20. APPENDIX

TABLE OF CONTENTS

Chemical Rehabilitation

Lake Winona - Winona County

REPORT BY MINNESOTA DEPARTMENT
OF NATURAL RESOURCES

Dates of Treatment:	September 17, 18, 19, 20, 1973
Type of Chemical:	Liquid 2½% Pro-Noxfish Rotenone
Application Method:	Helicopter, City water truck, back pack sprayer
Personnel:	State - Del Johnson, Skip Painter (Lanesboro); Donald Gilbertson, Joe Murck, Duane Shodeen (St. Paul); Dick Sternberg, Gary Grunwald, Dale Solga (Lake City) Lake Line Helicopter Service - Bud Bourguin and Al Schulz (pilot and crew) City of Winona - Robert Bollant, City Engineer, plus 1 tank truck, 1 pick-up and 2 men Winona County - 1 tank truck and driver

Monday September 17

Met at City Engineers' office to review work schedule.

Gary Grunwald and Dale Solga supervised treatment of catch basins and storm sewers which entered Lake Winona above lake level and those entering ditch from Boller Lake to Lake Winona above water level. City provided tank truck and driver, plus pick-up and driver. County provided tank truck and driver. Del Johnson and Skip Painter assisted in this phase of treatment.

Don Gilbertson and Joe Murck placed buoys in Lake Winona marking 5, 10, 15 and 20 ft. countours, plus deep holes.

Boller Lake dam closed to cut-off flow to Lake Winona. Flow could not be stopped completely, but was reduced to a trickle.

Gilmore Creek flow was determined by dumping fluoresceine dye in at sheet piling, 7 ft.-high barrier dam located on St. Mary's College grounds. Two hours later, dye arrived at new County Road 14 bridge. Flow measured and estimated at 4.8 c.f.s. Mixture determined as 8 gallons rotenone, plus 47 gallons water to be released over 10 hour period.

Rented plane and pilot from Winona Airport and flew over watershed to check on numbers previously placed by farm ponds to be treated. We also rechecked watershed for additional water areas that may have developed from recent rains. Poor results were realized due to scattered showers and the fact that airplane wing was fixed below cockpit. In the future, contract for helicopter service should include 1-2 hours of pretreatment watershed helicopter reconnaisance.

Tuesday September 18

Don Gilbertson and Joe Murck set up two 55-gallon drum drip stations on Gilmore Creek. One barrel set up at new Highway 14 bridge and started treating at 9:10 a.m. The second barrel set up at sheet piling barrier, and treatment began at 10:05 a.m. The barrier station was operated for 10 hours (55-gallon mix), and the new highway 14 station was operated for approximately 51-52 consecutive hours. Don and Joe walked the creek from Lake Winona to barrier spraying edge of stream with back-pack sprayers.

Gary Grunwald and Dale Solga supervised storm sewer treatment of all lines entering below water level of Lake Winona and inlet ditch. Retreated all flowing water areas, (spring seepage and permanent flow storm sewer lines).

Helicopter began treatment of water and marsh areas in early afternoon. Sequence of areas treated was Boller Slough marsh shoreline area, marshy portion of Gilmore Creek, ditch from Boller Lake to Lake Winona, marshy areas around Lake Winona, Boller Lake open water area from shoreline to center, and light treatment of Lake Winona shoreline.

Wednesday September 19

Opened Boller Lake Dam to create flow in ditch between Boller Lake and Lake Winona. Closed gates at Lake Winona outlet to prevent flow of toxic water to Mississippi.

Helicopter treatment sequence as follows; retreated Boller Lake marshy edge, retreated shoreline of Lake Winona, treated Lake Winona from shoreline to center.

Gary and Dale retreated permanent flowing storm sewers and air conditioner water lines, plus spring seepage areas.

Don Gilbertson and Joe Murch continued to man drip station on Gilmore Creek and recorded fish kill information for Gilmore Creek and gravel pit areas adjoining Boller Lake.

Del Johnson and Skip Painter handled 55-gallon drums of rotenone at helicopter landing site. Del and Skip completed their work on Wednesday and did not return on Thursday.

Thursday September 20

Gates on outlet of Lake Winona opened briefly to draw toxic water into culvert. These gates were then closed until lake detoxified. Closed Boller Lake outlet dam.

Gary and Dale supervised retreatment of below water line storm sewers entering Lake Winona and inlet ditch, retreated all other permanent flowing storm sewers, air condition lines and spring areas.

Helicopter retreated shoreline edge of Lake Winona and treated 8 farm ponds in watershed.

Set up drip station to treat de-watering flow which entered Lake Winona. Flow was started on this date as part of a sanitary sewer construction project.

Helicopter Treatment

Tuesday September 18, 1973

Area	Acres	Gallons of mix	Ratio	Rotenone	Water
Boller Lake shoreline	14	140	1:9	14	126
Shoreline of deep marsh	2	20	1:9	2	18
Boller Lake marsh area	45	450	1:9	45	405
Ditch from Boller L. to L. Winona	16	160	1:9	16	144
Highway 61 ditch by L. Winona	12	120	1:9	12	108
Boller Lake	65	650	3:7	195	455
Deep marsh (N.W. of Boller L.)	20	200	3:7	60	140
Gravel pit ponds	8	80	3:7	24	56
Lake Winona shoreline	24	240	1:9	24	216
New marsh areas found	29.5	295	1:9	29.5	265.5
Wednesday September 19, 1973					
Boller Lake shoreline	14	140	1:9	14	126
N.W. basin L.Winona: 0-5' contour	9	90	1:1	45	45
" " " 5'-10' "	60	600	5:1	500	100
" " " 10'-15' "	8	100	1:0	100	-
" " " 15'-20' "	9	160	1:0	160	-
" " " 20' + "	1.5	30	1:0	30	-
S.E. basin L.Winona: 0-5' contour	15	150	1:1	75	75
" " " 5'-10' "	140	1,400	4:1	1,120	280
" " " 10'-15' "	38	460	1:0	460	-
" " " 15'-20' "	27	470	1:0	470	-
" " " 20' +(A)	1.7	45	1:0	45	-
" " " 20' + (B)	2.5	55	1:0	55	-
" " " 20' + (C)	8	235	1:0	235	-
Thursday September 20, 1973					
N.W. basin L.Winona shoreline	9	90	1:1	45	45
S.E. basin L. Winona shoreline	15	150	1:1	75	75
Boller Lake shoreline	14	140	1:4	28	112
Boller Lake outlet area	8	80	1:4	16	64
Lower ½ of inlet to L. Winona	8	91.2	1:4	18.24	72.96
Farm Pond No.*1 150'x3'deep	0.4	6	1:4	1.2	4.8
" " " 13 20'x30' 2' deep	0.15	0.2	1:4	0.04	0.16
" " " 14 20'x3' deep	0.007	0.1	1:4	0.02	0.08
" " " 18 30'x5' deep	0.02	0.5	1:4	0.1	0.4
" " " 19 30'x5' deep	0.02	0.5	1:4	0.1	0.4
" " " 16 150'x90'x5 deep	0.3	7.5	1:4	1.5	6
" " " 15 250'x225'x8' deep	1.3	42	1:4	8.4	33.6
" " " 12 195'x120'x5' deep	0.5	12	1:4	2.4	9.6
Total	625.897	6,910		3,926.5	2,983.5

*Farm pond number based on Lake Winona Watershed map prepared by G. Sitter 2/23/72

Gilmore Creek Treatment

Area	C.F.S.	Gallons of mix	Ratio	Rotenone	Water
Tuesday September 18, 1973					
St. Mary's sheet piling dam to new Hwy 14	4.8	55	8:47	8	47
*New Hwy. 14 bridge to Boller L.	4.8	82.5	8:47	12	70.5
Wednesday September 19					
New Hwy. 14 bridge to Boller L.	4.8	132	8:47	19.2	112.8
Thursday September 20, 1973					
New Hwy. 14 bridge to Boller L.	4.8	66	8:47	9.6	56.4
Sub total		335.5		48.8	286.7

An additional 1.0 gallon of rotenone was used in back pack sprayers to treat spring seepage and stagnant water areas along the stream edge of Gilmore Creek from Boller Lake to the sheet piling barrier located on St. Mary's property. Total rotenone used on Gilmore Creek treatment was approximately 50 gallons.

Storm Sewer Treatment

22.55 miles of city storm sewers fed directly into the watershed. The storm sewers that came in above water were treated on Monday and those that came in below water were treated once on Tuesday and again on Thursday following treatment of the lake. A total of 98,000 gallons of rotenone-water mixture was pumped into the storm sewers using tank trucks with pre-mixed chemical and by flushing with hydrants and metering chemical into the flow with a backpack sprayer. The chemical was applied at a rate of one pint/1000 gallons water.

Fish Kill*

The fish kill was complete. No fish were taken in experimental gillnets set in Lake Winona and Boller's Lake after treatment. Dead fish were picked up by volunteers supervised by the "Save Lake Winona Committee". The kill consisted of the following species:

Species	Location	Pounds	Location	Pounds
	L. Winona		Boller's L.	
S.M. buffalo		134326		16187
Gizzard shad		52147		6284
Carp		34613		4171
Sheepshead		5805		699
Crappie spp.		4029		486
Bullhead spp.		3694		445
Channel catfish		1559		188
Sunfish spp.		1415		171
Northern pike		576		69
Bowfin		576		69
Walleye		432		52
L.M. bass		432		52
White bass		168		20
Yellow perch		96		12
TOTALS		239,868		28,905

In addition, the following fish were killed in Gilmore creek:

Brown trout	135 fgl., 10 adult
White sucker	100 fgl., 16 adult
Green sunfish	4
Northern pike	1 fgl.
Mudminnow	1

Water Temperatures

The water temperatures on September 12, 1973 ranged from 69-71°F. at all stations in the upper and lower lakes.

*No fish were found after treatment of the farm ponds.

FISH PICK UP

Robert Masyga, chairman of the clean-up committee for the Lake Winona project, reported that 239,868 pounds of fish were removed from Lake Winona as a result of the treatment of the lake with rotenone. Volunteers collected 191,160 pounds while city employees collected an additional 48,708 pounds during the final mid-week clean-up period. The actual poundage was undoubtably higher because many dead fish were not recovered (especially small gizzard shad). Fish were also collected by residents for use in their gardens.

An additional 28,905 pounds of fish were removed from Boller Lake. In this lake, which averages only 1.5 feet in depth, clean-up was not as complete as in Lake Winona because most of the shoreline was inaccessible to trucks.

Estimates of the total pounds of fish were made by measuring the box of a pick up truck, weighing the truck empty and loaded, thus determining the weight of a known volume of fish (1107 pounds per cubic yard). By keeping track of all loads hauled and by knowing the capacity of each truck it was possible to determine total poundage.

Trucks and end-loaders were provided by: City of Winona, Winona Excavating Co., Valentine Trucking Co., Dunn Blacktop, Elmer Mueller, and Modern Concrete.

After a natural winterkill in 1964, city crews removed 238,000 pounds of fish. This figure is remarkably close to the figure for 1973.

The following table is a breakdown of fish killed during the rotenone treatment of Lake Winona. The 1022-pound sample was made by the biology classes at Winona Senior High School and by the limnology class at Winona State University. Rough fish comprised 95.2% (by weight) of all fish collected.

Species Species	Number Collected	Total Weight (lbs.)	Average Wt. (lbs.)	% of total wt.
buffalo	820	566.5	.69	55.4%
gizzard shad	3,650	219.9	.06	21.5%
carp	58	146	1.07	14.2%
sheepshead	62	24.5	.4	2.4%
crappie	101	17	.17	1.6%
bullhead	84	15.6	.19	1.5%
channel catfish	16	6.6	.41	.65%
sunfish	86	6	.06	.59%
northern pike	1	2.5	2.5	.24%
dogfish	1	2.5	2.5	.24%
walleye	2	1.8	.9	.18%
large mouth bass	11	1.8	.35	.17%
white bass	2	.7	.04	.04%
TOTALS	4,842	1022	.21	100%

ESTIMATED TOTAL POUNDS OF FISH KILLED
DURING ROTENONE TREATMENT*

Species	Lake Winona	Boller Lake
Smallmouth Buffalo	134,326	16,187
Gizzard Shad	52,147	6,284
Carp	34,613	4,171
Sheepshead	5,805	699
Crappie spp.	4,029	486
Bullhead spp.	3,694	445
Channel Catfish	1,559	188
Sunfish spp.	1,415	171
Northern Pike	576	69
Bowfin	576	69
Walleye	432	52
L.M. Bass	432	52
White Bass	168	20
Yellow Perch	96	12
TOTALS	239,868	28,905

*In addition, the following fish were killed in Gilmore Creek:

Brown Trout	135	fingerling, 10 adult
White Sucker	100	fingerling, 16 adult
Green Sunfish	4	
Northern Pike	1	fingerling
Mudminnow	1	

FIELD OBSERVATIONS

The following selected observations have been included because they may give the reader insight into early problems and phenomena associated with the rehabilitation project. Unless otherwise indicated, the observations were made by Calvin R. Fremling who has maintained a log concerning the project from 1973 to the present.

September 8, 1973. We realized recently that if our compressors should malfunction or be shut down for any reason during the winter, lake water would enter our air lines and freeze. There would be no way to clear the lines and the compressors would be rendered inoperational until the following spring. Today, Charlie and Billy Olson (Olson Plumbing) and I replaced the shoreline segments of all 6 air lines. We waded into the water and cut out the segment of air hose which ran from a depth of 4 feet to the shore. The segment was then replaced by a length of steel pipe which had a one-way valve at the off-shore end. The valve will prevent water from entering the freeze zone if the compressors are turned off. The work went well and only took about 5 hours in spite of a constant drizzle and the fact that the water was too deep for chest waders, thus forcing us to work in swimming suits.

January 23, 1974. The two aerators on the East end of the lower lake were activated on January 14 and each has cut a hole about 200 feet in diameter. The aerators at the bathing beach have not been turned on because they would destroy the skating rink. The compressor in the upper lake has not been activated because it has an oil leak.

We are having problems with the electric weir at Mankato Avenue. The weir does not seem to be drawing enough amps. We thought that when the aerators were turned on they would muddy the water, thus increasing its conductivity. The change, if any, has not been noticeable. The outlet of the culvert has been dammed with 4" x 4" planks to raise the water level over the weir. This has not helped either.

March 1, 1974. The compressor in the upper lake has been repaired, installed by volunteers and turned on today. It had previously been removed from its housing to Stanley Spooner's Heat Treating Company to await repair by the company which sold it to us. Because the compressor weighed several hundred pounds and because the snow was over one foot deep, the project was accomplished with difficulty.

May 2, 1974. I received word today that the dam at Boller Lake had been opened at the bottom by residents around Boller Lake whose gardens had been flooded by high water in Boller Lake and that carp had been seen below the dam. Subsequent investigation revealed that area residents had not opened the gate, but that it had been opened by a city crew who opened the dam at the bottom although they had been asked to remove only one plank from the top of the gate. This evening Bob Bollant and I closed the gate. We saw several carp in County Ditch No. 3. This is a terible turn of events because it confirms the reports that we have been hearing of carp being seen in County Ditch No. 3.

May 3, 1974. I checked the dam at Boller Lake early this morning on the way to my two-day ecology field trip. Eight carp were stranded in the pool below the dam. I speared them and notified my son, Mark, who speared 38 more while I was gone on my field trip. There can be no doubt that carp have entered Boller Lake because the dam was opened at the bottom.

June 7, 1974. Chironomid midges have been hovering in columnar clouds along Highway 61 and along the service road at the base of the bluff. A plankton haul from Lake Winona is full of midge pupal exuviae and Cladoceran ephippia. The midges must have completed a generation since last fall's rotenone treatment.

June 18, 1974. Dick Sternberg (Minnesota DNR) and his crew scanned Upper Lake Winona visually fromtheir boat yesterday and saw three large schools of young largemouth bass. Sternberg said that one of the schools was the largest he had ever seen and must have contained at least 50,000 young. They also saw one school of smallmouth bass. No carp were seen. They reported that the electric weir was off. Today they saw 14 schools of largemouth bass and 5 schools of smallmouth bass in Upper Lake Winona. Upper Lake Winona is clearer than Lower Lake Winona. My crew of students trap-netted sunfish today which were full of eggs. They have obviously not begun spawning heavily.

June 23, 1974. Using swim mask, snorkel and fins I swam along the outer edge of the weed bed in Upper Lake Winona from the boat ramp at Dakota Street to the high school, and along Highway 61 to the delta formed by cemetery run-off. Two adult smallmouth bass were seen between the ramp and the high school. Each adult guarded a school of young about 3/4" long. The shoreline along Highway 61 is very rocky and contains many sunfish beds. There were at least 50 beds in one cluster. It is unlikely that the sunfish were spawning, however, because they were easily chased from their nests. No eggs were seen in the nests. Perhaps spawning has been retarded by the lake being kept cooler by circulation from the aerators. One adult smallmouth bass was seen in the same area and it was protecting a medium-sized school of young. The most common weed is Potamogeton crispus and it is festooned with snails.

June 25, 1974. Using SCUBA I swam in Upper Lake Winona from the boat launch at Dakota Street to Huff Street. Weeds are very evident along shore to a depth of about 8 feet. Saw no crayfish. Cuts made in the clay during the dredging of the 1950's were still very obvious. The water was clear and the visibility was about 8 feet at depths of 6-8 feet. Clouds of zooplankton (copepods?) hovered along the bottom at the interface of warm and cold water at about 8' of depth. There was an extensive bluegill spawning bed about 50' east of the launch site in about 7' of depth. Large males were in the area but I saw no eggs in the nests. I found 5 live Anodonta marginata (?) clams. They were large, thin-shelled and lacked an umbone. Obviously, the clams escaped the rotenone treatment. An Aphanezomenon algae bloom has become very noticeable. Tubificid tubes are abundant all over the bottom at depths to 10'.

June 26, 1974. John Drazkowski, a resident on Boller Lake, reported that he saw 9 or 10 carp spawning in one school yesterday. Robert Bollant said the dam at the outlet of Lake Winona was opened yesterday and that the electric weir was on. The river is dropping rapidly. The gate at Boller Lake will be opened on Monday. Gene Sweazey, Winona Rod and Gun Club, said that his crew would have the carp trap ready. Boller Lake is still very muddy from Thursday's devastating storm. Drazkowski reported carp spawning again today.

July 9, 1974. Gene Sweazey reported that two more carp were removed from the carp trap and that they were spawned out. Boller Lake has a thick mat of faded filamentous algae on it. John Hingeveld collected a 9" northern from Boller Lake. Scale analysis verified that it was this year's fish.

July 11, 1974. Three carp were removed from the carp trap at Boller Lake. One female was full of ripe eggs and could be easily stripped. The other female was about half full of semi-ripe eggs. Milt could be squeezed from the male with difficulty.

July 19, 1974. The city crew has installed a fan in the compressor room of Lake Park Lodge to keep the compressor unit from overheating. We have solved the compressor noise problem by installing Cadillac mufflers backwards on the air intakes of all three compressors. Charles Lanik of the university maintenance staff was the originator of the idea. Prior to this time, residents living near the compressors have complained about noise. Various other noise abatement procedures have been attempted, but all failed. The noise problem at Lake Park Lodge was especially bad but it was due to a compressor pipe touching the concrete wall, this setting up forced vibrations. City maintenance man (Nick Swing) has been supplied with a log, clipboard and pencil for each compressor so that he can keep track of running time, repairs, etc. Lifeguards have been instructed by Bob Welch to rake weeds out of the water near the beach.

September 17, 1974. The compressor on Upper Lake Winona quit yesterday. George Jessen said a coil was burned out. The coils come from Germany and are hard to get. Lightning probably did it. Bob Welch will have lightning arrestors installed on all compressors. The city will plant trees to screen compressors so that they will look better and so they will be shaded and thus run cooler. The plastic hose leading from the compressors keeps rupturing. The city will replace all sub-soil hose with steel pipe. The plastic hoses cannot stand the heat which is not disappated in dry soil. All compressor housing have had their roofs painted with silver paint to reflect sunlight so that the compressors will not overheat.

March 12, 1975. John Wu reported that the dissolved oxygen level just under the ice in Upper Lake Winona was only 5 ppm on March 2. I immediately called Bob Welch and asked that the aerators be turned on. John had not told me of the low D.O. level before because he thought that the city was going to turn the aerators on that week. The city had not turned them on because the J.C.'s wanted to lay out their speed boat course on the ice. Bob Welch notified the paper and radio stations and they notified the public that the units would be turned on in the upper lake and in the east end of the lower lake on the morning of March 13. Those units adjacent to the skating rink have not been turned on yet because skating is still in progress due to unusually cold weather.

On the afternoon of March 12, John Wu tested the D.O. under the ice in Upper Lake Winona and found it to be 3 ppm. The lower lake still had 8 ppm. When the aerators were turned on in upper lake there was no smell of hydrogen sulfide. The aerators at the beach were activated on March 17.

March 17, 1975. A student reported seeing small buffalo fish dying at Huff Street culvert. This was a scare, but the fish turned out to be young of the year gizzard shad. Some are still alive and swimming sluggishly. Those dead have small red blotches (indicating capillary fragility) on their abdomens. Dr. Fred Meyer of the LaCrosse Fish Control Laboratory later told me that the shad probably died from Aeromonas liquefaceans, bacterial infection. This happens frequently to shad at this latitude because their resistance becomes lowered during the prolonged cold of winter.

March 30, 1975. Brian Humphries and others dived through an aerator hole on upper lake and had about 5 ft. visibility. He said they saw dead fish "everywhere", but by his descriptions they all seemed to be gizzard shad. He saw no dead northerns. They did not see any live fish of any kind.

April 22, 1975. Lake Winona has had over 100 herring gulls and over 100 diving ducks on it for the past week. Most of the ducks are red-breasted mergansers, although some scaup, grebes, canvasbacks, mallards, coots, and one loon have been seen.

The red breasted mergansers are diving to the bottom and are pecking up dead gizzard shad which died during the winter. The gulls circle overhead and dive down upon the mergansers and try to rob them of their fish.

Dr. Fred Meyer says that this winter was especially hard on gizzard shad because of heavy snow cover and long winter. This stress makes them very susceptible to the bacterium Aeromonas liquefaciens and this bacterium kills them. Fred says that crappies are also very sensitive. Sunfish and bass are fairly sensitive but northern pike are resistant.

The mergansers may be eating live gizzard shad, too. A report "Life History of Gizzard Shad in Elephant Butte Lake (Arizona)" says that one merganser had 36 2-inch shad in its gullet and remains of 87 others in its stomach.

May 21, 1975. I met with George Jessen and 3 members of the Street Crew at Mankato Avenue at 7:15 A.M. The differential between the river and the lake is about 6 inches. George turned on the weir and two men raised the metal gates, one at a time. This is a very critical time because the 20-amp circuit breaker (there is only one) kicks out after about 15 minutes if the weir is turned on when gates are down (either because silt accumulates on the electrodes or because the metal gates are within the field of the electrodes - it is probably a combination of the two factors). If the weir were turned on, and if the gates were only partially raised, and if the workers then rested or something mechanical went wrong, the weir would short out and fish could get through the gates before the circuit breaker had cooled sufficiently to kick in again.

There are two lights on a pole to indicate if the weir is working. One light is a back up. If both lights are out the weir is not working. If the circuit breaker cuts out, the weir goes out in both culverts. The total amps drawn at first were about 18, I think, but that dropped to about 15 after one-half hour.

The first water that gushed out when the gate was opened was black, but turned clear within minutes. Within 3 hrs. about 300 carp had accumulated below the gate. I saw none try to enter. They swam to within a foot of the gate and then turned back. Jessen said he saw two try to jump into the weir and hit the concrete wall but they were not injured.

May 23, 1975. George Jessen reports that the electric weir still keeps kicking out and that there must be something lying across the electrodes. I met with George's crew at the weir at 9 A.M. and turned the weir off. Using an extension cord and trouble light I went down a man hole into the culvert. To my surprise the culvert was not 6 feet deep as shown in engineering drawings. It had filled with sand over the years up to the level of the ledge upon which the electrodes are fastened. The culvert is thus effectively only about 3 feet deep and I had to crawl on my hands and knees for about 40 feet to get to the electrodes. Crawling was very difficult because the ceiling of the culvert was studded with the ends of nails used during construction of the culvert. Because the extension cord was not long enough, the trouble light had to be turned off to add another extension on George's end. The culvert was even "creepier" in the dark. I yelled up to George to ask if he was sure that the weir was off and that there were no kids standing near the switch box. He reassured me, the light went on, and I carwled the rest of the way to the electrodes. A tree branch was lying across them and the spaces between the electrodes contained a child's metal tractor, a piece of wire and several flip tops from beer cans. A long glob of filamentous algae had also accumulated on a bolt that holds the electrode wire in place. In future construction there should be no such rough objects protruding. After all debris was removed, a similar trip was made into the second culvert and similar items were removed. The weir then seemed to function normally.

Boys had been snorkeling in County Ditch No. 4 in the crystal clear water just below the electric weir. One of them told me that he could feel a tingle if he reached in through the protective iron barrier and put his finger into the water within the culvert. I tried it and the tingle was very obvious. This made me surer than ever that the reason for the weir cutting out every time the gate is lowered is because the metal gate enters the electric field of the weir.

I discussed the rough fish problem with the same boy and he told me that if fish got through the weir they could get through the metal grating on the upper end of the culvert by swimming through a hole beneath the grating.

I inspected the grating and he was right! Over the years the approach to the culvert, and the culvert itself, have filled to a depth of 3 feet with sand. Thus, each time the metal grating was removed and replaced, it was higher above the concrete base that it should have been resting upon. This can be seen by the upward progression of lag bolt holes in the wall of the culvert. When the grating plugs with weeds, water rushes beneath the grating and digs a hole. This explains how rough fish entered the lake when the electric weir malfunctioned. If only we had known then what we know now!

May 24, 1975. The trap at Boller Lake contained about 20 very large carp (one female with eggs weighed 17 lbs.). Bob Masyga and Gene Sweazey removed them and I butchered some. Those which were about 6 lbs. (males and females) had white flesh instead of red and they were in excellent condition (hump behind head, etc.). The largest fish had red flesh. I saved scale samples. I think these carp came downstream from Boller Lake to escape the dropping H_2O. The trap also had a couple of northerns and it is very unlikely they would have run upstream at this time of year. Dropping Boller Lake at this time (just before spawning) seems like a good idea.

