United States General Accounting Office

GAO

Report to Congressional Requesters

August 1992

# NATURAL RESOURCES PROTECTION

# Reelfoot Lake Lease Terms Met, but Lake Continues to Deteriorate




GAO/RCED-92-99

GAO

**United States**
**General Accounting Office**
**Washington, D.C. 20548**

**Resources, Community, and**
**Economic Development Division**

B-241610

August 17, 1992

The Honorable John Tanner
House of Representatives

The Honorable James R. Sasser
The Honorable Albert Gore, Jr.
United States Senate

This report responds to your concerns about a 75-year lease and cooperative agreement signed on August 28, 1941, by the U.S. Department of the Interior's Fish and Wildlife Service (FWS) and the state of Tennessee pertaining to Reelfoot Lake. Hundreds of thousands of fishermen, hunters, wildlife observers, and other recreational users visit the lake annually. The lake also captures drainage from highly productive but highly erodible cropland bordering the lake and the streams that empty into it.

Under the terms of the lease agreement, FWS assumed certain responsibilities for the preservation and enhancement of the state-owned lake and established the Reelfoot National Wildlife Refuge on about 7,800 acres leased from the state. Because the condition of Reelfoot Lake has continued to deteriorate over the life of the lease, you asked us to (1) determine the extent to which FWS has complied with the terms of the lease agreement and (2) identify the primary causes of the lake's deterioration, options for improving the lake's condition, and barriers to implementing those options.

## Results in Brief

FWS has substantially complied with its responsibilities under the lease agreement. The lease provides FWS with considerable latitude in carrying out its terms. The Tennessee Wildlife Resources Agency (TWRA), the state agency responsible for managing fish and wildlife programs for the lake as well as administering the lease, agrees that FWS has complied with the lease.

The primary causes of the lake's accelerated aging and deteriorated water quality have been well documented. They are (1) silt reaching the lake, primarily from cropland in Tennessee, and (2) the accumulation of undecomposed organic material, which is aggravated by the lake's artificially maintained stable water level. The options for improving the lake's condition have also been well documented. Constructing additional silt retention basins near the lake and in the lake's watershed and

the lake's area, mostly land but also part of one of the lake's basins. The Reelfoot National Wildlife Refuge now encompasses an additional 541 acres in Tennessee and 2,039 acres in Kentucky that FWS has subsequently acquired. The small portion of the lake that is in Kentucky is within the FWS-owned refuge land. (App. I contains a map of Reelfoot Lake and vicinity.)

## The Reelfoot Lake Lease Agreement Gives FWS Major Responsibilities

Under the 1941 lease agreement and subsequent changes to it, FWS has major responsibilities both within the Reelfoot National Wildlife Refuge and over the entire lake. Within the refuge, FWS is to, among other things, (1) operate and maintain the refuge, (2) dig and maintain water circulation channels and boat access trails, (3) take steps it considers practical and necessary to control siltation through the construction and maintenance of silt retention basins and erosion control works, and (4) control undesirable vegetation. FWS and TWRA are to cooperate in the latter three efforts in the portion of the lake managed by TWRA.

The lease agreement also requires FWS to operate and maintain the water control structures—dam and spillway gates—located at the south end of the lake and to maintain a water level of not more than 3 feet above and below the spillway level at the time the lease was signed (282.2 feet mean sea level). In addition, the lease agreement allows FWS, with permission from the state of Tennessee, to temporarily drain the lake to a level that would allow cleaning, removing, or destroying undesirable plant or animal life. FWS cannot, however, drain the lake entirely. Appendix II contains more details on FWS' responsibilities under the lease agreement.

## FWS Has Substantially Complied With Its Responsibilities Under the Lease Agreement

In our view, FWS has substantially complied with its responsibilities under the lease agreement, and TWRA agrees. Neither the original 1941 lease agreement nor subsequent changes to it specify standards that FWS is to achieve in fulfilling its responsibilities under the lease or the time within which FWS is to take various actions. Consequently, the lease affords FWS considerable latitude in fulfilling its lease responsibilities. Additionally, under the lease agreement, FWS' fulfillment of its responsibilities is contingent on the availability of funds. The lease agreement does not require FWS to seek funds nor does it specify a timetable for FWS to obtain funds. In commenting on a draft of this report, TWRA stated that it would like to have seen FWS pursue funding more aggressively in order to assist the state in accomplishing what remains to be done at Reelfoot Lake.

water level within 6 inches of the 1941 level 75 percent of the time between the early 1970s and the mid-1980s. FWS followed this policy in an attempt to strike a balance between agricultural interests, who would prefer that the lake's water level not be raised because of the increased risk of flooding thousands of acres of prime Tennessee and Kentucky cropland, and recreational interests, particularly owners of boat docks and motels, who would prefer that the lake's water level not be lowered because doing so would adversely affect activities on the lake. FWS also wished to prevent damage to private and state lands and facilities for which it may be liable. This policy complied with the terms of the lease agreement, which allow but do not require FWS to fluctuate the lake's water level up to 3 feet above and below the 1941 spillway level and to temporarily drain most of the lake. However, the policy has also been identified as a major contributing cause of the lake's continued deterioration. More natural water level fluctuations—beyond those that have occurred because of rainfall[1] —could have slowed deterioration resulting from siltation and undesirable aquatic vegetation.

## Options for Improving Reelfoot Lake's Condition

The studies mentioned earlier have identified options for improving Reelfoot Lake's condition by either reducing the silt reaching the lake or by drying up and consolidating the silt and killing the undesirable vegetation in the lake. Options identified for reducing the silt reaching the lake include (1) constructing additional silt retention basins near the mouth of Reelfoot Creek and in other locations in the lake's watershed and (2) increasing the use of soil conservation and erosion control practices, by, for example, converting some cropland near the lake back into forest, pasture, and wetland. Two options have been identified for addressing the silt and vegetation problems in the lake. The first option is to acquire land and take other steps necessary to allow FWS to change its current policy of maintaining the lake at a stable water level to a policy that provides for more natural water level fluctuations, coupled with periodic major drawdowns every 5 to 10 years. The second option is to dredge or excavate the accumulated silt.

## Status of Options to Reduce the Silt Reaching the Lake

According to FWS, over 98 percent of the silt reaching Reelfoot Lake comes through Reelfoot Creek in Tennessee. FWS and TWRA are now attempting to acquire the land needed to construct a silt retention basin outside the boundaries of the refuge, near the mouth of Reelfoot Creek. Construction

[1]Reelfoot Lake's water level has experienced some natural fluctuation due to rainfall. Data from Interior's U.S. Geological Survey indicate that for at least some period during 27 of the first 50 years of the lease, the lake level exceeded 283.2 feet mean sea level.

The first step in implementing FWS' integrated water-level management program is to conduct a major drawdown and follow that with raising the water level to 284 feet mean sea level. However, implementation of this program could take years and can be done only after major measures to mitigate the effects of drawing down the lake and fluctuating the water level have been completed. The lease agreement gives FWS the authority to fluctuate the lake's water level by up to 3 feet above and below the 1941 spillway level and to temporarily drain most of the lake. However, the Department of the Interior stated in its comments on a draft of this report that this authority does not absolve FWS from the legal and environmental effects of such management actions. Fluctuating the water level could, for example, damage private and state lands and facilities as well as archaeological resources.

The mitigation measures needed before the lake's water level can be raised include, among other things, (1) acquiring land or easements in both Tennessee and Kentucky, so that water can be allowed to flow over the land when the level is raised; (2) making modifications to a state park and community sewage treatment facilities adjacent to the lake to accommodate the higher water level; and (3) completing archaeological surveys of and taking actions to protect cultural resources, such as Indian mounds, that may be inundated. Several of the mitigation measures, such as land acquisition, would occur outside the leased area and are thus beyond the requirements of FWS' lease with the state of Tennessee. As of July 1992, TWRA had acquired over 2,300 acres of Tennessee land to enable water-level fluctuations but stated in its comments on a draft of this report that it needed FWS' assistance to acquire land in Kentucky, since TWRA cannot acquire land there. TWRA would like to see FWS make more aggressive efforts to acquire Kentucky agricultural land, thus allowing the lake's water level to be raised.

A major drawdown would lower the lake's water level by up to 4 feet using the existing water control structures (exposing about 50 percent of the lake's bottom) and by up to 8 feet using new water control structures (exposing about 85 percent of the lake's bottom). The drawdowns would begin in early June and end in mid-July. A minimum of 120 days would be allowed for drying and aeration, and refilling would begin in November and be completed during the winter months. Because the lake is owned by the state of Tennessee, with the small portion in Kentucky owned by FWS, no land or easements need be acquired, and a major drawdown could be accomplished with little or no impact on the state of Kentucky. (A possible exception is that the drawdown could temporarily lower Kentucky's

the many stumps and logs in the lake. Appendix IV discusses options for improving Reelfoot Lake's condition in more detail.

## Barriers to Implementing the Options for Improving Reelfoot Lake

One barrier to implementing the options for improving the condition of Reelfoot Lake is their costs, which are estimated to run into the tens of millions of dollars. In addition, some landowners are resisting efforts by FWS and TWRA to acquire the land or easements needed to construct the silt retention basin near the mouth of Reelfoot Creek or to raise the lake's water level higher than about 1 foot above the lake's 1941 level. What appears to be a more formidable barrier, however, is the need to maintain the existing balance between agricultural and recreational interests while, at the same time, implementing a program to ensure the long-term preservation of the lake and its accompanying benefits to agriculture, recreation, and wildlife. In commenting on a draft of this report, Interior stated that completion of the mitigation measures identified in FWS' environmental impact statement will decrease or eliminate many of the barriers now existing between conflicting interests. For example, Interior stated that the acquisition of the designated land needed to allow raising the lake's water level would eliminate potential conflicts with agricultural interests. Acquiring this land from willing sellers, however, will be difficult and has thus far not been accomplished.

The difficulty FWS and TWRA have had in implementing options for improving the lake's condition is demonstrated by the agencies' recent efforts to change FWS' management policy of maintaining the lake's water level as close as possible to the 1941 level. In 1985, TWRA requested and FWS agreed to a transfer of control of the lake's spillway to TWRA. TWRA subsequently began a major drawdown of the lake's water level in May 1985 to address the problem of siltation and its impact on the lake's declining fish population.

The transfer of spillway control to TWRA resulted in a lawsuit by a group of citizens concerned about the potential impact of such an action on many of the lake's resources. Because of the litigation, FWS and TWRA agreed that FWS should retain control of the spillway. FWS' 1989 environmental impact statement was prepared as a result of the litigation, and a subsequent lawsuit concerning the adequacy of the statement was resolved in favor of FWS and TWRA in December 1990. These cases affirmed FWS' authority under the terms of the lease agreement to initiate more dynamic fluctuations and major drawdowns of the lake's water level.

FWS' integrated water-level management program. In its comments on the draft report, TWRA questioned the need for all the mitigation measures to be in place for FWS to conduct a major drawdown. TWRA pointed out that the acquisition of land and modifications to state park and community sewage treatment facilities are required to raise the lake's water level but are not required to conduct drawdowns. Likewise, the Department of the Interior stated that FWS could implement the second phase of its integrated water-level management program incrementally as mitigation measures are completed, rather than waiting until all the measures are in place before beginning the second phase. According to an FWS regional official, once the appropriate mitigation measures are in place, FWS will pursue options that will allow a major drawdown before completing the measures needed to raise the lake's water level to the higher level called for in the program. The Department of the Interior's and TWRA's comments and our evaluation of them are included in appendixes V and VI, respectively.

The Commonwealth of Kentucky stated in its comments, which are included in appendix VII, that it is very interested in stopping the deterioration of Reelfoot Lake. Kentucky said that it will intensify its efforts and that it stands ready to cooperate with other agencies to reduce erosion and siltation and prolong the life of the lake. However, Kentucky also stated that FWS' integrated water-level management program causes concern to its citizens because periodic drawdowns and water level fluctuation would adversely affect recreation, tourism, and agricultural interests. Kentucky urged that water-level control remain with FWS. As we concluded earlier, Kentucky along with other affected parties will need to decide whether the benefits of preserving Reelfoot Lake for future generations outweigh the costs, sacrifices, and trade-offs that will be associated with its survival.

The Departments of Defense and Agriculture concurred with our draft report. Their written comments are included in appendixes VIII and IX, respectively.

## Scope and Methodology

To determine the extent to which FWS has fulfilled its lease responsibilities, we reviewed the original lease and cooperative agreement and subsequent changes to the lease, identifying FWS' and the state of Tennessee's responsibilities. We also obtained and analyzed documentation on the actions FWS has taken over the years to fulfill its responsibilities, including the agency's requests for and receipt of appropriated funds. We discussed FWS' execution of its lease responsibilities with officials from FWS'

Figures

# FWS' Responsibilities Under the Terms of the Reelfoot Lake Lease Agreement

On August 28, 1941, the state of Tennessee, acting through the Reelfoot Lake Commission, and the federal government, acting through the Department of the Interior's Fish and Wildlife Service (FWS), executed a 75-year lease and a cooperative agreement under which FWS assumed certain responsibilities for maintenance and improvement of Reelfoot Lake in exchange for the right to establish and maintain a wildlife refuge there. The state of Tennessee subsequently transferred its lease responsibilities to the Tennessee Wildlife Resources Agency (TWRA).

