LAKE ASSESSMENT PROJECT

LAKE FAULKTON

FAULK COUNTY, SOUTH DAKOTA

Watershed Protection Program
Division of Financial and Technical Assistance
South Dakota Department of Environment and Natural Resources
Nettie H. Myers, Secretary

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Prepared By

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South Dakota Department of Environment and Natural Resources

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Faulk Conservation District

December, 1996

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Faulk Conservation District

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LAKE IDENTIFICATION AND LOCATION

Lake Name: Lake Faulkton

State: South Dakota

County: Faulk

Nearest Municipality: Faulkton

Latitude: 45 deg. 01 min. 53 sec. N

Longitude: 99 deg. 10 min. 23 sec. W

EPA Region: VIII

Major Tributary: South Fork Snake Creek

Receiving Body of Water: South Fork Snake Creek

WATER QUALITY STANDARDS

The surface water quality standards for Lake Faulkton are shown below:

1. Beneficial Use Classifications
   a. Warmwater Semipermanent Fish Life Propagation Waters: surface waters of the state which support aquatic life and are suitable for the propagation or maintenance, or both, of warmwater fish but which may suffer occasional fish kills because of critical natural conditions.

   b. Immersion Recreation Waters: surface waters of the state which are suitable for uses where the human body may come in direct contact with the water, to the point of complete submersion and where water may be accidentally ingested or where certain sensitive organs such as the eyes, ears, and nose may be exposed to water.

   c. Limited-Contact Recreation Waters: surface waters of the state which are suitable for boating, fishing, and other water-related recreation other than immersion recreation where a person's water contact would be limited to the extent that infections of eyes, ears, respiratory or digestive systems, or urogenital areas would normally be avoided.

   d. Wildlife Propagation and Stock Watering Waters: surface waters of the state which are satisfactory as habitat for aquatic and semiaquatic wild animals and fowl, provide natural food chain maintenance, and are of suitable quality for watering domestic and wild animals.

2. Applicable Criteria
   Water quality criteria for the maintenance of these beneficial use classifications are shown in Table 1.

Table 1. Lake Faulkton Water Quality Standards

Parameter	Standard
Total Dissolved Solids	<2500 mg/L
Nitrates	<50 mg/L (as N)
pH	>6.5 & <9.0 units
Fecal Coliform Organisms	<200 per 100 mL
Total Chlorine Residual	<0.02 mg/L
Un-ionized Ammonia Nitrogen	<0.04 mg/L (as N)
Dissolved Oxygen	>5.0 mg/L
Undisassociated Hydrogen Sulfide	<0.002 mg/L
Suspended Solids	<90 mg/L
Temperature	<90 deg. F
Total Alkalinity	<750 mg/L
Conductivity	<4000 micromhos/cm

The surface water quality standards for the South Fork of Snake Creek, the major tributary to Lake Faulkton, from Lake Faulkton to S23, T118N, R70W, are as follows:

1. Beneficial Use Classifications

   a. Warmwater Marginal Fish Life Propagation Waters: surface waters of the state which will support aquatic life and more tolerant species of warmwater fish naturally or by frequent stocking and intensive management but which suffer frequent fish kills because of critical natural conditions.

   b. Limited-Contact Recreation Waters: surface waters of the state which are suitable for boating, fishing, and other water-related recreation other than immersion recreation where a person's water contact would be limited to the extent that infections of eyes, ears, respiratory or digestive systems, or urogenital areas would normally be avoided.

   c. Irrigation Waters: surface waters of the state which are suitable for irrigating farm lands, ranch lands, gardens, and recreational areas.

   d. Wildlife Propagation and Stock Watering Waters: surface waters of the state which are satisfactory as habitat for aquatic and semiaquatic wild animals and fowl, provide natural food chain maintenance, and are of suitable quality for watering domestic and wild animals.

2. Applicable Criteria

   Water quality criteria for the maintenance of these beneficial use classifications are shown in Table 2.

Table 2. South Fork Snake Creek Water Quality Standards

Parameter	Standard
Total Chlorine Residual	<0.02 mg/L
Un-ionized Ammonia Nitrogen	<0.05 mg/L
Dissolved Oxygen	>5.0 mg/L
Undisassociated hydrogen sulfide	<0.002 mg/L
pH	>6.0 & <9.0 units
Suspended Solids	<150 mg/L
Temperature	<90 deg. F
Fecal Coliform Organisms	<1,000 per 100 mL
Conductivity	<2500 micromhos/cm
Sodium Adsorption Ratio	<10
Total Alkalinity	<750 mg/L
Total Dissolved Solids	<2500 mg/L
Nitrates	<50 mg/L (as N)

The surface water quality standards for the South Fork of Snake Creek, upstream from S23, T118N, R70W, and for three unnamed tributaries of the South Fork of Snake Creek which were monitored during the Lake Assessment Project, are shown below:

1. Beneficial Use Classifications

   a. Irrigation Waters: surface waters of the state which are suitable for irrigating farm lands, ranch lands, gardens, and recreational areas.

   b. Wildlife Propagation and Stock Watering Waters: surface waters of the state which are satisfactory as habitat for aquatic and semiaquatic wild animals and fowl, provide natural food chain maintenance, and are of suitable quality for watering domestic and wild animals.

2. Applicable Criteria

   Water quality criteria for the maintenance of these beneficial use classifications are shown in Table 3.

Table 3. South Fork Snake Creek and Unnamed Tributary Standards

Parameter	Standard
Conductivity	<2500 micromhos/cm
Sodium Adsorption Ratio	<10
Total Alkalinity	<750 mg/L
Total Dissolved Solids	<2500 mg/L
Nitrates	<50 mg/L (as N)
pH	>6.0 & <9.5 units

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EXECUTIVE SUMMARY

Lake Faulkton is located in Faulk County, South Dakota, which is in the north central part of the state. The Lake Faulkton Lake Assessment Project was initiated in 1993 at the request of local citizens concerned about the deteriorating conditions of the lake. The main concerns included encroachment of cattails and other aquatic plants, sporadic fish kills because of low oxygen conditions, and overall reduced recreational opportunities at the lake.

The Faulk County Conservation District, in cooperation with the South Dakota Department of Environment and Natural Resources (DENR), obtained a U. S. Environmental Protection Agency (EPA) 604(b) grant to carry out the Lake Assessment Project. The purpose of the project was to assess the lake's general status, to determine factors which were inhibiting the lake's uses, and to develop specific alternatives for lake restoration. The study project encompassed three major components: data collection, data analysis, and report preparation.

The data collection phase of the study included gathering information on tributary and in-lake water quality, an evaluation of the lakeshore, an aquatic plant survey, a sediment survey, and analysis of the lake watershed by use of the Agricultural Non-Point Source (AGNPS) computer runoff model. Collection of this information was the responsibility of the local project sponsor (Faulk Conservation District), with guidance and technical assistance from DENR's Watershed Protection Program. Analysis of the water quality samples was conducted by the State Health Laboratory in Pierre, South Dakota.

After the data was collected, it was submitted to the DENR Watershed Protection Program for evaluation. The evaluation of the data included computer analysis, computer modeling, and statistical testing. Outputs of the data evaluation included an assessment of the trophic status of the lake, computation of sediment and nutrient loadings to the lake, and identification of critical areas in the watershed.

Specific findings of the Lake Assessment Project included the following:

- Tributary Water Quality Sampling

  Results of the tributary monitoring program indicated that major loadings of sediment and nutrients flow into Lake Faulkton from the South Fork of Snake Creek, the primary tributary to the lake. A comparison of the loadings at the lake inlet and lake outlet revealed that significant quantities of the sediment and nutrient loadings are retained in the lake.

- In-Lake Water Quality Sampling

  The in-lake water quality sampling program confirmed that Lake Faulkton is in a hypereutrophic (very nutrient rich) condition. Concentrations of nitrogen and phosphorus are at extremely high levels, which result in frequent algae blooms and abundant growth of aquatic plants in and around the lake.

- In-Lake Sediment Survey

  An unsuccessful attempt was made to conduct a sediment survey using seismic (sonar) equipment. Later, a sediment survey was completed by using steel rods to probe for sediment depth. The soft sediment in the lake was found to vary from about a one-foot depth in near-shore areas to nearly a seven-foot depth in the deeper water areas of the lake.

- Aquatic Plant Survey

  A survey was conducted to document the diversity and extent of aquatic plant growth in and around the lake. The results of the survey indicated an extensive diversity of plants, both in the lake and around the shoreline. The intensity of plant growth prevents full recreational use of the lake.

- Lakeshore Evaluation

  The lakeshore evaluation showed that, to date, extensive development has not occurred around the lake. However, an evaluation of wastewater disposal for existing lake homes and cabins indicated some deficiencies. In addition, planning should be carried out to address the need for adequate disposal of wastewater from future development around the lake. Water quality samples from a golf course adjacent to the lake indicated high levels of nutrients, and the need for management practices to limit nutrient concentrations in runoff from the course. A shoreline erosion survey documented approximately 300 feet of erosion ranging from minor to severe.

- Land Use / Feedlot Survey

  An analysis of the Lake Faulkton watershed was completed by use of the Agricultural Non-Point Source (AGNPS) computer runoff model. The results of the model identified critical areas in the watershed for nutrient and sediment runoff. In addition, livestock feeding areas were identified for runoff modeling. The AGNPS model provided a comparison ranking for the runoff from the livestock operations in the watershed.

The last phase of the Lake Faulkton Lake Assessment Project included preparation of a final report by the DENR Watershed Protection Program. This report summarizes the results of the data collection and computer analysis phases of the study, and includes a list of recommended restoration alternatives. The alternatives have been classified into three broad categories which are shown below.

- General Restoration Alternatives
- Immediate Lake Area Alternatives
- Watershed Area Alternatives

Specific alternatives which are included in the three broad restoration categories are described in the following list.

- General Restoration Alternatives

    1. Advisory Board Formation
    2. Information / Education Program

- Immediate Lake Area Alternatives

    1. Shoreline Stabilization
    2. Wastewater Disposal
    3. Golf Course Management
    4. Aquatic Plant Removal
    5. Lake Outlet Modification
    6. Aeration System
    7. Sediment Sealing
    8. Sediment Removal

- Watershed Area Alternatives

    1. Animal Waste Management Systems
    2. Grassed Waterways
    3. Crop Residue Management
    4. Small Dams / Ponds
    5. Streambank Stabilization
    6. Grazing / Rangeland Management
    7. Filter Strips
    8. Grade Stabilization Structures
    9. Alternative Livestock Watering
    10. Integrated Crop Management
    11. Wetland Restoration / Development
    12. Windbreak / Shelterbelt Establishment
    13. Conservation Crop Rotation
    14. Habitat Management

This list should not be considered to include all restoration possibilities, nor are the alternatives necessarily listed in order of priority. These are procedures that have been successful in the restoration of other lakes, and which might prove useful in the restoration of Lake Faulkton. A more concise list of feasible alternatives will need to be developed prior to the implementation of a restoration project.

INTRODUCTION

General Description of Lake

Lake Faulkton is a 115-acre (46.6 ha) impoundment located one mile west of Faulkton in Faulk County, South Dakota. The lake was formed when a dam was constructed on the South Fork of Snake Creek by the Works Progress Administration in 1936. The maximum depth of the lake is 24 feet (7.3m), while the average depth is 9.3 feet (2.8 m). The watershed area for Lake Faulkton is 161,320 acres (65,335 ha) in size and lies primarily in Faulk County, with parts of the watershed also extending into Potter, Hyde, and Hand Counties. The watershed area to lake area ratio is 1,403 to 1.

The Lake Faulkton watershed is drained by the South Fork of Snake Creek. Snake Creek is a tributary of the James River, which lies in the Missouri River Basin.

Comparison to Other Lakes in the Area (TSI)

A well-documented effect of human impact upon aquatic ecosystems is eutrophication. Eutrophication is a multifaceted term generally associated with increased productivity, structural simplification of biotic components, and a reduced ability of aquatic organisms to adapt to imposed changes (reduced stability). In this condition of eutrophication, excessive inputs, such as nutrients and sediment, commonly seem to exceed the capability of the ecosystem to be balanced (Wetzel, 1983). The Carlson Trophic State Index (Carlson, 1977), or TSI, is an indicator which can be used to measure relative levels of eutrophication for bodies of water. TSI is calculated using several equations and actual measurements of total phosphorus, Secchi depth, and chlorophyll *a*. A TSI value can be calculated for each of these parameters. In addition, a mean TSI for a lake can be calculated by averaging the TSI results for all three of the parameters.

The Carlson Trophic State Index uses TSI values of 65 and greater to indicate hypereutrophic (very nutrient rich) bodies of water; values of 50 to 65 to indicate eutrophic bodies of water; and values of 35 to 50 to indicate mesotrophic (relatively nutrient-poor) bodies of water. The SD DENR has conducted statewide assessments of major lakes since 1989. Water quality results have provided the opportunity to calculate TSI values for phosphorus, Secchi depth, and chlorophyll *a*, as well as mean TSI values for all three parameters (South Dakota Lakes Assessment Final Report, SD DENR, 1994).

Figure 1 depicts a 50-mile radius area around Lake Faulkton. Table 4 lists major lakes located within this area. The lakes are listed in order of highest mean TSI values (hypereutrophic) to the lowest mean TSI value (eutrophic).

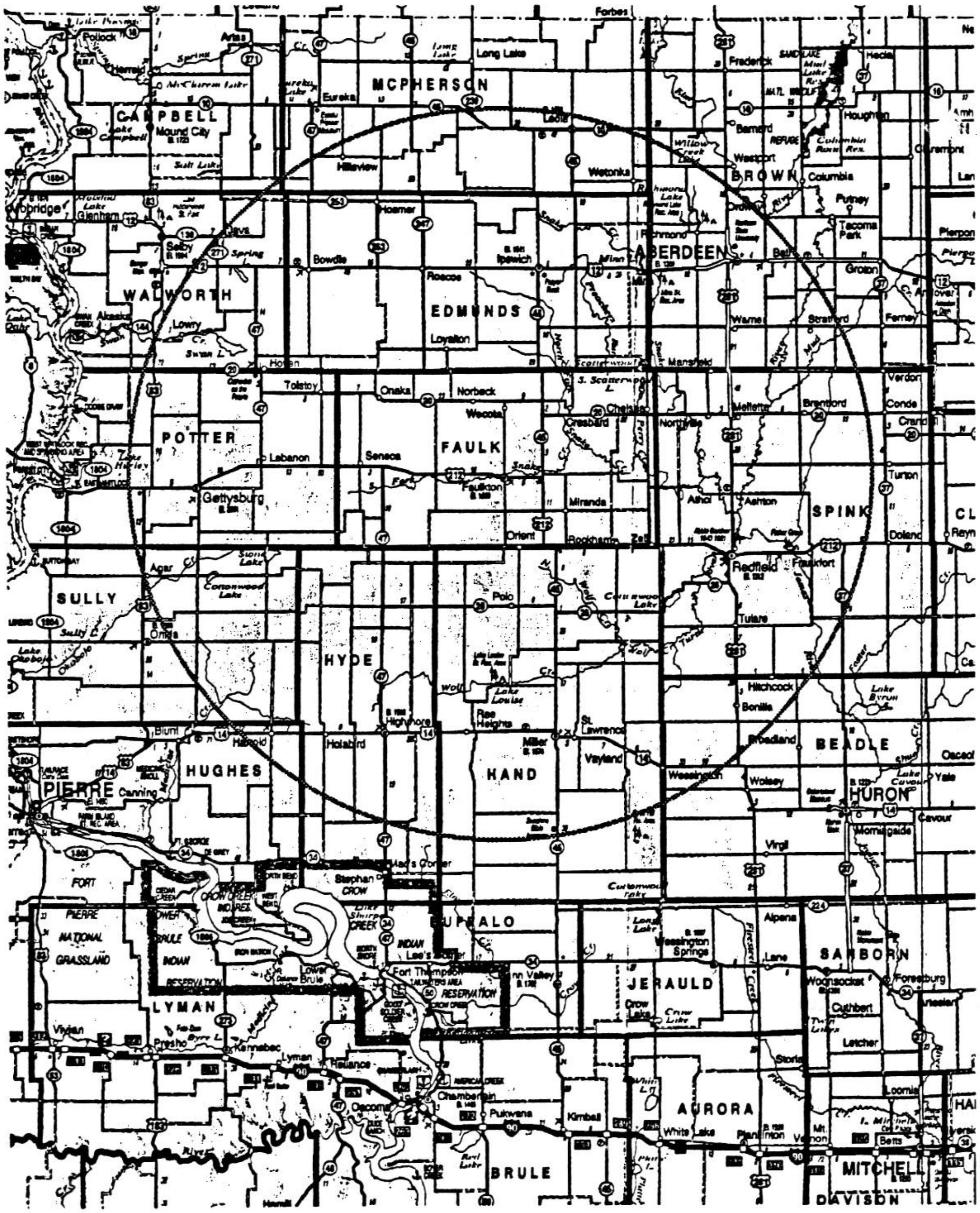

Figure 1. Fifty-Mile Radius Area Around Lake Faulkton

Table 4. Comparison of Mean TSI Values for Lakes Within a 50-Mile Radius of Lake Faulkton

Lake	Nearest Municipality	TSI	Mean Trophic State
Redfield	Redfield	83.38	Hypereutrophic
Cottonwood	Agar	79.79	Hypereutrophic
Mina	Mina	79.76	Hypereutrophic
Rosette	Ipswich	78.45	Hypereutrophic
Cottonwood	Redfield	76.84	Hypereutrophic
Faulkton	**Faulkton**	**76.32**	**Hypereutrophic**
Cresbard	Cresbard	71.28	Hypereutrophic
Louise	Ree Heights	71.16	Hypereutrophic
Bierman Gravel Pit	Chelsea	70.28	Hypereutrophic
Jones	St. Lawrence	68.30	Hypereutrophic
Loyalton Dam	Loyalton	65.28	Hypereutrophic
Richmond	Richmond	60.16	Eutrophic

From this comparison, it can be seen that Lake Faulkton, like nearly all of the other lakes within a 50-mile radius, is in a hypereutrophic condition. Within the 50-mile radius, five lakes are more eutrophic than Lake Faulkton, and six lakes are less eutrophic. Because Lake Faulkton is not extremely hypereutrophic, it could, with a relatively minor improvement in water quality, be reclassified as a eutrophic lake (TSI less than 65).

It should also be noted that the only lake within the 50-mile radius of Lake Faulkton that is not classified as hypereutrophic (Richmond Lake) is approximately 50 miles, or an hour's drive, away. Consequently, the improvement of Lake Faulkton from hypereutrophic to eutrophic could benefit nearly the entire population within 50 miles. Enhanced recreational opportunities could be provided to the majority of the population within the immediate area.

Comparison to Other Lakes in the Area (Recreation)

As shown above, there are only 11 other lakes within a 50-mile radius of Lake Faulkton. The table on the following page lists the lakes, and the nearest municipalities. This table provides a comparison of the recreational opportunities available at each of the lakes.

Table 5. Comparison of Recreational Uses to Other Lakes Within a 50-Mile Radius

Lake	Parks	Ramps	Uses*	Nearest Municipality
Redfield	1	1	B,C,F,P,S	Redfield
Cottonwood	0	1	B,F	Agar
Mina	1	3	B,C,F,P,S	Mina
Rosette	0	1	B,F	Ipswich
Cottonwood	0	2	B,F,S	Redfield
Faulkton	**1**	**1**	**B,C,F,P,S**	**Faulkton**
Cresbard	0	1	B,F	Cresbard
Louise	1	1	B,C,F,P,S	Ree Heights
Bierman Gravel Pit	0	0	F	Chelsea
Jones	0	1	B,F,P	St. Lawrence
Loyalton Dam	0	1	F	Loyalton
Richmond	1	2	B,C,F,P,S	Richmond

*B=Boating, C=Camping, F=Fishing, P=Picnicking, S=Swimming

Source: South Dakota Game, Fish and Parks; Watertown Regional Office; 1995

As can be seen from the above table, Lake Faulkton is one of the few lakes within a 50-mile radius that provides a full range of recreational opportunities. In addition to the recreational uses listed, the Lakeside Country Club at Lake Faulkton provides golfing for many other recreational enthusiasts in the area.

The recreational resources provided by Lake Faulkton are vitally important to the City of Faulkton, as well as a large surrounding area.

Objective of Investigation

The purpose of the Lake Faulkton Assessment Project was to assess the water quality of the lake and its tributary streams. The study was also intended to identify sources of nutrients and sediment that are causing the lake's degradation, and to propose feasible restoration alternatives to improve water quality in the lake and its watershed area.

BACKGROUND AND HISTORICAL INFORMATION

BRIEF HISTORY OF LAKE FAULKTON

Homestead Information

Faulk County was named after Andrew J. Faulk, the third governor of Dakota Territory. The first permanent settlers arrived in 1862. They came from states to the east and from Germany and the Scandinavian countries.

Lake Faulkton is located mainly in the two southern quarters of Section 17 in Tamworth Township, Faulk County. The first non-government owner of the SW 1/4 of Section 17 was John Keane, who filed for the patent on December 8, 1890. John C. Johnson filed for the patent on the NE 1/4 on October 29, 1902. The ownership of the NW 1/4 went to John S. Hamilton on September 13, 1904. On February 11, 1910, Patrick J. Healy, Jr., became the first private owner of the SE 1/4. There is no indication that any of these original owners, or those that followed, actually homesteaded or lived on the land.

By 1919 the NW 1/4 was owned by a Mr. Bergren, and then by his wife Louise. The deed was passed to Charles and Jenny Wherry in 1946. By 1979 ownership of this land was held by their two sons, Robert and Kenneth, as it remains today.

The ownership of the NE 1/4 by 1911 passed from John Johnson to Mattie Johnson and then to Meier and Lockwood (M&L) Corporation, a local cattle ranching company. In 1935 the M&L Corporation gave a quit claim deed to the Faulk County Lake Association (FCLA) for the NE 1/4.

By 1911 the deed to the South 1/2 of Section 17, T118N, R69W, had passed to Alice Pickler, wife of John C. Pickler. Mr. Pickler was the first representative to the U. S. House of Representatives from the area. Various other Pickler relatives then owned the South 1/2 until 1924 when the M&L Corporation gained possession. In 1932 M&L gave an easement contract to the South Dakota Game and Fish Commission for the South 1/2. In that same year M&L also deeded the SE 1/4 to George and Clara Zachritz, the local town doctor and his wife. It was in that year that construction on the Lake Faulkton dam commenced. At the completion of the dam project in 1935, M&L gave a quit claim deed on the SW 1/4 to the Faulk County Lake Association. In that same year Dr. Zachritz gave a warranty deed to the same lake association on the SE 1/4.

Nixon River vs. Snake Creek

The waterway that supplies Lake Faulkton was originally christened the "Nixon River" by early settlers and traders in the area. A U. S. Geological Survey map of 1839 shows it by that name. Within several decades, however, the "official" name changed to "South Fork of Snake Creek", even though local residents continued to call it the "Nixon". Within recent years U. S. governmental authority has prevailed, making the name change locally official by replacing all the Nixon River road signs with its preferred choice.

Dam Construction / Repairs

Lake Faulkton is located 2 1/2 miles west of downtown Faulkton, and 1/2 mile south of U. S. Highway 212. It is the result of an earthen dam constructed across the South Fork of Snake Creek. Construction of the dam began in 1932 as a County Work Project (CWP), and was completed in 1935, financed by the Works Progress Administration (WPA). Mr. R. H. Burrill was the superintendent of the construction work. Timber was first removed from the creek bottomland. Next, a trench was dug at the bottom to a depth of 22 feet to remove a seam of gravel, thereby reducing seepage. Clay was then added to the top of an impervious stratum. A horse barn was built on-site, and a cook's car provided hot meals at low cost for the workers.

From 1935 to 1936 the WPA constructed a concrete spillway using mainly horse and man power. The Lake Faulkton dam was the largest of 15 dams built by the WPA in Faulk County. The stated purposes and objectives were water conservation, recreation, and flood control.

The earthwork itself is 40 feet high and over 400 feet long. It contains 40,000 cubic yards of soil. The upstream face was rip-rapped with almost 2,000 cubic yards of field boulders, all brought in by horse teams and positioned by hand. The going rate of pay for doing that work was $1.00 per day. One source reported that over one summer season 60 men were employed for five months. Articles in the local newspaper at the time of construction reported more than once the estimated depth of the impoundment at its deepest point was 30 feet.

The majority of the approximately $10,000 expended on the dam was for labor and was financed through the Reconstruction Finance Corporation. [A later report put the total cost of the dam at only $5,600.] Material used in the project was provided by the South Dakota Game and Fish Commission. Faulk County provided all of the equipment: caterpillar tractors, a 60-inch elevating grader, trucks, and several 1 1/4 yard horse-drawn dump wagons. The cost of the spillway was reported at $17,000 and employed 35 men for six months.

According to local newspapers, water flowed over the spillway for the first time on Friday, March 12, 1937. "Interest has been running high all winter and arguments and betting on the possibility of the water reaching spillway level have been a daily pastime. Cars string in and out, from early morning until late at night, as lake enthusiasts measure and anticipate the possible rise occasioned by the melting snow and swollen streams."

In the summer of 1986 some routine repair and maintenance was undertaken. Minor repairs on the spillway were completed, and trees and their roots were removed from the dam. Most of the work was accomplished with local volunteer labor.

A major effort was undertaken in the summer of 1994. The South Dakota Department of Game, Fish and Parks contracted to have the spillway basin enlarged and then protected with a layer of field boulders. The sides of the gorge downstream of the spillway were re-contoured with heavy earth-moving equipment. The spillway face was repaired by filling and caulking cracks. The $160,000 spent will hopefully lengthen the life of the Lake Faulkton dam for many years.

Previous Lake Condition

Before construction of the dam from 1932 to 1935, the present lake bed was simply a segment of the South Fork of Snake Creek. Evidently the upper reaches of the creek bed must have been quite deep and narrow. A life-long resident who lives just north of the bridge (western end of the lake) recalls how the creek used to "roar" with the sound of rushing water during times of high runoff. Another recalls how children dived off the bridge into a rather deep hole of water.

Fishing improved and became a major activity at the lake within five years of dam construction. The lake was stocked in 1935 with 150,000 fish of three species: bullheads, bass, and crappies (three kinds). Later bluegills and sunfish also became plentiful. By the 1940's and 1950's, local sources report that Lake Faulkton had the best largemouth bass and bluegill fishing in the north-central region of South Dakota. Bluegills were often in the 1/2 to 1 pound range. Bass were taken weighing up to 8 pounds and 3 ounces, with many in the four to six pound range. Low water periodically proved harmful, although there has never been a complete fish kill because of low water. In the mid-1950's there was an over-population of sunfish which stunted their growth. Perch, pike, walleye, and catfish are other fish species found in Lake Faulkton.

Swimming has also been a popular recreational activity at the lake. Sand was hauled in within several years of the dam construction. A swimming beach was created along the northern shore just east of the present-day Game, Fish and Parks boat ramp area. At least one couple who owned a lake cabin operated a part-time summer business selling cookies, sandwiches, and cold drinks to swimmers and fishermen. So popular did swimming become at the lake that, for a time, life guard services were organized and employed to supervise that activity. A local Lutheran minister, who was an excellent swimmer, did much in this connection.

Evidently weeds and cattails made their appearance fairly early in lake history, although how severe a problem and nuisance they became cannot be accurately surmised. The decade of the 1960's seems to have been as bad as present. Some old-timers have stated the problem was mainly with shoreline cattails in the early years of the lake. Others have stated that shoreline fishing became impossible without a boat or long cane pole. Still others have insisted that boat motors had trouble some years navigating certain weed-choked areas of the lake.

Various species of fruit trees were planted on the island--mainly apples and plums--which were then harvested by those with access by way of boats. As recently as 1985 island plums, especially, were there for the picking by anyone of brave heart and thick skin willing to endure the onslaught of hordes of hungry mosquitoes.

Housing Developments

The main housing development on the shores of Lake Faulkton has been the construction of numerous lake cabins. A great majority of these are primarily used in the summer, with a few used on a year-round basis.

Previous Projects, Research, Ideas

In 1967 a small dam was constructed across a forebay on the southwest portion of the lake. It was envisioned and planned to be used as a rearing pond for future stocking of fish. This enterprise proved unsuccessful as the structure failed to hold water.

Lakeside Country Club

The Lakeside Country Club was organized in 1952 with at least 15 charter members. A 99-year lease was obtained from the South Dakota Game and Fish Commission. The rental rate on the golf course acreage was $10 per year. The golf course itself was constructed mainly with volunteer labor and donated equipment.

In 1958 a clubhouse was built. Several holes were re-arranged, or at least re-numbered, at that time. An extensive irrigation system was installed in 1979 to water the course.

In 1973 the Country Club became the outright owner of the acreage. In order to retain rights and possession of the golf course, the 34 acres of land were obtained from the South Dakota Game, Fish and Parks Commission by means of a land trade involving adjacent property. The golf course remains an attractive feature of the Faulkton community and is used extensively.

Faulk County Lake Association

As noted above, Lake Faulkton was a WPA project which commenced in 1932 when a dam was built on the South Fork of Snake Creek. The dam originally was intended primarily for recreation and to a lesser degree for flood control. The work on the dam continued until its completion in 1935. An interesting note was that in 1935 Kenneth Fillbach worked on the dam project for a total of 133 hours for which he received a total wage of $39.90, or 30 cents per hour.

On May 9, 1935, the Faulk County Lake Association (FCLA) received its Articles of Incorporation from the State of South Dakota. The original incorporators were W. J. Jacobs, L. P. Sawper, and Robert Byrne. The stated objective of the FCLA was the selling of lakeshore lots and, to a minor degree, publicity regarding the lake and its attractions. On July 25, 1935, the FCLA received a deed from George Zachritz and Clara Zachritz for the SE 1/4 of Section 17, Township 118 North, Range 69 West. This is the quarter section of land on which the Lake Faulkton dam is located. The deed was subject to an easement to the South Dakota Game and Fish Commission dated October 7, 1932. The lake lots were then platted around the lake from this quarter section of land.

The platted lots were sold to interested individuals in the Faulkton area beginning in October of 1932. The price per lot was $50.00. In examining the sale record of the $50.00 sale price, it is noted that many of the buyers paid for their lots over two to three years in increments ranging from $25.00 to $1.00. At a Board of Directors meeting held on April 4, 1945, the Lake Association set aside lots for the City of Faulkton, the Boy Scouts and Girl Scouts, and an easement was granted to Faulk County on all roads designated by the plat of the lake. In 1945 terracing and planting of trees at the lake was accomplished with WPA labor.

The FCLA continued to sell lake lots until January of 1947. At that time the unsold lots were deeded to the South Dakota Department of Game, Fish and Parks for public parks, with a provision that at no time should the lots be used as sites for the sale of intoxicating liquor or for any unlawful purpose. It is the understanding of Mr. Jarvis Brown, a local attorney and member of the FCLA who was very kind in providing the information under this heading, that the island at Lake Faulkton was also transferred to the South Dakota Department of Game, Fish and Parks by this deed.

The original charter of the corporation has expired because necessary papers have not been filed with the South Dakota Secretary of State. Recently there has been revived interest in a lake association with stated goals and objectives, at least one being to improve Lake Faulkton's water quality.

STUDY AREA DESCRIPTION

GEOLOGICAL DESCRIPTION OF DRAINAGE BASIN

[Reference: Bulletin 26; GEOLOGY AND WATER RESOURCES OF McPHERSON, EDMUNDS, AND FAULK COUNTIES, SOUTH DAKOTA; Part II: Water Resources by Louis J. Hamilton; Geological Survey; Department of Water and Natural Resources; Vermillion, SD; 1982.]

Geography and Climate

The Lake Faulkton watershed, which encompasses parts of Faulk, Potter, Hyde, and Hand Counties of South Dakota, is located primarily in the Great Plains physiographic province. The South Fork of Snake Creek, which is the major drainage stream for the Lake Faulkton watershed, is a tributary of the James River. The Lake Faulkton watershed area is shown in Figure 2.

The population in the Lake Faulkton watershed is supported principally by agriculture, and most of the land is used for range and field crops. Agriculture has been adapted to a semi-arid continental climate that is characterized by cool, wet springs; hot, dry summers; and long, cold winters. The mean annual temperature is about 44 degrees F (7 degrees C), but mean monthly temperatures average below freezing five months of the year. Normal annual precipitation is only 17 inches. Fortunately, more than three-fourths of the precipitation occurs during the growing season.

Topography

The Lake Faulkton watershed, which is in the Coteau du Missouri, is characterized by rolling hills that are separated by numerous poorly-drained depressions--"prairie potholes"--that are lakes and ponds in wet years. Local relief rarely exceeds 50 feet within a square mile.

Water Availability

A large supply of water, which generally is adequate for most uses, is available from lakes, ponds, streams, and glacial and bedrock aquifers in the Lake Faulkton watershed. The glacial and bedrock aquifers offer the most dependable supply because surface water supplies are highly variable due to depletion by evapotranspiration in summer and by periods of drought.

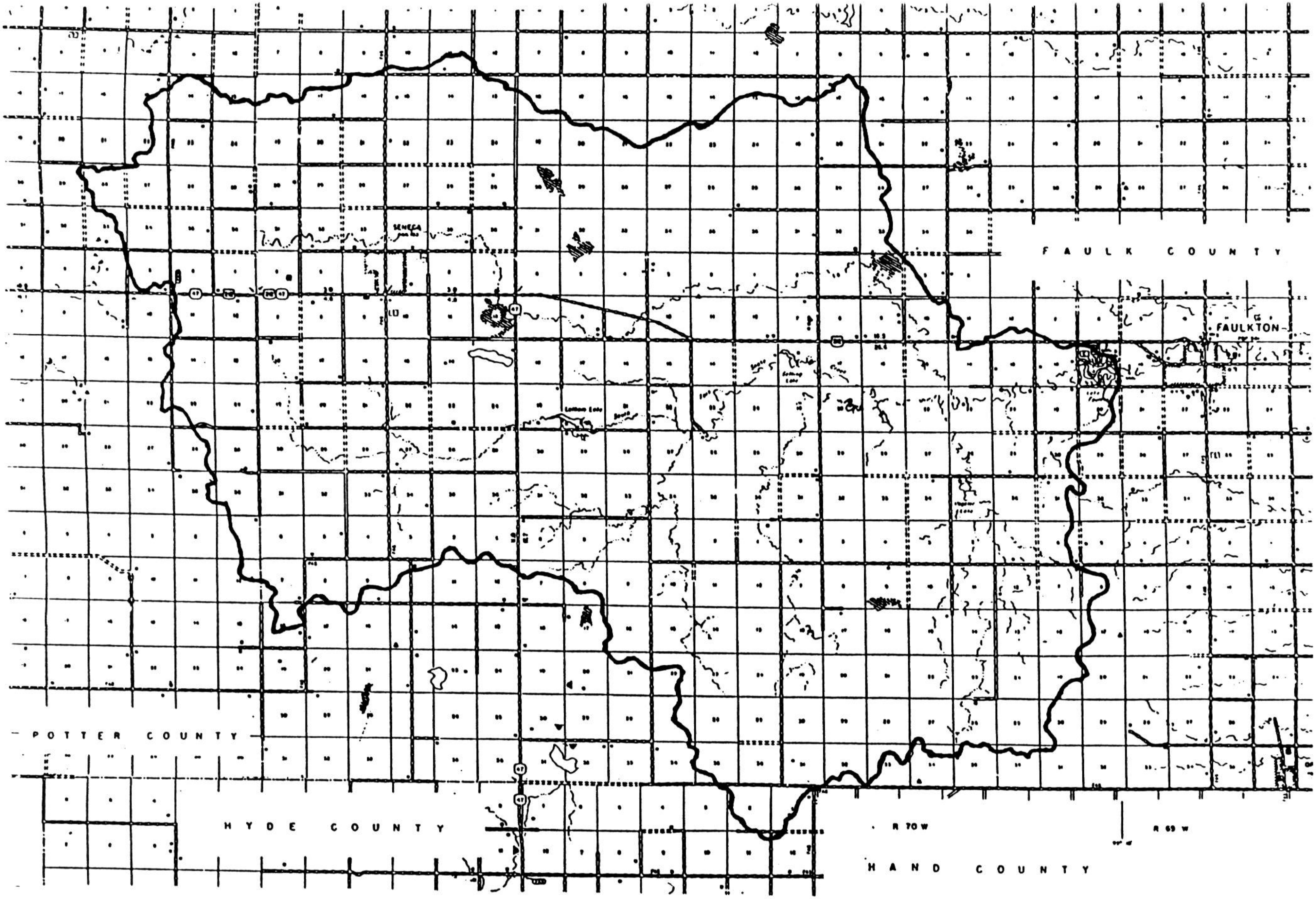

Figure 2. Lake Faulkton / South Fork Snake Creek Watershed Area
(Approximately 161,320 Acres)

Surface Water

Surface water is available from lakes, ponds, dugouts, and streams. Reservoirs are needed to provide supplies that are adequate for irrigation, municipal, and industrial uses because streams flow intermittently in the Lake Faulkton watershed. Most streams flow only in spring, and then only if there is sufficient snowmelt and rainfall. Runoff is increased relative to snow accumulations some years because prior precipitation saturates soils and fills lakes and ponds to overflowing. Drifting of snow into drainageways and freezing of saturated soils also contribute to an increase of runoff.

Flow Duration

The duration of streamflow is very short in the Lake Faulkton area because of low precipitation, high evapotranspiration, and the small amount of ground-water seepage (baseflow) into streams. Discharge from flowing wells does not noticeably increase streamflow. Thus, ground water supplies or reservoirs are needed to supply water during periods when streams do not flow.

Ground Water

A supply of ground water adequate to meet most needs is available from the glacial aquifers and underlying bedrock aquifers in the Lake Faulkton watershed area. A properly developed well in either type of aquifer may yield more than 500 gallons per minute.

Geology

A thick sequence of consolidated sedimentary rocks, shale, sandstone, limestone, and dolomite overlies Precambrian granite in the Lake Faulkton watershed area. The lower part of the sequence contains bedrock aquifers of sandstone, limestone, and dolomite. The aquifer units that are tapped by most bedrock wells are the Dakota Formation, and the Fall River Formation.

Unconsolidated Quaternary deposits, most of which are poorly permeable till, overlie Pierre Shale in the area. Some of these deposits are as much as 600 feet thick, where they cover a former river valley which was eroded deeply into the Pierre Shale. Outwash deposits of sand and gravel compose most of the glacial aquifers in the Lake Faulkton area. Although these deposits can be found in much of the area, they are thickest above and within the former river valley. Lake deposits of clayey silt and fine sand compose part of the glacial aquifers in northern Faulk County.

Glacial Aquifers

Glacial aquifers underlie a large portion of the Lake Faulkton watershed. They are mostly unconsolidated deposits of sand and gravel--outwash deposited during periods of melting of a continental ice sheet which once covered the entire area. The most extensive of the glacial aquifers is the Grand Aquifer.

The Grand Aquifer was buried under the coteau in the region by hundreds of feet of till and by outwash deposits which compose shallower aquifers in the area. This aquifer lies within a broad, branching, buried valley which was carved into bedrock by preglacial streams. The Grand Aquifer has an average width of about four miles. The thickness of the Grand Aquifer increases sharply inward from its margin and generally consists of one bed of sand and gravel in Faulk County. The maximum thickness of the Grand Aquifer is 175 feet, and the average thickness is about 50 feet. It is composed mostly of lake deposits, poorly permeable clayey silt, and moderately permeable fine sand in northern Faulk County. The Grand Aquifer is the major conduit through which most ground water moves through the Lake Faulkton watershed area. The rate of flow is estimated to average several hundred feet per year. The water in the Grand Aquifer generally is free from turbidity, less susceptible to pollution than surface water in the area, and very hard.

Bedrock Aquifers

Bedrock aquifers underlying the study area include, in descending order, the Dakota Formation, Fall River Formation, Sundance and Minnelusa Formations, and the Madison Group and Red River Formation. Most wells in bedrock in the Lake Faulkton watershed area tap the first two formations. Much of the water in bedrock aquifers probably has come from recharge areas in the Black Hills of western South Dakota.

Water in the bedrock aquifers contains higher concentrations of dissolved minerals than does water from the glacial aquifers. The minerals in the water were dissolved from rock as the water flowed underground from recharge areas in the Black Hills. Water from the Dakota Formation is soft to very hard, that in deeper aquifers is very hard.

Concentrations average about 2,000 milligrams per liter for dissolved solids and exceed 100 milligrams per liter for many major constituents in the water from the bedrock aquifers. Because of the high average dissolved-solids concentrations, much of the water is unsuitable for irrigation and also exceeds standards set for public water supplies. Such water, however, is used for public supplies in many areas where no other water is available.

Water Resource Development

Development of water resources in the study area has been extensive, but not intensive. Surface reservoirs and dugouts are small and widely scattered. Wells also are scattered, and annual withdrawals from each well are small. Nevertheless, these developments have caused some changes in hydrologic properties such as runoff, storage, water levels, and water quality. Serious changes in these properties could be expected to occur with intensive local development.

The principal effect of development on the Lake Faulkton area's surface water resources has been the loss of water by increased evapotranspiration. This has come about by the construction of numerous dugouts and small reservoirs for watering livestock. However, part of the evapotranspiration loss has been made up by salvage of runoff water which previously left the area.

Both surface and ground water are available in large quantities in the Lake Faulkton watershed area. Wells in glacial aquifers can yield more than 100 gallons per minute but yields are inadequate for irrigation in many areas. Well yields of more than 500 gallons per minute can be obtained from the Grand Aquifer, but the water generally is unsuitable for irrigation because of high concentrations of dissolved solids, sodium, and bicarbonate ions. Excessive hardness and high concentrations of iron and manganese make the water unsuitable for some domestic and industrial uses without treatment.

Streams in the Lake Faulkton watershed require storage reservoirs in order to be adequate for many uses. The South Fork of Snake Creek has the largest supply of surface water. However, streamflow is intermittent and many water users need reservoirs or alternative supplies. Lakes and ponds in the Lake Faulkton watershed are shallow, making surface water supplies inadequate for municipal and industrial demands during drought years. The quality of the surface water is also unsuitable for some uses without treatment.

SOILS DESCRIPTION OF DRAINAGE BASIN

[Reference: Soil Survey of Faulk County, South Dakota; by Kenneth F. Miller; Soil Conservation Service; United States Department of Agriculture; in cooperation with the South Dakota Agricultural Experiment Station; 1984.]

Soils Formation

Most of the soils in Faulk County formed in glacial material derived from preglacial formations of gneiss, granite, limestone, sandstone, siltstone, and shale. The glacier ground up and mixed this material. The resultant mass is an aggregate of sand, silt, clay, and some rock fragments.

The Lake Faulkton watershed is primarily in the Coteau du Missouri physiographic region. The Coteau du Missouri generally is undulating to hilly and has a poorly defined drainage pattern with many potholes and sloughs. In some areas as much as 250 feet of glacial till overlies shale bedrock. During glaciation the glacial ice in this region had a thick overburden of "superglacial till." The resulting landforms are characteristic of glacial stagnation. Examples are dead-ice moraines; formerly ice-walled lake plains; circular disintegration ridges, which have the appearance of doughnuts on aerial photos; and gravelly ridges of collapsed stream alluvium. A rolling and hilly dead-ice moraine formed when the glacial ice beneath the superglacial till melted. Vida, Williams, and Zahill are typical of the soils that formed on this landscape. Many depressional soils, such as Parnell and Tonka, also formed in this area.

As the ice melted, streams formed on the superglacial till and along the margin of the glacier. These streams deposited coarse material along the channels. Bowdle, Lehr, Manning, and Wabek soils formed in this gravelly superglacial stream alluvium.

Ice-walled lake plains formed where a superglacial stream terminated in a lake. The finer textured material settled in the lake, and after a time the sediments became very thick. As the glacial ice melted, a formation resembling a mesa remained. The formerly ice-walled lake plains are higher than the surrounding landscape. Bryant and Mondamin soils formed in these sediments.

Niobell and Noonan soils formed in glacial till having a high content of salts. Bowbells and Williams soils also formed partly or entirely in glacial till, but they have not been affected by saline ground water.

Bowbells, Parnell, and Tonka are examples of soils that formed partly or entirely in local alluvium washed in from the more sloping adjacent uplands. Harriet, La Prairie, and Ranslo soils formed in alluvium deposited by streams.

Crops and Pasture

About 55 percent of the acreage in Faulk County is used for cultivated crops or for pasture and hay (43% cropland and 12% percent pastureland). Another 43% of the land in the county is rangeland. Other land uses (2%) would include farmsteads, towns, shelterbelts, water, transportation, and wildlife areas.

The major crops are alfalfa, corn, oats, and spring wheat. Barley, flax, winter wheat, soy beans, millet, rye, sorghum, and sunflowers are also grown. Alfalfa is harvested mainly for hay. Spring wheat and barley are grown as cash crops. Oats and millet are grown as cash crops and as livestock feed. Corn is harvested for both silage and grain.

Water and wind erosion are major problems on more than half of the cropland, hayland, and pasture in Faulk County. Water erosion is a hazard on Bryant, Max, Mondamin, Vida, Williams, and other soils if the slope is more than two percent. Productivity is reduced when the more fertile surface layer is lost and part of the subsoil is incorporated into a plow layer. Loss of the surface layer is especially damaging on soils that have a claypan subsoil, such as Noonan, and on soils that have a thin surface layer, such as Vida and Zahl. Erosion also reduces the productivity of soils that tend to be droughty, such as Bowdle and Lehr. When erosion occurs, sediment rich in nutrients enters streams and lakes. Measures that control erosion minimize pollution and preserve water quality for fish and wildlife, recreation, and municipal use. Erosion control also reduces the amount of fertilizer needed in cropped areas by helping to prevent the removal of plant nutrients.

A cropping system that keeps a plant cover on the surface for extended periods holds soil losses to an amount that will not reduce the productive capacity of the soils. If a plant cover cannot protect the soil, careful management of crop residue is essential. Minimizing tillage and leaving crop residue on the surface increase the infiltration rate, reduce the runoff rate, and help to control erosion. Terraces and diversions can reduce the length of slopes and the runoff rate, and help to control erosion on gently sloping soils.

Rangeland

About 43 percent of the acreage of Faulk County is rangeland. More than half of the local farm income is derived from the sale of livestock, principally cattle. Cow-calf-steer enterprises are dominant throughout the county. The average size of farms or ranches is about 1,500 acres.

The rangeland generally occurs as scattered tracts throughout the county. The greatest concentration is in areas of the Williams-Bowbells-Vida, Williams-Zahill-Bowbells, Noonan-Miranda, and LaPrairie-Zahill-Lehr soil associations. The soils used as rangeland generally are too steep, too stony, or too shallow over the underlying material for cultivated crops. Examples are the steeper areas of Williams, Zahill, and Zahl soils.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water. Range management requires a knowledge of soils and of the potential natural plant community. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable species, conservation of water, and control of wind and water erosion.

The native vegetation in many parts of the Lake Faulkton watershed has been greatly depleted by continuous excessive use. Much of the acreage that was once mixed grass prairie is now covered with short grasses, weeds, and non-native species. Some of the introduced species have become less than desirable and very competitive. The amount of forage produced may be less than half of that originally produced. The productivity of the range can be increased by applying management that is effective on specific soils and range sites.

Adequate plant cover and ground mulch can help to control erosion and increase the moisture supply by reducing the runoff rate. If the range is overgrazed, the more desirable tall grasses lose vigor and are replaced by less productive short grasses. Without proper management, cool season grasses, especially introduced species, tend to dominate warm season grasses. Measures that prevent overgrazing help to keep the range in good condition. Practices that inhibit or promote the growth of individual species or groups of species do much to keep the range in balance. Crossfencing and properly distributed watering and salting facilities help to obtain a uniform distribution of grazing. Implementation of optimum range management techniques will significantly reduce runoff of sediment and nutrients to the streams and lakes in the Lake Faulkton watershed.

Native Woods

Native trees and shrubs grow on only about 500 acres in Faulk County. They generally grow as clumps and thickets in swales or adjacent to drainageways and sloughs. The early settlers used the native trees and shrubs as fuel and as a food supply. Today, the trees and shrubs are used mainly for wildlife habitat.

Scattered individual plants or clumps of American elm, common chokecherry, green ash, western snowberry, and wild rose are common on the Vida, Zahill, and Zahl soils along drainageways. Cottonwood and willow are on the margins of some sloughs and intermittent lakes and along the drainage channels on flood plains.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, maintaining existing plant cover, promoting the natural establishment of desirable plants, and constructing water reservoirs in appropriate soil type areas.

A variety of plants provide desirable wildlife habitat. Domestic grains and seed-producing herbaceous plants provide grain and seed for wildlife. Examples are barley, corn, oats, soy beans, and sorghum. Grasses and legumes--alfalfa, crested wheatgrass, intermediate wheatgrass, smooth bromegrass, and yellow sweetclover--provide food and cover. Wild herbaceous plants also provide food and cover. These plants are native or naturally established grasses and forbs such as beggartick, big and little bluestem, goldenrod, grama grasses, switchgrass, and western wheatgrass. Even weeds such as wild sunflower and pigeon grass provide excellent habitat and food. Trees also produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Examples are American elm, boxelder, green ash, hackberry, and plains cottonwood, willow, crabapple, and Russian olive. Fruit-producing shrubs that are suitable for planting on local soils are American plum, common chokecherry, Hausen hedgerose, Saskatoon serviceberry, skunkbush sumac, and cotoneaster. Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites and provide excellent wildlife habitat. Wetland plants include barnyard grass, cordgrass, reeds, rushes, sedges, and smartweed.

A wide variety of wildlife is adapted to the abundant habitat areas in the Lake Faulkton watershed. Openland habitats consist of cropland, pasture, meadows, and areas that are overgrown with forbs, grasses, and shrubs. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include eastern cottontail, gray partridge, meadowlark, mourning dove, red fox, ring-necked pheasant, whitetail deer, jackrabbit, and skunk.

Wetland habitats consist of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are beaver, ducks, geese, herons, mink, muskrat, raccoons, and shore birds.

Rangeland habitats consist of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include deer, lark bunting, meadowlark, sharp-tailed grouse, whitetail deer, and jackrabbit.

METHODS AND MATERIALS

MONITORING SITE LOCATIONS

Tributary / Lake Outlet Sites

Six sites were selected to monitor the Lake Faulkton watershed and the outlet of Lake Faulkton. These sites are shown in Figure 3 on the following page.

Site LF-1 was located on the South Fork of Snake Creek approximately six miles west of Lake Faulkton and about three-fourths of a mile south of U. S. Highway 212. The description of this site location was T118N, R70W, Section 18, SE 1/4; Latitude 45° 01' 58" N, Longitude 99° 18' 29" W.

Site LF-2 was located on a tributary to the South Fork of Snake Creek approximately six miles west of Faulkton and about one and one-fourth miles south of U. S. Highway 212. The description of this location was T118N, R70W, Section 19, NE 1/4; Latitude 45° 01' 26" N, Longitude 99° 18' 29 W".

Site LF-3 was located on the South Fork of Snake Creek one mile west of Lake Faulkton and one mile south of U. S. Highway 212. The description of this location was T118N, R69W, Section 18, SW 1/4; Latitude 45° 01' 46" N, Longitude 99°, 12' 10 W".

Site LF-6 was located at the spillway dam at the east end of Lake Faulkton, where water flows out of the lake to the South Fork of Snake Creek. The location of this site was T118N, R69W, Section 17, SE 1/4; Latitude 45° 02' 02" N, Longitude 99° 10' 03" W.

Site LF-7 was located on a tributary to the South Fork of Snake Creek three and one-half miles west of Lake Faulkton on U. S. Highway 212. The description of this site was T118N, R70W, Section 10, SW 1/4; Latitude 45° 02' 33" N, Longitude 99 ° 15' 42" W.

Site LF-8 was located on a tributary to the South Fork of Snake Creek about two and one-half miles west of Lake Faulkton and three miles south of U. S. Highway 212, downstream of Vogeler's dam. This location was at T118N, R70W, Section 26, SW 1/4; Latitude 44° 59' 50", Longitude 99° 14' 09".

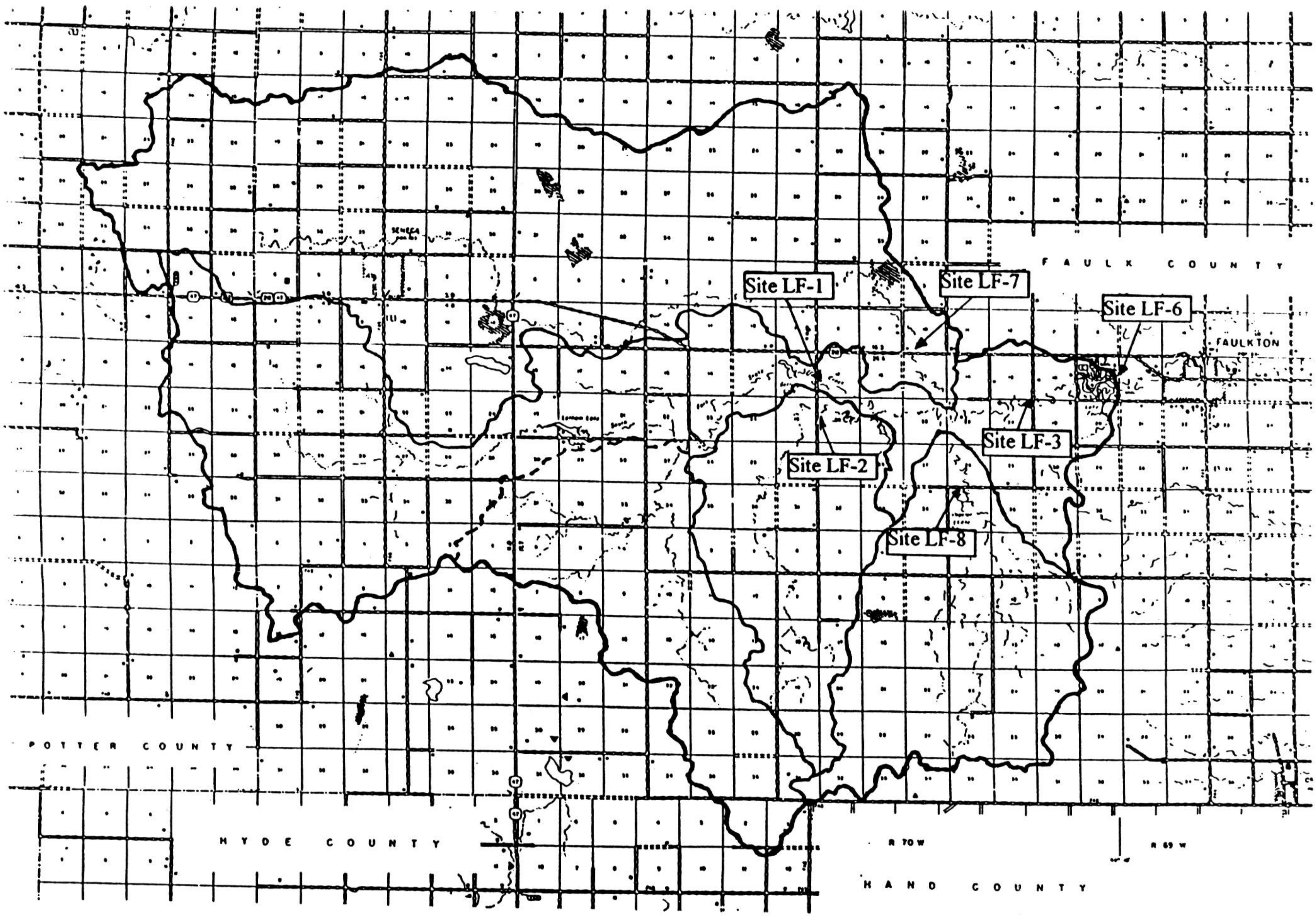

Figure 3. Lake Faulkton Tributary Monitoring Site Locations

In-Lake Sites

Two in-lake sites were selected to monitor Lake Faulkton. These sites are shown in Figure 4.

Site LF-4 was located west of the large peninsula which protrudes from the south central shoreline of the lake. The location of this site was T118N, R69W, Section 17, SW 1/4; Latitude 45° 01' 58" N, Longitude 99° 10' 34" W.

Site LF-5 was located south of the large island in the east half of the lake. This site location was T118N, R69W, Section 17, SE 1/4; Latitude 45° 01' 47" N, Longitude 99° 10' 11" W.

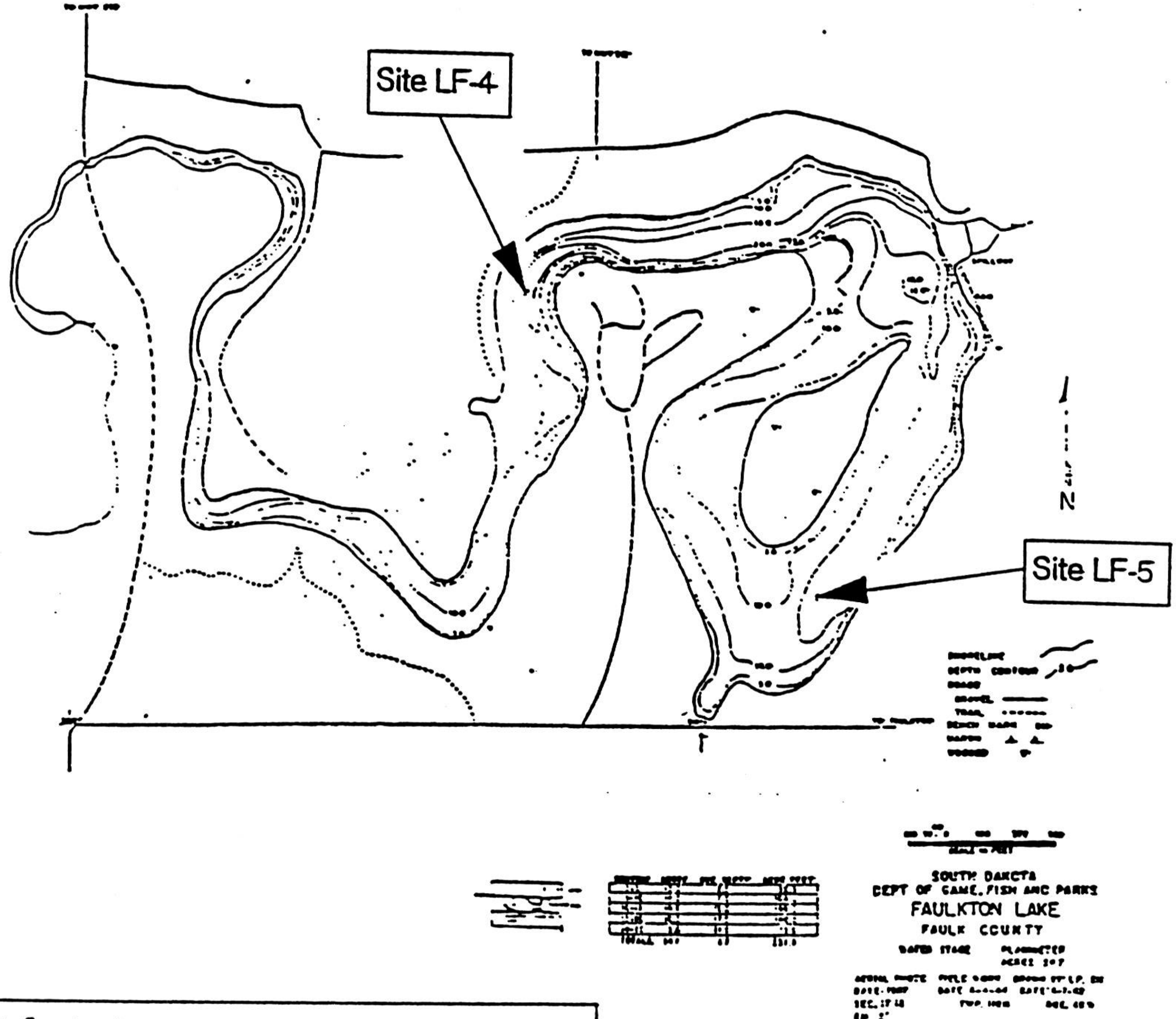

FIGURE 4. Lake Faulkton Site Locations

TRIBUTARY WATER QUALITY SAMPLING

Methods

Four tributary monitoring sites (LF-1, LF-2, LF-3, LF-8) were located in the Lake Faulkton watershed to comprehensively monitor water quality concentrations and flows into the lake (Figure 3). These sites were established on the South Fork of Snake Creek, and tributaries to the South Fork of Snake Creek. The sites were selected to determine loadings from defined subwatershed areas, allowing an analysis and interpretation of each area's contribution of contaminants to Lake Faulkton. A fifth tributary monitoring site (LF-7) was located on an intermittent tributary to the South Fork of Snake Creek. Only water quality concentrations--not flows--were monitored at this intermittent stream site. A sixth tributary monitoring site (LF-6) was located at the spillway dam at the east end of Lake Faulkton (Figure 3). The spillway functions as the outlet from the lake to the South Fork of Snake Creek. Both water quality concentrations and flows were monitored at this site to accurately determine loadings of contaminants leaving the lake.

All of the tributary monitoring sites, except for LF-7, were constructed as fixed stage recording sites with Stevens Type F stage recorders. Water velocities were routinely measured with a Marsh McBirney Model 201D portable water current meter. The velocity readings were correlated with stage data to calculate stage/discharge curves using U. S. Department of the Interior - Geological Survey forms (#9-279). Daily average stages and discharges were also recorded on U. S. Geological Survey forms (#9-192b).

Tributary Sampling Schedule

The following schedule was followed as closely as possible for collection of water samples at the tributary sites. During the spring, samples were collected as soon as possible when snowmelt runoff began. Samples were collected twice a week during the first week of snowmelt runoff. After the first week, samples were taken weekly until base flows occurred.

For rain runoff events, samples were also collected as soon as possible when rain runoff began. If the duration of flow continued for more than a day, another sample was taken at the peak of the runoff event. During base flow periods (no specific runoff events), samples were collected approximately every three weeks. Sampling at the lake outlet (spillway dam) was conducted to correspond to snowmelt and rain runoff events, as well as to the base flow sampling at the other tributary sites.

A limited number of discretionary samples were also collected at other tributary sites for the purpose of obtaining water quality concentrations upstream and downstream of suspected contamination sources.

The laboratory parameters that were analyzed to characterize the lake inflow and outflow, and to develop a nutrient and sediment budget, were as follows:

Fecal Coliform Bacteria	Ammonia
Total Alkalinity	Un-ionized Ammonia
Total Solids	Nitrate + Nitrite Nitrogen
Total Suspended Solids	Total Dissolved Solids
Total Phosphorus	Total Kjeldahl Nitrogen (TKN)
Total Dissolved Phosphorus	

The tributary samples for the above parameters were collected in separate bottles with appropriate preservatives. The bottles were packed in ice for shipment to the State Health Laboratory in Pierre, South Dakota.

