

Minnesota
F-29-R(P)-24
Area 315
Study 3
April 2007

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

Stream Survey Report

**South Two River
2006**

By

Eric R. Altena

Montrose Area Fisheries Office



Your purchase of fishing equipment
and motor boat fuel supports boating
access and Sport Fish Restoration.



Table of Contents

Summary	5
Watershed.....	6
Hydrology	6
Geomorphology.....	7
Water Chemistry	8
Biological.....	9
Connectivity issues and discussion.....	11
References	12
Acknowledgements	12

Figures

Figure 1. Location of South Two River (M-084) Watershed, Minnesota.	13
Figure 2. Estimated land use within the South Two River (M-084) Watershed.	14
Figure 3. Elevation profile and select sample points of the main stem South Two River (M-084) within the two county area, MN, 2006.	15
Figure 4. Bedrock geology for South Two River (M-084) Watershed.	16
Figure 5. Annual Hydrograph for the Sauk River (M-074) 1900-2005.	17
Figure 6. Stream order for the South Two River Watershed (M-084).	18
Figure 7. Locations of classification sites in the South Two River (M-084) Watershed, 2006.	19
Figure 8. Locations of electrofishing stations in the South Two River (M-084) Watershed, 2006.	20
Figure 9. Road network for the South Two River (M-084) major Watershed.	22

Tables

Table 1. South Two Rivers (M-084) major Watershed estimated land use by acres and percent (1991 data). -----	23
Table 2. Prominent metrics for the South Two Rivers Watershed. -----	23
Table 3. Results of classification on South Two Rivers 2006. -----	24
Table 4. Water chemistry values collected by MPCA monitoring stations on the South Two River (2004-2006) and several area Stearns County Streams during 2006. -----	24
Table 5. Electrofishing station sampling and Index of Biotic Integrity (IBI) information, South Two River, 2006. -----	25
Table 6. Species composition by electrofishing station collected from South Two River, September, 2006. -----	26
Table 7. Length range of fish sampled in all stations from the South Two River, September, 2006. -----	27

General Information

Stream Name: South Two River

Alternate Name: None

Tributary Number: M-084

Counties: Stearns, Morrison

Nearest Town(s): Holdingford, Albany, Bowlus

Source of flow: Wetlands, Stearns County, MN

Waterway sequence: Wetlands /Two Rivers Lake /Mississippi River

Classification: Class III (warm water feeder)

Watershed Name and Number

USGS HUC-8: 7010201

Major: Mississippi River – St. Cloud 17

Minor: South Two River 1500100

Summary

The South Two River is a warm water stream with a source near the town of Albany in Stearns County, Minnesota. The main stem of the South Two River represents 12% of the drainage network and flows 36 miles to the confluence with the Mississippi River. The South Two River Watershed (98,989 acres) is located in central Minnesota within Stearns and Morrison counties. The majority of the land use is agriculture (53%).

An assessment of the fish population in the South Two River was performed in 2006. The survey included barge electrofishing at three stations and backpack electrofishing at two stations between Albany and the mouth near Royalton for a total effort of 3.1 hours. South Two River is a cool to warm water stream system with smallmouth bass as the top level predator. Overall, 1,045 fish were captured, representing eight families and 29 species. Smallmouth bass were the most abundant game species with 135 sampled, however, most were small.

Access and morphology changes due to human interventions affect every river system in southern Minnesota, including the South Two River. The South Two River currently has no functional dams along its entire 36 miles of stream length, but other anthropogenic issues negatively affect the stream. Efforts will be made to educate stakeholders on the effects of dams, land use, wastewater treatment facilities, roads, bridges and culverts on natural stream systems.

Watershed

The South Two River Watershed is located in central Minnesota within Stearns and Morrison counties (Figure 1). The drainage area (98,936 acres, 154 square miles) has estimated land uses of 85% agricultural/pasture, 5.3% aquatic and 4.5% upland deciduous forest (Table 1 and Figure 2). The headwater of the South Two River is near the town of Albany Minnesota, in Stearns County. The main stem of the South Two River represents 12% of the drainage network and flows 36 miles to the confluence with the Mississippi River near Bowlus, MN. Tributaries and ditches encompass 240 miles of stream channel within the entire watershed. Other useful measurements of watershed shape and quality can be found in Table 2.

The South Two River Watershed is fairly wide (15.2 miles maximum) (Figure 1). The watershed is 22 miles in length. It lays along an axis oriented south-southwest to north-northeast, with a southerly aspect. Wetlands influence the groundwater inputs to the main stem channel. The watershed has moderate basin relief for central Minnesota (333 ft) (Figure 3). Lakes and wetlands represent 5,240 acres within the watershed. Five different categories make up the bedrock superficial geology within the watershed (Figure 4). However, within the watershed, the soils and impervious surfaces likely have more influence on the water quality and quantity in the South Two River.

In 2006, stream classification, watershed analysis, hydrologic analysis and electrofishing were performed in an effort to further describe the river geomorphology and sample the fish population. 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 South Two River has an overall gradient of 7.48 ft/mi and a sinuosity of 1.57 between the headwater and the confluence with the Mississippi River. The shape of the watershed, coupled with the low gradient,

and broad flood plain, would suggest a hydrograph that gradually rises and falls. As of 2006 there are no operational gages along the length of South Two River. Regional curve data from the adjacent Sauk River show that annual peak flows occur during spring snow melt (Figure 5). South Two River is unique for streams of similar size as it is a 5th order at its mouth (Figure 6). Similar streams are only 3rd or 4th order in nearby watersheds. Land use practices such as ditching, installation of tile, residential development and direct channel modification have likely changed the annual hydrograph.

Geomorphology

Classification sites

The South Two River Watershed covers approximately 180 square miles with gently rolling to abrupt land forms along the upper and middle reaches. The middle to lower reaches of the South Two River have much less relief overall. The lowest portion of the watershed approaching the confluence with the Mississippi River gains appreciable slope and moderate sinuosity. Classification (Rosgen 1996) was conducted at four sites in the lower and middle portion of the South Two River (Figure 7). 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 (XS 1) was located less than one mile from the confluence with the Mississippi River. Channel morphology in the lower portion of this reach appeared relatively stable, with mildly altered riparian vegetation. Reed canary grass dominated the majority of the wetland fringe vegetation. The area had a flood prone width of 170 ft. The stream classification for this station was C4, moderately entrenched (2.6), with a high width/depth ratio (26.5)(Table 3). The predominant substrate type (D-50) was medium gravel and the sinuosity was 1.3. The area had a slope of 0.12. A C4 stream type is considered to have a slightly entrenched, meandering, sand dominated, riffle/pool channel with a well developed floodplain (Rosgen 1996). The C4 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 classification cross section (XS 2) was at the downstream end of Happy Valley Wildlife Management Area (WMA) in Morrison County. This station was classified as E5. The area had a broad flood prone area (1,037 ft) and an entrenchment ratio of 7.7. The width/depth ratio was 141.3, while the D-50 was sand. The sinuosity was higher than Station 1 (1.7) and the slope was 0.055 (Table 3).

This area had relatively low impact from development and housing and included Happy Valley WMA and the Wobegon bike trail (formerly railroad grade). The channel within this reach was highly vegetated with grasses and shrubs, which allowed for considerable undercut areas. The area also lacked evidence of ditching.

