gate and in the outlet channel near the Highway 28 bridge when the outlet has water flowing into the lake. (See Appendix I).

Responsible Agency
GF&P, DWNR, LPHDA

(c) The results of these measurements must indicate that the incoming waters will not be detrimental to Lake Poinsett. Since the spring time influx of nutrients, specifically total phosphate (PO_4) directly influences the intensity of summer algal blooms, the total annual load of nutrients entering through the diversion will not exceed 4.0×10^6 g (8,200 lbs) total PO_4/year. When this yearly nutrient loading total is reached, the diversion gates will be closed for the duration of the year except under emergency conditions.

Responsible Agency
GF&P, DWNR, Committee

(d) Maintain closure of the diversion gates for at least 72 hours after the spring river breakup and initiation of flood flows, to avoid high concentrations of nutrients during the first flush of run-off water. Prior to operation of the diversion the concentration of total PO_4 in the Big Sioux River will be less than 0.5 mg/1.

Responsible Agency
GF&P, DWNR, Committee

C. Exceptional operation of the gates during extreme flood levels on the Big Sioux River.

(1) Exceptional operation of the gates during extreme flood levels on the Big Sioux River will be conducted in such a manner that the requirements for operation of the gates during low lake water levels will not be applicable.

Responsible Agency
GF&P, Committee

(2) The diversion gates will be opened only if flood conditions are so severe that great property damage is possible to bridges, roads, and other state, county, or private structures that can feasibly be reduced by diversion of river water into Dry Lake and Lake Poinsett. They will then be closed at first indication that flood waters are beginning to recede.

Responsible Agency
GF&P, DWNR, Committee

(3) If such an emergency should arise, a member of the committee will be contacted by Game, Fish and Parks. This person must then contact and gain a majority approval from the rest of the committee before a recommendation is made to the Secretary that the diversion gates be opened.

Responsible Agency
GF&P, Committee

(4) It will be the responsibility of DWNR to investigate the potential flooding hazard on the Big Sioux River prior to spring river breakup. If flooding problems are anticipated, DWNR will alert all committee members and the Secretary, and keep them abreast of all developments so that the decision whether to divert may be made by the Secretary after committee recommendation as quickly as possible.

Responsible Agency
DWNR

(5) Water chemistry and flow analysis will be performed as indicated in section IIB(b) above.

Responsible Agency
GF&P, DWNR, LPADA

(6) Exceptional operation of the gates during extreme flood levels on the Big Sioux River will be conducted in such a manner to attempt minimizing nutrient loading into the Dry Lake-Lake Poinsett system.

Responsible Agency
GF&P, DWNR, Committee

Appendix I

Chemical and Flow Monitoring Strategy
Lake Poinsett Diversion Operating Procedure

The Watertown Regional Office of the Department of Water and Natural Resources (DWNR), the local Wildlife Conservation Officer of the Department of Game, Fish and Parks (GF&P), or a representative of Lake Poinsett Area Development Association (LPADA), depending on who is available, will be responsible for collecting water samples, taking flow measurements, and shipping samples as expeditiously as possible to the Water Quality Laboratory at South Dakota State University, Brookings, S.D.

(1) The chemical parameters to be analyzed from the samples include:

(a) Ortho-Phosphate (PO_4) (b) Total Phosphate (PO_4) (c) Total Suspended Solids.

(2) (a) 1 sample will be taken at the confluence of the Lake Poinsett Diversion and the Big Sioux River, at the Boswell Dam.

(b) Flow measurements will be taken in the diversion channel at the diversion gates.

(c) 1 sample will be taken in the outlet channel near the Highway 28 bridge if water is flowing into the lake. When water is flowing an estimate of total discharge will be made in the same way as the flow measurements in the diversion channel.

(d) 1 composite sample will be taken from three widely separated areas of Lake Poinsett taking into consideration wind direction, localized conditions, etc.

(e) All sampling will be conducted according to standard procedures established by DWNR (see Appendix II).

(3) GF&P will assume the cost of sample analysis and shipping during any diversion into Lake Poinsett. Sampling and flow measurement during diversion will be conducted on a regular basis.

(4) DWNR will assume the cost of analysis and shipping of samples taken as needed at any other time than diversion.

