SHEBOYGAN MARSH  
GOAL, OBJECTIVES AND ADDITIONAL BENEFITS

Goal: To manage, preserve, and protect the fish and wildlife resources and their habitats on the Sheboygan Marsh for optimal fish and wildlife recreation, education and production compatible with property capabilities.

Annual Objectives:

1. Provide opportunities for 13,800 participant-days of recreation as follows:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Participant-days</th>
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</thead>
<tbody>
<tr>
<td>a. Waterfowl hunting</td>
<td>3,500</td>
</tr>
<tr>
<td>b. Deer (gun) hunting</td>
<td>1,500</td>
</tr>
<tr>
<td>c. Deer (bow) hunting</td>
<td>2,500</td>
</tr>
<tr>
<td>d. Ruffed grouse hunting</td>
<td>800</td>
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<tr>
<td>e. Fishing</td>
<td>4,000</td>
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<tr>
<td>f. Trapping</td>
<td>1,000</td>
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<tr>
<td>g. Other hunting</td>
<td>500</td>
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2. Produce 350 ducks and 80 pheasants.

3. Improve the northern pike population to allow a harvest averaging 0.75 northern pike 18 inches or larger per fishing trip.

4. Increase muskrat population base on the marsh to about 4,000 muskrats in the fall.

5. Accommodate 4,000 participant-days of snowmobiling on the county trail system.

Annual Additional Benefits:

1. Benefit resident and migratory nongame species indigenous to the area, including migratory endangered or threatened species.

2. Accommodate 4,000 participant-days of compatible recreation, including hiking, photography, nature observation, canoeing, and picnicking.

3. Harvest available forestry products consistent with property goals and compatible with fish and wildlife management objectives.
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RECOMMENDED MANAGEMENT AND DEVELOPMENT PROGRAM

Cooperation Between County and State:

To insure more effective and coordinated management efforts on the Sheboygan Marsh, a management agreement should be initiated and maintained between the county and state (Appendix A). The effects of management efforts on the state area largely depend on the habitat conditions on the county-owned portions of the marsh. With a management agreement, firm long-range plans for development of the state area can be based on anticipated actions on the marsh proper. With assurance of coordinated efforts, future plans for land acquisition and development will be based on the combined potential of state and county land.

With increased cooperation, the marsh will be more effectively managed. Roles and responsibilities will be defined by a management agreement and management based on this plan will help insure more consistent and cost-effective actions. This will help clarify the respective agency responsibilities and will ultimately increase hunting and fishing opportunities on the marsh.

Development (Figure 2):

Additional small water areas on the south side would improve the area for both migratory and breeding waterfowl. With current public ownership, there is potential for developing 2 small ponds. One should be built within a year at a cost of approximately $1,000. The other will be developed within 5 years at a cost of approximately $1,500. With further land acquisition, there is potential for developing 3 other small flowages and enlarging the other 2.

Because of the limited amount of upland nesting cover contiguous to the open water marsh, artificial nesting structures should substantially improve duck production on the marsh proper. Nest boxes for wood ducks will be maintained and more may be located in cattail fringe areas adjacent to pockets of open water. Also, islands of wet meadow will be cleared through prescribed burns and techniques for improving duck nesting on these wet meadows will be explored (including creating small "islands" of higher ground).

When land purchases are complete, another 150 acres of dense nesting cover will be developed. The current cost (1982) for establishment of dense nesting cover is $120-$140 per acre. Another 100 acres will be converted to permanent nesting cover with sharecropping agreements negotiated for maintenance purposes.

Recent land acquisition by the county has provided 3 more access points to the marsh. A 15-20 car parking lot will be developed on the northwest access point. The lot will cost approximately $2,000 and will be completed within 2 years. A 10 car lot will also be developed at Lot 5. This lot will cost about $1,000 and will be constructed after refuge changes are finalized.

Because of the terrain of the marsh, opportunities for hiking and cross-country skiing are limited. A hiking trail could be developed along portions of the old railroad grade running along the southern end of the marsh. Initial development costs would be less than $1,000 and maintenance through mowing will average $260 per year. Sheboygan County currently maintains a snowmobile trail on this right-of-way. Acquisition or year-round public access easement will be investigated for the entire railroad grade.
Land Acquisition (Figure 3):

To take advantage of potential flowage sites, nesting areas, and upland feeding areas for waterfowl, the Department recommends revising the boundaries. Some areas may be deleted from the boundaries without affecting the objectives of the property; 160 acres currently within the boundaries are already in county ownership. Desired land control for the W 1/2 SW, Sec. 28 and in the south 154 acres of the NE of Sec. 33 could be obtained via easements or long-term leases that would allow standard agricultural practices to continue, but would restrict development and provide public hunting rights. It is recommended that the new acquisition goal for the state become 860 acres, an increase of 283 acres over the existing goal of 577 acres.

All future land acquisition by the state will continue to be from willing sellers. Department purchases of improvements will be avoided where possible; if unavoidable, they will be traded for other lands the Department has interest in or sold outright.

Recommended areas for county acquisition are indicated in Figure 3. Those areas in Sections 29, 34, and 25 are for blocking in ownership boundaries in addition to providing more wildlife habitat and recreational area. The parcel in Section 29 is a private flowage development that would complement efforts on adjacent public-owned flowages. The parcel in Section 32 would allow access from the old railroad grade if an access easement is obtained.

Priority should be given to obtaining access through fee acquisition or easements. A permanent public boat access is desirable for the west side of the marsh. The county could accomplish this through permanent public access to the old railroad grade running along the southern boundary of the marsh. This would provide access to public lands in the marsh-proper and the river and could be maintained as a trail for hikers, birdwatchers, skiers, snowmobilers, etc., in addition to hunters. Another priority parcel is 80 acres in Section 20 that would complete ownership of flowed areas of the marsh, alleviate private access concerns, and block ownership.

Wildlife Refuge (Figure 4):

The overall size of the refuge will be reduced while the percentage of water and marsh area within the refuge will be increased. A refuge agreement will be necessary for one 40-acre parcel. The current refuge has not been successful in holding large numbers of waterfowl and expanding the land refuge is not feasible with current land control. When the necessary land control is obtained, the need to expand the refuge for geese will be re-evaluated.

This change will increase the marsh and water area in the refuge by 41% (160 acres), reduce disturbance on the east line, and retain small flowage developments in refuge status. This should increase duck use and may offset the loss of upland refuge for geese.

Currently, the refuge area is closed to all entry from October 1 to November 30, except for gun hunting for deer. The waterfowl refuge area would be just as effective if it were a no-entry refuge from October 1 through November 15, when it could be open for all hunting except waterfowl hunting. Because local sportsmen strongly favor this alternative, the rule will be processed in 1984.
Water Level Management:

Periodically, the marsh will be partially drawn down to allow recycling of nutrients and rejuvenation of emergent vegetation (Appendix B). The water level will be lowered to about 18 inches below the spillway during the summer. A gradual lowering of levels will begin in May and the Department will begin restoring levels in August. At least 25% of normal flow must be maintained during the refill period and the Department will attempt to minimize impacts on downstream flow rates.

A study of the effects of the partial drawdown on fish and wildlife will be undertaken. Comparable fish and wildlife surveys before and after the drawdown will be conducted. If the gains in waterfowl and muskrat based recreation do not offset any loss in recreation days of fishing, plans for future drawdowns will be re-evaluated. Partial drawdowns will recur every 5 to 7 years, depending on the rate of emergent vegetation loss and the effect on the fishery.

Between drawdown years, the water level will be allowed to undergo "natural" (normal) fluctuations over the spillway of the dam. The I-beams will be removed to return levels to those authorized under the original permit for the dam. The bypass will only be used to mitigate spring runoff, for abnormal runoff conditions, and for drawdown operations. Allowing water levels to undergo natural fluctuations will lower average levels and help retain emergent vegetation and waterfowl production.

A log boom will be installed upstream of the dam to catch cattails ahead of the dam and allow free flow of water over the dam. Partial drawdowns and lower average levels will reduce the loss of the cattail bog and should eliminate the need for the log boom during most years. When the log boom is needed, it will be installed right after ice melt and removed prior to fall freeze-up. The take-out sign on the dam will be moved just upstream of the log boom to alert boaters to the hazard and portage area.

Fish Management:

Maintenance dredging of the south ditch may be required about every 20 years to maintain desirable depth and fish habitat during winter; cost for a dragline side casting the spoils would be about $155,000 (in 1984 dollars).

The next maintenance dredging should be conducted before 1988 to keep silt deposits from reducing depth and, therefore, fish habitat to critical levels. The partial blockage at the south end of the south ditch should be removed as soon as possible to improve fish habitat during winter. The outlet tube should be screened during drawdown to prevent downstream migration of adult northern pike.

Following removal of the blockage on the south ditch, northern pike fishing should be closed from February 1st until the 1st Saturday in May. This will greatly reduce the harvest rate and will ultimately result in more big fish available for angling. Other more stringent regulations may be necessary following evaluation of the closed season.
Wildlife Management:

Farming operations on upland sites will be accomplished primarily by sharecropping. Some upland acreage will be converted to permanent nesting cover and hay crops. As more land is acquired and refuge changes are complete, the upland areas may be stocked with pheasants for additional hunting opportunities.

Most of the marsh proper is inaccessible to conventional heavy equipment. Large scale mechanical control of brush is impractical. Also, construction of subimpoundments on the marsh would be difficult to accomplish. The possibility of constructing small dikes to flood some areas for waterfowl and to set back succession will be investigated. For example, it may be possible to raise the water level on the St. Anna Creek to flood out the invading brush by constructing a small dam at its junction with the north ditch. Techniques for opening up large monotypic stands of cattails will be explored to improve the interspersion of cattails and water.

Some of the large ditches and marsh areas will be improved with nesting structures, loafing logs, and felled trees. Prescribed burns will be used to open up and improve small flowages and some of the islands in the marsh itself.

All areas proposed for development will be examined for the presence of endangered and threatened species. If listed species are found, development will be suspended until the District Endangered and Nongame Species Coordinator is consulted, the site evaluated and appropriate protective measures taken.

A complete biological inventory of the property will be conducted as funds permit. Additional property objectives may be developed following completion of such an inventory.

Forest Management:

Silver maple, northern white cedar and tamarack are the most important tree species in the marsh. However, tree growth is slow because of the nature of the soil, which has a high water table and low fertility level. Reproduction of trees by seed is difficult because of brush competition and a large deer population. The marketability of the timber is presently poor and there is no indication that the situation will improve.

Timber harvest will be limited to techniques that preserve the cover type, especially for lowland hardwoods and cedar. Removal of dead wood for firewood should be restricted to specific areas designated by the local DNR forester. Slash left from timber sales and areas with an overabundance of dead and down wood will normally be designated as areas for firewood cutting. Removal of dead wood, especially in cedar areas, will be minimal to preserve this important wildlife habitat component and to preserve the integrity of these natural cedar forests.

Strip cuts may be conducted to encourage cedar reproduction on the marsh. The strips should not be wider than 75 feet in width nor longer than 1/4 mile in length because the uncut strips must serve as the seed source for restocking the cut areas. Most of the cedar originated when the deer herd was almost nonexistent. At present, the herd is estimated to number as many as 60-70
deer/square mile in certain portions of the marsh. Until the deer population is substantially reduced, it is doubtful any method of maintaining the cedar type will work.

A complete forestry inventory will be done as time allows and a recon of all merchantable timber areas will be scheduled by 1990.

BACKGROUND INFORMATION

The Sheboygan Marsh lies in the extreme northwestern part of Sheboygan County and consists of about 14,000 acres of land and surface water; 7,250.5 acres are owned by Sheboygan County, 382 acres are owned by the state, and the remainder held in private ownership. The state acquisition goal is currently 577 acres. Public hunting leases are held on 240.0 acres.

This wetland complex was part of the former Glacial Lake Sheboygan. The last glacier covered the lake with glacial deposits leaving only a very shallow lake. The Sheboygan River flows through the area and, until 1870, was held back by a limestone ledge on the eastern end.

In 1870, John Bertschy (a Sheboygan businessman) bought approximately 6,000 acres of the marsh from the federal government. Bertschy attempted to drain the marsh and convert it into farmland. Drainage ditches were dug perpendicular to the river and he attempted to drain water out by cutting through the limestone ledge at the eastern edge of the marsh. The project was not successful because of difficulties encountered in blasting through the limestone.

He succeeded in lowering the limestone ledge at the outlet of the marsh by about 6 to 8 inches and "The daming (sic) up of the river was nearly as complete at the end of the work as before" (Peterson & Sinz, 1905).

The following is a general description of the marsh as it appeared in 1904 to Peterson & Sinz (1905, pg. 4):

"It is an irregular shaped tract of land, being about six miles long and four miles wide, containing about ten thousand acres. Half of this area is covered with tamarack woods which are located mostly around the outer edge of the swamp. The central portion is a prairie covered with tall marsh grass, which is a source of large fires each fall. The drainage area of the swamp is about forty thousand acres."

