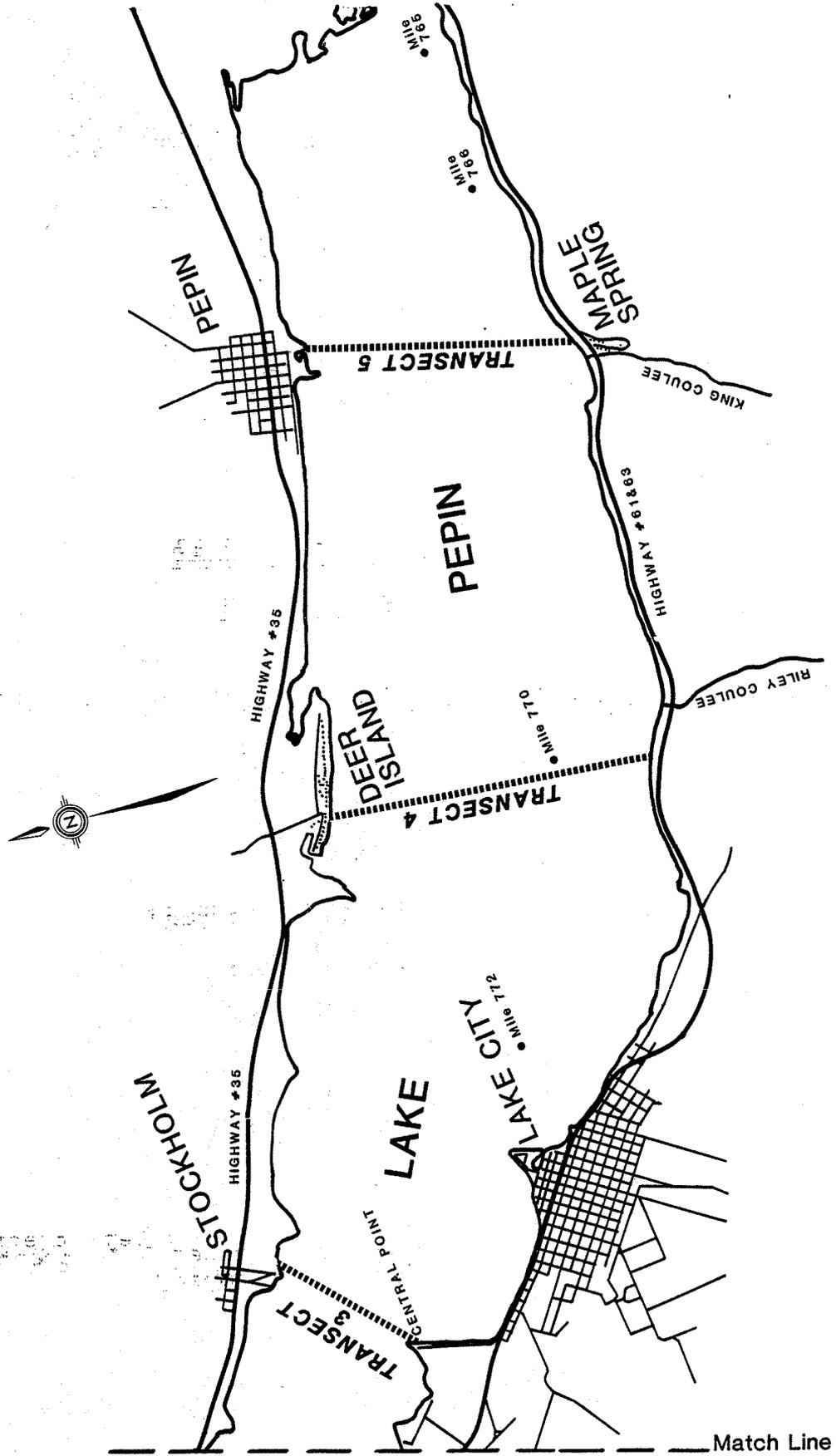


Figure 1 (Continued).



PRAIRIE ISLAND NUCLEAR GENERATING PLANT  
ENVIRONMENTAL MONITORING PROGRAM  
1983 ANNUAL REPORT

LAKE PEPIN ICE THICKNESS AND WATER TEMPERATURE SURVEY

by

Kenneth N. Mueller

Environmental and Regulatory Activities Department

Northern States Power Company

## LAKE PEPIN ICE THICKNESS AND WATER TEMPERATURE SURVEY

### INTRODUCTION

Modification of the cooling water system at Prairie Island Nuclear Generating Plant (PINGP) will result in increased discharge of heated water to the Mississippi River during winter open-cycle operation. A monitoring program was initiated in 1981 and has been conducted annually, during winter months, to determine effects of additional heated water on Lake Pepin ice cover and water temperature. Lake Pepin is a river lake approximately 21 miles long and 2.5 miles maximum width. The head of the lake, at River Mile 785.0, is approximately 13 miles downstream of PINGP. Monitoring in 1983 was conducted January through mid-February. Depending on ice conditions and snow depth, the lower three-fourths of the lake receives considerable recreational and commercial use such as, ice fishing, snowmobiling, and commercial fishing.

### METHODS AND MATERIALS

Transects were established at five locations across Lake Pepin (Table 1 and Figure 1). A control transect was established on Sturgeon Lake. Sturgeon Lake is a backwater lake upstream of Lock and Dam 3 and the plant discharge. The control transect (SL) is not shown on the Lake Pepin area map. Notes on visual observations from shore, of the extent of ice cover near the head of Lake Pepin were made from Greene Point, Wacouta (Figure 1).

Five points, "A" through "E", were monitored per transect, with point "A" near the Minnesota shore, and point "E" near the Wisconsin shore. Sampling frequency was scheduled at two-week intervals, depending on safe ice conditions, December, 1982 through March, 1983. Monitoring in 1983 commenced January 6 and

ended February 17. Visual observations of ice conditions and recreational activities were made from shore January 5 and March 1, 1983.

Ice thickness and snow depths were measured and recorded to the nearest inch at each transect point. Due to drifting, snow depth varied greatly, and the measurements recorded reflected an average depth in the vicinity of each transect point. Water temperature was recorded to the nearest one-tenth of one degree centigrade and measured at one-yard intervals, surface to bottom, with a YSI Model 46-TUC Tele-thermometer. Surface water temperatures, reported as zero (0) yards depth, were actually measured beneath the ice to avoid supercooled water created in the hole by drilling. Bottom depth, in feet, was recorded following the last temperature at each transect point.

A log of recreational and commercial activities in the vicinity of the survey transects is on file at the Prairie Island Environmental Laboratory. The log includes notes on: car, truck, and snowmobile traffic on the lake; number of ice fishing shelters in the general vicinity of the transects; numbers of ice fishermen and commercial fishermen; and any other pertinent information.

#### RESULTS AND DISCUSSION

The Lake Pepin monitoring program is a requirement stipulated by the MDNR, Division of Waters, and included in the permit for "Work in the beds of public waters". Survey data for 1983 (Tables 2 through 5) are presented as background information for comparison of Lake Pepin ice cover and water temperature and their effects on recreational activity after the modified intake and discharge at Prairie Island become operational.

Prior to monitoring, observations of ice conditions and recreational activities were made from shore January 5, 1983. Monitoring was conducted every two weeks January 6 through February 17. An attempt was made to monitor on March 1 also, but open water areas and hazardous ice conditions limited the survey to observations from shore only. No recreational activities were noted on the lake at that time.

Ice thickness and water temperature data were not collected near the head of the lake, due to continual hazardous ice conditions created by the main river channel entering the lake. Notes from observations made of the area from Greene Point are presented in Table 6. The first barge of the commercial shipping season passed through Lake Pepin and Lock and Dam 3 March 4, 1983.

Fine Mesh  
Current Velocity

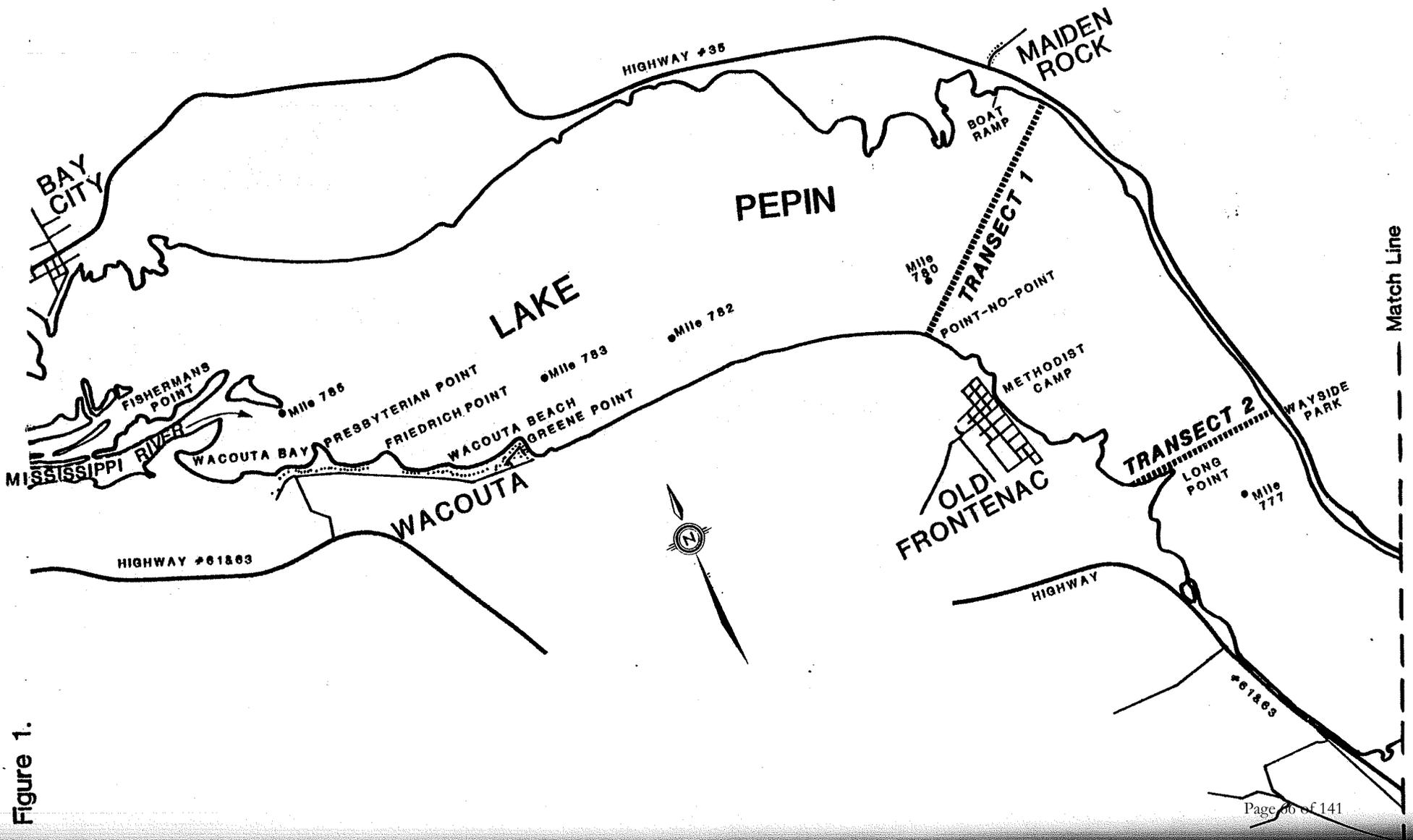


Figure 1.

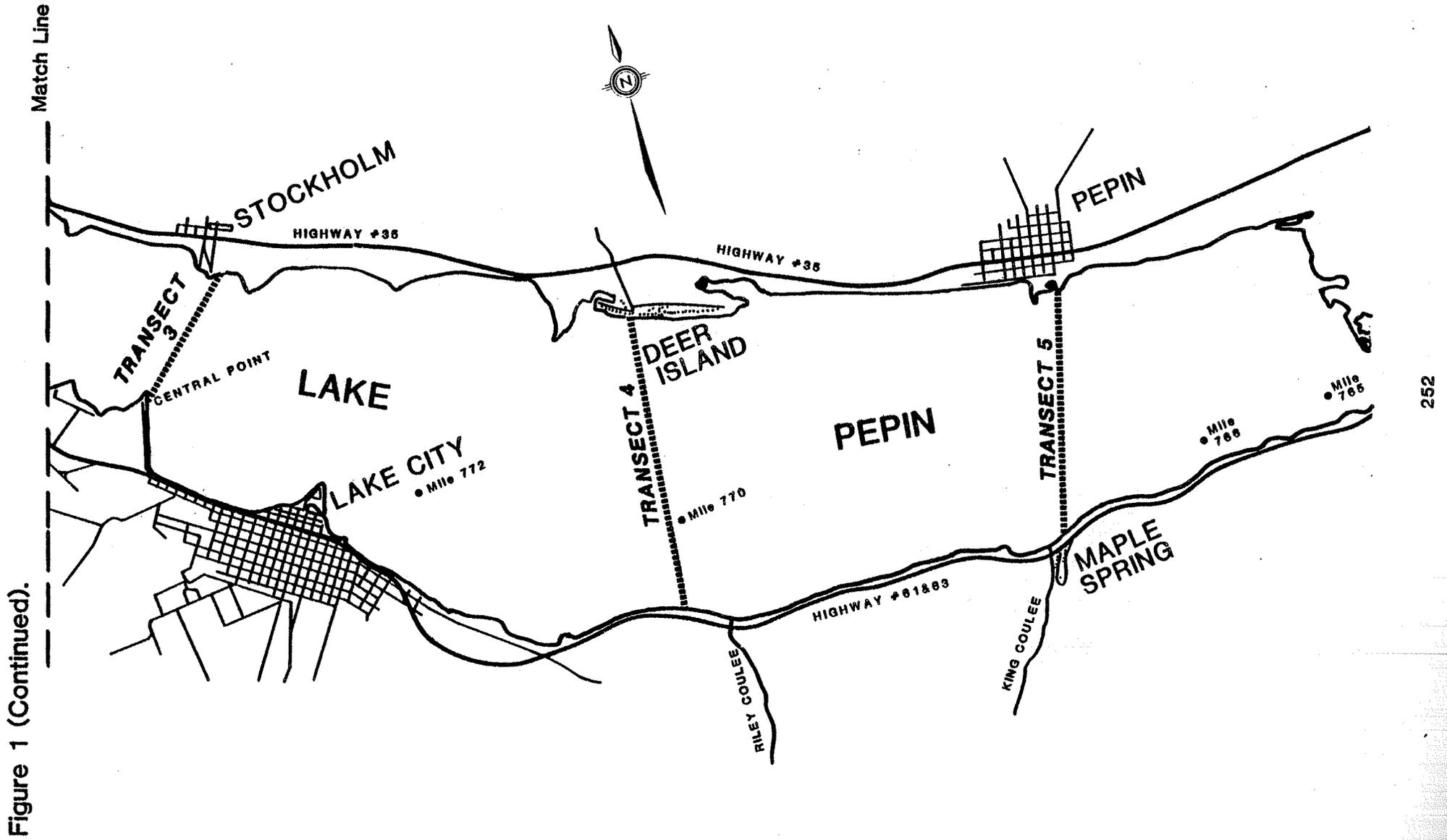


Figure 1 (Continued).

Table 1. Transects Surveyed for Ice Thickness and Water Temperature on Lake Pepin, 1983.

	<u>Approximate River Mile</u>	<u>Minnesota</u>	to	<u>Wisconsin</u>
Transect 1	780.0	Point-No-Point		*Maiden Rock (City of) (Boat Ramp)
Transect 2	777.5	*Long Point		Recreational Site (Wayside Rest Area)
Transect 3	774.3	*Central Point		*Stockholm (City of)
Transect 4	770.0	Riley Coulee		*Deer Island (Recreational site/ Boat ramp)
Transect 5	767.0	Maple Springs (King Coulee)		*Pepin (City of)
Greene Point	783.3	Observations from shore, only		

\*Points of Access Used During Survey

253

*Handwritten:* Fine Mesh  
 Current velocity  
 files

TABLE 2. Lake Pepin Ice Thickness and Water Temperature Survey Data. Monitoring Date 1-6-83; Water Temp.(Centigrade); Bottom Depth (feet); Ice and Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.4	.2	.2	.2	.2	.4	.2	.2	.2	.2	.6	.6	.6	.6	.4
1	.4	.2	.2	.2	.2	.4	.2	.2	.2	.2	.6	.6	.6	.6	.4
2	.4	.2	.2	.2	.2	.6	.2	.2	.2	.2	.6	.6	.6	.6	.4
3	.4	.4	.2	.2	.8	.6	.2	.2	.2	.2	.6	.6	.6	.6	.4
4	.6	.6	.4	.6	1.6	.6	.2	.2	.2	.2	.6	.6	.6	.6	.4
5	.6	.8	.4	.8	2.2	.6	.4	.2	.4	.6	.6	.8	1.0	1.0	.8
6	.6	.8	.6	1.2	15'	14'	.4	.6	.4	.6	.6	.8	1.0	1.0	1.2
7	.6	.8	.6	19'			.4	.6	.4	1.0	.6	1.0	1.0	1.0	1.4
8	.6	.8	21'				.6	.6	.4	1.2	.8	1.0	1.0	1.0	1.4
9	.6	24'					.6	.6	.4	24'	.8	1.0	1.0	1.0	1.8
10	27'						.6	27'	26'		.8	1.0	1.0	1.0	26'
11							30'				.8	1.0	31'	29'	
12											.8	33'			
13											36'				
ICE	10"	11"	12"	15"	11"	7"	10"	10"	11"	10"	9"	10"	10"	11"	9"
SNOW	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.2	.2	<.2	<.2	.4	.8	.6	.6	.6	.6	.2	<.2	<.2	<.2	<.2
1	.2	.2	<.2	.2	.4	1.0	.6	.6	.6	.6	.2	<.2	<.2	<.2	<.2
2	.2	.2	<.2	.2	.4	1.0	.8	.6	.6	.6	.2	<.2	<.2	<.2	<.2
3	.2	.2	<.2	.2	.6	1.0	.8	.6	1.0	2.0	5'	.2	<.2	5'	5'
4	.2	.4	.2	.2	1.0	1.0	.8	.8	1.0	2.8		<.2	8'		
5	.4	.4	.2	.2	1.2	1.0	1.0	.8	1.2	3.0		<.2			
6	.4	.4	.4	.6	1.4	1.0	1.0	1.0	1.2	3.1		14'			
7	.4	.4	.4	.8	1.6	1.2	1.0	1.0	1.6	3.2					
8	.4	.4	.4	1.2	2.0	1.2	1.0	1.0	1.8	21'					
9	.4	.4	.8	1.2	25'	1.2	1.2	1.4	2.0						
10	.4	.8	1.1	27'		1.2	1.2	1.4	27'						
11	.6	32'	29'			1.2	1.2	29'							
12	33'					1.2	1.2								
13						1.2	34'								
						39'									
ICE	13"	13"	11"	11"	11"	13"	10"	11"	11"	10"	11"	9"	9"	9"	9"
SNOW	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"

TABLE 3. Lake Pepin Ice Thickness and Water Temperature Survey Data.  
Monitoring Date 1-18-83; -Water Temp. (Centigrade); Bottom Depth  
(feet); Ice and Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.2	.0	.2	.0	.0	.0	.1	.0	.0	.0	.0
3	.2	.1	.4	.2	.4	.2	.2	.1	.0	.0	.1	.0	.0	.0	.0
4	.2	.2	.4	.2	1.6	.4	.2	.1	.2	.0	.1	.0	.0	.0	.0
5	.3	.2	.6	.8	1.8	12'	.4	.4	.4	.0	.2	.0	.0	.0	.0
6	.4	.4	.6	.8	13'		.4	.4	.4	1.0	.2	.2	.4	.6	.2
7	.4	.4	.6	18'			.4	.4	.4	1.4	.2	.4	.4	.6	.8
8	.4	.4	21'				.4	.4	.4	19'	.2	.4	.4	.6	.9
9	24'	24'					.4	.4	.4		.2	.4	.4	.6	1.2
10							.4	.4	.4		.2	.4	.4	.6	24'
11							27'	27'	26'		.2	.4	.4	.6	
12											.2	.4	.4	27'	
13											.2	30'	30'		
											36'				
ICE	10"	13"	14"	15"	15"	8"	9"	11"	11"	11"	9"	13"	12"	14"	13"
SNOW	1"	1"	1"	1"	3"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.1	.0
3	.4	.2	.0	.0	.0	.2	.2	.0	.0	.0	.0	.1	.0	3'	3'
4	.4	.4	.0	.0	.0	.4	.2	.2	.0	.4	6'	6'	.1		
5	.4	.6	.1	.2	.2	.4	.2	.4	.5	1.0			.1	9'	
6	.4	.6	.6	1.0	1.0	.6	.4	.4	1.0	1.8					
7	.5	.6	.7	1.0	1.4	.6	.4	.6	1.6	18'					
8	.6	.6	.8	1.6	2.4	.6	.6	1.0	2.6						
9	.6	.7	1.0	24'	24'	.6	.6	2.0	24'						
10	.7	1.0	27'			.6	.6	2.0	24'						
11	.8	30'				.8	1.0	27'							
12	33'					.8	30'								
13						33'									
ICE	14"	15"	15"	14"	14"	15"	15"	14"	15"	15"	11"	11"	11"	8"	11"
SNOW	1"	1"	1"	1"	1"	2"	1"	1"	1"	1"	1"	0"	0"	0"	0"

