

District Engineer: Maj. B. M. Harloe, Corps of Engineers, to July 22, 1935; Lt. Col. P. S. Reinecke, Corps of Engineers, since that date.

Division Engineer: Col. E. L. Daley, Corps of Engineers, to August 19, 1935; Col. J. N. Hodges, Corps of Engineers, since that date.

IMPROVEMENTS

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1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

*Location.*—The Mississippi River rises in Lake Itasca, Minn., flows in a southerly direction 2,440 miles, and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, 1,078 to 1,273 miles from the Gulf.

*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report dated April 13, 1872, and concurred in by the Chief of Engineers. The cost and expenditures for the middle Mississippi prior to the adoption of the present project in 1881 were \$1,610,000 for new work.

(For further details see p. 1879 of the Annual Report for 1915.)

*Existing project.*—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (1,078 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles, all to be obtained by regulating works and dredging.

First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency.

Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The project for regulating works was adopted in 1881 (Annual Report, 1881, p. 1536). Dredging was introduced as a part of the project by the River and Harbor Acts of 1896, 1902, 1907, and 1922, the latter of which provides for dredging channels to landing places on the main river and subsidiary sloughs for the river above the mouth of the Missouri River. That part of the project for the middle Mississippi which proposed regulating works was practically

abrogated by acts of March 3, 1905, March 2, 1907, and the joint resolution of June 29, 1906. The River and Harbor Act of June 25, 1910, restored regulating works to the project and began appropriations with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years, at an estimated cost of \$21,000,000, exclusive of amounts previously expended (H. Doc. No. 50, with accompanying atlas, 61st Cong., 1st sess.; and H. Doc. No. 168, 58th Cong., 2d sess.). The River and Harbor Act of January 21, 1927, provided for a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of St. Louis and increased the estimate for maintenance to \$900,000 annually (Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.). The River and Harbor Act of July 3, 1930, modified the project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance (Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.).

The estimated cost of new work, revised in 1934, is \$43,000,000, with \$1,300,000 for annual maintenance.

*Terminal facilities.*—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities is also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys.

*Operations and results during fiscal year.*—River stages were favorable to construction work, which was carried on extensively by hired labor with Government plant and by contract throughout the fall of 1935; river conditions were unfavorable during the early spring of 1936, mainly due to the extreme cold during the winter of 1935-36, which caused formation of heavy ice in the river from Memphis to the headwaters, the river freezing over in many places as far south as Cairo. Rivers within the districts were not clear of ice until early in March, when ice ran out on a medium high stage causing serious damage to piling dikes. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of regulating works follow:

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>New work by contract:</b>				
Goose Island	37	2	1,800	\$50,000.02
Ohoney Island-Cape Girardeau	51	2	1,070	10,460.74
Seventy-six-Craft Island	97	5	1,500	36,277.00
Chester, Ill.	115	4	2,300	77,838.22
Kaskaskia Island-St. Genevieve	116	4	1,500	30,310.15
Calico Island-Sulphur Springs	155	5	2,180	65,550.80
Wilson Island	193	3	1,020	74,352.09
Total		25	12,490	352,800.98
<b>New work by United States plant and hired labor:</b>				
Ohoney Island	50	1	700	13,944.80
Wilkinson	85	1	330	6,214.29
Danby Landing	144	1	205	22,438.06
Total		3	1,235	41,597.15
<b>Maintenance by United States plant and hired labor</b>				
				137,860.25

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetments)				Costs
		Number	Linear feet bank protected	Squares (100 square feet)		
				Mattress	Paving	
<b>New work by contract:</b>						
Hurricane Field-Boston Bar.....	8	(1)	550	575	555	\$28,381.68
Dogtooth Bend.....	23	1	1,685	2,340	350	26,853.77
Price Landing.....	30	1	2,515	2,510	1,341	70,977.45
Cape Girardeau.....	49	1	1,705	1,902	777	35,575.02
Olboney Island-Cape Girardeau.....	48	1	870	957	411	21,734.82
Olboney Island-Devils Island.....	59	(1)	605	737	482	19,097.53
Devils Island.....	60	1	5,230	5,353	1,745	94,162.00
Wilkinson.....	02	1	815	705	394	19,581.88
Liberty Bend (Thebes Reach).....	100	1	1,340	1,340	729	24,064.56
Kaskaskia Island.....	115	1	2,400	2,568	1,473	60,446.00
Pullticht.....	150	1	1,285	1,304	82	8,950.07
Total.....						
Maintenance by United States plant and hired labor.....		9	10,060	20,450	8,345	410,711.98
				789	1,614	41,744.09

<sup>1</sup> Reported fiscal year 1935.

*Regular funds.*—The following new work was done with regular funds by hired labor with Government plant: Three dikes totaling 1,295 linear feet in length at a cost of \$41,597.15. The total cost of new work with regular funds was \$41,597.15.

The following maintenance work was conducted with regular funds. The required 9-foot channel was maintained, except for short periods needed to move a dredge to the shoal, by five United States dredges. During the year 33 shoals developed, of which 20 were dredged once, 6 were dredged twice, 5 were dredged three times, and 2 required dredging four times. There were 7,329,235 cubic yards of sand and gravel removed by United States dredges from channels through 20 bars, and 840,297 cubic yards of material removed in outside-the-channel dredging, 71,218 cubic yards of which was done for the Missouri Pacific Railroad at Little Rock Landing for which the district was reimbursed. The channels dredged had a combined length of 25 miles, an average width of 265 feet, and an average gain in depth of 5.5 feet. The total cost of dredging was \$395,786.68, all charged to maintenance.

Hydrographic surveys were made covering 422 miles of river. The cost of surveys was \$68,760.38, charged to maintenance. The total cost of all maintenance was \$644,152.

*Public Works funds—New work.*—The following operations were conducted: Two dikes totaling 1,070 feet in length were built under contract at a cost of \$19,460.74; four revetments totaling 2,165 feet in length, consisting of 2,350 squares of mattress and 1,560 squares of paving, were built under contract at a cost of \$79,557.01. The total cost, Public Works funds, was \$99,017.75, all new work.

*Emergency Relief funds—New work.*—The following work was done: Twenty-three dikes totaling 11,410 feet in length were built under contract at a cost of \$333,340.24; eight revetments totalling 16,895 feet in length, consisting of 18,100 squares of mattress and 6,786 squares of paving, were built under contract at a cost of \$331,154.97. The total cost, Emergency Relief funds was \$664,495.21, all new work. In addition to completed work there were under construction, by contract, two dikes to total 1,200 linear feet and five revetments to total

7,995 linear feet, all to be paid for with Emergency Relief funds. The costs and expenditures during the fiscal year were as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$41,597.15	\$614,152	\$655,749.15	\$368,305.13
Public Works.....	99,017.75	-----	99,017.75	115,140.60
Emergency Relief.....	664,495.21	-----	664,495.21	639,226.83
Total.....	\$1,105,110.11	\$614,152	\$1,719,262.11	\$1,123,032.66

*Condition at end of fiscal year.*—The regulating works are about 69 percent completed. The quantities required to complete the project are estimated as follows: 120 dikes, 90,000 linear feet, and 50 revetments, 263,000 linear feet. All revetments are in very good repair, but piling dikes suffered a loss of about 40,000 linear feet due to ice. However, the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season usually lasts from the early part of February to the latter part of December, the river being generally closed by ice the remainder of the year. The river is usually above the 10-foot stage, St. Louis gage, for 6 months of the year during which time the minimum channel depth generally prevails without dredging.

The following table gives condition of the channel:

Fiscal year 1936

	Length of section	Afford- ing less than 9 feet	Period	Afford- ing more than 9 feet	Period	Proposed low- water width	Control- ling depth
	Miles	Miles	Days	Miles	Days	Feet	Feet
Mouth of Ohio to Commercial Point.....	32.2	0.5	34	31.7	241	2,000	7
Commercial Point to Com- more.....	7.2	7	13	0.5	262	2,500	8
Commerce to Grays Point.....	4.0	5	25	6.4	250	2,085	8
Grays Point to Grand Tower.....	33.5	4.5	53	20.0	222	2,250	7
Grand Tower to Fort Gage.....	36.2	2.0	56	33.3	219	2,250	7
Fort Gage to Little Rock.....	0.5	2.1	28	7.4	247	2,250	7
Little Rock to River Des Peres.....	40.5	3.1	45	43.4	230	2,250	8
River Des Peres to northern boundary, city of St. Louis.....	10.0	4.0	62	15.0	213	1,700	8
Northern boundary to mouth of Missouri River.....	4.1	1.1	53	3.0	222	2,250	6

The total costs under the existing project to the end of the fiscal year are \$29,623,329.95, including \$25,496,680.28 regular funds, \$3,462,154.46 Public Works funds, and \$664,495.21 Emergency Relief funds for new work, and \$18,559,331.84, regular funds, for maintenance, including dredging and surveys, a total of \$48,182,661.79. The total expenditures on the existing project are \$48,062,047.54, of which

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\$43,960,666.25 were regular funds, \$3,462,154.46 were Public Works funds, and \$639,226.83 were Emergency Relief funds.

*Proposed operations.*—The unexpended balance at the end of the year will be applied as follows:

*Regular funds*

Accounts payable, June 30, 1936.....	\$95,345.87
New work:	
By contract, July 1, 1936, to June 30, 1937:	
Piling dikes:	
Hurricane Field-Cairo protection.....	133,840.00
Price Landing.....	55,597.00
Powers Island-Goose Island.....	67,193.00
Devils Island-Schemmman.....	112,100.00
Willard-Hanging Dog.....	109,430.00
Liberty.....	52,202.00
Crain Island.....	46,503.00
Kaskaskia Island-Chester.....	90,000.00
Calico Island.....	106,522.00
Revetment, Devils Island.....	75,000.00
Total by contract.....	846,396.00
By hired labor with United States plant July 1, 1936, to June 30, 1937: Revetment, Price Landing.....	90,000.00
Total new work.....	944,396.00
Maintenance by hired labor with United States plant, July 1, 1936 to June 30, 1937:	
Dikes and revetments.....	520,500.00
Project channel dredging.....	964,000.00
Surveys, tests, and studies.....	110,000.00
Model tests.....	35,000.00
Total maintenance.....	1,629,500.00
Unallocated balance.....	269.90
Total regular funds.....	2,669,511.77
<i>Emergency Relief funds.</i> —The unexpended balance at the end of the fiscal year, will be applied as follows:	
Accounts payable June 30, 1936.....	\$25,268.38
New work: By contract (completion of existing contracts), July 1, 1936 to June 30, 1937:	
Pile dikes:	
Chester, Ill.....	40,000.00
Seventy Six-Crain Island.....	20,800.00
Kaskaskia Island-Ste. Genevieve.....	45,300.00
Calico Island-Sulphur Springs.....	28,000.00
Revetments:	
Dogtooth Bend.....	48,200.00
Liberty, Ill. (Thebes Reach).....	11,200.00
Cape Girardeau.....	19,400.00
Wilkinson.....	16,900.00
Kaskaskia Island.....	6,800.00
Ste. Genevieve.....	20,300.00
Pulltight.....	31,000.00
Cabaret Island.....	32,300.00
Total new work.....	335,300.00
Unallocated balance.....	204.79
Total Emergency Relief funds.....	360,773.17

The sum of \$2,000,000 can be profitably expended during the fiscal year 1938 as follows:

New work:	
By contract, July 1, 1937, to June 30, 1938:	
Dikes.....	\$500,000
Revetments.....	100,000
By hired labor, July 1, 1937, to June 30, 1938:	
Dikes.....	300,000
Revetments.....	100,000
Total, new work.....	<u>1,000,000</u>
Maintenance: By hired labor with United States plant, July 1, 1937, to June 30, 1938:	
Dikes and revetments.....	225,000
Project channel dredging.....	675,000
Surveys, tests, and studies.....	100,000
Total maintenance.....	<u>1,000,000</u>
Total for all work.....	<u>2,000,000</u>

It is expected that, with the proposed expenditures, the project will be 77 percent complete.

*Cost and financial summary*

MAINTENANCE AND IMPROVEMENT FUNDS

Cost of new work to June 30, 1936.....	\$27,106,680.28
Cost of maintenance to June 30, 1936.....	18,559,331.84
Total cost of permanent work to June 30, 1936.....	45,666,012.12
Minus accounts payable June 30, 1936.....	95,345.87
Net total expenditures.....	45,570,666.25
Unexpended balance June 30, 1936.....	2,669,511.77
Total amount appropriated to June 30, 1936.....	<u>48,240,178.02</u>

Fiscal year ending June 30	1932	1933	1934	1935	1936
Cost of new work.....	\$1,038,610.87	\$2,354,097.86	\$1,277,468.17	\$33,347.98	\$41,597.15
Cost of maintenance.....	1,120,165.37	951,859.78	1,059,616.63	890,974.77	644,152.00
Total cost.....	<u>2,158,776.24</u>	<u>3,305,957.64</u>	<u>2,337,084.70</u>	<u>924,322.75</u>	<u>685,749.15</u>
Total expended.....	2,704,331.23	3,599,802.51	2,006,285.24	1,002,032.93	308,305.13
Allotted.....	269,578.07	5,122,994.46	2,243,564.23	2,289,481.38	2,304,940.52

Balance unexpended July 1, 1935.....	\$732,936.38
Amount allotted from War Department Appropriation Act approved Apr. 9, 1935.....	\$225,000
Amount allotted from War Department Appropriation Act approved May 15, 1936.....	2,525,000
Amount to be accounted for.....	<u>2,750,000.00</u>
Deductions on account of revocation of allotments.....	3,482,936.38
.....	<u>445,059.48</u>

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Net amount to be accounted for.....		\$3,037,876.90
Gross amount expended.....	\$816,953.26	
Less:		
Reimbursements collected.....	\$303,442.40	
Receipts from sales.....	145,148.73	
	448,591.13	
		368,365.13
Balance unexpended June 30, 1936.....		2,000,511.77
Outstanding liabilities June 30, 1936.....	\$95,345.87	
Amount covered by uncompleted contracts.....	671,192.61	
		766,538.48
Balance available June 30, 1936.....		1,902,973.29
Amount (estimated) required to be appropriated for completion of existing project <sup>1</sup> .....		12,100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1938:		
For new work <sup>1</sup> .....		1,000,000.00
For maintenance <sup>1</sup> .....		1,000,000.00
Total <sup>1</sup> .....		2,000,000.00

<sup>1</sup> Exclusive of available funds.

PUBLIC WORKS FUNDS

Cost of new work to June 30, 1936.....	\$3,462,154.46
Cost of maintenance to June 30, 1936.....	
Total cost of permanent work to June 30, 1936.....	3,462,154.46
Net total expenditures.....	3,462,154.46
Total amount appropriated to June 30, 1936.....	3,462,154.46

Fiscal year ending June 30	1932	1933	1934	1935	1936
Cost of new work.....			\$2,802,005.51	\$500,531.20	\$99,017.75
Cost of maintenance.....					
Total expended.....			2,819,268.11	527,455.75	115,440.00
Allotted.....			2,917,380.47	625,000.00	-80,226.01

Balance unexpended July 1, 1935.....	\$195,686.61
Deductions on account of revocation of allotment.....	80,226.01
Net amount to be accounted for.....	115,440.60
Gross amount expended.....	\$115,584.60
Less reimbursements collected.....	144.00
	115,440.60

EMERGENCY RELIEF FUNDS

Cost of new work to June 30, 1936.....	\$664,495.21
Cost of maintenance to June 30, 1936.....	
Total cost of permanent work to June 30, 1936.....	664,495.21
Minus accounts payable June 30, 1936.....	25,208.38
Net total expenditures.....	639,226.83
Unexpended balance June 30, 1936.....	360,773.17
Total amount appropriated to June 30, 1936.....	1,000,000.00

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Fiscal year ending June 30	1932	1933	1934	1935	1936
Cost of new work.....					
Cost of maintenance.....					\$664,405.21
Total expended.....					630,226.83
Allotted.....				\$1,000,000	

Balance unexpended July 1, 1935..... \$1,000,000.00  
 Gross amount expended..... 630,226.83

Balance unexpended June 30, 1936..... 360,773.17  
 Amount covered by uncompleted contracts..... 360,773.17

CONSOLIDATED COST AND FINANCIAL SUMMARY FOR MISSISSIPPI RIVER, OHIO RIVER TO MISSOURI RIVER

Cost of new work to June 30, 1936..... \$31,233,329.95  
 Cost of maintenance to June 30, 1936..... 18,559,331.84

Total cost of permanent work to June 30, 1936..... 49,792,661.79  
 Minus accounts payable June 30, 1936..... 120,614.25

Net total expenditures..... 49,672,047.54  
 Unexpended balance June 30, 1936..... 3,030,284.94

Total amount appropriated to June 30, 1936..... 52,702,332.48

Fiscal year ending June 30	1932	1933	1934	1935	1936
Cost of new work.....	\$1,008,610.87	\$2,354,007.80	\$4,080,073.68	\$503,870.18	\$805,110.11
Cost of maintenance.....	1,120,165.37	951,859.78	1,059,816.53	899,974.77	644,152.00
Total cost.....	2,128,776.24	3,305,867.58	5,139,890.21	1,403,844.95	1,449,262.11
Total expended.....	2,704,331.23	3,609,802.51	5,725,543.35	-1,435,477.18	1,123,032.56
Allotted.....	260,578.07	5,122,904.40	5,160,044.70	-604,481.38	2,224,714.51

Balance unexpended July 1, 1935..... \$1,928,002.00  
 Amount allotted from War Department Appropriation Act approved Apr. 9, 1935..... \$225,000.00  
 Amount allotted from War Department Appropriation Act approved May 15, 1936..... 2,525,000.00

Amount to be accounted for..... 2,750,000.00  
 Deductions on account of revocation of allotments..... 4,078,602.99  
 525,285.49

Net amount to be accounted for..... 4,153,317.50  
 Gross amount expended..... \$1,571,767.69

Less:  
 Reimbursements collected..... \$303,586.40  
 Receipts from sales..... 145,148.73  
 448,735.13

1,123,032.56  
 Balance unexpended June 30, 1936..... 3,030,284.94



Outstanding liabilities June 30, 1936.....	\$95,345.87	
Amount covered by uncompleted contracts.....	1,031,965.78	
		\$1,127,311.65
Balance available June 30, 1936.....		1,902,973.29
Amount (estimated) required to be appropriated for completion of existing project <sup>1</sup> .....		12,100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1938:		
For new work <sup>1</sup> .....		1,000,000.00
For maintenance <sup>1</sup> .....		1,000,000.00
Total <sup>1</sup> .....		2,000,000.00

<sup>1</sup> Exclusive of available funds.

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND CLARKSVILLE, MO.

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 878.

3. MISSOURI RIVER, HERMANN TO THE MOUTH

See report, "Missouri River, Kansas City to the mouth", page 982.

