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Division of Fish and Wildlife
Section of Fisheries

Stream Survey Report

St. Francis River 2004

By

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General Information

Stream Name:	St. Francis River
Alternate Name:	None
Tributary Number:	M-65-5
Counties:	Benton, Sherburne
Nearest Town:	Brennyville, Santiago, Foley, Orrock, Big Lake
Source of flow:	Wetlands NW of Brennyville, Benton County, MN
Waterway sequence:	Wetlands /St. Francis River/Rice Lake/Elk River/Mississippi River
Stream Length:	79 miles, from headwater to confluence with Elk River
Gradient:	4.2 feet per mile from headwater to confluence with Elk River
Sinuosity:	2.45
Classification:	Class III (warm water feeder)

Watershed Description

Watershed Name and Number

Major:	Mississippi River – St. Cloud 17
Minor:	St. Francis River 17049
Watershed Area:	132,918 acres

Watershed Land Use: Agriculture 37%, grassland/pasture 27%, forest 20%, wetland 7%, grassland/shrub 5%, residential 2.0%, miscellaneous 2%.

Riparian Zone: The surrounding land is undeveloped or wetland in the lower portions of the watershed. In the upper portion the river is bordered by wetland or reed canary grass with willows, alders and cottonwood trees along the banks. Portions of the riparian corridor within the Sherburne National Wildlife Refuge have been restored to native grasses, shrubs and sedges.

Summary

The St. Francis River is a warm water stream with headwaters located approximately one mile northwest of the town of Brennyville in Benton County, Minnesota. The St. Francis River watershed encompasses 132,918 acres of gently rolling to flat terrain. Agricultural areas compose 37% of the land area. Wetland areas compose 7% of the estimated land use, while forested areas represent 20%. Residential land use estimated in 1991 was only 2%, however, during the 12 years since the information was made available, the rate of development in Sherburne County has increased substantially. New developments within the lower portion of the watershed have impacted the riparian corridor of the St. Francis River, and may have long-term effects on hydrology, erosion and fisheries potential. Six classification cross sections were measured in several areas of the St. Francis River between the mouth of the river near Big Lake, to 40 miles upstream near Santiago. The cross sections revealed a C channel with mostly fine sediments.

In cooperation with the Sherburne National Wildlife Refuge staff, an assessment of the fish population in the St. Francis River was performed in 2004. The survey included both barge and boat electrofishing at 17 stations between Big Lake and the Benton County line northwest of Santiago for a total effort of 7.04 hours. The St. Francis River is a cool water stream system with northern pike as a top level predator. Overall, 2,219 fish were captured representing eight families and 35 species. Northern pike were the most abundant game species. One hundred and five were captured and lengths ranged from 115 mm (4.5 in) to 628 mm (24.7 in). The average length was 374 mm (14.7 in). A spatial distribution of species primarily associated with dam placement seems apparent when comparing the electrofishing catch. TheLong Pool Dam limits movement of fish to upstream portions of the St. Francis River.

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Watershed

The St. Francis River watershed is located in central Minnesota within Sherburne, Benton and Mille Lacs counties (Figure 1). The drainage area (132,918 acres) has estimated land uses of 37% agricultural, 27% grassland/pasture, 20% forested, and 7% wetland (Table 1 and Figure 2) based on the 1991 Land-use/Land-cover GIS layer. The headwater of the St. Francis River is located approximately one mile northwest of the town of Brennyville, Minnesota in Benton County. The main stem of the St. Francis River represents 17% of the drainage network and flows 77 miles to the confluence with the Elk River. Tributaries and ditches encompass 466 miles of stream channel within the entire watershed. Within Sherburne County the St. Francis River meanders 48 miles to the mouth near Big Lake, Minnesota. The majority of the stream lies within lowland marsh and sand prairie.

The St. Francis River watershed is relatively wide within Sherburne County and narrower towards the headwater and the mouth. The watershed lies on a southeast to northwest axis with a southerly aspect. Wetlands influence the groundwater inputs to the main stem channel. The watershed has a low basin relief and a significant portion of the St. Francis River (26 miles) flows through the Sherburne National Wildlife Refuge (SNWR). The SNWR was founded in 1965, with land that had a long history of ditching and agriculture dating to the early 1900s. Currently, the SNWR encompasses 30,700 acres of mixed hardwood forest, oak woodland, prairie openings, four natural lakes and a diversity of wetlands.

The refuge has a series of 22 pools created by dams or dikes that range from 8 to 1,436 acres. Two of these structures directly influence sediment transport, flow regime and fish passage on the St. Francis River. St Francis Pool, located near Santiago, and Long Pool, located near the SNWR headquarters (middle of refuge), have radial gate structures that regulate flow. The two main stem impoundments were constructed in 1980 to help manage the other pools for wildlife management purposes, especially migrating and breeding waterfowl. The radial gate designs were specifically constructed to prevent fish passage while allowing water level manipulation.

An initial survey of the St. Francis River with a special study of the fishes of the Sherburne National Wildlife Refuge was conducted in 1988. Initial surveys compiled information on fish communities, physical and chemical characteristics and invertebrate species composition and abundance. During 2002, USFWS staff conducted a fishery and mussel survey on the SNWR at six stations. During 2003, DNR fisheries conducted a follow-up survey, including Rosgen classification (Rosgen 1996) and physical feature information to update information and plan for fisheries sampling during 2004. In 2004, additional Rosgen classification and electrofishing was performed in a effort to further describe the river geomorphology and sample the fish population in 17 locations. Analysis of land use was performed using Arcview® 3.3, and the 1991 land use/land cover layer. Locations of sampling stations and stream line were identified with a Global Positioning System (GPS) receiver or digitized at the 1:5,000 scale from 2003 aerial photography.

Hydrology

The St. Francis River has an overall gradient of 4.20 ft/mile and a sinuosity of 2.45 between the headwater and the confluence with the Elk River. The low gradient, broad flood plain and relatively high sinuosity throughout most of the watershed would suggest a flow profile (hydrograph) that should be gradually rising and falling. Land use practices such as ditching, installation of tile, residential development and direct channel modification have changed the annual hydrograph somewhat. Unfortunately, the St. Francis River currently does not have any operational gauges in the entire length. Estimates from pools above radial gate dams provide some insight to annual discharge and the potential flow regime. Estimated discharges were calculated from St. Francis Pool Dam during 2004. Discharge varied between a low of less than 5 ft^3/second during August and a high of 399 ft^3/second during April and averaged 116 ft^3/second between March and November. There may be problems associated with these measurements; they do not consider ground water inputs or the greater portion of the watershed and were based on pool elevations and gate opening dimensions rather than actual flow measurement within the channel. Additionally, the Long Pool outlet is upstream of Battle brook (74-21-1) where considerable flow was available from the Little Elk Lake watershed.

Prior to the installation of the two impoundments on the St. Francis River, three operational United States

Geological Survey (USGS) gages were in place upstream, within and downstream of the SNWR. The discharges recorded during 1966 (Figure 3) indicate the influence of ditches in the watershed upstream of SNWR (Near Santiago) by displaying more abrupt peaks and relatively abrupt falls from high flow events. Downstream of the SNWR during 1966 (Big Lake gage) the peak discharges are followed by more gradual falls indicating a more intact riparian corridor and a functional flood plain. The Big Lake site has not been operational since 1970, while the Santiago site has not been operational since 1981.