*Fine Mesh  
Current Velocity*

TABLE 4. Lake Pepin Ice Thickness and Water Temperature Survey Data. Monitoring Date 2-2-83; Water Temp.(Centigrade); Bottom Depth (feet); Ice and Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.1	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.1	.1	.1	.1	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.1	.0	.1	.2	.2	.1	.0	.1	.0	.0	.0	.0	.0	.0
3	.1	.4	.1	.1	.7	.2	.1	.0	.1	.0	.2	.0	.0	.0	.0
4	.2	.4	.2	.8	1.6	9'	.1	.0	.2	.1	.2	.1	.0	.0	.0
5	.2	.2	1.1	1.2	12'		.4	.6	.6	1.2	.2	.4	.3	.2	.9
6	.2	.2	1.2	1.8			.4	.8	1.0	1.6	.4	.5	.6	.9	1.2
7	.2	.2	18'	17'			.4	.8	1.0	1.6	.4	.6	.7	.9	1.3
8	.2	21'					.4	.8	1.0	20'	.4	.6	.8	1.0	1.6
9	24'						.4	24'	24'		.4	.6	.8	1.0	24'
10							27'				.4	.6	.8	26'	
11											.4	30'	28'		
12											33'				
13															
ICE	11"	17"	16"	19"	16"	7"	15"	16"	15"	15"	13"	15"	15"	17"	17"
SNOW	3"	3"	2"	3"	5"	2"	2"	5"	2"	6"	6"	7"	7"	9"	8"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.1	.1	.0	.0	.0	.0	.0	.0	.0	.1	.1	.1	.1	.1
1	.2	.2	.2	.0	.0	.1	.1	.0	.0	.0	.1	.1	.1	.1	.1
2	.3	.2	.2	.1	.0	.2	.1	.0	.0	.0	4'	.1	.1	.1	3'
3	.4	.3	.2	.2	.1	.4	.2	.1	.0	.1		.1	.1	.1	
4	.5	.5	.5	.2	.2	.4	.6	.6	.2	1.0		.1	.1	.1	
5	.5	.6	.5	.8	.8	.6	.7	1.0	1.0	1.7		.1	.1	.1	
6	.5	.6	.6	1.0	1.4	.6	.8	1.0	1.1	2.4		.1	.1	.1	
7	.5	.6	.6	1.0	2.0	.7	.8	1.0	2.2	18'		.1	.1	.1	
8	.5	.6	.6	1.4	3.4	.8	1.0	1.4	3.0			.1	.1	.1	
9	.6	1.0	1.4	24'	24'	.8	1.0	1.6	24'			.1	.1	.1	
10	.6	27'	27'			.8	1.0	26'				.1	.1	.1	
11	.8					30'	30'					.1	.1	.1	
12	32'											.1	.1	.1	
13												.1	.1	.1	
ICE	20"	19"	17"	18"	20"	17"	17"	19"	19"	17"	17"	13"	15"	14"	14"
SNOW	10"	7"	8"	8"	7"	9"	9"	7"	9"	9"	<1"	<1"	<1"	<1"	<1"

TABLE 5. Lake Pepin Ice Thickness and Water Temperature Survey Data.  
Monitoring Date 2-17-83; Water Temp.(Centigrade); Bottom Depth  
(feet); Ice and Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.4	.2	.1	.0	.0	.4	.1	.1	.0	.0	.1	.2	.2	.2	.2
1	.9	.2	.1	.0	.0	.4	.2	.1	.0	.0	.1	.2	.2	.2	.2
2	1.0	.3	.1	.0	.0	.4	.2	.1	.0	.0	.1	.2	.3	.2	.2
3	1.1	.4	.2	.1	.2	.4	.2	.1	.1	.0	.2	.2	.3	.2	.2
4	1.2	1.2	1.0	1.1	1.1	.6	.6	.2	.2	.0	.2	.2	.3	.2	.3
5	1.4	1.6	1.4	1.2	1.6	1.2	.9	1.1	1.0	1.0	.4	.6	.8	.3	.4
6	1.4	1.6	1.4	1.3	14'	1.2	1.3	1.2	1.0	1.8	.4	.6	.8	1.0	1.3
7	1.4	1.6	1.4	18'		1.2	1.3	1.2	1.0	1.8	.4	.6	.8	1.0	1.5
8	1.4	1.6	20'			1.2	1.4	1.2	1.0	21'	.4	.6	.8	1.2	2.1
9	24'	22'				1.2	1.4	24'	23'		.4	.6	.8	1.2	24'
10						1.2	27'				.4	.7	27'	26'	
11						29'					.4	30'			
12											33'				
13															
ICE	11"	14"	17"	19"	18"	12"	15"	16"	16"	18"	13"	16"	15"	16"	16"
SNOW	3"	2"	4"	4"	6"	2"	2"	3"	2"	2"	5"	4"	4"	4"	4"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.2	.2	.2	.0	.0	.0	.2	.0	.0	.0	.2	.2	.4	.3	.2
1	.2	.2	.2	.0	.0	.2	.0	.0	.0	.0	.4	.2	.4	.3	.2
2	.2	.2	.2	.1	.0	.2	.0	.0	.0	.0	4'	3'	.4	.3	.2
3	.2	.2	.2	.1	.0	.2	.0	.0	.0	.0			.4	5'	4'
4	.3	.2	.2	.1	.0	.2	.1	.0	.0	.4			.4		
5	.4	.4	.4	.1	.3	.3	.2	.2	.0	.8			16'		
6	.4	.4	.5	.5	.7	.4	.2	.2	.4	1.3					
7	.4	.4	.6	1.0	1.4	.4	.2	.3	1.0	2.1					
8	.4	.5	.6	1.5	3.2	.4	.4	.6	2.2	21'					
9	.5	1.0	1.6	2.2	24'	.4	.4	1.4	2.4						
10	.8	1.6	27'	25'		.4	1.2	1.5	26'						
11	.9	28'				28'	31'	28'							
12	31'														
13															
ICE	19"	19"	19"	19"	19"	18"	19"	18"	19"	17"	18"	15"	14"	14"	12"
SNOW	3"	4"	4"	5"	5"	3"	3"	4"	3"	4"	4"	4"	3"	3"	2"

*Five Mesh  
Current velocity*

Table 6. Notes from Observations of Ice Cover at the Head of Lake Pepin, Made from Shore at Greene Point, Wacouta.

- 1-5-83: Area apparently froze, thawed, and refroze approximately 1/3-1/2 width of river. Now frozen to head of lake. Appears to be unsafe conditions.
- 1-6-83: Same conditions as on 1-5-83.
- 1-19-83: Area from head of lake downstream to Greene Point frozen and rough, near Minnesota shore, but definitely not good ice.
- 2-2-83: Heavy snowfall (12"-14") on February 1 and 2; observed poor ice conditions and slush from approximately 200 yards downstream of Greene Point to head of lake.
- 2-17-83: Open water from head of lake downstream past Greene Point; open water approximately 1/4 width of lake and near Minnesota shore. Bad ice conditions appear to extend approximately 1/4 to 1/2 mile downstream of Greene Point.
- 3-1-83: Open water nearly shore to shore; areas of open water and bad ice to Point-No-Point.

No recreational activity was observed in the above described areas on any of the dates listed.

PRAIRIE ISLAND NUCLEAR GENERATING PLANT  
ENVIRONMENTAL MONITORING PROGRAM  
1984 ANNUAL REPORT

LAKE PEPIN ICE THICKNESS AND WATER TEMPERATURE SURVEY

by

Kenneth N. Mueller

Environmental and Regulatory Activities Department

Northwestern States Power Company



## LAKE PEPIN ICE THICKNESS AND WATER TEMPERATURE SURVEY

### INTRODUCTION

Modification of the cooling water system at Prairie Island Nuclear Generating Plant (PINGP) was completed in 1983. Increased discharge of heated water to the Mississippi River during winter open-cycle operation may elevate water temperature and influence ice thickness downstream of the plant. Open water and unpredictable ice conditions normally exist on the main river channel from the plant downstream to the head of Lake Pepin. Lake Pepin is a river lake approximately 21 miles long and 2.5 miles maximum width. The head of the lake, at river mile 785.0, is approximately 13 miles downstream of PINGP. Depending on ice conditions and snow depth, the lower three-fourths of the lake receives considerable recreational and commercial use, including ice-fishing, snowmobiling, ice-boating, and commercial fishing. The first full year of data was collected during the winter of 1981-82, December through March.

### METHODS AND MATERIALS

Transects were monitored at five locations across Lake Pepin during the winter of 1983-84 (Table 1 and Figure 1). A control transect is located on Sturgeon Lake, a backwater upstream of Lock and Dam 3 and the plant discharge. The control transect (SL) is not shown on the Lake Pepin area map. Notes on visual observations from shore, of the extent of ice cover near the head of Lake Pepin, were made from Greene Point, Wacouta (Figure 1).

Five points, "A" through "E", were monitored per transect, with point "A" near the Minnesota shore, and point "E" near the Wisconsin shore. Sampling frequency was scheduled at two-week intervals, depending on safe ice conditions, December, 1983 through March, 1984.

Ice thicknesses and snow depths were measured and recorded to the nearest inch at each transect point. Because of drifting, snow depth varied greatly, and the measurements recorded reflected an average depth in the vicinity of each transect point. Water temperature was recorded to the nearest one-tenth of one degree centigrade and measured at one-yard intervals, surface to bottom, with a YSI Model 46-TUC Tele-thermometer. Surface water temperature, reported as zero (0) yards depth, was actually measured beneath the ice to avoid supercooled water created in the hole by drilling. Bottom depth, in feet, was recorded following the last temperature at each transect point.

A log of recreational and commercial activities in the vicinity of the survey transects is on file at the Prairie Island Environmental Laboratory. The log includes notes on: car, truck, and snowmobile traffic on the lake; number of ice fishing shelters in the general vicinity of the transects; numbers of ice fishermen and commercial fishermen; and any other pertinent information.

#### RESULTS AND DISCUSSION

The Lake Pepin monitoring program is a requirement stipulated by the MDNR, Division of Waters, and included in the permit for "Work in the beds of public waters". Survey data for 1984 (Tables 2 through 5) are presented for comparison to Lake Pepin ice cover and water temperature data collected prior to cooling water system modifications and winter open-cycle operation. Use of cooling towers was discontinued December 1, 1983. This study was conducted to determine if there were any effects on winter recreational activity downstream of the plant.

Prior to monitoring, observations of ice conditions and recreational activity were made from shore December 2, 7, and 8, 1983. Monitoring was conducted every two weeks December 27, 1983 through February 8, 1984. No attempt was made to monitor on February 23, due to open water areas and unsafe ice, which limited the survey to observations from shore. No recreational activity was noted on the lake at that time. No observations or physical data collections were made during March due to spring break-up in late February and early March. The first barge of the commercial shipping season passed through Lake Pepin and Lock and Dam 3 March 4, 1984.

Observations from shore at Greene Point, Wacouta, indicate highly variable ice conditions from the head of the lake downstream to approximately one half mile below Greene Point. This area is directly affected by Mississippi River main channel current. This portion of the lake may freeze, open, and refreeze several times during a winter, making recreational use hazardous. Physical data were not collected there due to continual hazardous ice conditions.

Variations in ice thickness and water temperature occur throughout the transects and from year to year, but appear to be within a normal range when natural influencing factors are considered. Near bottom water temperatures, at Points D and E of Transects 4 and 5, usually exceed those of other points and transects. This has been seen from year to year and is presumably an influence of springs in the area. Other areas that draw attention are Points A of Transects 1 and 2, commonly referred to as Point-No-Point and Long Point, and a third point halfway between at Methodist Camp. Submerged bars extend into the lake at Long Point and Methodist Camp. All three areas are along the Minnesota shore and are directly affected by main channel current. Water temperatures at Point A, Transects 1 and 2, do not exceed

those recorded throughout the lake, but appear to be more uniform from top to bottom, and exhibit an earlier spring warming trend.

Measureable ice cover at Point A, Transects 1 and 2, has been generally less than at other transect points throughout the lake. The submerged bars at Long Point and Methodist Camp apparently cause a lifting and mixing effect as current passes, thus affecting ice formation.

These effects of current have been seen prior to plant open-cycle operation beginning December 1, 1983 and have been responsible for unpredictable ice conditions in the past. Two pickup trucks went through the ice at the Methodist Camp point March 2, 1983. Naturally occurring pressure ridges generally have formed across the lake at major points and adversely affect ice conditions in the vicinity.

#### SUMMARY

Changes in the intake and discharge of the PINGP cooling water system were completed in 1983, and allowed for additional discharge of heated water to the Mississippi River during winter open-cycle operation. The Lake Pepin Water Temperature and Ice Thickness Survey has been conducted for two years prior to, and one year following, modifications. Variations in ice thickness and water temperature appear to be naturally induced, primarily by current in the upstream portion of Lake Pepin. No plant-related effects have been detected, but monitoring will be continued.

Table 1. Transects Surveyed for Ice Thickness and Water Temperature on Lake Pepin, 1984

	<u>Approximate River Mile</u>	<u>Minnesota</u>	to	<u>Wisconsin</u>
Transect 1	780.0	Point-No-Point		*Maiden Rock (City of) (Boat Ramp)
Transect 2	777.5	*Long Point		Recreational Site (Wayside Rest Area)
Transect 3	774.3	*Central Point		*Stockholm (City of)
Transect 4	770.0	Riley Coulee		*Deer Island (Recreational site/ Boat ramp)
Transect 5	767.0	Maple Springs (King Coulee)		*Pepin (City of)
Greene Point	783.3	Observations from shore,		only

\* Points of Access Used During Survey

TABLE 2. Lake Pepin Ice Thickness And Water Temperature Survey Data.  
Monitoring Date 12-27-83; Water Temp.(Centigrade); Bottom Depth  
(feet); Ice And Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.1	.0	.3	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.1	.0	.3	.0	.0	.0	.0	.0	.0	.0	.0
3	.0	.1	.0	.0	.7	.0	.3	.0	.0	.0	.1	.0	.0	.0	.0
4	.0	.1	.0	.6	9'	.1	.3	.1	.0	.0	8'	.0	.1	.0	.0
5	.0	.1	.7	1.4		.1	.3	.2	.2	.0		.0	.1	.0	.2
6	.0	.2	1.3	1.5		.1	.4	.2	.2	1.0		.0	.1	.2	.2
7	.0	.2	18'	17'		.1	.4	.2	.2	1.2		.0	.1	.2	.2
8	.0	21'				.1	.4	.3	.3	1.2		.1	.2	.2	.2
9	24'					.1	.4	.3	.4	1.2		.1	.2	.2	.2
10						.1	.4	.3	27'	26'		27'	.2	27'	26'
11						.1	.5	29'					28'		
12						.1	31'								
13						36'									

ICE	13"	12"	14"	10"	10"	9"	12"	14"	12"	11"	14"	14"	13"	10"	12"
SNOW	9"	2"	3"	12"	8"	4"	2"	2"	2"	15"	2"	3"	2"	7"	1"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.1	.0	.0	.0	.6	.0	.0	.0	.0	2'
3	.0	.0	.0	.0	.1	.2	.0	.0	.0	1.6	4'	5'	5'	4'	
4	.0	.2	.0	.2	1.2	.2	.0	.2	.0	1.6					
5	.0	.2	.0	.4	1.4	.2	.0	.2	.0	1.7					
6	.2	.2	.0	.4	1.6	.2	.0	.4	1.2	1.8					
7	.2	.2	.0	.4	1.6	.4	.0	.4	1.6	17'					
8	.2	.3	.1	.8	1.7	.4	.0	.8	1.8						
9	.2	.6	1.6	1.6	24'	.4	.8	1.8	24'						
10	.2	1.1	27'	25'		.4	1.4	27'							
11	30'	28'				.4	30'								
12						.4									
13						36'									

ICE	12"	15"	8"	12"	11"	8"	14"	9"	15"	9"	11"	13"	17"	15"	13"
SNOW	8"	1"	9"	1"	3"	5"	7"	4"	4"	5"	7"	2"	2"	2"	7"

TABLE 3. Lake Pepin Ice Thickness And Water Temperature Survey Data. Monitoring Date 1-11-84; Water Temp.(Centigrade); Bottom Depth (feet); Ice And Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.1	.0	.0	.0	.0	.1	.0	.0	.0	.0	.1	.0	.0	.0	.0
1	.1	.0	.0	.0	.0	.1	.0	.0	.0	.0	.2	.0	.0	.0	.0
2	.1	.1	.0	.0	.0	.3	.0	.0	.0	.0	.2	.0	.0	.0	.0
3	.1	.1	.0	.0	.0	.4	.0	.0	.0	.0	.2	.0	.0	.0	.0
4	.1	.1	.5	.7	.7	.5	.1	.0	.2	.0	.3	.0	.0	.0	.0
5	.3	.6	.6	.9	1.2	10'	.6	.6	.7	.2	.4	.6	.8	.8	.4
6	.3	.7	.6	.9	1.5'		.6	.6	.8	1.3	.5	.7	.8	.8	.9
7	.3	.7	.6	24'			.6	.6	.8	1.3	.5	.7	.8	.8	1.0
8	.3	.7	20'				.6	.6	.8	21'	.5	.8	.8	.8	1.1
9	24'	22'					.6	24'	23'		.5	.8	.8	.8	1.1
10							27'				.5	.8	.8	26'	26'
11											.5	30'	28'		
12											33'				
13															
ICE	9"	19"	22"	19"	11"	8"	15"	12"	11"	13"	14"	17"	12"	13"	13"
SNOW	2"	3"	2"	2"	6"	1"	2"	4"	2"	3"	1"	3"	2"	1"	2"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	3'
3	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	4'	5'	6'	5'	
4	.0	.2	.4	.0	.2	.2	.2	.0	.0	.6					
5	.3	.4	.4	.5	.5	.2	.2	.0	.6	1.6					
6	.3	.4	.5	.8	1.5	.2	.2	.0	1.6	1.7					
7	.4	.4	.5	1.0	1.7	.2	.3	1.2	1.8	1.9					
8	.4	.4	.6	1.7	1.8	.2	.4	1.8	2.0	21'					
9	.4	.9	1.4	24'	23'	.2	.7	1.8	2.0						
10	.4	27'	26'			.2	1.3	26'	25'						
11	30'					30'	30'								
12															
13															
ICE	20"	22"	11"	15"	15"	13"	11"	20"	18"	12"	14"	15"	21"	19"	16"
SNOW	1"	2"	2"	2"	2"	4"	3"	3"	2"	4"	4"	3"	2"	2"	2"

TABLE 4. Lake Pepin Ice Thickness And Water Temperature Survey Data. Monitoring Date 1-25-84; Water Temp.(Centigrade); Bottom Depth (feet); Ice And Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.2	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.2	.1	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.2	.1	.2	.1	.0	.3	.1	.0	.0	.0	.0	.0	.0	.0	.0
3	.2	.1	.2	.1	.2	.4	.1	.0	.0	.0	.0	.0	.0	.0	.0
4	.6	.6	.8	.2	1.2	9'	.2	.1	.0	.0	.1	.0	.0	.0	.0
5	.8	.6	.8	1.4	12'		.4	.4	.4	.0	.2	.1	.3	.4	.0
6	.9	.7	.9	16'			.5	.5	.4	1.3	.2	.2	.4	.4	.8
7	.9	.8	.9				.6	.5	.4	1.3	.2	.2	.4	.4	1.0
8	.9	21'	19'				.6	.6	.6	20'	.2	.2	.4	.4	1.3
9	24'						.6	.6	23'		.2	.2	.4	.4	24'
10							.6	25'			.2	.2	27'	25'	
11							28'				.2	30'			
12											33'				
13															
ICE	16"	19"	17"	17"	13"	11"	18"	17"	21"	14"	25"	19"	13"	15"	18"
SNOW	2"	3"	3"	3"	7"	2"	3"	2"	2"	5"	2"	3"	4"	4"	4"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	3'	.0	.0	.0	.0
3	.0	.0	.0	.0	.0	.3	.0	.0	.0	.0		.0	6'	4'	4'
4	.2	.0	.0	.0	.0	.5	.2	.5	.0	.4		.0			
5	.4	.4	.4	.6	.4	.6	.7	.8	.4	.9		12'			
6	.4	.4	.5	.6	1.2	.6	.8	.9	1.0	2.2					
7	.4	.5	.6	.6	2.2	.6	.8	1.0	2.3	2.3					
8	.5	.6	.7	.8	2.4	.6	.9	1.5	2.4	20'					
9	.5	.6	1.7	1.3	24'	.6	1.4	2.0	2.4						
10	.5	1.5	27'	25'		.7	1.4	25'	25'						
11	30'	29'				.8	29'								
12						31'									
13															
ICE	23"	22"	18"	15"	19"	15"	16"	16"	16"	16"	20"	16"	21"	19"	20"
SNOW	2"	2"	2"	4"	2"	4"	3"	4"	3"	2"	2"	2"	2"	2"	2"

TABLE 5. Lake Pepin Ice Thickness And Water Temperature Survey Data.  
Monitoring Date 2-8-84; Water Temp.(Centigrade); Bottom Depth  
(feet); Ice And Snow Depth (inches).