Field parameters that were measured and recorded by sample collection personnel included the following:

Air Temperature	Dissolved Oxygen
Field pH	Water Depth

Visual and climatological observations by project staff included, but were not limited to, the following:

Precipitation	Dead Fish
Wind	Surface Film on Water
Odor	Turbidity
Septic Conditions	Water Color

The tributary sites were monitored for concentrations of the chemical parameters cited above. A summary table of the concentrations for each site are included in APPENDIX A, Tributary Water Quality Data Summary. Loadings of the chemical parameters at each site were also calculated and are included in APPENDIX B, Tributary Loadings Summary.

IN-LAKE WATER QUALITY SAMPLING

Methods

Two in-lake monitoring sites were established for the lake assessment project. These sites were LF-4, west of the large peninsula, and LF-5, south of the large island (Figure 4). The sites were monitored by grab samples from the surface. Dissolved oxygen and temperature were measured on-site with a Yellow Springs Instruments oxygen meter (YSI Model 51B). An Orion Research pH meter (Model 201) was used for on-site analyses of pH levels. Secchi depth and water depth readings were measured with a standard 8-inch Secchi disk and a weighted tape measure. During winter months samples were collected through holes drilled in the ice. No samples were collected during periods of unsafe ice. The local Project Coordinator provided a boat for sample collection during open water months. All water sampling procedures and on-site analyses were conducted in accordance with the methods set forth in "Standard Operating Procedures For Field Samplers" (SD DENR, Clean Lakes Program, 1992).

In-lake Sampling Schedule

Each in-lake site was sampled once a month from September, 1993, to August, 1995, except for the following months:

November, 1993
March, 1994
March, 1995
May, 1995
June, 1995
July, 1995

No in-lake samples were collected in November, 1993; March, 1994; or March, 1995; because of unsafe ice conditions. No in-lake or tributary samples were collected in May, June, and July, 1995, because of limited sampling funds. Much greater than normal tributary flows occurred during early spring, 1995, and consequently additional tributary samples were collected to accurately characterize the spring runoff. In order to stay within the sampling budget, neither tributary nor in-lake samples were collected during the May through July period in 1995. One final in-lake sample was collected during August, 1995, to determine if there were in-lake water quality effects which might be attributable to the greater than normal spring runoff.

Laboratory parameters which were analyzed to characterize in-lake water quality were the following:

Fecal Coliform Bacteria	Ammonia
Total Alkalinity	Un-ionized Ammonia
Total Solids	Nitrate + Nitrite Nitrogen
Total Suspended Solids	Total Dissolved Solids
Total Phosphorus	Total Kjeldahl Nitrogen
Chlorophyll *a*	Total Dissolved Phosphorus

The in-lake samples for the above parameters were collected in separate bottles with appropriate preservatives. The bottles were packed in ice for shipment to the State Health Laboratory in Pierre, South Dakota.

Field parameters which were routinely measured by sample collection personnel included the following:

Water Temperature	Dissolved Oxygen
Air Temperature	Field pH
Water Depth	Secchi Disk Depth

Visual and climatological observations by sample collection personnel included, but were not limited to, the following:

Precipitation	Dead Fish
Wind	Surface Film on Water
Odor	Turbidity
Septic Conditions	Water Color

The in-lake sites were monitored for concentrations of the chemical parameters referenced above. A summary of the concentrations for each site are included in APPENDIX C, In-Lake Water Quality Data Summary.

RESULTS AND DISCUSSION

TRIBUTARY MONITORING

The results of the tributary monitoring program conducted during 1994 and 1995 are summarized on the following pages. The monitoring during 1994 represents the total period during which water flowed in the tributaries, from approximately mid-March to the end of August. It should be noted, however, that the monitoring at Site LF-8 did not begin until April 13, 1994, approximately one month after the spring runoff started. The reason for the delay in monitoring at Site LF-8 was due to the fact that this site was not originally included in the monitoring plan. However, based on flow observations by the local Project Coordinator, it was determined that this site should be added to the monitoring program. Consequently, the loadings calculated for Site LF-8 do not include the loadings from the initial spring runoff in 1994. However, as will be seen in the discussion that follows, the loadings at this site were still very significant.

It is further noted that the monitoring during 1995 represents only the beginning of spring runoff, from the end of February to the beginning of April. The monitoring during this period did, however, begin and end on the same dates at all sites. The monitoring results during this period may, therefore, provide a better overall comparison of the loadings from all the tributary monitoring sites.

TRIBUTARY MONITORING RESULTS

FECAL COLIFORM BACTERIA

Fecal coliform bacteria found in water samples can indicate fecal contamination and thus potential human health hazards. Fecal coliform bacteria are bacteria which live in the digestive tract of warm-blooded animals. These bacteria are considered to be indicators of pollution from sewage or livestock manure. Fecal coliform bacteria are not found in the digestive tracts of cold-blooded animals such as fish or amphibians.

As can be seen in Figure 5, the highest mean fecal coliform bacteria results in 1994 occurred at Sites LF-1 and LF-3. Figure 6, on the other hand, indicates that the highest mean fecal coliform results during the 1995 spring runoff occurred at Sites LF-2 and LF-8. This indicates that high fecal coliform bacteria results were randomly distributed among all the tributary monitoring sites except Site LF-6, the Lake Faulkton outlet. Overall, the monitoring results for the two sampling periods indicate that there were sources of fecal coliform bacteria throughout the Lake Faulkton watershed.

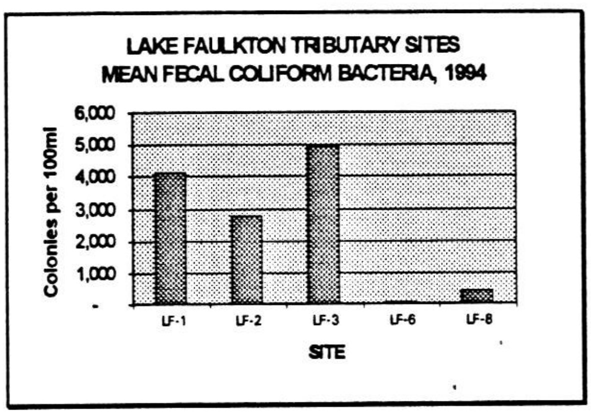

Fig. 5. 1994 Tributary Fecal Coliform Bacteria

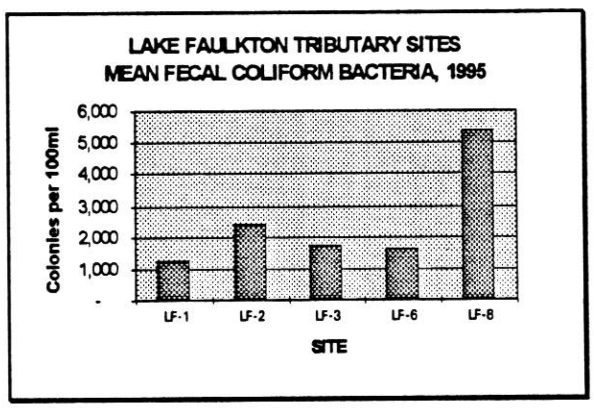

Fig. 6. 1995 Tributary Fecal Coliform Bacteria

In reviewing the results of the individual samples collected at the tributary monitoring sites (APPENDIX A) it is observed that the highest fecal coliform bacteria results during the entire sampling period occurred on July 7, 1994. The samples collected on that date followed a major rain storm event in the watershed. The results at Site LF-1 were 15,000 bacteria colonies per 100 mL of water, and the results at Site LF-2 were 13,000 bacteria colonies per 100 mL of water. Although these are very high results, they did not violate water quality standards, as there are no standards for fecal coliform bacteria on those segments of the South Fork of Snake Creek. At Site LF-3, the fecal coliform bacteria result on July 7, 1994, was 9,300 bacteria colonies per 100 mL of water. This result did violate the water quality standard for that segment of the South Fork of Snake Creek, which requires less than 1,000 colonies per 100 mL of water. All of these high results indicated sources of fecal coliform bacteria throughout the watershed. The most likely sources of fecal coliform bacteria were livestock feeding areas. Other potential sources could have included the discharge of overflow from septic systems to drainage ditches or streams.

pH

Field and laboratory pH is a measure of the hydrogen ion activity in water which directly affects the toxicity (solubility) of heavy metals in water, as well as many other factors. The pH scale is a number range between 1 and 14, with 7 being neutral. Any value less than 7 is considered acidic, and any value greater than 7 is considered basic, or alkaline. The pH range for most natural lakes is between 6 and 9. Deviation from a neutral pH of 7 is a result of the decomposition of salts as they react with water. Gases such as carbon dioxide, hydrogen sulfide, and ammonia have a significant effect on pH. The pH level of a lake is also directly related to the geography of the surrounding area.

Figures 7 and 8 show the mean field pH results for the tributary samples collected in 1994 and 1995.

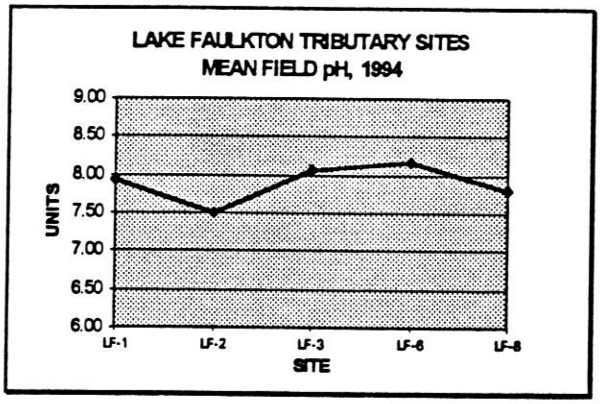

Figure 7. 1994 Tributary pH Results

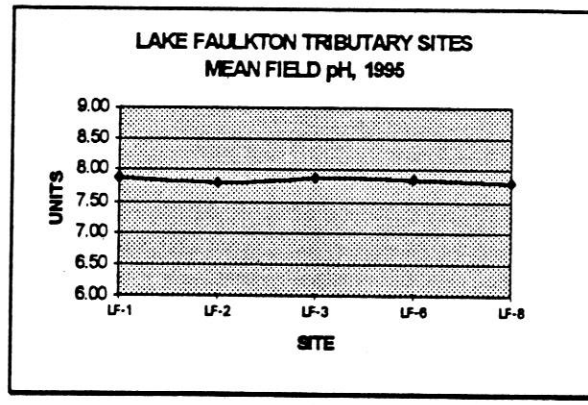

Figure 8. 1995 Tributary pH Results

A review of the Lake Faulkton tributary sample data for 1994 and 1995 (APPENDIX A) indicates that the results for all the tributary samples were well within the state water quality standards of greater than 6.0 standard units and less than 9.0 standard units.

ALKALINITY

The alkalinity of water refers to the quantities of different compounds that shift the pH level to the alkaline side of neutrality. Increased alkalinity is generally the result of increased levels of bicarbonates, but is expressed as a sum of hydroxide, carbonate, and bicarbonate. Carbonate and bicarbonate are common in water because carbonate minerals are common in nature. On the other hand, hydroxides generally do not contribute significantly to alkalinity levels. In general, the alkalinity of water is directly related to the geography of an area. Expected total alkalinities for water, in nature, range from 20 to 200 mg/L.

Figures 9 and 10 show a comparison of alkalinity loads at the Lake Faulkton tributary sites during 1994 and 1995. As can be seen from these figures, the greatest loadings occurred at Sites LF-3 and LF-6, in both 1994 and 1995. Site LF-3 was located on the South Fork of Snake Creek immediately upstream of Lake Faulkton. Site LF-6 was located at the outlet of Lake Faulkton. According to the results of the samples, in both years the loading of alkalinity into the lake (LF-3) was greater than the loading of alkalinity flowing out of the lake (LF-6). Assuming that the tributary monitoring results for 1994 and 1995 are typical of most years, this would indicate that the alkalinity of Lake Faulkton will gradually increase, as the alkalinity loads into the lake appear to be generally greater than the alkalinity loads that flow out of the lake.

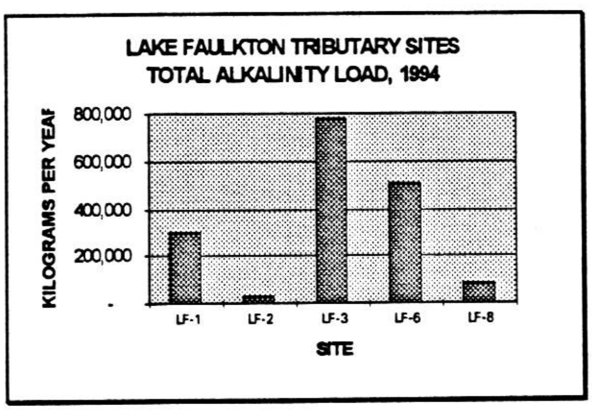

Figure 9. 1994 Tributary Total Alkalinity

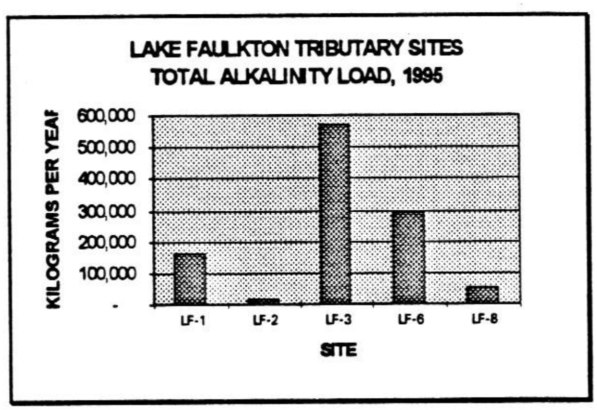

Figure 10. 1995 Tributary Total Alkalinity

A review of the monitoring results in APPENDIX A indicates that the mean concentration of total alkalinity was the highest at Site LF-3, immediately upstream of the lake.

TOTAL SOLIDS and TOTAL DISSOLVED SOLIDS

Total solids are all the materials, suspended and dissolved, present in water. These are the materials left after the water from a sample has been evaporated. Total dissolved solids include salts and organic residue which pass through with a filtered water sample. Total suspended solids are the solids retained on the filter. Total dissolved solids results for water samples can be determined by subtracting suspended solids results from total solids results.

Figures 11 and 12 compare the loadings of total solids at the tributary monitoring sites in 1994 and 1995. In both 1994 and 1995, the loadings of total solids into the lake (LF-3) were approximately double the loadings of total solids out of the lake (LF-6). This indicates that approximately half of the total solids loadings flowing into the lake were retained in the lake. In comparing the other sites, the loadings of total solids in order were LF-1, LF-8, and LF-2.

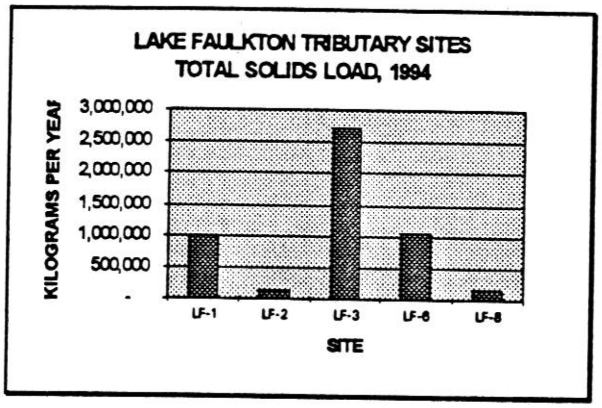

Figure 11. 1994 Tributary Total Solids

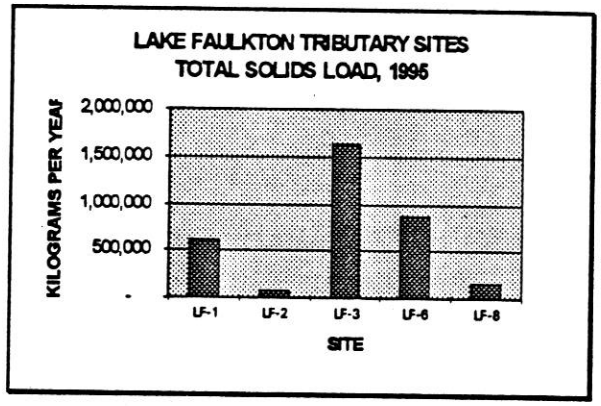

Figure 12. 1995 Tributary Total Solids

Likewise, in comparing the 1994 and 1995 loadings of total dissolved solids (Figures 13 and 14), the loadings of total dissolved solids into the lake (LF-3) were approximately double the loadings of total dissolved solids out of the lake (LF-6). As was the case with total solids, approximately half of the total dissolved solids flowing into the lake were retained in the lake. The LF-1 and LF-8 subwatersheds were the sources of the greatest loadings of both total and total dissolved solids.

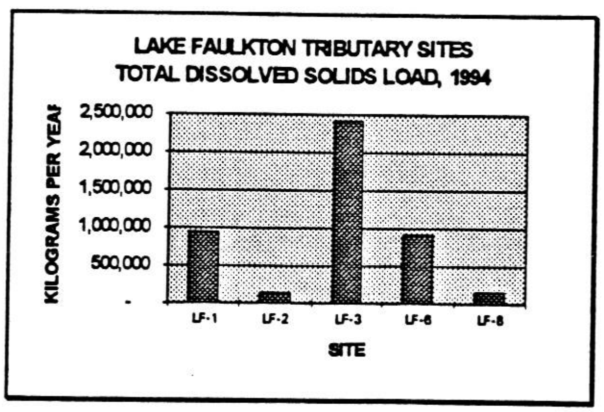

Figure 13. 1994 Tributary Total Dissolved Solids

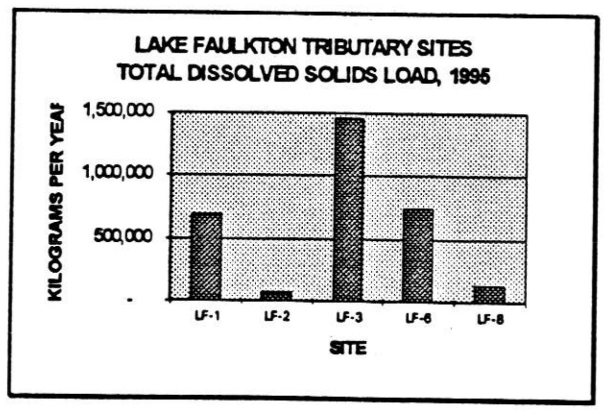

Figure 14. 1995 Tributary Total Dissolved Solids

TOTAL SUSPENDED SOLIDS

Total suspended solids include organic and inorganic materials that are not dissolved. This parameter can give an indication of the sediment loading into a body of water, and possible problems for the biological community associated with the water body. The analysis for suspended solids does not include a measure of larger particles that are moved along a stream bed during high flows (bed load).

The total suspended solids parameter can be used as an indicator of sedimentation in Lake Faulkton. Figures 15 and 16 provide a comparison of total suspended loadings at the tributary monitoring sites during 1994 and the 1995 (February to April) spring runoff. As can be seen from these figures, the loadings of total suspended solids into the lake (LF-3) were significantly greater than the loadings of total suspended solids out of the lake (LF-6). In 1994, nearly 200,000 kilograms (220 tons) of total suspended solids were retained in the lake. During the beginning of spring runoff in 1995, over 30,000 kilograms (33 tons) of total suspended solids were retained in the lake.

By comparing the other tributary sites (LF-1, LF-2, and LF-8, Figures 15 and 16), it can be seen that the greatest total suspended solids loadings during both monitoring periods occurred at Site LF-1, followed by Sites LF-8 and LF-2. This indicates that the subwatershed represented by the sampling at Site LF-1 was the greatest source of total suspended solids, followed by the subwatersheds represented by the sampling at Sites LF-8 and LF-2.

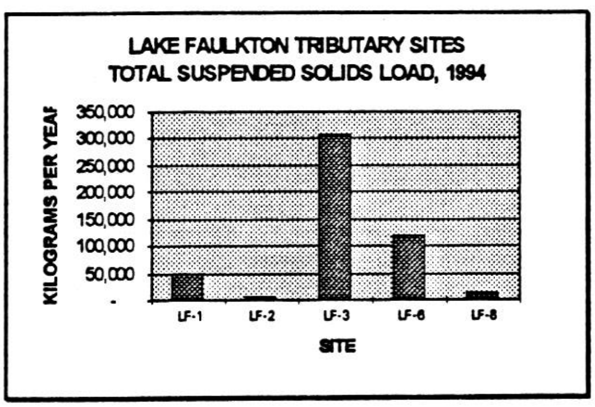

Figure 15. 1994 Tributary Total Suspended Solids

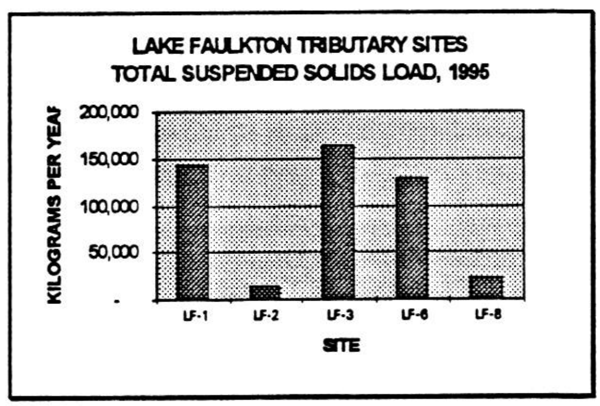

Figure 16. 1995 Tributary Total Suspended Solids

In reviewing the total suspended solids concentrations for all the tributary samples (APPENDIX A), it was found that all of the results were well within the suspended solids water quality limit of 150 milligrams per liter for the South Fork of Snake Creek.

AMMONIA

Ammonia is generated by bacteria as a primary end product of the decomposition of organic matter. Ammonia is the form of nitrogen directly available to plants as a nutrient for growth. High ammonia concentrations indicate pollution from organic sources.

In reviewing Figure 17, it is noted that during the 1994 monitoring period, the loading of ammonia flowing out of the lake (LF-6) was greater than the loading of ammonia flowing into the lake (LF-3). Consequently, it would appear that there was an overall exportation of ammonia out of the lake. In comparison, in 1995 (Figure 18) there was a greater loading of ammonia into the lake (LF-3) than out of the lake (LF-6). Because the 1995 monitoring began and ended on the same dates at all the sites, it is believed that the 1995 data may be more representative of ammonia loadings over the long term. Therefore, in most years, there is likely an abundance of ammonia available for the growth of algae and other aquatic plants.

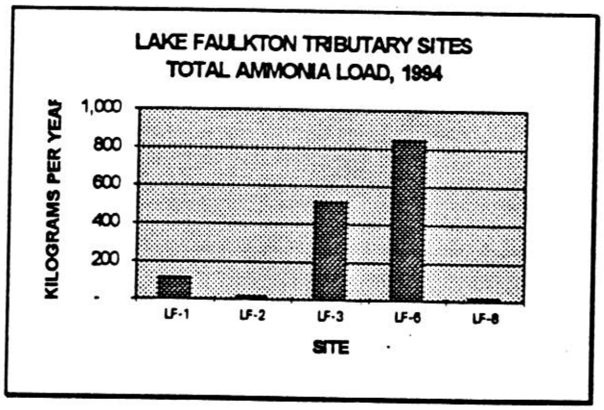

Figure 17. 1994 Tributary Total Ammonia

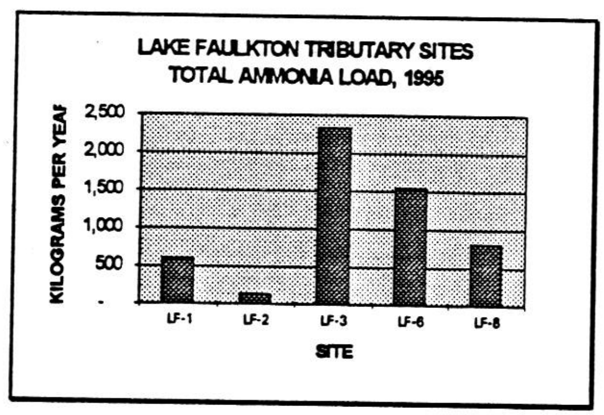

Figure 18. 1995 Tributary Total Ammonia

A comparison of the ammonia loadings at the other tributary sites during 1994 (LF-1, LF-2, and LF-8, Figure 17) indicates that the watershed represented by LF-1 was the greatest source of ammonia. In contrast, a comparison of the ammonia loadings during the 1995 spring runoff (LF-1, LF-2, and LF-8, Figure 18) shows that the LF-8 watershed was the greatest source of ammonia. A likely source of the ammonia loadings was runoff from livestock feeding areas.

TOTAL KJELDAHL NITROGEN (TKN)

Total Kjeldahl nitrogen is used to measure both total nitrogen and organic nitrogen. The amount of ammonia (inorganic nitrogen) is subtracted from the amount of total Kjeldahl nitrogen to arrive at the amount of organic nitrogen present. Organic forms of nitrogen can be broken down into different compounds which are used by phytoplankton.

Figures 19 and 20 show that for the monitoring in both 1994 and 1995, there were greater loadings of total Kjeldahl nitrogen into the lake (LF-3) than there were loadings out of the lake (LF-6). These results indicate that Lake Faulkton is acting as a nitrogen sink, making nitrogen available for the growth of algae and other aquatic plants.

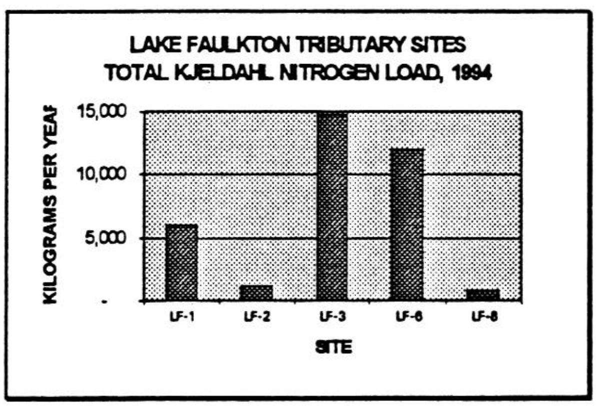

Fig. 19. 1994 Tributary Total Kjeldahl Nitrogen

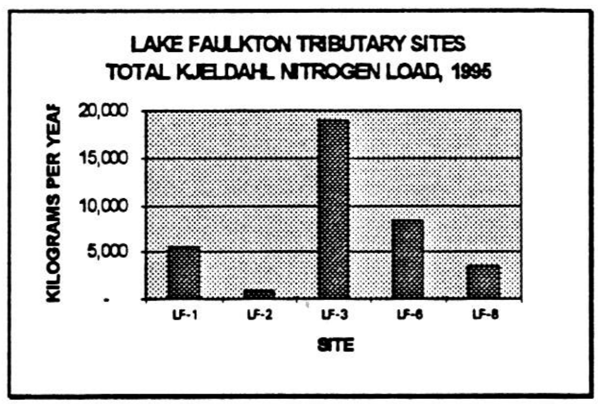

Fig. 20. 1995 Tributary Total Kjeldahl Nitrogen

In both 1994 and 1995, the greatest sources of total Kjeldahl nitrogen were derived from the LF-1 subwatershed. The most probable sources of total Kjeldahl nitrogen are runoff from cropland and livestock feeding areas.

NITRATE + NITRITE

Nitrate-nitrite nitrogen is often the most abundant inorganic form of nitrogen available in nature. It constitutes the inorganic form of nitrogen assimilated by algae and larger hydrophytes. In natural waters, the concentrations are usually low, around 0.1 milligram per liter. Sources of inorganic nitrogen include agricultural runoff, sewage, and atmospheric pollution.

The 1994 tributary monitoring results (Figure 21) indicate that slightly more nitrate-nitrite flowed out of the lake (LF-6) than flowed into the lake (LF-3). However, the results for the 1995 spring runoff (Figure 22) indicate that the amount of nitrate-nitrite that flowed into the lake (LF-3) was almost double the amount that flowed out (LF-6). Because the 1995 data provides a somewhat better over-all comparison of the tributary sites, it would appear that Lake Faulkton is most likely also acting as a sink for nitrate-nitrite nitrogen. Consequently, more than adequate amounts of nitrate-nitrite nitrogen are available for the growth of algae and other aquatic plants.

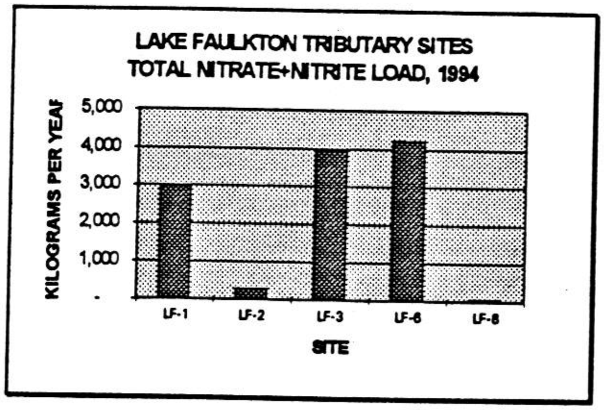

Figure 21. 1994 Tributary Nitrate / Nitrite

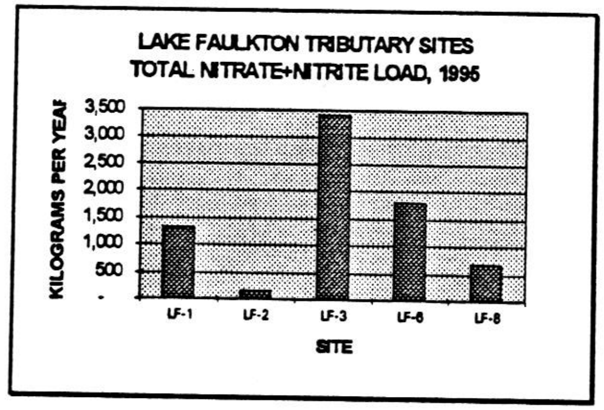

Figure 22. 1995 Tributary Nitrate /Nitrite

In comparing the loadings from the other tributary sites (Figures 21 and 22), it is again evident that the LF-1 subwatershed is the major source of nitrate-nitrite nitrogen.

TOTAL PHOSPHORUS

Total phosphorus represents all of the phosphorus found in a water sample. Phosphorus is an element which is essential to all life. Not all phosphorus is immediately available to aquatic plants and algae. Phosphorus can adsorb onto soil particles, causing it to be released only when dissolved oxygen levels are depleted. When phosphorus concentrations are high, nuisance growths of aquatic plants and algae can result. Sources of phosphorus include agricultural activities, sewage, and the decomposition of organic matter.

The tributary loadings of total phosphorus for the 1994 and 1995 monitoring periods are shown in Figures 23 and 24. These figures indicate that significantly greater quantities of total phosphorus flowed into the lake (LF-3) than flowed out (LF-6). As was generally the case for the nitrogen parameters, Lake Faulkton was also found to act as a sink for the total phosphorus nutrient. This is of particular concern because in most lake systems, phosphorus is the "limiting nutrient" for algae growth. Nitrogen is generally not a limiting nutrient because many species of algae, particularly nuisance blue-green algae, are capable of producing the nitrogen they need if it is not readily available in the environment. Algae and other plants, however, are not capable of generating the phosphorus nutrients they require. Consequently, if phosphorus can be limited, there may likewise be an opportunity to limit algae and aquatic plant growth. With Lake Faulkton acting as a phosphorus sink--more phosphorus coming in than going out--there is presently little opportunity to limit algae and aquatic plant growth. Any attempt at limiting algae and aquatic plant growth will require a reduction in available sources of phosphorus, including inflowing phosphorus as well as phosphorus available from the lake sediment.

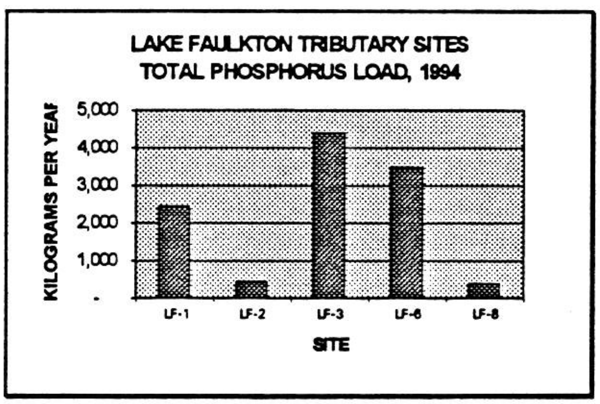

Figure 23. 1994 Tributary Total Phosphorus

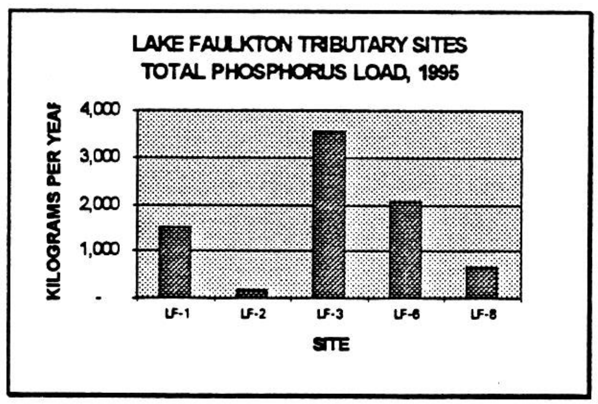

Figure 24. 1995 Tributary Total Phosphorus

In reviewing the loadings at the other tributary sites in 1994 and 1995 (Figures 23 and 24), it is evident that similar to the nitrogen parameters, the LF-1 and LF-8 subwatersheds are the largest contributors of total phosphorus to Lake Faulkton. Runoff from cropland and livestock feeding areas is the most likely source of total phosphorus.

TOTAL DISSOLVED PHOSPHORUS

In addition to total phosphorus, total dissolved phosphorus was also monitored during the Lake Faulkton Assessment Project. Total dissolved phosphorus is the portion of total phosphorus that is more readily available for uptake by algae and other aquatic plants. Figures 25 and 26 indicate that as was the case with total phosphorus, more dissolved phosphorus flowed into the lake (LF-3) than flowed out (LF-6). Therefore, similar to total phosphorus, Lake Faulkton was also found to act as a sink for dissolved phosphorus. The accumulation of dissolved phosphorus in the lake likewise limits the opportunity to limit the growth of algae or other aquatic plants.

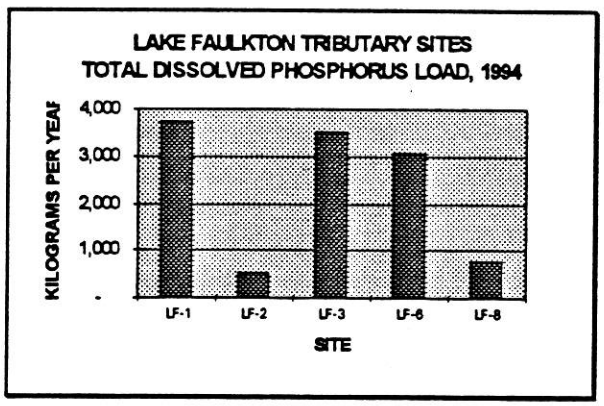

Fig. 25. 1994 Trib. Total Dissolved Phosphorus

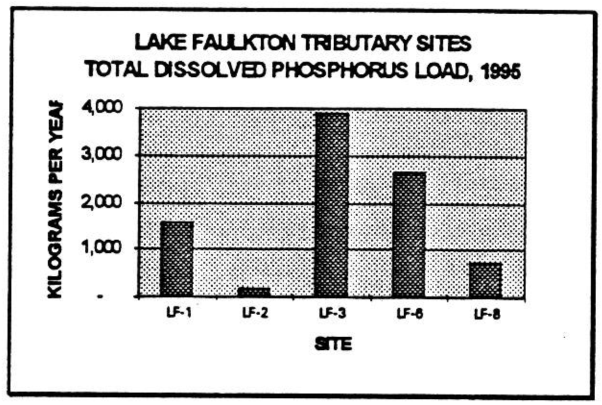

Fig. 26. 1995 Trib. Total Dissolved Phosphorus

In comparing the loads at the other tributary sites in 1994 and 1995 (Figures 25 and 26), it is again found that the LF-1 and LF-8 subwatersheds are the greatest sources of total dissolved phosphorus. Runoff from livestock feedlots is the most probable source of total dissolved phosphorus in the Lake Faulkton watershed.

SPECIAL TRIBUTARY SAMPLES

A limited number of discretionary samples were collected during the Lake Assessment Project. The purpose of these samples was to compare upstream and downstream results for potential nonpoint sources of pollution. The results of these samples are shown below:

Table 6. Discretionary Sample Results

DATE	SITE	FIELD pH	FECAL COLIFORM per/100 mL	TALKAL mg/L	TSOL mg/L	TSSOL mg/L	AMMON mg/L	NO_3NO_2 mg/L	TKN-N mg/L	TPO_4 mg/L	$TDPO_4$ mg/L
7/11/94	D1Up	7.60	20	139.0	462	2	<0.02	0.1	1.42	0.576	0.982
7/11/94	D1Down	7.60	80	141.0	453	7	<0.02	0.1	1.52	0.566	1.04
4/17/95	D2Up	8.05	10	55.0	161	10	<0.02	0.1	0.94	0.243	0.571
4/17/95	D2Down	8.15	<10	NA	NA	NA	<0.02	<0.1	1.66	0.295	0.236
4/17/95	D3Up	8.05	50	53.0	161	40	<0.02	<0.1	1.13	0.289	0.190
4/17/95	D3Down	8.15	450	53.0	190	76	0.02	0.1	0.54	0.394	0.213
4/19/95	D4Up	8.25	100	66.5	325	58	0.08	1.3	1.10	0.312	0.220
4/19/95	D4Down	8.10	130	66.0	354	58	0.09	1.3	1.08	0.361	0.220

A comparison of the upstream and downstream sample results at the four sites that were monitored indicates an impact from nonpoint sources of pollution. Downstream from Site D1, there is a notable increase in fecal coliform bacteria, and slight increases for total suspended solids and total Kjeldahl nitrogen (TKN-N). At Site D2, there is a downstream increase of TKN-N and total phosphate (TPO4). Site D3 shows a major increase for fecal coliform bacteria downstream, and significant increases for almost all other parameters. At Site D4, there is a significant increase for both fecal coliform bacteria and total phosphate in the downstream sample results.

Overall, the results of these discretionary samples indicate significant impacts from nonpoint sources of pollution in the watershed that need to be addressed.

LAKE FAULKTON WATERSHED AGNPS ANALYSIS

The amount of water quality data available from the watershed monitoring program was limited by the high cost of laboratory analysis for water samples. In order to supplement the information provided by the water quality monitoring program, a computer model was selected to assess the nonpoint source loadings throughout the watershed. The model which was selected was the Agricultural Non-Point Source (AGNPS) Pollution Model (version 5.00). This model was developed by the U. S. Department of Agriculture, 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 subwatersheds within a watershed, and watersheds throughout the state.

The size of the Lake Faulkton watershed area modeled was 161,320 acres. Initially, the watershed was divided into 40-acre cells with dimensions of 1,320 feet by 1,320 feet. The fluid flow directions were then determined. Based upon the fluid flow directions and drainage patterns, 10 subwatersheds were identified. The AGNPS analysis of the Lake Faulkton watershed consisted of calculation of nonpoint source yields for each cell and subwatershed, impact and ranking of each livestock feeding area, and estimated hydrology runoff volumes for each storm event modeled. The amount of sediment and nutrients delivered to Lake Faulkton and the amount deposited and transported out of the lake were also calculated. However, the calculated amounts of sediment and nutrients deposited in Lake Faulkton may be in error because the model does not account for retention time and the lake storage capacity.

AGNPS Goals

The primary objectives of running the AGNPS model on the Lake Faulkton watershed were to:

1) Evaluate and quantify nonpoint source yields from each cell and subwatershed and their net loading to Lake Faulkton.

2) Define critical cells within each subwatershed (elevated sediment, nitrogen, phosphorus); and

3) Priority rank each concentrated livestock feeding area and quantify the nutrient loadings from each feeding area.

AGNPS Conclusions

Based upon a comparison of other watersheds in eastern South Dakota, the overall sediment and nutrient loadings to Lake Faulkton appear to be low. A detailed subwatershed analysis indicated that the sediment and nutrient deliverability rates were very low. However, when a total sediment and nutrient yield analysis was performed, it was established that the sediment delivered to Lake Faulkton was low, and the nutrients delivered to Lake Faulkton were high. In summary, the calculated sediment and nutrient per acre yields are low, but due to the large size of the watershed, the nutrients delivered to Lake Faulkton were high. The livestock feeding area analysis indicated that the most probable sources of the elevated nutrients in the watershed were the large number of feeding areas. Many of these operations are located adjacent to waterways or in close proximity to Lake Faulkton.

The implementation of best management conservation practices should be targeted to the identified critical cells in the watershed and to priority livestock feeding areas. This methodology should produce the most cost-effective treatment plan for reducing sediment and nutrient yields to Lake Faulkton.

The entire AGNPS report for the Lake Faulkton watershed is included in APPENDIX D.

LAKESHORE EVALUATION

An evaluation of the lakeshore was conducted to determine if lake use impairment is occurring as a result of lakeshore neglect or improper management. Factors that were examined included lakeside development, lawn fertilizer application, pesticide use, livestock access, near-shore farming activities, public use facilities, storm drains, and refuse disposal. The operation of the Lakeside Country Club golf course located adjacent to Lake Faulkton was evaluated with respect to the use of pesticides and fertilizer. Figure 27 illustrates the development in the immediate vicinity of Lake Faulkton.

Concerning lakeside development, it was determined that there were about 33 dwellings around the lake as of October, 1995. A survey was sent to the lake property owners, and 20 responses were received. The responses are summarized below:

Table 7. Lakeshore Evaluation Survey Responses

What type of sewer system do you have in your cabin?	Do you use pesticides / fertilizer on your cabin lot(s)?	About how many days per year is your cabin used?
1. outhouse	no / no	60
2. outhouse	no / no	30
3. outdoor	no / no	all summer
4. outside toilet	no / no	all year
5. none	no / no	25
6. septic tank	no / no	30-60
7. septic tank/drainfield on lot away from lake	no / no	365
8. none	no / no	not many
9. no sewer system	no / no	15-20
10. none	no / no	20
11. outhouse	no / no	0
12. no cabin--just a lot	no / no	N. A.
13. none	no / no	10-12
14. none--no cabin	no / no	N. A.
15. holding tank--porta potty	no / no	50
16. outhouse	no / no	365
17. outhouse{ 3 }	no / no	very few
18. nothing { }	" "	" "
19. no cabin {lots}	" "	" "
20. outhouse--putting in holding tank	no / no	5

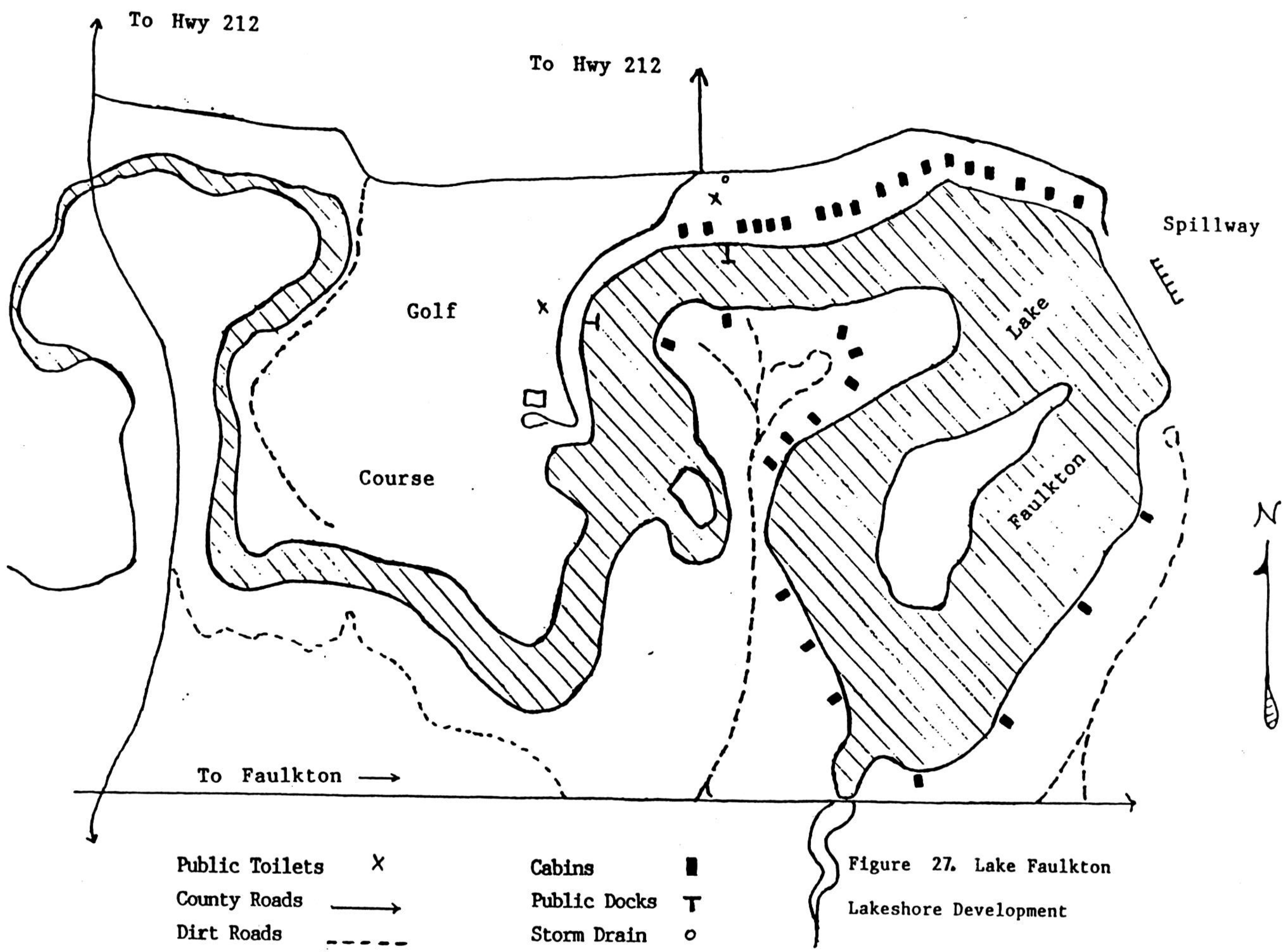

Figure 27. Lake Faulkton Lakeshore Development

From the summary of lakeshore evaluation survey responses in Table 7, it can be seen that wastewater disposal facilities for many of the lake dwellings may be somewhat inadequate. However, it should be noted that of the twenty survey responses, only three indicated year-round use of the home. At the present time the majority of the lake dwellings are used only on a very limited seasonal basis which minimizes the impact of generally inadequate wastewater disposal. Solid waste disposal is done by the lakeside property owners on an individual basis. There are no known complaints about wastewater or solid waste disposal around the lake.

Planning for the best long-term development of the lake area should take into account that the soils around the lake are of the LaPrairie-Zahill-Lehr association. These loamy soils are moderately well drained to somewhat excessively drained. In general, these soils are not well-suited for sanitary facilities, including septic tank absorption fields.

A comprehensive plan for lakeshore development should address the wastewater treatment needs around the lake. The plan should specify the need for upgraded treatment of wastewater from existing dwellings, and require adequate wastewater disposal for any new development at the lake.

With respect to near-shore farming activities, this is primarily limited to livestock pasture areas, which appear to be having minimal impact on the lake. The main farming activities that are of concern from a water quality standpoint are, for the most part, located further out in the watershed.

In evaluating public use facilities and storm drains, three priority areas were examined which included the Lakeside Country Club golf course; the South Dakota Game, Fish and Parks (GF&P) Lakeside Use Area; and the GF&P public boat ramp area.

Golf Course

A storm drain is located at the golf course which drains to the west end of the lake. The purpose of the drain is to alleviate water which tends to pond in that area of the course. Water samples were collected from the golf course area on five occasions during 1994 and 1995. The dates and results of these samples are shown in Table 8, Golf Course Water Sample Results.

Table 8. Golf Course Water Sample Results

Date	Fecal Coliform /100 mL	pH units	Total Alkal. mg/L	Total Solids mg/L	Diss. Solids mg/L	Susp. Solids mg/L	Ammon. mg/L	NO_{3+2} mg/L	TKN-N mg/L	TPO_4 mg/L	$TDPO_4$ mg/L
7/7/94*	220	7.15	17.2	76	69	7	0.05	0.2	1.79	0.49	0.49
2/22/95⁺	10	7.25	77.0	381	351	30	6.16	0.3	14.16	4.59	4.43
3/16/95⁺	NA	7.45	3.7	373	331	42	3.70	0.1	10.11	3.07	2.61
4/6/95*	10	7.95	95.1	415	399	16	0.39	0.4	7.73	2.67	2.89
6/15/95*	4100	7.65	134.0	1226	1204	22	0.26	0.6	8.16	2.47	2.12

*Denotes samples collected from the end of the storm drain pipe.

⁺Denotes samples collected from water ponded on the course prior to discharging through the storm drain pipe.

The sample results indicate quite a high level of fecal coliform bacteria in the sample collected on June 15, 1995. The reason for the high bacteria result on that date is uncertain. The bacteria results for the remaining dates do not indicate a very significant problem. On the other hand, the concentrations of ammonia, nitrate, total Kjeldahl nitrogen, total phosphorus, and total dissolved phosphorus are very high on almost all the sample dates. Because the discharge from the storm drain pipe flows quite directly to the lake, the high ammonia levels could present a toxicity problem for fish. In addition, the high nutrient levels for the various other forms of nitrogen and phosphorous will compound the problems of plant growth and algae blooms in the lake.

Application records indicate that the golf course uses as much or more fertilizer per acre than most farmers in the area. In addition, pesticides are used to some extent at the course. Because of its close proximity to the lake, the course presents a very likely potential for water quality problems from general runoff, as well as the drainage from the storm drain. Alternatives for reducing water quality impacts from the golf course are presented in the "Restoration Alternatives" section of the report.

Lakeside Use Area

The South Dakota Department of Game, Fish and Parks (GF&P) owns and operates a Lakeside Use Area on land adjacent to the Lakeside Country Club golf course on the northwest side of Lake Faulkton. The Lakeside Use Area has campsites and a fishing dock. The only facilities are running water, vault toilets, and refuse containers. Refuse from the area is collected and disposed by GF&P on a regular basis. This area is well maintained, with very minimal impact on the lake. As discussed later in the "Shoreline Erosion Survey" section of the report, there is some minor bank erosion occurring along part of the shoreline on the GF&P property.

Public Boat Ramp

The SD Department of Game, Fish and Parks (GF&P) also owns and operates a public access boat ramp and dock on the north side of the lake. The only facilities at this site are a vault toilet and refuse containers. The refuse from this public access area is collected and disposed by GF&P on a routine basis. This area, also, is well maintained and appears to have very minimal impact on the lake. It has been noted that the grade at this site is quite steep, which results in minor erosion across the parking lot area. The erosion across the parking lot results in some sand and gravel being deposited into the lake.

SHORELINE EROSION SURVEY

A shoreline erosion survey was conducted on July 24, 1995, in conjunction with an aquatic plant survey. The survey involved inspecting the entire shoreline around the lake from a boat. Areas of erosion were photographed and documented on a map of the lake.

In general, the lake shoreline is in very good condition. There is extensive vegetation around nearly the entire shoreline, which helps protect it against erosion. Only five areas of erosion were documented. The extent of erosion varied from minor to severe, but the majority of the areas had only minor to intermediate erosion. The areas of erosion are summarized in Table 9.

Table 9. Lake Faulkton Shoreline Erosion Survey Data, July 24, 1995

	Minor Height/Length	Intermediate Height/Length	Severe Height/Length
	3 ft. / 50 ft.	15 ft. / 35 ft. 18 ft. / 75 ft. 25 ft. / 30 ft.	30 ft. / 100 ft.
Ave. Height	3 ft.	19 ft.	30 ft.
Overall Length	50 ft.	140 ft.	100 ft.
% of Tot. Shoreline (26,928 ft.)	0.2%	0.5%	0.4%

From the table above, it can be seen that there is only one area of severe erosion along the shoreline. This area is between the west edge of the Lakeside Country Club golf course and the upper end of the lake. In total, there is 290 feet of erosion, which is 1.1% of the total 5.1 mile shoreline length.

Figure 28 on the following page illustrates the areas of minor, intermediate, and severe erosion around the lake.

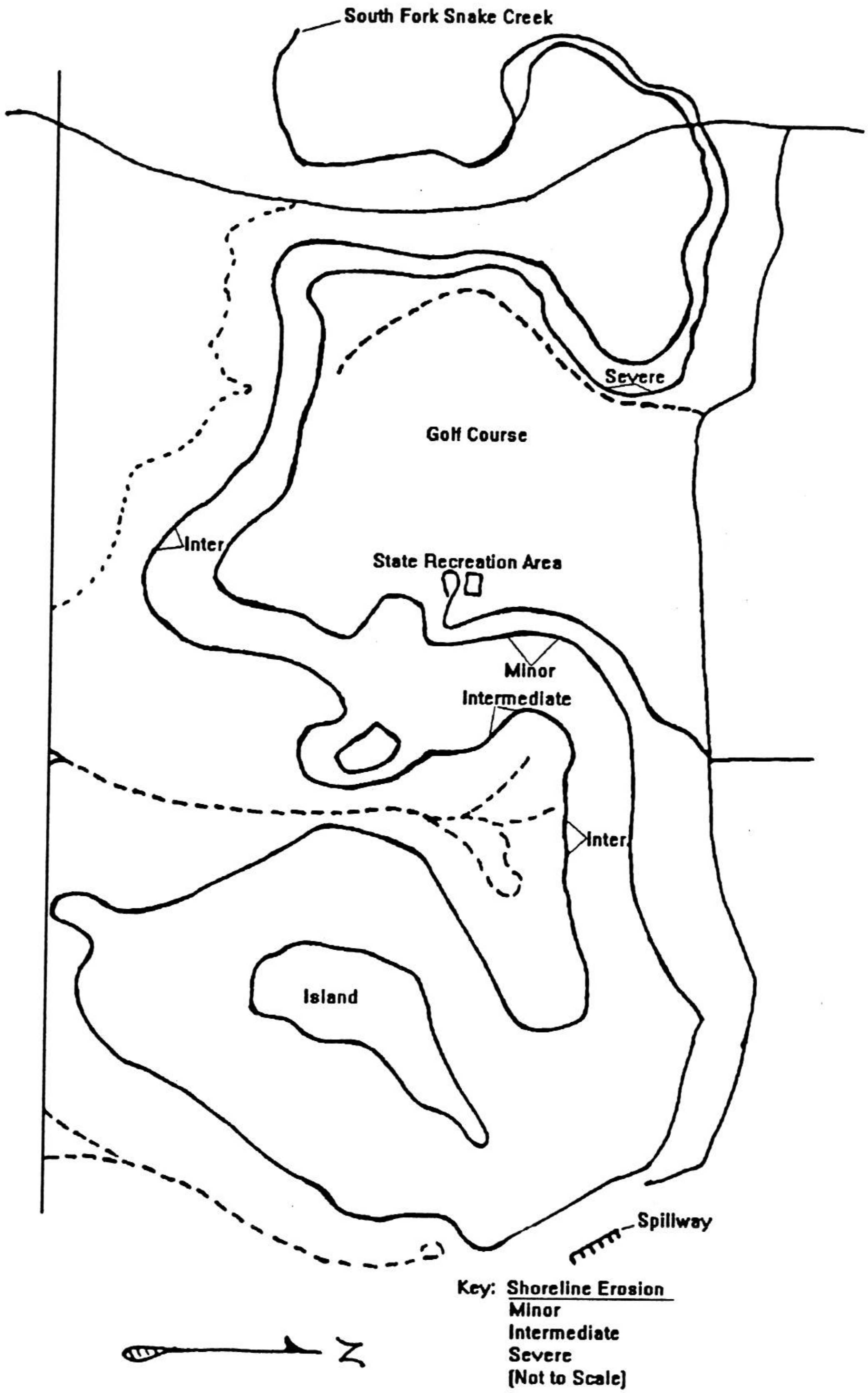

Figure 28. Lake Faulkton Shoreline Erosion Survey on July 24, 1995

AQUATIC PLANT SURVEY

An aquatic plant survey was conducted on July 24, 1995, by the local Project Coordinator and SD DENR staff. Emergent vegetation is very extensive and covers nearly 100% of the shoreline. Submergent and floating vegetation is also very abundant in the shallower portions of the lake. The vegetation that is present causes problems with boating and shore fishing.

The table below indicates the plants that were identified, their habitat, and relative abundance.

Table 10. Lake Faulkton Aquatic Plant Survey

COMMON NAME	GENUS	SPECIES	HABITAT	RELATIVE ABUNDANCE
Scarlet Smartweed	Polygonum	coccineum	Emergent	Minor
Sedge	Carex	spp.	Emergent	Minor
Giant Reed Grass	Phragmites	australis	Emergent	Minor
Green Bulrush	Scirpus	atrovirens	Emergent	Minor
Hardstem Bulrush	Scirpus	acutus	Emergent	Minor
Hybrid Cattail	**Typha**	**glauca**	**Emergent**	**Major**
Narrow-leaved Cattail	Typha	angustifolia	Emergent	Minor
Broad-leaved Cattail	Typha	latifolia	Emergent	Minor
Willow	Salix	spp.	Emergent	Moderate
Cottonwood	Populus	deltoides	Emergent	Moderate
Flowering Rush	**Butomus**	**umbellatus**	**Emergent/ Submergent**	**Major**
Bladderwort	Utricularia	minor	Submergent	Minor
Northern Water Milfoil	Myriophyllum	exalbescens	Submergent	Minor
Sago Pondweed	**Potamogeton**	**pectinatus**	**Submergent**	**Major**
Flat-stem Pondweed	**Potamogeton**	**zosteriformis**	**Submergent**	**Major**
Coontail	**Ceratophyllum**	**demersum**	**Submergent/ Floating**	**Major**
Duckweed	Lemna	minor	Submergent/ Floating	Moderate
Big Duckweed	Spirodela	polyrhiza	Submergent/ Floating	Moderate
Watermeal	Wolffia	columbiana	Submergent/ Floating	Minor

As noted in Table 10 on the previous page, the predominant plant species in and around the lake are hybrid cattail, flowering rush, sago pondweed, flat-stem pondweed, and coontail. The flowering rush is unique to Lake Faulkton (Van Bruggen, 1976). It has not been documented at any other lake in the state. The flowering rush is considered an exotic species, in that it is not native to North America. It is a perennial plant that spreads from the rhizome, which is a creeping underground stem. The flowering rush originated from Europe, and was introduced in the Midwest as an ornamental plant. It grows in shallow areas of lakes as an emergent, and as a submersed form in water up to 10 feet deep. Flowering rush crowds out native species like bulrush. The emergent form has pink, umbellate-shaped flowers, and is three feet tall with triangular-shaped stems (U. S. Fish and Wildlife Service, 1993). Dense stands of the flowering rush were observed throughout the lake, and are interspersed with dense stands of the hybrid cattail. There have been complaints that the extensive shoreline vegetation limits access to the lake by cabin owners and the general public. There has been some limited removal of the vegetation by cabin owners and by SD GF&P at the Lakeside Public Use Area.

There have been further complaints that extensive submerged vegetation, such as the sago pondweed and coontail, have limited boating and fishing on the lake. This is particularly true most years by late summer, when the submerged vegetation reaches its maximum seasonal growth. There have been no major efforts to remove the submerged vegetation. On the positive side, the extensive growth of emergent and submergent vegetation does provide some beneficial habitat for the fisheries in the lake.

The primary plant species observed during the survey on July 24, 1995, are shown in Figure 29 on the following page.

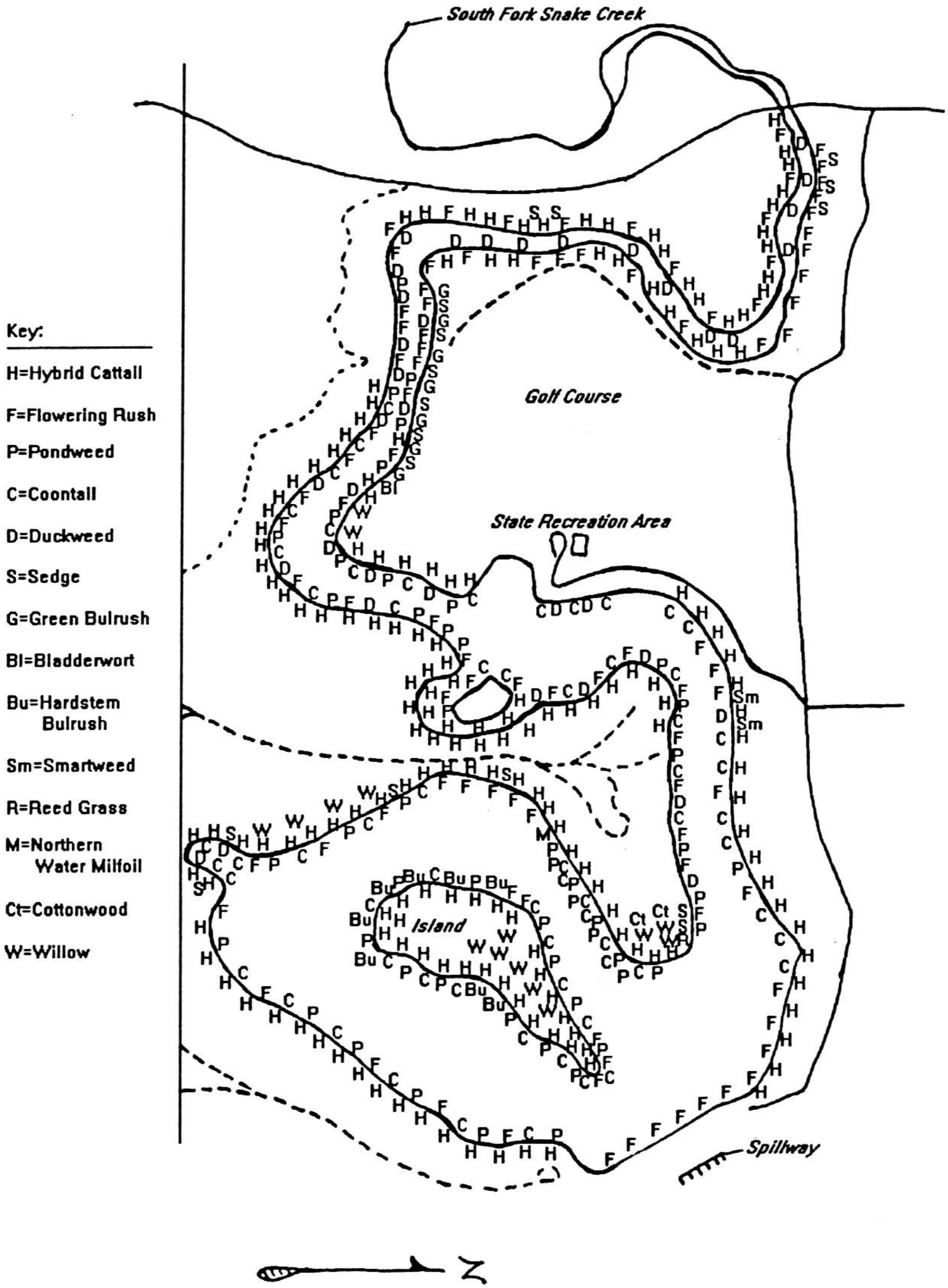

Figure 29. Lake Faulkton Plant Survey on July 24, 1995

SEDIMENT SURVEY

Results of Reconnaissance-level Seismic Survey of Lake Faulkton, South Dakota

by Steven K. Sando*

A reconnaissance-level seismic survey was performed on Lake Faulkton during June 27-28, 1995, to determine whether the thickness of deposited sediment could be determined using the seismic system. Continuous seismic-reflection systems transmit and receive high-energy acoustic signals through the water column and subsurface. When the signal encounters layers of different acoustical impedance (defined as the product of density of a medium and the velocity of sound within the medium), part of the signal is reflected back to the surface seismic receiver and part penetrates further into the sediment. The strength of the reflection is dependent on the contrast in acoustic impedance between two adjoining layers. The reflected signal returning from the sediments is recorded on a thermal chart recorder and digital audio tape recorder. Typically, variations in the intensity and pattern in the output on the thermal chart recorder indicate the depths of different subsurface layers in the sediment.

