

The Monroe Reservoir: A Multiple Use Project

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A Situation

The Monroe reservoir ground breaking ceremony took place on October 25, 1960, and there will be constructed within a few years thereafter the longest lake in Indiana. This lake will be approximately five times larger than the largest natural lake in the state, Lake Wawasee in Kosciusko County. The United States Army Corps of Engineers worked out the technical details. Now with the engineering plans crystallized, the public can be assured that the dam, spillway, and other structures will be technologically sound and efficient.

In sharp contrast with the progress made in mechanical engineering, the geographic, social and political engineering (so desperately needed for the success of the project) lag years behind. The people in the reservoir area, although not without some interest, seem to be more or less apathetic. Up to this time the greatest interest seems to be in real estate and in short-ranged personal economic gain rather than in the long-ranged public good. Some have the attitude that if a person hasn't lived in the county for several generations and does not own land, then he isn't qualified to discuss the numerous and serious problems and opportunities which construction of the lake would bring. At the present rate of progress, the reservoir will be filled with water and the country side surrounding it with land-use and other problems because our public officials (both elected and appointed) have failed to provide this and adjacent counties with county and township planning and zoning. The lake and rapid changes in land-use will come whether the public is ready for them or not. And if we fail in geographic, social and political engineering, this failure will rest more squarely on the shoulders of Monroe County citizens than upon the shoulders of anyone else. Not only is most of the reservoir and consequently the need for planning and zoning greatest in Monroe County, but if its citizens fail to adopt planning and zoning, people living in the townships of adjacent counties do not have the legal right to plan and zone unless their entire counties do so.

Will the economic and social development stimulated by the construction of this reservoir and the use of its water be wise or foolish, rational or irrational, financially sound or expensively wasteful?

Although many reports (some true, some half-true, and many false) have appeared in newspapers, newsletters, over the radio and by other means, by and large the general public is more or less uninformed, misinformed or bewildered about this project. The purpose of this paper is (1) to help clarify the major and minor uses of the reservoir and its water and (2) to point up the need for county and township planning and zoning.

Multiple-Use Reservoir

The two primary or major uses of the Monroe reservoir are (1) to help control floods on the Ohio River watershed and (2) to increase or augment the volume of low flow in Salt Creek below the dam and in the

East Fork of the White River. The reservoir's secondary or minor uses are (1) recreation, (2) restoration of fish and wildlife, and (3) water supply upstream from the dam.

Major Uses

Flood Control. About 58 per cent of the storage capacity of the Monroe reservoir at spillway crest is *allocated* to helping control floods on the Ohio River watershed (refer to Table 1). All other uses must yield to this primary one. For example, some people may wish to have the Monroe Lake cover 18,450 acres for 300 days out of the year so as to enjoy water sports on a large lake. However, nearly "full" lakes with water almost up to the spillways, contribute very little to flood control. Consequently, when the water in the Monroe reservoir gets higher than 538 feet above sea level, it will be drained through conduits and the surface of the lake again lowered to 538 feet.

The area of the lake between the 538 foot level and the spillway crest elevation of 556 is called the zone of expected frequent flooding or the flood control area (1). When the water stands at 538 feet, the reservoir's storage capacity is approximately 58 per cent empty as compared with its capacity at spillway crest (2). Studies based on water records for a 23 year period indicate that *flood water* would be stored in the reservoir "about 85 days in the year on an average." (3) In other words, the water is expected to be above the 538 foot elevation only 85 days in the year.

The lake will vary in size from 18,450 acres when the reservoir is full, water going over the spillway, to 10,750 acres when the surface of the lake is at "flood control" pool stage, reservoir elevation 538 (4). Consequently, 7,700 acres of land will be covered with water only during 85 days in the year. The other 280 days, or 77 per cent of the time, these 7,700 acres will be of necessity a big mud flat, perhaps covered in part in the years to come with some type of vegetation.

In times of exceptionally heavy rains, the reservoir stands ready to store 258,800 acre-feet of water and prevent it from rushing down Salt Creek into other rivers to help cause floods on the Ohio River watershed (Table 1).