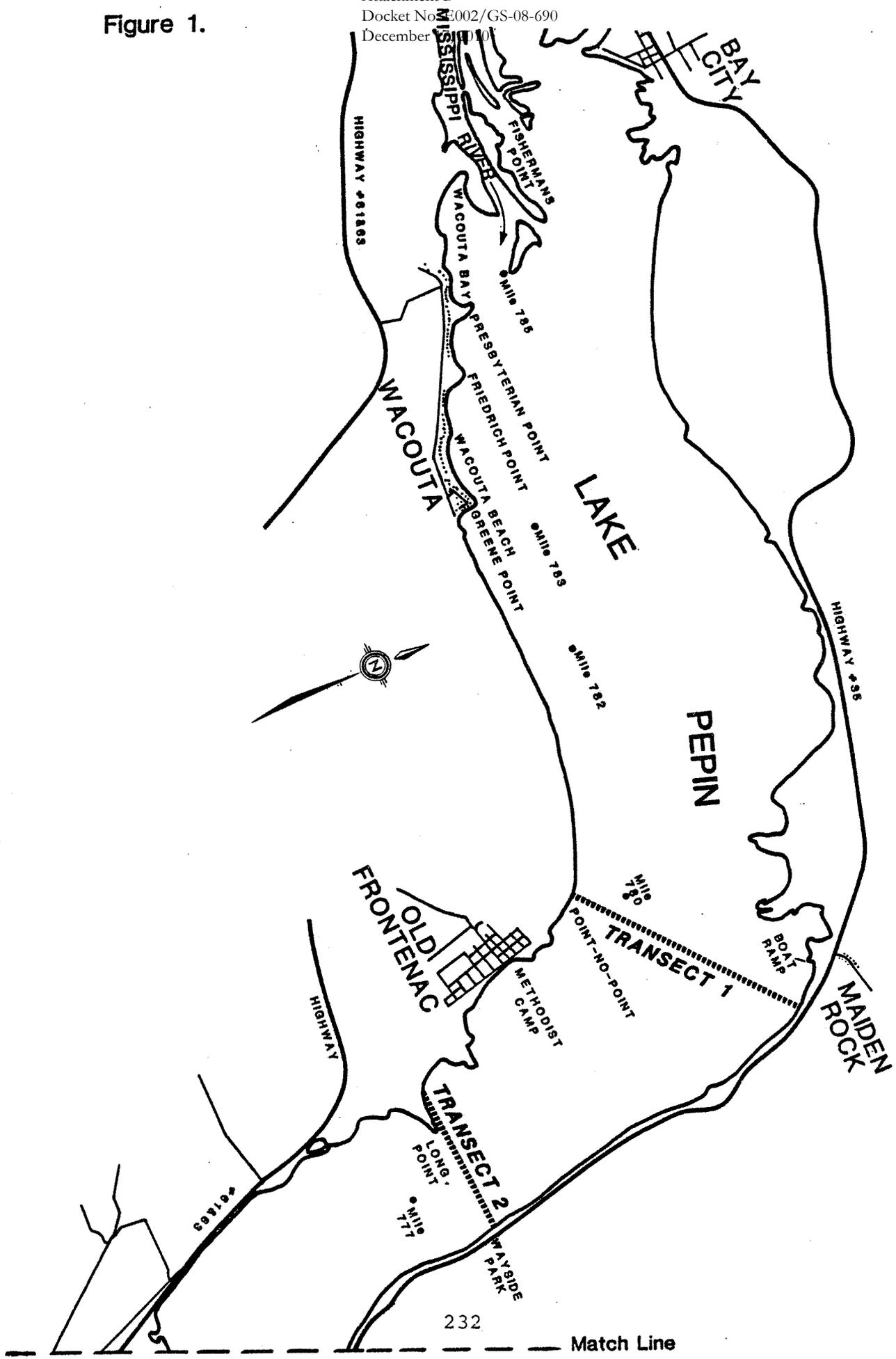
DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.1	.0	.0	.0	.0	.1	.0	.0	.0	.0	.2	.0	.0	.0	.0
1	.1	.0	.0	.0	.0	.1	.0	.0	.0	.0	.3	.1	.0	.0	.0
2	.1	.0	.0	.0	.0	.1	.0	.0	.0	.0	.3	.1	.1	.0	.0
3	.2	.0	.0	.0	.3	.3	.1	.0	.0	.0	.6	.1	.1	.0	.0
4	.4	.3	.4	.1	1.0	.3	.1	.0	.0	.0	.7	.9	.3	.8	.0
5	.4	.4	.4	1.5	1.4	.3	.4	.6	.0	.0	.8	1.0	1.0	1.1	1.3
6	.4	.4	.4	1.6	13'	13'	.4	.8	1.2	1.6	.8	1.0	1.0	1.2	1.4
7	.4	.4	.5	17'			.4	.8	1.2	1.6	.8	1.0	1.1	1.2	1.4
8	.4	.4	20'				.4	.8	1.2	20'	.9	1.0	1.1	1.2	1.4
9	24'	22'					.4	24'	23'		.9	1.0	1.1	1.2	1.4
10							27'				.9	1.0	1.1	27'	25'
11											1.0	30'	28'		
12											33'				
13															

ICE	14"	20"	20"	26"	17"	6"	18"	18"	20"	17"	16"	13"	20"	29"	18"
SNOW	3"	2"	2"	3"	4"	3"	3"	4"	3"	5"	3"	4"	4"	2"	2"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.2	.0	.0	.0	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.2	.0	.0	.0	.0	.4	.1	.0	.0	.0	3'	.0	.0	5'	4'
3	.4	.1	.0	.0	.0	.4	.2	.0	.0	.0		.0	.0		
4	.4	.4	.4	.2	.0	.5	.4	.2	.1	.0		.0	9'		
5	.5	.5	.5	.8	.4	.5	.6	.7	.7	.6		.0			
6	.5	.6	.6	.8	1.3	.5	.6	.8	.8	1.1		.2			
7	.6	.6	.7	.9	1.5	.5	.8	.8	.8	2.0		16'			
8	.6	.7	.8	1.0	2.7	.5	.8	.9	1.3	3.0					
9	.7	.8	1.6	1.6	24'	.5	1.0	1.4	2.0	24'					
10	.7	1.4	27'	26'		.6	1.1	27'	25'						
11	30'	29'				30'	30'								
12															
13															

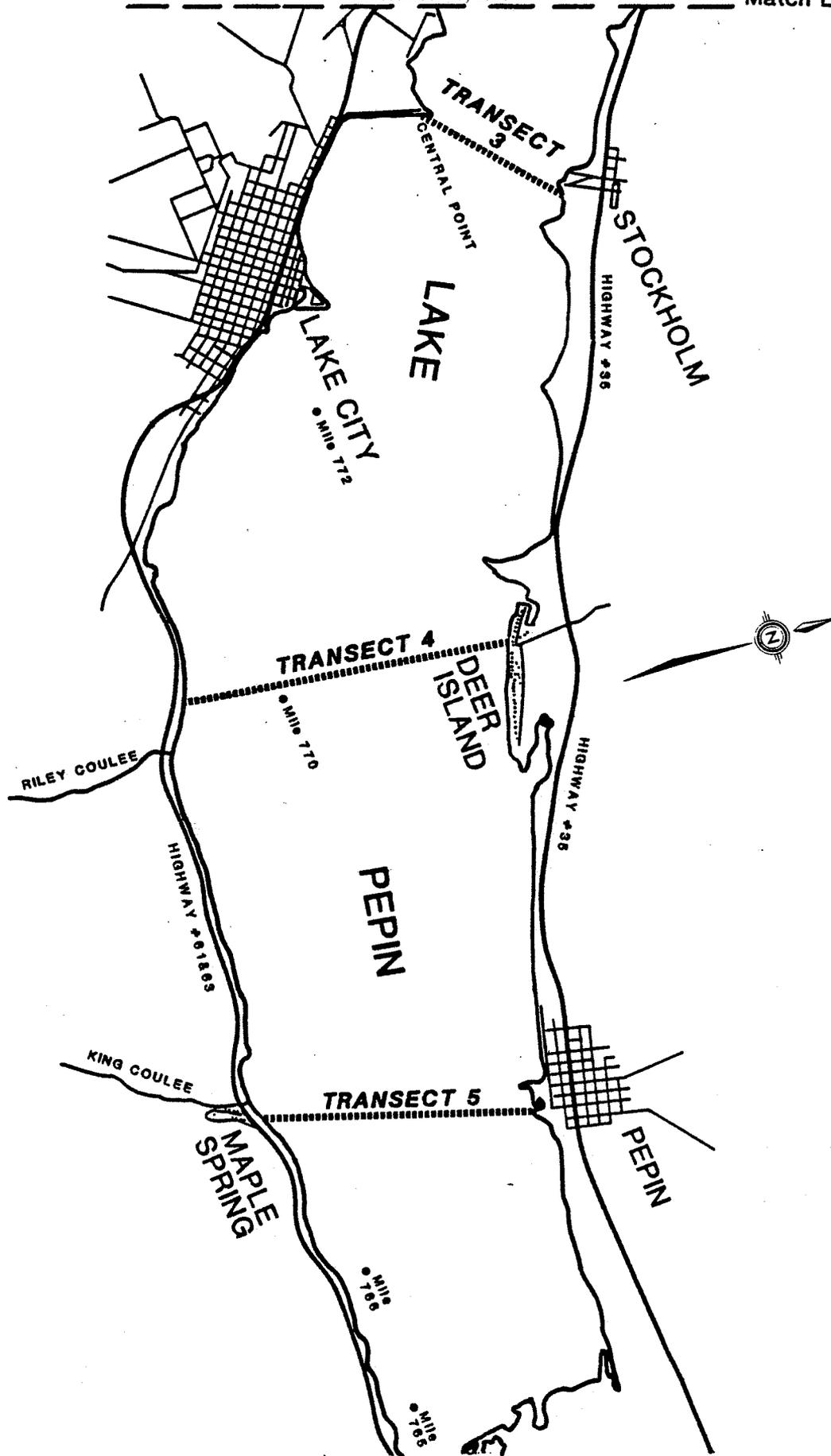
ICE	27"	26"	25"	22"	16"	16"	25"	23"	23"	22"	20"	20"	22"	22"	24"
SNOW	2"	2"	3"	3"	5"	5"	2"	3"	3"	3"	5"	3"	2"	3"	4"

Figure 1.



232

Match Line





PRAIRIE ISLAND NUCLEAR GENERATING PLANT  
ENVIRONMENTAL MONITORING PROGRAM  
1985 ANNUAL REPORT

LAKE PEPIN ICE THICKNESS AND WATER TEMPERATURE SURVEY

by

Kenneth N. Mueller

Environmental and Regulatory Activities Department

Northern States Power Company



## LAKE PEPIN ICE THICKNESS AND WATER TEMPERATURE SURVEY

### INTRODUCTION

Modification of the cooling water system at Prairie Island Nuclear Generating Plant (PINGP) was completed in 1983. Increased discharge of heated water to the Mississippi River during winter operation without cooling towers, may elevate water temperature and influence ice thickness downstream of the plant. Open water and unpredictable ice conditions normally exist on the main river channel from the plant downstream to the head of Lake Pepin. Lake Pepin is a river lake approximately 21 miles long and 2.5 miles maximum width. The head of the lake, at river mile 785.0, is approximately 13 miles downstream of PINGP. Depending on ice conditions and snow depth, the lower three-fourths of the lake receives recreational and commercial use, including ice-fishing, snowmobiling, ice-boating, and commercial fishing. Ice thickness and water temperature monitoring was initiated in 1981, with the first complete season of data collected in 1981-82, December through March. This report presents data from the winters of 1984-85 and 1985-86.

### METHODS AND MATERIALS

Ice thickness and water temperature were monitored at five transects on Lake Pepin during the winters of 1984-85 and 1985-86. Transect locations are described in Table 1 and shown in Figure 1. A control transect on Sturgeon Lake (SL), is upstream of Lock and Dam 3 and the plant discharge. The upstream transect is not shown on the Lake Pepin area map. Notes on visual observations from shore, of the extent of ice cover near the head of Lake Pepin, were made from Greene Point, Wacouta (See Appendix).

Five points, "A" through "E", were monitored per transect, with point "A" near the Minnesota shore, and point "E" near the Wisconsin shore. Sampling frequency was scheduled at two-week intervals, depending on safe ice conditions, December through March.

Ice thickness and snow depth were measured and recorded to the nearest inch at each transect point. Snow depth measurements reflect average depth in the vicinity of each transect point. Water temperature was recorded to the nearest one-tenth of one degree Centigrade and measured at one-yard intervals, surface to bottom. A YSI Model 46-TUC Tele-thermometer was used in 1984-85, and a Cole-Parmer Model 8110-20 thermistor was used in 1985-86. Surface water temperature, reported as zero (0) yards depth, was actually measured beneath the ice to avoid super-cooled water created in the hole by drilling. Bottom depth, in feet, was recorded following the last temperature at each transect point.

A log of recreational and commercial activities in the vicinity of the survey transects is on file at the Prairie Island Environmental Laboratory. The log includes notes on: car, truck, and snowmobile traffic on the lake; number of ice fishing shelters in the general vicinity of the transects; numbers of ice fishermen and commercial fishermen; and any other pertinent information.

#### RESULTS AND DISCUSSION

The Lake Pepin monitoring program is a requirement stipulated by the MDNR, Division of Waters, and included in the permit for "Work in the beds of public waters". Survey data for 1984-85 and 1985-86 (Tables 2 and 3, respectively) are presented for comparison to previous years data. The cooling towers off-line schedule was as follows:

1984-85

1985-86

Off: 2 towers - Oct. 31  
3 towers - Nov. 14  
4 towers - Nov. 16  
On: 4 towers - Mar. 31

Off: 2 towers - Oct.  
3 towers - Nov. 3  
4 towers - Nov. 6  
On: 4 towers - Mar. 31

Monitoring has been conducted to determine effects on ice conditions and recreational activity downstream of the plant, as related to discontinued use of cooling towers during winter months.

Prior to monitoring, observations of ice conditions and recreational activity were made from shore December 8, 13, and 27, 1984, and December 4 and 26, 1985. Monitoring was conducted every two weeks January 7, 1985 through February 22, 1985, and January 7 through March 12, 1986. No attempt was made to monitor on March 8, 1985, due to open water areas and unsafe ice, which limited the survey to observations from shore. No recreational activity was noted on the lake at that time. No observations or physical data collections were made during March 1985 due to spring break-up. The first barge of the commercial shipping season passed through Lake Pepin March 8, 1985, and March 22, 1986.

Observations from shore at Greene Point, Wacouta, (Appendix) indicate highly variable ice conditions near the head of the lake. This area is directly affected by Mississippi River main channel current, and may freeze, open, and refreeze several times during a winter. Physical data were not collected there due to continual hazardous ice conditions.

Variations in ice thickness and water temperature occur throughout the transects and from year to year, but appear to be within a normal range when natural influencing factors are considered. Near bottom water temperatures, at Points D and E of Transects 4

and 5, usually exceed those of other points and transects. This has been seen from year to year and may reflect an influence of springs or streams in the area. Other areas that draw attention are Points A of Transects 1 and 2, commonly referred to as Point-No-Point and Long Point, and a third point halfway between at Methodist Camp. Submerged bars extend into the lake at Long Point and Methodist Camp. All three areas are along the Minnesota shore and are directly affected by main channel current. Water temperatures at Point A, Transects 1 and 2, do not exceed those recorded throughout the lake, but appear to be more uniform from top to bottom, and exhibit an earlier spring warming trend. Measureable ice cover at Point A, Transects 1 and 2, has been generally less than at other transect points throughout the lake. The submerged bars at Long Point and Methodist Camp apparently cause a lifting and mixing effect as current passes, thus affecting ice formation. These effects of current have been seen prior to winter "no tower" operation and have been responsible for unpredictable ice conditions in the past. Naturally occurring pressure ridges generally form across the lake at major points, adversely affecting ice conditions in the vicinity.

#### SUMMARY

Changes in the intake and discharge of the PINGP cooling water system were completed in 1983, and allowed for plant operation without cooling towers during winter months. The Lake Pepin water temperature and ice thickness monitoring has been conducted for one year prior to, one year of transition, and three years following cooling system modifications to determine effects of increased warm water discharge on ice conditions and recreational activity downstream of the plant. Variations in ice thickness and water temperature appear to be naturally induced, primarily by current in the upstream portion of Lake Pepin. No plant-related effects have been detected.

Table 1. Transects Surveyed for Ice Thickness and Water Temperature on Lake Pepin.

	<u>Approximate River Mile</u>	<u>Minnesota</u>	to	<u>Wisconsin</u>
Transect 1	780.0	Point-No-Point		*Maiden Rock (City of) (Boat Ramp)
Transect 2	777.5	*Long Point		Recreational Site (Wayside Rest Area)
Transect 3	774.3	*Central Point		*Stockholm (City of)
Transect 4	770.0	Riley Coulee		*Deer Island (Recreational site/ Boat ramp)
Transect 5	767.0	Maple Springs (King Coulee)		*Pepin (City of)
Greene Point	783.3	Observations from shore, only		

\*Points of Access Used During Survey

TABLE 2. Lake Pepin Ice Thickness And Water Temperature Survey Data. Monitoring Date 1-7-85; Water Temp.(Centigrade); Bottom Depth (feet); Ice And Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	1.8	.6	1.2	1.0	.6	.3	.2	.6	.2	.1	.3	.4	.4	.4	.4
1	2.0	.6	1.2	1.0	.7	.4	.2	.7	.2	.2	.3	.4	.4	.4	.4
2	2.0	.6	1.2	1.0	1.0	.4	.2	.7	.2	.2	.4	.4	.4	.4	.4
3	2.1	.4	1.2	1.0	1.9	.4	.2	.7	.2	.2	.4	.4	.4	.4	.4
4	2.3	.4	1.8	1.5	2.0	.8	.4	.7	.7	.7	.4	.4	.4	.4	1.4
5	2.4	1.2	1.8	1.6	2.2	.8	.8	1.2	.7	.8	.4	.6	.7	.7	1.5
6	2.4	1.2	1.8	1.6	13'	.8	.8	1.3	.7	.8	.4	.6	.7	.8	1.5
7	2.4	1.2	1.9	17'		.8	.8	1.4	.7	.8	.4	.6	.8	.8	1.5
8	2.3	21'	19'			.8	.8	1.4	.7	.8	.4	.7	.8	.8	1.6
9	23'					.8	.8	1.4	24'	22'	.4	.7	.8	.8	23'
10						27'	27'	26'			.4	.7	27'	26'	
11											.4	30'			
12											33'				
13															
ICE	9"	12"	13"	14"	15"	8"	8"	10"	10"	10"	7"	11"	11"	11"	11"
SNOW	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"

DEPTH (yds)	TRANSECT. 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.2	.7	.6	.2	.4	.1	.1	.0	.0	.1	.6	.5	.7	.6	.5
1	.4	.7	.6	.2	.4	.2	.2	.1	.0	.1	.6	.5	.7	.6	.5
2	.4	.7	.6	.2	.4	.3	.3	.1	.1	.1	.6	3'	.7	.6	3'
3	.5	1.0	.6	.2	.4	.3	.4	.1	.1	.4	4'		.7	.5	
4	.6	1.1	.9	.2	.7	.3	.4	.4	.4	1.0			.7	8'	
5	.6	1.1	1.1	1.0	1.5	.3	.4	.7	1.1	2.1			.7		
6	.6	1.1	1.1	1.2	2.3	.3	.4	.9	1.2	2.3			.6		
7	.6	1.1	1.2	1.4	2.4	.3	.4	1.2	2.2	2.4			17'		
8	.6	1.2	1.4	1.8	21'	.3	.6	1.6	2.2	2.6					
9	.7	1.4	2.2	24'		.4	1.0	1.8	2.3	23'					
10	.8	1.7	26'			.5	1.0	26'	25'						
11	.8	29'				28'	30'								
12	31'														
13															
ICE	12"	13"	12"	12"	13"	14"	13"	12"	12"	12"	12"	9"	9"	10"	5"
SNOW	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	2"	2"	2"	2"	2"

Note: Attempts to calibrate the thermistor in the lab, following the survey, confirmed erroneously high values had been recorded in the field, at all transects.

TABLE 2. Lake Pepin Ice Thickness And Water Temperature Survey Data.  
(Cont.) Monitoring Date 1-21-85; Water Temp.(Centigrade); Bottom Depth  
(feet); Ice And Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0
1	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	.1	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	.1	.0	.0	.0	.0
3	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	.1	.0	.0	.0	.0
4	.0	.0	.0	.0	1.3	.2	.0	.0	.0	.0	.1	.0	.0	.0	.0
5	.0	.0	.1	1.0	1.3	10'	.0	.4	.3	.2	.1	.1	.0	.0	.0
6	.0	.1	.1	1.3	13'		.0	.4	.5	1.6	.1	.2	.2	.1	1.2
7	.0	.1	.2	17'			.2	.4	.6	1.6	.1	.2	.3	.5	1.5
8	.0	.1	20'				.2	.4	.8	20'	.1	.2	.3	.7	1.7
9	22'	22'					.2	24'	24'		.1	.2	.4	.7	24'
10							27'				.1	.2	.4	26'	
11											.2	.2	28'		
12											32'	31'			
13															
ICE	13"	17"	18"	19"	20"	8"	13"	14"	13"	16"	14"	12"	13"	18"	16"
SNOW	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	3'	.0	.0	.0	3'
3	.3	.0	.0	.0	.0	.4	.0	.0	.0	.0		.0	.0	4'	
4	.4	.4	.0	.0	.5	.4	.4	.5	.0	.6		.0	.0		
5	.4	.5	.4	.5	.8	.4	.5	.6	.6	1.3		10'			
6	.4	.6	.6	.7	1.7	.4	.6	.6	.8	2.2					
7	.4	.6	.8	.9	2.3	.4	.6	.8	1.5	2.7					
8	.5	.6	1.2	1.4	2.4	.5	.6	1.2	2.5	20'					
9	.6	.7	1.9	1.8	23'	.5	.7	2.0	2.7						
10	.6	2.4	26'	25'		.6	1.6	26'	25'						
11	.7	29'				30'	29'								
12	.7														
13	31'														
ICE	15"	16"	15"	18"	17"	16"	16"	16"	15"	13"	13"	10"	9"	8"	12"
SNOW	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"

TABLE 2. Lake Pepin Ice Thickness And Water Temperature Survey Data.  
(Cont.) Monitoring Date 2-6-85; Water Temp.(Centigrade); Bottom Depth  
(feet); Ice And Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	-	-	.0	.0	.0	-	-	-	-	-	.0	.0	.0	.0	.0
1	-	-	.0	.0	.0	-	-	-	-	-	.0	.0	.0	.0	.0
2	-	-	.0	.0	.0	-	-	-	-	-	.0	.0	.0	.0	.0
3	-	-	.0	.0	.0	-	-	-	-	-	.0	.0	.0	.0	.0
4	-	-	.0	.0	.0	-	-	-	-	-	.0	.0	.0	.0	.0
5	-	-	.1	1.1	.9	10'	-	-	-	-	.0	.1	.0	.0	.0
6	-	-	.4	1.5	14'	-	-	-	-	-	.0	.1	.2	.0	.0
7	-	-	.4	17'	-	-	-	-	-	-	.0	.2	.3	.9	1.6
8	-	-	19'	-	-	-	-	-	-	20'	.0	.2	.4	1.0	2.0
9	25'	22'	-	-	-	-	24'	23'	-	-	.1	.2	.4	1.0	24'
10	-	-	-	-	-	-	27'	-	-	-	.1	.2	.4	25'	-
11	-	-	-	-	-	-	-	-	-	-	30'	30'	28'	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ICE	23"	23"	21"	23"	25"	15"	20"	17"	21"	22"	23"	18"	21"	25"	25"
SNOW	2"	2"	2"	2"	2"	2"	2"	2"	3"	4"	2"	2"	2"	2"	2"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2	.5	.5	.0	.0
1	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	.3	.5	.6	.0	.0
2	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	3'	3'	.6	.0	3'
3	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	-	-	.6	.0	-
4	.1	.1	.0	.0	.0	.2	.0	.0	.0	.0	-	-	.6	.0	-
5	.2	.1	.0	.0	.0	.2	.0	.0	.2	.4	-	-	.6	9'	-
6	.2	.1	.0	.2	.5	.2	.1	.1	.4	.8	-	-	.6	-	-
7	.2	.2	.0	.2	1.4	.2	.4	.7	1.1	18'	-	-	.6	-	-
8	.2	.2	.4	.4	2.9	.2	.8	2.4	2.7	-	-	-	17'	-	-
9	.2	.4	1.6	1.4	24'	.7	1.9	2.8	24'	-	-	-	-	-	-
10	.4	1.4	27'	26'	-	1.1	2.0	25'	-	-	-	-	-	-	-
11	.6	29'	-	-	-	29'	28'	-	-	-	-	-	-	-	-
12	30'	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ICE	22"	21"	19"	20"	21"	20"	18"	20"	20"	17"	16"	12"	12"	16"	14"
SNOW	2"	2"	2"	2"	2"	4"	4"	4"	3"	3"	3"	3"	3"	3"	3"

Note: (-) indicates no temperature was recorded due to malfunction of thermistor.