May 28, 1975. Today I swam, with SCUBA gear, from the Dakota Street boat landing on the upper lake to Huff Street and back. The bottom drops off rather sharply along this zone and I swam toward Huff Street at a depth of about 10 feet and back toward Dakota Street right along the edge of the weeds at a depth of about 6 feet.

The weed beds are composed of Potamogeton crispus. I do not recall seeing another species. The bottom is covered with a faded algal mat at a depth of about 8 feet in most areas. One such patch contained many Hydra.

The thermocline was very obvious and could be felt at a depth of about 10 feet. The termocline water was more turbid than that of the epilimnion and was cloudy with zooplankton (copepods?). The zooplankton was especially abundant where the upper edge of the thermocline met the lake bottom (I observed this last year, too). I saw no fish in the thermocline, but they were very aboundant above it.

I cannot recall a freshwater environment where I saw more numbers and species of fish. Yearling bluegill sunfish and yearling largemouth bass were extremely abundant. Only one adult sunfish (a gravid female) and 9 one-pound largemouth bass were seen. A 3-lb. smallmouth bass was seen hovering over a white bicycle frame which was lying atop a pile of rocks just east of the boat landing. The bass patroled the area and was guarding a school of ¼-inch fry. They were obviously smallmouth bass fry and there were about 150 in the school. The bass was still in the same spot when I made my return trip.

I was surprised to see about 50 yearling black crappies singly or in groups of 2 or 3 along the edge of the weeds.

There was no evidence that sunfish were preparing to spawn. A large bed just out from the boat landing had no nests even though they were abundant there last year.

Perch and walleyes were very abundant. The walleyes and perch were about the same size (7"-9") and were usually seen schooling together. One one instance, a school of walleyes traveled without perch.

I was startled in the bend at Huff Street to see a large black object moving just at the edge of my visibility (about 12 feet). It swam about one-half way between the surface and the bottom and retreated as fast as I approached. I finally got close enough so that the object "fragmented" and was seen to be a dense school of about 200 6 - inch black bullheads. One smaller school was seen along the edge of the weeds on the return trip. Five one-pound northern pike were observed, but no smaller ones were seen. Crayfish were very abundant in all areas where there were shelters for them. Every rock had from one to five crayfish under it and they could be easily caught by hand. At least half of those captured had eggs hanging from their swimmerets. One rock sheltered 5 gravid females. The most

heavily populated area was at the boat landing where there was a lot of junk on the bottom. A vein of clay could be observed at a depth of about 7 or 8 feet all along the shoreline and it was used by the crayfish for digging burrows. By gliding very quietly along the clay vein, I could easily see the crayfish antennae poking out of the burrows ahead of me. They were quickly retracted, however, as soon as I was observed. The crayfish seem to clear the P. crispus from around their shelters. Perhaps weed control could begin by making crayfish shelters within the weed beds. Smallmouth bass structures could be easily constructed also.

May 30, 1975. Using SCUBA gear, I swam from the Huff Street culvert eastward along the south shore of the lower lake for about 3/4 mile. Visibility was about 4 feet and swimming was limited mainly to a depth of about 6 feet where the gravel bottom intersected an ooze bottom. The only macrophyte observed was Potamogeton crispus and it occurred in all firm bottoms. Ooze bottoms were virtually devoid of vegetation.

During the first 1/4 mile, only one fish was seen and it was a 7" bluegill which was hovering in the open mouth of a 5-gallon bucket which protruded out of the bottom for about 8 inches. The fish may have been planning to use it as a nest site. During the rest of the trip many 5" largemouth bass were seen in schools. One bluegill nesting area was seen. It contained about 20 nests and it lay in 6' of water on a sand bottom about one-half way down the south shore. The nests were not defended and only one male was seen. No eggs were observed in the nests. One 3-lb. largemouth bass was seen on a nest about 25 yds. down the shore from the bluegills. No eggs or young were seen. Only one crayfish was seen. There is no habitat (rock, clay, junk, etc.) for them.

June 2, 1975. Using SCUBA I swam from the Dakota Street boat ramp to the inlet of County Ditch No. 3 and back. The thermocline was very pronounced at about 8 feet. Phytoplankton has become quite abundant and pale green, irregular masses of algae (species?) were very visible. The predominant rooted aquatic was Potamogeton crispus.

The most predominant fish were yearling largemouth bass. They were always in sight as I cruised along the outer edge of the weed line. In two instances I encountered schools of yearlings which contained at least 100 individuals per school. One adult bass (about 3 lbs.) was seen. No large sunfish were seen, although yearlings and 4-inch sunfish were common. Yearling black crappies were commonly seen (about one black crappie per 100 sunfish). Only one smallmouth bass was seen and it was a yearling.

Five 1½ - 2 lb. northern pike were observed, but there may have been many more. Northerns are very difficult to approach; and at least 10 times I saw a dust plume and waving vegetation indicating that a large fish had been spooked. In one instance I saw the fish and it was definitely a northern pike.

Walleyes and perch were commonly seen. The walleyes often pursued crayfish which had been dislodged when I turned over rocks. Although the walleyes (8-9 inches long) followed the crayfish intently, they did not bite at them. Mixed schools of bass, perch and walleyes were seen. Perch and walleyes remained on the bottom while the bass schooled above them. Snails were very abundant and they were common in all habitats above the thermocline.

Crayfish were very abundant in areas where there was sufficient habitat (rock, rusted beer cans, broken bottles, etc.) or along a vein of clay where they were able to dig burrows. Many crayfish were seen about 3/4 of the way out of their burrows or hiding places. It was apparent in all instances that weeds did not grow where there were crayfish. This may be because crayfish are most abundant on firm substrates and weeds do not do well on firm substrates or because the crayfish destroy the weeds. In any event, it seems that weed beds might be controlled by dumping in rock or other debris to provide adequate substrate. The female crayfish were still carrying eggs.

No active sunfish beds were seen. One bed from last year was seen on the outer edge of the weeds in 6 feet of water. The bed contained about 15 unused nests. To my surprise, many dead gizzard shad were seen lying on the bottom in cold zones. They were white, soapy in appearance, and easily fragmented. They must be left from the kill of shad which took place last winter. I thought that they would have disintegrated long ago.

June 25, 1975

At 4:30 P.M. I went diving at the Dakota Street landing and found about 20 bluegill nests with males guarding them. Visibility was only about 5 feet because of phytoplankton clumps (species?). Crayfish were very abundant and I easily caught about 25 with my hands. Again, they seem to limit aquatic plant growth if rocks and debris are present.

Each storm sewer outlet was apparent because of the plume of leaves and seeds which covered the bottom of the lake. The vegetable matter was covered by a thin, fragile, white film which I first thought to be dying algae, but I think that it must have been a fungus. It fragmented at the slightest touch. The first ½ inch of organic ooze and detritus beneath the white film was brown and apparently oxidized, but deeper sediment was coal black, indicating anaerobic conditions.

July 23, 1975. Using SCUBA at 4:30 P.M. I left the tip of the point nearest the circular drive in the City Park at the east end of the lower lake. I swam at about the 15-ft. contour and proceeded eastward toward Mankato Avenue, around the bay to the east end boat launch and back to my starting point. Visibility was about 12 ft. in most areas except where there were clouds of zooplankton. Water temperature was very uniform and I felt no differences even though I used no wet suit.

Dredge cuts were still visible after 20 years. Vertical clay "cliffs" as high as four feet were visible around most of the perimeter. The clay outcrops were studded with holes that I assumed were made by crayfish. No crayfish were observed anywhere, however. I did not tear any of the "cliff dwellings" apart to check for crayfish. I expected to see antennae protruding from them as I had during dives in the upper lake, but saw none. As I cruised along a very prominent clay cliff, I noticed that some of the crayfish burrows seemed to be unusually large and round; and just at the limit of my visibility I thought that I saw a smallbullhead dart into one of them as I approached. I swam to the hole, reached in about a foot and felt the fish. I grasped it firmly, pulled it out of the burrow, and examined it carefully. I was surprised to see that it was one of our "long lost" channel catfish. They were stocked into the lake as fry in the spring of 1974 and were never seen again. The fish was about 8 inches long and was in very good condition.

I found 6 picnic tables resting on the bottom at intervals along my route. Each served as a fish attractor and beneath one, at depth of about 15 feet, I saw a 10-12 lb. carp which did not leave as I approached. As I held on to the metal leg of the table and observed the fish, it swam within two feet of me. We studied each other for 15-20 seconds before it swam away. Unfortunately, I had no spear with me. The same table had a school of sunfish fry milling about it. I was surprised to see them at such a depth.

I saw one large school of 8-inch perch which contained one 9-inch walleye. Smallmouth and largemouth bass were common. Most were 5-8 inches long but I observed two largemouths which were 3-4 pounds. The larger of the two was seen at a depth of about 18 feet.

Two one-pound bullheads were seen nesting in about 10 feet of water. One refused to leave the nest site and I was able to grasp the fish several times with my hand. Each time I did so, however, the fish squirmed away. At the same time that I was trying to catch the first fish, the second swam around me and bumped me repeatedly with its head.

About 10 male bluegills were guarding nests in a flat gravel area near the park in 5 feet of water. Sunfish were not seen frequently. In fact, more bass were seen than sunfish. One 6-inch black crappie was observed.

A dense layer of zooplankton (copepods) exists at a depth of 1 to 4 feet. They are probably responsible for the lake's clarity because they have controlled the algae. The copepod

abundance is due, in turn, to the relative scarcity of small fish, which is due to the super abundance of predators.

Aquatic weeds were very scarce. The bottom ooze was brown instead of black. Tubificid tubes were abundant over the entire bottom. Items found - one swim fin, one diving mask, two golf clubs, an ice chisel and 6 picnic tables.

September 1, 1976. Stan Spooner, Mark Fremling and I inspected the west aerator on the Upper Lake. It was bobbing vertically at the surface with about 4 inches protruding above the water and spouting a small volume of water. We feared that the anchor had broken loose but diving revealed that it was packed with weeds and that trapped air had buoyed it to the surface. By free diving without SCUBA, the hard-packed weeds were pulled out from the lower end; the aerator sank and functioned normally.

We also repaired one air hose at the swimming beach. It had apparently been cut accidentally during the discing operation done by city employees. Even after repair, the aerator did not function fully. Further checking revealed that the east air line at the beach was also leaking under the sand. It had apparently been cut also. We left it unrepaired because of darkness and will notify Bruce Reed tomorrow to see if his crew can fix it.

September 5, 1976. The west aerator in the upper lake was floating again. Using SCUBA I found it plugged with weeds. This time I dislodged the weeds, followed the aerator to the bottom when it sank, and then gave it a thorough cleaning. I could not see anything, but was able to find the 3-foot deep hole in the lake bottom where the aerator was supposed to be, and I pulled it into place. I then gathered all weeds from a 10-foot circle around the aerator and ran them up through the aerator to get rid of them.

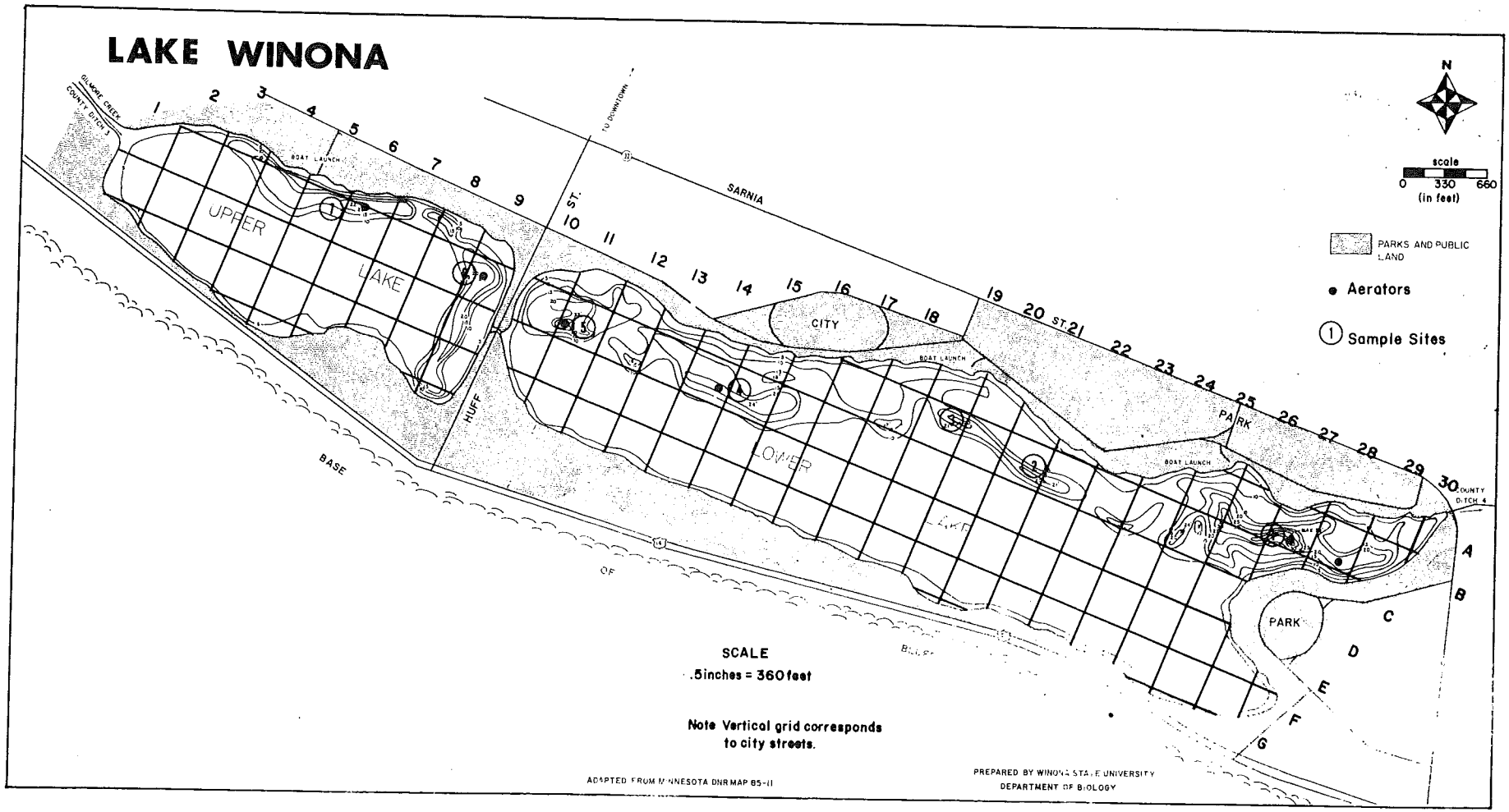
September 18, 1976. The aerator line just east of Huff Street has had a leak in it about 50 feet from the Helixor unit for most of the summer. A plume of bubbles rises continually from the leak, but no plume comes from the Helixor. Today, at 8 A.M. Jack Hickethier, Mark Fremling and I anchored near the leak and Jack and I used SCUBA and wet suits to swim to the leak. After we had time to get situated, Mark shut off the compressor at the beach house and we used a hack saw to saw out a 2-foot section of air hose which contained a crack adjacent to a coupling. We then inserted a new pre-cut section of hose which had a coupling mounted in either end. Stan Spooner had previously lathed off some of the ridges on the free ends of the couplings so that they could be inserted more easily. As added insurance, the ends of the coupling were lubricated with waterproof grease. The pre-cut section was inserted quite easily but it was very difficult to hold in place while the hose clamps were tightened. The waterproof grease also lubricated the handle of the screwdriver. Communication between the divers was limited to hand contact because visibility was zero in 10 feet of water. At the surface, the fog was so thick that the divers had to shout to Mark on shore to locate themselves. Although SCUBA techniques worked fairly well, it may have been easier to hoist the leaking section of line over a pontoon boat for repair.

Even after the leak was repaired the Helixor failed to function and it was evident that there had been enough air pressure to operate the leak at a depth of 10 feet but not enough pressure to operate the Helixor at 22 feet.

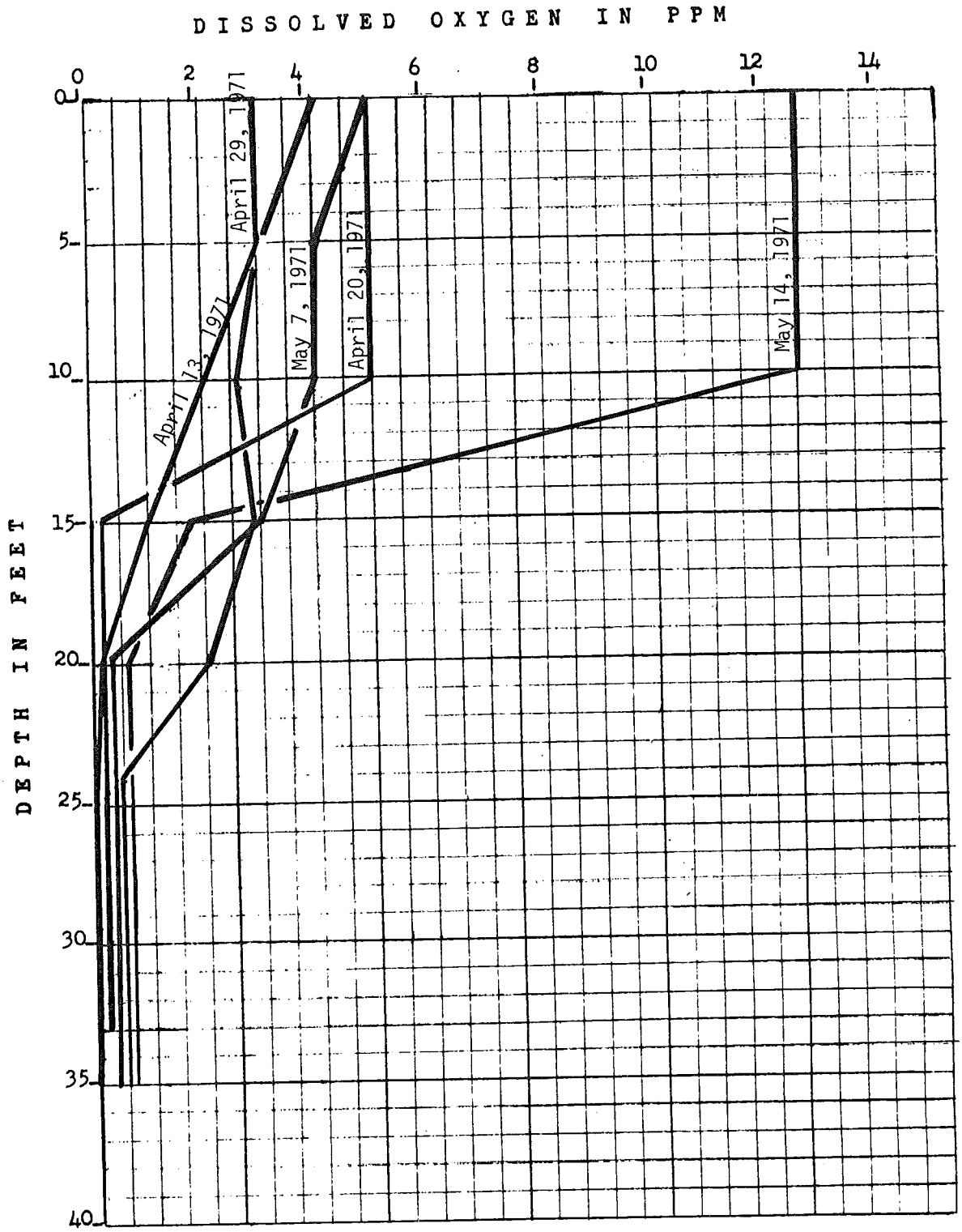
By shutting the balancing valves at the compressor one at a time we learned that the east hose was intact but that all air from the west hose was being lost under the beach.

The aerator nearest the high school was floating today. I cleaned it and sank it by tying another anchor near it on the air line. It should now operate normally.

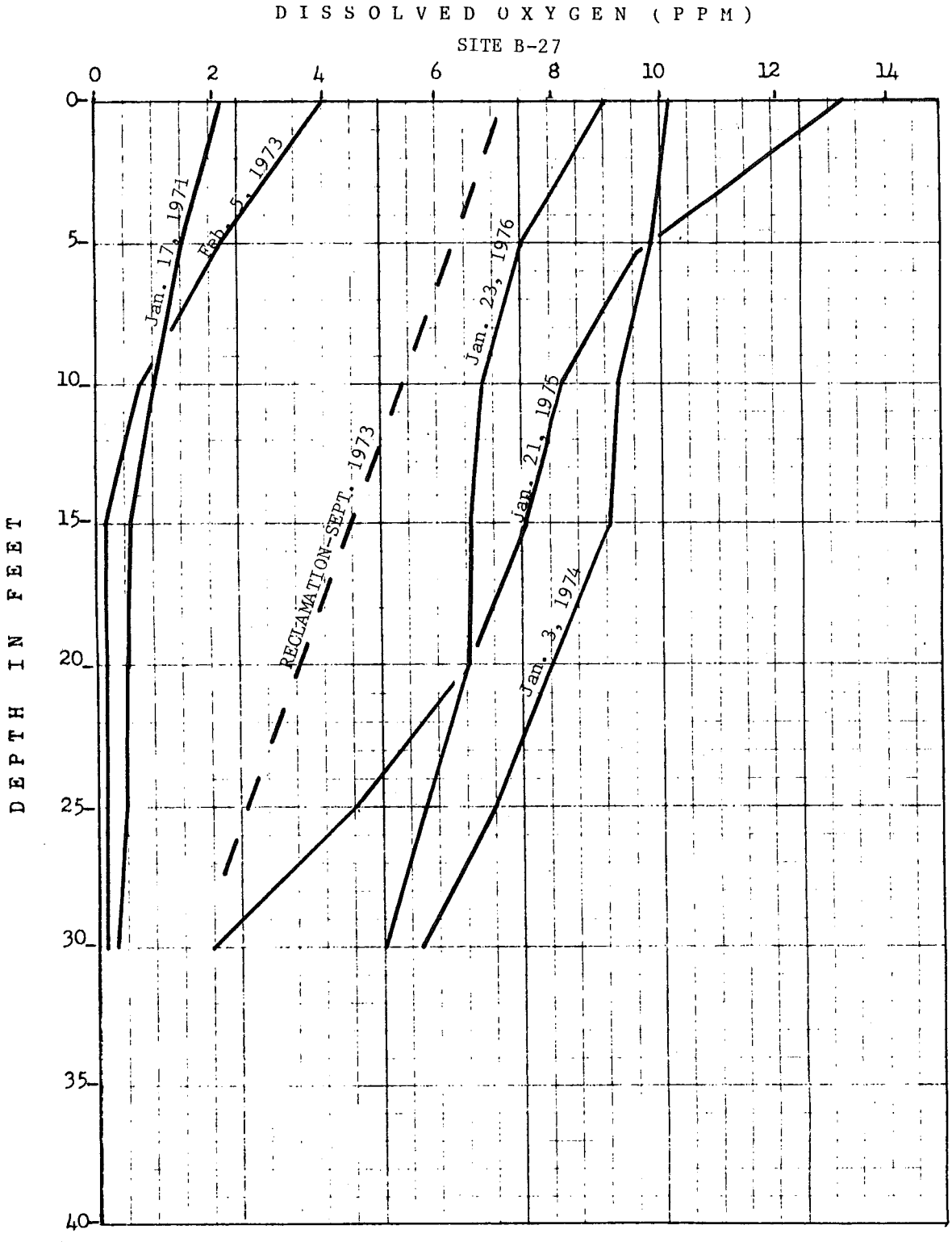
September 24, 1976. A park maintenance crew used a back hoe to dig up the air hose near the compressor this week. After considerable searching we found the leak beneath a large flat piece of old sidewalk where the hose had been laid through demolition fill. The hose was in dry sand at the point of the leak, and the failure of the dry band to absorb heat had caused the air hose to soften. Continual vibration and the weight of the rock caused it to split. The escaping air did not blast a hole in the sand because the flat rock dispersed the air. About 20 feet of hose was replaced with pipe. We should have used steel pipe in the first place for all on-shore work, but we lacked sufficient funds.