The third station (XS 3) was within the Holdingford City Park. The area had evidence of ditching because the west bank had considerable elevation compared to the background within the former floodplain. If the original floodprone area was intact, it would have measured 381 ft. However, the current floodprone area was used for classification purposes (75 ft). This area had an extremely low sinuosity of 1.05 and sand substrate. This site was classified as a C5. However, if the full extent of the floodprone area was intact and sinuosity was normal, the channel may have been classified as an E. Sites similar to this may be good candidates for simple restorations if funding is available.

The fourth station (XS 4) was located downstream of Stearns County Road 154 and above Two Rivers Lake. The station had mostly intact riparian vegetation with a 14.8 entrenchment ratio and a width/depth ratio of 16.4. Sinuosity was low (1.1) and was likely influenced by bridges in the area. This station was also classified as C5. A summary of all classification sites is shown in Table 3.

Water Chemistry

The South Two River passes through substantial amounts of agricultural and residential land throughout

its 36 mile length. Because of increased amounts of runoff due to waste water treatment plants, impervious surfaces and generally high nutrient supplies, the South Two River may have higher concentrations of phosphorous than other streams in the area. Water samples collected at three locations revealed total phosphorous amounts between 0.063 and 0.113 ppm. This was higher than some other streams sampled in 2006 by MPCA monitoring sites ([Table 4](#)).

Biological

Electrofishing

An assessment of the fish population in the South Two River was conducted in 2006. The survey included a total of five stations (three barge and two backpack) between the mouth near Royalton and the headwaters near Albany for a total effort of 2.18 hours ([Figure 8](#)). Barge electrofishing was conducted 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 amperages between 4 and 8. Backpack electrofishing was performed with a Smith Root model 15A electrofisher using a single anode, in an upstream direction. 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 either individually or bulk weighed to the nearest gram. 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 the number of individuals were counted and bulk weighed per MPCA guidelines for the Upper Mississippi River Index of Biotic Integrity (Niemela and Feist 2002).

Based on electrofishing results, the South Two River is a cool to warm water stream system with smallmouth bass as a top level piscivore. Overall, 1,045 fish were captured representing seven families and 29 species ([Tables 5 and 6](#)). Smallmouth bass were the most abundant game species; 135 were captured over all stations. Lengths for smallmouth bass ranged from 60 to 193 mm with an average

length of 98.8 mm (Table 7). Larger smallmouth bass were observed escaping our gear. The next most abundant species overall were fathead minnow (127), bluegill (126) hornyhead chub (102) and central mud minnow (102).

Species richness varied across stations from a low of 13 species (EF1, EF 4 and EF5) to a high of 16 species in EF2 (Table 5). IBI scores also varied among stations throughout the South Two River Watershed, although all stations were rated as “fair” or “good”. Electrofishing station EF2 had the highest IBI rating of good (71). This area was unique, having high sinuosity (1.7), low slope and banks with intact vegetation. This station was located in the downstream end of Happy Valley WMA where the channel was relatively undisturbed, the substrate was primarily sand and some deeper pools were present. While the channel morphology should have supported better habitat, it is likely the increased bedload from upstream ditching and poor land use practices has degraded the overall quality of the area. The electrofishing stations with the lowest IBI ratings were EF4 (48) and EF5 (49). Both of these stations were in areas of ditching and variable water quality and quantity. EF4 was located downstream of the Albany wastewater treatment facility, which discharges into South Two River. EF5 was located upstream of Two Rivers Lake and downstream of several road crossings. This area had sediment deposition throughout the channel length sampled. Similarly, given the close proximity to Two Rivers Lake, the species richness may have been limited by predators migrating to this area.

EF3 was located in an area where the channel had been ditched. Aerial photography indicated the presence of former oxbow areas in the channel. The sinuosity in this area was very low (1.05). The ditching affected channel form and function by not allowing a significant floodplain. The left or west bank of this reach had a levee-like area preventing higher discharges from entering the floodplain. However, abundant vegetation in the reach likely allowed for 15 species of fish to be sampled. The IBI rating of “good” (62) was likely more a function of instream habitat conditions rather than general morphology. This area of the South Two River would likely benefit from channel restoration if funding was available.

Connectivity issues and discussion

Electrofishing revealed an abundance of young-of-the year smallmouth bass in the two stations nearest the Mississippi River (EF1 and EF2). South Two River has a unique distinction of not having any dams or significant barriers to fish movement for the entire length of the channel. The presence of species associated with the Mississippi River in tributary streams such as South Two River, likely demonstrates the importance of unimpeded access to tributary streams. A former dam was located just downstream of EF1, although it was hard to determine its last date of effectiveness. Smallmouth bass, northern pike, walleye and even muskellunge are present in the Mississippi River near the mouth of South Two River; however, smallmouth bass were found as far upstream as Two Rivers Lake (from previous lake survey information). Attempts at fish barriers have been made on the outlet of the lake to limit carp movement; but high spring discharge has caused repeated failures.

South Two River flows 36 river miles through various terrains and levels of development such as wetlands, rural households, farmsteads, fields and urbanized areas such as the City of Albany. Road crossings can affect streams and rivers by constricting the flood plain, preventing natural channel migration and increasing water velocities. The main stem of the river has 20 road crossings, all of which are culverts (Figure 9). For most streams, if culverts are placed properly (correct alignment, slope and diameter), fish passage and sediment transport are minor issues. However, culverts effectively lock the stream channel into a given position and can affect the sinuosity of the stream. This change in stream sinuosity is usually observed above and below culverts and bridges. While South Two River does not have any dams to impede fish migration, road crossings, sewage treatment effluent and ditches can change stream function and support fish differently than similar streams without such issues.

South Two River is a canoe-navigable stream when discharge is high in the Spring. The fish population in the lower five miles of river has the potential to provide some recreational opportunity. If future waste-water discharge permits are sought by the cities of Holdingford or Albany, they should be carefully reviewed to avoid the potential of phosphorous overload in the system.

References

Niemela, S. and M. D. Feist. 2002. Index of Biological Integrity (IBI) Guidance for Coolwater Rivers and Streams of the Upper Mississippi River Basin. Minnesota Pollution Control Agency, Biological Monitoring Program, St. Paul.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

Acknowledgements

The author would like to thank Mark Pelham, Jason Neuman, Joe Stewig and Brad Maas for their work in field collection and logistical support.

