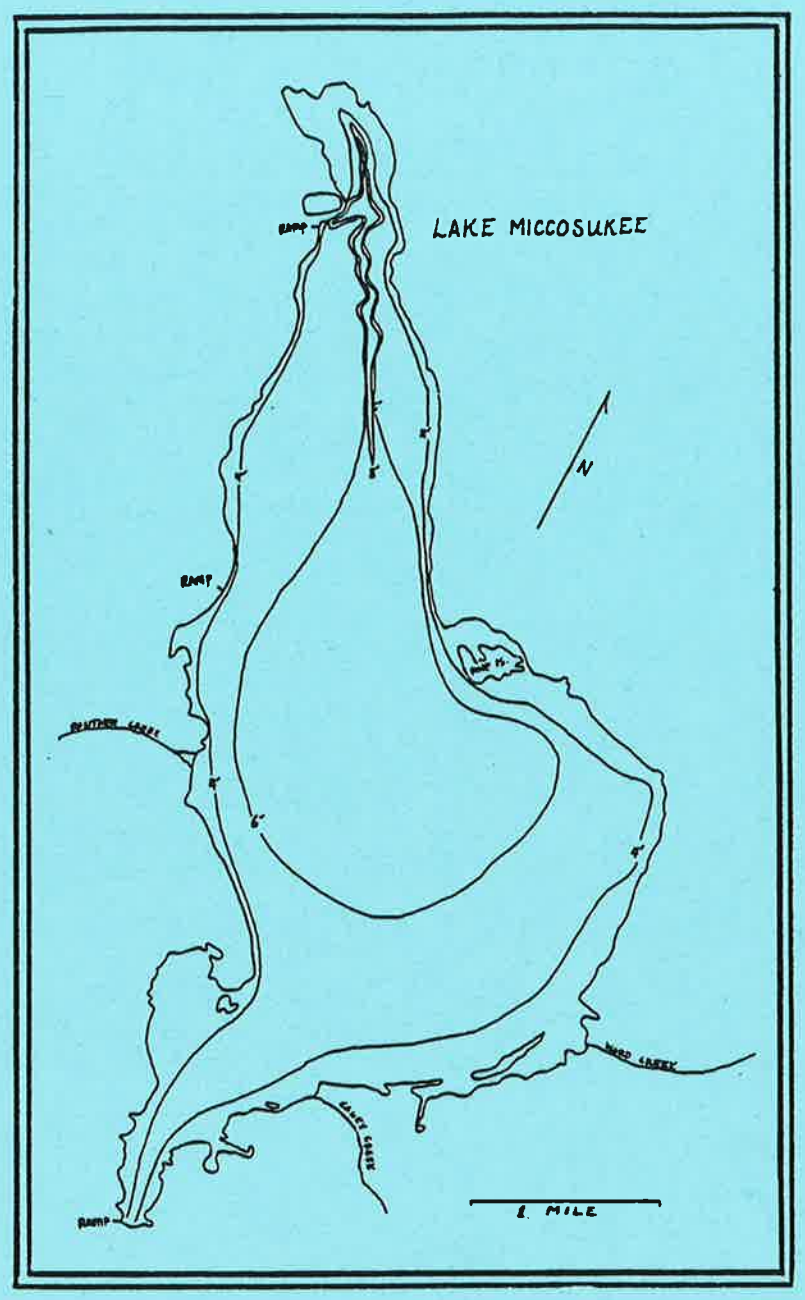
LAKE MICCOSUKEE

MANAGEMENT PLAN



Lake Miccosukee Technical Advisory Committee

March 1989

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INTRODUCTION

Lake Miccosukee (6,312 acres at 80' MSL) is one of the "disappearing lakes" north and east of Tallahassee described by Sellards (1914). These lakes "which at times disappear in a manner seemingly inexplicable" also include Lake Jackson, Lake Iamonia and Lake Lafayette. The reason for this periodic disappearing act is that these lakes are all basins formed by the collapsing of large channels in the underlying limestone with sinkholes connecting them directly to the aquifer. During prolonged droughts, the water levels can decline to a point that the total lake volumes are small compared to the volumes being accepted by the sinks. That phenomenon explains why these lakes seem to disappear rapidly. The swift flow of water into the sinks in the final stage of dewatering can create deeply dissected ravines in the substrate. Because of the shallow bathymetry of Lake Miccosukee and the large acceptance rate of its conduit, a large sink near the northwestern shore, this lake has the most pronounced ravine. Miccosukee's underwater valley meanders a length of 2 miles at depths of up to 14' below the surrounding sediment plain.

During this century, man has drastically altered the hydrology of many lakes in Florida. The "disappearing lakes" are no exception. Most of the sinkholes and large creeks associated with these waterbodies have been modified. Only Lake Jackson (excluding Carr Lake) functions naturally. The damming of these creeks and sinks was often a reaction to the temporary loss of recreational access caused by periodic natural drawdowns. Unfortunately the resulting water level stabilization accelerates the aging of lakes by increasing production and retarding the decomposition of organic matter. Aquatic plants flourish in stabilized systems, but decomposition proceeds very slowly. Protected by water from direct exposure to sunlight or air, organic sediments rapidly fill stabilized lakes. Dissolved oxygen levels, sport fish populations, and, ironically, recreational access decline. In summary, water level stabilization has damaged many lakes in Florida, and Lake Miccosukee is a prime example.