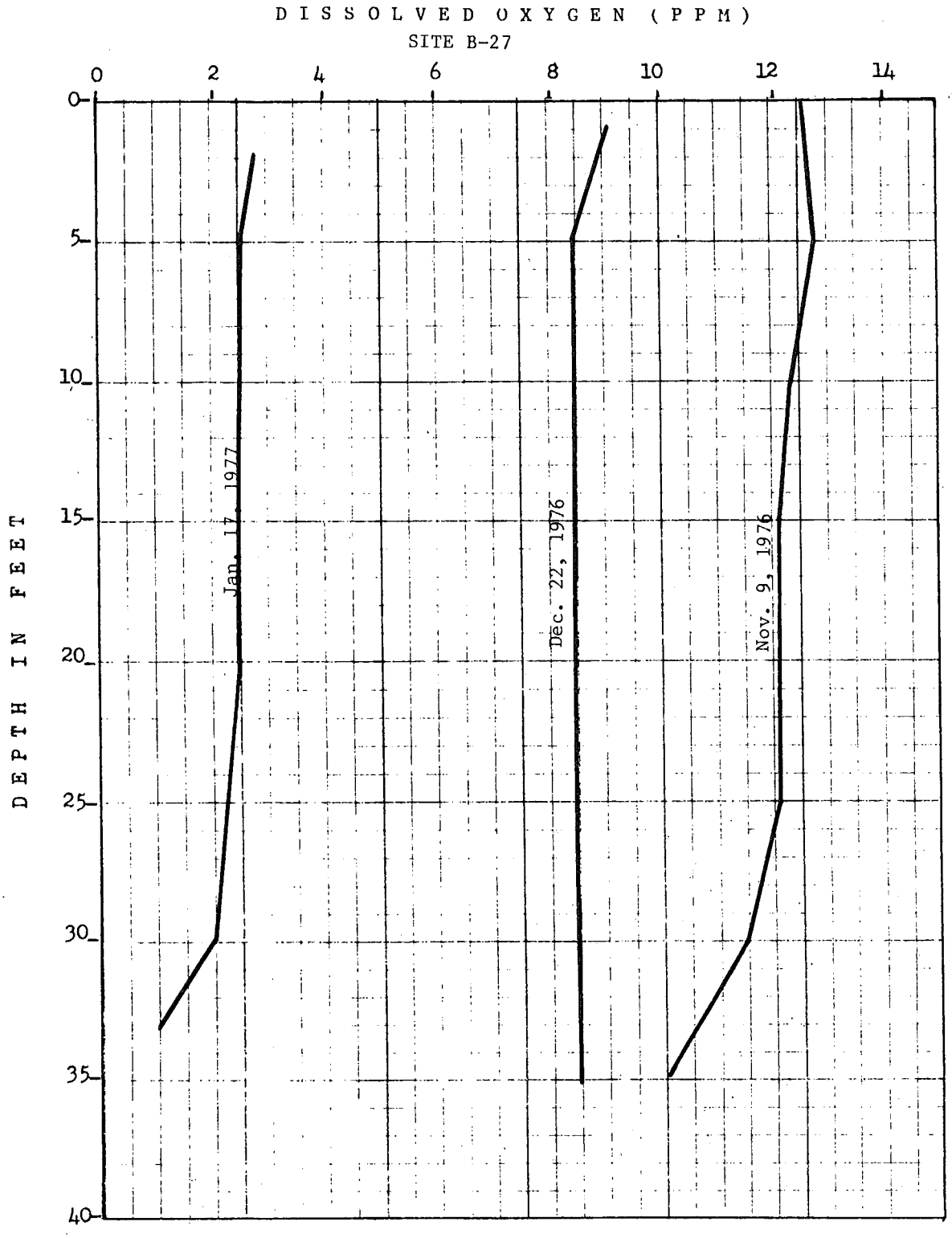

LAKE WINONA
GILMORE CREEK
COUNTY DITCH 3
BOAT LAUNCH
UPPER
LAKE
HUFF
TO DOWNTOWN
SARNIA
ST.
CITY
BOAT LAUNCH
PARK
BOAT LAUNCH
COUNTY DITCH 4
LOWER
LAKE
BASE
OF
BLUFF
PARK
A
B
C
D
E
F
G
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
N
scale
0 330 660
(in feet)
PARKS AND PUBLIC LAND
Aerators
1 Sample Sites
SCALE
.5inches = 360feet
Note Vertical grid corresponds to city streets.
ADAPTED FROM MINNESOTA DNR MAP 85-11
PREPARED BY WINONA STATE UNIVERSITY
DEPARTMENT OF BIOLOGY

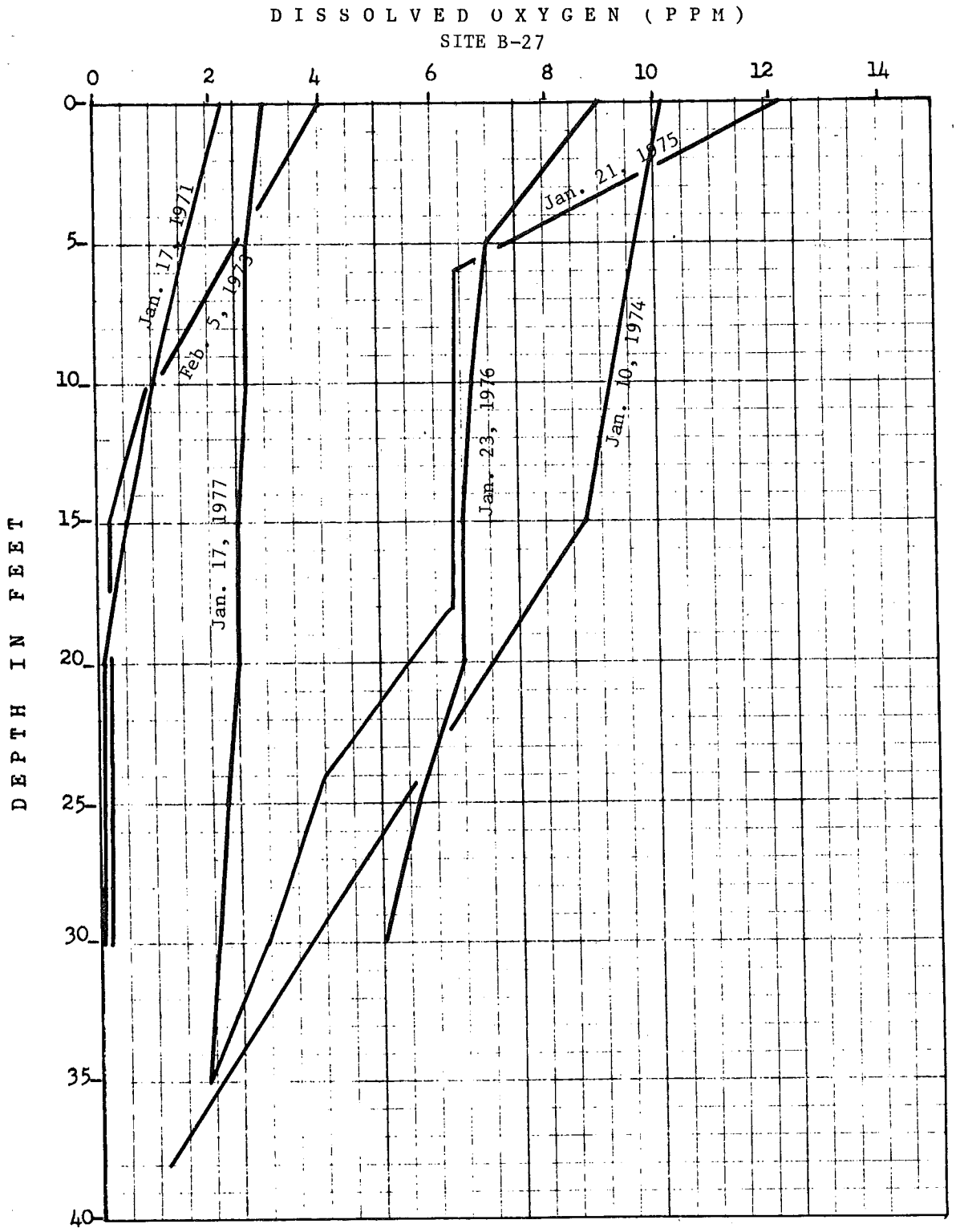
SPRING D.O. CONCENTRATIONS BEFORE RECLAMATION, SITE B-26

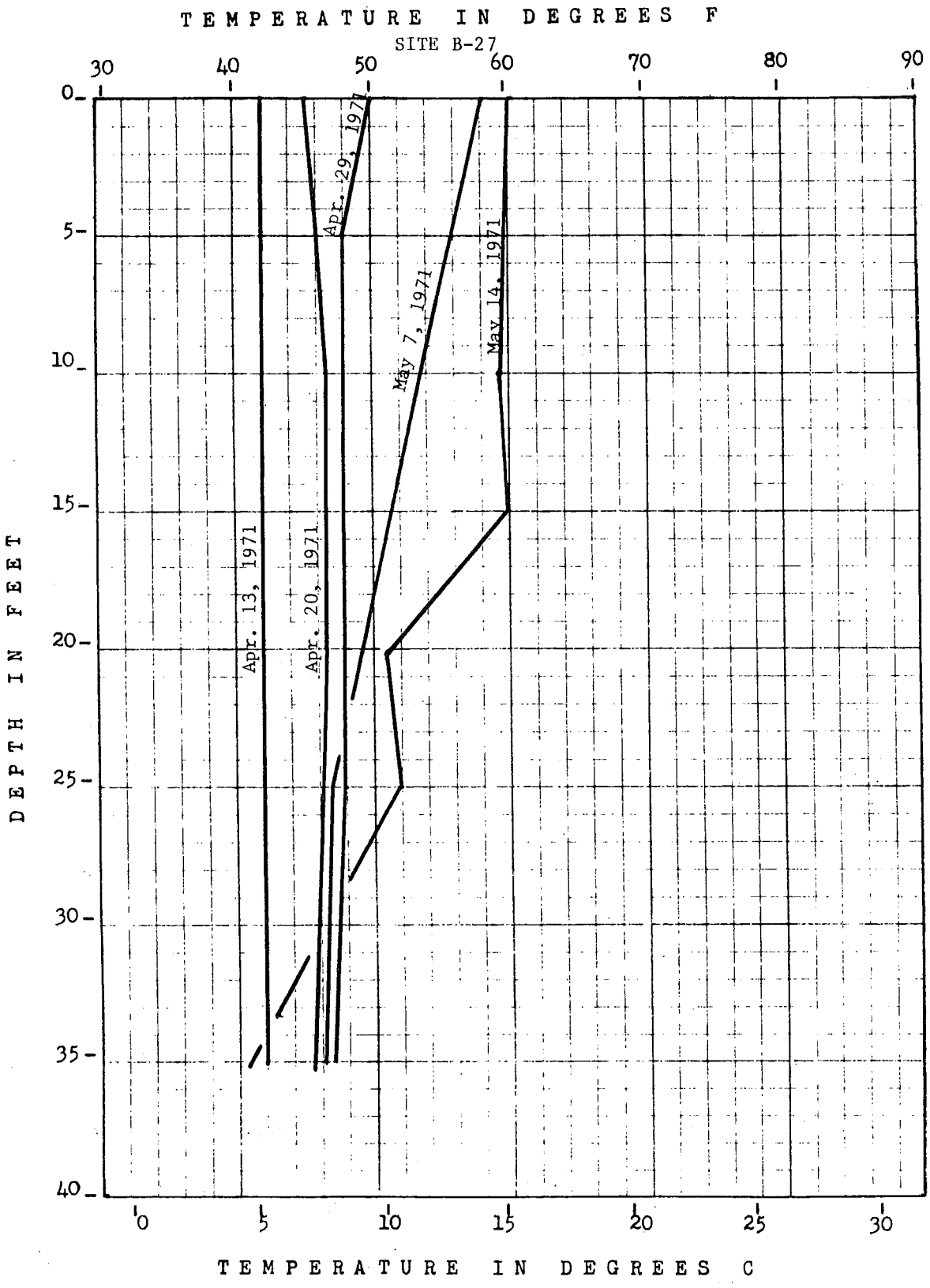


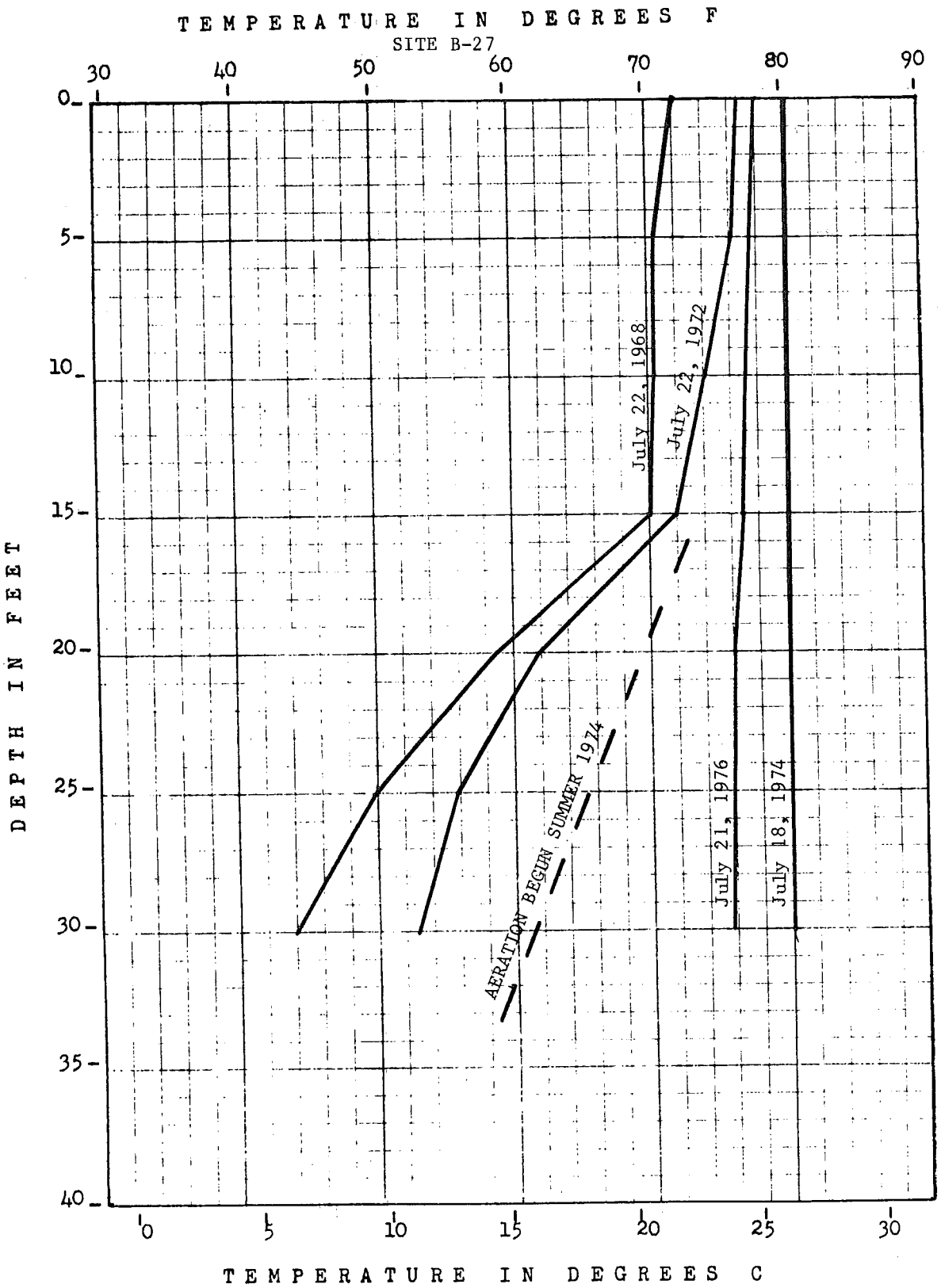
Appendix 8-2


DISSOLVED OXYGEN (PPM)
SITE B-27
0
2
4
6
8
10
12
14
0
5
10
15
20
25
30
35
40
DEPTH IN FEET
Jan. 17, 1971
Feb. 5, 1973
RECLAMATION-SEPT. 1973
Jan. 23, 1976
Jan. 21, 1975
Jan. 3, 1974

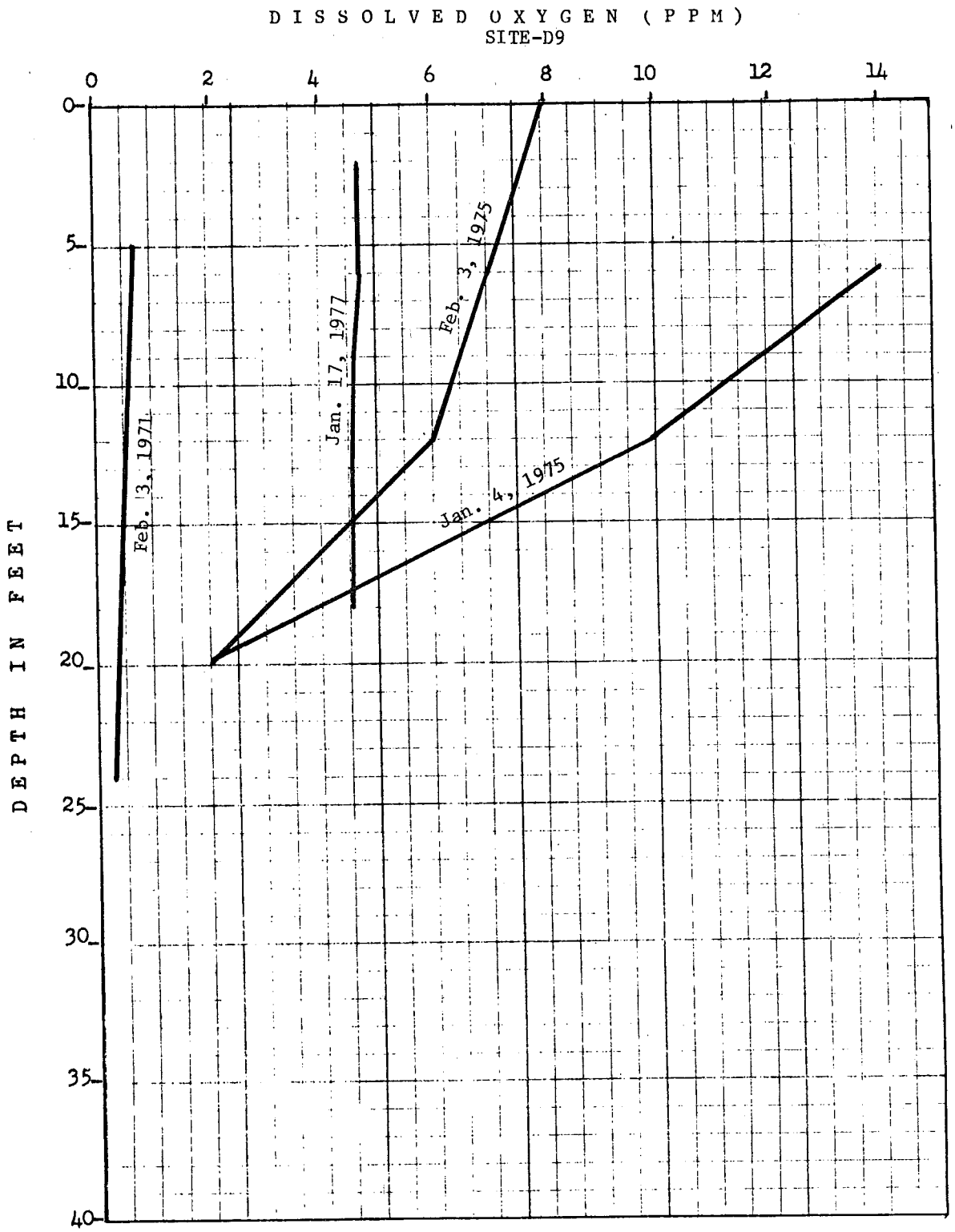

DISSOLVED OXYGEN (PPM)
SITE B-27
0
2
4
6
8
10
12
14
0
5
10
15
20
25
30
35
40
DEPTH IN FEET
Jan. 17, 1977
Dec. 22, 1976
Nov. 9, 1976


DISSOLVED OXYGEN (PPM)
SITE B-27
0
2
4
6
8
10
12
14
0
5
10
15
20
25
30
35
40
DEPTH IN FEET
Jan. 17, 1971
Feb. 5, 1973
Jan. 17, 1977
Jan. 23, 1976
Jan. 21, 1975
Jan. 10, 1974


TEMPERATURE IN DEGREES F
SITE B-27
30
40
50
60
70
80
90
0
5
10
15
20
25
30
35
40
DEPTH IN FEET
Apr. 13, 1971
Apr. 20, 1971
Apr. 29, 1971
May 7, 1971
May 14, 1971
0
5
10
15
20
25
30
TEMPERATURE IN DEGREES C


TEMPERATURE IN DEGREES F
SITE B-27
30
40
50
60
70
80
90
0
5
10
15
20
25
30
35
40
DEPTH IN FEET
July 22, 1968
July 22, 1972
July 21, 1976
July 18, 1974
AERATION BEGUN SUMMER 1974
0
5
10
15
20
25
30
TEMPERATURE IN DEGREES C

Appendix 8-2


DISSOLVED OXYGEN (PPM)
SITE-D9
0
2
4
6
8
10
12
14
0
5
10
15
20
25
30
35
40
DEPTH IN FEET
Feb. 3, 1971
Jan. 17, 1977
Feb. 3, 1975
Jan. 4, 1975

Appendix 8-2

Water quality characteristics of Lake Winona before and after rehabilitation. Unless otherwise indicated, all measurements are in parts per million. See accompanying map and descriptions of sampling sites.

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other (ppm)
					Calcium	Total	Total	Ortho	Meta	Organic				
B-27	7/21/68	0		7.0										H_2S - 0.0
		37		0.0										- 5.0
	7/22/68	0		7.0		170					0.0		8.4	H_2S - 0.0
		37		0.0										5.0
	2/16/71	15												H_2S - 0.0
		25												2.5
		33												5.5
	3/16/71	3												chloride-16.5
		6												16.5
		9												16.5
		13												19.5
		15												18.5
		18												22.0
		21												25.5
		24												23.5
		27												24.4

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other
					Calcium	Total	Total	Ortho	Meta	Organic				
B-27 (cont.)	3/16/71	30												17.5
	4/13/71	0	41	3.0										H_2S - 0.0 chloride-15.5
		5	41	3.0										0.0 15.5
		10	41	2.0										0.0 15.5
		15	41	1.0										0.0 15.5
		20	41	0.2										0.0 18.0
		25	41	0.0										slight odor 15.5
		30	41	0.0										" " 14.0
		35	41	0.0										" " 14.0
		38	41	0.0										" " 14.0
	4/20/71	0	49	5.0										H_2S - 0.0 chloride 17.5
		5	48	5.0										0.0
		10	48	5.0										0.0 16.0
		15	48	0.0										0.0
		20	48	0.0										2.0 13.5
		25	48	0.0										2.5

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other
					Calcium	Total	Total	Ortho	Meta	Organic				
B-27 (cont.)	10/10/72	22	56											
		37		10.0		188								
	1/22/73	1	32	4.0										
		15	31	0.0										
		34	30	0.0										
	2/5/73	1	34	4.0										
		34	41	0.0										
		35	40	0.0										
	2/14/73	1	32	4.0										
		15	40	0.0										
		34	41	0.0										
	12/19/73	5	34	13.0			0.8				0.10			
		38	34	11.0			1.0				0.10			
	12/27/73	5	36	15.0			0.8				0.11			
		38	36	6.0			1.0				0.12			
	1/3/74	5	36	12.0			0.4				0.10			
		38	36	1.0			1.8				0.10			

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other
					Calcium	Total	Total	Ortho	Meta	Organic				
B-27 (cont.)	1/10/74	5	36	11.0			0.3				0.08			
		15	36	9.0							0.05			
		38	36	1.0			0.3		0.3					
	1/18/74	5	38	11.0			0.5				.08			
		15	38	8.0										
		38	38	0.0			1.5		0.4		.05			
	1/22/74	5	38	15.0			0.4				0.11			
		15	38	10.0										
		38	38	8.0			0.5				0.10			
	1/29/74	5	36	9.0			0.2				0.12			
		10	36	9.0										
		38	36	9.0			0.5				0.10			
	2/6/74	5	36	10.0							0.08			
		15	36	9.0										
		38	36	8.0							0.10			
	2/12/74	5	36	9.0			0.4				0.05			
		15	36	9.0										

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other	
					Calcium	Total	Total	Ortho	Meta	Organic					
B-27 (cont.)	4/20/71	30	46	0.0										5.5	11.0
		33	44	0.0										5.5	
	4/29/71	0	45	4.0										0.0	17.0
		5	46	3.0										0.0	17.0
		10	49	2.6										0.0	17.0
		15	49	2.8										0.0	17.0
		20	49	2.0										0.0	17.0
		25	40	0.0										0.4	10.0
		30	46	0.0										0.4	9.5
		35	46	0.0										0.4	11.0
	5/7/71	0	58	5.0										0.0	16.5
		5	56	4.0										0.0	16.5
		10	54	4.0										0.0	16.5
		15	52	3.0										0.0	16.5
		20	49	0.2										0.0	15.0
		25	47	0.0										0.4	7.0
		30	47	0.0										0.4	7.0

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other	
					Calcium	Total	Total	Ortho	Meta	Organic					
B-27 (cont.)	5/7/71	35	47	0.0										H_2S - 0.4 chloride- 7.0	
	5/14/71	0	60	12.0										0.0	18.5
		5	60	12.0										0.0	18.5
		10	60	12.0										0.0	18.5
		15	60	1.8										0.0	18.0
		20	50	0.0										0.4	10.0
		25	52	0.0										0.5	8.0
		30	47	0.0										0.5	7.0
		35	50	0.0										0.5	7.0
	7/21/72	0				221					0.0			0.0	
		37									0.0			2.0	
	7/24/72	0				238					0.0			0.0	
		37				278								2.25	
	10/10/72	0	58	10.0		205									
		6	58												
		12	57												
		18	57												

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other
					Calcium	Total	Total	Ortho	Meta	Organic				
B-27 (cont.)	2/12/74	38	36	7.0			0.5				0.05			
	2/19/74	5	36	9.0			0.5				0.10			
		15	36	9.0										
		38	36	8.0			0.5				0.10			
	2/25/74	5	36	7.0			0.4				0.12			
		15	36	7.0										
		38	36	6.0			0.5				0.10			
	6/4/74	0	69	7.0			1.3				0.0			
		15	52	0.0										
		38	52	0.0			2.2				0.0			
	7/18/74	0	80	11.0										
		5	80	10.0										
		10	80	8.0										
		15	80	6.0										
		20	80	4.0										
	8/2/74	0	75.5	8.0										
		5	75.5	7.0										

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other
					Calcium	Total	Total	Ortho	Meta	Organic				
B-27 (cont.)	8/2/74	10	75.0	6.3										
		15	75.0	5.5										
		20	74.5	5.5										
		25	74.5	4.3										
		30	74.5	4.3										
		32	74.5	4.0										
	12/23/74	0	32.0	17.0		220	0.44				0.20			H_2S - 0.0 chloride-10.0
		6	34.5	12.0										
		12	37.0	12.0										
		17	38.0	12.0		230	0.50				0.27			0.0 15.0
		24	38.0	7.0										
		30	38.0	4.0										
		35	39.0	2.0		230	1.10				0.35			0.01 30.0
	12/31/74	0		2.0										
		18		4.0										
		38		2.0										
	1/31/75	0		13.0										