South Two River Watershed Relief

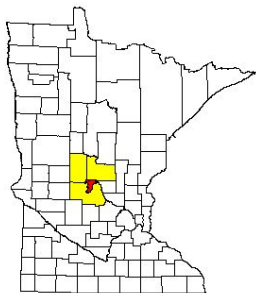
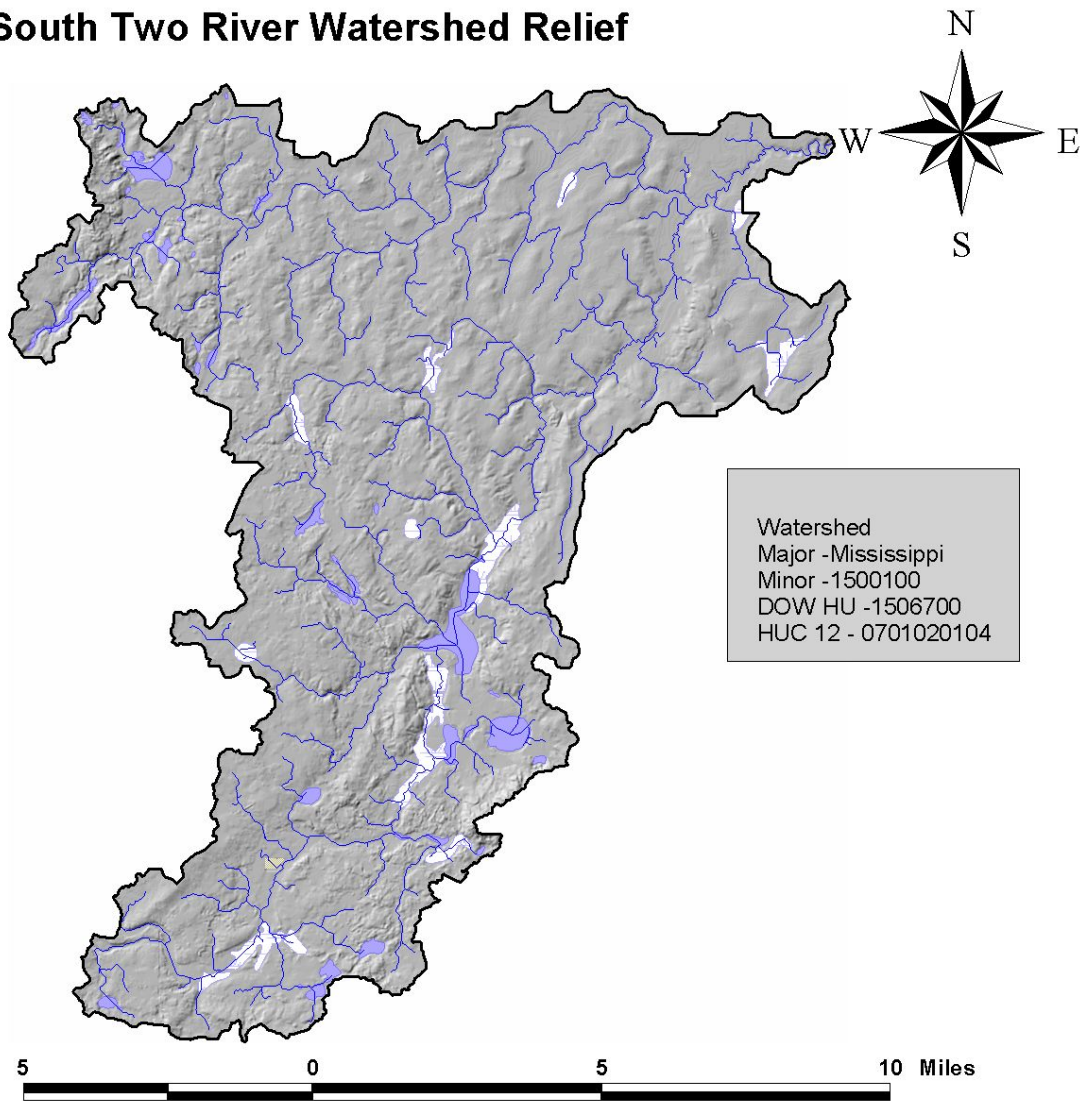
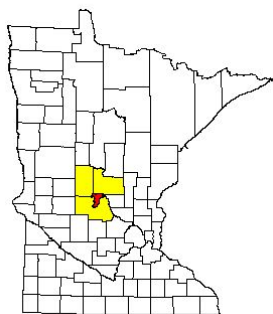
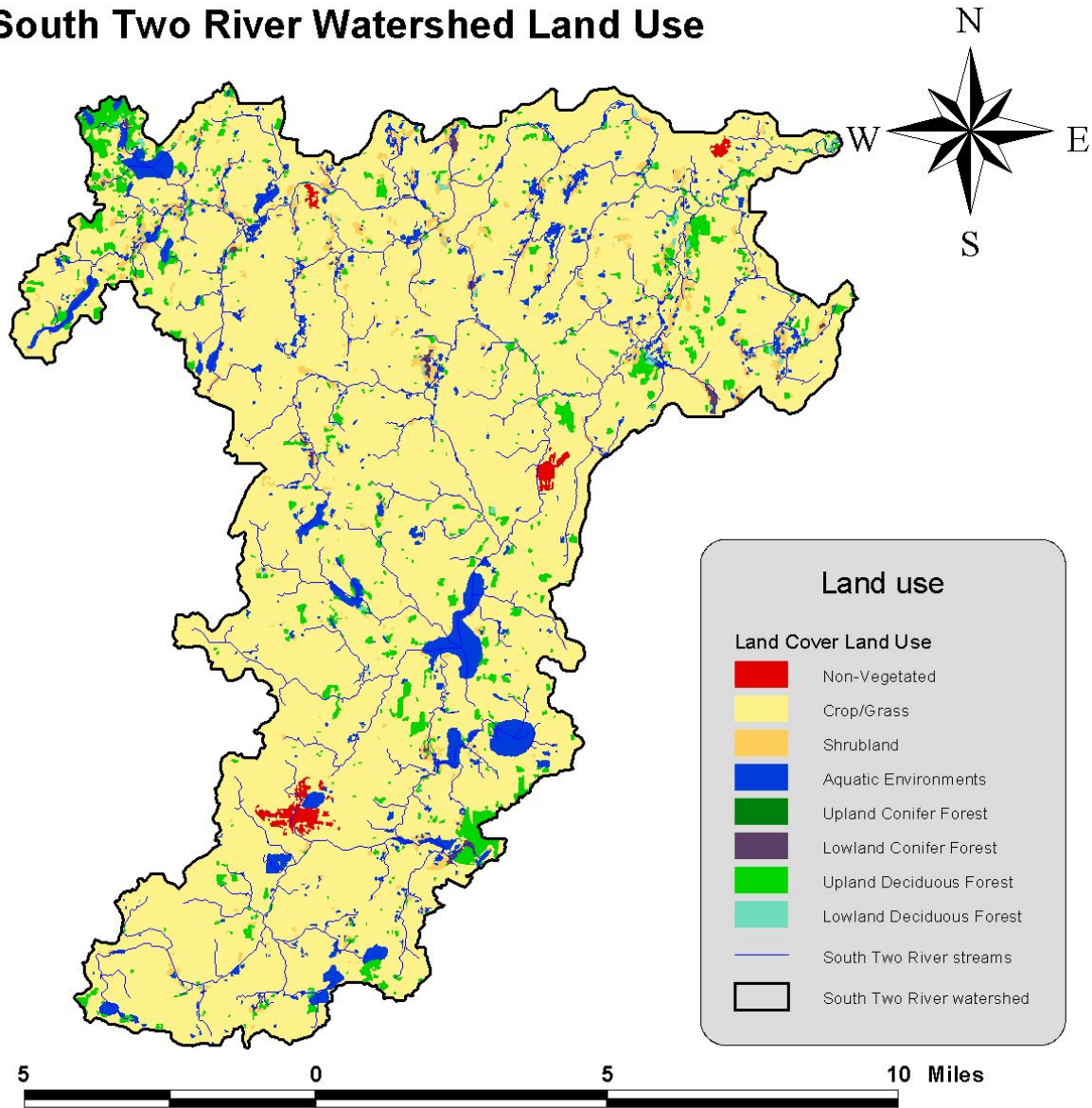


Figure 1. Location of South Two River (M-084) Watershed, Minnesota.

