UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

SEDIMENTATION IN LAKE TUSCALOOSA, ALABAMA

Open-File Report 76-158

Prepared in cooperation with

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University, Alabama

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ILLUSTRATIONS

Factors for converting English units to International System (SI) units

The following factors may be used to convert the English units published herein to the International System of Units (SI). Subsequent reports will contain both the English and SI unit equivalents in the station manuscript descriptions until such time that all data will be published in SI units.

Multiply English units	By	To obtain SI units
	Length	
feet (ft)	0.3048	metres (m)
miles (mi)	1.609	kilometres (km)
	Area	
acres	.4047	*hectares (ha)
square miles (mi^2)	2.590	square kilometres (km^2)
	Flow	
million gallons per day (mgd)	.04381	cubic metres per second (m^3/s)
	Mass	
tons per square mile (T/mi^2)	.3503	tonnes per square kilometre (t/km^2)

* The unit hectare is approved for use with the International System (SI) for a limited time. See NBS Special Bulletin 330, p. 15, 1972 edition.

SEDIMENTATION IN LAKE TUSCALOOSA, ALABAMA

By E. F. Hubbard

ABSTRACT

Lake Tuscaloosa is a water-supply and recreation reservoir on the North River in Tuscaloosa County. Present sediment yield of the North River basin is approximately 300 tons per square mile per year (105 tonnes per square kilometre per year). Surface mining, construction, or other activities that severly expose the earth could drastically increase the sediment yield of the basin. For present conditions, it is estimated that the time required to completely fill the storage capacity of the reservoir with sediment is over 3,000 years. If as much as 10 percent of the North River basin is severely exposed to erosion, the life of the reservoir might be reduced to slightly more than 200 years; and the useful life, even less.

There is legislation to protect the lake from excessive sedimentation, but this legislation will require enforcement to be truly effective. Further regulations requiring a buffer zone between mining operations in the lake, or tributaries to the lake, and a mandatory requirement of settling ponds to trap sediment carried by the runoff from severel exposed areas may be necessary to completely protect the lake. A program of sediment monitoring could provide accurate information on the rate at which sediment is reaching the lake.

THE PROBLEM

Lake Tuscaloosa is an impoundment of the North River at a point where the drainage area of the basin upstream is 417 square miles (1,080 square kilometres).[1/] The lake has a surface area of 5,885 acres (2,382 hectares) and a length of approximately 25 miles (40 kilometres) as measured along the old river channel. The purposes of the lake are primarily water supply and recreation. The lake was filled to a design elevation of 223.2 feet (68.0 metres) above mean sea level in 1969. Figure 1 is a high-altitude photograph of the lake.

Tuscaloosa city and county officials and interested citizens have been concerned about possible deterioration of the water quality of the lake. A principal concern is the possibility of a drastic increase in sedimentation from construction or mining in the basin. A recent article in the Birmingham News (Barton, 1975) outlines this problem in Lewis Smith Lake in north Alabama. There, active strip mining is reported to have caused serious problems of sedimentation and turbid water.

T. W. Daniel, Jr. (written commun., 1975), Head of the Office of Coal Research of the Geological Survey of Alabama, estimates that more than 50 percent of the North River basin above Lake Tuscaloosa is underlain by coal that could be removed by surface-mining techniques. This approximation is based on a study of the coal resources of the half of the basin that is depicted on the Samantha 15-minute topographic quadrangle. If significant

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1/ Geological Survey policy requires the use of International System (SI) units in published reports in addition to the more familiar English units. A table on page iv gives factors for converting English units to SI units.

Figure 1.--High-altitude photograph of Lake Tuscaloosa,

taken from NASA U-2 aircraft.

strip mining occurs in the basin, Lake Tuscaloosa may have problems similar to those reported at Lewis Smith Lake. Additionally, there is a possibility that sediment reaching the lake will drastically increase as a result of the construction that is occurring as the population in the basin increases, particularly with many people being attracted to build on the shores of the lake itself.

To assess the magnitude of the potential sediment problem, the Geological Survey of Alabama, which is conducting a cooperative environmental study of the Lake Tuscaloosa area with the city and the county, asked the U.S. Geological Survey to investigate sedimentation in Lake Tuscaloosa. This report conveys the results of that investigation.

THE EFFECTS OF SEDIMENTATION

Some sedimentation in a reservoir is almost unavoidable--a result of relatively minor erosion in the basin. In fact, a certain amount of sedimentation may be helpful to a reservoir in that harmful materials in the water such as trace metals, or nutrients that might cause eutrophication of the lake, are trapped by the clay particles associated with the sediment. Most of the clay particles subsequently settle to the bottom of the reservoir where the trapped undesirable materials have little effect on water quality. However, because severe exposure of the soil in the basin can cause drastic increases above the desirable level of reservoir sedimentation, it is necessary to consider the harmful effects of sedimentation.

The prime purpose of Lake Tuscaloosa is to provide sufficient storage of good water to meet municipal needs during periods when the flow of the North River is less than the quantity required. The present safe yield of the reservoir is calculated to be approximately 200 million gallons per day (8.8 cubic metres per second). During a severe drought the city could use water at this rate without completely depleting the reservoir. An increase in the amount of sediment reaching Lake Tuscaloosa would increase the rate at which sediment deposition was reducing the storage capacity of the reservoir, which would have the effect of reducing the safe yield available to the city.

The lake is presently very popular with fishermen in the area, often the scene of fishing tournaments, and almost never without a number of people enjoying their hobby. A drastic increase in the rate of sedimentation could very well reduce this fishery resource. Heavy sedimentation would smother fish eggs and reduce or prevent the growth of aquatic plants that are part of the food chain.

One of the first processes in purifying water for municipal supply is that of removing suspended material. Needless to say, chemicals used in this process are expensive and the amount required increases with the sediment concentration. Thus, an increase in sediment reaching the lake would increase the cost of water treatment. Also, if the increase in sedimentation was associated with strip mining or some other activity that might add undesirable dissolved materials or otherwise decrease the water quality, the treatment cost would rise even higher. The water from strip-mining areas typically contains excessive sulfates and is acidic.