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other	
					Calcium	Total	Total	Ortho	Meta	Organic					
B-27 (cont.)	1/31/75	15		10.0											
		38		2.0		210	0.30				0.15		9.0	H_2S - 0.0 chloride- 5.0	
	1/4/75	0	32.0	21.0											
		6	34.5	14.0											
		12	37.0	9.0											
		18	37.0	7.0			0.42				0.25			0.0	15.0
		24	38.0	4.0											
		30	38.0	3.0											
		35	39.0	2.0		220	0.20				0.20		8.5	0.01	30.0
	1/21/75	0	32.0	12.0		220	0.30				0.20		8.5	0.0	15.0
		6	36.0	7.0											
		12	37.0	7.0											
		18	37.0	7.0		217	0.40				0.25		7.5	0.0	20.0
		24	38.0	4.0											
		30	38.0	3.0											
		35	39.0	2.0		240	0.90				0.30		7.0	0.0	20.0
	2/3/75	0	33.0	12.0		225	0.32				0.20		8.5	0.0	15.0

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other	
					Calcium	Total	Total	Ortho	Meta	Organic					
B-27 (cont.)	2/3/75	6	35.0	10.0											
		12	37.0	7.0											
		18	37.0	6.0		210	0.47				0.25		8.0	H_2S - 0.0 chloride-20.0	
		24	38.0	3.0											
		30	38.0	2.0											
		35	39.0	1.0		235	1.25				0.25		7.0	0.0	35.0
	2/15/75	0	32.0	10.0		210	0.35				0.23		8.5	0.0	15.0
		6	35.0	8.0											
		12	36.0	7.0											
		18	37.0	5.0		220	0.54				0.20		8.0	0.0	20.0
		24	38.0	3.0											
		30	38.0	1.0											
		35	39.0	1.0		227	1.27				0.20		6.0	0.0	40.0
	3/1/75	0	33.0	8.0		235	0.56				0.25		8.5	0.0	15.0
		6	36.0	8.0											
		12	37.0	7.0											
		18	37.0	4.0		245	0.59				0.20		7.5	0.0	25.0

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other	
					Calcium	Total	Total	Ortho	Meta	Organic					
B-27 (cont.)	3/1/75	24	38.0	2.0											
		30	38.0	1.0											
		35	39.0	0.0		255	1.34				0.18		6.0	0.15	40.0
	11/9/76	0	36.0	12.4											
		5	36.0	12.8											
		10	36.0	12.4											
		15	36.0	12.4											
		20	36.0	12.0											
		25	36.0	11.6											
		30	36.0	11.4											
		35	36.0	9.8											
	12/20/76	1	34.0	9.0											
		5	37.4	8.2											
		10	38.0	8.2											
		15	38.0	8.2											
		20	39.0	8.2											
		25	39.0	8.2											

Sampling Site	Date	Depth (ft.	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other
					Calcium	Total	Total	Ortho	Meta	Organic				
B-27 (cont.)	12/20/76	30	39.0	8.2										
		35	39.0	8.2										
	1/17/77	2	37.0	2.7										
		5	37.0	2.7										
		10	37.0	2.7										
		15	37.0	2.6										
		20	37.0	2.6										
		25	37.5	2.4										
		30	37.5	2.3										
		35	37.5	2.0										

Date	Station	Total Depth (ft.)	Sample Depth (ft.)	Temp. (°C)	Dissolved O_2 (PPM)	Secchi Disk (in.)	NO_3	NO_2	Total as NH_3	Ortho	Organic & Poly	Total	Turbidity (JTU)	% Light Transmittance	Conductivity (micromhos)	Total Hardness	Hydrogen Sulfide
7/15/77	27-B	38	0.5	27.0	13.2	10	0.05	0.000	2.74	0.45	2.75	3.2		60	340	171	
			5.0	27.0	12.4												
			10.0	26.0	4.6												
			15.0	23.5	0.3												
			20.0	17.0	0.1												
			25	12.0	0.0												
			30	11.0	0.0												
			35	10.0	0.0												
			*38	10.5	0.0		0.04	0.000	1.08	1.04	2.06	3.1		76	390	274	

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other
					Calcium	Total	Total	Ortho	Meta	Organic				
C-21	8/2/74	5	75.5	9.0										
		10	74.3	4.0										
		15	74.3	3.8										
		20	74.0	3.3										
C-19	7/21/68	0												chloride-10.0
	6/13/74	0	78	10.0										
		10	68	9.5										
		20	67	7.0										
	6/20/74	0	72	10.0			0.05	0.1	0.25				9.2	
		10	66	6.5										
		20	65	1.0			0.0	0.1	0.6				8.4	
	8/2/74	0	75.5	10.5										
		5	74.7	6.8										
		10	73.7	5.0										
		15	73.7	3.8										
		20	73.2	1.3										

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other
					Calcium	Total	Total	Ortho	Meta	Organic				
D-14	2/12/71	0	32											
		10	38.5											
		24	40											
	9/17/73	0	64	5.0										
		24	64	5.0										
	8/2/74	0	75	9.3										
		5	74.5	6.3										
		10	74	5.0										
		15	73.5	4.0										
		21	62.5	1.0										
D-11	6/6/74	0	70	8.0			10.0				0.0			
		30	56	0.0			20.0				0.0			
	8/2/74	0	74	9.0										
		5	74	8.7										
		10	74	8.0										
		15	74	7.0										
		20	73.5	7.7										

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other	
					Calcium	Total	Total	Ortho	Meta	Organic					
D-11 (cont.)	8/2/74	25	73.5	7.0											
		30	73.5	6.0											
	12/23/74	0	33	18.0		220.0	0.36				0.15		8.5	H_2S - 0.0 chloride-10.0	
		6	36	16.0		--	--				--		--	--	--
		12	37	14.0		190.0	0.40				0.20		8.5	0.0	15.0
		18	37	13.0		--	--				--		--	--	--
		25	39	4.0		220.0	0.50				0.20		8.5	.01	25.0
	1/4/75	0	32	23.0		185.0	0.24				0.14		9.0	0.0	5.0
		6	35	15.0		--	--				--		--	--	--
		12	37	13.0		215.0	0.38				0.25		8.5	0.0	15.0
		18	37	7.0		--	--				--		--	--	--
		25	39	4.0		220.0	0.70				0.20		8.5	0.1	25.0
	1/21/75	0	33	11.0		227.0	0.28				0.24		8.5	0.0	15.0
		6	35	9.0		--	--				--		--	--	--
		12	37	10.0		185.0	0.32				0.26		8.5	0.0	15.0
		18	38	6.0		--	--				--		--	--	--
		25	39	3.0		192.0	0.80				0.27		8.0	0.0	25.0

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other	
					Calcium	Total	Total	Ortho	Meta	Organic					
D-11 (cont.)	2/3/75	0	33	10.0		230.0	0.27				0.15		8.5	H_2S - 0.0 CO_2 -15.0	
		6	35	9.0		--	--				--		--	--	--
		12	37	7.0		220.0	0.36				0.20		8.0	0.0	15.0
		18	38	5.0		--	--				--		--	--	--
		25	39	3.0		240.0	0.84				0.24		7.0	0.0	25.0
	2/15/75	0	32	8.0		210.0	0.28				0.20		8.5	0.0	15.0
		6	36	7.0		--	--				--		--	--	--
		12	36	5.0		220.0	0.38				0.23		8.0	0.0	20.0
		18	38	3.0		--	--				--		--	--	--
		25	39	2.0		237.0	0.82				0.20		8.0	0.0	30.0
	3/1/75	0	33	10.0		198.0	0.32				0.20		8.5	0.0	15.0
		6	35	8.0		--	--				--		--	--	--
		12	37	6.0		210.0	0.52				0.20		8.0	0.0	20.0
		18	38	4.0		--	--				--		--	--	--
		25	39	2.0		232.0	0.93				0.15		7.5	0.01	30.0
	1/17/77	2	39.0	2.9											
		5	38.0	2.8											

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other
					Calcium	Total	Total	Ortho	Meta	Organic				
D-11 (cont.)	1/17/77	8	38.0	2.8										
		11	38.0	2.7										
		14	38.0	2.7										
		17	38.0	2.6										
		20	38.0	2.6										
		23	38.0	2.3										
D-9	2/3/71	5		0.3										
		24		0.2										
	7/24/72	0	85	9.0										
		10	76	1.0										
		24	60	0.0										
	9/17/73	0	62	9.4										
		24	60	7.5										
	6/4/74	0	68	11.0			7				0.0			
		10	65	6.5			-				0.0			
		24	54	0.0			20				0.0			
	6/12/74	0	68	9.5				0.6			0.0		8.5	

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other
					Calcium	Total	Total	Ortho	Meta	Organic				
D-9 (cont.)	6/12/74	10	67	8.5				--			--		--	
		24	67	9.0				0.6			0.0		8.3	
	6/20/74	0	69	6.5				0.15	.25		0.0		8.3	
		10	68	5.5				--	--		--		--	
		24	66	5.0				0.1	.2		0.0		8.4	
	6/26/74	0	77	5.5							0.0		9.4	
		10	72	1.0							--		--	
		24	70	0.0							0.0		9.9	
	7/8/74	0	80	10.0			.8	0.2					9.7	
		10	78	5.5			--	--					--	
		24	77	1.0			.34	0.35					9.0	
	8/2/74	0	75.0	10.0										
		5	74.5	9.0										
		10	74.5	8.0										
		15	74.5	8.0										
		20	74.0	7.0										
		24	74.0	6.5										

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other	
					Calcium	Total	Total	Ortho	Meta	Organic					
D-9 (cont.)	12/31/74	0		24.0											
		13		12.0											
		24		4.0											
	1/4/75	0	33	23.0		195.0	0.25				0.15		9.0	CO_2 - 5.0 H_2S - 0.0	
		6	36	14.0		--	--				--		--	--	--
		12	37	10.0		220.0	0.40				0.18		8.5	15.0	0.0
		20	38	2.0		225.0	0.58				0.20		7.0	25.0	.01
	1/21/75	0	32	11.0		214.0	0.32				0.25		8.5		
		6	37	10.0		--	--				--		--		
		12	37	10.0		165.0	0.36				0.27		8.5		
		20	39	4.0		223.0	0.56				0.30		8.0		
	2/3/75	0	33	8.0		240.0	0.36				0.14		8.5	15.0	0.0
		6	37	7.0		--	--				--		--	--	--
		12	37	6.0		223.0	0.42				0.18		8.5	20.0	0.0
		20	39	2.0		240.0	0.52				0.20		8.0	25.0	0.0
	2/15/75	0	33	8.0		230.0	0.42				0.15		8.5	15.0	0.0
		6	36	7.0		--	--				--		--	--	--

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other	
					Calcium	Total	Total	Ortho	Meta	Organic					
D-9 (cont.)	2/15/75	12	37	4.0		225.0	0.54				0.17		8.5	CO_2 - 20.0 H_2S - 0.0	
		20	39	1.0		240.0	0.60				0.18		7.5	30.0	0.0
	3/1/75	0	33	5.0		240.0	0.58				0.14		8.0	20.0	0.0
		6	36	4.0		--	--				--		--	--	--
		12	38	1.2		240.0	0.90				0.12		7.5	25.0	0.0
		20	38	1.0		250.0	0.96				0.12		7.0	30.0	0.005
	1/23/76	0	36	8.8											
		6	42.5	7.3											
		12	42.8	6.6											
		18	42.8	6.5											
		24	42.8	6.0											
	11/9/76	0	35.5	13.2											
		5	38.0	14.0											
		10	38.0	14.0											
		15	38.0	13.8											
		20	38.0	13.4											
		24	38.0	10.2											

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other	
					Calcium	Total	Total	Ortho	Meta	Organic					
D-6 (cont.)	4/29/71	0	50	3.2										H_2S - 0.0 chloride- --	
		5	50	2.4										0.0	22.5
		10	--	3.2										--	--
		15	50	2.8										0.0	--
		20	50	2.0										0.0	23.0
	5/14/71	0	64	10.0										0.0	--
		5	60	10.0										0.0	23.5
		10	60	10.0										0.0	--
		15	60	2.4										0.0	--
		20	54	0.0										0.1	14.5
	8/2/74	0	74	8.9											
		5	74	8.9											
		10	74	5.5											
		15	74	3.0											
		20	73	1.9											

Sampling Site	Date	Depth (ft.)	Temp (°F)	Dissolved Oxygen	Hardness		Phosphate				Nitrate	Nitrite	Ph	Other
					Calcium	Total	Total	Ortho	Meta	Organic				
D-9 (cont.)	12/22/76	1	35.5	12.0										
		5	38.0	12.0										
		10	39.0	11.9										
		15	39.0	11.9										
		20	39.0	11.5										
		24	39.0	10.0										
	1/17/77	2	35.5	4.8										
		6	39.0	4.8										
		9	39.0	4.7										
		12	39.0	4.7										
		15	39.0	4.6										
		18	39.0	4.5										
D-6	4/20/71	0	60	3.0										H_2S - 0.0 chloride-24.5
		5	56	3.0										0.0 24.0
		10	54	3.0										0.0 24.0
		15	50	1.4										0.0 24.0
		20	49	0.0										0.0 24.0

June 13, 1978

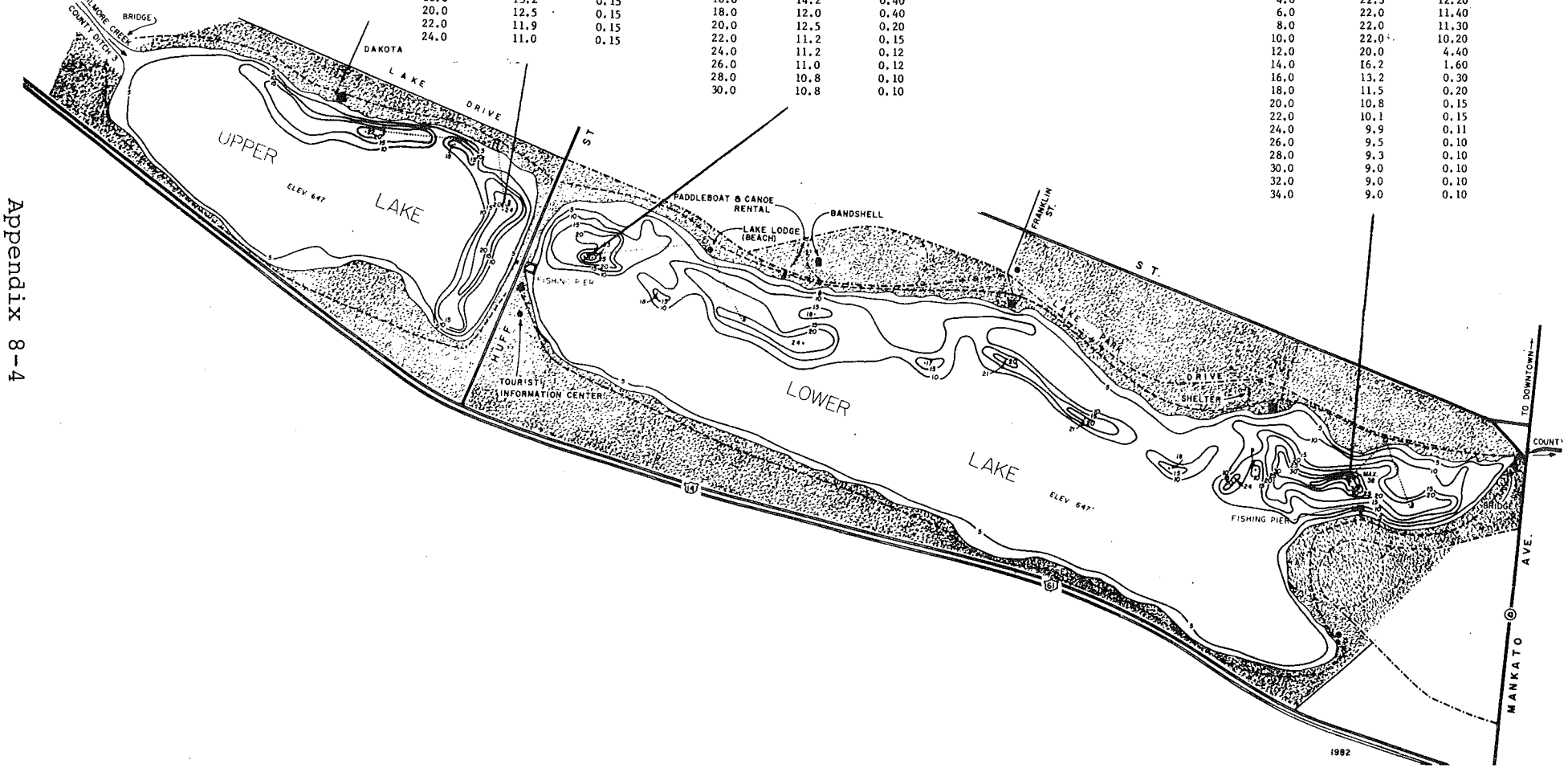
Depth (ft.)	Temp (°C)	D.O.
2.0	21.3	11.20
4.0	21.3	11.60
6.0	21.3	10.70
8.0	21.0	5.20
10.0	19.8	0.60
12.0	17.0	0.20
14.0	15.2	0.20
16.0	14.1	0.20
18.0	13.2	0.15
20.0	12.5	0.15
22.0	11.9	0.15
24.0	11.0	0.15

June 13, 1978

Depth (ft.)	Temp (°C)	D.O.
0.5	21.8	11.40
2.0	21.8	11.60
4.0	21.8	11.20
6.0	21.5	11.20
8.0	21.2	8.60
10.0	19.6	8.20
12.0	17.5	4.30
14.0	15.2	2.20
16.0	14.2	0.40
18.0	12.0	0.40
20.0	12.5	0.20
22.0	11.2	0.15
24.0	11.2	0.12
26.0	11.0	0.12
28.0	10.8	0.10
30.0	10.8	0.10

June 13, 1978

Depth (ft.)	Temp (°C)	D.O.
0.5	23.0	12.40
2.0	22.5	12.20
4.0	22.3	12.20
6.0	22.0	11.40
8.0	22.0	11.30
10.0	22.0	10.20
12.0	20.0	4.40
14.0	16.2	1.60
16.0	13.2	0.30
18.0	11.5	0.20
20.0	10.8	0.15
22.0	10.1	0.15
24.0	9.9	0.11
26.0	9.5	0.10
28.0	9.3	0.10
30.0	9.0	0.10
32.0	9.0	0.10
34.0	9.0	0.10



Appendix 8-4

July 17, 1978

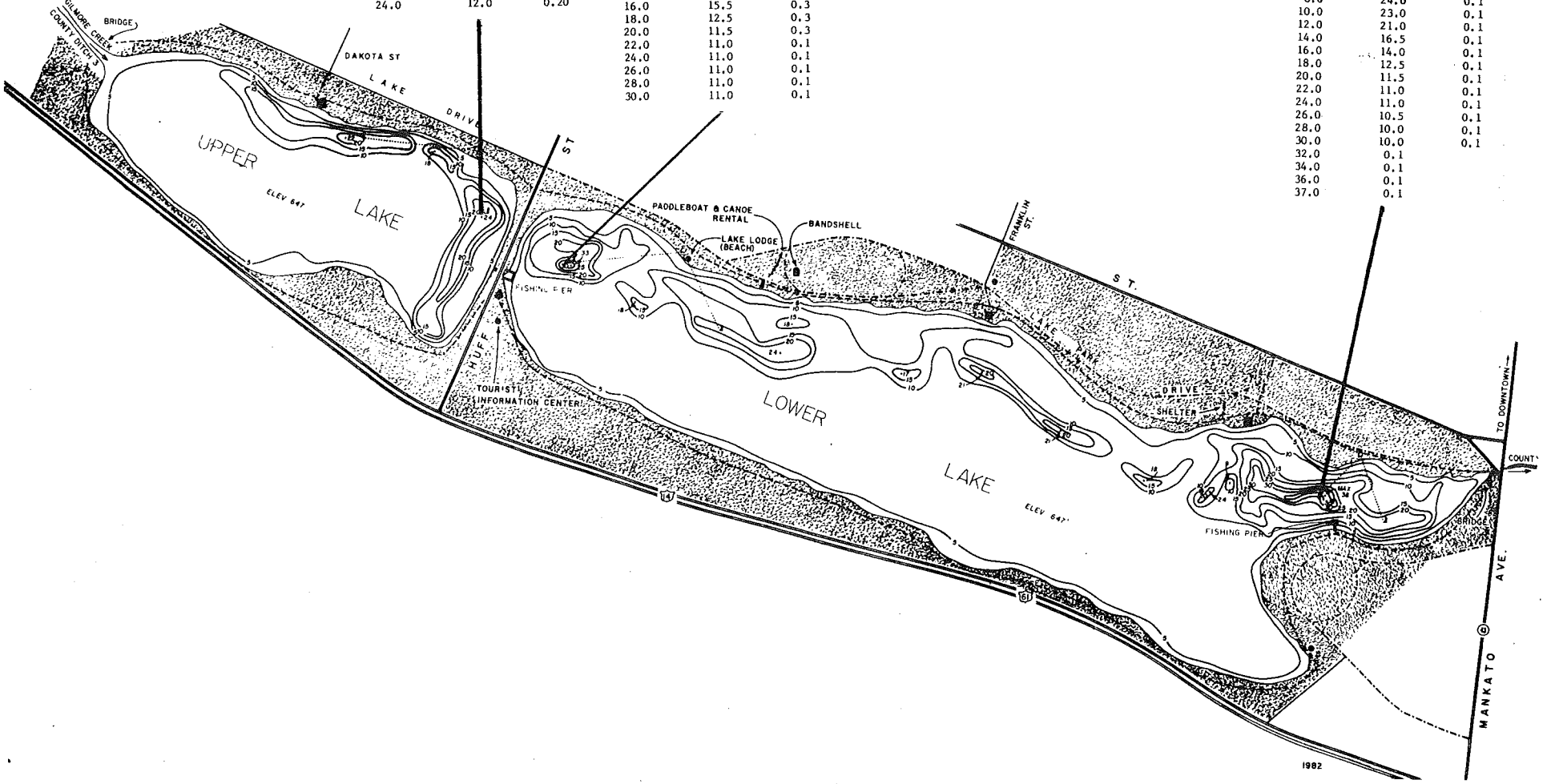
Depth (ft.)	Temp (°C)	D.O.
0.5	26.0	8.50
2.0	26.0	7.20
4.0	25.0	4.50
6.0	24.5	1.40
8.0	22.5	0.20
10.0	20.0	0.20
12.0	16.0	0.20
14.0	14.0	0.20
16.0	13.0	0.20
18.0	12.5	0.20
20.0	12.0	0.20
22.0	12.0	0.20
24.0	12.0	0.20

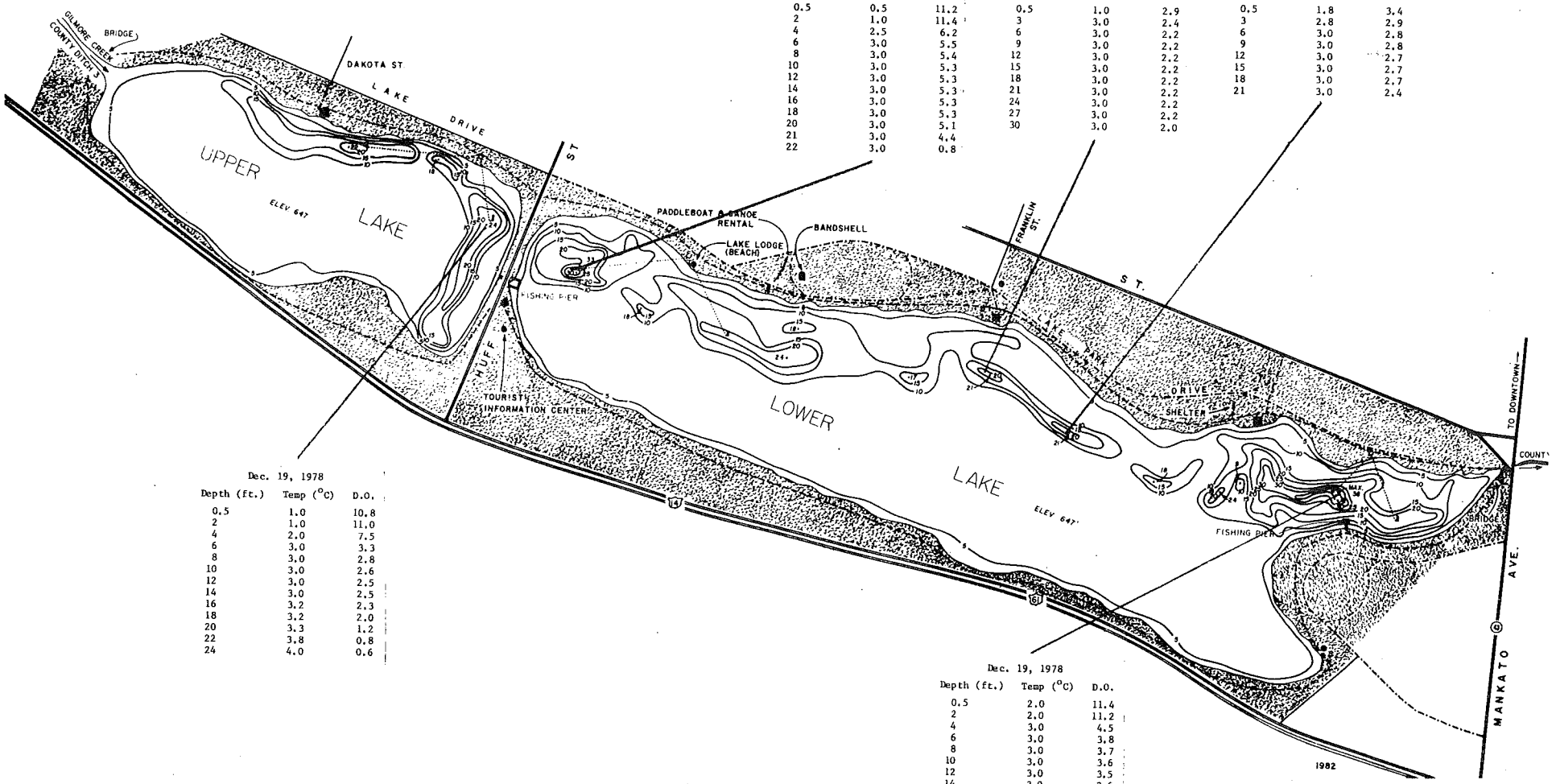
July 17, 1978

Depth (ft.)	Temp (°C)	D.O.
0.5	27.0	11.2
2.0	27.0	10.8
4.0	27.0	10.7
6.0	25.0	4.0
8.0	24.0	1.0
10.0	21.0	0.2
12.0	16.5	0.2
14.0	16.0	0.2
16.0	15.5	0.3
18.0	12.5	0.3
20.0	11.5	0.3
22.0	11.0	0.1
24.0	11.0	0.1
26.0	11.0	0.1
28.0	11.0	0.1
30.0	11.0	0.1