In 1954, an earthen dike with a concrete spillway was built around the large sinkhole near the northwestern shore of Lake Miccosukee. A timber weir was also constructed at the southern tip of the lake, thus effectively stabilizing the lake between 77' and 81' MSL. The lake remained stabilized for 23 years. On February 23, 1977, in response to increasing problems with aquatic vegetation, the Department of Natural Resources (DNR) opened both structures on Lake Miccosukee. The water level reached a minimum of 74' MSL in late September. The lake was completely reflooded by April of 1978 and remained stabilized until June 9, 1988, when the Northwest Florida Water Management District opened the control structure at the sink. This action was taken to prevent failure of the dike because of rapid deterioration of the spillway. By January 10, 1989, the level of Lake Miccosukee was down seven feet. To prevent failure of the dike, the control gate must remain open until the necessary repairs are completed. For the time being, Lake Miccosukee will function naturally; the water level will be determined by the amount of rainfall that occurs within its 240 square mile watershed.

Professional lake managers associated with Lake Miccosukee concur that this extreme drawdown is long overdue. The bottom of this lake has been exposed for only six months in the past 32 years. The greatest problem in managing this system is that it is impossible to predict rainfall patterns. That is why one school of thought suggests that repairs not be made and that the lake be allowed to fluctuate

naturally. Money would be saved, and drawdowns would be perfectly timed with droughts. The other school of thought proposes that the dam be repaired, and a management plan calling for periodic extreme drawdowns be initiated. After much discussion, we have chosen the latter position because of its management flexibility. This management plan will describe current conditions and trends of fish, wildlife, vegetation, and sediment of Lake Miccosukee and recommend a program to enhance these important resources.

DISCUSSION

AQUATIC PLANTS

Review of the historical data indicates that the "Miccosukee Basin", as Sellards (1914) called it, had an extensive littoral marsh prior to impoundment. The scarcity of terraces cut by wind-generated waves is evidence of a dense shoreline plant community. Historical information also suggests a very dynamic water level. There were times when most of the lake bottom would be exposed for a year or more. There were also extended periods of time when water levels were at least as high as the impoundment level. This evidence appears as water level marks on the buttresses of 100-150 year old swamp tupelo (Nyssa biflora) and the location of buttresses and knees of the oldest cypress trees (Taxodium spp.) on Lake Miccosukee. On the average, however, it is likely that Lake Miccosukee was about two feet shallower prior to impoundment.

Rigby (1876) wrote of Lake Miccosukee that "in summer its surface, where shallow, is covered by maidencane, flag, and bonnets with their broad white flowers." Thirty-eight years later, Sellards (1914) described the lake: "when full, Miccosukee Basin is covered with water to a depth of two to five feet. Toward the south end, around the border of the lake, grass and button-bushes project above the water even when the lake is full". From these descriptions, it is logical to assume that maidencane (Panicum hemitomon), "flag" or pickerelweed (Pontederia cordata), white waterlily (Nymphaea odorata), and button-bush (Cephalanthus occidentalis) were the dominant emersed plant species in Lake Miccosukee prior to impoundment. The dominance of maidencane is corroborated by vegetation transects conducted by the Florida Game & Fresh Water Fish Commission (GFC) in 1954, the year the dam was constructed around the sink. At that time, the emersed plant composition was described as 66% maidencane, 27% waterlilies, 11% wildmillet (Echinochloa sp.), and 1% smartweed (Polygonum sp.). Because of a severe drought in the mid-50's, Lake Miccosukee stayed dry for at least two years after the construction of the dam. By 1957, the dominant plant was dog fennel (Eupatorium capillifolium), a terrestrial plant (Jimmie McDaniel, pers. com.). When the lake refilled, most of the lake was free of vegetation, but by 1964, the emersed vegetation covered almost all of the impoundment and "was so thick that a cutter could not cut boat trails" (Blanchard, 1966). Analysis by the DNR of aerial photographs taken in May of 1976, revealed that Lake Miccosukee had 19.4 % open water. The dominant emersed plants were white waterlily, watershield (Brasenia schreberi), maidencane, and water-willow (Decodon verticillatus). Vegetation transects conducted that same year, indicated that the dominant submersed species were variable-leaf milfoil (Myriophyllum heterophyllum), bladderwort (Utricularia spp.), and fanwort (Cabomba caroliniana).

In 1977 and 1978, DNR conducted a drawdown of Lake Miccosukee for aquatic plant control. The water level remained more than five feet below the impoundment level from August of 1977 to January 1978. The maximum drawdown occurred in October of 1977, when the lake was down seven feet and 90% of the bottom was exposed. The success of the effort was mixed: "All problematic submersed species were substantially reduced, [however] control of emersed species was less than desired" (Tarver, 1980). According to a literature search by Leslie (1988), consecutive drawdowns are usually required for effective plant control. In the case of Lake Miccosukee, one six-month drawdown in thirty-two years would not be expected to have any great effect on the aquatic plant community. A survey of vegetation in Lake Miccosukee conducted by DNR in August of 1988 concluded the dominant species in Lake Miccosukee were white waterlily, fanwort, watershield, and water-willow. The percent open water in 1988 was 19.4%, identical to that in 1976.

