

MISSISSIPPI RIVER AND TRIBUTARIES WITH RESPECT  
TO OLD RIVER CONTROL

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LETTER

FROM

THE SECRETARY OF THE ARMY

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY, DATED APRIL 8, 1954, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND ILLUSTRATIONS, ON A REVIEW OF PROJECT FOR FLOOD CONTROL, MISSISSIPPI RIVER AND TRIBUTARIES WITH RESPECT TO OLD RIVER CONTROL, PREPARED IN ACCORDANCE WITH SECTION 6 OF THE RIVER AND HARBOR ACT APPROVED AUGUST 30, 1935

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JULY 26, 1954.—Referred to the Committee on Public Works and ordered to be printed with three illustrations

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LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY,  
*Washington, D. C., July 9, 1954.*

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

DEAR MR. SPEAKER: I am transmitting herewith a report dated April 8, 1954, from the Chief of Engineers, Department of the Army, together with accompanying papers and illustrations, on a review of the project for flood control, Mississippi River and tributaries with respect to Old River control. This report was prepared in accordance with section 6 of the River and Harbor Act approved August 30 1935, in view of important changes in economic factors and additional stream flow records and other factual data.

In accordance with section 1 of Public Law 534, 78th Congress, the views of the Governor of Louisiana and the Secretary of the Interior are set forth in the enclosed communications. The comments of the

Secretary of Agriculture and the Department of Health, Education, and Welfare are also enclosed.

The Department of the Interior interposes no objection to the proposed work, but believes that the act of August 14, 1946 (60 Stat. 1080) requires that adequate provision be made for prevention of losses to fish and wildlife and that this should be mentioned to the Congress.

The Bureau of the Budget advises that, while there would be no objection to the submission of the report to the Congress, it would not recommend authorization of the lock until a detailed project report is submitted and that no commitment can be made at this time as to when any estimate of appropriation would be submitted for construction of any modification to the project, if authorized by the Congress, since this would be governed by the then prevailing fiscal situation. The complete views of the Bureau of the Budget are contained in the attached copy of its letter.

Sincerely yours,

GEORGE H. RODERICK,  
*Acting Secretary of the Army.*

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#### COMMENTS OF THE BUREAU OF THE BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT,  
BUREAU OF THE BUDGET,  
*Washington 25, D. C., July 2, 1954.*

The honorable the SECRETARY OF THE ARMY.

MY DEAR MR. SECRETARY: This is in response to Assistant Secretary Roderick's letter of May 21, 1954, submitting a report of the Chief of Engineers on flood control, Mississippi River and tributaries, with respect to Old River control, prepared under authority of section 6 of the River and Harbor Act, approved August 30, 1935.

The Chief of Engineers recommends that the project for flood control and improvement of the Lower Mississippi River be modified and expanded to include the control of the Old and Atchafalaya Rivers, and a lock for navigation, at a cost to the United States (exclusive of the navigation lock) of \$46,741,000 based on December 1953 price levels. Local interests would be required to provide rights-of-way, estimated to cost \$10,000, for Mississippi River levee construction. Estimated annual carrying charges are \$1,880,865, all but \$865 of which would be Federal. Benefits are estimated at \$14,600,000 annually, based on the cost of construction, replacement, modification, and abandonment of facilities which would be required if the Mississippi River were to be captured by Old River. The benefit-cost ratio is thus stated to be 7.7.

The report states that before the size, cost, and economics of the proposed lock can be determined it will be necessary to analyze the trends of present traffic and the nature and magnitude of prospective traffic. In view of the absence of such data we are unable to appraise the need, merits, and justification for such a feature. It would appear to us that the authorization for the lock should be deferred until this information becomes available.

Accordingly, I am authorized to advise you that, while there would be no objection to the submission of the report to the Congress, we would not recommend authorization of the lock until a detailed project

report is submitted in accordance with established procedures outlining its capacity, cost, and benefits and demonstrating its economic feasibility. Furthermore, no commitment can be made at this time as to when any estimate of appropriation would be submitted for construction of any modification to the project, if authorized by the Congress, since this would be governed by the then prevailing fiscal situation.

Sincerely yours,

CARL H. SCHWARTZ, Jr.,  
*Chief, Resources and Civil Works Division.*

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COMMENTS OF THE GOVERNOR OF THE STATE OF LOUISIANA

STATE OF LOUISIANA,  
EXECUTIVE DEPARTMENT,  
*Baton Rouge, March 26, 1954.*

Maj. Gen. SAMUEL D. STURGIS, Jr.,  
*Chief of Engineers, Department of the Army,*  
*Washington, D. C.*

DEAR GENERAL STURGIS: Thank you for your letter of March 16, 1954, in which you enclosed a copy of the Review Report on Mississippi River and Tributaries With Respect to Old River Control.

The report has been reviewed by me and also by the Director of Public Works, Mr. Roy T. Sessums, and we are of the opinion that it reflects a thorough understanding of the phenomena applicable to the threatened capture of the Mississippi River by the Atchafalaya. It is understood that you concur in the Mississippi River Commission's desire to pursue a further study of the matter of the lock facilities to be installed to accommodate navigation as a part of the project and on that account, no recommendation is contained in the report relative to that aspect of the project. It is understood also that a recommendation will be made to the Congress, respecting the lock facility, in advance of the request of funds for construction purposes.

In view of the great urgency of adequate precaution to prevent the catastrophe which would result from the diversion of the Mississippi River to the Atchafalaya, we in Louisiana hope that you will take every possible opportunity to expedite the early authorization of the Old River project.

Assuring you of our continued cooperation with the Corps of Engineers, I am

Sincerely,

ROBERT F. KENNON.

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COMMENTS OF THE DEPARTMENT OF THE INTERIOR

DEPARTMENT OF THE INTERIOR,  
OFFICE OF THE SECRETARY,  
*Washington, D. C., May 3, 1954.*

Maj. Gen. S. D. STURGIS, Jr.,  
*Chief of Engineers,*  
*Department of the Army, Washington, D. C.*

DEAR GENERAL STURGIS: This is in reply to your letter of April 8, transmitting copy of your proposed report together with the report of the Mississippi River Commission on a review of the lower Missis-

issippi River, and tributaries with respect to Old River control. Your report recommends that the existing project authorized by act of Congress approved May 15, 1928, as amended, be modified to provide for control of flows from the Mississippi River into the Atchafalaya River and Basin.

The report of the Mississippi River Commission on Old River control has been reviewed by the Fish and Wildlife Service. It is noted that the report includes a summary of the Service's preliminary comments which concern primarily the probable effects of salt-water intrusion during periods of low water in the Atchafalaya River. Further consideration of the problem reveals that specific information is not available on which precise determinations of project effects can be made. The fish and wildlife resources of the Mississippi and Atchafalaya Rivers, the Red River backwater area, and other land and water areas subject to overflow in the lower Mississippi Valley are vastly important to the local people and the Nation as a whole. They include fresh and salt-water fisheries of great magnitude, waterfowl wintering habitat essential to the prosecution of the national migratory bird conservation program, and fur animal and upland game resources having outstanding economic, recreational, and esthetic values. Maintenance of flows in the Mississippi River below the latitude of Old River as contemplated in the authorized flood-control plan is desirable from a fish and wildlife conservation standpoint. The maintenance of balanced flows in the Atchafalaya River also is desirable.

This Department believes that the act of August 14, 1946 (60 Stat. 1080) requires that in the planning and prosecution of your proposed project adequate provision be made for the prevention of losses to fish and wildlife resources. This Department also believes that information presented to the Congress on the proposed plan should include mention of this obligation. We recommend, therefore, that your report to the Secretary of the Army and to Congress should include recognition of the necessity for considering and implementing all reasonable measures found to be necessary for the adequate protection of the important fish and wildlife resources of the land and water areas concerned.

No other interests of the Department would be affected by the proposed construction.

The opportunity to review this report is appreciated.

Sincerely yours,

FRED G. AANDAHL,  
*Assistant Secretary of the Interior.*

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#### COMMENTS OF THE DEPARTMENT OF AGRICULTURE

DEPARTMENT OF AGRICULTURE,  
*Washington, D. C., June 17, 1954.*

The honorable the SECRETARY OF THE ARMY.

DEAR MR. SECRETARY: This is in reply to the Chief of Engineers' letter of April 8, 1954, transmitting for our information and comment a copy of his proposed report on lower Mississippi River and tributaries with respect to Old River control.

The report is concerned with major improvements in the lower Mississippi Basin which do not appear to affect any interests of this

Department in the area. We, therefore, have no comments to offer on this report.

We appreciate your courtesy in making the report available to us for review.

Sincerely yours,

J. EARL COKE,  
*Assistant Secretary.*

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COMMENTS OF THE DEPARTMENT OF HEALTH, EDUCATION,  
AND WELFARE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,  
PUBLIC HEALTH SERVICE,  
Washington, D. C., April 26, 1954.

Maj. Gen. S. D. STURGIS, Jr.,  
*Corps of Engineers, Department of the Army,*  
Washington, D. C.

DEAR GENERAL STURGIS: Pursuant to the policies and procedures established by the Federal Interagency River Basin Committee, we have reviewed the Department of the Army's review report on the Mississippi River and tributaries with respect to Old River control.

Comments were previously made on this proposal at the field level by our Lower Mississippi and Western Gulf Drainage Basins Office in a letter dated November 12, 1953. This letter is included as a part of appendix A of the report. We have reviewed our field office's letter and concur in the comments contained therein. We have no additional comments to offer regarding this project.

The opportunity to review this report is appreciated.

Sincerely yours,

M. D. HOLLIS,  
*Chief Sanitary Engineering Officer, PHS,*  
*HEW Member, Federal Interagency River Basin Committee.*

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REPORT OF THE CHIEF OF ENGINEERS, DEPARTMENT  
OF THE ARMY

DEPARTMENT OF THE ARMY,  
OFFICE OF THE CHIEF OF ENGINEERS,  
Washington, D. C., April 8, 1954.

Subject: Review report on Mississippi River and Tributaries with respect to Old River Control.

To: The Secretary of the Army.

1. I submit herewith for transmission to Congress a report on the Lower Mississippi River and tributaries with respect to Old River control in accordance with section 6 of the River and Harbor Act approved August 30, 1935, which requires the Chief of Engineers to make such additional study and investigation as he finds necessary to take into account important changes in economic factors as they occur and additional streamflow records or other factual data.

2. In order to comply with this provision of law, I asked the Mississippi River Commission to make the accompanying report to me and to submit at the earliest practicable date its recommendation for any modifications with respect to the control of Old River and features

related thereto. After full consideration I have approved the report of the Mississippi River Commission and concur in its recommendation.

3. Due to the magnitude of this Old River control undertaking and its vital importance to the lower Mississippi Valley and the Nation, I am personally following all phases of the detailed planning and shall continue to do so throughout the planning and construction periods.

S. D. STURGIS, Jr.,  
Major General, Chief of Engineers.

## REPORT OF THE MISSISSIPPI RIVER COMMISSION

### SYLLABUS

The purpose of this report is to reexamine the project for the control of floods in the alluvial valley of the lower Mississippi River adopted by the act of May 15, 1928, as amended, with a view to determining and recommending the best means of preventing the Mississippi River from diverting the major portion of its flow through the Atchafalaya River. The adopted flood-control program which is 65 percent complete on a monetary basis is designed to afford protection against the maximum flood predicted as probable. To secure this protection in Louisiana below the latitude of Old River, the adopted plan requires that not more than 1,500,000 second-feet of the project design flood will be carried in the Mississippi below Morganza and the balance must find its way to the gulf through the Atchafalaya River and Basin floodways. It is equally important, however, that no deterioration be permitted to occur in the Mississippi River below Old River. The physical situation with which this report is concerned has been under surveillance for many years and has been reported on several times in the past 40 years. The most recent report is the Atchafalaya River Study—May 1951, by the Mississippi River Commission. This thorough engineering study was directed specifically toward answering the question of whether or not the Mississippi River would divert its flows into the Atchafalaya River. In this latest report the Commission finds that the Mississippi River, if left alone, will in time adopt the course of the Atchafalaya.

The Commission therefore recommends that the existing project authorized by the act approved May 15, 1928, as amended, be modified to provide for control of flows from the Mississippi River into the Atchafalaya River and Basin by mechanically operated control structures on the right bank of the Mississippi River. The Commission will report at a later time on the characteristics and cost of a navigation lock.

CORPS OF ENGINEERS, UNITED STATES ARMY,  
MISSISSIPPI RIVER COMMISSION,  
Vicksburg, Miss., February 2, 1954.

Subject: Review report on Mississippi River and tributaries with respect to Old River control.

To: The Chief of Engineers, Department of the Army, Washington 25, D. C.