Geomorphology

Rosgen classification DNR sites

Rosgen classification (Rosgen 1996) was conducted at two sites in the lower portion of the St. Francis River watershed and one above the SNWR (Figure 4). Elevations were recorded with the aid of a laser level. Classification of these areas included calculation of slope, sinuosity, entrenchment (flood prone width relative to stream channel width), and substrates (particle count) within the sample area.

The lower site (6) was located approximately one-half mile from the confluence with the Elk River. Channel morphology in this reach appeared relatively stable, with unaltered riparian vegetation and large cottonwood trees. The area could also be classified as floodplain forest with a flood prone area width of 960 ft. The Rosgen indicators estimated the channel was a C5, moderately entrenched (12.1), with a high width/depth ratio (37.9)(Table 2). The predominant substrate type (D-50) was fine sand; and the sinuosity was 2.27. The area had a slope of 0.064. A C5 stream type is considered a slightly entrenched, meandering, sand dominated, riffle/pool channel with a well developed floodplain (Rosgen 1996). The C5 stream type can be relatively stable when there is significant riparian vegetation present. However, it can be highly subject to lateral movements if bank vegetation is not present, if the channel is manipulated, or if changes in sediment or flow regimes occur . Sediment supplies are typically high to very high unless the banks are well vegetated.

The second Rosgen cross section (5) was performed just downstream of a potential road crossing near Eagle Lake, approximately four miles from the mouth. This area was unique compared to other portions of

the St. Francis River. Substrates, while mostly fine sand, also consisted of some gravel. The riffle chosen for the site may be one of few in the lower portion of the St. Francis River. This station was also classified as a C5 stream type. The area had a relatively broad flood prone area (700 ft) and a slight entrenchment ratio of 6.2. The sinuosity was slightly lower than R1 with 1.27 and the cross sectional area was considerably greater (273.9 ft^2). This area had relatively low impact from development and housing. The wide flood prone area and the moderate sinuosity has forced most development to be outside of the riparian corridor. Along the upper portion of the reach, where Big Lake Township had proposed an extension of 229th Street across the St. Francis River, the banks become more steep and the flood prone area became much more constricted (less than 200 ft). This area appeared as though it had been the site of a former crossing or dam, although information on any morphological changes in recent history were not found. The west bank of the river in this area does have a former access road, however, it has not been maintained. The entire river has relatively high sinuosity (2.45), yet this reach just below the proposed site has a sinuosity of 1.1 for approximately 3/4 of a mile.

The third and upper-most Rosgen cross section (1) was located at the site of a former USGS gauging station near Santiago. The site was best represented by the C4 stream classification. Although the area has been modified to some extent through the installation of bridges and culverts, the channel form and function appeared reasonably intact. The entrenchment ratio of 4.8 is similar to USFWS station 3. Both sites represent areas where more abrupt elevation changes were observed in the St. Francis River. Substrate composition and a relatively narrow floodprone width also suggest the site should have a lower width/depth ratio. The riparian corridor vegetation within this area appeared reasonably intact. Sinuosity (1.38) was lower than three of the other reaches sampled. Other than the narrow riparian vegetation corridor, the stream channel had minimal signs of erosion in this reach. This area is also above one of the two radial gate dams on the St. Francis River within the SNWR.

Rosgen classification USFWS sites

The three Rosgen cross sections within the SNWR were taken in locations that would give a general

characterization of the river in the refuge boundaries. All sites were best represented by the C5 and C4 channel types. The lowest site (4) within the refuge was approximately 15 miles from the mouth. The flood prone area was wider (1230.0 ft) than all DNR Rosgen sites, while sinuosity (1.86) was also lower than the most downstream DNR classification site (6). A D50 of very fine sand and a low slope (0.082) places this area of the stream into a C5C classification. This area of the refuge likely has impacts from the dams along the course of the St. Francis River as well as the additional volume of water from Battle Brook.

The middle Rosgen cross section (3) within the SNWR was approximately 29 miles from the mouth of the St. Francis River. This area of the refuge has been impacted by the dams, which retain sediment and minimize flushing flows. However, this area of the St. Francis River also benefits from shoreland and riparian protection due to the SNWR and the lack of urban development. The stream channel in this area had the lowest sinuosity (1.07) of all Rosgen cross sections measured. The flood prone area within this reach was also substantially narrower (145.2 ft) as compared with the remainder of the Rosgen sites (> 277 ft). This narrow flood prone area in association with greater slope (0.287) provided a larger substrate size than on other sites (D50 37.9, very coarse gravel) (Table 2). Similarly, the entrenchment ratio (2.8) was considerably lower than on any of the other sites where Rosgen cross sections were performed. The classification of this site was most similar to the DNR classification site 1 site with a C4C- designation.

The upper Rosgen cross section (2) within the refuge was approximately 40 miles from the mouth of the St. Francis River and near the western boundary of the SNWR. This area has had impacts from extensive ditching upstream of the refuge. This section had a similar channel type, but had the lowest width/depth ratio of all cross sections measured during 2003 or 2004. This area of the stream was more typical of the other reaches downstream of the refuge, as the slope was low and substrates were very fine sand. The flood prone area at this cross section was extremely wide (2,099 ft) suggesting a wide riparian corridor with associated floodplain wetlands. A comparison of all classification sites is presented in Table 2.

Biological

Electrofishing

Boat Electrofishing was performed using a 16 foot Coffelt VVP2C electrofishing boat with modified four dropper anode arrays. Electrofishing was performed in a downstream direction, netting all fish encountered during the run. Barge electrofishing was performed using a Smith Root model 1.5KVA electrofisher equipped with two hand-held anodes and a Honda 5000 watt generator. Barge electrofishing was performed in an upstream direction, attempting to cover all available habitat within each run. All fish were captured using pulsed DC current with typical amperages between 4 and 8. Start and end locations of electrofishing sites were recorded using a Global Positioning System (Trimble GeoExplorer 3c, Trimble Inc.) and plotted using Arcview® 3.3. Fish were measured and weighed to the nearest millimeter or gram and species-appropriate scales, spines and/or otoliths were removed from a sub-sample of game fish for estimating age and growth. Length ranges of non-game species were recorded and number of individuals were counted.

Sixteen electrofishing stations were sampled throughout the St. Francis River between the mouth and Benton County, MN during June-August 2004 (Figure 5 and Figure 6). Thirty five species representing eight families were found using both boat and barge electrofishing techniques. A total of 4.85 hours of energized time was used to sample 10 stations and capture 28 species of fish by boat, while barge electrofishing for 2.20 hours sampled 30 species of fish (Table 3). Overall, common shiner were most abundant in both boat and barge electrofishing stations with 29.88 and 38.4% of the catch, respectively. Common carp, while not representing a large number of the catch, were substantial in biomass in some stations. Within select stations, number of carp were counted while running the electrofisher and classified as abundant. White sucker were also relatively abundant in most electrofishing stations using both methods, representing 18.93 and 18.42% for barge and boat sampling, respectively. A summary of catch by sampling types is presented in Table 4 and Table 5.

The St. Francis River shows evidence of spatial heterogeneity in species composition. Stations closest to

the mouth had representatives similar to species composition found in the Elk River, whereas species composition above the refuge dams had representatives more common to smaller streams. The highest species richness (21) was recorded at BEF 5 near Big Lake. This portion of the river offered a variety of habitat types, pool depths and had close proximity to the Elk River. In contrast, the lowest species richness was recorded in EF 6 along the Benton County line (Figure 8). This portion of the St. Francis River had a lack of habitat diversity and was represented by pool habitat types with some deadfalls. Generally, species richness increased downstream of the Long Pool dam (above EF1) for each gear type (Figure 8), although station BEF 3 had the second highest number of species recorded (17) for any barge electrofishing stations. This site (BEF 3) was located above the Long Pool Dam within a reach (Middle SNWR Rosgen) that had some of the highest degree of habitat diversity and gradient (Figure 7). The abundance of riffle and pool areas within this reach likely provided additional habitat for several species of fish not found within lower gradient reaches of the St. Francis River.