In summary, Lake Miccosukee, when either naturally fluctuating or impounded, has usually had an abundance of aquatic vegetation. Impoundment appears to have caused a decrease in emersed grasses (maidencane and wild millet), and an increase in water-lily, watershield, and submersed species (fanwort and bladderwort). Before impoundment, it is likely that there were times when most of Lake Miccosukee was open water. These times occurred following rapid reflooding after an extended natural drawdown. Such periods of open-water were probably short-lived, lasting a few years perhaps. If Sellards (1914) was correct about the lake's usual depth being from 2' to 5', then it was most often well-vegetated. In essence, much of Lake Miccosukee was and is a marsh.

FISH

Just prior to the current drawdown, electrofishing and blocknet sampling conducted by the GFC indicated that Lake Miccosukee supported a very limited standing crop of fish. An average of only 123 fish, weighing 33 pounds, were collected per hour of electrofishing. Blocknet sampling revealed a standing crop of 31 pounds per acre. This low density is similar to that reported on Lake Iamonia, another stabilized, marsh system (Young and Crew, 1983). In Lake Miccosukee, the most numerous predator sport fish was largemouth bass (Micropterus salmoides), but chain pickerel (Esox niger) had the greatest total weight. Good reproduction was noted for the current year classes of largemouth bass, black crappie (Pomoxis nigromaculatus), and warmouth (Lepomis gulosus); however harvestable-sized sport fish amounted to only 19 fish per acre. In comparison to electrofishing efforts on a naturally fluctuating system (Lake Jackson), Lake Miccosukee had 50% fewer harvestable-sized bluegill (Lepomis macrochirus) and 95% fewer harvestable-sized largemouth bass (Young, 1989). In 1979, the standing crop in Lake Miccosukee was approximately 86 pounds of fish per acre (Young and Crew, 1980), indicating a 64% decrease has occurred during the past 9 years. During that period, harvestable-sized sport fish declined 42%. It appears the greater density of fish in 1979 was in direct response to the 1977-78 drawdown.

Perhaps, the cheapest and most reliable technique for rehabilitating fisheries resources has been the drawdown. Drawdowns implemented every five to seven years can successfully maintain high quality fisheries habitat and productivity (Williams et al, 1985). Concentrating forage fish with predatory fish in the absence of escape cover allows thinning of smaller fishes, resulting in a more balanced sport

fish population. Compaction and mineralization of the exposed organic substrate provides excellent fish spawning habitat after reflooding. The net effect can be a doubling of fish biomass within two years after a drawdown (Wegener and Williams, 1974).

Stabilized marsh systems, like Lake Miccosukee, tend to have rather poor sport fish populations. There is no question that a regular program of water level fluctuation would be highly beneficial to fishing on Lake Miccosukee. The optimal interval between drawdowns, to sustain a high-quality fishery, varies from lake to lake. In the case of Lake Miccosukee, it may be necessary to conduct frequent drawdowns (every five years) because of the lengthy stabilization of this lake. Ultimately, we may discover that less frequent drawdowns will be sufficient to provide good sport fishing. In summary, water level stabilization has adversely affected the sport fish population of Lake Miccosukee; water level fluctuation will greatly improve it.

WATERFOWL

Most of the large marsh complexes preserved in North America today are due to the efforts of those interested in waterfowl hunting (Good, et al. 1978). Likewise, there is strong public concern for the protection and enhancement of waterfowl habitat in Lake Miccosukee. Periodic dewatering is an effective tool in maintaining a high level of productivity in marsh habitats. Seed germination immediately following a drawdown typically results in dense stands of emergent vegetation providing cover and food for wood duck (Aix sponsa) and other dabbling ducks. Through time, plant species composition gradually shifts to include an increasing percentage of floating-leaved plants, such as white water lily and water-shield, which comprise the bulk of the diet of ring-necked ducks (Aythya collaris). A record 22,500 ring-necked ducks over-wintered in Lake Miccosukee in 1978-79, following the drawdown. During this period, ring-neck ducks were found to feed heavily upon water-shield (Tarver, 1980). In addition to the habitat provided for wintering waterfowl, Lake Miccosukee also provides very important brood rearing and molting habitats in the summer for resident wood ducks.

Active management of the lake, including periodic drawdowns of limited durations, will maintain good quality waterfowl habitat. Preferred feeding depths range from 3 to 10 inches for dabblers and 1.5 feet or more for ringnecks. Therefore, lake levels maintained at 78' to 80'(MSL) will provide the best feeding conditions for waterfowl. If the lake is allowed to function naturally, drawdowns will occur during extended periods of low rainfall. Such drawdowns could last several years, during which time the habitat of Lake Miccosukee would not be available to waterfowl. Therefore, artificially maintaining water levels between 78' and 80' (MSL) for five or more years between drawdowns and allowing drawdowns to last no more than one year will maintain the best habitat conditions for waterfowl on Lake Miccosukee.