South Two River Watershed Land Use



Watershed
 Major -Mississippi
 Minor -1500100
 DOW HU -1506700
 HUC 12 - 0701020104



Figure 2. Estimated land use within the South Two River (M-084) Watershed.

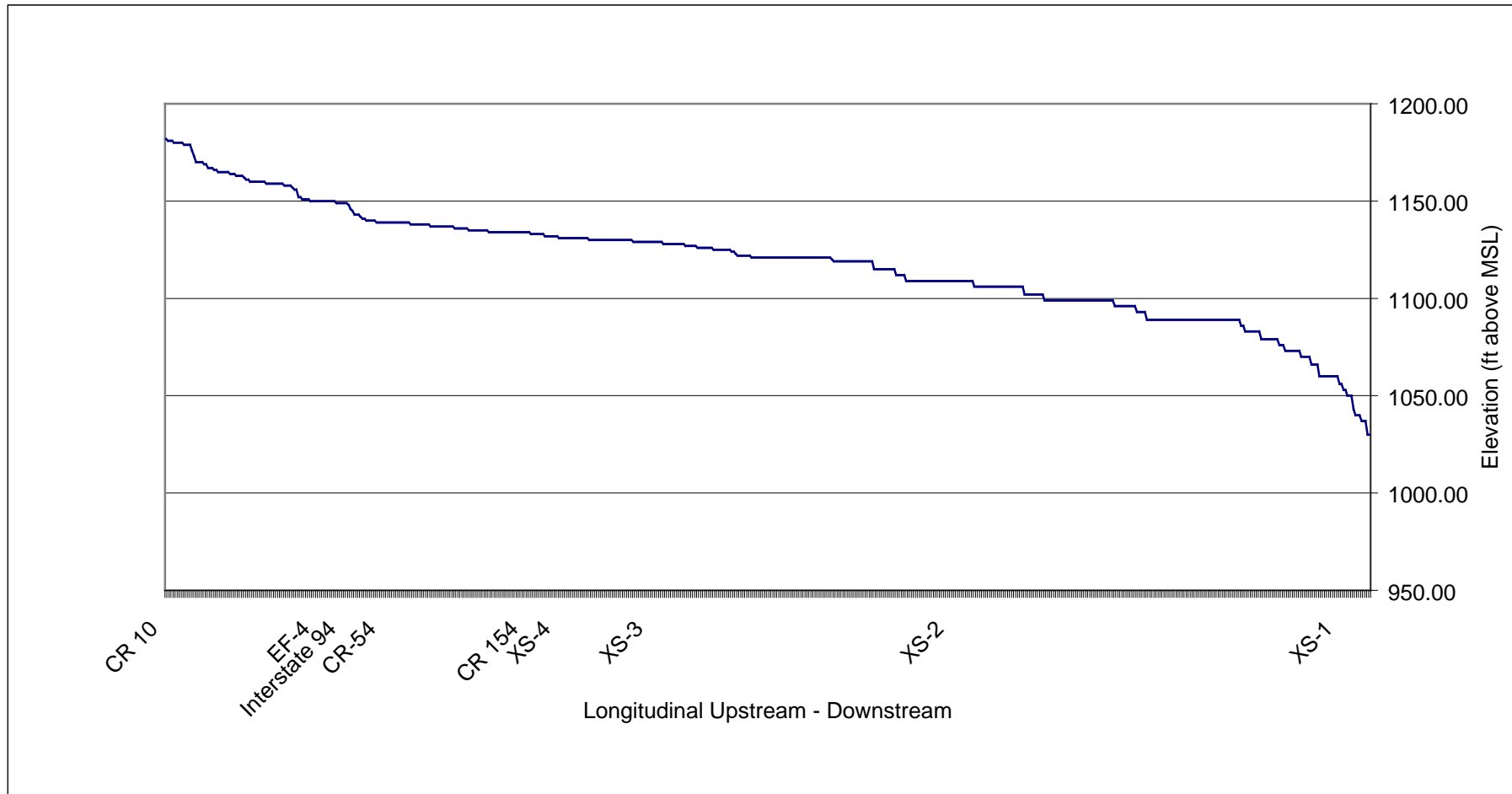


Figure 3. Elevation profile and select sample points of the main stem South Two River (M-084) within the two county area, MN, 2006.

South Two River Watershed Bedrock Geology

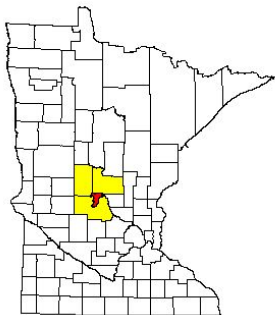
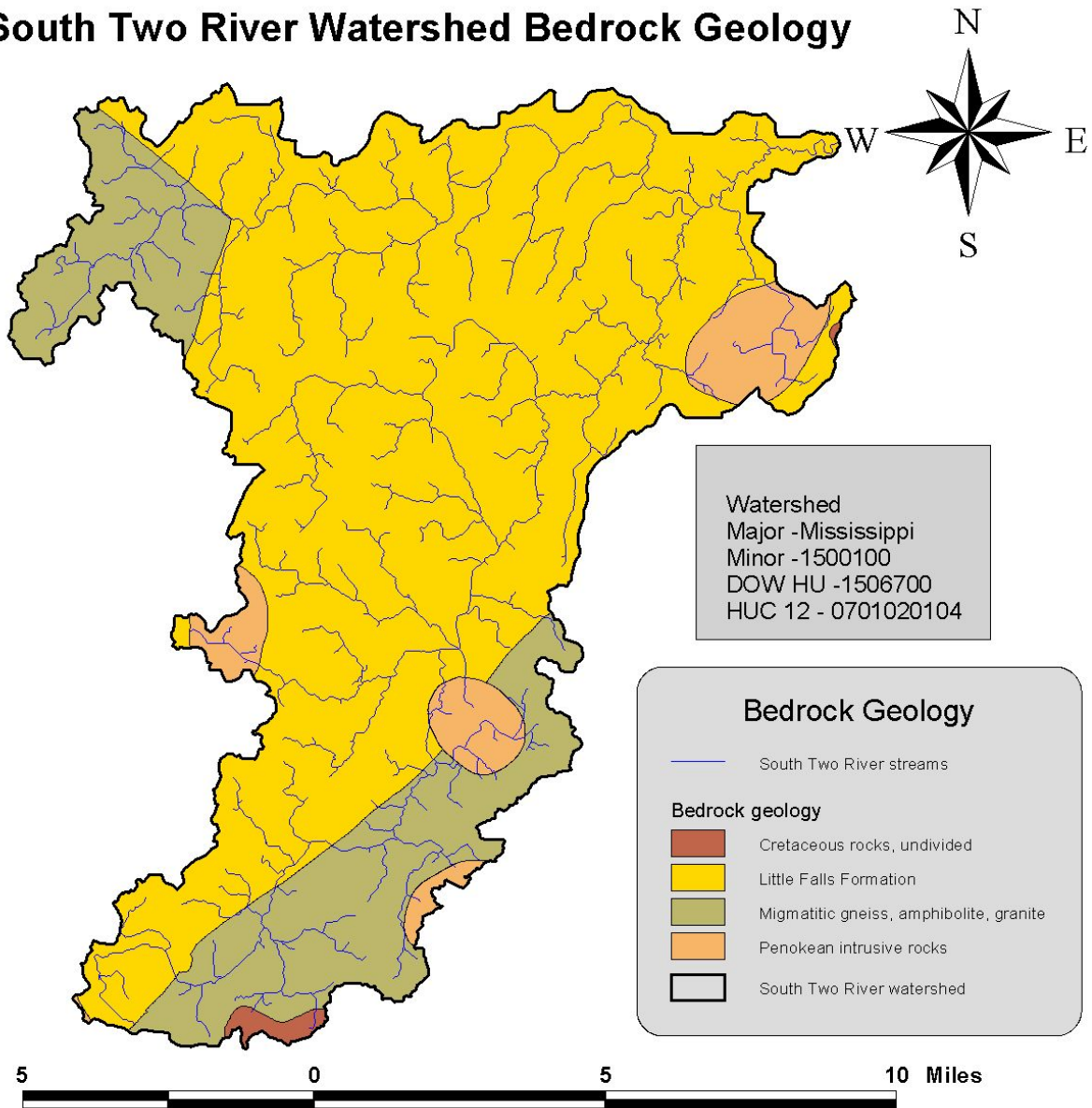