During this reconnaissance study, the seismic system was operated while traversing many transects covering the main body of the lake and extending into the upper reaches of the lake. During the period of trial operations, clear and distinct indications of the original lake bed were not apparent in the seismic record. A strong reflector at the top of the sediments was at all times present in the seismic record, even though the sediment was fine-grained (that is, silty), very loose and porous, and could be easily penetrated for up to several feet using a 1/2 inch steel rod. Multiple signals were produced by the strong reflection off the top of the sediment and obscured clear interpretation of any part of the acoustic signal that may have penetrated further into the sediments.

While traversing the trial transects, gain, power, and frequency settings on the seismic system were systematically varied in an attempt to penetrate the surface of the sediments with the acoustic signal. Variations in the settings that were performed during the trial operations include: the transmitter was operated at frequencies of 3.5 and 7.0 kilohertz; transmitter power was varied from 1 to 30 percent; thermal chart recorder gains were varied over a wide range; receiver constant gains and time-varied gains were varied over a wide range while adjusting the time-varied delay over a range of about 20 feet, extending from the top of the sediments downward. None of these adjustments were successful in being able to clearly discern the original lake bed within the seismic record.

Possible explanations for the inability of the seismic system to determine the thickness of deposited sediment include:

(1) Bottom material samples that were collected during the trial operations indicated that the sediment was plastic-like and gelatinous in consistency; even though the sediment was fine-grained and porous, thick sediments of this consistency may act as strong reflectors of the acoustic signal;

(2) The composition of the original lake bed may be similar to the deposited sediment with respect to particle size and density, a situation that would result in very little contrast in acoustic properties between the two layers; therefore, any of the acoustic signal that did penetrate the surface of the sediments would not strongly reflect off the original lake bed;

(3) Gas can accumulate in highly organic sediments as a byproduct of microbial decomposition of organic material and can serve as a strong reflector of the seismic signal; however, large accumulations of gas were not readily apparent in Lake Faulkton sediment when probing or collecting bottom material samples.

Because the reconnaissance operations were unsuccessful in distinguishing the original lake bed in the seismic record, a detailed survey of the lake was not performed.

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Results of Probing Sediment Survey of Lake Faulkton, South Dakota

As noted above, a seismic sediment survey could not be completed with available equipment and technology. Therefore, a probing sediment survey was conducted on June 11 and 12, 1996. One-half inch diameter steel rods were used to probe for sediment depth. The steel rods were pushed into the sediment until a hard bottom was encountered. It was assumed that the hard bottom represented the original lake bottom. By subtracting the water depth from the total length of rod under the water, an estimate could be made of the soft sediment depth. Measurements of silt depths were taken in this manner at approximately 100 locations throughout Lake Faulkton. The measurements at all the locations were recorded using global positioning system (GPS) equipment provided by the Natural Resources Conservation Service (NRCS). The data recorded by the GPS equipment was entered into a computer for analysis and mapping by the NRCS, Pierre, SD Office.

Figures 30 and 31 on the following pages show contour maps developed from the probing sediment survey data. Figure 30 depicts contours for water depths, and Figure 31 depicts contours for sediment depths. The data collected from the probing sediment survey were used to calculate a total sediment volume in Lake Faulkton of 7,500,400 cubic feet, which is equivalent to 277,793 cubic yards. This volume may be somewhat under-estimated because deep water in some areas of the lake limited the extent that the steel rods could be pushed into the sediment.

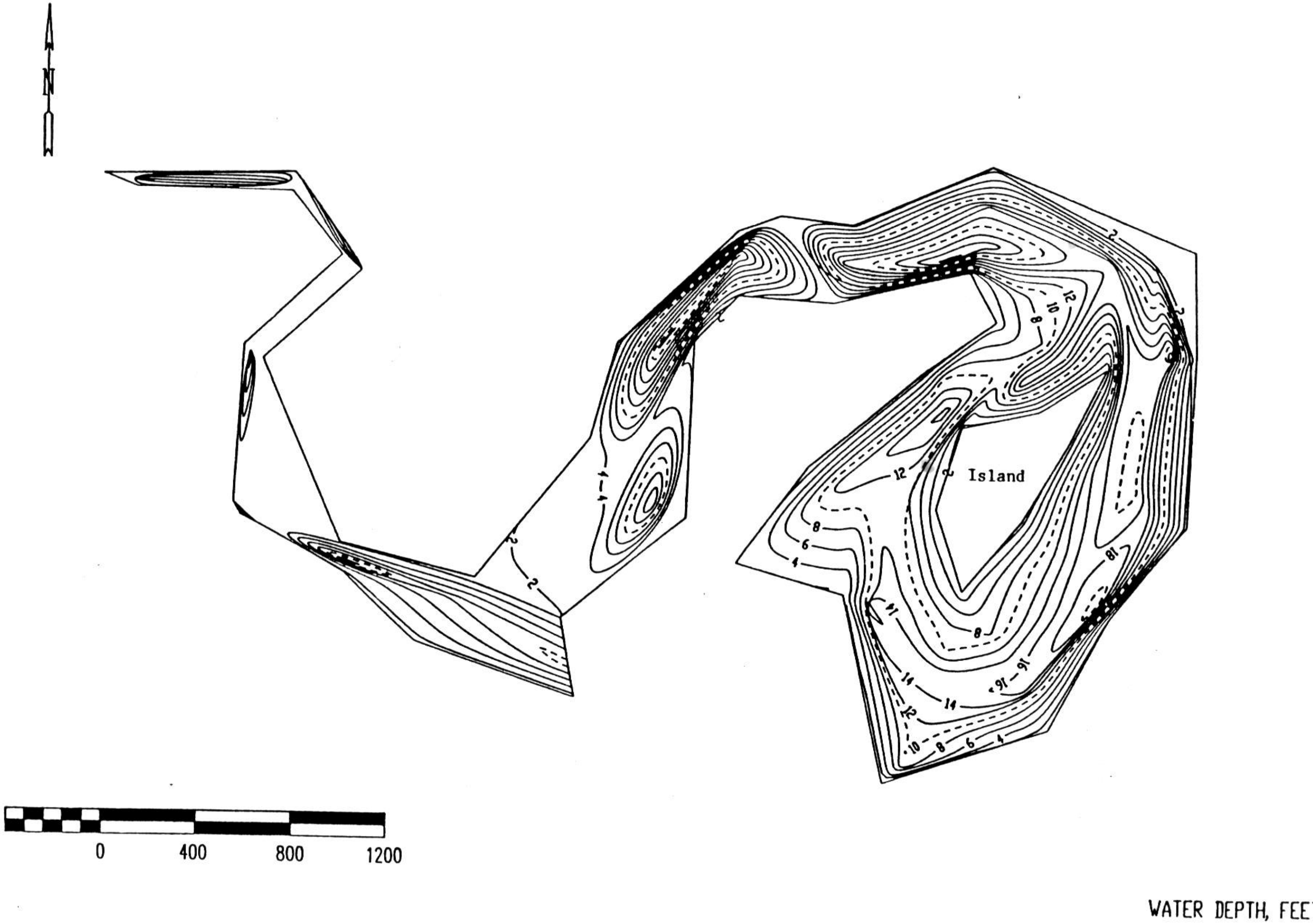


Figure 30. Lake Faulkton water depths, June, 1996.

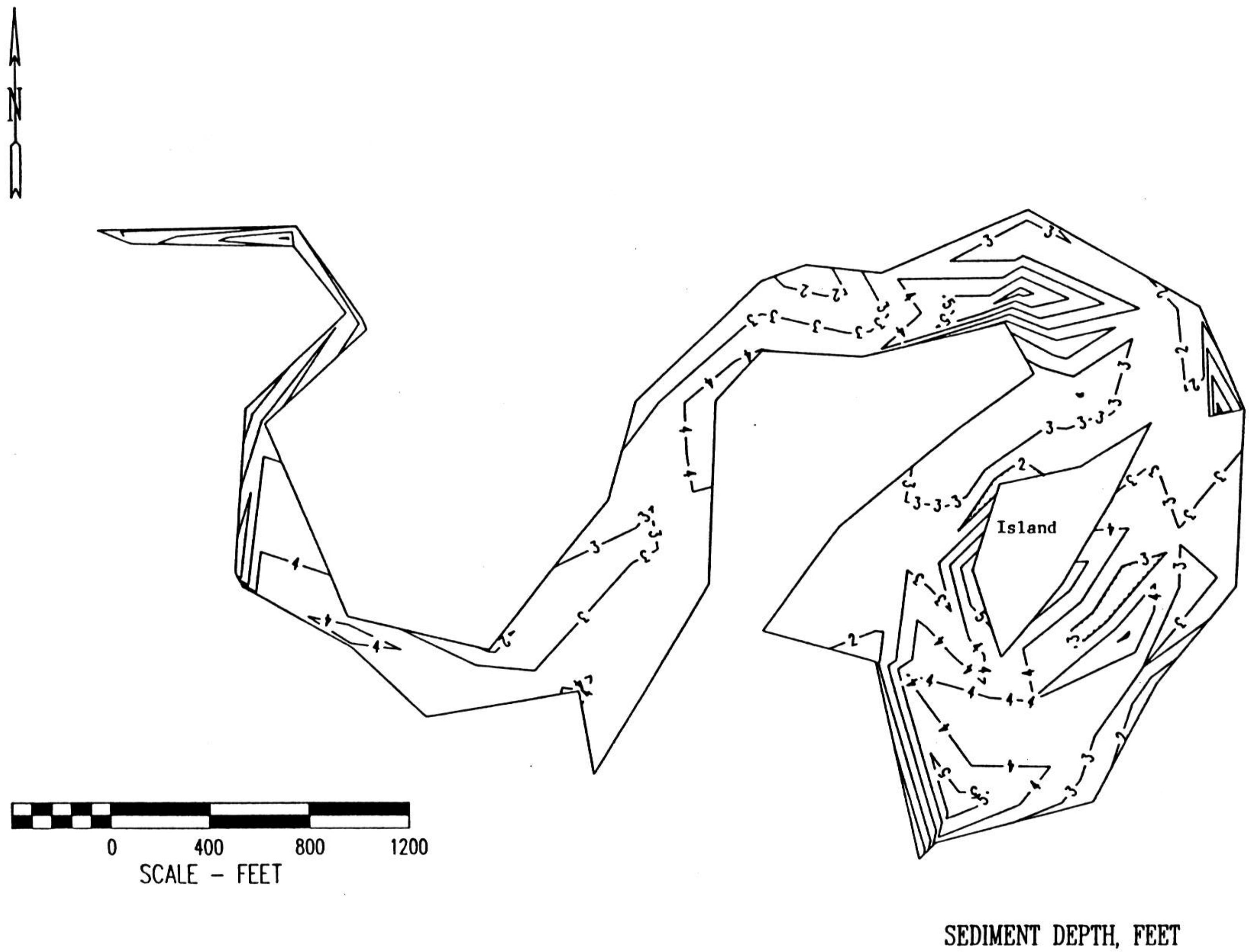


Figure 31. Lake Faulkton sediment depths, June, 1996.

FISHERIES

[Fisheries information was obtained from the SOUTH DAKOTA STATEWIDE FISHERIES SURVEY (2101-F21-R-29) provided by the South Dakota Department of Game, Fish and Parks.]

The most recent fisheries survey of Lake Faulkton was conducted on May 23, 1995. The most recent survey prior to 1995 was conducted on May 24, 1994.

The fisheries classification for Lake Faulkton is warmwater semipermanent. The primary game and forage species are largemouth bass, bluegill, black crappie, and fathead minnow. Secondary and other species are walleye, yellow perch, and northern pike.

Lake Faulkton is an artificial impoundment owned by the State of South Dakota and managed by the Game, Fish and Parks Department. Approximately 20% of the shoreline is under private ownership and 80% is owned by the State of South Dakota.

Biological Data--Methods

Lake Faulkton was electrofished on May 23, 1995. The electrofishing boat was navigated along the edge of the emergent vegetation when possible. Shocking was initiated after sunset. Weights and lengths were taken from all largemouth bass and from a sub-sample of bluegill. Largemouth bass scales were taken from behind the left pectoral fin below the lateral line. Age analysis of largemouth bass was done using the FishCalc program.

Results and Discussion

Electrofishing was conducted primarily to confirm findings observed in 1994 as well as to collect bluegill brood stock. Conclusions about species other than largemouth bass should be made based upon netting surveys. The bluegill sample is probably not representative as fish were captured during spawning activities and for suitability as brood stock.

The largemouth bass population is still depressed from the partial winter-kill of 1993/1994. Catch Per Unit Effort (CPUE) remained unchanged from 1994 at 6.0/hour. Growth of fish present is average with fish reaching 30 centimeters at age four. It appears that only the 1991 and 1992 year classes remain. In 1993, all year classes from 1987 to 1992 were present, indicating consistent natural reproduction. No sub-stock bass were sampled in 1995 indicating no reproduction in 1994. It is possible that stress induced by extended periods of low oxygen during the 1993/1994 winter caused decreased fecundity and year class failure. Based on a history of consistent recruitment, it is believed that given normal environmental conditions, this population has the ability to recover. Natural reproduction in 1995 should be evaluated before stocking is considered.

While electrofishing to assess the largemouth bass population, one hundred bluegill were collected. Length frequency indicates that fish of desirable length are fairly abundant. Previous netting information and this electrofishing sample suggest that the 1993/1994 partial winter-kill had little effect on bluegill. Abundance and size structure of the population is such that it should provide a suitable fishery.

Recommendations

1. Continue to manage for largemouth bass and bluegill.

2. Electrofish in 1996 to assess largemouth bass population.

3. Frame net to assess panfish populations and black bullhead response to decrease in predator population.

IN-LAKE MONITORING RESULTS

FECAL COLIFORM BACTERIA

Fecal coliform bacteria can indicate fecal contamination, and thus potential human health hazards. The in-lake fecal coliform results during the assessment project are shown in the figure below.

The in-lake fecal coliform bacteria results during the current assessment project were well within state standards (<200 organisms per 100 mL), and therefore did not indicate potential health related problems. It is noted, however, that the two times the bacteria results were somewhat elevated followed runoff events. For Site LF-5, south of the large island, the bacteria results were 20 per 100 mL on July 12, 1994, and 70 per 100 mL on April 25, 1995. The elevated results in July, 1994, followed a summer rain event, and the higher results in April, 1995, occurred following a spring rainfall. Site LF-5 was relatively close to a small inlet on the south side of the lake. This small inlet was not monitored during the Lake Assessment Project. However, because the two elevated in-lake bacteria results during the current assessment occurred near the small inlet, the area draining to that inlet should be evaluated for any potential sources of fecal coliform bacteria.

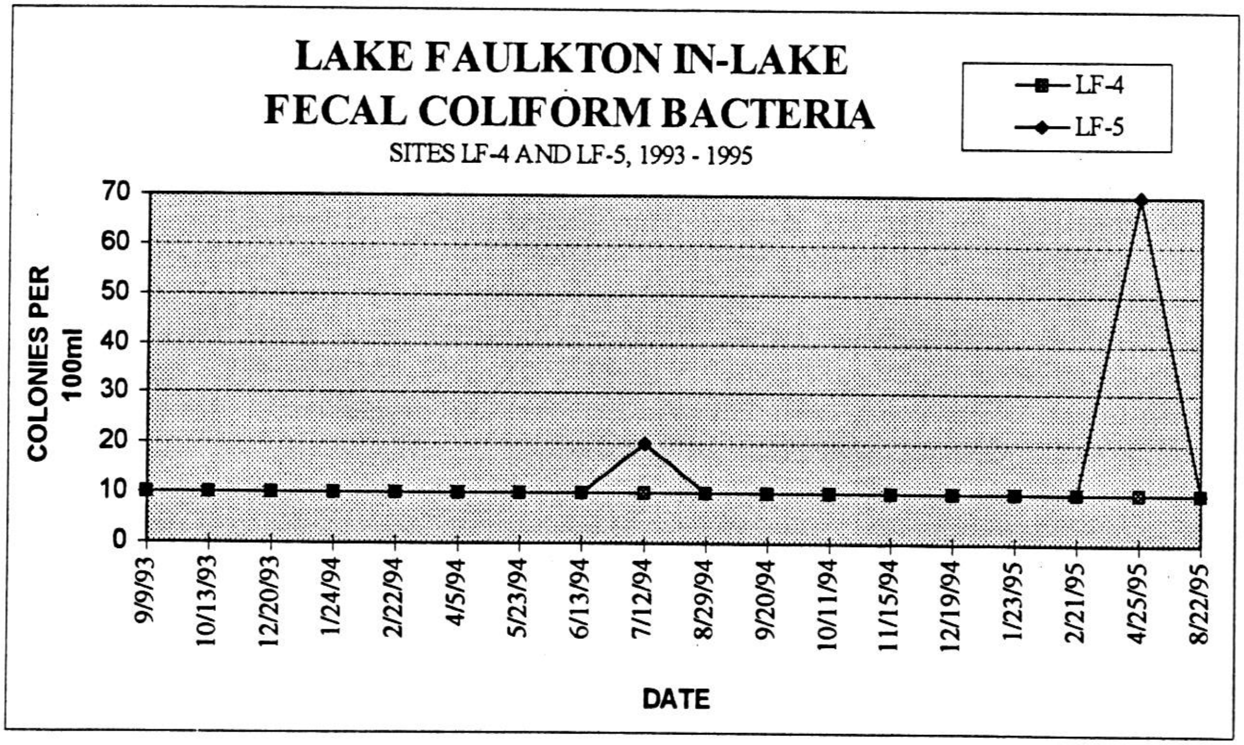


Figure 32. In-Lake Fecal Coliform Bacteria

DISSOLVED OXYGEN

Dissolved oxygen levels in a lake vary according to growth and decomposition activities, air to water interfaces, and distribution by wind driven mixing. Oxygen levels less than 5.0 mg/L are stressful to aquatic invertebrates and most other aquatic organisms. The monitoring results for dissolved oxygen are shown in Figure 33.

The dissolved oxygen levels in Lake Faulkton frequently dropped below the state water quality standard of 5.0 mg/L during the current assessment project. This was especially true for the dissolved oxygen levels at the bottom of the lake. Low oxygen levels were first noted during the winter of 1993-1994. The bottom oxygen level was less than 5 mg/L during December, 1993; and both surface and bottom oxygen were less than 5 mg/L during January and February of 1994.

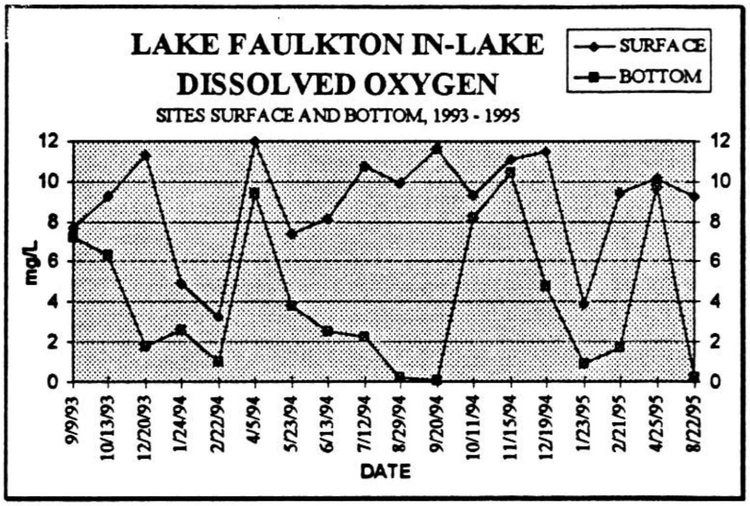
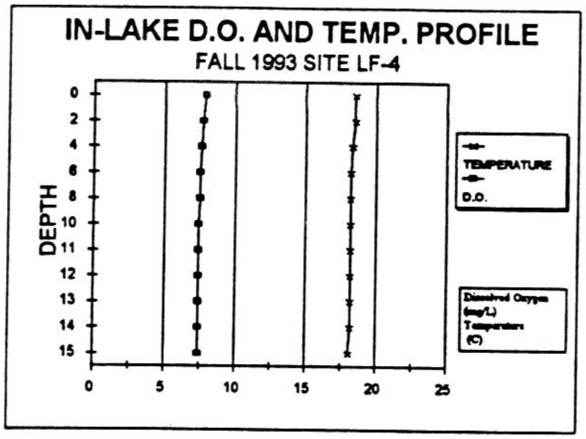


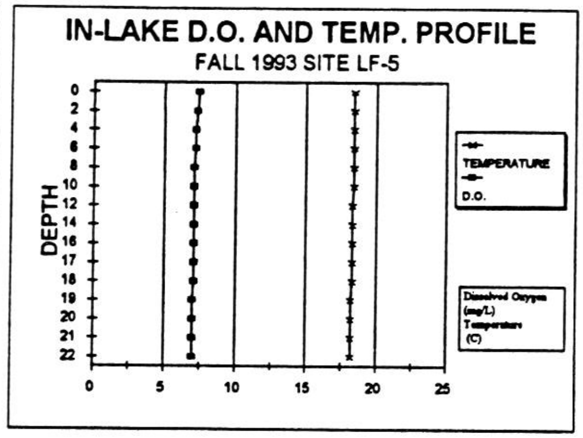
Figure 33. In-Lake Dissolved Oxygen

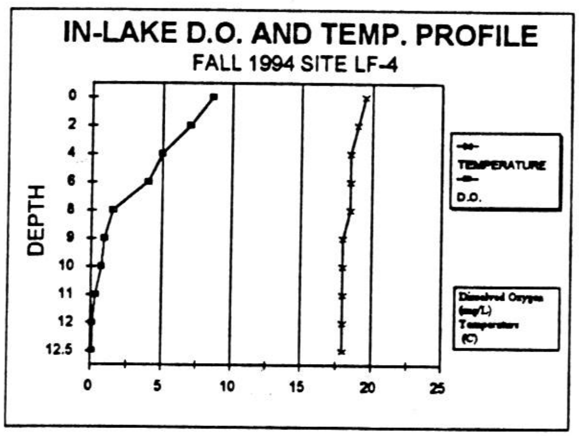
These low oxygen levels during the winter were partially caused by the decomposition of organic matter at the bottom of the lake. The decomposition process used up available oxygen. Snow cover on the ice also decreased the penetration of light, which in turn decreased photosynthesis by algae and aquatic plants. The decrease in photosynthesis resulted in less oxygen being given off as a by-product of the photosynthetic process. Another factor in the winter is less oxygen being derived from the air because of the ice cover. In April, 1994, oxygen levels quickly recovered during spring runoff, which brought an influx of water with high oxygen levels. Ice-out also resulted in wind driven mixing to replenish the oxygen supply.

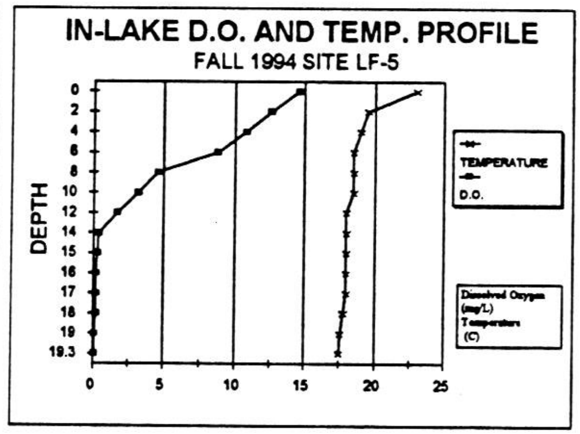
During the spring and over the summer in 1994, the bottom oxygen levels gradually decreased to a low point (0.1 mg/L) in September, 1994. These low oxygen levels at the bottom of the lake were again most likely caused by the decomposition of organic matter. Oxygen levels quickly recovered during the fall of 1994. The winter months of 1994 and 1995 once again revealed low oxygen levels as was noted the previous winter. As during the previous spring of 1994, oxygen levels also quickly recovered in the spring of 1995. By late summer in 1995 (August 22), the bottom oxygen level again dropped to a very low point (0.25 mg/L). The major cause of the low oxygen levels appears to be decomposition of organic matter at the lake bottom. Periods of low oxygen have resulted in fish kills at Lake Faulkton. The most recent was a partial winter-kill during the winter of 1993-1994. Dissolved oxygen/temperature profiles for seasonally representative dates during the Lake Assessment Project are shown on the following pages.

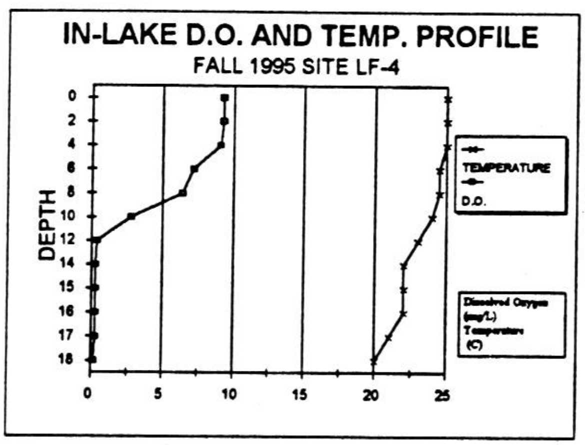
Figure 34. In-Lake Dissolved Oxygen / Temperature Profiles











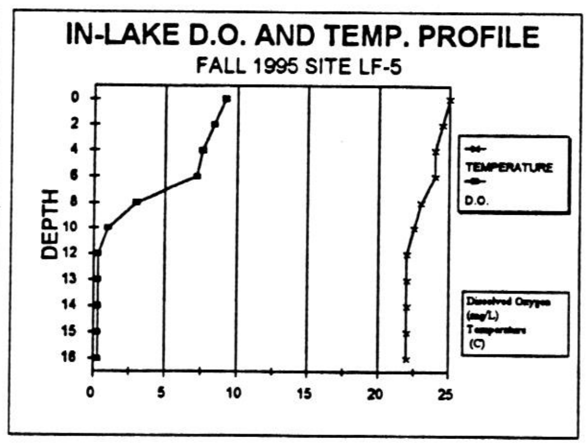
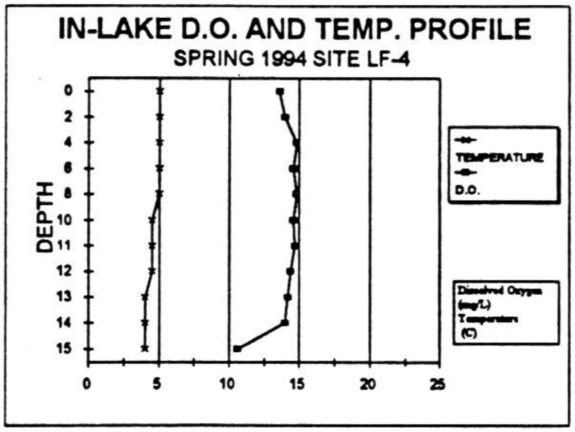
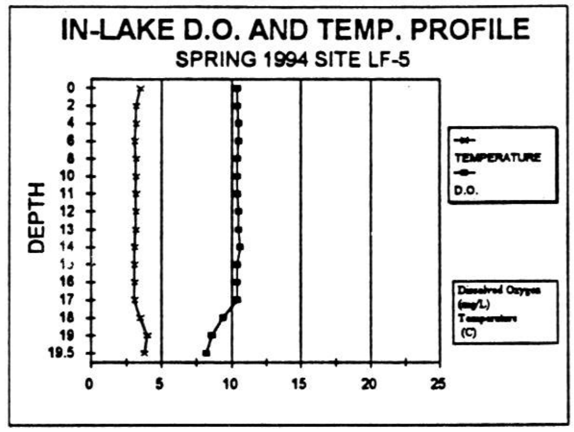
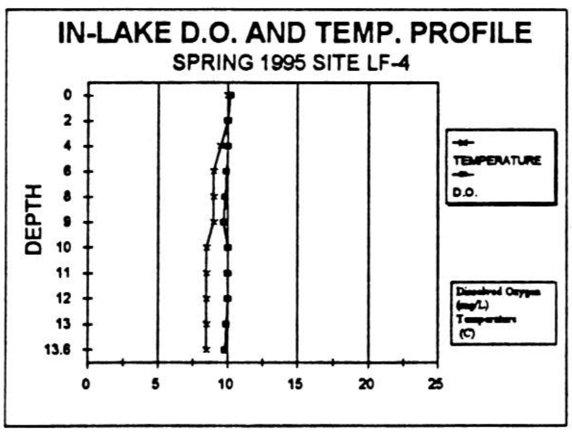
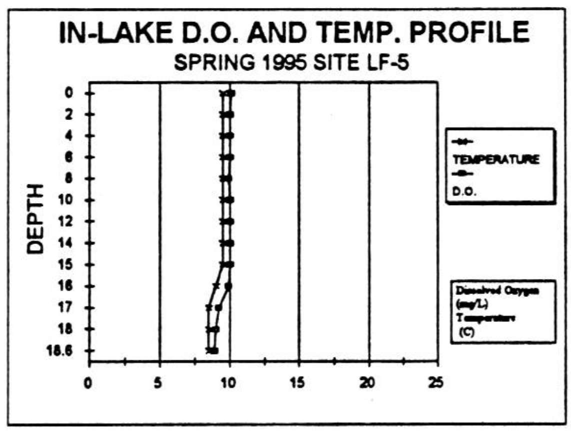


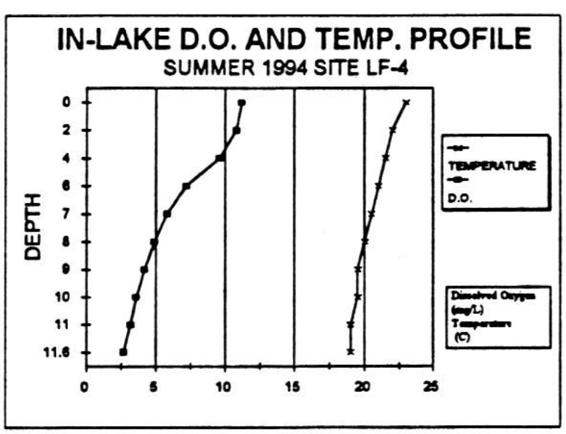
Figure 34. In-Lake Dissolved Oxygen / Temperature Profiles (continued)











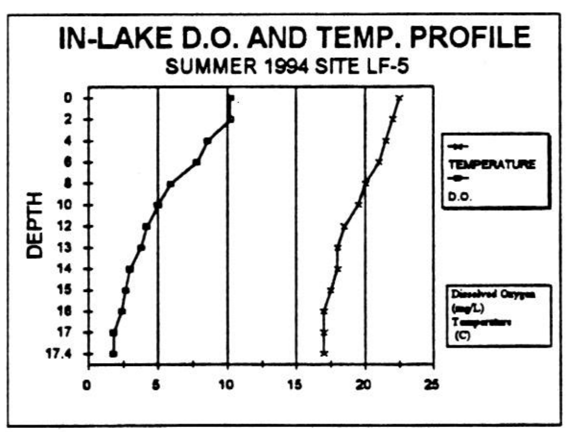
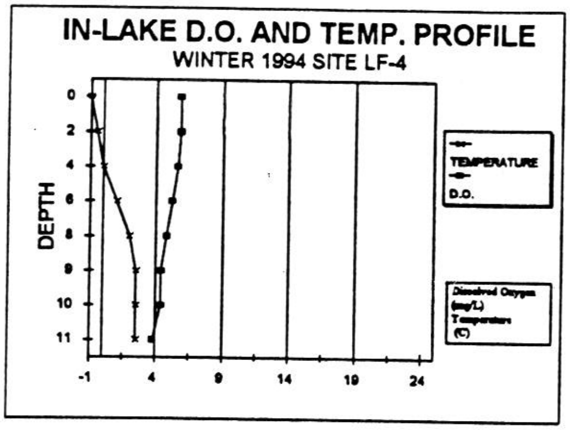
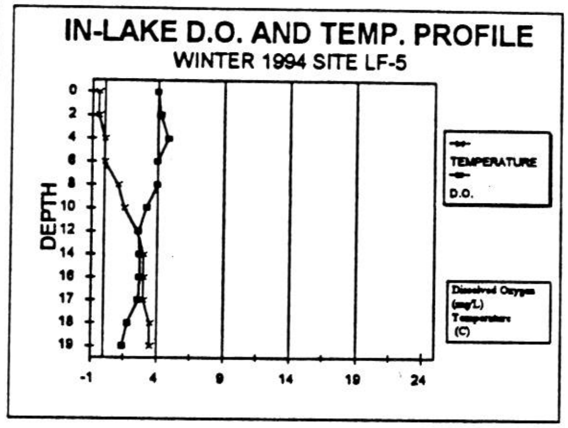
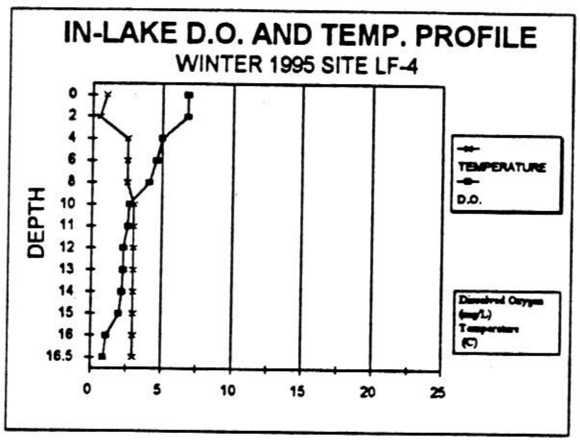
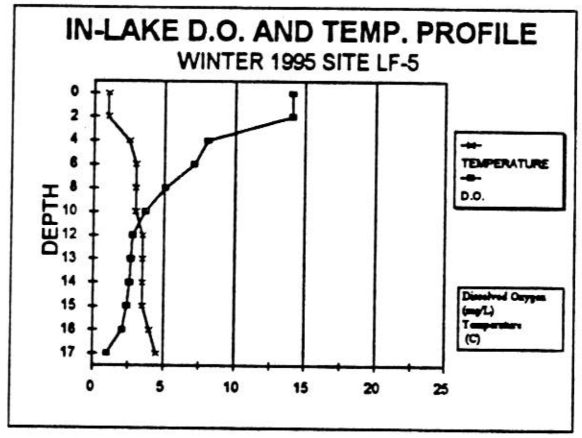


Figure 34. In-Lake Dissolved Oxygen / Temperature Profiles (continued)









pH

Field and laboratory pH are measures of hydrogen ion activity in water. The pH scale is a number range between 1 and 14, with 7 being neutral. Any value less than 7 is considered acidic, and any value greater than 7 is considered basic. The pH range for most natural lakes is between 6 and 9. Deviation from a neutral pH of 7 is a result of the decomposition of salts as they react with water. Gases such as carbon dioxide, hydrogen sulfide, and ammonia have a significant effect on pH. In addition, the pH level of a lake is directly related to the geography of its watershed area, which impacts the pH of inflowing runoff.

During the current assessment period, all monitored pH levels were within the state water quality standards of 6.5 to 9.0 standard units. Three of the pH measurements approached the upper standard of 9.0 units. Higher pH levels corresponded to periods of greater algae growth, and also increased following runoff events. The figure below shows a summary of the in-lake pH results during the sampling period.

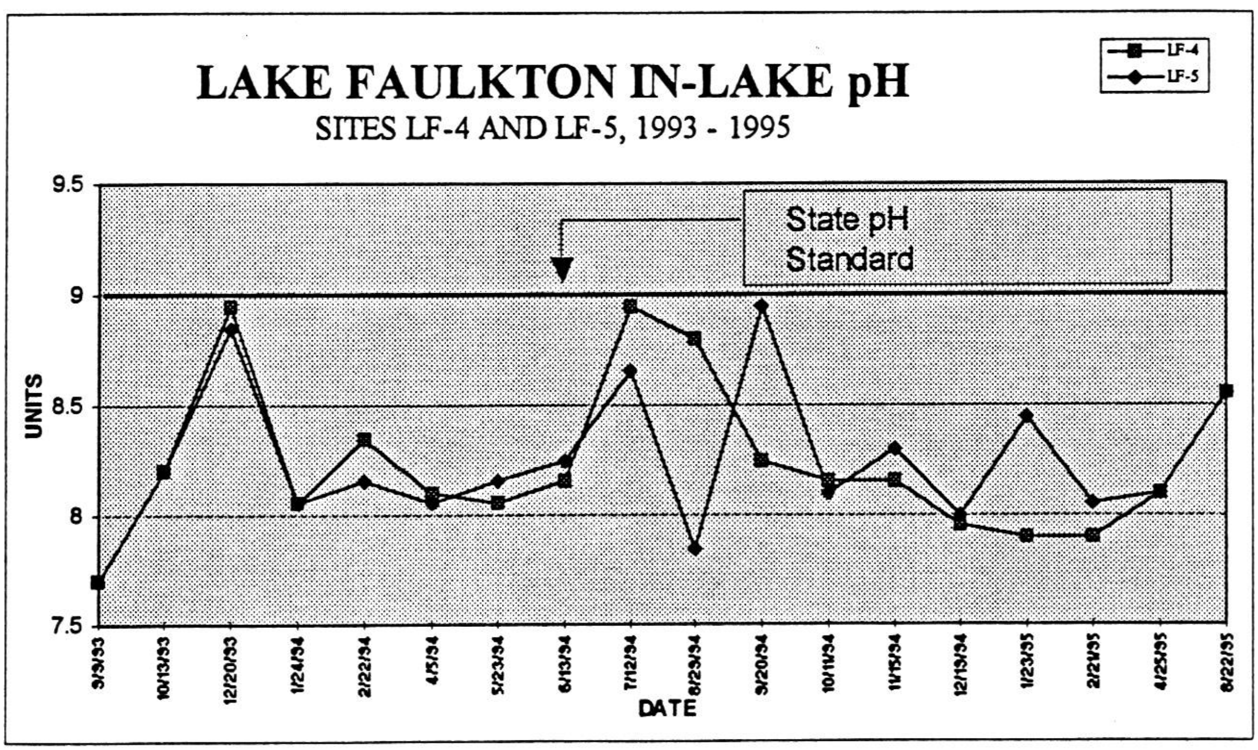


Figure 35. In-Lake pH Results

ALKALINITY

Alkalinity refers to the quantity of different compounds that shift the pH level of water to the alkaline side of neutrality. Alkalinity is generally the result of bicarbonates, but is expressed as a sum of hydroxide, carbonate, and bicarbonate. The contribution to alkalinity by hydroxides is rare in nature. Carbonate and bicarbonate, however, are common in water because carbonate minerals commonly occur in nature. Thus, the alkalinity of water is directly related to the geography of the area in which it occurs. The expected total alkalinities for water in nature generally range from 20 mg/L to 200 mg/L.

The alkalinity of Lake Faulkton during the current lake assessment showed seasonal trends, with short periods of low concentrations (Figure 36). The two periods of low concentrations occurred during early spring in both 1994 and 1995. The occurrences of low alkalinity may be attributed to inflows of ground water, or dilution from spring runoff.

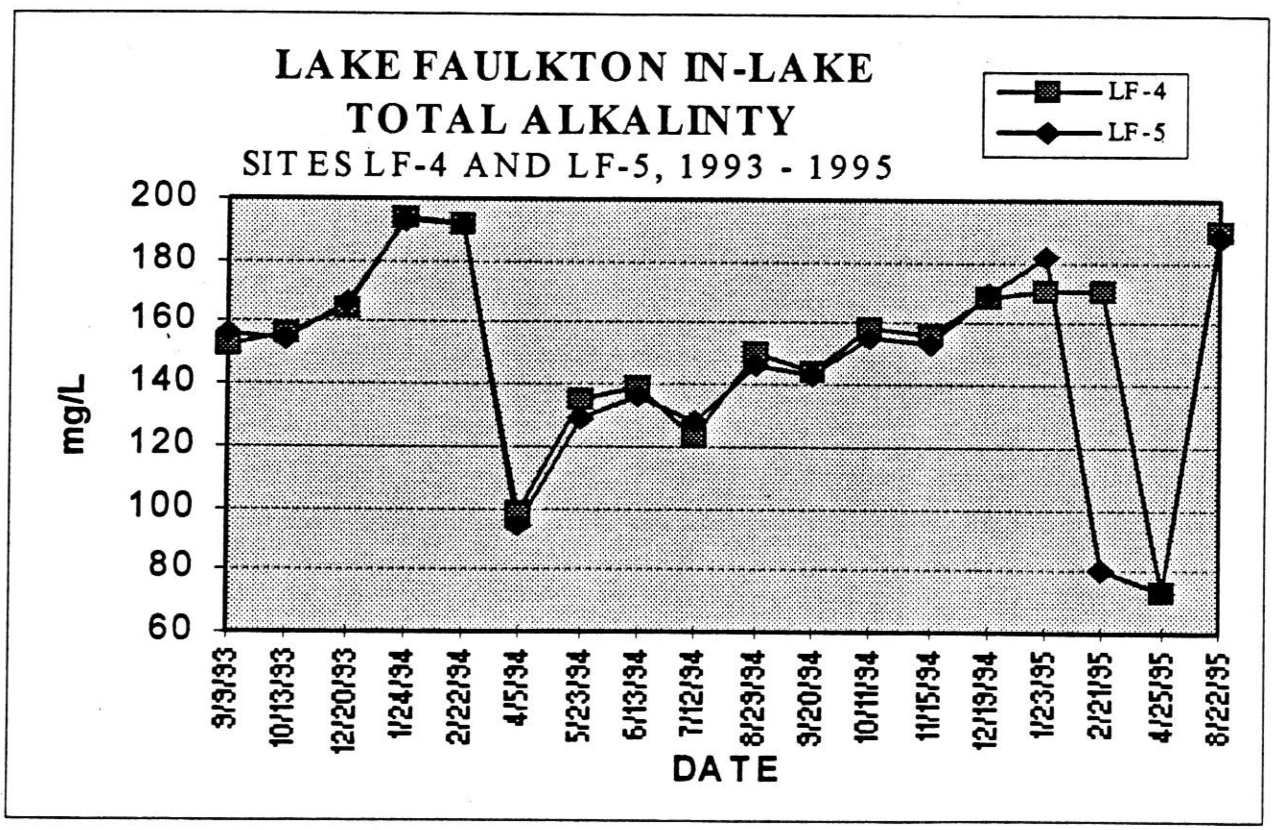


Figure 36. In-Lake Alkalinity

TOTAL DISSOLVED SOLIDS

Total dissolved solids include salts and organic residue which pass through a filtered water sample. Total dissolved solids can be estimated by subtracting the amount of total suspended solids from the amount of total solids.

The total dissolved solids concentrations were well within the state standard of <2500 mg/L during the current lake assessment sampling period (Figure 37). Greater concentrations of dissolved solids occurred during the winter months when ice cover prevented the wind from suspending bottom sediments. Periods of low dissolved solids concentrations occurred immediately following snowmelt runoff during the spring of both 1994 and 1995. This coincided with increases of total suspended solids at the in-lake monitoring sites. The increase in total dissolved solids for the August 22, 1995, samples corresponded to a decrease in total suspended solids for that same date.

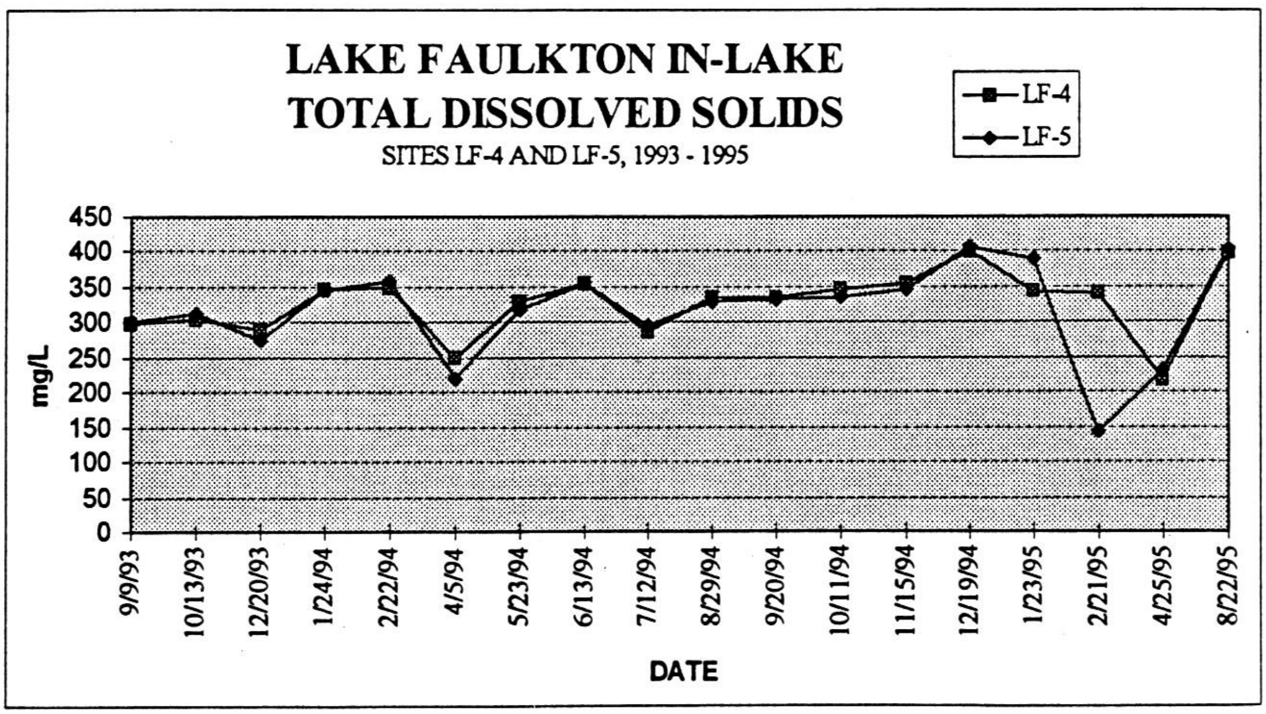


Figure 37. In-Lake Total Dissolved Solids

TOTAL SUSPENDED SOLIDS

Total suspended solids include organic and inorganic materials that are not dissolved in the water. This parameter can indicate the amount of sediment loading into a body of water and possible problems for the biological community. The suspended solids test does not include a measurement of larger particles which are moved along stream beds during high flow periods (bed load). All measurements of total suspended solids during the assessment were well below the water quality standard of 90 mg/L (Figure 38).

The total suspended solids parameter was used to measure the amount of sedimentation of Lake Faulkton during the study period. Total suspended solids concentrations can be attributed to many different factors. These factors include, but are not limited to: wind action, water depth, tributary loadings, shoreline erosion, boat motors, bottom feeding fish, and biological activity such as algae blooms.

The fluctuations in total suspended solids concentrations indicate that suspension and settling of solids and bound nutrients is a common occurrence in Lake Faulkton. The peak in total suspended solids on August 29, 1994, occurred at the same time as an extensive algae bloom in the lake. The peak on April 25, 1995, followed a major spring runoff event. Seasonally, the lowest values for total suspended solids were over the winter months, when the ice cover on the lake prevented suspension of solids by the wind.

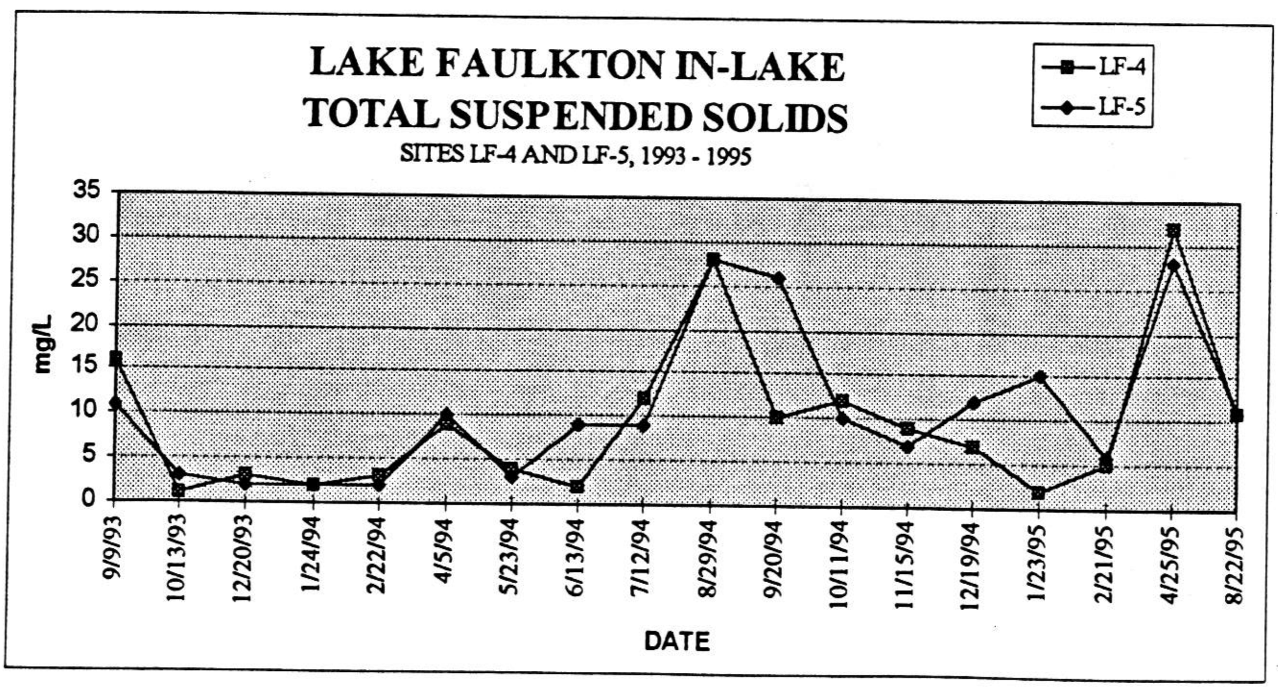


Figure 38. In-Lake Total Suspended Solids

SECCHI DISK

Total suspended solids concentrations have a direct influence on water clarity in Lake Faulkton. Water clarity was monitored during the study period by taking measurements of Secchi disk readings (Figure 39).

The depth at which a Secchi disk can be seen is a function of the reflection of light from the water's surface. The reflection of light is in turn influenced by the absorption characteristics of the water, and the amount of dissolved and particulate matter in the water. The deepest Secchi disk readings were observed during periods of low total suspended solids concentrations. These periods occurred during both cold and warm water months. The best readings were during the winter months of 1993 and 1994. However, good readings were also observed during the warmer water months of May, 1994, and October, 1994. Some of the worst readings occurred in April, 1994, and April, 1995, immediately following spring runoff. Other shallow Secchi disk readings were noted in August and September, 1994, which coincided with extensive algae blooms in the lake.

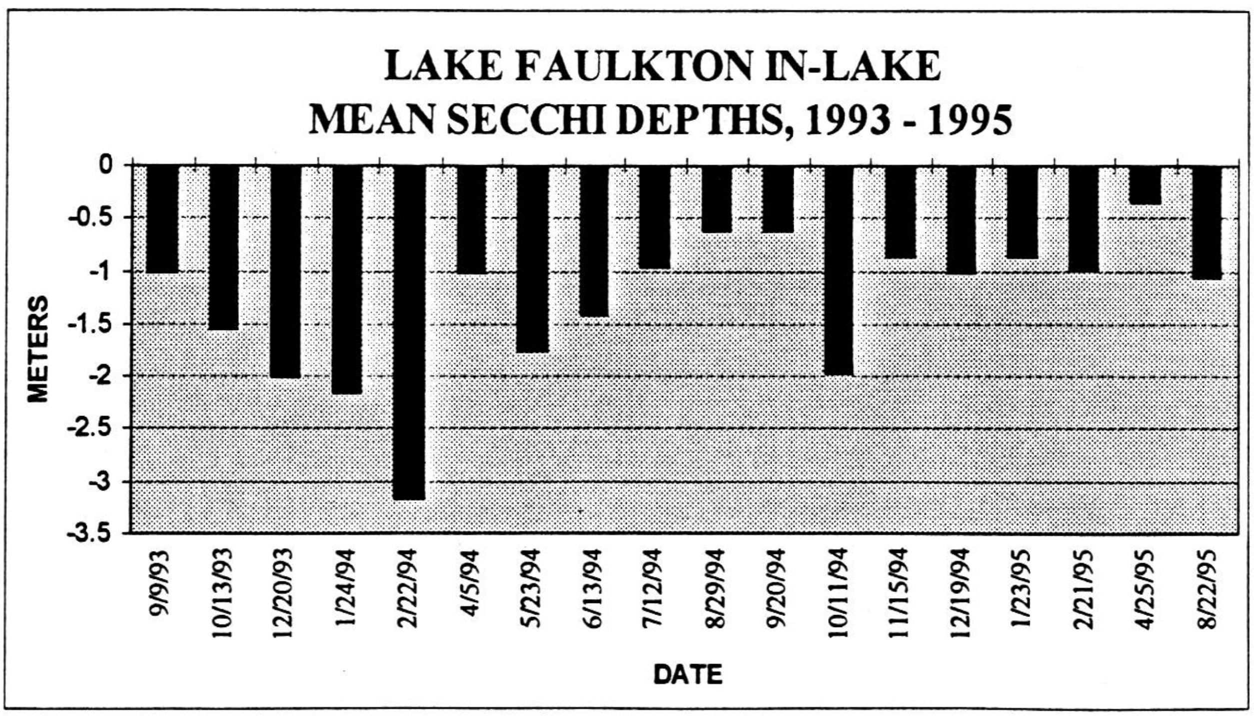


Figure 39. In-Lake Secchi Disk Depths

AMMONIA

Ammonia is generated by bacteria as a primary end product of the decomposition of organic matter. Ammonia is a form of nitrogen which is directly available to plants as a nutrient for growth. High ammonia concentrations demonstrate organic pollution, and can result in toxicity to fish and other aquatic organisms.

The ammonia levels in Lake Faulkton fluctuated greatly during the assessment (Figure 40). The highest concentrations occurred during winter months. The growth of algae and other aquatic plants was diminished during these months, so the ammonia that was produced by bacterial breakdown of nitrogen molecules was not readily assimilated into the lake's ecosystem. In addition, the ice cover on the lake during these periods minimized the escape of ammonia to the atmosphere. Once ice-out occurred in the spring, and plant growth resumed, ammonia levels dropped significantly. High ammonia levels during winter months, coupled with low dissolved oxygen levels, can lead to winter fish kills.

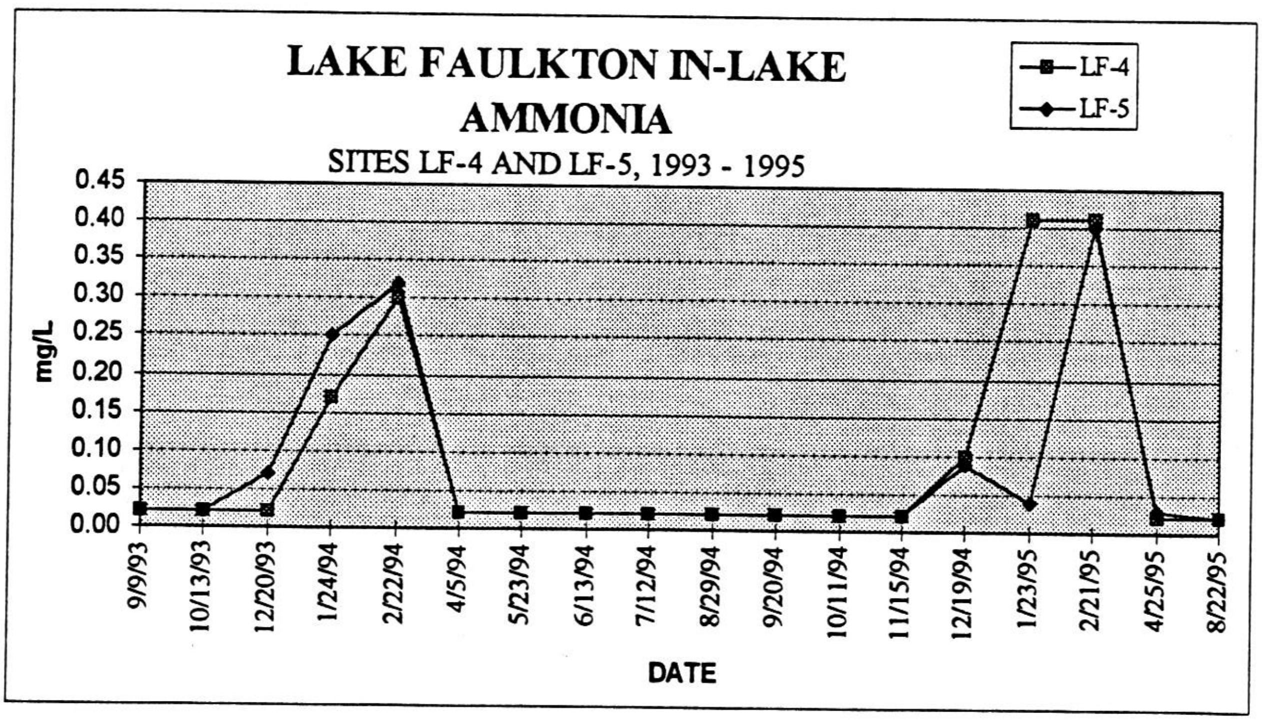


Figure 40. In-Lake Ammonia

TOTAL KJELDAHL NITROGEN

Kjeldahl nitrogen is the sum of organic nitrogen and ammonia nitrogen. Organic nitrogen includes such natural materials as proteins, peptides, nucleic acids, and urea. Organic nitrogen can be released from living plants, and large quantities can also be released from decaying plants.

The in-lake total Kjeldahl nitrogen (TKN) values fluctuated significantly during the assessment period (Figure 41). The amount of TKN increased during the winter months, when emergent, submergent, and floating vegetation died and decomposed by bacteriological activity. A decrease in TKN concentrations following snowmelt runoff indicated the incorporation of TKN into both the biota and sediment of Lake Faulkton. The relatively high levels of TKN during the summer months represents TKN being released from both living and decaying aquatic plants.

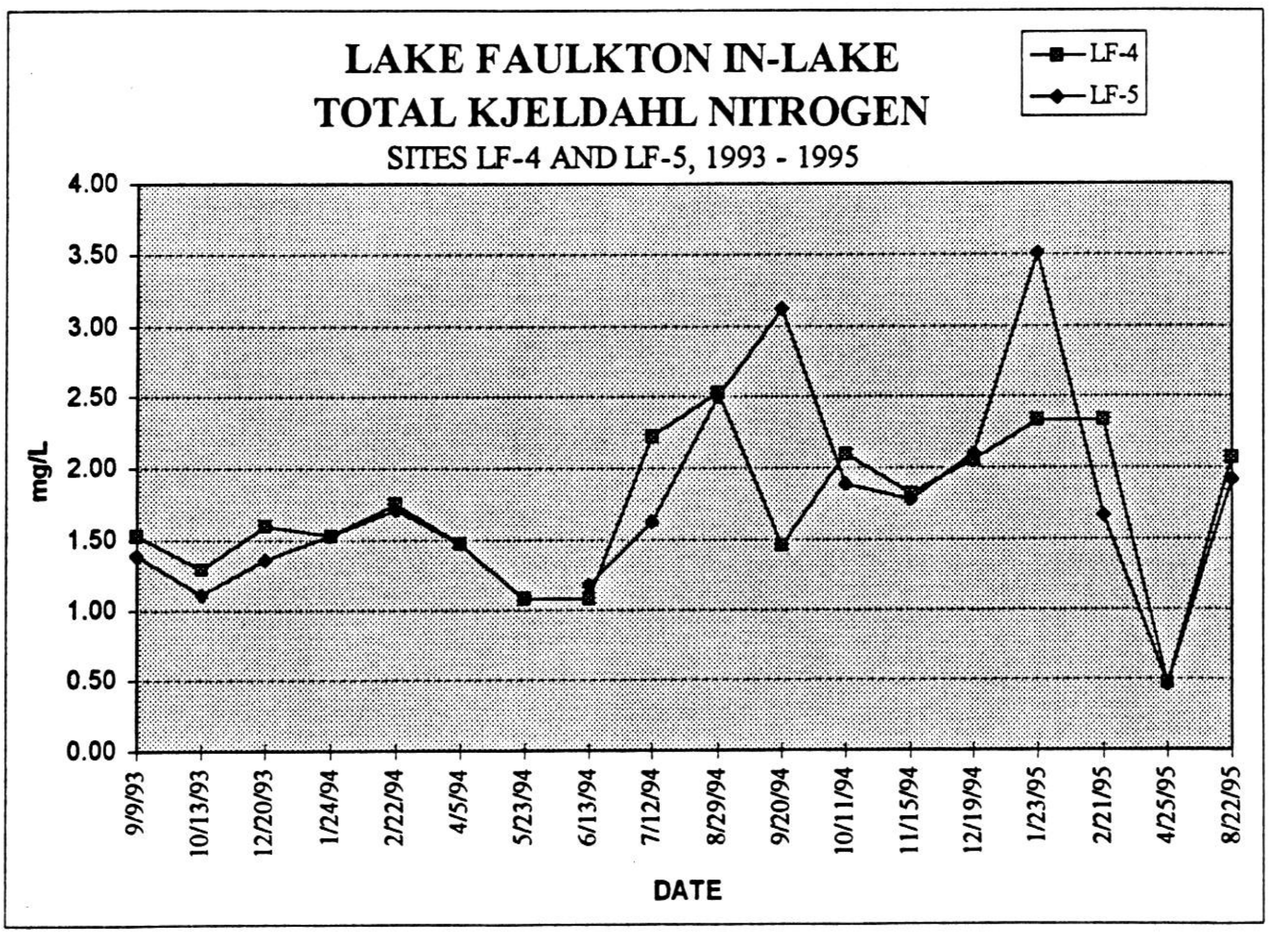


Figure 41. In-Lake Total Kjeldahl Nitrogen

NITRATE + NITRITE

Nitrate (NO_3^-) is the common form of inorganic nitrogen entering fresh waters from the drainage basin in surface waters, ground water, and precipitation (Wetzel, 1983). The high levels of nitrate (NO_3^-) and nitrite (NO_2^-) measured in April, 1994, and April, 1995, (Figure 42), reflect high levels of these nutrients, primarily NO_3^-, which flowed into the lake in spring runoff.