Under the Migratory Bird Conservation Act of 1929, the Secretary of the Interior was required to obtain the consent of individual states in order to establish wildlife refuges within the states' borders. The Secretary of the Interior obtained consent from both Tennessee and Kentucky to establish the Reelfoot National Wildlife Refuge. Kentucky is not a party to the Reelfoot Lake lease and thus has no jurisdiction regarding the changes to the lease between FWS and Tennessee. However, if changes to the lease adversely affect land in Kentucky—e.g., by raising the lake's water level so that Kentucky land is flooded—the state of Kentucky and its citizens have the right to take legal action to protect their interests. FWS' liability to the citizens of Kentucky is, however, no different than FWS' liability to the citizens of other states if they are harmed by FWS' actions.

## Responsibilities Under the Original 1941 Lease and Cooperative Agreement

Under the original lease and cooperative agreement, FWS is responsible for

- operating and maintaining the dam and spillway gates (water control structures);
- maintaining a water level of not more than 3 feet above and below the spillway level at the time of the lease (282.2 feet mean sea level), although with the state's permission FWS can—without draining the lake entirely—temporarily drain the lake to a level that allows cleaning, removing, or destroying undesirable plant or animal life;
- removing undesirable vegetation within the refuge and cooperating with the state in removing vegetation in other areas of the lake;
- digging and maintaining circulatory channels within the refuge sufficient to permit free circulation of water, free passage of fishing boats, and maintenance of habitats for migratory waterfowl and other wildlife; cooperating with the state in extending channels over the remainder of the lake; and providing equipment for the creation of channels to facilitate patrol and recreational use, relieve water stagnation, and speed the reintroduction of desirable plants;

relatively minor and have not substantially affected FWS' and the state's responsibilities.

In 1962, for example, the lease was amended to address the harvesting of timber on the refuge and the disposition of the proceeds. Under this amendment, FWS and the state were to jointly inventory all forest resources within the refuge, and FWS was to (1) develop a timber management plan and implement it after approval by both parties, (2) conduct sales of timber from the refuge through competitive bidding under FWS' regulations, and (3) remit the sales proceeds (net of FWS' costs to conduct the sales) to the state for deposit into the Reelfoot Lake Development and Protection Fund, from which the state (not FWS) would finance commitments under the original lease.

Two lease supplements and one amendment have been executed to establish and add to the land leased to FWS by the state. In April 1973, a lease supplement—which resulted from an FWS survey called for in the original lease—provided a legal description of the lease boundaries for about 7,607 acres. A December 1977 lease supplement included in the leased area an additional 182 acres that had been omitted in the previous supplement. A December 1980 amendment added 58 acres to the leased area.

In August 1984, a cooperative agreement was executed to improve the overall water quality of the lake by authorizing the state to use FWS' aquatic weed cutter to control noxious weeds on the state-managed areas of the lake. Use of the weed cutter in both the federal- and state-managed areas of the lake allows open water to be maintained and prolongs the life of the lake. The agreement specified that the state and FWS would share in the costs of the operation, maintenance, and repair of the weed cutter. The agreement was effective for 5 years and was renewed in April 1989 for another 5 years, through July 1994.

In September 1984, FWS, TWRA, and the Tennessee Department of Conservation entered into a memorandum of understanding to better define each party's lease responsibilities. The memorandum was not intended to amend the original lease but rather sought to clarify responsibilities under the 1941 lease and cooperative agreement, and made clear that FWS' responsibilities delineated in the memorandum conformed with the original lease. The memorandum generally called for cooperation among the three parties and assigned (1) most management responsibility for the lake outside the refuge and for the Reelfoot/Indian

TWRA and FWS have continued to consider modifications to the lease to reflect more current conditions and to look toward the future. A series of lawsuits concerning water-level management, however, has slowed these efforts. The most recent court ruling, rendered in December 1990, confirmed that FWS had the authority under the lease to alter the lake's water level, including conducting a major drawdown. However, in commenting on a draft of this report, the Department of the Interior stated that FWS could potentially be liable for any adverse effects on private and state lands and facilities resulting from any change in the lake's water level unless mitigation measures are implemented before FWS alters the level and conducts a major drawdown. Both TWRA and FWS said that serious consideration is now being given to renegotiating the lease to bring it up to date.

responsible for and has performed the maintenance of the dam itself because it also functions as a bridge for a major state highway.

FWS has operated the spillway since March 1942, when the first refuge manager retrieved and installed the stop-log structures that had been missing since 1937. FWS installed a new radial gate in 1947-48 to improve water management capability and to serve as a fishway. FWS has performed the necessary periodic maintenance on the radial gate and stop-log structures.

## Maintaining the Lake's Water Level

FWS' basic water-level management policy has been to maintain the lake level as close to 282.2 feet mean sea level as possible. Exceptions to this policy were made to (1) lower the lake's level during the winter months in the 1940s to control vegetation; (2) draw down the lake, at the request of the state, in late winter during the late 1950s and 1960s as a fishery management practice; and (3) lower the lake's level at various times to make repairs to the water control structures or allow a community sewage treatment facility to be installed adjacent to the lake in 1986. The drawdowns FWS conducted in the 1950s and 1960s were minor drawdowns and, according to TWRA, were not the kind of drawdowns needed for significant improvement to fisheries and the lake's condition.

In 1985, TWRA proposed a major drawdown of the lake to address the problem of siltation and its impact on the declining fish population. Under this proposal, the lake would have been drawn down to expose about 50 percent of the lake's bottom to drying by the sun—a technique that had been used at other locations to control dense growth of undesirable aquatic vegetation, consolidate silt, and stimulate the growth of desirable aquatic vegetation. TWRA's proposal also called for periodic major drawdowns (perhaps every 7 to 10 years) as required to control undesirable aquatic vegetation and consolidate silt.

FWS agreed to this proposal and relinquished control of the spillway to TWRA, which began a drawdown in May 1985. Shortly thereafter, a group of citizens, concerned about the potential impact of such actions on many of the resources at the lake, sought a court order to halt the drawdown. The U.S. District Court for the Western District of Tennessee ruled that such actions, by virtue of FWS' having exclusive responsibility for operating the spillway under the 1941 lease that clearly gives FWS responsibility for water-level management, constituted a major federal action significantly affecting the quality of the human environment. Thus, FWS was required to

Figure III.1: Undesirable Aquatic Vegetation in Reelfoot Lake

FWS has used mechanical methods, principally aquatic weed cutters, to remove undesirable vegetation during three separate periods—early in the lease, from the mid-1950s to the mid-1960s, and from 1984 to the present. Successful vegetation control over time has been hampered by frequent breakdowns and eventual inoperability of this equipment because of damage caused by submerged stumps and logs in the lake. In 1942, FWS used two aquatic weed cutters to cut about 2,000 acres of undesirable plants; however, these machines became inoperable because they were damaged by stumps and logs encountered in the lake during operation. FWS acquired another aquatic weed cutter in 1956. This cutter was used until 1966, when FWS determined that it had been extensively damaged by stumps and logs and was no longer adequate for vegetation removal. Because of the cost of a replacement weed cutter (over $200,000), FWS said it did not attempt to acquire another weed cutter on its own. Funds were eventually provided by the Congress, and a new aquatic weed cutter was acquired in 1984 and is still in use. The new cutter has also been damaged through prolonged use and has periodically been under repair.

The widespread use of chemicals to control vegetation on the lake began in 1948 and continued through 1972 with questionable, short-term results. No chemical was found to control several of the least desirable species. Because of opposition by local citizens and environmental restrictions,

From 1956 through 1959, FWS used an aquatic weed cutter to cut approximately 80 miles of boat trails through marsh vegetation so that the sides of the trails could be treated with herbicides. Maintenance of the boat trails created by the cutter began in 1959 and continued until 1966, when operation of the machine became economically infeasible because of its frequent breakdowns. Because no weed cutter was available, FWS used dynamite to clear trails between 1967 and 1969 and used chemicals to perform limited maintenance on the trails between 1966 and 1975. Little was done until 1984, when FWS acquired a new weed cutter. According to FWS, the limited maintenance between 1966 and 1984, coupled with high rates of siltation because of erosion from upland cropland, has greatly reduced channel depths. With the use of the new weed cutter, FWS and TWRA are presently maintaining a system of 35 miles of boat trails on the entire lake.

## Controlling Silt Flowing Into the Lake

FWS has taken actions that it deemed necessary and practical to control silt flowing into the lake, yet siltation remains a major problem. Specifically, FWS has (1) constructed silt retention basins near the mouths of Reelfoot and Indian creeks as called for in the lease agreement and (2) cooperated with the state and the U.S. Department of Agriculture's Agricultural Stabilization and Conservation Service (ASCS) and SCS to control siltation. ASCS and SCS have made efforts to (1) institute better farming practices to help reduce runoff from eroding cropland and (2) build a series of silt retention basins to help control silt that would otherwise flow into the lake from the streams in the Reelfoot Lake watershed. In addition, FWS and TWRA are attempting to acquire the land needed to construct a silt retention basin outside the boundaries of the refuge, near the mouth of Reelfoot Creek. Acquisition of this land and subsequent construction of the basin are beyond the requirements of the lease.

How best to control silt flowing into the lake has been a primary concern of FWS throughout the lease period. As early as the 1940s, FWS was considering such actions as diverting Reelfoot Creek, building a silt retention basin or constructing a series of smaller settling basins in the refuge, and suggesting that the state build such facilities in the watershed to control silt closer to the source. Practically from the beginning of the lease period, FWS recognized that actions it may take to control siltation within the refuge would be impractical unless steps were taken by others, either before or in conjunction with FWS' actions, to control silt closer to the source. Without better silt control in the watershed, FWS believed that

increasing the use of soil conservation practices would reduce the amount of silt reaching the lake. Allowing more natural fluctuations of the lake's water level and conducting periodic major drawdowns of the lake would help dry up and consolidate the silt and kill unwanted vegetation. Implementing these options would be costly, and some landowners have resisted efforts by FWS and TWRA to acquire the land or easements needed to construct a silt retention basin near the lake and to fluctuate the water to a higher level—efforts that are beyond the requirements of the lease agreement. However, a more formidable barrier facing FWS and TWRA appears to be the difficulty of implementing a program that will ensure the long-term preservation of the lake while at the same time maintaining a balance between competing agricultural and recreational interests. Overcoming these barriers will require public policy decisions involving all the parties likely to be affected by the choices made.

## Background

Located in northwestern Tennessee and southwestern Kentucky, Reelfoot Lake was formed by the New Madrid earthquakes of 1811 and 1812 and is Tennessee's largest natural lake, encompassing about 15,500 acres. The lake is mainly spread over two counties in Tennessee—Lake and Obion. The remaining small portion of the lake is in Fulton County, Kentucky. Reelfoot Lake is surrounded by bluffs to the east and flat, fertile Mississippi River bottomland to the north, west, and south. In addition to its recreational and agricultural benefits, Reelfoot Lake and its surrounding wetland provide habitat for various fish and wildlife species, including the endangered bald eagle and migratory waterfowl that use the lake as part of the Mississippi waterfowl flyway.

All freshwater bodies undergo a natural enrichment and aging process (called eutrophication), which may take several thousand years to complete. However, Reelfoot Lake's aging process has been hastened by human influence in the lake's watershed, and the lake appears to be in the latter stages of its natural ecological evolution toward a forested swamp. Less than 200 years after its formation, the lake's mean depth has decreased from about 20 feet to about 5 feet; over 40 percent of the lake is 3 feet deep or less.

Because the state-owned lake was deteriorating as a wildlife habitat in the early part of this century, establishing a national wildlife refuge on the lake and jointly undertaking efforts to restore the lake were considered to be of benefit to the state of Tennessee and the federal government. Under the 1941 lease agreement, FWS received a 75-year lease on about 7,800 acres of

Over the life of the lease, FWS has managed and protected the leased area as a national wildlife refuge and, from time to time, has sought and/or received appropriated funds to make various capital improvements and enhancements to the lake. These improvements and enhancements include (1) using primarily mechanical and chemical methods to remove undesirable aquatic vegetation and to dig and maintain circulatory channels and boat access trails and (2) constructing and maintaining silt retention basins and erosion control works within the refuge as called for in the lease agreement. With few exceptions, FWS has also maintained the lake's water level within the level required by the lease, that is, not more than 3 feet above and below the 1941 spillway level. FWS and TWRA officials are generally satisfied with the joint management established by the lease and mutually wish to retain the shared responsibilities. Appendix III discusses FWS' compliance with the terms of the lease agreement in more detail.

## Silt and Undecomposed Organic Material, Aggravated by a Stable Water Level, Are Causing Reelfoot Lake's Deterioration

In the last decade, studies by FWS, TWRA, the U.S. Army Corps of Engineers, and others have confirmed that the primary causes of Reelfoot Lake's accelerated aging and deterioration are (1) silt—which includes eroded soil and nutrients such as phosphorous and nitrogen—that is rapidly filling the lake and its surrounding wetland, primarily from cropland in Tennessee, and (2) the accumulation of undecomposed organic material, which is aggravated by the lake's artificially maintained stable water level. Together, these two causes have resulted in, among other things, a deterioration in wildlife habitat and an increase in undesirable aquatic vegetation. Such vegetation clogs the lake, interfering with fishing and other recreational pursuits, and reduces the oxygen available for fish and organisms in the lake.