TABLE 2. Lake Pepin Ice Thickness And Water Temperature Survey Data.  
(Cont.) Monitoring Date 2/22/85; Water Temp.(Centigrade); Bottom Depth  
(feet); Ice And Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.8	.6	.4	.4	.3	.3	.4	.3	.3	.3	.4	.4	.3	.3	.3
1	.8	.6	.4	.4	.4	.6	.4	.4	.3	.3	.6	.4	.4	.3	.3
2	.8	.6	.4	.5	.4	.6	.4	.3	.3	.3	.6	.5	.4	.3	.3
3	1.0	.7	.6	.5	.4	.6	.4	.3	.3	.3	.6	.5	.4	.3	.3
4	1.2	1.0	.9	.5	.8	.6	.4	.3	.3	.3	.6	.5	.4	.4	.4
5	1.2	1.4	1.0	1.2	1.9	.6	.9	1.1	1.1	.4	.6	.6	.9	.4	.4
6	1.3	1.4	1.0	1.3	15'	.7	.9	1.1	1.1	.4	.6	.8	1.0	.8	.8
7	1.3	1.4	1.0	17'		.8	.9	1.1	1.2	1.8	.6	.8	1.0	1.0	1.7
8	1.3	21'	20'			.8	1.0	1.1	1.3	2.0	.6	.8	1.0	1.2	2.3
9	23'					.8	1.0	24'	23'	20'	.7	.8	1.0	1.2	24'
10						25'	27'				.7	.8	1.0	25'	
11											.8	.8	28'		
12											32'	31'			
13															
ICE	22"	20"	26"	25"	27"	16"	16"	21"	26"	21"	19"	24"	24"	24"	25"
SNOW	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.3	.4	.4	.4	.4	.3	.3	.3	.3	.4	.3	.2	.2	.3	.4
1	.3	.5	.4	.4	.4	.3	.3	.3	.3	.5	.3	.2	.2	.4	.4
2	.6	.6	.4	.4	.4	.3	.3	.3	.3	.5	.4	3'	.2	.4	3'
3	.6	.6	.4	.4	.4	.5	.3	.3	.3	.5	4'		.2	.4	
4	.6	.6	.5	.4	.4	.5	.3	.3	.3	.5			.3	9'	
5	.6	.6	.8	.4	.6	.5	.5	.3	.3	.6			.3		
6	.8	.8	.9	.8	.9	.6	.6	.3	.3	1.0			.3		
7	.8	.8	1.0	1.5	1.7	.6	.7	.3	1.1	1.5			18'		
8	.8	.9	1.1	2.2	2.7	.6	.8	1.5	2.9	1.7					
9	.9	1.6	1.6	2.8	23'	.7	1.4	2.8	24'	22'					
10	1.2	2.0	26'	28'		1.3	2.4	26'							
11	1.9	28'				30'	30'								
12	31'														
13															
ICE	24"	23"	23"	23"	24"	22"	22"	22"	25"	21"	17"	12"	12"	13"	13"
SNOW	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Note: Attempts to calibrate the thermistor in the lab, following the survey, confirmed erroneously high values had been recorded in the field, at all transects.  
(---) indicates no snow depth recorded due to water and slush on ice.

TABLE 3. Lake Pepin Ice Thickness And Water Temperature Survey Data.  
Monitoring Date 1-7-86; Water Temp.(Centigrade); Bottom Depth  
(feet); Ice And Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0
3	.0	.0	.0	.0	.7	.1	.0	.0	.0	.0	.1	.0	.0	.0	.0
4	.0	.0	.0	.4	7'	.2	.0	.0	.0	.0	.2	.0	.0	.0	.0
5	.1	.3	.6	12'		10'	.2	.2	.0	.6	.2	.2	.2	.2	.1
6	.2	.3	.7				.2	.3	.5	.6	.3	.5	.5	.6	.8
7	.2	.3	.7				.2	.3	.6	.8	.3	.5	.5	.6	.8
8	.2	.4	19'				.2	.3	.6	.9	.4	.5	.5	.6	.8
9	.2	22'					.2	.3	.6	22'	.4	.5	.5	.6	.8
10	26'						.2	.3	.6	22'	.4	.5	.5	.6	.8
11							29'	28'			.4	.5	.5	.7	26'
12											.4	.5	.5	29'	
13											33'	33'	31'		
ICE	17"	15"	19"	14"	17"	10"	16"	19"	18"	15"	14"	16"	26"	20"	24"
SNOW	4"	3"	2"	4"	3"	2"	2"	4"	3"	6"	2"	4"	3"	4"	3"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	6'	.0	.0	6'	4'
4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0		.0	.0		
5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.3		.0	10'		
6	.0	.0	.0	.1	.1	.0	.0	.0	.0	1.2		14'			
7	.1	.0	.2	.2	.2	.0	.0	.3	1.1	1.6					
8	.2	.1	.2	.2	.3	.1	.1	1.2	1.4	20'					
9	.2	.2	.3	.8	.5	.2	.4	1.4	1.6						
10	.3	.6	.8	27'	26'	.3	1.3	27'	25'						
11	.3	30'	28'			1.3	30'								
12	32'					1.3									
13						34'									
ICE	18"	17"	20"	17"	18"	16"	21"	19"	16"	14"	21"	21"	20"	19"	18"
SNOW	4"	3"	2"	3"	5"	3"	3"	1"	1"	2"	3"	2"	2"	2"	2"

TABLE 3. Lake Pepin Ice Thickness And Water Temperature Survey Data.  
(Cont.) Monitoring Date 1-22-86; Water Temp.(Centigrade); Bottom Depth  
(feet); Ice And Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.3	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.2	.0	.0	.0	.0	.4	.2	.0	.0	.0	.0	.0	.0	.0	.0
2	.3	.0	.0	.0	.0	.7	.3	.0	.0	.0	.2	.0	.0	.0	.0
3	.3	.4	.6	.0	.6	.7	.4	.0	.0	.0	.5	.0	.0	.0	.0
4	.5	.8	.7	1.7	8'	8'	.4	.5	.5	.0	.6	.8	.8	.0	.0
5	.6	1.0	.9	2.0			.7	.7	.9	1.0	.7	.9	.9	.9	1.1
6	.7	1.0	1.0	15'			.9	.8	1.0	1.0	.7	.9	1.0	.9	1.1
7	.7	1.0	17'				.9	.8	1.0	1.2	.7	.9	1.0	.9	1.2
8	.7	20'					.9	.8	1.0	21'	.7	.9	1.0	1.0	1.3
9	.7						.9	.8	23'		.7	.9	1.0	1.0	1.3
10	25'						.9	26'			.7	.9	1.0	27'	25'
11							28'				.7	.9	29'		
12											32'	31'			
13															
ICE	11"	16"	19"	19"	18"	1"	13"	18"	20"	21"	16"	18"	21"	23"	25"
SNOW	2"	4"	4"	4"	5"	2"	4"	3"	4"	4"	2"	3"	2"	2"	4"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.1	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.2	.0	.0	.0	.1	.3	.0	.0	.0	.0	.0	.0	.0	.0	.0
3	.3	.0	.0	.0	.1	.3	.0	.0	.0	.0	5'	.0	6'	4'	4'
4	.4	.3	.4	.4	.2	.3	.0	.3	.0	.3		.0			
5	.4	.4	.5	.5	.8	.4	.4	.4	.8	1.4		11'			
6	.4	.5	.5	.6	1.0	.5	.5	.5	.9	2.0					
7	.4	.5	.5	.6	1.1	.5	.5	.7	1.0	2.1					
8	.4	.5	.5	.6	1.3	.5	.6	.8	1.2	2.2					
9	.4	.5	1.2	1.4	23'	.5	.6	.9	1.3	23'					
10	.4	.6	27'	26'		.7	.6	1.0	25'						
11	30'	30'				29'	.6	27'							
12							31'								
13															
ICE	21"	20"	19"	17"	21"	20"	20"	19"	16"	21"	23"	17"	21"	20"	19"
SNOW	3"	2"	3"	3"	4"	2"	2"	2"	3"	3"	4"	4"	4"	4"	3"

TABLE 3. Lake Pepin Ice Thickness And Water Temperature Survey Data.  
(Cont.) Monitoring Date 2-5-86; Water Temp.(Centigrade); Bottom Depth  
(feet); Ice And Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.2	.0	.0	.0	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.3	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
3	.3	.0	.0	.0	.0	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
4	.6	.7	.6	.5	1.1	8'	.0	.0	.0	.0	.1	.0	.0	.0	.0
5	.7	.7	.7	.6	1.8		.6	.6	.6	.6	.1	.0	.0	.4	.0
6	.8	.8	.7	.6	15'		.6	.7	.6	.6	.2	.3	.4	.4	.4
7	.8	.8	.8	17'			.6	.7	.6	.9	.2	.4	.4	.4	.6
8	.8	21'	19'				.6	.7	.6	21'	.2	.4	.4	.4	.9
9	24'						.6	.7	24'		.3	.4	.4	.5	24'
10							.6	.7	26'		.3	.4	.4	.5	24'
11							28'				.3	.4	.4	27'	
12											.3	.4	28'		
13											33'	31'			
ICE	13"	19"	16"	22"	18"	14"	13"	18"	20"	22"	8"	22"	20"	24"	26"
SNOW	6"	6"	6"	4"	6"	2"	7"	9"	4"	6"	4"	4"	5"	5"	5"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0
3	.1	.0	.0	.0	.0	.1	.0	.0	.0	.0	5'	.0	.0	5'	4'
4	.2	.0	.0	.0	.0	.3	.3	.0	.0	.0		.0	.0		
5	.2	.0	.0	.0	.0	.3	.3	.3	.3	1.0		.9'	.0		
6	.3	.2	.2	.2	.3	.3	.4	.4	.5	2.2			.0		
7	.3	.3	.3	.3	.8	.4	.4	.6	.9	2.3			13'		
8	.3	.3	.3	.4	2.0	.4	.4	.8	1.6	21'					
9	.3	.4	1.3	.8	24'	.4	.4	1.2	1.8						
10	.4	.7	27'	25'		.4	.7	26'	25'						
11	.4	29'				.9	30'								
12	31'					31'									
13															
ICE	23"	21"	24"	22"	24"	18"	23"	21"	19"	20"	24"	20"	19"	18"	16"
SNOW	5"	6"	4"	5"	5"	6"	5"	4"	8"	5"	6"	4"	4"	4"	4"

TABLE 3. Lake Pepin Ice Thickness And Water Temperature Survey Data.  
(Cont.) Monitoring Date 2-19-86; Water Temp.(Centigrade); Bottom Depth  
(feet); Ice And Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.2	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
3	.2	.0	.0	.0	.0	.3	.0	.0	.0	.0	.0	.0	.0	.0	.0
4	.6	.7	.5	.6	.5	8'	.0	.0	.0	.0	.1	.0	.0	.0	.0
5	.7	.8	.6	.7	10'		.3	.3	.4	.5	.1	.0	.0	.3	.0
6	.7	.8	.6	.7			.6	.6	.6	.8	.1	.2	.3	.4	.1
7	.7	.8	.7	16'			.6	.6	.6	1.0	.1	.3	.3	.4	.6
8	.7	20'	19'				.6	.6	.6	20'	.1	.3	.3	.4	.7
9	.7						.6	.6	.6	23'	.2	.3	.3	.4	24'
10	25'						27'	25'			.3	.3	.3	25'	
11											.4	.3	28'		
12											31'	31'			
13															
ICE	18"	15"	25"	22"	21"	11"	18"	19"	19"	24"	18"	20"	23"	26"	26"
SNOW	6"	7"	6"	9"	9"	5"	6"	6"	6"	6"	6"	6"	7"	7"	8"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.1	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	3'	3'
3	.3	.0	.0	.0	.0	.3	.0	.0	.0	.0	4'	.0	5'		
4	.3	.0	.0	.0	.0	.4	.3	.0	.0	.0		.0			
5	.3	.2	.3	.3	.0	.4	.4	.4	.6	1.2		.0			
6	.4	.2	.5	.4	.7	.4	.5	.5	.7	2.8		.0			
7	.4	.3	.6	.4	.9	.4	.5	.5	1.0	2.9	18'				
8	.4	.3	.6	.7	2.2	.4	.5	.6	2.2	20'					
9	.4	.5	1.5	1.5	24'	.4	.6	1.0	24'						
10	.4	.9	26'	25'		.7	.7	26'							
11	30'	28'				30'	30'								
12															
13															
ICE	24"	23"	27"	25"	23"	23"	23"	21"	24"	22"	22"	22"	18"	18"	22"
SNOW	7"	7"	6"	7"	8"	7"	6"	9"	7"	8"	10"	7"	8"	8"	8"

TABLE 3. Lake Pepin Ice Thickness And Water Temperature Survey Data.  
(Cont.) Monitoring Date 3-12-86; Water Temp.(Centigrade); Bottom Depth  
(feet); Ice And Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	-	.1	.0	.0	.0	.1	.0	.0	.0	.0
1	.0	.0	.0	.0	.0	-	.1	.0	.0	.0	.1	.1	.0	.0	.0
2	.0	.0	.0	.0	.2	-	.1	.1	.0	.0	.1	.1	.0	.0	.0
3	.3	.5	.1	.0	.5	-	.1	.1	.0	.0	.1	.1	.0	.0	.0
4	.5	.6	.8	1.6	7'	-	.3	.3	.8	.0	.2	.1	.0	.0	.0
5	1.0	.7	.9	2.0		-	.6	.8	.8	1.5	.4	.5	.6	1.0	.9
6	1.0	.8	.9	14'		-	.6	.8	.8	1.6	.5	.5	.6	1.1	1.5
7	1.0	.8	17'			-	.6	.8	.8	1.6	.5	.5	.6	1.1	1.6
8	1.0	20'				-	.6	.8	.8	20'	.5	.5	.7	1.1	2.0
9	22'					-	.6	24'	22'	20'	.5	.5	.7	1.1	24'
10						-	27'				.5	.5	.7	26'	
11											.5	30'	29'		
12											32'				
13															
ICE	16"	23"	27"	27"	25"	-	4"	20"	26"	25"	13"	22"	23"	29"	26"
SNOW	1"	1"	4"	3"	4"	-	1"	3"	4"	3"	0"	1"	2"	1"	2"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0
1	.0	.0	.0	.0	.0	.3	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.6	.0	.0	.0	.0	.4	.0	.0	.0	.0	.0	.0	.0	.0	.0
3	.8	.2	.0	.0	.0	.5	.0	.0	.0	.0	5'	.0	.0	5'	5'
4	.8	.8	1.0	.7	.0	.6	.6	.4	.8	.4		.0	.0		
5	.9	1.0	1.0	1.0	1.6	.7	1.0	.9	1.2	1.3		.0	.0		
6	.9	1.0	1.1	1.2	1.7	.9	1.2	1.2	1.2	2.4		.0	.0		
7	1.0	1.1	1.1	1.2	1.7	1.0	1.2	1.4	1.3	2.9		.0	.0		
8	1.0	1.2	1.2	1.3	1.7	1.0	1.2	1.4	1.4	25'		.0	.0		
9	1.0	1.2	1.3	1.3	24'	1.0	1.2	1.4	24'			.0	.0		
10	1.0	1.3	26'	25'		1.2	1.2	26'				.0	.0		
11	1.0	29'				1.3	29'					.0	.0		
12	31'					31'						.0	.0		
13												.0	.0		
ICE	28"	25"	29"	24"	28"	23"	29"	22"	26"	22"	26"	22"	14"	13"	19"
SNOW	3"	4"	3"	4"	3"	3"	3"	3"	4"	4"	2"	3"	2"	3"	3"

Figure 1.

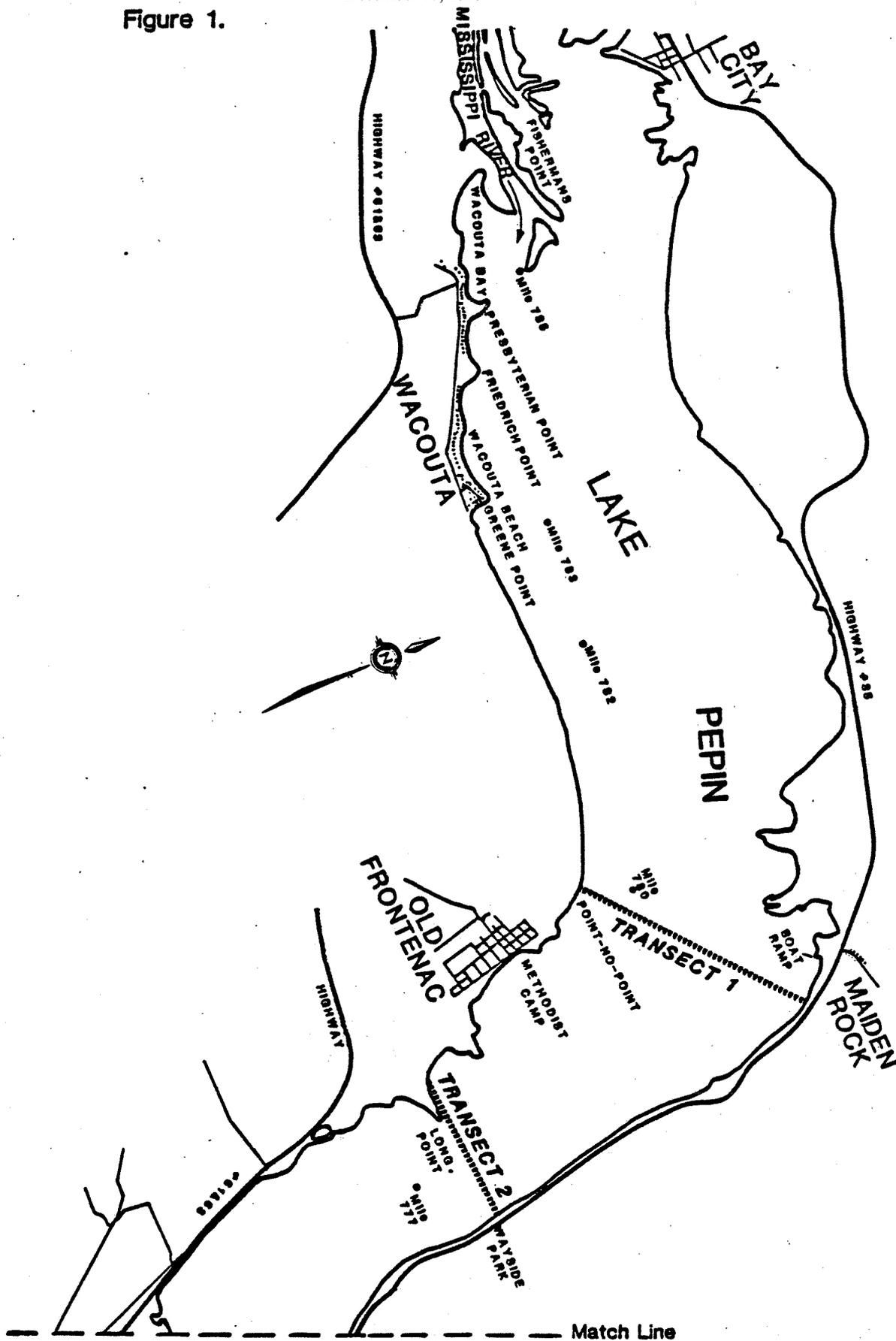
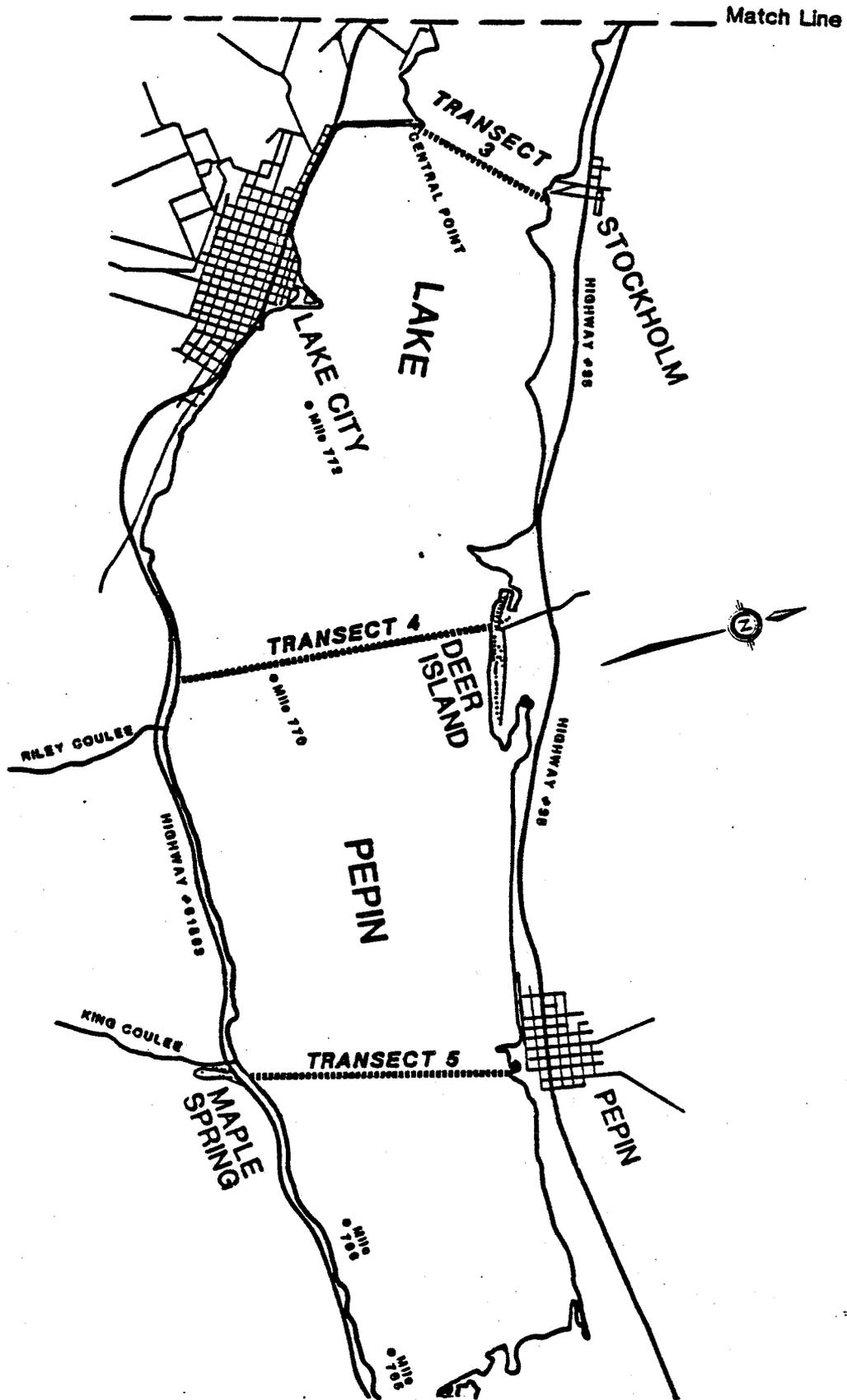


Figure 1 (Continued).