4. REMOVING SNAGS AND WRECKS FROM THE MISSISSIPPI RIVER BELOW THE MOUTH OF MISSOURI RIVER AND FROM OLD AND ATCHAFALAYA RIVERS

The section of the Mississippi River covered in this report was formerly in charge of the St. Louis engineer district, but for the purpose of administration on July 1, 1930, it was divided into three reaches, which are under the supervision and direction of the district engineers at St. Louis, Mo., Memphis, Tenn., and Vicksburg, Miss.

The St. Louis district extends from the mouth of the Missouri River to the mouth of the Ohio River, a distance of 195 miles. The Memphis district extends from the mouth of the Ohio River to the mouth of the Arkansas River, a distance of 398 miles. The Vicksburg district extends from the mouth of the Arkansas River to the Head of Passes, 671 miles, and includes 8 miles of Old River and 30 miles of the Atchafalaya River.

District engineers: St. Louis, Mo., Maj. Bartley M. Harloe, Corps of Engineers, to July 22, 1935; Lt. Col. P. S. Reinecke, Corps of Engineers, since that date; Memphis, Tenn., Lt. Col. Eugene Reyhold, Corps of Engineers; Vicksburg, Miss., Lt. Col. Lunsford E. Oliver, Corps of Engineers.

Division engineers: For the river below the mouth of the Ohio, Brig. Gen. H. B. Ferguson, Corps of Engineers; for the river above the mouth of the Ohio, Col. Edmund L. Daley, Corps of Engineers, to August 19, 1935, and Col. J. N. Hodges, Corps of Engineers, since that date.

*Location.*—The snagging district embraces that portion of the river between Head of Passes and the mouth of Missouri River, 1,265 miles, 8 miles of Old River (present mouth of Red River), and 30 miles of Atchafalaya River from Red River to Melville, La.; total, 1,295 miles.

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*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report dated April 13, 1872, and concurred in by the Chief of Engineers. The cost and expenditures for the middle Mississippi prior to the adoption of the present project in 1881 were \$1,610,000 for new work.

(For further details see p. 1879 of the Annual Report for 1915.)

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First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency.

Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The project for regulating works was adopted in 1881 (Annual Report, 1881, p. 1536). Dredging was introduced as a part of the project by the River and Harbor Acts of June 3, 1896, June 13, 1902, March 2, 1907, and September 22, 1922, the latter of which provides for dredging channels to landing places on the main river and subsidiary sloughs for the river above the mouth of the Missouri River. That part of the project for the middle Mississippi which proposed regulating works was practically abrogated by acts of March 3, 1905, March 2, 1907, and the joint resolution of June 29, 1906. The River and Harbor Act of June 25, 1910, restored regulating works to the project and began appropriations with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years, at an estimated cost of \$21,000,000, exclusive of amounts previously expended (H. Doc. No. 50, with accompanying atlas, 61st

Cong., 1st sess.; and H. Doc. No. 168, 58th Cong., 2d sess.). The River and Harbor Act of January 21, 1927, provided for a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of St. Louis and increased the estimate for maintenance to \$900,000 annually (Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.). The River and Harbor Act of July 3, 1930, modified the project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance (Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.).

The estimated cost of new work, revised in 1934, is \$43,000,000, with \$1,300,000 for annual maintenance.

*Terminal facilities.*—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities is also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys.

*Operations and results during fiscal year.*—River stages were favorable to construction work, which was carried on extensively by hired labor with Government plant and by contract during the fall of 1936; river conditions were generally unfavorable during the spring of 1937 and work was carried on only intermittently. Regulating works were maintained and project dimensions of channel were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>New work by contract:</b>				
Hurricane Field-Cairo Protection.....	8	7	5,000	\$121,899.14
Powers Island-Goose Island.....	36	9	3,830	84,016.35
Devils Island-Schänimann.....	60	8	6,985	165,464.89
Willard-Hanging Dog Island.....	69	7	3,910	83,440.50
Wilkinson.....	69	7	3,910	83,440.50
Seventy six-Crain Island.....	87	6	2,030	40,702.72
Liberty.....	97	(1)	(1)	5,372.32
Crain Island.....	100	8	4,020	90,931.55
Chester.....	106	4	2,020	46,629.05
Kaskaskia Island-Chester.....	114	1	750	72,372.63
Kaskaskia Island-St. Genevieve.....	115	5	2,345	72,391.09
Calico Island.....	116	(1)	(1)	21,659.60
Calico Island-Sulphur Springs.....	150	11	7,500	130,511.09
.....	155	1	450	22,010.62
<b>Total.....</b>		<b>67</b>	<b>35,840</b>	<b>964,551.54</b>
<b>New work by United States plant and hired labor:</b>				
Thebes Reach.....	43	1	740	66,655.80
Horsetail, East.....	170	2	990	21,891.05
<b>Total.....</b>		<b>3</b>	<b>1,700</b>	<b>88,546.85</b>
<b>Maintenance by United States plant and hired labor.....</b>			<b>12,820</b>	<b>302,215.76</b>

<sup>1</sup> Reported fiscal year 1936.  
<sup>2</sup> Solid dike, brush and stone.

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetments)				Costs
		Number	Linear feet bank protection	Squares (100 square feet)		
				Mattress	Paving	
<b>New work by contract:</b>						
Dogtooth Bend.....	23	( )	( )	( )	854	\$55,133.09
Cape Girardeau.....	50	( )	( )	( )	( )	124.10
Devils Island.....	60	1	4,390	4,382	2,229	98,883.17
Wilkinson.....	92	( )	( )	( )	( )	73.14
Liberty Bend.....	100	( )	( )	( )	( )	10,887.74
Kaskaskia Island.....	115	( )	( )	( )	( )	7,298.51
Cornice Island.....	150	1	1,435	1,429	( )	44,470.55
Pulltight.....	168	( )	( )	( )	828	25,686.61
Sawyer Bend.....	187	1	850	281	670	17,868.28
<b>Total.....</b>		3	6,675	6,092	5,052	260,395.17
<b>Maintenance by United States plant and hired labor.....</b>				2,877	2,652	155,135.17

Reported fiscal year 1936.

*Regular funds.*—The following new work was done with regular funds by hired labor with Government plant: Three dikes totaling 1,700 feet in length at a cost of \$88,546.86. Sixty-five dikes totaling 37,640 feet in length were built under contract at a cost of \$841,926.37. One revetment totaling 4,390 feet in length, consisting of 4,382 squares of mattress and 2,229 squares of paving, was built under contract at a cost of \$98,883.17. In addition to completed work there were under construction, by contract, 13 dikes to total 5,915 linear feet. The total cost of new work with regular funds was \$1,029,356.40.

The following maintenance work was conducted with regular funds. The required 9-foot channel was maintained, except for short periods needed to move a dredge to the shoal, by six United States dredges. During the year 68 shoals developed of which 51 were dredged once, 14 were dredged twice, 1 was dredged three times, 1 was dredged four times, and 1 was dredged five times. There were 8,921,980 cubic yards of sand and gravel removed by these dredges from channels through 68 bars, and 1,274,840 cubic yards of material removed in outside-the-channel dredging, 579,765 cubic yards of which was done for the Missouri Pacific Railroad at Little Rock Landing, Mo., for which the district was reimbursed. The channels dredged had a combined length of 41.8 miles, an average width of 280 feet and an average gain in depth of 3.9 feet. The total cost of dredging was \$563,403.40, all charged to maintenance.

Hydrographic surveys were made covering 293 miles of river, costing \$88,217.65. Other miscellaneous costs were: Snagging, \$16,176.73; aids to navigation, \$13,894.63; model tests, \$71,354.70; and mooring piles \$7,016.05, all charged to maintenance. The total cost of all maintenance was \$1,217,414.09.

*Emergency Relief funds—New work.*—The following work was done under contract: Two dikes totaling 1,200 feet in length were built at a cost of \$122,625.17; two revetments totaling 2,285 feet in length, consisting of 1,710 squares of mattress and 2,823 squares of paving, were built at a cost of \$161,512. In addition to completed

work there is under construction, by contract, one uncompleted re-  
 tment to total about 2,200 feet, to be paid for with Emergency  
 Relief funds. The total cost, Emergency Relief funds, was \$284,  
 137.17, all new work.

The costs and expenditures during the fiscal year were as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$1,029,356.40	\$1,217,414.09	\$2,246,770.49	\$2,282,503.32
Emergency Relief.....	284,137.17		284,137.17	306,566.55
Total.....	1,313,493.57	1,217,414.09	2,530,907.66	2,589,069.87

*Condition at end of fiscal year.*—Open river regulating works are  
 about 70 percent completed. The quantities required to complete the  
 project are virtually the same as estimated in last annual report (120  
 dikes, 90,000 linear feet, and 50 revetments, 263,000 linear feet) inas-  
 much as practically all the work done during the fiscal year was in  
 replacement of work damaged or destroyed by ice in the spring of  
 1936. Dikes and revetments are now in very good repair and the  
 channel has been greatly improved by the work that has been done.  
 Dredging is required at low stages to remove temporary shoals and  
 maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has  
 prevailed, the project dimensions of channels have generally been  
 maintained throughout the navigation season. The navigation season  
 usually lasts from the middle of February to the middle of Decem-  
 ber, the river being generally closed by ice the remainder of the  
 year. The river is generally above the 10-foot stage, St. Louis gage,  
 for 6 months of the year, latter part of February to latter part of  
 August, during which time project channel depths generally prevail  
 without dredging.

The following table gives condition of the channel during the fiscal  
 year 1937:

	Length of section	Afford- ing less than 9 feet	Period	Afford- ing more than 9 feet	Period	Proposed low- water width	Control- ling depth <sup>1</sup>
	Miles	Miles	Days	Miles	Days	Feet	Feet
Mouth of Ohio to Commercial Point.....	32.0	1.2	45	31.0	230	2,000	7
Commercial Point to Commerce Commerce to Grays Point.....	7.7	.8	16	6.4	259	2,500	6
Grays Point to Grand Tower.....	6.5	.6	19	6.3	256	2,085	6
Grand Tower to Fort Gage.....	33.5	6.1	51	27.4	224	2,250	5
Fort Gage to Little Rock.....	36.3	2.6	71	33.6	204	2,250	6
Little Rock to River Des Peres	9.5	3.0	37	6.5	238	2,250	5½
River Des Peres to northern boundary, city of St. Louis.....	40.5	5.8	63	40.7	212	2,250	5
Northern boundary to mouth of Missouri River.....	19.2	7.9	81	11.1	194	1,700	5½
	3.8	1.7	64	2.4	213	2,250	6½

<sup>1</sup> Lowest stages known during navigation season, occurred in fall 1936.

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The costs and expenditures under the existing project to June 30, 1937, have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$26,526,036.68	\$19,776,745.93	\$46,302,782.61	\$46,193,169.57
Public Works.....	3,462,154.46		3,462,154.46	3,462,154.46
Emergency Relief.....	948,632.38		948,632.38	948,793.38
<b>Total</b> .....	<b>30,936,823.52</b>	<b>19,776,745.93</b>	<b>50,713,569.45</b>	<b>50,601,117.41</b>

*Proposed operations.*—The unexpended balance at the end of the year, including accounts receivable, together with an allotment of \$1,975,000 made since June 30, 1937, will be applied as follows:

REGULAR FUNDS

Accounts payable, June 30, 1937.....		\$109,613.04
<b>New work:</b>		
By contract (completion of existing contracts): July 1, 1937, to June 30, 1938:		
Piling dikes:		
Hurricane Field-Cairo protection.....	\$25,500.00	
Powers Island-Goose Island.....	10,600.00	
Devil's Island-Schenmunn.....	42,700.00	
Willard-Hanging Dog Island.....	105,200.00	
Orain Island.....	43,600.00	
Kaskaskia Island-Chester.....	41,300.00	
By contract, July 1, 1937, to June 30, 1938:		
Piling dikes:		
Grand Tower Island.....	300,500.00	
Ste. Genevieve, Ill. and Mo.....	90,800.00	
Fish Bend-Danby Landing.....	145,000.00	
Calico Island-Cornice Island.....	135,000.00	
Revetments:		
Greenfield Bend-Hurricane Field.....	45,300.00	
Wilkinson-Liberty Bend.....	60,200.00	
By hired labor with United States plant, July 1, 1937, to June 30, 1938:		1,045,700.00
Piling dikes: Horsetail, east.....		48,000.00
<b>Total new work</b> .....		<b>1,093,700.00</b>
<b>Maintenance:</b>		
By hired labor with United States plant, July 1, 1937, to June 30, 1938:		
Dikes and revetments.....	\$243,170.00	
Aids to navigation.....	18,000.00	
Project channel dredging.....	792,500.00	
Snagging.....	30,000.00	
Surveys, tests, and studies.....	125,000.00	
		1,208,670.00
Unallocated balance.....		25.41
<b>Total for all work</b> .....		<b>2,412,008.45</b>

EMERGENCY RELIEF FUNDS

The unexpended balance at the end of the year, including accounts receivable, will be applied as follows:

Accounts payable, June 30, 1937.....	\$2,889.00
New work: By contract (completion of existing contracts) July 1, 1937, to June 30, 1938, revetment, Cape Girardeau.....	51,367.62
<b>Total Emergency Relief funds.....</b>	<b>54,206.62</b>

The sum of \$2,300,000 can be profitably expended during the fiscal year 1939 as follows:

New work:	
By contract, July 1, 1938, to June 30, 1939:	
Dikes.....	\$450,000
Revetments.....	400,000
By hired labor, July 1, 1938, to June 30, 1939:	
Dikes.....	75,000
Revetments.....	75,000
<b>Maintenance:</b>	<b>\$1,000,000</b>
By hired labor with United States plant, July 1, 1938, to June 30, 1939:	
Dikes and revetments.....	450,000
Project channel dredging.....	700,000
Surveys, tests, and studies.....	125,000
Snagging.....	25,000
<b>Total for all work.....</b>	<b>1,300,000</b>
<b>Total for all work.....</b>	<b>2,300,000</b>

It is expected that, with the proposed expenditures, the project will be 76 percent complete.

Cost and financial summary

MAINTENANCE AND IMPROVEMENT FUNDS

Cost of new work to June 30, 1937.....	\$31,598,191.14
Cost of maintenance to June 30, 1937.....	19,776,745.93
<b>Total cost of permanent work to June 30, 1937.....</b>	<b>51,374,937.07</b>
Minus accounts payable June 30, 1937.....	109,613.04
<b>Net total expenditures.....</b>	<b>\$51,265,324.03</b>
Unexpended balance June 30, 1937.....	437,008.45
<b>Total amount appropriated to June 30, 1937.....</b>	<b>\$51,702,332.48</b>

Fiscal year ending June 30.	1933	1934	1935	1936	1937
Cost of new work.....	\$2,354,097.86	\$1,277,468.17	\$33,347.98	\$41,597.15	\$1,029,358.49
Cost of maintenance.....	951,859.78	1,659,616.53	899,974.77	644,152.00	1,217,414.09
<b>Total cost.....</b>	<b>3,305,957.64</b>	<b>2,937,084.70</b>	<b>933,322.75</b>	<b>685,749.15</b>	<b>2,246,772.49</b>
Total expended.....	3,599,802.51	2,906,285.24	-1,912,932.93	368,365.13	2,232,506.32
Allotted.....	5,122,994.46	2,243,564.23	-2,289,481.88	2,304,940.32	

<sup>1</sup> Includes \$3,462,154.46 Public Works funds.

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Balance unexpended July 1, 1936.....		\$2,669,511.77
Gross amount expended.....		2,232,503.32
Balance unexpended June 30, 1937.....		437,008.45
Outstanding liabilities June 30, 1937.....	\$80,408.55	
Amount covered by uncompleted contracts.....	298,133.84	
		<u>378,542.39</u>
Balance available June 30, 1937.....		58,466.06
Amount allotted since June 30, 1937.....		1,975,000.00
Balance available for fiscal year 1938.....		<u>2,033,466.06</u>
Amount (estimated) required to be appropriated for completion of existing project <sup>1</sup> .....		<u>11,400,000.00</u>
Amount that can be profitably expended in fiscal year ending June 30, 1939:		
For new work <sup>2</sup> .....		1,000,000.00
For maintenance <sup>2</sup> .....		1,300,000.00
Total <sup>2</sup> .....		<u>2,300,000.00</u>

<sup>2</sup> Exclusive of available funds.

**EMERGENCY RELIEF FUNDS.**

Cost of new work to June 30, 1937.....		\$948,632.38
Cost of maintenance to June 30, 1937.....		
Total cost of permanent work to June 30, 1937.....		948,632.38
Minus accounts payable June 30, 1937.....		2,839.00
Net total expenditures.....		945,793.38
Unexpended balance June 30, 1937.....		54,206.62
Total amount appropriated to June 30, 1937.....		<u>1,000,000.00</u>

Fiscal year ending June 30	1933	1934	1935	1936	1937
Cost of new work.....					
Cost of maintenance.....				\$664,495.21	\$284,137.17
Total expended.....				639,226.83	306,566.55
Allotted.....			\$1,000,000		

Balance unexpended July 1, 1936.....		\$360,773.17
Gross amount expended.....		306,566.55
Balance unexpended June 30, 1937.....		54,206.62
Amount covered by uncompleted contracts.....		54,206.62

**CONSOLIDATED COST AND FINANCIAL SUMMARY FOR MISSISSIPPI RIVER, OHIO RIVER TO MISSOURI RIVER**

Cost of new work to June 30, 1937.....		\$32,546,823.52
Cost of maintenance to June 30, 1937.....		19,776,745.93
Total cost of permanent work to June 30, 1937.....		<u>52,323,569.45</u>



RIVERS AND HARBORS—ST. LOUIS, MO., DISTRICT

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Minus accounts payable June 30, 1937.....	\$112,452.04
Net total expenditures.....	52,211,117.41
Unexpended balance June 30, 1937.....	491,215.07
Total amount appropriated to June 30, 1937.....	52,702,332.48

Fiscal year ending June 30	1933	1934	1935	1936	1937
Cost of new work.....	\$2,354,097.86	\$4,080,073.68	\$593,879.18	\$805,110.11	\$1,313,493.57
Cost of maintenance.....	951,859.78	1,659,616.53	899,974.77	644,152.00	1,217,414.09
Total cost.....	3,305,957.64	5,739,690.21	1,493,853.95	1,449,262.11	2,530,907.66
Total expended.....	3,599,802.51	5,725,543.35	-1,435,477.18	1,123,032.56	2,539,069.87
Allotted.....	5,122,904.46	5,160,944.70	-664,481.38	2,234,714.51	

Balance unexpended July 1, 1936.....	\$3,080,284.94
Gross amount expended.....	2,539,069.87
Balance unexpended June 30, 1937.....	491,215.07
Outstanding liabilities June 30, 1937.....	\$80,408.55
Amount covered by uncompleted contracts.....	352,340.46
	432,749.01
Balance available June 30, 1937.....	58,466.06
Amount allotted since June 30, 1937.....	1,975,000.00
Balance available for fiscal year 1938.....	2,033,466.06
Amount (estimated) required to be appropriated for completion of existing project <sup>1</sup> .....	11,400,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1939:	
For new work <sup>1</sup> .....	1,000,000.00
For maintenance <sup>1</sup> .....	1,300,000.00
Total <sup>1</sup> .....	2,300,000.00

<sup>1</sup> Exclusive of available funds.