Some people have the impression that the Monroe reservoir is being built primarily to protect the cultivated land in the Salt Creek valley below the dam. This is not true. It would be foolish to build a lake and flood 18,450 acres above the dam as well as subject an additional 2,250 acres (5) in the zone of infrequent flooding by the lake itself (between 556 and 561 foot elevations) in order to protect 7,800 acres in the Salt Creek valley below the dam. "Operation of the Monroe reservoir will provide almost complete protection to about 7,800 acres of land in the Salt Creek overflow area" (6) below the dam, but this protected acreage is only about 42 per cent of the size of the lake when filled to overflowing.

Rather than being constructed to protect only cultivated land in the Salt Creek valley, the Monroe reservoir is one of 85 surface storage projects being developed on the Ohio River watershed with the chief object to reduce the number, size and damage of the Ohio and even Mississippi River floods. (7)

Low Flow Augmentation. The second major use of the reservoir is to store water which can be used whenever *needed* to increase the flow of Salt Creek below the dam and, in turn, increase the flow of the East Fork of the White River. All the water stored between reservoir elevations 515 and 538 is *allocated* already for low flow regulation (refer to Table 1).

TABLE 1.
Pertinent Data About Monroe Reservoir¹

	Elevation (ft. msl)	Area (acres)	Storage Capacity (acre-feet)
Silt pool	515	3,280	22,300
Low flow regulation pool.....	538	10,750	182,200
Flood control pool.....	556	18,450	441,000
Allocated to low flow regulation.	515-538		159,900
Allocated to flood control.....	538-556		258,800

1. The content of this table was made available by the courtesy of S. M. Bailey, Chief, Engineering Division, Corps of Engineers, United States Army, Louisville, Kentucky.

"A schedule of low flow regulation has not been finalized." (8) But the 159,000 acre-feet of storage between elevations 515 and 538 will be available to supplement runoff during periods of low flow due to fluctuations in the normal distribution of rainfall.

The state of Indiana will be primarily responsible for the use of water stored in the low flow regulation pool (Table 1). Should all the water allocated to low flow regulation be used for that purpose, there will remain in the reservoir only the water surface in the silt pool (Table 1). At such a time the water surface will be at reservoir elevation 515; the pool will cover only 3,280 acres, or less than 18 per cent of the area covered when the reservoir is at spillway crest; and the reservoir's storage capacity (at spillway crest) will be approximately 95 per cent empty.

Even the quantity of water in the silt pool will not remain constant. Silt will start to settle in the pool even before the lake is filled the first time. And if the surface of the reservoir is lowered artificially to the 515 foot elevation, nature through evaporation may lower it still further.

Low flow augmentation may be needed for (1) irrigation, (2) pollution abatement, and (3) domestic water supply and industrial water.

Approximately 20,000 acres of land above the dam will be taken permanently out of cultivation for flood control (18,450 acres covered by water at spillway crest and the area between 556 and 561 elevations in the zone of infrequent flooding). Agricultural production might be maintained or increased in Salt Creek valley by farming intensively the land below the dam. By using portable light-weight and inexpensive irrigation equipment, the rich flood plain soils could be placed under garden agriculture.

There is no serious pollution problem in the Salt Creek Valley today. "The present stream flow is sufficient to remove these wastes if adequate treatment is provided in accordance with existing legislation." (9) However, the prospects of new industry and suburban development along the Salt Creek and/or the East Fork, White River, may change this situation and create a need for more water for dilution. With water available, dilution becomes one of the cheaper methods of pollution control.

At the present there are no municipal demands for increasing the low flow of either Salt Creek or East Fork of the White River. In the Salt Creek watershed there is only one community, Oolitic, with a public water system. Its water comes from the Bedford water system. This city, in turn, gets its water from the East Fork of the White River above the mouth of Salt Creek. Some people believe "there is no foreseeable need for additional domestic water supply." (10)

Should Bloomington some day (for example, 15 years from now) need to supplement its water supply, other users may object, claiming they have a prior legal right to the water based on "priority of use."