Northern pike were the most abundant game species encountered in the sampling of the St. Francis River during 2004. One hundred and five northern pike were captured throughout all sampling stations. Lengths ranged from 115 mm (4.5 in) to 628 mm (24.7 in) and averaged 374 mm (14.7 in). A length frequency distribution of northern pike captured during 2004 electrofishing is presented in Figure 9. Larger individuals were observed during electrofishing runs but avoided electrofishing gear. Northern pike length at capture information was estimated from scales (Table 6). Northern pike sampled from the St. Francis River during 2004 had slower growth than found in most Minnesota lakes; age 0 pike mean length was 163 mm, while in Most Minnesota lakes the mean length was 198 mm. Representatives as old as age 8 (628 mm) also exhibited slower growth than most Minnesota lakes (mean 790 mm). This slower growth may be a function of habitat types and forage availability. Also, the apparent lack of abundant yellow perch (11 captured during all electrofishing sampling) may limit northern pike growth. In spite of the slower growth calculated in 2004, angler reports of larger individual northern pike were noted from communication with SNWR staff.

Other game species captured during electrofishing included smallmouth bass, bluegill, yellow perch and

black crappie. While the number captured of each of these species was low, the potential exists in select areas of the St. Francis River for them to be abundant.

Connectivity issues and discussion

Land use practices within the St. Francis River watershed are mostly agricultural, yet a large portion of the watershed area is in the Sherburne National Wildlife Refuge. This portion of the watershed has protection from development pressure, increasing impervious surfaces and therefore, water volume. However, past wildlife management within the refuge has been to provide waterfowl with viable food and cover during peak migration. This management objective conflicts with the needs of the fish species found in the St. Francis River. Maintenance of natural flow regimes during all portions of the year would benefit the fish populations in the St. Francis River. A mitigating scenario would be to allow fish passage and flows to remain consistent with normal watershed values. During electrofishing in 2004, eight species found below the Long Pool Dam were not found above. Species such as green sunfish, bluegill and pumpkinseed sunfish are generalists and were found only below the Long Pool Dam. However, the absence of smallmouth bass, bowfin, brassy minnow , spotfin shiner and yellow perch above the Long Pool Dam indicates the higher velocity and gradient of the dam has been preventing fish movement upstream. This apparent disconnect associated with the dam could explain some of the species distributions along the St. Francis River.

Dams also prevent sediment transportation from taking place. Interruption of this vital stream process generally causes the stream channel to have abundant sediment supplies upstream of the dam and sediment poor downstream of the dams. Sediment deposition and transport are important processes in channel formation, particularly in “C” and “E” channel streams. Since both “C” and “E” channel streams have relatively wide flood plains, sediment deposition and transport are key factors in maintaining the broad flood plain areas.

Land use practices and patterns have changed considerably since the 1991 land use layer was developed.

Residential development within Sherburne County has been increasing at rates ranked among the highest in Minnesota. The fragile floodplain forest corridor surrounding the St. Francis River has developments on both east and west sides of the river, downstream of the SNWR. While some of these developments may not directly impact the river or its floodplain, there is potential for new road development that could. Development pressure may also be seen in the river through an increase in flashy flows. Increased housing and commercial development results in increased amounts of impervious surfaces (roofs, driveways, and parking lots). More runoff can be attributed to residential housing development and impervious surfaces than to typical farm fields in most cases. This increase in runoff can cause increases in peak flow events and more flashy hydrographs. A useful tool to measure the effects of development on the St Francis River would be a stage and discharge logging device near the mouth of the river. Accurately measuring and modeling the discharge of the river could serve as a valuable tool for future decisions made by local units of government. Continually monitoring discharge may provide the evidence of impact of development and other changes in the watershed over time.

Konrad Schmidt (MN DNR, 1988) found 35 species of fish representing seven families within the SNWR. DNR backpack electrofishing in 1988 only captured 24 species of fish in seven families in areas around the SNWR, while DNR boat and barge electrofishing in 2004 captured 35 species and eight families of fish in the SNWR (Table 7). Sample timing, duration, flows and temperatures could all have affected the distribution of fish throughout the St. Francis River. The previous effort by the DNR in 1988 did not include diverse sampling techniques (seine, minnow trap) as did Konrad Schmidt, which may have limited effectiveness in sampling species richness throughout the river. A multiple stage approach that samples at different periods may give a better feel for species richness on the St. Francis River due to the complexity of habitat found in some areas while other areas, are devoid of quality fish habitat.

In the interest of increasing the amount of recreational use on the St. Francis River, two recommendations are offered. The DNR and SNWR should consider improving existing access points and developing new ones to allow more usable canoe access to the St Francis River. The SNWR should consider allowing

canoe travel in “closed areas” for angling during applicable angling seasons. By allowing access to the St. Francis River, wildlife viewing potential could also be enhanced.

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Table 1. St. Francis River (M–65-5) major watershed estimated land use by acres and percent (1991 data).

Land use	Acres	Percent
Agricultural	49,379.83	37.15
Grassland/pasture	35,901.64	27.01
Forest	27,186.21	20.45
Wetland	9,593.69	7.22
Grassland/shrub	6,869.42	5.17
Residential	2,704.33	2.03
Lakes	1,222.81	0.92
Gravel pits	53.23	0.04
Unclassified	6.91	0.01
Total	132,918.10	

Table 2. Results of classification on the St. Francis River at six sites in 2003 and 2004.

Sites	1	2	3	4	5	6
Dimension						
X-section	172.6	45.5	101.1	178.4	273.9	166.2
Width	57.5	24.7	52.0	73.9	112.2	79.4
Depth max	4.1	3.1	2.5	4.3	4.2	3.8
Flood prone width	277.0	2099.0	145.2	1230.0	700.0	960.0
Depth mean	3.0	1.8	1.9	2.4	2.4	2.1
W/d ratio	19.2	13.4	26.8	30.6	46.0	37.9
Ent ratio	4.8	85.1	2.8	16.6	6.2	12.1
Pattern						
Sinuosity	1.38	2.80	1.07	1.86	1.27	2.27
Slope	0.014	0.038	0.287	0.082	0.025	0.064
Hydraulics						
Velocity	1.9	0.4	6.4	2.2	1.2	1.8
Discharge	320.4	121.9	648.6	392.4	334.2	302.8
D-50	medium to course gravel	.1 very fine sand	36.0 very course gravel	.1 very fine sand	.2 fine sand	.2 fine sand
Channel Type	C4c-	C5c-	C4c-	C5c-	C5	C5
Watershed						
Drainage Area (Mi^2)	87	95	118	189	204	206

Site Locations

1 DNR	East of Santiago	4 FWS	South of CR 4
2 FWS	East of CR 11	5 DNR	Near Eagle Lake
3 FWS	East of Brande Bridge	6 DNR	North of Big Lake

Table 3. Electrofishing station sampling information, St. Francis River, Sherburne County MN 2004.