ALLIGATORS

The American alligator (Alligator mississippiensis) does well in stabilized systems. The protection given this species in 1962 and the excellent habitat of Lake Miccosukee has allowed the present population to reach approximately 1,200. In 1984, an alligator harvest research and development study was initiated by the GFC with the objectives of developing a demographic profile of the Lake Miccosukee alligator population, assessing the impact of selective harvesting, and refining guidelines for hunts on public wetlands. A harvest of 15% of the estimated population over four feet in length was implemented. The harvest quota from 1984 to 1987 was 70 alligators per year; the quota for 1988 was 75. The total economic values of the alligator hunts on Lake Miccosukee for 1987 and 1988 were $26,100 and $30,500, respectively.

The current drawdown of Lake Miccosukee to replace the spillway will have a negative impact on the alligator population and on the alligator research program. The alligator population will be subject to starvation and cannabalism, if alligator habitat is reduced to a few scattered holes upon complete dewatering. The recovery to a harvestable population would take several years. Actually, stabilized water levels are in the best interest of the alligator population. However, if periodic dewatering is implemented, the appropriate management strategy for alligators is similar to that of waterfowl; the drawdowns should last no more than one year and should be spaced at least five years apart.

NON-GAME WILDLIFE

The structure of an emergent wetland is a product of basin morphology and water regime (Good et al., 1978). The resultant pattern in the plant community strongly influences non-game animal populations. The particular habitat structure provided in a certain part of a marsh, eg. a stand of full, robust emergents, is often more important than the taxonomy of the plants. Certain plant species, however, are more important than others to wildlife because of their food production in the form of seeds, nuts, fleshy fruits or succulent leaves. In general, a marsh with a dynamic water level will be much more productive than a stable system in terms of species richness. Habitat heterogeneity is the second major factor influencing wildlife species richness. Wildlife species are most attracted to marsh complexes which include numerous islands and pools interspersed in stands of emersed vegetation.

The conversion of Lake Miccosukee from a permanently flooded aquatic bed to an intermittantly exposed emergent wetland should have a positive impact on non-game wildlife. Many wildlife species, especially birds, are strongly attracted to marshes because they provide nesting, resting, and feeding sites, as well as protection from predators (Good and Whigham, 1978). Waders, which are highly adapted to shallow aquatic habitats, should be particular beneficiaries of water level fluctuation in Lake Miccosukee. Since 1930, there has been a major decline in wading birds in Florida resulting from the destruction of marshes or the alteration of their hydrology (Pritchard, 1978). The wood stork (Mycteria americana) has been the most adversely-affected, wading species. Because of its specialized "grope-feeding" technique, the wood stork requires a greater concentration of fish than other waders.

Such high concentrations of small fish can be found in the pools remaining during a drawdown. Consequently, wood storks have been observed feeding in Lake Miccosukee during the current drawdown. Abundant white ibis (Eudocimus albus) have also been sighted. This "species of special concern" also feeds on densely concentrated fish and aquatic invertebrates.

Another group of non-game animals that should particularly benefit from water level fluctuation are the small mammals. An example is the round-tailed muskrat (Neofiber alleni), designated a "species of special concern". The round-tailed muskrat's preferred habitat is a maidencane marsh with a soft substrate and water depths not exceeding 20". The southeastern portion of Lake Miccosukee should fulfill those requirements quite well during a drawdown. A much more common rodent, the marsh rice rat (Oryzomys palustris) should also become quite numerous in Lake Miccosukee during periods of low water. This prolific species will in turn provide an abundant food supply for many predators, such as hawks and owls. Overall, water level fluctuation should have a positive impact on non-game wildlife species diversity in Lake Miccosukee.

SEDIMENT

The characteristics of bottom sediment determine the nature of habitats available for lacustrine fish and invertebrates and the rate of pioneering and survival of rooted aquatic plants (Weller, 1981). Organic accumulation promotes succession by raising the bottom elevation and by blocking or diverting waterflow patterns (Good et al., 1978). The production and deposition of organic matter in marsh systems, like Lake Miccosukee, is very high. The net effect is that the bottom of Lake Miccosukee is covered with a thick layer of mud and peat. In September of 1909, "borings put down near the north end of the basin, out from the margin of the drain, indicated the presence of muck for a depth of six inches to one foot" and a depth of one to three feet in the south end (Sellards, 1914). Because exposure of the substrate to sunlight and air promotes drying, compaction, and decay of organic material, the constant submersion of Lake Miccosukee's sediment probably accelerated the accumulation of organic matter (Leslie, 1988). Tarver (1980) reported that the 1977-78 drawdown reduced the layer of unconsolidated organic matter by 70% and the underlying muck zone by 7%. After the drawdown, the organic layer averaged eight inches in depth. Core samples taken February 15, 1989, indicated that the average depth of the organic layer in Miccosukee is now approximately two feet.

An important issue involving the organic sediment is the formation of "floating islands". Floating islands form when gases produced by anaerobic decomposition provide enough buoyancy to lift entire sections of the organic bottom substrate. These islands remain moist and are rich in nutrients and plant propagules. A succession of plant species proliferate on these islands, culminating in woody plants such as water-willow and button-bush. The floating islands and the open pools resulting from their formation can have a positive effect on the diversity of plants and animals in a marsh (Weller, 1981). The effects of floating islands on recreational access, however, is quite negative. Woody plants have long been a part of the vegetation community in Lake Miccosukee (Sellards, 1914). Water level stabilization, however, appears to have stimulated the formation of floating islands and the expansion

of woody plant species. The end result of stabilizing Lake Miccosukee indefinitely would likely be the creation of a 6,000 acre "bog" (Blanchard, 1966).