July 17, 1978

Depth (ft.)	Temp (°C)	D.O.
0.5	25.5	9.8
2.0	25.5	10.2
4.0	25.5	9.8
6.0	25.5	7.8
7.0	24.0	0.2
8.0	24.0	0.1
10.0	23.0	0.1
12.0	21.0	0.1
14.0	16.5	0.1
16.0	14.0	0.1
18.0	12.5	0.1
20.0	11.5	0.1
22.0	11.0	0.1
24.0	11.0	0.1
26.0	10.5	0.1
28.0	10.0	0.1
30.0	10.0	0.1
32.0	0.1	
34.0	0.1	
36.0	0.1	
37.0	0.1	





Dec. 19, 1978

Depth (ft.)	Temp (°C)	D.O.
0.5	0.5	11.2
2	1.0	11.4
4	2.5	6.2
6	3.0	5.5
8	3.0	5.4
10	3.0	5.3
12	3.0	5.3
14	3.0	5.3
16	3.0	5.3
18	3.0	5.3
20	3.0	5.1
21	3.0	4.4
22	3.0	0.8

Dec. 20, 1978

Depth (ft.)	Temp (°C)	D.O.
0.5	1.0	2.9
3	3.0	2.4
6	3.0	2.2
9	3.0	2.2
12	3.0	2.2
15	3.0	2.2
18	3.0	2.2
21	3.0	2.2
24	3.0	2.2
27	3.0	2.2
30	3.0	2.0

Dec. 20, 1978

Depth (ft.)	Temp (°C)	D.O.
0.5	1.8	3.4
3	2.8	2.9
6	3.0	2.8
9	3.0	2.8
12	3.0	2.7
15	3.0	2.7
18	3.0	2.7
21	3.0	2.4

Dec. 19, 1978

Depth (ft.)	Temp (°C)	D.O.
0.5	1.0	10.8
2	1.0	11.0
4	2.0	7.5
6	3.0	3.3
8	3.0	2.8
10	3.0	2.6
12	3.0	2.5
14	3.0	2.5
16	3.2	2.3
18	3.2	2.0
20	3.3	1.2
22	3.8	0.8
24	4.0	0.6

Dec. 19, 1978

Depth (ft.)	Temp (°C)	D.O.
0.5	2.0	11.4
2	2.0	11.2
4	3.0	4.5
6	3.0	3.8
8	3.0	3.7
10	3.0	3.6
12	3.0	3.5
14	3.0	3.6
16	3.0	3.5
18	3.0	3.5
20	3.0	3.6
22	3.0	3.5
24	3.0	3.3
26	3.0	3.2
28	3.0	3.1
30	3.0	3.1
32	3.0	3.0
34	3.0	2.6
36	3.5	0.8

Mar. 13, 1984

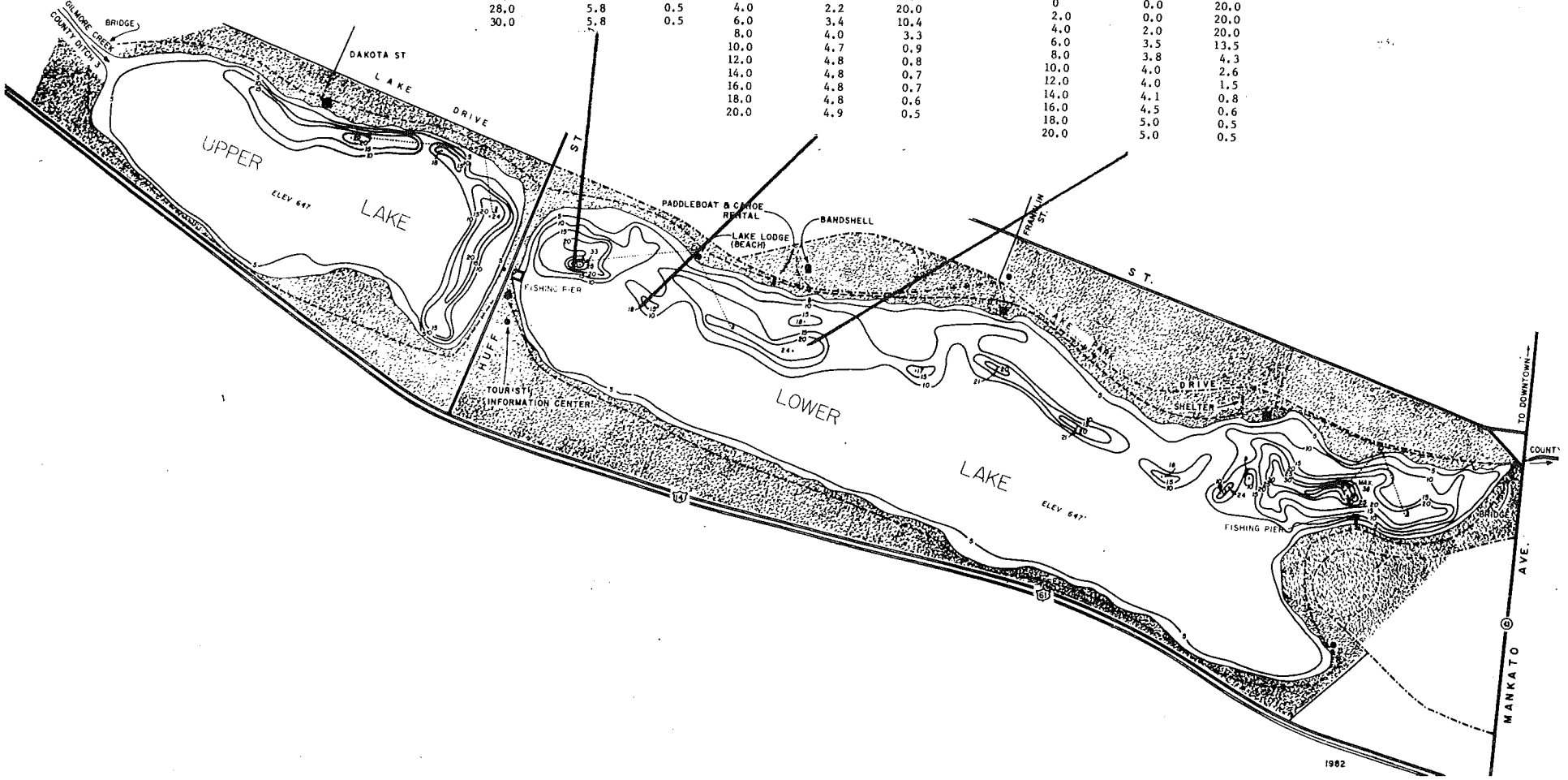
Depth (ft.)	Temp (°C)	D.O.
0	0.0	
2.0	1.0	17.3
4.0	3.0	16.6
6.0	3.7	11.1
8.0	4.0	6.3
10.0	4.5	2.7
12.0	4.9	1.5
14.0	5.0	0.8
16.0	5.1	0.6
18.0	5.5	0.5
20.0	5.7	0.5
22.0	5.8	0.5
24.0	5.8	0.5
26.0	5.8	0.5
28.0	5.8	0.5
30.0	5.8	0.5

Mar. 13, 1984

Depth (ft.)	Temp (°C)	D.O.
0	0.0	20.0
2.0	0.2	20.0
4.0	2.2	20.0
6.0	3.4	10.4
8.0	4.0	3.3
10.0	4.7	0.9
12.0	4.8	0.8
14.0	4.8	0.7
16.0	4.8	0.7
18.0	4.8	0.6
20.0	4.9	0.5

Mar. 13, 1984

Depth (ft.)	Temp (°C)	D.O.
0	0.0	20.0
2.0	0.0	20.0
4.0	2.0	20.0
6.0	3.5	13.5
8.0	3.8	4.3
10.0	4.0	2.6
12.0	4.0	1.5
14.0	4.1	0.8
16.0	4.5	0.6
18.0	5.0	0.5
20.0	5.0	0.5



Appendix 8-4

*Apr. 16, 1985

Depth (ft.)	Temp (°C)	D.O.
0	11.8	11.8
2	11.8	13.8
4	11.8	15.4
6	11.8	13.4
8	11.9	12.2
10	11.8	10.4
12	11.8	8.2
14	11.4	7.0
16	11.2	6.5
18	11.1	6.5
19	11.1	6.8

* 25 ft. SW of aerator.
Secchi disc 6 ft.

*Apr. 16, 1985

Depth (ft.)	Temp (°C)	D.O.
0	10.5	14.4
2	10.5	14.3
4	11.5	14.3
6	11.5	14.4
8	11.5	14.5
10	10.8	14.5
12	11.5	14.2
14	11.0	13.5
16	11.0	13.6
18	10.8	13.2
20	10.6	13.0
21	10.1	10.6

* 25 ft. South of aerator.
Secchi disc 11 ft.

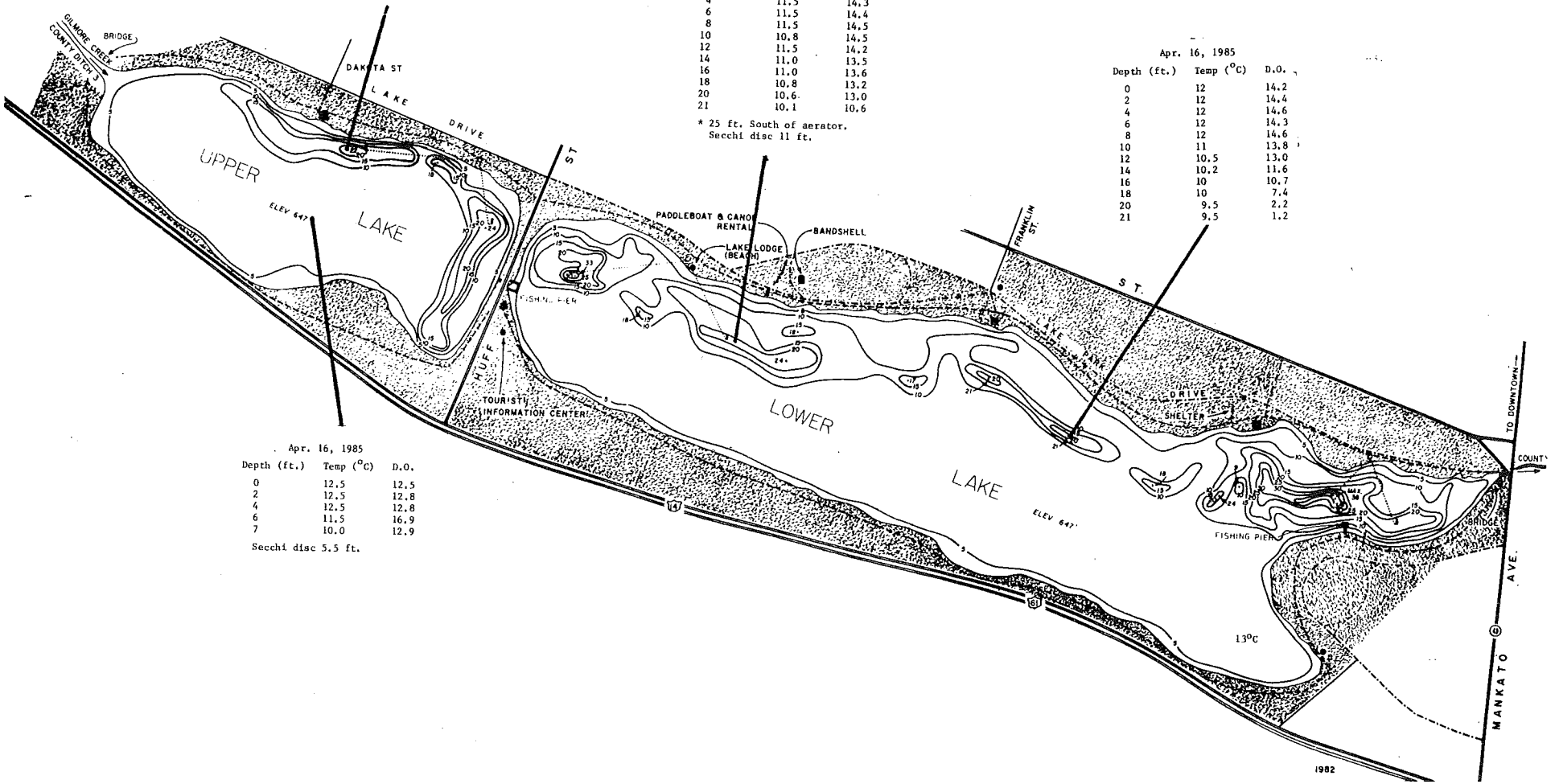
Apr. 16, 1985

Depth (ft.)	Temp (°C)	D.O.
0	12	14.2
2	12	14.4
4	12	14.6
6	12	14.3
8	12	14.6
10	11	13.8
12	10.5	13.0
14	10.2	11.6
16	10	10.7
18	10	7.4
20	9.5	2.2
21	9.5	1.2

Apr. 16, 1985

Depth (ft.)	Temp (°C)	D.O.
0	12.5	12.5
2	12.5	12.8
4	12.5	12.8
6	11.5	16.9
7	10.0	12.9

Secchi disc 5.5 ft.



WATER CHEMISTRY SAMPLING STATIONS WITHIN THE LAKE WINONA WATERSHED

1. Spooner's Spring (southeast corner, SE¼, SE¼, Sect. 31, T107, R7W, Winona Co.) - deep into the source where water comes from the ground.
2. Gilmore Creek - ten feet upstream from junction with the small stream which comes from Spooner's Spring.
3. Spooner's Roadside Spring (SE¼, SE¼, Sect. 31, T107, R7W, adjacent to Co. Highway 21.
4. Spooner's Trout Pond outlet (SE¼, SE¼, Sect. 31, T107, R7W).
5. Highway 14 bridge.
6. Boller Lake dam - just above dam.
7. Mall Shopping Center - just below culvert at east entrance from Sarnia Street.
8. Huff Street culvert - east end of culvert.
9. Lake Outlet at Mankato Avenue - just above inlet to culvert.
10. Mississippi River at Levee Park (foot of Main Street).
11. Well water - basement of Pasteur Hall.
12. Deionized, demineralized, distilled water - control.

Date	Station	Total Depth (ft.)	Sample Depth (ft.)	Temp. (°C)	Dissolved O_2 (ppm)	Secchi Disk (in.)	NO_3 (ppm)	Phosphate as PO_4 (ppm)			Total Hardness (ppm)	pH	Conductance (micromhos/cm)	Turbidity (JTU)	Coliform (MPN/100 ml)
								Ortho	Organic & Poly	Total					
4/23/79	1			11.0	8.5		1.00	0.60	0.40	1.00			440	0.9	
2-4 PM	2			15.0	13.2		1.00	0.23	0.55	1.78			450	1.4	
	4			18.0	18.1		1.00	0.31	0.47	0.78			375	1.6	
	5			18.0	15.5		1.00	0.51	0.55	1.05			420	3.1	
	6			18.0	15.5		0.70	0.05	0.34	0.39			295	3.6	
	7			15.0	10.1		1.50	0.65	0.05	0.70			525	9.8	
	8			13.0	19.8		0.90	0.15	0.24	0.39			399	6.7	
	9			14.8	19.6		1.00	0.10	0.10	0.20			375	6.3	
	10						4.70	0.49							
	11						0.80	0.29	0.06	0.35				0.7	

Date	Station	Total Depth (ft.)	Sample Depth (ft.)	Temp. (°C)	Dissolved O_2 (ppm)	Secchi Disk (in.)	NO_3 (ppm)	Phosphate as PO_4 (ppm)			Total Hardness (ppm)	pH	Conductance (micromhos/cm)	Turbidity (JTU)	Coliform (MPN/100 ml)
								Ortho	Organic & Poly	Total					
4/30/80	1			9.0	9.5		0.20	0.18		0.10	274	6.4	495		20
2-4 PM	2			12.5	11.9		0.20	0.10	0.05	0.15	257	7.0	500		excess
	4			12.2	18.3		0.30	0.05		0.00	239	7.2	470		360
	5			13.0	12.6		0.40	0.00	0.18	0.18	257	7.0	505		4600
	6			15.5	12.2		0.50	0.00	0.05	0.25	189	6.6	410		1200
	7			13.5	16.0		0.80	0.21	0.01	0.22	309	6.8	755		14300
	8			16.5	12.2		0.07	0.05	0.20	0.25	223	6.4	390		7300
	9			15.5	12.2		0.20	0.00	0.20	0.20	206	6.8	420		400
	11			22.8	1.5						253	7.2	660		

WATER CHEMISTRY SAMPLING STATIONS WITHIN THE LAKE WINONA WATERSHED

1. Spooner's Spring (southeast corner, SE¼, SE¼, Sect. 31, T107, R7W, Winona Co.) - deep into the source where water comes from the ground.
2. Gilmore Creek - ten feet upstream from junction with the small stream which comes from Spooner's Spring.
3. Spooner's Roadside Spring (SE¼, SE¼, Sect. 31, T107, R7W, adjacent to Co. Highway 21.
4. Spooner's Trout Pond outlet (SE¼, SE¼, Sect. 31, T107, R7W).
5. Highway 14 bridge.
6. Boller Lake dam - just above dam.
7. Mall Shopping Center - just below culvert at east entrance from Sarnia Street.
8. Huff Street culvert - east end of culvert.
9. Lake Outlet at Mankato Avenue - just above inlet to culvert.
10. Mississippi River at Levee Park (foot of Main Street).
11. Well water - basement of Pasteur Hall.
12. Deionized, demineralized, distilled water - control.

Date	Station	Total Depth (ft.)	Sample Depth (ft.)	Temp. (°C)	Dissolved O_2 (ppm)	Secchi Disk (in.)	NO_3 (ppm)	Phosphate as PO_4 (ppm) Ortho	Organic & Poly	Total	Total Hardness (ppm)	pH	Conductance (micromhos/cm)	Turbidity (JTU)	Coliform (MPN/100 ml)
3/30/81	1			7.0	8.4		1.50	0.60		0.40	291	6.0	400		
2-4 PM	2			8.5	14.0		1.40	0.07	0.42	0.49	326	6.4	500		
	4			8.5	11.2		0.90	0.00	0.32	0.32	291	6.4	410		
	5			10.0	11.6		2.00	0.31	0.44	0.75	309	6.4	450		
	6			11.5	10.5		1.70	0.04	0.40	0.44	206	5.5	285		
	7			7.5	5.0		3.20	0.46	0.38	0.84	120	5.0	210		
	8			7.0	14.0		1.40	0.10	0.30	0.40	189	6.0	310		
	9			7.0	13.0		1.20	0.01	0.33	0.34	171	5.5	275		
	10			6.5	5.5		3.20	0.39	0.21	0.60	171		290		
	11			19.2	0.3		1.40	0.09	0.47	0.56	326	6.6	900		
	12									0			2.6		

Date	Station	Total Depth (ft.)	Sample Depth (ft.)	Temp. (°C)	Dissolved O_2 (ppm)	Secchi Disk (in.)	NO_3 (ppm)	Phosphate as PO_4 (ppm) Ortho	Organic & Poly	Total	Total Hardness (ppm)	pH	Conductance (micromhos/cm)	Turbidity (JTU)	Coliform (MPN/100 ml)
5/19/82	1		0.5	10.0	9.6		1.75	0.19	0.56	0.77	274	6.4	490		10
2-4 PM	2		0.5	15.5	10.1		1.15	0.27		0.17	291	6.8	540		300
	4		0.5	15.8	14.4		1.12	0.17		0.08	274	7.0	490		0
	5		1.0	16.6	11.6		1.20	0.30		0.20	308	6.4	550		300
	6		1.0	23.5	8.3		0.25	0.28		0.21	239	6.8	440		0
	7		1.0	17.0	5.6		1.65	0.21	0.12	0.33	274	7.0	610		700
	8		1.0	19.0	13.9		0.97	0.03	5.97	6.00	154	6.0	355		0
	9		1.0	19.0	10.4		0.95	0.03	0.80	0.83	171	6.0	360		0
	10		1.0	18.0	8.8		3.25	0.19	0.31	0.50	171	5.5	350		0
	11			23.0	3.0		0.50	0.17			103	6.0	540		0
	12			25.0	7.4		0.90	0.19			3	4.0	13		0

WATER CHEMISTRY SAMPLING STATIONS WITHIN THE LAKE WINONA WATERSHED

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2. Gilmore Creek - ten feet upstream from junction with the small stream which comes from Spooner's Spring.
3. Spooner's Roadside Spring (SE¼, SE¼, Sect. 31, T107, R7W, adjacent to Co. Highway 21.
4. Spooner's Trout Pond outlet (SE¼, SE¼, Sect. 31, T107, R7W).
5. Highway 14 bridge.
6. Boller Lake dam - just above dam.
7. Mall Shopping Center - just below culvert at east entrance from Sarnia Street.
8. Huff Street culvert - east end of culvert.
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Date	Station	Total Depth (ft.)	Sample Depth (ft.)	Temp. (°C)	Dissolved O_2 (ppm)	Secchi Disk (in.)	NO_3 (ppm)	Phosphate as PO_4 (ppm)			Total Hardness (ppm)	pH	Conductance (micromhos/cm)	Turbidity (JTU)	Coliform (MPN/100 ml)
								Ortho	Organic & Poly	Total					
5/11/83	1			7.0	9.7		7.30	0.08		<0.08	291	6.0	505	1.0	5
2-4 PM	2			13.0	12.3		6.70	0.08		<0.08	291	6.4	535	3.0	800
	3			8.0	8.3		5.90	0.08		<0.08	308	6.0	540	2.0	6
	4			13.0	15.7		6.80	0.08		<0.08	257	6.4	460	7.5	280
	5			13.0	14.1		6.50	0.08		<0.08	325	5.5	540	4.0	140
	6			15.0	10.0		6.00	0.08		<0.08	257	6.4	440	4.0	140
	7			18.0	10.2		9.50	0.08	0.16	0.24	308	6.0	610	18.0	400
	8			16.0	13.2		4.40	0.08		<0.18	171	6.0	395	5.0	400
	9			15.0	13.0		4.80	0.08		<0.08	188	6.4	390	5.0	20
	10			15.0	12.0		14.70	0.08		<0.19	274	5.5	475	9.5	200
	11			19.0	1.2		3.70	0.08		<0.08	446	6.4	880	2.0	3
	12			25.0	5.5		0.00	0.08		<0.08	17	4.0	50	0.0	0

Date	Station	Total Depth (ft.)	Sample Depth (ft.)	Temp. (°C)	Dissolved O_2 (ppm)	Secchi Disk (in.)	NO_3 (ppm)	Phosphate as PO_4 (ppm)			Total Hardness (ppm)	pH	Conductance (micromhos/cm)	Turbidity (JTU)	Coliform (MPN/100 ml)
								Ortho	Organic & Poly	Total					
5/8/84	1			8.5	9.8		0.31	0.01	0.00	0.01	245	6.4	500	8.0	1
2-4 PM	2			9.0	11.8		0.26	0.00	0.01	0.01		6.4	510	0.03	20
	4			10.5	17.6		0.22				230	6.4	500	1.40	2000
	5			9.0	5.2		0.18				270	6.0	540	1.80	7
	6			11.0	11.6		0.09				180	6.4	350	1.50	200
	7						0.30	0.02	0.00	0.02	300		550	1.50	200
	8					66	0.22	0.00	0.02	0.02	186		375	1.80	20
	9					30	0.22	0.00	0.05	0.05	160		335	4.10	30
	10						0.44	0.01	0.09	0.10	253		465	12.00	40
	11						0.09			0.00	223		600	0.10	0
	12						0.13			0.00			3.9		0