Boat Station	Effort (seconds)	Date	Conductivity	Temperature °C
EF1	2100	6/22/2004		
EF2	1020	6/22/2004		
EF3	900	6/22/2004		
EF4	2460	6/24/2004	230	18
EF5	1140	7/7/2004	325	16
EF6	1920	7/7/2004		
EF7	2220	7/8/2004		
EF8	2040	7/8/2004	325	16
EF9	1800	7/9/2004		
EF10	1860	7/9/2004	250	20
Sum	17460			
Hour	4.85			
Barge Station	**Effort (seconds)**	**Date**	**Conductivity**	**Temperature °C**
BEF1	874	7/21/2004		
BEF1A	330	7/21/2004		
BEF1B	480	7/21/2004		
BEF2	719	7/21/2004		
BEF3	1898	7/23/2004	322	20
BEF4	896	7/23/2004	350	22.5
BEF5	2717	8/5/2004		
Sum	7914			
Hour	2.20			

Table 4. Number and species of fish captured by barge electrofishing from seven stations on the St. Francis River, Sherburne County, MN 2004.

Species	BEF1B	BEF1A	BEF1	BEF4	BEF2	BEF3	BEF5	Total	Percent
Bigmouth shiner							1	1	0.07
Black bullhead			1			5	8	14	0.95
Black crappie							2	2	0.14
Blacknose dace	34	2		1		57		94	6.38
Blacknose shiner							5	5	0.34
Blackside darter						41	13	54	3.66
Bluegill							12	12	0.81
Bluntnose minnow	27	12	14	3		35	8	99	6.72
Brook stickleback				3				3	0.20
Carp				1		1		2	0.14
Central mud minnow				52				52	3.53
Central stone roller	6							6	0.41
Common shiner	105	100	37	45		262	17	566	38.40
Creek chub		1				86		87	5.90
Fathead minnow	2							2	0.14
Golden shiner						2		2	0.14
Green sunfish							7	7	0.47
Hornyhead chub	1					11	10	22	1.49
Hybrid sunfish							7	7	0.47
Iowa Darter				2		24		26	1.76
Johnny darter	16	5	3			1	10	35	2.37
Log perch	4	2					4	10	0.68
Longnose dace						12	4	16	1.09
Northern pike	4	6	6	8		10	11	45	3.05
Rock bass						3	3	6	0.41
Shorthead redhorse							2	2	0.14
Spotfin shiner							13	13	0.88
Tadpole madtom	1		4			5	1	11	0.75
White sucker		76	12	48	13	117	13	279	18.93
Yellow bullhead						1	5	6	0.41
Grand Total	200	192	77	163	13	673	156	1474	
Species Richness	10	8	7	9	1	17	21	30	

*All stations shown sequence from upstream to most downstream.

Table 5. Number and species of fish captured by boat electrofishing from ten stations on the St. Francis River, Sherburne County, MN 2004.

Species	EF6	EF5	EF7	EF8	EF1	EF2	EF3	EF4	EF9	EF10	Total	Percent
Black bullhead			3	11		2			38	18	72	9.82
Black crappie				1							1	0.14
Blacknose dace					1						1	0.14
Bluegill					5				9	8	22	3.00
Bluntnose minnow					1				11		12	1.64
Bowfin								1			1	0.14
Brassy Minnow					3						3	0.41
Carp	Abun	Abun	17	Abun	37	8		1			63	8.59
Central mud minnow			7		2				1	1	11	1.50
Central stone roller					1						1	0.14
Common shiner	143	25		1	9	5		14	20	2	219	29.88
Creek chub											0	0.00
Golden shiner											0	0.00
Green sunfish									9	6	15	2.05
Hornyhead chub											0	0.00
Hybrid sunfish						1				2	3	0.41
Iowa Darter					1						1	0.14
Log perch					1						1	0.14
Northern pike	11	9	11	1	1	6	3	14	4		60	8.19
Pumpkinseed sunfish										1	1	0.14
Rock bass			2	6					3	1	12	1.64
Shorthead redhorse	1	6	1				6	8			22	3.00
Smallmouth bass									1		1	0.14
Spotfin shiner					19				4	5	28	3.82
Tadpole madtom									8	4	12	1.64
White sucker	44	25	26	7		11	2	4	15	1	135	18.42
Yellow bullhead			7	9	1	1			7		25	3.41
Yellow perch						1			7	3	11	1.50
Grand Total	199	65	74	36	82	35	11	42	137	52	733	
Species Richness	4	4	8	7	13	8	3	6	14	12	28	

*All stations shown in sequence from upstream to most downstream.

Table 6. Length at capture (mm) for northern pike captured by electrofishing the St. Francis River, Sherburne County MN 2004.

Year Class	Age	N	Average length	Min length	Max length	Std Error
2004	0	5	163.2	115	185	12.51
2003	1	11	278.6364	222	318	9.71
2002	2	26	363.3077	305	427	6.63
2001	3	11	438.3636	406	480	7.52
2000	4	8	478.75	454	510	7.05
1999	5	6	512.3333	474	549	10.25
1998	6	5	567.2	527	588	10.83
1997	7	2	606.5	601	612	5.50
1996	8	1	628	628	628	

Table 7. Species list from the St. Francis River and Sherburne National Wildlife Refuge 1988, and DNR electrofishing survey 2004.

DNR electrofishing survey 1988	Schmidt 1988 SNWR survey[1]	DNR electrofishing survey 2004
Black bullhead	Bigmouth shiner	Black bullhead
Black crappie	Black bullhead	Black crappie
Blacknose dace	Black crappie	Blacknose dace
Blacknose shiner	Blacknose dace	Blacknose shiner
Blackside darter	Blacknose shiner	Blackside darter
Bluntnose minnow	Blackside darter	Bluegill
Central mudminnow	Bluntnose minnow	Bigmouth shiner
Common carp	Brassy minnow	Bluntnose minnow
Common shiner	Brook stickleback	Brook stickleback
Creek chub	Brown bullhead	Bowfin
Fathead minnow	Central mudminnow	Brassy Minnow
Green sunfish	Common carp	Carp
Hornyhead chub	Common shiner	Central mud minnow
Iowa darter	Creek chub	Central stone roller
Johnny darter	Fathead minnow	Common shiner
Logperch	Golden shiner	Green sunfish
Longnose dace	Green sunfish	Creek chub
Northern pike	Hornyhead chub	Fathead minnow
Pumpkinseed sunfish	Iowa darter	Green sunfish
Rock bass	Iowa darter	Golden shiner
Shorthead redhorse	Johnny darter	Hornyhead chub
Smallmouth bass	Logperch	Hybrid sunfish
Tadpole madtom	Longnose dace	Iowa Darter
White sucker	Northern pike	Johnny darter
	Northern reddbelly dace	Log perch
	Pumpkinseed sunfish	Longnose dace
	Rock bass	Northern pike
	Shorthead redhorse	Pumpkinseed sunfish
	Smallmouth bass	Rock bass
	Spotfin shiner	Shorthead redhorse
	Spottail shiner	Smallmouth bass
	Tadpole madtom	Spotfin shiner
	White sucker	Tadpole madtom
	Yellow bullhead	White sucker
	Yellow perch	Yellow bullhead
		Yellow perch

[1]Survey done with a variety of gear.