The high levels observed in October, 1993, and February, 1995, more likely represent bacterial nitrification, in which ammonia nitrogen (NH_4^+) is oxidized through several intermediate compounds to NO_2^- and NO_3^-. Through the nitrification process, ammonia, which is the primary end product of the decomposition of organic matter, is converted to nitrite and nitrate. The high levels of NO_2^- and NO_3^- during these periods represent the active decomposition of organic matter in the lake.

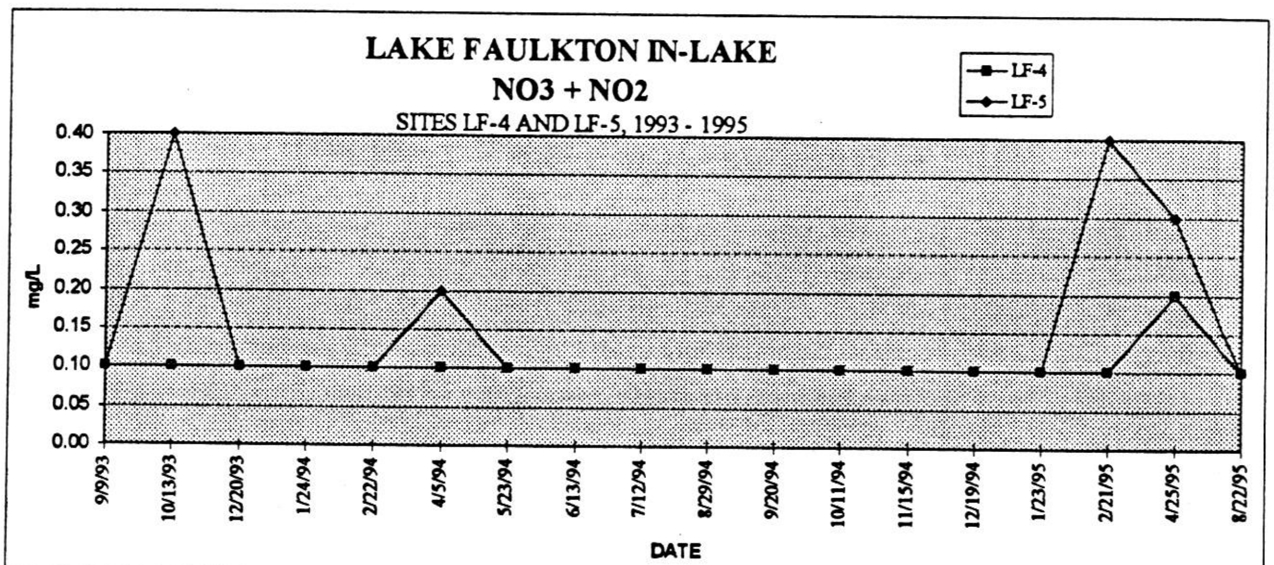


Figure 42. In-Lake Nitrate + Nitrite Nitrogen

TOTAL PHOSPHORUS

The analysis of total phosphorus measures all of the phosphorus present in water samples. Phosphorus is an element which is essential for all living things. In comparison to other nutrients required by algae and higher aquatic plants, phosphorus is least abundant and commonly is the first element to limit biological productivity. It enters fresh waters from atmospheric precipitation and from ground water and surface runoff. The loading rates of phosphorus vary greatly with patterns of land use, geology and morphology of the drainage basin, soil productivity, human activities, pollution, and other factors (Wetzel, 1983). Not all forms of phosphorus are immediately available to algae and other aquatic plants. Phosphorus readily adheres to soil particles and sediment, causing it to be released only when oxygen levels are depleted. When phosphorus concentrations are high, nuisance growths of algae and aquatic plants may result. Sources of phosphorus include agricultural activities, wastewater, and the decomposition of organic matter.

During the current assessment, total phosphorus concentrations in Lake Faulkton showed no strong seasonal trends, although phosphorus concentrations were elevated during both the cold water months in the winter, and also during the warm water months in the summer (Figure 43). All sample results were considerably higher than the hypereutrophic level of 0.02 mg/L (Wetzel, 1983).

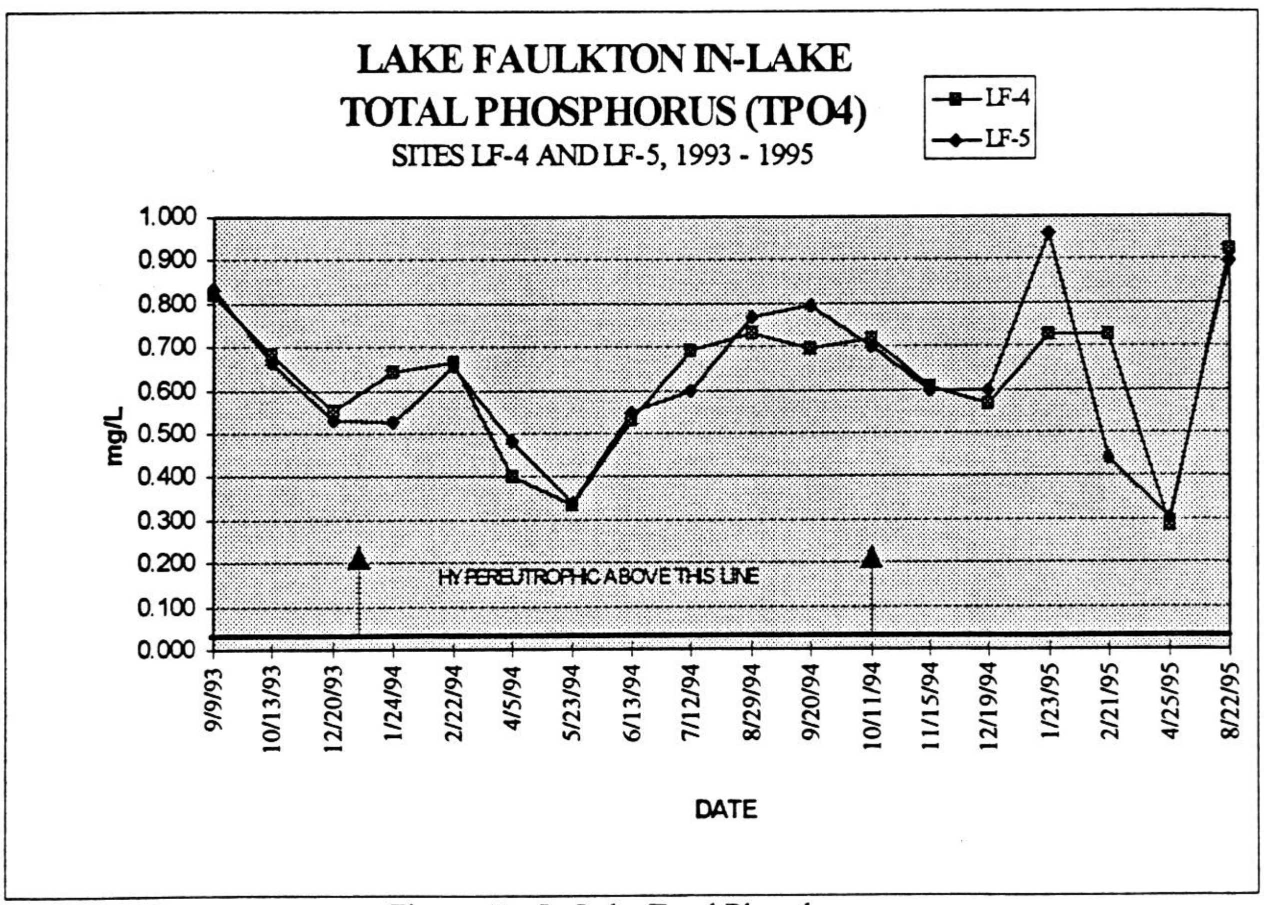


Figure 43. In-Lake Total Phosphorus

There was an increase in total phosphorus following the spring runoff events in both 1994 and 1995. However, there also appears to be a strong inverse correlation between lake bottom oxygen levels and total phosphorus concentrations. When oxygen levels at the bottom of the lake were at low points, the total phosphorus levels in the lake were at high points. For example, the lowest bottom oxygen measurements were recorded on February 22, 1994; September 20, 1994; January 23, 1995; and August 22, 1995. These same dates correspond to the highest total phosphorus results observed in the lake (Figure 43). This correlation suggests that when the hypolimnion, or lower layer of more dense, cooler, and relatively quiescent water begins to lose oxygen, the release of phosphorus from the bottom sediment is accelerated.

According to Wetzel (1983), if water above the sediments is oxygenated (approximately greater than 1 mg O_2 per liter), an oxidized microzone is formed below the sediment-water interface (0 to -5 mm), below which the sediments usually become extremely reducing. The oxidized microzone effectively prevents phosphorus (which goes into solution under reducing conditions in the sediments) from migrating by diffusion upward into the water column. As the hypolimnion becomes anoxic (oxygen deficient) in productive (hypereutrophic) lakes, the oxidized microzone is lost. The release of phosphate from the sediments into the water column occurs readily under these conditions.

Wetzel (1983) further explains that bacterial metabolism of organic matter is the primary mechanism by which organic phosphorus is converted to phosphate in the sediments. Bacterial metabolism also creates the reducing conditions required for release of phosphate to the water. The movement of phosphorus from the sediment-water interface can be accelerated by physical turbulence and by biota. For example, rooted aquatic macrophytes often obtain phosphorus from the sediments and can release large amounts into the water both during active growth and upon senescence and death. As discussed previously in the "Aquatic Plant Survey" section of this report, Lake Faulkton has very extensive areas of rooted aquatic vegetation which consist primarily of hybrid cattail, flowering rush, sago pondweed, and coontail.

Based upon Wetzel's explanations, and interpretation of the data for Lake Faulkton, it appears that primary sources of total phosphorus in the water column are sediments under anoxic conditions, and both growing and dying rooted aquatic vegetation. These sources are in addition to loadings of total phosphorus from the watershed.

TOTAL DISSOLVED PHOSPHORUS

As was the case with total phosphorus, total dissolved phosphorus also showed some increase following spring runoff in both 1994 and 1995 (Figure 44). Likewise, as with total phosphorus, the dissolved phosphorus levels seemed to reflect an inverse relationship with bottom oxygen levels. When bottom oxygen levels were at low points, the total dissolved phosphorus levels were generally at high points. This relationship again appears to confirm that anoxic conditions in the hypolimnion readily release phosphorus to the water column. Another primary source of this nutrient is the release of total dissolved phosphorus from both growing and dying rooted aquatic vegetation. As noted previously, there is abundant aquatic vegetation in Lake Faulkton, so this, in addition to nutrient loadings from the watershed, is another likely source of total dissolved phosphorus.

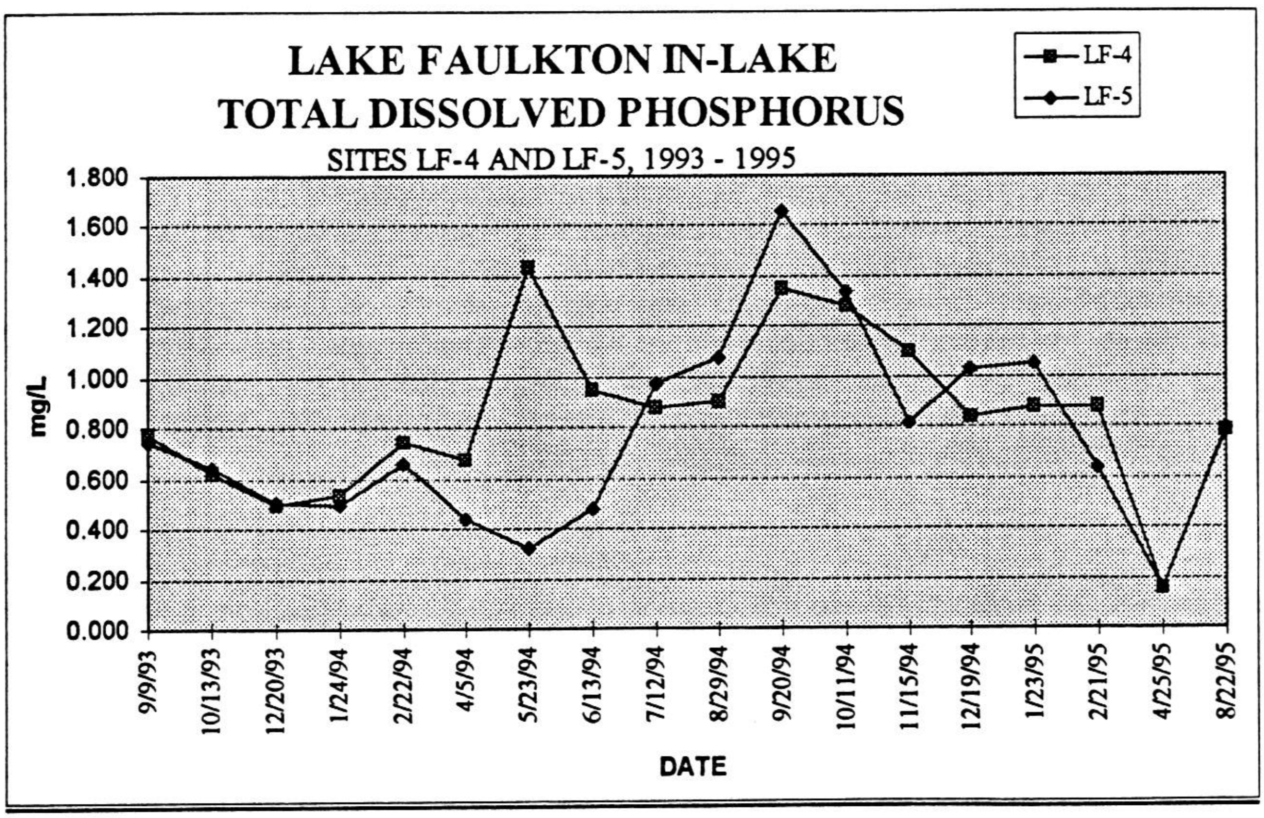


Figure 44. In-Lake Total Dissolved Phosphorus

NITROGEN / PHOSPHORUS RATIO

Enrichment of fresh waters with nutrients needed for plant growth occurs commonly as a result of losses from agricultural fertilization, animal feeding areas, loading from wastewater, and enrichment via atmospheric pollutants (especially nitrate). As phosphorus loading to fresh waters increases and lakes become more productive, nitrogen may become the nutrient limiting to plant growth. Excessive loading of nitrogen and phosphorus permits increased plant growth until other nutrients or light availability become limiting (Wetzel, 1983).

Total nitrogen to total phosphorus ratios of less than 10 generally indicate that a lake is nitrogen limited. An evaluation of the water quality results from the current lake assessment project indicates that the ratio of total nitrogen to total phosphorus was less than 5 during the study period (Figure 45). Based on these results, it would appear that nitrogen would be the nutrient that should be controlled to decrease aquatic plant growth. However, because nitrogen is available from the atmosphere, and can be generated by certain species of blue-green algae, it generally is not practical to control most major sources of nitrogen. Therefore, initial efforts should be targeted to reducing potential sources of phosphorus such as cropland runoff, livestock waste, wastewater, and sediments in the lake.

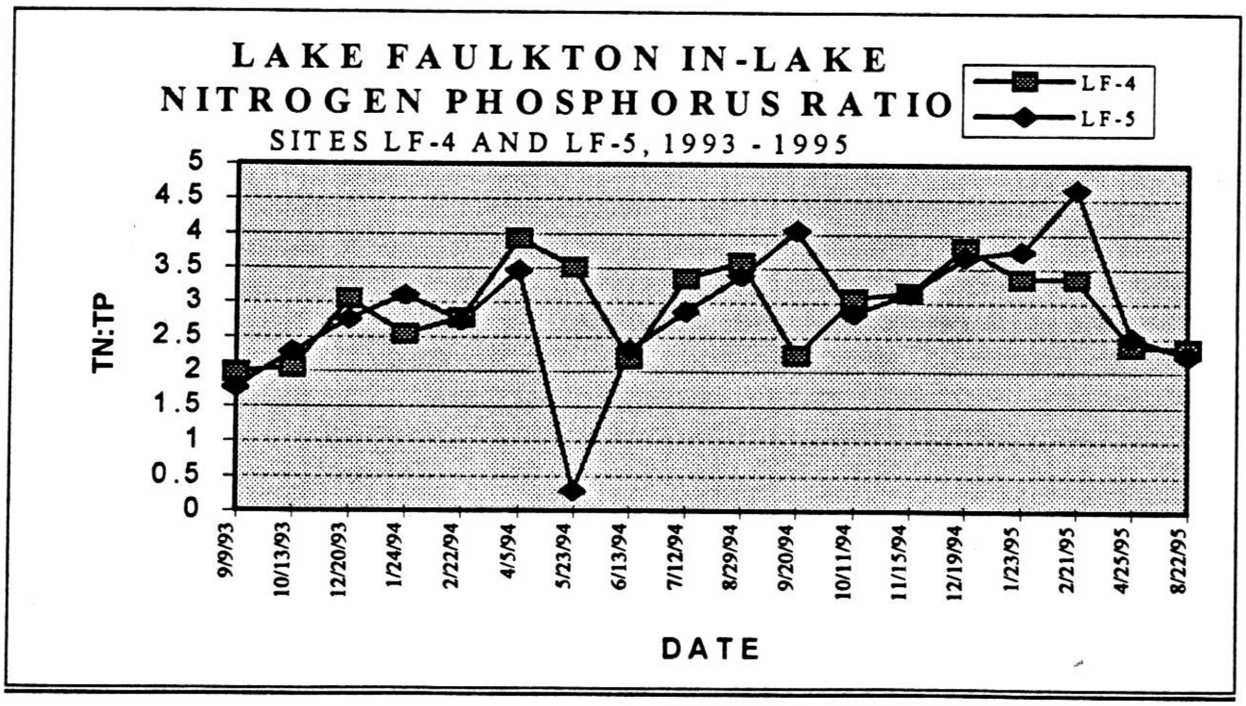


Figure 45. In-Lake Nitrogen/Phosphorus Ratio

TROPHIC STATE INDEX

The Carlson Trophic State Index (TSI) is an indicator which can be used to measure relative trophic states for bodies of water. A trophic state index is calculated from several equations using total phosphorus, Secchi disk, and chlorophyll *a* measurements. The resulting values are combined and a mean value is calculated for total phosphorus, Secchi depth, and chlorophyll *a*. The Carlson Index results used to determine Lake Faulkton's trophic state are shown below.

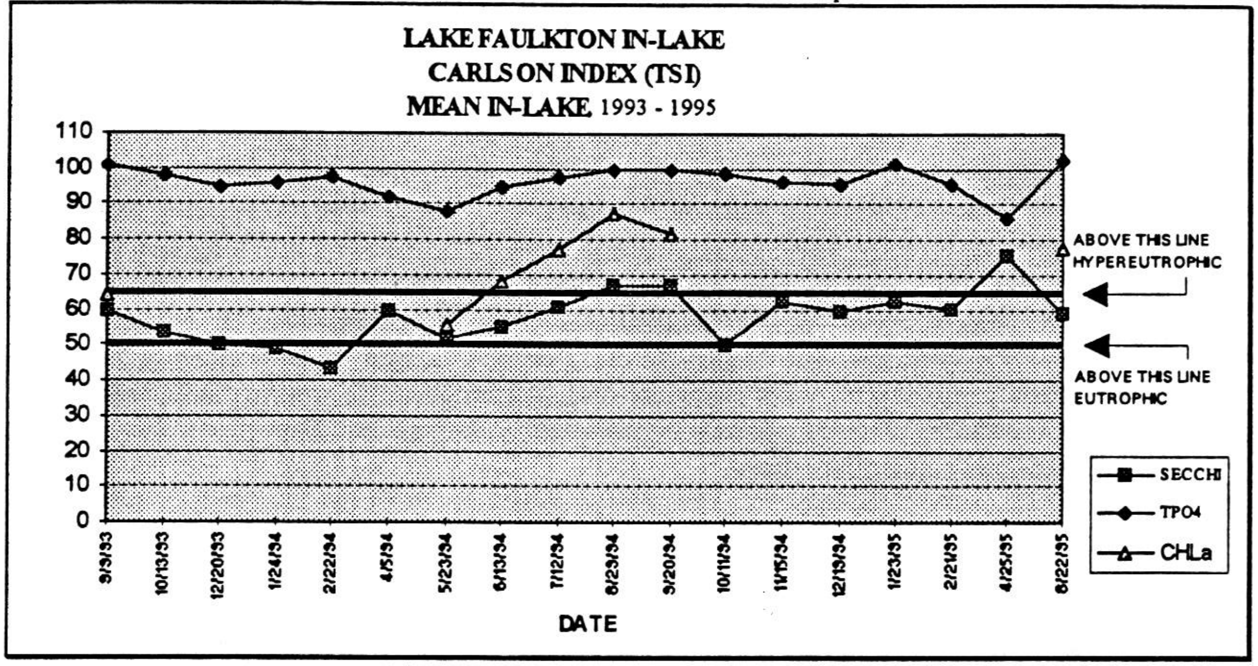


Figure 46. In-Lake Carlson Index

Chlorophyll *a* analyses were conducted as a part of the Lake Faulkton assessment project because of their primary importance in plant production. Measurements of photosynthetic pigments have been widely used to quantify phytoplankton standing crops, and to measure in-lake water quality. Chlorophyll *a* is the preferred pigment since it is normally the most important pigment in living material and because it has been studied extensively. It is a trophic state variable that characterizes the response of the lake system (level of productivity) to other variables such as phosphorus loadings, which are subject to watershed management. This response to external forces allows a linkage between activities in the watershed and in-lake quality.

The mean TSI values for Lake Faulkton during the study period were 96.5 for phosphorus, 58.3 for Secchi disk measurements, and 73.2 for chlorophyll *a*. These values resulted in an overall mean TSI of 76.0 for the study period. This compares to a mean of 76.32 for the assessment period from 1989 to 1993 (South Dakota Lakes Assessment Final Report, SD DENR, 1993).

The Carlson Index uses TSI levels of 65 and greater to classify hypereutrophic bodies of water, while values of 50 to 64 indicate eutrophic bodies of water. An overall TSI value of 76 places Lake Faulkton in the hypereutrophic classification.

CHLOROPHYLL *a* / TOTAL PHOSPHORUS RELATIONSHIP

Chlorophyll *a* is a common indicator of algal biomass. The productivity of blue-green algae (chlorophyll *a*) is typically dependent upon the concentration of total phosphorus. Generally, as total phosphorus increases, so does the concentration of chlorophyll *a*. However, as stated previously, Lake Faulkton is nitrogen limited. Therefore, this common relationship between phosphorus and chlorophyll was not exhibited. A regression analysis was completed between chorophyll *a* and total phosphorus indicating that the relationship between these two variables was not significant (r^2=0.44). The lack of a significant relationship between summer chlorophyll *a* (mg/m^3) values and in-lake total phosphorus concentrations can be explained by the super-abundance of in-lake phosphorus (average in-lake total phosphorus = 0.612 mg/L). Phosphorus levels are so high that nitrogen has become the limiting nutrient for the algal population. However, reducing nitrogen to a beneficial level is generally not practical, therefore reducing phosphorus must be the primary area of concern.

Another factor affecting the relationship between chlorophyll *a* and phosphorus is the abundance of aquatic macrophytes in the lake. Macrophytes such as coontail absorb most of their phosphorus from the water column, and may out-compete the algal species for bioavailable phosphorus. Excessive amounts of humus (tannins), byproducts of biodegradation, are also present in the water because of the large amount of native grasses in the watershed, and the release of tannins from macrophytes in the lake. The resultant staining of the water may also inhibit the growth potential of algae by reducing the sunlight penetration through the water column. All these factors working together may contribute to the overall lack of growth of algal populations even though excessive amounts of total phosphorus were exhibited.

PHOSPHORUS REDUCTION RESPONSE MODEL

Even though Lake Faulkton is nitrogen limited, a management plan addressing a reduction of in-lake total phosphorus concentrations will result in the greatest water quality benefit to the lake. A reduction in phosphorus may reduce the aquatic macrophyte problem, and result in less frequent algal blooms.

In-lake total phosphorus concentrations are a function of the total phosphorus load delivered to the lake by the watershed by means of surface water, ground water, 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 direction). The variables used in this relationship are:

1) the average in-lake total phosphorus concentrations;
2) the average inflow concentrations of total phosphorus;
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, affect the quantity of blue-green algae present in the lake at any specific time. The symbols used to represent these variables are shown below:

$\overline{[P]}_{\lambda}$ = average in-lake total phosphorus 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 Lake Assessment Project on Lake Faulkton 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 1 below and solve for $\overline{T}_{p}$ resulting in Equation 2:

$$\overline{[P]}_{\lambda} = \left[\frac{(\overline{T}_{p})}{(\overline{T}_{w})}\right]\overline{[P]}_{i} \qquad \text{\{Equation 1\}}$$

$$\left(\overline{T}_{p}\right) = \frac{\overline{[P]}_{\lambda}}{\overline{[P]}_{i}}\left(\overline{T}_{w}\right) \qquad \text{\{Equation 2\}}$$

The values for $\overline{[P]}_{\lambda}$, $\overline{[P]}_{i}$, and $\overline{T}_{w}$, were derived as follows. The total phosphorus results for water samples collected at the lake inlet, Site LF-3, were averaged for the study period (1994-1995) to arrive at an average total phosphorus inflow concentration ($\overline{[P]}_{i}$) of 0.444 mg/L. The total phosphorus results of all the in-lake samples were averaged to arrive at an average in-lake total phosphorus concentration ($\overline{[P]}_{\lambda}$) of 0.612 mg/L. The hydraulic residence time ($\overline{T}_{w}$) was calculated by dividing the total volume of Lake Faulkton (531.9 acre-feet) by the total volume discharged in a 12-month period (3,547.6 acre-feet). This calculation is shown below:

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

$$\overline{Tw} = 531.9 / 3{,}547.6 = 0.150 \text{ year}$$

By putting the numbers derived above into Equation 2, the total phosphorus residence time ($\overline{Tp}$) is calculated as follows: $\overline{Tp} = [0.612 / 0.444] \times [0.150] = 0.210$ year

The final values for all of the variables are then:

$$\overline{[P]}\lambda = 0.612 \text{ mg/L}$$

$$\overline{[P]}i = 0.444 \text{ mg/L}$$

$$\overline{Tp} = 0.210 \text{ year}$$

$$\overline{Tw} = 0.150 \text{ year}$$

To estimate the effect that a reduction of the total phosphorus inflow concentration ($\overline{[P]}i$) would have on the in-lake total phosphorus concentration, equation 1 can now be used. The results of 10%, 20%, 30%, 40%, or 50% reductions of the total phosphorus inflow concentration ($\overline{[P]}i$) value of 0.444 mg/L are shown in the table below. The results in the table are based on the Vollenweider and Kerekes Reduction Response Model (1980).

Table 11. Estimated effects of total phosphorus inflow reductions on in-lake total phosphorus concentrations and algal biomass.

TPO_4P INFLOW REDUCTION %	TPO_4P INFLOW mg/L	TPO_4P IN-LAKE mg/L	TPO_4P IN-LAKE mg/m^3	LOG OF TPO_4P mg/m^3	PREDICTED CHL *a*[1] mg/m^3
0% (current)	0.444	0.612	612.0	2.787	16,277.961
10%	0.400	0.551	551.0	2.741	11,708.466
20%	0.355	0.490	490.0	2.690	8,126.434
30%	0.311	0.428	428.0	2.631	5,325.986
40%	0.266	0.367	367.0	2.565	3,320.473
50%	0.222	0.306	306.0	2.486	1,885.819

1=Predicted CHL *a* was determined using equation 1 and Log of TPO_4 (in-lake). (1,000 L=1 m^3)

A 75% reduction of in-lake total phosphorus at current steady state nitrogen levels will result in the lake becoming phosphorus limited. However, a significant impact on the aquatic macrophytes and the intensity of algal blooms may occur at a phosphorus reduction level less than 75%. These in-lake problems should be monitored, as an implementation project proceeds, to evaluate the impact of in-lake phosphorus reductions.

The results of the current Lake Assessment Project, as well as the results from previous assessments (South Dakota Lakes Assessment Final Report, DENR, 1993), place Lake Faulkton in a hypereutrophic classification. Even with a major reduction in total phosphorus inflow, it would be impossible to completely eliminate blue-green algae blooms or the lush growth of other aquatic plants in the lake. However, with a major reduction of total phosphorus inflow, the duration and intensity of algal blooms could be reduced. Reducing total phosphorus inflow, together with the implementation of other restoration measures, could also limit the growth of aquatic plants in the lake. These measures would allow the full beneficial uses of Lake Faulkton to be improved and maintained.

QUALITY ASSURANCE / QUALITY CONTROL

Quality assurance / quality control (QA/QC) monitoring was conducted in accordance with methods set forth in "Standard Operating Procedures For Field Samplers" (SD DENR, Clean Lakes Program, 1992). Two types of samples were collected for QA/QC purposes:

1) Field Duplicates (Replicates)
2) Blanks (Distilled Water)

These samples were submitted along with routine samples to the South Dakota Department of Health Laboratory for analysis.

Water for the blank samples was obtained from commercial distilled sources. The results for the blank samples basically represent the detection limits of the laboratory equipment. Smaller detection limits could be obtained for some parameters such as nitrate-nitrogen, but this would result in an increase of analysis time and costs for the tests. A slightly elevated result for total phosphate in one blank sample, and a slightly elevated result for total dissolved phosphate in another blank sample, might indicate slight contamination of the blank sample source.

A comparison of the duplicate sample results indicates good agreement between the duplicates except for total dissolved phosphorus. Because there is very good agreement for the total phosphorus results, it appears that there may have been a minor problem with either the sampling technique or analysis of total dissolved phosphorus. Paper filters were used to filter samples for dissolved phosphorus analyses. The source and quality of such filters should be checked on future projects.

During the sampling period, no QA/QC samples exceeded recommended holding times for any parameters. These results, as well, do not indicate any need for changes in either sample shipping or laboratory procedures.

Table 12. QA/QC Results (Blanks and Duplicates)

DATE	SITE	FIELD pH	FECAL COLIFORM per/100 mL	TALKAL mg/L	TSOL mg/L	TSSOL mg/L	AMMON mg/L	NO_3/NO_2 mg/L	TKN-N mg/L	TPO_4 mg/L	$TDPO_4$ mg/L
4/19/94	LF-3B	8.35	<10	3.1	7.00	1	<0.02	<0.1	<0.10	0.010	<0.005
8/29/94	LF-5B	N/A	<10	3.0	7.00	<1	<0.02	0.1	<0.10	<0.005	0.010
4/3/95	LF-1B	8.15	<10	3.0	<22.34	5	0.25	<0.1	0.44	<0.008	<0.008
4/19/94	LF-3	8.00	610	173.0	477.00	19	<0.02	<0.1	1.27	0.300	0.593
4/19/94	LF-3R	8.00	430	172.0	478.00	22	<0.02	<0.1	1.63	0.300	0.210
8/29/94	LF-4	8.80	<10	150.0	362.00	28	<0.02	<0.1	2.53	0.733	0.902
8/29/94	LF-4R	8.80	<10	148.0	357.00	30	<0.02	0.1	2.82	0.709	0.539
2/27/95	LF-2	7.25	60	45.7	168.00	13	0.26	0.7	2.52	0.533	0.640
2/27/95	LF-2R	7.25	30	47.1	183.00	10	0.25	0.7	2.54	0.525	1.263
4/3/95	LF-1	8.15	<10	103.4	353.00	2	<0.02	<0.1	0.95	0.279	0.254
4/3/95	LF-1R	8.15	<10	102.8	346.00	12	<0.02	<0.1	1.12	0.271	0.230

BLANKS

REP

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REP

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CONCLUSIONS

The Lake Faulkton Lake Assessment Project was initiated in 1993 at the request of local citizens concerned about deteriorating conditions at the lake. Some of the main concerns included the extensive growth of cattails and other aquatic plants, periodic fish kills because of low oxygen levels, and overall reduced recreational opportunities at the lake because of poor water quality.

The Lake Assessment Project was designed to assess the lake's general status, to determine factors which were inhibiting the lake's uses, and to develop alternatives for restoration of the lake. Specific areas of study included tributary water quality sampling, in-lake water quality sampling, a survey to determine sediment depths, an aquatic plant survey, an evaluation of the lakeshore, and a land use/feedlot survey of the watershed. Conclusions derived from each of these study areas are summarized below:

- Tributary Water Quality Sampling

  The South Fork of Snake Creek is the major tributary that flows into Lake Faulkton. Tributary monitoring sites were established on the creek (Sites LF-1 and LF-3), as well as tributaries that flow to the creek (Sites LF-2, LF-7, and LF-8). A monitoring site was also established at the outlet of Lake Faulkton (Site LF-6, dam spillway).

  A comparison of the water quality monitoring results for the lake inlet (Site LF-3) and the lake outlet (Site LF-6) indicated that significant loadings of sediment and nutrients were retained in Lake Faulkton. A comparison of the watershed monitoring sites showed that the majority of the sediment and nutrient loadings were derived from the subwatershed areas which drained to the monitoring sites at LF-1 and LF-8. Much smaller quantities of sediment and nutrients were monitored from the subwatershed area which drained to Site LF-2. Because of extremely intermittent flows at Site LF-7, it was not possible to calculate loadings from the subwatershed area that drained to that site. Water does not flow out of the LF-7 subwatershed except under conditions of excessive snowmelt or precipitation. Based on the results of the tributary monitoring, the highest priority areas in the watershed for the implementation of best management conservation practices include the subwatershed areas that drain to Sites LF-1 and LF-8. The immediate Lake Faulkton subwatershed, including the area that was monitored at Site LF-3, should also be a high priority for best management practices because of its close proximity to the lake.

  High levels of fecal coliform bacteria were monitored at all of the tributary sites. High fecal coliform bacteria levels are indicative of contamination from human or animal waste. It is likely that the main source of fecal coliform bacteria was runoff from the large number of livestock feeding areas throughout the Lake Faulkton watershed. Other possible sources in the watershed might include individual wastewater (septic) systems that drain to ditches or waterways.

  Site-specific samples were taken up-stream and down-stream of four livestock feeding areas. A comparison of the results for the upstream and downstream samples showed downstream increases for suspended solids (sediment), nutrients (nitrogen and phosphorus), and fecal coliform bacteria. These results confirm the need to control runoff from the numerous livestock feeding areas in the Lake Faulkton watershed.

- In-Lake Water Quality Sampling

Previous assessment sampling of Lake Faulkton by the DENR (1989-1993) resulted in a mean trophic state index (TSI) of 76.32. Mean TSI values above 65 indicate that a lake is in a hypereutrophic (very nutrient enriched) condition. The in-lake monitoring conducted as part of the Lake Assessment Project (1993-1995) resulted in a mean TSI of 76.0, thus confirming that Lake Faulkton is properly classified as a hypereutrophic lake.

Nitrogen and phosphorus are the two primary nutrients that cause lake enrichment, and contribute to the abundant growth of algae and other aquatic plants. In most hypereutrophic lakes, phosphorus is less available than nitrogen and thus it becomes the nutrient that limits plant growth. However, in Lake Faulkton, phosphorus was found at a very high level (average 0.612 mg/L). Because phosphorus is so readily available, it is believed that under current conditions nitrogen is the nutrient that may somewhat limit plant growth in Lake Faulkton.

Controlling sources of nitrogen is generally not practical, and many species of blue-green algae are capable of generating nitrogen if it is not available at sufficient levels in the environment. It is easier to control sources of phosphorus, and algae are not capable of generating phosphorus if it is not readily available. Therefore, measures should be taken to reduce sources of phosphorus in the lake and its watershed to the greatest extent possible.

By use of a phosphorus reduction model, it was determined that a 75% reduction of the phosphorus level flowing into Lake Faulkton would result in the lake becoming phosphorus limited. Further reductions in phosphorus should result in limiting plant growth. However, a phosphorus reduction level less than 75% may result in a significant reduction in algae and other aquatic plants. These in-lake problems should be monitored, as a restoration project proceeds, to determine the impact of reducing phosphorus levels.

- Sediment Survey

An attempt was made to conduct a sediment survey using seismic (sonar) equipment. This proved unsuccessful, and consequently a probing survey was conducted by using one-half inch diameter steel rods. The steel rods were pushed into the soft sediment until a hard bottom was encountered. It was assumed that the hard bottom was original lake bottom. By subtracting the water depth from the total length of the rod under water, an estimate could be made of the sediment depth. The sediment was measured in this manner at approximately 100 locations throughout Lake Faulkton. Measurements of the sediment depth varied from one foot in near-shore areas, to nearly seven feet in deeper water areas.

The sediment depths were recorded using global positioning system (GPS) equipment. The results were entered into a computer for analysis and mapping. The total sediment volume for Lake Faulkton was calculated to be approximately 277,793 cubic yards. This volume may be somewhat under-estimated because deep water in some areas of the lake limited the ability to push the steel rods into the sediment.

- Aquatic Plant Survey

An aquatic plant survey was conducted at Lake Faulkton to document the diversity and extent of plant growth in and around the lake. Over twenty species of plants were identified. Emergent vegetation is extensive, covering nearly 100% of the shoreline. There have been complaints that the shoreline vegetation limits access to the lake by lakeshore property owners and the general public. Submergent and floating vegetation is also abundant in shallow areas of the lake. The extent of vegetation in the lake causes problems for boating and fishing.

One plant that is unique to Lake Faulkton is the flowering rush (Butomus umbellatus). It has not been documented at any other lake in South Dakota. The flowering rush is considered an exotic species because it is not native to North America. Stands of flowering rush can crowd out native species such as bulrush. Dense stands of flowering rush were observed along the shoreline throughout the lake.

High levels of nutrients (phosphorus and nitrogen) are contributing to the problem of extensive plant growth in and around the lake. Dead vegetation and other organic matter in the lake consumes oxygen in the process of decomposition. Low oxygen levels have caused periodic fish kills at Lake Faulkton. Nitrogen and phosphorus are released from decomposing organic materials, and add to the cycle of high nutrient levels and additional plant growth.

- Lakeshore Evaluation

An evaluation of the lakeshore was carried out to determine any factors that might be contributing to the deteriorating condition of Lake Faulkton. As of October, 1995, there were about 33 dwellings around the lake. The results of a survey sent to the lakeshore property owners indicated that the majority of the dwellings are seasonal cabins. There are very few permanent homes at the lake. The survey results further indicated that disposal facilities at some of the dwellings may be inadequate.

A golf course is located adjacent to Lake Faulkton. The results of runoff samples from the golf course showed high levels of ammonia, nitrate nitrogen, total Kjeldahl nitrogen, total phosphorus, and total dissolved phosphorus. The high levels of ammonia could present a toxicity problem for fish in the lake. The high concentrations of the nitrogen and phosphorus parameters may be contributing to the hypereutrophic condition of the lake, and the abundant growth of plants in and around the lake.

A survey of erosion around the lake shoreline confirmed a total of nearly 300 feet of erosion at five different locations The degree of erosion ranged from minor to severe. There was only one area of severe erosion, located between the west edge of the golf course and the upper end of the lake. The loss of soil at all of the erosion sites is contributing to the accumulation of sediment in Lake Faulkton.

- Land Use/Feedlot Survey

The Agricultural Non-Point Source (AGNPS) computer runoff model was used in a comprehensive analysis of the Lake Faulkton watershed. The first step in using the AGNPS model was to divide the entire watershed area (161,320 acres) into 40-acre cells. This resulted in over 4,000 cells, each with dimensions of 1,320 feet by 1,320 feet. Information on 22 different factors was collected for each of the 40-acre cells. Some of the 22 factors included land slope, soil erodibility, cropping history, and fertilization levels. In addition, a hydrological analysis was completed to determine flow patterns for water through the watershed. The hydrological analysis resulted in dividing the watershed into ten subwatersheds. In this manner, a comparison could be made to estimate which subwatersheds contribute the greatest loadings of sediment and nutrients to Lake Faulkton. Critical 40-acre cells were also identified within each subwatershed area.

The two parameters which are contributing most significantly to the hypereutrophic condition of Lake Faulkton are sediment and phosphorus. The AGNPS analysis indicated that two subwatersheds (#2004 and #2215) were contributing above normal sediment yields. Subwatershed #2004 is located immediately to the south and west of Lake Faulkton. Subwatershed #2215 is located at the western end of the watershed area, and contributes flow to the subwatershed that was monitored for water quality at Site LF-1. The water quality monitoring program also identified the LF-1 subwatershed as contributing major loadings of sediment (total suspended solids). The results of the water quality monitoring program likewise identified the subwatershed immediately surrounding the lake, including the area that was monitored at Site LF-3, as a major source of sediment. Consequently, there is general agreement between the AGNPS model and the water quality monitoring program that the LF-1 and LF-3 subwatershed areas are critical for erosion and sediment control.

The other parameter of greatest concern for the water quality of Lake Faulkton is phosphorus. The AGNPS model identified four subwatersheds (#2004, #2215, #1308, and #2069) that were contributing above normal phosphorus yields. The #2004 and #2215 subwatersheds again correspond to the subwatersheds monitored for water quality at Sites LF-1 and LF-3. The water quality monitoring of the LF-1 and LF-3 subwatersheds likewise indicated high loadings of total and dissolved phosphorus.

The #1308 subwatershed is located at the northwest end of the Lake Faulkton watershed. The water from this subwatershed was monitored at Site LF-7. However, because of extremely intermittent flows, loadings of phosphorus from this subwatershed could not be calculated. The water quality monitoring program for Lake Faulkton indicated that the LF-7 drainage area is often a non-contributing subwatershed. When runoff water does flow from this subwatershed, it flows later and slower than the runoff from the other subwatersheds. Therefore, even though the AGNPS computer model indicated that the northwest watershed area had high yields of phosphorus, the water monitoring program showed that quite often this runoff does not flow to Lake Faulkton. Based on the results of the monitoring program, the #1308 subwatershed should not be considered a high priority subwatershed for implementation of best management practices.

The #2069 subwatershed corresponds to the subwatershed area that was monitored for water quality at Site LF-2. The monitoring program did not indicate major loadings of total phosphorus or total dissolved phosphorus from this subwatershed. Because it is in relatively close proximity to Lake Faulkton, this subwatershed area should be given some priority for the implementation of best management practices. However, the results of the water quality monitoring indicated that the LF-1, LF-8, and LF-3 subwatersheds should be given higher priority than the LF-2 subwatershed.

The AGNPS model indicated that high levels of phosphorus and nitrogen might be attributed to the numerous livestock feeding areas located throughout the watershed. A total of 36 livestock feeding areas were identified as potential nonpoint sources of pollution during the AGNPS data collection phase of the project. The 36 feeding areas were priority ranked for potential nonpoint source pollution on a scale of 0 to 100. The priority rankings were then adjusted for factors based upon the distance from major streams and Lake Faulkton. Livestock feeding areas with a distance corrected ranking greater than 25 should be considered for treatment (runoff control). Based on this ranking system, 16 livestock feeding areas would receive the highest priority for treatment due to their AGNPS ranking and proximity to major streams and the lake.

RESTORATION ALTERNATIVES

Numerous alternatives are available for the restoration of lakes and their watersheds. The following alternatives are listed as possibilities for the restoration of Lake Faulkton and the South Fork Snake Creek watershed. This is not meant to be an exhaustive list of potential restoration measures, nor are the alternatives necessarily listed in priority order. Rather, these are measures that have proven successful at other lakes, and that might prove useful in the restoration of Lake Faulkton. A more concise list of restoration alternatives will need to be developed prior to the implementation of a restoration project.

The alternatives have been grouped together into three broad categories: General, Immediate Lake Area, and Watershed Area. The General alternatives would apply to both the immediate lake area and the watershed area. The Immediate Lake Area measures would apply to the lake itself (in-lake) or the immediate area around the lake. The Watershed measures would be implemented in areas of the watershed away from the immediate lake area.

- <u>General Restoration Alternatives</u>

1. Advisory Board Formation

   Local community leaders should investigate the possibility of forming an advisory board for the restoration of Lake Faulkton. The advisory board would be comprised of representatives of all the different organizations, agencies, local government units, and individuals that have a direct interest in the restoration of Lake Faulkton and its watershed. Possible membership of the advisory board might include representatives of the following within the Lake Faulkton watershed area:

   a. city councils/town boards

   b. county commissions

   c. township boards

   d. conservation districts

   e. lake associations

   f. natural resources agencies (NRCS, SD GF&P)

   g. conservation organizations (conservation clubs, Izaak Walton League)

   h. watershed landowners and other interested parties or individuals

   The purpose of establishing an advisory board would be to have one organization (comprised of the above representatives) that could make policy decisions in the interest of the lake and its watershed. An advisory board could coordinate applications for grants, and direct the implementation of a restoration project. The Upper Big Sioux River Watershed Advisory Board at Watertown, SD, is an example of this type of organization.

2. Information / Education Program

An information and education program should be developed to inform lake property owners and watershed landowners of the hypereutrophic condition of Lake Faulkton, and the need to initiate restoration measures. Residents at the lake and in the watershed should be informed of measures they can take to assist in a restoration effort. The use of best management practices should be promoted at the lake and in the watershed. For lake property owners, best management practices include the use of phosphate-free lawn fertilizers, minimal use of pesticides, proper storage of petroleum products and hazardous chemicals, shoreline protection/stabilization and adequate waste disposal. For watershed landowners, the implementation of a wide range of conservation practices should be promoted.

- <u>Immediate Lake Area Alternatives</u>

1. Shoreline Stabilization

A total of nearly 300 feet of shoreline around the lake was found to be eroding. The erosion ranged from minor to severe. This shoreline erosion is directly contributing sediment to Lake Faulkton, and should be corrected as soon as possible. The shoreline repair should begin with the severe erosion at the west side of the golf course. The other areas of erosion should be repaired as quickly as resources become available. Surveying and engineering plans should be completed prior to implementation of the repairs to ensure permanent solutions. Bio-engineering (soft stabilization) should be used wherever possible because it is less expensive and aesthetically more appealing. Hard stabilization (rock rip rap) may need to be used to stabilize some of the erosion areas.

2. Wastewater Disposal

A survey of cabins and homes at the lake indicated that wastewater disposal facilities may be inadequate in some cases. The issue of wastewater disposal for properties around the lake, including the golf course and state recreation area, must be given a high priority. Any individual wastewater systems (septic systems) that are failing should be repaired or replaced. The possibility of a central sewer collection system and wastewater facilities should be investigated. The initial steps in this process would be the formation of a sanitary district and completion of a preliminary engineering feasibility study. Prior to the construction of a centralized wastewater system, it must be ensured that adequate wastewater disposal is provided for any new cabins, homes, or other facilities at the lake. The adequacy of local zoning ordinances, and ordinances governing wastewater disposal, should be reviewed. Enforcement of the ordinances should be a high priority for local government officials.

3. Golf Course Management

Samples of runoff from the golf course adjacent to Lake Faulkton showed high levels of ammonia, nitrate nitrogen, total Kjeldahl nitrogen, total phosphorus, and total dissolved phosphorus. Because of the close proximity of the course to the lake, and the high potential for direct runoff, the management of the course should be reviewed to ensure minimum runoff to the lake. Fertilizer and pesticide applications must be kept to an absolute minimum. The use of phosphate-free fertilizer should be considered. Planting trees and shrubs along the lake shoreline may help to take up nutrients before they reach the lake.

4. Aquatic Plant Removal

The encroachment of aquatic plants is limiting the potential for full recreational use of the lake. The decomposition of dead plant material contributes to the nutrient loading in the lake, and consumes oxygen which is vital to fish and other aquatic organisms. Harvesting and removal of plants from the lake should be investigated. This would help to reduce some of the in-lake loading of nutrients. Care would need to be taken in the removal of plants from near-shore areas, as the plants do provide some measure of protection from shoreline erosion.

5. Lake Outlet Modification

The in-lake water quality sampling showed that the oxygen level often declines drastically in the hypolimnetic (lower) water layer in the lake. Low oxygen levels at the interface between the lake sediment and the hypolimnetic layer can cause the release of nutrients from the sediment. The possibility of withdrawing water from the hypolimnetic layer should be investigated. In this manner, lesser quality water could be removed, rather than the better quality water which presently flows over the outlet spillway when the lake fills and overflows. Potential downstream impacts on the South Fork of Snake Creek would need to be evaluated prior to implementation of this alternative.

6. Aeration System

The installation of an aeration system might help to reduce anoxic (low oxygen) conditions in the hypolimnetic (lower) water layer of the lake. The aeration system would help to mix the epilimnetic (upper) aerated water layer into the anoxic hypolimnetic layer. Caution must be exercised in the use of aeration systems over winter periods. Some aeration systems cause thin ice or open-water areas. Warning signs, buoy markers, public safety announcements, and other safety precautions would need to be implemented. Liability insurance would also be recommended. The advantages and disadvantages of aeration systems should be investigated at lakes where they have been used. Some lakes that have used aeration systems include Lake Hendricks (Brookings County, SD) and Lake Herman (Lake County, SD).

7. Sediment Sealing

A comparison of the average in-lake total dissolved phosphorus concentration (0.827 mg/L) to the average lake inlet total dissolved phosphorus concentration (0.444 mg/L), indicates that the in-lake concentration is nearly double the inlet concentration. In other words, the concentration of total dissolved phosphorus in the lake itself is almost twice as high as the concentration of total dissolved phosphorus in the water flowing into the lake. Total dissolved phosphorus concentrations are used for this comparison because total dissolved phosphorus is the portion of the total phosphorus that is readily available for plant uptake.

It is believed that the release of phosphorus from the lake sediments is the major cause for the much higher level of phosphorus in the lake than in the water flowing into the lake. A restoration alternative that should be investigated to reduce the internal loading of nutrients is sealing of the lake bottom sediments. Sealing the sediments with a material such as alum (aluminum sulfate) would reduce the release of nutrients (nitrogen and phosphorus) into the water column. The lake bottom sealing would not be permanent, but it might provide water quality improvement until more permanent measures can be implemented. Lakes where this method has been used successfully are Long Lake and Mirror Lake in Wisconsin.

8. Sediment Removal

A seismic (sonar) sediment survey was attempted but could not be completed with available equipment and technology. The results of a probing sediment survey indicated that sediment depths varied from about one foot in near-shore areas to nearly seven feet in deeper water areas of the lake. The total sediment volume estimated by this method was 277,793 cubic yards. However, this volume may be under-estimated because of the limitations of this technique, particularly in the deeper water areas of the lake.

The sediment volume estimated from the probing survey would probably not justify sediment removal. However, further investigation of sediment depths with improved techniques may be warranted. Confirmation of a greater sediment volume might make sediment removal a viable option in the future. At that time, the best removal technique would need to be determined. Hydraulic pumping with a cutter-head dredge is the most common procedure. However, if the lake could be drained, removal with land-based equipment such as scrapers might be more economical.

- Watershed Area Alternatives

[Note: Critical areas of the Lake Faulkton watershed for sediment and nutrient runoff were identified by the AGNPS computer model (see APPENDIX D). The following restoration alternatives should be promoted and implemented in the identified critical areas.]

1. Animal Waste Management Systems

   The water quality monitoring program indicated that livestock feeding areas may be major sources of nutrient runoff and fecal coliform bacteria. The AGNPS computer runoff model likewise indicated that livestock feeding areas may be major sources of nutrients. The AGNPS model ranked the livestock operations for potential to contribute runoff to major streams and Lake Faulkton. Based on this ranking system, 16 livestock feeding areas would receive the highest priority for treatment (runoff control).

2. Grassed Waterways

   Grassed waterways can help reduce erosion (sediment runoff) from cropland areas. Existing grassed waterways should be repaired, if needed, and new waterways should be constructed in critical cropland areas.

3. Crop Residue Management

   Crop residue management requires the management of organic residue so maximum amounts are left on the soil surface to reduce erosion. Several alternatives are possible for residue management such as no-till, strip till, mulch till, ridge till, and seasonal residue management. The residue management procedures most acceptable to watershed landowners should be promoted in critical areas.

4. Small Dams / Ponds

   The construction of small dams and ponds on watershed streams can be very effective in retaining sediment and allowing nutrient uptake by plants. Small ponds can also provide beneficial habitat for waterfowl and wildlife. In addition to implementation project funds, cost-sharing funds can often be secured from the U. S. Fish and Wildlife Service, SD GF&P, and the Ducks Unlimited organization. The potential for small dams and ponds should be investigated.

5. Streambank Stabilization

   Eroding streambanks directly contribute sediment to the South Fork of Snake Creek and its tributaries. Stabilizing the banks of the South Fork of Snake Creek and its tributaries can reduce sediment loadings in the stream channels, and ultimately Lake Faulkton.

6. Grazing / Rangeland Management

A large portion of the Lake Faulkton watershed is rangeland. Proper use and management of the rangeland is extremely important for improvement of the water quality in the South Fork of Snake Creek and Lake Faulkton. Some alternatives available for grazing and rangeland include critical area planting, deferred grazing, fencing, pasture and hayland planting / management, proper grazing use, range planting, and planned grazing systems.

7. Filter Strips

The implementation of filter strips involves the establishment of perennial vegetation along streams to trap sediment and nutrients from cropland and rangeland. Filter strips can be very effective in reducing the impacts of erosion and runoff on stream water quality.

8. Grade Stabilization Structures

Numerous sources of gully erosion were identified in the Lake Assessment Project. Grade stabilization structures help to control the grade and reduce erosion. These types of structures can be used to prevent the formation, or advancement, of gullies.

9. Alternative Livestock Watering

Alternative systems for watering livestock can help to reduce streambank erosion and grazing of livestock in immediate stream areas. Some of the systems that can be employed for alternative watering are pipelines, water storage facilities, and well construction.

10. Integrated Crop Management

Integrated Crop Management (ICM) involves both nutrient management and pest management. Nutrient management requires the proper amount, form, placement, and timing of plant nutrient applications. Pest management is necessary to control infestations of weeds, insects, and disease. This will result in a reduction of adverse effects on plant growth, crop production, and material resources.

11. Wetland Restoration / Development

This alternative involves the construction or restoration of the necessary facilities to provide the benefits of a wetland. Some of the benefits of wetlands include sediment retention, nutrient uptake, and waterfowl / wildlife habitat.

12. Windbreak / Shelterbelt Establishment

This practice requires the planting of single or multiple rows of trees or shrubs. Some of the alternatives include field windbreaks, and windbreak / shelterbelt renovation.

13. Conservation Crop Rotation

Conservation crop rotation requires growing crops in a planned rotation for biodiversity and to provide adequate amounts of organic material for erosion reduction, nutrient balance, and sustained soil organic matter. One option would be to plant grasses and/or legumes as part of a conservation cropping sequence to control erosion, produce forage for livestock, and improve soil productivity.

14. Habitat Management

Options under this alternative include wetland habitat management and upland habitat management for wildlife. These options require creating, maintaining, or enhancing areas to provide food and cover for waterfowl, furbearers, and other wildlife.

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APPENDIX A.

TRIBUTARY WATER QUALITY DATA SUMMARY

Tributary Water Quality Data Summary

LAKE FAULKTON TRIBUTARY SAMPLE DATA, 1994 AND 1995
SITE LF-1, SOUTH FORK SNAKE CREEK

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DATE	TIME	SITE	SAMP	FpH units	FECAL COLIFORM per 100 mL	TALK mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMONIA mg/L	NO3+2 mg/L	TKN-N mg/L	TPO4 mg/L	TDPO4 mg/L
3/14/94	1340	LF-1	Grab	7.65	10	51	174	160	14	0.02	0.90		0.576	0.500
3/17/94	1230	LF-1	Grab	8.05	10	52	179	170	9	0.02	0.60	1.47	0.476	0.939
3/21/94	1210	LF-1	Grab	8.00	10	62	214	204	10	0.02	0.40	1.13	0.386	0.896
3/28/94	1110	LF-1	Grab	8.10	10	86	292	291	1	0.02	0.10	1.15	0.275	1.320
4/4/94	1130	LF-1	Grab	7.95	10	110	421	419	2	0.02	0.10	1.09	0.190	0.673
4/12/94	1300	LF-1	Grab	7.95	10	139	562	560	2	0.02	0.10	0.94	0.130	0.693
4/18/94	1220	LF-1	Grab	7.85	10	168	777	775	2	0.02	0.10	0.78	0.123	0.586
4/26/94	1030	LF-1	Grab	7.95	10	215	1110	1107	3	0.02	0.10	0.88	0.143	0.424
5/2/94	1330	LF-1	Grab	7.95	10	173	595	593	2	0.02	0.10	1.23	0.005	0.776
7/7/94	1245	LF-1	Grab	7.85	15000	85	207	194	13	0.08	0.30	1.09	0.150	0.749
7/18/94	1245	LF-1	Grab	7.05	40	117	299	296	3	0.02	0.10	1.63	0.999	1.320
2/22/95	1000	LF-1	Grab	7.80	250	39	203	190	13	0.66	0.70	3.93	0.746	1.070
2/27/95	1200	LF-1	Grab	7.45	20	54	158	149	9	0.10	1.00	2.13	0.566	0.697
3/12/95	1410	LF-1	Grab	7.80	No C bottle	57	249	149	100	0.30	0.60	2.58	0.689	0.680
3/20/95	1300	LF-1	Grab	8.25	10	74	216	208	8	0.02	0.20	0.99	0.394	0.369
4/3/95	1245	LF-1	Grab	8.15	10	103	353	351	2		0.10	0.95	0.279	0.254
MINIMUM				7.05	10	39	158	149	1	0.02	0.10	0.78	0.005	0.254
MAXIMUM				8.25	15000	215	1110	1107	100	0.66	1.00	3.93	0.999	1.320
MEAN				7.86	1028	99	376	364	12	0.09	0.34	1.46	0.383	0.747

LAKE FAULKTON TRIBUTARY SAMPLE DATA, 1994 AND 1995
SITE LF-2, SOUTH FORK SNAKE CREEK

DATE	TIME	SITE	SAMP	FpH units	FECAL COLIFORM per 100 mL	TALK mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMONIA mg/L	NO3+2 mg/L	TKN-N mg/L	TPO4 mg/L	TDPO4 mg/L
3/14/94	1355	LF-2	Grab	7.45	10	30	151	146	5	0.02	0.90	1.56	0.406	0.373
3/17/94	1245	LF-2	Grab	7.85	10	32	142	136	6	0.02	0.30	1.31	0.330	0.290
3/21/94	1245	LF-2	Grab	8.05	10	60	211	201	10	0.02	0.10	1.28	0.386	0.346
3/28/94	1130	LF-2	Grab	7.80	10	81	280	279	1	0.02	0.10	1.30	0.346	0.336
4/4/94	1230	LF-2	Grab	8.05	10	94	353	351	2	0.02	0.10	2.00	0.629	0.599
7/7/94	1210	LF-2	Grab	7.75	13000	34	92	84	8	0.02	0.10	1.02	0.441	0.508
7/11/94	1300	LF-2	Grab	7.25	580	56	227	222	5	0.02	0.10	2.00	0.941	1.330
7/18/94	1220	LF-2	Grab	7.35	280	85	289	281	8	0.02	0.10	2.23	1.230	1.610
2/22/95	1015	LF-2	Grab	7.65	430	25	150	134	16	0.92	0.90	3.15	0.528	0.869
2/27/95	1130	LF-2	Grab	7.25	60	46	168	155	13	0.26	0.70	2.52	0.533	0.640
3/12/95	1425	LF-2	Grab	7.75	no samp.	29	157	115	42	0.35	0.40	2.37	0.451	0.508
3/16/95	1045	LF-2	Grab	8.00	10	46	204	199	5	0.02	0.10	1.86	0.287	0.230
4/3/95	1215	LF-2	Grab	8.35	10	78	462	450	12	0.02	0.10	1.45	0.205	0.148
MINIMUM				7.25	10	25	92	84	1	0.02	0.10	1.02	0.205	0.148
MAXIMUM				8.35	13000	94	462	450	42	0.92	0.90	3.15	1.230	1.610
MEAN				7.73	1202	54	222	212	10	0.13	0.31	1.85	0.516	0.599

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Tributary Water Quality Data Summary (Continued)

LAKE FAULKTON TRIBUTARY SAMPLE DATA, 1994 AND 1995
SITE LF-3, SOUTH FORK SNAKE CREEK (HADRICK'S BRIDGE) — INLET TO LAKE

DATE	TIME	SITE	SAMP	FpH units	FECAL COLIFORM per 100 mL	TALK mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMONIA mg/L	NO3+2 mg/L	TKN-N mg/L	TPO4 mg/L	TDPO4 mg/L
3/14/94	1415	LF-3	Grab	8.65	10	57	256	152	104	0.15	1.00	2.40	0.636	0.433
3/17/94	1310	LF-3	Grab	7.85	10	59	197	163	34	0.07	0.60	1.67	0.456	0.336
3/21/94	1315	LF-3	Grab	8.00	10	72	220	200	20	0.02	0.30	1.26	0.400	0.333
3/28/94	1200	LF-3	Grab	7.95	900	90	261	252	9	0.02	0.10	1.39	0.413	0.313
4/4/94	1200	LF-3	Grab	8.05	10	126	327	320	7	0.02	0.10	1.29	0.336	0.500
4/12/94	1130	LF-3	Grab	8.25	360	176	506	500	6	0.02	0.10	1.15	0.226	0.160
4/19/94	1130	LF-3	Grab	8.00	610	173	477	458	19	0.02	0.10	1.27	0.300	0.593
4/26/94	1130	LF-3	Grab	8.15	10	192	550	542	8	0.02	0.10	1.25	0.376	0.283
5/2/94	1430	LF-3	Grab	8.15	40	197	535	532	3	0.02	0.10	1.19	0.223	0.186
7/7/94	1345	LF-3	Grab	7.40	9300	104	442	431	11	0.02	0.20	1.70	0.669	0.589
2/22/95	1115	LF-3	Grab	7.70	250	110	293	253	40	0.82	0.50	4.47	0.943	1.120
2/27/95	1250	LF-3	Grab	7.50	40	57	250	235	15	0.31	1.00	2.83	0.590	0.713
3/11/95	1500	LF-3	Grab	7.85	no samp	44	173	133	40	0.55	0.90	3.83	0.402	0.508
3/20/95	1200	LF-3	Grab	8.05	10	89	214	205	9	0.03	0.10	1.27	0.369	0.320
4/3/95	1030	LF-3	Grab	8.25	20	97	256	246	10	0.02	0.10	1.36	0.320	0.271
MINIMUM				7.40	10	44	173	133	3	0.02	0.10	1.15	0.223	0.160
MAXIMUM				8.65	9300	197	550	542	104	0.82	1.00	4.47	0.943	1.120
MEAN				7.99	827	110	330	308	22	0.14	0.35	1.89	0.444	0.444

LAKE FAULKTON TRIBUTARY SAMPLE DATA, 1994 AND 1995
SITE LF-6, LAKE FAULKTON DAM SPILLWAY

DATE	TIME	SITE	SAMP	FpH units	FECAL COLIFORM per 100 mL	TALK mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMONIA mg/L	NO3+2 mg/L	TKN-N mg/L	TPO4 mg/L	TDPO4 mg/L
3/14/94	1435	LF-6	Grab	8.05	10	77	213	191	22	0.25	1.20	2.31	0.643	0.543
3/17/94	1325	LF-6	Grab	7.80	10	57	21	0	21	0.16	0.70	1.80	0.500	0.386
3/21/94	1345	LF-6	Grab	8.00	10	60	184	158	26	0.07	0.60	1.74	0.480	0.380
3/28/94	1220	LF-6	Grab	7.95	10	71	194	188	6	0.04	0.50	1.55	0.423	0.336
4/4/94	1100	LF-6	Grab	8.05	10	101	264	257	7	0.03	0.10	1.65	0.576	0.266
4/12/94	1115	LF-6	Grab	8.65	10	100	251	247	4	0.02	0.10	1.22	0.420	0.674
4/18/94	1330	LF-6	Grab	8.45	10	105	265	263	2	0.02	0.10	1.15	0.386	0.649
4/26/94	1145	LF-6	Grab	8.20	10	114	306	300	6	0.02	0.10	0.94	0.333	0.280
5/2/94	1450	LF-6	Grab	8.25	10	111	280	278	2	0.02	0.10	1.23	0.310	0.263
7/11/94	1400	LF-6	Grab	8.25	70	130	326	312	14	0.02	0.10	1.70	0.616	1.010
2/22/95	1145	LF-6	Grab	7.65	10	178	430	417	13	0.46	0.10	2.16	0.894	1.120
2/27/95	1315	LF-6	Grab	7.75	90	55	247	221	26	0.44	0.80	2.63	0.609	0.869
3/12/95	1530	LF-6	Grab	7.75	no samp	73	247	183	64	0.51	0.60	3.05	0.656	0.877
3/13/95	1530	LF-6	Grab	7.77	10	9	22	21	1	0.19	0.10	0.19	0.008	0.008
3/20/95	1045	LF-6	Grab	7.80	10	62	161	143	18	0.15	0.50	1.63	0.377	0.377
4/3/95	1530	LF-6	Grab	8.30	10	86	215	201	14	0.03	0.20	1.34	0.377	0.312
MINIMUM				7.65	10	9	21	0	1	0.02	0.10	0.19	0.008	0.008
MAXIMUM				8.65	90	178	430	417	64	0.51	1.20	3.05	0.894	1.120
MEAN				8.04	19	87	227	211	15	0.15	0.37	1.64	0.476	0.522

Not found

Tributary Water Quality Data Summary (Continued)

LAKE FAULKTON TRIBUTARY SAMPLE DATA, 1994 AND 1995
SITE LF-8, SOUTH FORK SNAKE CREEK (VOGELER'S DAM)

DATE	TIME	SITE	SAMP	FpH units	FECAL COLIFORM per 100 mL	TALK mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMONIA mg/L	NO3+2 mg/L	TKN-N mg/L	TPO4 mg/L	TDPO4 mg/L
4/13/94	1230	LF-8	Grab	8.25	10	139	295	235	60	0.02	0.10	1.27	0.310	0.170
7/26/94	1030	LF-8	Grab	7.75	940	150	363	317	46	0.04	0.10	1.52	0.974	1.250
8/29/94	1425	LF-8	Grab	7.40	70	197	382	366	16	0.05	0.10	1.77	0.716	2.060
2/22/95	1045	LF-8	Grab	7.65	900	83	254	212	42	1.69	0.90	6.86	1.205	1.440
2/27/95	1030	LF-8	Grab	7.65	120	57	202	182	20	0.63	1.40	3.69	0.779	0.812
3/11/95	1515	LF-8	Grab	7.70	no samp	77	219	181	38	1.17	0.80	4.59	0.886	1.040
3/16/95	1145	LF-8	Grab	7.75	10	59	162	148	14	0.68	0.60	3.24	0.574	0.361
4/3/95	1130	LF-8	Grab	8.30	90	85	201	181	20	0.24	0.50	2.73	0.484	0.344
MINIMUM				7.40	10	57	162	148	14	0.02	0.10	1.27	0.310	0.170
MAXIMUM				8.30	940	197	382	366	60	1.69	1.40	6.86	1.205	2.060
MEAN				7.81	306	106	260	228	32	0.57	0.56	3.21	0.741	0.935

APPENDIX B.