### AUTHORITY

1. This report, submitted in compliance with instructions dated August 7, 1953, from the Chief of Engineers to the president, Mississippi River Commission, is authorized by section 6 of the River and Harbor Act approved August 30, 1935. Additional streamflow records, changed physical conditions in the general vicinity of Old River, La, and other factual data provide the basis for this report. In summary, present instructions direct the president, Mississippi River Commission, to prepare a report on the project for flood control of the Mississippi River in its alluvial valley and for its improvement from the Head of Passes to Cape Girardeau, Mo., as authorized

by the Flood Control Act approved May 15, 1928, and as amended, and to submit at the earliest practicable date a recommendation for any modifications that are advisable with respect to the control of Old River and features related thereto.

## REFERENCES

2. Acts of Congress, congressional documents, reports, and studies pertinent to the adoption of the project for flood control, Mississippi River and tributaries, are tabulated below:

| <i>Acts</i>                                                                        | <i>Supporting documents</i>                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flood Control Act of May 15, 1928....                                              | H. Doc. 90, 70th Cong., 1st sess.<br>House committee Doc. 28, 70th Cong., 2d sess.                                                                                                                                                                                                                                                                                                                                           |
| Flood Control Act of June 15, 1936....                                             | Flood Control Committee Doc. 1, 74th Cong., 1st sess.<br>H. Doc. 198, 73d Cong., 2d sess.                                                                                                                                                                                                                                                                                                                                    |
| Flood Control Act of June 28, 1938....                                             | Flood Control Committee Doc. 1, 75th Cong., 1st sess.                                                                                                                                                                                                                                                                                                                                                                        |
| Flood Control Act of Aug. 18, 1941....                                             | H. Doc. 359, 77th Cong., 1st sess.                                                                                                                                                                                                                                                                                                                                                                                           |
| Flood Control Act of Dec. 22, 1944....                                             | H. Doc. 509, 78th Cong., 2d sess.                                                                                                                                                                                                                                                                                                                                                                                            |
| Flood Control Act of July 24, 1946....                                             | S. Doc. 151, 78th Cong., 2d sess.<br>S. Doc. 191, 79th Cong., 2d sess.<br>H. Doc. 516, 78th Cong., 2d sess.<br>H. Doc. 378, 74th Cong., 2d sess.<br>H. Doc. 308, 74th Cong., 1st sess.<br>H. Doc. 98, 76th Cong., 1st sess.<br>H. Doc. 188, 72d Cong., 1st sess.<br>H. Doc. 757, 79th Cong., 2d sess.<br>H. Doc. 138, 80th Cong., 1st sess.<br>S. Doc. 51, 80th Cong., 1st sess.<br>Corps of Engineers Report, Apr. 8, 1946. |
| Flood Control Act of June 30, 1948....                                             | H. Doc. 627, 80th Cong., 2d sess.<br>H. Doc. 651, 80th Cong., 2d sess.<br>H. Doc. 321, 80th Cong., 1st sess.                                                                                                                                                                                                                                                                                                                 |
| Flood Control Act of May 17, 1950....                                              | H. Doc. 32, 81st Cong., 1st sess.<br>S. Doc. 88, 81st Cong., 1st sess.<br>H. Doc. 485, 81st Cong., 2d sess.<br>S. Doc. 139, 81st Cong., 2d sess.<br>H. Doc. 255, 81st Cong., 1st sess.                                                                                                                                                                                                                                       |
| <i>Reports and studies</i>                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                              |
| The Atchafalaya River Study, Mississippi River Commission, May 1951, in 3 volumes. |                                                                                                                                                                                                                                                                                                                                                                                                                              |

# 1. DEVELOPMENT OF THE EXISTING PROJECT FOR FLOOD CONTROL AND NAVIGATION

3. The drainage basin of the Mississippi River and its tributaries, comprising an area of about 1,245,000 square miles, is the third largest in the world, being exceeded only by those of the Amazon and Congo Rivers. In extent, it reaches from within 250 miles of the Atlantic Ocean to within 500 miles of the Pacific Ocean and from Canada to the Gulf of Mexico. This vast funnel-shaped drainage basin covers all or parts of 31 States and 2 Canadian Provinces. The runoff from 41 percent of the entire area of the United States is accumulated at the latitude of Old River and carried to the Gulf of Mexico through the lower reaches of the Mississippi River and its natural distributary, the Atchafalaya River and basin.

4. Within this watershed, the Mississippi River meanders southward from Cape Girardeau, Mo., through an enormous alluvial flood plain and then passes through its delta into the Gulf of Mexico. The

alluvial valley is that area which was subject to overflow in its natural state by the Mississippi River and includes the lower reaches of tributary stream basins to the extent that these basins were inundated by floodwaters from the main river. Generally, the materials through which the river flows are easily eroded. The wide variations in the river's discharge and stage and the lack of cohesion in the materials of its banks and bed create a meandering stream of constantly changing alinement. The river, being alluvial does not excavate and maintain its channel deep enough and wide enough to carry the large floods within its banks. Sediment is deposited during overflow periods causing the natural banks of the stream to be generally higher than the large adjoining basins. As the river was the principal means of transportation in the early days, the first settlements were made along the stream on these high natural levees. With the advent of the steamboat, towns and cities developed and agricultural pursuits prospered. Earthen levees were constructed by the early settlers to provide protection against the river's floodwaters. Locally constructed levee systems were entirely inadequate, and in 1882 a great flood occurred which overflowed an estimated 34,600 square miles of the total 35,457 square miles in the alluvial valley. Vast areas were again flooded in 1912 and 1913. Beginning in 1917, the expenditure of Federal funds directly for flood-control purposes was authorized on a cooperative basis whereby the United States paid two-thirds of the construction costs and local interests contributed one-third and provided the necessary right-of-way. While this basis was sound in principle, it resulted in great inequalities. The smaller levee districts and those which had reached their bonded debt limits could not contribute the required one-third of the cost with the result that the larger and richer districts built their levees stronger and higher, thus forcing additional flood servitude on the smaller and poorer. For 200 years the levee system in the lower Mississippi Basin has been gradually extended, raised, and strengthened. Up to 1928, local interests had expended over \$292 million for flood protection against overflow of the river. The great flood of 1927 overflowed 23,000 square miles. Although the area overflowed was less than in 1882, the damage was far greater due to the higher state of development within the valley. In 1928 legislation was adopted which recognized that flood control in the alluvial valley and navigation on the river south of Cairo constituted a single great problem, and that in view of the great expenditures made by local interests, and the national aspects of flood losses, no local contribution was required other than furnishing certain rights-of-way and maintaining specified works after completion.

## II. EXISTING PROJECT

5. The existing project for the control of floods on the Mississippi River and its tributaries is authorized by the act approved May 15, 1928, as amended by the acts listed in paragraph 2 above.

6. The project as now fixed by law provides for works for the flood control of the Mississippi River in its alluvial valley and for its improvement from Cape Girardeau, Mo., to the Head of Passes, La., and for the maintenance of a channel for navigation 300 feet wide and 12 feet deep at low water between Cairo, Ill., and Baton Rouge, La.; the execution in the interest of navigation and flood control of a channel improvement and stabilization program; the diversion from

the Mississippi River of excess floodwaters through the New Madrid, Bonnet Carre, Morganza, and Atchafalaya Floodways; improvement of the discharge capacity of the Atchafalaya River; construction of the Wax Lake outlet; the control of headwater floods on the St. Francis and Yazoo Rivers; the protection of lands on the north and south banks of the Arkansas River below Pine Bluff, Ark., and of lands on the south bank of the Red River below Boyce, La.; the protection of lands near the mouths of the St. Francis, White, Yazoo and Red Rivers and St. John Bayou from Mississippi River backwaters; the construction of navigation harbors at Memphis, Tenn., and Baton Rouge, La.; construction and extension of a levee on the east bank of the Mississippi River from Tiptonville, Tenn., southward to the Obion River; local flood protection between Augusta and Clarendon and at Des Arc and DeValls Bluff in Arkansas, and at Lake Pontchartrain and Jonesville, La.; improvement of the Grand Prairie-Bayou Meto region in Arkansas for flood control and water supply; improvement of the flood-carrying capacities of the western Tennessee tributaries, the L'Anguille River in Arkansas, the Cache River in Arkansas and Missouri, Bayou Lafourche, Boeuf and Tensas Rivers and Bayou Macon in Louisiana and Arkansas, Big Sunflower River and tributaries in Mississippi, and Bayous Rapides, Boeuf and Cocodrie in Louisiana; certain works upon the Mississippi between Rock Island, Ill., and Cape Girardeau, Mo., and upon tributaries and outlets below Rock Island, Ill., insofar as affected by backwater of the Mississippi.

7. The design of all flood-control works is based on a project flood which is predicted to be the "maximum possible" by the Weather Bureau and the "maximum probable" by the Mississippi River Commission. Details of the derivation of this flood are contained in House Document No. 90, 70th Congress, 1st session, and House Document No. 359, 77th Congress, 1st session. After taking into consideration the effects of constructed upstream reservoirs the project flood is computed to have the following flows:

|                                   | <i>Cubic feet per second</i> |
|-----------------------------------|------------------------------|
| At Cairo, Ill.....                | 2, 450, 000                  |
| At Arkansas City, Ark.....        | 3, 035, 000                  |
| At latitude of Old River, La..... | 3, 000, 000                  |

In light of floods experienced, the above flows are definitely possible and should be used as a basis for design of flood protection works for the control of diversions from the Mississippi River through Old River. Discussion will be limited to the flow at the latitude of Old River (mile 302 above Head of Passes) and to its effect on those features of the project which would be affected should the Mississippi River be permitted to abandon its present course and adopt that of the Atchafalaya.

### III. PRESENT STATUS OF THE PROJECT

8. The total authorized cost of the project is \$1,292,748,500 of which \$848,770,400 has been appropriated through the fiscal year ending June 30, 1954. On this basis the project is 65.7 percent complete. Work on the main stem is about 70 percent complete and that in the tributary basins about 50 percent. No construction work has been accomplished on the Devils Swamp Harbor, the Cache River Basin, the L'Anguille River, the Grand Prairie-Bayou Meto region,

the west Tennessee tributaries, the Vicksburg-Yazoo area, the Yazoo Basin backwater, nor have funds been expended upon the 12-foot navigation channel project although improved navigable depths are being obtained progressively as a result of the bank stabilization program.

9. Inland waterborne commerce on the lower Mississippi, exclusive of deep sea traffic to Baton Rouge, has risen from 2 billion ton-miles in 1929 to approximately 11 billion ton-miles in 1951 and in 1952. Large floods have been carried safely through the valley in 1937, 1945, and 1950 as a result of the improved flood-control features. Benefits of the existing alluvial valley project, accumulated from its initiation in 1928 to June 30, 1951, are estimated to be \$4.6 billion. Thus in actual accomplishments the project has returned over \$5 for every dollar expended for the work.

#### IV. ESTIMATE OF THE GENERAL ENGINEERING SITUATION

10. The existing project as conceived is sound. Although certain features of the project should be reviewed in the light of present and expected future development of the region, and it is planned to do so in due course, the possible diversion of the Mississippi River through the Atchafalaya is the most serious problem which now confronts us and justifies separate consideration. This problem is confined to the lower section of the Mississippi River (plate 2<sup>1</sup>). No modification of the existing project should be considered which does not safeguard the interests of navigation, as the large tonnage now carried on the Mississippi River is increasing and more use is being made of the Atchafalaya outlet year by year. Neither should any modification be made which would materially alter or jeopardize the planned distribution of flood flows in the general latitude of Old River. The problem now existing has not been brought about by engineering deficiencies as the possibility that the Mississippi would divert its flow through the Atchafalaya has been recognized and the necessary development of this distributary stream has been under engineering surveillance for over a hundred years. While there is no danger of this diversion taking place abruptly, studies indicate that remedial action should be initiated promptly in order that protective works will be ready when needed. The estimated date when control measures should be completed after giving due regard to risks and uncertainties involved as well as the element of economy in construction is no later than 1965.

11. The foregoing statement of the situation leads to a discussion of the following technical and economic considerations before proceeding to the examination of possible changes in the existing project:

- Present authority.

- Maintenance of the present plan of distribution of project flood flows in the general latitude of Old River.

- Diversion of the Mississippi River into the Atchafalaya.

- Need for positive control measures.

- Requirements of navigation.

- Economic changes which would result from the diversion of the Mississippi through the Atchafalaya.

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<sup>1</sup> Not printed.