Lake Tuscaloosa is a great asset to Tuscaloosa County because of its beauty. Many people have moved to the vicinity of the lake to enjoy this beauty. Much of the shoreline is surrounded by picturesque sandstone bluffs that rise, in places, more than 100 feet (30 metres) above the surface of the lake. In the spring, these bluffs are covered with blooms of wild flowers consisting principally of rhododendron (fig. 2). The water in the lake is usually very clear; however, after heavy rain it becomes turbid and often

Figure 2.--Rhododendron blooming on the sandstone bluff along Carroll Creek, April 1975.

contains a great deal of debris. Figure 3 shows the debris in the upper part of the lake following the rains that occurred during the middle of March 1975. If some activity caused an increase in the sediment yield of the basin, the water in the lake would be muddy longer and the volume of material settling in the lake would be larger.

Sediment-laden tributary streams, as they reach the backwater of the lake, first drop the coarse sandy material. This deposition forms deltas or bars that can extend for some distance upstream and choke the entire flood plain of the stream. Figure 4 shows a small sand bar found on Carroll Creek below an area of residential development. The finer clay particles in the sediment-laden streams move further into the lake making the water turbid, and eventually either go over the spillway and out of the reservoir or settle downward to form mud flats under the water surface.

Heavy sedimentation could completely choke tributaries and small coves. Figure 5 shows an example of the effect of heavy sedimentation in Lake Harris, another City of Tuscaloosa water-supply lake. Here a tributary stream is completely filled, including the low-water channel and the flood plain, and a delta has formed out into the lake. The reason for the formation of this sediment deposit is apparent in figure 6, an upstream view of the tributary. The land is almost barren of vegetation and is covered with spoil piles left behind after strip mining for coal.

THE STUDY

There were two phases to this study, which was conducted from March through June 1975. One phase consisted of the data collection necessary to determine the present rate of sedimentation in the lake. Because the activities that might drastically increase sedimentation have not yet occurred to any extent in the basin, the other phase of the study consisted

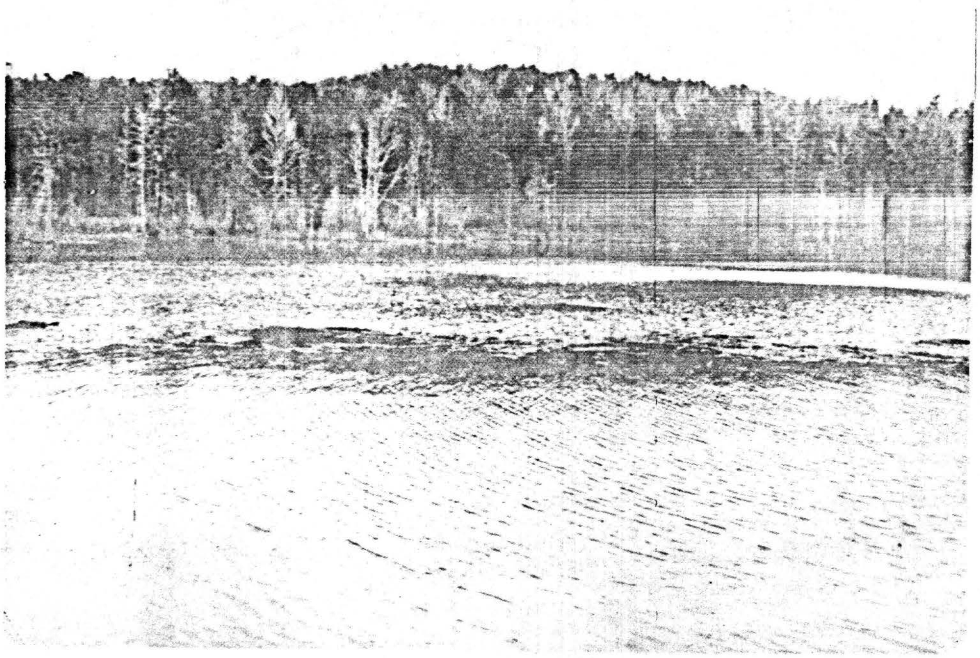

Figure 3.--Debris in upper part of lake, March 16, 1975.

Figure 4.--Small sand bar on Carroll Creek, April 1975.

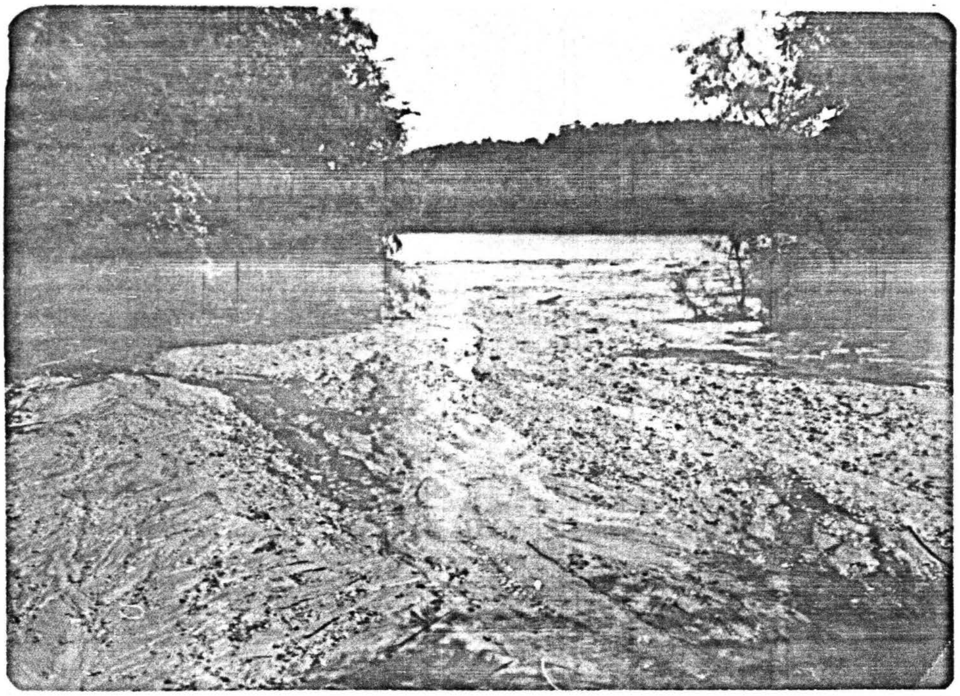

Figure 5.--Effects of heavy sedimentation in Lake Harris, June 1975.