Figure 4. Bedrock geology for South Two River (M-084) Watershed.

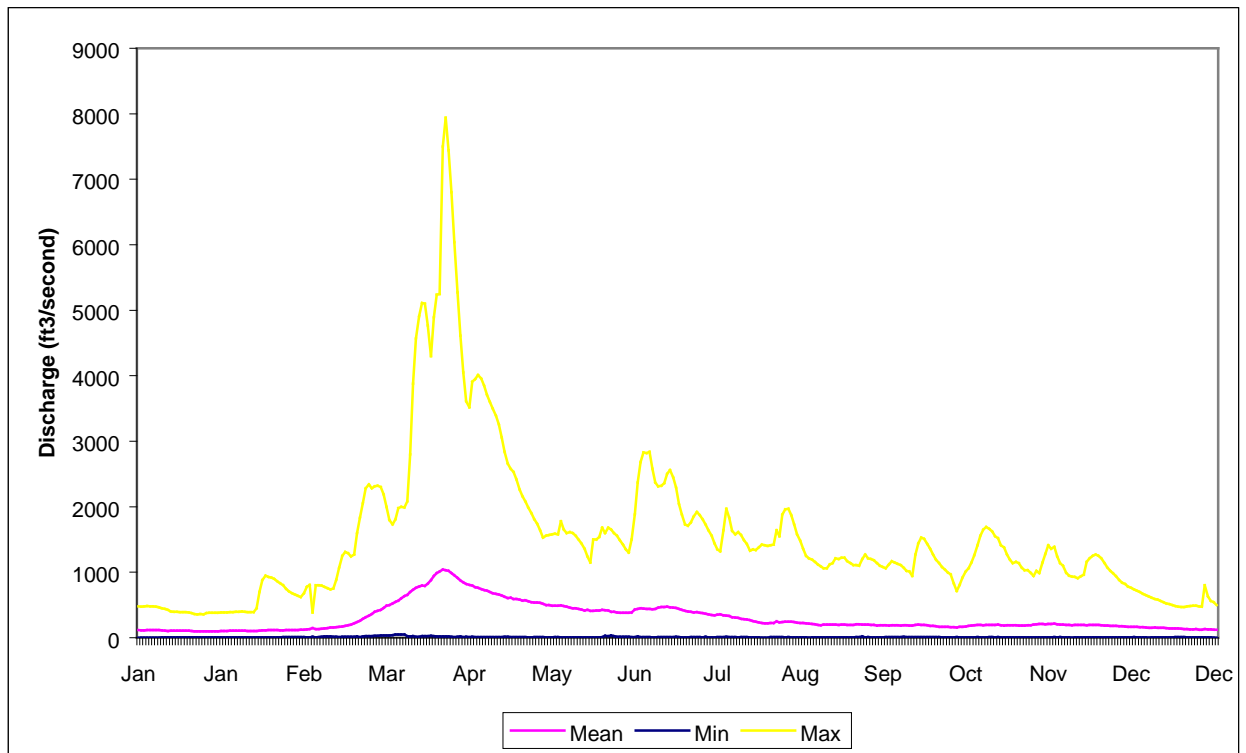


Figure 5. Annual Hydrograph for the Sauk River (M-074) 1900-2005.

South Two River Watershed Stream Order

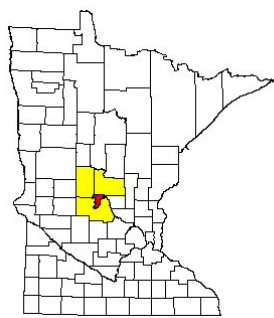
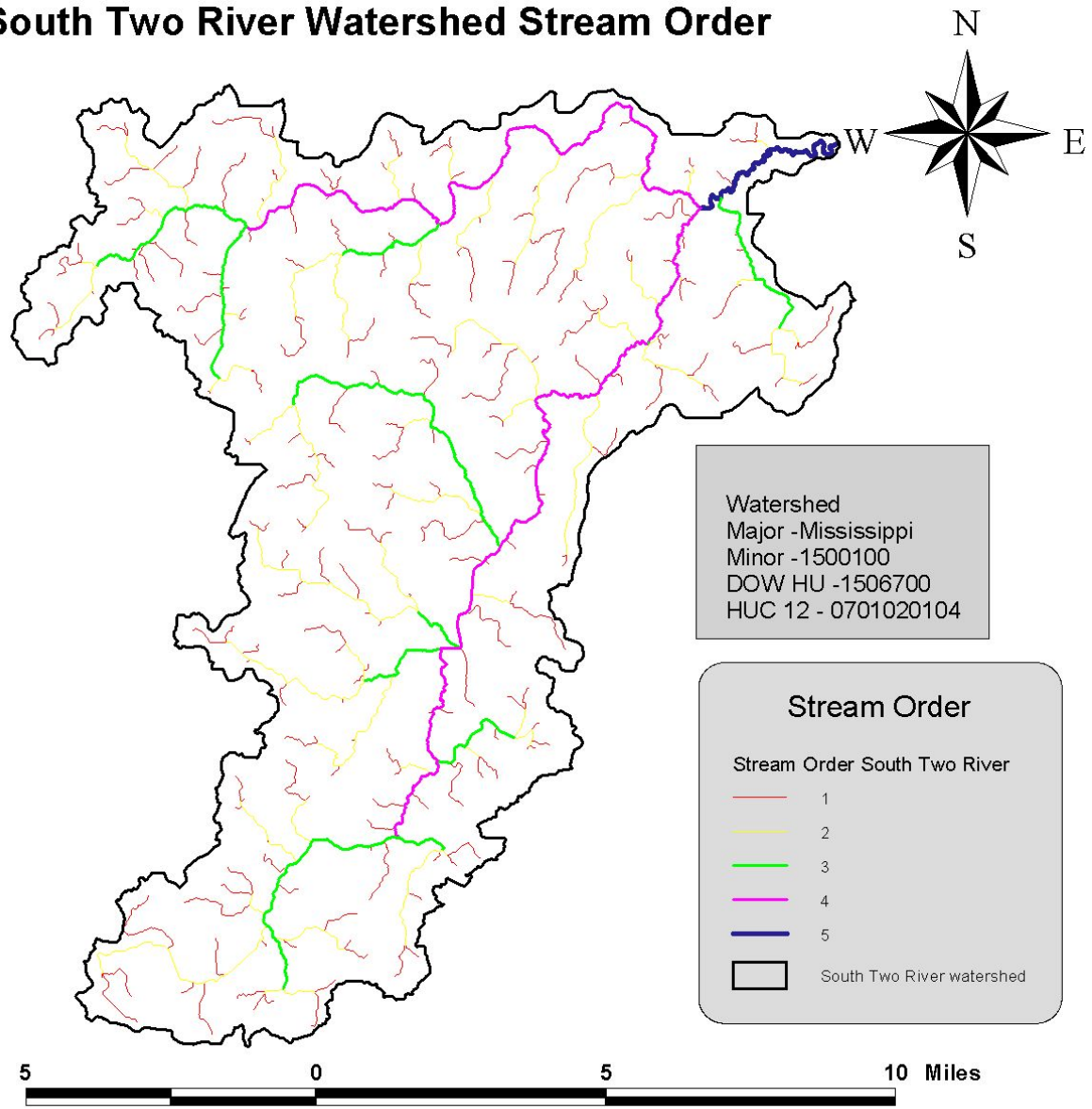