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND CLARKSVILLE, MO.

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 916.

3. REMOVING SNAGS AND WRECKS FROM THE MISSISSIPPI RIVER BELOW THE MOUTH OF MISSOURI RIVER AND FROM OLD AND ATCHAFALAYA RIVERS

The section of the Mississippi River covered in this report was formerly in charge of the St. Louis engineer district, but for the purpose of administration on July 1, 1930, it was divided into three reaches, which are under the supervision and direction of the district engineers at St. Louis, Mo., Memphis, Tenn., and Vicksburg, Miss.

I. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

*Location.*—The Mississippi River rises above Lake Itasca, Minn., flows in a southerly direction 2,440 miles, and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, 1,078 to 1,273 miles from the Gulf.

*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report dated April 13, 1872, and concurred in by the Chief of Engineers. The cost and expenditures for the middle Mississippi prior to the adoption of the present project in 1881 were \$1,610,000 for new work.

(For further details see p. 1879 of the Annual Report for 1915.)

*Existing project.*—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (1,078 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles, all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The estimated cost of new work, revised in 1934, is \$43,000,000, with \$1,300,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Act	Work authorized	Documents and reports
June 3, 1896	Project for regulating works adopted in 1881.....	Annual Report, 1891, p. 1536
June 13, 1902 Mar. 2, 1907	Dredging introduced as part of the project.....	
Sept. 22, 1922	Dredging channel to landing places on the main river and subsidiary sloughs for the river above the mouth of the Missouri River	-
Mar. 3, 1905 Mar. 2, 1907	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works	
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	
Jan. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$9,000,000 annually.	H. Doc. No. 50, 61st Cong. 1st sess. and H. Doc. No. 168, 58th Cong. 2d sess.
July 3, 1930	Project between northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,600,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 9, 69th Cong. 2d sess.  Rivers and Harbors Committee Doc. No. 12, 70th Cong. 1st sess.

<sup>1</sup> Also joint resolution, June 29, 1906.

*Terminal facilities.*—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House

Document No. 652. Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys.

*Operations and results during fiscal year.*—River stages were favorable to construction work, which was carried on extensively by contract and by hired labor with Government plant during the fall of 1937; river conditions were generally unfavorable during the spring of 1938 and work was carried on only intermittently. Regulating works were maintained and project dimensions of channel were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>New work by contract:</b>				
Hurricane Field-Cairo Protection.....	8	2	1,395	\$18,011.32
Powers Island-Chase Island.....	37	1	425	7,120.00
Devils Island-Schenmunn.....	59	1	500	41,480.53
Willard-Hanging Dog Island.....	65	12	3,500	79,513.81
Grand Tower Island.....	79	2	2,400	59,455.06
Crain Island.....	105	4	981	12,453.04
Kaskaskia Island-Chester.....	113	1	2,325	41,172.48
St. Genevieve, Ill. and Mo.....	123	9	2,615	48,889.97
Fish Bend.....	136	6	2,575	47,802.89
Fish Bend-Danby Landing.....	145	(1)	(1)	15,105.20
Cairo Island-Cornice Island.....	149	7	4,250	113,073.25
Total.....		48	21,215	515,776.57
<b>New work by United States plant and hired labor:</b>				
Establishment Island.....	132	(1)	(1)	13,110.75
Horsetail East.....	169	4	1,225	38,524.53
Total.....		4	1,225	51,644.28
<b>Maintenance by United States plant and hired labor.....</b>				
			4,615	69,773.72

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetments)					Costs
		Number	Linear feet bank protection	Squares (100 square feet)		Piles, linear feet bank protected	
				Mattress	Paving		
<b>New work by contract:</b>							
Greenfield Bend-Hurricane Field.....	7	1	1,300	1,650	704		\$37,814.04
Grand Tower Island.....	78	1	8,730	11,068	5,250		216,605.49
Wilkinson-Liberty Bend.....	85-100	2	2,275	2,275	1,178		43,764.01
Total.....		4	12,305	14,993	7,138		298,244.14
<b>Maintenance by United States plant and hired labor.....</b>							
				1,415	4,045	20,080	200,330.88

<sup>1</sup> Dikes not completed during fiscal year 1938.

*Regular funds—New work.*—Four dikes totaling 1,225 feet in length were built by hired labor with Government plant at a cost of \$51,644.28. Forty-eight dikes totaling 21,245 feet in length were built under contract at a cost of \$515,776.57. Four revetments totaling 12,305 feet in length, consisting of 14,993 squares of mattress and

7,168 squares of paving, were built under contract at a cost of \$298,-244.14. In addition to completed work there were under construction, by contract, 10 dikes to total 10,070 linear feet, and one revetment, length included in above table. The total cost of new work with regular funds was \$865,664.99.

*Maintenance.*—Dikes and revetments were repaired at a cost of \$270,160.60. The required 9-foot channel was maintained, except for short periods needed to move a dredge to the shoal, by five United States dredges. During the year 54 shoals developed of which 40 were dredged once, 7 were dredged twice, 6 were dredged three times, and 1 was dredged four times. There were 10,597,490 cubic yards of sand and gravel removed by these dredges from channels through 54 bars, 81,357 cubic yards of material removed in outside-the-channel dredging, and 74,629 cubic yards of material was removed in miscellaneous snagging operations. The channels dredged had a combined length of 31.8 miles, an average width of 297 feet, and an average gain in depth of 4 feet. The total cost of dredging was \$772,394.68, all charged to maintenance.

Hydrographic surveys were made covering 246 miles of river, costing \$96,067.05. Model studies were made at Waterways Experiment Station, Vicksburg, Miss., of the following river reaches: Boston Bar, Dogtooth Bend, Swiftsure, Grand Tower, and Chain of Rocks, at a total cost of \$59,139.61. Other miscellaneous costs were: Snagging, \$26,454.82; aids to navigation, \$2,071.98; and gages, \$1,132.01, all charged to maintenance. The total cost of all maintenance was \$1,227,420.75.

*Emergency Relief funds—New work.*—There remains under contract one uncompleted revetment to total about 2,200 feet, to be paid for with Emergency Relief funds, on which no work was done pending the rectification of bank alinement by river currents. There were no costs or expenditures from Emergency Relief funds.

The costs and expenditures during the fiscal year were as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular .....	\$865,664.99	\$1,227,420.75	\$2,093,085.74	2,138,338.29
Emergency Relief .....				
Total .....	865,664.99	1,227,420.75	2,093,085.74	2,138,338.29

*Condition at end of fiscal year.*—Open river regulation works are about 74 percent completed. The quantities required to complete the project are estimated as 73 dikes, 73,000 linear feet, and 50 revetments, 268,800 linear feet. Dikes and revetments are now in very good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season usually lasts from the middle of February to the middle of December, the river being generally closed by ice the remainder of

RIVERS AND HARBORS—ST. LOUIS, MO., DISTRICT 1017

the year. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging.

The following table gives condition of the channel during the fiscal year 1938:

Section	Length of section	Channel affording—								Controlling depth <sup>1</sup>
		9 feet or more		9 feet or less		7 feet or less		6 feet or less		
		Length	Period	Length	Period	Length	Period	Length	Period	
		Miles	Days	Miles	Days	Miles	Days	Miles	Days	
Ohio River to Commercial Point.....	32.7	32.3	226	0.4	49	0.4	6	0	0	7
Commercial Point to Commerce.....	6.7	5.5	215	1.2	60	0.4	4	0	0	7
Commerce to Grays Point.....	6.0	5.8	250	0.8	19	0.4	5	0.4	5	6
Grays Point to Grand Tower.....	33.7	31.2	184	2.5	91	2.4	32	0.4	12	6
Grand Tower to Fort Gage.....	30.3	33.5	166	2.8	119	2.8	31	0.4	4	6
Fort Gage to Little Rock.....	9.5	8.3	228	1.2	47	1.2	19	0.4	8	6
Little Rock to River des Peres.....	40.5	41.2	136	5.3	139	4.3	65	0.8	8	6
River des Peres to Merchants Bridge.....	11.2	10.8	255	0.4	20	0	0	0	0	9
Merchants Bridge to northern boundary, city of St. Louis <sup>2</sup> .....	8.0	7.2	205	0.8	70	0.8	10	0	0	7
Northern boundary to mouth of Missouri River <sup>3</sup> .....	3.8	3.4	227	0.4	48	0.4	10	0	0	6.5

<sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis, and 200 feet from that point to Missouri River, with additional width in bends throughout.

<sup>2</sup> Stage, St. Louis gage, was continuously below zero, for 57 days in full of 1936, the previous record, and for 141 days in full of 1937.

<sup>3</sup> This is known as the "Chain of Rocks Reach."

The costs and expenditures under the existing project to June 30, 1938, have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$27,301,701.67	\$21,004,166.68	\$48,305,868.35	\$48,331,507.86
Public Works.....	3,462,154.46		3,462,154.46	3,462,154.46
Emergency Relief.....	948,632.38		948,632.38	945,793.38
Total.....	31,802,488.51	21,004,166.68	52,806,655.19	52,739,455.70

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*Proposed operations.*—The unexpended balance, together with an allotment of \$300,000 received since June 30, 1938, will be applied as follows:

REGULAR FUNDS

Accounts payable, June 30, 1938		\$64,300.49
<b>New work:</b>		
By contract (completion of existing contracts), July 1, 1938 to June 30, 1939:		
Piling dikes:		
Ste. Genevieve, Ill. and Mo.	\$50,080.00	
Fish Bend	97,400.00	
Fish Bend-Danby Landing	91,400.00	
Calico Island-Cornice Island	10,810.00	
Bank protection: Wilkinson-Liberty Bend	7,430.00	
By contract, July 1, 1938, to June 30, 1939:		
Piling dikes:		
Price Landing	60,700.00	
Devils Island-Schenmann-Willard	95,700.00	
Hanging Dog Island	73,000.00	
Kaskaskia Island-Ste. Genevieve, Mo.	124,700.00	
Fish Bend	52,200.00	
Calico Island-Sulphur Springs	92,800.00	
Bank protection: Price Landing-Powers Island-Goose Island	145,000.00	
Rock removal: Grayshoro	100,000.00	
		1,011,480.00
By hired labor with United States plant, July 1, 1938, to June 30, 1939:		
Piling dikes: Fort Chartres	46,400.00	
Crib dikes: Thebes Reach	60,900.00	
Solid dikes: Grayshoro	42,000.00	
Bank protection:		
Boston Bar	27,000.00	
Kaskaskia Island	29,000.00	
Bank rectification:		
Price Landing	14,000.00	
Powers Island	30,000.00	
		249,300.00
Total new work		1,260,780.00
<b>Maintenance:</b>		
By hired labor with United States plant, July 1, 1938 to June 30, 1939:		
Dikes and bank protection	\$145,000.00	
Aids to navigation	10,000.00	
Project channel dredging	750,000.00	
Snagging	30,000.00	
Surveys, tests and studies	80,000.00	
		1,015,000.00
Unallocated balance		3,529.67
Total regular funds		2,343,670.16
<b>EMERGENCY RELIEF FUNDS</b>		
Unexpended balance at the end of the year will be applied as follows:		
Accounts payable, June 30, 1938		2,830.00
New work: By contract (completion of existing contract), July 1, 1938 to June 30, 1939: Bank protection, Cape Grardeau		51,307.62
Total Emergency Relief funds		54,206.62
Total for all work		2,307,876.78

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The sum of \$2,300,000 can be profitably expended during the fiscal year 1940, as follows:

New work:	
By contract, July 1, 1939, to June 30, 1940:	
Dikes .....	\$300,000
Bank protection .....	500,000
By hired labor, July 1, 1939, to June 30, 1940:	
Dikes .....	100,000
Bank protection .....	100,000
Total new work .....	1,000,000
Maintenance (by hired labor with United States plant, July 1, 1939, to June 30, 1940):	
Dikes and bank protection .....	400,000
Project channel dredging .....	770,000
Surveys, tests, and studies .....	100,000
Slugging .....	30,000
Total maintenance .....	1,300,000
Total for all work .....	2,300,000

It is expected that, with the proposed expenditures, the project will be 80 percent complete.

*Cost and financial summary*

MAINTENANCE AND IMPROVEMENT FUNDS

Cost of new work to June 30, 1938 .....	\$32,463,856.13
Cost of maintenance to June 30, 1938 .....	21,004,166.68
Total cost of permanent work to June 30, 1938 .....	53,468,022.81
Minus accounts payable June 30, 1938 .....	64,360.49
Net total expenditures .....	53,403,662.32
Unexpended balance June 30, 1938 .....	2,043,670.16
Total amount appropriated to June 30, 1938 .....	55,447,332.48

Fiscal year ending June 30	1934	1935	1936	1937	1938
Cost of new work .....	\$1,277,468.17	\$33,317.09	\$41,567.15	\$1,029,356.40	\$405,604.99
Cost of maintenance .....	1,659,616.53	899,974.77	644,152.00	1,217,414.09	1,227,420.75
Total cost .....	2,937,084.70	933,322.75	685,719.15	2,246,770.49	2,093,095.74
Total expended .....	2,900,285.24	-1,962,932.93	368,365.13	2,232,503.32	2,138,338.29
Allotted .....	2,243,564.23	-2,259,481.38	2,304,910.52		3,715,000.00

Balance unexpended July 1, 1937 .....	\$437,008.45
Amount allotted from War Department Appropriation Act approved Apr. 9, 1935 .....	\$120,000
Amount allotted from War Department Civil Appropriation Act approved July 19, 1937 .....	1,975,000
Amount allotted from War Department Civil Appropriation Act approved June 11, 1938 .....	1,650,000
	3,745,000.00
Amount to be accounted for .....	4,182,008.45
Gross amount expended .....	2,138,338.29
Balance unexpended June 30, 1938 .....	2,043,670.16

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Outstanding liabilities June 30, 1938.....	\$44,390.31
Amount covered by uncompleted contracts.....	281,741.63
	\$326,131.94
Balance available June 30, 1938.....	1,717,538.22
Amount allotted from War Department Civil Appropriation Act approved June 11, 1938.....	300,000.00
Balance available for fiscal <sup>1</sup> year 1939.....	2,017,538.22
Amount (estimated) required to be appropriated for completion of existing project <sup>1</sup> .....	9,900,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1940:	
For new work <sup>1</sup> .....	1,000,000.00
For maintenance <sup>1</sup> .....	1,300,000.00
Total <sup>1</sup> .....	2,300,000.00

<sup>1</sup> Exclusive of available funds.

EMERGENCY RELIEF FUNDS

Cost of new work to June 30, 1938.....	\$948,632.38
Cost of maintenance to June 30, 1938.....	
Total cost of permanent work to June 30, 1938.....	948,632.38
Minus accounts payable June 30, 1938.....	2,839.00
Net total expenditures.....	945,793.38
Unexpended balance June 30, 1938.....	54,206.62
Total amount appropriated to June 30, 1938.....	1,000,000.00

Fiscal year ending June 30	1934	1935	1936	1937	1938
Cost of new work.....			\$264,495.21	\$284,137.17	
Cost of maintenance.....					
Total expended.....			639,226.83	304,596.55	
Allotted.....		\$1,000,000			

Balance unexpended July 1, 1937.....	\$54,206.62
Balance unexpended June 30, 1938.....	54,206.62
Amount covered by uncompleted contracts.....	54,206.62

CONSOLIDATED COST AND FINANCIAL SUMMARY—MISSISSIPPI RIVER, OHIO RIVER TO MISSOURI RIVER

Cost of new work to June 30, 1938.....	\$33,412,488.51
Cost of maintenance to June 30, 1938.....	21,004,166.68
Total cost of permanent work to June 30, 1938.....	54,416,655.19
Minus accounts payable June 30, 1938.....	67,199.49
Net total expenditures.....	54,349,455.70
Unexpended balance June 30, 1938.....	2,097,876.78
Total amount appropriated to June 30, 1938.....	56,447,332.48



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Fiscal year ending June 30	1934	1935	1936	1937	1938
Cost of new work.....	\$4,080,073.68	\$503,870.18	\$805,110.11	\$1,313,404.57	\$905,064.09
Cost of maintenance.....	1,650,610.53	809,971.77	614,152.00	1,217,414.09	1,227,420.75
Total cost.....	5,730,684.21	1,403,853.95	1,419,262.11	2,530,807.66	2,093,085.74
Total expended.....	5,725,543.35	-1,135,177.18	1,123,032.56	2,539,060.87	2,139,338.29
Allotted.....	5,160,944.70	-664,481.35	2,224,714.51		3,715,000.00

Balance unexpended July 1, 1937.....	\$491,215.07
Amount allotted from War Department Appropriation Act approved Apr. 5, 1935.....	\$120,000.00
Amount allotted from War Department Civil Appropriation Act approved July 19, 1937.....	1,975,000.00
Amount allotted from War Department Civil Appropriation Act approved June 11, 1938.....	1,650,000.00
	3,745,000.00
Amount to be accounted for.....	4,230,215.07
Gross amount expended.....	2,138,338.29
	2,097,876.78
Balance unexpended June 30, 1938.....	\$44,390.31
Outstanding liabilities June 30, 1938.....	335,948.25
Amount covered by uncompleted contracts.....	380,338.56
	1,717,538.22
Balance available June 30, 1938.....	300,000.00
Amount allotted from War Department Civil Appropriation Act approved June 11, 1938.....	2,017,538.22
Balance available for fiscal year 1939.....	9,900,000.00
Amount (estimated) required to be appropriated for completion of existing project <sup>1</sup> .....	1,600,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1940:	1,300,000.00
For new work <sup>1</sup> .....	1,000,000.00
For maintenance <sup>2</sup> .....	1,300,000.00
Total.....	2,300,000.00

<sup>1</sup> Exclusive of available funds.

**2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND CLARKSVILLE, MO.**

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1046.

**3. REMOVING SNAGS AND WRECKS FROM THE MISSISSIPPI RIVER BELOW THE MOUTH OF MISSOURI RIVER AND FROM OLD AND ATCHAFALAYA RIVERS**

The section of the Mississippi River covered in this report was formerly in charge of the St. Louis engineer district, but for the purpose of administration, on July 1, 1930, it was divided into three reaches, which are under the supervision and direction of the district engineers at St. Louis, Mo., Memphis, Tenn., and Vicksburg, Miss.

The St. Louis district extends from the mouth of the Missouri River to the mouth of the Ohio River, a distance of 195 miles. The Memphis district extends from the mouth of the Ohio River to the mouth of the Arkansas River, a distance of 399 miles. The Vicks-

## IMPROVEMENT OF RIVERS AND HARBORS IN THE ST. LOUIS, MO., DISTRICT

This district includes the Mississippi River between the Ohio River and Clarksville, Mo., and for compliance with provisions of the Flood Control Act of June 22, 1936, includes the Mississippi River between Cape Girardeau, Mo., and Clarksville, Mo., on the right bank, and between Thebes, Ill., and Hamburg Bay, Ill., on the left bank. That section of Mississippi River between Missouri River and Clarksville is included in the report of Mississippi River between Missouri River and Minneapolis, Minn.