1994 TRIBUTARY LOADINGS SUMMARY

SAMPLE DATA FOR SITE LF-1 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
11-Mar-94	1340	LF-1	Grab	479528920	24456	83438	76725	6713	9.59	431.58	0.00	276.209	239.764
12-Mar-94				538246747	27720	95001	88811	6190	10.76	403.69	791.22	283.118	387.269
13-Mar-94				596964574	30744	105364	98499	6865	11.94	447.72	877.54	314.003	429.516
14-Mar-94				836729034	43092	147683	138060	9622	16.73	627.55	1229.99	440.119	602.027
15-Mar-94				479528920	24696	84637	79122	5515	9.59	359.65	704.91	252.232	345.021
16-Mar-94				318054896	16380	56137	52479	3658	6.36	238.54	467.54	167.297	228.840
17-Mar-94	1230	LF-1	Grab	161474024	8397	28904	27451	1453	3.23	96.88	237.37	76.862	151.624
18-Mar-94				114989078	6554	22595	21503	1092	2.30	57.49	149.49	49.560	105.502
19-Mar-94				100309621	5718	19711	18758	953	2.01	50.15	130.40	43.233	92.034
20-Mar-94				75843860	4323	14903	14183	721	1.52	37.92	98.60	32.689	69.587
21-Mar-94	1210	LF-1	Grab	53824675	3337	11518	10980	538	1.08	21.53	60.82	20.776	48.227
22-Mar-94				37921930	2806	9594	9386	209	0.76	9.48	43.23	12.533	42.017
23-Mar-94				29358913	2173	7428	7266	161	0.59	7.34	33.47	9.703	32.530
24-Mar-94				25689049	1901	6499	6358	141	0.51	6.42	29.29	8.490	28.463
25-Mar-94				22019185	1629	5571	5450	121	0.44	5.50	25.10	7.277	24.397
26-Mar-94				19572609	1448	4952	4844	108	0.39	4.89	22.31	6.469	21.686
27-Mar-94				15902745	1177	4023	3936	87	0.32	3.98	18.13	5.256	17.620
28-Mar-94	1110	LF-1	Grab	12232881	1052	3572	3560	12	0.24	1.22	14.07	3.364	16.147
29-Mar-94				9296989	911	3314	3300	14	0.19	0.93	10.41	2.162	9.264
30-Mar-94				8807674	863	3140	3127	13	0.18	0.88	9.86	2.048	8.777
31-Mar-94				8318359	815	2965	2953	12	0.17	0.83	9.32	1.934	8.289
1-Apr-94				7584386	743	2704	2692	11	0.15	0.76	8.49	1.763	7.558
2-Apr-94				6801482	667	2425	2415	10	0.14	0.68	7.62	1.581	6.778
3-Apr-94				6801482	667	2425	2415	10	0.14	0.68	7.62	1.581	6.778
4-Apr-94		LF-1	Grab	5724988	630	2410	2399	11	0.11	0.57	6.24	1.088	3.853
5-Apr-94				4917618	612	2417	2407	10	0.10	0.49	4.99	0.787	3.359
6-Apr-94				4428303	551	2177	2168	9	0.09	0.44	4.49	0.709	3.025
7-Apr-94				4208111	524	2068	2060	8	0.08	0.42	4.27	0.673	2.874
8-Apr-94				3987919	496	1960	1952	8	0.08	0.40	4.05	0.638	2.724
9-Apr-94				3987919	496	1960	1952	8	0.08	0.40	4.05	0.638	2.724
10-Apr-94				3547535	442	1744	1737	7	0.07	0.35	3.60	0.568	2.423
11-Apr-94				3547535	442	1744	1737	7	0.07	0.35	3.60	0.568	2.423

SAMPLE DATA FOR SITE LF-1 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
12-Apr-94	1300	LF-1	Grab	3547535	493	1994	1987	7	0.07	0.35	3.33	0.461	2.458
13-Apr-94				3327344	511	2228	2221	7	0.07	0.33	2.86	0.421	2.128
14-Apr-94				3767727	578	2522	2515	8	0.08	0.38	3.24	0.477	2.409
15-Apr-94				3767727	578	2522	2515	8	0.08	0.38	3.24	0.477	2.409
16-Apr-94				3107152	477	2080	2074	6	0.06	0.31	2.67	0.393	1.987
17-Apr-94				2886960	443	1933	1927	6	0.06	0.29	2.48	0.365	1.846
18-Apr-94	1220	LF-1	Grab	1223288	206	950	948	2	0.02	0.12	0.95	0.150	0.717
19-Apr-94				978630	187	923	921	2	0.02	0.10	0.81	0.130	0.494
20-Apr-94				978630	187	923	921	2	0.02	0.10	0.81	0.130	0.494
21-Apr-94				733973	141	693	691	2	0.01	0.07	0.61	0.098	0.371
22-Apr-94				489315	94	462	460	1	0.01	0.05	0.41	0.065	0.247
23-Apr-94				733973	141	693	691	2	0.01	0.07	0.61	0.098	0.371
24-Apr-94				1223288	234	1154	1151	3	0.02	0.12	1.02	0.163	0.618
25-Apr-94				2446576	469	2308	2302	6	0.05	0.24	2.03	0.325	1.236
26-Apr-94	1030	LF-1	Grab	3107152	668	3449	3440	9	0.06	0.31	2.73	0.444	1.317
27-Apr-94				3547535	688	3024	3015	9	0.07	0.35	3.74	0.263	2.129
28-Apr-94				4208111	816	3587	3577	11	0.08	0.42	4.44	0.311	2.525
29-Apr-94				4648495	902	3963	3951	12	0.09	0.46	4.90	0.344	2.789
30-Apr-94				5994112	1163	5110	5095	15	0.12	0.60	6.32	0.444	3.596
1-May-94				6801482	1319	5798	5781	17	0.14	0.68	7.18	0.503	4.081
2-May-94	1330	LF-1	Grab	7339728	1270	4367	4352	15	0.15	0.73	9.03	0.037	5.696
3-May-94				7070605	912	2835	2782	53	0.35	1.41	8.20	0.548	5.391
4-May-94				6801482	877	2727	2676	51	0.34	1.36	7.89	0.527	5.186
5-May-94				6263235	808	2512	2465	47	0.31	1.25	7.27	0.485	4.776
6-May-94				5724988	739	2296	2253	43	0.29	1.14	6.64	0.444	4.365
7-May-94				5455865	704	2188	2147	41	0.27	1.09	6.33	0.423	4.160
8-May-94				5455865	704	2188	2147	41	0.27	1.09	6.33	0.423	4.160
9-May-94				7339728	947	2943	2888	55	0.37	1.47	8.51	0.569	5.597
10-May-94				6801482	877	2727	2676	51	0.34	1.36	7.89	0.527	5.186
11-May-94				6532358	843	2619	2570	49	0.33	1.31	7.58	0.506	4.981
12-May-94				4917618	634	1972	1935	37	0.25	0.98	5.70	0.381	3.750
13-May-94				4428303	571	1776	1743	33	0.22	0.89	5.14	0.343	3.377

SAMPLE DATA FOR SITE LF-1 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
14-May-94				4208111	543	1687	1656	32	0.21	0.84	4.88	0.326	3.209
15-May-94				3767727	486	1511	1483	28	0.19	0.75	4.37	0.292	2.873
16-May-94				1467946	189	589	578	11	0.07	0.29	1.70	0.114	1.119
17-May-94				978630	126	392	385	7	0.05	0.20	1.14	0.076	0.746
18-May-94				244658	32	98	96	2	0.01	0.05	0.28	0.019	0.187
19-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
21-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
31-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-1 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
15-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
16-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
18-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
19-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
21-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Jul-94				1223288	124	309	300	10	0.06	0.24	1.66	0.703	1.265
7-Jul-94	1245	LF-1	Grab	7339728	741	1857	1798	59	0.37	1.47	9.98	4.217	7.593
8-Jul-94				17615348	1779	4457	4316	141	0.88	3.52	23.96	10.120	18.223
9-Jul-94				5455865	551	1380	1337	44	0.27	1.09	7.42	3.134	5.644
10-Jul-94				2666768	269	675	653	21	0.13	0.53	3.63	1.532	2.759
11-Jul-94				2886960	292	730	707	23	0.14	0.58	3.93	1.659	2.987
12-Jul-94				4648495	469	1176	1139	37	0.23	0.93	6.32	2.671	4.809
13-Jul-94				21040555	2125	5323	5155	168	1.05	4.21	[illegible]	12.088	21.766
14-Jul-94				97373730	9835	24636	23857	779	4.87	19.47	132.43	55.941	100.733
15-Jul-94				122328806	12355	30949	29971	979	6.12	24.47	166.37	70.278	126.549
16-Jul-94				68504131	6919	17332	16784	548	3.43	13.70	93.17	39.356	70.868

SAMPLE DATA FOR SITE LF-1 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
17-Jul-94				51867414	5239	13122	12708	415	2.59	10.37	70.54	29.798	53.657
18-Jul-94	1245	LF-1	Grab	41591794	4866	12436	12311	125	0.83	4.16	67.79	41.550	54.901
19-Jul-94				31805490	3467	8778	8603	175	1.11	4.77	47.55	25.023	37.443
20-Jul-94				22019185	2400	6077	5956	121	0.77	3.30	32.92	17.324	25.922
21-Jul-94				17615348	1920	4862	4765	97	0.62	2.64	26.33	13.859	20.738
22-Jul-94				15413430	1680	4254	4169	85	0.54	2.31	23.04	12.127	18.145
23-Jul-94				12722196	1387	3511	3441	70	0.45	1.91	19.02	10.009	14.977
24-Jul-94				8807674	960	2431	2382	48	0.31	1.32	13.17	6.929	10.369
25-Jul-94				8318359	907	2296	2250	46	0.29	1.25	12.44	6.544	9.793
26-Jul-94				7829044	853	2161	2118	43	0.27	1.17	11.70	6.160	9.217
27-Jul-94				6532358	712	1803	1767	36	0.23	0.98	9.77	5.139	7.690
28-Jul-94				5455865	595	1506	1476	30	0.19	0.82	8.16	4.292	6.423
29-Jul-94				4208111	459	1161	1138	23	0.15	0.63	6.29	3.311	4.954
30-Jul-94				3987919	435	1101	1079	22	0.14	0.60	5.96	3.137	4.695
31-Jul-94				3327344	363	918	900	18	0.12	0.50	4.97	2.618	3.917
1-Aug-94				1957261	213	540	529	11	0.07	0.29	2.93	1.540	2.304
2-Aug-94				1223288	133	338	331	7	0.04	0.18	1.83	0.962	1.440
3-Aug-94				733973	80	203	199	4	0.03	0.11	1.10	0.577	0.864
4-Aug-94				244658	27	68	66	1	0.01	0.04	0.37	0.192	0.288
5-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Aug-94				1712603	187	473	463	9	0.06	0.26	2.56	1.347	2.016
10-Aug-94				2201919	240	608	596	12	0.08	0.33	3.29	1.732	2.592
11-Aug-94				1467946	160	405	397	8	0.05	0.22	2.19	1.155	1.728
12-Aug-94				978630	107	270	265	5	0.03	0.15	1.46	0.770	1.152
13-Aug-94				489315	53	135	132	3	0.02	0.07	0.73	0.385	0.576
14-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
15-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
16-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-1 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
18-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
19-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
21-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
31-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
15-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
16-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
18-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-1 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
19-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
21-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
15-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
16-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
18-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
19-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-1 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
21-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
31-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
MINIMUM VALUE				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
MAXIMUM VALUE				836729034	43092	147683	138060	9622	16.73	627.55	1229.99	440.119	602.027
MEAN VALUE				19060498	1209	3956	3758	198	0.45	11.85	24.21	9.784	14.904
TOTAL YEARLY LOAD				4746064089	300919	985009	935756	49254	111.72	2950.32	6028.96	2436.210	3711.099

SAMPLE DATA FOR SITE LF-2 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
11-Mar-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Mar-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Mar-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Mar-94	1355	LF-2	Grab	0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
15-Mar-94				188875677	1889	27670	26631	1039	3.78	113.33	271.04	69.506	62.612
16-Mar-94				106181404	1062	15556	14972	584	2.12	63.71	152.37	39.075	35.199
17-Mar-94	1245	LF-2	Grab	42815082	1370	6080	5823	257	0.86	12.84	56.09	14.129	12.416
18-Mar-94				42815082	1969	7557	7214	343	0.86	8.56	55.45	15.328	13.615
19-Mar-94				42815082	1969	7557	7214	343	0.86	8.56	55.45	15.328	13.615
20-Mar-94				15291101	703	2699	2577	122	0.31	3.06	19.80	5.474	4.863
21-Mar-94	1245	LF-2	Grab	9688441	581	2044	1947	97	0.19	0.97	12.40	3.740	3.352
22-Mar-94				8807674	621	2162	2114	48	0.18	0.88	11.36	3.224	3.003
23-Mar-94				5137810	362	1261	1233	28	0.10	0.51	6.63	1.880	1.752
24-Mar-94				5137810	362	1261	1233	28	0.10	0.51	6.63	1.880	1.752
25-Mar-94				4159179	293	1021	998	23	0.08	0.42	5.37	1.522	1.418
26-Mar-94				4159179	293	1021	998	23	0.08	0.42	5.37	1.522	1.418
27-Mar-94				4159179	293	1021	998	23	0.08	0.42	5.37	1.522	1.418
28-Mar-94	1130	LF-2	Grab	2813563	228	788	785	3	0.06	0.28	3.66	0.973	0.945
29-Mar-94				2568905	225	813	809	4	0.05	0.26	4.24	1.252	1.201
30-Mar-94				2201919	193	697	694	3	0.04	0.22	3.63	1.073	1.029
31-Mar-94				1565809	137	496	493	2	0.03	0.16	2.58	0.763	0.732
1-Apr-94				978630	86	310	308	1	0.02	0.10	1.61	0.477	0.458
2-Apr-94				391452	34	124	123	1	0.01	0.04	0.65	0.191	0.183
3-Apr-94				391452	34	124	123	1	0.01	0.04	0.65	0.191	0.183
4-Apr-94	0	LF-2	Grab	0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-2 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
12-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
15-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
16-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
18-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
19-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
21-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Apr-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-2 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
14-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
15-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
16-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
18-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
19-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
21-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
31-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-2 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
15-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
16-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
18-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
19-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
21-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Jul-94	1210	LF-2	Grab	5137810	177	473	432	41	0.10	0.51	5.24	2.266	2.610
8-Jul-94				20551239	929	3278	3144	134	0.41	2.06	31.03	14.201	18.887
9-Jul-94				23242473	1051	3707	3556	151	0.46	2.32	35.10	16.061	21.360
10-Jul-94				14190142	641	2263	2171	92	0.28	1.42	21.43	9.805	13.041
11-Jul-94	1300	LF-2	Grab	13138114	736	2982	2917	66	0.26	1.31	26.28	12.363	17.474
12-Jul-94				13456169	950	3472	3384	87	0.27	1.35	28.46	14.607	19.781
13-Jul-94				28135625	1986	7259	7076	183	0.56	2.81	59.51	30.541	41.359
14-Jul-94				36698642	2590	9468	9230	239	0.73	3.67	77.62	39.836	53.947
15-Jul-94				23854117	1684	6154	5999	155	0.48	2.39	50.45	25.894	35.066
16-Jul-94				17126033	1209	4419	4307	111	0.34	1.71	36.22	18.590	25.175

SAMPLE DATA FOR SITE LF-2 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
17-Jul-94				12820059	905	3308	3224	83	0.26	1.28	27.11	13.916	18.845
18-Jul-94	1220	LF-2	Grab	10911730	929	3153	3066	87	0.22	1.09	24.33	13.421	17.568
19-Jul-94				11865894	924	3245	3159	86	0.24	1.19	25.78	13.738	18.273
20-Jul-94				8807674	686	2409	2345	64	0.18	0.88	19.13	10.197	13.564
21-Jul-94				6679153	520	1827	1778	48	0.13	0.67	14.51	7.733	10.286
22-Jul-94				5137810	400	1405	1368	37	0.10	0.51	11.16	5.948	7.912
23-Jul-94				4746358	370	1298	1264	34	0.09	0.47	10.31	5.495	7.309
24-Jul-94				3767727	293	1030	1003	27	0.08	0.38	8.19	4.362	5.802
25-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
31-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
15-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
16-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-2 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
18-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
19-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
21-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
31-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
15-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
16-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
18-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-2 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
19-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
21-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
15-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
16-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
18-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
19-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-2 (SOUTH FORK SNAKE CREEK), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
21-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
31-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
MINIMUM VALUE				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
MAXIMUM VALUE				188875677	2590	27670	26631	1039	3.78	113.33	271.04	69.506	62.612
MEAN VALUE				3016953	119	568	549	19	0.06	0.97	4.79	1.759	2.046
TOTAL YEARLY LOAD				751221199	29684	141413	136713	4699	15.02	241.31	1192.18	438.027	509.426

SAMPLE DATA FOR SITE LF-3 (SOUTH FORK SNAKE CREEK (HADRICK'S BRIDGE)), 1994

DATE	TIME	SITE	SAMP	FLOW L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
11-Mar-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Mar-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Mar-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Mar-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
15-Mar-94				2006192421	116359	454403	315975	138427	220.68	1604.95	4082.60	1095.381	771.381
16-Mar-94				1419014151	82303	321407	223495	97912	156.09	1135.21	2887.69	774.782	545.611
17-Mar-94	1310	LF-3	Grab	270346662	15950	53258	44067	9192	18.92	162.21	451.48	123.278	90.836
18-Mar-94				239764460	15705	49991	43517	6474	10.79	107.89	351.25	102.619	80.201
19-Mar-94				225085003	14743	46930	40853	6077	10.13	101.29	329.75	96.336	75.291
20-Mar-94				200619242	13141	41829	36412	5417	9.03	90.28	293.91	85.865	67.107
21-Mar-94	1315	LF-3	Grab	200619242	14445	44136	40124	4012	4.01	60.19	252.78	80.248	66.806
22-Mar-94				154134296	12485	37069	34834	2235	3.08	30.83	204.23	62.656	49.785
23-Mar-94				125998670	10206	30303	28476	1827	2.52	25.20	166.95	51.218	40.698
24-Mar-94				97863045	7927	23536	22117	1419	1.96	19.57	129.67	39.781	31.610
25-Mar-94				85630164	6936	20594	19352	1242	1.71	17.13	113.46	34.809	27.659
26-Mar-94				91746605	7431	22065	20735	1330	1.83	18.35	121.56	37.295	29.634
27-Mar-94				97863045	7927	23536	22117	1419	1.96	19.57	129.67	39.781	31.610
28-Mar-94	1200	LF-3	Grab	91746605	8257	23946	23120	826	1.83	9.17	127.53	37.891	28.717
29-Mar-94				85630164	9248	25175	24490	685	1.71	8.56	114.74	32.068	34.809
30-Mar-94				81960300	8852	24096	23441	656	1.64	8.20	109.83	30.694	33.317
31-Mar-94				77067148	8323	22658	22041	617	1.54	7.71	103.27	28.862	31.328
1-Apr-94				70950708	7663	20860	20292	568	1.42	7.10	95.07	26.571	28.841
2-Apr-94				67280843	7266	19781	19242	538	1.35	6.73	90.16	25.197	27.350
3-Apr-94				58717827	6342	17263	16793	470	1.17	5.87	78.68	21.990	23.869
4-Apr-94	0	LF-3	Grab	43059740	5426	14081	13779	301	0.86	4.31	55.55	14.468	21.530
5-Apr-94				36943299	5578	15387	15147	240	0.74	3.69	45.07	10.381	12.191
6-Apr-94				22019185	3325	9171	9028	143	0.44	2.20	26.86	6.187	7.266
7-Apr-94				7119537	1075	2965	2919	46	0.14	0.71	8.69	2.001	2.349
8-Apr-94				5284604	798	2201	2167	34	0.11	0.53	6.45	1.485	1.744
9-Apr-94				5137810	776	2140	2107	33	0.10	0.51	6.27	1.444	1.695
10-Apr-94				6385564	964	2660	2618	42	0.13	0.64	7.79	1.794	2.107
11-Apr-94				6091975	920	2537	2498	40	0.12	0.61	7.43	1.712	2.010

SAMPLE DATA FOR SITE LF-3 (SOUTH FORK SNAKE CREEK (HADRICK'S BRIDGE)), 1994

DATE	TIME	SITE	SAMP	FLOW L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
12-Apr-94	1130	LF-3	Grab	5431399	956	2748	2716	33	0.11	0.54	6.25	1.227	0.869
13-Apr-94				4991015	871	2453	2391	62	0.10	0.50	6.04	1.313	1.879
14-Apr-94				5578194	973	2742	2672	70	0.11	0.56	6.75	1.467	2.100
15-Apr-94				5724988	999	2814	2742	72	0.11	0.57	6.93	1.506	2.155
16-Apr-94				6091975	1063	2994	2918	76	0.12	0.61	7.37	1.602	2.294
17-Apr-94				13456169	2348	6614	6446	168	0.27	1.35	16.28	3.539	5.066
18-Apr-94				17615348	3074	8658	8438	220	0.35	1.76	21.31	4.633	6.632
19-Apr-94	1130	LF-3	Grab	7339728	1270	3501	3362	139	0.15	0.73	9.32	2.202	4.352
20-Apr-94				6458961	1179	3317	3229	87	0.13	0.65	8.14	2.183	2.829
21-Apr-94				6018577	1098	3091	3009	81	0.12	0.60	7.58	2.034	2.636
22-Apr-94				5504796	1005	2827	2752	74	0.11	0.55	6.94	1.861	2.411
23-Apr-94				5284604	964	2714	2642	71	0.11	0.53	6.66	1.786	2.315
24-Apr-94				4697426	857	2412	2349	63	0.09	0.47	5.92	1.588	2.057
25-Apr-94				5358002	978	2751	2679	72	0.11	0.54	6.75	1.811	2.347
26-Apr-94	1130	LF-3	Grab	6972742	1339	3835	3779	56	0.14	0.70	8.72	2.622	1.973
27-Apr-94				9052332	1761	4911	4861	50	0.18	0.91	11.04	2.711	2.123
28-Apr-94				17615348	3426	9556	9459	97	0.35	1.76	21.49	5.276	4.131
29-Apr-94				21040555	4092	11415	11299	116	0.42	2.10	25.67	6.302	4.934
30-Apr-94				20061924	3902	10884	10773	110	0.40	2.01	24.48	6.009	4.705
1-May-94				19572609	3807	10618	10510	108	0.39	1.96	23.88	5.862	4.590
2-May-94	1430	LF-3	Grab	27890968	5495	14922	14838	84	0.56	2.79	33.19	6.220	5.188
3-May-94				27890968	4198	13625	13430	195	0.56	4.18	40.30	12.439	10.808
4-May-94				24955076	3756	12191	12016	175	0.50	3.74	36.06	11.130	9.670
5-May-94				20551239	3093	10039	9895	144	0.41	3.08	29.70	9.166	7.964
6-May-94				14190142	2136	6932	6833	99	0.28	2.13	20.50	6.329	5.499
7-May-94				9052332	1362	4422	4359	63	0.18	1.36	13.08	4.037	3.508
8-May-94				7119537	1071	3478	3428	50	0.14	1.07	10.29	3.175	2.759
9-May-94				6752550	1016	3299	3251	47	0.14	1.01	9.76	3.012	2.617
10-May-94				6018577	906	2940	2898	42	0.12	0.90	8.70	2.684	2.332
11-May-94				5504796	828	2689	2651	39	0.11	0.83	7.95	2.455	2.133
12-May-94				4917618	740	2402	2368	34	0.10	0.74	7.11	2.193	1.906
13-May-94				4917618	740	2402	2368	34	0.10	0.74	7.11	2.193	1.906

SAMPLE DATA FOR SITE LF-3 (SOUTH FORK SNAKE CREEK (HADRICK'S BRIDGE)), 1994

DATE	TIME	SITE	SAMP	FLOW L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
14-May-94				5137810	773	2510	2474	36	0.10	0.77	7.42	2.291	1.991
15-May-94				4917618	740	2402	2368	34	0.10	0.74	7.11	2.193	1.906
16-May-94				4183645	630	2044	2014	29	0.08	0.63	6.05	1.866	1.621
17-May-94				3963453	596	1936	1908	28	0.08	0.59	5.73	1.768	1.536
18-May-94				3743261	563	1829	1802	26	0.07	0.56	5.41	1.669	1.451
19-May-94				3376275	508	1649	1626	24	0.07	0.51	4.88	1.506	1.308
20-May-94				2935891	442	1434	1414	21	0.06	0.44	4.24	1.309	1.138
21-May-94				2495508	376	1219	1202	17	0.05	0.37	3.61	1.113	0.967
22-May-94				1981727	298	968	954	14	0.04	0.30	2.86	0.884	0.768
23-May-94				1614740	243	789	777	11	0.03	0.24	2.33	0.720	0.626
24-May-94				1394548	210	681	671	10	0.03	0.21	2.02	0.622	0.540
25-May-94				1100959	166	538	530	8	0.02	0.17	1.59	0.491	0.427
26-May-94				733973	110	359	353	5	0.01	0.11	1.06	0.327	0.284
27-May-94				366986	55	179	177	3	0.01	0.06	0.53	0.164	0.142
28-May-94				366986	55	179	177	3	0.01	0.06	0.53	0.164	0.142
29-May-94				366986	55	179	177	3	0.01	0.06	0.53	0.164	0.142
30-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
31-May-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Jun-94				366986	55	179	177	3	0.01	0.06	0.53	0.164	0.142
3-Jun-94				880767	133	430	424	6	0.02	0.13	1.27	0.393	0.341
4-Jun-94				1100959	166	538	530	8	0.02	0.17	1.59	0.491	0.427
5-Jun-94				1247754	188	610	601	9	0.02	0.19	1.80	0.556	0.484
6-Jun-94				1100959	166	538	530	8	0.02	0.17	1.59	0.491	0.427
7-Jun-94				1100959	166	538	530	8	0.02	0.17	1.59	0.491	0.427
8-Jun-94				1027562	155	502	495	7	0.02	0.15	1.48	0.458	0.398
9-Jun-94				1027562	155	502	495	7	0.02	0.15	1.48	0.458	0.398
10-Jun-94				1027562	155	502	495	7	0.02	0.15	1.48	0.458	0.398
11-Jun-94				954165	144	466	459	7	0.02	0.14	1.38	0.426	0.370
12-Jun-94				954165	144	466	459	7	0.02	0.14	1.38	0.426	0.370
13-Jun-94				954165	144	466	459	7	0.02	0.14	1.38	0.426	0.370
14-Jun-94				954165	144	466	459	7	0.02	0.14	1.38	0.426	0.370

SAMPLE DATA FOR SITE LF-3 (SOUTH FORK SNAKE CREEK (HADRICK'S BRIDGE)), 1994

DATE	TIME	SITE	SAMP	FLOW L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
15-Jun-94				954165	144	466	459	7	0.02	0.14	1.38	0.426	0.370
16-Jun-94				954165	144	466	459	7	0.02	0.14	1.38	0.426	0.370
17-Jun-94				954165	144	466	459	7	0.02	0.14	1.38	0.426	0.370
18-Jun-94				954165	144	466	459	7	0.02	0.14	1.38	0.426	0.370
19-Jun-94				954165	144	466	459	7	0.02	0.14	1.38	0.426	0.370
20-Jun-94				954165	144	466	459	7	0.02	0.14	1.38	0.426	0.370
21-Jun-94				733973	110	359	353	5	0.01	0.11	1.06	0.327	0.284
22-Jun-94				733973	110	359	353	5	0.01	0.11	1.06	0.327	0.284
23-Jun-94				366986	55	179	177	3	0.01	0.06	0.53	0.164	0.142
24-Jun-94				366986	55	179	177	3	0.01	0.06	0.53	0.164	0.142
25-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Jun-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Jul-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Jul-94				1321151	199	645	636	9	0.03	0.20	1.91	0.589	0.512
7-Jul-94	1345	LF-3	Grab	195726090	20356	86511	84358	2153	3.91	39.15	332.73	130.941	115.283
8-Jul-94				305822015	38916	142284	139531	2752	6.12	53.52	480.91	170.496	149.318
9-Jul-94				134561687	17123	62605	61394	1211	2.69	23.55	211.60	75.018	65.700
10-Jul-94				113521132	14446	52816	51794	1022	2.27	19.87	178.51	63.288	55.427
11-Jul-94				79513724	10118	36994	36278	716	1.59	13.91	125.04	44.329	38.823
12-Jul-94				79513724	10118	36994	36278	716	1.59	13.91	125.04	44.329	38.823
13-Jul-94				85630164	10896	39839	39069	771	1.71	14.99	134.65	47.739	41.809
14-Jul-94				91746605	11675	42685	41859	826	1.83	16.06	144.27	51.149	44.795
15-Jul-94				254443917	32378	118380	116090	2290	5.09	44.53	400.11	141.852	124.232
16-Jul-94				188386361	23972	87647	85951	1695	3.77	32.97	296.24	105.025	91.980

SAMPLE DATA FOR SITE LF-3 (SOUTH FORK SNAKE CREEK (HADRICK'S BRIDGE)), 1994

DATE	TIME	SITE	SAMP	FLOW L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
17-Jul-94				160740051	20454	74784	73338	1447	3.21	28.13	252.76	89.613	78.481
18-Jul-94				140433469	17870	65337	64073	1264	2.81	24.58	220.83	78.292	68.567
19-Jul-94				129423877	16469	60214	59050	1165	2.59	22.65	203.52	72.154	63.191
20-Jul-94				107649349	13698	50084	49115	969	2.15	18.84	169.28	60.015	52.560
21-Jul-94				92969893	11830	43254	42418	837	1.86	16.27	146.20	51.831	45.393
22-Jul-94				79513724	10118	36994	36278	716	1.59	13.91	125.04	44.329	38.823
23-Jul-94				70950708	9028	33010	32371	639	1.42	12.42	111.57	39.555	34.642
24-Jul-94				34007408	4327	15822	15516	306	0.68	5.95	53.48	18.959	16.604
25-Jul-94				6458961	822	3005	2947	58	0.13	1.13	10.16	3.601	3.154
26-Jul-94				6605756	841	3073	3014	59	0.13	1.16	10.39	3.683	3.225
27-Jul-94				5578194	710	2595	2545	50	0.11	0.98	8.77	3.110	2.724
28-Jul-94				5578194	710	2595	2545	50	0.11	0.98	8.77	3.110	2.724
29-Jul-94				4991015	635	2322	2277	45	0.10	0.87	7.85	2.782	2.437
30-Jul-94				4477234	570	2083	2043	40	0.09	0.78	7.04	2.496	2.186
31-Jul-94				3890056	495	1810	1775	35	0.08	0.68	6.12	2.169	1.899
1-Aug-94				3890056	495	1810	1775	35	0.08	0.68	6.12	2.169	1.899
2-Aug-94				3890056	495	1810	1775	35	0.08	0.68	6.12	2.169	1.899
3-Aug-94				3669864	467	1707	1674	33	0.07	0.64	5.77	2.046	1.792
4-Aug-94				3523070	448	1639	1607	32	0.07	0.62	5.54	1.964	1.720
5-Aug-94				3302878	420	1537	1507	30	0.07	0.58	5.19	1.841	1.613
6-Aug-94				3376275	430	1571	1540	30	0.07	0.59	5.31	1.882	1.648
7-Aug-94				3302878	420	1537	1507	30	0.07	0.58	5.19	1.841	1.613
8-Aug-94				3302878	420	1537	1507	30	0.07	0.58	5.19	1.841	1.613
9-Aug-94				4036851	514	1878	1842	36	0.08	0.71	6.35	2.251	1.971
10-Aug-94				4110248	523	1912	1875	37	0.08	0.72	6.46	2.291	2.007
11-Aug-94				4110248	523	1912	1875	37	0.08	0.72	6.46	2.291	2.007
12-Aug-94				4036851	514	1878	1842	36	0.08	0.71	6.35	2.251	1.971
13-Aug-94				3963453	504	1844	1808	36	0.08	0.69	6.23	2.210	1.935
14-Aug-94				3449672	439	1605	1574	31	0.07	0.60	5.42	1.923	1.684
15-Aug-94				2862494	364	1332	1306	26	0.06	0.50	4.50	1.596	1.398
16-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-3 (SOUTH FORK SNAKE CREEK (HADRICK'S BRIDGE)), 1994

DATE	TIME	SITE	SAMP	FLOW L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
18-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
19-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
21-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
31-Aug-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
15-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
16-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
18-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-3 (SOUTH FORK SNAKE CREEK (HADRICK'S BRIDGE)), 1994

DATE	TIME	SITE	SAMP	FLOW L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
19-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
21-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Sep-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
15-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
16-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
17-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
18-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
19-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
20-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000

SAMPLE DATA FOR SITE LF-3 (SOUTH FORK SNAKE CREEK (HADRICK'S BRIDGE)), 1994

DATE	TIME	SITE	SAMP	FLOW L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
21-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
22-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
23-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
24-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
25-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
26-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
27-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
28-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
29-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
30-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
31-Oct-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
1-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
2-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
3-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
4-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
5-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
6-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
7-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
8-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
9-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
10-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
11-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
12-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
13-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
14-Nov-94				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
MINIMUM VALUE				0	0	0	0	0	0.00	0.00	0.00	0.000	0.000
MAXIMUM VALUE				2006192421	116359	454403	315975	138427	220.68	1604.95	4082.60	1095.381	771.381
MEAN VALUE				35066216	3118	10896	9660	1236	2.06	15.83	59.46	17.658	14.133
TOTAL YEARLY LOAD				8731487662	776350	2713032	2405229	307803	513.05	3941.62	14804.33	4396.830	3519.097

SAMPLE DATA FOR SITE LF-6 (LAKE FAULKTON DAM SPILLWAY (OUTLET)), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
11-Mar-94				0	0	0	0	0	0	0	0	0	0
12-Mar-94				0	0	0	0	0	0	0	0	0	0
13-Mar-94				0	0	0	0	0	0	0	0	0	0
14-Mar-94	1435	LF-6	Grab	0	0	0	0	0	0	0	0	0	0
15-Mar-94				644	1575595023	184345	150469	105565	184344.6	150469.3	33875.29	322.997	1496.815
16-Mar-94				425	1039794852	121656	99300	69666	121656	99300.41	22355.59	213.1579	987.8051
17-Mar-94	1325	LF-6	Grab	280	685041314	14386	0	39047	14385.87	0	14385.87	109.6066	479.5289
18-Mar-94				255	623876911	63947	49286	36497	63947.38	49286.28	14661.11	71.74584	405.52
19-Mar-94				140	342520657	35108	27059	20037	35108.37	27059.13	8049.235	39.38988	222.6384
20-Mar-94				52	127221958	13040	10051	7442	13040.25	10050.53	2989.716	14.63053	82.69427
21-Mar-94	1345	LF-6	Grab	46	112542502	20708	17782	6753	20707.82	17781.72	2926.105	7.877975	67.5255
22-Mar-94				32	78290436	14797	13544	5128	14796.89	13544.25	1252.647	4.305974	43.05974
23-Mar-94				21	51378099	9710	8888	3365	9710.461	8888.411	822.0496	2.825795	28.25795
24-Mar-94				19	45261658	8554	7830	2965	8554.453	7830.267	724.1865	2.489391	24.89391
25-Mar-94				23	56271251	10635	9735	3686	10635.27	9734.926	900.34	3.094919	30.94919
26-Mar-94				28	67280843	12716	11640	4407	12716.08	11639.59	1076.493	3.700446	37.00446
27-Mar-94				30	73397284	13872	12698	4808	13872.09	12697.73	1174.357	4.036851	40.36851
28-Mar-94	1220	LF-6	Grab	32	78290436	15188	14719	5559	15188.34	14718.6	469.7426	3.131617	39.14522
29-Mar-94				25	61164403	14007	13609	5260	14006.65	13609.08	397.5686	2.140754	18.34932
30-Mar-94				23	56271251	12886	12520	4839	12886.12	12520.35	365.7631	1.969494	16.88138
31-Mar-94				23	56271251	12886	12520	4839	12886.12	12520.35	365.7631	1.969494	16.88138
1-Apr-94				21	51378099	11766	11432	4419	11765.58	11431.63	333.9576	1.798233	15.41343
2-Apr-94				19	45261658	10365	10071	3893	10364.92	10070.72	294.2008	1.584158	13.5785
3-Apr-94				19	45261658	10365	10071	3893	10364.92	10070.72	294.2008	1.584158	13.5785
4-Apr-94	0	LF-6	Grab	19	45261658	11949	11632	4571	11949.08	11632.25	316.8316	1.35785	4.526166
5-Apr-94				19	45261658	11655	11406	4549	11654.88	11405.94	248.9391	1.131541	4.526166
6-Apr-94				19	45261658	11655	11406	4549	11654.88	11405.94	248.9391	1.131541	4.526166
7-Apr-94				17	41591794	10710	10481	4180	10709.89	10481.13	228.7549	1.039795	4.159179
8-Apr-94				12	28135625	7245	7090	2828	7244.924	7090.178	154.7459	0.703391	2.813563
9-Apr-94				12	28135625	7245	7090	2828	7244.924	7090.178	154.7459	0.703391	2.813563
10-Apr-94				12	28135625	7245	7090	2828	7244.924	7090.178	154.7459	0.703391	2.813563
11-Apr-94				10	24465761	6300	6165	2459	6299.934	6165.372	134.5617	0.611644	2.446576

SAMPLE DATA FOR SITE LF-6 (LAKE FAULKTON DAM SPILLWAY (OUTLET)), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
12-Apr-94	1115	LF-6	Grab	10	24465761	6141	6043	2447	6140.906	6043.043	97.86304	0.489315	2.446576
13-Apr-94				10	24465761	6312	6239	2508	6312.166	6238.769	73.39728	0.489315	2.446576
14-Apr-94				10	24465761	6312	6239	2508	6312.166	6238.769	73.39728	0.489315	2.446576
15-Apr-94				9	21040555	5428	5365	2157	5428.463	5365.341	63.12166	0.420811	2.104055
16-Apr-94				9	21040555	5428	5365	2157	5428.463	5365.341	63.12166	0.420811	2.104055
17-Apr-94				7	17860006	4608	4554	1831	4607.881	4554.301	53.58002	0.3572	1.786001
18-Apr-94	1330	LF-6	Grab	7	17860006	4733	4697	1875	4732.902	4697.181	35.72001	0.3572	1.786001
19-Apr-94				7	17860006	5099	5028	1956	5099.032	5027.592	71.44002	0.3572	1.786001
20-Apr-94				7	17860006	5099	5028	1956	5099.032	5027.592	71.44002	0.3572	1.786001
21-Apr-94				6	14924114	4261	4201	1634	4260.835	4201.138	59.69646	0.298482	1.492411
22-Apr-94				6	14924114	4261	4201	1634	4260.835	4201.138	59.69646	0.298482	1.492411
23-Apr-94				5	11988223	3423	3375	1313	3422.638	3374.685	47.95289	0.239764	1.198822
24-Apr-94				5	11988223	3423	3375	1313	3422.638	3374.685	47.95289	0.239764	1.198822
25-Apr-94				7	17860006	5099	5028	1956	5099.032	5027.592	71.44002	0.3572	1.786001
26-Apr-94	1145	LF-6	Grab	7	17860006	5465	5358	2036	5465.162	5358.002	107.16	0.3572	1.786001
27-Apr-94				9	21040555	6165	6081	2367	6164.883	6080.72	84.16222	0.420811	2.104055
28-Apr-94				9	21040555	6165	6081	2367	6164.883	6080.72	84.16222	0.420811	2.104055
29-Apr-94				10	24465761	7168	7071	2752	7168.468	7070.605	97.86304	0.489315	2.446576
30-Apr-94				10	24465761	7168	7071	2752	7168.468	7070.605	97.86304	0.489315	2.446576
1-May-94				10	24465761	7168	7071	2752	7168.468	7070.605	97.86304	0.489315	2.446576
2-May-94	1450	LF-6	Grab	12	28135625	7878	7822	3123	7877.975	7821.704	56.27125	0.562713	2.813563
3-May-94				12	28135625	8525	8300	3390	8525.095	8300.009	225.085	0.562713	2.813563
4-May-94				13	32539462	9859	9599	3921	9859.457	9599.141	260.3157	0.650789	3.253946
5-May-94				13	32539462	9859	9599	3921	9859.457	9599.141	260.3157	0.650789	3.253946
6-May-94				13	32539462	9859	9599	3921	9859.457	9599.141	260.3157	0.650789	3.253946
7-May-94				13	32539462	9859	9599	3921	9859.457	9599.141	260.3157	0.650789	3.253946
8-May-94				12	28135625	8525	8300	3390	8525.095	8300.009	225.085	0.562713	2.813563
9-May-94				7	17860006	5412	5269	2152	5411.582	5268.702	142.88	0.3572	1.786001
10-May-94				5	11988223	3632	3537	1445	3632.432	3536.526	95.90578	0.239764	1.198822
11-May-94				5	11009593	3336	3248	1327	3335.907	3247.83	88.07674	0.220192	1.100959
12-May-94				4	9786304	2965	2887	1179	2965.25	2886.96	78.29044	0.195726	0.97863
13-May-94				3	7339728	2224	2165	884	2223.938	2165.22	58.71783	0.146795	0.733973

SAMPLE DATA FOR SITE LF-6 (LAKE FAULKTON DAM SPILLWAY (OUTLET)), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
14-May-94				2	4893152	1483	1443	590	1482.625	1443.48	39.14522	0.097863	0.489315
15-May-94				1	2446576	741	722	295	741.3126	721.74	19.57261	0.048932	0.244658
16-May-94				1	2691234	815	794	324	815.4438	793.914	21.52987	0.053825	0.269123
17-May-94				1	2324247	704	686	280	704.2469	685.653	18.59398	0.046485	0.232425
18-May-94				1	1957261	593	577	236	593.0501	577.392	15.65809	0.039145	0.195726
19-May-94				1	1590274	482	469	192	481.8532	469.131	12.7222	0.031805	0.159027
20-May-94				1	1223288	371	361	147	370.6563	360.87	9.786304	0.024466	0.122329
21-May-94				0	978630	297	289	118	296.525	288.696	7.829044	0.019573	0.097863
22-May-94				0	733973	222	217	88	222.3938	216.522	5.871783	0.014679	0.073397
23-May-94				0	513781	156	152	62	155.6756	151.5654	4.110248	0.010276	0.051378
24-May-94				0	489315	148	144	59	148.2625	144.348	3.914522	0.009786	0.048932
25-May-94				0	464849	141	137	56	140.8494	137.1306	3.718796	0.009297	0.046485
26-May-94				0	440384	133	130	53	133.4363	129.9132	3.52307	0.008808	0.044038
27-May-94				0	366986	111	108	44	111.1969	108.261	2.935891	0.00734	0.036699
28-May-94				0	293589	89	87	35	88.95751	86.60879	2.348713	0.005872	0.029359
29-May-94				0	220192	67	65	27	66.71813	64.9566	1.761535	0.004404	0.022019
30-May-94				0	146795	44	43	18	44.47875	43.3044	1.174357	0.002936	0.014679
31-May-94				0	73397	22	22	9	22.23938	21.6522	0.587178	0.001468	0.00734
1-Jun-94				0	97863	30	29	12	29.6525	28.8696	0.782904	0.001957	0.009786
2-Jun-94				0	97863	30	29	12	29.6525	28.8696	0.782904	0.001957	0.009786
3-Jun-94				0	122329	37	36	15	37.06563	36.087	0.97863	0.002447	0.012233
4-Jun-94				0	122329	37	36	15	37.06563	36.087	0.97863	0.002447	0.012233
5-Jun-94				0	146795	44	43	18	44.47875	43.3044	1.174357	0.002936	0.014679
6-Jun-94				0	146795	44	43	18	44.47875	43.3044	1.174357	0.002936	0.014679
7-Jun-94				0	122329	37	36	15	37.06563	36.087	0.97863	0.002447	0.012233
8-Jun-94				0	97863	30	29	12	29.6525	28.8696	0.782904	0.001957	0.009786
9-Jun-94				0	73397	22	22	9	22.23938	21.6522	0.587178	0.001468	0.00734
10-Jun-94				0	48932	15	14	6	14.82625	14.4348	0.391452	0.000979	0.004893
11-Jun-94				0	24466	7	7	3	7.413126	7.2174	0.195726	0.000489	0.002447
12-Jun-94				0	0	0	0	0	0	0	0	0	0
13-Jun-94				0	0	0	0	0	0	0	0	0	0
14-Jun-94				0	0	0	0	0	0	0	0	0	0

SAMPLE DATA FOR SITE LF-6 (LAKE FAULKTON DAM SPILLWAY (OUTLET)), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
15-Jun-94				0	0	0	0	0	0	0	0	0	0
16-Jun-94				0	0	0	0	0	0	0	0	0	0
17-Jun-94				0	0	0	0	0	0	0	0	0	0
18-Jun-94				0	0	0	0	0	0	0	0	0	0
19-Jun-94				0	0	0	0	0	0	0	0	0	0
20-Jun-94				0	0	0	0	0	0	0	0	0	0
21-Jun-94				0	0	0	0	0	0	0	0	0	0
22-Jun-94				0	0	0	0	0	0	0	0	0	0
23-Jun-94				0	0	0	0	0	0	0	0	0	0
24-Jun-94				0	0	0	0	0	0	0	0	0	0
25-Jun-94				0	0	0	0	0	0	0	0	0	0
26-Jun-94				0	0	0	0	0	0	0	0	0	0
27-Jun-94				0	0	0	0	0	0	0	0	0	0
28-Jun-94				0	0	0	0	0	0	0	0	0	0
29-Jun-94				0	0	0	0	0	0	0	0	0	0
30-Jun-94				0	0	0	0	0	0	0	0	0	0
1-Jul-94				0	0	0	0	0	0	0	0	0	0
2-Jul-94				0	0	0	0	0	0	0	0	0	0
3-Jul-94				0	0	0	0	0	0	0	0	0	0
4-Jul-94				0	0	0	0	0	0	0	0	0	0
5-Jul-94				0	0	0	0	0	0	0	0	0	0
6-Jul-94				0	318055	96	94	38	96.37063	93.82619	2.544439	0.006361	0.031805
7-Jul-94				1	1467946	445	433	177	444.7875	433.044	11.74357	0.029359	0.146795
8-Jul-94				23	56271251	17050	16600	6781	17050.19	16600.02	450.17	1.125425	5.627125
9-Jul-94				23	56271251	17050	16600	6781	17050.19	16600.02	450.17	1.125425	5.627125
10-Jul-94				9	21040555	6375	6207	2535	6375.288	6206.964	168.3244	0.420811	2.104055
11-Jul-94	1400	LF-6	Grab	5	11988223	3908	3740	1558	3908.161	3740.326	167.8351	0.239764	1.198822
12-Jul-94				5	11988223	3770	3638	1502	3770.296	3638.426	131.8705	0.239764	1.198822
13-Jul-94				1	3547535	1116	1077	444	1115.7	1076.677	39.02289	0.070951	0.354754
14-Jul-94				1	2104055	662	639	264	661.7254	638.5808	23.14461	0.042081	0.210406
15-Jul-94				1	3547535	1116	1077	444	1115.7	1076.677	39.02289	0.070951	0.354754
16-Jul-94				13	32539462	10234	9876	4076	10233.66	9875.727	357.9341	0.650789	3.253946

SAMPLE DATA FOR SITE LF-6 (LAKE FAULKTON DAM SPILLWAY (OUTLET)), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
17-Jul-94				13	32539462	10234	9876	4076	10233.66	9875.727	357.9341	0.650789	3.253946
18-Jul-94				10	24465761	7694	7425	3064	7694.482	7425.359	269.1234	0.489315	2.446576
19-Jul-94				1	3547535	1116	1077	444	1115.7	1076.677	39.02289	0.070951	0.354754
20-Jul-94				5	11988223	3770	3638	1502	3770.296	3638.426	131.8705	0.239764	1.198822
21-Jul-94				10	24465761	7694	7425	3064	7694.482	7425.359	269.1234	0.489315	2.446576
22-Jul-94				1	3547535	1116	1077	444	1115.7	1076.677	39.02289	0.070951	0.354754
23-Jul-94				9	21040555	6617	6386	2635	6617.254	6385.808	231.4461	0.420811	2.104055
24-Jul-94				1	3547535	1116	1077	444	1115.7	1076.677	39.02289	0.070951	0.354754
25-Jul-94				13	31805490	10003	9653	3984	10002.83	9652.966	349.8604	0.63611	3.180549
26-Jul-94				5	11988223	3770	3638	1502	3770.296	3638.426	131.8705	0.239764	1.198822
27-Jul-94				1	3547535	1116	1077	444	1115.7	1076.677	39.02289	0.070951	0.354754
28-Jul-94				3	7217400	2270	2190	904	2269.872	2190.481	79.3914	0.144348	0.72174
29-Jul-94				4	9541647	3001	2896	1195	3000.848	2895.89	104.9581	0.190833	0.954165
30-Jul-94				1	2104055	662	639	264	661.7254	638.5808	23.14461	0.042081	0.210406
31-Jul-94				0	318055	100	97	40	100.0283	96.52966	3.498604	0.006361	0.031805
1-Aug-94				2	5260139	1654	1596	659	1654.314	1596.452	57.86153	0.105203	0.526014
2-Aug-94				2	5260139	1654	1596	659	1654.314	1596.452	57.86153	0.105203	0.526014
3-Aug-94				2	5260139	1654	1596	659	1654.314	1596.452	57.86153	0.105203	0.526014
4-Aug-94				3	7217400	2270	2190	904	2269.872	2190.481	79.3914	0.144348	0.72174
5-Aug-94				2	5260139	1654	1596	659	1654.314	1596.452	57.86153	0.105203	0.526014
6-Aug-94				1	3547535	1116	1077	444	1115.7	1076.677	39.02289	0.070951	0.354754
7-Aug-94				1	2104055	662	639	264	661.7254	638.5808	23.14461	0.042081	0.210406
8-Aug-94				0	318055	100	97	40	100.0283	96.52966	3.498604	0.006361	0.031805
9-Aug-94				0	1027562	323	312	129	323.1682	311.8651	11.30318	0.020551	0.102756
10-Aug-94				0	318055	100	97	40	100.0283	96.52966	3.498604	0.006361	0.031805
11-Aug-94				0	1027562	323	312	129	323.1682	311.8651	11.30318	0.020551	0.102756
12-Aug-94				0	318055	100	97	40	100.0283	96.52966	3.498604	0.006361	0.031805
13-Aug-94				0	318055	100	97	40	100.0283	96.52966	3.498604	0.006361	0.031805
14-Aug-94				0	1027562	323	312	129	323.1682	311.8651	11.30318	0.020551	0.102756
15-Aug-94				1	2104055	662	639	264	661.7254	638.5808	23.14461	0.042081	0.210406
16-Aug-94				1	3547535	1116	1077	444	1115.7	1076.677	39.02289	0.070951	0.354754
17-Aug-94				10	24465761	7694	7425	3064	7694.482	7425.359	269.1234	0.489315	2.446576

SAMPLE DATA FOR SITE LF-6 (LAKE FAULKTON DAM SPILLWAY (OUTLET)), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
18-Aug-94				10	24465761	7694	7425	3064	7694.482	7425.359	269.1234	0.489315	2.446576
19-Aug-94				1	3547535	1116	1077	444	1115.7	1076.677	39.02289	0.070951	0.354754
20-Aug-94				0	0	0	0	0	0	0	0	0	0
21-Aug-94				0	0	0	0	0	0	0	0	0	0
22-Aug-94				0	0	0	0	0	0	0	0	0	0
23-Aug-94				0	0	0	0	0	0	0	0	0	0
24-Aug-94				0	0	0	0	0	0	0	0	0	0
25-Aug-94				0	0	0	0	0	0	0	0	0	0
26-Aug-94				0	0	0	0	0	0	0	0	0	0
27-Aug-94				0	0	0	0	0	0	0	0	0	0
28-Aug-94				0	0	0	0	0	0	0	0	0	0
29-Aug-94				0	0	0	0	0	0	0	0	0	0
30-Aug-94				0	0	0	0	0	0	0	0	0	0
31-Aug-94				0	0	0	0	0	0	0	0	0	0
1-Sep-94				0	0	0	0	0	0	0	0	0	0
2-Sep-94				0	0	0	0	0	0	0	0	0	0
3-Sep-94				0	0	0	0	0	0	0	0	0	0
4-Sep-94				0	0	0	0	0	0	0	0	0	0
5-Sep-94				0	0	0	0	0	0	0	0	0	0
6-Sep-94				0	0	0	0	0	0	0	0	0	0
7-Sep-94				0	0	0	0	0	0	0	0	0	0
8-Sep-94				0	0	0	0	0	0	0	0	0	0
9-Sep-94				0	0	0	0	0	0	0	0	0	0
10-Sep-94				0	0	0	0	0	0	0	0	0	0
11-Sep-94				0	0	0	0	0	0	0	0	0	0
12-Sep-94				0	0	0	0	0	0	0	0	0	0
13-Sep-94				0	0	0	0	0	0	0	0	0	0
14-Sep-94				0	0	0	0	0	0	0	0	0	0
15-Sep-94				0	0	0	0	0	0	0	0	0	0
16-Sep-94				0	0	0	0	0	0	0	0	0	0
17-Sep-94				0	0	0	0	0	0	0	0	0	0
18-Sep-94				0	0	0	0	0	0	0	0	0	0

SAMPLE DATA FOR SITE LF-6 (LAKE FAULKTON DAM SPILLWAY (OUTLET)), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
19-Sep-94				0	0	0	0	0	0	0	0	0	0
20-Sep-94				0	0	0	0	0	0	0	0	0	0
21-Sep-94				0	0	0	0	0	0	0	0	0	0
22-Sep-94				0	0	0	0	0	0	0	0	0	0
23-Sep-94				0	0	0	0	0	0	0	0	0	0
24-Sep-94				0	0	0	0	0	0	0	0	0	0
25-Sep-94				0	0	0	0	0	0	0	0	0	0
26-Sep-94				0	0	0	0	0	0	0	0	0	0
27-Sep-94				0	0	0	0	0	0	0	0	0	0
28-Sep-94				0	0	0	0	0	0	0	0	0	0
29-Sep-94				0	0	0	0	0	0	0	0	0	0
30-Sep-94				0	0	0	0	0	0	0	0	0	0
1-Oct-94				0	0	0	0	0	0	0	0	0	0
2-Oct-94				0	0	0	0	0	0	0	0	0	0
3-Oct-94				0	0	0	0	0	0	0	0	0	0
4-Oct-94				0	0	0	0	0	0	0	0	0	0
5-Oct-94				0	0	0	0	0	0	0	0	0	0
6-Oct-94				0	0	0	0	0	0	0	0	0	0
7-Oct-94				0	0	0	0	0	0	0	0	0	0
8-Oct-94				0	0	0	0	0	0	0	0	0	0
9-Oct-94				0	0	0	0	0	0	0	0	0	0
10-Oct-94				0	0	0	0	0	0	0	0	0	0
11-Oct-94				0	0	0	0	0	0	0	0	0	0
12-Oct-94				0	0	0	0	0	0	0	0	0	0
13-Oct-94				0	0	0	0	0	0	0	0	0	0
14-Oct-94				0	0	0	0	0	0	0	0	0	0
15-Oct-94				0	0	0	0	0	0	0	0	0	0
16-Oct-94				0	0	0	0	0	0	0	0	0	0
17-Oct-94				0	0	0	0	0	0	0	0	0	0
18-Oct-94				0	0	0	0	0	0	0	0	0	0
19-Oct-94				0	0	0	0	0	0	0	0	0	0
20-Oct-94				0	0	0	0	0	0	0	0	0	0

SAMPLE DATA FOR SITE LF-6 (LAKE FAULKTON DAM SPILLWAY (OUTLET)), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
21-Oct-94				0	0	0	0	0	0	0	0	0	0
22-Oct-94				0	0	0	0	0	0	0	0	0	0
23-Oct-94				0	0	0	0	0	0	0	0	0	0
24-Oct-94				0	0	0	0	0	0	0	0	0	0
25-Oct-94				0	0	0	0	0	0	0	0	0	0
26-Oct-94				0	0	0	0	0	0	0	0	0	0
27-Oct-94				0	0	0	0	0	0	0	0	0	0
28-Oct-94				0	0	0	0	0	0	0	0	0	0
29-Oct-94				0	0	0	0	0	0	0	0	0	0
30-Oct-94				0	0	0	0	0	0	0	0	0	0
31-Oct-94				0	0	0	0	0	0	0	0	0	0
1-Nov-94				0	0	0	0	0	0	0	0	0	0
2-Nov-94				0	0	0	0	0	0	0	0	0	0
3-Nov-94				0	0	0	0	0	0	0	0	0	0
4-Nov-94				0	0	0	0	0	0	0	0	0	0
5-Nov-94				0	0	0	0	0	0	0	0	0	0
6-Nov-94				0	0	0	0	0	0	0	0	0	0
7-Nov-94				0	0	0	0	0	0	0	0	0	0
8-Nov-94				0	0	0	0	0	0	0	0	0	0
9-Nov-94				0	0	0	0	0	0	0	0	0	0
10-Nov-94				0	0	0	0	0	0	0	0	0	0
11-Nov-94				0	0	0	0	0	0	0	0	0	0
12-Nov-94				0	0	0	0	0	0	0	0	0	0
13-Nov-94				0	0	0	0	0	0	0	0	0	0
14-Nov-94				0	0	0	0	0	0	0	0	0	0
MINIMUM VALUE				0	0	0	0	0	0	0	0	0	0
MAXIMUM VALUE				644	1575595023	184345	150469.32	105565	184344.6	150469.3	33875.29	322.997	1496.815
MEAN VALUE				11	27049012	4157.33	3683.3474	2045	4157.327	3683.347	473.9797	3.393378	16.9766
TOTAL YEARLY LOAD				2753	6735203875	1035174	917153.5	509146	1035174	917153.5	118020.9	844.9512	4227.172