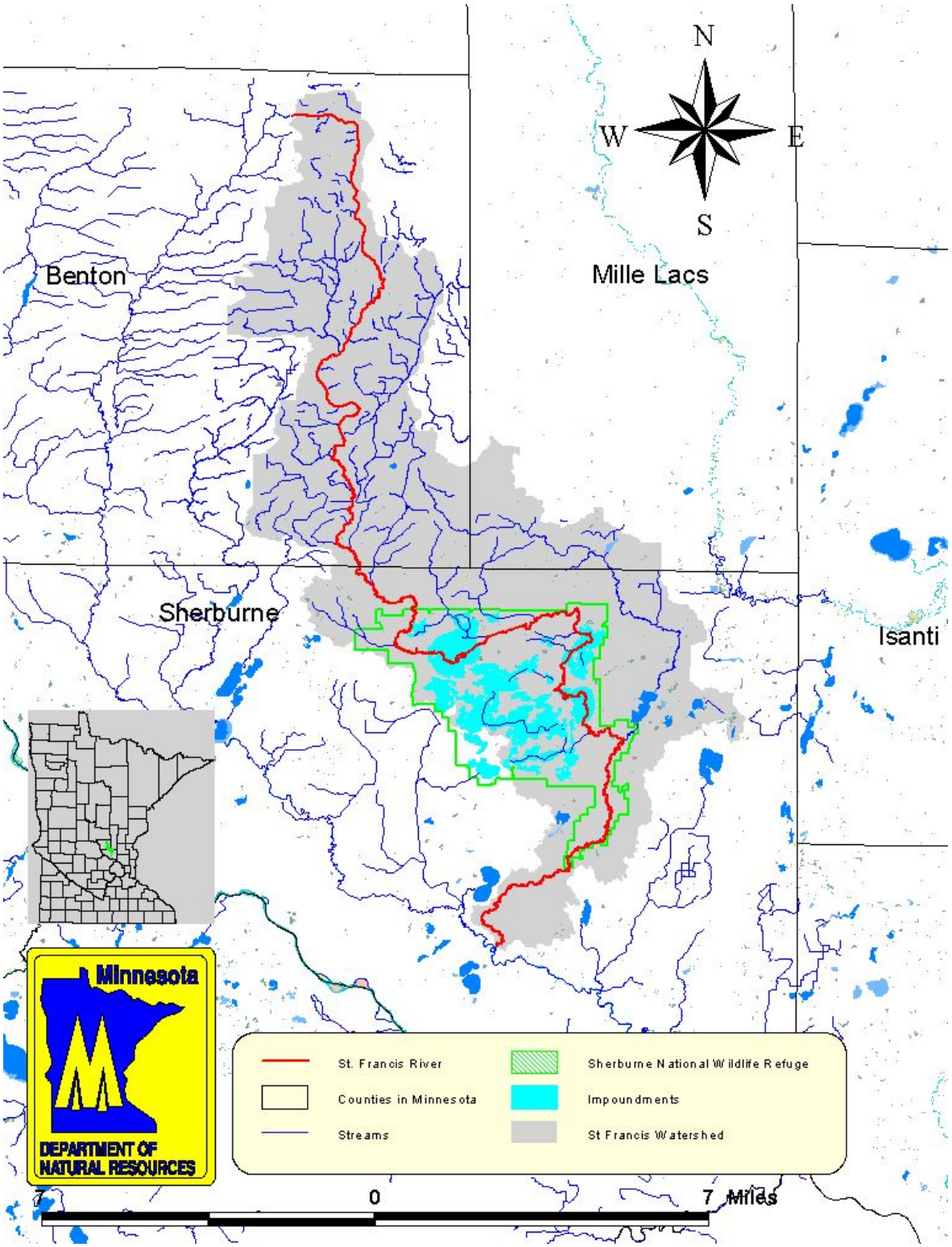

Figure 1. Location of St. Francis River, Minnesota.

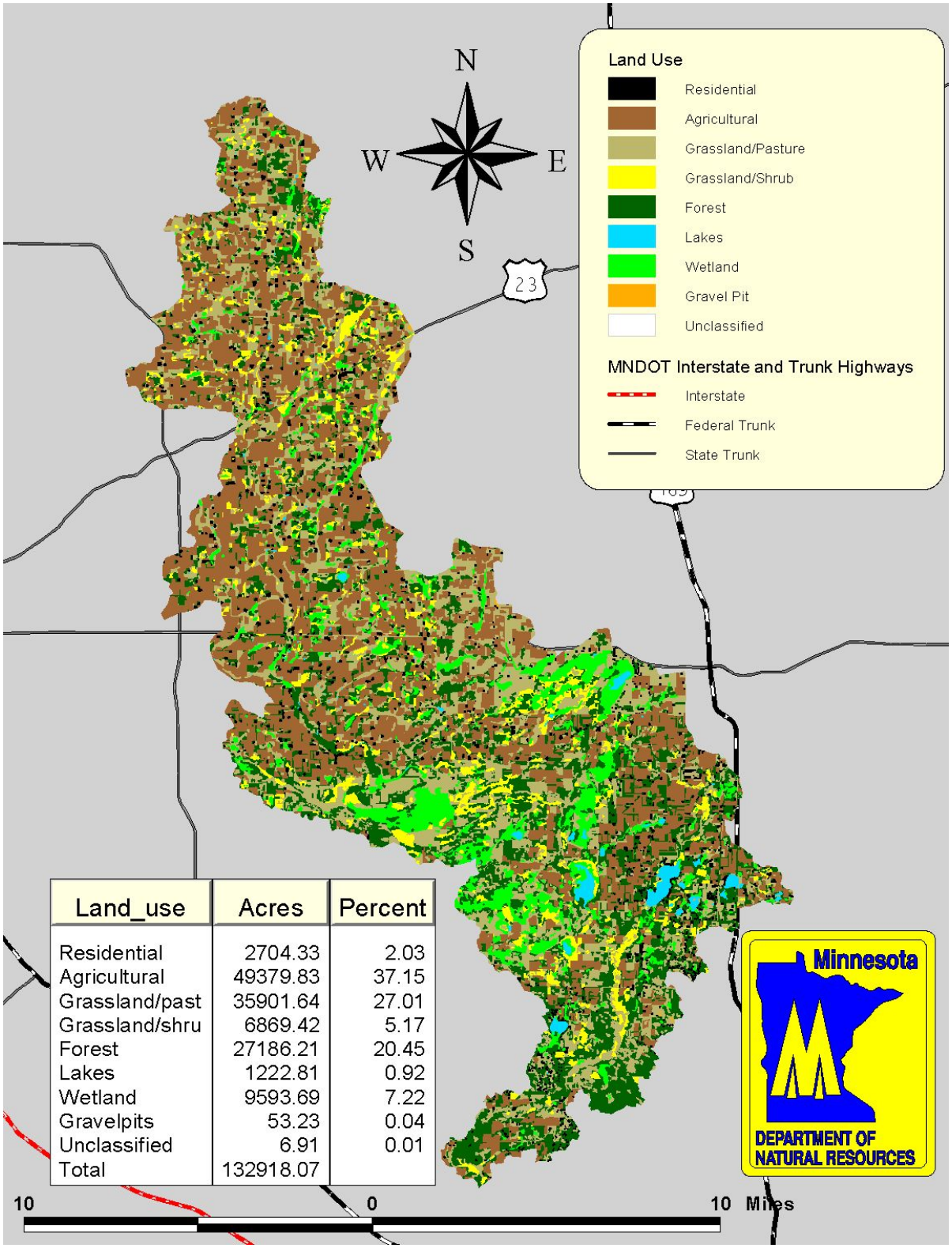

Figure 2. Estimated 1991 land use with in the St. Francis River (M-74-4) major watershed.

