Arkansas
RESOURCES AND DEVELOPMENT COMMISSION
STATE CAPITOL
LITTLE ROCK

Mr. Wayne Fletcher
Executive Director
Arkansas Resources & Development Commission
State Capitol
Little Rock, Arkansas

Dear Sir:

Since opposition to the Wolf Bayou Dam was first expressed by several mineral property owners and mineral producers at the public hearing at Newport, Arkansas, on October 12, 1949, our Division has been making a study of the mineral resources of the Wolf Bayou reservoir area and the possible effects of the reservoir on these resources. As a part of this study a brief reconnaissance survey was made of the reservoir area in conjunction with the Corps of Engineers geologists to supplement the data available from published maps and reports. The detailed information resulting from these studies appears in the attached report prepared by Mr. Drew F. Holbrook, and is summarized briefly as follows:

I. High-Calcium Limestone

A. High-calcium limestone is a valuable, essential, and exhaustible mineral resource.

B. Proven deposits of high-calcium limestone occur in the Wolf Bayou reservoir area along the White River from Penters Bluff to Guion.

C. The current production of high-calcium limestone from the reservoir area is valued at $823,280 and is used in processing Arkansas bauxite. In addition to the above, according to information furnished us, Batesville White Lime Company with an annual production valued at $1,200,000.00 will, within the near future, be dependent upon limestone deposits located at Williamson Switch and Bolt Spur, both within the area affected by the dam.

D. The potential production of high-calcium limestone from the reservoir area far exceeds the current production because of new limestone plants being planned to serve the needs of the chemical industries in the expanding Gulf-Southwest and, because of the increased limestone requirements for lower grades of Arkansas bauxite. The deposits

in the proposed reservoir area are the only high-grade limestone and silica sand between northern Arkansas and the Gulf.

E. Wolf Bayou reservoir will render economically inaccessible and will in a few instances inundate the high-calcium limestone deposits in the reservoir area. The reservoir will also inundate numerous excellent plant sites in this area.

F. A barge system in the reservoir would increase present production costs 33-1/3 percent.

G. There are no other proven deposits of high-calcium limestone with significant reserves in Arkansas outside of the reservoir area that are accessible by railroad.

II. Silica Sand

A. Silica sand has been produced by the Silica Products Company at Guion, Arkansas, in the reservoir area continuously since 1922 for glass manufacturing, foundry sands and other uses.

B. Silica sand is widely distributed in north Arkansas especially in the St. Peter sandstone formation which is exposed in the reservoir area on both sides of the river from Guion to Sylamore.

C. The quality of the silica sand has been established only in the reservoir area in the vicinity of Guion.

D. The current (1948) production of silica sand from the reservoir area which is the only production in Arkansas is valued at $276,754.

E. New developments in silica sand operations are anticipated in the reservoir area because of the industrial expansion of the Gulf-Southwest and the new uses for this raw material in fillers, manufacture of fibreglass, etc.

F. Practically all of the 13 miles of St. Peter sandstone now exposed along White River from Guion to Sylamore as well as the Silica Products Company's plant and mines will be inundated by Wolf Bayou reservoir.

G. There are no outcrops of the St. Peter sandstone outside the reservoir area that are accessible to rail transportation.

III. Other Mineral Deposits

A. Deposits of manganese ore, phosphate rock and marble are known to occur in the reservoir area.

B. Sufficient time was not available during the recent investigation to determine the size of these deposits or the extent to which they would be affected by Wolf Bayou reservoir.

C. It is believed from the available published data that these deposits are significant enough to prevent their isolation or inundation.

From a review of this outline it might appear that the Wolf Bayou reservoir would merely result in an increased cost of some operations and the abandonment of a few others. The effects of this project are more far reaching, however. In the processing of bauxite, for example, the cost of the limestone used, to some extent, governs the grade of bauxite that can be mined. Consequently, an increase in the cost of limestone would have to be offset by mining higher average grades of bauxite and leaving the lower grades. This lower grade bauxite would be irretrievably lost as it would be covered with worthless sands and clays and a valuable natural resource would be wasted.

The aluminum business is now highly competitive and low production costs are an important factor in the survival of any company producing aluminum. We cannot afford to jeopardize the future of the $70 million aluminum production plants which are such an important part of the industrial economy of Arkansas by permitting an arbitrary increase in the cost of one of their basic raw materials.

The loss by inundation of the silica sand operation at Guion would be particularly unfortunate as this has been the only silica sand production in the state since the closing of the plant at Everton forced by the abandonment of the M. & A. railroad. Glass plants and foundries in Arkansas and other Gulf-Southwest states would have to obtain their silica sand from other areas probably at a higher cost. The possibility of developing silica sand operations outside the reservoir area has not been adequately investigated and there is no rail transportation available in other areas of St. Peter sandstone outcrop.