District engineer: Lt. Col. P. S. Reinecke, Corps of Engineers.

Division engineer: Lt. Col. Malcolm Elliott, Corps of Engineers, to May 1, 1939; Lt. Col. Philip B. Fleming, Corps of Engineers, acting division engineer, May 1 to June 8, 1939; Lt. Col. Malcolm Elliott, Corps of Engineers, since that date.

### IMPROVEMENTS

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### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

*Location.*—The Mississippi River rises above Lake Itasca, Minn., and, from that lake, flows in a southerly direction about 2,440 miles, and empties into the Gulf of Mexico. The portion included in this report embraces the 196-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,078 to 1,278 miles from the Gulf.

*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

*Existing project.*—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 1,078 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The estimated cost of new work, revised in 1934, is \$43,000,000, with \$1,300,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1886	Project for regulating works adopted in 1881 . . . .	Annual Report, 1881, p. 1836.
June 13, 1902	Dredging introduced as part of the project. . . . .	
Mar. 2, 1907		
Mar. 3, 1905	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
Mar. 2, 1907		
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 80, 61st Cong., 1st sess., and H. Doc. No. 168, 58th Cong., 2d sess.
Jan. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.
July 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,600,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.

<sup>1</sup> Also joint resolution, June 29, 1906.

*Recommended modifications of project.*—Under date of March 15, 1939, the Chief of Engineers recommended modifications of the existing project to approve a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of

approximately \$10,290,000, with annual maintenance and operation costs of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

*Terminal facilities.*—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys.

*Operations and results during fiscal year.*—River stages were favorable to construction work, which was carried on extensively by contract and by hired labor with Government plant during the fall of 1938; river conditions were generally unfavorable during the spring of 1939 and work was carried on only intermittently. Regulating works were maintained and project dimensions of channel were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>New work by contract:</b>				
Price Landing.....	27	5	2,185	\$71,953.26
Devils Island-Schenmann-Willard.....	62	8	4,835	105,894.57
Hanging Dog Island.....	68	3	2,195	53,462.42
Kaskaskia Island-St. Genevieve.....	116	8	5,070	116,661.10
St. Genevieve, Ill. and Mo.....	123	2	2,180	43,177.85
Fish Bend.....	185	4	4,925	124,376.95
Fish Bend-Danby Landing.....	143	8	4,310	91,246.89
Calico Island-Cornice Island.....	149	4	2,075	40,274.68
Calico Island-Sulphur Springs.....	154	6	3,625	62,275.45
<b>Total.....</b>		<b>48</b>	<b>31,850</b>	<b>718,323.06</b>
<b>New work by United States plant and hired labor:</b>				
Brooks Point.....	25	7	1,415	65,027.58
Graysboro.....	42	1	840	48,207.47
Liberty Bend.....	58	4	1,260	43,780.75
St. Genevieve, Ill.....	123	1	750	13,019.40
Establishment Island.....	123	3	935	25,654.11
<b>Total.....</b>		<b>16</b>	<b>5,200</b>	<b>194,189.31</b>
<b>Maintenance by United States plant and hired labor:</b>				
			5,000	120,195.93

<sup>1</sup> Solid dikes.

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Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetments)					Cost
		Number	Linear feet bank protection	Squares (100 square feet)		Toe piles, bank protection, linear feet	
				Mattress	Paving		
New work by contract:							
Price Landing-Powers Island-Goose Island.....	30-39	3	3,145	3,585	1,640	2,230	\$60,062.45
Cape Girardeau.....	50	1	1,995	1,955	690	.....	48,115.57
Wilkinson-Liberty Bend.....	85-100	(?)	(?)	(?)	519	.....	12,119.12
Total.....		4	5,140	5,540	2,858	2,230	140,297.14
New work by United States plant and hired labor:							
Grand Lake.....	13	1	410	328	169	375	9,677.16
Kaskaskia Island.....	118	1	1,000	.....	612	1,000	17,534.68
Total.....		2	1,410	328	781	1,375	27,211.84
Maintenance by United States plant and hired labor.....						10,645	106,261.06

\* Reported fiscal year 1938.

*Regular funds—New work.*—Sixteen dikes, totaling 5,220 feet in length, were built by hired labor with Government plant, at a cost of \$194,159.31. Two revetments, totaling 1,410 feet in length, consisting of 328 squares of mattress and 781 squares of paving, were built by hired labor with Government plant at a cost of \$27,211.84. A total of 49,782 cubic yards of rock was removed by United States dipper dredge at a cost of \$63,557.07. Forty-eight dikes, totaling 31,850 feet in length, were built under contract at a cost of \$718,323.88. Three revetments, totaling 3,145 feet in length, consisting of 3,585 squares of mattress and 2,168 squares of paving, were built under contract at a cost of \$92,201.57. In addition to completed work there was under construction, by contract, one revetment, to total about 2,855 linear feet. The total cost of new work with regular funds was \$1,095,453.67.

*Maintenance.*—Dikes and revetments were repaired at a cost of \$286,456.99. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by five United States hydraulic dredges. During the year 53 shoals developed, of which 49 were dredged once, 2 were dredged twice, 1 was dredged 3 times, and 1 was dredged 4 times. There were 7,971,257 cubic yards of sand and gravel removed by these dredges from channels through 53 bars; 556,673 cubic yards of material was removed in outside-the-channel dredging, and 128,630 cubic yards of material was removed in miscellaneous snagging operations by dipper and hydraulic dredges. The channels dredged had a combined length of 25.7 miles, an average width of 330 feet, and an average gain in depth of 6 feet. The total cost of dredging was \$570,386.02, all charged to maintenance.

Hydrographic surveys were made covering 270 miles of river, costing \$96,862.32. Model studies were made at Waterways Experiment Station, Vicksburg, Miss., of the following river reaches: Boston Bar, Dogtooth Bend, Swiftsure, and Chain of Rocks, at a total cost of \$24,218.60. Other miscellaneous costs were: Snagging, \$51,119.31; aids to navigation, \$456.82; and gages, \$8,479.03, all charged to maintenance. The total cost of all maintenance was \$1,037,999.09.

*Emergency Relief funds—New work.*—One revetment, totaling 1,995 linear feet, consisting of 1,955 squares of mattress and 690

squares of paving, was completed under contract at a cost of \$48,115.57, completing all work under Emergency Relief funds.

*Costs and expenditures—All funds.*—The costs and expenditures during the fiscal year were as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$1,095,452.67	\$1,087,900.09	\$2,183,452.76	\$2,092,057.18
Emergency Relief.....	48,115.57		48,115.57	50,964.67
Total.....	1,143,568.24	1,087,900.09	2,181,568.33	2,113,011.78

*Condition at end of fiscal year.*—Open river regulation works are about 77 percent completed. The quantities required to complete the project are estimated as 100 dikes, 74,000 linear feet, and 44 revetments, 210,000 linear feet. Dikes and revetments are now in very good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by heavy running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 5½ months of the year, latter part of February to middle of August, during which time project channel depths generally prevail without dredging.

The following table gives condition of the channel during the fiscal year 1939:

Section	Length of section	Channel affording—								Controlling depth <sup>1</sup>
		9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		
		Length	Period	Length	Period	Length	Period	Length	Period	
Ohio River to Commercial Point.....	Miles 32.7	Miles 31.4	Days 260	Miles 1.3	Days 5	Miles 0	Days 0	Miles 0	Days 0	8.5
Commercial Point to Commerce.....	6.7	5.2	360	1.5	5	0	0	0	0	7.5
Commerce to Grays Point.....	6.6	6.2	364	.4	1	0	0	0	0	8
Grays Point to Grand Tower.....	33.7	29.8	344	3.9	21	1.9	7	1.2	4	6
Grand Tower to Fort Gage.....	36.3	35.0	357	1.3	5	.4	1	0	0	7
Fort Gage to Little Rock.....	9.5	8.3	303	1.2	3	0	0	0	0	8.5
Little Rock to River des Peres.....	46.5	44.0	356	2.5	9	0	0	0	0	7
River des Peres to Merchants Bridge.....	11.2	11.2	366	0	0	0	0	0	0	9
Merchants Bridge to northern boundary of St. Louis.....	2.0	6.8	360	1.2	5	.4	1	.4	1	6
Northern boundary of Missouri River.....	2.8	2.4	302	.4	3	0	0	0	0	8

<sup>1</sup> Previous tables were computed on a navigation season of 275 days.  
<sup>2</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.  
<sup>3</sup> This is known as the "Chain of Rocks Reach."

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The costs and expenditures under the existing project to June 30, 1939, have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$28,487,155.34	\$22,042,165.77	\$50,529,321.11	\$50,393,565.02
Public Works.....	3,462,154.46	.....	3,462,154.46	3,462,154.46
Emergency Relief.....	996,747.95	.....	996,747.95	996,747.95
Total.....	32,946,057.75	22,042,165.77	54,988,223.52	54,852,467.43

*Proposed operations.*—The unexpended balance will be applied as follows:

Accounts payable June 30, 1939 (including \$960 Emergency Relief Administration funds to be revoked).....

\$135,756.09

New work:

By contract (completion of existing contract), July 1, 1939, to Sept. 30, 1939:

Bank protection: Price Landing-Powers Island-Goose Island..... \$41,000.00

By contract, July 1, 1939, to June 30, 1940:

Piling dikes:

Giboney Island..... 111,800.00  
 Schenimann..... 54,000.00  
 Liberty..... 56,000.00  
 Chester..... 59,800.00  
 Fort Chartres..... 63,000.00  
 Fish Bend-Danby Landing..... 159,000.00  
 Bank protection: Dogtooth Bend..... 60,000.00

605,200.00

By hired labor with United States plant, July 1, 1939, to June 30, 1940:

Bank protection, Dogtooth Bend..... 81,000.00  
 Crib dikes, Thebes Reach..... 45,000.00  
 Piling dikes, Calico Island..... 59,800.00  
 Rock removal, Graysboro..... 36,000.00

171,800.00

Total, new work.....

777,000.00

Maintenance: By hired labor with United States plant, July 1, 1939, to June 30, 1940:

Dikes and bank protection..... \$148,800.00  
 Project channel dredging..... 701,000.00  
 Snagging..... 15,000.00  
 Aids to navigation..... 10,000.00  
 Surveys, tests, and studies..... 70,016.91

Total maintenance.....

944,816.91

Total for all work.....

1,857,578.00

The sum of \$2,300,000 can be profitably expended during the fiscal year 1941, as follows:

New work:

By contract, July 1, 1940, to June 30, 1941:

Dikes..... \$300,000  
 Bank protection..... 500,000

By hired labor:

Dikes..... 100,000  
 Bank protection..... 100,000

Total, new work.....

\$1,000,000

**RIVERS AND HARBORS—ST. LOUIS, MO., DISTRICT 1119**

Maintenance by hired labor with United States plant:

Dikes and bank protection.....	\$450,000
Project channel dredging.....	750,000
Surveys and studies.....	100,000
<b>Total maintenance.....</b>	<b>\$1,300,000</b>
<b>Total for all work.....</b>	<b>2,800,000</b>

It is expected that, with the proposed expenditures, the project will be 80 percent complete.

*Cost and financial summary*

**MAINTENANCE AND IMPROVEMENT FUNDS**

Cost of new work to June 30, 1939.....	\$38,559,309.80
Cost of maintenance to June 30, 1939.....	22,042,165.77
<b>Total cost of permanent work to June 30, 1939.....</b>	<b>55,601,475.57</b>
Minus accounts payable June 30, 1939.....	135,756.09
<b>Net total expenditures.....</b>	<b>55,465,719.48</b>
Unexpended balance June 30, 1939.....	1,856,613.00
<b>Total amount appropriated to June 30, 1939.....</b>	<b>57,322,332.48</b>

Fiscal year ending June 30	1935	1936	1937	1938	1939
Cost of new work.....	\$33,347.98	\$41,597.15	\$1,029,356.40	\$885,664.99	\$1,095,453.67
Cost of maintenance.....	899,974.77	644,182.00	1,217,414.09	1,227,420.75	1,087,999.09
<b>Total cost.....</b>	<b>933,322.75</b>	<b>685,779.15</b>	<b>2,246,770.49</b>	<b>2,003,085.74</b>	<b>2,133,452.76</b>
<b>Total expended.....</b>	<b>-1,062,262.93</b>	<b>368,365.13</b>	<b>2,232,533.32</b>	<b>2,133,333.29</b>	<b>2,062,067.16</b>
<b>Allotted.....</b>	<b>-2,289,481.38</b>	<b>2,304,940.52</b>	<b>.....</b>	<b>3,745,000.00</b>	<b>1,875,000.00</b>

Balance unexpended July 1, 1938.....	\$2,043,670.16
Amount allotted from War Department Civil Appropriation Act approved June 11, 1938.....	\$800,000.00
Amount allotted from War Department Civil Appropriation Act approved June 28, 1939.....	1,575,000.00
<b>Amount to be accounted for.....</b>	<b>1,875,000.00</b>
<b>Gross amount expended.....</b>	<b>8,918,670.16</b>
<b>Balance unexpended June 30, 1939.....</b>	<b>1,856,613.00</b>
Outstanding liabilities June 30, 1939.....	\$98,980.53
Amount covered by uncompleted contracts.....	86,200.25
<b>Balance available June 30, 1939.....</b>	<b>1,671,452.22</b>
<b>Amount (estimated) required to be appropriated for completion of existing project.....</b>	<b>9,200,000.00</b>
<b>Amount that can be profitably expended in fiscal year ending June 30, 1941:</b>	
For new work.....	1,000,000.00
For maintenance.....	1,800,000.00
<b>Total.....</b>	<b>2,800,000.00</b>

<sup>1</sup> Exclusive of available funds.



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EMERGENCY RELIEF FUNDS

Cost of new work to June 30, 1939.....	\$996,747.95
Cost of maintenance to June 30, 1939.....	-----
Total cost of permanent work to June 30, 1939.....	996,747.95
Net total expenditures.....	996,747.95
Unexpended balance June 30, 1939.....	960.00
Total amount appropriated to June 30, 1939.....	997,707.95

Fiscal year ending June 30	1935	1936	1937	1938	1939
Cost of new work.....		\$664,495.21	\$284,187.17		\$48,115.57
Cost of maintenance.....					
Total expended.....		664,495.21	308,564.55		50,954.57
Allotted.....	\$1,000,000				-2,292.05

Balance unexpended July 1, 1938.....	\$54,206.62
Deductions on account of revocation of allotment.....	2,292.05
Net amount to be accounted for.....	51,914.57
Gross amount expended.....	50,954.57
Balance unexpended June 30, 1939.....	960.00

CONSOLIDATED COST AND FINANCIAL SUMMARY—MISSISSIPPI RIVER, OHIO RIVER TO MISSOURI RIVER

Cost of new work to June 30, 1939.....	\$34,556,037.75
Cost of maintenance to June 30, 1939.....	22,042,165.77
Total cost of permanent work to June 30, 1939.....	56,598,223.52
Minus accounts payable June 30, 1939.....	135,756.09
Net total expenditures.....	56,462,467.43
Unexpended balance June 30, 1939.....	1,857,573.00
Total amount appropriated to June 30, 1939.....	58,320,040.43

Fiscal year ending June 30	1935	1936	1937	1938	1939
Cost of new work.....	\$593,870.18	\$805,110.11	\$1,313,493.57	\$935,664.99	\$1,143,569.24
Cost of maintenance.....	899,974.77	644,152.00	1,217,414.09	1,227,420.75	1,037,999.09
Total cost.....	1,493,844.95	1,449,262.11	2,530,907.66	2,063,085.74	2,181,568.33
Total expended.....	-1,435,477.18	1,123,032.50	2,539,066.87	2,138,338.29	2,113,011.73
Allotted.....	-664,481.38	2,224,714.51		3,745,000.00	1,872,707.95

Balance unexpended July 1, 1938.....	\$2,097,876.78
Amount allotted from War Department Civil Appropriation Act approved June 11, 1938.....	\$300,000.00
Amount allotted from War Department Civil Appropriation Act approved June 28, 1939.....	1,575,000.00
Amount to be accounted for.....	1,872,876.78
Deductions on account of revocation of allotments.....	2,292.05
Net amount to be accounted for.....	8,970,584.73
Gross amount expended.....	2,113,011.73
Balance unexpended June 30, 1939.....	1,857,573.00

RIVERS AND HARBORS--ST. LOUIS, MO., DISTRICT 1121

Outstanding liabilities June 30, 1939	\$98,960.53	
Amount covered by uncompleted contracts	86,200.25	
		\$185,160.78
Balance available June 30, 1939		1,872,412.22
Amount (estimated) required to be appropriated for completion of existing project		9,200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1941:		
For new work		1,000,000.00
For maintenance		1,300,000.00
Total		2,300,000.00

<sup>1</sup> Exclusive of available funds.

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND CLARKSVILLE, MO.

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1146.

3. REMOVING SNAGS AND WRECKS FROM THE MISSISSIPPI RIVER BELOW THE MOUTH OF MISSOURI RIVER AND FROM OLD AND ATCHAFALAYA RIVERS

The section of the Mississippi River covered in this report was formerly in charge of the St. Louis engineer district, but for the purpose of administration on July 1, 1930, it was divided into three reaches, which are under the supervision and direction of the district engineers at St. Louis, Mo., Memphis, Tenn., and Vicksburg, Miss.

The St. Louis district extends from the mouth of the Missouri River to the mouth of the Ohio River, a distance of 195 miles. The Memphis district extends from the mouth of the Ohio River to the mouth of the Arkansas River, a distance of 399 miles. The Vicksburg district extends from the mouth of the Arkansas River to the Head of Passes, 671 miles, and includes 8 miles of Old River and 30 miles of the Atchafalaya River.

District engineers: St. Louis, Mo., Lt. Col. P. S. Reinecke, Corps of Engineers; Memphis, Tenn., Maj. Daniel Noce, Corps of Engineers; Vicksburg, Miss., Lt. Col. Raymond G. Moses, Corps of Engineers.

Division engineers: For the river below the mouth of the Ohio, Brig. Gen. H. B. Ferguson, Corps of Engineers; for the river above the mouth of the Ohio, Lt. Col. Malcolm Elliott, Corps of Engineers; Lt. Col. Philip B. Fleming, Corps of Engineers, acting May 1 to June 8, 1939.

*Location.*—The snagging district embraces that portion of the river between Head of Passes and the mouth of Missouri River, 1,265 miles, 8 miles of Old River (present mouth of Red River), and 30 miles of Atchafalaya River from Red River to Melville, La.; total, 1,303 miles.

*Previous projects.*—For the removal of these obstructions general appropriations were made at irregular intervals as early as 1824. For further details, see page 1880, Annual Report for 1915.