Figure 6. Stream order for the South Two River Watershed (M-084).

South Two River Classification 2006

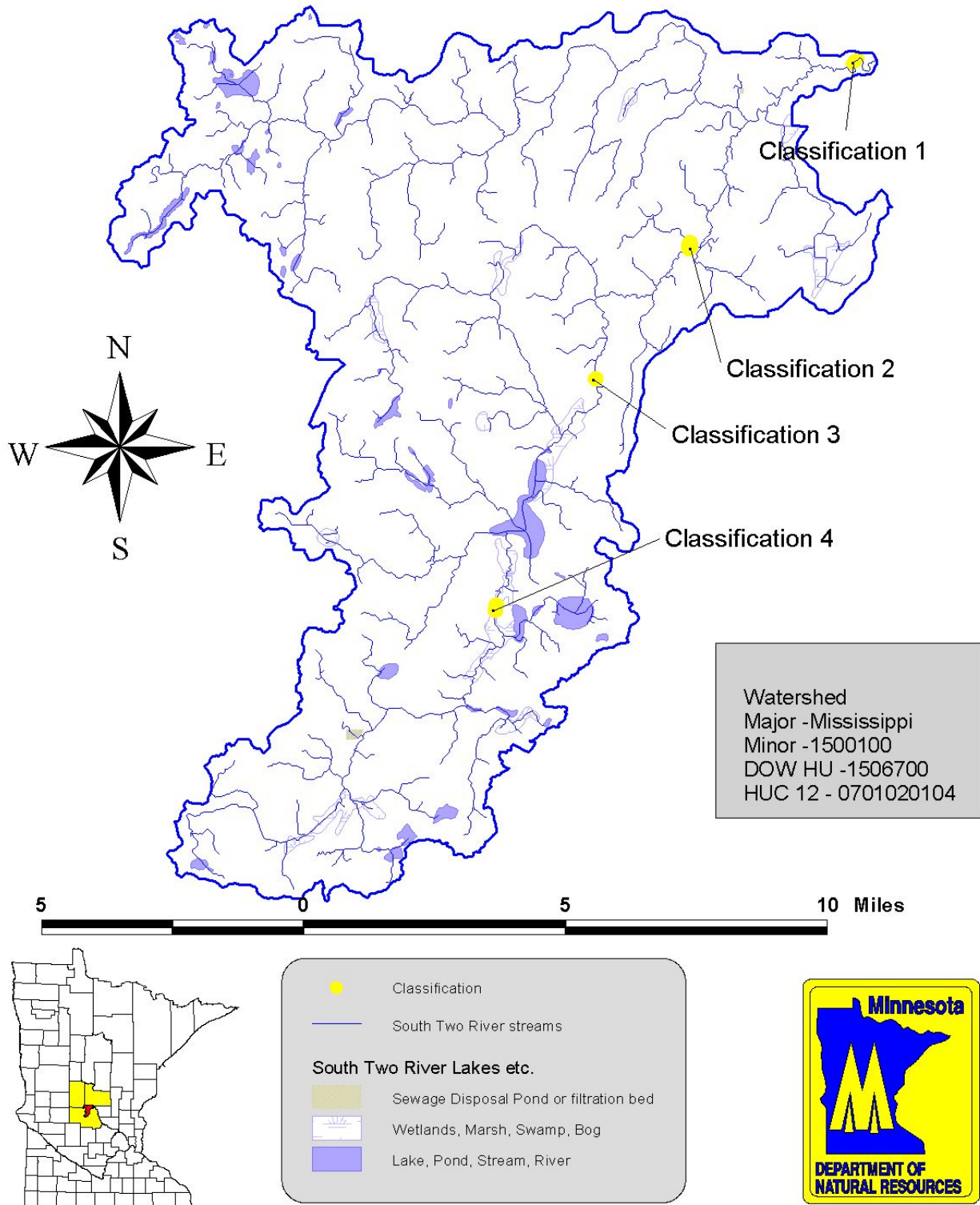


Figure 7. Locations of classification sites in the South Two River (M-084) Watershed, 2006.