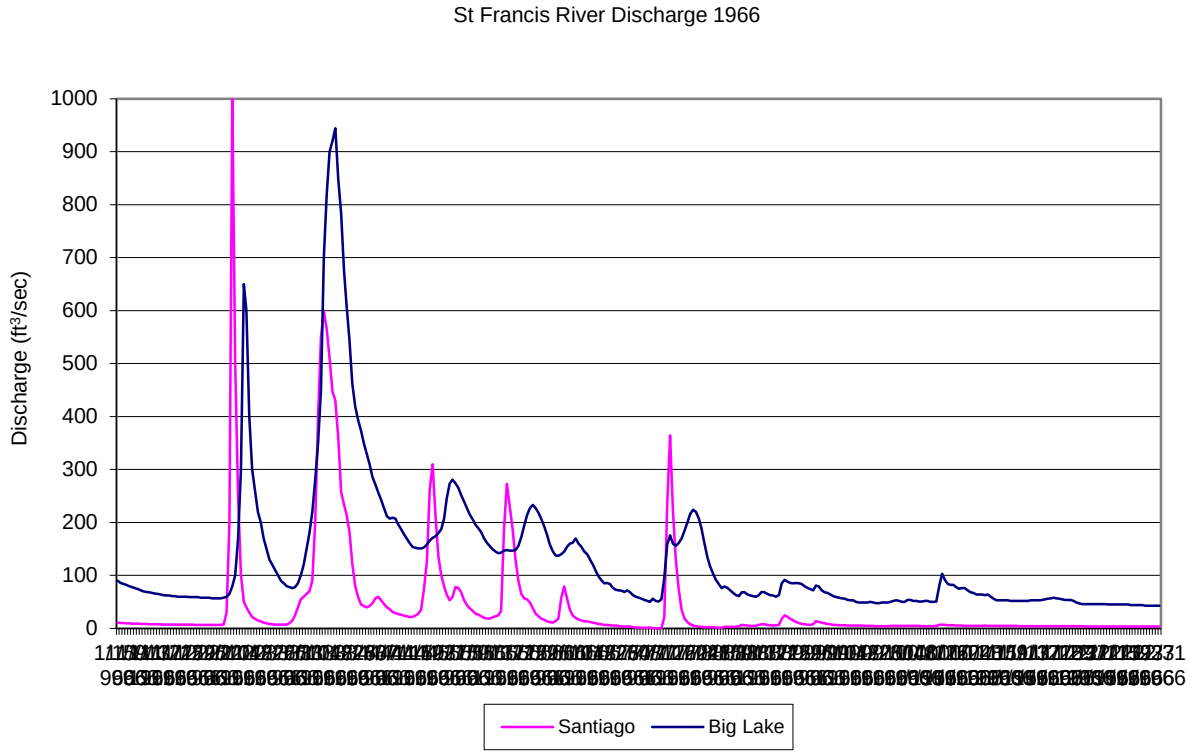

Figure 3. Discharge recorded at two locations on the St. Francis River during 1966, prior to construction of two radial gate dams within Sherburne National Wildlife Refuge. The Santiago station was located upstream of the SNWR and Big Lake station located downstream of the SNWR.

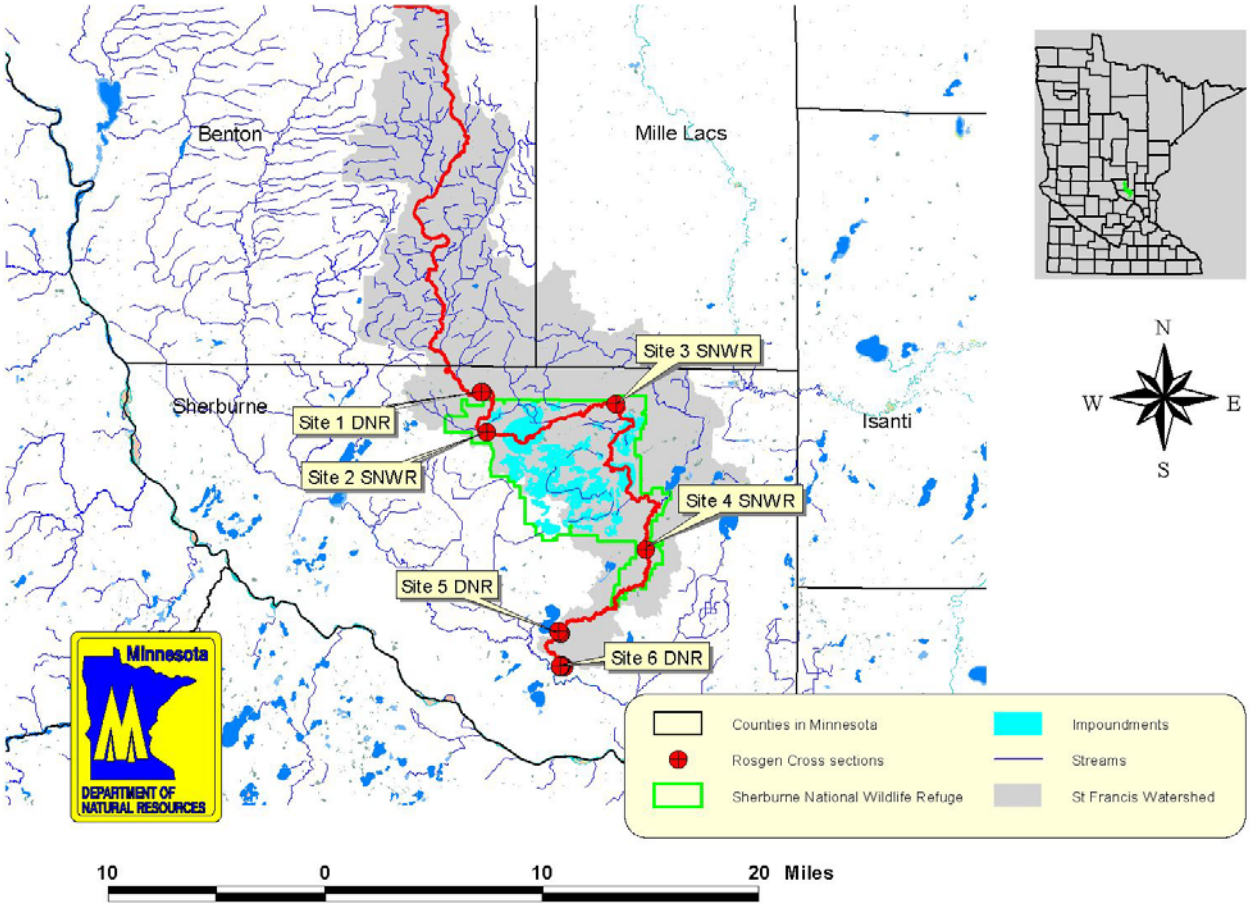

Figure 4. Location of classification cross sections on the St. Francis River 2003 and 2004.