Since our Commission was originally created to encourage and stimulate the industrial development of the state, it behooves us to guarantee that such important industrial raw materials of proven value such as these White River mineral deposits be at all times available to both operating and prospective industries in the state and at the lowest possible cost. In view of the proposed construction of Wolf Bayou dam we are no longer able to state that deposits of high-calcium limestone or silica sand will be available in the future to prospective industries. The fact that the dam may not be constructed for 5 or even 10 years is of no consequence, as industries with a large

plant investment are interested in reserves of 50 years or more. Thus, the utility of some of the state's most essential mineral resources will be destroyed and the industrial development of the state retarded.

It is apparent from the preceding statements that the construction of the Wolf Bayou dam as specified in the Engineers survey report could seriously affect the basic economy and future industrial development of the state of Arkansas. Several possible solutions to this situation have been listed below:

1. Abandon the Wolf Bayou project

2. Move the location of the dam upstream to a point near Ruddells or Sylamore above these mineral resources.

3. Through detailed geologic mapping and adequate core drilling and sampling develop outside the reservoir area mineral deposits of a quality, quantity, and accessibility similar to the known deposits prior to further consideration of construction of the Wolf Bayou Dam.

In making these suggestions, we are not ignoring the benefits in flood control and power that can be derived from a dam such as Wolf Bayou, but it should be remembered that power can be manufactured—a natural resource cannot.

Sincerely yours,

Harold B. Foxhall
Director

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THE MINERAL RESOURCES OF THE WHITE RIVER VALLEY IN INDEPENDENCE, IZARD AND STONE COUNTIES, ARKANSAS WITH RELATION TO THE PROPOSED WOLF BAYOU DAM AND RESERVOIR

Division of Geology
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INTRODUCTION

On October 12, 1949, a public hearing was held at Newport, Arkansas, by the Corps of Engineers to receive the views of local interests on several proposed White River flood control and power projects one of which was the Wolf Bayou dam to be located on the White River approximately ten miles upstream from Batesville. At the Newport hearing several mineral producers and owners of mineral deposits went on record as opposing the Wolf Bayou project, pointing out that the reservoir would either inundate or render economically inaccessible their limestone and silica sand deposits. In order to give further consideration to the effect of the proposed Wolf Bayou reservoir on the mineral resources, a second hearing was held October 19, 1949, at the Arkansas State Capitol in Little Rock at the invitation of Wayne C. Fletcher, Executive Director of the Arkansas Resources and Development Commission. The meeting was attended by representatives of the Little Rock Corps of Engineers and further testimony on mineral resources was presented by owners and operators of mineral properties and by Mr. H. B. Foxhall, State Geologist. As a result of this second hearing a letter from the Arkansas Resources and Development Commission was sent to the District Engineer, Little Rock District, requesting that submission of the White River report be delayed for sufficient time to permit a re-evaluation and thorough study of the economics of the Wolf Bayou

project and that consideration be given to the matter of moving the proposed dam upstream to a point above these mineral resources.

The Division of Geology has attempted in the following report to summarize separately the significance of each mineral resource affected by Wolf Bayou reservoir and the extent to which this resource would be affected, and to evaluate the possibilities of finding deposits of these minerals in areas unaffected by the reservoir. Much of the data in the report has been presented at the two previous hearings, but some was acquired during a brief reconnaissance survey of the reservoir area made by the Division of Geology and the geologic section of the Little Rock Branch, Corps of Engineers, after the hearing at the State Capitol.

HIGH-CALCIUM LIMESTONE

General

Limestone, the rock, is common and abundant in the United States, but high-calcium* limestone constitutes only a very small part of the total volume of limestone rock. The importance of high-calcium limestone deposits today has been emphasized in a recent report** by Dr. Kenneth K. Landes, Chairman of the Department of Geology at the University of Michigan. A portion of the abstract of this report follows:

> "Contrary to usual opinion the reserves of limestone suitable for metallurgical operations (high-calcium limestone) are by no means unlimited. With very few exceptions, the high grade limestone deposits being exploited today will be exhausted during the next 50 years."

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* Limestone averaging 98 percent or greater in calcium carbonate content.

** Landes, K. K., Metallurgical limestone reserves - paper presented at Annual Meeting of the Geological Society of America, El Paso, Texas, November 1949.

From the foregoing statement it is apparent that high-calcium limestone is a valuable, essential, and exhaustible resource.

Distribution

High-calcium limestone outcrops in the vicinity of the proposed Wolf Bayou reservoir in the Kimmswick and Fernvale limestone formations and to a very limited extent in the Boone formation. Although outcrops of the Fernvale limestone are known to occur from Independence County westward to Newton County and the Kimmswick limestone outcrops in Independence, Stone and Izard Counties, these two formations reach their maximum combined thickness (150 feet at Penters Bluff, shown in Figure 1) and are accessible to rail transportation only in the Wolf Bayou reservoir area. In the reservoir area these two limestone formations are exposed in the bluffs along both sides of the White River from the Izard-Independence County line upstream to Sylamore in Izard County, a distance along the river of about 19 miles (see Plate I).