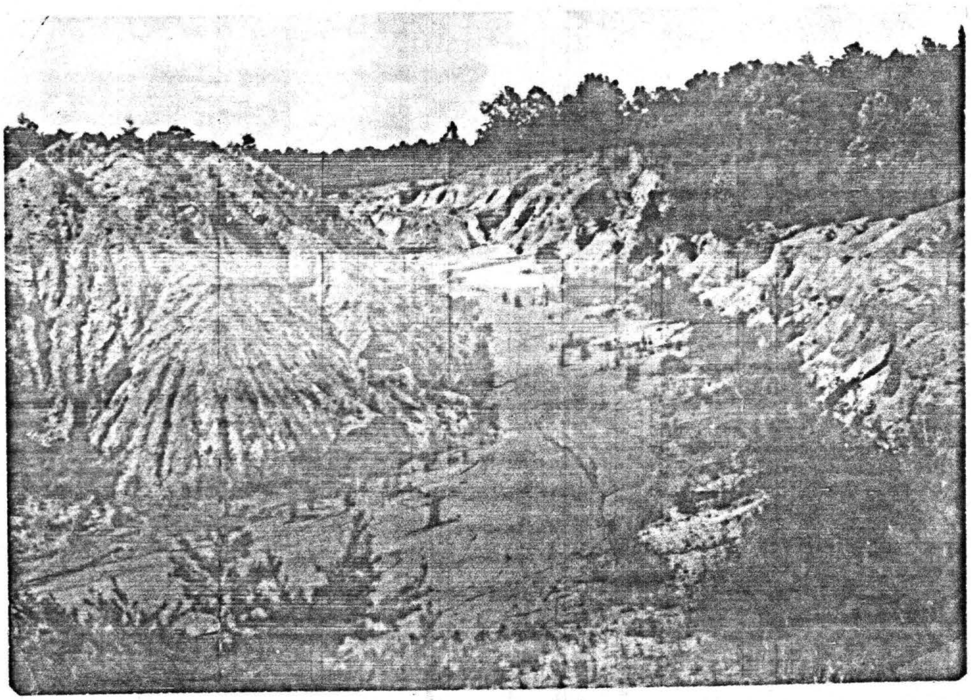

Figure 6.--Strip-mined area along a tributary to Lake Harris, June 1975.

of a literature search to determine the rate of sedimentation that could result if mining, construction, farming, or logging activities increase.

The data-collection phase of the project included the operation of a sediment-sampling station at the long term gaging station, North River at Samantha, which is located at the county road 38 crossing of the river a few miles upstream from the lake. The drainage area of the basin above this site is 219 square miles (567 square kilometres), thus the station measured the sediment yield of more than half of the North River basin upstream from the Lake Tuscaloosa Dam. Figure 7 is a photograph of the sediment-sampling apparatus at North River at Samantha.

Another data-collection activity was the collection of sediment samples from the lake. The project team made three sampling trips during selected hydrologic events to determine the concentration of suspended sediment in the lake. Three sites were sampled--at Hilltop Estates landing just downstream from the confluence of Turkey Creek and North River, near the mouth of Carroll Creek, and near the dam. The samples were collected in such manner as to represent the average concentration of sediment with respect to both width and depth in the cross sections, which were perpendicular to the length of the lake at the sampling site.

The first set of samples were taken in March 1975 following a period of heavy rainfall and associated flooding. The lake level was high, and the water contained much sediment and debris. Figure 8 is a photograph of a sediment sample being collected during this trip.

A subsequent sampling trip in April followed a long decline in streamflow, reflecting a period of dry weather. Lake level was at a low for the 3-month study period. The June sampling trip was during a period of unsettled water. Although inflows and lake levels were relatively low during the

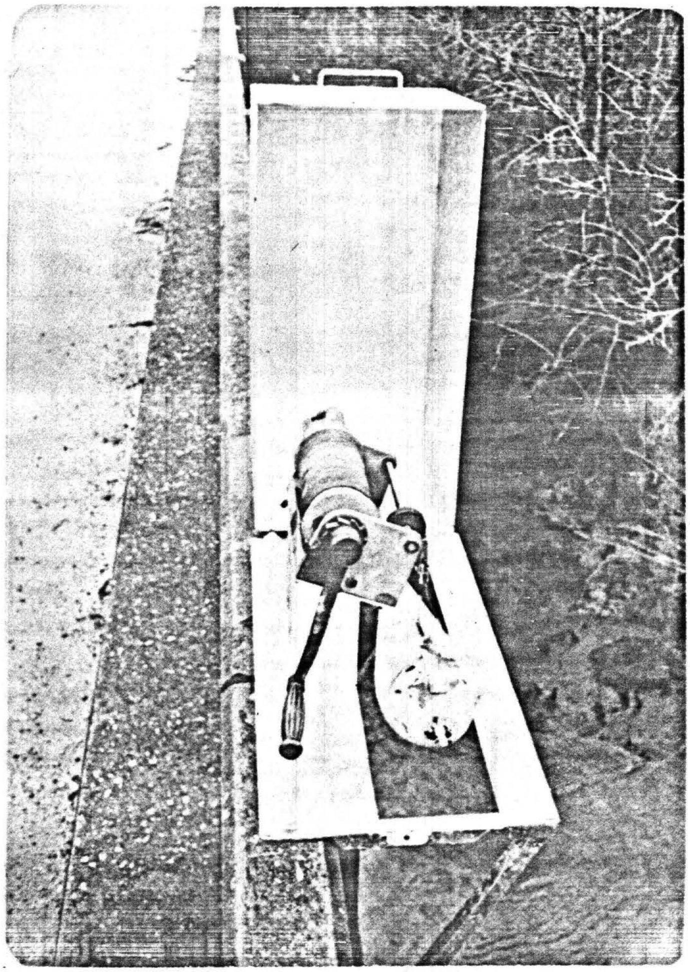

Figure 7.--Sediment-sampling apparatus at North River at Samantha, March 1975.