WATER CHEMISTRY SAMPLING STATIONS WITHIN THE LAKE WINONA WATERSHED

1. Spooner's Spring (southeast corner, SE¼, SE¼, Sect. 31, T107, R7W, Winona Co.) - deep into the source where water comes from the ground.
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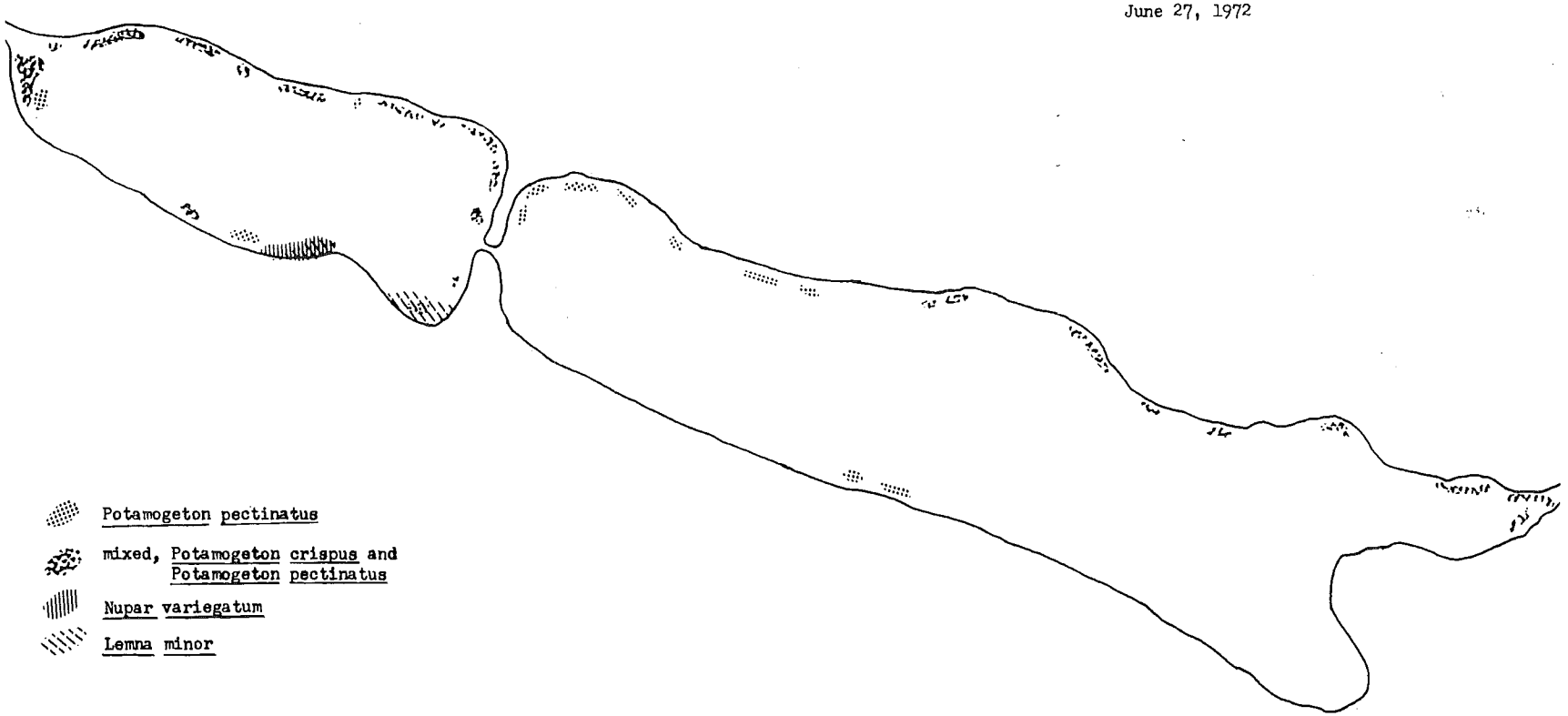
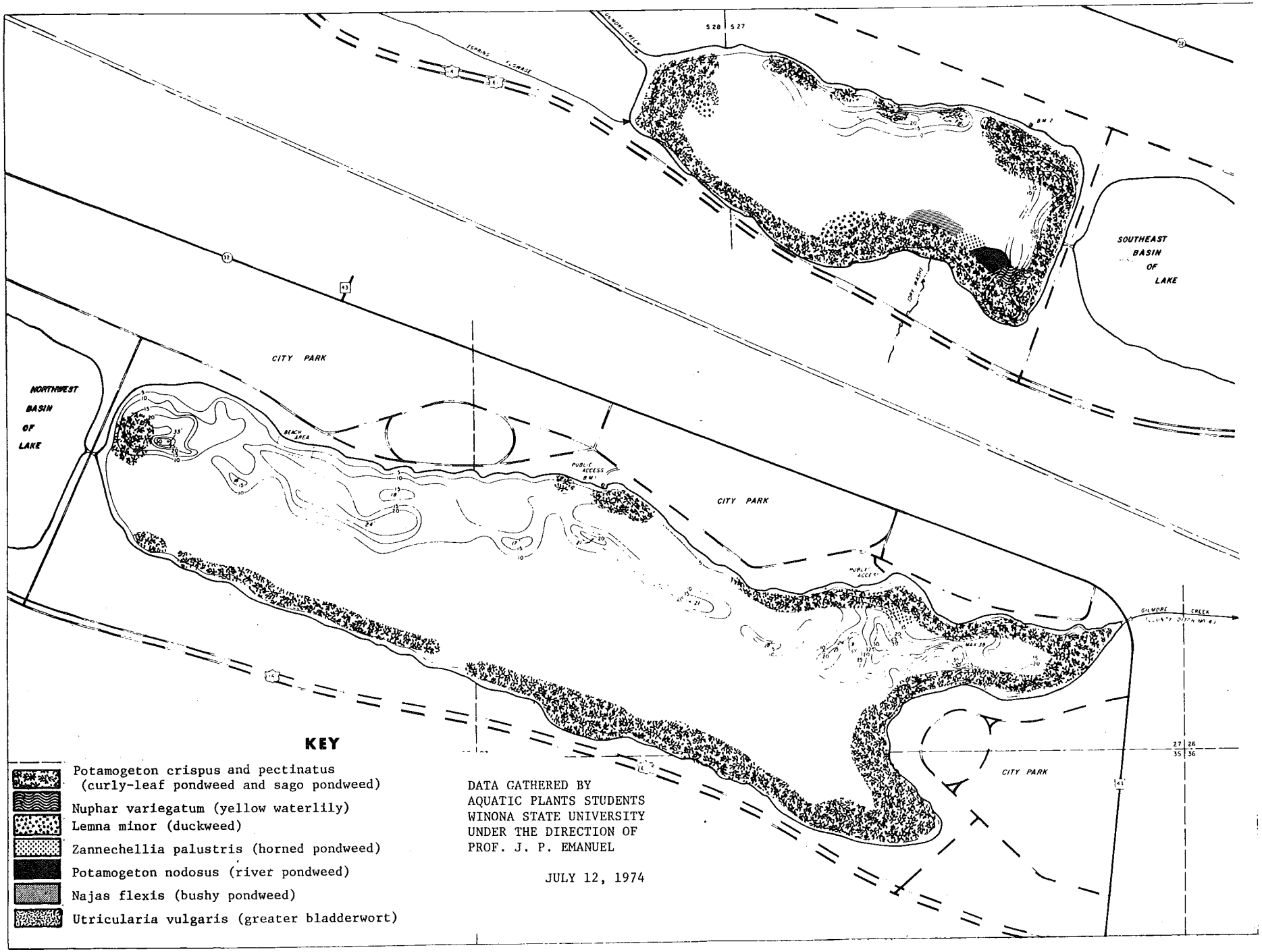
Date	Station	Total Depth (ft.)	Sample Depth (ft.)	Temp. (°C)	Dissolved O_2 (ppm)	Secchi Disk (in.)	NO_3 (ppm)	Phosphate as PO_4 (ppm)			Total Hardness (ppm)	pH	Conductance (micromhos/cm)	Turbidity (JTU)	Coliform (MPN/100 ml)
								Ortho	Organic & Poly	Total					
05/07/85	1		0.5	9.0	10.2		0.3	0.06	0.44	0.50	360	7.2	410	0.20	0
	2		0.5	14.0	12.5		0.6	0.07	0.63	0.70	360	7.1	200	0.52	800
	3		0.5	9.5	10.5		1.1	0.01	0.79	0.80	360	7.2	450	0.06	8
	4		0.5	14.0	>20.0		0.8	0.20	0.10	0.30	343	7.0	425	0.40	100
	5		0.5	15.1	10.8		0.8	0.01	0.54	0.55	411	6.8	180	0.60	70
	6		0.5	22.6	10.9		0.5	0.08	0.45	0.53	274	6.9	280	1.20	100
	7		0.5	18.8	16.2		0.8	0.08	0.72	0.80	411	6.6	540	3.20	80
	8		0.5	20.4	14.2		0.6	0.00	0.20	0.20	223	6.8	300	0.75	40
	9		0.5	20.5	12.4		0.5	0.06	0.14	0.20	206	6.4	275	0.63	0
	10		0.5	18.2	10.2		2.4	0.07	0.73	1.80	223	6.4	280	2.25	90
	11		0.5					0.01			480		227		0
	12		0.5	26.9	6.0			0.00	0.20	0.20	17	6.0			0

SUBMERGED AQUATIC VEGETATION OF LAKE WINONA

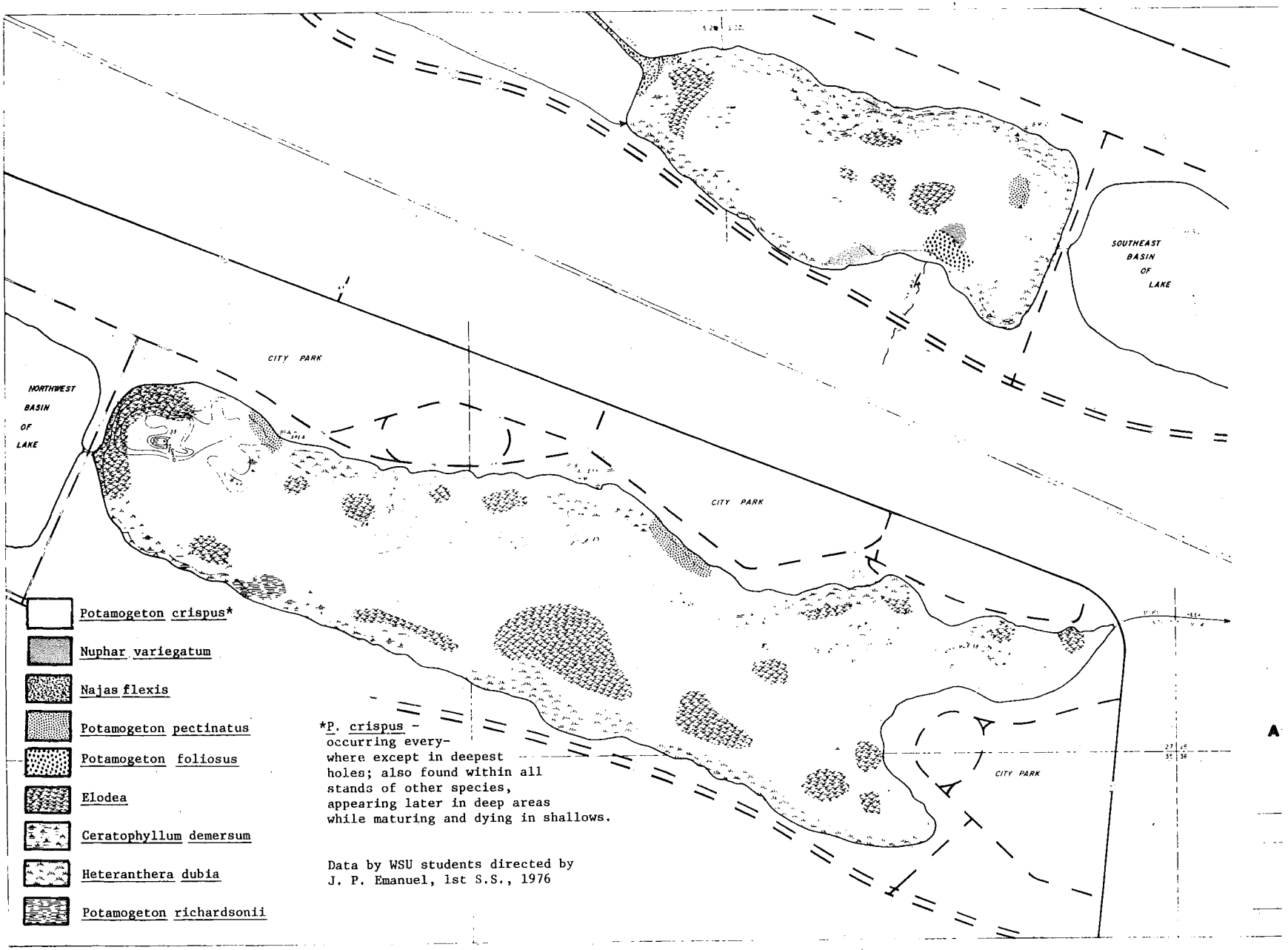
Aquatic Vegetative Analysis: Lake Winona
June 27, 1972



Appendix 9-1


S 28
S 27
SOUTHEAST BASIN OF LAKE
CITY PARK
NORTHWEST BASIN OF LAKE
BEACH AREA
PUBLIC ACCESS
CITY PARK
CITY PARK
GILMORE CREEK
27
35
26
36
KEY
Potamogeton crispus and pectinatus (curly-leaf pondweed and sago pondweed)
Nuphar variegatum (yellow waterlily)
Lemna minor (duckweed)
Zannechellia palustris (horned pondweed)
Potamogeton nodosus (river pondweed)
Najas flexis (bushy pondweed)
Utricularia vulgaris (greater bladderwort)
DATA GATHERED BY
AQUATIC PLANTS STUDENTS
WINONA STATE UNIVERSITY
UNDER THE DIRECTION OF
PROF. J. P. EMANUEL
JULY 12, 1974

Appendix 9-3


SOUTHEAST BASIN OF LAKE
CITY PARK
NORTHWEST BASIN OF LAKE
CITY PARK
CITY PARK
A
A
Potamogeton crispus*
Nuphar variegatum
Najas flexis
Potamogeton pectinatus
Potamogeton foliosus
Elodea
Ceratophyllum demersum
Heteranthera dubia
Potamogeton richardsonii
*P. crispus - occurring everywhere except in deepest holes; also found within all stands of other species, appearing later in deep areas while maturing and dying in shallows.
Data by WSU students directed by J. P. Emanuel, 1st S.S., 1976

LAKE WINONA WEED CONTROL REPORT 1978
A Report by Bruce Fuller, City Forester

The purpose of this report is to summarize and review the weed spraying in Lake Winona during 1978. In addition, recommendations will be made on future spraying operations. Attached with this report is the label information for Aquathol "K"; with dosage recommendations, precautions, and general information.

Date: The spraying was on June 15, 1978, between 7:00 a.m. and 6:00 p.m.
Weather Conditions: Partly cloudy to sunny, 65-80°F, 70% humidity, 3-8 miles per hour wind from the east.
Weed Control: The predominent weed that we were attempting to control was curly leaf pondweed (Potamogeton crispus).
Materials Used & Application:

A. Chemical = Aquathol "K" - Active ingredient dispotassium salt of indothall - a water emulsifiable liquid concentrate solution.
B. Concentration Used - For curly leaf control to a depth of four feet with 1.5 parts per million recommended dosage, approximately four gallons per acre were used.
C. Application: (2-man operation)
   1. Sprayer - An Amerind MacKissic Mighty Mac was used. The tank capacity was 20 gallons. A Hypro piston pump series 5300 was used to pump the spray. The unit is powered by a 3-horsepower Briggs and Stratton gasoline engine.
   2. Calibration of amount needed for a four gallon per acre dosage.
      a. The sprayer pumped out 9 gallons material in 40 rods with a 10 foot spray band.
      b. $\frac{\text{Gals in 40 rods X 66}}{\text{Width of Spray}}$ = gallons per acre
      c. $\frac{9 \text{ X } 66}{10}$ = 60 gallons per acre
      d. We want four gal./acre. We have 60 gal/acre, therefore we want the mixture at 1/15 full strength.
      e. We used one gallon of concentrate to 15 gallons of water to give us four gallons/acre coverage and the 1.5 ppm for a four foot depth control.
   3. Boat Used: Park and Recreation pontoon with an 18 horse motor.
   4. Safety Equipment: Rubber boots, rubber rain gear, and rubber gloves were used to protect the person spraying the chemical. In addition, safety goggles and a facemask was worn. When spraying the drift was carried downwind of the boat and applicators.
   5. Areas Sprayed: Fishing pier and public access areas on the north side of both lakes. Special attention was given to heavy weed beds located around the beach area, the band-shell dock, maintenance shop dock, Hamilton dock, the east end culvert and the cove by the jet. The south side of the lake was not sprayed except for the fishing areas.

Results

1. One Week
   A. Most of the curly leaf showed signs of decomposition.
   B. The heavy weed beds though now broken up were still very thick.
   C. Wave action and wind carried much of the chemical and weeds to the shorelines on the lake.
   D. There was no evidence that the fish were being affected by the spraying.
2. Two Weeks
   A. Most of the curly leaf has been sinking to the bottom of the lake. Much of the regression of the weed is due to normal seasonal cycling of the weed growth. (Potamogeton crispus is a cold water plant).
   B. Though the heavy weed beds are much smaller there is need of further control.
   C. Still no evidence of fish being affected by chemical.

Recommendations for Future Spraying:

1. Spray during early May when curly leaf is first developing.
2. Administer more intense spraying around heavy weedbeds.
3. Try to spray during days when wind and wave action will be nill for two or three days.
4. Use a coarse spray to reduce loss of chemical through evaporation and misting.
5. Administer the chemical close to the shoreline where high public use is anticipated.
6. Spray when temperature is around 50°F to reduce evaporation.
7. Special attention should be given to the east end culvert to keep the area clear of weeds during high water.
8. Because of transportation problems with the pontoon boat, the west lake should be sprayed by using a large johnboat or flat bottom to transport men and equipment to areas to be sprayed.

1979 LAKE WINONA WEED CONTROL
A Report By Bruce Fuller, City Forester

The following is a summary of the spraying of Aquathol "K" in Lake Winona for the control of curly leaf pondweed. We tried to make use of the recommendations from the 1978 spraying of the lake. Included in this report are application recommendations for subsequent years.

Date: The spraying was on May 31, 1979, between 6:00 a.m. and 6:00 p.m.
Weather Conditions: Cloudy, 60°F., 80% humidity, 5-10 miles per hour wind from the Northeast.
Weed Control: The predominent weed that we were attempting to control was curly leaf pondweed (Potamogeton crispus).

Materials Used & Application:

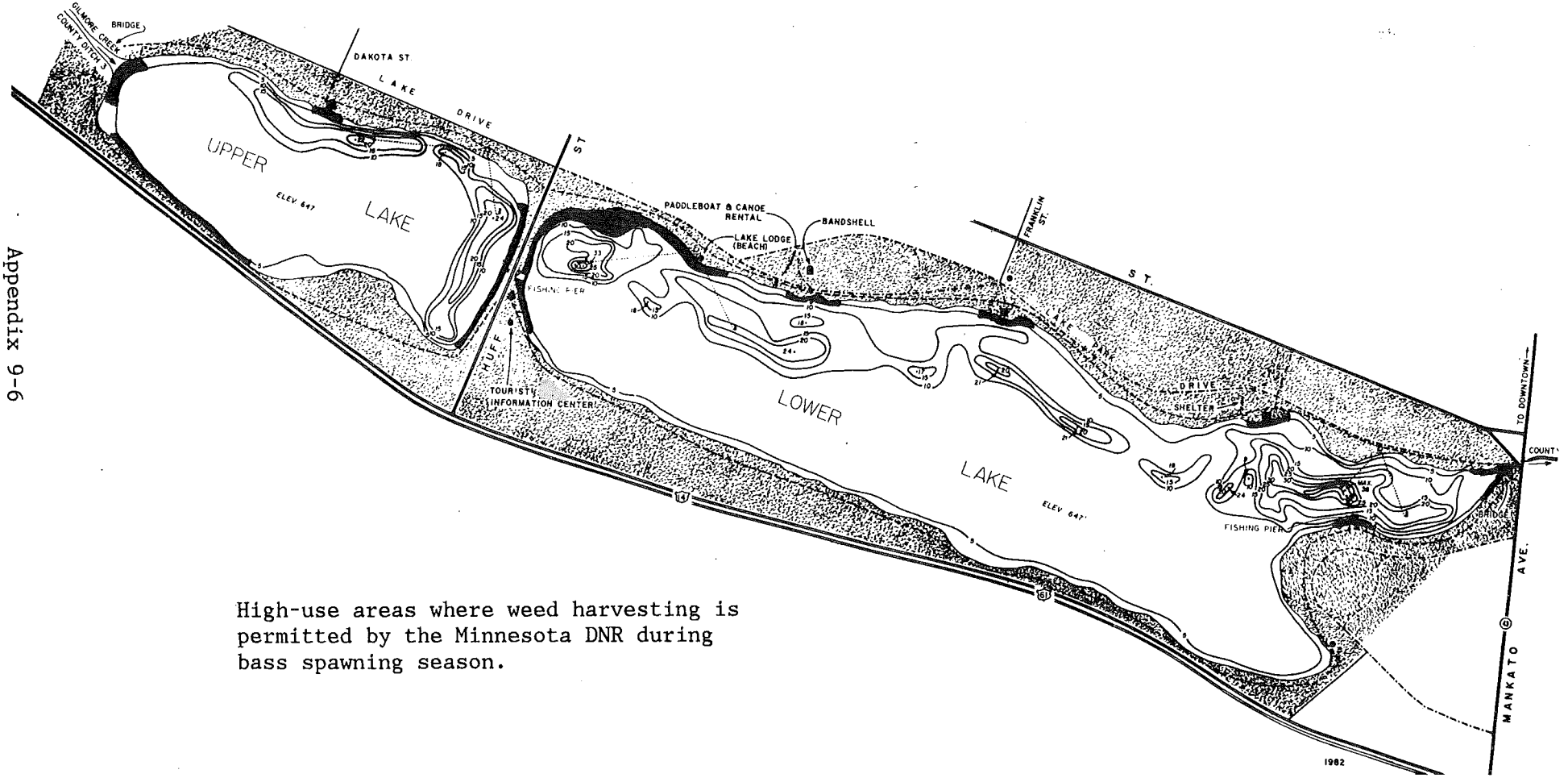
A. Chemical = Aquathol "K" - Active ingredient dispotassium salt of indothall - a water emulsifiable liquid concentrate solution.
B. Concentration Used - Control to a depth of 6 feet with 1.5 parts per million recommended dosage (approximately 6 gallons per acre was used).
C. Application (2-Man Operation)
   1. Sprayer - An Amerind MacKissis Mighty Mac was used; tank capacity 20 gallons. A Hypro piston pump series 5300 was used to pump the spray. The unit was powered by a 3 horse-power Briggs and Stratton gasoline engine.
   2. Calibration of amount needed for a six gallon per acre dosage:
      a. sprayer pumped out 9 gallons material in 40 rods with a 10 foot spray band.
      b. gallons in 40 rods X 66 = gallons per acre width of spray.
      c. $\frac{9 \times 66}{10}$ = 60 gallons per acre
      d. We want 6 gal./acre. We have 60 gal/acre; therefore we want the mixture at 1/10 full strength.
      e. We used one gallon of concentrate to 10 gallons of water (2 gallons per 20 gallon tank) to give us 6 gallons/acre coverage and the 1.5 ppm for a 6 foot depth control.
      f. A coarse spray was used to reduce misting and evaporation of the chemical.
   3. Boat Used: Park and Recreation pontoon with an 18 horse motor.
   4. Safety Equipment: Rubber boots, rubber rain gear, and rubber gloves were used to protect the person spraying the chemical. In addition, safety goggles and a facemask were worn. Care was taken to ensure that drift was carried downwind of the boat and applicators. A shower and sauna were taken after the 12-hour shift to clean the bodies and souls.
   5. Areas Sprayed: Only the east lake was sprayed this year. The entire shore line was sprayed with emphasis on the swimming beach, fishing pier, and east pumping station. We wanted to reduce the spawning beds of sun fish on the south side of the lake so the larger predatory fish could reduce the stunted sun fish numbers.

Results:

1. One Week
   A. curly leaf showed browning and start of decomposition.
   B. heavy weed beds still very evident.
   C. We had a stiff wind the following day of the application which had an adverse effect on the weed control.
   D. There was a start of a sun fish kill on the lake but caused by a combination of factors, (fish fungus, oil spill).
2. One Month
   A. There is a notable difference between the east lake and the west lake where no control measures were taken. However, there is still a weed and algae problem on the east lake.
   B. Spraying did not give good control due to the wind and wave action following the spray. The question could be raised whether or not the oil spill had an effect on the Aquathol "K".
   C. The oil spill clean-up and weed clean-up operations made it impossible to determine the effectiveness of the Aquathol "K".

Recommendations for Future Sprayings:

1. Spray around the first of May. The weed beds were still a problem during the application of the chemical at the end of May.
2. Try to find a chemical medium that will sink the chemical faster so the wave action will not affect it on subsequent days.
3. Because of other noxious weeds and algae in Lake Winona, we are facing an impossible task when trying to control weed and algae in the lake. My recommendations for controlling these problems can be summed up in one word, "dredging"!



High-use areas where weed harvesting is permitted by the Minnesota DNR during bass spawning season.

NA-01473-02
GF-9 Rev. 2/80

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF FISH AND WILDLIFE

1984

FISHERIES LAKE SURVEY

Date of Survey Various - 1984

Date Mapped August 10, 1973

☐ Initial Survey
☐ Re-Survey
☒ Other Population Assessment

Lake Identification, Location and Accessibility

(1) Name(s) Winona (2) D.O.W. No. 85-11 (3) Watershed No. 36 (4) Meandered yes

(5) County(ies) Winona Twp. 107N. R. 7W. S. 26,27,28,35

(6) Nearest town (Distance and direction to lake) Winona - within city limits

(7) Accessibility

(a) Designated public access (Location and Ownership) Three sites are maintained by the Winona Park Board for boat launching. Two on the N.E. shore of the S.E. basin; one on the N. shore of the N.W. basin.

(b) Other access areas Public fishing piers on east and west ends of southeast basin. Bank fishermen have access to the entire lake perimeter.

(8) Reason for Survey and Requested by Updated information on panfish requested by Area Fisheries Manager

(9) Previous Investigations, Surveys, and Dates

Population assessment - 1981,1982,1983

Fish kill report - September 12, 1978

Lake surveys - 1980,1960,1953

[1]Lake Winona Compendium (Fremling, 1977)

Lake and Drainage Basin Characteristics and Use

(10) Lake Area 319 acres (Planimetered from 1973 (date) sounding map) D.O.W. 318 acres

(11) Maximum Depth 38 ft.

(12) Littoral Area 279 acres Percent littoral 87.0

(13) Length of Shoreline 5.3 mile(s) Greatest length 2.0 mile(s)

[1]To fully understand the complexity of the Lake Winona system, this compendium must be reviewed.

Lake Winona

County(ies) Winona

(28) Natural Reproduction of Fish – Shoal Water Seining

Seine Measurements: Length 50 feet, Depth 4 feet, Mesh size 3/16 -inch square

	Station Number in ( )		show number of seine hauls made at each station				Totals
	1 (1)	2 (1)	3 (1)	4 (1)	5 (1)	6 ( )	
Total linear distance covered – feet	100	100	100	100	100		500 Linear Feet
Greatest water depth – feet	4	4	4	4	4		
Bottom Soil Type	sand	sand&rubble	sand&rubble	sand	sand		
Amount of Vegetation++	heavy	moderate	light	moderate	light		0.18 Acre(s)
Water Temperature – °F.	74°F	74°F	74°F	74°F	74°F		
Wind Intensity and Direction +	moderate N.W.	moderate N.W.	moderate N.W.	moderate N.W.	moderate N.W.		
Time (Military) of Day and Date	1300 082284	1400 082284	0900 082284	1000 082284	1100 082284		
Location on Lake	NW shore	E shore	E shore	NE corner	N side lower		
	upper lake 10 wide	upper lake 12 wide	lower lake 20 wide	lower lake 15 wide	lake 20 wide		

Size and Numbers

Species***	YY**	O*	YY	O	YY	O	YY	O	YY	O	YY	O	YY	O	Totals All
Bluegill	5	10	18	10	99	54	20	16	9	37			151	127	278
Largemouth bass	6		20			1	1		1				28	1	29
Green sunfish		1		5				1						7	7
Pumpkinseed		1		1		1								3	3
Hybrid sunfish				1										1	1
Unidentified centrarchid			2		11		7						20		20
Black crappie						1		1						2	2

++ Heavy, Moderate, Light, None, etc. + Strong, Moderate, Light, Calm.