Although siltation is worse in some areas of the lake than in others, silt is filling the lake at an average rate of 1 foot every 30 years. Siltation has been difficult to control because the cropland bordering the lake and in its watershed is highly productive but highly erodible, with topsoil in some areas ranging from 30 to 40 feet deep. Because of the abundance of rich topsoil, farmers in the area tend to place less importance on soil conservation, thus increasing the amount of silt entering the lake.

Moreover, for about the first 50 years of the lease, FWS generally followed a management policy of maintaining Reelfoot Lake's water level as close as possible to the water level at the time the lease agreement was signed. According to one study, for example, under this policy FWS managed the

of this basin is beyond the requirements of the lease agreement. The basin will capture an estimated 70 percent of the silt coming into the lake from the creek. Current plans call for FWS to acquire about 1,100 acres and TWRA to acquire about 3,200 acres of private land for this project, and the Congress has appropriated $2 million for FWS' acquisitions. As of July 1992, TWRA had acquired about 250 acres of its share, but FWS had not acquired any land. FWS and TWRA are attempting to acquire the land needed for this as well as other projects from willing sellers; consequently, neither agency is contemplating acquisitions through condemnation at this time.[2] In commenting on a draft of this report, TWRA stated that it would like FWS to be more aggressive in its efforts to help with silt control projects.

The U.S. Department of Agriculture's Agricultural Stabilization and Conservation Service (ASCS) and Soil Conservation Service (SCS) continue to help farmers institute better management practices and take other actions to reduce runoff from eroding cropland. In 1968, for example, SCS began construction of the first of 15 planned silt retention basins in Reelfoot Lake's watershed to help control silt coming into the lake. As of the end of 1991, SCS had completed eight of these structures. Between 1980 and 1990, ASCS conducted a Reelfoot Lake Rural Clean Water Project that provided farmers with financial incentives and technical assistance to employ the best management practices to control runoff from highly erodible cropland into the streams that carry silt into Reelfoot Lake. During this 10-year project, ASCS spent almost $3.4 million to help reseed over 26,000 acres of cropland, converting it into pasture. ASCS reported that this resulted in preventing the erosion of about 800,000 tons of soil annually by 1990.

## Status of Options to Dry Up and Consolidate Silt and Kill Undesirable Vegetation in the Lake

In July 1989, FWS issued an environmental impact statement on water-level management of Reelfoot Lake that describes its preferred alternative for drying up and consolidating the silt and killing the undesirable aquatic vegetation accumulating in the lake. This alternative water-level management program integrates dynamic water-level fluctuations of at least 2 feet each year—varying between 280 feet and 284 feet mean sea level depending on rainfall and other climatic conditions—with major drawdowns every 5 to 10 years. Other studies have called for new water control structures, such as a new spillway, to better accommodate raising and lowering the lake's water level.

[2]A state or federal government may take private property for public use under its authority (eminent domain); however, just compensation must be paid to the owner.

groundwater tables.) At present, FWS has not completed the mitigation measures required before a major drawdown can be conducted. According to Interior's comments on a draft of this report, archaeological surveys will cost FWS hundreds of thousands of dollars, for which funding will have to be obtained. Other negative effects that would need to be addressed or mitigated before conducting a major drawdown include, among other things, reduced waterfowl habitat, public access to open water, tourism, and use of the lake by businesses; fish kills and their associated odors; loss of cypress trees; and fewer fish available as food for bald eagles.

Because of the need for mitigation measures, FWS plans to implement its integrated water-level management program in two phases. The interim phase does not require major mitigation measures. In this phase, begun in May 1991, the lake's water level is allowed to rise about 1 foot above the lake's 1941 level during the nongrowing season (November 15 to April 15) and about one-half foot above the 1941 level during the remainder of the year. FWS believes that it cannot raise the water level any higher until, among other things, additional land or easements have been acquired and modifications have been made to community sewage treatment facilities. The second phase of the integrated water-level management program will be implemented incrementally as the needed mitigation measures are completed. For example, once appropriate mitigation measures are in place, FWS will pursue options that will allow a major drawdown before completing the measures needed to raise the lake's water to the higher level called for in the program.

Some farmers, primarily in Kentucky, are concerned that the plan to raise the lake's water level about 1 foot through April 15 of each year in the interim phase will require them to delay the planting of early crops. In their view, the higher water levels will also reduce the lake's ability to capture drainage from their cropland, especially during periods of heavy rainfall. During the period that FWS' interim phase has been in effect, however, agricultural interests have not been significantly affected.

A draft of FWS' environmental impact statement also considered the option of dredging or excavating to remove the accumulated silt. Several of those who commented on FWS' draft favored this alternative because it would have increased the lake's depth without having to raise the lake's water level. However, FWS rejected this option as infeasible because of the high costs (ranging from $6 million to $27 million) and operational difficulties it presented, such as disposing of the dredged material and dredging around

While FWS has raised the lake's water level up to about 1 foot above the 1941 level in both 1991 and 1992, it has not completed the mitigation measures necessary to conduct a major drawdown or to raise the lake's water to the higher level called for in its integrated water-level management program. Completion of the measures to fully implement this program could take years, and the opposition of the competing agricultural and recreational interests will have to be overcome. Meanwhile, the condition of Reelfoot Lake continues to deteriorate.

## Conclusions

While FWS has substantially complied with the terms of the lease agreement, the lake continues to deteriorate because of siltation and the accumulation of undecomposed organic material, which is aggravated by the artificially maintained stable water level. Options are available and plans are under way—both within and beyond the requirements of the lease—to improve the lake's condition by (1) constructing a silt retention basin near the mouth of Reelfoot Creek and controlling soil erosion in the lake's watershed to reduce siltation and (2) implementing an integrated water-level management program to correct the problems associated with the long-standing stable water-level management. However, the costs of these options and the difficulties of both acquiring the needed land or easements from willing sellers and mitigating the effects—many of them economic—on agricultural and recreational interests are formidable barriers. Overcoming these barriers will require public policy decisions involving the federal government, state and local governments in Tennessee and Kentucky, and the divergent agricultural and recreational interests that will be affected by these decisions. Ultimately, participants in this decision-making process will need to decide whether the benefits of preserving Reelfoot Lake for future generations outweigh the costs, sacrifices, and trade-offs that will be associated with Reelfoot Lake's survival.

## Agency Comments

We requested and received written comments on a draft of this report from the Departments of the Interior, Agriculture, and Defense; TWRA, on behalf of the state of Tennessee; and the Commonwealth of Kentucky. These entities generally agreed with the information in the report, and we incorporated their comments where appropriate.

In the draft of this report, we stated that FWS did not plan to conduct a major drawdown until all mitigation measures had been completed so that the lake could be refilled up to the 284 feet mean sea level called for in

headquarters in Washington, D.C., its regional office in Atlanta, Georgia, and the Reelfoot National Wildlife Refuge; officials from TWRA and other Tennessee state agencies and a local government; and interested private citizens in Tennessee.

We obtained information from and held discussions on the causes of the lake's deterioration, options for improving the lake's condition, and barriers to implementing the options with (1) the above officials, (2) state and local government officials and interested private citizens in Kentucky, and (3) officials from the U.S. Army Corps of Engineers, ASCS, and SCS, which have studied and taken various actions to help improve the condition of Reelfoot Lake.

Our work was conducted from October 1990 through July 1992 in accordance with generally accepted government auditing standards.

Unless you publicly announce its contents earlier, we plan no further distribution of this report for 30 days after the date of this letter. At that time, we will send copies to the Secretaries of the Interior, Agriculture, and Defense; the Director, Office of Management and Budget; the Governor of the state of Tennessee; the Executive Director of TWRA; the Governor of the Commonwealth of Kentucky; the Commissioner of the Kentucky Department of Fish and Wildlife Resources; and interested congressional committees. We will make copies available to others on request.

Please contact me at (202) 275-7756 if you or your staff have any questions. Major contributors to this report are listed in appendix X.

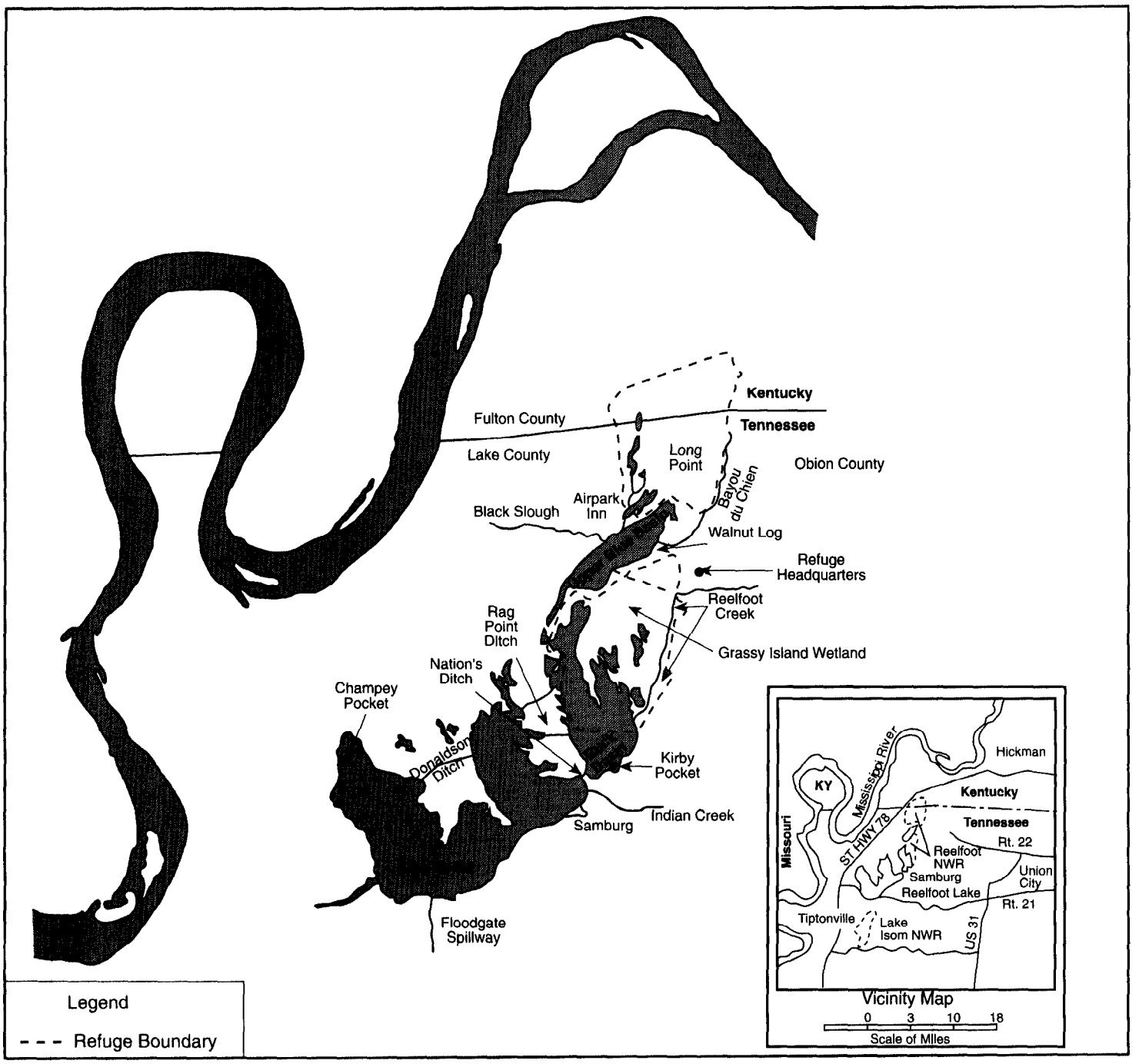
James Duffus III
Director, Natural Resources
Management Issues

# Contents

## Abbreviations

| | |
|---|---|
| ASCS | Agricultural Stabilization and Conservation Service |
| FWS | U.S. Fish and Wildlife Service |
| GAO | General Accounting Office |
| SCS | Soil Conservation Service |
| TWRA | Tennessee Wildlife Resources Agency |

# Reelfoot Lake and Vicinity




Source: FWS.

- taking steps it deems necessary and practical to control siltation in the lake through construction and maintenance of silt retention basins and erosion control works within the refuge area, with the specific requirement of constructing silt retention basins near the mouths of Reelfoot and Indian creeks and in other areas where practical, and cooperating with the state to extend the operations of the U.S. Department of Agriculture's Soil Conservation Service (SCS) and the soil conservation districts in the lake's watershed;
- maintaining the leased area as a refuge for migratory waterfowl and other wildlife in accordance with the Migratory Bird Conservation Act of 1929;[1]
- seeding desirable aquatic plants for fish, furbearer, and waterfowl food;
- establishing a Civilian Conservation Corps[2] camp in connection with development of the lake;
- providing and maintaining additional recreational facilities on the lake;
- using Lake Isom National Wildlife Refuge (near Reelfoot Lake) as a rearing pond for the production of fingerlings (young fish) to stock Reelfoot Lake, and cooperating with the state in increasing and maintaining the fishery resources of the lake; and
- introducing food plants for muskrat and other furbearers and making the refuge suitable and available for public trapping.

The lease provides that the fulfillment of the state's and FWS' lease responsibilities is contingent on the availability of funds. If such funds are not made available, the parties are released from all liability. The lease further specifies that it shall not be construed as affecting any privately held properties in the areas referred to in the lease.