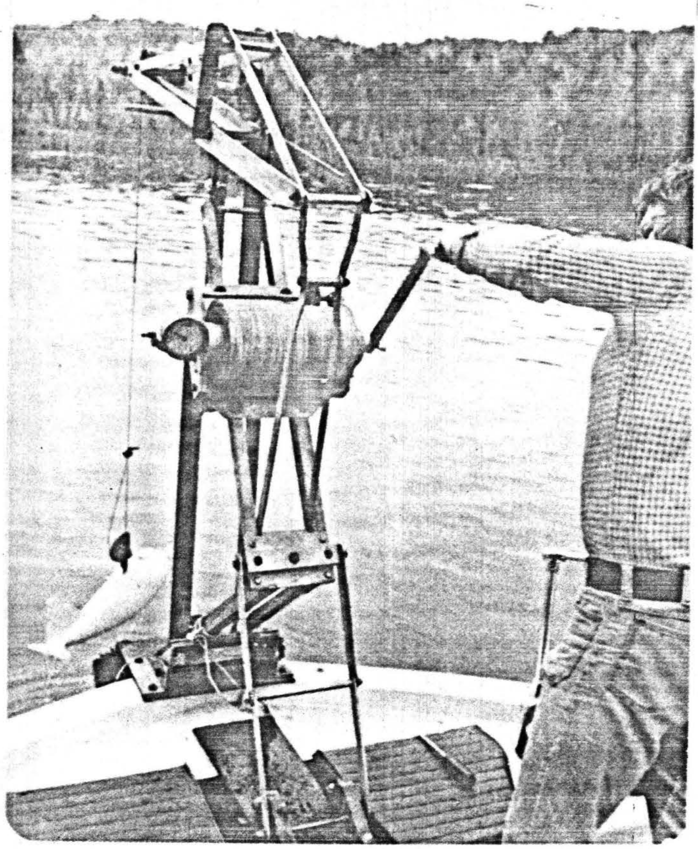

Figure 8.--Sediment sample being collected from the lake, March 1975.

preceding days, they exhibited quite a bit of variability. Thus, the sediment samples collected in the lake during the study period represented a wide variety of hydrologic conditions ranging from flood to low flow. Hubbard (1976) gives the results of the analysis of these samples in a separate report.

An important part of the data-collection phase of the project was the opportunity to observe the movement and deposition of sediment in the lake. Some evidence of sediment deposition was noted at nearly every small tributary visited during this study. Figure 9 shows the formation of the sand bar on the northeast side of the lake near the dam. The rapid buildup of sediment at this point resulted from the erosion of exposed land on the hillside above. During construction of the earth-filled dam, it was necessary to obtain large amounts of fill material both from the east and the west side of the dam. The barrow pit on the west side was grassed over; however, funds did not permit the grassing of the barrow pit on the east side. As a result, the exposed east barrow pit has contributed to this minor sediment problem in the lake.

The other phase of the project consisted of a literature search--which also included discussions with investigators presently working in the fields of lake sedimentation, mineral resources, or surface-mining techniques. The purpose of this phase was to determine the potential for strip mining in the North River basin and to estimate the effect that this and other activities in the basin might have on the rate of sedimentation in the lake. A key factor in estimating the increase in the rate of sedimentation that might occur as a result of strip mining or other activity is the area of exposed earth. To determine this area, it was necessary to study the potential of the North River basin for strip mining and to use information for nearby

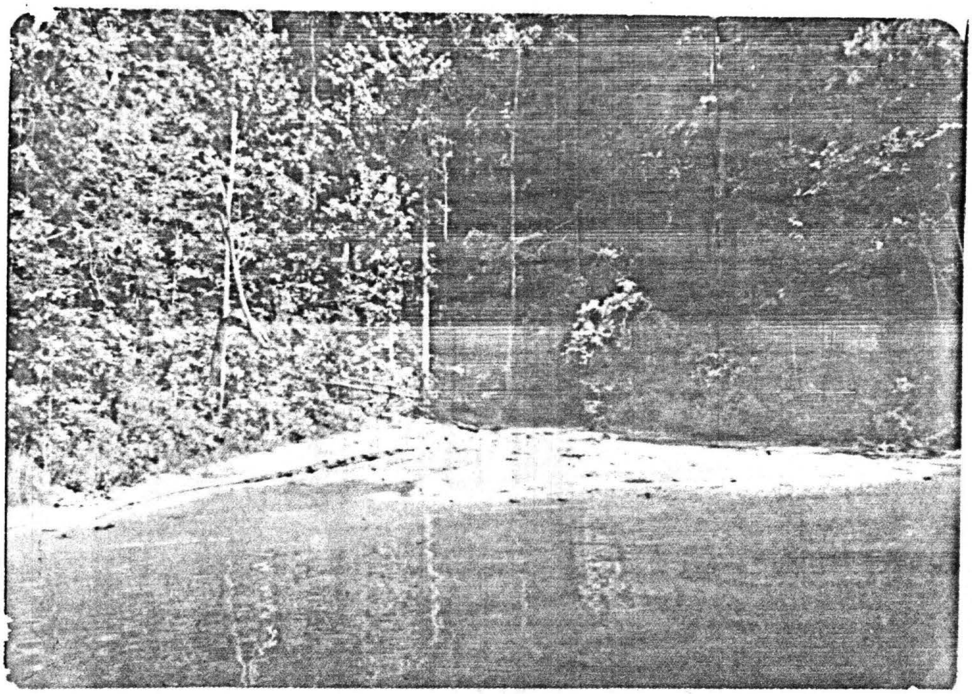

Figure 9.--Sand bar in the lake near the dam, June 1975.

actively mined areas that have coal deposits and overburden similar to those in the North River basin. Strip-mining activity in east Tuscaloosa County is depicted in figure 10. This area outside of the North River basin has been actively mined since before the turn of the century. By determining the amount of severly exposed land in this area, it is possible to estimate the probable land exposure in the North River basin.

The remainder of the literature search consisted of reviews of studies concerning the sediment yield from strip-mined areas in Tuscaloosa County or nearby states and that resulting from highway construction or other severe exposure of the land in several eastern seaboard states.

RESULTS

During the investigation, sediment samples were collected daily at the Samantha station, except during major floods when they were collected at more frequent intervals. Simmons (1975) presents a technique utilizing long term gaging station records and sediment data collected for a short period of time to estimate the long term average sediment yield of a basin. Based on this technique, the present sediment yield from the North River is about 300 tons per square mile per year (105 tonnes per square kilometre per year). This sediment yield is considered relatively low for the area. Rainwater (1962) shows that sediment yields range from about 400 to 3,000 tons per square mile per year (140 to 1,050 tonnes per square kilometre per year) for the part of the country in which the North River basin lies.

Part of this average annual sediment yield results from the formation of gullies or sheet erosion. Figure 11 shows typical erosion that is occurring in the North River basin.

Figure 10.--Strip mining in east Tuscaloosa County, June 1975.