The river was described, in part, as follows:

"The channel of the river is very tortuous and varies in depth from six inches to two feet. The width is fairly uniform, being about forty to fifty feet. The bottom of the river consists mainly of a mixture of marl and peat which flows very easily. As the river leaves the swamp or its eastern edge, the bottom is of a gravelly nature, containing many large boulders. This gravel, however, soon changes to a solid limestone channel which extends for three quarters of a mile farther east. The width of the river becomes narrow after it leaves the swamp, being only about fifteen feet wide. The limestone ledge is the main cause of the existence of the swamp.... The cross section of the channel at this point being so very small as compared to that in the swamp, in times of flood flow it is entirely too small to carry all the water. In the spring of the year the eastern part of the swamp for two to three miles up is entirely covered
It appears from the above description that after the first attempt to drain the marsh, the marsh was only seasonally flooded, and prior to the first attempt it was probably a very shallow lake or marsh that became enlarged and deeper during times of rainfall and runoff.

From 1912 to 1921, a second attempt to drain the marsh was initiated by the Sheboygan Valley Land and Lime Company. More than 20 miles of ditches, varying in depth from 6 to 20 feet, were dug by a massive floating dredge. The project was fairly successful, but post-war farmland prices were low and availability high; the demand for this marshland vanished. The promoters eventually defaulted on their taxes and abandoned the area.

Peat fires in 1928 and 1931 encouraged a local group of concerned citizens to build a temporary dam. In 1937, the county purchased 6,349 acres of the marsh at a public foreclosure auction for $17,646.16. "The site of the dam and the adjoining eight acres..." was purchased by C. E. Broughton in 1936 for $550.00. Work on the present dam was started in 1937 under W.P.A. and completed in March of 1938. The following account was given (1941):

"In 1938, the present dam was built and the water level restored; according to the engineer in charge, to about what it was between the years of 1868 to 1921. By water level was not meant depth, however. The depths in 1938 were much greater than the ones reported by Peterson and Sinz in 1905. No data was given in the government surveys of 1837 as to water depths but undoubtedly the marsh was deeper in places in 1938 than it was in 1837."

The area became an excellent waterfowl area for several years. Herman (1941) reported 1,500 acres flooded and the remainder is typical marshy terrain (defined as grass, sedge and cattail cover). The atlas states, "Although thousands of hunters invaded the area everyone had some success and many reported shooting their limit in a very short time."

Some indication of habitat conditions just after construction of the dam is given in a summary of surveys by Wisconsin Conservation Department biologists in 1938, 1941, 1942, 1949, and 1952 (Zimmerman, 1953):

"The area of open water on the Sheboygan Marsh has been increasing in size since 1942. Previously, this particular area had a considerable stand of wild rice, hardstem and river bulrush, and some reed grass. When visited in 1949, the area of open water appeared to be at least 150 acres in size. It is believed that this increase in size of the open water area is due in a large measure to the high water level held at the dam."

It appears from water level records that around 1953, the water level was raised another 6 inches by the installation of 6-inch I-beams as flashboards on top of the spillway.
The following is a report of hunting pressure (Zimmerman, 1953):

"Heavy hunting pressure; good shooting; an estimated 3,000 hunters invaded the marsh on the opening day of the 1939 season; mainly puddle ducks bagged; although the 1939 season saw a decrease in the waterfowl take throughout the southeast, the waterfowl harvest increased in Sheboygan Marsh; system of refuges covering 670 acres in 3 units."

Construction of shelters, concessions, piers, etc., at what is now the Broughton Sheboygan Marsh Park on the east end, was initiated in 1938. The Sheboygan County Planning and Resources Department prepared a plan (1980) for this developed 30-acre park area at the marsh. Management plans for this recreational facility have already been published and will not be addressed in this plan.

The sportsmen of Sheboygan County have always been involved in the management and development of the Sheboygan Marsh. In 1960 local sportsmen formed a corporation to raise funds for purchase of additional land on the marsh. In 1965 and 1966, the Waterfowl Management Fund, Inc. deeded over a total of 320 acres to Sheboygan County with the restriction that it never be sold or traded and it be used for waterfowl habitat purposes. This area is known locally as the Holbrook Farm.

Two flowage areas with high-capacity bottom-draw pumps are located on the south side of the marsh. The flowage area on the county land was constructed around 1966. It included around 1.25 miles of dredging to create about 65 acres of flowage in 2 impoundments. In 1967, a 23-acre flowage area was developed on the state land. A 7-acre runoff pond is also associated with the ditches of the latter flowage.

From 1966 to 1971, 1,668 mallards were released on the Sheboygan Marsh. This practice was discontinued after research found no significant gain in the duck population as a result of stocking.

A captive flock of Canada geese was used to entice more migratory geese to the Sheboygan Marsh for several years. The records are incomplete, but it appears captive flocks were used in the fall during most of the years from 1960-1968 and then again for a couple of years between 1975 and 1977.

Records show that potholes were blasted in at least 2 years, 1966 and 1968. These were blasted by the south side of the marsh and along the river channel on the east side of the marsh. Each time, about a dozen potholes were blasted.

In 1968, a bypass tube was installed around the dam with state, county, and sportsmen's clubs funds. The purpose was to allow water-level management in the marsh to improve hunting and fishing and to reduce loss of marsh bogs (Sheboygan Press, April 1967, March, 1968). The marsh had to be drawn down that summer to allow the installation of the bypass. Other reasons were to allow redredging of the south ditch, peat compaction, and to promote
vegetation regrowth. It took 20 days to drain the marsh in April of 1968. A wet summer and dry fall disrupted plans to reflood the area for the fall of 1968. Geese responded dramatically to the refuge and feeding area provided by the exposed mud flats in the fall of 1968. The bottom did compact by an estimated 6 inches and the vegetation also responded. The effect on migratory duck use was evident for at least 3 years after the drawdown; in 1969, 6,000 ducks reportedly used the marsh as a feeding and staging area.

Local reaction to the drawdown was apparently negative. As a result of this opposition, the bypass tube has not been used for its intended purpose since its installation in 1968.

The locations of the refuge have changed several times since first being established in 1938. At one time, a significant portion of the upland refuge was leased from private landowners. The system in operation in 1963 was allegedly successful in attracting geese, but some of the private landowners declined to be involved in 1965.

Forestry History:

Sheboygan County has never had a formalized policy regarding timber harvesting practices carried out in the marsh. Most requests for harvesting have been screened on a one-by-one basis by the Property Committee (formally the Parks Property & Aviation Committee) of the County Board. Since the majority of the Property Committee members were not well acquainted with forest management, they asked for the recommendations of the local DNR forester. Most of the requests for harvesting have come from sportsmen's clubs in need of a couple hundred fence posts. Most of the requests were granted as long as the trees to be cut were blowdowns and there was no adverse public reaction.

The only recorded sawlog harvest of any significance was initiated by the local DNR forester in 1978. He discovered a substantial volume of American elm was dying from the effects of Dutch elm disease. In order to make the elm more desirable to the local log buyers, the forester selectively marked additional acreage of mature silver maple and green ash. The 33,000 board feet of sawlogs was sold for $90.00/MBM. County officials were quite pleased with the revenue. Local residents near the sale area were also pleased because they were given permission by the county to clean up the tops from the timber sale for firewood.

Fish Management History:

The earliest fish management information is the documentation of a winterkill in 1939. It has long been known that winter oxygen levels remain higher in the south ditch than in the rest of the marsh due to inflow from Big Elkhart Lake. A winter fish refuge was established in this area from 1949 until 1968, apparently to prevent overharvest by anglers. It was only enforced, however, during that portion of the year when the rough fish traps were operated. This period was typically from freeze-up until late winter, so that some years there was significant ice fishing late in the winter. The traps were located at each end of the south ditch and were used to remove carp and bullheads. The rough fish removal program was in operation as early as 1940 and continued until drawdown in 1968.
A 6-month drawdown occurred from April to September of 1968 to compact the bottom and increase the amount of emergent vegetation for the benefit of waterfowl. Both were accomplished to some degree. Average compaction was estimated at 6 inches and aerial photography documented the increase in aquatic vegetation. A significant winterkill and summerkill occurred that year, reportedly caused by a combination of factors: stress due to summer drawdown, low water levels continuing through the winter, blocking of the south ditch during dredging, and decay of newly flooded vegetation. No quantitative information exists other than infrequent creel checks to document the fish population changes caused by the drawdown.

Sheboygan Marsh has been stocked periodically since 1935 due to occasional winterkill and in an effort to provide a more diverse fishery. Species stocked between 1935 and 1970 included northern pike, bullhead, black crappie, bluegill, yellow perch, largemouth bass, and walleye. The current game fish populations continue to be dominated by natural populations of northern pike and yellow perch.

A moderate fish kill of northern pike, bullheads, and carp occurred during the winter of 1982. Dead fish were observed from the inlet from Big Elkhart Lake to the west along the south ditch. The blockage on the south ditch diverted flow in this direction and the shallow water resulted in oxygen depletion and the subsequent fish kill. This demonstrates the necessity of removing this obstruction.

Current Management Activities:

Wildlife refuges have been established and revised over the years. Currently, a NR 15.02, no entry refuge exists on about 2,280 acres of the marsh (Figure 4). Management consists of maintaining posted refuge lines.

Intensive management is restricted to the upland and 4 flowages on the south end of the marsh. Administrative buildings are maintained for equipment storage and workshop facilities. About 25 wood duck boxes are maintained on the marsh. Some 260 rods of ditch and dike are maintained on the state land to maintain a 23-acre flowage and 7.5-acre runoff pond. About 460 rods of ditch and dike are maintained on county land to maintain 2 flowages (28 acres and 40 acres).

State waterfowl stamp monies have been used recently to establish permanent nesting cover, to purchase and install a water control structure on the runoff pond, to remove brush from a nesting area, and to redredge the feeder ditch on state land.

About 50 acres are planted to food plots each year on the state land, primarily for waterfowl and pheasants. Another 45 acres are sharecropped on the county land.

Much of the upland area is retired to nesting cover. This requires occasional maintenance by mowing or burning. About 30 acres of this is mowed each year to provide grazing and loafing areas for geese.
Traditionally, strips of corn have been planted adjacent to the retrieving zones on the refuge. An area has also been mowed in front of these strips to facilitate decoy use and retrieving.

Management of the marsh proper is primarily by way of surveys and recommendations. The Department has acted in an advisory capacity to the County Board's Property Committee which is responsible for management of the county marsh. The Department is usually consulted on the desirability of land purchases, for advice on timber harvests and water level manipulation. The county committee also relies on advice from the Sheboygan County Conservation Association and the County Planning Director.

Recent fish management activities have concentrated on data gathering on the fish populations, the physical factors affecting the fish populations, and the winter fishery. Details of these surveys and the results may be found in a report by Claggett (1981). The major conclusions of that report as they affect marsh management are discussed in this plan. The survey information has been primarily used to determine sources of fish mortality and suggest methods to delay or reduce it so larger fish are available to the angler. The baseline data from the surveys may also be used to assess future changes in the fish populations caused by water level fluctuations or angling regulations.

RESOURCES CAPABILITIES AND INVENTORY

Most of the county-owned land has soils of the Boots-Houghton Association, very poorly drained organic soils that are underlain by muck. The soils of upland areas on the south end of the marsh are primarily of the Hochheim-Theresa Association, well-drained soils that have a subsoil of mainly clay loam or silty clay loam underlain by gravelly sandy-loam glacial till.

Sheboygan Marsh was formed on Silurian limestone (dolomite), which is some of the youngest bedrock in Wisconsin. Bedrock geology of the Sheboygan Marsh and Kettle Moraine areas are similar in their formation. Glacial till soils cover the bedrock of the entire region.

The Sheboygan Marsh has no abrupt relief other than small bedrock supported hills that rise above the marsh on all sides except the east. In various places around the marsh are small, irregular glacial land forms (mostly kames).

The marsh lies directly behind the front of the Green Bay lobe of the last glaciation. That lobe abutted ice of the Lake Michigan lobe to form the Kettle Interlobate Moraine in Sheboygan County. Located between the Valders Glacial Ice that filled the area of Lake Winnebago to the northwest and Lake Michigan to the east, the marsh was located in a deep preglacial valley in which water levels were raised by the damming of the Sheboygan River.

During stagnation of the Cary Glacial Ice, water flowed across and around a number of hills surrounding the marsh. The water movement created distinct channels north of the former "Sheboygan Lake." Former lakes that received sediment from the enclosing glacial ice are located in the southern and northeastern corners of the marsh.
Hydrology:

A comprehensive study of the hydrology of the marsh has not been completed. No consistent records of water levels or flow rates have been taken. Occasional records give some indication of water levels and potential for water level management. The water regime includes:

- Drainage area = 133 Mi²
- Runoff = about 7.7" per year
- Mean flow = 76 cfs
- Median flow (Q50%) = about 30 cfs
- Wildlife area = 675 acres open water, 14,000 acres marsh vegetation

The watershed of the Sheboygan Marsh is 133 square miles. Flow rates over the dam vary seasonally and annually. In some years the flow over the dam in July and August is very low or nonexistent. The 2-year, 7-day low flow (Q7, 2) is estimated to be 1.45 CFS, which approximates the average low flow at the dam. The 10-year, 7-day low flow (Q7, 10) is estimated to be 0.68 CFS. Actual flow measurements taken have been 262.2 CFS in September, 1978 and 625.9 CFS in May, 1981. However, these flow measurements are not typical of this drainage area.