## V. PRESENT AUTHORITY

12. Under the provisions of the act approved May 15, 1928, and amendments, protection is to be given in the lower river (Old River to the Gulf of Mexico) against the project flood whose flow at the latitude of Old River is 3 million cubic feet per second. Of this amount, half is to go down the main river and the balance is to go into the Atchafalaya Basin. The basic plan and authority are still valid. While general authority exists to accomplish the objectives set forth in the basic plan, it has been considered advisable to inform the Congress in advance of each additional major undertaking and the cost thereof. For instance, the substitution of the Morganza Floodway for the East Atchafalaya Floodway received congressional approval in the act approved June 15, 1936, prior to construction, as did the plan for the Wax Lake outlet and improvement of the discharge capacity of the leveed channel of the Atchafalaya River and of its outlets. This report therefore was prepared to inform the Congress of the necessity for controlling the diversions through Old River, its urgency, the plan for accomplishment, and the additional costs involved.

## VI. DISTRIBUTION OF PROJECT FLOOD FLOWS

13. The runoff from the entire Mississippi River watershed passes through the relatively narrow gap between the Marksville hills and the Mississippi bluffs above Angola (vicinity map, pl. 1). Of the total flow of the project flood at this latitude (fig. 1), the plan provides that 2,100,000 cubic feet per second will continue in the Mississippi past Old River and down to the Morganza control structure where 600,000 cubic feet per second will be diverted through the Morganza Floodway into the Atchafalaya Basin. Below Morganza, 1,500,000 cubic feet per second will continue downstream to the Bonnet Carre Spillway where 250,000 cubic feet per second will be diverted into Lake Pontchartrain, with 1,250,000 cubic feet per second continuing past New Orleans to the Gulf of Mexico.

14. Above Morganza, 700,000 cubic feet per second, according to plan, will be diverted from the Mississippi River through its tributary, Old River and the Red River backwater area, to which will be added a flow of 300,000 cubic feet per second from the Red-Black-Ouachita-Tensas Rivers system. Of this total flow of 1 million cubic feet per second, under project flood conditions flow at the rate of 100,000 cubic feet per second will go into storage in the Red River backwater area, 650,000 cubic feet per second will go down the leveed Atchafalaya River, and 250,000 cubic feet per second will pass through the West Atchafalaya Floodway. These flows supplemented by the flow through the Morganza structure and totaling 1,500,000 cubic feet per second will pass to the Gulf of Mexico through the lower Atchafalaya River and Wax Lake outlet.

## VII. DIVERSION OF THE MISSISSIPPI RIVER THROUGH THE ATCHAFALAYA

15. The Old-Atchafalaya River system is the farthest upstream tributary or natural diversion outlet of the Mississippi and departs from its parent stream at a point 313 miles above the Gulf of Mexico or 302 miles above the Head of Passes. The distance from the depar-

ture point to the Gulf of Mexico by way of the Atchafalaya Basin is only about 140 miles. Thus the slope through the Old-Atchafalaya Rivers system is more than twice that found in the Mississippi below their common point. Over the past 90 years since the early settlers removed the extensive logjams (known as rafts) which obstructed free flows, the development of an efficient and adequate channel in the Atchafalaya River for accommodating large flows from the Mississippi River has been retarded due to the existence of a deep layer of erosion-resistant clays. However, surveys show that the more resistant material has worn through in places, the currents are now working on the more easily erodible underlying sands and gravels, and the river is enlarging at an accelerated rate.

16. Studies of surveys indicate that in general the lower Mississippi River is in equilibrium, but that its channel immediately below Old River in late years has shown a tendency toward deterioration. The Old and Atchafalaya are clearly in a period of adjustment but are far from equilibrium and are actively flattening their slopes and enlarging their channels in this effort. Serious concern about the possible capture of the Mississippi River by the Atchafalaya was evidenced in 1888 by reports to the Mississippi River Commission from the field staff. A close watch has been maintained of the rate of development. Several formal reports have heretofore been rendered to the Chief of Engineers and at times to the Congress, but no action was recommended due to the lack of a positive trend or rate of development. The increasing flood-carrying capacity of the Atchafalaya River has not been opposed because this development has been in keeping with the adopted flood-control plan which contemplated the enlargement of the Atchafalaya River so that it and the adjacent floodways could carry their share of the project flood.

17. Since 1932, for a discharge of 410,000 cubic feet per second, the water surface elevation or stage at Simmesport has decreased 10 feet, while the stage at the end of the Atchafalaya River levees, 70 miles downstream from Simmesport, has increased 3 feet. Stated in another way, during the 40-year period between 1892 and 1932, for a stage of 40 feet at Simmesport, the discharge of the river increased 60,000 cubic feet per second, an average of 1,500 cubic feet per second per year. During the 18-year period between 1932 and 1950, and for the same stage at Simmesport, the discharge increased an additional 130,000 cubic feet per second, or an average of 7,200 cubic feet per second per year. Although some assistance in this enlargement was provided by dredging, its effect has been minor. A study of the areas, depths, and widths of the river in its upper 45 miles clearly shows that these elements are becoming larger and, most important, that their rate of enlargement has been accelerated since about 1932. It is indicated that if the discharge capacity at Simmesport continues to increase in the future as in the past 18 years, a condition will be developed where by 1968 the major portion of the flow of the Mississippi River will have been seized by the Atchafalaya. This enlargement in the upper reaches of the Atchafalaya has been accompanied by a flattening of slopes due to the deposition of scoured material in the basin below the termination of the river levees. As a result of these flattened slopes, it may reasonably be expected that the rate of acceleration of increase in discharge in

the upper river of the last 18 years will not continue for the next similar period.

18. Consideration has been given to the rate at which the Atchafalaya has been pushing through the deposits being dropped in the lower portion of the Atchafalaya Basin known as Grand Lake and Six-Mile Lake just north of Morgan City. It is estimated that if the downstream advancement of the river channel which occurred from 1916 to 1950 were continued, an efficient single river channel would be developed by 1985 or 1990. The existence of such a well-developed channel is considered to be an important consideration before the major flows of the Mississippi River will choose a new route to the gulf. However, it may be expected that the channel in the lower basin will accelerate its development due to a confinement of flows within the material deposited.

19. Geological studies clearly show that each new course of the Mississippi River developed because it held a gradient advantage providing a shorter route to the sea. Available information indicates that the initial stages of each diversion took place slowly and at a certain stage of the development water flowing through the main channel was insufficient to maintain it and rapid deterioration set in. The stage just before diversion became certain has been termed the critical stage. After this stage had been reached deterioration of the main channel added further impetus to diversionary action in the new distributary channel until little discharge could pass through the Old main channel except during floods. The critical stage in stream diversion development is reached when about 40 percent of the total flow is carried through the distributary channel. If this critical stage has been reached, a few flood flows can result in completing the diversionary action and any effort to prevent this action becomes extremely costly or even impracticable. The Old-Atchafalaya distributary has increased its discharge carrying capacity from approximately 10 percent of the Mississippi River flow in 1928 to an average of 24 percent in 1952. However, the rate at which the increase in discharge has been occurring is accelerating and has been doing so since 1928. Several large floods such as were experienced in 1927 or 1950 could readily cause the critical stage to be reached. Under existing and anticipated conditions of development, it is believed that the diversion will have reached a critical stage somewhere between 1965 and 1975. The time when the Atchafalaya River will have become the master stream depends, of course, upon a number of factors, most of which are dependent upon the wet or dry weather cycles occurring after the critical stage is reached.

20. It is believed that all of the elements present in the concept of diversions are now present in the Old-Atchafalaya situation and in a pattern favorable to the Mississippi accepting the Atchafalaya Channel as its own within a relatively brief span of years. After considering all the contributing factors, it is estimated that the Atchafalaya River can well become the main or master stream below Old River somewhere between 1968 and 1985, probably around 1975. The problem of control and the timing of corrective action should be approached on the basis of the critical stage rather than when major flows will have accepted the new channel.

## VIII. NEED FOR POSITIVE CONTROL MEASURES

21. If the channel conditions now existing could be reliably stabilized and further change prevented, there would be no need for the construction of control structures. As has been shown, however, natural conditions are changing definitely in favor of the Atchafalaya and the rate of change is accelerating. Should the Mississippi be permitted to adopt the course of the Atchafalaya, a major change in the economy of the basin would result. The entire flood-control plan for the lower river upon which very large sums, both local and Federal, have been expended to date would require abandonment or extensive revision. A single river channel through the Atchafalaya Basin of sufficient capacity to accommodate flood flows now carried by the Mississippi, the Red, Ouachita, and Black Rivers would completely change the flood situation in south Louisiana. As the Mississippi River Channel below Old River gradually became filled with sands and silt it would be capable of carrying less and less of the flood flows until finally the the Atchafalaya River and basin would have to carry the major portion of the project flood. This would require improvement of the overbank and channel capacities through the lower portion of the floodway and make necessary the raising and widening of the floodway protection or guide levees. These levees are now being constructed to a height considered practicable for foundation conditions in extensive reaches on both sides of the basin and further raising can only be accomplished at great cost and risk. Development of the channels and overbank area to accommodate the increased discharges would require large expenditures of funds for many years to come. The Atchafalaya Basin Floodway below the leveed Atchafalaya River is not now capable of carrying safely its assigned flows within its present guide levees and will not be capable of doing so with reasonable freeboard until an efficient channel is developed from the end of the Atchafalaya River levees to the Gulf of Mexico. During high stages, sediment is deposited in the lake and overbank areas thereby increasing flood stages and thus the capacity of the floodway will continue to be reduced unless compensating channel and overbank improvements are provided. Maximum channel development occurs under natural conditions when stages range from medium to bankfull. Although some dredging will be necessary to assist in the development of an efficient channel in this area, controlling the flow to maintain the most beneficial stages would assist in this development materially and result in reduced dredging costs. In addition to project and medium to bankfull flows, consideration must be given to low-water flows. Any works constructed for the control of Old River should provide for the regulation of low flows so that both the Mississippi and Atchafalaya will receive their fair share of fresh water which is now becoming a critical concern to municipalities and industries. It is equally important that the Atchafalaya receive its share of the sediments in order that scouring of its bed in the upper river will not be increased. The distribution of flow and sediment in the Mississippi and Atchafalaya Rivers is now in desirable proportions and should be so maintained. Control measures which will assure the maintenance of the present water-sediment relationship are needed.

## IX. NAVIGATION

22. Old River is an existing natural waterway. It is the connection between the Mississippi River and the Atchafalaya River, and the Red-Black-Ouachita Waterway. It is an integral part of the Overton-Red River Waterway which was authorized in 1946.

23. The Atchafalaya River is navigable and has long been used in local traffic. At Morgan City, La., it connects with the Gulf Intra-coastal Waterway between Apalachee Bay, Fla., and Brownsville, Tex. In recent years, since 1948, it has been in active use by contract carriers in barge operations, principally by the more modern high-powered, integrated tows transporting petroleum products from the west Louisiana and east Texas refineries to the upper Mississippi and Ohio Rivers. The Atchafalaya is not under improvement for navigation, and on an average of about 6 months in the year adequate depths for large barge operations are not available in the lower reaches of the basin, generally in the Grand Lake-Six-Mile Lake area where the deposition of eroded material is particularly active. A report from the Chief of Engineers is now before Congress (S. Doc. 53, 82d Cong., 1st sess.), which recommends that navigable depths be made available at low stages by dredging at an estimated cost of \$440,000 and \$150,000 for annual maintenance.

24. The gulf coast region, including the lower Mississippi Valley, is in an active stage of development. The petroleum and natural gas developments have attracted industry of many types. Favorable climate and adequate labor are also contributing factors. The existence of navigable waterways has not only aided in this development, but to a very considerable degree has made it possible. The expansion of industry, together with the further development of petroleum resources, especially the offshore operations, will, it is believed, result in further rapid growth of waterway traffic east and west along the gulf coast. The great developments in natural resources and industrial expansion in the Deep South and the readiness of waterway transportation to meet the needs of this movement indicate that navigation on the Atchafalaya, an important artery in the expanding region, should be carefully considered and amply provided for in any plan for preventing the diversion of the Mississippi River. However, in view of the necessity for a detailed analysis of the trends of present traffic and the nature of prospective traffic, it is not practicable at this time to present the economics and to determine the size and estimated cost of providing a lock in the Old River control project. In keeping with the proposed sequence of construction (pars. 38-43) it will be at least 4 years after the control structures are begun before the construction of a navigation lock would be initiated. Although it is considered that a lock will be necessary, the required provisions for navigation will be determined more adequately prior to a request for construction funds.