SAMPLE DATA FOR SITE LF-8 (SOUTH FORK SNAKE CREEK (VOGELER'S DAM), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
25-Jul-94				4208111	608	1384	1161	223	0.13	0.42	5.87	2.702	2.988
26-Jul-94	1030	LF-8	Grab	3816659	572	1385	1210	176	0.15	0.38	5.80	3.717	4.771
27-Jul-94				5284604	917	1969	1805	164	0.24	0.53	8.69	4.465	8.746
28-Jul-94				4991015	866	1859	1704	155	0.22	0.50	8.21	4.217	8.260
29-Jul-94				4403837	764	1640	1504	137	0.20	0.44	7.24	3.721	7.288
30-Jul-94				3816659	662	1422	1303	118	0.17	0.38	6.28	3.225	6.317
31-Jul-94				4403837	764	1640	1504	137	0.20	0.44	7.24	3.721	7.288
1-Aug-94				4403837	764	1640	1504	137	0.20	0.44	7.24	3.721	7.288
2-Aug-94				4991015	866	1859	1704	155	0.22	0.50	8.21	4.217	8.260
3-Aug-94				3816659	662	1422	1303	118	0.17	0.38	6.28	3.225	6.317
4-Aug-94				3620933	628	1349	1237	112	0.16	0.36	5.96	3.060	5.993
5-Aug-94				5284604	917	1969	1805	164	0.24	0.53	8.69	4.465	8.746
6-Aug-94				4403837	764	1640	1504	137	0.20	0.44	7.24	3.721	7.288
7-Aug-94				4403837	764	1640	1504	137	0.20	0.44	7.24	3.721	7.288
8-Aug-94				5578194	968	2078	1905	173	0.25	0.56	9.18	4.714	9.232
9-Aug-94				7339728	1273	2734	2507	228	0.33	0.73	12.07	6.202	12.147
10-Aug-94				3620933	628	1349	1237	112	0.16	0.36	5.96	3.060	5.993
11-Aug-94				22019185	3820	8202	7520	683	0.99	2.20	36.22	18.606	36.442
12-Aug-94				4697426	815	1750	1604	146	0.21	0.47	7.73	3.969	7.774
13-Aug-94				4403837	764	1640	1504	137	0.20	0.44	7.24	3.721	7.288
14-Aug-94				4403837	764	1640	1504	137	0.20	0.44	7.24	3.721	7.288
15-Aug-94				4208111	730	1568	1437	130	0.19	0.42	6.92	3.556	6.964
16-Aug-94				4991015	866	1859	1704	155	0.22	0.50	8.21	4.217	8.260
17-Aug-94				4697426	815	1750	1604	146	0.21	0.47	7.73	3.969	7.774
18-Aug-94				4697426	815	1750	1604	146	0.21	0.47	7.73	3.969	7.774
19-Aug-94				4697426	815	1750	1604	146	0.21	0.47	7.73	3.969	7.774
20-Aug-94				4697426	815	1750	1604	146	0.21	0.47	7.73	3.969	7.774
21-Aug-94				4697426	815	1750	1604	146	0.21	0.47	7.73	3.969	7.774
22-Aug-94				4991015	866	1859	1704	155	0.22	0.50	8.21	4.217	8.260
23-Aug-94				4697426	815	1750	1604	146	0.21	0.47	7.73	3.969	7.774
24-Aug-94				4208111	730	1568	1437	130	0.19	0.42	6.92	3.556	6.964
25-Aug-94				4208111	730	1568	1437	130	0.19	0.42	6.92	3.556	6.964

SAMPLE DATA FOR SITE LF-8 (SOUTH FORK SNAKE CREEK (VOGELER'S DAM), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
26-Aug-94				3425207	594	1276	1170	106	0.15	0.34	5.63	2.894	5.669
27-Aug-94				4403837	764	1640	1504	137	0.20	0.44	7.24	3.721	7.288
28-Aug-94				4403837	764	1640	1504	137	0.20	0.44	7.24	3.721	7.288
29-Aug-94	1425	LF-8	Grab	4403837	868	1682	1612	70	0.22	0.44	7.79	3.153	9.072
30-Aug-94				5284604	917	1969	1805	164	0.24	0.53	8.69	4.465	8.746
31-Aug-94				4208111	730	1568	1437	130	0.19	0.42	6.92	3.556	6.964
1-Sep-94				3816659	662	1422	1303	118	0.17	0.38	6.28	3.225	6.317
2-Sep-94				4208111	730	1568	1437	130	0.19	0.42	6.92	3.556	6.964
3-Sep-94				3620933	628	1349	1237	112	0.16	0.36	5.96	3.060	5.993
4-Sep-94				3816659	662	1422	1303	118	0.17	0.38	6.28	3.225	6.317
5-Sep-94				3229480	560	1203	1103	100	0.15	0.32	5.31	2.729	5.345
6-Sep-94				2642302	458	984	902	82	0.12	0.26	4.35	2.233	4.373
7-Sep-94				2446576	424	911	836	76	0.11	0.24	4.02	2.067	4.049
8-Sep-94				3033754	526	1130	1036	94	0.14	0.30	4.99	2.564	5.021
9-Sep-94				2838028	492	1057	969	88	0.13	0.28	4.67	2.398	4.697
10-Sep-94				5871783	1019	2187	2005	182	0.26	0.59	9.66	4.962	9.718
11-Sep-94				2446576	424	911	836	76	0.11	0.24	4.02	2.067	4.049
12-Sep-94				2642302	458	984	902	82	0.12	0.26	4.35	2.233	4.373
13-Sep-94				2324247	403	866	794	72	0.10	0.23	3.82	1.964	3.847
14-Sep-94				2642302	458	984	902	82	0.12	0.26	4.35	2.233	4.373
15-Sep-94				4403837	764	1640	1504	137	0.20	0.44	7.24	3.721	7.288
16-Sep-94				3816659	662	1422	1303	118	0.17	0.38	6.28	3.225	6.317
17-Sep-94				3816659	662	1422	1303	118	0.17	0.38	6.28	3.225	6.317
18-Sep-94				2642302	458	984	902	82	0.12	0.26	4.35	2.233	4.373
19-Sep-94				3033754	526	1130	1036	94	0.14	0.30	4.99	2.564	5.021
20-Sep-94				3425207	594	1276	1170	106	0.15	0.34	5.63	2.894	5.669
21-Sep-94				3033754	526	1130	1036	94	0.14	0.30	4.99	2.564	5.021
22-Sep-94				3425207	594	1276	1170	106	0.15	0.34	5.63	2.894	5.669
23-Sep-94				3033754	526	1130	1036	94	0.14	0.30	4.99	2.564	5.021
24-Sep-94				3425207	594	1276	1170	106	0.15	0.34	5.63	2.894	5.669
25-Sep-94				3620933	628	1349	1237	112	0.16	0.36	5.96	3.060	5.993
26-Sep-94				3229480	560	1203	1103	100	0.15	0.32	5.31	2.729	5.345

SAMPLE DATA FOR SITE LF-8 (SOUTH FORK SNAKE CREEK (VOGELER'S DAM), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
27-Sep-94				3425207	594	1276	1170	106	0.15	0.34	5.63	2.894	5.669
28-Sep-94				5578194	968	2078	1905	173	0.25	0.56	9.18	4.714	9.232
29-Sep-94				4991015	866	1859	1704	155	0.22	0.50	8.21	4.217	8.260
30-Sep-94				3620933	628	1349	1237	112	0.16	0.36	5.96	3.060	5.993
1-Oct-94				3229480	560	1203	1103	100	0.15	0.32	5.31	2.729	5.345
2-Oct-94				6165372	1142	2326	2181	145	0.29	0.62	10.53	4.812	11.452
3-Oct-94				4403837	816	1661	1558	103	0.21	0.44	7.52	3.437	8.180
4-Oct-94				5871783	1088	2215	2077	138	0.28	0.59	10.03	4.583	10.907
5-Oct-94				2838028	526	1071	1004	67	0.13	0.28	4.85	2.215	5.272
6-Oct-94				3425207	635	1292	1212	80	0.16	0.34	5.85	2.673	6.362
7-Oct-94				3033754	562	1144	1073	71	0.14	0.30	5.18	2.368	5.635
8-Oct-94				3033754	562	1144	1073	71	0.14	0.30	5.18	2.368	5.635
9-Oct-94				3033754	562	1144	1073	71	0.14	0.30	5.18	2.368	5.635
10-Oct-94				3033754	562	1144	1073	71	0.14	0.30	5.18	2.368	5.635
11-Oct-94				2642302	489	997	935	62	0.13	0.26	4.51	2.062	4.908
12-Oct-94				6458961	1197	2437	2285	152	0.31	0.65	11.03	5.041	11.998
13-Oct-94				3620933	671	1366	1281	85	0.17	0.36	6.18	2.826	6.726
14-Oct-94				2838028	526	1071	1004	67	0.13	0.28	4.85	2.215	5.272
15-Oct-94				2838028	526	1071	1004	67	0.13	0.28	4.85	2.215	5.272
16-Oct-94				5284604	979	1994	1869	124	0.25	0.53	9.02	4.125	9.816
17-Oct-94				4991015	925	1883	1766	117	0.24	0.50	8.52	3.895	9.271
18-Oct-94				4208111	780	1588	1489	99	0.20	0.42	7.19	3.284	7.817
19-Oct-94				4208111	780	1588	1489	99	0.20	0.42	7.19	3.284	7.817
20-Oct-94				5871783	1088	2215	2077	138	0.28	0.59	10.03	4.583	10.907
21-Oct-94				3816659	707	1440	1350	90	0.18	0.38	6.52	2.979	7.089
22-Oct-94				2446576	453	923	865	57	0.12	0.24	4.18	1.910	4.545
23-Oct-94				2201919	408	831	779	52	0.10	0.22	3.76	1.719	4.090
24-Oct-94				1834932	340	692	649	43	0.09	0.18	3.13	1.432	3.408
25-Oct-94				1957261	363	738	692	46	0.09	0.20	3.34	1.528	3.636
26-Oct-94				8367290	1550	3157	2960	197	0.40	0.84	14.29	6.531	15.542
27-Oct-94				4012385	743	1514	1419	94	0.19	0.40	6.85	3.132	7.453
28-Oct-94				3033754	562	1144	1073	71	0.14	0.30	5.18	2.368	5.635

SAMPLE DATA FOR SITE LF-8 (SOUTH FORK SNAKE CREEK (VOGELER'S DAM), 1994

DATE	TIME	SITE	SAMP	FLOWS L/DAY	TALK KG/DAY	TSOL KG/DAY	TDSOL KG/DAY	TSSOL KG/DAY	AMMONIA KG/DAY	NO3+2 KG/DAY	TKN-N KG/DAY	TPO4 KG/DAY	TDPO4 KG/DAY
29-Oct-94				3033754	562	1144	1073	71	0.14	0.30	5.18	2.368	5.635
30-Oct-94				2838028	526	1071	1004	67	0.13	0.28	4.85	2.215	5.272
31-Oct-94				2838028	526	1071	1004	67	0.13	0.28	4.85	2.215	5.272
1-Nov-94				2642302	489	997	935	62	0.13	0.26	4.51	2.062	4.908
2-Nov-94				2838028	526	1071	1004	67	0.13	0.28	4.85	2.215	5.272
3-Nov-94				3033754	562	1144	1073	71	0.14	0.30	5.18	2.368	5.635
4-Nov-94				3033754	562	1144	1073	71	0.14	0.30	5.18	2.368	5.635
5-Nov-94				3033754	562	1144	1073	71	0.14	0.30	5.18	2.368	5.635
6-Nov-94				3229480	598	1218	1142	76	0.15	0.32	5.51	2.521	5.999
7-Nov-94				2642302	489	997	935	62	0.13	0.26	4.51	2.062	4.908
8-Nov-94				3033754	562	1144	1073	71	0.14	0.30	5.18	2.368	5.635
9-Nov-94				3425207	635	1292	1212	80	0.16	0.34	5.85	2.673	6.362
10-Nov-94				3229480	598	1218	1142	76	0.15	0.32	5.51	2.521	5.999
11-Nov-94				2838028	526	1071	1004	67	0.13	0.28	4.85	2.215	5.272
12-Nov-94				2642302	489	997	935	62	0.13	0.26	4.51	2.062	4.908
13-Nov-94				2324247	431	877	822	55	0.11	0.23	3.97	1.814	4.317
14-Nov-94				1834932	340	692	649	43	0.09	0.18	3.13	1.432	3.408
MINIMUM VALUE				1834932	340	692	649	43	0.09	0.18	3.13	1.432	2.988
MAXIMUM VALUE				22019185	3820	8202	7520	683	0.99	2.20	36.22	18.606	36.442
MEAN VALUE				4001126	709	1495	1381	115	0.18	0.40	6.66	3.285	6.865
TOTAL YEARLY LOAD				452127268	80145	168971	156026	12945	20.67	45.21	752.39	371.187	775.709

APPENDIX C.

IN-LAKE WATER QUALITY DATA SUMMARY

In-Lake Water Quality Data Summary

LAKE FAULKTON IN-LAKE SAMPLE DATA, 1993-1995
SITE LF-4, WEST OF LARGE PENINSULA, SURFACE

line 100

DATE	TIME	SITE	SAMP	WTEMP SURF C	ATEMP	SDISK meters	DISOX SURF mg/L	DISOX BOTT mg/L	FIELD pH units	FECAL COLIFORM per 100 mL	TALK mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMONIA mg/L	NO3+2 mg/L	TKN-N mg/L	TPO4 mg/L	TDPO4 mg/L
9/9/93	1200	LF-4	GRAB	18.5	20.0	1.1	7.9	7.4	7.70	10	152	313	297	16	0.02	0.10	1.53	0.820	0.780
10/13/93	1215	LF-4	GRAB	11.0	14.0	1.5	9.3	5.6	8.20	10	156	306	305	1	0.02	0.10	1.29	0.681	0.624
12/20/93	1215	LF-4	GRAB	0.1	-3.0	1.3	12.6	3.0	8.95	10	164	293	290	3	0.02	0.10	1.59	0.554	0.498
1/24/94	1140	LF-4	GRAB	0.1	-3.0	1.8	5.8	3.8	8.05	10	194	350	348	2	0.17	0.10	1.53	0.641	0.533
2/22/94	1015	LF-4	GRAB	0.1	-15.0	2.8	3.4	1.1	8.35	10	192	353	350	3	0.30	0.10	1.75	0.666	0.749
4/5/94	1330	LF-4	GRAB	5.0	8.0	0.8	13.6	10.6	8.10	10	99	259	250	9	0.02	0.10	1.47	0.400	0.673
5/23/94	1425	LF-4	GRAB	24.5	29.0	1.7	7.4	4.8	8.05	10	135	334	330	4	0.02	0.10	1.07	0.333	1.440
6/13/94	1200	LF-4	GRAB	22.5	26.0	1.4	7.6	2.4	8.15	10	139	357	355	2	0.02	0.10	1.07	0.533	0.952
7/12/94	1050	LF-4	GRAB	23.0	25.0	0.7	11.2	2.7	8.95	10	123	299	287	12	0.02	0.10	2.22	0.691	0.882
8/29/94	1300	LF-4	GRAB	23.5	23.5	0.7	10.6	0.2	8.80	10	150	362	334	28	0.02	0.10	2.53	0.733	0.902
9/20/94	1130	LF-4	GRAB	19.5	22.0	0.7	8.6	0.1	8.25	10	144	344	334	10	0.02	0.10	1.46	0.696	1.350
10/11/94	1200	LF-4	GRAB	12.5	15.0	0.8	9.8	9.6	8.15	10	158	359	347	12	0.02	0.10	2.10	0.718	1.280
11/15/94	1200	LF-4	GRAB	5.5	9.0	0.8	11.2	10.5	8.15	10	156	364	355	9	0.02	0.10	1.82	0.609	1.100
12/19/94	1200	LF-4	GRAB	0.0	-6.5	1.1	11.4	4.8	7.95	10	169	408	401	7	0.10	0.10	2.05	0.566	0.841
1/23/95	1050	LF-4	GRAB	1.0	-12.2	1.2	6.8	0.9	7.90	10	171	345	343	2	0.41	0.10	2.34	0.728	0.882
2/21/95	935	LF-4	GRAB	1.0	10.0	1.2	7.8	1.7	7.90	10	171	345	340	5	0.41	0.10	2.34	0.728	0.882
4/25/95	1200	LF-4	GRAB	10.0	15.0	0.4	10.2	9.8	8.10	10	73	249	217	32	0.02	0.20	0.48	0.287	0.157
8/22/95	1400	LF-4	GRAB	25.0	29.0	1.0	9.3	0.2	8.55	10	190	408	397	11	0.02	0.10	2.07	0.923	0.785
MINIMUM				0.0	-15.0	0.4	3.4	0.1	7.70	10	73	249	217	1	0.02	0.10	0.48	0.287	0.157
MAXIMUM				25.0	29.0	2.8	13.6	10.6	8.95	10	194	408	401	32	0.41	0.20	2.53	0.923	1.440
MEAN				11.0	10.3	1.2	9.1	4.3	8.28	10	150	338	328	10	0.11	0.11	1.72	0.612	0.861

LAKE FAULKTON IN-LAKE SAMPLE DATA, 1993-1995
SITE LF-5, SOUTH OF LARGE ISLAND

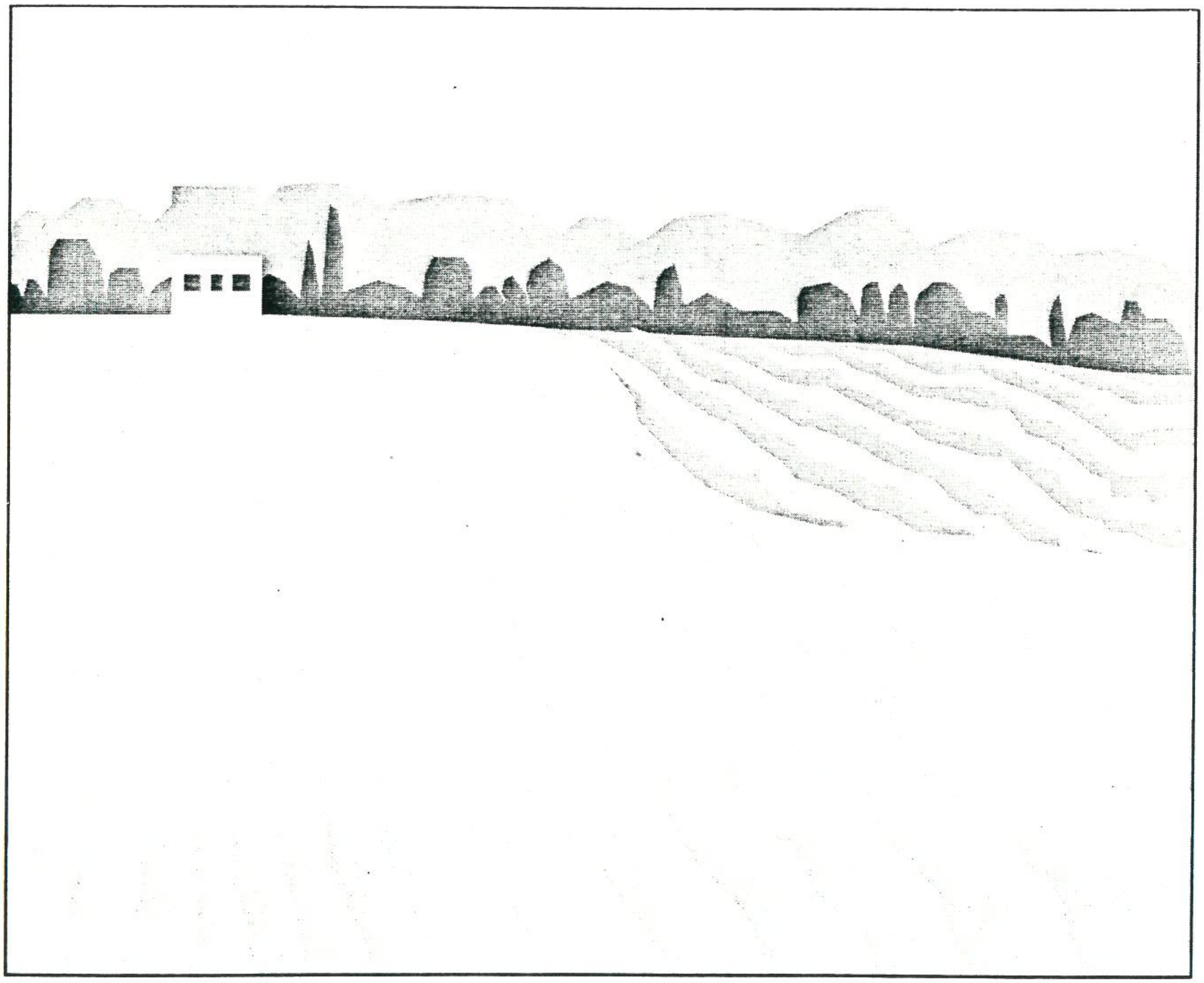
DATE	TIME	SITE	SAMP	WTEMP SURF C	ATEMP C	SDISK meters	DISOX SURF mg/L	DISOX BOTT mg/L	FpH units	FECAL COLIFORM per 100 mL	TALK mg/L	TSOL mg/L	TDSOL mg/L	TSSOL mg/L	AMMONIA mg/L	NO3+2 mg/L	TKN-N mg/L	TPO4 mg/L	TDPO4 mg/L
9/9/93	1230	LF-5	GRAB	18.4	20.0	0.9	7.4	7.0	7.70	10	156	313	302	11	0.02	0.10	1.38	0.837	0.750
10/13/93	1245	LF-5	GRAB	10.8	14.8	1.6	9.2	7.0	8.20	10	154	314	311	3	0.02	0.40	1.11	0.664	0.647
12/20/93	1315	LF-5	GRAB	0.0	-4.0	2.7	10.0	0.6	8.85	10	167	277	275	2	0.07	0.10	1.36	0.531	0.505
1/24/94	1306	LF-5	GRAB	0.0	-1.0	2.5	4.0	1.4	8.05	10	193	350	348	2	0.25	0.10	1.53	0.526	0.493
2/22/94	1055	LF-5	GRAB	0.0	5.0	3.5	3.2	1.0	8.15	10	192	359	357	2	0.32	0.10	1.70	0.658	0.658
4/5/94	1430	LF-5	GRAB	1.5	8.0	1.2	10.4	8.2	8.05	10	95	231	221	10	0.02	0.20	1.47	0.483	0.440
5/23/94	1515	LF-5	GRAB	24.0	29.0	1.8	7.4	2.8	8.15	10	129	320	317	3	0.02	0.10		0.340	0.323
6/13/94	1235	LF-5	GRAB	22.0	25.0	1.4	8.6	2.6	8.25	10	136	364	355	9	0.02	0.10	1.17	0.549	0.483
7/12/94	1135	LF-5	GRAB	22.5	25.0	1.2	10.2	1.8	8.65	20	128	304	295	9	0.02	0.10	1.62	0.599	0.974
8/29/94	1340	LF-5	GRAB	23.5	26.0	0.5	9.2	0.2	7.85	10	146	359	331	28	0.02	0.10	2.50	0.766	1.080
9/20/94	1230	LF-5	GRAB	21.0	24.0	0.5	14.6	0.1	8.95	10	143	359	333	26	0.02	0.10	3.12	0.796	1.660
10/11/94	1215	LF-5	GRAB	12.5	15.0	3.1	8.8	6.8	8.10	10	155	356	336	10	0.02	0.10	1.89	0.699	1.340
11/15/94	1300	LF-5	GRAB	5.5	9.0	0.9	11.0	10.4	8.30	10	153	354	347	7	0.02	0.10	1.78	0.599	0.816
12/19/94	1245	LF-5	GRAB	0.0	-8.0	0.9	11.6		8.00	10	170	418	406	12	0.09	0.10	2.10	0.599	1.030
1/23/95	1130	LF-5	GRAB	1.0	-12.2	0.5			8.45	10	182	405	390	15	0.04	0.10	3.51	0.961	1.050
2/21/95	1005	LF-5	GRAB	2.0	10.0	0.8	11.0		8.05	10	80	149	143	6	0.40	0.40	1.66	0.443	0.640
4/25/95	1300	LF-5	GRAB	9.5	11.5	0.3	10.1		8.10	70	73	261	233	28	0.03	0.30	0.46	0.303	0.161
8/22/95	800	LF-5	GRAB	25.0	30.0	1.1	9.2		8.55	10	188	414	403	11	0.02	0.10	1.91	0.898	0.796
MINIMUM				0.0	-12.2	0.3	3.2	0.1	7.70	10	73	149	143	2	0.02	0.10	0.46	0.303	0.161
MAXIMUM				25.0	30.0	3.5	14.6	10.4	8.95	70	193	418	406	28	0.40	0.40	3.51	0.961	1.660
MEAN				10.8	11.7	1.5	9.2	3.6	8.29	17	144	325	313	12	0.10	0.15	1.87	0.612	0.793

APPENDIX D.

AGRICULTURAL NONPOINT SOURCE (AGNPS) RUNOFF MODEL

FINAL REPORT ON THE

AGRICULTURAL NONPOINT SOURCE (AGNPS) ANALYSIS OF THE LAKE FAULKTON WATERSHED FAULK COUNTY, SOUTH DAKOTA



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

AUGUST 1996

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LAKE FAULKTON WATERSHED AGNPS ANALYSIS

Due to the lack of water quality data, a computer model was selected in order to assess the Nonpoint Source (NPS) loadings throughout the Lake Faulkton watershed. The model which was selected was the Agricultural Nonpoint Source Pollution Model (AGNPS) (version 5.00). 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.

The size of the Lake Faulkton watershed and area modeled was 161,320 acres. Initially, the watershed was divided into cells each of which had an area of 40 acres with dimensions of 1320 feet by 1320 feet. The fluid flow directions were than determined (map #1, page 43). Based upon the fluid flow directions and drainage patterns, 10 subwatersheds were identified (map #2, page 44). The AGNPS analysis of the Lake Faulkton watershed consisted of calculation of NPS yields for each cell and subwatershed, impact and ranking of each animal feeding area, and estimated hydrology runoff volumes for each storm event modeled. The amount of sediment and nutrients delivered to Lake Faulkton and the amount deposited and transported out of the lake were also calculated. However, the calculated amounts of sediment and nutrients deposited in Lake Faulkton may be in error because the model does not account for retention time and the lake storage capacity.

AGNPS GOALS

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

1.) Evaluate and quantify NPS yields from each cell and subwatershed and their net loading to Lake Faulkton;
2.) Define critical cells within each subwatershed (elevated sediment, nitrogen, phosphorous); and
3.) Priority rank each concentrated feeding area and quantify the nutrient loadings from each feeding area.

The following is a brief overview of each objective.

OBJECTIVE 1 - EVALUATE AND QUANTIFY SUBWATERSHED NPS LOADINGS

DELINEATION AND LOCATION OF SUBWATERSHEDS

Based upon the fluid flow directions and drainage patterns, 10 subwatersheds were identified.

	SUBWATERSHED	DRAINAGE AREA	OUTLET CELL #	DESCRIPTION
	1	18680	1308	Inlet to Ford Lake
	2	158240	1914	Inlet to Lake Faulkton
	3	63000	1989	Northern watershed (Inc. Ford)
	4	2840	2004	South trib. to Lake Faulkton
	5	12960	2069	Southern watershed
	6	3520	2158	Southern watershed
	7	800	2163	Southern watershed
	8	17840	2164	Southern watershed
	9	26200	2215	Inlet to Latham Lake
	10	18080	2391	Southwest watershed
	-------	-----------	---------	
TOTAL	10	161320	1828	

LAKE FAULKTON SUBWATERSHED PER ACRE LOADING

SUBWATERSHED	DRAINAGE AREA (ACRES)	♣ SEDIMENT TON/AC/EVT. (ANN.+1 YR.)	SEDIMENT TON/AC/EVT. (25YR..EVT)	TOTAL NITRO. TON/AC/EVT. (ANN.+1 YR.)	TOTAL NITRO. TON/AC/EVT. (25YR. EVT)	TOTAL PHOS. TON/AC/EVT. (ANN.+1 YR.)	TOTAL PHOS. TON/AC/EVT. (25YR. EVT)
1 (#1308) (Loading to Ford Lake)	18680	.059 (.041+.018)	.08	**.00118** (.00087+.00031)	**.0007**	**.00026** (.000180+ .000080)	**.00018**
1 (#1452) (Outflow of Ford Lake)	25280	.027 (.020+.007)	.03	.00108 (.00080+.00028)	.0006	.00027 (.000210+ .000055)	.00013
2 (#1914) (Loading to Lake Faulkton)	158240	.009 (.005+.004)	.02	.00037 (.00026+.00011)	.0003	.00011 (.00008+ .000025)	.00007
2 (#1828) (Outflow of Lake Faulkton)	161320	.003 (.002+.001)	.01	.00035 (.00025+.00010)	.0002	.00009 (.00007+ .00002)	.00005
3 (#1989) (Northern watershed - Inc.Ford)	63000	.033 (.022+.011)	.04	.00059 (.00042+.00017)	.0004	.00019 (.000140+ .00005)	.00011
4 (#2004) (South Trib. to Lake Faulkton)	2840	**.071** (.045+.026)	**.12**	**.00120** (.00087+.00033)	**.0009**	**.00032** (.00023+ .00009)	**.00024**
5 (#2069) (Southern watershed)	12960	.151 (.110+.041) (gully.084+.028)	.13 (.07 gully)	**.00095** (.00071+.00024)	**.0006**	**.00038** (.00029+ .00009)	**.00020**
6 (#2158) (Southern watershed)	3520	.037 (.022+.015)	.05	.00046 (.00031+.00015)	.0004	.00009 (.00005+ .00004)	.00011
7 (#2163) (Southern watershed)	800	.016 (.008+.008)	.04	.00013 (.00006+.00007)	.0003	.00005 (.00003+ .00002)	.00008
8 (#2164) (Southern watershed)	17840	.032 (.020+.012)	.05	.00042 (.00029+.00013)	.0004	.00014 (.000095+ .000040)	.00011
9 (#2215) (Loading to Latham Lake)	26200	**.069** (.051+.018)	**.08**	**.00098** (.00072+.00026)	**.0006**	**.00029** (.00022+ .00007)	**.00016**
9 (#2216) (Outflow of Latham Lake)	26320	.017 (.010+.007)	.04	.00079 (.00057+.00022)	.0005	.00015 (.00010+ .00005)	.00012
10 (#2391) (Southwest watershed)	18080	.046 (.031+.015)	.06	.00055 (.00039+.00016)	.0004	.00015 (.00010+ .00005)	.00011
MEAN		.057	.07	.00072	.00052	.00020	.00014
MEDIAN		.046	.06	.00059	.00040	.00019	.00011
♥STDS		.040	.03	.00037	.00019	.00011	.00005
MEAN + 1 STDS (σ)		.097	.10	.00109	.00071	.00031	.00019
♠EXP.CRIT. RANGE		.10 ⇒ .20	.20 ⇒ .89	.002 ⇒ .003	.001 ⇒ .003	.0005 ⇒ .0008	.0004 ⇒ .0012

♣- Annual loadings were estimated by calculating the NPS loadings for the cumulation of rainfall events during a normal year. These include a 1 year 24 hour event of 1.9" (E.I. = 19.6), 2 six month rainfall events of 1.4" (E.I. = 10.0) and a series of 9 small rainfall events of .9" (E.I. = 3.9) for a total "R" factor of 74.7. Rainfall events of less than .9" were modeled and found to produce insignificant amounts of sediment and nutrient yields.

♥ - 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. The "critical range" was developed based on estimated NPS loadings utilizing the AGNPS model from six watersheds found in Eastern South Dakota.

LAKE FAULKTON SUBWATERSHED TOTAL LOADING

SUBWATERSHED	DRAINAGE AREA (ACRES)	♣ SEDIMENT TON/YR. (ANN.+ 1 YR.)	SEDIMENT TON/YR. (25YR. .EVT)	TOTAL NITRO. TON/YR. (ANN.+ 1 YR.)	TOTAL NITRO. TON/YR. (25YR. EVT)	TOTAL PHOS. TON/YR. (ANN.+ 1 YR.)	TOTAL PHOS. TON/YR. (25YR. EVT)
1 (#1308) (Loading to Ford Lake)	18680	1106 (768,338)	1441	21.8 (16.1,5.7)	13.2	4.9 (3.4,1.5)	3.3
1 (#1452) (Outflow of Ford Lake)	25280	678 (493,185)	725	27.3 (20.2,7.1)	15.6	6.6 (5.2,1.4)	3.3
2 (#1914) (Loading to Lake Faulkton)	158240	1331 (720,611)	3429	57.8 (40.4,17.4)	45.1	15.8 (11.8,4.0)	11.1
2 (#1828) (Outflow of Lake Faulkton)	161320	493 (266,227)	1462	54.8 (39.5,15.3)	39.5	13.7 (10.5,3.2)	8.1
3 (#1989) (Northern watershed Inc. Ford)	63000	2118 (1447,671)	2595	36.6 (26.2,10.4)	24.9	11.7 (8.9,2.8)	6.6
4 (#2004) (South Trib. to Lake Faulkton)	2840	203 (129,74)	329	3.4 (2.5,.9)	2.5	1.0 (.7,.3)	.7
5 (#2069) (Southern watershed)	12960	1947 (1420,527) (gully 1092,363)	1743 (960 gully)	12.1 (9.1,3.0)	7.4	4.8 (3.7,1.1)	2.6
6 (#2158) (Southern watershed)	3520	128 (77,51)	183	1.6 (1.1,.5)	1.3	.4 (.3,.1)	.4
7 (#2163) (Southern watershed)	800	13 (6.5,6.5)	33	2.0 (1.4,.6)	.2	.1 (.08,.02)	.1
8 (#2164) (Southern watershed)	17840	586 (372,214)	946	7.4 (5.1,2.3)	6.5	2.4 (1.7,.7)	1.9
9 (#2215) (Loading to Latham Lake)	26200	1806 (1332,484)	1991	25.4 (18.7,6.7)	15.1	7.3 (5.6,1.7)	4.1
9 (#2216) (Outflow of Latham Lake)	26320	435 (157,178)	959	20.7 (14.9,5.8)	12.9	3.8 (2.5,1.3)	3.0
10 (#2391) (Southwest watershed)	18080	846 (572,274)	1030	9.7 (6.9,2.8)	7.2	2.5 (1.7,.8)	2.0
NPS Loads deposited in Lake Faulkton		1041 (583+458)	2296	6.4 (3.4+3.0	8.1	3.1 (1.1+2.0)	3.7
Trapping Efficiency		67.9% (68.7%,66.8%)	61.1%	10.4% (7.9%,16.4%)	17.0%	18.4% (16.0%,25.6%)	31.3%

♣- Annual loadings were estimated by calculating the NPS loadings for the cumulation of rainfall events during a normal year. These include a 1 year 24 hour event of 1.9" (E.I. = 19.6), 2 six month rainfall events of 1.4" (E.I. = 10.0) and a series of 9 small rainfall events of .9" (E.I. = 3.9) for a total "R" factor of 74.7. Rainfall events of less than .9" were modeled and found to produce insignificant amounts of sediment and nutrient yields.

♥ - 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. The "critical range" was developed based on estimated NPS loadings utilizing the AGNPS model from six watersheds found in Eastern South Dakota.

SEDIMENT YIELDS

The AGNPS data indicates that the Lake Faulkton watershed has below normal sediment yields. The model also indicated that there was very little variation of sediment yields between subwatersheds ($<1\sigma$). The average sediment deliverability rate to Lake Faulkton was found to be .02 tons/ event/ acre during a 25 year 24 year storm event. The average annual sediment deliverability rate to Lake Faulkton was estimated to be .009 tons/ year/ acre. These values are approximately one tenth the expected critical value. The AGNPS analysis did indicate that there were two (2) subwatersheds contributing above normal sediment yields (#2004, #2215). Subwatershed #2215 had 42% of the critical erosions cells even though it comprised only 16% of the total watershed area. Overall, the cell sediment yields and subwatershed sediment deliverability rates are very low. These two factors resulted in low sediment yields to Lake Faulkton (1534 tons/ $yr._{annual}$, 3758 tons/ $event_{25\ year\ event}$). Any future efforts to reduce erosion rates should be targeted to the critical cells identified on pages 5 and 6. Cell #2069 was found to be a source of very high gully erosion (1455 tons/ $yr._{annual}$, 960 tons/ $event_{25\ year\ event}$). This cell contains and impoundment with a 30 inch culvert. It is recommended that this structure be evaluated to determine the extent of this apparent problem and if a solution is needed.

NITROGEN YIELDS

The AGNPS data indicates that the Lake Faulkton watershed has below normal nitrogen yields. The model also indicated that there was very little variation of nutrient yields between subwatersheds ($<1\sigma$). The average nitrogen deliverability rate to Lake Faulkton was found to be .00037 tons/ event/ acre during a 25 year 24 year storm event. The average annual nitrogen deliverability rate to Lake Faulkton was estimated to be .00030 tons/ year/ acre. These values are approximately one third the expected critical value. The AGNPS analysis did indicate that there were four (4) subwatersheds contributing above normal nitrogen yields (#1308, #2004, #2069, #2215). The suspected source of the elevated nitrogen concentrations are from animal feeding areas.

PHOSPHOROUS YIELDS

The AGNPS data indicates that the Lake Faulkton watershed has below normal phosphorous yields. The model also indicated that there was very little variation of phosphorous yields between subwatersheds ($<1\sigma$). The average phosphorous deliverability rate to Lake Faulkton was found to be .00007 tons/ event/ acre during a 25 year 24 year storm event. The average annual phosphorous deliverability rate to Lake Faulkton was estimated to be .00011 tons/ year/ acre. These values are approximately one fifth the expected critical value. The AGNPS analysis did indicate that there were four (4) subwatersheds contributing above normal phosphorous yields (#1308, #2004, #2069, #2215). The suspected source of the elevated phosphorous concentrations are from animal feeding areas.

It is recommended that Best Management Practices should be targeted to the selected critical cells identified on pages 5 and 6 in order to achieve the highest benefit/ cost ratio. **It is also 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 Lake Faulkton subwatershed sediment yields appear to be very low, while the nutrient yields appear to be below normal. However, due to the size of the watershed, the volume of nutrients being delivered to Lake Faulkton appear to be high (61.2 tons nitrogen/ $yr._{annual}$, 47.6 tons nitrogen/ $event_{25\ yr.\ event}$, 16.8 tons phos./ $yr._{annual}$, 11.8 tons phos./ $event_{25\ yr.\ event}$). Based upon this analysis, it is recommended that conservation practices should be targeted to erosion and nutrient control practices concentrated in critical cells and cells which have elevated levels. The most probable source of the high nutrient yields found within the subwatersheds is from the management and landuse practices associated with animal feeding areas.

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

LAKE FAULKTON SUBWATERSHEDS

SUBWATERSHED	DRAINAGE AREA (ACRES)	NUMBER OF CELLS WITH EROSION > 1.5 TONS/AC.	(%)	NUMBER OF CELLS WITH TOT. NIT. > 10.0 PPM	(%)	NUMBER OF CELLS WITH TOT. PHOS. > 2.0 PPM	(%)	NUMBER OF CELLS WITH ANIMAL FEEDING AREAS
1 (#1308) (Loading to Ford Lake)	18680	4	.9	7	1.5	6	1.2	5
1 (#1452) (Outflow of Ford Lake)	25280	1	.2	5	.8	6	.9	0
2 (#1914) (Loading to Lake Faulkton)	158240 (direct 15720)	2	.5	7	1.8	7	1.8	9
3 (#1989) (Northern watershed)	63000	8	.5	8	.5	11	.7	8
4 (#2004) (South Trib. to Lake Faulkton)	2840	2	2.8	0	0	0	0	4
5 (#2069) (Southern watershed)	12960	1	.3	0	0	0	0	2
6 (#2158) (Southern watershed)	3520	0	0	0	0	0	0	0
7 (#2163) (Southern watershed)	800	0	0	0	0	0	0	0
8 (#2164) (Southern watershed)	17840	3	.7	0	0	0	0	3
9 (#2215) (Loading to Latham Lake)	26200	21	3.2	7	1.1	7	1.1	4
10 (#2391) (Southwest watershed)	18080	7	1.5	0	0	0	0	1
TOTAL	161320	49	1.2	34	.8	37	.9	36

Priority Erosion Cells
(erosion>1.5 tons/acre)

116 1.76 tons/acre
118 2.63 "
652 1.76 "
840 1.54 "
990 1.58 "
1001 2.43 "
1002 1.76 "
1007 1.76 "
1038 1.52 "
1062 1.91 "
1353 1.76 "
1412 1.55 "
1641 2.01 "
1726 2.01 "
1806 2.01 "
1866 1.76 "
1897 1.52 "
1945 1.66 "
2126 1.77 "
2282 1.84 "
2298 1.58 "
2355 1.77 "

Priority Feeding Areas
(AGNPS ranking > 30)

942 (92)
1106 (81)
3394 (81)
2001 (78)
2003 (78)
160 (76)
2941 (76)
2664 (73)
266 (72)
404 (72)
2013 (71)
781 (68)
1821 (68)
2509 (66)
1565 (55)
3255 (54)
2079 (52)
66 (51)
1738 (51)
2004 (51)
2212 (51)
2344 (51)

Priority Nitrogen Cells
(Tot.nit.conc.>10.0 ppm)

66 20.86 ppm
111 10.74 "
266 28.74 "
267 21.53 "
334 11.07 "
404 133.44 "
781 13.25 "
942 32.39 "
1085 10.74 "
1106 149.81 "
1107 77.98 "
1108 51.75 "
1155 18.84 "
1156 13.40 "
1228 18.84 "
1229 18.75 "
1230 15.60 "
1231 13.35 "
1232 10.49 "
1565 35.11 "
1738 10.07 "
1821 17.09 "

Priority Phos. Cells
(Tot.phos.conc.>2.0 ppm)

66 3.15 ppm
266 6.21 "
267 4.62 "
334 2.31 "
335 2.04 "
404 20.55 "
781 2.06 "
942 5.36 "
1085 2.40 "
1106 30.15 "
1107 15.84 "
1108 10.47 "
1155 4.37 "
1156 3.05 "
1228 4.37 "
1229 4.35 "
1230 3.59 "
1231 3.05 "
1232 2.37 "
1297 2.13 "
1335 2.10 "
1549 2.06 "

continued on next page

Priority Erosion Cells (erosion>1.5 tons/acre)	**Priority Feeding Areas** (AGNPS ranking > 30)	**Priority Nitrogen Cells** (Tot.nit.conc.>10.0 ppm)	**Priority Phos. Cells** (Tot.phos.conc.>2.0 ppm)
2438 1.84 tons/acre	2165 (46)	1912 48.60 ppm	1558 2.24 ppm
2439 1.84 "	3281 (42)	2001 73.21 "	1565 8.27 "
2441 1.64 "	933 (39)	2003 73.52 "	1738 2.01 "
2446 2.01 "	1549 (39)	2013 19.66 "	1821 2.76 "
2448 2.25 "	1558 (39)	2014 15.14 "	1912 9.94 "
2453 1.61 "	1107 (36)	2015 12.32 "	2001 15.04 "
2526 1.77 "	1335 (36)	2016 10.40 "	2003 11.33 "
2529 1.84 "		2165 11.41 "	2013 5.24 "
2530 2.51 "		2224 12.46 "	2014 3.99 "
2600 1.69 "		2509 48.40 "	2015 3.22 "
2707 1.90 "		2520 10.80 "	2016 2.69 "
3209 1.54 "		2599 14.53 "	2165 2.61 "
3210 2.08 "			2509 7.86 "
3349 1.61 "			2520 2.37 "
3370 1.52 "			2599 3.27 "
3410 1.52 "			
3411 1.52 "			
3458 3.31 "			
3491 1.51 "			
3863 2.52 "			
3864 2.34 "			
3910 1.54 "			
3998 1.76 "			
4005 1.70 "			
4023 1.69 "			
4025 1.92 "			
4030 1.76 "			

An analysis of the Lake Faulkton watershed indicates that there are approximately 49 non-water cells which have greater than 1.5 tons/ acre of sediment yield (map #4, page 46). This is approximately 1.2 % of the non-water cells found within the watershed. The model also estimated that there are 34 cells which have nitrogen yields of > 10.0 ppm (map #5, page 47) and 37 cells which have phosphorous yields > 2.0 ppm (map #6, page 48). This is approximately .9 % of the non-water cells within the watershed. The location and yields for each of these cells are listed on pages 5 and 6. These cells should be given high priority when installing any future Best Management Practices. It is recommended these areas be "Field Verified" prior to the installation of any Best Management Practices.

OBJECTIVE 3 - PRIORITY RANKING OF ANIMAL FEEDING AREAS (25 YEAR EVENT)

A total of 36 animal feeding areas were identified as potential NPS sources during the AGNPS data acquisition phase of the project (map #3, page 45). Below is a listing of the AGNPS analysis of the feedlots:

FEEDLOT (CELL #)	SUBWATERSHED LOCATION	AGNPS RATING (25 YR. EVT.)	RANKING PRIORITY	VARIANCE FROM RANKED MEAN OF 50.2	VARIANCE FROM 1 SSTD (σ = 25.5) FROM MEAN	PRIORITY RANK BASED ON AGNPS RANK AND DISTANCE FACTORS * C.FACT	C.RATE	C.RANK
66	#1308	51	18	+.8	+.03	.12	6	31
160	#1308	76	6	+25.8	+1.01	.12	9	24
266	#1989	72	9	+21.8	+.85	.24	17	20
404	#1989	72	10	+21.8	+.85	.60	43	9
687	#1989	23	31	-27.2	-1.07	.36	8	27
781	#1308	68	12	+17.8	+.70	.48	33	12
933	#1308	39	25	-11.2	-4.4	.60	23	17
942	#1308	92	1	+41.8	+1.64	.48	44	8
1106	#1989	81	2	+30.8	+1.21	.24	19	18
1107	#1989	36	28	-14.2	-.56	.24	9	25
1335	#1989	36	29	-14.2	-.56	.48	17	21
1549	#1828	39	26	-11.2	-.43	.48	19	19
1558	#1989	39	27	-11.2	-.43	.24	9	26
1565	#1989	55	15	+4.8	+.19	.48	26	15
1738	#1828	51	19	+.8	+.03	1.00	51	4
1821	#1828	68	13	+17.8	+.70	.90	61	3
2001	#1828	78	4	+27.8	+1.09	.90	70	2
2003	#1828	78	5	+27.8	+1.09	1.00	78	1
2004	#2004	51	20	+.8	+.03	1.00	51	5
2013	#2215	71	11	+20.8	+.81	.12	8	28
2079	#1828	52	17	+1.8	+.07	.80	42	10
2165	#1828	46	23	-4.2	-.16	.80	37	11
2166	#1828	16	32	-34.2	-1.34	.80	13	22
2212	#2215	57	21	+.8	+.03	.60	31	14
2224	#1828	0	33	-50.2	-1.97	.60	0	33
2344	#2004	51	22	+.8	+.03	.16	8	29
2509	#2215	66	14	+15.8	+.62	.12	8	30
2562	#2069	0	34	-50.2	-1.97	.36	0	34
2664	#2004	73	8	+22.8	+.89	.14	10	23
2941	#2391	76	7	+25.8	+1.01	.60	46	7
3141	#2215	25	30	-25.2	-.99	.12	3	32
3205	#2164	0	35	-50.2	-1.97	.60	0	35
3255	#2069	54	16	+3.8	+.15	.60	32	13
3281	#2004	42	24	-8.2	-.32	.60	25	16
3394	#2164	81	3	+30.8	+1.21	.60	49	6
3493	#2164	0	36	-50.2	-1.97	.48	0	36

* - 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      = 50.2
Median value    = 51.0
STDS            = 25.5
Mean + 1STDS    = 75.7
```

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

1.) Animal feedlot ranking	25 year event
2.) Range of feedlot rankings	0 - 92
3.) Mean	50.2
4.) Sample standard deviation (σ)	25.5

5.) Feedlots with rating (≥+1 σ) from mean are :160, 942, 1106, 2001, 2003, 2941, 3394

```
Cell #  160 000
Nitrogen concentration (ppm)       20.905
Phosphorus concentration (ppm)      3.454
COD concentration (ppm)           342.252
Nitrogen mass (lbs)              1039.543
Phosphorus mass (lbs)             171.754
COD mass (lbs)                  17019.545
Animal feedlot rating number           76  (+1.01σ)

Cell #  942 000
Nitrogen concentration (ppm)      100.080
Phosphorus concentration (ppm)     15.519
COD concentration (ppm)          1761.541
Nitrogen mass (lbs)              3543.742
Phosphorus mass (lbs)             549.512
COD mass (lbs)                  62374.715
Animal feedlot rating number           92  (+1.64σ)

Cell # 1106 000
Nitrogen concentration (ppm)       92.108
Phosphorus concentration (ppm)     18.610
COD concentration (ppm)          1867.482
Nitrogen mass (lbs)              1816.155
Phosphorus mass (lbs)             366.953
COD mass (lbs)                  36822.543
Animal feedlot rating number           81  (+1.21σ)

Cell # 2003 000
Nitrogen concentration (ppm)      189.000
Phosphorus concentration (ppm)     29.325
COD concentration (ppm)          3307.500
Nitrogen mass (lbs)              1772.247
Phosphorus mass (lbs)             274.980
COD mass (lbs)                  31014.320
Animal feedlot rating number           78  (+1.09σ)

Cell # 2941 000
Nitrogen concentration (ppm)       51.485
Phosphorus concentration (ppm)     11.700
COD concentration (ppm)          1142.782
Nitrogen mass (lbs)              1044.504
Phosphorus mass (lbs)             237.355
COD mass (lbs)                  23184.277
Animal feedlot rating number           76  (+1.01σ)

Cell # 3394 000
Nitrogen concentration (ppm)        4.941
Phosphorus concentration (ppm)      1.185
COD concentration (ppm)           118.819
Nitrogen mass (lbs)               782.363
Phosphorus mass (lbs)             187.654
COD mass (lbs)                  18814.400
Animal feedlot rating number           81  (+1.21σ)
```

FEEDLOT SELECTION CRITERIA AND STATISTICS (WEIGHTED FOR DISTANCE FACTORS)

1.) Animal feedlot ranking — 25 year event
2.) Range of feedlot rankings — 0 - 78
3.) Mean — 25.1
4.) Sample standard deviation (σ) — 21.1
5.) Feedlots with rating ($\geq$+1 σ) from mean are : 1738, 1821, 2001, 2003, 2004, 2941, 3394
6.) Additional feeding areas contributing high nutrients ($\geq$ mean) : 404, 781, 942, 1565, 2079, 2165, 2212, 3255, 3281.

```
Cell # 1738 000
Nitrogen concentration (ppm)       144.231
Phosphorus concentration (ppm)      29.750
COD concentration (ppm)           2865.394
Nitrogen mass (lbs)                280.059
Phosphorus mass (lbs)               57.766
COD mass (lbs)                    5563.829
Animal feedlot rating number            51  (+1.22σ)

Cell # 1821 000
Nitrogen concentration (ppm)        90.035
Phosphorus concentration (ppm)      13.990
COD concentration (ppm)           1553.177
Nitrogen mass (lbs)                817.088
Phosphorus mass (lbs)              126.966
COD mass (lbs)                   14095.373
Animal feedlot rating number            61  (+1.70σ)

Cell # 2001 000
Nitrogen concentration (ppm)       223.209
Phosphorus concentration (ppm)      46.242
COD concentration (ppm)           3818.159
Nitrogen mass (lbs)               1764.639
Phosphorus mass (lbs)              365.582
COD mass (lbs)                   30185.502
Animal feedlot rating number            70  (+2.13σ)

Cell # 2003 000
Nitrogen concentration (ppm)       189.000
Phosphorus concentration (ppm)      29.325
COD concentration (ppm)           3307.500
Nitrogen mass (lbs)               1772.247
Phosphorus mass (lbs)              274.980
COD mass (lbs)                   31014.320
Animal feedlot rating number            78  (+2.51σ)

Cell # 2004 000
Nitrogen concentration (ppm)        25.614
Phosphorus concentration (ppm)       6.162
COD concentration (ppm)            319.513
Nitrogen mass (lbs)                341.967
Phosphorus mass (lbs)               82.270
COD mass (lbs)                    4265.779
Animal feedlot rating number            51  (+1.22σ)

Cell # 2941 000
Nitrogen concentration (ppm)        51.485
Phosphorus concentration (ppm)      11.700
COD concentration (ppm)           1142.782
Nitrogen mass (lbs)               1044.504
Phosphorus mass (lbs)              237.355
COD mass (lbs)                   23184.277
Animal feedlot rating number            46  (+.99σ)
```