Quality

The Kimmswick limestone formation and all but the upper 10 to 15 feet of the Fernvale limestone formation are composed of high-calcium limestone in the Wolf Bayou reservoir area as shown by numerous chemical analyses of both drill core and surface samples two of which are listed below:

A. Analysis* of drill core from Hole #7, Myersville Quarry of the Reynolds Mining Company - Izard County, Arkansas

Depth in Feet From	To	Formation	SiO_2	Fe_2O_3	Total Carbonate
0.0	3.2	Fernvale	0.64	1.70	95.64
3.2	5.0	"	0.30	0.26	99.19
5.0	9.5	"	0.28	0.12	99.55
9.5	14.5	"	0.34	0.18	98.98
14.5	19.5	"	0.37	0.22	97.75
19.5	24.5	"	0.35	0.13	98.00
24.5	29.5	"	0.38	0.16	98.37
29.5	34.5	"	0.65	0.16	97.28
34.5	39.5	"	0.72	0.16	97.08
39.5	44.0	"	0.42	0.14	98.47
44.0	48.6	"	0.14	0.10	98.67
48.6	52.4	Kimmswick	0.22	0.10	98.83
52.4	57.4	"	0.32	0.08	99.81
57.4	62.4	"	0.04	0.08	100.01
62.4	66.3	"	0.47	0.08	99.19
66.3	71.3	"	0.19	0.08	99.40
71.3	76.3	"	0.14	0.12	98.88
76.3	79.3	"	2.10	0.10	97.34
79.3	81.3	"	11.47	0.14	86.16
81.3	85.2	Plattin	1.55	0.22	96.82

* Analyses by Reynolds Metals Company, Bauxite, Arkansas.

B. Analysis of a composite sample of Fernvale limestone from an outcrop 90 feet thick on the Missouri Pacific railroad half a mile south of Penters Bluff in Independence County, Arkansas

	Per Cent
SiO_2	0.45
Fe_2O_3 and Al_2O_3	0.60
$CaCO_3$	98.9
MgO	Nil
Total	99.95

Production of High-Calcium Limestone

At the present time one quarry (Myersville operation of the Batesville White Lime Company) is producing limestone from the reservoir area. This quarry (see Figure 2) furnishes limestone to the Jones Mill alumina plant of the Reynolds Metals Company. The production and value of limestone from the quarry according to Arkansas severance tax records are tabulated below:

1943 Production Short Tons	Value Per Ton Delivered at Bauxite	Total Value of 1943 Production
351,829	$2.34	$823,280

The limestone from this quarry is used as a flux in extracting aluminum from the lower grades of Arkansas bauxite. About one ton of limestone is required for each ton of bauxite. Any increase in cost in the limestone would have to be offset by mining a higher average grade of bauxite, and as a result the lower grades of bauxite left in the ground would be irretrievably lost, as they would be covered with valueless sands and clays. The limestone production from this quarry is not only

essential to the processing of Arkansas bauxite, but it represents 58 percent of the entire limestone production of the state.

Potential Production from the Wolf Bayou Reservoir Area

The potential production of high-calcium limestone from the Wolf Bayou reservoir area is much more important than the preservation of the current production from the Myersville quarry. The development of this resource in Arkansas is just beginning, and since high-calcium limestone is a basic mineral second only to coal in the manufacture of 150 important industrial chemicals, its development will follow closely the rapid industrial development of the Gulf-Southwest which began during World War II and has continued into the post-war period. The importance of the Arkansas deposits to this industrial development is illustrated by Plate III which shows the scarcity of high-calcium limestone deposits of the five-state Gulf-Southwest area. The following extracts from letters recently received by the Arkansas Division of Geology provide additional evidence of the scarcity of this important raw material. A letter from Leo W. Hough, State Geologist of Louisiana, dated November 29, 1949, states:

> "As you probably know, Louisiana is deficient in limestone and I do not know of any deposits which have a calcium carbonate content of more than 98%."

William C. Morse, State Geologist of Mississippi, in a letter dated November 28, 1949, states:

> "We have the pleasure of sending to you by separate mail Bulletin 46, Mississippi Agricultural Limestone, in which you will find a great deal of information requested. However, none of the limestones treated therein are going to be the high-calcium limestone you are seeking.

The current value of lime production in Missouri is a good example of the extent to which the high-calcium limestone resources of a state can be developed in an industrial area. In 1947 high-calcium limestone was used in the manufacture of 889,090 short tons of quick and hydrated lime valued at $7,000,426*. This figure does not include tonnages of high-calcium limestone sold to industry as stone.

Perhaps the most immediate increase in production of high-calcium limestone from the reservoir area will be an increased production of stone from the Myersville operation. This will develop as the higher grades of bauxite are exhausted and lower grades requiring more limestone for processing will be mined.

Several high-calcium limestone properties in the Wolf Bayou reservoir area are now being developed to meet the anticipated demand for this raw material in the Gulf-Southwest.

The White River Limestone Products Company of Little Rock, Arkansas, has core-drilled an extensive limestone deposit just southeast of Penters Bluff in Izard County, Arkansas, in the reservoir area (see Plate I). Machinery for the proposed plant is now being acquired and the products from this plant will include crushed stone, riprap, high-calcium limestone, aggregate, agricultural limestone and lime flour. Company officials estimate that 500,000 tons of limestone will be produced annually with a total annual value at the quarry of $625,000.