## Changes to the Lease

The original lease and cooperative agreement between the federal government and the state of Tennessee can be modified as long as the two parties agree to the changes. FWS' Regional Director in Atlanta, Georgia, has been delegated the authority to amend the lease on behalf of the federal government and has exercised that authority in the past. Over the years, FWS' and TWRA's original lease requirements have been changed by various amendments, supplements, cooperative agreements, and memorandums of understanding. Generally, these changes have been

[1]The Migratory Bird Conservation Act of 1929 authorizes the Secretary of the Interior to acquire or rent land for migratory bird habitat.

[2]The Civilian Conservation Corps functioned from 1933 to 1943 to alleviate unemployment among the nation's youth. It employed and trained young citizens in a national program, primarily for the conservation of natural resources—including soil erosion protection, reforestation, flood control, and other such activities.

Creek silt retention basins that SCS built in the watershed to TWRA; (2) primary responsibility for the lake within the refuge, and for control of the lake's water level and maintenance of the water control structures to FWS; and (3) responsibility for Reelfoot Lake State Park programs and for acquisition of land for the Reelfoot/Indian Creek silt retention basins that are to be built by SCS to the Tennessee Department of Conservation. The parties also agreed that a master plan was needed for the protection and management of Reelfoot Lake and its surroundings and that adoption of a master plan must be a joint effort. Responsibility was to be shared by the parties to the memorandum and other federal, state, regional, and local agencies and organizations interested in the management and protection of the land and water resources and the wildlife that use these resources for habitat. The memorandum may be amended at any time by agreement of all parties; any party may terminate the memorandum by giving a 30-day written notice to the other parties.

An August 1987 memorandum of understanding, which was never implemented, would have modified the lease with respect to the lease period, water-level management, and construction of a silt retention basin near the mouth of the Reelfoot Creek. Under this memorandum, the lease would have been extended for 50 years until 2066, FWS would have relinquished water-level control to TWRA, and TWRA would have assumed responsibility for constructing a silt retention basin near the mouth of Reelfoot Creek. This memorandum was never implemented because of, among other things, opposition by many Tennessee and Kentucky citizens and local government officials to the transfer of water-level control from FWS to the state of Tennessee, concerns of Kentucky landowners and the Kentucky congressional delegation about the potential acquisition of Kentucky land needed to raise the lake's water level, and citizens' and local government officials' concerns about the legality of extending the lease for another 50 years. In a May 1990 letter to TWRA, FWS initiated action to terminate the memorandum. FWS informed TWRA that the memorandum (1) had been written to record planning decisions regarding the development of a draft environmental impact statement on Reelfoot Lake's water-level management, (2) had become obsolete, and (3) should be rescinded. In June 1990, TWRA responded to FWS that the memorandum had been developed as an aid to the eventual renegotiation of the lease, did nothing other than identify areas for serious consideration as the two parties moved toward renegotiation, and did not need to be rescinded because it was never in force and had no binding effect.

# FWS' Compliance With the Terms of the Lease Agreement

The lease agreement and its subsequent changes do not specify standards that FWS must attain in fulfilling its responsibilities nor prescribe the time in which such activities must be carried out. Consequently, FWS has considerable latitude under the lease in carrying out its responsibilities.

The lease states that the fulfillment of FWS' lease responsibilities is contingent on the availability of funds, but it does not require FWS to seek funds nor does it specify times within which it must obtain such funds. Over the life of the lease, FWS has sought appropriated funds to do what it considered necessary and practical to fulfill its lease responsibilities regarding capital improvements and enhancements. FWS' efforts to obtain these funds have been sporadic, however. In the 1950s, for example, FWS built silt retention basins near the mouths of Reelfoot and Indian creeks to help control silt coming into the lake. FWS has not sought funds for other erosion control works, however, because it has considered such projects to be impractical unless other parties take steps to control silt reaching the lake from cropland in the lake's watershed.

According to FWS officials, the funds needed to fulfill FWS' Reelfoot Lake lease responsibilities are not given priority within FWS' yearly budget process. In certain years, FWS headquarters or regional budget guidance has indicated that requests for funds for capital improvements and enhancements would not be considered, and the refuge manager has therefore not requested any funds for these activities. In other years, the refuge manager has requested, but not received, funds because of higher regional or national priorities. On occasion, the Congress has unilaterally added funds to FWS' fiscal-year budget for Reelfoot Lake projects for which FWS has not requested funding. For example, the funds for an aquatic weed cutter acquired in 1984 and for an ongoing effort to acquire land for a silt retention basin outside the leased area near the mouth of Reelfoot Creek were not requested by FWS but rather were added to FWS' budget by the Congress.

Some of the actions FWS has taken to meet its various lease responsibilities are described below. The description is not intended to be all-inclusive.

## Operating and Maintaining the Dam and Spillway Gates (Water Control Structures)

FWS and TWRA agree that FWS' responsibility for operating and maintaining the dam and spillway gates is restricted to the water control structures—the radial water control gate and other stop-log structures (adjustable water gates) that regulate the water level of the lake. The two agencies also agree that the Tennessee Department of Transportation is

prepare an environmental impact statement under the terms of the National Environmental Policy Act of 1969. The Court therefore issued a preliminary injunction halting the drawdown pending the preparation of the required environmental impact statement. This order was appealed by TWRA but was upheld by the U.S. Court of Appeals for the Sixth Circuit.[1]

Accordingly, FWS issued an environmental impact statement in July 1989 that described six alternatives for managing water levels at Reelfoot Lake. FWS' preferred alternative was an integrated water-level management program that combined two of the alternatives—dynamic water-level fluctuation of at least 2 feet annually to imitate a more natural water cycle and periodic major drawdowns every 5 to 10 years.

In January 1990, the city of Samburg, Tennessee, and 18 riparian landowners (owners of land bordering the lake) intervened in the case and requested a temporary injunction to prevent FWS from implementing its preferred alternative because, in their view, the environmental impact statement did not adequately address navigational concerns. The intervening plaintiffs maintained that the environmental impact statement failed to address their rights as riparian landowners and that they were entitled to a full flow of water in its natural channel, undiminished and unimpaired. In December 1990, the U.S. District Court for the Western District of Tennessee ruled in favor of FWS and TWRA on both issues. The Court stated that the riparian landowners have no right to a full, natural flow of water since the waters are held by the state in trust for the public and the state had granted its right to control the lake level to FWS. The Court also stated that the environmental impact statement discussed the environmental consequences of the alternatives for the riparian landowners, and this was all the National Environmental Policy Act required. Following the Court's ruling of December 1990, FWS began taking steps toward implementing its preferred alternative as described in the environmental impact statement. (See app. IV for more details.)

## Removing Undesirable Vegetation

Over the life of the lease, FWS has used primarily mechanical and chemical methods to remove and control undesirable aquatic vegetation such as cut-grass, mulefoot, lotus, and spatterdock. The vegetation depletes the oxygen in the water, thereby stressing fish and the invertebrates, such as midge larvae, that regulate algae in the lake. The efforts to control the vegetation have had only limited success, and undesirable vegetation remains a major problem in the lake. (See fig. III.1.)

[1]Bunch v. Hodel, 642 F. Supp. 363 (W.D. Tenn. 1985), affd., 793 F. 2d 129 (6th Cir. 1986).

chemical use was discontinued on the open waters of the lake in 1972. Limited use of chemicals continued on the lake's banks and boat trails until 1975.

## Digging and Maintaining Circulatory Channels

Under the lease agreement, FWS has constructed a series of channels and has cleared and maintained a series of boat access trails through plant-infested areas to improve public access and to aid water circulation. (See fig. III.2.) FWS has used two principal methods for digging and maintaining these circulatory channels—a barge and dragline system early in the lease period to excavate the channels and the aquatic weed cutters in later years.

**Figure III.2: Boat Access Trail Through Vegetation in Reelfoot Lake**

From 1942 to 1951, FWS used a barge and dragline to excavate much of the lake's current channel system—about 70,000 feet or over 13 miles. The original dragline-constructed channels were approximately 25 feet wide and 6 feet deep. Maintenance has not been performed on the channels since the original excavation except to remove some vegetation and debris on the banks. The size and depth of the channels, regular use by boats, and water circulation through the channels have kept most of them open to commercial fishermen and recreational boat users.

any basins constructed within the refuge would fill up in a few years, rendering them essentially useless.

In the 1950s, several federal agencies and the state took various actions to begin to control siltation. In 1951, FWS set up 38 silt-measuring stations near the mouths of Reelfoot and Indian creeks. In 1955, a siltation conference was held at Reelfoot Lake at which FWS, the U.S. Army Corps of Engineers (Corps), and the state agreed to cooperatively gather information on silt deposits so that adequate control plans could be made. In 1955 and 1956, FWS constructed silt retention basins near the mouths of Reelfoot and Indian creeks at Kirby's Pocket and at Grassy Island, respectively. Constructing basins near the mouths of these creeks was specifically called for in the lease agreement. The basin at Kirby's Pocket has since filled with silt. The basin at Grassy Island continues to catch silt, although its effectiveness has been lessened considerably because culverts had to be installed in the dike to relieve flooding of adjacent private land. Although FWS continued to consider other means of controlling siltation in the late 1950s, the agency did not undertake any projects because it believed that (1) any new projects would affect private land in much the same way as the Grassy Island project did, (2) the purchase of private land would be necessary for the projects but would be beyond the scope of the lease, and (3) others needed to take steps to control silt closer to the source.

In the 1960s, SCS initiated its Reelfoot-Indian Creek Watershed Plan, with the objectives of providing relief from damaging floods to productive cropland and reducing silt damage to Reelfoot Lake. SCS's plan included (1) devoting land to uses for which it was best suited and employing needed conservation measures, primarily for protection of the watershed; (2) stabilizing critical runoff and silt-producing areas; (3) installing 14 floodwater-retarding structures and one major silt basin (all 15 serving as silt retention basins); and (4) improving the drainage capability of about 188,000 linear feet of stream channel. In 1968, SCS began construction of the silt retention basins and, as of the end of 1991, had completed eight of these structures. (Fig. III.3 shows one of these silt retention basins.) SCS also has continued to help farmers employ better conservation practices in the watershed, but these efforts have had limited success. Because of the abundant rich but highly erodible topsoil, from 30 to 40 feet deep in some areas, farmers in the area are not always inclined to practice conservation or soil erosion prevention techniques. As a result, the silt coming into the lake increases.

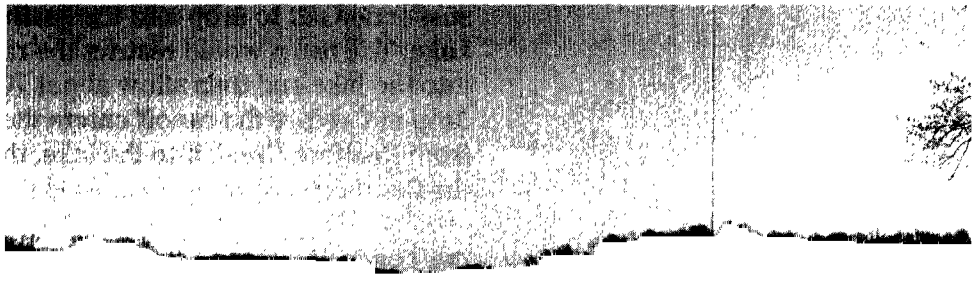


**Figure III.3: Silt Retention Basin Near the Mouth of Indian Creek, Constructed Under SCS' Reelfoot-Indian Creek Watershed Plan**

In 1980, ASCS initiated its Reelfoot Lake Rural Clean Water Program project, which provided farmers with financial incentives and technical assistance to employ the best management practices to control runoff from highly erodible cropland into the streams that carry silt into Reelfoot Lake. One of the project's objectives was to try to reconvert much of the land that had been converted to cropland in the 1970s back into pasture. Growing crops on this highly erodible converted pasture land produced high soil erosion. Consequently, the creeks carrying the runoff dumped sediments and associated pollutants, particularly pesticides and nutrients, into the lake. Under this 10-year project, ASCS shared in the cost of reseeding the cropland for pasture with the farmers. Furthermore, if the farmer signed an agreement to keep the land in grass for 10 years, ASCS would pay the farmer a one-time, $70-per-acre bonus. At the end of the 10-year period, in September 1990, ASCS reported that it had entered into 325 contracts with farmers covering over 26,000 acres, with cost-share obligations of almost $3.4 million. ASCS further reported that using the best management practices to control runoff had resulted in preventing the erosion of about 800,000 tons of soil annually for the 10-year period.

In a May 1988 Reelfoot Lake reconnaissance report, the Corps stated that another silt retention basin near the mouth of Reelfoot Creek would help control erosion from the Reelfoot Creek basin by allowing much of the

suspended silt to drop into the basin before the water enters Reelfoot Lake. The basin would restrict the rate of discharge from Reelfoot Creek into the lake and thus allow about 70 percent of the silt from the stream to drop out before the runoff enters the lake. By slowing the flow of runoff from Reelfoot Creek into the lake, the retention basin would also augment the flood control capacity of the lake.

FWS began planning for the silt retention basin in the late 1980s, intending to complete the planning process in fiscal year 1992. However, the Congress appropriated funds for FWS to acquire land before FWS had completed its planning and requested the funds through its yearly budget process. The land needed for the basin is adjacent to, but outside, the refuge. Thus, acquisition of the land to construct the basin is beyond FWS' silt control responsibilities under the lease agreement.