```
Cell # 3394 000
Nitrogen concentration (ppm)        4.941
Phosphorus concentration (ppm)      1.185
COD concentration (ppm)           118.819
Nitrogen mass (lbs)               782.363
Phosphorus mass (lbs)             187.654
COD mass (lbs)                  18814.400
Animal feedlot rating number           49 (+1.13σ)
```

Feedlots located in cells #404, #781, #942, #1565, #1738, #1821, #2001, #2003, #2004, #2079, #2165, #2212, #2941, #3255, #3281 and #3394 appear to be contributing excessive nutrients to the watershed. The feedlot rankings were derived from the AGNPS version 3.65 model. These rankings were than adjusted for factors based upon the distance from major streams and Lake Faulkton. In general, the further a animal feeding area is from a stream and lake, the less likely runoff from the facility will reach the lake. It is recommended that animal feeding areas with a distance corrected ranking greater than 25 should be targeted for treatment. The 16 animal feeding areas listed above, should be considered for treatment due to their AGNPS ranking and to their proximity to major streams and the lake. Other possibly sources of nutrient loadings not modeled through this study were those from septic systems and from livestock depositing fecal material directly into the lake or adjacent streams. Overall, the total nutrients being deposited from the watershed into Lake Faulkton appear to be fairly high even though the per acre loadings are low.

CONCLUSIONS

Based upon a comparison of other watersheds in Eastern South Dakota, the overall sediment and nutrient loadings to Lake Faulkton appear to be low. A detailed subwatershed analysis indicated that the sediment and nutrient deliverability rates were very low. However, when a total sediment and nutrient yield analysis was performed, it was established that the sediment delivered to Lake Faulkton were low and nutrients delivered to Lake Faulkton were high. Overall, the calculated sediment and nutrient per acre yields are low, but due to the large size of the watershed, the nutrients delivered to Lake Faulkton were high. An animal feeding area analysis indicated that most probable source of the elevated nutrients were from the large number of animal feeding operations found within the watershed and the frequency of these feeding areas to be located adjacent to waterways or in close proximity to Lake Faulkton. Therefore, it is recommended that the implementation of appropriate Best Management Practices be targeted to the critical cells and priority feeding areas. This methodology should produce the most cost effective treatment plan in reducing sediment and nutrient yields to Lake Faulkton.

If you have any questions concerning this study, please contact the Department of Environment and Natural Resources at 605-773-4254.

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 fo watersheds up to about 320,000 acres (8000 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):

<u>Data input for watershed</u> (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 impoundment's 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 FAULKTON WATERSHED STUDY

EVENT	RAINFALL	ENERGY INTENSITY
Monthly	.9	3.9
1 year	1.9	19.6
5 year	3.0	52.6
10 year	3.5	73.7
25 year	4.1	104.0
50 year	4.6	133.5
100 year	5.2	174.4

NRCS R_{factor} for Faulkton watershed = 75

Annual Loadings Calculations

monthly events = 9 events x 3.9 = 35.1

6 month event = 2 event x 10.0 = 20.0

1 year event = 1 event x 19.6 = 19.6

Modeled Cumm. R_{factor} = 74.7

LAKE FAULKTON WATERSHED SUMMARY (25 YEAR EVENT)

Watershed Identification	Lake Faulkton
Drainage Area of the Watershed	161320.00 acres
Area of each base cell	40.00 acres
Type of event modeled	**25 year, 24 hr.**
Characteristic Storm Precipitation	4.10 inches
Storm Energy-Intensity Value	104.00

VALUES AT THE WATERSHED OUTLET (LAKE FAULKTON OUTLET)

Cell Number	1828 000
Runoff Volume	1.57 inches
Peak Runoff Rate	9395.93 cfs
Total Sediment Yield	1461.74 tons
Total Nitrogen in Sediment	0.05 lbs/acre
Total Soluble Nitrogen in Runoff	0.44 lbs/acre
Soluble Nitrogen Concentration in Runoff	1.23 ppm
Total Phosphorus in Sediment	0.03 lbs/acre
Total Soluble Phosphorus in Runoff	0.07 lbs/acre
Soluble Phosphorus Concentration in Runoff	0.20 ppm
Total Soluble Chemical Oxygen Demand	14.35 lbs/acre
Soluble Chemical Oxygen Demand Concentration in Runoff	40.35 ppm

VALUES AT THE WATERSHED OUTLET (LAKE FAULKTON OUTLET)

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	0.02	0.02	16	12	32.36	0.01	928.19
SILT	0.03	0.01	6	3	11.97	0.00	343.35
SAGG	0.18	0.01	1	0	6.24	0.00	178.86
LAGG	0.11	0.03	0	0	0.31	0.00	9.00
SAND	0.02	0.01	0	0	0.08	0.00	2.35
TOTAL	0.36	0.06	2	1	50.97	0.01	1461.74

HYDROLOGY OF PRIMARY SUBWATERSHEDS (25 YEAR EVENT)

HYDROLOGY: - Cell - Num	Div	Drainage Area (acres)	Overland Runoff (in.)	Upstream Runoff (in.)	Peak Flow Upstream (cfs)	Downstream Runoff (in.)	Peak Flow Downstream (cfs)
1308	000	18680.00	1.33	1.67	4425.37	1.67	4428.18
1452	000	25280.00	2.46	1.72	4120.98	1.72	5520.77
1828	000	161320.00	4.10	1.57	9892.21	1.57	9395.93
1914	000	158240.00	4.10	1.57	18416.19	1.57	9219.97
1989	000	63000.00	1.33	1.61	9249.83	1.61	9253.90
2004	000	2840.00	1.33	1.46	1125.88	1.46	1134.99
2069	000	12960.00	2.04	1.55	3337.30	1.55	3222.15
2158	000	3520.00	1.33	1.37	1222.44	1.37	1170.45
2163	000	800.00	1.33	1.21	392.09	1.22	408.76
2164	000	17840.00	1.33	1.40	3687.41	1.40	3692.45
2215	000	26200.00	2.04	1.69	6012.40	1.69	5826.67
2216	000	26320.00	4.10	1.69	5902.94	1.69	2970.00
2391	000	18080.00	2.46	1.52	4138.08	1.52	4017.39

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (25 YEAR EVENT)

SEDIMENT: - Cell - Num	Div	Particle Type	Cell Erosion (t/a)	---- Generated ---- Above (tons)	Within (tons)	Yield (tons)	Deposition (%)
1308	000	CLAY	0.00	678.68	0.19	684.98	-1
		SILT	0.01	342.06	0.30	345.12	-1
		SAGG	0.05	284.95	1.90	287.78	0
		LAGG	0.03	107.98	1.18	96.21	12
		SAND	0.01	31.62	0.23	27.16	15
		TOTL	0.10	1445.29	3.80	1441.25	0
1452	000	CLAY	0.01	362.60	0.23	361.43	0
		SILT	0.01	126.23	0.36	118.34	7
		SAGG	0.06	82.97	2.26	87.70	-3
		LAGG	0.03	17.83	1.40	121.02	-84
		SAND	0.01	5.31	0.27	36.67	-85
		TOTL	0.11	594.95	4.51	725.17	-17
1828	000	CLAY	0.00	1215.87	0.00	928.19	24
		SILT	0.00	432.49	0.00	343.35	21
		SAGG	0.00	232.04	0.00	178.86	23
		LAGG	0.00	12.74	0.00	9.00	29
		SAND	0.00	3.33	0.00	2.35	29
		TOTL	0.00	1896.46	0.00	1461.74	23
1914	000	CLAY	0.00	4193.52	0.00	2237.85	47
		SILT	0.00	1042.33	0.00	726.46	30
		SAGG	0.00	629.81	0.00	426.16	32
		LAGG	0.00	557.74	0.00	30.60	95
		SAND	0.00	160.07	0.00	7.95	95
		TOTL	0.00	6583.47	0.00	3429.02	48
1989	000	CLAY	0.01	1354.76	0.39	1355.20	0
		SILT	0.02	442.44	0.63	442.92	0
		SAGG	0.10	441.80	3.94	444.97	0
		LAGG	0.06	276.22	2.44	273.24	2
		SAND	0.01	79.96	0.47	78.69	2
		TOTL	0.20	2595.17	7.89	2595.03	0
2004	000	CLAY	0.02	123.50	0.71	124.19	0
		SILT	0.03	74.44	1.14	75.12	1
		SAGG	0.18	95.68	7.11	99.77	3
		LAGG	0.11	22.43	4.41	22.63	16
		SAND	0.02	6.73	0.85	6.80	10
		TOTL	0.36	322.78	14.21	328.51	5
2069	000	CLAY	0.02	361.08	0.79	648.86	-44
		SILT	0.01	171.24	0.47	328.95	-48
		SAGG	0.11	164.07	4.50	326.42	-48
		LAGG	0.05	60.84	1.97	337.02	-81
		SAND	0.00	18.35	0.16	102.13	-82
		TOTL	0.20	775.59	7.89	1743.40	-55
2158	000	CLAY	0.01	51.50	0.33	62.95	-18
		SILT	0.01	28.52	0.53	34.50	-17
		SAGG	0.08	35.87	3.33	40.97	-12
		LAGG	0.05	25.61	2.07	34.19	-25
		SAND	0.01	7.70	0.40	10.36	-26
		TOTL	0.17	149.20	6.67	182.97	-18
2163	000	CLAY	0.01	11.04	0.33	11.37	0
		SILT	0.01	6.44	0.53	6.83	2
		SAGG	0.08	8.91	3.33	11.03	10
		LAGG	0.05	7.27	2.07	3.08	67
		SAND	0.01	2.20	0.40	0.93	64
		TOTL	0.17	35.86	6.67	33.24	22

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (25 YEAR EVENT)

2164 000	CLAY	0.01	518.97	0.29	519.25	0
	SILT	0.01	190.92	0.46	191.15	0
	SAGG	0.07	109.65	2.86	112.02	0
	LAGG	0.04	93.98	1.77	95.91	0
	SAND	0.01	27.67	0.34	27.87	1
	TOTL	0.14	941.19	5.72	946.20	0
2215 000	CLAY	0.01	897.62	0.25	897.75	0
	SILT	0.01	445.54	0.40	443.98	0
	SAGG	0.06	483.41	2.51	475.68	2
	LAGG	0.04	141.17	1.56	133.49	6
	SAND	0.01	41.67	0.30	39.93	5
	TOTL	0.13	2009.42	5.02	1990.84	1
2216 000	CLAY	0.00	901.98	0.00	557.70	38
	SILT	0.00	446.41	0.00	239.01	46
	SAGG	0.00	478.61	0.00	155.92	67
	LAGG	0.00	136.88	0.00	4.79	96
	SAND	0.00	40.95	0.00	1.25	97
	TOTL	0.00	2004.84	0.00	958.67	52
2391 000	CLAY	0.01	480.42	0.37	480.72	0
	SILT	0.01	214.18	0.59	213.76	0
	SAGG	0.09	212.28	3.66	211.18	2
	LAGG	0.06	120.84	2.27	95.70	22
	SAND	0.01	35.90	0.44	28.38	22
	TOTL	0.18	1063.63	7.33	1029.74	4

CONDENSED SOIL LOSS (25 YEAR EVENT)

			------ RUNOFF -----			----------- SEDIMENT	----------------			
	Drainage		Generated	Peak	Cell	-- Generated --				
- Cell -	Area	Vol.	Above	Rate	Erosion	Above	Within	Yield	Depo
Num Div	(acres)	(in.)	(%)	(cfs)	(t/a)	(tons)	(tons)	(tons)	(%)
1308 000	18680.00	1.33	99.8	4428.18	0.10	1445.29	3.80	1441.25	0
1452 000	25280.00	2.46	99.8	5520.77	0.11	594.95	4.51	725.17	-17
1828 000	161320.0	4.10	100.0	9395.93	0.00	1896.46	0.00	1461.74	23
1914 000	158240.0	4.10	99.9	9219.97	0.00	6583.47	0.00	3429.02	48
1989 000	63000.00	1.33	99.9	9253.90	0.20	2595.17	7.89	2595.03	0
2004 000	2840.00	1.33	98.7	1134.99	0.36	322.78	14.21	328.51	5
2069 000	12960.00	2.04	99.7	3222.15	0.20	775.59	7.89	1743.40	-55
2158 000	3520.00	1.33	98.9	1170.45	0.17	149.20	6.67	182.97	-18
2163 000	800.00	1.33	94.5	408.76	0.17	35.86	6.67	33.24	22
2164 000	17840.00	1.33	99.8	3692.45	0.14	941.19	5.72	946.20	0
2215 000	26200.00	2.04	99.8	5826.67	0.13	2009.42	5.02	1990.84	1
2216 000	26320.00	4.10	99.8	2970.00	0.00	2004.84	0.00	958.67	52
2391 000	18080.00	2.46	99.6	4017.39	0.18	1063.63	7.33	1029.74	4

NUTRIENT ANALYSIS (25 YEAR EVENT)
NITROGEN

		---- Sediment	----	------ Water Soluble	-----	
	Drainage	Within	Cell	Within	Cell	
- Cell -	Area	Cell	Outlet	Cell	Outlet	Conc
Num Div	(acres)	(lbs/a)	(lbs/a)	(lbs/a)	(lbs/a)	(ppm)
1308 000	18680.00	0.37	0.37	0.26	1.04	2.74
1452 000	25280.00	0.55	0.14	0.48	1.09	2.79
1828 000	161320.00	0.00	0.05	0.74	0.44	1.23
1914 000	158240.00	0.00	0.13	0.74	0.44	1.22

NUTRIENT ANALYSIS (25 YEAR EVENT)
NITROGEN

- Cell -		Drainage	---- Sediment ----		------ Water Soluble -----		
		Drainage	Within	Cell	Within	Cell	
		Area	Cell	Outlet	Cell	Outlet	Conc
Num	Div	(acres)	(lbs/a)	(lbs/a)	(lbs/a)	(lbs/a)	(ppm)
1989	000	63000.00	0.86	0.22	0.26	0.57	1.57
2004	000	2840.00	1.38	0.53	8.81	1.23	3.73
2069	000	12960.00	0.99	0.67	0.39	0.47	1.34
2158	000	3520.00	0.04	0.27	0.26	0.47	1.53
2163	000	800.00	0.75	0.25	0.26	0.29	1.06
2164	000	17840.00	0.67	0.30	0.26	0.43	1.36
2215	000	26200.00	0.60	0.34	0.40	0.81	2.12
2216	000	26320.00	0.00	0.18	0.74	0.80	2.09
2391	000	18080.00	0.81	0.31	0.48	0.49	1.41

NUTRIENT ANALYSIS (25 YEAR EVENT)
PHOSPHOROUS

- Cell -		Drainage	---- Sediment ----		------ Water Soluble -----		
		Drainage	Within	Cell	Within	Cell	
		Area	Cell	Outlet	Cell	Outlet	Conc
Num	Div	(acres)	(lbs/a)	(lbs/a)	(lbs/a)	(lbs/a)	(ppm)
1308	000	18680.00	0.19	0.18	0.02	0.17	0.46
1452	000	25280.00	0.28	0.07	0.03	0.19	0.48
1828	000	161320.00	0.00	0.03	0.00	0.07	0.20
1914	000	158240.00	0.00	0.07	0.00	0.07	0.20
1989	000	63000.00	0.43	0.11	0.02	0.10	0.26
2004	000	2840.00	0.69	0.26	2.07	0.22	0.66
2069	000	12960.00	0.50	0.33	0.02	0.07	0.19
2158	000	3520.00	0.02	0.14	0.02	0.07	0.22
2163	000	800.00	0.38	0.12	0.02	0.03	0.11
2164	000	17840.00	0.33	0.15	0.02	0.06	0.19
2215	000	26200.00	0.30	0.17	0.02	0.14	0.36
2216	000	26320.00	0.00	0.09	0.00	0.14	0.36
2391	000	18080.00	0.41	0.15	0.03	0.07	0.20

NUTRIENT ANALYSIS (25 YEAR EVENT)
CHEMICAL OXYGEN DEMAND

- Cell -		Drainage	---- Sediment ----		------ Water Soluble -----		
		Drainage	Within	Cell	Within	Cell	
		Area	Cell	Outlet	Cell	Outlet	Conc
Num	Div	(acres)	(lbs/a)	(lbs/a)	(lbs/a)	(lbs/a)	(ppm)
1308	000	18680.00			18.10	29.55	77.95
1452	000	25280.00			33.43	29.22	74.91
1828	000	161320.00			0.00	14.35	40.35
1914	000	158240.00			0.00	14.46	40.66
1989	000	63000.00			18.10	17.78	48.73
2004	000	2840.00			124.75	33.57	101.70
2069	000	12960.00			27.79	18.76	53.49
2158	000	3520.00			18.10	17.74	57.30
2163	000	800.00			18.10	14.50	52.48
2164	000	17840.00			18.10	17.61	55.63
2215	000	26200.00			27.79	24.69	64.43
2216	000	26320.00			0.00	24.38	63.67
2391	000	18080.00			33.43	20.25	58.90

FEEDLOT ANALYSIS (25 YEAR EVENT)

Cell # 66 000

Nitrogen concentration (ppm)	40.320
Phosphorus concentration (ppm)	6.256
COD concentration (ppm)	705.600
Nitrogen mass (lbs)	244.350
Phosphorus mass (lbs)	37.913
COD mass (lbs)	4276.121
Animal feedlot rating number	51

Cell # 160 000

Nitrogen concentration (ppm)	20.905
Phosphorus concentration (ppm)	3.454
COD concentration (ppm)	342.252
Nitrogen mass (lbs)	1039.543
Phosphorus mass (lbs)	171.754
COD mass (lbs)	17019.545
Animal feedlot rating number	76

Cell # 266 000

Nitrogen concentration (ppm)	75.572
Phosphorus concentration (ppm)	16.698
COD concentration (ppm)	1669.700
Nitrogen mass (lbs)	1020.914
Phosphorus mass (lbs)	225.578
COD mass (lbs)	22556.311
Animal feedlot rating number	72

Cell # 404 000

Nitrogen concentration (ppm)	162.452
Phosphorus concentration (ppm)	25.121
COD concentration (ppm)	2935.575
Nitrogen mass (lbs)	1616.519
Phosphorus mass (lbs)	249.968
COD mass (lbs)	29211.166
Animal feedlot rating number	72

Cell # 687 000

Nitrogen concentration (ppm)	1.888
Phosphorus concentration (ppm)	0.467
COD concentration (ppm)	44.955
Nitrogen mass (lbs)	36.707
Phosphorus mass (lbs)	9.076
COD mass (lbs)	873.904
Animal feedlot rating number	23

Cell # 781 000

Nitrogen concentration (ppm)	161.677
Phosphorus concentration (ppm)	25.914
COD concentration (ppm)	2884.239
Nitrogen mass (lbs)	1377.475
Phosphorus mass (lbs)	220.785
COD mass (lbs)	24573.533
Animal feedlot rating number	68

FEEDLOT ANALYSIS (25 YEAR EVENT), continued

Cell # 933 000	
Nitrogen concentration (ppm)	69.889
Phosphorus concentration (ppm)	15.331
COD concentration (ppm)	1494.259
Nitrogen mass (lbs)	103.273
Phosphorus mass (lbs)	22.654
COD mass (lbs)	2208.014
Animal feedlot rating number	39

Cell # 942 000		
Nitrogen concentration (ppm)	100.080	
Phosphorus concentration (ppm)	15.519	
COD concentration (ppm)	1761.541	
Nitrogen mass (lbs)	3543.742	
Phosphorus mass (lbs)	549.512	— 115.13 80% REDUCTION
COD mass (lbs)	62374.715	
Animal feedlot rating number	92	

Cell # 1106 000	
Nitrogen concentration (ppm)	92.108
Phosphorus concentration (ppm)	18.610
COD concentration (ppm)	1867.482
Nitrogen mass (lbs)	1816.155
Phosphorus mass (lbs)	366.953
COD mass (lbs)	36822.543
Animal feedlot rating number	81

Cell # 1107 000	
Nitrogen concentration (ppm)	8.723
Phosphorus concentration (ppm)	2.277
COD concentration (ppm)	242.351
Nitrogen mass (lbs)	82.985
Phosphorus mass (lbs)	21.658
COD mass (lbs)	2305.521
Animal feedlot rating number	36

Cell # 1335 000	
Nitrogen concentration (ppm)	5.772
Phosphorus concentration (ppm)	7.112
COD concentration (ppm)	383.196
Nitrogen mass (lbs)	23.971
Phosphorus mass (lbs)	29.539
COD mass (lbs)	1591.523
Animal feedlot rating number	36

Cell # 1549 000	
Nitrogen concentration (ppm)	8.224
Phosphorus concentration (ppm)	2.582
COD concentration (ppm)	280.240
Nitrogen mass (lbs)	77.988
Phosphorus mass (lbs)	24.482
COD mass (lbs)	2657.619
Animal feedlot rating number	39

Cell # 1558 000

Nitrogen concentration (ppm)	1.593
Phosphorus concentration (ppm)	2.743
COD concentration (ppm)	297.324
Nitrogen mass (lbs)	15.540
Phosphorus mass (lbs)	26.753
COD mass (lbs)	2900.387
Animal feedlot rating number	39

Cell # 1565 000

Nitrogen concentration (ppm)	157.500
Phosphorus concentration (ppm)	37.931
COD concentration (ppm)	1968.750
Nitrogen mass (lbs)	517.641
Phosphorus mass (lbs)	124.665
COD mass (lbs)	6470.506
Animal feedlot rating number	55

Cell # 1738 000

Nitrogen concentration (ppm)	144.231
Phosphorus concentration (ppm)	29.750
COD concentration (ppm)	2865.394
Nitrogen mass (lbs)	280.059
Phosphorus mass (lbs)	57.766
COD mass (lbs)	5563.829
Animal feedlot rating number	51

Cell # 1821 000

Nitrogen concentration (ppm)	90.035
Phosphorus concentration (ppm)	13.990
COD concentration (ppm)	1553.177
Nitrogen mass (lbs)	817.088
Phosphorus mass (lbs)	126.966
COD mass (lbs)	14095.373
Animal feedlot rating number	68

Cell # 2001 000

Nitrogen concentration (ppm)	223.209
Phosphorus concentration (ppm)	46.242
COD concentration (ppm)	3818.159
Nitrogen mass (lbs)	1764.639
Phosphorus mass (lbs)	365.582
COD mass (lbs)	30185.502
Animal feedlot rating number	78

Cell # 2003 000

Nitrogen concentration (ppm)	189.000
Phosphorus concentration (ppm)	29.325
COD concentration (ppm)	3307.500
Nitrogen mass (lbs)	1772.247
Phosphorus mass (lbs)	274.980
COD mass (lbs)	31014.320
Animal feedlot rating number	78

FEEDLOT ANALYSIS (25 YEAR EVENT), continued

Cell # 2004 000

Nitrogen concentration (ppm)	25.614
Phosphorus concentration (ppm)	6.162
COD concentration (ppm)	319.513
Nitrogen mass (lbs)	341.967
Phosphorus mass (lbs)	82.270
COD mass (lbs)	4265.779
Animal feedlot rating number	51

Cell # 2013 000

Nitrogen concentration (ppm)	17.604
Phosphorus concentration (ppm)	4.926
COD concentration (ppm)	369.815
Nitrogen mass (lbs)	702.839
Phosphorus mass (lbs)	196.679
COD mass (lbs)	14764.666
Animal feedlot rating number	71

Cell # 2079 000

Nitrogen concentration (ppm)	43.009
Phosphorus concentration (ppm)	9.260
COD concentration (ppm)	891.256
Nitrogen mass (lbs)	227.862
Phosphorus mass (lbs)	49.062
COD mass (lbs)	4721.854
Animal feedlot rating number	52

Cell # 2165 000

Nitrogen concentration (ppm)	6.507
Phosphorus concentration (ppm)	1.578
COD concentration (ppm)	158.250
Nitrogen mass (lbs)	128.905
Phosphorus mass (lbs)	31.268
COD mass (lbs)	3134.763
Animal feedlot rating number	46

Cell # 2166 000

Nitrogen concentration (ppm)	1.812
Phosphorus concentration (ppm)	0.760
COD concentration (ppm)	37.276
Nitrogen mass (lbs)	23.901
Phosphorus mass (lbs)	10.025
COD mass (lbs)	491.807
Animal feedlot rating number	16

Cell # 2212 000

Nitrogen concentration (ppm)	31.380
Phosphorus concentration (ppm)	6.546
COD concentration (ppm)	706.711
Nitrogen mass (lbs)	284.428
Phosphorus mass (lbs)	59.336
COD mass (lbs)	6405.696
Animal feedlot rating number	51

FEEDLOT ANALYSIS (25 YEAR EVENT), continued

Cell # 2224 000

Nitrogen concentration (ppm)	2.426
Phosphorus concentration (ppm)	0.404
COD concentration (ppm)	12.131
Nitrogen mass (lbs)	425.229
Phosphorus mass (lbs)	70.872
COD mass (lbs)	2126.146
Animal feedlot rating number	0

Cell # 2344 000

Nitrogen concentration (ppm)	31.418
Phosphorus concentration (ppm)	6.786
COD concentration (ppm)	652.579
Nitrogen mass (lbs)	204.597
Phosphorus mass (lbs)	44.188
COD mass (lbs)	4249.695
Animal feedlot rating number	51

Cell # 2509 000

Nitrogen concentration (ppm)	47.879
Phosphorus concentration (ppm)	7.402
COD concentration (ppm)	867.278
Nitrogen mass (lbs)	737.566
Phosphorus mass (lbs)	114.023
COD mass (lbs)	13360.224
Animal feedlot rating number	66

Cell # 2562 000

Nitrogen concentration (ppm)	1.676
Phosphorus concentration (ppm)	0.279
COD concentration (ppm)	8.378
Nitrogen mass (lbs)	12.629
Phosphorus mass (lbs)	2.105
COD mass (lbs)	63.145
Animal feedlot rating number	0

Cell # 2664 000

Nitrogen concentration (ppm)	201.086
Phosphorus concentration (ppm)	31.037
COD concentration (ppm)	3540.857
Nitrogen mass (lbs)	1220.992
Phosphorus mass (lbs)	188.458
COD mass (lbs)	21500.082
Animal feedlot rating number	73

Cell # 2941 000

Nitrogen concentration (ppm)	51.485
Phosphorus concentration (ppm)	11.700
COD concentration (ppm)	1142.782
Nitrogen mass (lbs)	1044.504
Phosphorus mass (lbs)	237.355
COD mass (lbs)	23184.277
Animal feedlot rating number	76

FEEDLOT ANALYSIS (25 YEAR EVENT), continued

Cell # 3141 000	
Nitrogen concentration (ppm)	4.220
Phosphorus concentration (ppm)	1.702
COD concentration (ppm)	129.697
Nitrogen mass (lbs)	22.585
Phosphorus mass (lbs)	9.108
COD mass (lbs)	694.071
Animal feedlot rating number	25

Cell # 3205 000	
Nitrogen concentration (ppm)	0.214
Phosphorus concentration (ppm)	0.036
COD concentration (ppm)	1.072
Nitrogen mass (lbs)	6.617
Phosphorus mass (lbs)	1.103
COD mass (lbs)	33.084
Animal feedlot rating number	0

Cell # 3255 000	
Nitrogen concentration (ppm)	5.864
Phosphorus concentration (ppm)	1.573
COD concentration (ppm)	146.431
Nitrogen mass (lbs)	170.790
Phosphorus mass (lbs)	45.813
COD mass (lbs)	4265.136
Animal feedlot rating number	54

Cell # 3281 000	
Nitrogen concentration (ppm)	8.853
Phosphorus concentration (ppm)	7.069
COD concentration (ppm)	317.396
Nitrogen mass (lbs)	64.342
Phosphorus mass (lbs)	51.380
COD mass (lbs)	2306.830
Animal feedlot rating number	42

Cell # 3394 000	
Nitrogen concentration (ppm)	4.941
Phosphorus concentration (ppm)	1.185
COD concentration (ppm)	118.819
Nitrogen mass (lbs)	782.363
Phosphorus mass (lbs)	187.654
COD mass (lbs)	18814.400
Animal feedlot rating number	81

Cell # 3493 000	
Nitrogen concentration (ppm)	4.811
Phosphorus concentration (ppm)	0.802
COD concentration (ppm)	24.054
Nitrogen mass (lbs)	70.439
Phosphorus mass (lbs)	11.740
COD mass (lbs)	352.194
Animal feedlot rating number	0

LAKE FAULKTON WATERSHED SUMMARY (1 YEAR EVENT)

Watershed Identification	Lake Faulkton
Drainage Area of the Watershed	161320.00 acres
Area of each base cell	40.00 acres
Type of event modeled	**1 year, 24 hr.**
Characteristic Storm Precipitation	1.90 inches
Storm Energy-Intensity Value	19.60

VALUES AT THE WATERSHED OUTLET (LAKE FAULKTON OUTLET)

Cell Number	1828 000
Runoff Volume	0.28 inches
Peak Runoff Rate	1674.97 cfs
Total Sediment Yield	227.01 tons
Total Nitrogen in Sediment	0.01 lbs/acre
Total Soluble Nitrogen in Runoff	0.18 lbs/acre
Soluble Nitrogen Concentration in Runoff	2.76 ppm
Total Phosphorus in Sediment	0.01 lbs/acre
Total Soluble Phosphorus in Runoff	0.03 lbs/acre
Soluble Phosphorus Concentration in Runoff	0.49 ppm
Total Soluble Chemical Oxygen Demand	2.84 lbs/acre
Soluble Chemical Oxygen Demand Concentration in Runoff	44.40 ppm

VALUES AT THE WATERSHED OUTLET (LAKE FAULKTON OUTLET)

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	0.01	11	15	34.13	0.00	175.99
SILT	0.01	0.00	2	2	6.35	0.00	32.76
SAGG	0.03	0.00	0	0	3.39	0.00	17.50
LAGG	0.02	0.01	0	0	0.12	0.00	0.60
SAND	0.00	0.00	0	0	0.03	0.00	0.16
TOTAL	0.07	0.03	1	1	44.02	0.00	227.01

HYDROLOGY OF PRIMARY SUBWATERSHEDS (1 YEAR EVENT)

HYDROLOGY: - Cell - Num	Div	Drainage Area (acres)	Overland Runoff (in.)	Upstream Runoff (in.)	Peak Flow Upstream (cfs)	Downstream Runoff (in.)	Peak Flow Downstream (cfs)
1308	000	18680.00	0.18	0.32	888.78	0.32	889.20
1452	000	25280.00	0.67	0.34	874.00	0.34	1142.67
1828	000	161320.00	1.90	0.28	1773.25	0.28	1674.97
1914	000	158240.00	1.90	0.28	3273.58	0.28	1640.72
1989	000	63000.00	0.18	0.30	1737.32	0.30	1737.82
2004	000	2840.00	0.18	0.24	205.10	0.24	206.27
2069	000	12960.00	0.47	0.27	631.07	0.27	635.29
2158	000	3520.00	0.18	0.20	201.85	0.20	192.74
2163	000	800.00	0.18	0.15	58.22	0.15	60.87
2164	000	17840.00	0.18	0.22	606.72	0.22	607.36
2215	000	26200.00	0.47	0.33	1223.52	0.33	1183.84
2216	000	26320.00	1.90	0.33	1197.60	0.33	604.11
2391	000	18080.00	0.67	0.26	759.62	0.26	730.07

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (1 YEAR EVENT)

SEDIMENT: - Cell - Num	Div	Particle Type	Cell Erosion (t/a)	---- Generated ---- Above (tons)	Within (tons)	Yield (tons)	Deposition (%)
1308	000	CLAY	0.00	198.74	0.04	198.76	0
		SILT	0.00	56.78	0.06	56.64	0
		SAGG	0.01	40.29	0.36	41.27	-2
		LAGG	0.01	35.01	0.22	31.51	10
		SAND	0.00	10.60	0.04	9.37	12
		TOTL	0.02	341.42	0.72	337.55	1
1452	000	CLAY	0.00	73.53	0.04	73.89	0
		SILT	0.00	12.17	0.07	28.10	-56
		SAGG	0.01	8.78	0.43	28.73	-68
		LAGG	0.01	5.44	0.26	41.80	-86
		SAND	0.00	1.64	0.05	12.67	-87
		TOTL	0.02	101.56	0.85	185.18	-45
1828	000	CLAY	0.00	234.23	0.00	175.99	25
		SILT	0.00	44.75	0.00	32.76	27
		SAGG	0.00	24.68	0.00	17.50	29
		LAGG	0.00	0.85	0.00	0.60	30
		SAND	0.00	0.23	0.00	0.16	30
		TOTL	0.00	304.73	0.00	227.01	26
1914	000	CLAY	0.00	1063.56	0.00	457.19	57
		SILT	0.00	167.61	0.00	90.76	46
		SAGG	0.00	167.01	0.00	60.81	64
		LAGG	0.00	167.11	0.00	1.87	99
		SAND	0.00	50.00	0.00	0.49	99
		TOTL	0.00	1615.29	0.00	611.12	62
1989	000	CLAY	0.00	359.64	0.07	359.71	0
		SILT	0.00	100.79	0.12	100.82	0
		SAGG	0.02	104.40	0.74	104.70	0
		LAGG	0.01	86.83	0.46	82.24	6
		SAND	0.00	26.06	0.09	23.79	9
		TOTL	0.04	677.71	1.49	671.27	1
2004	000	CLAY	0.00	36.77	0.13	36.88	0
		SILT	0.01	14.34	0.21	14.33	2
		SAGG	0.03	13.89	1.34	14.17	7
		LAGG	0.02	6.69	0.83	6.75	10
		SAND	0.00	2.03	0.16	2.04	7
		TOTL	0.07	73.71	2.68	74.16	5
2069	000	CLAY	0.00	88.72	0.15	197.78	-55
		SILT	0.00	27.28	0.09	88.60	-69
		SAGG	0.02	21.80	0.85	85.76	-74
		LAGG	0.01	19.23	0.37	118.82	-84
		SAND	0.00	5.83	0.03	36.01	-84
		TOTL	0.04	162.85	1.49	526.97	-69
2158	000	CLAY	0.00	12.80	0.06	17.80	-28
		SILT	0.00	6.71	0.10	9.36	-28
		SAGG	0.02	7.29	0.63	9.51	-23
		LAGG	0.01	7.17	0.39	11.03	-35
		SAND	0.00	2.17	0.08	3.33	-35
		TOTL	0.03	36.15	1.26	51.02	-29
2163	000	CLAY	0.00	2.60	0.06	2.66	0
		SILT	0.00	1.29	0.10	1.31	6
		SAGG	0.02	1.37	0.63	1.50	25
		LAGG	0.01	1.81	0.39	0.77	65
		SAND	0.00	0.55	0.08	0.23	63
		TOTL	0.03	7.62	1.26	6.46	28

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (1 YEAR EVENT)

2164 000	CLAY	0.00	130.15	0.05	130.19	0
	SILT	0.00	24.59	0.09	25.00	-1
	SAGG	0.01	23.75	0.54	24.69	-2
	LAGG	0.01	26.44	0.33	26.50	1
	SAND	0.00	7.97	0.06	7.98	1
	TOTL	0.03	212.89	1.08	214.36	0
2215 000	CLAY	0.00	274.95	0.05	274.88	0
	SILT	0.00	82.67	0.08	81.92	1
	SAGG	0.01	70.33	0.47	67.83	4
	LAGG	0.01	46.65	0.29	45.46	3
	SAND	0.00	14.07	0.06	13.77	3
	TOTL	0.02	488.66	0.95	483.86	1
2216 000	CLAY	0.00	275.64	0.00	139.95	49
	SILT	0.00	82.33	0.00	25.99	68
	SAGG	0.00	68.26	0.00	11.27	83
	LAGG	0.00	46.07	0.00	0.35	99
	SAND	0.00	13.94	0.00	0.09	99
	TOTL	0.00	486.26	0.00	177.64	63
2391 000	CLAY	0.00	152.35	0.07	152.34	0
	SILT	0.00	45.46	0.11	45.04	1
	SAGG	0.02	39.09	0.69	37.89	5
	LAGG	0.01	41.02	0.43	29.42	29
	SAND	0.00	12.38	0.08	8.91	28
	TOTL	0.03	290.30	1.38	273.60	6

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 (%)
1308	000	18680.00	0.18	99.9	889.20	0.02	341.42	0.72	337.55	1
1452	000	25280.00	0.67	99.7	1142.67	0.02	101.56	0.85	185.18	-45
1828	000	161320.0	1.90	100.0	1674.97	0.00	304.73	0.00	227.01	26
1914	000	158240.0	1.90	99.8	1640.72	0.00	1615.29	0.00	611.12	62
1989	000	63000.00	0.18	100.0	1737.82	0.04	677.71	1.49	671.27	1
2004	000	2840.00	0.18	98.9	206.27	0.07	73.71	2.68	74.16	5
2069	000	12960.00	0.47	99.7	635.29	0.04	162.85	1.49	526.97	-69
2158	000	3520.00	0.18	98.9	192.74	0.03	36.15	1.26	51.02	-29
2163	000	800.00	0.18	94.1	60.87	0.03	7.62	1.26	6.46	28
2164	000	17840.00	0.18	99.8	607.36	0.03	212.89	1.08	214.36	0
2215	000	26200.00	0.47	99.8	1183.84	0.02	488.66	0.95	483.86	1
2216	000	26320.00	1.90	99.8	604.11	0.00	486.26	0.00	177.64	63
2391	000	18080.00	0.67	99.4	730.07	0.03	290.30	1.38	273.60	6

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)
1308	000	18680.00	0.10	0.13	0.04	0.48	6.64
1452	000	25280.00	0.15	0.04	0.14	0.52	6.66
1828	000	161320.00	0.00	0.01	0.34	0.18	2.76
1914	000	158240.00	0.00	0.04	0.34	0.18	2.77
1989	000	63000.00	0.23	0.08	0.04	0.25	3.72

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)
2004	000	2840.00	0.36	0.18	1.69	0.47	8.78
2069	000	12960.00	0.26	0.29	0.10	0.18	3.01
2158	000	3520.00	0.02	0.11	0.04	0.19	4.07
2163	000	800.00	0.20	0.07	0.04	0.07	2.10
2164	000	17840.00	0.18	0.10	0.04	0.16	3.21
2215	000	26200.00	0.16	0.13	0.10	0.38	5.08
2216	000	26320.00	0.00	0.06	0.34	0.38	5.02
2391	000	18080.00	0.21	0.13	0.14	0.18	3.03

NUTRIENT ANALYSIS (1 YEAR EVENT)
PHOSPHOROUS

- 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)