The greatest demand for increased low water flow may come from industry such as mineral and stone plants and mills, potential wood-using and chemical industries, and thermal-electric plants. Although no thermal-electric generating plant, burning coal and generating electricity by steam, is located in the area today, one electric company has a site immediately below the confluence of the East Fork of the White River and the West Fork of the White River. (11)

"Present indications are that one and possibly two steam-electric generating plants with capacities of 1,300,000 kilowatts each may be built in this locality." (12) If two plants of such a size were constructed they would need an enormous supply of water for cooling purposes and/or expensive supplementary cooling equipment. For example, the Indiana-Kentucky Electric Corporation, Clifty Creek Station, Madison, Indiana, uses a total of "approximately 1,000,000 gallons of water per minute" (13) in generating 1,350,000 kilowatts. Furthermore, if these plants were built in the future on the White River generating 1,300,000 kilowatts each, nearly two million gallons of water per minute would be needed for cooling purposes, or as much water as could be obtained from both White Rivers. In addition to using all the water available in the two White Rivers for cooling purposes, expensive cooling machinery would be required to supplement the rivers. At the point where the electric company has acquired a site minimum water flow in the White River is only of sufficient size to supply a thermal-electric plant generating 600,000 kilowatts. (14)

The White River could be supplemented by water from the Monroe reservoir since Salt Creek flows into the East Fork of the White River above the potential electrically-generating plant site. According to tentative plans water will be drained out of the Monroe reservoir at the rate of "1,400 cubic feet per second for the period June 15 to September 15, and 1,000 cubic feet per second for the remainder of the year. . . ." (15) One thousand four hundred cubic feet per second is equivalent to approximately 628 thousand gallons per minute. If we add this potential low-flow augmentation of the Salt Creek to the natural flow in the East Fork of the White River, there would then be enough water to water-cool one plant

generating about 1,200,000 kilowatts. But if two plants of this size were built, a much greater supply of water from the Monroe reservoir would be needed. In fact, all the water above the reservoir 515-foot level is allocated to low-flow regulation. All of the water stored between reservoir levels 515 and 538 could be used for cooling electrical generating plants if no other use had a priority, or if a new restriction were not placed on how low the state of Indiana has a legal right to lower the level of the reservoir. In fact, the Monroe reservoir plus the White Rivers cannot furnish enough cooling water to supply several steam-electric generating plants capable of making a million kilowatts each. The amount of cooling water available may be a limiting factor in the design of these plants. Mr. J. I. Perrey, Chief Engineer for Indiana's Flood Control and Water Resources Commission, writes, "Cooling water will be required in large volumes by these plants and will be a limiting factor in their design." (16)

Minor Uses

Secondary Functions. Minor uses of Monroe Lake and its water will be (1) recreation, (2) restoration of fish and wildlife, and (3) water supply upstream from the dam.

Recreation

Unfortunately many people in the reservoir area have the impression that recreation is to become one of the major uses of the reservoir. According to present plans and published reports, approximately 95 per cent of the storage capacity of the Monroe reservoir at spillway crest has been allocated to flood control and to increasing the flow of Salt Creek during low flow periods (Table 1). The people may use whatever water is in the reservoir for recreational purposes as the surface level fluctuates between 556 feet at spillway crest to 515 feet at silt pool crest. Public facilities will be provided to help people obtain recreational benefits. But legally, according to priority water rights as now allocated, the reservoir can be lowered to the 515 foot level in order to increase the flow of Salt Creek below the dam. No one living today knows how often this will happen or how many days in the year the water will be at or near elevation 515.

For the first few years following the completion of the dam and the filling of the reservoir, recreation is expected to be the most important secondary use of Monroe Lake. Both the lake's surface and the land adjacent to its banks are expected to attract people seeking outdoor recreation. In fact, as soon as (and even before) the Indiana legislature passed the bill to support economically this project, real estate in the lake area started to change hands. After the necessary legislation passed, real estate speculation increased. To some the greatest interest in the lake has not been in its potential public contribution to the Salt Creek, East Fork of the White River and Ohio River watersheds, but what real estate would be involved. What land would the government buy? What land could speculators buy quickly from the uninformed rural folk to sell a few years later to recreation-hungry city dwellers and make a hundred or a thousand per cent profit or more? Who has the "inside information" as to how close one can get land to the water's edge? An interesting study might be made five years from now to learn who had the earliest and best informa-

tion about potential recreational real estate. But this study is limited primarily to the public recreational use of the lake and its environs.

According to Colonel Kenneth Marlin, Director of the Indiana Department of Conservation, his department will control the *use of the water surface* and will zone it for different uses. (17) The lake's surface will be divided into zones where each water sport of (1) swimming, (2) boating and skiing, (3) fishing, and (4) hunting will have priority during part or all of the year.