Figure 11.--Eroded land in the North River basin, March 1975.

By using the average annual sediment yield of the North River and assuming that this yield is typical of the entire basin upstream from the dam, it is possible to estimate the life expectancy of the lake; that is, the length of time required to fill the lake with sediment to the top of the spillway. To make this estimation, it is necessary to assume a trap efficiency for the lake, which is the percentage of sediment arriving from the North River and the other tributaries that will be deposited in the lake. As will be covered in more detail later in this report, Lake Tuscaloosa may be expected to last for more than 3,000 years before being completely filled with sediment, assuming a 95-percent trap efficiency.

An interesting, but perhaps incidental, part of the data collection was the observation of bank erosion occurring around the lake. Figure 12 shows a bank along the main body of the lake actively eroding. This phenomena, however, has minor effect on the total sediment load entering the reservoir. Evidence for this conclusion are the times during the summer when the lake water is very clear, indicating little sediment input, and yet the wakes of the many boats and water skiers are causing more bank erosion than at any other time of the year.

If sediment is entering the lake at a fairly low rate under present conditions, what is the potential for a drastic increase in sedimentation? Collier and Musser (1964) in a study of sedimentation resulting from strip mining in the Beaver Creek basin of Kentucky measured a sediment yield of 30,000 tons per square mile (10,500 tonnes per square kilometre) from a strip-mined area in 1959. In a parallel study, Roehl and Johnson (1964) used an empirical soil-loss equation to estimate the average sheet-erosion potential of the strip-mined land in the Beaver Creek basin as being 47,000 tons per square mile per year (16,500 tonnes per square kilometre per year).

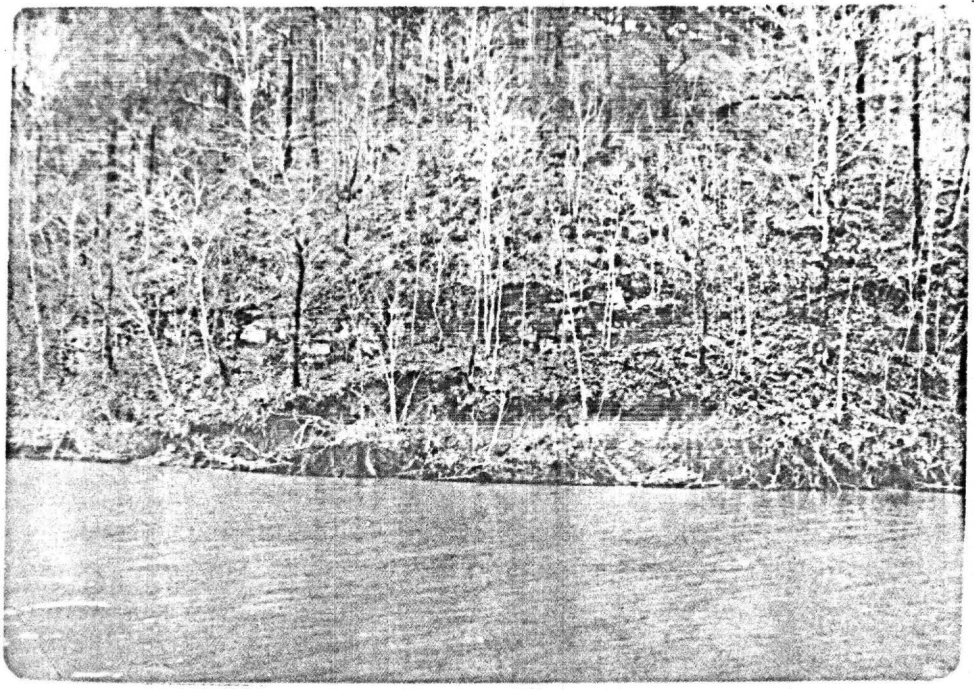

Figure 12.--Bank erosion along the lake, March 1975.

Arteaga and Hubbard (1974), using the results of a study of data from several eastern seaboard states, concluded that an annual sediment yield of nearly 68,000 tons per square mile (23,800 tonnes per square kilometre) can result from a severely exposed area of 1 square mile (2.59 square kilometres).

Vice, Guy, and Ferguson (1969) measured the sediment yield from a severely exposed area associated with highway construction in northern Virginia. During a 3½-year period, they measured an average yield of 36,000 tons per square mile (12,600 tonnes per square kilometre) per year. Figure 13 shows the runoff occurring from a construction site in Tuscaloosa County during heavy rains of March 1975.

One of the most startling examples of sedimentation from strip mining occurred on Daniel Creek in Tuscaloosa County. The downstream part of Daniel Creek was a Corps of Engineers public recreation area. The Corps had utilized old railroad trestles and tunnels to construct a scenic hiking trail along the creek, which is surrounded with some of the most rugged terrain in the county. The Daniel Creek basin, however, is the scene of considerable strip mining (figure 14). Sediment yield from the strip-mined areas became so great that the creek channel, including the flood plain, was filled. Figure 15 shows the filled channel, the trees that were killed, and the flow of the creek which is now on top of the thick bed of sediment.

The U.S. Army Corps of Engineers (1974) measured the sediment deposited in the channel during 1973. This deposition, which did not include the fine materials washed downstream to the Black Warrior River, represented a sediment yield of 300,000 tons per square mile (105,000 tonnes per square kilometre) from the strip-mined part of the basin. The Corps report states that this high yield may be attributable to the practice that the mining companies had of placing their spoil in the creek or along the banks of