MANAGEMENT PHILOSOPHY AND GOALS

The total area of Florida's wetlands has been reduced by one-third in this century (Fernald and Patton, 1984). The sharp decline of wetlands has been repeated on a national and global scale. In view of the ecological importance of wetland communities and their increased scarcity, the major emphasis of resource managers must be conservation of marshes in a state as natural as possible for future generations. Water level stabilization is detrimental to a marsh system because it precludes the rejuvenating effects of periodic drawdowns. Marshes support a variety of plant communities through time ranging from emersed annuals through submersed and floating-leaved species. Ideal marsh management mimics the dynamic nature of a marsh system through water level fluctuation resulting in a diversity of aquatic plant species. That is why, in some cases, management of water levels is valuable, if not essential, to the preservation of a given marsh. The goals of such management must focus on long term benefits rather than short term, promote productivity under the most natural conditions possible, protect the species richness and stability of the marsh community, and serve the greatest range of public interests.

In the case of Lake Miccosukee, resource managers have concurred that water level stabilization, though well-intentioned, has been a bad policy. Though it was unanimous that fluctuation was essential, there was debate on how to do it. Should we continue to impound the lake and conduct extreme drawdowns on a set schedule or should we keep the control structure open and allow the lake to function naturally? A compromise management plan that encompasses both philosophies is presented below.

MANAGEMENT PLAN

The most important component of the management plan for Lake Miccosukee is to provide for periods of complete dewatering for most of the basin. However, to maintain a marsh community, the maximum duration of dewatering should be limited to one year. After repairing the dam around the sink and the timber weir at U.S. 90, the control structure should be closed. After five years of impoundment, the control structure should be opened in early January. The structure should remain open until the water level of Lake Miccosukee remains at or below 74'MSL as measured at the sinkhole dam for up to one year. At that time, the control structure will be closed and the process will repeat itself. This strategy combines impoundment with natural fluctuation. We cannot predict rainfall patterns, but after five years of impoundment, we can open the structure and wait for a period of low rainfall and an adequate drawdown.

During the current drawdown, a strange phenomenon was noted on Lake Miccosukee. At the northern sink, the water level was down 8', but at U.S. 90 the level was down only 3.5'. Upon inspection,

it was apparent that the water flow from south to north was impeded by the vast layer of organic matter and by ridges in the underlying mineral substrate. Peat accumulation has been found to alter hydrology by acting as a barrier to the percolation of surface waters (Buttery et al., 1965). To facilitate thorough drying of the sediment during drawdowns, it might be prudent to enhance certain boat trails. After funding for the repairs of the dams is acquired, additional assets should be sought to deepen the restrictive areas of the main north-south boat trail by one to two feet. At times when the lake is flooded, DNR will continue to manage the aquatic vegetation in the boat trails. DNR will also focus on stemming the expansion of nuisance exotic plants, such as hydrilla (Hydrilla verticillata) and water hyacinth (Eichhornia crassipes).

Prior to impoundment, wildmillet (Echinochloa spp.) and smartweed (Polygonum spp.) were fairly abundant members of Lake Miccosukee's aquatic plant community. These species are important food sources for waterfowl. If these species do not regenerate during the first drawdown, then seeds of these plants should be broadcasted during the second.

According to the attached letter from the Florida Natural Areas Inventory, the federally protected Miccosukee gooseberry (Ribes echinellum) exists in only three localities in the world, two of which are near Lake Miccosukee. "One population . . . occurs near the lake's edge and could be affected by changes in waterlevels, particularly high levels." In general, the endangered Miccosukee gooseberry deserves special consideration prior to any management activity.

The capability of a sink to transmit water can be reduced by sediments washed into the small openings which act as conduits (Wagner and Musgrove, 1983). During the repair of the dam at the sink, particular care should be taken to prevent eroded material from plugging the sinkhole and ending water level management capability.

Lake Miccosukee, aside from the western shore, is entirely within Jefferson County. There is, however, no improved public boat launching facility convenient to the citizens of Jefferson County. If feasible, a boat ramp should be constructed on the eastern shore of the lake near U.S. 90. In addition, all boat ramps should be improved to allow boat launching in periods of low water.

RECOMMENDATIONS

Short Term

1. Replace spillway on the dam at the sinkhole.

2. Install a new drawdown pipe capable of achieving a minimum of an 8' drawdown.

3. Protect the sink from sedimentation during construction activities at the dam.

4. Replace wooden weir structure at U.S. 90, while maintaining its drawdown capability.

5. Every 5 to 7 years of impoundment, conduct a drawdown of 6'-8' for up to one year.

6. Control aquatic plants in boat trails, when the lake is flooded.

7. Prevent expansion of waterhyacinth and hydrilla.

8. Extend existing boat ramps to facilitate boat launching in periods of low water.

9. Assess the effects of the current drawdown on aquatic vegetation, fish, wildlife and organic sediment.

10. Survey public opinion on management goals and strategies.

Long Term

1. Conduct a study of the hydrology of the lake to assist in the timing of drawdowns.

2. Investigate the feasibility of enhancing boat trails to facilitate dewatering.

3. Assess mechanical methods of creating shallow pools dispersed throughout the marsh.

4. Prepare a detailed contour and land-use map of the watershed.

5. Test controlled burning techniques to provide optimal marsh habitat for fish and wildlife.

6. Conduct a cost/benefit feasibility study related to changing the elevation level of impoundment.

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FLORIDA NATURAL AREAS INVENTORY

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May 9, 1989

Jess VanDyke
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Re: Lake Miccosukee Management Plan

Dear Mr. VanDyke:

We have reviewed the Lake Miccosukee Management Plan and first commend the authors on developing an informative and lucid report. There are a few considerations in developing this plan that we will emphasize and, in light of these points, make some recommendations for the formulation of a final plan.