***Group separately minnows and darters without identifying them, unless readily identifiable in field. Preserve sample for later identification in laboratory.

**YY – Young-of-year or fingerlings.

*O – Others, includes yearlings and adults, minnows and darters. Take scale samples from sizes of fish, especially game fish, not taken in test nets.

Lake Winona

County(ies) Winona

(29) Fish Abundance

Test Netting Summary

a. Gillnets: 5 sets — 250 ft. Experimental Nylon Net

Species	Total Number	Number per Set	Numbers per Set: Statewide Median	Numbers per Set: Local * Median	Total Pounds	Pounds per Set	Pounds per Set: Statewide Median	Pounds per Set: Local * Median
Bowfin	4	0.8	0.40	0.50	13.2	2.64	1.50	1.66
Northern pike	15	3.0	2.67	3.00	38.2	7.64	5.62	8.33
Golden shiner	1	0.2	0.815	1.37	0.2	0.04	0.10	0.10
White sucker	6	1.2	1.90	0.81	12.6	2.52	2.53	1.27
Shorthead redhorse	3	0.6	0.34	0.25	0.7	0.14	0.70	0.35
Black bullhead	42	8.4	1.50	9.00	19.0	3.80	0.90	2.51
Pumpkinseed	1	0.2	1.17	0.67	--	--	0.20	0.10
Bluegill	137	27.4	1.61	2.21	12.9	2.58	0.35	0.30
Black crappie	52	10.4	2.00	4.58	5.9	1.18	0.50	0.75
Yellow perch	142	28.4	8.00	6.22	14.5	2.90	1.51	0.68
Walleye	4	1.0	3.60	1.50	16.0	3.20	5.16	3.65

b. Trapnets: 15 -Total Pots _____ Double Pot Sets _____ Single Pot Sets

Species	Total Number	Number per Set	Numbers per Set: Statewide Median	Numbers per Set: Local* Median	Total Pounds	Pounds per Set	Pounds per Set: Statewide Median	Pounds per Set: Local* Median
Bowfin	15	1.00	0.50	0.50	55.7	3.71	2.02	1.60
Northern pike	2	0.13	0.50	0.40	3.8	0.25	0.93	0.98
Black bullhead	23	1.53	2.60	6.725	13.0	0.87	2.18	1.905
Green sunfish	3	0.20	0.33	0.50	--	--	0.06	0.0414
Pumpkinseed	3	0.20	2.83	2.00	0.3	0.02	0.55	0.2725
Bluegill	538	35.87	11.67	20.425	54.2	3.61	2.48	2.985
White crappie	2	0.13	2.74	2.105	2.8	0.19	0.64	0.54
Black crappie	158	10.53	2.67	6.31	22.1	1.47	0.97	1.32
Yellow perch	6	0.40	1.50	0.55	0.9	0.06	0.26	0.10

*Source of local median - Metro Region Netting Medians, 1946-76 inclusive

A.C. Electrofishing
October 1984

Lake Winona

County(ies) Winona

(30) Fish Sizes

Length – Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Blue-gill	Large-mouth bass	Black crappie	North-ern pike	Yellow perch	Green sun-fish	Carp			
1.4 - 1.9	2									
3.0 – 3.4		5				1				
3.5 – 3.9	3	1								
4.0 – 4.4	2									
4.5 – 4.9	31									
5.0 – 5.4	82	1								
5.5 – 5.9	68									
6.0 – 6.4	18									
6.5 – 6.9		1	3							
7.0 – 7.4	1	2	5							
7.5 – 7.9		2								
8.0 – 8.4		1			1					
8.5 – 8.9		2								
9.0 – 9.4		2								
9.5 – 9.9										
10.0 – 10.4										
10.5 – 10.9		1								
11.0 – 11.4										
11.5 – 11.9		3								
12.0 – 12.9		2								
13.0 – 13.9		1								
14.0 – 14.9		1								
15.0 – 15.9										
16.0 – 16.9		1								
17.0 – 17.9										
18.0 – 18.9										
19.0 – 19.9										
20.0 – 20.9										
21.0 – 21.9										
22.0 – 22.9										
23.0 – 23.9							1			
24.0 – 24.9										
25.0 – 25.9										
26.0 – 26.9										
27.0 – 27.9				1						
28.0 – 28.9							1			
29.0 – 29.9										
30.0 – 30.9										
31.0 – 31.9										
32.0 – 32.9										
33.0 – 33.9										
34.0 – 34.9										
35.0 – 35.9										
36.0 – 36.9										
TOTALS	207	26	8	1	1	1	2			
Catch per hour	138.0	17.3	5.3	0.7	0.7	0.7	1.3			

Appendix 11-1

Lake Winona

A.C. Electrofishing
May 1984

County(ies) Winona

(30) Fish Sizes

Length – Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Blue gill	Large-mouth bass	Black crap-pie	Pump-kin-seed	Yellow perch	Black bull-head	Bowfin			
3.0 – 3.4										
3.5 – 3.9										
4.0 – 4.4	4									
4.5 – 4.9	12									
5.0 – 5.4	26			1						
5.5 – 5.9	7									
6.0 – 6.4	6		8							
6.5 – 6.9	1		9							
7.0 – 7.4	1	1	2							
7.5 – 7.9										
8.0 – 8.4					1					
8.5 – 8.9										
9.0 – 9.4										
9.5 – 9.9						1				
10.0 – 10.4						1				
10.5 – 10.9										
11.0 – 11.4										
11.5 – 11.9										
12.0 – 12.9		1								
13.0 – 13.9		1								
14.0 – 14.9										
15.0 – 15.9		3								
16.0 – 16.9		3								
17.0 – 17.9		10								
18.0 – 18.9		2								
19.0 – 19.9		1								
20.0 – 20.9										
21.0 – 21.9							1			
22.0 – 22.9							1			
23.0 – 23.9							1			
24.0 – 24.9										
25.0 – 25.9										
26.0 – 26.9										
27.0 – 27.9										
28.0 – 28.9										
29.0 – 29.9										
30.0 – 30.9										
31.0 – 31.9										
32.0 – 32.9										
33.0 – 33.9										
34.0 – 34.9										
35.0 – 35.9										
36.0 – 36.9										
TOTALS	57	22	19	1	1	2	3			
Catch per hour	51.0	19.7	17.0	0.9	0.9	1.8	2.7			

Appendix 11-1

Lake Winona

Trapnetting
July 1984

County(ies) Winona

(30) Fish Sizes

Length – Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Blue-gill	Black crap-pie	White crap-pie	North-ern pike	Yellow perch	Black bull-head	Bowfin	Green sunfish	Pump-kin-seed	
2.5 - 2.9	5							1		
3.0 – 3.4	21							1		
3.5 – 3.9	4									
4.0 – 4.4	64									
4.5 – 4.9	173							1	1	
5.0 – 5.4	126				1				2	
5.5 – 5.9	115				1					
6.0 – 6.4	25	3								
6.5 – 6.9		46								
7.0 – 7.4	3	89			1					
7.5 – 7.9		13			1					
8.0 – 8.4	2	3			1					
8.5 – 8.9		1				2				
9.0 – 9.4		1			1	1				
9.5 – 9.9						6				
10.0 – 10.4						3				
10.5 – 10.9		2				10				
11.0 – 11.4										
11.5 – 11.9						1				
12.0 – 12.9							1			
13.0 – 13.9			1							
14.0 – 14.9			1							
15.0 – 15.9										
16.0 – 16.9										
17.0 – 17.9							2			
18.0 – 18.9										
19.0 – 19.9				1			1			
20.0 – 20.9							1			
21.0 – 21.9							2			
22.0 – 22.9										
23.0 – 23.9				1			4			
24.0 – 24.9							4			
25.0 – 25.9										
26.0 – 26.9										
27.0 – 27.9										
28.0 – 28.9										
29.0 – 29.9										
30.0 – 30.9										
31.0 – 31.9										
32.0 – 32.9										
33.0 – 33.9										
34.0 – 34.9										
35.0 – 35.9										
36.0 – 36.9										
TOTALS	538	158	2	2	6	23	15	3	3	

Appendix 11-1

Lake Winona

Gillnetting
July 1984

County(ies) Winona

(30) Fish Sizes

Length – Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Blue-gill	Black crap-pie	Wall-eye	North-ern pike	Yellow perch	Pump-kin-seed	Large-mouth bass	Bowfin	Black bull-head	Golden shiner
3.0 – 3.4										
3.5 – 3.9										
4.0 – 4.4	13	1								
4.5 – 4.9	32					1				
5.0 – 5.4	49				3					
5.5 – 5.9	27	9			44					
6.0 – 6.4	13	26			53		1			
6.5 – 6.9	3	13			32					
7.0 – 7.4		2			8				5	
7.5 – 7.9		1			1				5	1
8.0 – 8.4					1				3	
8.5 – 8.9									3	
9.0 – 9.4									6	
9.5 – 9.9									6	
10.0 – 10.4									6	
10.5 – 10.9									2	
11.0 – 11.4									3	
11.5 – 11.9									3	
12.0 – 12.9										
13.0 – 13.9										
14.0 – 14.9										
15.0 – 15.9										
16.0 – 16.9										
17.0 – 17.9			1							
18.0 – 18.9								1		
19.0 – 19.9				2						
20.0 – 20.9				2				1		
21.0 – 21.9			1	4				1		
22.0 – 22.9				1				1		
23.0 – 23.9				3						
24.0 – 24.9			2	1						
25.0 – 25.9										
26.0 – 26.9										
27.0 – 27.9				2						
28.0 – 28.9										
29.0 – 29.9										
30.0 – 30.9										
31.0 – 31.9										
32.0 – 32.9										
33.0 – 33.9										
34.0 – 34.9										
35.0 – 35.9										
36.0 – 36.9										
TOTALS	137	52	4	15	142	1	1	4	42	1

Lake Winona

Gillnetting
July 1984

County(ies) Winona

(30) Fish Sizes

Length – Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	White sucker	Shorthead red-horse							
3.0 – 3.4									
3.5 – 3.9									
4.0 – 4.4									
4.5 – 4.9									
5.0 – 5.4									
5.5 – 5.9									
6.0 – 6.4									
6.5 – 6.9		1							
7.0 – 7.4									
7.5 – 7.9									
8.0 – 8.4									
8.5 – 8.9		1							
9.0 – 9.4		1							
9.5 – 9.9									
10.0 – 10.4									
10.5 – 10.9									
11.0 – 11.4									
11.5 – 11.9									
12.0 – 12.9									
13.0 – 13.9									
14.0 – 14.9									
15.0 – 15.9	3								
16.0 – 16.9	2								
17.0 – 17.9									
18.0 – 18.9	1								
19.0 – 19.9									
20.0 – 20.9									
21.0 – 21.9									
22.0 – 22.9									
23.0 – 23.9									
24.0 – 24.9									
25.0 – 25.9									
26.0 – 26.9									
27.0 – 27.9									
28.0 – 28.9									
29.0 – 29.9									
30.0 – 30.9									
31.0 – 31.9									
32.0 – 32.9									
33.0 – 33.9									
34.0 – 34.9									
35.0 – 35.9									
36.0 – 36.9									
TOTALS	6	3							

Appendix 11-1

Lake Winona

(31) Fish Age-Class Distributions

County(ies) Winona

Species*	Sample Size	Subsample Size	Number of Fish in Age Group							
			I	II	III	IV	V	VI	VII	VIII+
Bluegill	79	79	16	5	36	14	6	2		
Largemouth bass	37	37	2	9	6	4	13	3		
Black crappie	39	39		9	19	10	1			
Walleye	4	4				2	1	1		

(32) Fish Ages and Growth Rates

Calculated Mean Total Length in Inches at Time of Last Annulus Formation

Species*	Age Groups (Number of Fish)							
	I(N)	II(N)	III(N)	IV(N)	V(N)	VI(N)	VII(N)	VIII+(N)
Bluegill	1.9(16)	2.7(5)	4.2(36)	4.9(14)	6.2(6)	7.2(2)		
Largemouth bass	3.4(2)	5.9(9)	9.2(6)	13.4(4)	16.3(13)	17.0(3)		
Black crappie		4.7(9)	6.2(19)	7.1(10)	7.2(1)			
Walleye				17.8(2)	19.5(1)	24.8(1)		

*List species in phylogenetic order.

Lake Winona

County(ies) Winona

(36) Special Problems and Conditions Affecting Fish or Fishing (Winter kill records, algae problems, etc.) During trapnetting operations on July 26, 1984 in the lower basin, the aeration unit located at the public beach was not operational. This factor coupled with a dense algae bloom and three consecutive days of calm, cloudy weather, resulted in a very limited zone of adequate dissolved oxygen. The majority of fish collected in nets set deeper than three feet were dead when lifted.

(37) Additional Field Notes Many adult bluegills were still noted on spawning beds in the lower basin on July 27, 1984. Electrofishing was conducted in Lake Winona on May 18 and October 22, 1984. Surface water temperatures at these times were 62°F in May and 50°F in October. No flathead catfish from the 1981-82 stockings were recovered during assessment netting, electrofishing, or by the crew operating the aquatic vegetation harvester.

(38) Present Fish Population Status Bluegills and black crappies are very abundant and represented by several consecutive year classes. The 1984 year class is moderate for bluegill and black crappie reproduction is absent for the second consecutive year. Growth of both species is very slow for the area. Northern pike are average in abundance with average growth. Very little natural spawning area is present. Northern pike are stocked from a cooperative pond and/or winter rescue. Black bullheads are average in number and size. Seven hundred thirty-seven adult bowfin weighing 2,373 pounds have been released into Lake Winona since April of 1984 in order to establish an additional bluegill predator. Walleye, yellow perch, carp, and channel catfish are present in low numbers.

Crew Leader Gary Grunwald

Lake Winona

County(ies) Winona

(39) Ecological Classification Centrarchid

(40) Management Classification Centrarchid-Largemouth bass

(41) Management Recommendations

Efforts to obtain the recommended 15,000 pounds of adult bowfin for biological control of bluegill will continue in 1985.

Survival of the 3,000 flathead catfish stocked in 1981/82 appears very low. This species was not established at a level required to become a biological control on bluegills.

Due to the uncertainity of Boller's Lake providing northern pike for stocking into Lake Winona, a request for statewide winter rescue northern pike is now being done on an annual basis. This should provide the recommended quota of 3,000 yearling northern pike annually.

Annual spring, summer, and fall assessments will continue as they have in order to document management changes.

The new electric weir at the lake outlet is, at this writing, very near completion. We will test the weir upon completion to verify it is providing a total barrier. We anticipate no problems with operation of the new weir.

Area Fisheries Manager 012285 (date)

Regional Fisheries Supervisor (date)

Natural Resources - Fisheries V
January 26, 1981

Lake Winona File

Bruce Hawkinson, Area Fisheries Manager

Results of a five-month creel survey on Lake Winona, May-Sept. 1980

Lake Winona is divided into an upper and lower section and contains 321 surface acres, with 87% littoral area or 279 acres being less than 15 feet of depth. It has a maximum depth of 44 feet and a median depth of nine feet. Total alkalinity is 220 ppm.

In July of 1973 before reclamation, the largest fish caught in the children's fishing contest was a 4½-inch bluegill weighing approximately two ounces. The lake had become characterized by stunted buffalo, carp, bullhead, bluegills and winterkill. A rotenone reclamation was conducted on September 17-21, 1973.

Upper and Lower Lake Winona has been monitored closely since the fishery reclamation of the watershed. There have not been many surprised by the population developments since rehabilitation; however, it was disappointing to find populations of shad, bullhead, carp, buffalo and yellow perch in the lake after reclamation.

Following reclamation these fish have been stocked:

Channel catfish	10-73	720	Fingerlings
Sunfish	10-73	88,080	Yearlings-Fingerlings
Largemouth bass	10-73	8,085	Fingerlings
Northern pike	4-74	98	Adult
Northern pike	5-74	21,000	Fingerlings
Walleye	5-74	350,000	Fry
Largemouth bass	5-74	70	Adult
Smallmouth bass	5-74	35	Adult
Bluegill	5-74	40	Adult
Bluegill	6-74	1,530	Adult
Channel catfish	6-74	50,000	Fry
Muskellunge	9-75	300	Fingerlings
Northern pike	1-76	600	Yearlings
Northern pike	1-77		Yearlings
Northern pike	1-78	300	Yearlings
Northern pike	1-79	4,200	Yearlings
Northern pike	1-80	2,000	Yearlings

The creel survey was conducted to supplement the first full lake survey conducted since 1960. Instead of simply collecting fishery information, lake associated use was also counted so that estimates off these types of activities could also be enumerated. The result being documentation of lake orientated uses via various associated pressures.

Methods

A census clerk working four hours per day and five days per week worked May through September. The days were divided into four-hour periods during daylight hours. A table of random numbers was used to schedule days off and period of the day worked.

The clerk made total counts of fishermen and users when he started, after two hours and at the end of four hours. These counts were used to estimate the average number of people using the lake for a one-hour period. The counts of boat, bank and pier fishermen were separated by weekdays and weekend days with holidays treated as weekend days. These averages for each month together with daylight hours in the month representing fishing hours were used to estimate man-hours of fishing for boat, bank and pier fishing.

Anglers were interviewed during the periods when counts were not being made. Anglers were asked the following questions: when they started fishing, what they were fishing for, the numbers and kinds of fish caught, type (boat, bank or pier), method (still, casting, fry, mix), bait (natural, artificial, mix), their age and home. Also noted on the form was ending time, elapsed time, completed or unfinished fishing trip and Upper Lake or Lower Lake.

Fish lengths and weights were also taken at the time of interview. Some scale samples were taken from a few selected fish.

Comments and remarks from the clerk were required on the count sheets.

Results

The average monthly counts for weekends-holiday and weekdays for Lake Winona are shown in Table 1.

Table 1. Estimated fishing pressure for Lake Winona, May-Sept. 1980

	Weekend-Holidays				
	Average Monthly Fisherman Counts				Estimated
	N	Boats	Bank	Pier	Man-hours
May	15	12.1	29.5	7.0	7,180
June	24	6.3	21.9	12.0	5,580
July	13	5.2	11.0	6.2	3,050
August	15	3.9	13.3	4.5	3,030
September	12	4.9	9.8	5.5	2,280

Table 1 (cont'd)

Weekdays

	Average N	Monthly Fisherman Counts Boats	Bank	Pier	Estimated Man-hours
May	48	1.2	6.9	2.6	3,310
June	35	4.1	12.8	6.6	7,610
July	39	3.3	8.5	5.0	5,580
August	24	1.9	6.5	3.5	3,460
September	22	2.4	4.6	3.6	2,780

There were 1,953 hours of actual interviewed man-hours. This represented talking with 1,541 anglers. They had been fishing an average time of 1.27 hours before being interviewed. The catch rate of interviewed Lake Winona fishermen from May through September, 1980, is shown in Table 2.

Table 2. The actual catch rate by species of all interviewed anglers in Lake Winona, May-September, 1980.

	Number of Fish	Catch rate (fish/m-h)
Bluegill	7,004	3.59
Crappies	204	.10
Largemouth bass	95	.05
Northern pike	89	.05
Bullhead	60	.03
Walleye	26	.01
Perch	17	.01
TOTAL	7,495	3.84

The average fish weights are shown in Table 3.

Table 3. The average fish weight of fish caught by angling in Lake Winona from May-September, 1980.

Species	No. Weighed	Average
Bluegill	873	0.25
Crappie	34	0.27
Largemouth bass	24	1.8
Northern pike	25	3.2
Bullhead	10	1.2
Walleye	16	2.6

The estimated harvest by species for Lake Winona can be calculated for the May-September, 1980 period. These estimates are shown in Table 4 (see attached).

As part of collecting information, the clerk asked the anglers what they were fishing for. This made it possible to calculate a catch rate for people who were seeking specific or non-specific species. These catch rates are shown in Table 5.

Table 5. The sought species catch rate for Lake Winona anglers who fished during May-September, 1980.

Sought Species	% of People Seeking	Hours Spent	Number Caught	Catch Rate
Anything	29%	544	462 - Bluegill	0.85
			26 - Crappie	0.05
			55 - LM bass	0.10
			71 - No. pike	0.13
			17 - Bullhead	0.03
			4 - Walleye	0.01
			4 - Perch	0.01
Panfish	25%	470	2,395 - Bluegill	5.12
			138 - Crappie	0.30
			5 - LM bass	0.01
			2 - Bullhead	Tr*
			10 - Perch	0.02
Bluegill	38%	705	3,507	4.98
Crappie	Tr	11	25	2.36
Largemouth bass	2%	43	25	0.58
Northern pike	1%	19	16	0.84
Bullhead	Tr	6	9	1.48
Walleye	4%	72	21	0.29

*Tr = less than 0.005

The ages of fishermen were taken during the survey. The age classes correspond with the National Survey of Hunting and Fishing done by the Department of Interior. The data is shown in Table 6 by percent and percent/year in each class.

Table 4. The estimated harvest of angled fish, by species, with an estimated fishing pressure of 43,860 man-hours during May-September, 1980, for Lake Winona.

Species	Catch Rate	No. Caught	Av. Weight in Pounds	Est. Harvest in Pounds	Harvest/ Acre in Pounds/Acre	Harvest/ Littoral Acre
Bluegill	3.59	157,460	0.25	39,370	123	141
Crappie	0.10	4,390	0.27	1,190	4	4
Largemouth bass	0.05	2,190	1.8	3,940	12	14
Northern pike	0.05	2,190	3.2	7,010	22	25
Bullhead	0.03	1,320	1.2	1,580	5	6
Walleye	0.01	440	2.6	1,140	4	4
Perch	0.01	440	*	*	*	*
		168,430		54,230	170	194

* unknown

Table 6. The age composition by percent of fishermen using Lake Winona from May-September, 1980.

Ages Class	%	%/Year
1-11	6	.5
12-17	20	3.3
18-34	31	1.8
35-44	14	1.4
45-64	13	.7
65+	16	1.6

Hometown and state of Lake Winona anglers were recorded. The information is shown in Table 7.

Table 7. The hometown and state of fisherman, by percent, using Lake Winona from May-September, 1980.

Cities	%
Winona	80.1
Rochester	3.4
Lewiston	2.8
Rushford	2.8
Twin Cities Area	1.2
Minnesota City	1.0
Stockton	0.7
Goodview	0.5
St. Charles	0.7
Kellogg	0.7
Dover-Eyota	0.5
Altura	0.7
Rollingstone, LaCrescent, Weaver, Ridgeway, Plainview, Utica, Austin, Adams, Houston, Pickwick, Homer, Lanesboro, Stewartville, Albert Lea, Troy, Owatonna, Red Wing, Dakota, Monticello, Cedar Valley, Peterson, Mabel, Pine Island, Isanti, Waterville, Herron Lake, Wilson, Millville -	*

States and Countries	%
Alaska	*
Arkansas	*
California	*
Colorado	*
Illinois	2.6
Indiana	*
Iowa	1.4
Kansas	*
Michigan	*
Minnesota	92.1
Missouri	*
N. Dakota	*
Oregon	*
S. Carolina	*
Tennessee	*
Texas	*
Virginia	*
Wisconsin	1.6
Israel	*

*Represents less than .5%

Record of the type of fishing (boat, bank or pier), the methods used (still fishing, casting, fly fishing or a mixture of these) and baits (natural, artificial, a mixture or corn) were also kept. They are shown in Table 8.

Table 8. The type, method and bait used by Lake Winona fishermen from May-September, 1980.

Type (%)			Method (%)				Bait (%)			
Boat	Bank	Pier	Still	Cast.	Fly	Mix	Nat.	Art.	Corn	Mix
7	64	29	72	23	2	3	71	25	1	3

Counts of lake users were taken three times a day when angler interviewing was done. The weekend and weekday percentage of lake activity use is recorded in Table 9.

Table 9. A summary of lake orientated use of Lake Winona on weekends and weekdays from May-September, 1980.

	Weekend(%)		Weekday(%)	
Fishermen				
Boat	5.4)		3.6)	
Bank	15.8)	27.9	11.4)	21.3
Pier	6.7)		6.3)	
Bikers	13.9		17.8	
Picnickers	27.1		18.3	
Sunners	12.8		18.3	
Swimmers	8.2		6.6	
Joggers	3.3		7.1	
Paddleboaters	0.5		*	
Canoeists	0.9		0.7	
Rowboaters (not fishing)	0.6		*	
Sailboaters	*		0.7	
Readers	0.6		1.1	
Thinkers	*		0.9	
Lovers	1.1		1.3	
Rollerskaters	0.7		0.9	
Football players	*			
Softball players	*		1.0	
Cross country skiers	*		*	
Scuba divers	*		*	
Frisbee throwers	0.5		2.4	
Guitar players			*	
Artists			*	
Skateboarders			*	
Remote control boaters			*	
Badminton			*	
Total Numbers Counted	8,978		11,456	

* Less than .005

Discussion

The creel survey conducted during the May-September, 1980 season went very well. The interviews were very consistent (relatively short time with fish already creeled and no zero counts for fishing were recorded). Thus, from previous experience, the estimate should be very reliable with relatively small confidence intervals and small standard errors. However, these were not calculated for the survey report.

By going through the tables in order, the success of the fishery which has been developed becomes more and more apparent.

The pressure on the fishery is very heavy. There was an estimated 21,210 man-hours on weekends and 22,740 man-hours on weekdays. This combined to give a five-month fishing pressure estimate of 43,860 man-hours or 137 man-hours/acre or 157 man-hours/littoral acre for this short five-month period of May through September.