## X. RED RIVER BACKWATER

25. Protection for the Tensas-Cocodrie area in the Red River backwater has been provided under existing authority. Likewise, authority exists to provide protection to additional areas in the Red River backwater when economically justified and which can be accomplished without jeopardizing the main Mississippi River levees and without preventing or jeopardizing the confinement of flood

flows through the Atchafalaya River and Atchafalaya Basin as contemplated in the adopted project. The Red River backwater lands should remain available for temporary storage and overbank flow of excess floodwaters from the Red and Mississippi Rivers as now occurs under existing conditions and authority. It is important that further reduction of storage capacity in the Red River backwater area be permitted only after careful and judicious engineering study has shown that the flood protection works on the Mississippi River and in the Atchafalaya River Basin can safely contain major floods without their safety being jeopardized. The magnitude of the project flood in this latitude makes it imperative that first and continuing consideration be given to the accommodation of flood flows without endangering the safety of the downstream flood-control works. The development of the Atchafalaya River and its lower basin must have progressed to such an extent that their increased flood-carrying capacity will compensate for any amount of reduction in storage capacity in the Red River backwater without an increase in stage below the latitude of Old River or in the Red River backwater area.

26. The lands in the lower portion of the Red River backwater area are generally flat, poorly drained, and interlaced with shallow lakes, sloughs and the remains of old water courses which have become partly filled with silt from many overflows. This area is mostly cutover woodland with a remaining stand of about 1,000 board-feet per acre of merchantable timber. Only a narrow strip of relatively high land adjacent to and along the Mississippi River at and below Point Breeze has been developed as practically the entire area is subject to annual flooding.

#### XI. ECONOMIC CONSIDERATIONS

27. New Orleans is one of the Nation's largest ports, and from Baton Rouge to the Head of Passes a vast industrial development has occurred along the banks of the river. Should the Mississippi be lost to the Atchafalaya it could be expected that the present channel of the Mississippi River would become filled with sands and silt for a considerable distance below Old River and eventually no flow, except during floods, would pass down the leveed channel. The loss of low-water flow down the Mississippi and through South and Southwest Passes would increase the cost of maintenance of the deepwater navigation channel up to Baton Rouge. The present large tonnage of barge traffic from the upper reaches of the Mississippi and Ohio Rivers would eventually have to be rerouted through the Old Atchafalaya system and the Intracoastal Waterway to New Orleans thus adding materially to costs of operation. In order to provide for the resulting increase in volume of traffic between Morgan City and New Orleans, the section of the Intracoastal Waterway connecting these points would have to be reconstructed. An alternative solution of this problem would be to construct a navigation lock and barrier dam in the Mississippi below Old River and maintain a dredged channel from the lock to the vicinity of Baton Rouge. The initial cost of either solution would be great and the maintenance costs would likewise be high. The present deepwater channel below Baton Rouge would become ineffective as an adequate source of fresh-water supply for domestic and industrial use because there would be salt-water

intrusion probably as far up as Baton Rouge. The impact on the present and fast growing industrial developments in this area would be very great.

28. The effectiveness of the costly Bonnet Carre and Morganza structures and floodways would be practically eliminated since the amount of flow which could pass below Old River would not exceed the present below-bank channel capacity of the Mississippi River at New Orleans.

29. Equilibrium conditions now existing in the Mississippi would be disturbed upstream probably beyond Vicksburg with a consequential increase in meander activity. The increase in meander activity by the Mississippi would result in making obsolete a large part of the now effective bank stabilization works and would add a threat to the almost completed main line levee system. During the transition stage in development of the Atchafalaya, river navigation below Natchez would be difficult due to increased velocities and meander.

30. The existing low-lift locks and navigation floodgates in the lower Atchafalaya Basin would have to be reconstructed to provide higher lifts made necessary by an increase in flood stages. The present Intra-coastal Waterway would have to be radically modified in this region. Reconstruction of existing bridges, pipelines, power and telephone lines and cables crossing the Atchafalaya River and Basin would be necessary as a result of the increased channel area of the Atchafalaya River and increased stages caused by the additional flows. Existing levees and railroad and highway high-level crossings would have to be redesigned and reconstructed to higher elevations. Raising of the levees to the new grades in the middle and lower reaches of the basin would be difficult and costly due to the lack of satisfactory material for embankment purposes and to the weak foundation conditions in this area. The urban areas of Simmesport, Melville, Krotz Springs, Morgan City and Berwick would be subjected to the threat of destruction.

31. While these economic losses would not all occur immediately, there is no doubt of the final consequences should the Mississippi be permitted to change its course to that of the Atchafalaya.

## XII. ALTERNATIVE PLANS CONSIDERED

32. Any satisfactory plan for the control of Old River must have the structures located in Old River, in the Atchafalaya River, on the west bank of the Mississippi River above Old River, or at a combination of such locations. Regardless of where located, the structure or structures must be capable of passing the planned amount of project flood flows, must prevent diversion of the Mississippi through the Atchafalaya, must be flexible in operation in order to maintain as nearly as possible the present distribution of flows of water and sediment, must provide for low flows and navigation, must offer assurances of long life, and must be reasonable in first cost and in subsequent maintenance. The nature and importance of the problem clearly require a safe and permanent solution. Hydraulic considerations, foundation conditions, and excessive construction costs make infeasible the selection of either Old River or the Atchafalaya as a possible location for the major control structure or structures. Many plans

were given close engineering consideration, and some of the results are summarized in the following paragraphs.

33. Studies indicate that any structure located near the lower end of the Atchafalaya River levees would require an extensive and impractical amount of levee raising in order to affect appreciably the stage and discharge of the Atchafalaya near its head and hence such a location would not be feasible. Thus, a control should be located as far upstream as practicable. Several plans consisting of dams across the Atchafalaya River in conjunction with weirs, overflow dams, and notches, all of which required the construction of one or more locks for navigation, were considered. A series of low-sill dams in the upper reaches of the Atchafalaya River constructed of stone or other nonerodible material which would distribute the fall in water surface over a long reach of river and thereby eliminate the necessity for a lock were also considered. Although these plans met a varying number of the requirements, disadvantages inherent in the structures were the high cost of initial construction and subsequent maintenance, the high velocities which would be created, a lack of means for regulating the flows needed to aid in the development of channels in the lower basin, and most important, the danger of failure during critical periods of flow. Studies indicate that the Atchafalaya River will continue to enlarge and deepen downstream from any structure built within its banks and the uncertainty incident to the protection of structures so located would make their construction, in the Atchafalaya River proper, undesirable. Also a means of friction control in Old River was considered by which the channel roughness would be increased by shingling with stone. In addition to most of the disadvantages enumerated above and the fact that it would be more or less experimental in nature, this treatment would require extensions or additions in order to maintain its effectiveness as the river enlarged or deepened downstream.

34. The remaining possibility then is to locate the structures where flow from the Mississippi River can be definitely controlled before it reaches the Red River backwater area. As Old River and the Red River backwater area now act as a temporary storage and distributing basin for overbank flows in this latitude, structures located so as to take advantage of this already existing condition would be ideal from both an engineering and economic viewpoint. Structures located on the west bank of the Mississippi River above Old River with a lock in Old River for the passage of navigation would satisfy the conditions of effectiveness, permanence, safety, and reasonable cost.

### XIII. PLAN OF IMPROVEMENT

35. *Description.*—The plan outlined herein provides for the control of flows from the Mississippi River into the Atchafalaya River and Basin. Principal features of the plan, as shown on plate 3, consist of two mechanically operated control structures located on the right bank of the Mississippi River approximately at mile 312 above the Head of Passes, an inflow channel from the Mississippi River to the low-sill control structure, an outflow channel connecting the low-sill control structure with Red River at about mile 12 above its mouth, a lock for navigation connecting the Mississippi and Old Rivers, inflow and outflow channels for the lock, an earthen dam closing Old

River, enlargement and extension of main-line Mississippi River levees from Black Hawk to Torrass, and bank stabilization as required in the Red and Atchafalaya Rivers between the outflow channel and the vicinity of Simmesport. The two control structures are designed to assure the passage of a flow of approximately 700,000 cubic feet per second from the Mississippi River during the project flood. A general description of each of the principal features of the plan of improvement follows:

(a) The low-sill control structure will be reinforced concrete with gates having a gross length of 577 feet between abutments and consisting of 13 gate bays each having a 37-foot clear opening between piers. Except for 3 low bays with weir-crest elevation at -5 feet mean sea level for the purpose of passing low flow, weir crest elevation will be 10 feet mean sea level, which will permit passage above this elevation of Mississippi River flows into an outflow channel which extends to Red River (plate 4 <sup>1</sup>).

(b) The inflow channel from the Mississippi River to the low-sill control structure will be about one-half mile long, having a bottom width of 1,000 feet at elevation -5 feet mean sea level and 1 on 4 side slopes.

(c) The outflow channel from the low-sill control structure to Red River will be about 7 miles long, having a bottom width of 900 feet at elevation -8 feet mean sea level near the structure and at elevation -10 feet mean sea level where it enters Red River. Side slopes will be 1 on 4 between the structure and the uniform channel section which will be constructed by dredging.

(d) The overbank control structure will be of reinforced concrete with shutters, having a gross length of 3,356 feet between abutments and consisting of 73 bays each having a 44-foot clear opening between piers. Above the weir-crest elevation of 52 feet mean sea level, flows will pass from the Mississippi River into the Red River backwater area where they will be carried overland and through natural channels to the head of the Atchafalaya Basin (plate 5 <sup>1</sup>).

(e) The lock will be located approximately 1 mile southwest of the mouth of Old River in a land cut between Old River and the existing south bank levee. The dimensions of the lock will be determined after further detailed studies have developed the requirements of navigation (par. 24).

(f) The inflow channel extending from the Mississippi River to the lock will be about one-half mile long and the outflow channel extending from the lock to Old River will be about 1½ miles long.

(g) Between Black Hawk and Torrass, existing Mississippi River levees will be raised above project flood-flow line, strengthened and extended where necessary to link the proposed structures with each other and with the existing main-line levee system. An operation, storage, and maintenance area about 1,000 feet long will be provided between the two control structures. Final closure of the Old River Channel will be made by a hydraulically constructed earth dam.

(h) After favorable channel alinement has been obtained in the Red and Atchafalaya Rivers between the outflow channel and the vicinity of Simmesport, this reach will be stabilized by means of bank protection works.

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<sup>1</sup> Not printed.

(i) Approximately 9,800 acres will be required for the structures and their inflow and outflow channels. An additional 11,700 acres will be needed for a spoil-disposal area for the excavated material from the outflow channel. The major portion of these lands lying between the outflow channel and Old River is undeveloped and subject to annual flooding.

(j) There are no railroads or utilities which interfere with the contemplated structures. The right-of-way of the abandoned railroad between Coochie and Terras was acquired by the Louisiana Department of Highways in 1940 for use in constructing a secondary road. No work has been accomplished south of Coochie.

36. This plan of improvement constitutes the most practicable and economical known means of preventing the diversion of the Mississippi River into the Atchafalaya at the least overall cost to the United States. It meets all of the criteria stated in section XII above.

37. *Possible deviations from the plan.*—Deviations from the plan described above may be found to be desirable after more detailed engineering studies have been completed. The dimensions and elevations set forth above are preliminary and subject to modification. Any such departures, however, will be in details of design rather than in overall concept.

38. *Order of construction.*—It is important that construction be initiated promptly and accomplished in a prescribed order because the earliest date when construction can be completed very nearly coincides with the date when it is estimated that the critical stage in diversionary development of the Mississippi into the Atchafalaya will be reached. Any material delay in commencement of construction of the works can and probably will add to the construction difficulties and result in added costs. Construction should start not later than fiscal year 1956 beginning in July of 1955.

39. The low-sill control structure with its appurtenant inflow and outflow channels and adjoining embankments should be constructed first. The completion of these works will provide a means of passing low flows and considerable flow above elevation 10 feet mean sea level. It is the most necessary control unit to have available should it become imperative to close Old River prior to completion of the overbank structure, the navigation lock, or both.

40. The overbank control structure and upper levee embankments should be completed next. After completion of the two control structures, the gap and channel area at Old River could be reduced or entirely closed if necessary to prevent enlargement of the Old and Atchafalaya Rivers to a point where it would be impracticable or impossible to control them.

41. Construction of the lock and its appurtenant channels should be initiated promptly after the two control structures are well advanced toward completion. Unless emergency conditions dictate otherwise, the lock and its channels should be completed prior to commencement of closure of Old River.

42. After the low-sill and overbank structures and the lock have been completed, the closure of Old River and the remaining levees

should be constructed. This construction should be undertaken and completed during favorable low-water stages.

43. The required stabilization of the channel alinement in the Red and Atchafalaya Rivers referred to in paragraph 35 (*h*) above will be accomplished in increments as channel and alinement conditions become favorable. These conditions will not develop until all other features of the plan have been completed and in operation for several years.

#### XIV. PLAN OF REGULATION

44. The authorized flood-control project provides for diversion of floodwaters in excess of the safe carrying capacity of the various levee systems protecting the agricultural, urban, and industrial areas lying within the lower Mississippi valley. The adoption and construction of the improvements proposed in this report will not adversely affect the security of these levee systems as the structures can be manipulated so as to maintain the division or proportioning of the total flow in this latitude contemplated in the adopted project.