Appendix

Notes on observations of ice cover near the head of Lake Pepin, as observed from Greene Point, Wacouta, during winters of 1984/85 and 1985/86:

12-27-84 - Unsafe ice and patches of open water;

1-7-85 - Unsafe ice conditions, refrozen ice with scattered patches of open water;

1-21,22-85 - Ice cover from Greene Pt. to head of lake; unsafe and extremely rough ice conditions exist;

2-6,8-85 - No observations made;

2-20-85 - Open water in area affected by main channel current from head of lake downstream to approximately 1/4 mile below Greene Pt.;

3-8-85 - Open water from approximately 1/2 mile downstream of Greene Pt. to head of the lake; approximately 1/3 width of lake from Minnesota shore out is open water;

12-26-85 - Greene Pt. Open water, slushy ice, bad ice;

1-7-86 - No observation made;

1-22-86 - Open water, refrozen areas, and generally poor ice conditions appear to exist approximately 1/3 of the way across the lake and downstream of Greene Pt., possibly a half mile or more; there has been unseasonably mild weather during January;

Appendix (Cont.)

- 2-5-86 - Open water near the head of the lake extends downstream to approximately 1/2 mile beyond Greene Pt.; majority of the open area at the upper end was nearest the Minnesota shore, extending approximately 1/2 way across the lake; the open area narrows near Greene Pt. and is restricted to the current effected area along the Minnesota side.
- 2-19-86 - Open water from head of lake to approximately 1/2 mile below Greene Pt.; open area restricted primarily to area near Minnesota shore where river main channel current has most effect.
- 3-12-86 - Area of open water extends from the head of the lake to approximately one and a half miles downstream of Greene Pt.; the open area narrows downstream of the point and is confined near the Minnesota shore.

### Ice Thickness - Upper Mississippi River - Lake Pepin Year 2000

River	2-Mar			28-Feb	22-Feb	14-Feb				
Mile	Blue	White	Total	Total	Total	Total	Total	Total	Total	Total
765	0	0	open	open	5	5				
766	0	0	*1	10.5	12	12	* = Honeycomb Ice			
767	0	0	*7	11	14	15				
768	0	0	*8	10	15	15				
769	0	0	*8.5	11.5	17	18				
770	0	0	*6.5	10	14	14				
771	0	0	*6	9.5	13	13				
772	0	0	*3	8	12	11				
773	0	0	open	9	12	12				
774	0	0	open	5	13	12				
775	0	0	open	*9	12	12.5				
776	0	0	open	6	12	12				
777	0	0	open	open	10	9.5				
778	0	0	open	*6	12	13				
779	0	0	open	*5.5	14.5	14				
780	0	0	open	open	11	13				
781	0	0	open	open	8	9				
782	0	0	open	open	open	1				
783	0	0	open	open	open	open				
784	0	0	open	open	open	open				
785	0	0	open	open	open	open				
786	0	0	open	open	open	open				

Data is listed in inches. Measurements are taken weekly beginning in mid-February. Frequency may be increased if appropriate. Measurement locations are duplicated using GPS. Weather conditions can sometimes result in unexpected readings. Blue ice, sometimes called black ice is clear and solid. White ice or snow ice has air bubbles. Together they equal the total ice thickness.

### Ice Thickness - Upper Mississippi River - Lake Pepin Year 2001

River Mile	10-Apr		6-Apr	2-Apr	26-Mar	23-Mar	19-Mar	14-Mar	5-Mar	26-Feb	20-Feb	12-Feb
	Blue	White	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
765	open	open	open	open	open	14	16	18	19	17	16	14
766	open	open	open	14	18	22	21	24	24	24	20	18
767	0	4.5	4.5	16	21	22	23	22	24	21	20	19
768	0	9	9	18	23	25	24	24	26	25	22	20
769	0	11	11	18	22	25	25	24	24	23	20	19
770	0	11	11	20	24	26	25	24	25	23	21	19
771	0	10	10	21	23	25	25	26	25	23	22	22
772	open	open	open	18	22	24	24	24	25	24	22	21
773				14	19	22	23	23	23	24	21	20
774				open	14	16	17	21	20	20	20	17
775				9	18	20	22	24	25	22	22	18
776				open	14	18	21	22	24	21	20	18
777					open	open	14	18	20	18	16	16
778						9	18	20	20	21	19	16
779							18	20	21	22	16	15
780								10	13	16	12	13
781									2	11	12	11
782										7	7	6
783												
784												
785												
786												

Data is listed in inches. Measurements are taken weekly beginning in mid-February. Frequency may be increased if appropriate. Measurement locations are duplicated using GPS. Weather conditions can sometimes result in unexpected readings. Blue ice, sometimes called black ice is clear and solid. White ice or snow ice has air bubbles. Together they equal the total ice thickness.

**Ice Thickness - Upper Mississippi River - Lake Pepin Year 2002**

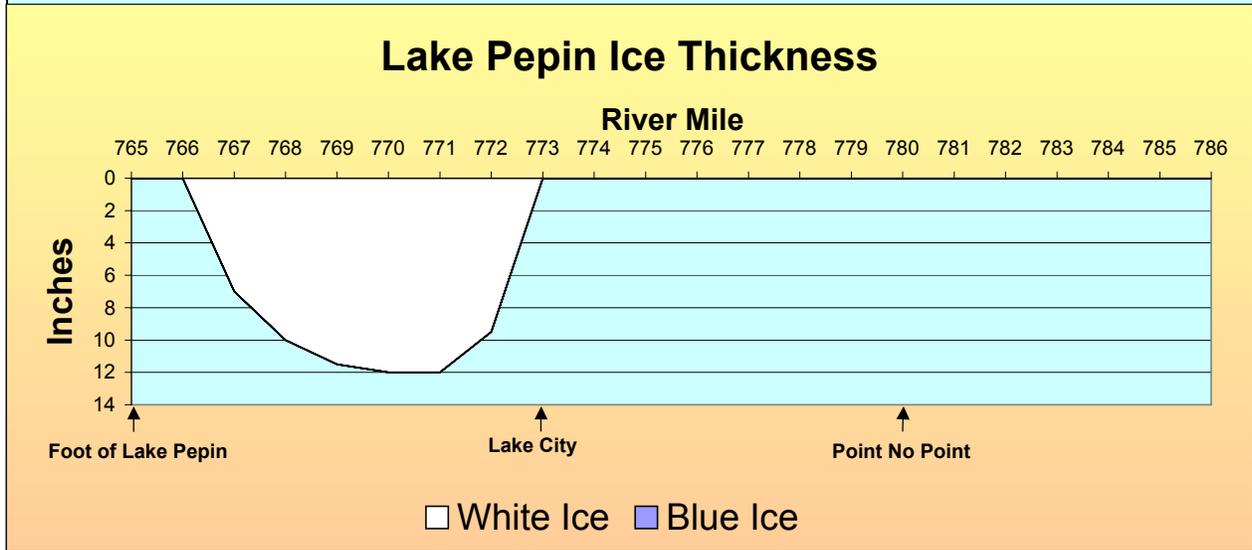
River Mile	12-Mar		4-Mar	20-Feb								
	Blue	White	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
765	open	open	open	open	open							
766	open	open	open	open	open							
767	5	5	10	8	9							
768	5	6	11	10	9							
769	4	9	13	11	9							
770	4	9	13	12	10							
771	5	8	13	11	10							
772	7	5	12	7	9							
773	0	5	5	3	8							
774	0	4	4	3	open							
775	5	5	10	8	8							
776	1	5	6	3	5							
777	8	0	8	7	open							
778	5	6	11	9	7							
779	0	7	7	6	7							
780	1	3	4	5	open							
781	0	4	4	5	open							
782	open	open	open	open	open							
783	open	open	open	open	open							
784	open	open	open	open	open							
785	open	open	open	open	open							
786	open	open	open	open	open							

Data is listed in inches. Measurements are taken weekly beginning in mid-February. Frequency may be increased if appropriate. Measurement locations are duplicated using GPS. Weather conditions can sometimes result in unexpected readings. Blue ice, sometimes called black ice is clear and solid. White ice or snow ice has air bubbles. Together they equal the total ice thickness.

The Corps will coordinate these results with the towing industry to determine the need for additional measurements. However, these will likely be the last ice thickness measurements in 2003.

Ice Thickness - UMR Lake Pepin												
Year 2003												
River Mile	27-Mar			24-Mar Total	17-Mar Total	10-Mar Total	3-Mar Total	18-Feb Total	10-Feb Total	Total	Total	Total
	Blue Ice	White Ice	Total									
765		open	open	open	open	8.5	8	9				
766		open	open	open	9	13	12	12.5				
767		7	7	8	18	24	22	25				
768		10	10	13	20	25	24	25				
769		11.5	11.5	14	21	24	24	25				
770		12	12	13	20	25	24	25				
771		12	12	14	22	26	25	24				
772		9.5	9.5	13	22	25.5	23	25				
773		open	open	12.5	20	24	23	22				
774		open	open	open	15	17	16	21				
775		open	open	9	21	24	22	23	21			
776		open	open	4	18	21	21	22	15			
777		open	open	open	14	18	18	17	15			
778		open	open	2	18	22	22	21	19			
779		open	open	2	21	24.5	24	24	21			
780		open	open	open	14	19	18	20				
781		open	open	open	4	13	13	17				
782		open	open	open	open	4	0	9				
783		open	open	open	open							
784												
785												
786												

Data is listed in inches. Measurements are taken weekly, or as needed beginning in mid-February. Frequency may be increased if appropriate. Measurement locations are duplicated using GPS. Weather conditions can sometimes result in unexpected readings. Blue ice, sometimes called black ice is clear and solid. White ice or snow ice has air bubbles. Together they equal the total ice thickness.



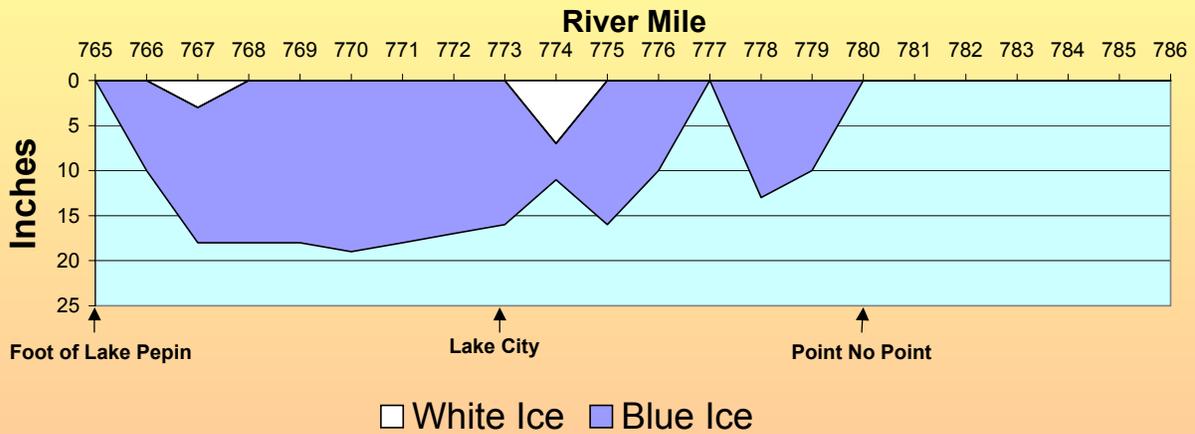
**A tow went through Lake Pepin on 19 March. No further measurements will be taken in 2004.**

**Ice Thickness - UMR Lake Pepin  
Year 2004**

River Mile	16-Mar			12-Mar Total	8-Mar Total	5-Mar Total	1-Mar Total	25-Feb Total	18-Feb Total	Total	Total	Total	Total
	Blue Ice	White Ice	Total										
765	open	open	open	open	open	open	2	6	7				
766	10	0	10	12	13	13	14	16	16				
767	15	3	18	18	19	19	20	20	21				
768	18	0	18	18	18	19	20	20	20				
769	18	0	18	18	19	19	19	19	21				
770	19	0	19	19	19	19	20	21	21				
771	18	0	18	19	19	19	20	20	21				
772	17	0	17	18	18	18	18	19	19				
773	16	0	16	17	17	18	19	19	20				
774	4	7	11	13	14	14	18	18	18				
775	16	0	16	18	18	18	19	20	20				
776	10	0	10	13	16	16	17	18	19				
777	open	open	open	open	12	13	13	13	16				
778	13	0	13	15	16	16	17	18	18				
779	10	0	10	14	16	18	18	18	20				
780	open	open	open	open	open	10	18	18	19				
781	open	open	open	open	open	open	10	12	16				
782	open	open	open	open	open	open	open	open	10				
783													
784													
785													
786													

Data is listed in inches. Measurements are taken weekly, or as needed beginning in mid-February. Frequency may be increased if appropriate. Measurement locations are duplicated using GPS. Weather conditions can sometimes result in unexpected readings. Blue ice, sometimes called black ice is clear and solid. White ice or snow ice has air bubbles. Together they equal the total ice thickness.

**Lake Pepin Ice Thickness**

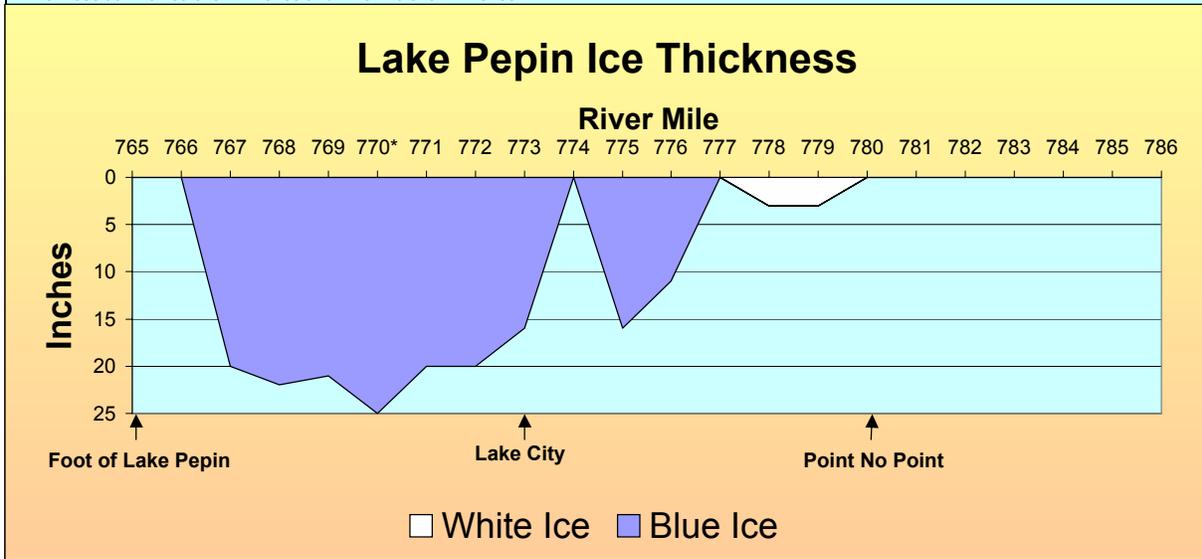


**A tow broke through the ice in Lake Pepin on 28 March 2005 and traffic is moving through.  
No more measurements are scheduled.**

Ice Thickness - UMR Lake Pepin												
Year 2005												
River Mile	25-Mar			22-Mar Total	16-Mar Total	11-Mar Total	2-Mar Total	23-Feb Total	16-Feb Total	10-Feb Total		
	Blue Ice	White Ice	Total									
765	open	0	open	open	open	open	open	1	6	9		
766	open	0	open	9	10	11	11	12	14	14		
767	20	0	20	19	20	19	20	19	18	18		
768	22	0	22	21	21	21	20	20	19	19		
769	21	0	21	21	21	21	21	19	19	18		
770*	25	0	25	25	25	26	25	25	25	23		
771	20	0	20	21	21	20	21	19	19	17		
772	20	0	20	19	19	19	20	19	19	18		
773	16	0	16	15	17	17	18	18	19	18		
774	open	0	open	5	5	7	10	10	12	14		
775	16	0	16	15	16	17	16	16	16	17		
776	11	0	11	13	13	12	15	15	11	17		
777	open	0	open	open	open	open	9	9	14	13		
778	0	3	3	5	8	9	12	13	16	15		
779	0	3	3	10	10	14	14	15	12	16		
780	open	open	open	open	open	open	7	6	9	13		
781							1	open	open	6		
782							open			open		
783												
784												
785												
786												

Data is listed in inches. Measurements are taken weekly, or as needed beginning in mid-February. Frequency may be increased if appropriate. Measurement locations are duplicated using GPS. Weather conditions can sometimes result in unexpected readings.

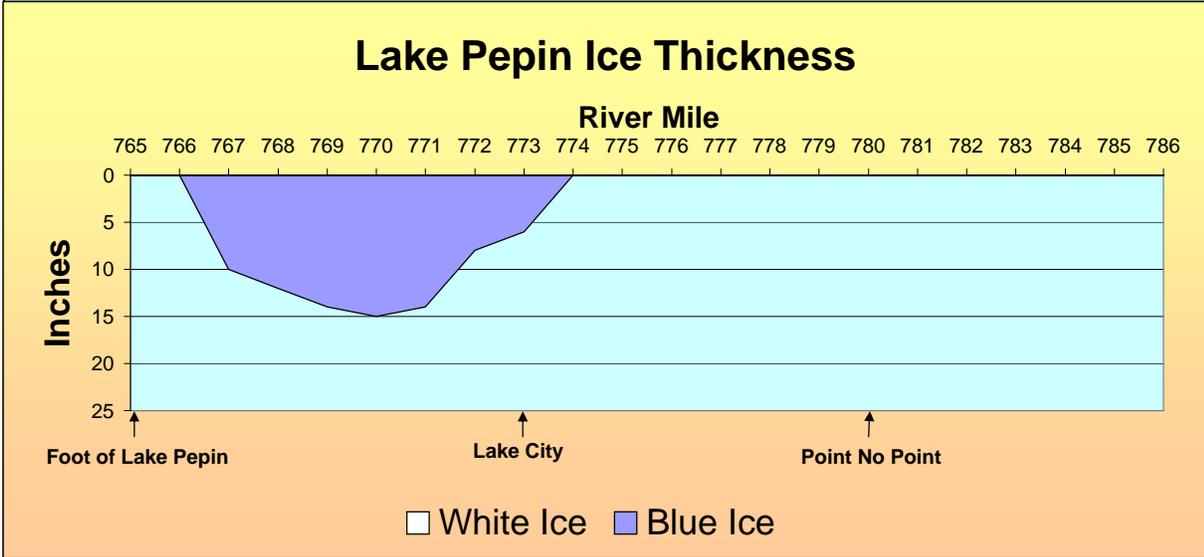
\* Thickness at Mile 769.5 is 22 inches and Mile 770.5 is 21 inches.