The 1,541 interviewed anglers fished 1,953 hours and caught 7,495 fish. This approaches four fish/hour. The bluegill in Lake Winona, like many lakes in Minnesota, was the principal fish caught and sought after. Of the total 170 pound/acre harvested in Lake Winona, 123 pounds (72%) were from bluegills which averaged a very good 0.25 pounds.

People who were seeking a specific variety or species of fish were much more successful than the person after anything or the catch rate of all fishermen combined, i.e. bluegill fishermen had a better catch rate than fishermen fishing for anything and catching bluegills. The same sort of results apply to largemouth bass, northern pike and bullheads.

The age data demonstrates that over 50% of all the fishing pressure comes from the 12 to 17 and 18 to 34 year age groups. People less than 12 and older than 65 made up 22%. The majority of anglers still-fished from the bank with natural bait.

Winona citizens represented 80% of the fishing pressure on the lake; Rochester, Lewiston, Rushford, the Twin Cities area and Minnesota City accounted for 11.2%; and a multitude of other towns, states and one Israeli accounted for the remaining 8.7%. There were 17 additional states involved. There were more Illinois people fishing than people from Wisconsin or Iowa.

The user summary shows the importance of the Lake Winona fishery even during the heaviest lake orientated use period of the year (May through September). Fishermen accounted for 27.9% of the users on weekends and 21.3% on weekdays. Fishermen, bikers, picnickers, sunbathers, swimmers and joggers accounted for 90% of the use.

Conclusions

From this creel survey and historical data, the reclamation has been and continues to be an outstanding success. Acre for acre this lake may rival any lake in the State of Minnesota for use, catch rate and harvest.

The fisherman use during this period doesn't appear to be high compared to other uses during this period. However, this period is the most heavily used period for picnicking, biking, jogging, swimming and sunning. If a study were to be done from October to April, probably 90% of use would be fishing. The catch rate, harvest and use of Lake Winona by fishermen is truly an important recreational outlet for the community.

Based on the money for reclamation, management and maintenance of the Lake Winona fishery, it is easily worth every cent and actually a bargain.

BWH/bkd/bl

cc: Jim Schneider
D. Shodeen
C. Fremling
D. Dieterman
C. Bylander

Gillnetting 9/19-23/60

Lake Winona

County Winona

Date 1960

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Northern Pike	Dog fish	Gar	Walleye	Silver Bass	Brown Bullhead	Carp	Buffalo fish	Common Sucker	
3.0 - 3.4										
3.5 - 3.9										
4.0 - 4.4										
4.5 - 4.9										
5.0 - 5.4										
5.5 - 5.9										
6.0 - 6.4										
6.5 - 6.9										
7.0 - 7.4					1					
7.5 - 7.9										
8.0 - 8.4										
8.5 - 8.9										
9.0 - 9.4										
9.5 - 9.9						1				
10.0 - 10.4						1				
10.5 - 10.9						1				
11.0 - 11.4										
11.5 - 11.9										
12.0 - 12.9					2					
13.0 - 13.9					1					
14.0 - 14.9					2					
15.0 - 15.9										
16.0 - 16.9									1	
17.0 - 17.9										
18.0 - 18.9				1			1			
19.0 - 19.9				1			1			
20.0 - 20.9				1			1			
21.0 - 21.9			1	1			1			
22.0 - 22.9		1					1			
23.0 - 23.9			1				1			
24.0 - 24.9	1			1				1		
25.0 - 25.9										
26.0 - 26.9	3									
27.0 - 27.9	1									
28.0 - 28.9										
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	5	1	2	5	6	4	6	1	1	

Gillnetting 9/19-23/60

Lake Winona

County Winona

Date 1960

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Gizzard Shad	Black Crappie	Blue-gill	Yellow Perch						
3.0 - 3.4										
3.5 - 3.9			2							
4.0 - 4.4	1		6							
4.5 - 4.9	1		5							
5.0 - 5.4	3		2	3						
5.5 - 5.9	4		1	30						
6.0 - 6.4	27	1	1	33						
6.5 - 6.9	26	10		10						
7.0 - 7.4		13	2	6						
7.5 - 7.9		4	1	3						
8.0 - 8.4		4		5						
8.5 - 8.9		10	1	6						
9.0 - 9.4		31	1	6						
9.5 - 9.9		42		6						
10.0 - 10.4	4	14		3						
10.5 - 10.9	6	3								
11.0 - 11.4	14									
11.5 - 11.9	7	1								
12.0 - 12.9	7									
13.0 - 13.9										
14.0 - 14.9										
15.0 - 15.9										
16.0 - 16.9										
17.0 - 17.9										
18.0 - 18.9										
19.0 - 19.9										
20.0 - 20.9										
21.0 - 21.9										
22.0 - 22.9										
23.0 - 23.9										
24.0 - 24.9										
25.0 - 25.9										
26.0 - 26.9										
27.0 - 27.9										
28.0 - 28.9										
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	100	133	22	111						

Lake Winona

Gillnetting 7/25/80

County Winona

Date 1980

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Wall-eye	North-ern pike	Black crappie	Blue-gill	Yellow perch	Black bull-head	Fresh-water Drum			
3.0 - 3.4										
3.5 - 3.9				3		1				
4.0 - 4.4				6		3				
4.5 - 4.9				25		2				
5.0 - 5.4				33	10	10				
5.5 - 5.9			12	64	16	4				
6.0 - 6.4			44	149	7					
6.5 - 6.9			12	203	7					
7.0 - 7.4			11	54	4	2				
7.5 - 7.9			7		2					
8.0 - 8.4			14			2				
8.5 - 8.9		1	5		1					
9.0 - 9.4			2			6				
9.5 - 9.9					2	17				
10.0 - 10.4						8				
10.5 - 10.9						6				
11.0 - 11.4		1				10				
11.5 - 11.9						10				
12.0 - 12.9						10				
13.0 - 13.9		1				13				
14.0 - 14.9										
15.0 - 15.9		1					1			
16.0 - 16.9		3								
17.0 - 17.9	4									
18.0 - 18.9	2	2								
19.0 - 19.9		2								
20.0 - 20.9										
21.0 - 21.9	1									
22.0 - 22.9	2	1								
23.0 - 23.9	2	6								
24.0 - 24.9		1								
25.0 - 25.9										
26.0 - 26.9		1								
27.0 - 27.9		2								
28.0 - 28.9		4								
29.0 - 29.9										
30.0 - 30.9		1								
31.0 - 31.9		1								
32.0 - 32.9		1								
33.0 - 33.9		2								
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	11	31	107	537	49	104	1			

Lake Winona

Gillnetting 6/30/81

County Winona

Date 1981

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Northern pike	Walleye	Large mouth bass	Bluegill	Black crappie	Yellow perch	Black bullhead	Carp		
3.0 - 3.4					3		1			
3.5 - 3.9				3	19		2			
4.0 - 4.4				12	16		7			
4.5 - 4.9				16		2	10			
5.0 - 5.4			1	9	1	27	13			
5.5 - 5.9				2	2	7				
6.0 - 6.4				9	1	3	4			
6.5 - 6.9				15	5	2	15			
7.0 - 7.4				6	6	5	16			
7.5 - 7.9				2	4	4	2			
8.0 - 8.4					1	3	5			
8.5 - 8.9					4	4	4			
9.0 - 9.4					2		3			
9.5 - 9.9							1			
10.0 - 10.4							3			
10.5 - 10.9							1			
11.0 - 11.4							1			
11.5 - 11.9							3			
12.0 - 12.9	1						1			
13.0 - 13.9	6		1							
14.0 - 14.9	2		1				1			
15.0 - 15.9	6		1							
16.0 - 16.9	5									
17.0 - 17.9	2	2								
18.0 - 18.9		5								
19.0 - 19.9	4	4								
20.0 - 20.9	4									
21.0 - 21.9	2							1		
22.0 - 22.9	3									
23.0 - 23.9		3								
24.0 - 24.9	1									
25.0 - 25.9	1									
26.0 - 26.9	3									
27.0 - 27.9	5									
28.0 - 28.9										
29.0 - 29.9	1									
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9	1									
35.0 - 35.9										
36.0 - 36.9										
TOTALS	47	14	4	74	64	57	93	1		

Lake Winona

Trapnetting 7/2/81

County Winona

Date 1981

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Blue-gill	Black crappie	North-ern pike	Wall-eye	Yellow perch	Black bull-head	Channel cat-fish	Carp		
3.0 - 3.4	38	2								
3.5 - 3.9	8	19								
4.0 - 4.4	63	8								
4.5 - 4.9	105				3					
5.0 - 5.4	54				3					
5.5 - 5.9	30	1			2					
6.0 - 6.4	67	3				1				
6.5 - 6.9	98	10				1				
7.0 - 7.4	73	4								
7.5 - 7.9	20	8								
8.0 - 8.4	1	10				1				
8.5 - 8.9		5			1					
9.0 - 9.4		7				1				
9.5 - 9.9		1				1				
10.0 - 10.4			1			2				
10.5 - 10.9						1				
11.0 - 11.4						4				
11.5 - 11.9						2		1		
12.0 - 12.9			1			5				
13.0 - 13.9			1			4		1		
14.0 - 14.9						1				
15.0 - 15.9										
16.0 - 16.9										
17.0 - 17.9										
18.0 - 18.9										
19.0 - 19.9										
20.0 - 20.9										
21.0 - 21.9										
22.0 - 22.9										
23.0 - 23.9				1						
24.0 - 24.9			1							
25.0 - 25.9										
26.0 - 26.9										
27.0 - 27.9							1			
28.0 - 28.9										
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	557	78	4	1	9	24	1	2		

Lake Winona

Electro-fishing 5/6/81
10/15/81

County Winona

Date 1981

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Large mouth bass	Wall-eye	Blue-gill	North-ern pike	Carp	Black bull-head	Black crappie	Hybrid sun-fish	Green sun-fish	
3.0 - 3.4										
3.5 - 3.9	3		3							
4.0 - 4.4			1			1				
4.5 - 4.9			5				1			
5.0 - 5.4	2		36				1	1		
5.5 - 5.9	3		53						1	
6.0 - 6.4	2		35							
6.5 - 6.9	7		37				11	1		
7.0 - 7.4	5		19				9			
7.5 - 7.9			4				2			
8.0 - 8.4	2						4			
8.5 - 8.9	2						2			
9.0 - 9.4	1						4			
9.5 - 9.9	1			1						
10.0 - 10.4										
10.5 - 10.9					2					
11.0 - 11.4					2					
11.5 - 11.9					4					
12.0 - 12.9	2				4					
13.0 - 13.9	4									
14.0 - 14.9	4				1					
15.0 - 15.9	11									
16.0 - 16.9	23			1						
17.0 - 17.9				1						
18.0 - 18.9				2						
19.0 - 19.9		1								
20.0 - 20.9					1					
21.0 - 21.9										
22.0 - 22.9		1		1	3					
23.0 - 23.9					2					
24.0 - 24.9				2	2					
25.0 - 25.9					2					
26.0 - 26.9					2					
27.0 - 27.9					3					
28.0 - 28.9					1					
29.0 - 29.9										
30.0 - 30.9					1					
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	72	2	193	8	30	1	34	2	1	

Lake Winona

County Winona

Gillnetting- July 1982 Date 1982

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Northern pike	Walleye	Large mouth bass	Bluegill	Black crappie	Yellow perch	Black bullhead	Carp	Channel catfish	White crappie
3.0 - 3.4				10						
3.5 - 3.9				17						
4.0 - 4.4				5	1		1			
4.5 - 4.9				11	27					
5.0 - 5.4				13	18	11				
5.5 - 5.9				16	4	17	1			1
6.0 - 6.4					11	1				
6.5 - 6.9					4	2	2			
7.0 - 7.4					2					
7.5 - 7.9			1		2		7			
8.0 - 8.4							10			
8.5 - 8.9							10			1
9.0 - 9.4							9			
9.5 - 9.9							8			
10.0 - 10.4										
10.5 - 10.9										
11.0 - 11.4										
11.5 - 11.9										
12.0 - 12.9										
13.0 - 13.9										
14.0 - 14.9										
15.0 - 15.9			1							
16.0 - 16.9										
17.0 - 17.9	5									
18.0 - 18.9	14	1								
19.0 - 19.9	13	1								
20.0 - 20.9	5	2								
21.0 - 21.9	13								1	
22.0 - 22.9	5									
23.0 - 23.9	2									
24.0 - 24.9	1								1	
25.0 - 25.9	4									
26.0 - 26.9	4									
27.0 - 27.9								1		
28.0 - 28.9										
29.0 - 29.9	1									
30.0 - 30.9	1									
31.0 - 31.9	1									
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	69	4	2	72	69	31	48	1	2	2

Lake Winona

County Winona

Trapnetting- July 1982

Date 1982

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Blue-gills	Black crappie	North-ern pike	Wall-eye	Yellow perch	Black bull-head	Carp	White crappie	Pump-kin-seed	Green sun-fish
2.5-2.9	8								1	
3.0 - 3.4	12					2				1
3.5 - 3.9	142	1				6				
4.0 - 4.4	243	1				8				
4.5 - 4.9	121	21			6	3				
5.0 - 5.4	178	189			28	1				
5.5 - 5.9	203	91			15	1				
6.0 - 6.4	85	22			3	1				
6.5 - 6.9	39	118								
7.0 - 7.4	12	27				2				
7.5 - 7.9	7	27				8				
8.0 - 8.4		20				8				
8.5 - 8.9		21				15				
9.0 - 9.4		11				20				
9.5 - 9.9		4				10				
10.0 - 10.4		1				6				
10.5 - 10.9						3				
11.0 - 11.4						4				
11.5 - 11.9										
12.0 - 12.9						4				
13.0 - 13.9						10				
14.0 - 14.9										
15.0 - 15.9										
16.0 - 16.9							1			
17.0 - 17.9			2				1			
18.0 - 18.9			5							
19.0 - 19.9			4	2						
20.0 - 20.9			6	3			1			
21.0 - 21.9				1						
22.0 - 22.9			2							
23.0 - 23.9			5							
24.0 - 24.9			3							
25.0 - 25.9			1							
26.0 - 26.9			2							
27.0 - 27.9										
28.0 - 28.9										
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9			1							
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	1,050	554	31	6	52	112	3	1	1	

Lake Winona

County Winona

A.C. Electo- fishing
May 1982

Date 1982

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Large mouth bass	Blue-gill	Carp	Black crappie	Green sun-fish	Yellow perch	Small mouth bass			
3.0 - 3.4	1	5								
3.5 - 3.9		12								
4.0 - 4.4		4								
4.5 - 4.9		2								
5.0 - 5.4		34		5		1				
5.5 - 5.9	2	19		1	1					
6.0 - 6.4	7	8				1				
6.5 - 6.9	1	7		2		1				
7.0 - 7.4		2		7						
7.5 - 7.9	1			2						
8.0 - 8.4	2			9						
8.5 - 8.9				6						
9.0 - 9.4	1			3						
9.5 - 9.9				1						
10.0 - 10.4										
10.5 - 10.9										
11.0 - 11.4										
11.5 - 11.9										
12.0 - 12.9										
13.0 - 13.9	1									
14.0 - 14.9	4									
15.0 - 15.9	8		1							
16.0 - 16.9	7		1							
17.0 - 17.9	4		1					1		
18.0 - 18.9			2					1		
19.0 - 19.9			2				1	1		
20.0 - 20.9			1					1		
21.0 - 21.9										
22.0 - 22.9										
23.0 - 23.9								1		
24.0 - 24.9								1		
25.0 - 25.9			2							
26.0 - 26.9			1							
27.0 - 27.9										
28.0 - 28.9										
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9			1							
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	39	93	12	136	1	3	1	6		
catch per hour	27.9	66.4	8.6	25.7	0.7	2.1	0.7	4.3		

Lake Winona

County Winona

A.C. Electro-fishing
October 1982

Date 1982

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Large mouth bass	Wall-eye	Blue-gill	North-ern pike	Carp	Black crappie	Green sun-fish	Yellow perch		
3.0 - 3.4	3		2							
3.5 - 3.9	1		5							
4.0 - 4.4			14							
4.5 - 4.9			30				1			
5.0 - 5.4	1		23			1				
5.5 - 5.9			19			8		2		
6.0 - 6.4			14			9				
6.5 - 6.9	1		9			3		2		
7.0 - 7.4	1		1			4				
7.5 - 7.9			1			2				
8.0 - 8.4	1					1				
8.5 - 8.9	4					1				
9.0 - 9.4	4					1				
9.5 - 9.9	1									
10.0 - 10.4	1									
10.5 - 10.9										
11.0 - 11.4	2									
11.5 - 11.9										
12.0 - 12.9	1									
13.0 - 13.9	1									
14.0 - 14.9										
15.0 - 15.9			1	1						
16.0 - 16.9										
17.0 - 17.9	1				2					
18.0 - 18.9				1	2					
19.0 - 19.9				2	1					
20.0 - 20.9				2						
21.0 - 21.9										
22.0 - 22.9		1		1	2					
23.0 - 23.9					4					
24.0 - 24.9				1	2					
25.0 - 25.9										
26.0 - 26.9				1	1					
27.0 - 27.9					2					
28.0 - 28.9										
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	23	1	118	9	16	30	1	4		
Catch per hour	10.9	0.5	56.2	4.3	7.6	14.8	0.5	1.9		

Lake Winona

County Winona

Date 1983

Gillnetting July - 1983

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Walleye	Northern pike	Bluegill	Black crappie	Yellow perch	Pumpkinseed	Black bullhead			
3.0 - 3.4										
3.5 - 3.9			33	1						
4.0 - 4.4			9			1				
4.5 - 4.9			12							
5.0 - 5.4			12	1	2					
5.5 - 5.9			9	53	9					
6.0 - 6.4			9	67	17					
6.5 - 6.9			3	10	2		2			
7.0 - 7.4			1	2	3		2			
7.5 - 7.9					1		3			
8.0 - 8.4							3			
8.5 - 8.9							3			
9.0 - 9.4							7			
9.5 - 9.9							12			
10.0 - 10.4							13			
10.5 - 10.9							4			
11.0 - 11.4							2			
11.5 - 11.9										
12.0 - 12.9										
13.0 - 13.9		2					1			
14.0 - 14.9										
15.0 - 15.9		2								
16.0 - 16.9										
17.0 - 17.9		2								
18.0 - 18.9										
19.0 - 19.9	2									
20.0 - 20.9	2	1								
21.0 - 21.9		3								
22.0 - 22.9	1	4								
23.0 - 23.9		1								
24.0 - 24.9		1								
25.0 - 25.9		2								
26.0 - 26.9		1								
27.0 - 27.9		1								
28.0 - 28.9		1								
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	5	21	88	134	34	1	52			

Trapnetting
July - 1983

Lake Winona

County Winona

Date 1983

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Blue-gill	North-ern pike	Wall-eye	Yellow perch	Black crappie	White crappie	Green sun-fish	Pump-kin-seed	War-mouth	Carp
									1	
3.0 - 3.4	35						2	1		
3.5 - 3.9	128						2	7		
4.0 - 4.4	98						1	10		
4.5 - 4.9	219				7					
5.0 - 5.4	366			1	42		1			
5.5 - 5.9	288			3	132					
6.0 - 6.4	221			1	77					
6.5 - 6.9	50			3	34					
7.0 - 7.4	13				5					
7.5 - 7.9	7			2	5					
8.0 - 8.4					15					
8.5 - 8.9					7					
9.0 - 9.4					3					
9.5 - 9.9					1					
10.0 - 10.4					1					
10.5 - 10.9										
11.0 - 11.4										
11.5 - 11.9										
12.0 - 12.9		1				1				
13.0 - 13.9										
14.0 - 14.9		1								
15.0 - 15.9		1								
16.0 - 16.9										
17.0 - 17.9										
18.0 - 18.9		1								
19.0 - 19.9		1								
20.0 - 20.9										
21.0 - 21.9		1								
22.0 - 22.9										1
23.0 - 23.9		2								
24.0 - 24.9		1								
25.0 - 25.9		1								
26.0 - 26.9			1							
27.0 - 27.9										
28.0 - 28.9										
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	1,425	10	1	10	329	1	6	18	1	1

Lake Winona

Trapnetting
July - 1983

County Winona

Date 1983

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Black bull-head	Brown bull head								
3.0 - 3.4										
3.5 - 3.9										
4.0 - 4.4										
4.5 - 4.9										
5.0 - 5.4										
5.5 - 5.9										
6.0 - 6.4										
6.5 - 6.9	1									
7.0 - 7.4	2									
7.5 - 7.9	2									
8.0 - 8.4	2									
8.5 - 8.9	6									
9.0 - 9.4	12									
9.5 - 9.9	8									
10.0 - 10.4	7									
10.5 - 10.9	6									
11.0 - 11.4	3									
11.5 - 11.9	2									
12.0 - 12.9										
13.0 - 13.9		1								
14.0 - 14.9	1									
15.0 - 15.9										
16.0 - 16.9										
17.0 - 17.9										
18.0 - 18.9										
19.0 - 19.9										
20.0 - 20.9										
21.0 - 21.9										
22.0 - 22.9										
23.0 - 23.9										
24.0 - 24.9										
25.0 - 25.9										
26.0 - 26.9										
27.0 - 27.9										
28.0 - 28.9										
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	52	1								

Lake Winona

County Winona

A.C. Electro-fishing
May 1983

Date 1983

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Large-mouth bass	Blue-gills	Black crappie	North-ern pike	carp	Pump-kin-seed	Green sunfish	Black bull-head	Snap-ping turtle	
2.5-2.9		6								
3.0 - 3.4	2	20								
3.5 - 3.9		11								
4.0 - 4.4		25				1				
4.5 - 4.9		44								
5.0 - 5.4	2	32					1			
5.5 - 5.9	1	31					1			
6.0 - 6.4	1	35	9							
6.5 - 6.9		16	2							
7.0 - 7.4		2	3							
7.5 - 7.9		3								
8.0 - 8.4			1					1		
8.5 - 8.9			3							
9.0 - 9.4			1							
9.5 - 9.9										
10.0 - 10.4	2									
10.5 - 10.9										
11.0 - 11.4										
11.5 - 11.9	1									
12.0 - 12.9										
13.0 - 13.9	1			1						
14.0 - 14.9										
15.0 - 15.9	1								1	
16.0 - 16.9	9									
17.0 - 17.9	5									
18.0 - 18.9	1									
19.0 - 19.9										
20.0 - 20.9										
21.0 - 21.9					2					
22.0 - 22.9				1						
23.0 - 23.9				1						
24.0 - 24.9										
25.0 - 25.9										
26.0 - 26.9										
27.0 - 27.9										
28.0 - 28.9				1						
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	26	225	19	4	2	1	2	1	1	
Catch per hour	11.0	94.9	8.0	1.7	0.8	0.8	0.8	0.4	0.4	

Lake Winona

County Winona

A.C. ELectro-fishing
October - 1983

Date 1983

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Blue-gill	Black crappie	North-ern pike	Small-mouth bass	Large mouth bass	Wall-eye	White sucker	Black bull-head	Green sun-fish	Carp
2.5-2.9	2				3				1	
3.0 - 3.4	1				1				1	
3.5 - 3.9	5				1				1	
4.0 - 4.4	19									
4.5 - 4.9	18				2				3	
5.0 - 5.4	40				1				2	
5.5 - 5.9	21									
6.0 - 6.4	9									
6.5 - 6.9	1									
7.0 - 7.4	1	3			1					
7.5 - 7.9					1					
8.0 - 8.4										
8.5 - 8.9					1					
9.0 - 9.4								2		
9.5 - 9.9		1			1			1		
10.0 - 10.4		1						2		
10.5 - 10.9					1					
11.0 - 11.4					1					
11.5 - 11.9					2			1		
12.0 - 12.9					4			1		
13.0 - 13.9					2					
14.0 - 14.9					3		1			
15.0 - 15.9										
16.0 - 16.9					1					
17.0 - 17.9										
18.0 - 18.9										
19.0 - 19.9				1		1				
20.0 - 20.9						3				1
21.0 - 21.9			1			5				2
22.0 - 22.9						1				2
23.0 - 23.9										2
24.0 - 24.9						1				2
25.0 - 25.9						1				1
26.0 - 26.9			2			1				
27.0 - 27.9			1							
28.0 - 28.9										1
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	117	5	4	1	26	13	1	7	8	11
Catch per hour	86.7	3.7	3.0	0.7	19.3	9.6	0.7	5.2	5.9	8.2

A.C. Electro-fishing
October - 1983

Lake Winona

County Winona

Date 1983

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	Yellow perch	Pump-kin-seed								
3.0 - 3.4		1								
3.5 - 3.9										
4.0 - 4.4										
4.5 - 4.9		1								
5.0 - 5.4		1								
5.5 - 5.9										
6.0 - 6.4	1									
6.5 - 6.9	2									
7.0 - 7.4	2									
7.5 - 7.9										
8.0 - 8.4										
8.5 - 8.9										
9.0 - 9.4										
9.5 - 9.9										
10.0 - 10.4										
10.5 - 10.9										
11.0 - 11.4										
11.5 - 11.9										
12.0 - 12.9										
13.0 - 13.9										
14.0 - 14.9										
15.0 - 15.9										
16.0 - 16.9										
17.0 - 17.9										
18.0 - 18.9										
19.0 - 19.9										
20.0 - 20.9										
21.0 - 21.9										
22.0 - 22.9										
23.0 - 23.9										
24.0 - 24.9										
25.0 - 25.9										
26.0 - 26.9										
27.0 - 27.9										
28.0 - 28.9										
29.0 - 29.9										
30.0 - 30.9										
31.0 - 31.9										
32.0 - 32.9										
33.0 - 33.9										
34.0 - 34.9										
35.0 - 35.9										
36.0 - 36.9										
TOTALS	5	3								

Catch per hour 3.7 2.2

Gillnetting- July 1982

Lake Winona

County Winona

Date 1982

Length - Frequency Distributions
Species and Numbers of Fish in Length Groups

Total Length in Inches	White sucker									
3.0 - 3.4										
3.5 - 3.9										
4.0 - 4.4										
4.5 - 4.9										
5.0 - 5.4										
5.5 - 5.9										
6.0 - 6.4										
6.5 - 6.9										
7.0 - 7.4										
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