45. Improvement in the capacity of the Mississippi River Channel resulting from the stabilization program as well as many other reasons may cause some local changes in the present flow conditions in this latitude, and it may be desirable to maintain or improve the Mississippi River below Old River by increasing its flow during moderate floods. It is also desirable that the efficiency of the upper Atchafalaya River be increased by permitting continued but limited enlargement. It is especially desirable that flows be regulated in a manner which will promote and assist in the development of the channel in the lower Atchafalaya Basin so that the river and floodway through this region will be capable of carrying their portion of the project flood at stages no higher and probably lower than the present design flow lines. This will, if successful, avoid the necessity of constructing the guide levees to a higher grade at great cost, even if practicable. It is especially important that backwater stages in the Red River backwater area not be worsened. Distribution of future total major flows in approximately the same proportions as occurred in 1950 is necessary if these objectives are to be accomplished. The 1950 flood and flood data provide a suitable basis for future controls. The structures will be operated in such a manner as not to increase flooding in the Red River backwater area during future floods over that which would have naturally occurred had such future floods occurred in 1950. It is contemplated that the proposed improvements will eventually result in improved flood conditions in the backwater area, through the Atchafalaya Basin, and along the Mississippi River below Old River.

#### XV. COSTS

46. Estimated first costs and annual charges (based on current prices as of December 1953) of the improvements, excluding at this time the navigation lock, are as follows (see table 1 for details):

| Item                                          | Federal             | Non-Federal   |
|-----------------------------------------------|---------------------|---------------|
| <b>First cost:</b>                            |                     |               |
| Lands.....                                    | \$425,000           |               |
| Roads and bridges.....                        | 340,000             |               |
| Channels and canals.....                      | 10,510,000          |               |
| Levees and closure section.....               | 5,094,000           |               |
| Low-sill structure.....                       | 17,769,000          |               |
| Overbank structure.....                       | 8,569,000           |               |
| Bank stabilization.....                       | 4,025,000           |               |
| Rights-of-way (Mississippi River levees)..... |                     | \$10,000      |
| <b>Total.....</b>                             | <b>1 46,741,000</b> | <b>10,000</b> |
| <b>Annual charges:</b>                        |                     |               |
| Interest.....                                 | 1,169,000           | 400           |
| Amortization (60 years).....                  | 480,000             | 65            |
| Operation and maintenance.....                | 231,000             | 400           |
| <b>Total.....</b>                             | <b>1,880,000</b>    | <b>865</b>    |

<sup>1</sup> Exclusive of navigation lock and approach channels thereto.

#### XVI. BENEFITS

47. A measure of the benefits which would accrue as a result of preventing the diversion of the Mississippi River into the Atchafalaya is the cost which would be necessary to provide substitute facilities and the cost of irreplaceable economic losses. A vast industrial complex has developed below, in, and above New Orleans which is vitally dependent upon Mississippi River fresh water for manufacturing processes. These industries utilize the Mississippi not only as a source of fresh water but also as a means of carrying off the effluents and byproducts. Reduced flow in the Mississippi would permit salt-water intrusion to an extent where its water would be practically useless to these industries. The high degree of pollution in the reduced stream would make the water unfit as a source of public water supply and for many other uses. Increased meandering of the Mississippi and Red Rivers would result in a loss of agricultural lands along their banks. During the time when the new route for the Mississippi is being developed, neither channel will be efficient and large flood damages will occur. These losses are presently intangible.

48. The cost of major works which would need to be constructed, modified, replaced or which would be completely lost has been estimated, based on 1953 price levels. A new source of water for the water supply systems serving a population of approximately 750,000, including the city of New Orleans, would have to be developed at great expense. New Orleans, Baton Rouge, and many smaller communities with a total population of about 825,000 which are now discharging raw sewage into the Mississippi would be forced to construct sewage disposal plants. Changed slopes and increased velocities in the Mississippi between Vicksburg and Old River and in Red River below Boyce would cause these streams to meander actively with the probable result that existing revetments, bank-protection works, and even some of the main-line levees would be destroyed. Widening of the Atchafalaya River would result in the loss of the levees along its banks, necessitate the relocation of the urban centers of Simmesport, Melville, and Krotz Springs, and require modification of railroad and highway bridges and utility crossings over this stream. The Atchafalaya Basin protection levees and the flood walls at Morgan City and Berwick would need raising but can be done only at great cost and risk due to poor foundation conditions. Wax Lake Outlet would

require enlargement with a consequential need to modify railroad, highway, and utility crossings. It would be necessary to modify utilities and reconstruct the high-level crossings over the Atchafalaya Basin Floodway. Reconstruction of the navigation locks at Bayou Sorrel, Bayou Boeuf and Berwick to provide a higher lift would be required as would modification of the Calumet floodgates. A navigation lock in the Mississippi River below Old River and in the intra-coastal canal on each side of Wax Lake Outlet would be necessary and channel maintenance costs would be increased. The approximate cost for construction, replacement, modification, and abandonment, based on current prices, is estimated to be at least \$475 million with additional annual maintenance costs of \$6,700,000. Thus the tangible benefits to be derived from preventing the diversion of the Mississippi into the Atchafalaya, after proper allowance has been made for the projection of benefits over the economic life of the improvement and the discounting of such benefits to present day conditions, are estimated to be \$14,600,000 annually. These benefits are in addition to the intangible benefits mentioned above. Annual charges (exclusive of the navigation lock) are estimated to be \$1,880,865. A comparison of the annual benefits with the annual charges indicates the high favorable benefit-to-cost ratio of 7.7 to 1.

#### XVII. ALLOCATION OF COSTS

49. Except for the additional Mississippi River levee right-of-way costs, estimated to be \$10,000, which should be furnished by local interests in accordance with the provisions of section 3 of the act approved May 15, 1928, all costs are considered to be Federal.

#### XVIII. FLOWAGE CONSIDERATIONS

50. The flood Control Act, approved May 15, 1928, contains in section 4 the provision that the United States shall provide flowage rights for additional destructive floodwaters that will pass by reason of diversion from the main channel of the Mississippi River. It further provides that in all cases where the execution of the flood-control plan results in benefits to property such benefits shall be taken into consideration. The comprehensive plan for flood control as authorized did not include the protection of areas whose reclamation was not economically justified, it being contemplated that such areas would be left open for temporary storage and discharge of floods. The authorized plan provides that flood flows in excess of the safe capacity of the leveed channel of the Mississippi River, except for those diverted through Bonnet Carre, will be diverted into the Atchafalaya Basin. Passage of a major portion of this excess flow through Old River and the Red River backwater area, without payment for flowage easements, is and always has been contemplated.

51. Partial protection for the Tensas-Cocodrie area essentially has been completed. Authority exists to provide protection to additional areas in the Red River backwater area which may be found in the future to possess economic justification and to be feasible without jeopardizing the safety and integrity of the main Mississippi River levees and without preventing or jeopardizing the diversions contemplated in the adopted project and their confinement through the Atchafalaya Basin.

52. Under the authorized plan and under existing conditions, uncontrolled flood flows from the Mississippi River enter the Red River backwater area through the  $3\frac{1}{2}$ -mile gap in the main line levees at Old River. During flows of maximum or near maximum volumes, the existing Mississippi River levees below Shaw, La., are overtopped and flood flows enter the Red River backwater area opposite river mile 317 above Head of Passes, some 5 miles upstream from the location of the proposed control structures. A large portion of the Red River backwater area is now flooded almost annually from Red River and from the Mississippi River through Old River, a natural distributary. Flooding in the Red River backwater area under existing conditions is normally controlled by stages in the Mississippi River and under these conditions, there is little head loss during overbank stages with the result that the backwater pool is practically level during floods except when it is affected by substantial headwater flows from the Red and Ouachita Rivers. When these rivers are contributing a substantial flow, they may induce a slope ascending upstream in the backwater pool. In 1945 flooding extended to above Monroe. (See pl. 1). The maximum volume of the 1945 flood at the latitude of Old River was 2,123,000 cubic feet per second whereas the project flood flow at this latitude is 3 million cubic feet per second.

53. The plan of improvement does not incorporate a new diversion or floodway nor is the diversion of additional floodwaters contemplated over that presently authorized. It merely provides for the control of an existing natural diversion to preserve the integrity of the authorized flood control plan and in fact prevent that diversion from exceeding the flow that would obtain if present conditions remained unchanged. The discharge will flow through the same general area as under existing conditions with the intake located about 10 miles above Old River and some 5 miles downstream from the highest upstream point of entrance of Mississippi River flood waters into the Red River backwater area if the project flood should occur under the presently authorized plan and existing conditions. Manifestly, these controlled flows will not constitute the passage of additional destructive flood waters within the meaning of section 4 of the Flood Control Act approved May 15, 1928.

54. Inasmuch as it was contemplated in the basic Flood Control Act that the Mississippi River levees below Shaw, La., would be left at the 1914 grade and that the Red River backwater area would be left open and used for temporary storage and discharge of floods except for those areas where partial protection was economically justified; as no increase in flooding in the Red River backwater is contemplated; inasmuch as the plan of improvement provides a substitute means for an existing natural diversion rather than the creation of a new diversion; and because no additional area is adversely affected; it follows that under the provisions of law applicable to the existing project, as amended and modified for Mississippi River and tributaries, and as herein recommended, no flowage rights are to be acquired by the United States.

#### XIX. DISCUSSION

55. The natural development of the Old and Atchafalaya Rivers has been under observation by engineers for more than a century with the result that a wealth of valuable data have been accumulated. The findings and conclusions resulting from a thorough study of these data

have been reported previously in the Atchafalaya River study. The gradient advantage held by the Atchafalaya over the Mississippi, the wearing away of the more resistant materials in the upper Atchafalaya River channel, the rate and amount of cross-sectional enlargement in the upper Atchafalaya River, the change in the stage-discharge relationship at Simmesport, the increasing amount of deposition in the lower Atchafalaya Basin, and the increase in percent of total flows carried by the Atchafalaya all clearly indicate that, unless control measures are undertaken, the Mississippi will in time divert its flows into the Atchafalaya. Studies indicate that the critical stage in diversion will be reached between 1965 and 1975 after which one or more floods could make the diversion a fact. Thus a point in the stage of development of these distributory streams has been reached which requires that steps must now be undertaken to provide structures which will prevent the Mississippi River from abandoning its present channel below Old River and adopting the shorter course of the Atchafalaya. This problem can not be solved by simply closing Old River and thus keeping all except major flood flows of the Mississippi River from entering the Old-Atchafalaya system. Such a solution would not provide a means for insuring that the proper proportion of flood flow would be diverted through the Atchafalaya Basin as required and as contemplated in the Flood Control Act of May 15, 1928. The discharge capacity of the lower Atchafalaya Basin must be encouraged to increase, within limits, in order that this part of the flow distribution system will function successfully during the project flood. It is especially important that the Atchafalaya River develop its channel from the end of the leveed portion to the Gulf of Mexico so that the lower basin can carry the flows required within practicable levee grades. At the present stage of development the lower basin will not carry the project flood flows without extensive emergency steps to prevent the protection levees being overtopped. Some dredging in this portion of the basin is contemplated to assist in the concentration of flows and development of a single channel. However, not much dredging of this character should be undertaken prior to initiating construction of control works. The most economical way of providing adequate flood-carrying capacity through the Atchafalaya Basin is to use the energies developed by flowing water as a force for scouring out and enlarging the river channel through its swamp and lake area, with some hydraulic dredging assistance where resistant materials restrict natural enlargement. Observations over a long period indicate that the river in the lower basin develops greater scouring activity between midbank to bank-full stages and the capability of regulating the rate of flow from the more moderate and prolonged floods should permit the development of adequate flood capacity at the least cost to the United States. It is also necessary that the Mississippi River channel below Old River be maintained in order that the flows it must carry in times of great floods can be passed at stages no higher than those provided for under the adopted project. Maintenance of low flow distribution, of navigation channels, and above all else, needed flood capacities below Old River require the capability of regulating flow in both the Mississippi and Atchafalaya Rivers. None of the alternative plans considered possessed the characteristics of flexibility needed to overcome the varying patterns of floods in timing or magnitude or permit regulated and controlled flood flows to be directed so as to assist in these objectives.

56. In order to be effective, the control structures must be located in the upper Atchafalaya River, in Old River, or on the west bank of the Mississippi River above Old River. Since safety and performance of any structures located in the Atchafalaya River proper cannot be assured at reasonable cost it is felt that construction of control measures in the Atchafalaya entails risks too great for an undertaking of this importance and magnitude. The location in Old River of control structures which will meet all the requirements would be too costly to construct and maintain. The only acceptable location then is on the west bank of the Mississippi River above Old River. The site selected is also favorable to the maintenance of desirable proportions of sediment flow distribution, an important factor in preserving the regimen of the Mississippi and Atchafalaya Rivers under conditions now existing.