1308	000	18680.00	0.05	0.07	0.00	0.09	1.18
1452	000	25280.00	0.07	0.02	0.01	0.09	1.20
1828	000	161320.00	0.00	0.01	0.00	0.03	0.49
1914	000	158240.00	0.00	0.02	0.00	0.03	0.49
1989	000	63000.00	0.11	0.04	0.00	0.05	0.67
2004	000	2840.00	0.18	0.09	0.40	0.09	1.58
2069	000	12960.00	0.13	0.14	0.01	0.03	0.50
2158	000	3520.00	0.01	0.05	0.00	0.03	0.71
2163	000	800.00	0.10	0.03	0.00	0.01	0.30
2164	000	17840.00	0.09	0.05	0.00	0.03	0.54
2215	000	26200.00	0.08	0.06	0.01	0.07	0.93
2216	000	26320.00	0.00	0.03	0.00	0.07	0.91
2391	000	18080.00	0.11	0.06	0.01	0.03	0.51

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)
1308	000	18680.00			2.48	7.01	96.72
1452	000	25280.00			9.16	6.71	86.57
1828	000	161320.00			0.00	2.84	44.40
1914	000	158240.00			0.00	2.85	44.58
1989	000	63000.00			2.48	3.69	54.79
2004	000	2840.00			23.10	7.47	138.74
2069	000	12960.00			6.32	3.52	57.30
2158	000	3520.00			2.48	2.83	61.95
2163	000	800.00			2.48	1.91	54.61
2164	000	17840.00			2.48	3.10	63.12
2215	000	26200.00			6.32	5.29	70.66
2216	000	26320.00			0.00	5.22	69.82
2391	000	18080.00			9.16	3.82	64.49

LAKE FAULKTON WATERSHED SUMMARY (6 MONTH EVENT)

Watershed Identification	Lake Faulkton
Drainage Area of the Watershed	161320.00 acres
Area of each base cell	40.00 acres
Type of event modeled	**6 month, 24 hr.**
Characteristic Storm Precipitation	1.40 inches
Storm Energy-Intensity Value	10.00

VALUES AT THE WATERSHED OUTLET (LAKE FAULKTON OUTLET)

Cell Number	1828 000
Runoff Volume	0.11 inches
Peak Runoff Rate	654.10 cfs
Total Sediment Yield	80.99 tons
Total Nitrogen in Sediment	0.01 lbs/acre
Total Soluble Nitrogen in Runoff	0.10 lbs/acre
Soluble Nitrogen Concentration in Runoff	4.14 ppm
Total Phosphorus in Sediment	0.00 lbs/acre
Total Soluble Phosphorus in Runoff	0.02 lbs/acre
Soluble Phosphorus Concentration in Runoff	0.75 ppm
Total Soluble Chemical Oxygen Demand	1.25 lbs/acre
Soluble Chemical Oxygen Demand Concentration in Runoff	49.73 ppm

VALUES AT THE WATERSHED OUTLET (LAKE FAULKTON OUTLET)

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	8	16	33.68	0.00	68.18
SILT	0.00	0.00	1	1	4.35	0.00	8.81
SAGG	0.02	0.00	0	0	1.89	0.00	3.83
LAGG	0.01	0.01	0	0	0.07	0.00	0.14
SAND	0.00	0.00	0	0	0.02	0.00	0.04
TOTAL	0.03	0.02	1	1	40.01	0.00	80.99

HYDROLOGY OF PRIMARY SUBWATERSHEDS (6 MONTH EVENT)

HYDROLOGY: - Cell - Num	Div	Drainage Area (acres)	Overland Runoff (in.)	Upstream Runoff (in.)	Peak Flow Upstream (cfs)	Downstream Runoff (in.)	Peak Flow Downstream (cfs)
1308	000	18680.00	0.05	0.13	373.40	0.13	373.57
1452	000	25280.00	0.36	0.15	383.67	0.15	496.93
1828	000	161320.00	1.40	0.11	694.70	0.11	654.10
1914	000	158240.00	1.40	0.11	1271.88	0.11	638.45
1989	000	63000.00	0.05	0.12	702.16	0.12	702.27
2004	000	2840.00	0.05	0.09	77.95	0.08	78.20
2069	000	12960.00	0.21	0.10	250.69	0.10	271.17
2158	000	3520.00	0.05	0.06	68.14	0.06	65.28
2163	000	800.00	0.05	0.04	17.21	0.04	18.01
2164	000	17840.00	0.05	0.07	215.06	0.07	215.20
2215	000	26200.00	0.21	0.14	523.17	0.14	506.77
2216	000	26320.00	1.40	0.14	511.42	0.14	258.70
2391	000	18080.00	0.36	0.10	297.49	0.10	283.23

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (6 MONTH EVENT)

SEDIMENT: - Cell - Num	Div	Particle Type	Cell Erosion (t/a)	---- Generated ---- Above (tons)	Within (tons)	Yield (tons)	Deposition (%)
1308	000	CLAY	0.00	94.84	0.02	94.84	0
		SILT	0.00	24.89	0.03	24.79	0
		SAGG	0.00	22.16	0.18	22.02	1
		LAGG	0.00	19.59	0.11	17.34	12
		SAND	0.00	5.94	0.02	5.24	12
		TOTL	0.01	167.42	0.37	164.23	2
1452	000	CLAY	0.00	28.04	0.02	33.79	-17
		SILT	0.00	3.96	0.03	15.99	-75
		SAGG	0.01	3.30	0.22	16.41	-79
		LAGG	0.00	3.00	0.13	23.87	-87
		SAND	0.00	0.91	0.03	7.23	-87
		TOTL	0.01	39.21	0.43	97.30	-59
1828	000	CLAY	0.00	90.63	0.00	68.18	25
		SILT	0.00	12.41	0.00	8.81	29
		SAGG	0.00	5.39	0.00	3.83	29
		LAGG	0.00	0.20	0.00	0.14	30
		SAND	0.00	0.05	0.00	0.04	31
		TOTL	0.00	108.69	0.00	80.99	26
1914	000	CLAY	0.00	487.21	0.00	176.45	64
		SILT	0.00	92.82	0.00	30.43	67
		SAGG	0.00	88.54	0.00	13.20	85
		LAGG	0.00	90.48	0.00	0.41	100
		SAND	0.00	27.39	0.00	0.11	100
		TOTL	0.00	786.44	0.00	220.59	72
1989	000	CLAY	0.00	165.40	0.04	165.43	0
		SILT	0.00	55.44	0.06	55.42	0
		SAGG	0.01	54.42	0.38	54.41	1
		LAGG	0.01	47.51	0.24	42.93	10
		SAND	0.00	14.38	0.05	12.50	13
		TOTL	0.02	337.15	0.76	330.69	2
2004	000	CLAY	0.00	15.95	0.07	16.00	0
		SILT	0.00	5.46	0.11	5.43	2
		SAGG	0.02	5.71	0.68	5.67	11
		LAGG	0.01	3.38	0.42	3.41	10
		SAND	0.00	1.03	0.08	1.03	7
		TOTL	0.03	31.53	1.37	31.55	7
2069	000	CLAY	0.00	50.04	0.08	113.93	-56
		SILT	0.00	15.27	0.05	51.00	-70
		SAGG	0.01	10.79	0.43	48.35	-77
		LAGG	0.00	10.14	0.19	68.20	-85
		SAND	0.00	3.07	0.02	20.67	-85
		TOTL	0.02	89.32	0.76	302.14	-70
2158	000	CLAY	0.00	5.96	0.03	9.39	-36
		SILT	0.00	3.07	0.05	4.93	-37
		SAGG	0.01	3.16	0.32	4.90	-35
		LAGG	0.00	3.36	0.20	6.48	-48
		SAND	0.00	1.02	0.04	1.96	-48
		TOTL	0.02	16.56	0.64	27.66	-40
2163	000	CLAY	0.00	1.12	0.03	1.14	1
		SILT	0.00	0.52	0.05	0.50	11
		SAGG	0.01	0.53	0.32	0.49	42
		LAGG	0.00	0.75	0.20	0.32	67
		SAND	0.00	0.23	0.04	0.10	64
		TOTL	0.02	3.14	0.64	2.55	33

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (6 MONTH EVENT)

2164 000	CLAY	0.00	61.26	0.03	61.27	0
	SILT	0.00	11.62	0.04	11.96	-3
	SAGG	0.01	11.41	0.27	11.90	-2
	LAGG	0.00	13.09	0.17	13.11	1
	SAND	0.00	3.97	0.03	3.97	1
	TOTL	0.01	101.35	0.55	102.22	0
2215 000	CLAY	0.00	153.49	0.02	153.40	0
	SILT	0.00	43.38	0.04	42.71	2
	SAGG	0.01	31.97	0.24	30.31	6
	LAGG	0.00	26.36	0.15	25.86	2
	SAND	0.00	7.98	0.03	7.84	2
	TOTL	0.01	263.19	0.48	260.12	1
2216 000	CLAY	0.00	153.67	0.00	64.56	58
	SILT	0.00	42.85	0.00	6.43	85
	SAGG	0.00	30.45	0.00	2.79	91
	LAGG	0.00	26.06	0.00	0.09	100
	SAND	0.00	7.89	0.00	0.02	100
	TOTL	0.00	260.92	0.00	73.88	72
2391 000	CLAY	0.00	60.08	0.04	60.06	0
	SILT	0.00	16.83	0.06	16.62	2
	SAGG	0.01	15.22	0.35	14.68	6
	LAGG	0.01	18.18	0.22	15.47	16
	SAND	0.00	5.50	0.04	4.69	15
	TOTL	0.02	115.81	0.70	111.52	4

CONDENSED SOIL LOSS (6 MONTH 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 (%)
1308	000	18680.00	0.05	99.9	373.57	0.01	167.42	0.37	164.23	2
1452	000	25280.00	0.36	99.6	496.93	0.01	39.21	0.43	97.30	-59
1828	000	161320.0	1.40	100.0	654.10	0.00	108.69	0.00	80.99	26
1914	000	158240.0	1.40	99.7	638.45	0.00	786.44	0.00	220.59	72
1989	000	63000.00	0.05	100.0	702.27	0.02	337.15	0.76	330.69	2
2004	000	2840.00	0.05	99.2	78.20	0.03	31.53	1.37	31.55	7
2069	000	12960.00	0.21	99.7	271.17	0.02	89.32	0.76	302.14	-70
2158	000	3520.00	0.05	98.9	65.28	0.02	16.56	0.64	27.66	-40
2163	000	800.00	0.05	93.9	18.01	0.02	3.14	0.64	2.55	33
2164	000	17840.00	0.05	99.8	215.20	0.01	101.35	0.55	102.22	0
2215	000	26200.00	0.21	99.8	506.77	0.01	263.19	0.48	260.12	1
2216	000	26320.00	1.40	99.8	258.70	0.00	260.92	0.00	73.88	72
2391	000	18080.00	0.36	99.2	283.23	0.02	115.81	0.70	111.52	4

NUTRIENT ANALYSIS (6 MONTH 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)
1308	000	18680.00	0.06	0.07	0.01	0.30	10.12
1452	000	25280.00	0.08	0.03	0.08	0.32	9.72
1828	000	161320.00	0.00	0.01	0.25	0.10	4.14
1914	000	158240.00	0.00	0.02	0.25	0.10	4.15
1989	000	63000.00	0.13	0.04	0.01	0.15	5.64

NUTRIENT ANALYSIS (6 MONTH EVENT)
NITROGEN

- 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)
2004	000	2840.00	0.21	0.09	0.89	0.28	14.62
2069	000	12960.00	0.15	0.19	0.05	0.11	4.55
2158	000	3520.00	0.02	0.07	0.01	0.10	7.09
2163	000	800.00	0.12	0.03	0.01	0.03	3.40
2164	000	17840.00	0.10	0.06	0.01	0.09	5.18
2215	000	26200.00	0.09	0.08	0.05	0.23	7.24
2216	000	26320.00	0.00	0.03	0.25	0.22	7.15
2391	000	18080.00	0.12	0.06	0.08	0.10	4.52

NUTRIENT ANALYSIS (6 MONTH EVENT)
PHOSPHOROUS

- 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)
1308	000	18680.00	0.03	0.04	0.00	0.05	1.80
1452	000	25280.00	0.04	0.01	0.00	0.06	1.75
1828	000	161320.00	0.00	0.00	0.00	0.02	0.75
1914	000	158240.00	0.00	0.01	0.00	0.02	0.75
1989	000	63000.00	0.07	0.02	0.00	0.03	1.03
2004	000	2840.00	0.11	0.04	0.21	0.05	2.65
2069	000	12960.00	0.08	0.09	0.00	0.02	0.80
2158	000	3520.00	0.01	0.03	0.00	0.02	1.30
2163	000	800.00	0.06	0.02	0.00	0.01	0.55
2164	000	17840.00	0.05	0.03	0.00	0.02	0.92
2215	000	26200.00	0.05	0.04	0.00	0.04	1.34
2216	000	26320.00	0.00	0.01	0.00	0.04	1.32
2391	000	18080.00	0.06	0.03	0.00	0.02	0.80

NUTRIENT ANALYSIS (6 MONTH 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)
1308	000	18680.00			0.68	3.63	122.40
1452	000	25280.00			4.83	3.34	101.26
1828	000	161320.00			0.00	1.25	49.73
1914	000	158240.00			0.00	1.24	49.82
1989	000	63000.00			0.68	1.70	62.85
2004	000	2840.00			11.64	3.66	190.64
2069	000	12960.00			2.91	1.42	60.81
2158	000	3520.00			0.68	0.96	66.58
2163	000	800.00			0.68	0.53	56.62
2164	000	17840.00			0.68	1.22	72.46
2215	000	26200.00			2.91	2.42	77.23
2216	000	26320.00			0.00	2.39	76.29
2391	000	18080.00			4.83	1.59	71.16

LAKE FAULKTON WATERSHED SUMMARY (MONTHLY EVENT)

Watershed Identification	Lake Faulkton
Drainage Area of the Watershed	161320.00 acres
Area of each base cell	40.00 acres
Type of event modeled	**Monthly, 24 hr.**
Characteristic Storm Precipitation	0.90 inches
Storm Energy-Intensity Value	3.90

VALUES AT THE WATERSHED OUTLET (LAKE FAULKTON OUTLET)

Cell Number	1828 000
Runoff Volume	0.02 inches
Peak Runoff Rate	111.44 cfs
Total Sediment Yield	11.52 tons
Total Nitrogen in Sediment	0.00 lbs/acre
Total Soluble Nitrogen in Runoff	0.03 lbs/acre
Soluble Nitrogen Concentration in Runoff	6.84 ppm
Total Phosphorus in Sediment	0.00 lbs/acre
Total Soluble Phosphorus in Runoff	0.01 lbs/acre
Soluble Phosphorus Concentration in Runoff	1.25 ppm
Total Soluble Chemical Oxygen Demand	0.29 lbs/acre
Soluble Chemical Oxygen Demand Concentration in Runoff	67.05 ppm

VALUES AT THE WATERSHED OUTLET (LAKE FAULKTON OUTLET)

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	18	30.94	0.00	10.77
SILT	0.00	0.00	0	1	1.48	0.00	0.52
SAGG	0.01	0.00	0	0	0.64	0.00	0.22
LAGG	0.00	0.00	0	0	0.02	0.00	0.01
SAND	0.00	0.00	0	0	0.01	0.00	0.00
TOTAL	0.01	0.01	0	1	33.09	0.00	11.52

HYDROLOGY OF PRIMARY SUBWATERSHEDS (MONTHLY EVENT)

HYDROLOGY: - Cell - Num	Div	Drainage Area (acres)	Overland Runoff (in.)	Upstream Runoff (in.)	Peak Flow Upstream (cfs)	Downstream Runoff (in.)	Peak Flow Downstream (cfs)
1308	000	18680.00	0.00	0.02	67.59	0.02	67.56
1452	000	25280.00	0.11	0.03	79.90	0.03	104.91
1828	000	161320.00	0.90	0.02	120.40	0.02	111.44
1914	000	158240.00	0.90	0.02	209.24	0.02	105.97
1989	000	63000.00	0.00	0.02	126.00	0.02	125.99
2004	000	2840.00	0.00	0.01	10.34	0.01	10.28
2069	000	12960.00	0.04	0.02	40.76	0.02	66.12
2158	000	3520.00	0.00	0.00	4.85	0.00	4.85
2163	000	800.00	0.00	0.00	0.53	0.00	0.52
2164	000	17840.00	0.00	0.01	29.10	0.01	29.08
2215	000	26200.00	0.04	0.03	103.50	0.03	101.06
2216	000	26320.00	0.90	0.03	101.09	0.03	51.80
2391	000	18080.00	0.11	0.02	50.66	0.02	46.44

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (MONTHLY EVENT)

SEDIMENT: - Cell - Num	Div	Particle Type	Cell Erosion (t/a)	---- Generated ---- Above (tons)	Within (tons)	Yield (tons)	Deposition (%)
1308	000	CLAY	0.00	32.12	0.01	32.11	0
		SILT	0.00	5.73	0.01	5.66	1
		SAGG	0.00	5.21	0.07	4.99	5
		LAGG	0.00	6.27	0.04	4.72	25
		SAND	0.00	1.90	0.01	1.43	25
		TOTL	0.00	51.23	0.14	48.91	5
1452	000	CLAY	0.00	4.05	0.01	10.57	-62
		SILT	0.00	0.80	0.01	5.72	-86
		SAGG	0.00	0.74	0.08	5.86	-86
		LAGG	0.00	0.94	0.05	8.53	-88
		SAND	0.00	0.28	0.01	2.59	-89
		TOTL	0.00	6.82	0.17	33.26	-79
1828	000	CLAY	0.00	14.54	0.00	10.77	26
		SILT	0.00	0.72	0.00	0.52	29
		SAGG	0.00	0.31	0.00	0.22	29
		LAGG	0.00	0.01	0.00	0.01	29
		SAND	0.00	0.00	0.00	0.00	29
		TOTL	0.00	15.59	0.00	11.52	27
1914	000	CLAY	0.00	87.37	0.00	28.62	67
		SILT	0.00	27.51	0.00	1.67	94
		SAGG	0.00	25.92	0.00	0.73	97
		LAGG	0.00	28.90	0.00	0.02	100
		SAND	0.00	8.76	0.00	0.01	100
		TOTL	0.00	178.45	0.00	31.05	83
1989	000	CLAY	0.00	41.77	0.01	41.78	0
		SILT	0.00	14.86	0.02	14.82	0
		SAGG	0.00	13.84	0.15	13.75	2
		LAGG	0.00	15.47	0.09	13.06	16
		SAND	0.00	4.69	0.02	3.93	17
		TOTL	0.01	90.62	0.30	87.34	4
2004	000	CLAY	0.00	3.80	0.03	3.81	0
		SILT	0.00	1.54	0.04	1.44	9
		SAGG	0.01	1.22	0.27	1.04	30
		LAGG	0.00	0.82	0.17	0.82	17
		SAND	0.00	0.25	0.03	0.25	11
		TOTL	0.01	7.63	0.53	7.36	14
2069	000	CLAY	0.00	7.17	0.03	30.16	-76
		SILT	0.00	2.90	0.02	15.52	-81
		SAGG	0.00	2.32	0.17	15.59	-84
		LAGG	0.00	2.86	0.07	22.60	-87
		SAND	0.00	0.87	0.01	6.85	-87
		TOTL	0.01	16.10	0.30	90.71	-82
2158	000	CLAY	0.00	0.97	0.01	0.99	-1
		SILT	0.00	0.46	0.02	0.44	6
		SAGG	0.00	0.45	0.13	0.38	16
		LAGG	0.00	0.54	0.08	0.55	0
		SAND	0.00	0.16	0.02	0.17	0
		TOTL	0.01	2.58	0.25	2.52	3
2163	000	CLAY	0.00	0.08	0.01	0.09	5
		SILT	0.00	0.04	0.02	0.03	57
		SAGG	0.00	0.04	0.13	0.02	90
		LAGG	0.00	0.05	0.08	0.02	81
		SAND	0.00	0.01	0.02	0.01	75
		TOTL	0.01	0.23	0.25	0.17	65

SEDIMENT ANALYSIS FOR THE PRIMARY SUBWATERSHEDS (MONTHLY EVENT)

2164 000	CLAY	0.00	8.31	0.01	8.31	0
	SILT	0.00	2.90	0.02	3.01	-3
	SAGG	0.00	2.73	0.11	2.88	-1
	LAGG	0.00	3.41	0.07	3.42	2
	SAND	0.00	1.03	0.01	1.04	1
	TOTL	0.01	18.39	0.21	18.65	0
2215 000	CLAY	0.00	57.86	0.01	57.75	0
	SILT	0.00	12.97	0.02	12.46	4
	SAGG	0.00	7.65	0.09	7.35	5
	LAGG	0.00	8.98	0.06	8.88	2
	SAND	0.00	2.72	0.01	2.69	2
	TOTL	0.00	90.19	0.19	89.14	1
2216 000	CLAY	0.00	57.75	0.00	11.40	80
	SILT	0.00	12.46	0.00	0.46	96
	SAGG	0.00	7.35	0.00	0.20	97
	LAGG	0.00	8.88	0.00	0.01	100
	SAND	0.00	2.69	0.00	0.00	100
	TOTL	0.00	89.14	0.00	12.07	86
2391 000	CLAY	0.00	20.35	0.01	20.30	0
	SILT	0.00	7.37	0.02	6.92	6
	SAGG	0.00	7.36	0.14	5.74	24
	LAGG	0.00	10.22	0.09	4.50	56
	SAND	0.00	3.10	0.02	1.36	56
	TOTL	0.01	48.40	0.27	38.82	20

CONDENSED SOIL LOSS (MONTHLY 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 (%)
1308	000	18680.00	0.00	99.9	67.56	0.00	51.23	0.14	48.91	5
1452	000	25280.00	0.11	99.4	104.91	0.00	6.82	0.17	33.26	-79
1828	000	161320.0	0.90	99.9	111.44	0.00	15.59	0.00	11.52	27
1914	000	158240.0	0.90	98.8	105.97	0.00	178.45	0.00	31.05	83
1989	000	63000.00	0.00	100.0	125.99	0.01	90.62	0.30	87.34	4
2004	000	2840.00	0.00	100.0	10.28	0.01	7.63	0.53	7.36	14
2069	000	12960.00	0.04	99.7	66.12	0.01	16.10	0.30	90.71	-82
2158	000	3520.00	0.00	98.9	4.85	0.01	2.58	0.25	2.52	3
2163	000	800.00	0.00	100.0	0.52	0.01	0.23	0.25	0.17	65
2164	000	17840.00	0.00	100.0	29.08	0.01	18.39	0.21	18.65	0
2215	000	26200.00	0.04	99.7	101.06	0.00	90.19	0.19	89.14	1
2216	000	26320.00	0.90	99.7	51.80	0.00	89.14	0.00	12.07	86
2391	000	18080.00	0.11	98.4	46.44	0.01	48.40	0.27	38.82	20

NUTRIENT ANALYSIS (MONTHLY EVENT)
NITROGEN

			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)
1308	000	18680.00	0.03	0.03	0.00	0.08	16.03
1452	000	25280.00	0.04	0.01	0.03	0.09	13.80
1828	000	161320.00	0.00	0.00	0.16	0.03	6.84
1914	000	158240.00	0.00	0.00	0.16	0.03	6.93
1989	000	63000.00	0.06	0.01	0.00	0.04	9.36

NUTRIENT ANALYSIS (MONTHLY EVENT)
NITROGEN

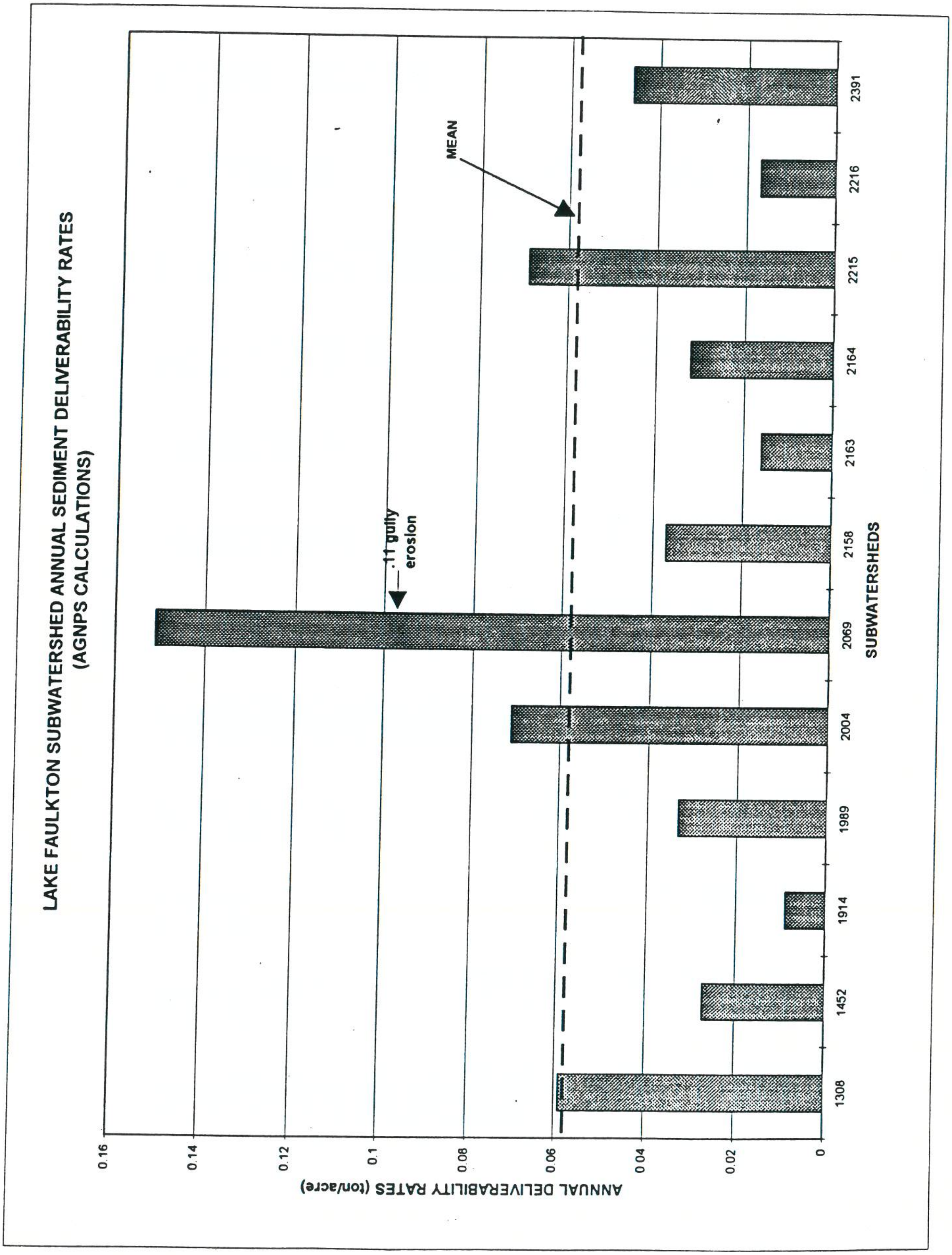
- Cell - Num	Div	Drainage Area (acres)	Sediment Within Cell (lbs/a)	Sediment Cell Outlet (lbs/a)	Water Soluble Within Cell (lbs/a)	Water Soluble Cell Outlet (lbs/a)	Conc (ppm)
2004	000	2840.00	0.10	0.02	0.43	0.09	42.77
2069	000	12960.00	0.07	0.06	0.01	0.03	8.27
2158	000	3520.00	0.01	0.01	0.00	0.02	22.50
2163	000	800.00	0.05	0.00	0.00	0.00	22.90
2164	000	17840.00	0.05	0.01	0.00	0.02	10.21
2215	000	26200.00	0.04	0.03	0.01	0.06	10.03
2216	000	26320.00	0.00	0.01	0.16	0.06	9.94
2391	000	18080.00	0.06	0.02	0.03	0.03	7.41

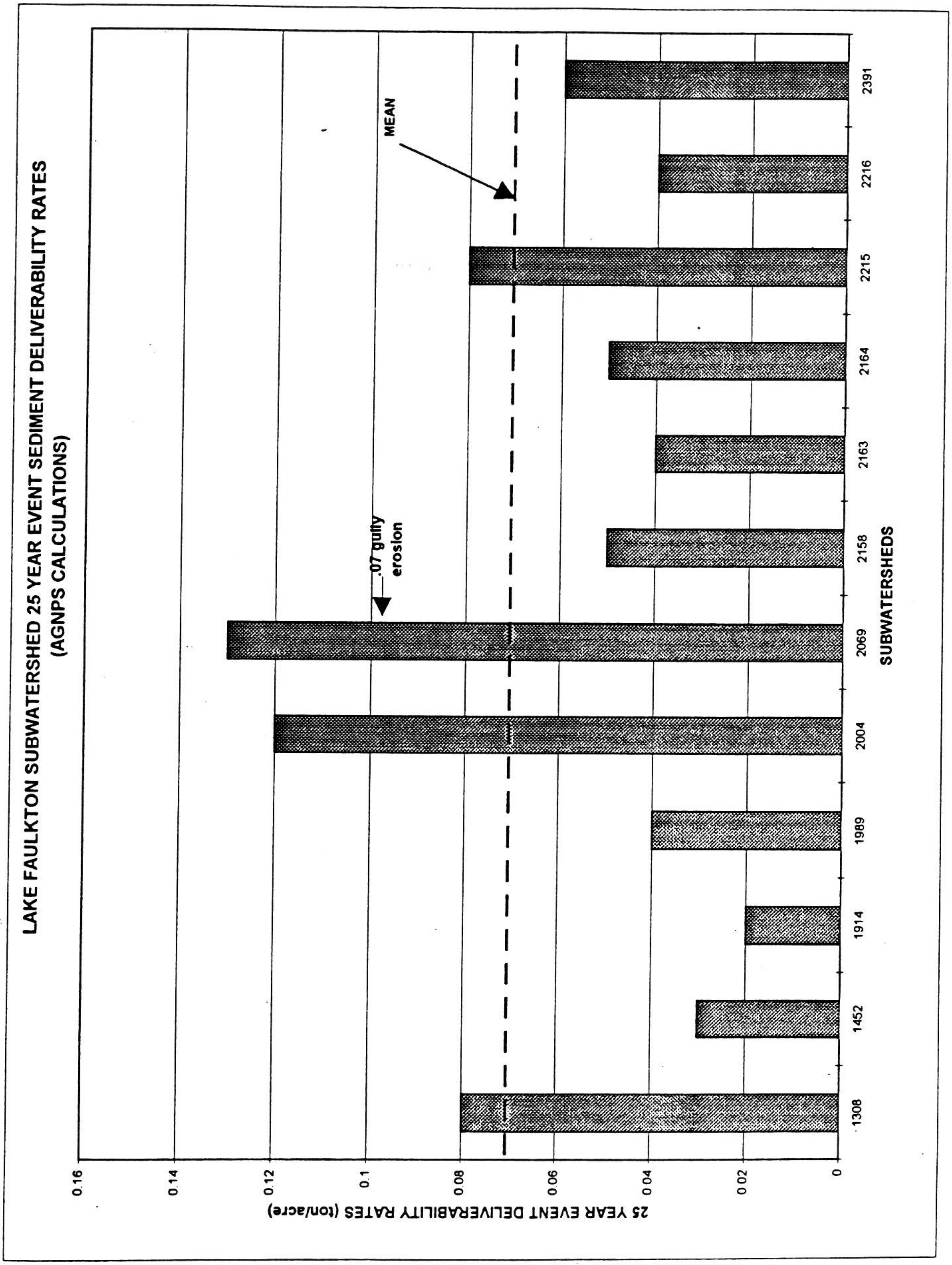
NUTRIENT ANALYSIS (MONTHLY EVENT)
PHOSPHOROUS

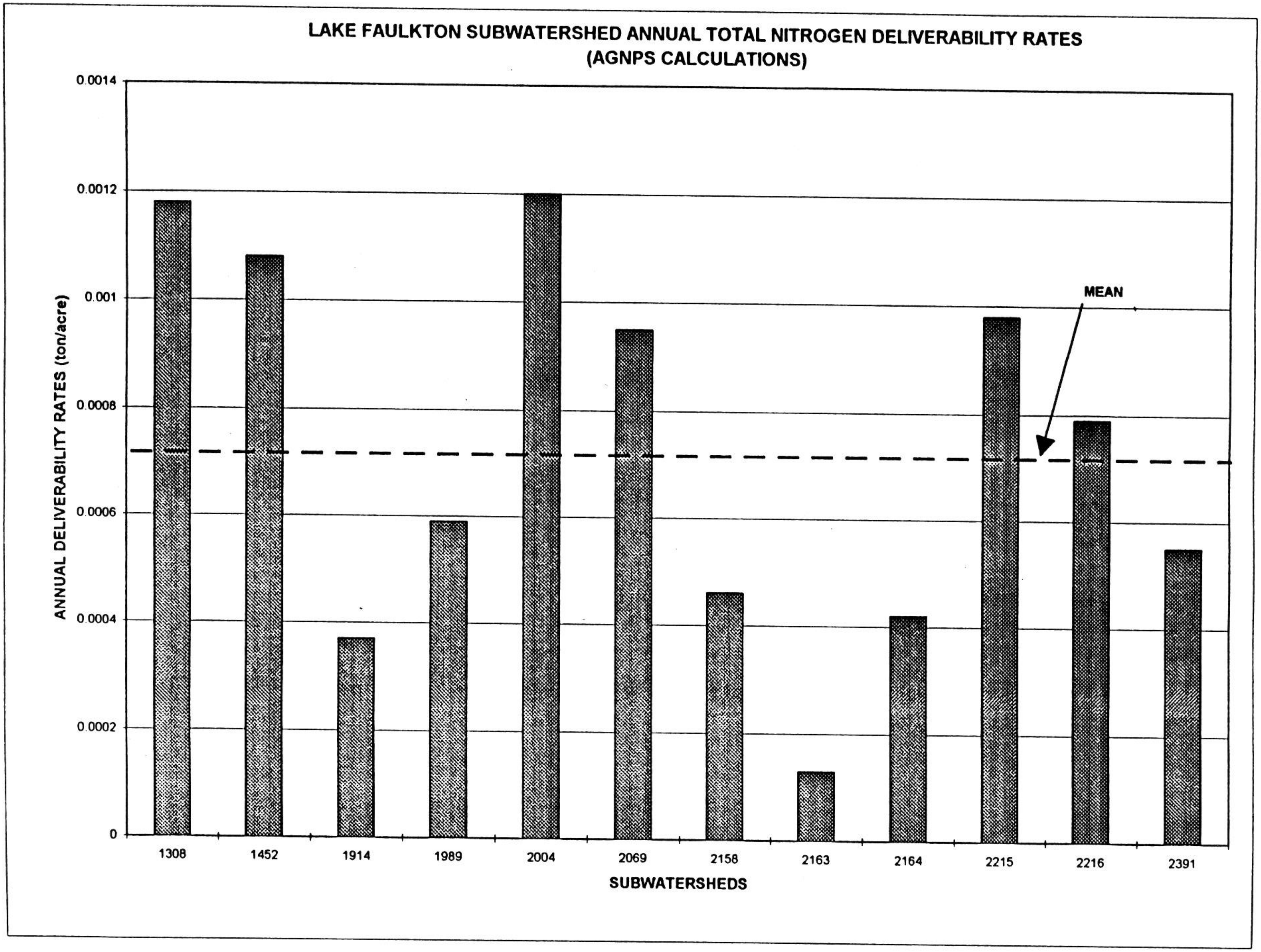
- Cell - Num	Div	Drainage Area (acres)	Sediment Within Cell (lbs/a)	Sediment Cell Outlet (lbs/a)	Water Soluble Within Cell (lbs/a)	Water Soluble Cell Outlet (lbs/a)	Conc (ppm)
1308	000	18680.00	0.01	0.01	0.00	0.01	2.85
1452	000	25280.00	0.02	0.01	0.00	0.02	2.47
1828	000	161320.00	0.00	0.00	0.00	0.01	1.25
1914	000	158240.00	0.00	0.00	0.00	0.01	1.28
1989	000	63000.00	0.03	0.01	0.00	0.01	1.73
2004	000	2840.00	0.05	0.01	0.10	0.02	7.84
2069	000	12960.00	0.04	0.03	0.00	0.01	1.50
2158	000	3520.00	0.00	0.00	0.00	0.00	4.35
2163	000	800.00	0.03	0.00	0.00	0.00	4.45
2164	000	17840.00	0.02	0.01	0.00	0.00	1.92
2215	000	26200.00	0.02	0.02	0.00	0.01	1.85
2216	000	26320.00	0.00	0.00	0.00	0.01	1.83
2391	000	18080.00	0.03	0.01	0.00	0.00	1.37

NUTRIENT ANALYSIS (MONTHLY EVENT)
CHEMICAL OXYGEN DEMAND

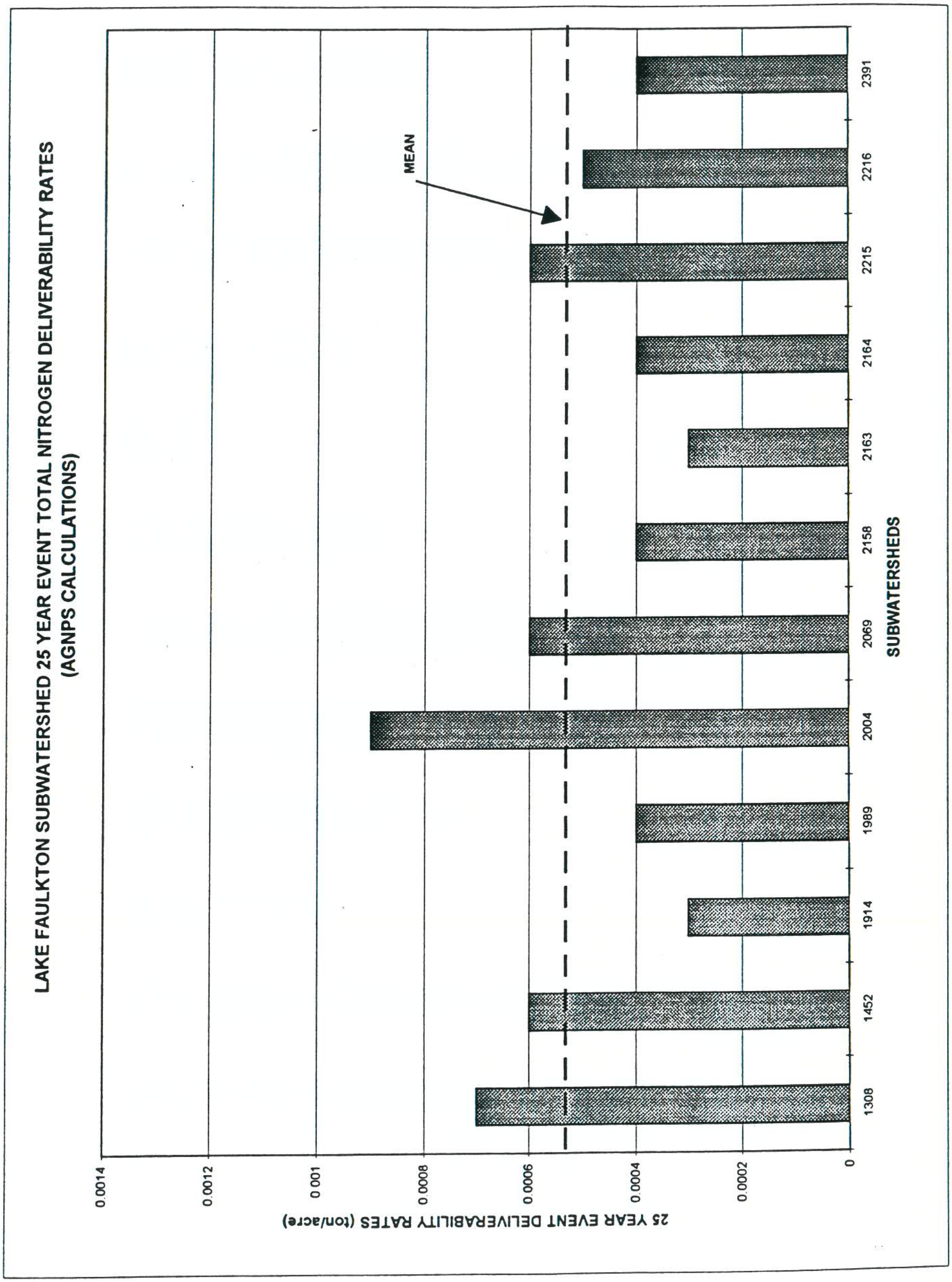
- Cell - Num	Div	Drainage Area (acres)	Sediment Within Cell (lbs/a)	Sediment Cell Outlet (lbs/a)	Water Soluble Within Cell (lbs/a)	Water Soluble Cell Outlet (lbs/a)	Conc (ppm)
1308	000	18680.00			0.00	0.87	170.43
1452	000	25280.00			1.51	0.77	115.30
1828	000	161320.00			0.00	0.29	67.05
1914	000	158240.00			0.00	0.28	67.08
1989	000	63000.00			0.00	0.40	83.27
2004	000	2840.00			5.39	1.22	549.15
2069	000	12960.00			0.61	0.25	71.55
2158	000	3520.00			0.00	0.08	87.73
2163	000	800.00			0.00	0.01	62.72
2164	000	17840.00			0.00	0.25	116.94
2215	000	26200.00			0.61	0.56	93.66
2216	000	26320.00			0.00	0.55	92.47
2391	000	18080.00			1.51	0.34	97.40

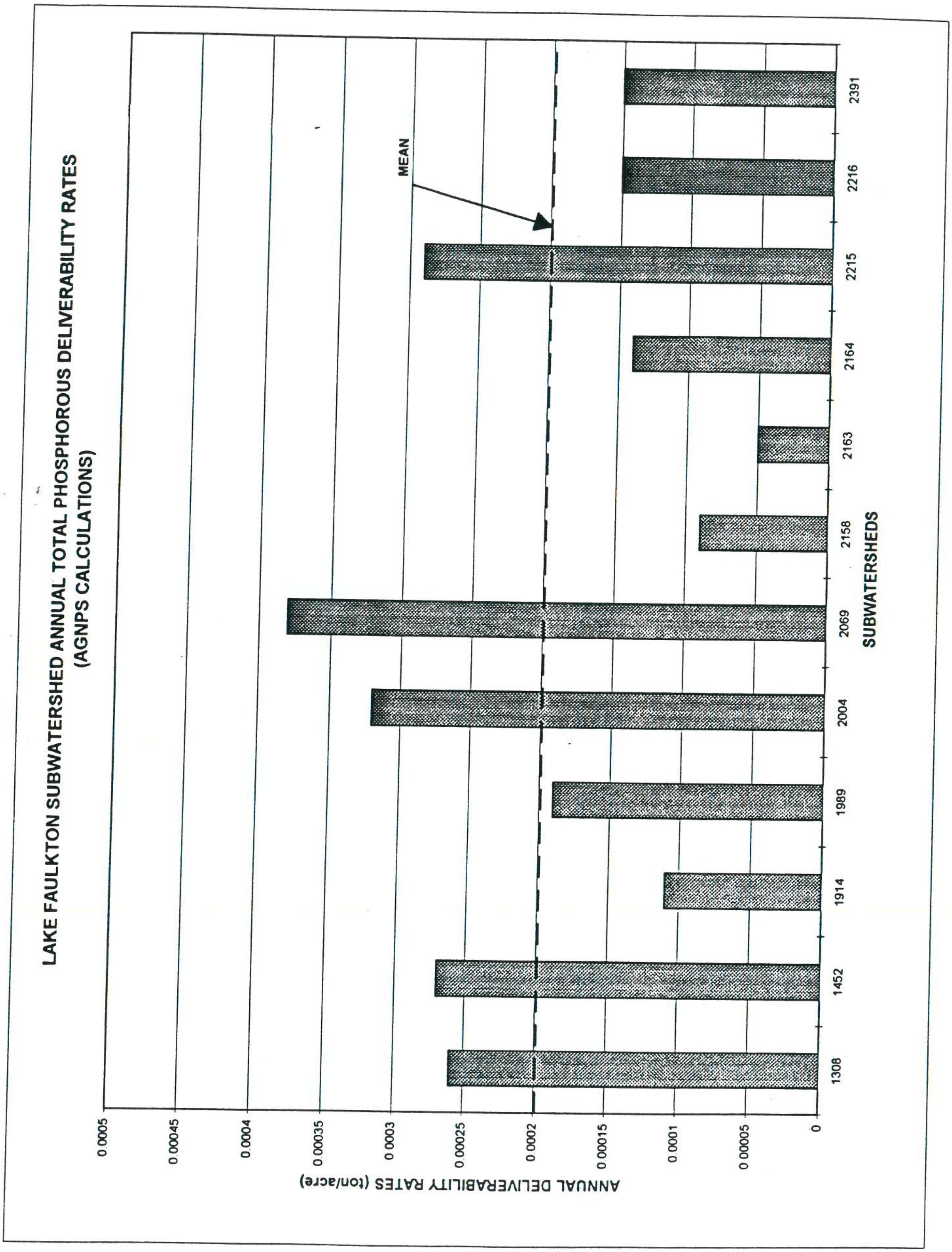

LAKE FAULKTON SUBWATERSHED ANNUAL SEDIMENT DELIVERABILITY RATES
(AGNPS CALCULATIONS)
ANNUAL DELIVERABILITY RATES (ton/acre)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
.11 gully erosion
MEAN
1308
1452
1914
1989
2004
2069
2158
2163
2164
2215
2216
2391
SUBWATERSHEDS

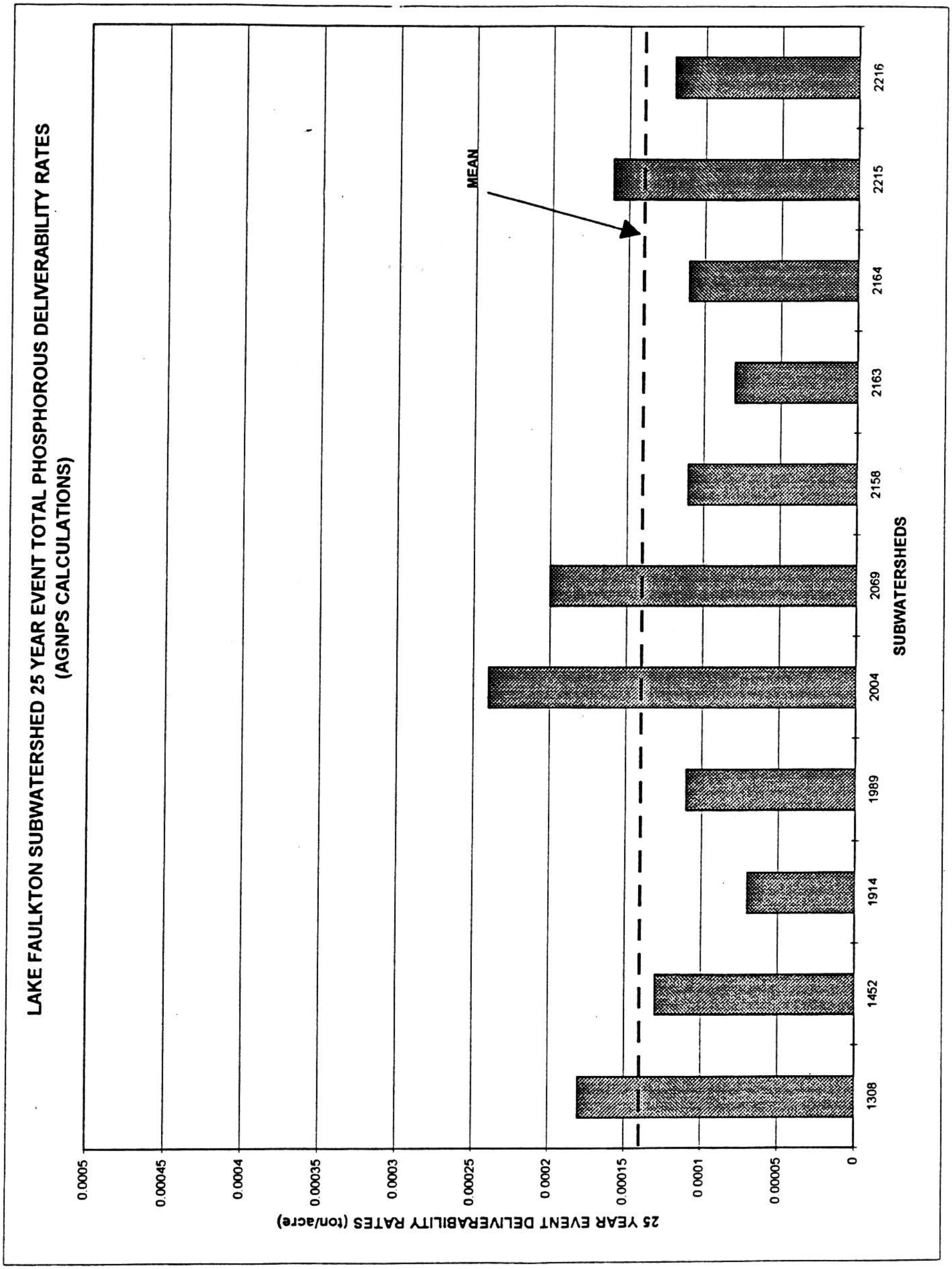

LAKE FAULKTON SUBWATERSHED 25 YEAR EVENT SEDIMENT DELIVERABILITY RATES
(AGNPS CALCULATIONS)
25 YEAR EVENT DELIVERABILITY RATES (ton/acre)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
MEAN
.07 gully erosion
1308
1452
1914
1989
2004
2069
2158
2163
2164
2215
2216
2391
SUBWATERSHEDS



LAKE FAULKTON SUBWATERSHED ANNUAL TOTAL NITROGEN DELIVERABILITY RATES
(AGNPS CALCULATIONS)
ANNUAL DELIVERABILITY RATES (ton/acre)
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
MEAN
1308
1452
1914
1989
2004
2069
2158
2163
2164
2215
2216
2391
SUBWATERSHEDS

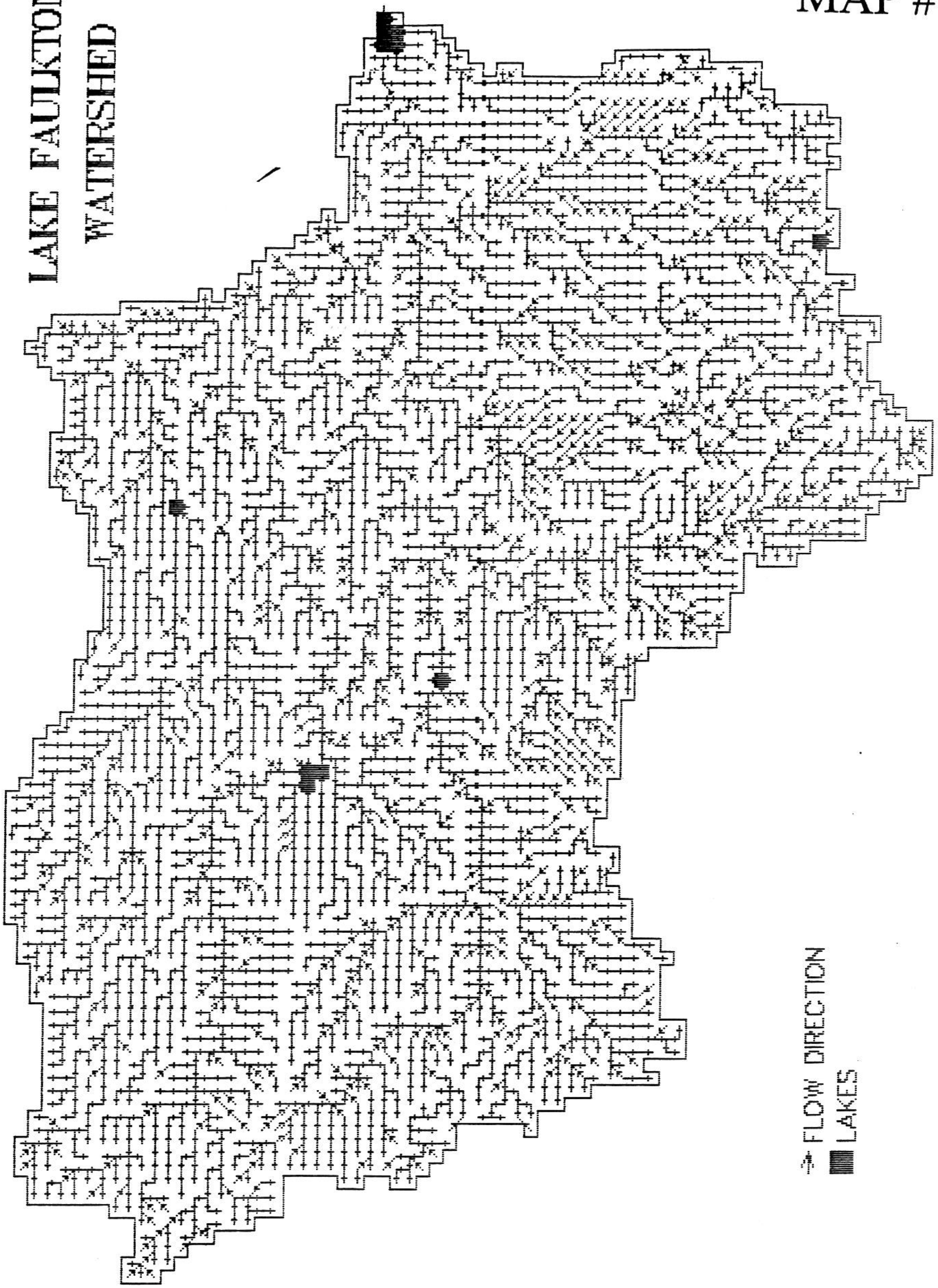

LAKE FAULKTON SUBWATERSHED 25 YEAR EVENT TOTAL NITROGEN DELIVERABILITY RATES
(AGNPS CALCULATIONS)
MEAN
25 YEAR EVENT DELIVERABILITY RATES (ton/acre)
0
0.0002
0.0004
0.0006
0.0008
0.001
0.0012
0.0014
1308
1452
1914
1989
2004
2069
2158
2163
2164
2215
2216
2391
SUBWATERSHEDS


LAKE FAULKTON SUBWATERSHED ANNUAL TOTAL PHOSPHOROUS DELIVERABILITY RATES
(AGNPS CALCULATIONS)
MEAN
ANNUAL DELIVERABILITY RATES (ton/acre)
0.0005
0.00045
0.0004
0.00035
0.0003
0.00025
0.0002
0.00015
0.0001
0.00005
0
1308
1452
1914
1989
2004
2069
2158
2163
2164
2215
2216
2391
SUBWATERSHEDS

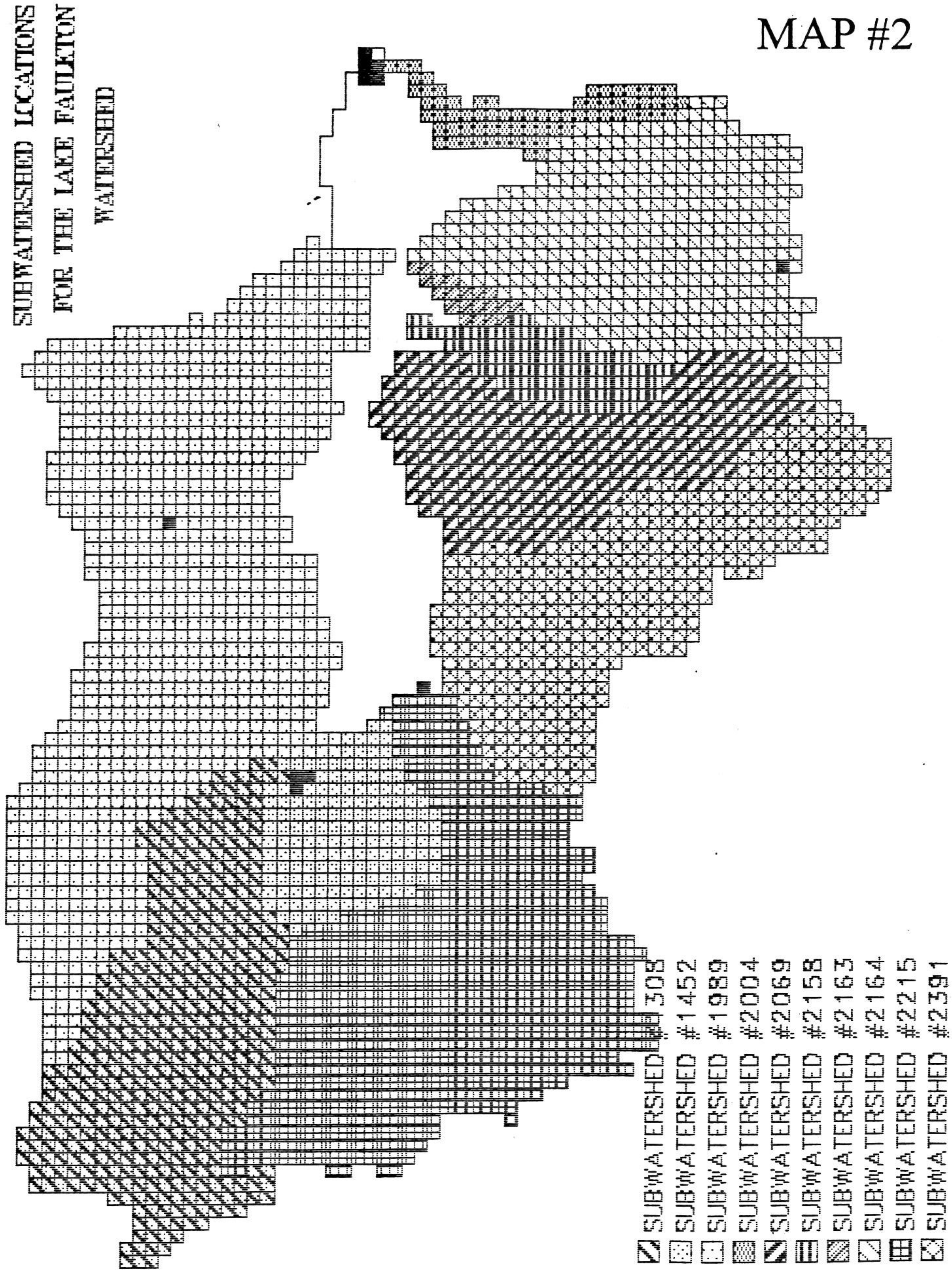

LAKE FAULKTON SUBWATERSHED 25 YEAR EVENT TOTAL PHOSPHOROUS DELIVERABILITY RATES
(AGNPS CALCULATIONS)
MEAN
25 YEAR EVENT DELIVERABILITY RATES (ton/acre)
SUBWATERSHEDS
0.0005
0.00045
0.0004
0.00035
0.0003
0.00025
0.0002
0.00015
0.0001
0.00005
0
1308
1452
1914
1989
2004
2069
2158
2163
2164
2215
2216

MAP #1

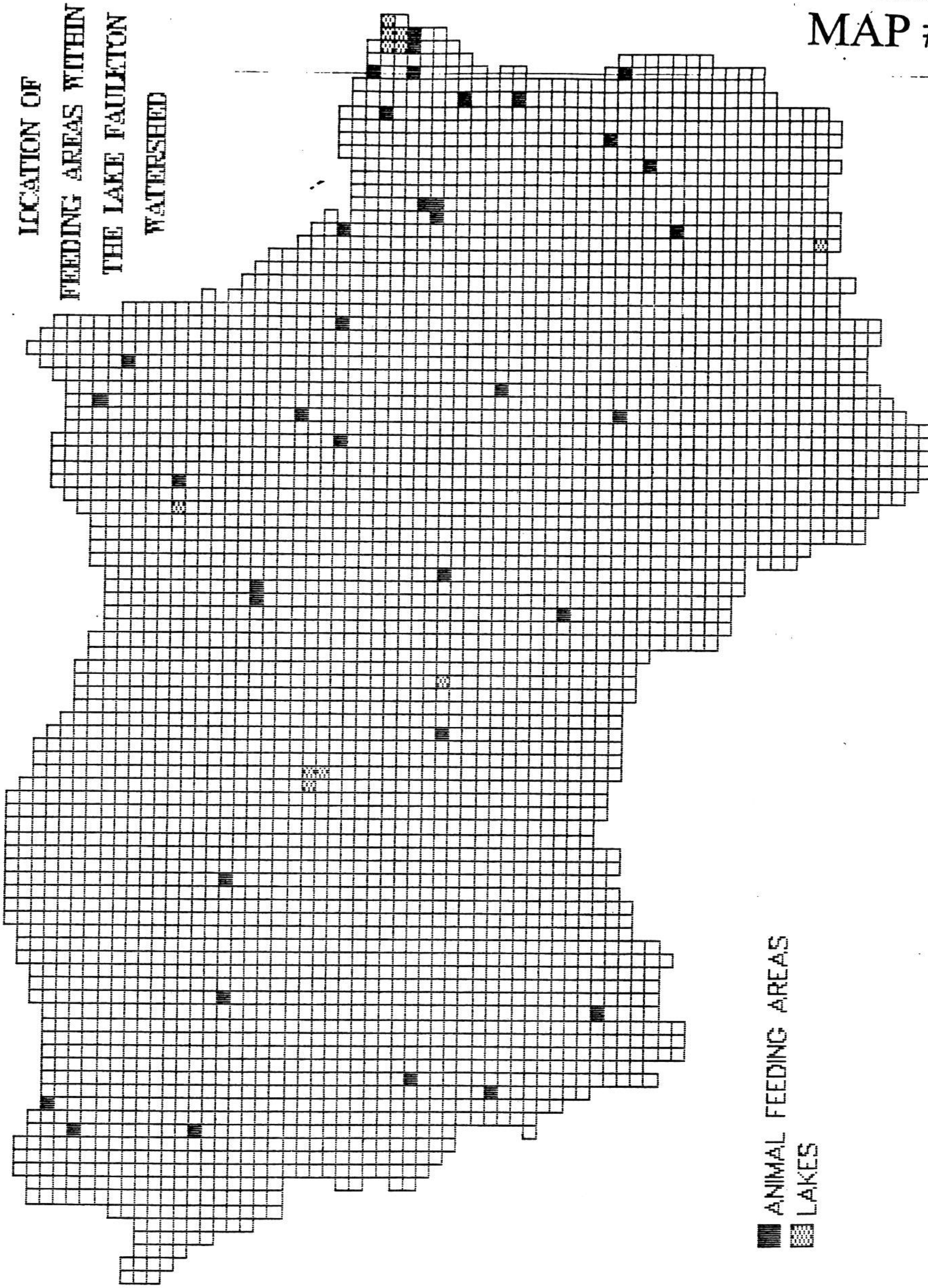
LAKE FAULKTON WATERSHED



MAP #2

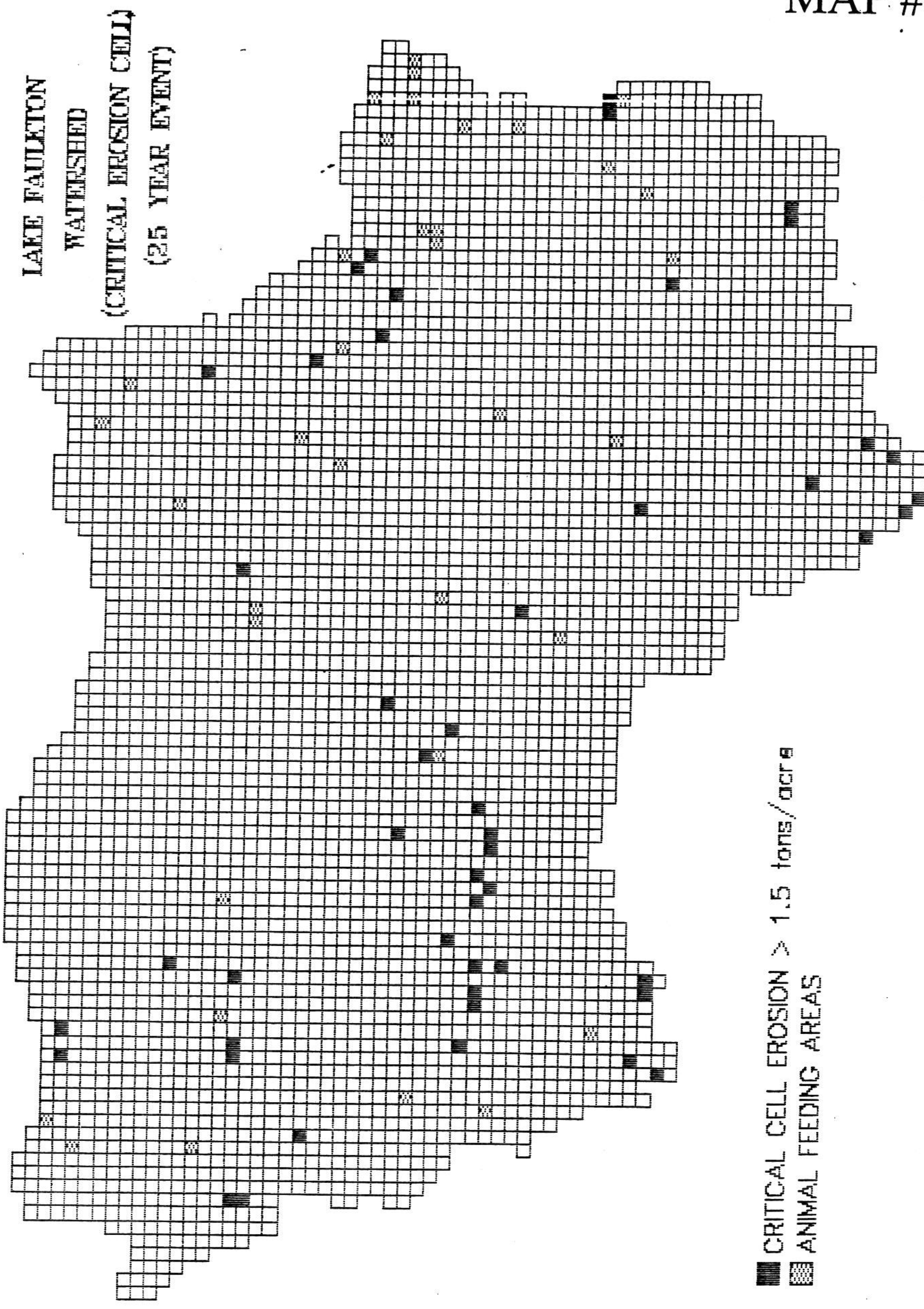

SUBWATERSHED LOCATIONS
FOR THE LAKE FAULKTON
WATERSHED
SUBWATERSHED 308
SUBWATERSHED #1452
SUBWATERSHED #1989
SUBWATERSHED #2004
SUBWATERSHED #2069
SUBWATERSHED #2158
SUBWATERSHED #2163
SUBWATERSHED #2164
SUBWATERSHED #2215
SUBWATERSHED #2391

MAP #3

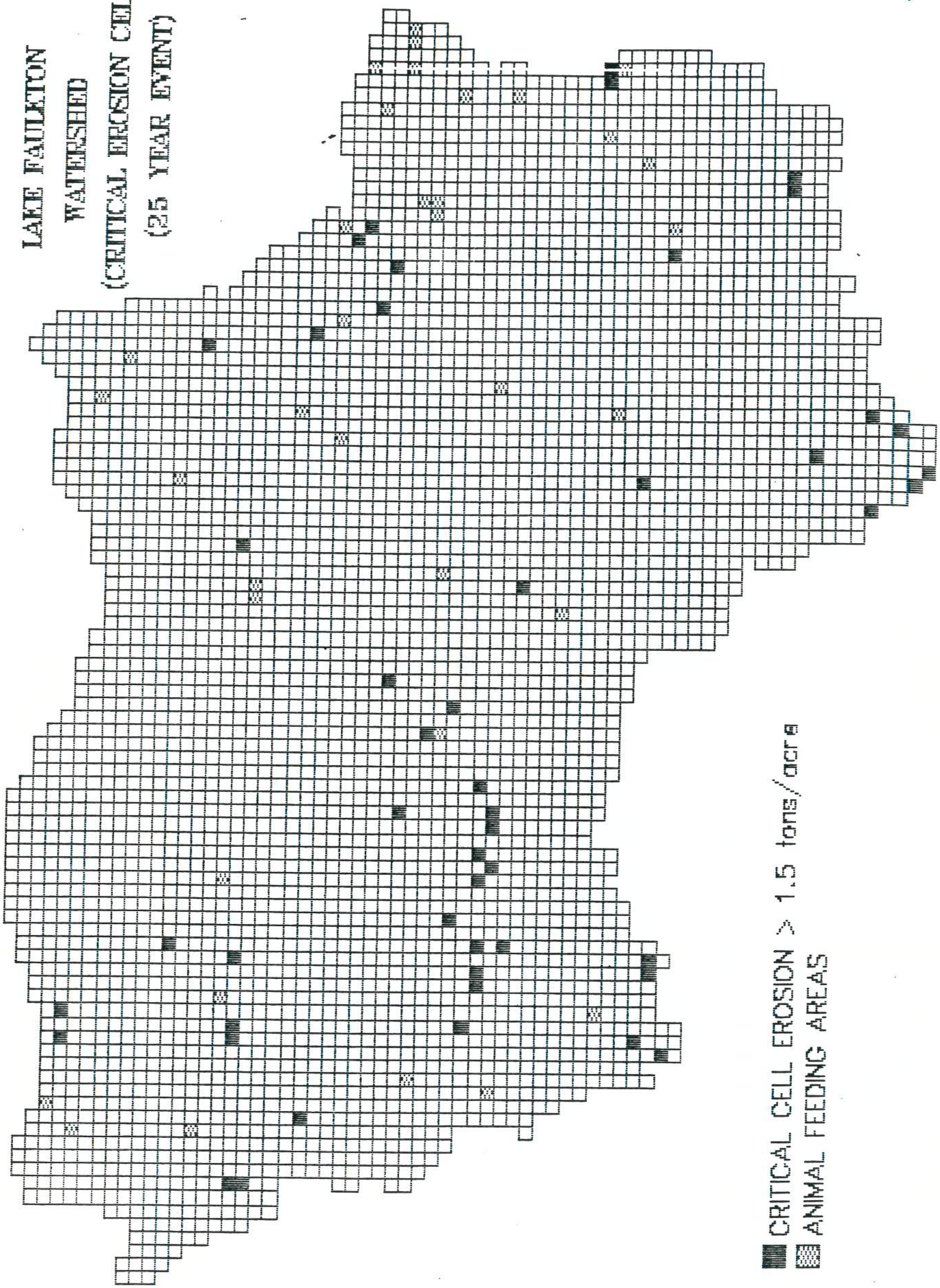


LOCATION OF
FEEDING AREAS WITHIN
THE LAKE FAULKTON
WATERSHED
ANIMAL FEEDING AREAS
LAKES

MAP #4

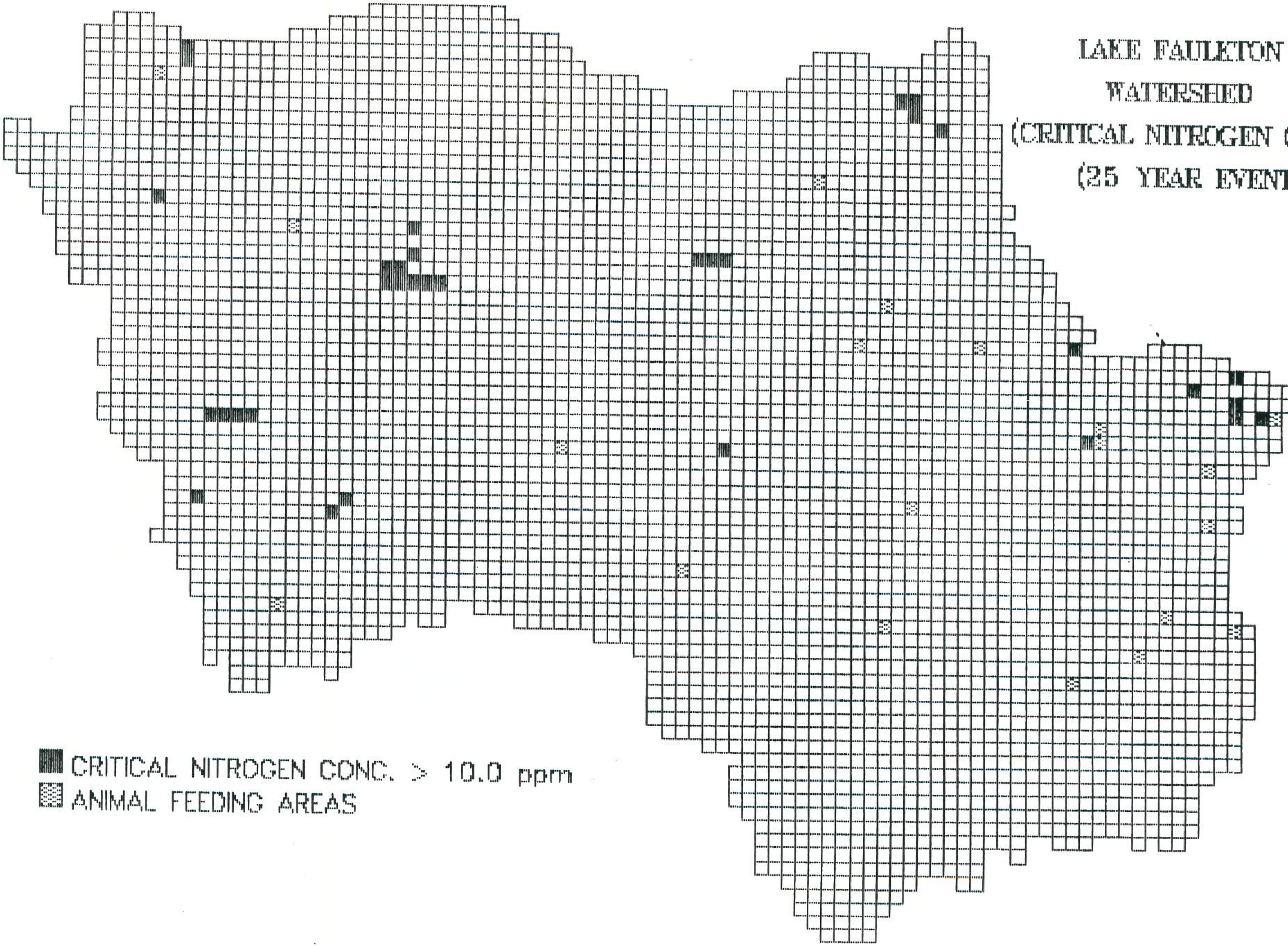

LAKE FAULKTON
WATERSHED
(CRITICAL EROSION CELL)
(25 YEAR EVENT)
CRITICAL CELL EROSION > 1.5 tons/acre
ANIMAL FEEDING AREAS

MAP #4

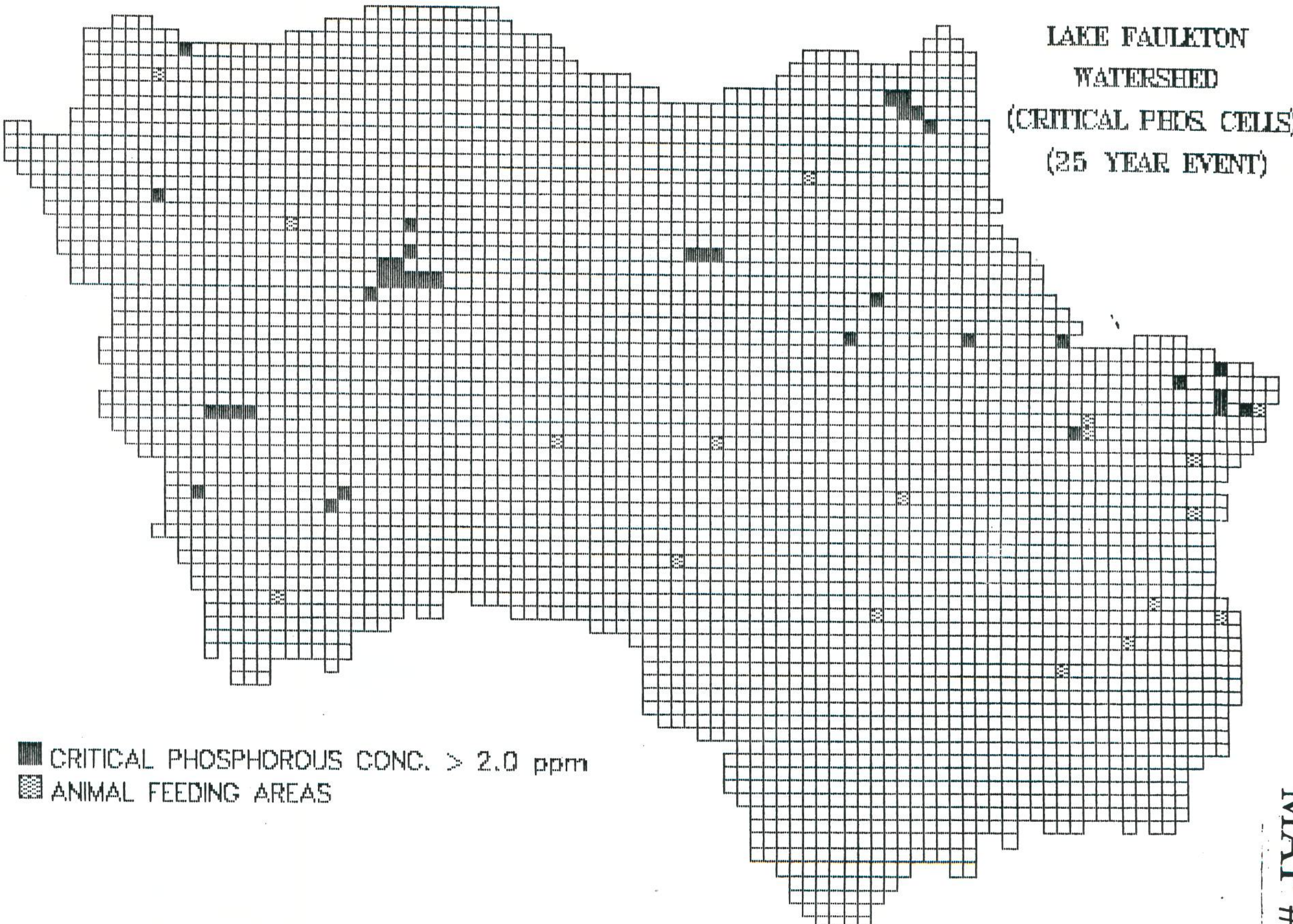

LAKE FAULKTON
WATERSHED
(CRITICAL EROSION CELL)
(25 YEAR EVENT)
CRITICAL CELL EROSION > 1.5 tons/acre
ANIMAL FEEDING AREAS

MAP #5

LAKE FAULKTON
WATERSHED
(CRITICAL NITROGEN CELLS)
(25 YEAR EVENT)



MAP #6


LAKE FAULETON
WATERSHED
(CRITICAL PHOS CELLS)
(25 YEAR EVENT)
CRITICAL PHOSPHOROUS CONC. > 2.0 ppm
ANIMAL FEEDING AREAS

APPENDIX E.

RARE, THREATENED, OR ENDANGERED SPECIES

RARE, THREATENED, OR ENDANGERED SPECIES

[The following information was provided by Mr. Doug Backlund; South Dakota Department of Game, Fish and Parks; Foss Building; 523 East Capitol; Pierre, SD]

Rare, threatened, or endangered species documented by the South Dakota Natural Heritage Database as occurring in the South Fork Snake Creek watershed include regal fritillary, Swainson's hawk, yellow rail, ferruginous hawk, and great blue heron. These species are not listed as threatened or endangered, but are monitored by the South Dakota Natural Heritage Program as rare or declining species.

The regal fritillary is a prairie butterfly that has disappeared from most of its range in the eastern United States. This butterfly is found on native prairie throughout most of South Dakota, but its habitat is greatly reduced, degraded, and fragmented. The regal fritillary will probably continue to decline due to the loss and fragmentation of its habitat.

With the exception of the yellow rail, the bird species listed above can be expected to nest in the watershed area. Little is known about the yellow rail. This secretive species may nest in the watershed area or may be migrant. Migrant species such as the federally threatened bald eagle and the federally endangered whooping crane, eskimo curlew, piping plover, and interior least tern could be expected to occur temporarily during migration. Of these federally listed species, bald eagles and whooping cranes would be the most likely to use this area during migration.

The lack of records for other rare, threatened, or endangered species does not indicate absence of these species. Most of South Dakota remains poorly inventoried for rare, threatened, or endangered species. If suitable habitat occurs in the watershed, other species considered rare or declining are probably present but remain undocumented.

APPENDIX F.

POTENTIAL USER POPULATION

SIZE AND ECONOMIC STRUCTURE OF POTENTIAL USER POPULATION

[The following information is taken from a report titled "LAKE FAULKTON: SOCIO-ECONOMIC CHARACTERISTICS OF THE USER POPULATION"; South Dakota State University; Census Data Center; December, 1995; Dr. Jim Satterlee, Director.]

The description of socio-economic characteristics of the potential user population will follow using two foci for analysis. First will be an examination of an area within a 50 mile radius surrounding Lake Faulkton. Secondly, will be a more focused analysis examining the same characteristics, but for those rural areas and communities within 20 miles of the lake (see Figures below).

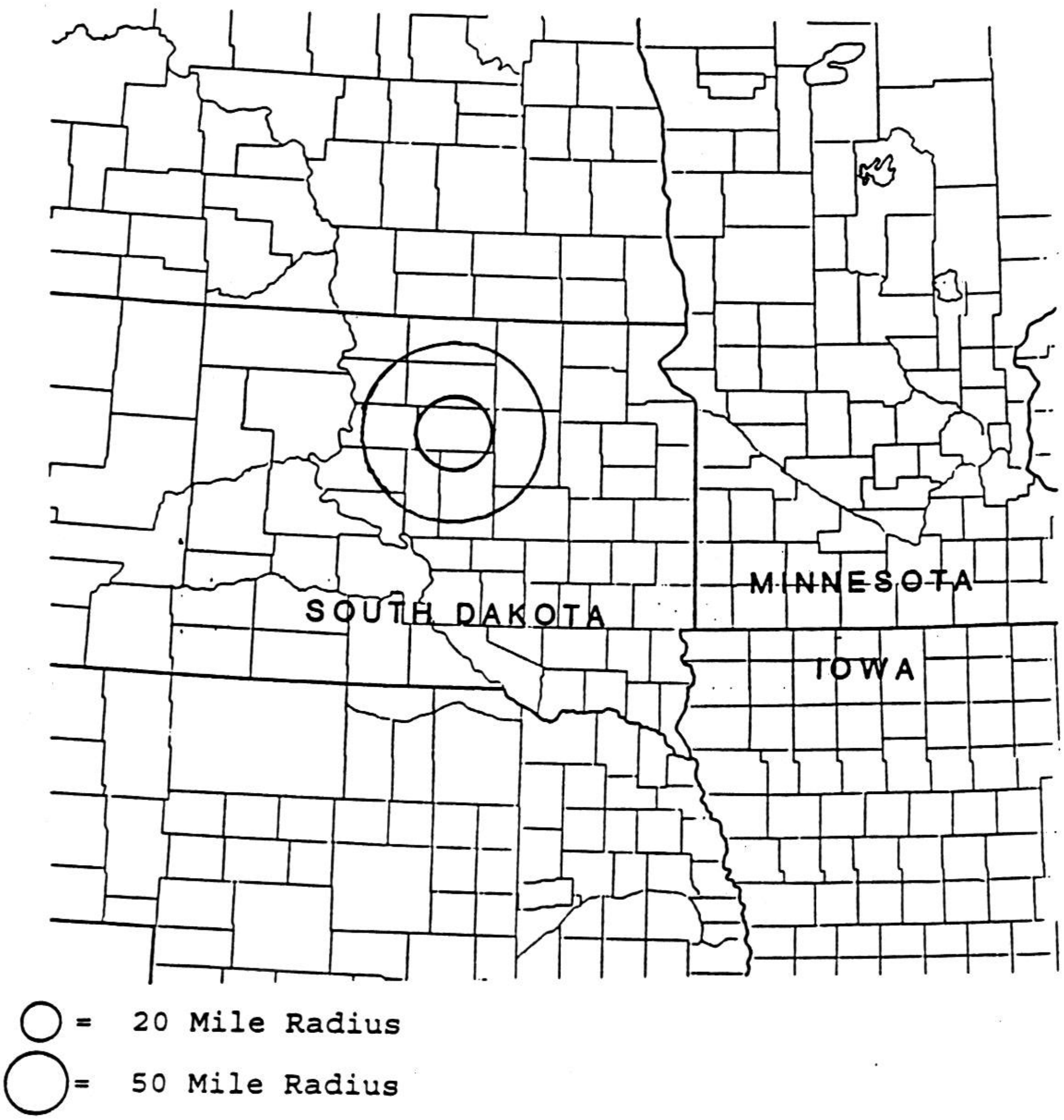
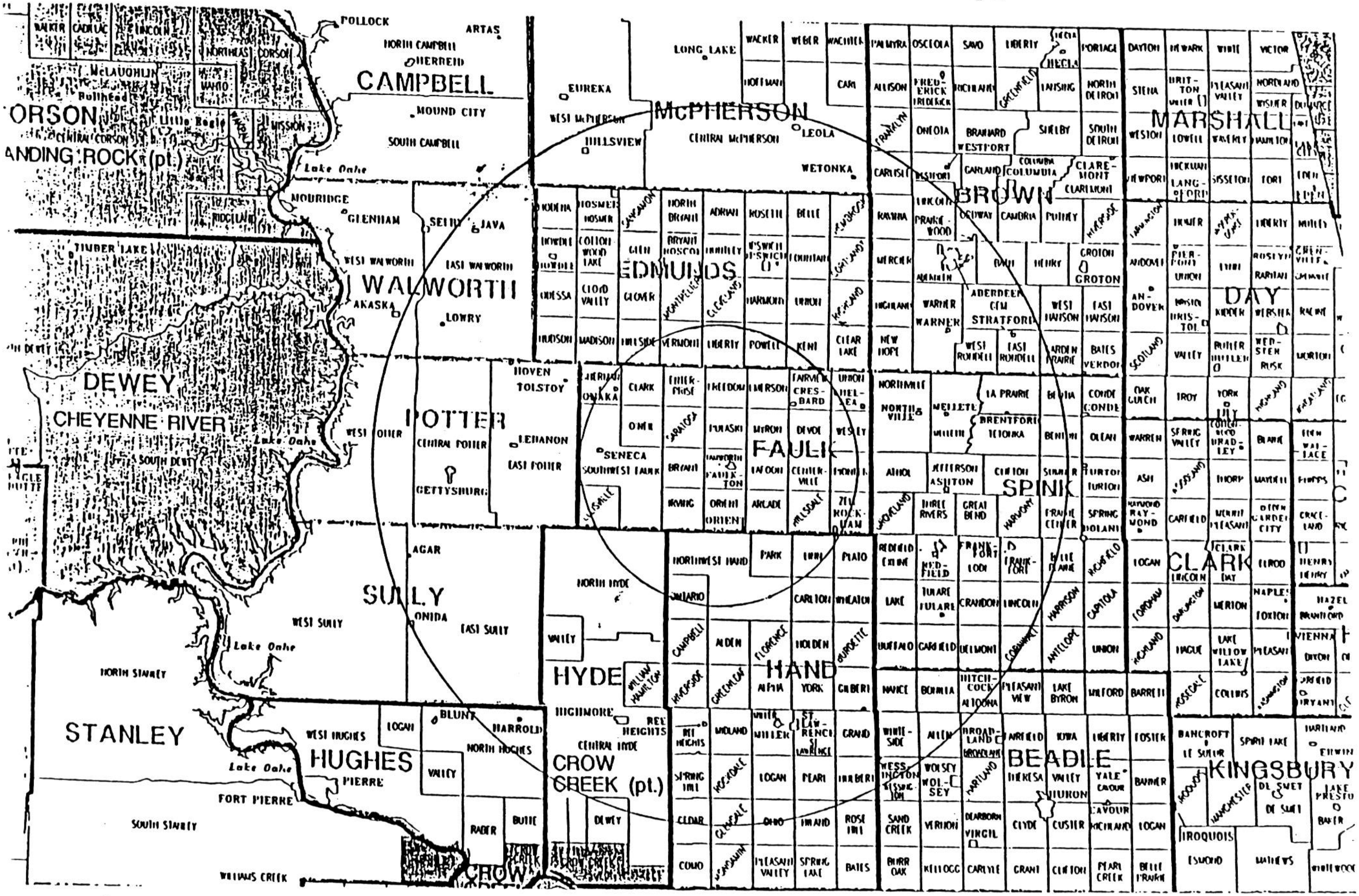


Figure : Lake Faulkton User Population Areas

Figure: Lake Faulkton User Population Areas (Counties and Townships)



 = 20 Mile Radius

 = 50 Mile Radius

POPULATION PROFILE

Lake Faulkton, located 3 miles west and 1/2 mile south of Faulkton, received its name from the city of Faulkton. One part of Lake Faulkton is a State Recreation Area and is managed by the Parks Division of the South Dakota Department of Game, Fish and Parks. It is used for camping, fishing, snowmobiling, swimming, boating, water skiing, bird watching, hunting, and trapping. This area is used primarily by people within 40 miles, but is also used by tourists and hunters.

The number of potential users to be found within 50 miles of Lake Faulkton requires an examination of census data from thirteen South Dakota counties (see previous figure). These 13 counties represent a total of 157 townships and 40 communities (see previous figure). In order to most accurately portray the characteristics of the population around the Lake Faulkton user area, data from these townships will be used. The 1990 U. S. Census of Population serves as the source of population numbers, 1989 data will be used for per capita and median family income information.

The total population represented within the 50 mile radius of Lake Faulkton is 60,279 persons. Sixty-six percent (39,767) of these residents live in communities ranging in size from less than 50 persons to an urban area of 25,000 persons. The remaining 34% (20,512 persons) of the population live on open-country farms or acreages outside of incorporated city boundaries. The figure on the following page provides a profile of the 50 mile user population by age and sex distribution.

A more focused examination of the user area (20 mile radius) incorporates only 4 counties (36 townships) and 6 communities (see figure on previous page). The total population represented in this area is 3,639 persons of which 1,234 (34%) reside in communities ranging from 48 persons (Rockham) to the largest community (Faulkton), located 3 miles east of the lake, with 809 persons. Sixty-six percent (2,405) of the user population live on open-country farms or acreages outside of incorporated boundaries. The population pyramid (following page) represents the distribution of persons by age and sex within the 20 mile radius.

The population pyramids representing both foci of analysis are indicative of the overall age and sex structure for the state of South Dakota. It is important to note that the 20-24 age group make up the smallest portion of the total population. It is this age group that is characterized by the highest incidences of out-migration.

Figure : USER POPULATION AREA - 50 MILE RADIUS

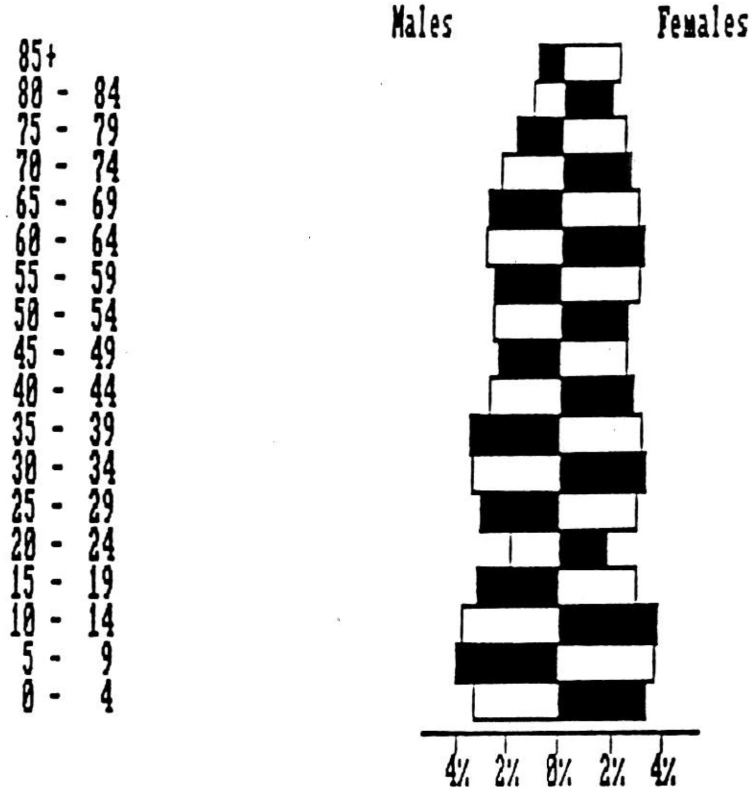
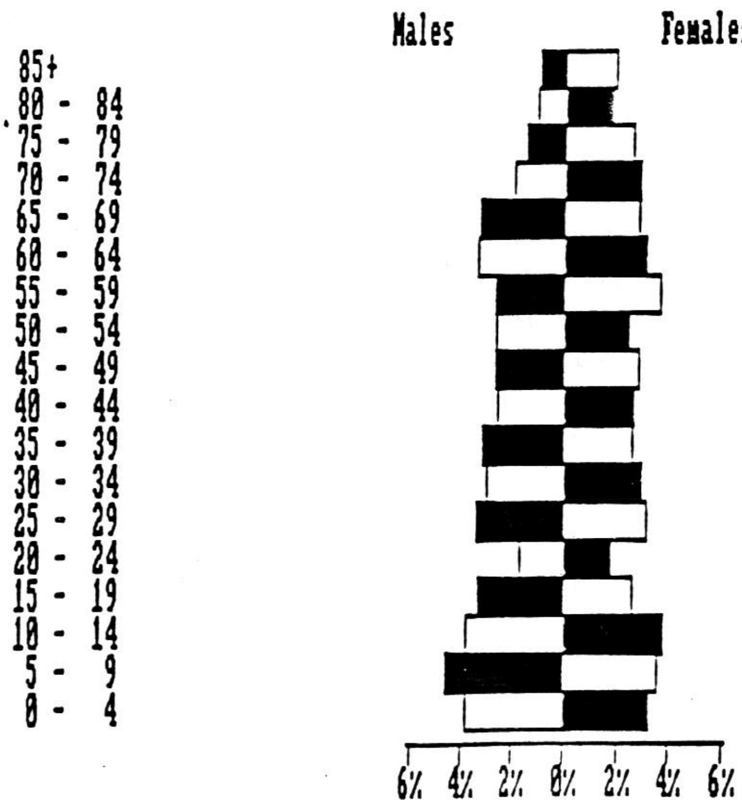


Figure : USER POPULATION AREA - 20 MILE RADIUS



EMPLOYMENT PROFILE

50 Mile Radius

Residents of the larger user area are for the most part employed in non-manufacturing occupations (90%) (see figure on the following page). These occupations are represented by agriculture, ag business, education, and service industries. Unemployment rates for both the larger user area (50 mile radius = 2.4%) and more local area (20 mile radius = 2.0%) are below the State average (4.2%) and substantially below the national average of 6.3%.

Per capita income for the larger user area was that of $10,099 and for the more local area $8,899. As noted in the figure on the following page, both are substantially below the national average of $14,420 and slightly less than the State average of $10,661.

A more recognizable comparison of economic status would be that of median family income. The table below reflects the variation among counties and states. One will note the substantial differences between the state average and that of the United States.

Real Median Family Income, 1989

SOUTH DAKOTA COUNTIES	REAL MEDIAN FAMILY INCOME 1989
BEADLE	$27,354
BROWN	29,665
CAMPBELL	20,771
EDMUNDS	23,788
FAULK	21,526
HAND	22,660
HUGHES	33,863
HYDE	25,081
McPHERSON	19,810
POTTER	25,029
SPINK	24,507
SULLY	26,722
WALWORTH	25,050
SOUTH DAKOTA	27,602
U. S.	35,225

Figure 1 Socio-Economic Characteristics of User Population - Lake Faulkton

	S. Dakota User Area Counties	Civilian Labor Force	Unemployment Rate	Employment Manufacturing	Employment Non-Manufacturing	Per Capita Income	
	Edmunds	2004	1.6%	86	1886	$ 8792	
20 Mile	Faulk	1223	2.0%	24	1175	8653	Average
Radius	Hand	1957	1.9%	56	1864	9305	$ 8899
	Hyde	800	2.4%	5	776	9648	
	Beadle	8918	4.1%	1228	7325	10373	
	Brown	18632	3.3%	1797	16219	11579	
	Campbell	920	1.8%	84	819	8678	
50 Mile	Hughes	8056	2.2%	271	7604	12263	Average
Radius	McPherson	1397	1.9%	57	1314	8790	$ 10,099
	Potter	1482	2.7%	54	1388	10177	
	Spink	3476	1.8%	106	3306	9674	
	Sully	840	2.0%	12	811	11559	
	Walworth	2887	3.2%	76	2719	10518	
		52592	2.4% (AVG.)	3856 (7%)	47206 (90%)		
	South Dakota		4.2%			10661	
	United States		6.3%			14420	