Estimating the amount of water which would be drained by reducing levels 18 inches is very difficult due to the lack of detailed topographic and hydrographic maps. Assuming that 3,000 acres suffered an 18-inch drop in water level, and further assuming a water loss equal to 50%, the total amount of drained water would be approximately (675 x 1.5) + (3,000 x 1.5 x 0.5) = 3,300 acre-feet. This is about 1,700 cfs days. Thus, to refill in 30 days would require a net inflow averaging 1,700/30 = 57 cfs. Put another way, the required runoff to fill the marsh would be 0.48 inches over the entire basin.

Fish & Wildlife:

The primary Sheboygan Marsh wildlife species are white-tailed deer, ruffed grouse, woodcock, ducks, geese, muskrats, and mink. Other game species that are less significant in terms of the number of recreational-days include: raccoon, beaver, fox, coyote, pheasants, gray partridge, squirrels, and rabbits. Only primary species which have management potential will be discussed in any detail.

White-tailed Deer

The major attraction for deer is the cover provided by the vast areas of shrub carr associated with lowland hardwood, tamarack, and cedar. The major browse species in the marsh is red osier dogwood. Other preferred species of browse are present, but are less abundant or not available. Except for wind thrown trees, white cedar is browsed to the point of being out of reach. Viburnums, poison sumac, and aspen are not as widespread or abundant as red osier dogwood. Tag alder and willow are abundant, but are not preferred browse species for deer.
The deer population increases in the late fall and winter. This is probably a result of deer moving to better cover for the winter from the adjacent farmland. Deer may also seek this cover as an escape from hunters in the fall. The marsh acts as a natural refuge during much of the deer season. Much of the marsh is generally inaccessible during the gun season, although it is heavily hunted during the late bow season.

Most of the deer using the marsh in the winter also use part of it as their summer range. Studies on a similar swamp in Columbia County, Wisconsin, found 80-90% of the deer using the swamp had summer and winter ranges that overlapped. Some bucks did move considerable distances in winter, up to 6 miles from the swamp. No firm population estimates are available for the Sheboygan Marsh, but similar areas in southern Wisconsin have estimates as high as 100 deer per square mile during the early winter (excluding cattail and water areas).

In the spring, many of the deer move out to the fringes of the marsh and beyond. No estimates of summer populations are available, but from the amount of deer sign, it is still significant, especially in the fringe areas.

The habitat on the marsh can support the current deer population in a normal winter without problems. During severe winters with deep snow cover and long cold spells, there can be some losses due to a combination of malnutrition and dog kills. The winter of 1978-1979 was the last winter that had significant losses of deer. The problem was most severe in the northwest corner of the marsh where there is very little browse close to the cedar area.

Management efforts should be aimed at maintaining the cedar and increasing the amount of browse adjacent to these cedar areas. The white cedar on the marsh is not reproducing, probably because of deer browsing. Most of the cedar is over 100 years old and may have experienced losses due to wind. Without reproduction, the cedar areas may last for another 100 years or more but will eventually be lost. Although not an immediate problem, overbrowsing by deer will eventually have to be addressed.

Corn is planted and left as winter food on the south end of the marsh. Although heavily used by deer and other wildlife, corn food plots are not considered essential to survival of the deer herd in the marsh. The deer in this area make use of the adjoining private farmlands and go into the winter in good condition. During severe winters, most of the deer yard in the cedar areas and do not tend to move to distant crop areas to feed.

Ruffed Grouse

Ruffed grouse are abundant on the marsh. Spring transects of drumming male grouse indicate relatively high grouse populations compared with other state transects. For example, in 1980, over 100 drumming grouse were heard on about 11 miles of transects. By extrapolating from spring drummers, a fall estimate of about 1,000 grouse was calculated. An average harvest rate of 25% and 3.29 hunter-days per bird harvested provides estimates of potential for a harvest of 250 birds with about 800 days of hunting opportunity. Because of the large areas of good cover on the marsh, this estimate of harvest is probably high and the number of hunting-days low.
Habitat used by grouse on the marsh includes the large areas of dense shrub cover. The white cedar in the marsh is probably an important cover component during the winter. There are no large stands of aspen in the marsh, which is considered essential to the maintenance of good grouse range in northern Wisconsin. Along with a scattering of offsite aspen, the shrub species in the marsh are important for food as well as cover; these would include dogwoods, viburnums, high bush cranberry, alder, and willow.

As the shrub areas on the marsh changes to tamarack, the grouse populations will decrease. Currently, openings among the live tamarack produce good stands of red osier dogwood important for grouse. Lack of cedar reproduction will also have an effect on grouse. Management for grouse will require maintaining the shrub and white cedar components of the swamp.

Ring-necked Pheasant

The Sheboygan Marsh is a wintering area for pheasants. Because of the poor habitat quality of the marsh proper, most of the pheasants winter on the brushy edge of the marsh. There is a fair to good breeding population on the uplands and reed canary areas adjacent to the marsh. Within 1-2 miles of the marsh there are probably from 10-15 hens per square mile in the spring. In recent years, intensive agriculture and wetland drainage has reduced the native population on surrounding areas.

The establishment of nesting cover for waterfowl on the south end also provides nesting cover for pheasants. Most of the brushy fenceslines have been maintained on the public lands for cover for upland game. Food plots have been established for upland game and waterfowl on the state-owned lands and on the county-owned lands on the south end of the marsh. The small cereal grains including oats and legumes provide cover and food for broods. Standing crops do receive use by pheasants during the winter.

Gray Partridge

There is a fairly stable population of gray partridge on the uplands adjacent to the marsh. Many of the management practices that benefit pheasants also benefit gray partridge. There are usually 1-3 coveys of gray partridge on the public-owned uplands on the south side during the winter.

Woodcock

The woodcock population on the marsh usually fair to good during the fall. The brushy areas of the marsh provide abundant cover and feeding areas. Most of the resident or breeding population is concentrated along the upland fringes and small upland openings of the marsh. The lack of upland breeding and nesting sites and few openings for mating probably limit the breeding population on the marsh proper. No estimates of breeding populations are available.

Ducks

The Sheboygan Marsh has potential as an important migrational area for ducks. There is a very limited amount of contiguous upland along brood water areas so the number of ducks nesting in the marsh is relatively low.
The most common duck species nesting in the vicinity of the marsh are blue-winged teal, mallards, and wood ducks. Other species that have been recorded as nesting on the marsh infrequently or fewer in number include: shovellers, ring-necked ducks, green-winged teal, ruddy ducks, hooded mergansers, pintail, and black ducks.

Although duck production is not as high as in areas with more upland nesting habitat, production occurs annually. No estimate of total production is available because some of the more productive areas are not easily accessible during the breeding season. Brood surveys have documented from 80-140 young, mostly in the north ditch, the river channel north of the main ditch, and the ditches south of the lake. Up to 310 adult birds have been recorded on the marsh in July.

Duck nesting occurs on ditch banks, wet meadows, cattail areas, lowland brush areas, and on muskrat houses. Wood duck nesting in trees also occurs, but the numbers of nesting wood ducks are difficult to estimate.

Duck nesting habitat on the marsh could be improved. Lower water levels during the breeding season would provide more nesting habitat through exposure of more substrate and increasing the amount of emergent vegetation for cover. Maintaining stable and lower water levels would ensure nests are not inundated in May and early June. Less disturbance by boaters would also improve duck production.

Providing artificial nesting structures may also have potential on this marsh. Loafing logs and downed timber could be used to improve breeding habitat by providing increased pair territories along undisturbed ditches. Maintenance of existing open marsh meadows and removal of brush from some areas could also improve nesting habitat.

A limited amount of breeding habitat is also provided by nesting cover and brood water associated with the uplands and small flowages on the south end of the marsh. The creation of more ponds in this area will attract more breeding ducks.

Use of the Sheboygan Marsh by migrating ducks varies within the season and from year to year. Peak numbers, recorded since 1969, vary from 850 to 6,500 ducks in the fall. The average numbers during the fall are considerably lower, usually from 300 to 1,500. Almost all of the species of ducks that migrate through Wisconsin may be found on the marsh during the fall. The harvest primarily consists of mallards, blue-winged teal, green-winged teal, wood ducks, ring-necked ducks, and wigeon. Some species commonly harvested (usually composing less than 5% of the birds harvested) include: redheads, scaup, pintails, mergansers, and black ducks.

The potential for attracting more migrating waterfowl can be realized by using different management techniques. The greatest potential lies with increasing both the amount and the interspersion of emergent vegetation on the marsh proper through water-level management.
Periodic summer drawdowns and lower water levels during the spring and summer will increase the quantity and quality of emergent vegetation for duck food and cover. Refuge changes that include a larger percentage of water and marsh habitat will attract more ducks and also provide some protection from overharvest. The upland unit on the south end of the marsh could be managed more intensively for migrating ducks. In some years, 40 acres of buckwheat combined with mowed cornfields have attracted and held 3,000 to 4,000 mallards. With additional acquisition, the potential exists for creating more shallow flowage areas.

If the current continuously high water levels on the marsh are not lowered the loss of cattail bog will continue. The number of dabbling ducks using the marsh will continue to decline, but there may be an increase in the number of diving ducks in the fall; although diving duck use could be limited because of boater disturbance.

Canada and Snow Geese

Table 1 summarizes the peak number of fall migrating geese on the Sheboygan Marsh since 1961. The number of geese on the marsh has dramatically fluctuated from year to year. There may be several reasons for these fluctuations: the number of geese migrating through the area, changes in goose management in east central Wisconsin, changes in the refuge on the Sheboygan Marsh, and water levels on the marsh. During the 1968 drawdown, poor hunter access allowed geese to use the mudflats and shallow waters of the marsh without disturbance. During the fall of 1964, the upland refuge was larger.

The history of goose-use on the marsh indicates the potential exists for attracting more migrating geese in the fall. More geese can be attracted to the marsh by increasing the amount of open uplands in the refuge and can also be increased with more water area within the refuge. Another method that might help, but is not very practical to implement, is more restricted hunting hours. Small decoy flocks have been used in the past without any consistent success. Unless the size of the refuge is increased substantially, the number of geese expected to use the marsh for any length of time, on a consistent basis, would not be much over 5,000. Although this would not be very significant on a regional basis, it would be considered locally significant.

There have been reports of one or 2 pairs of geese nesting on the marsh in some years. If the amount of emergent vegetation on the marsh was substantially increased, some breeding geese may be attracted to the marsh, but the supply of short grass areas for broods is so limited that few geese could be expected to nest in the area.
<table>
<thead>
<tr>
<th>Year</th>
<th>Peak Count</th>
<th>Date</th>
<th>Goose Use Days**</th>
<th>Estimated Kill Canada (Snow &amp; Blue)*</th>
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<tbody>
<tr>
<td>1961</td>
<td>250</td>
<td>Oct. 7</td>
<td>1,162</td>
<td></td>
</tr>
<tr>
<td>1962</td>
<td>250</td>
<td>Oct. 21</td>
<td>1,813</td>
<td></td>
</tr>
<tr>
<td>1963</td>
<td>261</td>
<td>Oct. 28</td>
<td>1,771</td>
<td></td>
</tr>
<tr>
<td>1964</td>
<td>6,000</td>
<td>Sept. 27</td>
<td>102,000</td>
<td>500 (35)</td>
</tr>
<tr>
<td>1965</td>
<td>1,700</td>
<td>Oct. 9</td>
<td>20,519</td>
<td>25 (6)</td>
</tr>
<tr>
<td>1966</td>
<td>1,500</td>
<td>Oct. 2</td>
<td>32,502</td>
<td>90 (14)</td>
</tr>
<tr>
<td>1967</td>
<td>70</td>
<td>Oct. 13</td>
<td>2,219</td>
<td>4</td>
</tr>
<tr>
<td>1968</td>
<td>8,000</td>
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<td>104,450</td>
<td>272</td>
</tr>
<tr>
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<td>Oct. 18</td>
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</tr>
<tr>
<td>1970</td>
<td>700</td>
<td>Oct. 31</td>
<td>21,700</td>
<td>121 (80)</td>
</tr>
<tr>
<td>1971</td>
<td>200</td>
<td>Oct. 30</td>
<td>5,100</td>
<td>38 (8)</td>
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<td>1972</td>
<td>12</td>
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<td>177</td>
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<td>1974</td>
<td>2,000</td>
<td>Oct. 2</td>
<td>42,184</td>
<td>170</td>
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<td>1975</td>
<td>610</td>
<td>Sept. 24</td>
<td>13,784</td>
<td>53</td>
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<td>1976</td>
<td>1,290</td>
<td>Oct. 3</td>
<td>45,245</td>
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<td>1978</td>
<td>125</td>
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<td>1979</td>
<td>800</td>
<td>Oct. 1</td>
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<td>55 (20)</td>
</tr>
<tr>
<td>1980</td>
<td>1,500</td>
<td>Oct. 2</td>
<td>14,637</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>400</td>
<td>Sept. 19</td>
<td>10,156</td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>250</td>
<td>Sept. 29</td>
<td>6,253</td>
<td></td>
</tr>
</tbody>
</table>

*Numbers within ( ) are for the Snow & Blue geese.