57. An increasing amount of waterborne commerce is being transported on the Atchafalaya River. If the proposed navigation project now before the Congress (S. Doc. 53, 82d Cong., 1st sess.) is authorized, and funds are provided for construction and maintenance of an all-year route it can be expected that commerce on the Atchafalaya River will increase rapidly. Economic development in the upper reaches of the Ouachita and Red give indications of additional commerce on these streams. The closure of Old River to navigation would result in the abandonment of navigation projects serving these areas. Therefore, a navigation lock connecting Old River with the Mississippi should be provided. Before the size of the lock can be determined and the economics developed in support of this feature of the overall plan of improvement, it will be necessary to analyze the trends of present traffic and the nature and magnitude of prospective traffic. Therefore it is not practicable at this time to include the navigation lock in the cost estimate.

58. Since the control structures will be designed and operated so as not to increase flooding but rather to improve conditions and in view of the conclusions reached in section XVIII, it is not contemplated that the United States acquire flowage easements over the Red River backwater area or any part of it. In view of the operational requirements of the plan, the purchase in fee of the lands on which the structures and channels are located is contemplated. Rights-of-way for new main-line Mississippi River levees and enlargements should be provided by the local interests in accordance with the provisions of the Flood Control Act of May 15, 1928, as amended.

59. Authority exists under present law to provide protection to additional areas in the Red River backwater area where economically justified and without jeopardizing the safety and integrity of the main Mississippi River levees and without preventing or jeopardizing the control of diversions through the Atchafalaya River and Basin as contemplated in the adopted project. Although protection for additional areas is not an integral part of this plan, studies indicate that some additional areas may have economic justification for partial protection. However, no part of the Red River backwater area should be withdrawn from temporary storage use until the development of the Atchafalaya River and its lower basin has progressed to such an extent that their increased flood-carrying capacity will compensate for the amount of storage withdrawn without raising stages in the

Atchafalaya River, the Atchafalaya Basin, or in the Red River backwater.

60. Justification for the plan of improvement is based upon the enormous economic losses which would be sustained by cities, industries, agriculture, utilities, communications, navigation, existing flood-control works, and the United States if the works recommended are not undertaken or are unduly delayed. Should the Mississippi River divert its major flow through Old River into the Atchafalaya Basin the additional costs to the United States of providing means of regaining control of floods by development and construction of new structures to care for the project flood of 3 million cubic feet per second would be many times the cost of the works recommended herein.

61. Statements received from the Forest Service and Soil Conservation Service of the United States Department of Agriculture indicate that there will be no harmful effects on either the agriculture or on National Forests of the region as a result of construction of these improvements. The Louisiana Forestry Commission concurs in this opinion. The United States Department of Health, Education, and Welfare and the Louisiana Department of Health state that no adverse effects can be foreseen as a result of the proposed improvements. The Fish and Wildlife Service of the Department of the Interior states that the possibility of salt water intrusion resulting from low flows is the only hazard foreseeable to that agency (appendix A). However, each agency is much concerned over pollution problems which are likely to result from diversion of the Mississippi into the Atchafalaya. These problems pertain to pollution by sewage, trade wastes, oilfield brines, and salt water intrusion from the Gulf of Mexico. Pollution of the smaller Mississippi River flows resulting from diversion would render it unfit as a source of public water supply for twenty communities having a population of approximately 750,000 people. Water from the Mississippi is used by a large number of industries in their manufacturing processes. The polluted water could not be made potable by treatment because of the impracticability of removing salt and certain industrial wastes. Salt water intrusion becomes of serious concern when flow in the Mississippi below Old River is less than 180,000 cubic feet per second. Inasmuch as it is planned to maintain as near as practicable flows in the proportions contemplated in the adopted project, no adverse effects will result from the project.

62. The control of Old River has the approval of the Louisiana Department of Public Works and of the people of Louisiana who would be affected by a change in the course of the Mississippi River.

63. Should the Mississippi River be permitted to adopt the course of the Atchafalaya River the cost of new construction which would be required to modify and replace existing facilities in the interests of flood control, navigation, municipal water supply, pollution abatement, communications, and utilities would amount to approximately \$475 million. Additional maintenance costs would approximate \$6,700,000 annually. Other losses pertaining to relocation of industry, economy of the region, etc., not susceptible of monetary evaluation certainly would be much greater. The minimum value of benefits to be obtained as a result of construction of the plan of improvement is about \$14,600,000 annually which compared to the annual charges (exclusive of navigation lock) of \$1,880,865 results in a favorable benefit-to-cost ratio of 7.7 to 1.

## XX. CONCLUSIONS

64. Ample engineering information and the thorough Atchafalaya River study completed in 1951, fully support the conclusion that unless adequate control measures are taken, the Mississippi will in time divert its flows into the Atchafalaya River. The time when a critical stage of development toward diversion may be reached is estimated to be somewhere between the years 1965 and 1975. Should the diversion be permitted, the Nation will suffer a severe loss to its economy.

65. The plan of improvement described in section XIII is considered to be the most practicable since it will best meet the several requirements, it is easily integrated into the approved plan for flood control and navigation, it can be constructed without disruption to other interests, it is safe, it has long life, and it is economical in cost of construction and future maintenance. It is justified and essential at this time. The critical stage in development of the Atchafalaya is being approached. Delay in constructing the works will result in added construction costs and increased difficulties during construction. Delay will also prevent active steps being taken to develop an adequate channel in the lower basin.

66. A lock for navigation in Old River will be required in order to obviate the abandonment of existing and authorized waterways of which Old River is an integral part. Although the dimensions and cost of a lock are not included in this report, and it may be considered interim for that reason, a detailed study and analysis of the trends of present traffic and the nature of prospective traffic should be reported on at a later date with recommendations for the size of the lock and its estimated cost.

## XXI. RECOMMENDATION

67. On the basis of the foregoing data and conclusions, it is recommended that the project for flood control and improvement of the lower Mississippi River, adopted by the act of May 15, 1928, as amended, be modified and expanded to include the control of the Old and Atchafalaya Rivers and a lock for navigation substantially as set forth in section XIII of this report at an estimated cost (exclusive of the navigation lock) of \$46,741,000 for construction and \$231,000 annually for operation and maintenance with such modifications as the Chief of Engineers in his discretion may find advisable and that the authorization for said project be increased accordingly. The United States shall acquire such lands, rights-of-way, and spoil disposal areas as may be necessary for construction of the project except that local interests shall comply with the provisions of section 3 of the Flood Control Act approved May 15, 1928, as amended, with regard to the enlargement and extension of the Mississippi River levee below Shaw, La., and except that no flowage rights are to be acquired by the United States.

## OLD RIVER CONTROL, LOUISIANA

TABLE 1.—Detailed cost estimate

[Current prices as of December 1953]

## LOW SILL STRUCTURE

| Description                                         | Unit        | Quantity  | Unit price | Total cost |
|-----------------------------------------------------|-------------|-----------|------------|------------|
| Cofferdam and dewatering                            | Job         |           |            | \$400,000  |
| Storage area and unloading facilities               | do.         |           |            | 125,000    |
| Excavation                                          | Cubic yard  | 3,387,000 | \$0.50     | 1,693,500  |
| Backfill                                            | do.         | 124,000   | .50        | 62,000     |
| Fill                                                | do.         | 374,000   | .35        | 130,900    |
| Filter blanket                                      | do.         | 71,515    | 9.00       | 643,635    |
| Gravel drains                                       | do.         | 520       | 10.00      | 5,200      |
| Riprap                                              | do.         | 79,626    | 14.00      | 1,114,764  |
| Derrick stone                                       | do.         | 6,950     | 20.00      | 139,000    |
| Concrete paving                                     | do.         | 2,917     | 26.00      | 76,622     |
| Concrete in walk slab                               | do.         | 18,395    | 26.00      | 478,270    |
| Concrete in chute and stilling basin slabs          | do.         | 12,834    | 26.00      | 333,684    |
| Concrete in baffles                                 | do.         | 1,175     | 30.00      | 35,250     |
| Concrete in piers and abutment                      | do.         | 20,754    | 42.00      | 871,668    |
| Concrete in training walls                          | do.         | 13,346    | 41.00      | 547,186    |
| Concrete in curtain walls                           | do.         | 1,776     | 42.00      | 74,592     |
| Concrete in crane bridge                            | do.         | 611       | 60.00      | 36,660     |
| Concrete in roadway bridge                          | do.         | 1,592     | 65.00      | 103,480    |
| Portland cement                                     | Barrel      | 101,488   | 5.00       | 507,440    |
| Reinforcing steel                                   | Pound       | 7,812,000 | .14        | 1,093,680  |
| Steel H pile 14 inches, at 73#                      | Linear foot | 167,780   | 9.00       | 1,510,020  |
| Piles, untreated                                    | do.         | 79,000    | 1.50       | 118,500    |
| Steel sheet pile 22#                                | Square foot | 51,260    | 2.75       | 140,965    |
| Pipe handrail                                       | Linear foot | 3,160     | 6.00       | 18,960     |
| Crane rail                                          | do.         | 2,330     | 5.00       | 11,650     |
| Crane-rail accessories                              | Pound       | 48,200    | .20        | 9,640      |
| Bridge bearings                                     | do.         | 103,000   | .25        | 25,750     |
| Miscellaneous structural steel                      | do.         | 484,100   | .25        | 121,025    |
| Corrosion-resisting steel                           | do.         | 101,000   | 1.00       | 101,000    |
| Stainless clad steel                                | do.         | 171,500   | .75        | 128,625    |
| Miscellaneous metalwork                             | do.         | 1,000     | .50        | 500        |
| Water stops                                         | Linear foot | 1,600     | 3.50       | 5,600      |
| Gate seals, rubber                                  | do.         | 2,600     | 8.50       | 22,100     |
| Gates                                               | Pound       | 3,502,000 | .35        | 1,225,700  |
| Gantry crane                                        | Job         |           |            | 400,000    |
| Gaging station                                      | do.         |           |            | 10,000     |
| Collector pipe, 15-inch ½ round                     | Linear foot | 2,580     | 4.00       | 10,320     |
| Levee embankment                                    | Cubic yard  | 1,720,000 | .10        | 172,000    |
| Pile test and preload test                          | Job         |           |            | 325,000    |
| Preload test                                        | do.         |           |            | 7,000      |
| Pumping test                                        | do.         |           |            | 6,000      |
| Road maintenance                                    | do.         |           |            | 15,000     |
| Impervious blanket                                  | Yard        | 18,407    | 1.00       | 18,407     |
| Subtotal                                            |             |           |            | 12,876,293 |
| Contingencies, ± 20 percent                         |             |           |            | 2,575,000  |
| Engineering, inspection, and overhead, ± 15 percent |             |           |            | 2,317,707  |
| Total                                               |             |           |            | 17,769,000 |