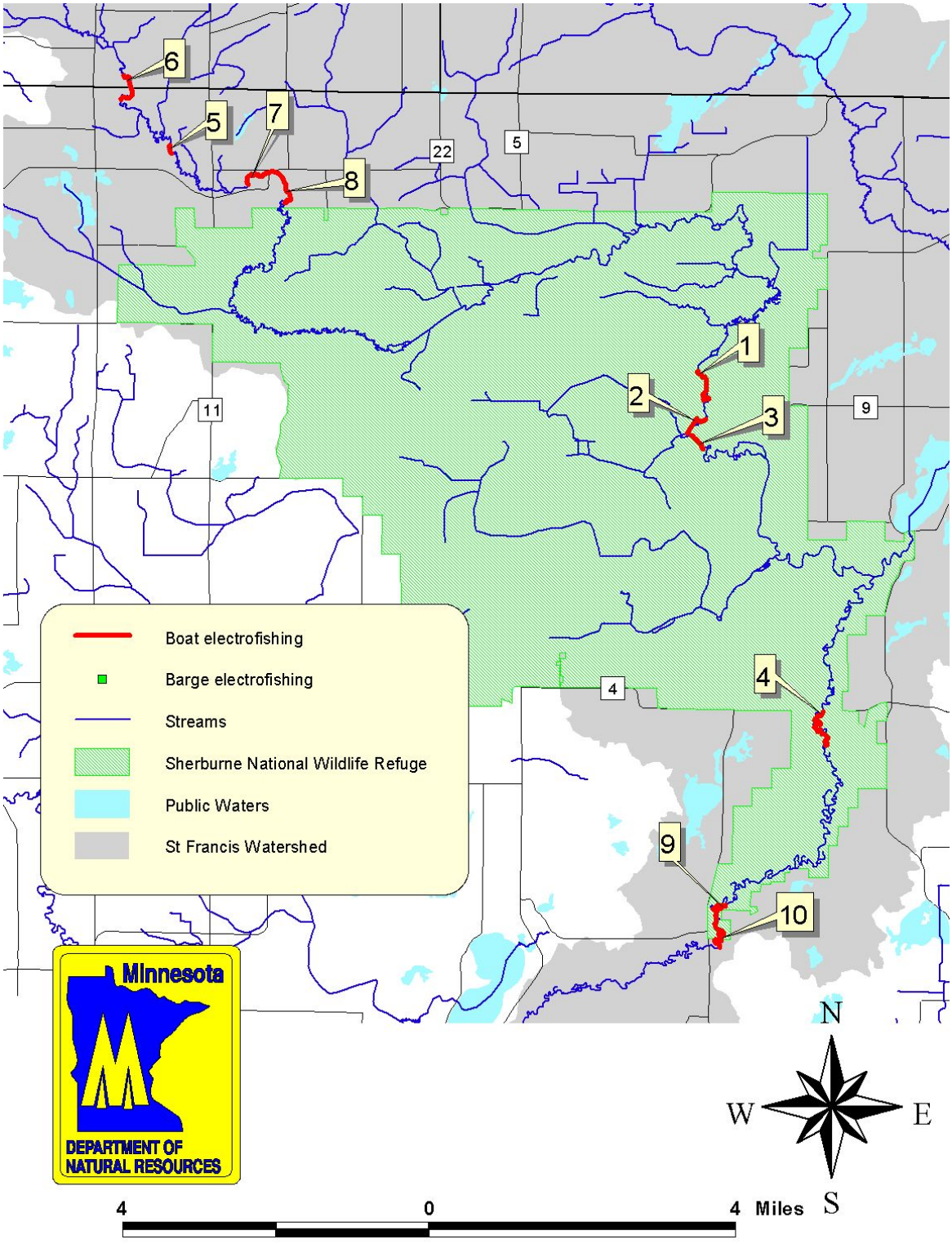

Figure 5. Location of boat electrofishing sampling stations on the St. Francis River, Sherburne County MN, 2004.

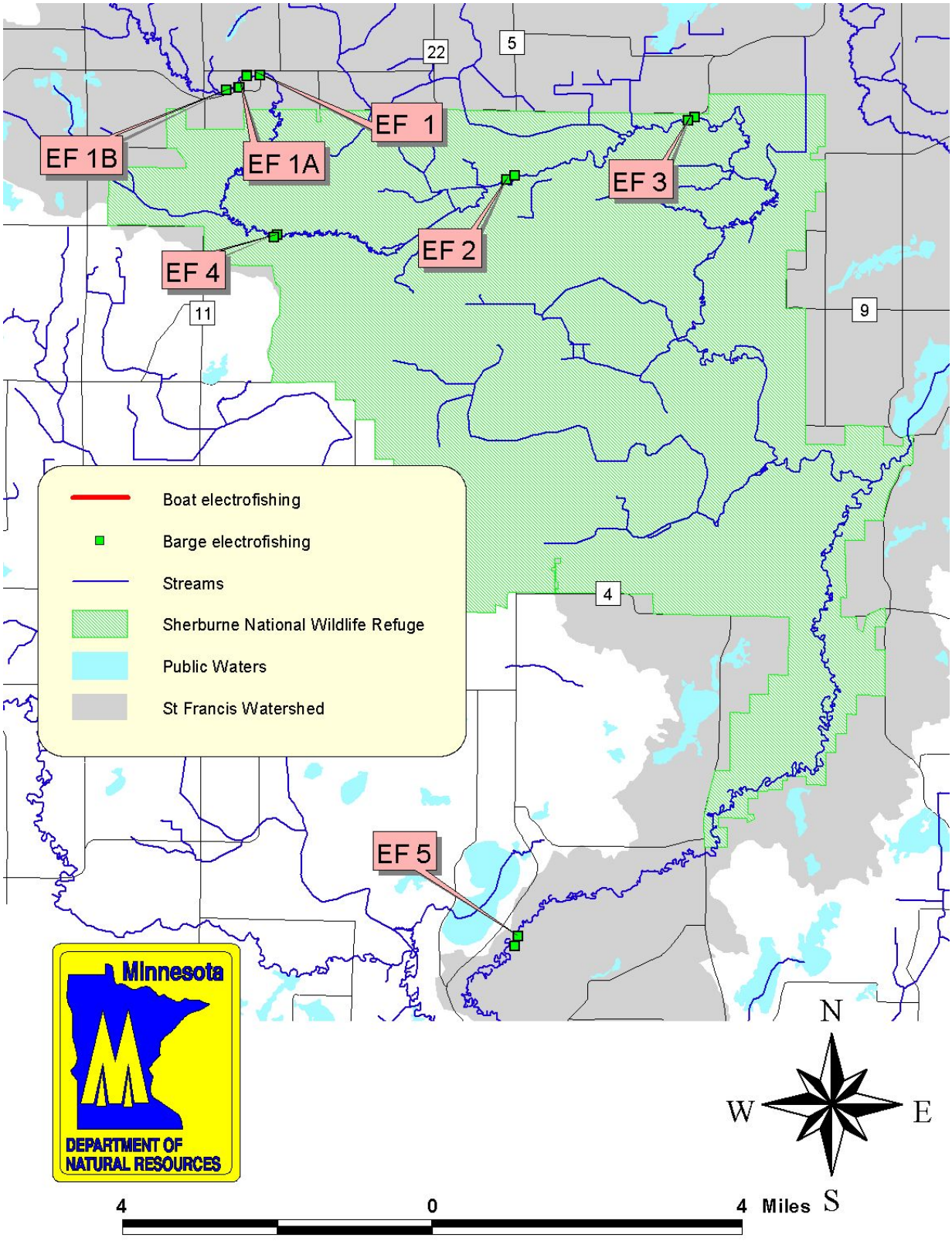

Figure 6. Location of barge electrofishing sampling stations on the St. Francis River, Sherburne County MN, 2004.