Initially, FWS and TWRA planned to acquire about 1,300 acres each for the silt retention basin, and the Congress added $1 million to FWS' fiscal year 1991 budget for this purpose. As of July 1992, FWS planned to acquire about 1,100 acres and TWRA planned to acquire about 3,200 acres for the basin, and both were appraising and making offers on the properties to be acquired. Although FWS did not request it, the Congress appropriated another $1 million for FWS to continue these activities in fiscal year 1992. As of July 1992, TWRA had acquired about 250 acres of its share, but FWS had not yet acquired any land. Depending on the success of the land-acquisition phase and the availability of funds, FWS plans to design the basin in fiscal year 1993 and construct it in fiscal year 1994.

## Maintaining the Leased Area as a Wildlife Refuge

FWS has managed and protected the leased area as a national wildlife refuge continuously since 1942. Some slight modifications to lease boundaries have occurred over time to accommodate public needs for access and recreation. FWS purchased additional land during the 1960s in Tennessee and Kentucky to expand the refuge and meet the needs of an increasing flock of Canadian geese and other migratory birds. Canadian geese have increased from 6 birds in 1942 to 60,000 in recent years, with peaks as high as 200,000 during harsh winters. (See fig. III.4.) Bald eagles using the refuge have increased from about 30 in the 1940s to over 200 each winter in recent years.

Figure III.4: Canadian Geese at Reelfoot National Wildlife Refuge

## Seeding Desirable Aquatic Plants for Waterfowl Food

FWS began to introduce desirable aquatic food plants for waterfowl on the refuge and the remainder of the lake as early as 1942 and continued to do so up to the 1960s with some success. No seeding has been attempted recently because of a general consensus that sufficient waterfowl foods are available or could be made available by other management techniques, such as growing waterfowl food plants (corn and grains) on some of the refuge's land area.

## Establishing a Civilian Conservation Corps Camp

The Civilian Conservation Corps camp planned in connection with development of the lake was not funded by the Congress. However, a work crew of 11 to 14 men was employed at Lake Isom and Reelfoot Lake from 1941 to 1943 under the Work Projects Administration.[2] The refuge participated in another work program from 1963 to 1965, employing a labor force that made improvements to the refuge. The refuge has also used other work programs, such as the Youth Conservation Corps and Young Adult Conservation Corps, in recent years.

[2]The Work Projects Administration (called the Works Progress Administration in its early years) was a federal office that functioned in the 1930s and 1940s to cope with unemployment created by the Great Depression. It conducted a broad program of public works and community services.

## Providing and Maintaining Additional Recreational Areas

FWS has taken steps to provide and maintain additional recreational areas. FWS (1) built a new refuge headquarters with a visitors' station and a museum in 1981 and added a boardwalk and observation tower in 1985, (2) installed a nature display and information booth at Long Point, (3) maintained channels within the lake for recreational use, and (4) cleared channels to the state-owned Airpark Inn and other state-controlled lake areas. (See app. I for a map of Reelfoot Lake and vicinity.)

## Using Lake Isom to Stock Reelfoot Lake and Cooperating With the State on Fishery Resources

FWS built a dike and water control structure at Lake Isom in 1947 to enable it to serve as a nursery area for fish as well as a wintering area for ducks. However, FWS has not used Lake Isom as a fingerling rearing pond to stock Reelfoot Lake for two primary reasons: (1) fingerlings cannot feasibly be transported from Lake Isom to Reelfoot Lake and (2) the Reelfoot Lake fisheries have been so productive that stocking Reelfoot Lake with fingerlings from Lake Isom has not been considered necessary.

FWS has historically recognized that the state has the lead role in improving fisheries at Reelfoot Lake. FWS has fulfilled its responsibility to cooperate with the state on fisheries by (1) managing the water level of the lake, including conducting minor winter drawdowns during the late 1950s and 1960s to help improve the fisheries; (2) digging and maintaining channels that provide for water circulation and boat access to fishing areas; and (3) taking steps to control undesirable aquatic vegetation and siltation, both of which are detrimental to the lake's fisheries.

## Introducing Food Plants for Muskrats and Other Furbearers and Making the Refuge Suitable and Available for Public Trapping

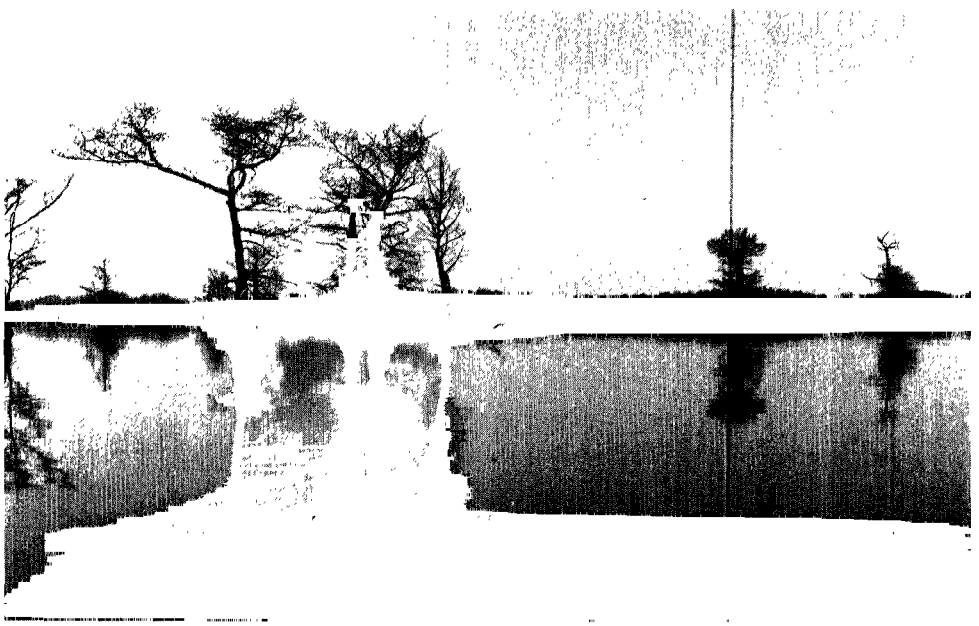
FWS and TWRA agreed that there was never a pressing need to introduce food plants for furbearers to supplement the natural vegetation at the refuge. To fulfill its responsibilities regarding trapping, particularly in the early years, FWS introduced beaver to the lake in 1942. In 1943 and for several years thereafter, muskrats were protected by the state. According to FWS, however, the state did not enforce the regulation, and the refuge was the only area protected. Refuge personnel devoted considerable time in the early years to preventing illegal trapping on the refuge. By the 1950s, the muskrat population had increased sufficiently to allow trapping on the refuge through the decade. According to the refuge manager, little or no trapping has been allowed on the refuge since the early 1960s because (1) the furbearer populations on the refuge have not been high enough to support trapping and (2) trapping would conflict with the refuge's primary objective of providing habitat to migratory waterfowl, since the trapping and waterfowl migration seasons coincide. He also said that some trapping

has occurred around the perimeter of the refuge since the 1960s, but not to a great degree because the market for furs has been low for many years.

# Options for Improving Reelfoot Lake's Condition

Reelfoot Lake's deterioration—resulting from siltation and the accumulation of undecomposed organic material, which is aggravated by the lake's artificially maintained stable water level—has long been known to the state, FWS, and users of the lake. In fact, the state of Tennessee entered into the lease with FWS in 1941 to, among other things, address problems of the lake's accelerated aging, deteriorated water quality, and undesirable aquatic vegetation. Despite its deterioration, Reelfoot Lake is picturesque and is a haven for fish, birds, animals, and recreationists. For these reasons, many people are interested in improving its condition. (Reelfoot Lake is shown in fig. IV.1.)

**Figure IV.1: Reelfoot Lake**



In the last decade, various state and federal agencies have undertaken studies to further identify the causes of the lake's deterioration and to develop options for improving the lake's condition. These studies have been, in some cases, quite extensive and have included options both within and outside the scope of the lease between Tennessee and FWS. This appendix summarizes some of the more significant studies and their suggested options for improving Reelfoot Lake.

## Special Task Force on Reelfoot Lake (1983-87)

The Special Task Force on Reelfoot Lake was created by the Tennessee General Assembly (state legislature) and consisted of members from both houses of the General Assembly and representatives of the offices of the Tennessee delegation to the U.S. Congress, the governor of Tennessee, TWRA, the Tennessee Department of Conservation, and FWS. The task force collected and analyzed data on the various man-made and natural forces endangering the lake and took steps to increase public awareness of the lake's plight and the need for immediate and long-term corrective actions. The task force also prompted accelerated action by state agencies, FWS, the Corps, SCS, and others to (1) reduce the silt coming into the lake, (2) control aquatic vegetation in the lake, (3) acquire land to enable fluctuation of the lake's water level, (4) complete the wastewater treatment system for the communities bordering the lake, and (5) take other steps to preserve and protect Reelfoot Lake. The task force completed its work in 1987 and disbanded.

## TWRA's Recommendations to the Special Task Force on Reelfoot Lake (1987)

In August 1987, TWRA made a series of recommendations to the Special Task Force on Reelfoot Lake that it believed were necessary to ensure the long-term existence of Reelfoot Lake and its ecosystem. TWRA recommended

- an extensive program to acquire lowland adjacent to the lake, buffer zones, floodways, and critically eroding privately owned land in the watershed;
- state sponsorship of a Corps feasibility study for projects to, among other things, construct an alternative spillway to enhance water-level management at the lake, build a silt retention basin near the mouth of Reelfoot Creek, and dredge channels to improve water circulation in the lake; and
- reforestation of land near the lake.

The estimated cost of implementing these recommendations was about $44 million; the state's share was to be about $33 million and the Corps' share about $11 million. TWRA included these recommendations in a 50-year management plan issued in 1988.

## TWRA's Reelfoot Lake Fifty Year Management Plan (1988)

In response to an April 1986 Joint Senate Resolution of the Tennessee General Assembly, TWRA developed the Reelfoot Lake Fifty Year Management Plan and issued it in March 1988. The plan—more than 300 pages long—examined the history of Reelfoot Lake to provide insight into future expectations and management priorities; discussed physical, chemical, biological, and socioeconomic conditions in some detail; and proposed a series of techniques for future management of the lake. The management proposals and estimated implementation costs in the plan are similar to those in TWRA's 1987 recommendations to the Special Task Force on Reelfoot Lake but are more extensive and detailed. TWRA has since purchased 2,345 acres bordering the lake, and FWS and TWRA are attempting to acquire additional land needed to build a silt retention basin near the mouth of Reelfoot Creek. As discussed below, however, the Corps' feasibility study called for in both TWRA's 1987 recommendations to the Special Task Force and the 1988 50-year management plan has not been certified for funding by the Corps.

## The Corps' Reconnaissance Report for Reelfoot Lake, Tennessee and Kentucky (1988)

In response to August 1984 congressional resolutions and with federal funds provided in December 1985, the Corps performed a reconnaissance study of Reelfoot Lake. The study identified water and related land resource problems, established planning objectives, and formulated and evaluated a range of alternatives for addressing these objectives. The Corps evaluated alternatives for flood control, silt control, water quality and water supply improvements, preservation and enhancement of fish and wildlife resources, recreation, regional development, and related purposes. Some of the specific alternatives studied were

- designing an alternative spillway to provide a safe and more versatile structure for water-level control,
- clearing out vegetation and other obstructions downstream from the spillway to make the channel more compatible with the water-level management capabilities of the alternative spillway,
- dredging in critical areas to remove silt deposits near tributary inlets and connecting channels and to increase the efficiency of both the discharge from tributaries into the lake and the interchange among major open water pools of the lake, and
- constructing a silt retention basin near the mouth of Reelfoot Creek to capture more than 70 percent of the silt entering the lake.

The Corps' May 1988 reconnaissance report contained three alternative plans that ranged from providing basic improvements to address

immediate flood control needs to enhancing the current value of the lake for fish and wildlife recreation. The implementation costs of the plans ranged from about $11.2 million to $34.4 million, and the benefit-to-cost ratios ranged between 1.7 to 1 and 2.4 to 1. The report called for a feasibility phase to study in more detail the alternatives identified in the reconnaissance phase and to develop more comprehensive plans for addressing options for improving the lake's condition. A cost-sharing agreement with the state of Tennessee was proposed for the feasibility phase. The report recommended that the reconnaissance report and proposed feasibility phase be approved so that the cost-sharing agreement could be put into effect and the feasibility phase initiated. The estimated cost of the feasibility phase was $2 million, which was to be shared equally by the Corps and the state over 5 years from 1988 through 1992.

The state supported the reconnaissance report's findings and agreed to pay its 50-percent share of the cost of the feasibility phase, and the report was forwarded to the Assistant Secretary of the Army for Civil Works in August 1988 for certification of federal interest. At the time the report was submitted, however, the Department of the Army's policy was that projects not justified by high priorities, such as flood-damage reduction or improvements to commercial navigation, would not be budgeted for during times of large budget deficits. Although the majority of projects contained in the Corps' report on Reelfoot Lake pertained to flood-damage reduction, certification was not granted and the feasibility phase was not initiated. However, the Army's guidance for preparing the fiscal year 1992 budget elevated restoration of fish and wildlife resources to a high priority. The Corps' Memphis District officials believe that restoration of fish and wildlife resources, in tandem with flood-damage reduction, provides sufficient justification for reconsidering the certification of the feasibility phase, and the District intends to continue its efforts at Reelfoot Lake. Tennessee members of the U.S. Congress, the state, and other federal agencies have expressed considerable interest in the Corps' pursuing studies and projects at Reelfoot Lake, particularly the silt retention basin.