## OLD RIVER CONTROL, LOUISIANA—Continued

TABLE 1.—Detailed cost estimate—Continued

## OVERBANK STRUCTURE

| Description                                            | Unit             | Quantity  | Unit price | Total cost |
|--------------------------------------------------------|------------------|-----------|------------|------------|
| Cofferdam.....                                         |                  |           |            | \$150,000  |
| Excavation, structure.....                             | Cubic yard.....  | 199,000   | \$0.50     | 99,500     |
| Fill.....                                              | do.....          | 42,500    | .15        | 6,375      |
| Backfill.....                                          | do.....          | 1,860     | .75        | 1,395      |
| Sand blanket.....                                      | do.....          | 5,500     | 8.00       | 44,000     |
| Gravel blanket.....                                    | do.....          | 18,900    | 9.00       | 170,100    |
| Gravel drains.....                                     | do.....          | 510       | 10.00      | 5,100      |
| Riprap paving.....                                     | do.....          | 34,130    | 14.00      | 477,820    |
| Concrete in weir slab.....                             | do.....          | 34,910    | 26.00      | 907,660    |
| Concrete in stilling basin slab.....                   | do.....          | 21,421    | 26.00      | 556,946    |
| Concrete in stilling basin walls.....                  | do.....          | 348       | 42.00      | 14,616     |
| Concrete in piers.....                                 | do.....          | 4,507     | 42.00      | 189,294    |
| Concrete in approach piers and abutment.....           | do.....          | 536       | 42.00      | 22,512     |
| Concrete in curtain walls.....                         | do.....          | 208       | 42.00      | 8,736      |
| Concrete in training walls.....                        | do.....          | 681       | 42.00      | 28,602     |
| Concrete in crane rail beam.....                       | do.....          | 3,610     | 60.00      | 216,600    |
| Concrete in highway bridge.....                        | do.....          | 1,870     | 65.00      | 121,550    |
| Portland cement.....                                   | Barrel.....      | 93,700    | 5.00       | 468,500    |
| Reinforcing steel.....                                 | Pound.....       | 6,459,000 | .14        | 904,260    |
| Pile, concrete, 16-inch.....                           | Linear foot..... | 106,000   | 8.00       | 848,000    |
| Steel sheet pile.....                                  | Square foot..... | 980       | 2.75       | 2,695      |
| Water stops.....                                       | Linear foot..... | 2,908     | 3.50       | 10,388     |
| Hand rail, pipe.....                                   | do.....          | 10,512    | 6.00       | 63,072     |
| Steel needles.....                                     | Pound.....       | 1,566,000 | .18        | 281,880    |
| Bridge bearings.....                                   | do.....          | 54,500    | .25        | 13,625     |
| Miscellaneous structural steel.....                    | do.....          | 270,500   | .25        | 67,625     |
| Miscellaneous metalwork.....                           | do.....          | 2,000     | .50        | 1,000      |
| Crane rail.....                                        | Linear foot..... | 7,208     | 5.00       | 36,040     |
| Crane rail accessories.....                            | Pound.....       | 73,360    | .20        | 14,672     |
| Levee embankment.....                                  | Cubic yard.....  | 180,000   | .10        | 18,000     |
| Roadway rehabilitation.....                            | Sum.....         | 15        | 10,000.00  | 150,000    |
| Storage house.....                                     |                  |           |            | 20,000     |
| Operating machinery.....                               |                  |           |            | 200,000    |
| Prelord test.....                                      | do.....          |           |            | 12,600     |
| Pile test.....                                         | do.....          |           |            | 50,000     |
| Roadway maintenance.....                               | do.....          |           |            | 8,000      |
| Collector pipe.....                                    | Linear foot..... | 6,732     | 2.00       | 13,464     |
| Outlet pipe.....                                       | do.....          | 2,190     | 2.00       | 4,380      |
| Subtotal.....                                          |                  |           |            | 6,209,007  |
| Contingencies, ±20 percent.....                        |                  |           |            | 1,241,845  |
| Engineering, inspection and overhead, ±15 percent..... |                  |           |            | 1,118,148  |
| Total.....                                             |                  |           |            | 8,569,000  |

## LEVEES

## EMBANKMENT

|                                                        |                 |           |         |           |
|--------------------------------------------------------|-----------------|-----------|---------|-----------|
| Embankment, enlargement.....                           | Cubic yard..... | 1,280,000 | \$0.256 | \$327,680 |
| Embankment, new and setback.....                       | do.....         | 4,566,000 | .30     | 1,369,800 |
| Rights-of-way for setbacks.....                        | Acre.....       | 500       | 15.00   | 7,500     |
| Subtotal.....                                          |                 |           |         | 1,701,980 |
| Contingencies, ±10 percent.....                        |                 |           |         | 170,200   |
| Engineering, inspection, and overhead ±14 percent..... |                 |           |         | 262,820   |
| Total.....                                             |                 |           |         | 2,135,000 |

## CLOSURE SECTION

|                                                                              |                 |           |        |           |
|------------------------------------------------------------------------------|-----------------|-----------|--------|-----------|
| Revetment, asphalt.....                                                      | Ton.....        | 28,000    | \$8.00 | \$224,000 |
| Hydraulic fill, sand.....                                                    | Cubic yard..... | 170,000   | .40    | 68,000    |
| Hydraulic fill, sand.....                                                    | do.....         | 2,525,000 | .24    | 606,000   |
| Hydraulic fill, clay.....                                                    | do.....         | 100,000   | .30    | 30,000    |
| Gravel.....                                                                  | do.....         | 126,600   | 3.00   | 379,800   |
| Riprap.....                                                                  | do.....         | 63,200    | 8.00   | 505,600   |
| Placement of gravel and riprap.....                                          | Job.....        |           |        | 136,700   |
| Rehandle of hydraulic fill and construction of clay blanket above water..... | do.....         |           |        | 210,000   |
| Subtotal.....                                                                |                 |           |        | 2,180,100 |
| Contingencies ±20 percent.....                                               |                 |           |        | 432,000   |
| Engineering, inspection, and overhead ±14 percent.....                       |                 |           |        | 366,900   |
| Total.....                                                                   |                 |           |        | 2,959,000 |

## OLD RIVER CONTROL, LOUISIANA—Continued

TABLE 1.—Detailed cost estimate—Continued

## LANDS AND DAMAGES

| Description                                           | Unit     | Quantity | Unit price | Total cost |
|-------------------------------------------------------|----------|----------|------------|------------|
| Lands and damages.....                                | Job..... |          |            | \$310,000  |
| Contingencies ±20 percent.....                        |          |          |            | 68,000     |
| Engineering, inspection, and overhead ±5 percent..... |          |          |            | 17,000     |
| Total.....                                            |          |          |            | 425,000    |

## CHANNELS AND CANALS

|                                                         |                 |            |         |            |
|---------------------------------------------------------|-----------------|------------|---------|------------|
| Spill disposal, west approach.....                      | Acre.....       | 545        | \$15.00 | \$8,175    |
| Spill disposal, east approach.....                      | do.....         | 180        | 15.00   | 2,700      |
| Dredging (inflow channel).....                          | Cubic yard..... | 3,877,300  | .10     | 387,730    |
| Dredging (outflow channel).....                         | do.....         | 76,416,700 | .10     | 7,641,670  |
| Rights of way (inflow and outflow channels).....        | Acre.....       | 8,586      | 15.00   | 128,790    |
| Clearing for channels.....                              | do.....         | 1,055      | 190.00  | 200,450    |
| Clearing for retainer dikes.....                        | do.....         | 365        | 190.00  | 69,350     |
| Subtotal.....                                           |                 |            |         | 8,438,865  |
| Contingencies, ±10 percent.....                         |                 |            |         | 843,900    |
| Engineering, inspection and overhead, ±13 per cent..... |                 |            |         | 1,227,235  |
| Total.....                                              |                 |            |         | 10,510,000 |

## BANK STABILIZATION

|                                                          |          |  |  |             |
|----------------------------------------------------------|----------|--|--|-------------|
| Bank stabilization.....                                  | Job..... |  |  | \$2,000,000 |
| Contingencies, ±20 percent.....                          |          |  |  | 600,000     |
| Engineering, inspection, and overhead, ±15 per cent..... |          |  |  | 525,000     |
| Total.....                                               |          |  |  | 4,025,000   |

## ROADS, RAILROADS, AND BRIDGES

|                                                          |          |  |  |            |
|----------------------------------------------------------|----------|--|--|------------|
| Access roads.....                                        | Job..... |  |  | \$253,000  |
| Contingencies, ±20 percent.....                          |          |  |  | 51,000     |
| Engineering, inspection, and overhead, ±15 per cent..... |          |  |  | 45,000     |
| Total.....                                               |          |  |  | 349,000    |
| Grand total.....                                         |          |  |  | 46,741,000 |

JOHN R. HARDIN,  
*Brigadier General, United States Army,*  
*Member and President.*

LEO O. COLBERT,  
*Rear Admiral, United States Coast and Geodetic Survey,*  
*Member.*

ALBERT L. CULBERTSON,  
*Member.*

DEWITT L. PYBURN,  
*Civil Engineer,*  
*Member.*

EUGENE F. SALISBURY,  
*Civil Engineer,*  
*Member.*

HERBERT D. VOGEL,  
*Brigadier General, United States Army,*  
*Member.*

## VIEWS OF OTHER AGENCIES

LETTER FROM UNITED STATES DEPARTMENT OF AGRICULTURE—  
FOREST SERVICE

DEPARTMENT OF AGRICULTURE,  
FOREST SERVICE, SOUTHERN REGION,  
November 4, 1953.

PRESIDENT, MISSISSIPPI RIVER COMMISSION,  
*Corps of Engineers, United States Army, Vicksburg, Miss.*

DEAR SIR: This will acknowledge your letters of October 13 and 19, your file No. LMVKH.

The primary interest of the Forest Service in the proposed project lies in the possible flooding of national forest land on the Kisatchie National Forest. On the basis of the 1945 flood area, as shown on the map attached to your letter of October 13, approximately 200 acres of national forest land would be likely to be flooded in the backwater area north of State Highway 19 and between United States Highways 165 and 84. From our standpoint, this would not be cause for serious objection to the project.

Very truly yours,

CHAS. A. CONNAUGHTON, *Regional Forester.*  
By J. F. BROOKS, *Acting.*

## LETTER FROM LOUISIANA FORESTRY COMMISSION

LOUISIANA FORESTRY COMMISSION,  
*Baton Rouge, La., November 12, 1953.*

MR. CHARLES C. PHILLIPS,  
*Chief, Operations Division,*  
*Corps of Engineers, United States Army,*  
*Vicksburg, Miss.*

DEAR MR. PHILLIPS: We have briefly reviewed your information on the flow requirements and the plan of operations for the prevention of the capture of the Mississippi by the Atchafalaya River. From the information presented, we are not able to tell with certainty whether or not any forest lands of value will be materially affected. According to our interpretation of your information, the flood elevations in the backwater areas will not be altered from those under present conditions and no servitude of additional lands is involved in the project. Under these conditions we therefore cannot see any material affect on forest lands by this proposal. We often wonder, however, what future problems will be caused by the increasing number of dams, spillways, and such manmade structures.

We will sincerely appreciate being currently informed on the development of this project, and we thank you for the information which you have already sent us on it.

Yours very truly,

JAMES E. MIXON, *State Forester.*

LETTER FROM UNITED STATES DEPARTMENT OF HEALTH,  
EDUCATION, AND WELFARE—PUBLIC HEALTH SERVICE

DEPARTMENT OF  
HEALTH, EDUCATION, AND WELFARE,  
PUBLIC HEALTH SERVICE,  
DIVISION OF WATER POLLUTION CONTROL,  
·LOWER MISSISSIPPI AND  
WESTERN GULF DRAINAGE BASIN,  
*Little Rock, Ark., November 12, 1953.*

PRESIDENT, MISSISSIPPI RIVER COMMISSION,  
*Corps of Engineers, United States Army,*  
*Vicksburg, Miss.*

DEAR SIR: Reference is made to your letter of October 10, 1953, to the United States Public Health Service Communicable Disease Center, Atlanta, Ga., asking for comments from a public health standpoint on the proposed plan for prevention of the capture of the Mississippi River by the Atchafalaya River. A copy of the plan was enclosed. Your letter and the enclosures were forwarded to this office for reply.

The Public Health Service chief interest in water management is found in mosquito control, pollution abatement, and municipal water supplies. The relationship of the plan of operation as given in paragraph 9, on page 3, titled "Summary of Plan of Operation" to the interest of the Public Health Service is as follows:

*Mosquito control.*—Since the structures named in the plans are designed in such a manner that they will not increase stages in the backwater over stages which would have occurred under present conditions, there should not be an increase in the mosquito population of the area. We believe that there will be no increase in the population of disease-bearing mosquitoes and pest mosquitoes in the lower reach of these rivers due to the construction planned at Old River.

There should be no adverse effect upon the public health from mosquitoes as a result of the work described in your plan.

*Pollution abatement and municipal water supply.*—These Public Health Service interests are so closely allied that they will be treated together. Two specific problems have been brought to our attention in the past which would probably be of major importance if the Atchafalaya River were to capture the Mississippi River. First, the New Orleans water supply has been polluted by salt water from the gulf at times of low flow in the Mississippi River. Second, the Louisiana Stream Control Commission is making studies to determine whether wastes discharged to the Mississippi River at Baton Rouge and below are responsible for taste and odors in the New Orleans water supply. Reduction in low flows would be expected to accentuate both the above problems.

The Public Health Service has made no investigation, to our knowledge, that pertain to the above matters; however, we are interested in the problem as it affects municipal water supplies and would be glad to discuss these matters with you further if you so desire.

We would like to refer you to Mr. John O'Neill, director of the division of public health engineering, State Department of Health, 207 Civil Courts Building, New Orleans, La., who has an intimate

knowledge of municipal water supplies in Louisiana and particularly about New Orleans supply. We feel any comment Mr. O'Neill cares to make will be of value to you.

Sincerely yours,

E. C. WARKENTIN, *Officer in Charge.*

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LETTER FROM STATE OF LOUISIANA—DEPARTMENT OF HEALTH

STATE OF LOUISIANA,  
DEPARTMENT OF HEALTH,  
*New Orleans, October 28, 1953.*

Col. C. F. MITCHIM,  
*Corps of Engineers,  
Secretary, Mississippi River Commission,  
Vicksburg, Miss.*

DEAR COLONEL MITCHIM: Thank you for yours of October 10, 1953, relative to survey report on a plan for prevention of the capture of the Mississippi River by the Atchafalaya River, with request for information as to whether the Louisiana State Department of Health would have any interest in the project from a public health or pollution standpoint.