South Two River Electrofishing 2006

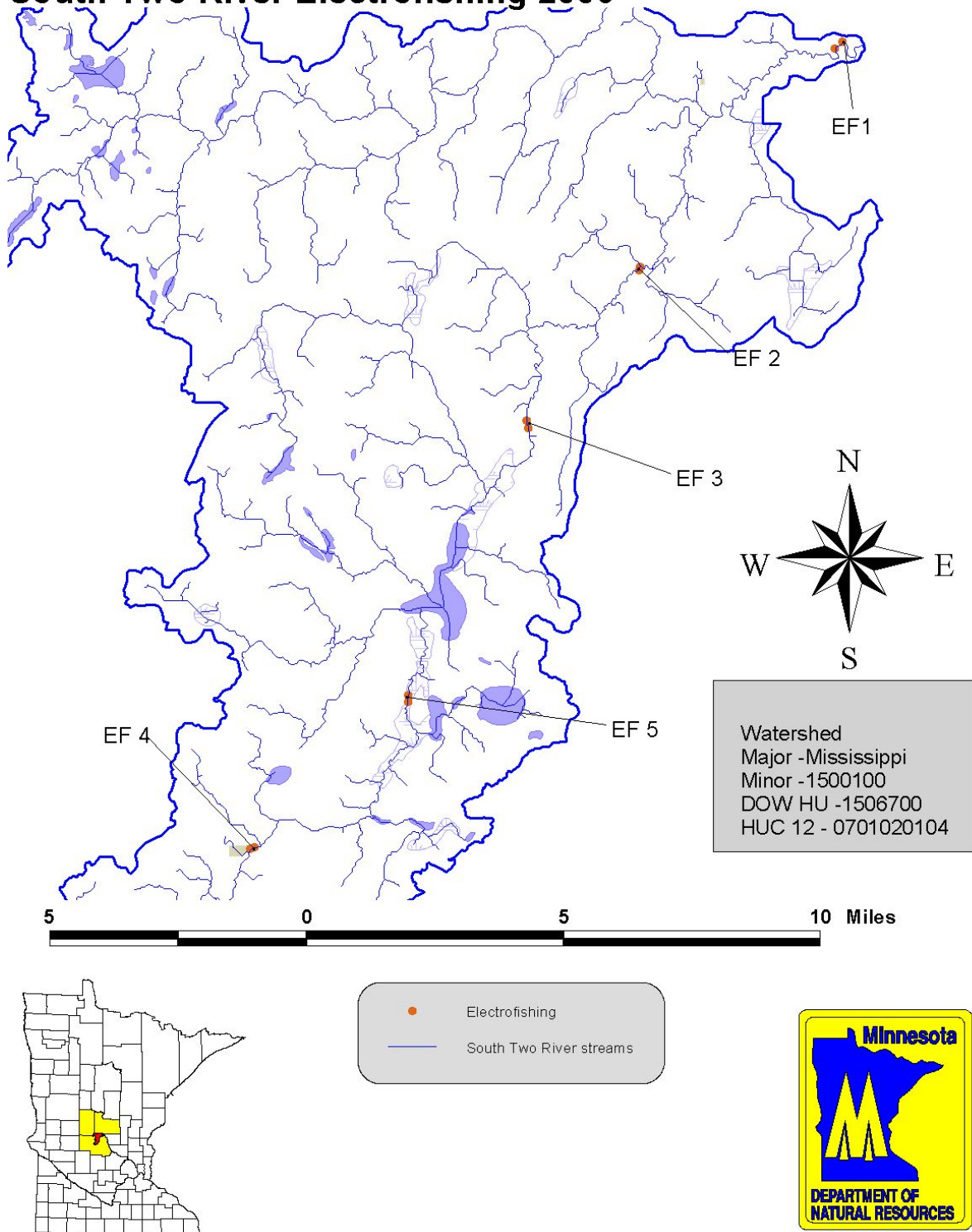


Figure 8. Locations of electrofishing stations in the South Two River (M-084) Watershed, 2006.

South Two River Watershed roads

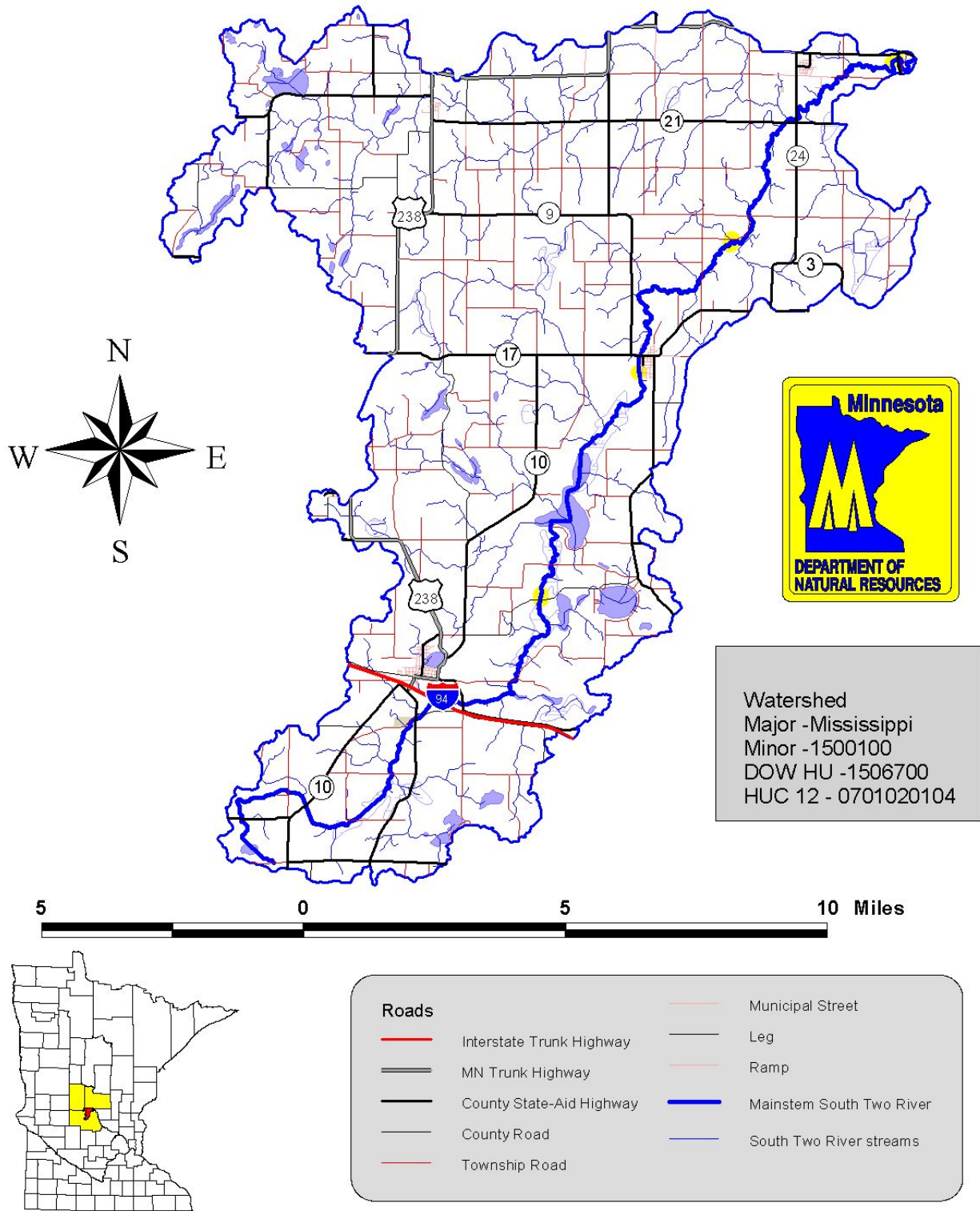


Figure 9. Road network for the South Two River (M-084) major Watershed.

Table 1. South Two Rivers (M-084) major Watershed estimated land use by acres and percent (1991 data).

<i>Land use</i>	<i>Acres</i>	<i>Percent</i>
Crop/Grass	84,947.9	85.8
Aquatic Environments	5,240.5	5.3
Upland Deciduous Forest	4,410.5	4.5
Shrubland	3,254.6	3.9
Non-Vegetated	559.8	0.6
Lowland Deciduous Forest	293.8	0.3
Lowland Conifer Forest	222.1	0.2
Upland Conifer Forest	7.9	0.0
Grand Total	98,936.9	

Table 2. Prominent metrics for the South Two Rivers Watershed.