## Reelfoot Joint Venture Project (1989)

Under the auspices of the North American Waterfowl Management Plan—a broad policy and strategy framework completed in 1986 to protect and enhance wetland habitat critical to waterfowl populations in Canada and the United States—the states of Tennessee and Kentucky, in cooperation with FWS and the Corps, developed the Reelfoot Joint Venture Project and published a draft report in March 1989. The report pointed out

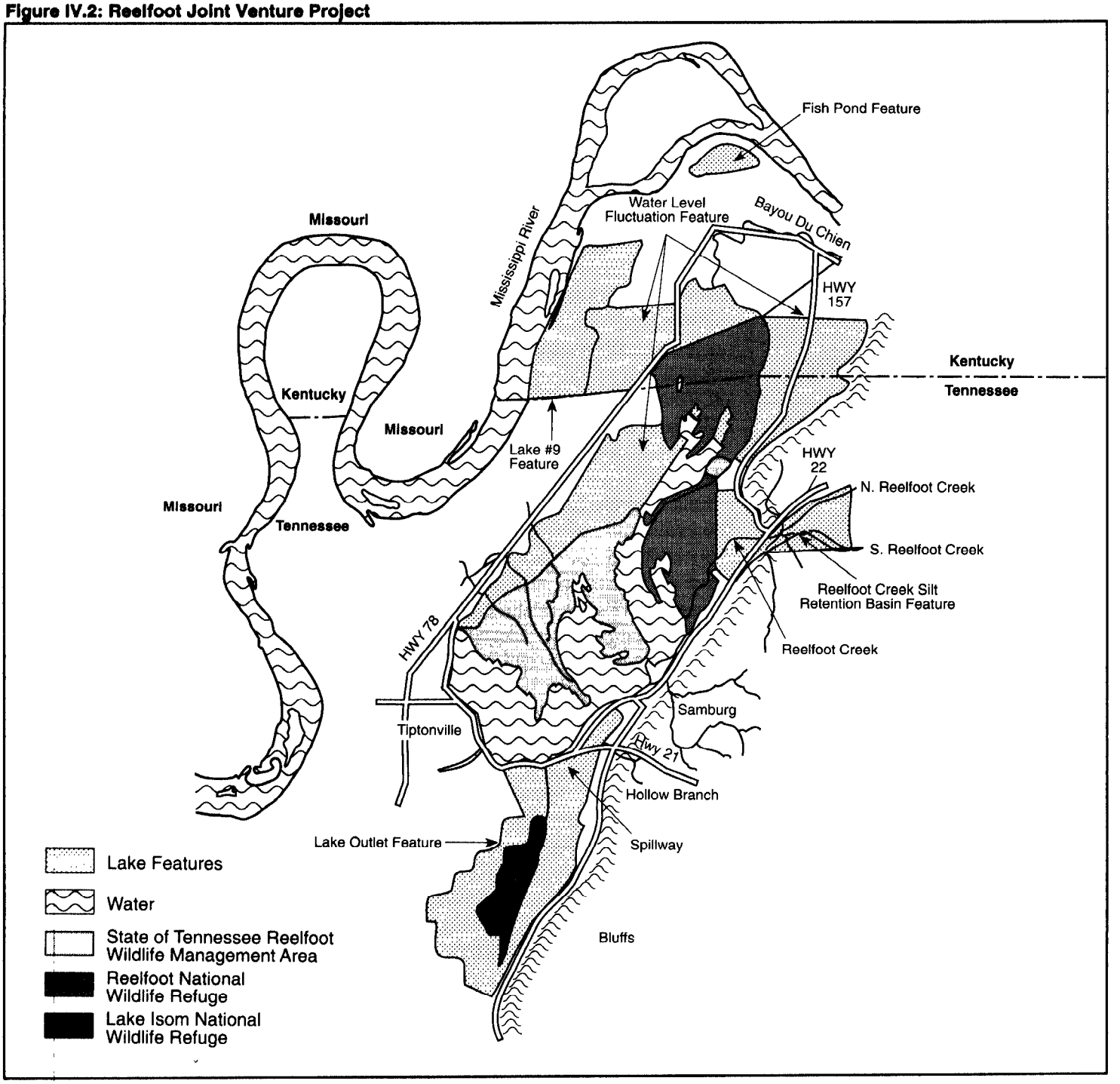
that 14 private, state, and federal agencies have collectively investigated Reelfoot Lake's management needs and have documented three key problems significantly affecting the quantity and quality of wetland habitats in the lake's area: (1) silt from the watershed that rapidly fills Reelfoot Lake and other wetland, (2) stable water levels in the lake over the past decades that have resulted in a loss of species diversity and deterioration of desirable wildlife habitat, and (3) agricultural encroachment on wetland areas, which has greatly reduced the quantity and quality of wetland habitats.

The project's goals and objectives were to protect the integrity of the lake and associated wetland, increase and enhance habitat and the capability to accommodate historic peak populations of waterfowl and associated wetland species, and restore and enhance the intrinsic functions and values of the Reelfoot Lake wetland ecosystem. The draft report described five specific features—to be established through interdependent acquisition, development, and management actions—that would be needed to accomplish these goals. The features, shown in figure IV.2, were the following:

- a silt retention basin near the mouth of Reelfoot Creek;
- a water-level fluctuation feature, added through land acquisition and other measures, that would allow water level fluctuations to 3 feet above the current spillway elevation of 282.2 feet mean sea level—the level in effect at the time FWS signed the lease with Tennessee;
- a lake outlet wetland corridor, formed by replacing the current spillway, constructing a new outlet channel and silt diversion channel, and building associated dikes and other water control structures;
- a sanctuary and migration stepping-stone to Reelfoot Lake (referred to as the "Fish Pond") in Kentucky, added through land acquisition and other measures; and
- restored wetlands (referred to as "Lake Number 9"), recovered through land acquisition and other measures from land that had been converted to agricultural production in Kentucky.

The first three features are located in Tennessee on the borders of Reelfoot Lake, and the last two features are located in Kentucky in areas not immediately adjoining the lake.

**Figure IV.2: Reelfoot Joint Venture Project**




Source: Reelfoot Joint Venture Project draft report.

Total acquisition and development costs were estimated to be about $38.4 million, with estimated annual operating and maintenance costs of about $900,000. The acquisition and development costs would be shared by FWS ($13.5 million, or about 35 percent), TWRA ($12.3 million, or about 32 percent), the Corps ($7.3 million, or about 19 percent), the Kentucky Department of Fish and Wildlife Resources ($3.0 million, or about 8 percent), and the Tennessee Department of Transportation ($2.3 million, or about 6 percent). Most of the annual operating and maintenance costs would be borne by FWS ($509,500, or about 56 percent) and TWRA ($308,500, or about 34 percent).

The silt retention basin at Reelfoot Creek was estimated to cost about $6.2 million, with annual operating and maintenance costs of $180,000. The project's proposed water-level fluctuation feature was estimated to cost about $12.2 million, with annual operating and maintenance costs of about $426,000. The lake outlet wetland corridor was estimated to cost about $17 million, with annual operating and maintenance costs of about $247,000.

The Joint Venture Project report identified the agencies that were considered the feasible contributors to the various features, contingent on the availability of funds. The report did not specify authority or responsibility for each feature; hence its classification as a "draft" report. Progress has been slow in implementing the project's planned features, primarily because of the difficulty of acquiring the estimated 20,150 acres that are needed. FWS and TWRA are actively proceeding with the silt retention basin by acquiring land from willing sellers. Neither agency is currently contemplating acquiring land for this or any other option through condemnation.

## FWS' Environmental Impact Statement on Reelfoot Lake Water-Level Management (1989)

As discussed in appendixes II and III, a group of citizens brought a series of lawsuits against FWS and TWRA over their agreement in 1985 for FWS to turn over control of the spillway to TWRA and TWRA's initiation of a major drawdown of the lake. As a result of these lawsuits, FWS issued an environmental impact statement in July 1989 that discussed six alternatives for managing water levels at Reelfoot Lake. The environmental impact statement described the environmental and socioeconomic conditions at Reelfoot Lake and the consequences of each alternative. The six alternatives are described below.

### Alternative One—Take No Action

Management of state and federal lands and waters would continue as in the past with respect to both water levels and other programs. The surface

elevation of Reelfoot Lake would continue to be maintained as close to 282.2 feet mean sea level as possible.

## Alternative Two—Manage for Dynamic Water Fluctuation

The surface elevation of Reelfoot Lake would be managed for a dynamic or more natural fluctuation, depending on the rainfall in particular years. Water levels would be managed for at least a 2-foot seasonal fluctuation between elevations of 284.0 feet mean sea level and 280.0 feet mean sea level each year.

## Alternative Three—Conduct Major Drawdowns

Periodically (every 5 to 10 years), Reelfoot Lake would be lowered by 4 feet using the present water control structures (dam and spillway gates) or up to 8 feet using new water control structures. Dredging of existing channels may be required to facilitate an 8-foot drawdown. The drawdown would begin on June 1 and be completed by July 15, or earlier, using the new water control structures. A minimum of 120 days would be permitted for drying, and refilling would start between November 1 and November 15. Following the drawdown, the lake would gradually refill and be held at 283.2 feet mean sea level until June 1 of the following year.

## Alternative Four—Follow State Law on Surface Elevation

An interim management action, described in Public Chapter No. 670 of the Tennessee Public Acts of 1986, requires the gates of the water control structures to remain closed until the lake's surface elevation is higher than 283.6 feet mean sea level. The lake would still drain over the water control structure at its current level of 282.2 feet mean sea level, but the gates would not be opened until the lake exceeded the 283.6 feet mean sea level. This alternative would eventually be superseded by management options contained in the 50-year management plan issued by TWRA in March 1988.

## Alternative Five—Raise the Permanent Pool by 1 Foot

A new water control structure would be required, with a spillway level set at 283.2 feet mean sea level and adequate spillway capacity to control flooding above that elevation.

## Alternative Six—Implement Integrated Program of Dynamic Water Level Fluctuation Combined With Periodic Major Drawdowns

This alternative, preferred by FWS, is an integrated water-level management program that combines the management approaches defined in alternatives two (dynamic water fluctuation) and three (major drawdowns). This alternative would result in drying up and consolidating some of the silt and killing some of the undesirable vegetation. Complete implementation of this alternative can begin only after major mitigation measures—such as the purchase of land or easements to allow water to flow over the land, modifications to the state park and sewer system facilities, and surveys of cultural resources (like Indian mounds) and the implementation of measures to protect them—are completed, which may take several years. FWS has implemented an interim water-level management plan that does not require these major mitigation measures. The interim plan includes allowing the water level to fluctuate about 1 foot above the level of the lake at the time the lease was signed (283.2 versus 282.2 feet mean sea level) during the nongrowing season (November 15 to April 15) and about one-half foot above the 1941 level (282.7 versus 282.2 feet mean sea level) during the remainder of the year. As measures to mitigate the effects of water-level fluctuations are completed, the water level may gradually be changed until the integrated management program is fully implemented.

## Alternatives Considered but Rejected

Several alternatives were developed but eventually rejected because they either were beyond the scope of the environmental impact statement or could not be realistically implemented. One alternative was to return the lake to uncontrolled, natural water fluctuations. This alternative was not considered further because, while it might appear ideal in some respects, the resulting damage to private and public property could be extreme during periods of high water. Another alternative considered but rejected was dredging or excavating to remove the accumulated silt. Several of those who commented on the environmental impact statement believed that proper consideration had not been given to this alternative, which would increase the lake's depth rather than raising the lake's water level. Although dredging received additional consideration, it was rejected as infeasible because of the high costs (ranging from $6 million to $27 million). FWS also believed there would be operational complications because of the difficulties of disposing of the dredged material and dredging around the many stumps in the lake. Dredging was particularly favored by some of the Kentucky agricultural interests because, by increasing the lake's depth, it would reduce the amount of land, primarily highly productive farmland, that needed to be acquired to allow the lake's water to be raised.

# Comments From the Department of the Interior

Note: GAO's comments supplementing those in the report text appear at the end of this appendix.

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

JUL 29 1992

Mr. James Duffus III
Director, Natural Resources Management Issues
General Accounting Office
Washington, D.C. 20548

Dear Mr. Duffus:

Enclosed is the U.S. Fish and Wildlife Service's response to the draft General Accounting Office Report entitled: "NATURAL RESOURCES PROTECTION: Reelfoot Lake Lease Terms Met, but Lake Continues to Deteriorate" (GAO/RCED-92-99).

The Service agrees with the report and feels it is fair and relatively factual in its assessment of the primary causes of the lake's deterioration, options for improvement and the barriers that have to be overcome before meaningful actions can be taken. However, the Service does have clarifications and modifications that are addressed in the enclosed response.

If there are any questions, please let us know.

Sincerely,

Joseph E. Aldrich

For Assistant Secretary for Fish and Wildlife and Parks

Enclosure

**DEPARTMENTAL VIEWS ON DRAFT GENERAL ACCOUNTING OFFICE REPORT**

Natural Resources Protection: Reelfoot Lake Lease Terms Met, but Lake Continues to Deteriorate.