The Louisiana State Department of Health is very definitely interested in this.

The very large volumes of flow in the Mississippi River afford a high degree of dilution of sewage and trade wastes which would render the water of a smaller river unfit as a source of public water supply.

Consider, for example, the matter of salt (sodium chloride).

Very large amounts of this compound are discharged into the river in oilfield brines, wastes from the regeneration of zeolite water-softening units, and from such industries as the Solvay plant at Baton Rouge.

Consideration should be given also to the intrusion into the river of salt water from the gulf and its travel upstream on the bottom of the river for considerable distances.

It appears that a stream flow of approximately 180,000 to 200,000 cubic feet per second, as measured at Red River Landing, is necessary to prevent the upstream travel of this salt water stream on the bottom of the river.

In the section below Old River, the Mississippi is used as source of public water supply by 20 communities, serving a population of approximately 725,000 people.

In addition the Mississippi is used by a large number of industries as source of water supply which is used both for industrial purposes and for drinking water for the plant employees.

The very low flows, or practically zero flows, in the lower Mississippi which would inevitably result if the Mississippi were diverted to the gulf through the Atchafalaya Basin would result in a concentration of salt, sewage, and industrial wastes which would make the river water unfit as a source of drinking water supply. The water could not be made potable by treatment because of the impracticability of removing salt and certain industrial wastes.

On the basis of information available at present it appears that ground water of satisfactory quality in large volumes is not available in this area below Baton Rouge on the left bank and below White Castle on the right bank.

Paragraph 5 of the plan of operation states:

*Operation for low-water flow.*—For reasons of economy it is proposed that the navigation lock will be operated to permit flow into Old River at extreme low stages by remaining fully open, except when passing navigation, until the combined flow of the lock and the low sill structure reaches approximately 45,000 cubic feet per second. The lock will then be regulated to maintain about that total flow until the discharge through the low sill structure reaches about 45,000 cubic feet per second by which time the lock will be operated only to pass navigation. This situation will occur when the water elevation is about 17 feet mean sea level at the low sill structure.

Economy of operation is, of course, a very desirable, and important, objective but so, too, is the avoidance of harmful effects on the public water supplies of the lower river due to salt water intrusion.

Any diversion from the Mississippi to the Atchafalaya through Old River, when the flow in the Mississippi is below the critical flow—that is, the rate of flow which will permit upstream travel of salt water—is undesirable because it will tend to increase the intensity and the duration of the harmful effects of salt water on our water supplies.

This critical flow, as previously noted, is about 180,000 to 200,000 cubic feet per second.

Accordingly it is recommended that during periods when the flow in the Mississippi River is less than 200,000 cubic feet per second, the navigation lock be closed, except when passing navigation, with a view to preventing, or at least slowing down, the upstream travel of salt water in the river.

Yours very truly,

JOHN H. O'NEILL,  
*Director, Division of Public Health Engineering.*

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LETTER FROM UNITED STATES DEPARTMENT OF INTERIOR—  
FISH AND WILDLIFE SERVICE

DEPARTMENT OF THE INTERIOR,  
FISH AND WILDLIFE SERVICE,  
OFFICE OF REGIONAL DIRECTOR,  
*Atlanta, Ga., February 10, 1954.*

PRESIDENT, MISSISSIPPI RIVER COMMISSION,  
*Corps of Engineers, United States Army,*  
*Vicksburg, Miss.*

DEAR SIR: Reference is made to Colonel Mitchim's letter of October 8, 1953, requesting comments of the Fish and Wildlife Service regarding plans to prevent capture of the Mississippi River by the Atchafalaya River. Briefly, the engineering plan provides for the construction of a water-control structure on the west bank of the Mississippi River about 11 miles above the mouth of Old River and a closure structure and navigation lock in Old River near its mouth.

Based on preliminary data provided us by your office, the plan of operation for the project entails control of distribution of flow between the Mississippi River and Atchafalaya River. Flow requirements of the project are described in the following statements:

1. The distribution of flows for the project flood shall be such that the discharge can be handled safely by the leveed channel and floodways of the existing project.

2. The distribution of flows during floods of less magnitude than the project flood shall be such that the existing project can operate essentially as planned.

3. The total annual volume of flow in the Mississippi River below Old River shall not be changed to a point which would materially affect the maintenance of effective flood-carrying capacity and navigation channels below Old River.

4. Flows shall be provided during low-water periods to supplement flows from Red River and tributaries into Atchafalaya River.

5. Insofar as other limitations permit, medium- to bank-full flows shall be maintained in the Atchafalaya River to facilitate development of channels through the lower Atchafalaya Basin.

6. Elevations of floods in the backwater area shall not be raised above those which would be obtained under present conditions.

It is anticipated that the effects of the proposed plan on fish and wildlife would be limited to low-water conditions. No changes in high-water characteristics such as time, extent, and duration of over-flow in the project area are expected. The major possible damage to fish and wildlife habitat would result from salt-water intrusion during periods of low water in the Atchafalaya River. It is believed that salt-water intrusion would not be increased in the Atchafalaya River if the project would be operated as described in paragraph 5 of Colonel Mitchim's letter. However, it is understood that consideration is being given to increasing the low-water discharges of the Mississippi River by about 15,000 second-feet. This increase would be in compliance with a request by officials of the city of New Orleans with the additional water to be used for industrial and municipal purposes. Any reduction in low-water discharge in the Atchafalaya River to provide the increase in the Mississippi River discharge would increase the hazard of salt-water intrusion into the Atchafalaya River. No other changes in fish and wildlife habitat are anticipated as a result of the project as planned.

When more detailed investigations of this project are conducted, the Fish and Wildlife Service desires to work closely with your staff and the Louisiana Wild Life and Fisheries Commission in evaluating opportunities for improving fish and wildlife habitat in the Atchafalaya floodway by controlled discharge into or from the Mississippi River. It appears possible that by management of river stages in the Atchafalaya River to achieve seasonal pattern of fluctuation, the value of the fish and wildlife resources in the area under consideration could be enhanced without conflicting with navigation, flood control, or public health. Toward this end we would appreciate your advising

us well in advance of the time scheduled for more thorough field investigation in order that we can program our work accordingly.

Very truly yours,

WALTER A. GRESH,  
*Regional Director.*

FIGURE MADE IN CONNECTION WITH REPORT OF THE MISSISSIPPI  
RIVER COMMISSION

1. Distribution of project flood

LIST OF ILLUSTRATIONS MADE IN CONNECTION WITH THE  
REPORT OF THE MISSISSIPPI RIVER COMMISSION

(Only plates 1 and 3 printed)

Plate 1. Index.

Plate 2. General area (in 3 sheets).

Plate 3. Plan of improvement.

Plate 4. Low-sill control structure—plan and profile.

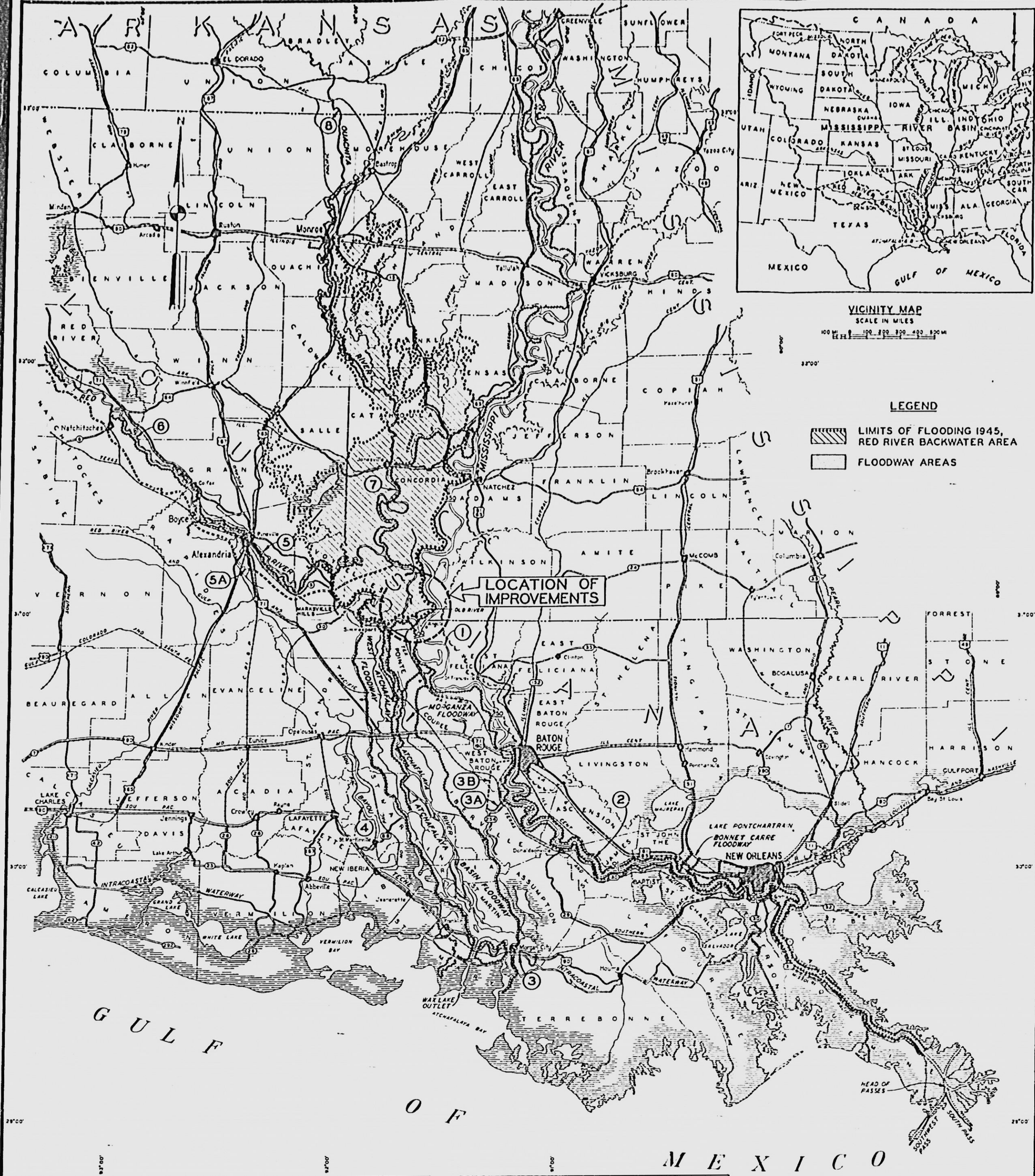
Plate 5. Overbank control structure—plan, elevation, and section.

APPENDIX A MADE IN CONNECTION WITH THE REPORT OF THE  
MISSISSIPPI RIVER COMMISSION

Views of other agencies







PRINCIPAL EXISTING PROJECTS

- ① MISSISSIPPI RIVER AND TRIBUTARIES
- ② MISSISSIPPI RIVER, BATON ROUGE TO THE GULF OF MEXICO, LA.
- ③ GULF INTRACOASTAL WATERWAY BETWEEN APALACHEE BAY, FLA.. AND THE MEXICAN BORDER
  - ③A FEATURE OF ③: PLAQUEMINE-MORGAN CITY ALTERNATE ROUTE
  - ③B FEATURE OF ③: EXTENSION OF PLAQUEMINE-MORGAN CITY ALTERNATE ROUTE FROM INDIAN VILLAGE TO PORT ALLEN
- ④ BAYOU TECHE, LA.
- ⑤ RED RIVER BELOW FULTON, ARK.
  - ⑤A FEATURE OF ⑤: OVERTON-RED RIVER WATERWAY
- ⑥ RED RIVER BELOW DENISON DAM
- ⑦ OUACHITA AND BLACK RIVERS, ARK. AND LA.
- ⑧ OUACHITA RIVER AND TRIBUTARIES, ARK. AND LA.

ELEMENTS OF IMPROVEMENT PLAN

- A NEW LEVEE
- B LEVEE ENLARGEMENT
- C OVERBANK CONTROL STRUCTURE
- D LOW-SILL CONTROL STRUCTURE
- E INFLOW CHANNEL
- F OUTFLOW CHANNEL
- G NAVIGATION LOCK
- H NAVIGATION AND INFLOW CHANNEL
- I NAVIGATION AND OUTFLOW CHANNEL
- J CLOSURE DAM
- K CHANNEL STABILIZATION

SEE PLATE 3 FOR PLAN OF IMPROVEMENT

MISSISSIPPI RIVER AND TRIBUTARIES  
OLD RIVER CONTROL

INDEX

SCALES AS SHOWN  
OFFICE OF THE PRESIDENT, MISSISSIPPI RIVER COMMISSION  
VICKSBURG, MISSISSIPPI  
TO ACCOMPANY REPORT DATED FEBRUARY 1954