**Sum of the number of geese per day in the fall.
Furbearers

Furbearing mammals on the marsh include: muskrat, mink, raccoon, red and gray fox, skunks, coyote, beaver, weasels, and opossum. Badgers occur on the upland edge and otter are occasionally reported. Of these species, muskrats and beaver can be managed.

The muskrat is the most important fur resource on the marsh in terms of economic returns and the number of days of trapping. Marshes with stable water levels of 15 to 30 inches and consisting of about 70% emergent vegetation and 30% open water are ideal for muskrats. Many of the muskrats on Sheboygan Marsh use banks for their dens.

Habitat management for muskrats is largely carried out in conjunction with or incidental to marsh management for waterfowl. Management consists of manipulation of water levels to provide suitable emergent vegetation and proper water depths. Muskrats do cause damage to some earthen dikes which requires constant maintenance. Also, without proper harvest, they can overpopulate and "eat out" a marsh, resulting in large population fluctuations.

Based on similar marshes in southern Wisconsin and reports from previous years, the Sheboygan Marsh has potential for large muskrat populations. Local trappers reported a large increase in the muskrat population on the Sheboygan Marsh following the last drawdown. Horicon Marsh with its water level manipulation, including drawdowns, provides for a consistent annual harvest of about 3 animals per acre of habitat. A similar harvest could be expected from Sheboygan Marsh under ideal management.

There are usually several beaver colonies on the marsh. In some areas they have set back succession by creating shallow flowages. Their tree and shrub cutting activities can also temporarily stop brush encroachment.

Local residents have reported a much higher population of beaver existed in the past. Overharvest of the marsh population could occur if prices for beaver pelts increase dramatically.

Cottontails and Squirrels

Other game animals exist on the marsh, but either do not require intensive management or management is impractical. The cottontail rabbit occurs in the marsh and has abundant cover in the large shrub carr areas. Brush piles can be constructed along the marsh edge to give them added cover. Generally they will benefit from management for pheasants.

Fox and gray squirrels are also present, but the habitat on the marsh is not conducive to large populations of these species.
Wildlife:

There is a great variety of mammals found on the marsh in addition to the game species. Besides gray and fox squirrels, there are red squirrels and flying squirrels on the marsh. Other common small mammals include shrews, moles, bats, the meadow voles, and several species of mice. The red-backed vole has been reported in the Sheboygan Marsh and is considered a relic species indicative of remnant northern habitats.

The rich bird life includes several species of small rails, with the sora rail being the most common; the American coot and the common gallinule are present on the marsh (coot usually use the marsh as a staging area in the fall). Bitterns and herons are also found on the marsh. Black crowned night herons have been seen on the marsh, but no breeding colony is known to exist. There are usually several great blue herons on the marsh during the breeding season, but no rookery has been found; Herman (1941) reported a couple of small rookeries in 1939.

Sandhill cranes are usually present on the marsh during the breeding season. In both 1980 and 1981, at least one pair was successful in raising of a single young. Herman (1941) also reported that black terns were very abundant and breeding everywhere in his 1939 study; only a few black terns have been observed on the marsh in recent years. A great variety of songbirds breed in or migrate through the Sheboygan Marsh. Some common species for this area include: marsh wrens, yellow-throat, yellow warblers, catbirds, brown thrashers, flickers, chickadees, downy and hairy woodpeckers, and red-winged blackbirds. The northern shrike has been reported on the area during migration and there is a small breeding colony of yellow-headed blackbirds on the marsh.

There are several species of hawks and owls inhabiting the marsh. The most common species are the red-tailed hawk, broad-winged hawk, marsh hawk, great horned owl, screech owl, and barred owl. Some threatened species have been reported on the marsh, including the Cooper's hawk and red-shouldered hawk. Turkey vultures are often seen soaring over the marsh. Ospreys and bald eagles, Wisconsin endangered species, are often reported soaring and hunting over the marsh in the spring and fall. Some other bird species that are uncommon but are occasionally seen on the marsh include: whistling swans, double-crested cormorants (Wisconsin endangered species), and common egrets.

There are many species of amphibians and reptiles on the marsh. No inventory has been completed. The common turtles are snapping turtles and painted turtles. Pickerel frogs (threatened) were reported in Herman's 1939 survey and are present in the NU-KMSF.

Except for the above observations, no endangered or threatened species of fish, amphibians, molluscs, mammals, birds, reptiles, or plants are known to reside on the property.
Fish:

The dominant game fish present in the Sheboygan Marsh are northern pike and yellow perch. Other species of some recreational importance are black and brown bullheads, pumpkinseed sunfish, and black crappie. Other species known to inhabit the marsh are green sunfish, bluegill, warmouth, largemouth bass, white sucker, carp, golden shiner, and creek chub. Carp were considered a problem before the 1968 drawdown, but were greatly reduced thereafter. Recent observations indicate they are increasing in number, and a drawdown may help alleviate future problems with this species.

Northern pike have declined in abundance since surveys began in 1975 when there was an estimated population of 9,400 pike larger than 15 inches (14 per acre). The great majority of northern pike from recent surveys have been age 2 and 3 (fish in the 16- to 19-inch range). Abundance of fish older than age 3 (larger than 20 inches) declines rapidly. Mortality estimates calculated from catch curves average 70 percent. According to the creel survey from the winter of 1980, and gross estimates of open water fishing, most of this mortality (75%) can be attributed to angling rather than natural causes. Growth of northern pike appears to be slightly less than average for this area of the state.

The yellow perch population was stable in total numbers from 1974 to 1979, but had progressively fewer large fish. Perch older than age 4 (larger than 10 inches) became scarce after 1979. Mortality of perch after age 3 averaged about 70 percent. A large portion of this mortality is due to winterkill and other natural causes. Growth of yellow perch is relatively fast in the Sheboygan Marsh compared to surrounding waters.

Vegetative Cover (Figure 5, Table 2):

Plants:

No comprehensive floral survey has been conducted on the marsh, but some limited surveys have been conducted by the State Scientific Areas Preservation Council. The only comprehensive faunal survey was conducted in 1939-1940 by E.F. Herman. Other incidental observations have been recorded while conducting routine game surveys. Lists of floral and faunal species recorded on the marsh are not necessary for this plan but are available at the DNR office in Plymouth.

The Sheboygan Marsh is about 50% forested. Cattails, lowland brush, and marsh grass occupy the remaining land area. The major tree species are northern white cedar, tamarack, silver maple, and black ash. An increase in size of the forested acreage is very unlikely because of soil limitations. The soil is very high in organic matter and natural fertility is low. Because the water table is at or near the surface, the tree root systems are shallow. Contrary to common belief, white cedar and tamarack do not grow best in a swampy environment. A high water table or slow moving groundwater restricts aeration and tends to reduce the growth rate of any tree species.
Silver maple - Commercially, silver maple is the most important tree species growing in the Sheboygan Marsh. Its present sawlog stumpage value averages $200 per thousand board feet (1981 values). It appears to be the fastest growing tree on the Boots muck soil type. The species is shade intolerant and is, therefore, best managed by the even-aged system of management. A rotation period of about 60-80 years is feasible. The species reproduces well from seed and by stump sprouts. However, if flooding occurs for too long a period, the majority of the seedlings will die. Thus, if at all possible, harvesting should only be conducted after the establishment of ample reproduction.

Northern white cedar - This species occupies only 365 acres of the marsh. However, it is quite important from the wildlife management standpoint. During severe winters, the larger cedar stands are quite palatable to deer and serve as wintering areas for the marsh deer herd. Because of the pressure from deer browsing, white cedar reproduction is almost nonexistent. Cedar attains its best growth on soils of limestone origin with a pH anywhere from neutral to alkaline. Boots muck does not meet that criteria. Thus, it has taken 80-100 years to grow a 10-inch tree.

Slow growth usually leads to other problems such as heart rot fungus, which is prevalent in trees that grow slow and are over 100 years old. Increment borings indicate the 2 major cedar stands in the marsh are well over 100 years. Old growth stands are best managed by even-aged management. Thus, strip clear cutting appears to work best if natural seeding is desired.

Tamarack - This species occupies the greatest land area of trees in the marsh. Most of the stands are inadequately stocked. Stocking levels are probably low for several reasons. In most stands there is a thick understory of brush. The best seedbed for reproduction establishment is moist mineral soil. Mortality has also been caused by periodic infestations of the larch sawfly. Complete defoliation by the insect is not uncommon. Because tamarack is shallow rooted, the tree is usually killed by fire in swamps, unless the burn is very light. Tamaracks' shallow root system also makes it quite susceptible to blowdown. Abnormally high water levels will also cause considerable mortality.

Tamarack growing in the Sheboygan Marsh is very slow growing. Generally, it only reaches a diameter of 14" DBH before it succumbs to one of the causes of mortality mentioned. Accessibility to most of the merchantable timber is almost impossible. Because of its poor accessibility, low volume per acre, and small size, the wood-using industries in the area are not interested in buying it. Some of the stems could be used by the pulp and paper industry; however, it is economically unfeasible to transport the material to the nearest mill, thus, utilization of tamarack does not look bright for the immediate future.

<table>
<thead>
<tr>
<th>Vegetative Type</th>
<th>Acreage</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>State Land</td>
<td>County Land</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>--</td>
<td>700</td>
<td></td>
</tr>
<tr>
<td>Agricultural</td>
<td>233.5</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>Cedar</td>
<td>25.0</td>
<td>365</td>
<td></td>
</tr>
<tr>
<td>Swamp Hardwoods</td>
<td>61.5</td>
<td>963</td>
<td></td>
</tr>
<tr>
<td>Northern Hardwoods</td>
<td>11.0</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Upland Hardwoods</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Tamarack</td>
<td>--</td>
<td>2,267</td>
<td></td>
</tr>
<tr>
<td>Lowland Brush</td>
<td>51.0</td>
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</tr>
<tr>
<td>Cattails</td>
<td>--</td>
<td>1,180</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>382</td>
<td>7,087</td>
<td></td>
</tr>
</tbody>
</table>

Water Resources (Table 3):

Sheboygan Marsh (Lake) is an extensive drainage impoundment of the Sheboygan River totaling 674 acres within the 14,000 acres of marsh. The total open water acreage can be divided into the main lake (368 acres), the Sheboygan River (130 acres), St. Anna Creek (29 acres), and a series of artificial ditches (147 acres) (Table 3). The maximum depth of the main lake is 3.5 feet with over 75 percent less than 3 feet deep.

The dredged channels range in depth from 3 to 9 feet with a 5-foot average depth. Flow of water into the Sheboygan Marsh is mainly from the Sheboygan River, but also from an outlet of Big Elkhart Lake, St. Anna Creek, and several unnamed tributaries. Water level in the marsh is controlled at approximately 907 feet above sea level by a dam maintained by Sheboygan County and located at the northeast corner of the marsh.

As is characteristic of many marsh lakes, the water is light brown in color and is sometimes low in dissolved oxygen (DO). During a typical winter, the main body of the marsh and both river channels become very low in DO. DO is often less than one PPM just above the dam. The flow from Big Elkhart Lake that enters the South Ditch in the southeast corner of the marsh is always high in DO. The majority of this flow travels east and then north along the south ditch before passing over the dam. DO in the south ditch has almost always been greater than 3 PPM (except when flow was blocked in 1981 and 1982).
The Department attempted to open the center of the dike by blasting during the winter of 1982, but was unsuccessful due to the soft bottom. Low water, beaver cuttings, and silt accumulations on an old dike at the south end of the ditch changed the flow pattern in 1981 and 1982. The elevated DO in the south ditch is responsible for concentrating fish (and fishermen) in this area during the winter.

A small amount of fish mortality has been observed throughout the marsh during most winters. Fish likely over-winter in small upstream spring areas as well as the south ditch. During severe winters, numerous dead bullheads and yellow perch are observed in these spring holes. High winter DO levels have also been found upstream at the outlet of Mischo's pond and throughout Dotyville Creek.