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According to the cover letter of the subject report, the General Accounting Office (GAO) was to: (1) determine the extent to which the Fish and Wildlife Service (FWS) had complied with the terms of the lease agreement; and (2) identify the primary causes of the lake's deterioration, options for improving the lake's condition, and barriers to implementing the options.

We agree with the report that the FWS has complied with the terms of the lease. We think this is evidenced by our past accomplishments, continued commitment, and cooperation with the Tennessee Wildlife Resources Agency (TWRA) in helping the State of Tennessee deal with what many refer to as "the unsolvable problems of Reelfoot Lake." In general, we also feel the report was fair and relatively factual in its assessment of the primary causes of the lake's deterioration, options for improvement, and barriers that have to be overcome before meaningful actions could be taken.

The problems besetting Reelfoot Lake are numerous, diverse, and complex, as well as sensitive. A generally agreed upon series of actions that are needed to improve the environmental conditions of Reelfoot Lake have been identified in the 1989 Reelfoot Lake Water Level Management Environmental Impact Statement (EIS) prepared by the FWS. Needed actions include the implementation of a more dynamic fluctuating water level, including a major drawdown and the construction of a silt retention basin along Reelfoot Creek. However, until and unless wholesale support can be generated for the acquisition of lands needed for the implementation of these actions, the accomplishment of the corrective measures would be difficult to implement.

Although not critical, the report's assessment is that the FWS has substantially complied with the terms of the lease agreement. There are several references in the report which indicate an apparent misunderstanding relative to the expected results of specific management actions and the lack of a clear understanding as to why certain management actions cannot be immediately implemented. These references are identified and discussed in the comments which follow. Since the report contains no recommendations, but only findings, assessments, and conclusions, the comments will be directed to those. For clarity, those sections of the report commented on are referenced above each response.

Page 1, Paragraph 1: "The lake also serves as a flood-retention reservoir, capturing drainage from highly productive, but highly erodible, cropland bordering the lake and the streams that empty into it."

See comment 1.

**This sentence implies that an objective/purpose of Reelfoot Lake is to serve as a flood-retention reservoir; this is not the case, nor should the inference be made.**

Page 1, Paragraph 2: "Although the terms of the lease agreement allow FWS to fluctuate and to temporarily draw down the lake's water level to remove silt and undesirable aquatic vegetation, FWS has generally followed a management policy of maintaining the lake's water level as close as possible to the level at the time the lease agreement was signed in 1941."

See comment 1.

**The terms of the lease agreement with respect to artificially raising or lowering the water level of the lake are stated in reference to cleaning and removing or destroying obnoxious plant or animal life, not for the purpose of removing silt. The lease's reference to control of silt is through the construction and maintenance of silt basins and erosion control work on the refuge area. Raising and lowering water will not remove silt.**

Page 1, Paragraph 2: "FWS has adopted this policy in order to strike a balance between agricultural interests who would prefer that the lake's water level not be raised because of the increased risk of flooding thousands of acres of prime Tennessee and Kentucky cropland, and recreational interests who would prefer that the lake's water level not be lowered because of its adverse impact on lake-based activities."

See comment 1.

**The FWS adopted this policy (of constant water level management) not only as an attempt to give consideration to all interests but to prevent damage and associated Service liability to private and state lands/facilities as a result of permitting higher lake levels.**

Page 2, Paragraph 4: "The major causes of the lake's accelerated aging and deteriorated water quality have been well documented; they are (1) agriculturally related silt reaching the lake primarily from cropland in Tennessee and (2) the lake's artificially maintained stable water level that prevents the silt and accompanying vegetation from being dried up or flushed out."

See comment 2.

See comment 1.

**The environmental problems of Reelfoot Lake, as identified in the 1989 EIS, stem from two primary sources: (1) siltation reaching the lake primarily from cropland in Tennessee and (2) hypereutropic conditions caused by the accumulation of undecomposed organic material and high nutrient inflow, plus limited water level fluctuations. Again, the implication that silt can be "flushed out" is**

**incorrect. Nothing short of physical removal by dredging, or drag line, etc., will actually remove silt from the lake bed.**

Page 3, Paragraph 1: "Allowing more natural fluctuations of the lake's water level coupled with periodic major drawdown would help remove the silt in the lake and kill unwanted vegetation."

See comment 1.

**Allowing more natural fluctuations of the lake's water level and periodic drawdowns are not expected to "remove" existing silt from the lake. The drawdown phase of the preferred alternative will consolidate the muck-type bottom sediments thereby increasing the volume/capacity of the lake. The higher fluctuating water level should reduce the amount of undesirable vegetation in the lake and increase the vegetative fringe around the shoreline which should reduce the amount of sediment flow into the lake.**

Page 3, Paragraph 1: "However a more formidable barrier facing FWS and TWRA appears to be implementing a program that will ensure the long-term preservation of the lake while, at the same time, maintaining the balance between competing agricultural and recreational interests."

See comment 1.

**Completion of the associated mitigative features identified in the EIS will decrease or eliminate many of the barriers presently existing between conflicting interests. For example, the acquisition of designated lands up to elevation 285 feet mean sea level would eliminate potential conflicts with farming interests.**

Page 3, Paragraph 2: "Located in northwestern ... encompassing over 14,000 acres."

See comment 1.

**The lake encompasses over 15,000 acres at full pool.**

Page 5, Paragraph 2: "The lease agreement also requires FWS to operate and maintain the water control structures located at the south end of the lake and to maintain a water level of not more than 3 feet above and below the spillway level at the time the lease was signed (282.2 feet mean sea level)."

See comment 3.

**Although the lease agreement gives the Service the authority to fluctuate the water level 3 feet above and 3 feet below the spillway and to temporarily drain the lake, this does not absolve the Service from the legal/environmental aspects associated with management actions, such as raising the lake level 3 feet or a drawdown, which could adversely impact private and state lands/facilities and archaeological resources, respectively.**

Page 6, Paragraph 3: "In the last decade, studies by FWS, TWRA, the U.S. Army Corps of Engineers, and others have confirmed that the primary causes of Reelfoot Lake's accelerated aging and

deterioration are (1) silt, which includes soil erosion and nutrients such as phosphorous and nitrogen, that is rapidly filling the lake and its surrounding wetland primarily from cropland in Tennessee (2) the lake's artificially maintained stable water level."

See comment 2.

**The environmental problems of Reelfoot Lake stem from two primary sources: sedimentation and hypereutrophic conditions. The lake's artificially maintained stable water level simply aggravates the eutrophication process.**

Page 7, Paragraph 3: "Moreover, from 1941 to 1991, FWS generally allowed a management policy of maintaining Reelfoot Lake's water level as close as possible to the water level at the time the lease agreement was signed in an attempt to strike a balance between agricultural and recreational interests."

See comment 1.

**Moreover... to strike a balance between agricultural interests and to prevent damage-associated Service liability to private and state lands/facilities.**

Page 7, Paragraph 3: "While this policy complied...as a major contributing cause of the lake's continued deterioration."

See comment 2.

**The major causes were mentioned previously for page 6, paragraph 3.**

Page 8, Paragraph 1: "More natural water-level fluctuations, beyond those that have occurred because of rainfall, could have dried up or flushed out some of the silt in the lake and killed some of the undesirable aquatic vegetation."

See comment 1.

**As mentioned before, no type of water level management--either stable or dynamic--will remove or flush out any silt from the lake. This same misconception is mentioned again in the latter part of the next paragraph.**

Page 9, Paragraph 1: "Current plans call for FWS and TWRA to acquire about 900 acres of private land each for this project, and the Congress has appropriated $2 million for FWS' acquisitions."

See comment 4.

**Current plans call for FWS and TWRA to acquire about 1,000 acres and 2,500 acres, respectively.**

Page 10, Paragraph 2: "FWS preferred alternative for removing the silt and undesirable aquatic vegetation that are accumulating in the lake was a water level management program that integrates dynamic water level fluctuations of at least 2 feet each year -- varying between 280 feet and 284 feet mean sea level depending on rainfall and other climatic conditions--with a major drawdown every 5 to 10 years."

See comment 1.

The preferred alternative is not expected to "remove" existing silt from the lake. The drawdown phase of the preferred alternative will consolidate the muck-type bottom sediments thereby increasing the volume/capacity of the lake. The higher fluctuating water level should reduce the amount of undesirable vegetation in the lake and increase the vegetative fringe around the shoreline which should reduce the sediment flow into the lake.

Page 11, Paragraph 2: "According to the refuge manager, however, FWS does not plan to conduct a major drawdown until all the major mitigation measures have been completed so that the lake can be refilled up to the 284 feet mean sea level called for in FWS' preferred integrated water level management alternative."

The Regional Director's Record of Decision on Reelfoot Lake water level management states: "Implementation of the preferred alternative will of necessity be done in two phases. Phase 1, which will begin immediately, will be an interim management plan that will change the past practice of stable water levels but will not cause the undesirable impacts that will eventually be eliminated through the mitigation measures described above. When the needed mitigation measures are in place, Phase 2 (full implementation of the preferred alternative) will begin."

The EIS states ..."Complete implementation of the preferred alternative can commence only after major mitigative measures such as purchase of lands as flowage easements, modification to the state park and sewer system facilities, and cultural resources surveys and protective measures are completed or in place. However, some changes in water management could be implemented as certain mitigative measures are in place. Once mitigative measures for cultural resources are in place, an interim phase of the preferred alternative could be implemented without significant impacts."

"As mitigation of other impacts above these levels are in place, the water level practices could be changed in a gradual manner until all mitigative measures are eventually in place and the preferred alternative fully implemented.

See comment 1.

Although this language specifically refers to implementation of the interim water level plan, it would appear that other phases of the preferred alternative could be implemented as specific mitigative measures are implemented/completed."

Page 11, Paragraph 2: "Because the lake is entirely owned by the State of Tennessee and FWS, no land or easements need to be acquired and a major drawdown could be accomplished with little or no impact on the State of Kentucky."

See comment 1.

**This is a true statement, yet mitigation features associated with a drawdown would need to be in place before a drawdown was initiated.**

Page 13, Paragraph 1: "A more formidable barrier, however,...."

See comment 1.

**Refer to response to Page 3, Paragraph 1: "However,..."**

Page 13, Paragraph 2: "An example of the difficulty FWS and TWRA have had in maintaining a balance between recreational and agricultural interests is the agencies' recent efforts to change FWS' management policy of maintaining the lake's water level as close as possible to the 1941 level. In 1985, TWRA requested, and FWS agreed to, a transfer of control of the lake's spillway to TWRA."

See comment 1.

**This example used does not represent a conflict between recreational and agricultural interests. The plaintiffs in this example represented recreational interests opposed to the short-term impacts of resource management actions.**

Page 14, Paragraph 2: "While FWS has raised the lake's water level..., the condition of Reelfoot Lake continues to deteriorate."

See comment 1.

**The FWS presently does not have the mitigative features identified in the EIS in place to implement a major drawdown. The archaeological reconnaissance/surveys required to conduct a drawdown of four feet will cost the Service hundreds of thousands of dollars. Other potential negative impacts associated with reduced waterfowl habitat, reduced public access to open water, reduced tourism and public use for local lake-based businesses, fish kills and associated odors, encroachment of undesirable vegetation into the lake, loss of cypress trees, less forage fish available for bald eagles, less soil moisture for agricultural crops, and lower water quality would need to be addressed and/or mitigated prior to a drawdown.**

Page 14, Paragraph 3: "While FWS...possible to the level at the time the lease agreement was signed has been identified as a primary cause of the lake's continued deterioration."

See comment 1.

**The FWS management policy of stable water level management is more of a contributing factor of the lake's continued deterioration. Siltation and eutrophication remain the primary causes of the lake's deterioration. This misconception continues to appear throughout the report.**

Page 15, Paragraph 1: "FWS has developed an integrated water-level management program to remove some of the silt and undesirable aquatic vegetation from the lake, and one alternative would have been to implement the program incrementally beginning with a major drawdown of the lake's water level."

See comment 1.

Once again, the water management program in place does not remove silt from the lake. Also, as mentioned earlier certain mitigative measures must be in place before full implementation of the plan. A major drawdown of the lake level cannot be implemented until the mitigative measure for cultural resources are in place. Refer to the response for page 11, paragraph 2.

Page 15, Paragraph 1: "FWS has chosen instead to delay the program's implementation until all the major measures required to mitigate its effects have been completed..."

See comment 5.

This statement is inaccurate. As stated earlier in response to page 11, paragraph 2, the FWS Record of Decision, dated September 25, 1987, states that ..."Implementation of the preferred alternative will of necessity be done in two phases. Phase 1, which will begin immediately, will be an interim management plan that will change the past practice of stable water levels, but will not cause the undesirable impacts that will eventually be eliminated through the mitigation measures described above. When the needed mitigation measure are in place, Phase 2 (full implementation of the preferred alternative) will begin."

The FWS implemented Phase 1 of the preferred alternative in May of 1991 with implementation of the Interim Water Level Management Plan. Phase 1 of the preferred alternative was implemented in an experimental manner with changes to be made as needed. As mitigation of the other impacts are in place, the water level practices may be changed in a gradual manner until all mitigative measure are eventually in place and the preferred alternative fully implemented.

See comment 1.

Siltation, as a primary cause of the lake's continued deterioration, and the need for additional sediment basins should be included in this section. The reduction/control of silt flowing into the lake is equal, if not more important, than an integrated water level management program.