There was no mention in the report of the occurrence of Ribes echinellum at Lake Miccosukee. The populations of Miccosukee gooseberry around the lake are two of three localities known world wide and the only Florida populations. Because of its extreme rarity, the species is listed under both the federal and state protection laws as endangered. Only 25 species have federal status in Florida to date. One population of the gooseberry occurs near the lake edge and could be affected by changes in water levels - particularly high levels. The location of these very important populations and the biology of this species should be considered in determining the range of flux in lake conditions. We would be happy to provide you with more specific information as it is needed.

It is not clear from discussion in the plan what information supports the decision to manage Lake Miccosukee rather than leave it a natural lake system. Has the possibility of phasing out active management of the lake been considered? Once the organic debris has been reduced by draw-downs, would it be possible to allow the lake to naturally function? We would certainly support such a plan. It is acknowledged that very few disappearing lakes are allowed to function without intervention and it follows that this habitat and the fauna that are adapted to these conditions have been dramatically reduced. It is not known whether the simulated conditions that are outlined in this draft plan would support the same fauna as a natural system. Neither is it clear whether or not a natural cycle of water flux would be a detriment to recreational fishing or waterfowl habitat.

The following is a list of recommendations for consideration in developing the final management plan for Lake Miccosukee:

1) Because of the presence of the gooseberry and the undefined affect on other species (both short and long term), we recommend that herbicides not be used. This is consistent with recommendations being developed by the Environmental Protection Agency for federally endangered species. Ribes echinellum has been specifically addressed under this review;

2) Several pockets of water should remain in the lake at all times to provide refuge for aquatic species;

3) The effect of increased boating on the water quality as a result of improved boat landings and management of the hydrology for recreational fishing should be addressed;

4) Proposed construction of improved boat landing facilities should be carefully considered so as not to destroy natural areas where Ribes echinellum is established;

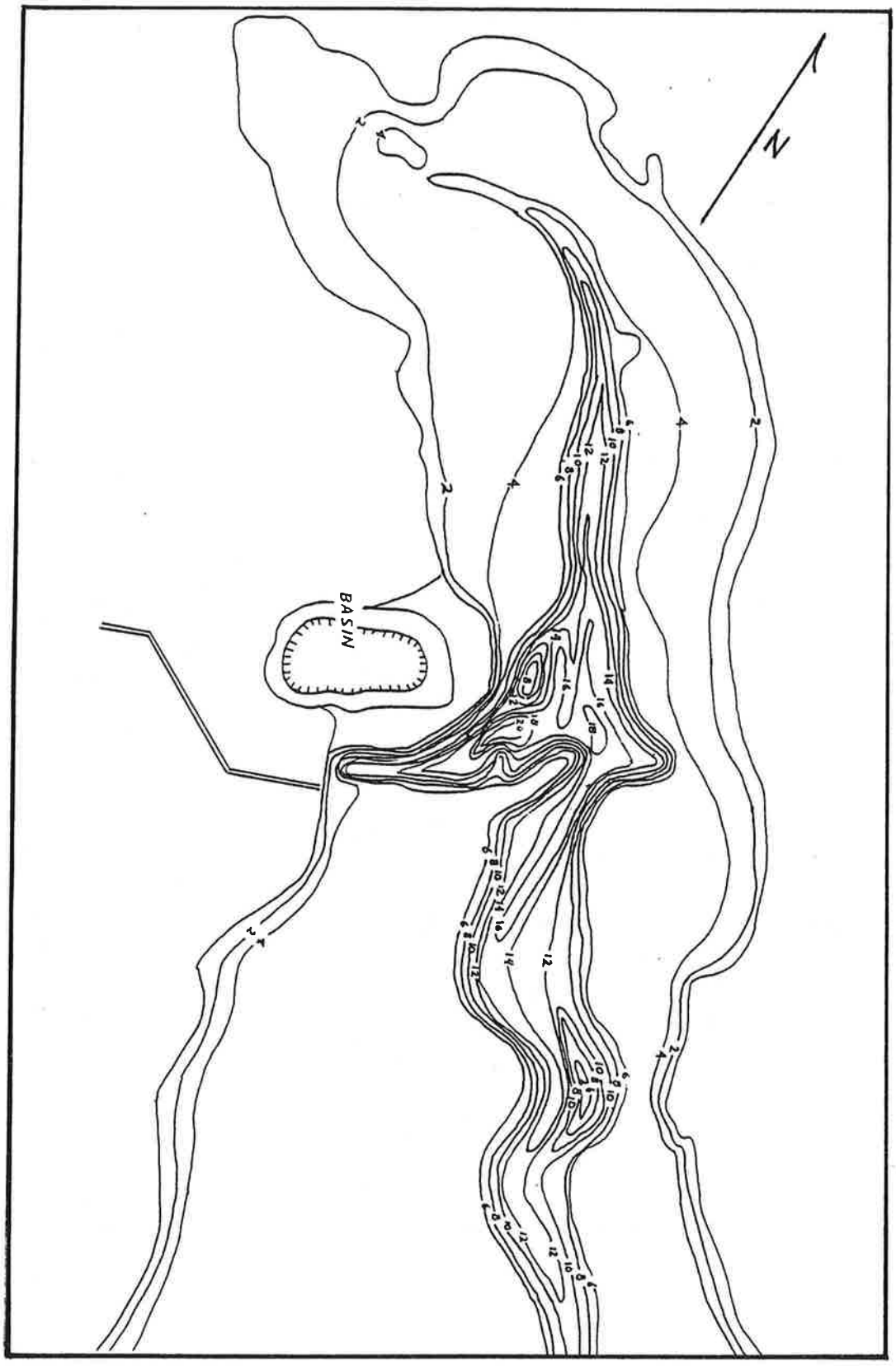
5) The lake biota should be monitored before, during and after the manipulations of the lake level.