### TABLE 3. Water Areas Within the Sheboygan Marsh (From 1975 Aerial Photo)

<table>
<thead>
<tr>
<th>Name</th>
<th>Length (Feet)</th>
<th>Width (Feet)</th>
<th>Acres</th>
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</thead>
<tbody>
<tr>
<td>Main Lake</td>
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</tr>
<tr>
<td>Sheboygan River</td>
<td>130.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Anna Creek</td>
<td>29.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ditches:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vic's</td>
<td>6,600</td>
<td>50</td>
<td>7.58</td>
</tr>
<tr>
<td>Froelich</td>
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<td>7.81</td>
</tr>
<tr>
<td>Bergin</td>
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<td>7.62</td>
</tr>
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</tr>
<tr>
<td>Main</td>
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<tr>
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<td>75</td>
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<tr>
<td><strong>Total Ditches</strong></td>
<td></td>
<td></td>
<td>147.3</td>
</tr>
<tr>
<td><strong>Total Open Water</strong></td>
<td></td>
<td></td>
<td>674.2</td>
</tr>
</tbody>
</table>

**Historical and Archaeological Features:**

Preliminary surveys by the State Scientific Areas Preservation Council have indicated potential for Public Use Natural Areas or Scientific Areas, designation for at least 2 sites, and consideration of also designating some of the cedar area (Figure 6).
FIGURE 6  LAND USE CLASSIFICATION
The Natural Area on the northwest edge of the marsh represents 3 types of plant communities: marsh, cedar swamp, and southern floodplain forest. The marsh is bisected by a tributary stream to St. Anna Creek. The floodplain forest is comprised of large, multiple stemmed silver maple, with an understory of Cornus sp., Ribes sp. and small tree saplings. The cedar swamp is dominated by an even aged stand of white cedar (8" - 10" d.b.h.) which is over 75 years old. The cedar swamp is bordered on the southeast by aspen and black ash and the marsh.

The Natural Area on the south end of the property is southern floodplain forest. It is comprised of older growth silver maple forest, but an inventory has not been completed.

Although no systematic survey has been made of northwestern Sheboygan County, the State Historical Society has identified 7 archaeological sites on the marsh. Sheboygan Marsh was the location of intensive prehistoric settlement and the whole area is rich in Indian artifacts. Because of the area's archaeological significance, the State Historical Society, Historic Preservation Division, will be consulted prior to any major developments.

Ownership:

The state owns 382.23 acres, all of which have been acquired in fee title at a cost of $66,035.00. The current acreage goal is 577.0, of which 194.7 acres remain to be acquired.

The county currently owns 7,250.5 acres in fee title. The county has no official boundaries or acquisition goal.

Current Use:

Hunting Pressure

The following are estimates of the number of user-days per year on the Sheboygan Marsh. User-days for deer hunting were estimated by using car count records and deer registration by township and land ownership in 1980. Hunter-days for waterfowl hunting were estimated by using car count and bag check information from 3 years of intensive bag checks on the Sheboygan Marsh (1975, 1976, 1977).

<table>
<thead>
<tr>
<th>Activity</th>
<th>User Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deer Hunting</td>
<td>3,100 - 3,700</td>
</tr>
<tr>
<td>Bow</td>
<td>2,000 - 2,200</td>
</tr>
<tr>
<td>Gun</td>
<td>1,100 - 1,500</td>
</tr>
<tr>
<td>Duck Hunting</td>
<td>2,500 - 3,100</td>
</tr>
<tr>
<td>Grouse &amp; Woodcock Hunting</td>
<td>500 - 600</td>
</tr>
<tr>
<td>Trapping &amp; Other Small Game</td>
<td>Unknown</td>
</tr>
</tbody>
</table>


Fishing Pressure

Winter fishing pressure was estimated by an intensive creel census in 1980. The summer fishery is much less concentrated and would be very expensive and time-consuming to accurately estimate. For the purposes of this plan, a gross estimate has been made based on expansion of infrequent observations of car-trailer units and shore anglers.

Fishing pressure becomes very concentrated in the south ditch area of the Sheboygan Marsh during the winter. Fish move into this area as dissolved oxygen becomes depleted in the rest of the marsh, typically in February and March. Estimates for the 1980 winter fishery are 11,200 angler hours or 3,500 angler days. Seventy-two percent of the winter fishing pressure occurred during the extended season in March.

Slightly less than 50 percent of the year-round fishing pressure was estimated to occur during the open-water season. A gross estimate is 10,000 angler hours and 3,300 angler days from April through November. Fifty-two percent of this open water pressure occurred during what would be the time of proposed periodic drawdowns, from June through September.

The marsh is also used by a variety of groups and individuals for education, bird watching, berry picking, cross-country skiing, boating and canoeing. Information on use levels for these activities has not been compiled.

MANAGEMENT PROBLEMS

1. Poor Waterfowl Habitat:

   The Sheboygan Marsh is almost completely surrounded by extensive stands of tamarack and cedar that effectively separate the marsh from the upland perimeter. The limited upland nesting habitat that's adjacent to open marsh will continue to limit waterfowl production except for wood ducks. Because of this, the marsh is primarily a waterfowl staging and harvest area with a limited amount of local production. Also, since the installation of the bypass tube in 1968, the water level on the marsh has been maintained at a consistently high level that continues to erode and dislodge cattail bogs, and decreases other food and cover plants for waterfowl and other marsh wildlife.

2. Lack of White Cedar Reproduction:

   White cedar appears to be an important habitat component for deer and grouse on the marsh. Cedar will not reproduce under its own shade, and competition from brush and browsing by deer limits its expansion into openings and along edges. Strip cutting of cedar is a technique that may allow cedar to reproduce, but high deer populations would probably thwart this management attempt.

   In recent years, the demand for fuel wood has increased dramatically. This has resulted in an increase of requests for permission to harvest trees for free from the marsh. The County has been issuing permits for down and dead wood, and there has been a lot of wood-cutting activity.
Dead wood is an important wildlife habitat component, especially for grouse, certain songbirds, owls, and rabbits. Also, in cedar areas, downed trees may act as a substrate for the re-establishment of cedar. With increasing energy costs, this activity may soon cause a significant loss of dead wood on the marsh.

3. Lack of Adequate Uplands for Goose Refuge:

There is not an adequate amount of uplands within the refuge area to attract and hold a significant number of geese during the waterfowl season. The refuge should extend to Hull's Crossing Drive (Figure 4) to be effective. Until such lands could be purchased, refuge leases would suffice; but without cooperation from all landowners, the refuge would remain ineffective.

4. Difficulties in Fire Control:

Most of the marsh is inaccessible except by boat and foot travel. Prescribed burns of certain sections of the marsh may not be possible because effective fire control would be difficult. Since uncontrolled fires were stopped by temporary dams and then a permanent dam in the 1930's, plant succession has proceeded to replace most of the marsh-meadow areas with brush. Some portions of the marsh should be burned to maintain or reclaim nesting and cover areas for waterfowl.

5. Socio-Political Problems:

Currently, the Property Committee of the Sheboygan County Board is charged with the responsibility of managing the marsh. They make decisions based on input from an alliance of Sheboygan County sportsmen’s clubs, advice from the County Planning and Resources Department, and the local DNR office. There is no manager, per se, for the 7,000 plus acres of county-owned recreation land in the marsh. The Department of Natural Resources has neither management authority nor responsibility for this property. This limits the Department's active involvement in physical management of the property. Without a management agreement, coordinated and consistent management efforts are difficult to effectuate.

The roles that the Department and the County play in managing the marsh are not clearly understood by most of the Sheboygan County citizens. Problems result because people do not understand who is responsible for management activities. Past management proposals have not been carried out because no clear goals or objectives have been agreed upon.

6. Poor Access:

Because most of the marsh is not accessible to heavy equipment, many conventional management techniques are difficult to accomplish. Brush mowing, dike development, construction of nesting islands, etc. are all difficult to accomplish on the marsh. Also, access for recreation is limited to boat travel until the marsh freezes. Access on the south side is restricted in October and November because of the no-entry refuge. Public access is also restricted in the west end because of private ownership.
7. **Fish Overharvest:**

The size of northern pike available to anglers has decreased in recent years. The angler exploitation rate, most of which takes place in the winter, is excessive. More restrictive angling regulations are needed to address this problem.

The reduction in numbers of large perch since 1975 seems to be related to the problems of low water levels in 1977, and severe winters in 1978 and 1979. This is most likely a cyclic phenomenon, and the number of larger perch appeared to be rebounding in the 1979 sample.

8. **Poor Fish Habitat:**

Much of the Sheboygan Marsh becomes very low in dissolved oxygen by late winter. Levels of less than 1 PPM are common in all areas except those influenced by the outflow from Big Elkhart Lake. Typically, this highly oxygenated water flows northerly through the south ditch and over the dam. Many fish move into this area of the marsh under these conditions as indicated by the history of rough fish trapping, the abundant angler catches sometimes observed, and the observation of abundant bullheads through holes cut in the ice.

These fish undergo stress associated with crowding and are very vulnerable to angling at this time. These conditions may be limiting overall fish production in the marsh. The south ditch is gradually becoming shallower, and a dike at the south end has recently restricted flow during the winter.

**RECREATIONAL NEEDS AND JUSTIFICATION**

The Sheboygan Marsh is easily accessible to many people. It is centrally located between Green Bay and Milwaukee, and between Sheboygan and Fond du Lac. Approximately one million people live within an hour's drive of the area and 200,000 within a half hour drive (Sheboygan County's 1980 population was 100,935-Wisconsin Blue Book).

According to the 1975 Sheboygan County Comprehensive Outdoor Recreation and Open Space Plan, the 1980 weekend day-use (user-days) in Sheboygan County was expected to be between 15,637 and 18,362 for hunting, and between 8,372 and 8,985 for inland fishing. Wisconsin's 1972 Outdoor Recreation Plan projected hunting demand to increase in Sheboygan County from 144,000 hunter-days in 1970 to 161,000 in 1980, and 180,000 in 1990.

Although several other public hunting areas are available in this area of the state, the Sheboygan Marsh is the major waterfowl hunting area in the county.

Demand for duck, goose, and pheasant hunting will exceed the opportunity (supply) in the very near future, if it doesn't already.

**Citizen Participation**

Several attempts were made to obtain citizen input prior to writing this plan. Because the primary use of the marsh is known to be hunting and fishing, and because of their past involvement in advising the county on
management decisions, the county alliance of sportsmen's clubs were the first to be surveyed for input. (Sheboygan County Conservation Association, Inc., representing about 21 sportsmen's clubs throughout the county.)

Table 4 summarizes the results of a survey conducted in July of 1979. Delegates from 13 clubs ranked activities by importance for recreation opportunities and management. The table also summarizes the results of the same survey given to 20 individual clubs to complete (only 8 responded).

<table>
<thead>
<tr>
<th>July 1979</th>
<th>August 1979</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Delegates (13 clubs)</strong></td>
<td><strong>Clubs (w/8 clubs)</strong></td>
</tr>
<tr>
<td><strong>Rank</strong></td>
<td><strong>Activity</strong></td>
</tr>
<tr>
<td>1.</td>
<td>Deer Hunting</td>
</tr>
<tr>
<td>2.</td>
<td>Duck Hunting</td>
</tr>
<tr>
<td>3.</td>
<td>Trapping</td>
</tr>
<tr>
<td>4.</td>
<td>Other Hunting</td>
</tr>
<tr>
<td>5.</td>
<td>Ice Fishing</td>
</tr>
<tr>
<td>6.</td>
<td>Open Water Fishing</td>
</tr>
<tr>
<td>8.</td>
<td>Timber</td>
</tr>
<tr>
<td>10.</td>
<td>Grouse Hunting</td>
</tr>
<tr>
<td>11.</td>
<td>Cross-country Skiing</td>
</tr>
<tr>
<td>15.</td>
<td>Water Skiing</td>
</tr>
<tr>
<td>17.</td>
<td>Artifact Hunting</td>
</tr>
</tbody>
</table>

A similar but less comprehensive survey was conducted in August of 1980. Table 5 summarizes the results. Delegates from 12 clubs responded to the species survey and 14 responded to the activity survey.
TABLE 5. Recreation Ranking Sheboygan Marsh, August 1980

<table>
<thead>
<tr>
<th>Rank</th>
<th>Activity (14 Clubs)</th>
<th>Rank</th>
<th>Species (12 Clubs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Duck Hunting</td>
<td>1.</td>
<td>Deer</td>
</tr>
<tr>
<td>2.</td>
<td>Deer Hunting</td>
<td>2.</td>
<td>Ducks</td>
</tr>
<tr>
<td>4.</td>
<td>Open Water Fishing</td>
<td>4.</td>
<td>Geese</td>
</tr>
<tr>
<td>5.</td>
<td>Ice Fishing</td>
<td>5.</td>
<td>Pan Fish</td>
</tr>
<tr>
<td>7.</td>
<td>Trapping</td>
<td>7.</td>
<td>Ruffed Grouse</td>
</tr>
<tr>
<td>8.</td>
<td>Other Hunting</td>
<td>8.</td>
<td>Pheasants</td>
</tr>
<tr>
<td>10.</td>
<td>Timber Production</td>
<td>10.</td>
<td>Other Small Game</td>
</tr>
</tbody>
</table>

A final attempt to gather preliminary citizen input was undertaken in May of 1981. At a well-advertised informational meeting, a questionnaire was distributed to the 52 people in attendance. The audience was not a true cross section of county sportsmen; fishermen and bow hunters dominated because of special interest in water levels and refuge changes. Table 6 is a summary of the 42 questionnaires that were returned.