A33405RF

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2466

Ref: 8EPR-EP

DEC 26 1996

Mr. Steve Pirner, Director
Division of Environmental Regulations
Department of Environment and Natural Resources
Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

Re: Approval of TMDLs
(Section 303(d) Clean Water Act)

Dear Mr. Pirner:

Thank you for the submittal dated October 30 requesting approval of certain actions under Section 303(d) of the Clean Water Act. We have completed our review of these projects as TMDLs and wish to provide approval on some of the actions. In particular, we approve those TMDLs listed on the attached table in accordance with Section 303(d) of the Clean Water Act (33 U.S.C. 1251 et. seq.). We wish to also acknowledge that these projects submitted to us are primarily based on a voluntary approach to solving water quality problems.

In our June 26, 1996 correspondence to all of the Region VIII states, we requested that past point and nonpoint source actions be evaluated for approval as TMDLs under the Clean Water Act. We feel that each state has completed certain projects that should get acknowledgement as TMDLs. The June 26 correspondence provided a list of minimum characteristics for TMDLs. We feel that several of the actions mentioned in your October 30 letter meet these minimum characteristics.

There are several reports submitted to us regarding projects that do not qualify as TMDLs. These projects appear to have relied on a technology-based approach, using best professional judgement to develop a plan of action. Although the technology-based approach is appropriate and effective in many cases and will result in attainment of water quality goals, there were pieces missing from these particular projects that would have qualified them as TMDLs. These projects most often did not include a quantitative water quality endpoint (such as an in-lake phosphorus concentration, Secchi depth reading, or standing crop goal) or a quantitative reduction target (such as a percent reduction in either sediment or nutrient loading). Again, these projects may lead to or have resulted in attainment of water quality goals, but are considered as using a technology-based approach rather than a TMDL approach. The following are the projects that fall under the technology-based approach:

- Lake Andes (Charles Mix County)
- Beaver Lake/Beaver Creek Watershed (Yankton County)
- Burke Lake (Gregory County)
- Lake Byron (Beadle County)
- Lake Campbell/Battle Creek (Lake & Moody Counties)
- Canyon Lake/Rapid Creek
- East Lake Eureka (McPherson County)
- Lake Herman (Lake County)
- McCook Lake (Union County)
- Mina Lake (Edmunds County)
- Punished Woman's Lake (Codington County)
- Ravine Lake (Beadle County)
- Richmond Lake (Brown County)
- Swan Lake (Turner County)
- Wall Lake (Minnehaha County)

In contrast, the projects listed on the attached table fully qualify as TMDLs, meeting all the minimum requirements as provided for in our June 26 correspondence to you.

Thank you for this submittal. If you have any questions concerning this approval, feel free to contact Bruce Zander of my staff at 303/312-6846.

Sincerely,

Max H. Dodson
Assistant Regional Administrator
Office of Ecosystems Protection and Remediation

cc: Tim Bjork

Attachment

Attachment

APPROVED TMDLs

Waterbody Name	TMDL Parameter/ Pollutant	Water Quality Goal/Endpoint	TMDL	Reference Document(s)
Big Stone Lake*	total nitrogen total phosphorus	39 μg/l area-weighted annual mean chlorophyll-*a* 105 μg/l area weighted mean total phosphorus	40% reduction in total phosphorus & total nitrogen	"Restoration of Big Stone Lake; Evaluation of the Effectiveness of Lake Management Measures; EPA Clean Lakes Phase II Final Report" (HDR Engineering; 1994)
Lake Kampeska*	total nutrients sediment	return Lake Kampeska from hypereutrophic to eutrophic condition	35% reduction in nutrient loadings 25% reduction in sediment loadings	Upper Big Sioux River Watershed Project (Section 319) Project Implementation Plan (SDDENR; June 1996) and Lake Kampeska Watershed Project (Section 319) (SDDENR; 1994)
Pelican Lake	total nutrients sediment	70 μg/l total phosphorus trophic state index (TSI) 65	55% reduction in nutrient loadings 65% reduction in sediment loadings	Upper Big Sioux River Watershed Project (Section 319) Project Implementation Plan (SDDENR: June 1996) and Lake Assessment Project; Pelican Lake; Codington County, South Dakota (SDDENR; 1995)
Lake Poinsett	total phosphorus	158 tons total lake algal biomass	40% reduction in total phosphorus	Phase I Diagnostic Feasibility Study; Final Report; Lake Poinsett; Hamlin County, South Dakota (SDDENR, 1996)

* These waterbodies are currently on or have been on the State's Section 303(d) waterbody list. The TMDLs associated with these waters are considered Section 303(d)(1) TMDLs. All others are considered Section 303(d)(3) TMDLs since the waters were not on the State's waterbody list.