Page 20, Paragraph 2: "However, if changes to the lease adversely affect land in Kentucky--e.g., by raising the lake's water level so that Kentucky land is flooded--the State of Kentucky and its citizens have the right to take legal action to protect their interests."

See comment 1.

The FWS's liability to the citizens of Kentucky would be no different than the FWS' liability to the citizens of other states, if adversely impacted by actions of FWS.

Page 26, Paragraph 2: "The most recent court ruling, rendered in December, 1990, confirmed that FWS had the authority under the lease to alter the lake's water level, including conducting a major drawdown."

See comment 1.

**The most recent court ruling...The December, 1990 ruling, also confirmed the FWS's authority to implement the preferred alternative as identified in the EIS. However, the identified mitigative measures for each action (drawdown, fluctuating water level) must be in place before implementation. Otherwise, the Service could potentially incur liability as a result of adverse impacts to private/state lands and facilities.**

Page 33, Paragraph 2: "Because of local opposition and environmental restrictions, chemical use was discontinued on the lake in 1972. Limited use of chemicals continued on the lake's banks until 1976 and on boat trails until 1984."

See comment 1.

**Because of local...discontinued on the open water areas of the lake in 1972. Limited use of chemicals continued on the lake's banks and boat trails until 1975.**

Page 39, Paragraph 2: "By slowing the flow of runoff from Reelfoot Creek into the lake, the retention basin would also augment the flood control capacity of the lake."

See comment 6.

**Refer to response to Page 1, Paragraph 1: "The lake..."**

Page 40, Paragraph 2: "Initially, FWS and TWRA planned to acquire about 1,300 acres each for the silt retention basin, and the Congress added $1 million to FWS fiscal year 1991 budget for this purpose."

See comment 4.

**As mentioned earlier, current plans call for FWS and TWRA to acquire about 1,000 acres and 2,500 acres respectively.**

Page 42, Paragraph 2: "The refuge has also used other work programs, such as Youth Conservation Corps and Neighborhood Youth Corps, in recent years."

See comment 1.

**The Neighborhood Youth Corp is actually the Young Adult Conservation Corp.**

Page 45, Paragraph 1: "Reelfoot Lake's deterioration resulting from siltation and stable water level have long been known to the state, FWS and users of the lake."

See comment 2.

**Again, we would make the same point made in our response to page 2, paragraph 4: "The major..."**

Page 56, Paragraph 1: "This alternative would flush out and dry up some of the silt and kill some of the undesirable vegetation."

See comment 1.

**Again, this alternative is not expected to "flush out" silt in the lake itself. A general reference is made in the FWS EIS that a dynamic fluctuation could result in flushing of sediments from drainageways/tributaries draining into Reelfoot Lake.**

The following are GAO's comments on the Department of the Interior's letter dated July 29, 1992.

## GAO's Comments

1. The report has been revised to recognize these comments.

2. FWS' July 1989 environmental impact statement on water-level management, TWRA's 1988 50-year management plan for Reelfoot Lake, the Corps' 1988 reconnaissance report, and the 1989 Reelfoot Joint Venture Project draft report all identify stable water-level management as a major contributing cause of Reelfoot Lake's deterioration. Following a discussion with an FWS regional official, we revised the report to recognize that a major cause of the lake's deterioration is the accumulation of undecomposed organic material, which is aggravated by the lake's artificially maintained stable water level. The FWS official concurred with this revision.

3. This section of the report describes the terms of the lease agreement. This comment has been incorporated into the section of the report that discusses the mitigation measures needed to implement FWS' preferred alternative, identified in its July 1989 environmental impact statement on water-level management at Reelfoot Lake.

4. We revised the report to incorporate more precise data provided by TWRA in its comments on the draft report—that is, about 1,100 acres are to be acquired by FWS and about 3,200 acres are to be acquired by TWRA.

5. The draft report stated that FWS did not plan to conduct a major drawdown until all the mitigation measures needed to implement the complete integrated water-level management program identified in FWS' environmental impact statement were completed. In its comments, Interior stated that FWS could implement the second phase of the program, which would include a major drawdown as specific mitigation measures are implemented or completed, rather than waiting until all the mitigation measures are in place before beginning the second phase. According to an FWS regional official, once the appropriate mitigation measures are in place, FWS would pursue options that would allow a major drawdown before completing the mitigation measures needed to raise the lake's water to the higher level called for in the integrated program. The report has been revised to reflect these comments.

6. This statement comes from the Corps' 1988 reconnaissance report.

# Comments From the Tennessee Wildlife Resources Agency

Note: GAO's comments supplementing those in the report text appear at the end of this appendix.

TENNESSEE WILDLIFE RESOURCES AGENCY

ELLINGTON AGRICULTURAL CENTER
P. O. BOX 40747
NASHVILLE, TENNESSEE 37204

July 22, 1992

Mr. James Duffus III
Director, Natural Resources Management Issues
United States General Accounting Office
Resources, Community, and Economic Development Division
Washington, D.C. 20548

re: TWRA Comment: GAO Draft Report
Reelfoot Lake Lease Terms Met But Lake
Continues To Deteriorate

Dear Mr. Duffus:

See comment 1.

Thank you for requesting the comments of the Tennessee Wildlife Resources Agency on your Reelfoot Lake Draft report referenced above. We are generally in agreement with the GAO conclusion that the Fish and Wildlife Service (FWS) has met the terms of the 1941 lease agreement with the State. We should state, however, that we would like to have seen more aggressive pursuit of funding by FWS to assist the State in accomplishing what remains to be done at Reelfoot.

See comment 2.

The report often refers to the concept of striking a "balance" between agricultural interests and recreational interests. These two factions are so diametrically opposed to each other, that the notion of striking a "balance" between them does not seem appropriate. Lands that must be flooded in order to achieve the goals of Reelfoot Lake management cannot be farmed traditionally. These are lands inappropriately encroached upon by farmers in the past. There is usually no way to "balance" these lands to somehow allow them to serve both purposes. Plans are to eventually purchase agricultural lands in Tennessee and Kentucky below Elevation 285 so that private lands would not be impacted by lake management practices.

See comment 1.

Sometimes, such as at the top of page two, the term "recreational interests" needs to be clarified. The general lake users at Reelfoot tend to favor manipulation of lake levels. Businesses (dock owners, motels, etc.) sometimes oppose lake level manipulation because of the short term impact on revenues.

The State of Tennessee

AN EQUAL OPPORTUNITY EMPLOYER

See comment 1.

Another general comment refers to the references to the drawdowns as a method of removing silt (sediment) from the lake. Drawdowns will result in drying and compaction of sediment deposits in the lake. Unless these deposits are excavated from the lake (an alternative that has been dismissed as too expensive), the drawdowns will not contribute to actually removing them. Similarly, it cannot be "flushed out" as stated at the bottom of page two.

We would like to make the following comments specific to page numbers in the draft:

See comment 1.

1. Page 9, 1st paragraph; page 40, 2nd paragraph: For the silt retention basin at the mouth of Reelfoot Creek, TWRA plans to acquire 3,216 acres which constitutes what is needed lying east of SR 22 and north of SR 157. Two hundred, fifty one of those acres have been purchased as of now. The Fish and Wildlife Service will acquire 1,112 acres which constitutes what is needed lying west of SR 22 and south of SR 157. Discussion in these two paragraphs should be refined to reflect these figures.

See comment 1.

2. Page 10, last paragraph: The discussion of what remains to be accomplished to implement the major drawdown should reflect the fact that 2,345 acres of Tennessee land has been acquired already. Since Tennessee cannot make such acquisitions in Kentucky, the assistance of FWS is desperately needed there.

See comment 1.

3. Page 11, last sentence of the first full paragraph: We question the need for all major mitigation measures to be in place in order for FWS to conduct a major drawdown. The acquisition of lands and modifications to state park and community sewage treatment facilities are not required to conduct drawdowns - only to raise the lake above normal pool elevation.

See comment 1.

4. Page 14, 1st full paragraph: See points 2 and 3 above.

See comment 1.
See comment 1.

5. Page 23, last line: Change "make" to "made".
Page 47, 9th line: Change "built" to "build".

See comment 1.

6. Page 43, last paragraph: The drawdowns conducted by FWS in the '50's and '60's were minor winter drawdowns, not the kind of drawdowns needed for significant fisheries and lake condition improvement.

See comment 1.

7. Page 47, last line: The "some land" referred to here could be specifically stated as 2,345 acres.

See comment 3.

8. Page 48, 1st full sentence: It is true that the Corps' feasibility study has not been certified for funding. Circumstances have changed in the past several years, however, so that it probably could easily be authorized now.

See comment 1.

9. Page 51, 4th indented point: "a fish pond" in Kentucky is a proper name: Fish Pond

See comment 1.

We appreciate consideration of these comments for adjustments in the final draft of your report. Most importantly, we solicit the most aggressive efforts of FWS to assist us outside of the refuge boundary in acquiring agricultural lands in Kentucky below Elevation 285, and help with sediment control projects. Of course, the major first step in this effort is for FWS to seek funding to facilitate these needs.

Please contact me at 615/781-6552 if you would like our views clarified.

Sincerely,

Gary T. Myers
Executive Director

GTM/bjs
cc: Mr. Ron Fox
Mr. Harold Hurst
Mr. Jim Johnson
Mr. Ken Arney
Mr. Dan Sherry

The following are GAO's comments on the Tennessee Wildlife Resources Agency's letter dated July 22, 1992.

## GAO's Comments

1. The report has been revised to recognize these comments.

2. We refer to FWS' policy of maintaining a stable water level over the life of the lease as a means of "striking a balance" between the agricultural and recreational interests. The report recognizes the divergent interests of the two groups and the barriers they create to implementing options for improving the lake's condition.

3. We recognize in our discussion of the Corps' reconnaissance report that the Department of the Army has elevated restoration of fish and wildlife resources to a high priority, which provides justification for reconsideration of the feasibility study. The Corps' Memphis District intends to continue its efforts at Reelfoot Lake.

# Comments From the Commonwealth of Kentucky

COMMONWEALTH OF KENTUCKY
OFFICE OF THE GOVERNOR

BRERETON C. JONES
GOVERNOR

THE CAPITOL
700 CAPITAL AVENUE
FRANKFORT 40601
(502) 564-2611

July 24, 1992

Mr. James Duffus III, Director
Natural Resources Management Issues
U.S. General Accounting Office
Washington, D.C. 25048

Dear Mr. Duffus:

On behalf of the people of the Commonwealth of Kentucky I want to thank you for the opportunity to comment on the draft report entitled Natural Resources Protection: Reelfoot Lake Lease Terms Met, but Lake Continues to Deteriorate. We offer the following comments regarding the report.

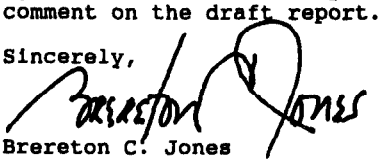
The Commonwealth of Kentucky is very interested in stopping the deterioration of the water quality in Reelfoot Lake. The lake is a natural asset to the Western part of our state. It enhances the tourism industry and the annual economy of the area. It also provides a beautiful area for recreation and relaxation for the citizens of this part of the country.

The preferred plan for improvement of the quality of water in the lake or alternative six (6) causes concern of the citizens of Kentucky. This alternative, calling for periodic drawdown and water fluctuation, would adversely affect recreation, tourism and agricultural interests. The report recognizes mitigation for land rights and easements for land that would be flooded due to the one (1) additional foot in elevation of the permanent pool.

Although Kentucky is not a party to the lease agreement, we urge that control of Reelfoot Lake through the lease agreement remain with the U.S. Fish and Wildlife Service. The Conservation Districts and other conservation agencies in Kentucky will intensify their efforts to reduce erosion and land siltation. We stand ready to cooperate with other agencies in using existing and new programs to reduce erosion and prolong the life of the lake.

Again, we want to thank you for the opportunity to comment on the draft report.

Sincerely,



Brereton C. Jones

/jw

# Comments From the Department of Defense

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310-0103

21 JUL 1992

Mr. James Duffus III
Director, Natural Resources
Management Issues
Resources, Community, and Economic
Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Duffus:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "NATURAL RESOURCES: Reelfoot Lake Lease Terms Met, but Lake Continues to Deteriorate," dated July 7, 1992 (GAO Code 140640/OSD Case 9127).

The DoD has reviewed the draft report and concurs without further comment. The Department appreciates the opportunity to review the report in draft form.

Sincerely,

Nancy P. Dorn
Assistant Secretary of the Army
(Civil Works)

# Comments From the Department of Agriculture

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20250

29 JUL 1992

SUBJECT: U.S. General Accounting Office Draft Report RCED-92-99, "NATURAL RESOURCES PROTECTION: Reelfoot Lake Lease Terms Met, but Lake Continues to Deteriorate"

TO: James Duffus III
Director, Natural Resources Management
Issues, Resources, Community and
Economic Development Division

The Soil Conservation Service and the Agricultural Stabilization and Conservation Service reviewed the official draft report titled "Natural Resources Protection: Reelfoot Lake Lease Terms Met, but Lake Continues to Deteriorate" (GAO/RECD-92-99).

Neither agency has any comments to offer on the report.

JOHN H. BEUTER
Acting Assistant Secretary
Natural Resources and Environment

# Major Contributors to This Report

| | |
|---|---|
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