Mr. Roy Jeffery of Little Rock, Arkansas, has completed a survey of another large deposit of high-calcium limestone near Twin Creek about 5 miles downstream from Sylamore on the north side of White River, Izard County, Arkansas (see Plate I). Mr. Jeffery plans to produce 400,000

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* U. S. Bureau of Mines Minerals Yearbook for 1947, p. 709.

tons of high-calcium limestone annually of which 200,000 tons would be used in the manufacture of quick and hydrated lime and the remaining 200,000 tons would be sold as high-calcium limestone and agricultural limestone.

The Batesville White Lime Company now manufactures quicklime and hydrated lime with an annual value of $1,200,000 at its Limedale plant (see Figure 3) in Independence County, Arkansas. The quarry (see Figure 4) from which the company now obtains its high-calcium limestone is near Limedale and will not be directly affected by the proposed Wolf Bayou reservoir. Company officials, however, state that the reserves in their present deposit are limited and they will in the future be forced to rely on developed high-calcium limestone reserves at Williamson Switch and Bolt Spur, Izard County, both of which are in the reservoir area.

Effect of Wolf Bayou Dam and Reservoir on High-Calcium Limestone Deposits of the White River Valley

A recent joint survey of the geological division of the Little Rock Branch of the Corps of Engineers and the Arkansas Division of Geology, and published maps of the U. S. Geological Survey, show that the high-calcium limestone formations (Fernvale and Kimmswick) exposed along both sides of the White River lie, with a few exceptions, above the 410 foot contour which is the top of the flood control pool (see the geologic sections on Plate II). Thus, these deposits will not be inundated but they will become economically inaccessible, as the Missouri Pacific railroad which now follows the north side of the river will be inundated and the rugged topography of the region would make the truck haulage prohibitive.

The Wolf Bayou reservoir will also inundate numerous potential plant sites (see Figure 5) by flooding the lower portions of the tributary valleys

along the White River in the high-calcium limestone area. The principal streams on both sides of the White River have developed steep-walled valleys that broaden out as they approach the river. The relatively flat floors of these valleys near the river and the railroad afford excellent plant locations. The steep valley walls permit the early and relatively inexpensive development of a high quarry face with a minimum of rock wastage. These valleys also furnish dump areas for overburden and other waste rock. The disposal of waste rock from a quarry adjacent to the proposed reservoir would be a problem, as it is unlikely that such waste could be dumped into the reservoir.

For certain types of operations in which limestone is a raw material (the manufacture of quicklime and cement) it is necessary to have rail facilities at the plant site as the product cannot be exposed to the air for long periods. Since the Wolf Bayou reservoir would make it virtually impossible to establish plants of this type at the quarry sites along White River, such plants would have to be built outside of the reservoir area with the additional expense of excessive handling of the raw materials.

The Feasibility of a Barge System in the Reservoir

Although in its present form the White River report of the Corps of Engineers does not authorize the operation of a barge system in the Wolf Bayou reservoir, it has been suggested that it would be feasible to set up such a system to move stone out of the reservoir area. Under this system the stone from quarries operating in the reservoir area would be barged down to the dam where it would be passed through a chute and loaded into railroad cars. There are several objections to this solution to the problem, the most important of which are listed below:

1. It is assumed that even if such a system were authorized, the original cost, and maintenance and operating costs of the system would have to be borne by the mineral producers in the reservoir area.

2. Any individual or company desiring to begin operations after the reservoir is full would have to build separate dock facilities for his operation.

3. A barge system would not furnish a substitute for the plant sites that would be inundated by the reservoir.

It is apparent, therefore, that such a system would greatly increase production costs of a limestone operation in the reservoir area over the present costs. Personnel of the Little Rock District, Corps of Engineers estimated that a barge operation would increase limestone production costs 50 cents per ton, which would be a 33-1/3 percent increase over present costs of $1.00 per ton. Since the present margin of profit on high-calcium limestone is small (a large producer in the St. Louis area nets 10 cents a ton), this prohibitive cost increase would discourage the development of the high-calcium limestone in the reservoir area.

Deposits Outside the Wolf Bayou Reservoir Area

The area of outcrop of the Fernvale and Kimmswick limestone formations is shown on Plate I. Although the outcrop of these formations is extensive in this region, it should be noted that the workable deposits of high-calcium limestone occupy only an insignificant part of the total area covered by the formations. In many places where these formations have been mapped erosion has stripped away all the good stone or due to environmental conditions at the time of deposition good stone was never present in

the area or the overburden is too thick for removal. It is obvious, therefore, that the geologic map is merely a guide to prospecting and not a basis for estimating the high-calcium limestone reserves of an area. Extensive drilling and chemical analyses of core samples have proven that there are several deposits of high-calcium limestone along the bluffs of the White River in the Wolf Bayou reservoir area, and recent surface sampling in the same area by the Arkansas Division of Geology and the Foundation Section of the Little Rock District, Corps of Engineers, indicates that additional deposits may exist. However, there has been little surface sampling and no known drilling to verify the presence of high-calcium limestone deposits outside this area. Thus, there is no justification for the assumption that high-calcium limestone deposits exist along the relocated route of the Missouri Pacific railroad up Polk Bayou proposed by the Corps of Engineers even though the Fernvale and Kimmswick limestone formations outcrop along the lower reaches of Polk Bayou. In fact, the extensive development of manganese deposits* and caves particularly in the Fernvale limestone formation would indicate that the formations would be unlikely to contain high-calcium limestone deposits. T. C. Hopkins** who investigated high-calcium limestone formations in this area for building stone (marble) quarry states:

> "It is possible that good marble occurs at other places along Cave Creek beneath the inferior surface rock but the possibility of opening at any time into one of the numerous caverns would make quarrying of it for dimension stone alone attended with considerable risk."

It should also be pointed out that the relocated route of the Missouri Pacific railroad up Polk Bayou is only the route proposed by the Corps

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* Miser, H. D., Deposits of manganese ore in the Batesville District, Arkansas; U. S. Geol. Surv. Bull. 734, 1922.

** Hopkins, T. C., Marbles and other limestones, Vol. IV., Ann. Rept. Ark. Geol. Surv. 1890, p. 28, 1893.

of Engineers. In a letter dated December 2, 1949, to the Executive Director of the Arkansas Resources and Development Commission, Mr. P. V. Neff, President of the Missouri Pacific Railroad Company stated:

> "It is difficult to see how we can continue to operate this (White River Division) at a profit if the Wolf Bayou project is consummated and the most productive part of this line is relocated over the hills to the east—through undeveloped country without substantial known resources."

Thus, the possibility exists that the entire high-calcium limestone area may be for all practical purposes lost because of the abandonment of this important line of the railroad.

The only known deposits of high-calcium limestone in the state outside of the White River valley are those that occur in the St. Joe limestone member of the Boone formation in the vicinity of St. Joe, Searcy County, Arkansas. These deposits were accessible from the M. & A. railroad, however these deposits have been, for all practical purposes, lost since the abandonment of that railroad in 1946.

SILICA SAND

General

The term silica sand as here used refers to sand which consists chiefly of quartz grains. Sand of this composition can be used for many special purposes, the most important of which are glass manufacture, and foundry cores and molds. Extensive outcrops of silica sand have been mapped in northern Arkansas and the value of the silica sand outcrops in the Wolf Bayou area in the vicinity of Guion, Izard County, Arkansas, is established by the fact that the Silica Products Company has produced silica sand for glass manufacturing, foundry and other uses continuously since 1922.

Distribution

Although other silica sand formations are exposed in northern Arkansas, the St. Peter sandstone formation is the only one which has been worked commercially. The St. Peter sandstone has a wide distribution in northern Arkansas extending from Madison County eastward almost to the eastern border of Independence County. Thus, it outcrops on either side, as well as in the Wolf Bayou reservoir area (see Plate I). In the Wolf Bayou reservoir area the formation is exposed in the lower portions of the bluffs and tributary valleys on both sides of the White River from Guion upstream to Sylamore in Izard County, Arkansas. These reservoir area exposures are the only outcrops of the St. Peter sandstone that are accessible to rail transportation. The St. Peter sandstone formation is variable in thickness even within short distances. It reaches its maximum thickness 150-200 feet in Izard, Stone and Independence Counties, Arkansas.

Quality

Silica sand used in glass manufacture or in foundry work must meet rigid specifications. For glass manufacture the sand must be almost pure silica and only very small percentages of impurities such as iron oxide that tend to color or cloud the glass can be tolerated. The following is an analysis of washed glass sand from the Guion plant:

Analysis No. 29*

SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	Ign.Loss	Total
99.38	0.023	0.57	0.01	0.00	0.012	100.0%

Proper grain size in a glass sand is also very important as excessive fines are undesirable.

Foundry sands must also have special physical characteristics. The important properties of such sands are texture, permeability, strength, deformation, flowability and stability at high temperatures.

Since the Guion plant of the Silica Products Company has produced and sold both glass and foundry sands from the St. Peter sandstone, it is apparent that the sandstone is of suitable quality in this portion of the reservoir area. During the recent joint survey of the reservoir area by the Foundation Section, Little Rock District Corps of Engineers, and the Arkansas Division of Geology, several outcrops of the St. Peter sandstone along the White River in the Wolf Bayou reservoir area were sampled.

Analyses** of Samples from St. Peter Sandstone Outcrops in the Wolf Bayou Reservoir Area

Columnar Section No.	Sample Thickness	Loss	Percent SiO_2	Percent Fe_2O_3
3	40'	0.23	99.25	0.02
14	69'	0.22	99.03	0.02

* Giles, A. W., St. Peter and Older Ordovician Sandstones of Northern Arkansas, Ark. Geol. Surv. Bull. 4, p. 71

** Analyses by T. W. Carney, Chief Chemist, Division of Geology, Arkansas Resources and Development Commission, Little Rock, Ark.