TABLE 6. Summary of 42 Questionnaires From May, 1981, Citizen Input Meeting

<table>
<thead>
<tr>
<th>Rank</th>
<th>Activity</th>
<th>Rank</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Deer Hunting</td>
<td>1.</td>
<td>Deer</td>
</tr>
<tr>
<td>2.</td>
<td>Open Water Fishing</td>
<td>2.</td>
<td>Northern Pike</td>
</tr>
<tr>
<td>4.</td>
<td>Duck Hunting</td>
<td>4.</td>
<td>Ducks</td>
</tr>
<tr>
<td>5.</td>
<td>Trapping</td>
<td>5.</td>
<td>Furbearers</td>
</tr>
<tr>
<td>6.</td>
<td>Ice Fishing</td>
<td>6.</td>
<td>Pheasants</td>
</tr>
<tr>
<td>7.</td>
<td>Goose Hunting</td>
<td>7.</td>
<td>Geese</td>
</tr>
<tr>
<td>8.</td>
<td>Snowmobiling</td>
<td>8.</td>
<td>Woodcock</td>
</tr>
<tr>
<td>9.</td>
<td>Canoeing</td>
<td>9.</td>
<td>Other Small Game</td>
</tr>
<tr>
<td>11.</td>
<td>Other (hiking, bird watching, Cross-country skiing, etc.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(Table 6 cont.)

On the following four questions, the number of votes are underlined.

**Water Level Management**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>A. Status Quo (i.e. - Over I-beam (6&quot;) above spillway at all times)</td>
</tr>
</tbody>
</table>
| 23 | B. Partial Summer Drawdowns  
|    | a. every 3 years  
|    | b. every 5 years  
|    | c. every ____ years (1-2 years 2-10 years) (1-1 year 1-8 years 1-100 years) |
|   | C. Full Summer Drawdowns  
|    | a. every 3 years  
|    | b. every 5 years  
|    | c. every ____ years |

**Water Level Maintenance**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 18 | A. Status Quo (6" I-beam)  
| 2 | B. Summer levels at spillway level  
| 13 | C. Late Winter drawdown with summer levels at:  
|    | a. 6" I-beams  
|    | b. spillway level  
| 2 | D. Raise water levels even higher than current levels for a certain period of time. |

**Refuge Changes**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 6 | A. Status Quo  
| 5 | B. Enlarge Water Area in Refuge  
| 10 | C. Enlarge Upland Area in Refuge  
| 18 | D. Reduce Refuge Area  
|   | E. Other ____________________ |

**Northern Pike Fishery**

**Do you favor:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 4 | A. Status Quo  
| 10 | B. Closing South Ditch to all fishing during the winter  
| 22 | C. A Year-Round Size Limit on northern pike (e.g., 18 inches)  
| 3 | D. A Reduced Bag Limit for northern pike (e.g., 2) |

**Do you prefer:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 2 | A. Catching larger numbers of small northern pike (less than 18")  
| 3 | B. Catching small numbers of large northern pike (greater than 18") |

Except for deer hunting, the ranking varies from survey to survey. The first 2 surveys were completed by sportsmen club delegates and the third was completed by people interested enough to attend an informational meeting.
ANALYSIS OF ALTERNATIVES

The following is an analysis of the major management actions possible for 10 broad management areas. Obviously, the type of management implemented in any one of these areas will have some affect on the results of management actions attempted in other areas.

Management Cooperation

1. Status Quo - Under current conditions, the department does not have any direct responsibility for the management of any area outside the state-owned lands. Responsibility for maintenance and management of the uplands and flowages of the county land lies with the County Property Committee; the assistance the Department provides is voluntary and its intensity depends on budget and personnel constraints, as in the past. The Department does not have the authority for prescribed burns or for farming this area.

Water levels on the marsh proper are controlled by the owner of the dam, the county. The Department has advised the county on water-level management in the past but does not make the decisions on water-level management. Unless maximum and minimum levels are established through public hearing, the county can control water levels as it sees fit, unless public rights are infringed.

With the current arrangement, it is difficult to ensure coordinated efforts between state and county land for any period of time. The effectiveness of management efforts on state land depends on coordinated efforts on the larger county property. Without assurance of long-range coordinated efforts, the management on the state-owned property may have to be reduced to allow redistribution of funds for more secure properties.

2. Less Cooperation - Unfortunately, reduced management attention is quite possible, given the current economic conditions and budgetary planning process of the Department. Without Department assistance, the county would have to assume a more active role or give less attention to the land and flowages. The flowages would rapidly deteriorate without constant maintenance of dikes and water control structures. The county would have to take over the upland and moist soil farming and water-level management activities or allow them to go unmanaged.

3. Increased Cooperation - With increased cooperation, based on a management agreement and this plan, the marsh can be more effectively managed. Roles and responsibilities would be defined and a long-range plan could clearly outline goals and objectives for the property. If the Department was given the authority for implementing this plan, more aggressive management actions could be undertaken. This would also help insure continued and consistent management efforts by justifying the Department's responsibilities during our budget planning process. These efforts should result in increased wildlife production, hunting and fishing opportunities, and improve resource use and other recreation.
Small Flowage Management

Figure 2 shows existing and potential flowage on public lands on the south side of the marsh. Two of the existing flowages are on state land and 2 are on county lands.

1. No Management: Without yearly maintenance the existing flowages will deteriorate within 5 years to a point where major renovation will be required. Muskrat damage to the dikes and ditches and brush growth requires yearly control efforts. Without control of water levels on these flowages (through pumping and drainage), the flowages will not be effective in attracting breeding or migrating waterfowl.

2. Status Quo: With current management efforts, these flowages normally attract and hold about 500 ducks and 500 geese in the fall. They also provide about 65 acres of brood water. In conjunction with upland food plots and refuges, the number of ducks and geese using the area around the flowages has varied from 250 to 5,000 ducks and/or geese in the fall.

With current maintenance and some recent renovation work on these flowages, they should remain functional for another 15 to 20 years.

3. Reduced Management: With less management, these flowages can be expected to deteriorate faster and be less attractive to migrating and breeding waterfowl. Reducing management efforts to maintenance and water-level control without planting moist soil plants has not been very effective in drawing fall migrating ducks, and would not fulfill the original intent of these developments.

The emphasis would turn to waterfowl production by maintaining high water in all flowages and the runoff pond through midsummer. Cattails would have to be controlled through occasional winter drawdowns, cutting, and flooding.

4. Increased Management: More intense efforts could increase waterfowl use substantially. Prescribed burns on the large flowages would increase use by waterfowl and expand the life of their water holding capabilities. Several other flowages could be developed (Figure 2), increasing the waterfowl use on the south end of the marsh and should increase duck and goose use of the total marsh area.

Most of the potential flowage areas will have to await further land acquisition.

Wildlife Refuge

The current refuge is a Chapter NR 15.02 game refuge, all species; no entry; this prohibits entry for any purpose from October 1 through November 30, except for deer hunting during the deer gun season. Figure 6 shows the current refuge and some alternatives. Table 7 compares the acreages by broad cover types of the different alternatives discussed below.
TABLE 7. Refuge Alternatives

<table>
<thead>
<tr>
<th>Refuge Alternative</th>
<th>Total Acres</th>
<th>Upland &amp; Agricultural Land (Acres)</th>
<th>Timber &amp; Shrub Swamp (Acres)</th>
<th>Marsh &amp; Water (Acres)</th>
<th>Acres to Lease or Purchase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status Quo</td>
<td>2,280</td>
<td>360</td>
<td>1,530</td>
<td>390</td>
<td>160</td>
</tr>
<tr>
<td>Reduced</td>
<td>1,430</td>
<td>200</td>
<td>680</td>
<td>550</td>
<td>40</td>
</tr>
<tr>
<td>Expanded</td>
<td>3,050</td>
<td>890</td>
<td>1,610</td>
<td>550</td>
<td>770</td>
</tr>
</tbody>
</table>

The possible alternatives include changes in the location, size, and type of refuge. Refuges or closed areas that allowed entry were found ineffective in holding waterfowl. Two areas on the south side have been developed, at considerable expense, for use by migratory waterfowl and portions in Sections 20 and 29 have deed restrictions requiring management for waterfowl. Considering these restrictions, the following are the most plausible alternatives:

1. **Status Quo:** The current refuge has not been very effective in holding large numbers of waterfowl during the fall. Its effectiveness is influenced by habitat conditions including other management efforts on the uplands and flowages. Considering the size of the Sheboygan Marsh, the acreage of waterfowl habitat within the refuge is relatively small (Table 7). The upland refuge does not appear to be large enough to hold geese, and the amount of water and marsh is not large enough to hold large numbers of ducks or geese.

2. **Reduce Wildlife Refuge:** With this alternative the area of water and marsh in the refuge would be expanded while the acres of upland and timber/shrub swamp would be reduced. This would allow hunting in another 600 acres of shrub and timber swamp, and upland game hunting on 160 acres of the current refuge (assuming the lessor of 120 acres continues to lease his land for public hunting outside of the refuge). The refuge should hold more ducks, but may not have as much potential for holding geese, although the increase in water area may offset the loss of uplands for geese.

3. **Increase Size of Refuge Area (Figure 4):** There are 2 areas where the refuge might be expanded for waterfowl. An increase of water area in the refuge should increase both duck and goose use of the marsh. A larger upland area within the refuge is necessary if it is going to be effective in holding more geese. The upland area necessary to this increase is in private ownership, and such an increase would require easements, leases, or acquisition to accomplish. This would also require developing at least one other parking area outside the refuge.

**Water Level Management (Sheboygan Lake)**

1. **Status Quo:** Currently, the marsh remains at flood level throughout the spring and well into the summer. Maintenance of these high water levels throughout the year continuously dislodges clumps of emergent vegetation, thereby enlarging the areas of open water on the marsh. Clumps of cattail
accumulate at the dam site and require a very costly and annoying removal process for the county. Much of the cattail bog on the marsh is actually floating and any sudden increase in water levels causes clumps to break away. Spring thaws cause sudden water level increases that actually uproot mats of cattails from the bottom of the marsh.

As the marsh continues to open up it will become less attractive to puddle ducks. It may become more attractive to diving ducks, but the amount of boat traffic on the main lake will discourage large or long-term concentration of diving ducks as well.

The muskrat population will decrease as the area of emergent vegetation decreases. Other marsh wildlife will also decrease in numbers and diversity on the marsh.

The continued holding of water levels at the highest controllable level, as currently done, would provide the deepest and largest water area possible. It would provide the most fish habitat and highest fish production. It would allow for the best access for summer fishing and boating recreation.

Unfortunately, waterfowl hunting and muskrat trapping opportunities would continue to decline to probably half of the current levels, a decline of about 2,000 user-days per year.

2. Partial Summer Drawdowns: Periodic drawdowns to expose the bottom of the shallower portions of the marsh will allow these areas to revegetate. With a drawdown or lower water-level maintenance, moist soil plant growth will be stimulated. The release of nutrients through increased oxidation and reduction should stimulate some renewal of perennial emergent vegetation as well.

Studies have revealed that the most productive waterfowl marshes are those with a 50:50 ratio of emergent vegetation to open water and a good interspersion of emergent vegetation to open water.

Drawdowns have also been found to improve muskrat populations on marshes as well. Studies indicate that both flora and fauna increase after a drawdown, probably due to the increase in productivity from the nutrients released from the stagnant bottom containing partially decayed vegetation. The frequency of drawdowns required to maintain the desired vegetation on the marsh will depend on how fast the emergent vegetation recedes. The probable time period would be every 5 to 7 years.

The effect of partial summer drawdowns on the Sheboygan Marsh fish populations will depend on the depth, duration, and frequency of the drawdowns. A complete drawdown over an extended period, such as occurred in 1968, would have negative fishery effects. Fish would be extremely concentrated, leading to increased competition, emigration, disease, and angling mortality. Young fish would experience increased mortality rates as they are forced out of shallow nursery areas.
Upstream movement of northern pike during drawdown would be partially compensated for by immigration back into the marsh following reflooding. A screen placed across the bypass tube could be used to prevent downstream migration of large northern pike. Another negative result of a drawdown would be increased winter biological oxygen demand of the increased vegetation causing more severe DO reduction.

Some positive effects of drawdown on the fishery may be (1) increased depth due to sediment compaction, (2) increased growth both during drawdown when prey is more vulnerable to predation and after drawdown as unoccupied habitats are reflooded, and (3) increased northern pike reproduction due to flooding of desirable vegetation used for spawning. Both the negative and positive effects would be reduced by smaller drawdowns over a shorter period and less frequently.

The amount of fishing, boating, and other water-based recreation lost due to drawdown depends on the availability of public access. Shore fishing and boat launching from the ramps near the dam would probably be difficult even during a partial drawdown. The only unimpeded water access would be from the upstream river channel at St. Cloud. An estimated 1,730 angler-days would be lost during the drawdown period from June through September. Waterfowl hunting and muskrat trapping would improve for several years. An increase of about 1,500 user-days could be expected for 2-4 years and maintenance of current levels for 2-3 years after that.

3. Full Summer Drawdown: This alternative would result in a more dramatic response by vegetation in the marsh. This would allow a larger area of the marsh to become revegetated with emergent vegetation and would probably allow more compaction of the marsh bottom.

A full drawdown would probably have a negative impact on breeding ducks for the summer of the drawdown, but improved conditions for production would more than compensate for this loss in the years after the drawdown. There may also be some impact on beaver and muskrat for that summer, but it would not cause a significant population decline.