If you have any questions about our comments or recommendations please let me know.

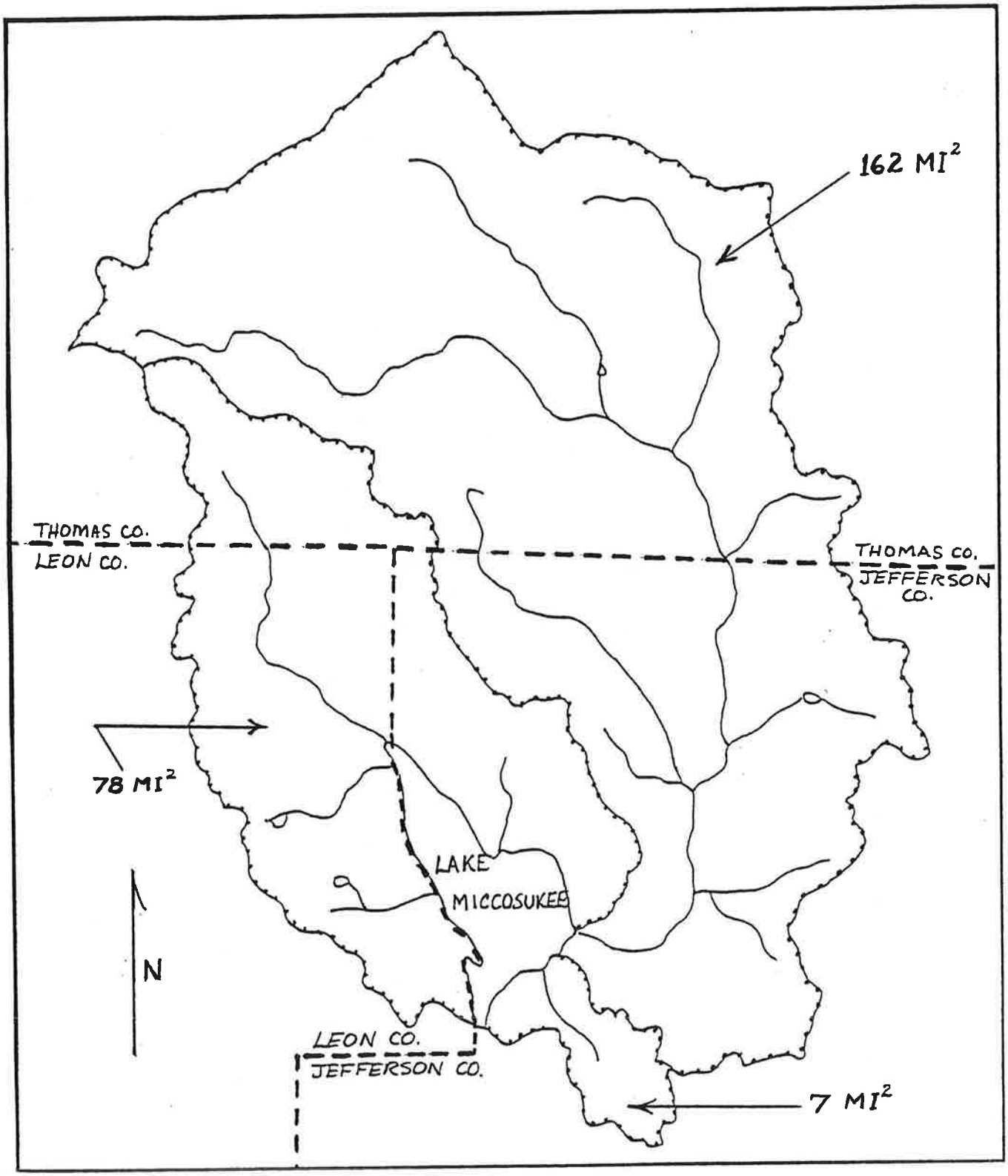
Sincerely,

Deborah

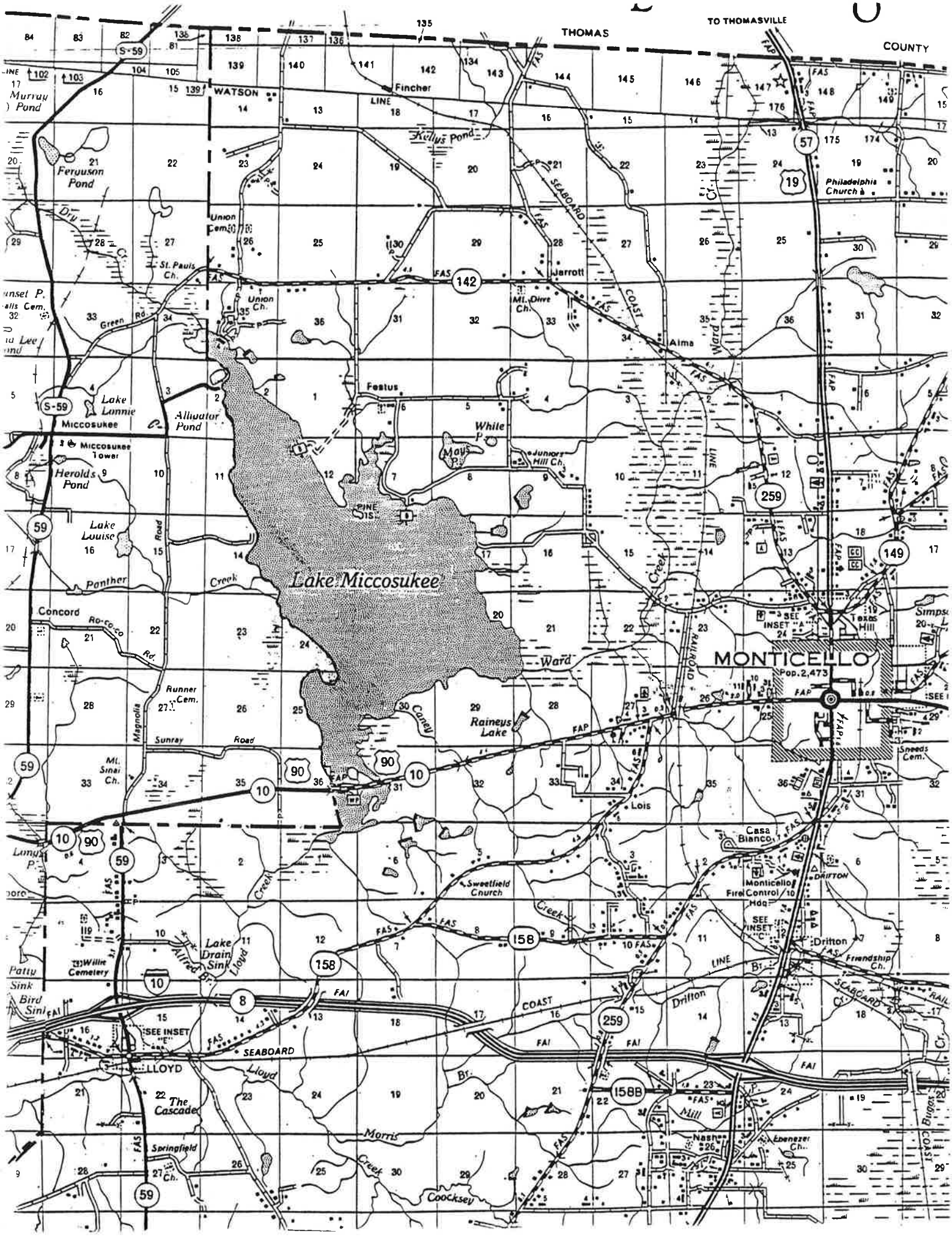
Deborah L. White
Botanist



NORTHERN LAKE MICCOSUKEE



THE WATERSHED OF LAKE MICCOSUKEE


THOMAS
TO THOMASVILLE
COUNTY
WATSON
Fincher
Kellys Pond
Ferguson Pond
Murray Pond
Philadelphia Church
Union Cem.
St. Pauls Ch.
Union Ch.
Jarrott
Mt. Olive Ch.
Alma
Festus
Lake Lonnie Miccosukee
Alligator Pond
White P.
Mays P.
Junior Hill Ch.
Herolds Pond
Lake Louise
Panther Creek
Lake Miccosukee
Concord
Ro-co-co Rd.
Runner Cem.
Magnolia Road
Sunray Road
Mt. Sinai Ch.
Raineys Lake
Texas Hill
MONTICELLO
Pop. 2,473
Sneeds Cem.
Lois
Casa Blanco
Monticello Fire Control Hdq
Sweetfield Church
Dritton
Friendship Ch.
Willie Cemetery
Lake Drain Sink
Alfred Br.
Lloyd Creek
Patty Sink
Bird Sink
LLOYD
The Cascade
Springfield Ch.
Morris Creek
Cooksey
Nashe
Ebenezer Ch.
Mill Br.
SEABOARD
COAST
Ward
SEE INSET "A"
SEE INSET "C"
SEE INSET "E"
FAP
FAS
FAI
CR
S-59
59
90
10
8
57
19
142
259
149
158
158B