It is estimated that more people will spend more time swimming than in any other water sport. Fishing as an activity may rank second, but it may be overshadowed by boating and skiing. Until a decade ago, as far as boat traffic was concerned, some 25 million fishermen in the United States had the nation's waterways nearly to themselves. Within the last five years, however, with the nearly maintenance-free aluminum and fiberglass boats and reliable, big outboard motors, both boaters and skiers have just about driven the fisherman from some lakes. It is now estimated that there are currently more than two million water skiers. (18) It is obvious that water skiing and fishing in the same area at the same time or any time are not feasible; consequently, there is conflict of use. Skiing interferes with swimming and swimming interferes with fishing. The best way to reconcile these conflicts in use is by zoning parts of the lake for each.

But swimmers, skiers, and anglers must all have adequate access to the lake. Colonel Marlin believes that the Department of Conservation's greatest responsibility is to provide the public with such an access. (19) Tentatively, plans have been made to provide the public with eleven points of access. (20) Colonel Marlin revealed that the Indiana Department of Conservation is interested in two good beach areas on the reservoir and that this department will also acquire land for swimming, picnic areas, and public boat docks. (21)

The United States Forest Service, the largest land owners on the watershed (37,000 acres), will have nine miles of shoreline when the reservoir is filled. In July, 1960, Mr. Howard C. Cook, Supervisor of the Hoosier National Forest, reported that these nine miles will be developed for "forest-type" recreation such as camping, hiking, riding and swimming. These can be provided without interfering with the primary purposes of the Hoosier National Forest, namely (1) to produce lumber and wood products, and (2) to provide watershed protection. (22) Helping provide recreation has always been a secondary function of this forest. (23)

Restoration of Fish and Wildlife

As soon as water is impounded behind the dam and months before the reservoir is filled, the water will contribute to the restoration of fish, birds, and animals. One of the most severe limiting factors in the restoration of wildlife in southern Indiana has been the lack of an adequate water supply.

One hundred and fifty years ago southern Indiana had an abundance of various types of fish and wildlife. Some were consumed by the pioneers but the destruction of wildlife habitat more than the harvest of fish, fur-bearing animals and meat animals led to their dwindling in numbers. In quick succession the virgin forests were removed, the soil subject to ero-

sion, the water table dropped, springs went dry and the streams became polluted. (24)

If fish, birds, and animals are provided with water, food, shelter and nesting places and if breeding stock is present, the wildlife can restock the water and the adjacent land areas. Of course the Department of Conservation has the facilities with which to stock the lake with game fish. The 7,800 acre mud flat will be quickly occupied by birds that find such a habitat almost ideal for their type of life. Migratory waterfowl, especially ducks, may nest here if food, water and some protection is available.

One of the most controversial issues concerning the public use of the lake is the difference of opinion as to whether the upper reaches of the lake should be made into a waterfowl refuge. Some duck hunters are opposed to the establishment of a refuge because it would prevent hunting. Many nature lovers and those who prefer to hunt waterfowl with a camera rather than a gun believe a waterfowl refuge should be established or at least a study made by wildlife experts not employed by the Department of Conservation. These citizens believe that the department is "caught in a bind." Operation of the department depends in part upon the sale of hunting licenses and the hunters are reported to be a strong pressure group in the state. Other people maintain there would not be enough water in the upper reaches during long enough periods of time to establish a good refuge.

On March 2, 1960, at a public meeting in Bedford, Indiana, the Director of the Conservation Department announced the establishment of a duck refuge. On March 3, 1960, *The Daily Herald-Telephone* in Bloomington, Indiana, quoted the Director as saying that:

. . . a large area of the eastern portion of the lake in Brown County will become a duck refuge. . . .
 . . . said that wild ducks will come naturally to the area and must be protected. He said he could not say whether duck hunting will be permitted anywhere on the lake.
 No shooting or motor boats would be permitted in the duck refuge during the migrating season, which usually runs from about Nov. 1 to Jan. 1. (25)

However, by the time a public meeting was held in Bloomington on July 14, 1960, the duck refuge plan had apparently been dropped. The Director then announced a plan to:

. . . restrict certain upper reaches in the shallows for hunting during the migratory fowl season. (26)

Water Supply Upstream from the Dam

If all the water stored between reservoir levels 515 and 538 and allocated to low-flow regulation is not needed, the surplus could be used for (1) domestic, (2) municipal, and (3) industrial purposes upstream from the dam.