*Existing project.*—This is a continuation of the plan adopted in 1879, and provides for the removal and destruction of snags, wrecks, drift heaps, and other obstructions to navigation in the Mississippi River between Head of Passes (18 miles from mouth of South Pass) and mouth of Missouri River, and in Old and Atchafalaya Rivers

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IMPROVEMENTS—continued

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1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

*Location.*—The Mississippi River rises above Lake Itasca, Minn., and, from that lake, flows in a southerly direction about 2,450 miles, and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,081 to 1,276 miles from the Gulf.

*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

*Existing project.*—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 1,081 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The estimated cost of new work, revised in 1934, is \$43,000,000, with \$1,300,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1896	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.)	Annual Report, 1881, p. 1536.
June 13, 1902	Dredging introduced as part of the project.	
Mar. 2, 1907		
Mar. 3, 1905 †	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
Mar. 2, 1907 †		
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 50, 61st Cong., 1st sess., and H. Doc. No. 168, 58th Cong., 2d sess.
Jan. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.
July 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.

† Also joint resolution, June 29, 1906.

See House Document No. 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

*Recommended modifications of project.*—Under date of March 15, 1939, the Chief of Engineers recommended modifications of the existing project to approve a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation costs of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided

that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

*Terminal facilities.*—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys.

*Operations and results during fiscal year.*—River stages were favorable to construction work, which was carried on extensively by contract and hired labor with Government plant during the fall of 1939; river conditions were generally unfavorable during the spring of 1940 and work was carried on only intermittently. Regulating works were maintained and project dimensions of channel were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>Now work by contract:</b>				
Giboney Island .....	53	7	4,030	\$78,712.70
Schenimann .....	63	11	2,675	76,122.37
Liberty .....	100	4	1,600	53,835.36
Chester .....	113	1	705	16,233.18
Kaskaskia Island-St. Genevieve .....	111	1	320	8,721.15
Fort Chartres .....	130	5	1,525	71,205.38
Fish Bend-Danby Landing .....	138	5	3,520	20,244.74
Total .....		34	14,375	334,074.94
<b>New work by United States plant and hired labor:</b>				
Dogtooth Bend .....	23	3	1,990	84,403.20
Brooks Point .....	25	2	140	4,743.75
Goose Island .....	36			358.20
Thibes Reach .....	42	1	1,500	45,032.14
Wilkinson .....	87	3	400	10,739.45
Calico Island .....	149	2	2,335	51,631.98
Total .....		11	6,365	190,908.78
Maintenance by United States plant and hired labor .....			12,484	182,168.16

† Includes cost of screening 12,930 linear feet of dikes with lumber mattress.

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetments)					Cost
		Number	Linear feet bank protection	Squares (100 square feet)		Toe piles, bank protection, linear feet	
				Mattress	Paving		
New work by contract: Price Landing-Powers Island-Goose Island .....	34-37	2	3,085	3,394	1,930	2,025	\$84,021.38
New work by United States plant and hired labor: Kaskaskia Island .....	155	1	975	877	131		11,286.46
Maintenance by United States plant and hired labor .....			15,237	5,741	3,740	9,660	209,981.77

*New work.*—Eleven dikes, totaling 6,365 feet in length, were built by hired labor with Government plant, at a cost of \$199,908.78. One revetment, totaling 975 feet in length, consisting of 877 squares of mattress and 134 squares of paving, was built by hired labor with Government plant, at a cost of \$11,286.46. A total of 41,482 cubic yards of rock was removed by United States dipper dredge at a cost of \$56,763.67. Thirty-four dikes, totaling 14,375 feet in length, were built under contract at a cost of \$334,074.94. Two revetments, totaling 3,085 feet in length, consisting of 3,394 squares of mattress and 1,930 squares of paving, were built under contract at a cost of \$84,621.38. In addition to completed work there was under construction, by contract, two dikes to total about 1,980 linear feet, and by hired labor three dikes to total about 900 linear feet. The total cost of new work was \$686,655.23 from regular funds.

*Maintenance.*—Dikes and revetments were repaired at a cost of \$391,149.93. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by five United States hydraulic dredges. During the year 78 shoals developed, of which 70 were dredged once, 7 were dredged twice, and 1 was dredged 3 times. There were 9,963,785 cubic yards of sand and gravel removed by these dredges from the channels through 78 bars; 249,629 cubic yards of material was removed in outside-the-channel dredging, and 32,245 cubic yards of material was removed in miscellaneous snagging operations by dipper and hydraulic dredges. The channels dredged had a combined length of 25 miles, an average width of 360 feet, and an average gain in depth of 5.6 feet. The total cost of dredging was \$555,501.20, all charged to maintenance.

Hydrographic surveys were made covering 245 miles of river, costing \$72,991.65. Model studies were made at the Waterways Experiment Station, of the following river reaches: Boston Bar and Chain of Rocks at a total cost of \$6,872.92. Other miscellaneous costs were: Snagging, \$24,378.03; aids to navigation, \$4,742.94; cooperative stream gaging, \$18,400; and gages, \$18,271.29; all charged to maintenance. The total cost of all maintenance was \$1,092,307.96. The costs during the year were \$686,655.23 from regular funds for new work and \$1,092,307.96 for maintenance. The expenditures were \$2,071,694.10 from regular funds, and minus \$9.14 from Public Works funds.

*Condition at end of fiscal year.*—Open river regulating works are about 78 percent completed. The quantities required to complete the project are estimated at 84 dikes, 63,000 linear feet, and 43 revetments, 206,000 linear feet. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by heavy running

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ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 5½ months of the year, latter part of February to middle of August, during which time project channel depths generally prevail without dredging.

The following table gives condition of the channel during the fiscal year 1940:

Section	Length of section	Channel affording--								Controlling depth <sup>1</sup>
		9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		
		Length	Period <sup>1</sup>	Length	Period	Length	Period	Length	Period	
Ohio River to Commercial Point.....	Miles 32.7	Miles 25.3	Days 329.	Miles 7.4	Days 36	Miles 3.2	Days 13	Miles 1.6	Days 5	6
Commercial Point to Commerce.....	6.7	4.2	338	2.5	27	1.5	7	.4	1	6
Commerce to Grays Point.....	6.6	4.6	356	2.0	9	.8	3	0	0	7
Grays Point to Grand Tower.....	33.7	21.2	313	12.5	52	7.0	17	1.2	4	5½
Grand Tower to Fort Gage.....	30.3	26.0	322	10.3	43	5.5	16	1.5	2	6
Fort Gage to Little Rock.....	9.5	7.6	344	2.3	21	1.6	11	1.4	6	6
Little Rock to River des Peres.....	40.5	31.7	312	14.8	53	9.5	24	3.6	8	5½
River des Peres to Merchants Bridge.....	11.2	9.9	348	1.3	17	.8	3	0	0	6½
Merchants Bridge to northern boundary, City of St. Louis <sup>2</sup> .....	8.0	4.5	309	3.6	56	3.5	40	1.3	12	6
Northern boundary to mouth of Missouri River <sup>3</sup> .....	3.8	3.2	343	.6	22	.4	2	0	0	7

<sup>1</sup> Previous tables were computed on a navigation season of 275 days; during the fall and winter (1939-40) river stages remained below zero (St. Louis gage) for 180 consecutive days, the record to date.  
<sup>2</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.  
<sup>3</sup> This is known as the "Chain of Rocks Reach."

The costs and expenditures under the existing project to June 30, 1940, have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$29, 173, 810. 57	\$23, 134, 473. 73	\$52, 308, 284. 30	\$52, 465, 259. 12
Public Works.....	3, 462, 145. 32	-----	3, 462, 145. 32	3, 462, 145. 32
Emergency Relief.....	996, 747. 95	-----	996, 747. 95	996, 747. 95
Total.....	33, 632, 703. 84	23, 134, 473. 73	56, 767, 177. 57	56, 924, 152. 39

*Proposed operations.*—The unexpended balance, including \$200,000 which was advanced to the plant allotment, will be applied as follows:

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Accounts payable, June 30, 1940-----	\$43,025.18
New work:	
By contract (completion of existing contract), July 1 to Sept. 15, 1940:	
Piling dikes:	
Giboney Island-----	1,700.00
Chester-----	11,200.00
Fish Bend-Danby Landing-----	62,000.00
By hired labor with United States plant (completion of existing jobs), July 1 to Sept. 1, 1940:	
Piling dikes: Goose Island-----	22,000.00
By contract, July 1, 1940, to June 30, 1941:	
Piling dikes:	
Price Towhead-----	38,500.00
Seventy Six-Liberty-----	87,400.00
Ste. Genevieve, Ill-----	49,500.00
Pile and crib dikes: Calico Island-Cornice Island-----	114,400.00
Crib dikes: Neelys Landing-----	52,800.00
Bank protection:	
Greenfield Bend-----	46,200.00
Willard-----	52,200.00
Wilkinson-----	60,900.00
Fish Bend (bank rectification)-----	92,800.00
By hired labor with United States plant, July 1, 1940, to June 30, 1941:	
Piling dikes:	
Dogtooth bend-----	8,250.00
Graysboro-----	8,500.00
Devils Island-----	31,500.00
Willard-----	20,000.00
Grand Tower Island-----	18,600.00
Rockwood-----	28,600.00
Crain Island-----	49,500.00
Horsetail, East-----	22,500.00
Solid dikes: Graysboro-----	8,750.00
Bank protection:	
Goose Island-----	18,000.00
Pulltight-----	22,500.00
Land acquisition: Fish Bend (purchase of 14½ acres for bank rectification)-----	5,000.00
Dredging: Fish Bend (for bank rectification)-----	34,000.00
Total for new work-----	967,300.00
Maintenance by hired labor with United States plant, July 1, 1940, to June 30, 1941:	
Dikes and bank protection-----	212,000.00
Project channel dredging-----	652,000.00
Snagging-----	15,000.00
Surveys, tests and studies-----	70,000.00
Aids to navigation-----	15,000.00
Transfer to U. S. Geological Survey for cooperative stream gaging-----	20,000.00
Total maintenance-----	984,000.00
Total for all work-----	1,994,325.18
Unallocated balance-----	602.86
Total-----	1,994,928.04



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The sum of \$2,850,000 can be profitably expended during the fiscal year 1942, as follows:

New work:	
By contract, July 1, 1941, to June 30, 1942:	
Dikes.....	\$400,000
Bank protection.....	650,000
By hired labor:	
Dikes.....	100,000
Bank protection.....	100,000
Total for new work.....	<u>1,250,000</u>
Maintenance by hired labor with United States plant:	
Dikes and bank protection.....	780,000
Project channel dredging.....	680,000
Transfer to U. S. Geological Survey for cooperative stream gaging.....	20,000
Surveys and studies.....	120,000
Total maintenance.....	<u>1,600,000</u>
Total for all work.....	<u>2,850,000</u>

It is expected that, with the proposed expenditures, the project will be about 83 percent completed.

*Cost and financial summary*

Cost of new work to June 30, 1940.....	<sup>1</sup> \$35,242,703.84
Cost of maintenance to June 30, 1940.....	23,134,473.73
Total cost of permanent work to June 30, 1940.....	58,377,177.57
Undistributed costs June 30, 1940 (Advanced to Plant account).....	200,000.00
Net total cost to June 30, 1940.....	58,577,177.57
Minus accounts payable June 30, 1940.....	48,025.18
Net total expenditures.....	58,534,152.39
Unexpended balance June 30, 1940.....	1,794,928.04
Total amount appropriated to June 30, 1940.....	60,329,080.43

<sup>1</sup> Cost of new work in 1936 reduced in the amount of \$9.14

Fiscal year ending June 30	1936	1937	1938	1939	1940
Cost of new work.....	<sup>1</sup> \$305,100.97	\$1,313,403.57	\$865,604.99	\$1,143,569.24	\$986,655.23
Cost of maintenance.....	644,152.00	1,217,414.09	1,227,420.75	1,037,999.09	1,092,307.96
Total cost.....	1,449,252.97	2,530,907.66	2,093,085.74	2,181,568.33	1,778,963.19
Total expended.....	1,123,032.56	2,539,069.87	2,138,338.20	2,113,011.73	2,071,684.96
Allotted.....	2,224,714.51		3,745,000.00	1,872,707.95	2,009,040.00

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Balance unexpended July 1, 1939-----		\$1, 857, 573. 00
Amount allotted from War Department Civil Appropriation Act approved June 28, 1939-----	\$220, 000. 00	
Amount allotted from War Department Civil Appropriation Act approved June 24, 1940-----	1, 790, 000. 00	
		2, 010, 000. 00
Amount to be accounted for-----		3, 867, 573. 00
Deductions on account of revocation of allotment-----		960. 00
Net amount to be accounted for-----		3, 866, 613. 00
Gross amount expended-----		2, 071, 684. 96
Balance unexpended June 30, 1940-----		1, 794, 928. 04
Outstanding liabilities June 30, 1940-----	\$31, 515. 11	
Amount covered by uncompleted contracts-----	101, 652. 11	
		133, 167. 22
Balance available June 30, 1940-----		1, 661, 760. 82
Amount (estimated) required to be appropriated for comple- tion of existing project <sup>2</sup> -----		8, 400, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1942:		
For new work <sup>2</sup> -----		1, 250, 000. 00
For maintenance <sup>2</sup> -----		1, 600, 000. 00
Total <sup>2</sup> -----		2, 850, 000. 00

<sup>2</sup> Exclusive of available funds.

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND  
MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and  
Minneapolis, Minn.," page 1152.

3. REMOVING SNAGS AND WRECKS FROM THE MISSISSIPPI RIVER  
BELOW THE MOUTH OF MISSOURI RIVER AND FROM OLD AND  
ATCHAFALAYA RIVERS

The section of the Mississippi River covered in this report was  
formerly in charge of the St. Louis engineer district, but for the  
purpose of administration on July 1, 1930, it was divided into three  
reaches, which are under the supervision and direction of the district  
engineers at St. Louis, Mo., Memphis, Tenn., and Vicksburg, Miss.

The St. Louis district extends from the mouth of the Missouri  
River to the mouth of the Ohio River, a distance of 195 miles. The  
Memphis district extends from the mouth of the Ohio River to the  
mouth of the Arkansas River, a distance of 399 miles. The Vicks-  
burg district extends from the mouth of the Arkansas River to the  
Head of Passes, 671 miles, and includes 8 miles of Old River and 30  
miles of the Atchafalaya River.

District engineers: St. Louis, Mo., Col. P. S. Reinecke, Corps of  
Engineers; Memphis, Tenn., Lt. Col. Daniel Noce, Corps of En-  
gineers; Vicksburg, Miss., Lt. Col. Raymond G. Moses, Corps of En-  
gineers.

Division engineers: For the river below the mouth of the Ohio,  
Brig. Gen. H. B. Ferguson, Corps of Engineers, to September 1,  
1939; Brig. Gen. Max C. Tyler, Corps of Engineers, since that date;

1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

*Location.*—The Mississippi River rises above Lake Itasca, Minn., and from that lake flows in a southerly direction about 2,450 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,081 to 1,276 miles from the Gulf.

*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a board of engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

*Existing project.*—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 1,081 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The estimated cost of new work, revised in 1934, is \$43,000,000, with \$1,300,000 for annual maintenance. The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1896	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.)	Annual Report, 1881, p. 1536.
June 13, 1902	Dredging introduced as part of the project.....	
Mar. 2, 1907		
Mar. 3, 1905	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
Mar. 2, 1907		
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 30, 61st Cong., 1st sess., and H. Doc. No. 166, 63th Cong., 2d sess.
Jan. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.
July 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.

<sup>1</sup> Also joint resolution, June 29, 1906.

See House Document No. 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

*Recommended modifications of project.*—Under date of March 15, 1939, the Chief of Engineers recommended modifications of the existing project to approve a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation costs of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

*Terminal facilities.*—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys.

*Operations and results during fiscal year.*—River stages were favorable to construction work, which was carried on extensively by contract and hired labor with Government plant during the fall of 1940; river conditions were generally unfavorable during the spring of 1941 and work was carried on only intermittently. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

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Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>New work by contract:</b>				
Giboney Island.....	51	(1)	(1)	\$3,755.63
Noelys Landing.....	87	3	1,200	41,560.22
Seventy Six-Liberty.....	97	5	2,300	79,367.87
Chester.....	112	(1)	775	9,977.20
Sts. Genevieve, Mo.....	119			2,144.19
Sts. Genevieve, Ill.....	122	2	3,255	46,808.39
Fish Bend-Danby Landing.....	139	1	1,205	58,235.63
Calico Island-Cornice Island.....	152	13	4,785	134,487.11
<b>Total.....</b>		<b>24</b>	<b>13,580</b>	<b>376,336.14</b>
<b>New work by United States plant and hired labor:</b>				
Goose Island.....	36	2	845	27,403.25
Graysboro.....	42	2	780	12,142.64
Giboney Island.....	51	1	2,000	18,787.34
Cape Girardeau.....	56	3	920	32,130.72
Devils Island.....	58	3	920	27,474.08
Willard.....	65	2	795	16,576.09
Rockwood.....	103	2	1,075	22,932.31
Crain Island.....	105	4	1,620	38,683.31
Sulphur Springs, Ill.....	155	6	415	23,151.10
Horsetail, East.....	167	2	980	31,561.53
<b>Total.....</b>		<b>27</b>	<b>10,750</b>	<b>250,842.37</b>
<b>Maintenance by United States plant and hired labor.....</b>			<b>9,740</b>	<b>133,760.94</b>

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetments)					Cost
		Number	Linear feet bank protection	Squares (100 square feet)		Toe piles, bank protection, linear feet	
				Mattress	Paving		
<b>New work by contract:</b>							
Greenfield Bend.....	2	1	1,295	1,557	1,125	720	\$58,389.09
Willard.....	66	1	1,800	1,800	847		39,412.62
Wilkinson.....	85-90	2	2,355	2,355	1,292		62,205.22
Fish Bend.....	142	1	2,675	3,338	1,517	1,160	73,103.27
<b>Total.....</b>		<b>5</b>	<b>8,125</b>	<b>9,050</b>	<b>4,781</b>	<b>1,870</b>	<b>233,110.20</b>
<b>New work by United States plant and hired labor:</b>							
Goose Island.....	39	1	425	361	170		6,234.34
Pulltight.....	164	1	880	704	590		18,547.09
<b>Total.....</b>		<b>2</b>	<b>1,305</b>	<b>1,065</b>	<b>760</b>		<b>24,781.43</b>
<b>Maintenance by United States plant and hired labor.....</b>			<b>1,587</b>	<b>700</b>	<b>755</b>	<b>1,980</b>	<b>28,611.27</b>

<sup>1</sup> Reported, 1940 fiscal year.

<sup>2</sup> Crib dikes.

<sup>3</sup> Pile and crib dikes.

<sup>4</sup> Includes cost of screening 16,550 linear feet of dikes with lumber mattress.