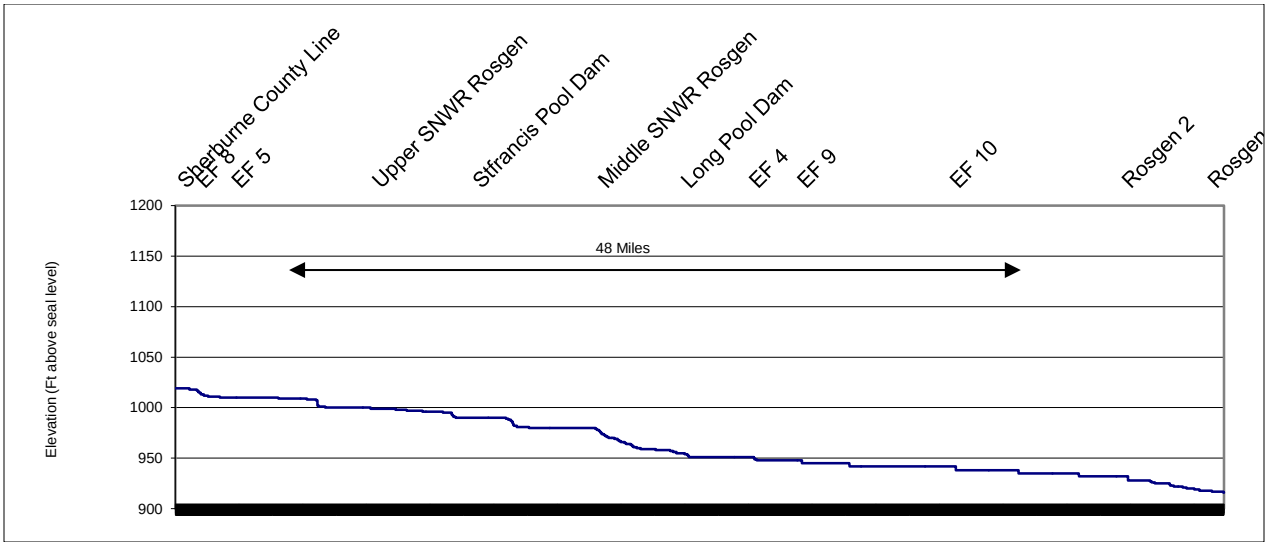

Figure 7. Elevation profile and select sample points of the St. Francis River within Sherburne County MN 2003 and 2004.

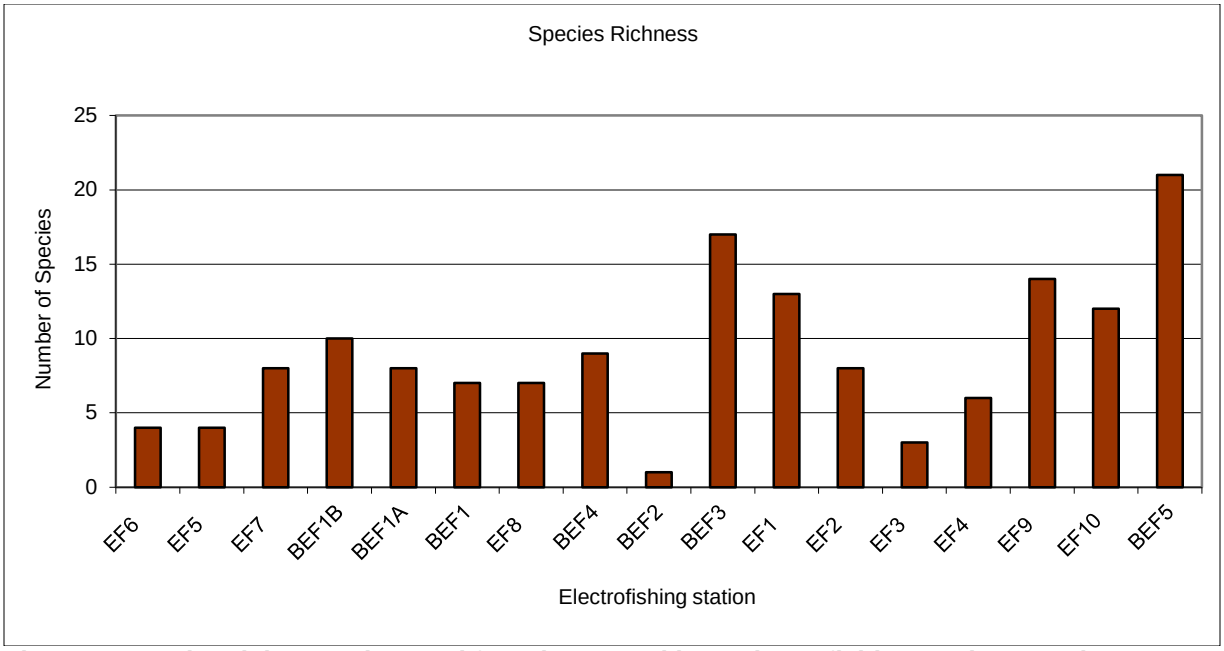

Figure 8. Species richness observed from barge and boat electrofishing stations on the St. Francis River, Sherburne County, MN 2004. Stations are shown from upstream to downstream, left to right.

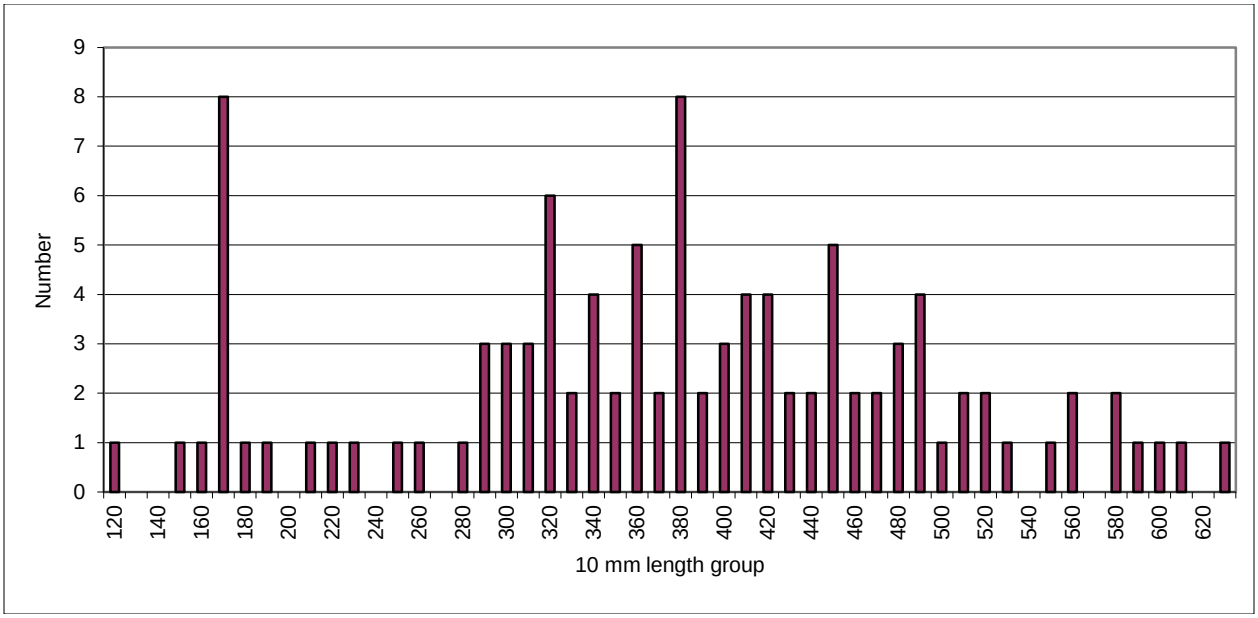

Figure 9. Number of northern pike per 10 mm length group sampled by electrofishing the St. Francis River, Sherburne County MN, 2004.

Minnesota Department of Natural Resources
Division of Fish and Wildlife
Section of Fisheries

Stream Survey Report

St. Francis River 2004

Author	Date
Area Fisheries Supervisor	Date
Regional Fisheries Supervisor	Date