Rural dwellers in the eastern half of Monroe County need water. Mr. Corry Alcorn, county agricultural agent, reported to the members of the Monroe County Development Committee at a meeting on September 23, 1960, that the region east of Indiana Highway 37 is largely barren of accessible underground water deposits. (27) Mr. Alcorn also reported that "ponds in the eastern part of the county retained water better than those in the western half." (28) The committee members present dis-

cussed "the possibilities of encouraging private financing for filtering plant and water system linked to the Monroe reservoir and of county-community financing. . . ." (29)

After the lake becomes a reality new recreational communities may require a source of water.

Industrial plants may locate adjacent to the reservoir above the dam in order to use water from the reservoir. However, the plants located upstream from the dam and taking their water directly from the reservoir will have no guarantee that water will be available between reservoir levels 515 and 538. These potential industries cannot rely on a daily water supply stored between these two levels for at least two reasons. First, the water may not be between these two elevations during part of the year. Consequently the water users who wish to take water directly from the reservoir will need to place the mouths of their intake water pipes in or near the silt pool. Therefore the water intakes in the reservoir will be located near the dam where the silt pool is located. Of course industrial users will want to locate their plants as near to their source of water as possible. If industry attempts to locate as near the silt pool as possible they will be competing for land desired by recreational interests. The best recreational facilities should also be located as near the silt pool as possible.

Second, although the water is there, the water users downstream from the dam may have prior legal water rights to it. Because of these conditions, most of the industrial plants will likely occupy sites downstream from the dam.

Conflict in Uses

The State of Indiana may become, if it is not already, involved in "water rights" and "priority of use."

When man attempts to use a resource or project for several purposes, conflict in use develops unless allocations and priority of uses and restrictions on such are well clarified from the beginning. Although the State of Indiana is paying for 54.1 per cent (30) of the project's cost, about 58 per cent of the reservoir's storage capacity is "earmarked" for flood control. Storage in the Monroe reservoir between elevations 538 and 556 feet is legally reserved for flood waters and this part has a storage capacity of 258,000 acre feet. (31) The public should be informed that except for about 85 days in the year (or less than a ratio of one day in four) the water will not be above the 538 foot level. The reservoir or lake will cover only 18,450 acres during exceptionally heavy rains and for a few weeks after. Although the public is not aware of these statistics, it seems to generally accept the fact that the use of the reservoir is chiefly for flood control.

Apparently the public does not know or does not understand that an additional 37 per cent of the reservoir's storage capacity is allocated or "earmarked" for increasing the size of the minimum flow of Salt Creek below the dam. This means that the state of Indiana not only has the right and the responsibility, but it may be legally obligated to drain out all the water in the reservoir above the 515 foot level if a user (such as a city or industry) downstream from the dam needs and requests the water. Of course, if all the water allocated for increasing the low-flow of Salt Creek were used for this purpose, only a shallow pool covering 3,280 acres

would remain in the reservoir; the mud flat would cover 15,170 acres and the storage capacity of the reservoir at spillway level would be about 95 per cent empty. The Army Corps of Engineers has called attention to the fact that a large demand for increasing low flow would adversely affect the recreational use of the reservoir. Their report reads:

. . . major drawdown of the permanent pool for low-flow regulation in the streams below the dam would reduce the potential recreational value of the reservoir pool; although on the other hand, increased stream flows would enhance fishing values in the streams below Monroe Dam. (32)

Along the shoreline people on a hot summer day subject to mounting rage, gazing out of their expensive cabins, unable to go swimming, boating or fishing because they cannot reach the shallow pool of water across a broad 15,170 acre mud flat, may not be in the mood to be placated when told that there are more fish in the streams below the dam because of the water drained from the reservoir for low flow augmentation. In their anger some may reply that "naturally the regulators of the conduits had to let some of the fish through with the water because there isn't enough oxygen left in the silt pool to keep the fish alive." If the water in the reservoir were lowered to the 515 foot level very many times in a year and should the water stand at or near silt pool stage for many days in succession, then recreational real estate values might well come tumbling down. What organization, institution or agency would want to invest thousands of dollars in recreational facilities near a reservoir which *may be* drained about 95 per cent dry in order to increase the flow of Salt Creek below the dam.