Full summer drawdowns would result in all the positive and negative fishery impacts mentioned under partial drawdowns. The negative would likely outweigh the positive for the fishery. If major reductions in northern pike abundance did occur because of a drawdown, 3 to 4 years would be necessary to recover to their maximum adult abundance for fish produced the following spring. Drawdowns as often as every 3 years would not allow complete recovery and maximum utilization of adult northern pike.

Stocking fry following drawdown would not add appreciably to the increased amount of natural reproduction expected. As during partial drawdown, an estimated 1,700 angler-days would be lost during the 4-month drawdown period. An unknown amount of boating recreation would also be lost. The number of user-days for waterfowl hunting and muskrat trapping would probably increase by about 2,000 user-days for 2-4 years.
4. **Winter Drawdown:** A complete drawdown right after freeze-up would give the marsh a greater capacity for containing spring runoff; although the large watershed above the marsh dam overshadows the marsh’s ability to effectively contain flood waters. A winter drawdown would probably depress muskrat and beaver populations on the marsh as well as increase the chances for a fish winterkill.

A late-winter-early-spring drawdown just prior to spring thaw could be used to help control flooding without serious impacts on muskrats or beaver. It would have a negative impact on northern pike spawning. Considering the size of the watershed, a drawdown of 18 to 20 inches below the dam would not have a significant effect on flooding, although such a drawdown may allow more response time to control a major increase in water levels, thereby reducing the dislodging effect of ice on emergent vegetation during rapidly raising water levels.

5. **Longer or Shorter Drawdown Periods:** A longer drawdown period would allow more emergent vegetation to become established and more compaction of the bottom sediments, but would cause problems for fish, breeding marsh birds, and mammals. Shorter drawdowns would not allow enough time for germination and growth of vegetation.

**Water Level Maintenance**

Originally, the water level was established at the spillway level of the permanent dam installed in 1938 without a method of control. This level was reportedly close to the level of the marsh prior to the drainage attempts from 1917 to 1921.

Sometime after the dam was installed, around 1953, two 6 inch I-beams were installed side by side on the top of the spillway to raise the water level another 6 inches. The I-beams have been kept down during most of the year to maintain higher water levels. This is the major reason for the rather rapid deterioration of the cattail bog and the loss of other species of emergent vegetation on the marsh. Whatever level is maintained, it is important to keep levels fairly constant in the late spring to keep duck nests from being flooded and keep emergent vegetation from dislodging.

1. **Status Quo:** If no change is implemented in current management practices, the amount of emergent vegetation will continue to decline and the area of open water will expand. There will be a concomitant loss of wildlife habitats; the number of puddle ducks and muskrats will continue to decline. There may be a slight increase in the number of diving ducks using the marsh in the fall but the amount of boating on the lake will keep numbers of diving ducks to a minimum.

   Fish habitat and access are maximized by maintaining water levels as high as possible. However, desirable northern pike spawning habitat is not created or made accessible with stable water levels.

2. **Levels at Spillway Level:** If levels were allowed to stabilize at the spillway level, there will probably be an increase in the amount of emergent vegetation. There would be more areas with water depths conducive to the establishment of emergent vegetation, especially in conjunction with periodic summer drawdowns. There would also be more undisturbed areas for duck nesting, as boat access to some areas would be more difficult.
Total area of water in the marsh would be slightly decreased. Fish production may be slightly less, although vegetation growing at the water's edge could be flooded in the spring to increase northern pike reproduction. Boating would be more difficult in shallow areas. Access problems in the summer would likely result in objections from boaters.

3. **Late Winter Drawdown with Summer Water Levels Up**: Northern pike reproduction would be reduced by late winter drawdown. Fish habitat would be maximized during high summer water levels. Motor boating opportunities would be maximized. There would be a increased risk to snowmobilers using the channels because of the possibility of intermittent hollow ice.

Wildlife impacts would be similar to that under status quo except for further negative impact on muskrats.

4. **Raise Water Levels**: It is possible to raise the water level another 6 inches or more. This would probably flood some brush and tamarack areas-causing a slow opening up of these areas. This would increase the area for marsh wildlife. However, there would be resulting problems of dislodged bogs floating to and blocking the dam, requiring expensive removal operations. Also, intensive surveys would have to be conducted to ensure that private lands and cedar areas would not be flooded. This would probably not be practical in the near future.

Higher water levels would result in greater water area and increased fish habitat. Newly flooded vegetation may reduce winter oxygen levels for several years. More area would be available for boating. Higher water levels would increase the amount of marsh habitat and increase numbers of waterfowl and muskrats for a time, but with maintenance of these levels the marsh would revert to current conditions in about 10 years.

**Terrestrial Vegetation Management on the Sheboygan Marsh**

1. **Status Quo**: No intensive vegetation management has been accomplished in the recent past. A couple of small timber sales have been accomplished in lowland hardwood areas. Without management, the vast areas of lowland brush may slowly succeed to tamarack forests. Cedar will probably decline due to lack of reproduction and loss of trees stands during wind storms.

2. **Increase Vegetation Management Activities**: Because of lack of good access to many areas of the marsh, there are limited opportunities for management. Limited harvests of cedar could be undertaken to try to encourage reproduction. Prescribed burns could be tried in some areas to open up areas for breeding and migrating waterfowl. Actual cutting of brush to maintain or open up brush areas may be impractical in any large scale because of difficult access for machinery. A floating machine designed to cut cattails off below the water ("Cookie Cutter") could be used to improve the interspersion of cattail and open water, but this managerial technique has to be explored further.

Water levels on the marsh could also be used to flood out timber and brush (this was discussed above). This technique is being used on a smaller scale on two of the small flowages on the south side of the marsh.
3. Reduce Vegetation Management: No major difference from status quo.
Without water level control in the small flowages, the brush and timber would remain or increase and the usefulness of these flowages would not be realized.

Dredging

1. Do Nothing: If no dredging is done in the future, much of the marsh will eventually decrease in depth due to siltation and encroachment of vegetation. This will eventually decrease fish habitat, increase winterkill problems, and reduce the area accessible by motorboats. This is the long-term natural succession of all marshes. As an impoundment of the Sheboygan River, the marsh tends to collect silt carried by the river. The loose nature of the soils causes the ditch banks to erode and slough into the channels because of wave action.

Aquatic vegetation also decomposes and adds a small amount of detritus to the bottom. The exact rate of deposition is unknown but the best available information indicates it is relatively slow. Herman (1941) listed the average depth of the ditches as 6 feet in 1941, compared to about 5 feet as measured in 1981. Assuming this one-foot decrease in 40 years is correct, an estimated yearly deposition of about 0.25 inches would be accurate. The south ditch, however, was redredged in 1968 to approximately 10 feet but now averages 6 feet. Most of this deposition probably occurred immediately after dredging due to bank instability.

2. Redredging of All Channels: Redredging of all channels could substantially deepen an area of about 150 acres. It would increase fish habitat, decrease winterkill conditions, decrease aquatic vegetation, and increase navigability.

It would be an extensive project and would be very expensive. Deepening all channels by 5 feet would involve the removal of approximately 1,185,000 cubic yards of sediment. Cost estimates in 1981 dollars for a simple dragline operation are about $1.00 per cubic yard of material removed (personal communication, Richard Wedepohl, Office of Inland Lake Renewal). Deposition of the spoils would probably not be allowed in the marsh due to federal and state laws protecting wetlands. Therefore, a suitable upland disposal site would have to be found and engineered. This would at the least double or triple the cost of dredging, making it about $3.5 million (1982 values).

3. Redredging of South Channel: The south channel is the most intensively used area in the marsh, by both fish and anglers. Deepening this area would improve it as a wintering area and make it more suitable for angling. Deepening the 19 acres of the south channel by 5 feet would remove 150,000 cubic yards of sediment. Depending on the equipment used and necessity for transporting the spoils, costs may vary from $1.00 to more than $3.00 per cubic yard (1981 estimate).

A dragline would be the least expensive, but could not as effectively remove the material to prevent its migration back in the channel; a dragline would be most effective if operated during a drawdown. Hydraulic dredging would more effectively remove the sediment but would probably
involve an upland disposal site. If dredging is not done and the rate of deposition continues at the rate experienced since 1968, it will take only 6 more years before winter ice freezes to the bottom. Fish habitat and angling opportunities would then be practically nil.

Fishing Regulations

1. Status Quo: With no change in regulations, the quality of northern pike fishing will continue to deteriorate. Fishing pressure and harvest will continue to increase. This higher exploitation rate will mean fewer fish of large sizes. Catch rates will only decrease slightly, but the average size of pike taken will remain small.

Yellow perch should be able to withstand considerably more fishing pressure. Natural mortality probably accounts for most of the total mortality for these fish.

2. Closed Season: There is currently a year-round open fishing season on the Sheboygan Marsh. An estimated 50% of the total fishing pressure occurs during the winter from December through March. During the winter of 1980, 72% of the winter fishing pressure and 78% of the catch occurred in March. Although 1980 was a relatively mild winter, it is typical for northern fishing to improve in late winter. In 1982, most northern pike were caught in February.

Closing the northern pike angling season on February 1 would substantially reduce the winter exploitation of northern pike during most winters, and ultimately result in slightly improved catches of larger fish. Closing the season on March 1 to correspond with most other waters would reduce the catch substantially only during mild winters. Under a hypothetical March 1 closing date during the mild 1980 winter, angler-hours and the catch of northern pike would have been reduced by 8,000 and 1,850, respectively.

3. Closed Area: Closing the south ditch to northern pike fishing during the entire winter would substantially reduce the year-round harvest. Half of the fishing pressure and probably more than half of the harvest would be eliminated. As more fish survive to larger sizes, increased catch rates and size of fish caught would increase during the open water season. Pounds of fish harvested would increase, assuming natural mortality would not increase and growth rate would not decrease. Fishing recreation during the early winter when harvest is not excessive would needlessly be reduced.

If the south ditch had been closed in 1980, approximately 11,000 angler hours and 2,400 northern pike harvested would not have occurred. Local businesses such as the Marsh Bar would experience a decrease in use by anglers.

4. Size Limit: Currently, no minimum size limit exists on northern pike in the Sheboygan Marsh. Theoretically, a minimum size limit would allow more fish to reach a desirable size, thereby increasing the quality of fishing. Also, the catch and release of smaller northerns could provide improved catch and release fishing. These potential benefits rely on the assumption of only small decreases in survival rate and growth.
Angling mortality under a minimum size limit could be high, especially in winter when fish are often deeply hooked with live bait and exposed to harsh conditions during handling. Because a large percentage of angling occurs during the winter, high angling mortality would probably negate the benefits of releasing all undersized fish.

Growth of northern pike is slightly below average for this area of the state. A large increase in the numbers of fish below a certain size would further reduce growth.

5. Bag Limit: The current daily bag limit on northern pike is 5. During the winter of 1980, the average fish per trip was less than one (0.64). Reducing the bag limit would not likely have a great affect on the total amount of fish harvested. This regulation is also easy to circumvent by local anglers making repeated trips when fishing is good.

Property Boundaries

1. Enlarge Property Boundaries: The existing state boundaries include some areas already in public ownership (County) and were originally set to provide upland feeding areas and refuge for geese as well as food and cover for pheasants and ducks. The existing boundaries should be changed to take advantage of potential flowage sites, alleviate drainage problems with private landowners, exclude lands already owned by the county, and provide more emphasis on upland food and cover adjacent to the large county-owned swamp and marsh land.

The county does not delineate acquisition boundaries, but rather evaluates tracts adjacent to their land, as they come on the market. The large public ownership (7,250 acres) encompasses most of the ditches and flowed areas of the marsh and much of the marsh proper. In the future, emphasis should be on acquisition for improved access, improved boundary delineation, and completing ownership of the flowage.

2. Reduce Property Boundaries: Reducing boundaries for state acquisition would not take advantage of the full potential of the marsh proper. Some uplands are needed to provide nesting cover for upland game that use the marsh fringe for wintering and escape cover. Small ponds and flowages adjacent to large wetlands are usually highly productive waterfowl breeding areas. Also, these uplands, when protected from disturbance, can be attractive to geese and ducks as feeding and resting areas in the fall, thereby providing a reservoir of waterfowl for hunting on the marsh throughout the hunting season.

3. Status Quo: Would not take advantage of as much of the potential of the marsh and surrounding lands for providing breeding upland game and waterfowl or for migratory waterfowl use.

See rationale under expanded boundaries option.
Change in Species Emphasis

It would be possible to change management emphasis to primarily waterfowl and pheasant production and pheasant hunting. The potential for waterfowl production is, however, limited because of the limited amount of upland nesting cover adjacent to the marsh proper, and the increase would be minimal without substantial development and boundary expansion.

Pheasant production could not be increased substantially without major boundary changes and acquisition to increase upland nesting around more of the marsh fringe. Pheasant stocking and refuge changes would increase upland game hunting opportunities, but there would be a net loss in recreation days due to loss of waterfowl hunting opportunities. Also, this is the only major waterfowl hunting area in the county while there are several large public hunting areas for pheasant hunting.