Analyses of the samples indicate that the sandstone in these localities (see Plate I) is also of suitable quality for glass sand.

Current Production of Silica Sand from the Reservoir Area

The Silica Products Company plant (see Figure 6) at Guion is now producing silica sand. The total annual production and value of products from this plant during 1948 are as follows:

Production in Short Tons	Unit Value	Total Value
140,485	$1.97	$276,754.00

It should be noted that this production has been the entire production of silica sand for the state since the closing of the Silica Products Company mines at Everton, Boone County, caused by the recent abandonment of the M. & A. railroad. Most of the sand produced is sold as glass sand to glass plants in the Gulf Southwest area. Other products of the plant are shipped to foundries, smelters, roofing plants, tile plants, the building trade, paint companies, rubber companies and chemical companies.

Potential Production of Silica Sand in the Reservoir Area

Although there are no new silica sand operations being developed at the present time, it seems likely that there will be such developments, as demands for silica sand in this area should increase with the industrial expansion of the Gulf Southwest. Oklahoma silica sand industry is already undergoing such development. Since 1941 two new plants have been built to produce glass sand. The glass and foundry sand production of Missouri indicates the importance of these raw materials in that industrial area. The 1947 production* and value of these two commodities in Missouri follow:

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* U. S. Bureau of Mines Minerals Yearbook for 1947, p. 1037.

	Production in Short Tons	Value
Glass Sand	499,465	$894,958
Molding Sand	91,136	104,203
	Total Value	$ 999,161

Another factor that should stimulate development of the silica sand deposits along White River is the many new applications of this raw material such as the manufacture of fibreglass and the use of ground silica as a filler in many products such as asbestos siding and roofing.

Effect of Wolf Bayou Dam and Reservoir on Outcrops of the Silica Sand in the Reservoir Area

The recent joint reconnaissance survey of the Corps of Engineers and the Arkansas Division of Geology revealed that the silica sand mines and plant of the Silica Products Company at Guion will be completely inundated by the Wolf Bayou reservoir. Furthermore, this survey showed that of the 13 miles of almost continuous outcrops of the St. Peter sandstone in the bluffs of both sides of the river from Guion to Sylamore all but two miles will be entirely inundated (see Plate II). Even in these remaining two miles, the St. Peter sandstone formation will be only partially exposed with a maximum exposed thickness above water at Round Bottom in Stone County of only 65 feet. It is apparent, therefore, that the Wolf Bayou reservoir would not only destroy the only silica sand plant now operating in Arkansas, but it would also discourage further development of the state's silica sand resources by inundating practically all of its outcrops now accessible to rail transportation.

Deposits of Silica Sand Outside the Reservoir Area

Dr. A. W. Giles has made the only extensive geologic survey of the St. Peter and other sandstone formations in northern Arkansas. As a part of this survey, Giles recommended in his published report areas favorable for development. The following statement is taken from his report*:

> "The most favorable area for development (of the St. Peter sandstone) lies between Guion and Sylamore, on the north side of White River. (See Fig. 9) The White River branch of the Missouri Pacific railroad is adjacent and the sandstone bluffs overlook both railroad and river, making gravity haul feasible from the mine to the mill and railroad. The Silica Products Company has a large operation at Guion and holds extensive leases along the river. The sandstone is 100 to 150 feet thick, with almost continuous outcrop on the railroad and up the sides of the valleys of Rocky Bayou, Hidden Creek, Lyons Creek, and Twin Creeks, leading away from the river. The creeks possess gentle gradient, permitting gravity transportation from any locations on their courses."

Commercial deposits of silica sand are analogous to commercial deposits of high-calcium limestone in that they represent only a small part of the total volume of the rock in the formation in which they occur. Several factors must be investigated before a silica sand deposit can be considered commercial. The most important of these are listed below:

1. Accessibility to rail transportation
2. Size of the deposit
3. Chemical purity of the sand
4. Physical character of the sand grains
5. Water supply for washing plant

In view of the above factors, there are several reasons why outcrops of the St. Peter sandstone outside of the Wolf Bayou reservoir area cannot be assumed to be commercial silica sand deposits. The most important reason is that these

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* Giles, A. W., St. Peter and Older Ordovician Sandstones of Northern Arkansas, Ark. Geol. Surv. Bull. 4, p. 105, 1930.

outcrops are not now accessible to rail transportation and there is no assurance that any will become accessible as a result of the construction of Wolf Bayou. In fact, there is a possibility that the entire area of outcrop of the St. Peter sandstone would be made inaccessible because of the possible abandonment of the White River Division of the Missouri Pacific railroad should the Wolf Bayou dam be built. Although Giles during his survey of the St. Peter sandstone sampled several localities outside the reservoir area, he did not indicate whether or not the samples represented workable thicknesses or whether they were spot samples. Thus the results of chemical analyses of these samples, even though satisfactory, do not indicate the existence of commercial silica sand deposits at the localities sampled.