At the present the silt pool covering 3,280 acres is the only part of the reservoir "allocated" for recreation and the restoration of fish and wildlife.

If the people truly understood this situation, some people would demand that the Indiana legislature set up some type of restriction on the use of water for low-flow regulation in order to protect the recreational rights of the people. Should part of the reservoir storage be legally allocated to recreation? Or is it too late to get such an allocation?

It also becomes rather obvious why there may be delays in a commitment to the establishment of a Migratory Water Fowl Refuge on the upper reaches of the reservoir. A waterfowl refuge without water for long periods of time wouldn't be much of a refuge.

Perhaps it is not too late to allocate part of the Monroe reservoir's storage capacity for recreation. But shouldn't the people, particularly those interested in recreation, be informed or act quickly to have their rights safeguarded before thousands of dollars are invested in recreational facilities built on the false assumption that they will have available for their use throughout the year a 10,750 acre lake? Unfortunately the drawdown of the reservoir for low flow augmentation would coincide in time (during the warm summer months and early fall) when expected potential recreational use would be at a peak.

In summary, as of October 1, 1960, when this paper was completed, it appears that the recreational use of the reservoir has no protection or assurance under present laws or policies. This lack of protection (unless changed) may well influence the Federal government's reactional policy

and expenditures on the land managed by the Hoosier National Forest in the Monroe Reservoir area.

Planning or Waste

Can the people in Monroe, Brown, Jackson and Lawrence counties who in the past, either by indifference or obstruction, opposed county (or rural) planning and zoning reverse their position now and adopt zoning regulations that would control future land use development around the Monroe reservoir? In the next ten years will the development around this reservoir prove that local and state planning is superior to Federal planning?

Up to October 1, 1960, when this paper was completed, we seem to have failed.

(1) We have failed to follow the planning suggestion made in March 1960 by both Robert W. Kellum, executive secretary of the Indiana Flood Control and Water Resource Commission, and Colonel Kenneth Marlin, Director of the Indiana Department of Conservation. These two men in public addresses in Bedford emphasized the fact that one of two uppermost problems regarding the Monroe reservoir would be ". . . zoning of the entire reservoir area to assure orderly growth in the future after the lake becomes a reality." Mr. Kellum assures me by letter that in this suggestion he meant the countryside as well as the lake's surface should be zoned.

Mr. Kellum also suggested at the March, 1960, meeting in Bedford that "a four county meeting of county and township officials from Monroe, Lawrence, Brown and Jackson counties be held for the purpose of discussing zoning."

To date such a meeting had not been held.

(2) The citizens in Monroe County have also failed to (a) make an inventory, (b) produce a master plan, and (c) zone the use of land in Monroe County. In January, 1949, Monroe County organized a Planning Commission. For eleven years this Planning Commission successfully (a) blocked the city of Bloomington from planning and zoning a two mile fringe area around the city, (b) ignored county problems, (c) shelved possible planning issues, and (d) refused to take action to secure money that would help to operate efficiently a positive planning and zoning pattern.

However public pressure grew so strong in favor of planning during the first six months in 1960 that the Monroe County Planning Commission in July agreed to include in its 1961 budget a request for \$12,000 to pay a professional agency to make an inventory and draw a tentative master plan for county zoning. The Board of County Commissioners later cut this request almost in half. In spite of this, the board for the first time in 12 years at least appropriated enough money so the Planning Commission could take some positive action.

(3) We have failed to complete comprehensive state planning. For example, it is not yet known whether "a migratory waterfowl refuge" will be established on the Monroe reservoir or not. Mr. Kellum assured me by letter that:

There is no answer that will be satisfactory for (waterfowl refuge) use at this time because this is being studied in compre-

hensive planning. This is a prospect, of course, but to say "yes" or "no" merely causes embarrassment in the study phases. No answer is possible now. (33)

Thus we see that geographic and political engineering for the reservoir and the surrounding country-side lags dangerously behind mechanical engineering. Can the public be alerted in time? If a study of the planning phases of the Monroe reservoir were made in 1970 or 1980, would it indicate that local and state planning were superior to Federal planning?

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