**A tow broke through the ice in Lake Pepin on 21 March 2006.  
No more measurements are scheduled.**

Ice Thickness - UMR Lake Pepin											
Year 2006											
River Mile	15-Mar			8-Mar Total	1-Mar Total	22-Feb Total	14-Feb Total	Total	Total	Total	Total
	Blue Ice	White Ice	Total								
765				open	3	open	open				
766	open	open	open	7	7	6	3				
767	10	0	10	11	13	10	7.5				
768	12	0	12	13	15	15	9.5				
769	14	0	14	13	17	14	11				
770	15	0	15	16	17	16	12				
771	14	0	14	15	16	15	13				
772	8	0	8	11	11	10	7				
773	6	0	6	10	11	10	3				
774	open	open	open	3	4	7	3				
775				7	8	8	3				
776				3	8	8	3				
777				3	4	8	3				
778				3	7	9	3				
779				2	8	8	3				
780				2	5	8	open				
781				2	4	8					
782				open	3	5.5					
783					open	open					
784											
785											
786											

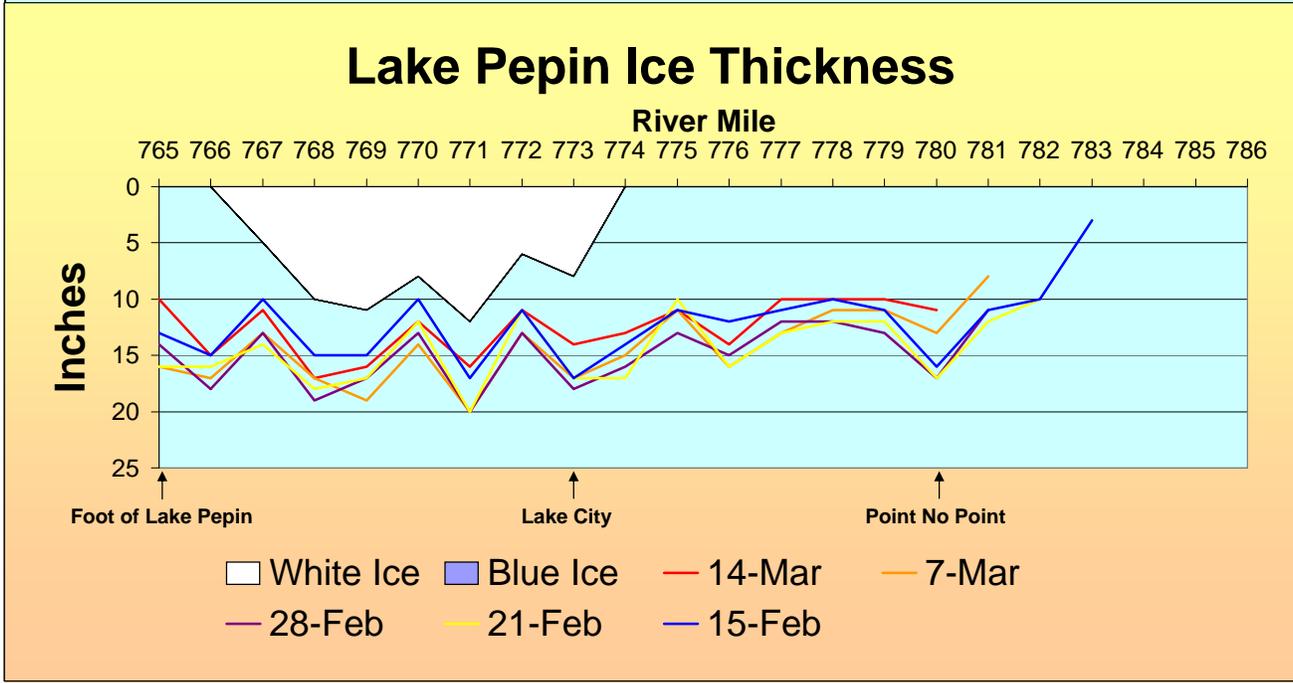
Data is listed in inches. Measurements are taken weekly, or as needed beginning in mid-February. Frequency may be increased if appropriate. Measurement locations are duplicated using GPS. Weather conditions can sometimes result in unexpected readings. Blue ice, sometimes called black ice is clear and solid. White ice or snow ice has air bubbles. Together they equal the total ice thickness.



**Warm weather since the last measurements has taken care of the ice in Lake Pepin and no ice remains to measure. The first tow went through Lake Pepin on 29 March 2007.**

Ice Thickness - UMR Lake Pepin												
Year 2007												
River Mile	21-Mar			14-Mar Total	7-Mar Total	28-Feb Total	21-Feb Total	15-Feb Total	Total	Total	Total	Total
	Blue Ice	White Ice	Total									
765	Open	Open	Open	10	16	14	16	13				
766	Open	Open	Open	15	17	18	16	15				
767	0	5	5	11	13	13	14	10				
768	0	10	10	17	17	19	18	15				
769	0	11	11	16	19	17	17	15				
770	0	8	8	12	14	13	12	10				
771	0	12	12	16	20	20	20	17				
772	0	6	6	11	13	13	11	11				
773	0	8	8	14	17	18	17	17				
774	Open	Open	Open	13	15	16	17	14				
775	Open	Open	Open	11	11	13	10	11				
776	Open	Open	Open	14	16	15	16	12				
777	Open	Open	Open	10	13	12	13	11				
778	Open	Open	Open	10	11	12	12	10				
779	Open	Open	Open	10	11	13	12	11				
780	Open	Open	Open	11	13	17	17	16				
781	Open	Open	Open	Open	8	11	12	11				
782	Open	Open	Open	Open	Open	Open	10	10				
783	Open	Open	Open	Open	Open	Open	Open	3				
784	Open	Open	Open	Open	Open	Open	Open	Open				
785	Open	Open	Open	Open	Open	Open	Open	Open				
786	Open	Open	Open	Open	Open	Open	Open	Open				

Data is listed in inches. Measurements are taken weekly, or as needed beginning in mid-February. Frequency may be increased if appropriate. Measurement locations are duplicated using GPS. Weather conditions can sometimes result in unexpected readings. Blue ice, sometimes called black ice is clear and solid. White ice or snow ice has air bubbles. Together they equal the total ice thickness.



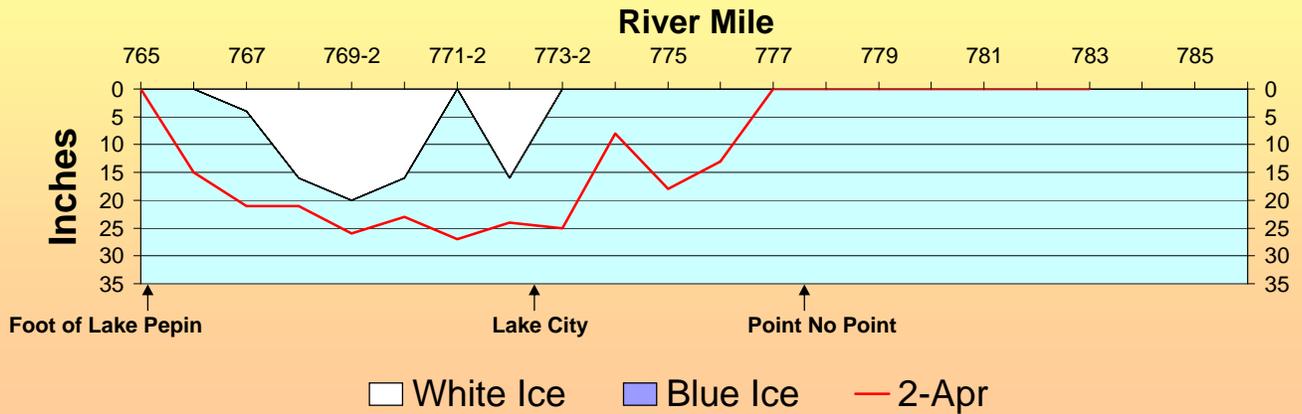
**This will be the last ice report for 2008**

Ice Thickness - UMR Lake Pepin Year 2008													
River Mile	9-Apr			2-Apr Total	26-Mar Total	19-Mar Total	12-Mar Total	5-Mar Total	22-Feb Total	Total	Total	Total	Total
	Blue Ice	White Ice	Total										
765	open	open	open	open	2	15	18	16	17				
766	open	open	open	15	18	23	25	24	23				
767	0	4	4	21	23	25	26	25	24				
768	0	16	16	21	23	25	27	25	23				
769	0	18	18	22	26	28	29	28	26				
769-2	0	20	20	26	27	28	30	29	26				
770	0	16	16	23	25	27	28	27	25				
771	0	16	16	23	26	26	27	26	24				
771-2	open	open	open	27	27	29	32	30	29				
772	0	16	16	24	24	27	28	28	24				
773	open	open	open	21	23	26	28	27	25				
773-2	open	open	open	25	26	28	30	29	27				
774	open	open	open	8	16	21	23	24	19				
775	open	open	open	18	22	25	28	28	25				
776	open	open	open	13	21	22	24	24	20				
777	open	open	open	open	14	21	24	23	15				
778	open	open	open	open	18	22	24	23	19				
779	open	open	open	open	19	25	25	25	24				
780	open	open	open	open	open	18	21	20	17				
781	open	open	open	open	open	12	16	18	15				
782	open	open	open	open	open	open	9	11	11				
783	open	open	open	open	open	open	open	open	9				
784													
785													
786													

Data is listed in inches. Measurements are taken weekly, or as needed beginning in mid-February. Frequency may be increased if appropriate. Measurement locations are duplicated using GPS. Weather conditions can sometimes result in unexpected readings. Blue ice, sometimes called black ice is clear and solid. White ice or snow ice has air bubbles. Together they equal the total ice thickness.

\*\* Three additional readings (769-2, 771-2, 773-2) were taken in a straight line, closer to the WI shoreline as requested by the tow industry.

## Lake Pepin Ice Thickness



## Minnesota's Lake Ice-Out Status (as of April 27, 1998)

Each Monday, the State Climatology Office polled observers around Minnesota for information regarding lake ice conditions.

The definition of lake ice-out varies from lake to lake and individual to individual. For some, ice-out occurs only when the lake is completely free of ice. For others, ice-out is defined as the moment when navigation is possible from point A to point B. And yet for others, ice-out is when 90 percent of the lake is ice free. Due to the variable definitions of this rather subjective observation, the State Climatology Office attempts to contact the same individuals each year to maintain consistency. The table below will offer the information obtained by this informal poll.

All of Minnesota's lakes are now free of ice. Lake ice-out was approximately two weeks ahead of the [historical averages](#), and in some cases, nearly the earliest on record.

<b>Northwest</b>			<b>North Central</b>			<b>Northeast</b>		
<i>Name</i>	<i>County</i>	<i>Status</i>	<i>Name</i>	<i>County</i>	<i>Status</i>	<i>Name</i>	<i>County</i>	<i>Status</i>
Bronson	Kittson	out - 4/10	Pokegama	Itasca	out - 4/11	Saganaga	Lake	out
Detroit	Becker	out - 4/10	Bemidji	Beltrami	out - 4/13	Fall	Lake	out
Cormorant	Becker	out - 4/12	Leech	Cass	out - 4/13	Vermilion	St. Louis	out - 4/13
L.o.t. Woods	L.o.t. Woods	out - 4/16	Rainy	Kooch.	out - 4/13	Island	St. Louis	out - 4/13
<b>West Central</b>			<b>Central</b>			<b>East Central</b>		
<i>Name</i>	<i>County</i>	<i>Status</i>	<i>Name</i>	<i>County</i>	<i>Status</i>	<i>Name</i>	<i>County</i>	<i>Status</i>
Minnewaska	Pope	out - 4/6	Green	Kandiyohi	out - 4/7	Minnetonka	Hennepin	out - 4/3
West Battle	Ottertail	out - 4/10	Osakis	Todd	out - 4/7	White Bear	Ramsey	out - 4/3
Ottertail	Ottertail	out - 4/10	Gull	Cass	out - 4/7	Big Sandy	Aitkin	out - 4/7
Big Stone	Big Stone	out - 4/11				Mille Lacs	Mille Lacs	out - 4/12
<b>Southwest</b>			<b>South Central</b>			<b>Southeast</b>		
<i>Name</i>	<i>County</i>	<i>Status</i>	<i>Name</i>	<i>County</i>	<i>Status</i>	<i>Name</i>	<i>County</i>	<i>Status</i>
Sarah	Murray	out - 3/30	Budd	Martin	out - 3/31	Pepin	Wabasha	out - 3/25
Shetek	Murray	out - 4/6	Clear	Waseca	out - 3/27			
			Sakatah	Le Seuer	out - 3/27			
			Albert Lea	Freeborn	out - 3/27			



[Return to the Lake Ice Out Page](#)

[mcwg@soils.umn.edu](mailto:mcwg@soils.umn.edu)

URL: [http://climate.umn.edu/doc/journal/ice\\_out\\_status\\_98.html](http://climate.umn.edu/doc/journal/ice_out_status_98.html)

Last modified: April 27, 1998

## Minnesota's Lake Ice-Out Status (as of May 5, 1999)

All of Minnesota's lakes are now free of ice.

The definition of lake ice-out varies from lake to lake and individual to individual. For some, ice-out occurs only when the lake is completely free of ice. For others, ice-out is defined as the moment when navigation is possible from point A to point B. And yet for others, ice-out is when 90 percent of the lake is ice free. Due to the variable definitions of this rather subjective observation, the State Climatology Office attempts to contact the same individuals each year to maintain consistency. The table below will offer the information obtained by this informal poll.

<b>Northwest</b>			<b>North Central</b>			<b>Northeast</b>		
<i>Name</i>	<i>County</i>	<i>Status</i>	<i>Name</i>	<i>County</i>	<i>Status</i>	<i>Name</i>	<i>County</i>	<i>Status</i>
Lake Bronson	Kittson	out - 4/10	Pine Mountain	Cass	out - 4/15	Sturgeon	St. Louis	out - 4/23
Detroit	Becker	out - 4/13	Pokegama	Itasca	out - 4/20	Fall Lake	Lake	out - 4/24
Cormorant	Becker	out - 4/18	Leech	Cass	out - 4/25	Island	St. Louis	out - 4/24
Lower Red	Beltrami	out - 4/28	Bemidji	Beltrami	out - 4/25	Vermillion	St. Louis	out - 4/27
			Kabetogama	St. Louis	out - 4/25	Snowbank	Lake	out - 4/29
			Lk of the Woods	LOW	out - 5/1	Saganaga	Cook	out - 5/2
			Rainy	Kooch.	out - 5/1			
<b>West Central</b>			<b>Central</b>			<b>East Central</b>		
<i>Name</i>	<i>County</i>	<i>Status</i>	<i>Name</i>	<i>County</i>	<i>Status</i>	<i>Name</i>	<i>County</i>	<i>Status</i>
Traverse	Traverse	out - 3/31	Rice	Stearns	out - 4/1	Waconia	Hennepin	out - 3/31
Minnewaska	Pope	out - 4/2	Pulaski	Wright	out - 4/2	Medicine	Hennepin	out - 3/30
West Battle	Ottertail	out - 4/9	Green	Kandiyohi	out - 4/6	Minnetonka	Hennepin	out - 4/2
Ottertail	Ottertail	out - 4/10	Osakis	Todd	out - 4/8	White Bear	Ramsey	out - 4/2
			Fish Trap	Morrison	out - 4/9	Knife	Kanabec	out - 4/6
			Gull	Cass	out - 4/13	Big Sandy	Aitkin	out - 4/11
						Mille Lacs	Mille Lacs	out - 4/16
<b>Southwest</b>			<b>South Central</b>			<b>Southeast</b>		
<i>Name</i>	<i>County</i>	<i>Status</i>	<i>Name</i>	<i>County</i>	<i>Status</i>	<i>Name</i>	<i>County</i>	<i>Status</i>
Shetek	Murray	out - 3/27	Budd	Martin	out - 3/27	Pepin	Wabasha	out - 3/27
Sarah	Murray	out - 3/27	Clear	Waseca	out - 3/27			

	Sakatah	Le Seuer	out - 3/27
	Albert Lea	Freeborn	out - 3/28



[Return to the Lake Ice Out Page](#)

[mcwg@soils.umn.edu](mailto:mcwg@soils.umn.edu)

URL: [http://climate.umn.edu/doc/ice\\_out/ice\\_out\\_status\\_99.htm](http://climate.umn.edu/doc/ice_out/ice_out_status_99.htm)

Last modified: May 5, 1999

## Minnesota's Lake Ice-Out Status as of May 1, 2000

Delayed early-winter ice development and a mild winter led to extraordinarily early lake ice-out dates in 2000. White Bear Lake in Ramsey County was ice free on March 21, the earliest ice-out date in its 72 year record. Lake Minnetonka in Hennepin County lost its ice on March 18, the second earliest ice-out date in a 123 year record. March ice-out dates are rare for Lake Minnetonka, occurring only six times prior to 2000. The ice-out date for Lake Osakis of Todd/Douglas counties was March 24, the second earliest ever, and only the third time in 130 years that ice-out occurred in March. The April 2 ice-out date for Mille Lacs and Gull lakes is more than three weeks earlier than their long-term averages, a very rare occurrence.

The definition of lake ice-out varies from lake to lake, and individual to individual. For some, ice-out occurs only when the lake is completely free of ice. For others, ice-out is defined as the moment when navigation is possible from point A to point B. And yet for others, ice-out is when 90 percent of the lake is ice free. Due to the variable definitions of this rather subjective observation, the State Climatology Office attempts to contact the same individuals each year to maintain a consistent record. The table below depicts the information obtained by this informal poll in the year 2000.

[Historical averages and extremes](#) have been calculated for lakes in highlighted in green.

Northwest			North Central			Northeast		
Name	County	Status	Name	County	Status	Name	County	Status
<a href="#">Bronson</a>	Kittson	out - Apr 1	<a href="#">Bemidji</a>	Beltrami	out - Apr 19	<a href="#">Fall</a>	Lake	out - Apr 15
Cormorant	Becker	out - Apr 5	<a href="#">Kabetogama</a>	St. Louis	out - Apr 18	<a href="#">Island</a>	St. Louis	out - Apr 5
<a href="#">Detroit</a>	Becker	out - Apr 3	<a href="#">L. of the Woods</a>	LOW	out - Apr 8	Saganaga	Cook	out
<a href="#">Red (Lower)</a>	Beltrami	out - Apr 12	<a href="#">Leech</a>	Cass	out - Apr 17	Snowbank	Lake	out
			<a href="#">Pokegama</a>	Itasca	out - Apr 6	Sturgeon	St. Louis	out - Apr 13
			<a href="#">Rainy</a>	Kooch.	out - Apr 22	<a href="#">Vermillion</a>	St. Louis	out - Apr 21
			Winnibigoshish	Cass/Itas.	out - Apr 6			
West Central			Central			East Central		
Name	County	Status	Name	County	Status	Name	County	Status
<a href="#">Big Stone</a>	Big Stone	out - Mar 22	Fish Trap	Morrison	out - Mar 26	<a href="#">Big Sandy</a>	Aitkin	out - Mar 31
<a href="#">Minnewaska</a>	Pope	out - Mar 23	<a href="#">Green</a>	Kandiyo.	out - Mar 24	<a href="#">Forest</a>	Washing.	out - Mar 18
<a href="#">Osakis</a>	Todd	out - Mar 24	<a href="#">Gull</a>	Cass	out - Apr 2	<a href="#">Knife</a>	Kanabec	out - Mar 27
<a href="#">Ottertail</a>	Ottertail	out - Apr 3	Pulaski	Wright	out - Mar 21	Medicine	Hennepin	out - Mar 9
Swan	Traverse	out - Mar 15	Rice	Stearns	out - Mar 20	<a href="#">Mille Lacs</a>	M. Lacs	out - Apr 2
Traverse	Traverse	out - Mar 15	Sullivan	Morrison	out - Mar 24	<a href="#">Minnetonka</a>	Hennepin	out - Mar 18
<a href="#">West Battle</a>	Ottertail	out - Mar 31				Rush	Chisago	out - Mar 25
						<a href="#">Waconia</a>	Hennepin	out - Mar 15
						<a href="#">White Bear</a>	Ramsey	out - Mar 21
Southwest			South Central			Southeast		
Name	County	Status	Name	County	Status	Name	County	Status
Sarah	Murray	out - Mar 6	Albert Lea	Freeborn	out - Mar 5	Pepin	Wabasha	out - Feb 29
<a href="#">Shetek</a>	Murray	out - Mar 8	<a href="#">Budd</a>	Martin	out - Mar 6			
			<a href="#">Clear</a>	Waseca	out - Mar 7			
			Sakatah	Le Seuer	out - Mar 11			



## Minnesota's Lake Ice-Out Status as of May 4, 2001

An early onset of winter, cold winter temperatures, and a persistent snow cover combined to produce Minnesota's latest lake ice-out dates since 1997. On average, lake ice-out occurs during the first week of April in the southern tier of Minnesota counties; near the end of the second week of April in the Twin Cities metropolitan area; towards the end of the third week of April for Brainerd, Alexandria, Detroit Lakes area lakes; and during the final week of April in far northern Minnesota. This year's lake ice-out was later than historical averages in many areas. A later than average ice-out is especially notable coming on the heels of record breaking or near record breaking **early** lake ice-outs in 2000 (see: [historical averages and extremes](#)).

The definition of lake ice-out varies from lake to lake, and individual to individual. For some, ice-out occurs only when the lake is completely free of ice. For others, ice-out is defined as the moment when navigation is possible from point A to point B. And yet for others, ice-out is when 90 percent of the lake is ice free. Due to the variable definitions of this rather subjective observation, the State Climatology Office attempts to contact the same individuals each year to maintain a consistent record. The table below will depict the information obtained by this informal poll in the year 2001.

[Historical averages and extremes](#) have been calculated for lakes in highlighted in green.