OTHER MINERAL DEPOSITS THAT WILL BE AFFECTED BY WOLF BAYOU RESERVOIR

Published geologic maps and reports* show that deposits of manganese ore, marble, and phosphate rock occur in the Wolf Bayou reservoir area. Sufficient time was not available during the recent reconnaissance survey to determine the extent of these deposits and the degree to which they will be affected by the reservoir so that only a few general statements may be made about them at this time.

The deposits of manganese ore in the Batesville district lie in an east-west belt 4 to 8 miles wide and 24 miles long. The Wolf Bayou reservoir area is at the west end of this belt. In the reservoir area numerous mines and prospects have been mapped, particularly in the Penters Bluff and Lafferty Creek localities where manganese oxides and carbonates are found in the Fernvale limestone and overlying Cason shale. Although the production from individual mines has been intermittent and small, the total tonnage produced from this area is significant because of the scarcity of manganese deposits in this country. The United States must now import 90 percent of its manganese requirements. Hence, in the event of future emergencies, the domestic production even though small and comparatively low-grade is exceedingly important.

Phosphate rock occurs in the Cason shale formation at several localities in northern Independence County. One of the best deposits occurs on the hillside above Lafferty Creek about one mile from its mouth in the reservoir area and since there has not been much prospecting for phosphate rock in the reservoir area, it is possible that other deposits may exist

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* Miser, H. D., Manganese Carbonate in the Batesville District, Ark., U. S. Geol. Surv. Bull. 921-A, 1941.

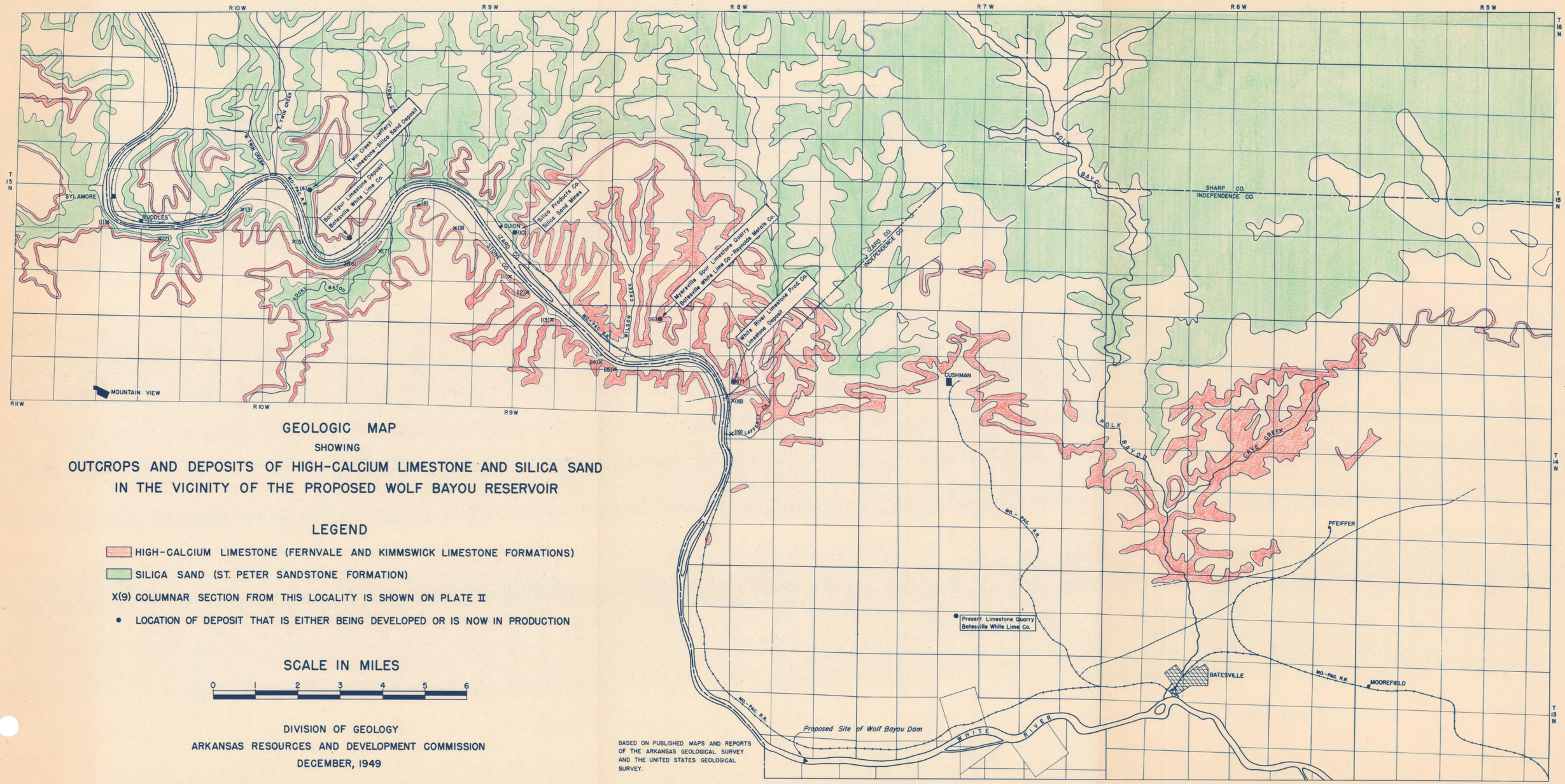
* Wells, C. J., Hickory Valley Phosphate Deposit in Independence County, Ark., Ark. Division of Geology, Bull. 15, 1949.