Management opportunities for other game species is limited and cannot be significantly improved. The major action for other game species is to retain public ownership for hunting opportunities and limited timber management.

Literature Cited

Claggett, Larry

Herman, E. F.

Peterson, H. W. & Sinz, E. F.

Sheboygan County Comprehensive Outdoor Recreation and Open Space Plan 1981, by Sheboygan County Planning and Resources Department.

Zimmerman, F. R.
APPENDIX A

Management Agreement

Agreement between the Wisconsin Department of Natural Resources and the County of Sheboygan for the management, development, protection, and maintenance of the county-owned lands on the Sheboygan Marsh in the Town of Russell and north part of Town of Greenbush, all in Township 16 North, Range 20 East, excluding the 30-acre developed Broughton County Marsh Park in Sections 13 and 24.

This agreement, is made and entered into this __________ day of __________, 1984, by and between the Wisconsin Department of Natural Resources, hereinafter referred to as the WDNR, and Sheboygan County, hereinafter referred to as the County.

WITNESSETH

WHEREAS, S. 23.09(2)(h), Stats., authorizes the WDNR to enter into cooperative agreements with governmental agencies for purposes consistent with S. 23.09, Stats.; and

WHEREAS, the WDNR and County both own substantial acreage within Sheboygan Marsh with current acreages of 382.23 and 7,330.5, respectively, and

WHEREAS, the WDNR and Sheboygan County are desirous of cooperating to assure coordinated and effective efforts in the management of natural resources and especially the fish and wildlife resources of the Sheboygan Marsh; and

WHEREAS, the WDNR and the County are desirous in defining the roles and responsibilities of the management of the natural resources of the Sheboygan Marsh; and

WHEREAS, the WDNR through its resource division and Sheboygan County, through their respective representative, will formulate a comprehensive management plan for the Sheboygan Marsh and further desire to cooperate in management, protection, and development of the Sheboygan Marsh in accordance with the concepts of said plan and any future revisions that are mutually agreed upon.

NOW, THEREFORE, the WDNR and the County mutually agree as follows:

1. Habitat Management: The WDNR will provide resource management service for the mutual benefit of the State and County. The WDNR shall have authority to manipulate vegetative cover types for the maintenance and perpetuation of fish and wildlife on Sheboygan Marsh as outlined in the plan. Manipulation of vegetative types shall include the use of the following techniques: bulldozer, herbicide control, cutting, timber harvesting, mowing, prescribed burning, various agricultural techniques, and other necessary, feasible methods. The WDNR may contract with other parties for the maintenance and development of wildlife habitat.

2. Recreational Activities: Outdoor recreational activities shall be permitted throughout the above designated area as long as they are compatible with the fish and wildlife management program.
3. **Timber Harvests:** The County agrees to leave to the discretion of WDNR "representatives" (local forester and wildlife manager), any decisions regarding the harvest of forest products. Timber harvests shall be consistent with the goals and objectives of the Master Plan. The County reserves the right to all forest products removed from its lands.

4. **Wildlife Refuges:** The WDNR may establish refuges as delineated in the Master Plan.

5. **Hunting & Fishing:** The County agrees to allow any person or persons to hunt, pursue, take, catch, and kill game and fish in any legal manner on said described lands during the open season for such fish and game.

6. **Enforcement of Public Use:** The WDNR agrees to enforce laws pertaining to conservation of the above-described lands wherein it is within the provision of their action (Chapter 45 of Wisconsin Administrative Code included). The County agrees to assist WDNR in regulating vehicular use on the above-described property.

7. **Land Ownership:** The County agrees that none of the lands described herein will be sold or otherwise disposed of while this agreement is in effect. This agreement will also cover any additional lands acquired by the County as part of the Sheboygan Marsh complex.

8. **Management on Small Impoundments:** The WDNR will maintain the dikes, and ditches, and pumps associated with the small flowages in Sections 20 and 21. The WDNR will have sole authority for water level manipulation of these flowages. The County may provide funds for material that are necessary to maintain said pumps and flowages. This will also apply to any new flowages developed on the Sheboygan Marsh complex.

9. **Water Levels:** A) The County and the WDNR agree to manage water levels according to the recommended management regime described in the Master Plan and the laws and regulations governing the management of flowages in the State. Refusal to allow such management will justify the termination of this agreement.

   b) The County will designate an individual to assist WDNR personnel in the maintenance of water levels on the marsh according to guidelines established through the Master Plan and/or public hearings on water level maintenance. The WDNR personnel and County Assistant will maintain records of water levels as deemed necessary by the County and the WDNR.

10. **Recreational Facilities:** The WDNR will be responsible for the maintenance of parking lots other than those of the Broughton Sheboygan Marsh Park, Sections 13 and 24. Any future development of recreational facilities shall be mutually agreed upon by the County and the WDNR. The cost of materials may be charged to the County.

11. **Periodic Review:** This agreement shall become effective when signed by the parties hereto and shall continue in force until terminated by mutual agreement or at the option of either party upon one year's notice given upon any anniversary date hereof. The agreement shall be reviewed by the County and the WDNR biennially and at such other times as may be requested by either party on 60 days written notice.
An annual activity report shall be prepared by the WDNR and presented to the County in January of each year or within 30 days of written request. Project proposals submitted by the WDNR or the County that will affect the above-described area shall be reviewed by the other party.

12. Liaison and Coordination Responsibilities: To provide for the primary point of contact between WDNR and the County, the fish manager and wildlife manager at the Plymouth Field Station of WDNR and the Property Committee of the County Board are assigned.

IN WITNESS WHEREOF, the parties hereto cause this agreement to be executed on the date hereinafore first set forth.

[Signatures]

Secretary of the WDNR

Sheboygan County Chairman

1-17-74
# APPENDIX B

## Water Level Regime (every year except for drawdown years).

<table>
<thead>
<tr>
<th>Date</th>
<th>Action*</th>
<th>Anticipated Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>March to mid-April</td>
<td>1) Drain water off 6-12&quot; below spillway prior to spring thaw, depending on anticipated runoff.</td>
<td>Keep from up-rooting emergent vegetation while allowing northerns to spawn in flooded emergents.</td>
</tr>
<tr>
<td></td>
<td>2) Monitor water levels keeping levels at or below spillway level.</td>
<td>Relative stable conditions.</td>
</tr>
<tr>
<td>Mid-April to March of the following year</td>
<td>Allow normal water level fluctuations to occur.</td>
<td></td>
</tr>
</tbody>
</table>

## Recommended Schedules

**Partial Drawdown** (recur at 5-7 year intervals)  
Prior to this, schedule will be the same as other years.

<table>
<thead>
<tr>
<th>Date</th>
<th>Action*</th>
<th>Anticipated Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-May</td>
<td>1) Open by-pass to draw water down to 18 inches or more below spillway.</td>
<td>Allow muskrats to have one or 2 litters and avoid interference with duck nesting.</td>
</tr>
<tr>
<td>June</td>
<td>1) Remove surface water from mudflats which are to be exposed.</td>
<td>Encourage moist soil plants to become established: smartweeds, bidens, wild millet, burread, some bullrush and cattail expansion.</td>
</tr>
<tr>
<td></td>
<td>2) Try to keep surface water off mudflats, but keep flats moist.</td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>Slowly bring water back up to maintain 25% of flow.</td>
<td>Protect downstream fish and wildlife habitat.</td>
</tr>
<tr>
<td>October</td>
<td>Water levels at or above spillway.</td>
<td>Allow access for hunters and limit cattail seed establishment.</td>
</tr>
</tbody>
</table>

*Manipulation of water levels at the Sheboygan Marsh dam will be coordinated with the operators of the Kiel dam to minimize water level fluctuations downstream of the Sheboygan Marsh.
APPENDIX C

Master Plan Comments

By: Stanley Nichols
Representing: Wisconsin Geological and Natural History Survey
Date: August 17, 1983

Comment: P. 14, par. 4. The conclusion here, that cattails and other emergent plants decrease in high water, is probably correct. However the reasoning is probably wrong. Emergent species establish themselves much better on mud flats than in water, it probably has little to do with fertility.


Comment: Page 18, last par. & page 19, last par. Both paragraphs indicate that increased emergent vegetation will improve conditions for waterfowl. These statements need more explanation and scientific back up. There are cases in the state where emergent vegetation is too dense for optimal waterfowl production (Horicon Marsh and Lake Sinnissippi). Drawdown is an inexact tool because you can't manipulate the species or the densities which might occur. These statements are probably true that more emergent vegetation will benefit waterfowl. However, more explicit recommendations for use of water level manipulation are needed. The whole area could be turned into a monotype of cattail which would not be beneficial.

DNR RESPONSE: A more detailed discussion can be found on pages 38-42. References added to page 46.

Comment: Page 19, par. 2. The disturbance of diving ducks by boaters should not be a planning problem. It can be handled by use restriction or law enforcement means.

DNR RESPONSE: The intent of this text reference is to remind planners that this problem exists.

Comment: Page 25, par. 1, line 8. Change would to will.

DNR RESPONSE: Concur.

Comment: Figure 2. Proposed boundary expansions look good as a means of "blocking" the area for better management.

By: Robert L. Fisher
Representing: Bay-Lake Regional Planning Commission
Date: July 20, 1983

Overall view: Good. Unique resource feature in close proximity to approximately one million population - needs an effective long-range plan and management activity. Excellent opportunity for state/local and private interest partnerships in establishing a sound resource management program.
Additional comments: State, county and local sportsman clubs should proceed with implementation of a management plan for the area.

By: Forest Stearns, Chairman
Representing: Scientific Areas Preservation Council
Date: August 126, 1983

We have reviewed the Sheboygan Marsh Wildlife Area Master Plan and find that we are in general agreement with the property goal and management objectives.

Management of the white cedar timber type discussed on page 25 needs clarification. Slow growth of white cedar is normal for the type and provides survival value considering the recent history of poor reproduction. Since current deer populations prevent cedar reproduction, we urge no cutting until the deer population is reduced to a level which will allow reproduction to occur.

The agreement with Sheboygan County is obviously a key to future management. Is the agreement acceptable to the county? Thank you for providing the opportunity to review the plan.

DNR RESPONSE: Cedar management clarified in the forest management section, page 8.

By: Cynthia A. Morehouse, Director
Representing: Department of Transportation
        Bureau of Environmental and Data Analysis
Date: August 23, 1983

We have reviewed the Sheboygan Marsh Wildlife Area Master Plan and determined that our transportation interests and concerns would not be adversely affected by the recommended management and development program.

Thank you for the opportunity to review and comment on this Master Plan.

By: Allen Roeder
Representing: County Board of Supervisors
        Greenbush and Russell Townships

Overall view: Fair. Some of the County Property Committee members want to turn management over to DNR so they won't get complaints.

Major Comments: My comment is on the additional farm land that this plan needs to draw in geese to the Sheboygan Marsh. The farmers around the marsh don't need the goose population and problems they have around Horicon. We don't need additional land taken off the tax roll, especially some of the best producing land in Greenbush Township. We, as farmers, have enough to get rid of weeds, insects, and blackbirds without having to put up with geese. The state does a poor job on handling the land they own now. Very little food is raised on this land. This results in more crop damage on family-owned farms. We don't need geese in the Sheboygan Marsh.
DNR RESPONSE: The wildlife area is not designed to attract a significant number of geese. The peak counts shown on page 20 demonstrates that the property will not sustain the peak numbers common on Horicon Marsh (100,000+). The tax impact of state ownership is negligible. The master plan ultimately was accepted unanimously by the Sheboygan County Board as follows:

The clerk read the report of the Executive Committee with regard to Resolution #67 (1983-84) Re: Approval of Sheboygan Marsh Master Plan recommending adoption. It was moved by Supervisor Rigotti and seconded by Vice Chairman Paulmann that Resolution #67 (1983-84) be adopted. Supervisor Rigotti then moved to request privilege of the floor for Mr. Dale Katsma, Wildlife Manager from the Department of Natural Resources, to explain the Marsh Master Plan. There being no objections, Mr. Katsma proceeded to clarify the plan and answered questions from the supervisors. Resolution #67 (1983-84) was adopted on unanimous voice vote of the board.

By: Roy Sebald, District Counselor
Representing: Wisconsin Conservation Congress
Date: August 25, 1983

Major comments: Figure 4 Wildlife Refuge Alternatives: The Winooski Bowhunters Association requested a part of the refuge in Section 35 be removed from the refuge and opened to hunters. They offered to do the brushing of the survey line if it were changed. The Wildlife Manager Katsma agreed their proposal was valid and said he would assure the change they requested.

All Conservation Congress members were contacted. All agreed the plan was fair to all groups of sportsmen and said they would support the implementation.

Additional comments: At the public informational meeting pertaining to this Master Plan, about 75 persons attended. The most frequent remarks at the hearing were concerned that this plan should be implemented as quickly as possible. The other major concern was from farmers downstream stating concern that their land would be flooded when partial drawdowns were made on the Marsh. I spoke to Mr. Katsma of these possibilities and he assured me he would do everything in his power to prevent this flooding downstream.

DNR RESPONSE: The refuge will be modified in 1984. Downstream landowners will receive consideration when establishing fluctuations in water flow regimes.

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