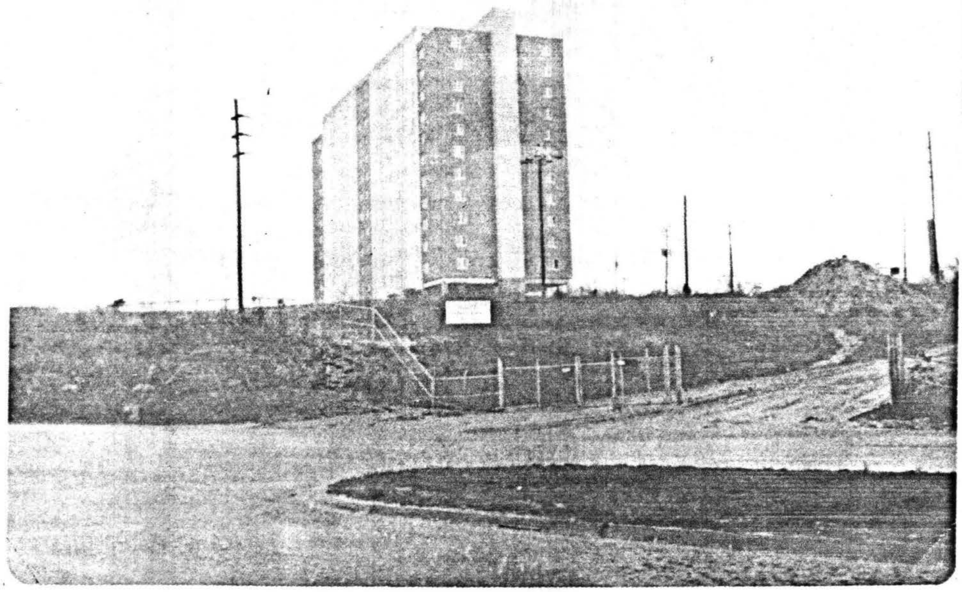

Figure 13.--Sediment-laden runoff from a construction site in Tuscaloosa County, March 1975.

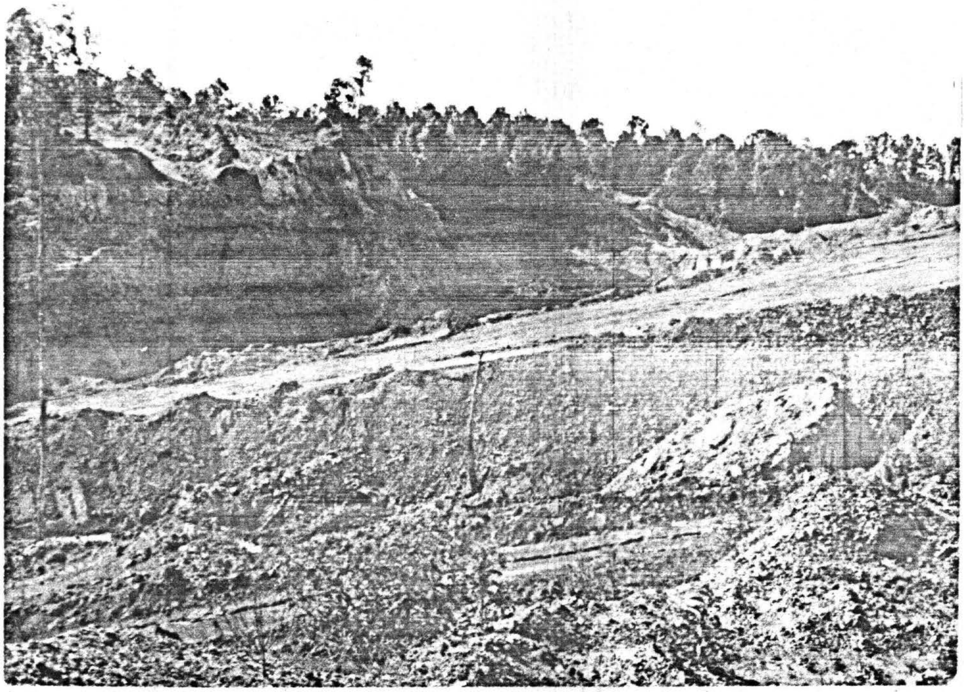

Figure 14.--Strip-mined area in Daniel Creek basin, June 1975.

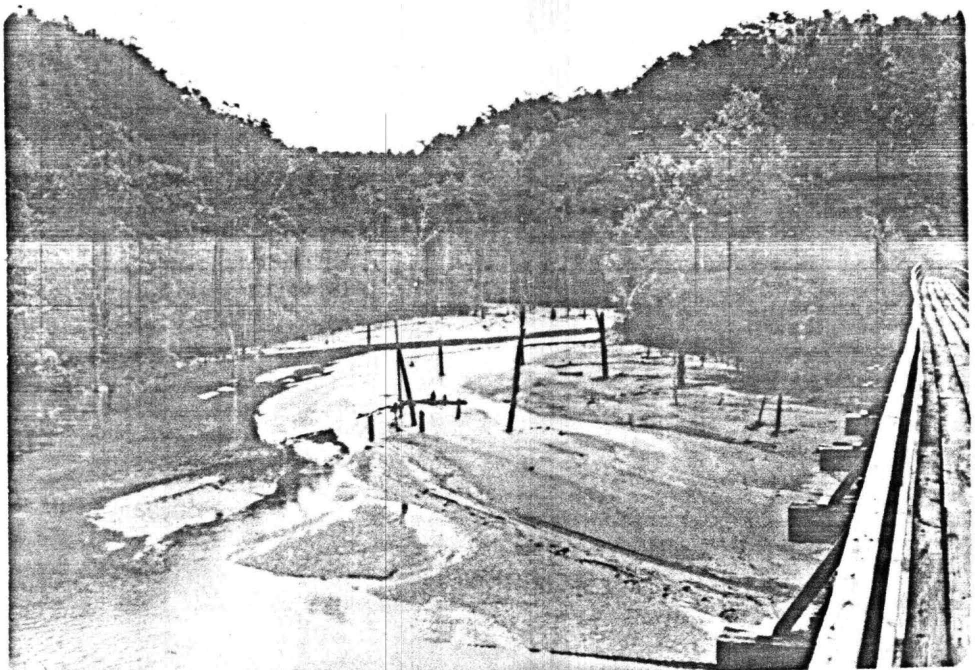

Figure 15.--Sediment-choked channel of Daniel Creek, June 1975.

the creek. Had this practice not been followed, the sediment yield of the strip-mined areas might have been an order of magnitude lower, similar to the yields experienced in Kentucky. This supposition serves to illustrate that mining practices can have profound impact on the amount of sediment entering a stream.

As reported above, other investigators have estimated sediment yields from severely exposed areas ranging from 30,000 to 300,000 tons per square mile (10,500 to 105,000 tonnes per square kilometre) per year. Based on these results, this report assumes that a sediment yield from a severely exposed area of 40,000 tons per square mile (14,000 tonnes per square kilometre) per year is a reasonable value to use in subsequent interpretation.