* Hopkins, T. C., Marbles and other Limestones, Vol. IV, Ann. Rept. Ark. Geol. Surv. for 1890, 1893.

there. It is true that the known deposits of phosphate rock are low grade in comparison to the rock now on the market. The Arkansas phosphate rock can, however, be used for direct application to the soil as a natural fertilizer, and if cheap power becomes available in the area it can be used in the manufacture of phosphorus by the electrothermal method. It appears, however, that power from the Wolf Bayou dam will not be cheap, and, therefore, this power cannot be considered a contributing factor in the development of these deposits.

Arkansas "marble" is actually coarsely crystalline limestone that has a pleasing color and texture. Thus, marble deposits are found in several limestone formations that outcrop in north Arkansas including the Kimmswick and Fernvale previously described, and the overlying St. Clair limestone formation. The effect of Wolf Bayou reservoir on the marble deposits would be in general the same as its effect on the high-calcium limestone deposits. Suitable marble quarry sites would, however, be fewer in number over any given area of outcrop of a limestone formation because of the more rigid specifications of the physical characteristics of the stone such as color, texture, and the absence of fractures. The only quarry that is now producing marble in the reservoir area is the Wolford quarry $2\frac{1}{2}$ miles downstream from Guion on the north bank of the White River. Rough marble blocks are quarried from the Kimmswick limestone formation at this locality and are shipped to Carthage, Missouri for finishing. It should be pointed out that the top of the Kimmswick limestone formation is at a low elevation (357 feet MSL) at this quarry and, consequently, that the quarry will be inundated by the Wolf Bayou reservoir.

Although the deposits of manganese, phosphate rock, and marble are perhaps not as important as the high-calcium limestone and silica sand deposits, they are important enough to the state's economy and the national security to avoid isolating or inundating them.



GEOLOGIC MAP

SHOWING

OUTCROPS AND DEPOSITS OF HIGH-CALCIUM LIMESTONE AND SILICA SAND IN THE VICINITY OF THE PROPOSED WOLF BAYOU RESERVOIR

LEGEND

- HIGH-CALCIUM LIMESTONE (FERNVALE AND KIMMSWICK LIMESTONE FORMATIONS)
- SILICA SAND (ST. PETER SANDSTONE FORMATION)
- X(9) COLUMNAR SECTION FROM THIS LOCALITY IS SHOWN ON PLATE II
- • LOCATION OF DEPOSIT THAT IS EITHER BEING DEVELOPED OR IS NOW IN PRODUCTION

SCALE IN MILES

0 1 2 3 4 5 6

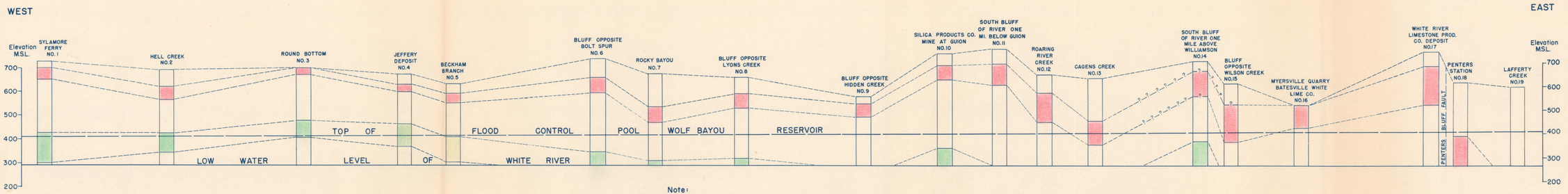
DIVISION OF GEOLOGY
ARKANSAS RESOURCES AND DEVELOPMENT COMMISSION
DECEMBER, 1949

BASED ON PUBLISHED MAPS AND REPORTS OF THE ARKANSAS GEOLOGICAL SURVEY AND THE UNITED STATES GEOLOGICAL SURVEY.

COLUMNAR SECTIONS ALONG WHITE RIVER

IN STONE, IZARD, AND INDEPENDENCE COUNTIES, ARKANSAS SHOWING ELEVATIONS OF HIGH-CALCIUM LIMESTONE AND SILICA SAND FORMATIONS RELATIVE TO WOLF BAYOU RESERVOIR

Sections measured in field by E. B. Brewster of the Arkansas Division of Geology and E. F. Palmer of the Foundations Section, Little Rock District, U.S. Corps of Engineers



Note:
Number of section refers to location on Plate I
Distance between sections is in river miles

LEGEND

HIGH-CALCIUM LIMESTONE (Fernvale and Kimmswick Limestone Formations)

SILICA SAND (St. Peter Sandstone Formation)

HORIZONTAL SCALE IN MILES

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