Northwest			North Central			Northeast		
Name	County	Status	Name	County	Status	Name	County	Status
<a href="#">Bronson</a>	Kittson	out - 4/13	<a href="#">Bemidji</a>	Beltrami	out - 4/29	<a href="#">Fall</a>	Lake	out - 4/29
Cormorant	Becker	out - 4/27	<a href="#">Kabetogama</a>	St. Louis	out - 5/1	<a href="#">Island</a>	St. Louis	out - 4/29
<a href="#">Detroit</a>	Becker	out - 4/28	<a href="#">L. of the Woods</a>	LOW	out - 5/1	Saganaga	Cook	out - 5/4
<a href="#">Red (Lower)</a>	Beltrami	out - 5/1	<a href="#">Leech</a>	Cass	out - 4/29	Snowbank	Lake	out - 5/1
			<a href="#">Pokegama</a>	Itasca	out - 4/28	Sturgeon	St. Louis	out - 4/29
			<a href="#">Rainy</a>	Kooch.	out - 5/1	<a href="#">Vermillion</a>	St. Louis	out - 5/2
			Winnibigoshish	Cass/Itas.	out - 4/29			
West Central			Central			East Central		
Name	County	Status	Name	County	Status	Name	County	Status
<a href="#">Big Stone</a>	Big Stone	out - 4/21	Fish Trap	Morrison	out	<a href="#">Big Sandy</a>	Aitkin	out - 4/29
<a href="#">Minnewaska</a>	Pope	out - 4/24	<a href="#">Green</a>	Kandiyo.	out - 4/25	Calhoun	Hennepin	out - 4/14
<a href="#">Osakis</a>	Todd	out - 4/25	<a href="#">Gull</a>	Cass	out - 4/28	<a href="#">Forest</a>	Washing.	out - 4/16
<a href="#">Ottertail</a>	Ottertail	out - 4/26	Rice	Stearns	out - 4/22	Harriet	Hennepin	out - 4/15
Traverse	Traverse	out - 4/22				Keller	Ramsey	out - 4/15
<a href="#">West Battle</a>	Ottertail	out - 4/27				<a href="#">Knife</a>	Kanabec	out - 4/20
						Medicine	Hennepin	out - 4/15
						<a href="#">Mille Lacs</a>	M. Lacs	out - 4/29
						<a href="#">Minnetonka</a>	Hennepin	out - 4/19
						Minnewashta	Carver	out - 4/16
						Rush	Chisago	out - 4/19
						<a href="#">Waconia</a>	Carver	out - 4/20
						<a href="#">White Bear</a>	Ramsey	out - 4/19
Southwest			South Central			Southeast		
Name	County	Status	Name	County	Status	Name	County	Status
Sarah	Murray	out - 4/16	Albert Lea	Freeborn	out - 4/13	Pepin	Wabasha	out - 4/11
<a href="#">Shetek</a>	Murray	out - 4/18	<a href="#">Budd</a>	Martin	out - 4/11			
			<a href="#">Clear</a>	Waseca	out - 4/15			
			Sakatah	Le Seuer	out - 4/12			

<a href="#">Shields</a>	Rice	out - 4/15
Swan	Nicollet	out - 4/14



[Return to the Minnesota Climatology Working Group Main Page](#)

[mcwg@soils.umn.edu](mailto:mcwg@soils.umn.edu)

URL: [http://climate.umn.edu/doc/ice\\_out/ice\\_out\\_status\\_01.htm](http://climate.umn.edu/doc/ice_out/ice_out_status_01.htm)

Last modified: May 4, 2001

## Minnesota's Lake Ice-Out Status as of May 9, 2002

In sharp contrast with a winter-long trend of unusually warm weather, March temperatures finished significantly below normal. Temperatures across the state were four to nine degrees lower than historical averages. In a unique juxtaposition, the March mean temperature was colder than any of the preceding winter months in many communities. The first week of April continued the trend from March with below normal temperatures over Minnesota. By the second week of April temperatures had warmed up to above normal and ice was melting rapidly off lakes in central Minnesota. The weather by the end of the third week of April turned colder, but windy so the ice out line continued to moved north. The first week of May was cool, but the ice had left nearly all the lakes in Minnesota by May 9th.

The definition of lake ice-out varies from lake to lake, and individual to individual. For some, ice-out occurs only when the lake is completely free of ice. For others, ice-out is defined as the moment when navigation is possible from point A to point B. And yet for others, ice-out is when 90 percent of the lake is ice free. Due to the variable definitions of this rather subjective observation, the State Climatology Office attempts to contact the same individuals each year to maintain a consistent record. The table below will depict the information obtained by this informal poll in the year 2002. The table is updated on Mondays.

Historical averages and extremes have been calculated for lakes in highlighted in green.

Northwest			North Central			Northeast		
Name	County	Status	Name	County	Status	Name	County	Status
Bronson	Kittson	out - 4/18	Bemidji	Beltrami	out - 4/29	Fall	Lake	out - 4/22
Cormorant	Becker	out - 4/16	Kabetogama	St. Louis	out - 4/30	Island	St. Louis	out - 4/24
Detroit	Becker	out - 4/16	L. of the Woods	LOW	out - 5/3	Saganaga	Cook	out - 5/9
Red (Lower)	Beltrami	out - 4/24	Leech	Cass	out - 4/24	Snowbank	Lake	out - 5/9
			Pokegama	Itasca	out - 4/24	Sturgeon	St. Louis	out - 4/22
			Rainy	Kooch.	out - 5/4	Vermilion	St. Louis	out - 4/30
			Winnibigoshish	Cass/Itas.	out - 4/26			
West Central			Central			East Central		
Name	County	Status	Name	County	Status	Name	County	Status
Big Stone	Big Stone	out - 4/14	Fish Trap	Morrison	out - 4/16	Big Sandy	Aitkin	out - 4/19
Minnewaska	Pope	out - 4/16	Green	Kandiyo.	out - 4/16	Calhoun	Hennepin	out - 4/14
Osakis	Todd	out - 4/15	Gull	Cass	out - 4/19	Forest	Washing.	out - 4/15
Ottertail	Ottertail	out - 4/16				Gervias	Ramsey	out - 4/15
Traverse	Traverse	out - 4/10				Harriet	Hennepin	out - 4/14
West Battle	Ottertail	out - 4/17				Keller	Ramsey	out - 4/14
						Knife	Kanabec	out - 4/16
						Medicine	Hennepin	out - 4/14
						Mille Lacs	M. Lacs	out - 4/23
						Minnetonka	Hennepin	out - 4/16
						Rush	Chisago	out - 4/16
						Waconia	Carver	out - 4/15
						White Bear	Ramsey	out - 4/15
Southwest			South Central			Southeast		
Name	County	Status	Name	County	Status	Name	County	Status
Sarah	Murray	out - 4/12	Albert Lea	Freeborn	out - 3/28	Pepin	Wabasha	out - 3/25
Shetek	Murray	out - 4/12	Budd	Martin	out - 4/1			
			Clear	Waseca	out - 4/1			
			Fountain	Freeborn	out - 4/9			

Loon	Waseca	out - 4/4
Sakatah	Le Seuer	out - 4/1
Shields	Rice	out - 4/5
Swan	Nicollet	out - 4/6



[Return to Minnesota Climatology Working Group Main Page](#)

[mcwg@soils.umn.edu](mailto:mcwg@soils.umn.edu)

URL: [http://climate.umn.edu/doc/ice\\_out/ice\\_out\\_status\\_02.htm](http://climate.umn.edu/doc/ice_out/ice_out_status_02.htm)

Last modified: May 9, 2002

## Minnesota's Lake Ice-Out Status as of May 7, 2003

The definition of lake ice-out varies from lake to lake, and individual to individual. For some, ice-out occurs only when the lake is completely free of ice. For others, ice-out is defined as the moment when navigation is possible from point A to point B. And yet for others, ice-out is when 90 percent of the lake is ice free. Due to the variable definitions of this rather subjective observation, the State Climatology Office attempts to contact the same individuals each year to maintain a consistent record. The table below will depict 2003 information obtained from this informal poll. The table is updated on Mondays.

Historical averages and extremes have been calculated for lakes in highlighted in green.

Northwest			North Central			Northeast		
Name	County	Status	Name	County	Status	Name	County	Status
Bronson	Kittson	out 4-17	Bemidji	Beltrami	out 4-24	Fall	Lake	out 4-28
Cormorant	Becker	out 4-14	Kabetogama	St. Louis	out 5-1	Island	St. Louis	out 4-27
Detroit	Becker	out 4-15	L. of the Woods	LOW	out 5-6	Saganaga	Cook	out 5-6
Red (Lower)	Beltrami	out 4-26	Leech	Cass	out 4-22	Snowbank	Lake	out 5-5
			Pokegama	Itasca	out 4-22	Sturgeon	St. Louis	out 4-27
			Rainy	Kooch.	out 5-5	Vermilion	St. Louis	out 5-1
			Winnibigoshish	Cass/Itas.	out 4-27			
West Central			Central			East Central		
Name	County	Status	Name	County	Status	Name	County	Status
Artichoke	Big Stone	out 4-3	Fish Trap	Morrison	out	Big Sandy	Aitkin	out 4-15
Big Stone	Big Stone	out 4-10	Green	Kandiyo.	out 4-13	Calhoun	Hennepin	out 4-3
Minnewaska	Pope	out 4-11	Gull	Cass	out 4-16	Forest	Washing.	out 4-8
Osakis	Todd	out 4-13				Gervais	Ramsey	out 4-3
Ottertail	Ottertail	out 4-14				Harriet	Hennepin	out 4-3
Traverse	Traverse	out 4-3				Keller	Ramsey	out 4-2
West Battle	Ottertail	out 4-15				Knife	Kanabec	out 4-13
						Medicine	Hennepin	out 4-6
						Mille Lacs	M. Lacs	out 4-22
						Minnetonka	Hennepin	out 4-12
						Moose	Pine	out 4-17
						Rush	Chisago	out 4-10
						Waconia	Carver	out 4-10
						White Bear	Ramsey	out 4-11
Southwest			South Central			Southeast		
Name	County	Status	Name	County	Status	Name	County	Status
Benton	Lincoln	out 3-26	Albert Lea	Freeborn	out 3-27	Canon	Rice	out 3-25
Sarah	Murray	out 3-27	Budd	Martin	out 3-19	Pepin	Wabasha	out 3-31
Shetek	Murray	out 4-3	Hall	Martin	out 3-21			
			Clear	Waseca	out 3-27			
			Loon	Waseca	out 3-26			
			Sakatah	Le Seuer	out 3-26			
			Shields	Rice	out 3-28			
			Swan	Nicollet	out 3-19			



## Minnesota's Lake Ice-Out Status as of May 10, 2004

The definition of lake ice-out varies from lake to lake, and individual to individual. For some, ice-out occurs only when the lake is completely free of ice. For others, ice-out is defined as the moment when navigation is possible from point A to point B. And yet for others, ice-out is when 90 percent of the lake is ice free. Due to the variable definitions of this rather subjective observation, the State Climatology Office attempts to contact the same individuals each year to maintain a consistent record. The table below will depict 2004 information obtained from this informal poll. The table is updated on Mondays.

Historical averages and extremes have been calculated for lakes in highlighted in green.

Northwest			North Central			Northeast		
Name	County	Status	Name	County	Status	Name	County	Status
Bronson	Kittson	out 4-9	Bemidji	Beltrami	out 4-24	Fall	Lake	out 4-24
Cormorant	Becker	out 4-18	Kabetogama	St. Louis	out 4-27	Island	St. Louis	out 4-26
Detroit	Becker	out 4-16	L. of the Woods	LOW	out 4-28	Moosehead	Carlton	out 4-20
Itasca	Clearwater	out 4-18	Leech	Cass	out 4-24	Saganaga	Cook	out 5-7
Red (Lower)	Beltrami	out 4-28	Pokegama	Itasca	out 4-21	Shagawa	St. Louis	out 4-27
Sallie	Becker	out 4-15	Rainy	Kooch.	out 5-1	Snowbank	Lake	out 5-4
			Winnibigoshish	Cass/Itas.	out 4-25	Sturgeon	St. Louis	out 4-26
						Vermilion	St. Louis	out 4-28
West Central			Central			East Central		
Name	County	Status	Name	County	Status	Name	County	Status
Artichoke	Big Stone	out 3-28	Alexander	Morrison	out 4-13	Big Sandy	Aitkin	out 4-18
Big Stone	Big Stone	out 3-28	Big Sauk	Stearns/Todd	out 4-6	Forest	Washing.	out 4-7
Minnewaska	Pope	out 4-4	Green	Kandiy.	out 4-4	Gervias	Ramsey	out 4-5
Osakis	Todd	out 4-7	Gull	Cass	out 4-17	Keller	Ramsey	out 4-4
Ottertail	Ottertail	out 4-14	Spirit	Wadena	out 4-14	Knife	Kanabec	out 4-11
Traverse	Traverse	out 3-31				Medicine	Hennepin	out 4-4
West Battle	Ottertail	out 4-13				Mille Lacs	M. Lacs	out 4-19
						Minnetonka	Hennepin	out 4-6
						Moosehead	Carlton	out 4-20
						Rush	Chisago	out 4-7
						Waconia	Carver	out 4-4
						White Bear	Ramsey	out 4-7
Southwest			South Central			Southeast		
Name	County	Status	Name	County	Status	Name	County	Status
Sarah	Murray	out 3-24	Albert Lea	Freeborn	out 3-28	Canon	Rice	out 3-28
Shetek	Murray	out 3-26	Budd	Martin	out 3-26	Pepin	Wabasha	out 3-27
			Clear	Waseca	out 3-28			
			Iowa	Martin	out 3-20			
			Loon	Waseca	out 3-27			
			Sakatah	Le Seuer	out 3-27			
			Swan	Nicollet	out 3-24			



[Return to Minnesota Climatology Working Group Main Page](#)

[mcwg@soils.umn.edu](mailto:mcwg@soils.umn.edu)

URL: [http://climate.umn.edu/doc/ice\\_out/ice\\_out\\_status\\_04.htm](http://climate.umn.edu/doc/ice_out/ice_out_status_04.htm)

Last modified: May 10, 2004

## Minnesota's Lake Ice-Out Status as of April 25, 2005

The definition of lake ice-out varies from lake to lake, and individual to individual. For some, ice-out occurs only when the lake is completely free of ice. For others, ice-out is defined as the moment when navigation is possible from point A to point B. And yet for others, ice-out is when 90 percent of the lake is ice free. Due to the variable definitions of this rather subjective observation, the State Climatology Office attempts to contact the same individuals each year to maintain a consistent record. The table below will depict 2005 information obtained from this informal poll. The table is updated on Mondays.

### 2005 ice-out recap

Prospects for an early ice-out for 2005 didn't seem to be in the cards for Minnesota. Indeed the first few lakes in the far south central portions of the state lost their ice near historical averages. Tiny Iowa Lake in Martin County was first, losing its ice by March 28th. Budd Lake in Martin County followed on March 30, one day later than the historical average. The statewide temperature average for March 2005 was just a little cooler than average.

April came with May-like temperatures. The first 17 days of the month were ten degrees above average statewide. Even in northeast Minnesota, which still held onto a snow pack at the beginning of the month, was seven degrees above average. The balmy conditions accelerated ice-out across the rest of Minnesota. In central portions of the state, lakes like White Bear and Minnetonka were ice-free by April 9th, which was several days ahead of average. Green Lake in Kandiohi County lost its icy cover on April 10th six days ahead of its long term average. In general, lakes were ice-free three days to a week ahead of average in Central Minnesota. Mille Lacs was stubborn to lose its ice and one couldn't pilot a boat from Isle to Garrison until April 20, still four days earlier than average.

The warmth continued during the third week of April and ice thawed on northern lakes more rapidly. As of April 21 virtually all lakes across northeast Minnesota were ice-free. Even lakes that typically keep their ice the latest like Vermillion looked blue to airplane pilots on April 19th. The last two years the lake was still iced until the end of April. Shagawa Lake just north of Ely lost its ice ten days ahead of average. Most lakes in northern Minnesota were ice-free seven to ten days ahead of average.

By Monday, April 25 all the lakes in Minnesota were ice-free. The last lakes to lose their ice were Rainy Lake and Lake of the Woods on April 23.

While 2005 will not go into the record books as the earliest ice-out ever for any lakes with long-term records, the rapid warm-up though moved the ice-out quicker than what was expected at the beginning of the month.

Historical averages and extremes have been calculated for lakes in highlighted in green.

Northwest			North Central			Northeast		
Name	County	Status	Name	County	Status	Name	County	Status
Bronson	Kittson	out 4-8	Bemidji	Beltrami	out 4-18	Fall	Lake	out 4-16
Cormorant	Becker	out 4-17	Kabetogama	St. Louis	out 4-20	Island	St. Louis	out 4-17
Detroit	Becker	out 4-14	L. of the Woods	LOW	out 4-23	Saganaga	Cook	out 4-20
Red (Lower)	Beltrami	out 4-22	Leech	Cass	out 4-17	Shagawa	St. Louis	out 4-17
Sallie	Becker	out 4-12	Pokegama	Itasca	out 4-17	Snowbank	Lake	out 4-19
			Rainy	Kooch.	out 4-23	Sturgeon	St. Louis	out 4-16
			Winnibigoshish	Cass/Itas.	out 4-19	Vermillion	St. Louis	out 4-19
						Wolf	Lake	out 4-18
West Central			Central			East Central		
Name	County	Status	Name	County	Status	Name	County	Status
Artichoke	Big Stone	out 3-30	Fish Trap	Morrison	out 4-9	Big Sandy	Aitkin	out 4-14
Big Stone	Big Stone	out 4-3	Green	Kandio.	out 4-10	Bear	Aitkin	out 4-9
Minnewaska	Pope	out 4-9	Gull	Cass	out 4-11	Calhoun	Hennepin	out 4-6
Osakis	Todd	out 4-9				Forest	Washing.	out 4-6
Ottertail	Ottertail	out 4-15				Gervias	Ramsey	out 4-6

Traverse Traverse out 4-6 West Battle Ottertail out 4-15		Harriet Hennepin out 4-6 Keller Ramsey out 4-5 Knife Kanabec out 4-10 Medicine Hennepin out 4-6 Mille Lacs M. Lacs out 4-20 Minnetonka Hennepin out 4-9 Rush Chisago out 4-8 Waconia Carver out 4-8 White Bear Ramsey out 4-9
<b>Southwest</b> <b>Name County Status</b> Benton Lincoln out 4-1 Sarah Murray out 3-31 Shetek Murray out 4-1	<b>South Central</b> <b>Name County Status</b> Albert Lea Freeborn out 3-31 Budd Martin out 3-30 Clear Waseca out 4-4 Hall Martin out 3-30 Loon Waseca out 4-4 Shields Rice out 4-6 Sakatah Le Seuer out 4-5 Swan Nicollet out 3-31 Tetonka Le Sueur out 4-5	<b>Southeast</b> <b>Name County Status</b> Cannon Rice out 4-4 Pepin Wabasha out 4-4



[Return to Minnesota Climatology Working Group Main Page](#)

[mcwg@soils.umn.edu](mailto:mcwg@soils.umn.edu)

URL: [http://climate.umn.edu/doc/ice\\_out/ice\\_out\\_status\\_05.htm](http://climate.umn.edu/doc/ice_out/ice_out_status_05.htm)

Last modified: April 25, 2005

## Minnesota's Lake Ice-Out Status as of April 21, 2006

The definition of lake ice-out varies from lake to lake, and individual to individual. For some, ice-out occurs only when the lake is completely free of ice. For others, ice-out is defined as the moment when navigation is possible from point A to point B. And yet for others, ice-out is when 90 percent of the lake is ice free. Due to the variable definitions of this rather subjective observation, the State Climatology Office attempts to contact the same individuals each year to maintain a consistent record. The table below will depict 2006 information obtained from this informal poll. The table is updated on Mondays. Here is a [description](#) of how lake ice melts.

[Historical averages and extremes](#) have been calculated for lakes in highlighted in green.

Northwest			North Central			Northeast		
Name	County	Status	Name	County	Status	Name	County	Status
Bronson	Kittson	out 4-10	Bemidji	Beltrami	out 4-16	Ash	St. Louis	out 4-14
Cormorant	Becker	out 4-13	Kabetogama	St. Louis	out 4-16	Fall	Lake	out 4-13
Detroit	Becker	out 4-13	L. of the Woods	LOW	out 4-20	Gunflint	Cook	out 4-17
Red (Upper)	Beltrami	out 4-17	Leech	Cass	out 4-19	Island	St. Louis	out 4-16
Sallie	Becker	out 4-13	Pokegama	Itasca	out 4-14	Saganaga	Cook	out 4-19
			Rainy	Kooch.	out 4-16	Shagawa	St. Louis	out 4-16
			Webb	Cass	out 4-12	Side	St. Louis	out 4-15
			Winnibigoshish	Cass/Itas.	out 4-15	Snowbank	Lake	out 4-18
						Sturgeon	St. Louis	out 4-16
						Vermilion	St. Louis	out 4-18
						Wolf	Lake	out 4-17
West Central			Central			East Central		
Name	County	Status	Name	County	Status	Name	County	Status
Artichoke	Big Stone	out 4-6	Fish Trap	Morrison	out 4-9	Bald Eagle	Ramsey	out 4-7
Big Stone	Big Stone	out 4-8	Green	Kandiyo.	out 4-9	Big Sandy	Aitkin	out 4-12
Minnewaska	Pope	out 4-10	Gull	Cass	out 4-10	Bear	Aitkin	out 4-9
Osakis	Todd	out 4-8	Pelican	Crow Wing	out 4-10	Lake of the Isles	Hennepin	out 4-6
Ottertail	Ottertail	out 4-12	Serpent	Crow Wing	out 4-9	Forest	Washing.	out 4-9
Traverse	Traverse	out 4-9	Whitefish	Crow Wing	out 4-11	Gervias	Ramsey	out 4-7
West Battle	Ottertail	out 4-11				Harriet	Hennepin	out 4-7
						Keller	Ramsey	out 4-6
						Kohlman	Ramsey	out 4-6
						Knife	Kanabec	out 4-9
						Medicine	Hennepin	out 4-7
						Mille Lacs	M. Lacs	out 4-13
						Minnetonka	Hennepin	out 4-9
						Rush	Chisago	out 4-8
						Waconia	Carver	out 4-7
						White Bear	Ramsey	out 4-9
Southwest			South Central			Southeast		
Name	County	Status	Name	County	Status	Name	County	Status
Benton	Lincoln	out 4-4	Albert Lea	Freeborn	out 4-2	Cannon	Rice	out 4-5
Lime	Murray	out 4-3	Budd	Martin	out 3-31	Pepin	Wabasha	out 4-1
Long	Watonwan	out 4-4	Clear	Waseca	out 4-3			
Sarah	Murray	out 4-4	Fountain	Freeborn	out 4-5			
Shetek	Murray	out 4-5	Lily	Blue Earth	out 4-1			
			Loon	Waseca	out 3-31			
			Shields	Rice	out 4-5			
			Sakatah	Le Seuer	out 4-5			
			Swan	Nicollet	out 3-31			

	Tetonka	Le Sueur	out 4-5	
--	---------	----------	---------	--



[Return to Minnesota Climatology Working Group Main Page](#)

[mcwg@soils.umn.edu](mailto:mcwg@soils.umn.edu)

URL: [http://climate.umn.edu/doc/ice\\_out/ice\\_out\\_status\\_06.htm](http://climate.umn.edu/doc/ice_out/ice_out_status_06.htm)

Last modified: April 21, 2006

## Minnesota's Lake Ice-Out Status as of May 4, 2007

The definition of lake ice-out varies from lake to lake, and individual to individual. For some, ice-out occurs only when the lake is completely free of ice. For others, ice-out is defined as the moment when navigation is possible from point A to point B. And yet for others, ice-out is when 90 percent of the lake is ice free. Due to the variable definitions of this rather subjective observation, the State Climatology Office attempts to contact the same individuals each year to maintain a consistent record. The table below will depict 2007 information obtained from this informal poll. The table is updated on Mondays. Here is a [description](#) of how lake ice melts.