*New work.*—Twenty-seven dikes, totaling 10,750 feet in length, were built by hired labor with Government plant, at a cost of \$250,842.37. Two revetments, totaling 1,305 feet in length, consisting of 1,065 squares of mattress and 760 squares of paving, were built by hired labor with Government plant, at a cost of \$24,781.43. A total of 1,374,890 cubic yards of material was handled by United States dredges in preparing 5 localities for new regulating works, at a cost of \$105,652.40; 24 dikes, totaling 13,580 feet in length, were built

under contract, at a cost of \$376,336.14. Five revetments, totaling 8,125 feet in length, consisting of 9,050 squares of mattress and 4,781 squares of paving, were built under contract at a cost of \$233,110.20. In addition to completed work there was under construction by contract 7 dikes to total about 2,220 linear feet, and by hired labor, 2 dikes to total about 1,310 linear feet. The total cost of new work was \$990,722.54 from regular funds.

*Maintenance.*—Dikes and revetments were repaired at a cost of \$162,372.21. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by four United States hydraulic dredges. During the year 64 shoals developed, of which 62 were dredged once and 2 were dredged twice. There were 8,217,354 cubic yards of sand and gravel removed by these dredges from the channels through 64 bars; 124,663 cubic yards of material was removed in outside-the-channel dredging, and 58,036 cubic yards of material was removed in miscellaneous snagging operations by dipper and hydraulic dredges. The channels dredged had a combined length of 21 miles, an average width of 360 feet, and an average gain in depth of 6.2 feet. The total cost of maintenance dredging was \$439,165.65.

Hydrographic surveys were made covering 96 miles of river, costing \$32,856.69. Other miscellaneous costs were: Mooring piles, \$641.40; snagging, \$50,010.35; aids to navigation, \$12,267.32; studies at Chain of Rocks, \$3,608.18; cooperative stream gaging, \$1,420.66; and gages, \$9,487.03; a stream gaging car track, suspended from Thebes Bridge (mile 43.7) was completed by contract at a cost of \$13,221.46; all charged to maintenance. The total cost of all maintenance was \$725,050.95. The costs during the year were \$990,722.54 from regular funds for new work and \$725,050.95 for maintenance, a total of \$1,715,773.49. The expenditures were \$1,568,351.79 from regular funds.

*Condition at end of fiscal year.*—Open river regulating works are about 80 percent completed. The quantities required to complete the project are estimated at 100 dikes, 50,000 linear feet, and 40 revetments, 190,625 linear feet. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by heavy running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage (period of record, 80 years) for 5½ months of the year, latter part of February to middle of August, during which time project channel depths generally prevail without dredging. However, the 10 years ending June 30, 1940, have been years of unusual low water, the mean stage of river for the fiscal year 1940 being 1.97 feet, St. Louis gage. The mean stage of river for the fiscal year 1941 was 4.84 feet.

The following table gives condition of the channel during the fiscal year 1941:

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Section	Length of section	Channel affording								Controlling depth <sup>1</sup>
		9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		
		Length	Period	Length	Period	Length	Period	Length	Period	
Ohio River to Commercial Point.....	Miles 32.7	Miles 26.3	Days 350	Miles 6.4	Days 15	Miles .4	Days 1	Miles 0	Days 0	7
Commercial Point to Commerce.....	6.7	5.0	354	1.7	11	.8	2	0	0	7
Commerce to Grays Point.....	6.6	5.4	359	1.2	6	.4	1	0	0	7
Grays Point to Grand Tower.....	33.7	24.9	336	8.8	29	1.4	4	0	0	6½
Grand Tower to Fort Gage.....	36.3	30.5	342	5.8	23	1.2	3	.4	1	6
Fort Gage to Little Rock.....	9.5	7.4	353	2.1	12	0	0	0	0	8
Little Rock to River des Peres.....	46.5	36.6	339	10.0	26	2.0	5	.4	1	5½
River des Peres to Merchants Bridge.....	11.2	10.0	351	1.2	14	.4	1	0	0	7
Merchants Bridge to northern boundary, city of St. Louis <sup>1</sup> .....	8.0	3.4	341	4.6	24	2.7	10	.8	2	6
Northern boundary to mouth of Missouri River <sup>2</sup> .....	3.8	2.0	351	1.2	14	.4	4	0	0	7

<sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.  
<sup>2</sup> This is known as the Chain of Rocks Reach.

The costs and expenditures under the existing project to June 30, 1941, have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$30,357,913.45	\$23,859,524.68	\$54,217,438.13	\$54,220,991.25
Public Works.....	3,462,154.46		3,462,154.46	3,462,145.32
Emergency Relief.....	996,747.95		996,747.95	996,747.95
<b>Total.....</b>	<b>\$34,816,815.86</b>	<b>23,859,524.68</b>	<b>58,676,340.54</b>	<b>\$58,685,884.52</b>

<sup>1</sup> Includes \$193,380.34 transferred from previous projects costs and expenditures.

*Proposed operations.*—The unexpended balance will be applied as follows:

Accounts payable, June 30, 1941.....	\$30,446.88
<b>New work:</b>	
By contract (completion of existing contract), July 1 to Aug. 14, 1941:	
Piling dikes:	
Seventy Six-Liberty.....	\$55,000
Culico Island-Cornice Island.....	30,000
Bank protection: Willard.....	3,000
By hired labor with United States plant (completion of existing jobs), July 1 to 25, 1941:	
Piling dikes: Horsetail, east.....	25,000
By contract, July 1, 1941, to June 30, 1942:	
Piling dikes:	
Missouri Sister Island-Thompson Towhead-Brooks Point.....	90,600
Price Towhead-Goose Island.....	120,750
Establishment Island - Fishbend - Fort Chartres.....	178,500
Crib dikes: Seventy Six.....	54,000

RIVERS AND HARBORS—ST. LOUIS, MO., DISTRICT. 1103

New work—Continued.

By contract, July 1, 1941, to June 30, 1942—Continued.

Bank protection:

Cairo protection .....	\$30,000
Goose Island .....	75,000
Ste. Genevieve, Ill. ....	30,000

By hired labor with United States plant, July 1, 1941, to June 30, 1942:

Filling dikes:

Greenfield Bend .....	19,500
Cairo protection .....	10,500
Brooks Point .....	16,200
Willard .....	27,000
Neelys Landing .....	24,500
Orain Island .....	28,000
Solid dikes: Cornice Island .....	33,000

Bank protection:

Greenfield Bend .....	18,000
Pulltight .....	12,000

Total for new work .....

\$880,550.00

Maintenance:

By hired labor with United States plant, July 1, 1941, to June 30, 1942:

Dikes and bank protection .....	\$318,000
Project channel dredging .....	609,500
Snagging .....	25,000
Surveys, tests, and studies .....	85,000
Aids to navigation .....	20,000
Contingencies .....	8,900

Total maintenance .....

1,065,000.00

Total for all work .....

1,975,996.88

Unallocated balance .....

570.23

1,976,567.11

The sum of \$2,600,000 can be profitably expended during the fiscal year 1943, as follows:

New work:

By contract, July 1, 1942, to June 30, 1943:

Dikes .....	\$400,000
Bank protection .....	700,000

By hired labor:

Dikes .....	100,000
Bank protection .....	100,000

Total for new work .....

\$1,300,000

Maintenance:

By hired labor with United States plant:

Dikes and bank protection .....	\$580,000
Project channel dredging .....	580,000
Contingencies .....	20,000
Survey and studies .....	120,000

Total maintenance .....

1,300,000

Total for all work .....

2,600,000



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It is expected that, with the proposed expenditures, the project will be about 85 percent completed.

*Cost and financial summary*

Cost of new work to June 30, 1941.....	\$36,233,435.52
Cost of maintenance to June 30, 1941.....	29,202,120.51
<b>Total cost of permanent work to June 30, 1941.....</b>	<b>65,435,565.03</b>
Undistributed costs June 30, 1941.....	40,000.00
<b>Net total cost to June 30, 1941.....</b>	<b>65,475,565.03</b>
Minus accounts payable June 30, 1941.....	30,446.88
<b>Net total expenditures.....</b>	<b>65,445,118.15</b>
Unexpended balance June 30, 1941.....	1,976,567.11
<b>Total amount appropriated to June 30, 1941.....</b>	<b>67,421,685.26</b>

Fiscal year ending June 30	1937	1938	1939	1940	1941
Cost of new work.....	\$1,313,493.57	\$865,004.99	\$1,143,568.24	\$486,655.23	\$900,722.54
Cost of maintenance.....	1,217,414.09	1,227,420.75	1,037,930.09	1,092,307.90	725,050.95
<b>Total cost.....</b>	<b>2,530,907.66</b>	<b>2,092,425.74</b>	<b>2,181,508.33</b>	<b>1,778,963.10</b>	<b>1,715,773.49</b>
Total expended.....	2,530,069.87	2,139,338.29	2,113,011.73	2,071,684.90	1,568,360.93
Allotted.....		3,746,000.00	1,872,707.95	2,009,040.00	1,760,000.00

Balance unexpended July 1, 1940.....	\$1,704,928.04
Amount allotted from War Department Civil Appropriation Act approved May 23, 1941.....	1,750,000.00
<b>Amount to be accounted for.....</b>	<b>3,544,928.04</b>
Gross amount expended.....	\$1,661,197.12
Less reimbursements collected.....	92,776.19
<b>Balance unexpended June 30, 1941.....</b>	<b>1,976,567.11</b>
Outstanding liabilities June 30, 1941.....	\$9,633.75
Amount covered by uncompleted contracts.....	89,099.16
<b>Balance available June 30, 1941.....</b>	<b>98,732.01</b>
<b>Amount (estimated) required to be appropriated for completion of existing project<sup>a</sup>.....</b>	<b>7,300,000.00</b>
<b>Amount that can be profitably expended in fiscal year ending June 30, 1943:</b>	
For new work <sup>b</sup> .....	1,300,000.00
For maintenance.....	1,300,000.00
<b>Total<sup>c</sup>.....</b>	<b>2,600,000.00</b>

<sup>a</sup> Includes \$9,14 Public Works funds for new work in 1936 which was reported fiscal year 1940 as a minus expenditure.  
<sup>b</sup> Increased \$5,280,604.88 from permanent indefinite appropriation and \$82,000 regular funds for removing snags and wrecks (previously reported as a separate project).  
<sup>c</sup> Exclusive of available funds.

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1128.

IMPROVEMENTS

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1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

*Location.*—The Mississippi River rises above Lake Itasca, Minn., and, from that lake, flows in a southerly direction about 2,450 miles, and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,081 to 1,276 miles from the Gulf.

*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

*Existing project.*—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 1,081 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The estimated cost of new work, revised in 1934, is \$43,000,000, with \$1,300,000 for annual maintenance.

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The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
----- June 3, 1898 June 13, 1902 Mar. 2, 1907	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.) Dredging introduced as part of the project.	Annual Report, 1881, p. 1536.
Mar. 3, 1905 Mar. 2, 1907	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 50, 61st Cong., 1st sess. and H. Doc. No. 168, 58th Cong., 2d sess.
Jan. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.
July 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.

<sup>1</sup> Also joint resolution, June 29, 1906.

See House Document No. 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

*Recommended modifications of project.*—Under date of March 15, 1939, the Chief of Engineers recommended modifications of the existing project to approve a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation costs of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction,

maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

*Terminal facilities.*—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for terminal facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys.

*Operations and results during fiscal year.*—River stages were favorable to construction work, which was carried on extensively by contract and hired labor with Government plant during the fall of 1941; river conditions were unfavorable during the spring of 1942 and work was carried on only intermittently. A stage of 34.22 feet was recorded on the St. Louis (Market Street) gage on June 30. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>New work by contract:</b>				
Missouri Sister Island-Thompson Towhead-Brooks Point.....	18	2	1,160	\$39,459.50
Price Towhead-Goose Island.....	34	4	1,685	65,970.48
Seventy Six <sup>1</sup> .....	85	.....	.....	1,896.33
Seventy Six-Liberty.....	100	2	630	21,499.19
St. Genevieve, Mo.....	118	7	2,220	53,570.03
Establishment Island-Fish Bend-Fort Chartres.....	134	6	2,010	86,420.31
Calico Island-Cornice Island <sup>1</sup> .....	149	2	1,095	30,145.61
<b>Total</b> .....	.....	23	8,800	298,861.45
<b>New work by United States plant and hired labor:</b>				
Greenfield Bend.....	1	2	610	16,825.00
Cairo Protection.....	6	1	600	16,470.67
Brooks Point.....	24	1	340	7,994.26
Graysboro.....	42	1	435	11,691.82
Willard.....	63	3	1,035	31,120.12
Wilkinson.....	86	2	225	7,173.54
Craia Island.....	106	2	700	23,199.86
St. Genevieve, Ill.....	123	2	270	9,281.90
Cornice Island.....	153	2	1,010	32,158.12
Horseshall, East.....	167	3	1,310	24,928.07
<b>Total</b> .....	.....	19	6,535	180,843.36
<b>Maintenance by United States plant and hired labor</b> .....	.....	.....	18,735	261,899.98

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetments)					Cost
		Number	Linear feet bank protection	Squares (100 square feet)		Toe piles bank protection linear feet	
				Mattress	Faving		
<b>New work by contract:</b>							
Cairo Protection.....	1	1	.....	.....	.....	.....	
Price Landing-Goose Island.....	31-35	2	1,965	2,462	883	\$1,059.68	
Willard.....	92	1	515	515	184	67,704.02	
St. Genevieve, Ill.....	126	1	.....	.....	.....	9,720.96	
<b>Total</b> .....	.....	5	2,470	2,977	1,067	79,027.66	
<b>Maintenance by United States plant and hired labor</b> .....							
.....	.....	.....	4,193	2,707	7,164	5,310	170,528.15

<sup>1</sup> Pile and crib dikes.

<sup>2</sup> Includes cost of screening 24,960 linear feet of dikes with lumber mattress.

*New work.*—Nineteen dikes, totaling 6,535 feet in length, were built by hired labor with Government plant, at a cost of \$180,848.36; 23 dikes, totaling 8,800 feet in length, were built under contract at a cost of \$298,861.45. Five revetments, totaling 2,470 feet in length, consisting of 2,977 squares of mattress and 1,067 squares of paving were built under contract at a cost of \$79,027.66. In addition to completed work there was under construction by contract, 20 dikes to total about 9,870 linear feet and 2 revetments totaling about 2,000 linear feet, and by hired labor, 3 dikes to total about 885 linear feet. The total cost of new work was \$558,732.47 from regular funds.

*Maintenance.*—Dikes and revetments were repaired at a cost of \$432,428.18. There were 3,094 cubic yards of rock removed at Beaver Dam, mile 38.4, at a cost of \$22,056.03. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by 4 United States hydraulic dredges. During the year 86 shoals developed of which 32 were dredged once and 1 was dredged 4 times. There were 4,252,588 cubic yards of sand and gravel removed by these dredges from the channels through 36 bars; 670,440 cubic yards of material was removed in outside-the-channel dredging. The channels dredged had a combined length of 18 miles, an average width of 315 feet, and an average gain in depth of 4.7 feet. The total cost of maintenance dredging was \$263,233.25.

Hydrographic surveys were made covering 105 miles of river, costing \$77,794.91. Other miscellaneous costs were: Snagging, \$18,766.37; aids to navigation, \$19,576.78; studies at Chain of Rocks, \$1,200.20; cooperative stream gaging, \$8,810.27; and gages, \$5,403.53; flood relief, \$24,811.95; defense lighting at service base, \$17,034.92, and at Cape Girardeau fleet, \$11.59, all charged to maintenance. The total cost of all maintenance was \$891,127.93. The costs during the year were \$558,732.47 from regular funds for new work and \$891,127.93 for maintenance, a total of \$1,449,860.40. The expenditures were \$1,594,454.40 from regular funds.

*Condition at end of fiscal year.*—Open river regulating works are about 82 percent completed. The quantities required to complete the project are estimated at 60 dikes, 45,000 linear feet, and 35 revetments, 147,000 linear feet. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, notwithstanding the unusual low water that has prevailed, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by heavy running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage (period of record, 81 years) for 5½ months of the year, latter part of February to middle of August, during which time project channel depths generally prevail without dredging. The mean stage of river for the fiscal year 1941 was 4.84 feet, St. Louis gage. The mean stage of river for the fiscal year 1942 was 13.60 feet.

RIVERS AND HARBORS—ST. LOUIS, MO., DISTRICT 997

The following table gives condition of the channel during the fiscal year 1942:

Section	Length of section	Channel affording <sup>1</sup>								Controlling depth
		9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		
		Length	Period	Length	Period	Length	Period	Length	Period	
Ohio River to Commercial Point.....	Miles 32.7	Miles 30.8	Days 359	Miles 1.9	Days 6	Miles 0.4	Days 1	Miles 0	Days 0	Feet 7
Commercial Point to Commerce.....	6.7	5.9	362	.8	3	0	0	0	0	8
Commerce to Grays Point.....	6.6	6.6	365	0	0	0	0	0	0	10 1/4
Grays Point to Grand Tower.....	33.7	30.8	348	2.9	17	.4	1	0	0	7
Grand Tower to Fort Gage.....	36.3	36.3	365	0	0	0	0	0	0	9
Fort Gage to Little Rock.....	9.5	9.1	364	.4	1	0	0	0	0	8
Little Rock to River des Peres.....	46.5	44.5	358	2.0	7	0	0	0	0	7 1/4
River des Peres to Merchants Bridge.....	11.2	11.2	365	0	0	0	0	0	0	9
Merchants Bridge to northern boundary city of St. Louis <sup>2</sup> .....	6.0	5.7	359	2.3	6	.4	1	0	0	7
Northern boundary to mouth of Missouri River <sup>2</sup> .....	3.8	3.8	365	0	0	0	0	0	0	9

<sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.

<sup>2</sup> This is known as the Chain of Rocks Reach.

The costs and expenditures under the existing project to June 30, 1942, have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$30,916,645.92	\$24,750,652.61	\$55,667,298.53	\$55,821,445.65
Public works.....	3,462,154.46		3,462,154.46	3,462,154.46
Emergency Relief.....	996,747.95		996,747.95	996,747.95
<b>Total.....</b>	<b>35,375,548.33</b>	<b>24,750,652.61</b>	<b>60,126,200.94</b>	<b>60,280,348.06</b>

<sup>1</sup> Includes \$123,390.34 transferred from previous project costs and expenditures.

**Proposed operations.**—The unexpended balance, including \$200,000 advanced to the plant allotment, will be applied as follows:

Accounts payable June 30, 1942..... \$45,852.88

New work:

By contract (completion of existing contracts),

July 1 to Sept. 30, 1942:

Piling dikes:

Missouri Sister Island-Thompson Towhead-Brooks Point..... \$194,890.00

Price Towhead-Goose Island..... 152,575.00

Establishment Island-Fish Bend-Fort Chartres..... 122,091.00

Crib dikes: Seventy-Six..... 72,620.00

Bank protection:

Cairo protection..... 40,476.00

Price Landing-Goose Island..... 40,958.00

Ste. Genevieve, Ill..... 31,063.00

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New work--Continued.