By knowing the natural sediment yield of a basin, and by assuming the yield from severely exposed land, one can estimate the increase in sediment yield, if the area to be exposed is known. Earlier, this report mentioned that more than 50 percent of the North River basin is underlain by coal that could be removed by surface-mining techniques. Because the removal is dependent on the price of coal, the economics may be such that much of this resource will never be mined. Other factors, such as clean air standards, might decrease the demand for the coal from the North River basin, which has a relatively high sulfur content. And, needless to say, present government regulations or those which may be promulgated in the future could either encourage or inhibit surface mining in the basin. Overall, however, Ward and Evans (1975) predict a doubling of Alabama coal production by 1985. The North River basin surely must share in this tremendous increase in the rate at which coal will be mined. Even so, east Tuscaloosa County, an area which has been extensively surface mined for many years, and which contains a generally better grade of coal than that in the North River basin, has had only a small percentage of the land disturbed by mining operations. J. G. Newton (written comm., 1975) after studying 1973 aerial photography of an approximately 300 square mile (780 square kilometre) area in east Tuscaloosa County, reports that only 4 percent of the total land area is disturbed by strip-mining operations--including the mining pits, spoil piles, and coal-haul roads. Even when considering the two townships most heavily mined in east Tuscaloosa County, Newton reported that only 11 percent of the total land area had been severly exposed. Thus, it would seem unlikely that the over 400 square mile (1,040 square kilometre) North River drainage basin would ever experience more than 5 to 10 percent of the total area severely exposed because of strip mining.

The culmination of this phase of the project is the graph, figure 16, which shows the years required to completely fill the total storage capacity of Lake Tuscaloosa with sediment versus the percentage of the total basin severely exposed by mining, logging, construction, farming, or other activities. Zero percentage on the graph represents conditions as they presently exist in the basin.

To construct this relationship, it was necessary to make some preliminary assumptions. As mentioned earlier, the first assumption was that sediment yield from a severely exposed area would be at the rate of 40,000 tons per square mile (14,000 tonnes per square kilometre) per year. Another assumption was that the trap efficiency of the lake, that is, the percentage of sediment that would remain in the lake of the total that entered, would be 95 percent. Of course, as the lake approached a full condition the trap efficiency would progressively decrease. The calculations of the life of the lake did not account for the effects of the lessened trap efficiency.

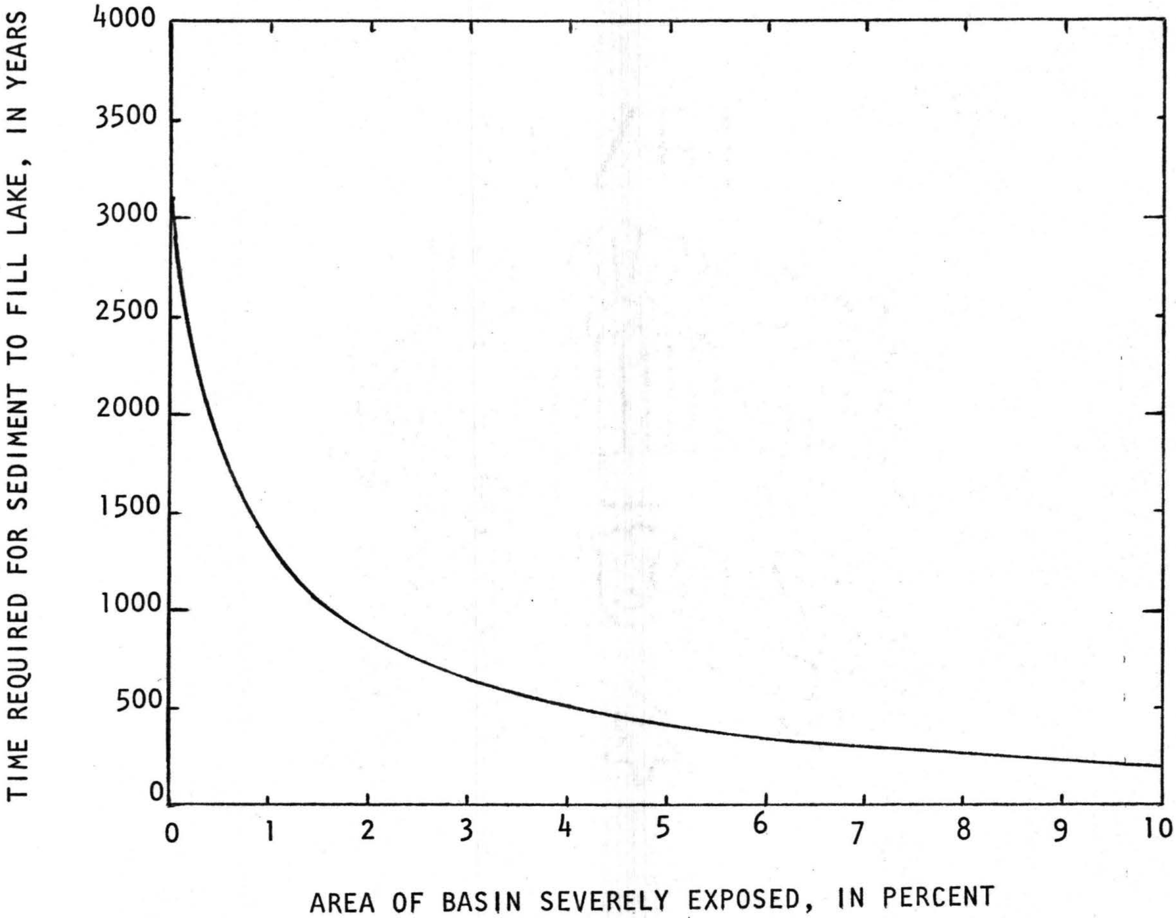

Figure 16.--The time required to completely fill the storage capacity of Lake Tuscaloosa versus the area of the drainage basin severely exposed, assuming a 95 percent trap efficiency.

The graph was also based on the concept that the disturbed land would remain severely exposed during the entire period of time required for sediment to fill the lake. Thus, even if 10 percent of the basin is strip mined during the next few years, proper reclamation could heal the scars and the basin would experience a high sediment yield for a relatively short time as compared to the expected life of the lake.

Bailey (1975) predicts that coal resources available for surface mining, with only moderate increases in production, will be depleted in the next 20 to 30 years. Based on this prediction, it would seem improbable that the basin would remain severely exposed because of strip mining for more than about 50 years; however, during this period of exposure, irreparable damages would be done.