On clear days, it is possible to discern ice-covered lakes from satellite imagery. A [satellite image](#) from 11:32 AM, Thursday, April 12 shows that lakes south of a line from Alexandria to Hinckley are mostly free of ice (see: [latest satellite image](#)).

With the last stubborn ice leaving Rainy Lake and Saganaga on May 4th, all lakes in Minnesota are now free of ice.

[Historical averages and extremes](#) have been calculated for lakes in highlighted in green.

Northwest			North Central			Northeast		
Name	County	Status	Name	County	Status	Name	County	Status
Bronson	Kittson	out 4-22	Bemidji	Beltrami	out 4-27	Fall	Lake	out 4-25
Cormorant	Becker	out 4-25	Kabetogama	St. Louis	out 4-30	Greenwood	Cook	out 5-3
Detroit	Becker	out 4-21	L. of the Woods	LOW	out 5-3	Gunflint	Lake	out 5-1
Red (Lower)	Beltrami	out 4-29	Leech	Cass	out 4-25	Island	St. Louis	out 4-27
Sallie	Becker	out 4-21	Pokegama	Itasca	out 4-25	Saganaga	Cook	out 5-4
			Rainy	Kooch.	out 5-4	Shagawa	St. Louis	out 4-26
			Winnibigoshish	Cass/Itas.	out 4-27	Snowbank	Lake	out 4-29
						Sturgeon	St. Louis	out 4-26
						Vermilion	St. Louis	out 4-29
						Wolf	Lake	out 4-26
West Central			Central			East Central		
Name	County	Status	Name	County	Status	Name	County	Status
Artichoke	Big Stone	out 3-30	Fish Trap	Morrison	out 4-18	Big Sandy	Aitkin	out 4-22
Big Stone	Big Stone	out 3-30	Green	Kandiyo.	out 4-11	Calhoun	Hennepin	out 3-29
Blanche	Ottertail	out 4-19	Gull	Cass	out 4-22	Forest	Washing.	out 3-31
Minnewaska	Pope	out 4-2				Gervias	Ramsey	out 3-27
Osakis	Todd	out 4-19				Harriet	Hennepin	out 3-28
Ottertail	Ottertail	out 4-23				Kohlman	Ramsey	out 3-26
Traverse	Traverse	out 3-30				Knife	Kanabec	out 4-18
West Battle	Ottertail	out 4-21				Medicine	Hennepin	out 3-30
						Mille Lacs	M. Lacs	out 4-28
						Minnetonka	Hennepin	out 4-3
						Phalen	Ramsey	out 3-27
						Rush	Chisago	out 4-11
						Waconia	Carver	out 4-1
						White Bear	Ramsey	out 3-31
Southwest			South Central			Southeast		
Name	County	Status	Name	County	Status	Name	County	Status
Bingham	Cottonwood	out 3-26	Albert Lea	Freeborn	out 3-26	Cannon	Rice	out 3-26
Lime	Murray	out 3-27	Budd	Martin	out 3-27	Pepin	Wabasha	out 3-24
Okabena	Nobles	out 3-26	Clear	Waseca	out 3-27	Zumbro	Olmsted	out 3-26
Sarah	Murray	out 3-27	Fountain	Freeborn	out 3-27			
Shetek	Murray	out 3-26	Loon	Waseca	out 3-26			
			Sakatah	Le Seuer	out 3-26			

Shields	Rice	out 3-26
Swan	Nicollet	out 3-24
Tetonka	Le Sueur	out 3-28



[Return to Minnesota Climatology Working Group Main page](#)

[Comments/Questions](#)

URL: [http://climate.umn.edu/doc/ice\\_out/ice\\_out\\_status\\_07.htm](http://climate.umn.edu/doc/ice_out/ice_out_status_07.htm)  
Last modified: May 4, 2007

# Minnesota Climatology Working Group

State Climatology Office - DNR Waters University of Minnesota

[home](#) | [current conditions](#) | [journal](#) | [past data](#) | [summaries](#) | [agriculture](#) | [other sites](#) | [contact us](#) | [search](#)

## Minnesota's Lake Ice-Out Status - May 19, 2008

The definition of lake ice-out varies from lake to lake, and individual to individual. For some, ice-out occurs only when the lake is completely free of ice. For others, ice-out is defined as the moment when navigation is possible from point A to point B. And yet for others, ice-out is when 90 percent of the lake is ice free. Due to the variable definitions of this rather subjective observation, the State Climatology Office attempts to contact the same individuals each year to maintain a consistent record. The table below will depict 2008 information obtained from this informal poll. The table is updated as conditions warrant.

### Other lake ice-out resources:

- high resolution [polar orbiting satellites](#) can be used to observe ice on larger lakes
- a [description](#) of how lake ice melts
- [lake ice-out map](#)

### Lake ice-out dates

[Historical averages and extremes](#) have been calculated for lakes in highlighted in [green](#).

Northwest			North Central			Northeast		
Name	County	Status	Name	County	Status	Name	County	Status
<a href="#">Bronson</a>	Kittson	out 4-24	<a href="#">Bemidji</a>	Beltrami	out 5-12	Bear Head	St. Louis	out 5-6
<a href="#">Cormorant</a>	Becker	out 5-7	<a href="#">Kabetogama</a>	St. Louis	out 5-8	Brule	Cook	out 5-14
<a href="#">Detroit</a>	Becker	out 5-5	<a href="#">L. of the Woods</a>	LOW	out 5-12	Caribou	Cook	out 5-7
Elk	Clearwater	out 5-10	<a href="#">Leech</a>	Cass	out 5-13	Crane	St. Louis	out 5-5
Itasca	Clearwater	out 5-7	<a href="#">Pokegama</a>	Itasca	out 5-6	<a href="#">Fall</a>	Lake	out 5-7
<a href="#">Red (Lower)</a>	Beltrami	out 5-10	<a href="#">Rainy</a>	Kooch.	out 5-14	Crescent	Cook	out
Red (Upper)	Beltrami	out 5-2	Ten Mile	Cass	out 5-12	Devil Track	Cook	out 5-11
<a href="#">Sallie</a>	Becker	out 5-1	Woman	Cass	out 5-7	Greenwood	Cook	out 5-18
			<a href="#">Winnibigoshish</a>	Cass/Itas.	out 5-13	<a href="#">Gunflint</a>	Lake	out 5-12
						<a href="#">Island</a>	St. Louis	out 5-4
						Moose	lake	out 5-7
						Northern Light	Cook	out 5-6

One, Two, Three and Four	Lake	all out 5-6
Pelican	St. Louis	out 5-7
Saganaga	Cook	out 5-15
Sawbill	Cook	out 5-6
Seagull	Cook	out 5-12
Shagawa	St. Louis	out 5-7
Side Lake	St. Louis	out 5-6
Snowbank	Lake	out 5-12
Sturgeon	St. Louis	out 5-7
Trout	Cook	out 5-15
Trout	St. Louis	out
Vermilion	St. Louis	out 5-12
Wolf	Lake	out 5-3

**West Central**

Name	County	Status
Artichoke	Big Stone	out 4-20
Big Stone	Big Stone	out 4-20
Blanche	Otter Tail	out 4-25
Minnewaska	Pope	out 4-24
Osakis	Todd	out 4-25
Otter Tail	Otter Tail	out 5-4
Traverse	Traverse	out 4-21
West Battle	Otter Tail	out 5-3

**Central**

Name	County	Status
Belle Lake	Meeker	out 4-22
Big Sand Lake	Hubbard	out 5-7
Carrie Lake	Kandiyo.	out 4-21
Cedar Lake	Morrison	out 4-30
Green	Kandiyo.	out 4-30
Gull	Cass	out 5-5
Little Sand Lake	Hubbard	out 5-5
Lower Bottle Lake	Hubbard	out 5-7
Pearl	Stearns	out 4-22
Pelican	Crow Wing	out 5-3
Portage	Hubbard	out 5-3

**East Central**

Name	County	Status
Big Sandy	Aitkin	out 4-26
Forest	Washing.	out 4-22
Gervias	Ramsey	out 4-21
Calhoun	Hennepin	out 4-21
Kohlman	Ramsey	out 4-18
Knife	Kanabec	out 4-23
Lake of the Isles	Hennepin	out 4-18
Medicine	Hennepin	out 4-21
Mille Lacs	M. Lacs	out 5-4
Minnetonka	Hennepin	out 4-23
Phalen	Ramsey	out 4-20
Rush	Chisago	out 4-24

Big Waverly	Wright	out 4-21	South Center	Chisago	out 4-23
Upper Bottle Lake	Hubbard	out 5-5	Waconia	Carver	out 4-22
			White Bear	Ramsey	out 4-23

Southwest			South Central			Southeast		
Name	County	Status	Name	County	Status	Name	County	Status
Cottonwood	Cottonwood	out 4-15	Albert Lea	Freeborn	out 4-15	Cannon	Rice	out 4-17
Hendricks	Lincoln	out 4-17	Budd	Martin	out 4-15	Pepin	Wabasha	out 4-15
Yankton	Lyon	out 4-14	Clear	Waseca	out 4-16	Zumbro	Olmsted	out 4-10
Sarah	Murray	out 4-15	Fountain	Freeborn	out 4-16			
Shaokatan	Lincoln	out 4-16	Loon	Waseca	out 4-15			
Shetek	Murray	out 4-16	St Olaf	Waseca	out 4-16			
			St James	Watonwan	out 4-14			
			Sakatah	Le Seuer	out 4-17			
			Shields	Rice	out			
			Swan	Nicollet	out 4-15			
			Tetonka	Le Sueur	out 4-17			

Last modified: May 19, 2008

# Minnesota Climatology Working Group

State Climatology Office - DNR Waters University of Minnesota

[home](#) | [current conditions](#) | [journal](#) | [past data](#) | [summaries](#) | [agriculture](#) | [other sites](#) | [contact us](#) | [search](#)

## Minnesota's Lake Ice-Out Status - May 16, 2009

The definition of lake ice-out varies from lake to lake, and individual to individual. For some, ice-out occurs only when the lake is completely free of ice. For others, ice-out is defined as the moment when navigation is possible from point A to point B. And yet for others, ice-out is when 90 percent of the lake is ice free. Due to the variable definitions of this rather subjective observation, the State Climatology Office attempts to contact the same individuals each year to maintain a consistent record. The table below will depict 2009 information obtained from this informal poll. The table is updated as conditions warrant.

### Other lake ice-out resources:

- high resolution [polar orbiting satellites](#) can be used to observe ice on larger lakes
- a [description](#) of how lake ice melts
- [lake ice-out map](#)

**Despite having substantial ice cover during the winter of 2008-09, the strong winds, warm temperatures and rain during the third of March hastened ice melt. By the end of March, the ice out line had reached the south edge of the Twin Cities Metropolitan area. Cooling temperatures for the last week of March and the first ten days of April slowed ice out progress considerably. Many of the medium-sized lakes have lost their ice in the Twin Cities Metropolitan area by April 8. By April 13, both White Bear Lake and Minnetonka had lost their ice.**

**The ice out line continued to inch northward with warmer temperatures from April 14 to 17. Lake Traverse had just a little ice left by noon on April 17 near Browns Valley. The average ice out for Lake Traverse is April 9.**

**By April 21, the ice out line for small and medium sized lakes had crept northward into the Alexandria area eastward to Mille Lacs. Mille Lacs still has substantial ice on it. In fact, the ice on Mille Lacs has been on the move the past few days. With a stiff north wind on April 19th and 20th, ice piled up on the south shore of Mille Lacs. The Mille Lacs Messenger has a [video](#) of the ice pile up. On April 23, strong south winds shoved the ice on Mille Lacs northward. The warm and windy conditions on April 23rd and 24th caused many lakes shed their ice in central Minnesota including Otter Tail and Mille Lacs**

**By May 4th, the ice remaining on lakes had retreated to mainly the far**

**northeastern tip of Minnesota, and some of the larger border lakes with Canada. In general, lakes still had ice on them in Cook County, especially east of Saganaga in the Boundary Waters. Lake of the Woods still had substantial ice on it, with open water in some of the bays.**

**On Friday, May 8th there was still ice on Devil Track, Greenwood and Brule lakes in far northeast Minnesota.**

**As of the afternoon on May 11, only a few lakes including Greenwood Lake and Trout Lake in northeast Minnesota seem still have ice on them. On Saturday, May 16 Greenwood Lake was reported to be 95% ice free and thus was the last lake to be ice free in Minnesota.**

**See the May 10 high resolution polar orbiting satellite image for a great snapshot of lakes that were ice covered on that date for northern Minnesota.**

[Historical averages and extremes](#) have been calculated for lakes in highlighted in green.

Northwest			North Central			Northeast		
Name	County	Status	Name	County	Status	Name	County	Status
Bronson	Kittson	out 4-12	Bemidji	Beltrami	out 4-27	Ash	Lake	out 4-25
Cormorant	Becker	out 4-29	Kabetogama	St. Louis	out 4-29	Basswood	Lake	out 5-2
Detroit	Becker	out 4-23	L. of the Woods	LOW	out 5-8	Bear Head	St. Louis	out 4-27
Elk	Clearwater	out 4-22	Leech	Cass	out 4-30	Brule	Cook	out 5-11
Itasca	Clearwater	out 4-22	Pokegama	Itasca	out 4-28	Burntside	St. Louis	out 5-1
Red (Lower)	Beltrami	out 5-1	Rainy	Kooch.	out 4-30	Fall	Lake	out 4-26
Red (Upper)	Beltrami	out 5-1	Ten Mile	Cass	out 4-30	Devil Track	Cook	out 5-13
Sallie	Becker	out 4-24	Winnibigoshish	Cass/Itas.	out 4-29	East Bearskin Lake	Cook	out 5-6
						Elephant	St. Louis	out 4-26
						Greenwood	Cook	out 5-16
						Gunflint	Lake	out 5-7
						Island	St. Louis	out 4-27
						Lax	Lake	out 5-5

Northern Light	Cook	out 5-7
Pelican	St. Louis	out 4-26
Saganaga	Cook	out 5-7
Sawbill	Cook	out 5-7
Seagull	Cook	out 5-1
Shagawa	St. Louis	out 4-30
Side Lake	St. Louis	out 4-25
Snowbank	Lake	out 5-2
Sturgeon	St. Louis	out 4-29
Tait	Cook	out 5-9
Trout	Cook	out 5-14
Vermilion	St. Louis	out 4-30
Wolf	Lake	out 5-6

**West Central**

Name	County	Status
Artichoke	Big Stone	out 4/15
Big Stone	Big Stone	out 4/15
Blanche	Otter Tail	out 4-22
Carlos	Douglas	out 4-23
Minnewaska	Pope	out 4-18
Osakis	Todd	out 4-20
Otter Tail	Otter Tail	out 4-23
Pelican	Grant	out 4-20
Swan Lake	Otter Tail	out 4-21
Traverse	Traverse	out 4-17
West Battle	Otter Tail	out 4-23

**Central**

Name	County	Status
Belle Lake	Meeker	out 4-10
Big Sand Lake	Hubbard	out
Carrie Lake	Kandiyo.	out 4-9
Cedar Lake	Morrison	out 4-20
Green	Kandiyo.	out 4-19
Gull	Cass	out 4-24
Little Sand Lake	Hubbard	out
Lower Bottle Lake	Hubbard	out
North Long	Crow Wing	out 4-19
Pearl	Stearns	out 4-15
Pelican	Crow Wing	out 4-25

**East Central**

Name	County	Status
Big Sandy	Aitkin	out 4-22
Bald Eagle	Ramsey	out 4-7
Forest	Washing.	out 4-8
Gervias	Ramsey	out 4-3
Calhoun	Hennepin	out 4-8
Kohlman	Ramsey	out 3-31
Knife	Kanabec	out 4-15
Lake of the Isles	Hennepin	out 3-31
Medicine	Hennepin	out 4-8
Mille Lacs	M. Lacs	out 4-24
Minnetonka	Hennepin	out 4-13
Peltier	Anoka	out 4-9
Phalen	Ramsey	out 4-5
Rush	Chisago	out 4-10

Portage	Hubbard	out 4-22	South Center	Chisago	out 4-10
Red Sand	Crow Wing	out 4-18	Waconia	Carver	out 4-10
Sullivan	Morrison	out 4-19	White Bear	Ramsey	out 4-11
Big Waverly	Wright	out 4-13			
Winsted	McLeod	out 4-9			
Upper Bottle Lake	Hubbard	out			

**Southwest**

Name	County	Status
Sarah	Murray	out 3-22
Shaokatan	Lincoln	out 3-24
Shetek	Murray	out 3-23

**South Central**

Name	County	Status
Albert Lea	Freeborn	out 3-24
Budd	Martin	out 3-24
Clear	Waseca	out 3-25
Fountain	Freeborn	out 4-3
Loon	Waseca	out 3-24
Madison	Blue Earth	out 3-20
St Olaf	Waseca	out 3-24
St James	Watonwan	out 3-24
Sakatah	Le Sueur	out 3-24
Shields	Rice	out 3-25
Swan	Nicollet	out 3-25
Tetonka	Le Sueur	out 3-26
Lake Washington	Le Sueur	out 3-24

**Southeast**

Name	County	Status
Cannon	Rice	out 3-24
Pepin	Wabasha	out 3-23
Zumbro	Olmsted	out 3-31

Last modified: June 19, 2009



STATE OF  
**MINNESOTA**  
**DEPARTMENT OF NATURAL RESOURCES**

PHONE NO.

FILE NO.

P. O. Box 6247  
St. Paul, MN 55055

November 30, 1987

Mr. G. V. Welk, Manager  
Regulatory Compliance and Services  
Northern States Power Company  
414 Nicollet Mall  
Minneapolis, MN 55401

Dear Mr. Welk:

PERMIT 80-5081, PRAIRIE ISLAND NUCLEAR GENERATING PLANT, GOODHUE CO.

Special Provision #12 of the above referenced permit to monitor the ice cover of Lake Pepin is no longer required. Analysis of the data collected over the five year period does not indicate continued monitoring of the ice cover of Lake Pepin will necessarily identify the impact of the thermal discharge into Lake Pepin even during extreme periods of low flow or occurrence of high flow. Should uncharacteristic areas of open water or ice thinness develop and become prevalent, modeling may be required to determine if thermal discharge from Prairie Island is the cause.

We appreciate your compliance with this provision and cooperation with this Department. If you have any questions, please contact Area Hydrologist, Jim Haertel at (507) 285-7430.

Sincerely,

  
Ronald D. Harnack  
Administrator  
Permit and Land Use Section

cc: Lee Eberly, NSP ✓  
Larry Gates, Fisheries, Lake City  
Goodhue County Sheriff  
Waters, Rochester  
Greg Turner, C. O.  
U. S. Army Corps of Engineers  
U. S. Fish and Wildlife Service  
MPCA, St. Paul

**File Copy  
PI Lab**

DEPARTMENT : Natural Resources, Waters

STATE OF MINNESOTA

# Office Memorandum

DATE : November 23, 1987

TO : Ronald D. Harnack, Administrator  
Permits and Land Use Section

FROM : James F. Cooper, Regional Hydrologist  
Jim Haertel, Area Hydrologist *J.S.H.*

PHONE : 285-7430

SUBJECT : PERMIT 80-5081, PRAIRIE ISLAND NUCLEAR GENERATING PLANT

Special Provision #12 of the above referenced permit requires NSP to monitor the ice cover of Lake Pepin for 5 years. In October of 1986, after 5 years of monitoring, NSP requested to discontinue the ice cover monitoring. We required NSP to analyze the data and requested a consultant be contacted. Dr. H. G. Stefan of the St. Anthony Falls Hydraulic Lab analyzed the data and prepared a report titled "Residual Heat Input From the Mississippi River to Lake Pepin During the Winters of 1981/82 to 1985/86". Dr. Stefan's conclusions were, in essence, that no statistically significant impacts on ice cover resulted from the thermal discharge of the plant.

Dr. Stefan did indicate that it is still unknown what impact the heated flow discharged into Lake Pepin would have during periods of extreme low flow or for flows higher than those monitored during the last five years. Continued monitoring would not necessarily result in meaningful data being collected for extreme flow events in the near future since it is unknown when such events will occur. If uncharacteristic ice conditions become prevalent which adversely affect the resource, modeling may be the best way to determine if the adverse conditions are caused by thermal discharge.

We met with Dr. Stefan, officials from NSP and DNR Fisheries staff. Dr. Stefan explained his report in detail. DNR Fisheries had no negative comments. Our analysis of the data in this office does not support continuance of the monitoring program. Based on the above, we recommend that Special Provision #12 not be required any longer.

JC:JH:jp

cc: ~~Lee Eberly, NSP~~  
Larry Gates, Fisheries - Lake City  
Waters, Rochester  
U. S. Army Corps of Engineers  
U. S. Fish & Wildlife Service  
Greg Turner C. O.  
MPCA, St. Paul  
Goodhue County Sheriff

File Copy  
PI Lab