By hired labor with United States plant (completion of existing job), July 1 to July 25, 1942:	
Piling dikes: Wilkinson-----	\$39,826.00
By contract, July 1, 1942, to June 30, 1943:	
Piling dikes:	
Schenimann-Willard-----	77,280.00
Seventy-Six-Liberty-----	128,060.00
Crib dikes: Danby Landing-----	79,300.00
Bank protection:	
Cape Girardeau-----	148,500.00
Wilkinson-----	157,500.00
By hired labor with United States plant, July 1, 1942, to June 30, 1943:	
Piling dikes:	
Cairo protection-----	40,800.00
Dogtooth Bend-----	16,500.00
Price Landing-----	20,400.00
Goose Island-----	33,600.00
Giboney Island-----	41,000.00
Cornice Island-----	23,040.00
Calico Island-----	7,650.00
Solid dikes: Seventy-Six-----	17,250.00
Bank protection:	
Giboney Island-----	26,000.00
Willard-----	24,000.00
St. Louis Harbor-----	46,800.00
Total for new work-----	\$1,582,179.00

Maintenance:

By hired labor with United States plant, July 1, 1942, to June 30, 1943:	
Dikes and bank protection-----	\$233,250.00
Project channel dredging-----	618,500.00
Snagging-----	7,720.00
Surveys, gages, and studies-----	44,030.00
Aids to navigation-----	42,160.00
Safeguarding structures-----	23,220.00
Cooperative stream gaging-----	19,400.00

Total maintenance----- 988,280.00

Total for all work----- 2,616,311.88

Unallocated balance----- 200.83

2,616,512.71

The sum of \$2,300,000 can be profitably expended during the fiscal year 1944, as follows:

New work:

By contract, July 1, 1943, to June 30, 1944:	
Dikes-----	\$200,000
Bank protection-----	500,000
By hired labor:	
Dikes-----	150,000
Bank protection-----	150,000

Total for new work----- \$1,000,000

Maintenance:

By hired labor with United States plant:	
Dikes and bank protection-----	\$580,000
Project channel dredging-----	580,000
Cooperative stream gaging-----	20,000
Surveys and studies-----	120,000

Total maintenance----- 1,300,000

Total for all work----- 2,300,000

RIVERS AND HARBORS—ST. LOUIS, MO., DISTRICT 999

It is expected that, with the proposed expenditures, the project will be about 86 percent complete.

*Cost and financial summary*

Cost of new work to June 30, 1942.....	\$36,792,167.90
Cost of maintenance to June 30, 1942.....	30,011,257.44
<b>Total cost of permanent work to June 30, 1942.....</b>	<b>66,803,425.43</b>
Undistributed costs June 30, 1942.....	200,000.00
<b>Net total cost to June 30, 1942.....</b>	<b>67,003,425.43</b>
Minus accounts payable June 30, 1942.....	45,852.88
<b>Net total expenditures.....</b>	<b>66,957,572.55</b>
Unexpended balance June 30, 1942.....	2,416,512.71
<b>Total amount appropriated to June 30, 1942.....</b>	<b>69,374,085.26</b>

Fiscal year ending June 30	1938	1939	1940	1941	1942
Cost of new work.....	\$865,604.99	\$1,143,569.24	\$686,655.23	\$990,722.54	\$558,732.47
Cost of maintenance.....	1,227,420.75	1,037,999.09	1,092,307.96	725,050.95	891,127.93
<b>Total cost.....</b>	<b>2,093,025.74</b>	<b>2,181,568.33</b>	<b>1,778,963.19</b>	<b>1,715,773.49</b>	<b>1,449,860.40</b>
Total expended.....	2,138,338.20	2,113,011.73	2,071,684.96	1,668,360.93	1,594,464.40
Allotted.....	3,745,000.00	1,872,707.95	2,009,040.00	1,780,000.00	2,034,400.00

Balance unexpended July 1, 1941.....	\$1,976,567.11
Amount allotted from War Department Civil Ap- propriation Act approved May 23, 1941.....	\$24,400.00
Amount allotted from War Department Civil Ap- propriation Act approved Apr. 28, 1942.....	2,010,000.00
<b>Amount to be accounted for.....</b>	<b>2,034,400.00</b>
Gross amount expended.....	\$1,621,480.31
Less reimbursements collected.....	27,025.91
<b>Balance unexpended June 30, 1942.....</b>	<b>2,416,512.71</b>
Outstanding liabilities June 30, 1942.....	\$24,030.43
Amount covered by uncompleted contracts.....	508,427.88
<b>Balance available June 30, 1942.....</b>	<b>6,050,000.00</b>
Amount (estimated) required to be appropriated for completion of existing project <sup>2</sup> .....	1,884,054.40
<b>Amount that can be profitably expended in fiscal year ending June 30, 1944:</b>	<b>2,300,000.00</b>
For new work <sup>1</sup> .....	1,000,000.00
For maintenance <sup>2</sup> .....	1,300,000.00
<b>Total<sup>2</sup>.....</b>	<b>2,300,000.00</b>

<sup>1</sup> Includes \$5,260,604.83 from permanent indefinite appropriation.  
<sup>2</sup> Exclusive of available funds.

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1018.



IMPROVEMENT OF RIVERS AND HARBORS IN THE ST. LOUIS, MISSOURI, DISTRICT

This district comprises those portions of southwestern Illinois and eastern Missouri embraced in the drainage basin of the Mississippi River and its western tributaries, exclusive of the Missouri River, between the mouth of the Ohio River and mile 300 above the same, and of its eastern tributaries to Hamburg Bay at mile 261 on the left bank, exclusive of the tributary basin of the Illinois Waterway upstream of the new La Grange Lock and Dam at mile 80.15 above the confluence of the Illinois and Mississippi Rivers. The district also includes the drainage basin in Missouri tributary to the Little River Diversion Channel. Report on Mississippi River between the Missouri River and mile 300 is included in the report on Mississippi River between Missouri River and Minneapolis, Minn. Report on that portion of the Illinois River downstream of the new La Grange Lock and Dam is included in report on Illinois Waterway, Ill., contained in the report of the district engineer, Chicago, Ill.

District engineer: Col. Roy W. Grower, Corps of Engineers, to August 4, 1942; Col. Lawrence B. Feagin, Corps of Engineers, since that date.

Division engineer: Col. Malcolm Elliott, Corps of Engineers.

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1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

*Location.*—The Mississippi River rises above Lake Itasca, Minn., and, from that lake, flows in a southerly direction about 2,450 miles and empties into the Gulf of Mexico. The portion included in this

report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,081 to 1,276 miles from the Gulf.

*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report, dated April 18, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

*Existing project.*—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 1,081 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

The estimated cost of new work, revised in 1934, is \$43,000,000, with \$1,300,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1886	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.)	Annual Report, 1881, p. 1536.
June 13, 1902 Mar. 2, 1907	Dredging introduced as part of the project.....	
Mar. 3, 1905 <sup>1</sup> Mar. 2, 1907 <sup>1</sup>	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
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*Recommended modifications of project.*—Under date of March 15, 1939, the Chief of Engineers recommended modifications of the existing project to approve a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

*Terminal facilities.*—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for water terminal and transportation facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys, and as of 1941, in volume 1 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled "Survey of Terminals and Landings on the Inland Waterways of the United States."

*Operations and results during fiscal year.*—River stages were favorable to construction work, which was carried on extensively by contract and hired labor with Government plant during the fall of 1942; river conditions were unfavorable during the spring of 1943 and work was carried on only intermittently. A stage of 38.90 feet was recorded on the St. Louis (Market Street) gage on May 24. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 907

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>New work by contract:</b>				
Missouri Sister Island-Thompson Point	16	7	2,795	\$79,827.42
Price Towhead-Goose Island	32	7	3,205	143,810.14
Schenemann-Willard	62	3	1,230	60,271.76
Seventy Six <sup>1</sup>	85	4	1,600	77,425.74
Seventy Six-Liberty	98	2	3,335	134,152.90
Establishment Island-Fish Bend-Fort Chartres	132	10	2,635	113,673.52
<b>Total</b>		<b>33</b>	<b>14,800</b>	<b>609,161.48</b>
<b>New work by United States plant and hired labor:</b>				
Cairo protection	5	2	1,295	36,502.36
Dogtooth Bend	23	1	315	7,620.72
Price Landing	28	1	210	8,396.16
Graysboro <sup>2</sup>	41	1	445	12,639.16
Giboney Island	49	2	820	30,781.94
Wilkinson	86	4	1,025	36,863.47
Kaskaskia Island	114	1	175	11,248.55
Jalico Island	149	1	170	5,625.38
Cornice Island <sup>3</sup>	150	3	580	14,922.47
<b>Total</b>		<b>16</b>	<b>5,035</b>	<b>164,600.21</b>
Maintenance by United States plant and hired labor			23,365	172,090.44

<sup>1</sup> Pile and crib dikes.

<sup>2</sup> Solid dikes.

<sup>3</sup> Includes 140 linear feet of solid dikes.

<sup>4</sup> Includes cost of screening 14,915 linear feet of dikes with mattress lumber.

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetments)					Cost
		Number	Linear feet bank protection	Squares (100 square feet)		Toe piles bank protection linear feet	
				Mattress	Paving		
<b>New work by contract:</b>							
Cairo protection	1	1	1,000	1,285	324		\$37,277.66
Price Landing-Goose Island	28						2,190.24
Cape Girardeau	49	1	2,055	2,039	478		50,935.96
Wilkinson	91	1	510	510	232		22,037.99
Ste. Genevieve, Ill.	126	1	750	760	444		30,710.79
<b>Total</b>		<b>4</b>	<b>4,315</b>	<b>4,694</b>	<b>1,478</b>		<b>143,162.64</b>
<b>New work by United States plant and hired labor:</b>							
Giboney Island	50	1	475	333	157		18,946.55
Willard	66	1	525	525	200		16,311.77
<b>Total</b>		<b>2</b>	<b>1,000</b>	<b>858</b>	<b>357</b>		<b>35,258.32</b>
Maintenance by United States plant and hired labor			5,142	1,249	2,204	1,415	121,246.80

*New work.*—Sixteen dikes, totaling 5,035 feet in length, were built by hired labor with Government plant, at a cost of \$164,600.21. Two revetments, totaling 1,000 feet in length, consisting of 858 squares of mattress and 357 squares of paving were built by hired labor with Government plant, at a cost of \$35,258.32. A total of 271,349 cubic yards of material was handled by a United States hydraulic dredge in preparing one locality for new regulating works at a cost of \$27,673.61,

and 6.08 acres of land in connection with regulating works was purchased at a cost of \$684. Thirty-three dikes, totaling 14,800 feet in length, were built under contract at a cost of \$609,161.48. Four revetments, totaling 4,315 feet in length, consisting of 4,594 squares of mattress and 1,478 squares of paving, were built under contract at a cost of \$143,152.64. In addition to completed work there was under construction, by contract, one dike to total about 165 linear feet and one revetment totaling about 1,240 linear feet, and by hired labor, one revetment to total about 700 feet. The total cost of new work was \$980,530.26 from regular funds.

*Maintenance.*—Dikes and revetments were repaired at a cost of \$293,337.24. There were 9,074 cubic yards of rock removed at Beaver Dam, mile 38.4, at a cost of \$16,071.66. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by 3 United States hydraulic dredges. During the year 25 shoals developed of which 23 were dredged once, and 1 was dredged twice. There were 2,406,540 cubic yards of sand and gravel removed by these dredges from the channel through 25 bars; 305,597 cubic yards of material were removed in outside-the-channel dredging. The channels dredged had a combined length of 23 miles, an average width of 310 feet, and an average gain in depth of 5.4 feet. The total cost of maintenance dredging was \$240,926.71.

Hydrographic surveys were made covering 110 miles of river, costing \$52,684.01. Other miscellaneous costs were: Snagging, \$8,730.02; aids to navigation, \$25,380.06; cooperative stream gaging, \$18,232.90; and gages, \$9,947.05; and safeguarding structures, \$38,002.27, all charged to maintenance. The total cost of all maintenance was \$698,311.92. The costs during the year were \$980,530.26, from regular funds for new work, and \$698,311.92 for maintenance; however, \$24,811.95 representing the cost of flood relief operations during 1942 fiscal year were transferred in the 1943 fiscal year to the allotment "Emergency repairs and rescue work along the upper Mississippi River, St. Louis District" leaving a net cost for maintenance of \$673,499.97; the total net costs were \$1,654,030.23. The expenditures were \$1,982,642.26 from regular funds.

*Condition at end of fiscal year.*—Open river regulating works are about 84 percent completed. The quantities required to complete the project are estimated at 75 dikes, 60,000 linear feet; and 40 revetments, 120,000 linear feet. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by heavy running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage (period of record, 81 years) for 5½ months of the year, latter part of February to middle of August, during which time project channel depths generally prevail without dredging. The mean stage of river for the fiscal year 1942 was 13.60 feet, St. Louis gage. The mean stage of river for the fiscal year 1943 was 14.90 feet.

RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 909

The following table gives condition of the channel during the fiscal year 1943:

Section	Length of section	Channel affording <sup>1</sup> —								Controlling depth
		9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		
		Length	Period	Length	Period	Length	Period	Length	Period	
Ohio River to Commercial Point.....	Miles 32.7	Miles 32.7	Days 365	Miles 0	Days 0	Miles 0	Days 0	Miles 0	Days 0	9
Commercial Point to Commerce.....	6.7	6.7	365	0	0	0	0	0	0	9
Commerce to Grays Point.....	6.6	6.6	365	0	0	0	0	0	0	9
Grays Point to Grand Tower.....	33.7	33.7	365	0	0	0	0	0	0	9
Grand Tower to Fort Gage.....	36.3	36.3	365	0	0	0	0	0	0	9
Fort Gage to Little Rock.....	9.5	9.5	365	0	0	0	0	0	0	9
Little Rock to River des Peres.....	46.5	46.5	365	0	0	0	0	0	0	9½
River des Peres to Merchants Bridge.....	11.2	11.2	365	0	0	0	0	0	0	9
Merchants Bridge to northern boundary city of St. Louis <sup>2</sup> .....	8.0	8.0	365	0	0	0	0	0	0	12
Northern boundary to mouth of Missouri River <sup>2</sup> .....	3.8	3.8	365	0	0	0	0	0	0	9½

<sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.  
<sup>2</sup> This is known as the "Chain of Rocks Reach."

The costs and expenditures under the existing project to June 30, 1943, have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$31,897,176.18	\$25,424,152.58	\$57,321,328.76	\$57,804,087.91
Public Works.....	3,462,154.46	—	3,462,154.46	3,462,154.46
Emergency Relief.....	996,747.95	—	996,747.95	996,747.95
<b>Total.....</b>	<b>36,356,078.59</b>	<b>25,424,152.58</b>	<b>61,780,231.17</b>	<b>62,262,990.32</b>

*Proposed operations.*—The unexpended balance, including accounts receivable in the amount of \$8,495.58 and \$500,000 advanced to the plant allotment, less revocation of allotment received since June 30, 1943, amounting to \$450,000 will be applied as follows:

Accounts payable, June 30, 1943.....	\$25,736.43
New work:	
By contract (completion of existing contracts), July 1 to August 30, 1943:	
Piling dikes: Seventy Six-Liberty.....	\$9,100.00
Bank protection:	
Cape Girardeau.....	41,000.00
Wilkinson.....	59,600.00
By hired-labor with United States plant (completion of existing job) July 1 to August 30, 1943:	
Bank protection Cape Girardeau.....	37,600.00
By contract, July 1, 1943, to June 30, 1944:	
Piling dikes: Thompson Towhead.....	124,800.00
Bank protection:	
Cape Girardeau-Giboney Island—Willard.....	44,000.00
Wilkinson.....	70,000.00
Ste. Genevieve, Ill.....	100,000.00

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New work—Continued.

By hired labor with United States plant, July 1, 1943, to June 30, 1944:

Piling dikes:	
Cairo protection.....	\$18,000.00
Horsetail, East.....	43,000.00
Schenlmann.....	34,000.00
Bank protection:	
Price Landing.....	22,000.00
Ste. Genevieve, Missouri.....	44,100.00

Total for new work..... \$647,200.00

Maintenance:

By hired labor with United States plant, July 1, 1943, to June 30, 1944:

Dikes and bank protection.....	\$524,000.00
Project channel dredging.....	577,000.00
Snagging.....	78,000.00
Rock removal at Beaver Dam.....	34,000.00
Surveys, gauges, and studies.....	100,000.00
Aids to navigation.....	43,000.00
Cooperative stream gauging.....	13,000.00

Total maintenance..... 1,364,000.00

Total for all work..... 2,036,936.43

Unallocated balance..... 29,429.60

2,066,366.03

The sum of \$2,300,000 can be profitably expended during the fiscal year 1945, as follows:

New work:

By contract, July 1, 1944, to June 30, 1945:

Dikes.....	\$200,000
Bank protection.....	500,000

By hired labor:

Dikes.....	150,000
Bank protection.....	150,000

Total for new work..... \$1,000,000

Maintenance:

By hired labor with United States plant:

Dikes and bank protection.....	580,000
Project channel dredging.....	580,000
Cooperative stream gauging.....	20,000
Surveys and studies.....	120,000

Total maintenance..... 1,300,000

Total for all work..... 2,300,000

It is expected that, with the proposed expenditures, the project will be about 88 percent complete.

*Cost and financial summary*

Cost of new work to June 30, 1943.....	\$37,772,698.25
Cost of maintenance to June 30, 1943.....	30,684,757.41
Total cost of permanent work to June 30, 1943.....	68,457,455.66
Undistributed costs June 30, 1943.....	500,000.00
Net total cost to June 30, 1943.....	68,957,455.66
Plus accounts receivable June 30, 1943.....	8,495.58
Gross total costs to June 30, 1943.....	68,965,951.24

RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 911

Minus accounts payable June 30, 1943.....	\$25,736.48
Net total expenditures.....	1 68,940,214.81
Unexpended balance June 30, 1943.....	2,007,870.45
Total amount appropriated to June 30, 1943.....	70,948,085.26

Fiscal year ending June 30	1939	1940	1941	1942	1943
Cost of new work.....	\$1,143,568.24	\$686,655.23	\$990,722.54	\$558,732.47	\$980,530.26
Cost of maintenance.....	1,037,999.09	1,092,307.96	725,060.85	891,127.93	673,499.97
Total cost.....	2,181,568.33	1,778,963.19	1,715,773.49	1,449,860.40	1,654,030.23
Total expended.....	2,113,011.73	2,071,084.96	1,568,360.93	1,594,464.40	1,982,642.26
Allotted.....	1,872,707.95	2,009,040.00	1,750,000.00	2,034,400.00	1,574,000.00

Balance unexpended July 1, 1942.....	\$2,416,512.71
Amount allotted from War Department Civil Appropriation Act approved June 2, 1943.....	\$1,074,000.00
Amount allotted from First Deficiency Appropriation Act 1941 approved Apr. 1, 1941.....	500,000.00
	1,574,000.00
Amount to be accounted for.....	3,990,512.71
Gross amount expended.....	\$2,185,553.91
Less reimbursements collected.....	202,911.05
	1,982,642.26
Balance unexpended June 30, 1943.....	2,007,870.45
Amount covered by uncompleted contracts.....	166,292.56
Balance available June 30, 1943.....	1,841,577.89
Accounts receivable June 30, 1943.....	8,495.58
Unobligated balance available June 30, 1943.....	1,850,073.47
Amount (estimated) required to be appropriated for completion of existing project <sup>2</sup> .....	6,000,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1945:	
For new work <sup>1</sup> .....	1,000,000.00
For maintenance <sup>2</sup> .....	1,300,000.00
Total <sup>1</sup> .....	2,300,000.00

<sup>1</sup> Includes \$5,260,604.83 from permanent indefinite appropriation covering snagging operations, of which \$280,572.72 pertained to Vicksburg and Memphis districts.