While changes in the assumptions could shift the graph (fig. 16) up or down and variations in the percentage of severely exposed area during the lifetime of the lake would shift parts of the curve; the shape of the curve is determined by the mathematical principles involved. No matter what the starting assumptions are, a great deal of damage will be done to the lake if even a very small percentage of the basin is severely exposed. The graph shows that the life of the lake is reduced by more than half with only 1 percent of the basin severely exposed.

CONCLUSIONS

There are two basic courses of action that could be taken to protect Lake Tuscaloosa from effects of greatly increased sedimentation. One alternative would be to insure that the present rate of sediment entering the lake is either maintained or decreased. To achieve this condition it would be necessary to exercise regulatory control of construction, farming, mining, and logging in the North River basin. The control would have to extend beyond Tuscaloosa County into that part of the North River basin which lies in Fayette County.

A more viable alternative might be one that would allow the utilization of coal and other resources of the basin, but would reasonably prevent these activities from causing excessive damage to the lake. Regulations reducing sedimentation in the lake would have to minimize the areas exposed to severe erosion in the basin. A vigorous program of land reclamation would be necessary so that, at any one time, only the actively mined area would be severely exposed.

Reclamation could include terracing the spoil piles and steep slopes, or returning the land surface to the original slopes, and replanting and reforesting the exposed land.

All drainage from the actively mined area and those areas undergoing the process of reclamation could be diverted through a sediment basin to trap most of the sediment from the exposed area. These settling ponds would have to be designed to hold the runoff from a heavy rain falling on the exposed area, allowing the water to leave the pond slowly after most of the sediment had settled to the bottom.

Another suitable regulation would be to minimize or prevent the occurrence of a severely exposed area in the vicinity of the lake or in the vicinity of streams in the basin. Some mandatory buffer zone between the lake or its tributaries and mining activities or any other activity that severely exposes the soil would aid in reducing the total load of sediment reaching the lake.

Present regulations, if enforced, would probably achieve most of the goals outlined above. The Alabama Water Pollution Control Act of 1971

(Act 1260, 1971 Regular Session) charges the Alabama Water Improvement Commission with establishing and enforcing regulations to prevent those discharging any effluent to a stream from contravening water-quality standards.

There are no water-quality standards that deal directly with the concentration of sediment in the water, but the Water Improvement Commission, in a draft report (written comm., 1975) has proposed standards dealing with turbidity. These standards, which differ for streams of differing classifications, generally state that the increase in turbidity will not be visible above natural turbidity nor be detrimental for the intended use of the water.

To implement the Water Pollution Control Act, the Water Improvement Commission adopted a set of surface-mining regulations on June 14, 1974. In general, these regulations called for the issuance of a permit by the Commission prior to surface mining in the State. The issuance of this permit is contingent on the applicant furnishing a plan designed to minimize the effect of his activity on water resources. While not made mandatory, the Water Improvement Commission includes with these regulations guidelines suggesting a buffer zone of 100 feet (30.5 metres) from water courses in the area, ditches to divert runoff from the mined area and settling basins constructed below mining activities or coal washing operations to allow for the settling of sediment and coal fines and to permit other water treatment such as reducing acidity. If the Commission is strict in enforcing these regulations and guidelines, and if they effectively monitor the implementation of the plans, then the adverse effect of surface mining on Lake Tuscaloosa could be greatly minimized.

Other legislation that will help protect the lake is the Alabama Surface Mining Reclamation Act of 1975 (Act 551, 1975 Regular Session), which sets up a commission to regulate certain activities of companies engaged in surface coal-mining in the State. A major part of the act is directed toward reclamation of strip-mined land. While the act does not directly deal with the effect of strip mining on water resources, it does require a rapid reclamation of the land after completion of strip-mining activities. This requirement effectively reduces the area of severely exposed land to that which is being actively mined. Generally, the act requires that within 6 months after the completion of mining operations, or by the next growing season, that the strip-mined area be graded and replanted to trees or other vegetation. Again, this law will require enforcement to fully achieve all the benefits pertaining to water quality.

The 1975 act requires a setback of 1,000 feet (305 metres) for surface-mining activities from the shoreline from Lewis Smith Lake and from the rim of Little River Canyon. A similar regulation would be beneficial to the water quality in Lake Tuscaloosa. For additional protection, such a regulation might also require a buffer zone between mining operations and tributaries to the lake.

Because Lake Tuscaloosa is a major water-supply and recreation lake, it would be reasonable to have a mandatory requirement of a settling pond capable of retaining the drainage from any area of disturbed earth associated with mining, construction, or other activities. Ponds such as these would not only allow sediment to be trapped, but would permit pH adjustment or other water treatment as necessary.

A continuing program of sediment monitoring is necessary to protect the lake. A minimum program would be to operate sediment measuring stations on North River at Samantha, and on selected smaller tributaries. A more elaborate program would include sediment measurement of more smaller tributaries, monitoring of strip mining or other activities, and periodic sediment measurements within the lake.

SUMMARY

Presently, the estimated sediment yield of the North River basin is about 300 tons per square mile (105 tonnes per square kilometre) per year. At this rate it will take approximately 3,000 years to completely fill the storage capacity of the lake, assuming a 95-percent trap efficiency. Coal mining, construction, or other activities that severely expose the soil will increase the sediment yield of the basin drastically, reducing the life of the lake.

More than half the North River basin is underlain by coal that could conceivably be mined using surface techniques. Based on reasonable assumptions, if as much as 1 percent of the land area in the North River basin is severely exposed, the life of the lake can be reduced by more than half. If as much as 10 percent of the basin is exposed to erosion, the life of the lake can be reduced to about 200 years. The useful life of the lake could be much shorter than this because the sediment load might soon ruin the lake for recreation or for water supply.

Present legislation protecting the lake includes the Alabama Water Pollution Control Act of 1971 and the Alabama Surface Mining Reclamation Act of 1975. Enforcement of regulations stemming from these acts would afford the lake some degree of protection against sedimentation. Mandatory requirements, however, for settling ponds below severely exposed areas and for buffer zones between these areas and the lake or its tributaries, could do much to protect water quality. Lewis Smith Lake, for example, is specifically protected by the Alabama Surface Mining Reclamation Act of 1975, which requires a 1,000-foot (305 metres) setback from the lake for any surface-mining operation.

A final and most important recommendation is that a continuing program of sediment monitoring be established for Lake Tuscaloosa. Only with an accurate knowledge of the amount of sediment entering the lake can steps be taken to protect this important resource.

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