<i>Metric</i>	<i>Feet</i>	<i>Miles</i>
Watershed Area	98,939	180.3
Basin Length	119,438	22.6
Basin Relief	266	
Basin Relief Ratio	0.002	
Basin Shape	Rf = 6.94E-06 Re = 0.003	
Basic Drainage Pattern	Dendritic	
Stream Order (see Figure)	5	
Bifurcation Ratio	12.3	
Main Stem Stream Length	187,756.8	36
Total Channel Length	1,457,491.2	276.0
Mean Stream Slope	0.001 (7.48 ft/mile)	
Longitudinal Elevation Profile (See Figure)		
Drainage Density	2,956.9	
Valley length	119,856	22.7
Sinuosity	1.57	
Bifurcation Ratio at mouth	12.3	

Table 3. Results of classification on South Two Rivers 2006.

<i>Station id</i>	<i>XS 4</i>	<i>XS 3</i>	<i>XS 2</i>	<i>XS 1</i>
Location	CR 154	Holdingford City Park	Happy Valley WMA	CR 24 near mouth
Bankfull Dimensions				
x-section area (ft.sq.)	111.1	64.4	127.3	157.2
width (ft)	42.7	25.6	134.1	64.6
mean depth (ft)	2.6	2.5	0.9	2.4
max depth (ft)	4.2	3.0	4.5	3.7
wetted parimeter (ft)	44.6	27.5	139.8	65.7
hyd radi (ft)	2.5	2.3	0.9	2.4
width-depth ratio	16.4	10.2	141.3	26.5
Flood Dimensions				
W flood prone area (ft)	633.0	75 (381.0)	1,037	170.3
entrenchment ratio	14.8	2.9 (14.9)	7.7	2.6
Longitudinal Profile				
Slope (%)	0.033	0.06	0.055	0.12
length (ft)	695.0	649.0	613.0	1092
Sinuosity	1.1	1.05	1.7	1.3
D50	Sand	Sand	Sand	Gravel
Classification	C5	C5	E5	C4

Table 4. Water chemistry values collected by MPCA monitoring stations on the South Two River (2004-2006) and several area Stearns County Streams during 2006.

<i>2006 data</i>	<i>South Two R.</i>	<i>Spunk Ck</i>	<i>Getchell Ck</i>	<i>Watab R.</i>	<i>Adely Ck</i>
max TP mg/L	0.142	0.258	0.479	0.109	0.110
min TP mg/L	0.031	0.027	0.169	0.024	0.038
mean TP mg/L	0.083	0.083	0.303	0.056	0.064
South Two River Data					
<i>Year</i>	<i>Average TP mg/l</i>	<i>Max TP mg/l</i>	<i>Average DO mg/l</i>	<i>Max Fecal Coliform #/ml</i>	
2004	0.111	0.253	11.242	300	
2005	0.137	0.292		2930	
2006	0.083	0.142	10.946	1400	

Table 5. Electrofishing station sampling and Index of Biotic Integrity (IBI) information, South Two River, 2006.

Criteria	EF1	EF2	EF3	EF5	EF4
Effort (Seconds)	1466	1539	2170	1640	1044
Gear	Barge EF	Barge EF	Back Pack	Barge EF	Back Pack
Location	Near CR 21 Morrison	Happy Valley WMA	Holdingford Veterans Park	Downstream of CR 154	South of Albany
Station length (ft)	1,103	645	702	677	452
# species	13	16	15	13	13
Species Richness and Composition Metrics					
Number DSM ¹	0	0	0	-	-
Number WE ²	2	3	5	4	3
Number INT ³	3	3	2	0	1
Percent TO ⁴	31	25	40	46	54
Percent Dominant Two Species	-	-	-	78	80
Trophic and Reproductive Function Metrics					
Number INS ⁵ Species	5	6	4	5	4
Number PI ⁶ Species	4	5	5	-	-
Percent of SL ⁷ Individuals	2	1	1	1	2
Fish Abundance and Condition Metrics					
Number of fish /100 m	52	173	72	102	121
Percent DELT Anomalies	0	0.58	0	0	0
Drainage area (Mi ²)	154	96	88	29	16
Overall IBI Score	59	71	62	49	48
IBI Rating	Fair	Good	Good	Fair	Fair
Range for Rating	59-40	79-60	79-60	59-40	59-40

¹ DSM- Darter, sculpin and madtom species, ² WE- Wetland species, ³ INT – Intolerant species, ⁴ TO – Tolerant species, ⁵ INS – Invertivore, ⁶ PI- Piscivore, ⁷ SL – Simple lithophil

Table 6. Species composition by electrofishing station collected from South Two River, September, 2006.

<i>Species</i>	<i>EF1</i>	<i>EF2</i>	<i>EF3</i>	<i>EF5</i>	<i>EF4</i>	<i>Total</i>
Brook silverside					2	2
Black bullhead			44	22	1	67
Black crappie	15	8	4	2	4	33
Bluegill		9	6	111		126
Bigmouth shiner		1				1
Blacknose dace					5	5
Bluntnose minnow		11		1		12
Burbot	1					1
Common carp	1		1	1		3
Central mudminnow	1	64	23	10	4	102
Creek chub	3	44	3		2	52
Common shiner	1	48		2	6	57
Fathead minnow				1	126	127
Green sunfish			1		1	2
Hornyhead chub	24	78				102
Hybrid sunfish		1				1
Johnny darter		12			1	13
Logperch	1					1
Largemouth bass		2	8	53	4	67
Mimic shiner					3	3
Northern pike		8	2			10
Pumpkinseed sunfish			2	1		3
Rock bass	1	9	1			11
Spotfin shiner	2					2
Smallmouth bass	117	17	1			135
Tadpole madtom	1	7	25	2		35
White Sucker	6	21	24	2	8	61
Yellow bullhead			8			8
Yellow perch				3		3
Sum	174	340	153	211	167	1,045

Table 7. Length range of fish sampled in all stations from the South Two River, September, 2006.

Species	Number	Minimum length(mm)	Maximum length(mm)
Brook Silverside	2	54	57
Black bullhead	67	76	107
Black crappie	33	55	127
Bluegill	126	44	122
Bigmouth shiner	1	67	67
Blacknose Dace	5	61	61
Bluntnose minnow	12	55	78
Burbot	1	212	212
Common carp	3	110	136
Central mudminnow	102	43	96
Creek chub	52	30	210
Common shiner	57	39	168
Fathead minnow	127	30	55
Green sunfish	2	91	96
Horny head chub	102	63	192
Hybrid sunfish	1	50	50
Johnny darter	13	38	57
Logperch	1	114	114
Largemouth bass	67	53	106
Mimic shiner	3	57	57
Northern pike	10	145	272
Pumpkinseed sunfish	3	50	65
Rock bass	11	50	118
Spotfin shiner	2	72	72
Smallmouth bass	135	60	193
Tadpole madtom	35	32	78
White Sucker	61	98	480
Yellow bullhead	8	71	71
Yellow perch	3	66	81

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

Stream Survey Report

South Two River

2006



Author

March 16, 2007

Date

Area Fisheries Supervisor

Date

Regional Fisheries Supervisor

Date

Copyright 2007. State of Minnesota, Department of Natural Resources.

Reproduction of this material without the express written authorization of the Department of Natural Resources is prohibited.