<sup>2</sup> Exclusive of available funds.

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 934.

3. ILLINOIS WATERWAY, ILLINOIS (ST. LOUIS DISTRICT)

See report, "Illinois Waterway, Illinois," page 1381.

4. EXAMINATIONS, SURVEYS, AND CONTINGENCIES (GENERAL)

The cost of the work during the year was \$37,442.14 and the expenditures were \$34,712.40. The balance unexpended, \$24,548.54, plus \$5,000



and Dam is included in report on Illinois Waterway, Ill., contained in the report of the district engineer, Chicago, Ill.

District engineer: Col. Lawrence B. Feagin, Corps of Engineers.

Division engineer: Col. Malcolm Elliott, Corps of Engineers.

IMPROVEMENTS

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3. Illinois Waterway, Ill. (St. Louis district).....	1371	14. East St. Louis and vicinity, Illinois.....	928
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1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

*Location.*—The Mississippi River rises above Lake Itasca, Minn., and, from that lake, flows in a southerly direction about 2,450 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,081 to 1,276 miles from the Gulf.

*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report, dated April 18, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

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RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 911

from the mouth of the Ohio River (about 1,081 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; all to be obtained by regulating works and dredging: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency. Second, by dredging or other temporary expedients to maintain channels of project dimensions.

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*Recommended modifications of project.*—Under date of March 15, 1939, the Chief of Engineers recommended modifications of the existing project to approve a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation

cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

*Terminal facilities.*—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211-1239. Additional data for water terminal and transportation facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys, and as of 1941, in volume 1 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled "Survey of Terminals and Landings on the Inland Waterways of the United States."

*Operations and results during fiscal year.*—Extensive construction work was carried on throughout the first half of the fiscal year, but during the last half of the year, practically no construction work was done because of high river stages. A stage of 39.1 feet (9.1 feet above flood stage) was recorded on the St. Louis (Market Street) gage on April 30. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>New work by contract:</b>				
Missouri Sister Island-Thompson Towhead-Brooks Point.....	18			\$33,387.32
Cairo Protection-Thompson Towhead-Schenlmann.....	5-58	5	1,810	88,414.47
Seventy Six-Liberty.....	99	1	165	15,863.99
Total.....		6	1,975	137,665.78
<b>Maintenance by United States plant and hired labor.....</b>			8,970	235,040.04

<sup>1</sup> Includes cost of screening 9,920 linear feet of dikes with mattress lumber.

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetment)				Cost	
		Number	Linear feet bank protection	Squares (100 square feet)			Toe piles bank protection linear feet
				Mattress	Paving		
<b>New work by contract:</b>							
Cape Girardeau	49.5	1			178	\$20,195.75	
Cape Girardeau-Giboney Island-Willard	48-67	2	810	807	295	38,259.80	
Wilkinson	90.5	1	2,000	1,800	667	76,062.15	
Do	91.5	1	1,260	1,260	254	51,442.73	
Stc. Genevieve, Ill.	125	2	2,035	2,035	1,085	93,613.99	
<b>Total</b>		<b>7</b>	<b>6,105</b>	<b>5,902</b>	<b>2,479</b>	<b>279,574.42</b>	
<b>New work by United States plant and hired labor:</b>							
Cape Girardeau	49.5	1	860	861	453	35,550.28	
Stc. Genevieve, Mo.	123.5	1	1,700	1,020		35,233.11	
<b>Total</b>		<b>2</b>	<b>2,560</b>	<b>1,881</b>	<b>453</b>	<b>70,783.39</b>	
<b>Maintenance by United States plant and hired labor:</b>							
			3,456	1,164	4,530	9,955	
						243,701.11	

*New work.*—Two revetments, totaling 2,560 feet in length, consisting of 1,881 squares of mattress and 453 squares of paving were built by hired labor with Government plant, at a cost of \$70,783.39. A total of 66,969 cubic yards of material was handled by a United States hydraulic dredge in preparing one locality for new regulating works at a cost of \$10,904.99, and an additional cost of \$230.06 was incurred in connection with the purchase of land for regulating works. Six dikes, totaling 1,975 feet in length, were built under contract at a cost of \$137,665.78. Seven revetments, totaling 6,105 feet in length, consisting of 5,902 squares of mattress and 2,479 squares of paving, were built under contract at a cost of \$279,574.42. In addition to completed work there was under construction, by contract, two dikes to total about 2,380 linear feet. The total cost of new work was \$499,208.64, from regular funds.

*Maintenance.*—Dikes and revetments were repaired at a cost of \$478,741.15. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by four United States hydraulic dredges. During the year 73 shoals developed, of which 71 were dredged once, and 2 were dredged twice. There were 6,810,051 cubic yards of sand and gravel removed by these dredges from the channel through 73 bars; 32,639 cubic yards of material were removed in outside-the-channel dredging at a cost of \$4,496.62. The channels had a combined length of 26 miles, an average width of 345 feet, and an average gain in depth of 5.4 feet. The total cost of maintenance dredging was \$531,092.86.

Hydrographic surveys were made covering approximately 200 miles of river, costing \$68,372.26. Other miscellaneous costs were: Snagging, \$1,598.03; aids to navigation, \$47,258.23; cooperative stream gaging, \$7,010.97; gages, \$21,684.56; safeguarding structures, \$51,894.91; and removing grounded vessels, \$4,815.39, all charged to maintenance. The total cost of all maintenance was \$1,212,468.36. The expenditures were \$1,215,608.81 from regular funds.

*Condition at end of fiscal year.*—Open river regulating works are about 86 percent completed. The quantities required to complete the project are estimated at 70 dikes, 58,000 linear feet; and 30 revetments, 110,000 linear feet. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging. The mean stage of the river for the fiscal year 1943 was 14.90 feet, St. Louis gage. The mean stage of the river for the fiscal year 1944 was 12.13 feet.

The following table gives condition of the channel during the fiscal year 1944:

Section	Length of section	Channel affording 1—								Controlling depth
		9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		
		Length	Period	Length	Period	Length	Period	Length	Period	
Ohio River to Commercial Point.....	Miles 32.7	Miles 31.0	Days 363	Miles 0.8	Days 2	Miles 0	Days 0	Miles 0	Days 0	Feet 8
Commercial Point to Commerce.....	6.7	5.5	363	1.2	2	0	0	0	0	8
Commerce to Grays Point.....	6.6	5.7	363	.9	2	0	0	0	0	8
Grays Point to Grand Tower.....	33.7	32.9	362	.8	3	0	0	0	0	8
Grand Tower to Fort Gage.....	36.3	35.9	364	.4	1	0	0	0	0	8½
Fort Gage to Little Rock.....	9.5	9.5	365	0	0	0	0	0	0	9
Little Rock to River des Peres.....	46.5	45.3	364	1.2	1	0	0	0	0	8
River des Peres to Merchants Bridge.....	11.2	11.2	365	0	0	0	0	0	0	11
Merchants Bridge to northern boundary city of St. Louis <sup>1</sup> .....	8.0	8.0	365	0	0	0	0	0	0	9
Northern boundary to mouth of Missouri River <sup>2</sup> .....	3.8	3.8	365	0	0	0	0	0	0	9

<sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.  
<sup>2</sup> This is known as the "Chain of Rocks Reach."

The costs and expenditures under the existing project to June 30, 1944, have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$32,396,384.82	\$26,636,620.94	\$59,033,005.76	\$59,019,696.72
Public Works.....	3,462,154.46		3,462,154.46	3,462,154.46
Emergency Relief.....	996,747.95		996,747.95	996,747.95
Total.....	36,855,287.23	26,636,620.94	63,491,908.17	63,478,599.13

RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 915

*Proposed operations.*—The unexpended balance at the end of the fiscal year plus \$2,000,000 allotted since June 30, 1944, will be applied as follows:

Accounts payable, June 30, 1944.....		\$13,309.04
New work:		
By contract (completion of existing contract), July 1 to Aug. 25, 1944:		
Piling dikes: Cairo protection-Thompson Towhead-Schenimann.....	\$86,000.00	
By contract, July 1, 1944, to June 30, 1945:		
Piling dikes:		
Hurricane Field-Thompson Towhead.....	104,000.00	
Kaskaskia Island-Ste Genevieve, Ill.....	155,000.00	
Fish Bend-Pulltight.....	345,000.00	
Bank protection:		
Price Landing-Goose Island.....	100,000.00	
Seventy Six.....	100,000.00	
By hired labor with United States plant, July 1, 1944, to June 30, 1945:		
Piling dikes:		
Devils Island.....	54,000.00	
Chesley Island.....	26,000.00	
Solid dikes:		
Boston Bar.....	33,000.00	
Goose Island.....	50,000.00	
Bank protection:		
Giboney Island.....	33,000.00	
Total for new work.....		1,086,000.00
Maintenance:		
By hired labor with United States plant, July 1, 1944, to June 30, 1945:		
Dikes and bank protection.....	\$404,000.00	
Project channel dredging.....	567,000.00	
Snagging.....	73,000.00	
Rock removal at Beaver Dam.....	34,000.00	
Surveys, gages, and studies.....	99,000.00	
Aids to navigation.....	50,000.00	
Cooperative stream gaging.....	15,000.00	
Total maintenance.....		1,242,000.00
Unallocated balance.....		952.60
Total for all work.....		2,342,261.64
The sum of \$2,000,000 can be profitably expended during the fiscal year 1946, as follows:		
New work:		
By contract, July 1, 1945, to June 30, 1946:		
Dikes.....	\$280,000	
Bank protection.....	470,000	
By hired labor:		
Dikes.....	100,000	
Bank protection.....	150,000	
Total for new work.....		\$1,000,000
By hired labor with United States plant:		
Dikes and bank protection.....	\$265,000	
Project channel dredging.....	550,000	
Snagging.....	30,000	
Surveys, gages, and studies.....	90,000	
Aids to navigation.....	50,000	
Cooprative stream gaging.....	15,000	
Total maintenance.....		1,000,000
Total for all work.....		2,000,000

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It is expected that, with the proposed expenditures, the project will be about 91 percent complete.

*Cost and financial summary*

Cost of new work to June 30, 1944.....	\$38,271,906.89
Cost of maintenance to June 30, 1944.....	<sup>1</sup> 31,897,225.77
Total cost of permanent work to June 30, 1944.....	70,169,132.66
Minus accounts payable June 30, 1944.....	13,309.04
Net total expenditures.....	<sup>1</sup> 70,155,823.62
Unexpended balance June 30, 1944.....	342,261.64
Total amount appropriated to June 30, 1944.....	<sup>1</sup> 70,498,085.26

Fiscal year ending June 30	1940	1941	1942	1943	1944
Cost of new work.....	\$896,655.23	\$900,722.54	\$558,732.47	\$980,530.26	\$499,208.04
Cost of maintenance.....	1,092,307.99	726,050.95	891,127.93	673,490.97	1,212,468.36
Total cost.....	1,778,963.19	1,716,773.40	1,449,860.40	1,654,030.23	1,711,677.00
Total expended.....	2,017,684.96	1,568,360.93	1,594,454.40	1,982,642.26	1,215,608.81
Allotted.....	2,009,040.00	1,750,000.00	2,034,400.00	1,674,000.00	-450,000.00

Balance unexpended July 1, 1943.....	\$2,007,870.45
Deductions on account of revocation of allotment.....	450,000.00
Net amount to be accounted for.....	1,557,870.45
Gross amount expended.....	\$1,734,620.41
Less reimbursements collected.....	519,011.60
	1,215,608.81
Balance unexpended June 30, 1944.....	342,261.64
Outstanding liabilities June 30, 1944.....	\$6,127.72
Amount covered by uncompleted contracts.....	121,319.17
	127,446.89
Balance available June 30, 1944.....	214,814.75
Amount allotted since June 30, 1944.....	2,000,000.00
Amount available for fiscal year 1945.....	2,214,814.75
Amount (estimated) required to be appropriated for completion of existing project <sup>2</sup> .....	5,000,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1946:	
For new work <sup>2</sup> .....	1,000,000.00
For maintenance <sup>2</sup> .....	1,000,000.00
Total <sup>2</sup> .....	2,000,000.00

<sup>1</sup> Includes \$5,260,604.83 from permanent indefinite appropriation covering snagging operations of which \$280,572.72 pertained to Vicksburg and Memphis districts.

<sup>2</sup> Exclusive of available funds.

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 939.

### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

*Location.*—The Mississippi River rises in Lake Itasca, Minn., and, from that lake, flows in a southerly direction about 2,450 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 1,081 to 1,276 miles from the Gulf.

*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a Board of Engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

*Existing project.*—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 1,081 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; to be obtained: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency; Second, by dredging or other temporary expedients to maintain channels of project dimensions; Third, by construction of works authorized for the Chain of Rocks reach in the River and Harbor Act of March 2, 1945, which approved a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

The estimated cost of new work, revised in 1945, is \$53,266,000, with \$1,370,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:



Acts	Work authorized	Documents
.....	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.)	Annual Report, 1891, p. 1536.
June 3, 1896	Dredging introduced as part of the project.....	
June 13, 1902		
Mar. 2, 1907		
Mar. 3, 1905 <sup>1</sup>	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
Mar. 2, 1907 <sup>1</sup>		
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 50, 61st Cong., 1st sess., and H. Doc. No. 168, 68th Cong., 2d sess.
Jan. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.
July 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bonds, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.
Mar. 2, 1945	Modified to provide for construction of a lateral canal with lock at Chain of Rocks, at an estimated first cost to the United States of about \$10,200,000, with \$70,000 annually for maintenance and operation.	H. Doc. No. 231, 78th Cong., 1st sess.

<sup>1</sup> Also joint resolution, June 29, 1906.

See House Document No. 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

*Terminal facilities.*—The water terminal and transfer facilities of the district are fully described as of December 31, 1918, in House Document No. 652, Sixty-sixth Congress, second session, pages 1211–1239. Additional data for water terminal and transportation facilities are also contained in Transportation Series No. 2, 1929, Transportation in the Mississippi and Ohio Valleys, and as of 1941, in volume 1 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled "Survey of Terminals and Landings on the Inland Waterways of the United States."

*Operations and results during fiscal year.*—Construction work by contract and hired labor was curtailed due to high river stages. Stages in excess of 32 feet were recorded during March, April, May, and June, and for the third consecutive year a stage in excess of 30 feet (flood stage) was recorded on the St. Louis (Market Street) gage. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's

standard specifications for construction work were used. Location, quantities and costs of open river regulating works follow:

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>New work by contract:</b>				
Cairo Protection-Thompson Towhead-Schenmann.....	17.4-17.8	2	2,380	\$77,119.05
Hurricane Field-Thompson Towhead.....	8.3-17.5	5	555	65,372.03
Kaskaskia Island-St. Genevieve, Ill.....	112.7-124.5	6	1,410	120,563.91
Fish Bend-Pulltight.....	158.9-160.6	6	3,490	208,681.58
Total.....		19	7,835	471,626.57
<b>New work by United States plant and hired labor:</b>				
Devils Island.....	58.0	3	1,140	52,122.10
Chesley Island.....	169.0	3	380	18,005.43
Total.....		6	1,520	70,127.53
<b>Maintenance by United States plant and hired labor:</b>				
			6,400	1202,342.58

<sup>1</sup> Includes cost of screening 2,640 linear feet of dikes with mattress lumber.

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetment)				Cost	
		Number	Linear feet bank protection	Squares (100 square feet)			Too piles bank protection
				Mattress	Paving		
<b>New work by contract:</b>							
Price Landing-Goose Island.....	27.0	1	1,015	1,015	113	\$14,978.16	
Seventy Six.....	94.7	1	1,110	1,110	471	51,009.13	
Total.....			2,155	2,155	584	65,987.28	
<b>New work by United States plant and hired labor: Seventy Six.....</b>							
	95	1	(1)			153.25	
Total.....						153.25	
<b>Maintenance by United States plant and hired labor:</b>							
			7,578	1,303	3,273	3,070	198,423.01

<sup>1</sup> Work consisted of grading only.

*New work.*—Six dikes, totaling 1,520 feet in length, were built by hired labor with Government plant, at a cost of \$70,127.53. Work for one revetment, consisting only of grading 1,200 cubic yards of material by hired labor with Government plant, was accomplished at a cost of \$153.25, and 241,797 cubic yards of material were handled by two United States hydraulic dredges in preparing one locality for new regulating works at a cost of \$35,743.25. Nineteen dikes, totaling 7,835 feet in length, were built under contract at a cost of \$471,626.57. Two revetments, totaling 2,155 feet in length, consisting of 2,155 squares of mattress and 584 squares of paving, were built under contract at a cost of \$65,987.28. In addition to complete work there was under construction, by contract, 1 revetment to total about 1,160 linear feet and 10 dikes, totaling about 5,645 linear feet. The total cost of new work was \$643,637.88, from regular funds.

*Maintenance.*—Dikes and revetments were repaired at a cost of \$400,806.49. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by three United States hydraulic dredges. During the year 46 shoals developed, of which 43 were dredged once, and 2 were dredged twice. There were 4,824,627 cubic yards of sand and gravel removed by these dredges from the channel through 46 bars; 217,173 cubic yards of material were removed in outside-the-channel dredging at a cost of \$30,840.27. The channels had a combined length of 19 miles, an average width of 310 feet, and an average gain in depth of 5.9 feet. The total cost of maintenance dredging was \$440,223.35.

Hydrographic surveys were made covering approximately 105 miles of river, costing \$36,943.85. Other miscellaneous costs were: Snagging, \$15,837.42; aids to navigation, \$21,836.16; gages, \$15,565.61; cooperative stream gaging, \$6,981.87; safeguarding structures, \$39,394.15; and releasing grounded vessels, \$598.64, all charged to maintenance. The total cost of all maintenance was \$978,187.54. The expenditures were \$1,749,137.27 from regular funds.

*Condition at end of fiscal year.*—Work under this project is about 70 percent complete. The quantities required to complete the project are estimated at 45 dikes, 49,000 linear feet; 28 revetments, 108,000 linear feet, and the canal, lock, and levees at Chain of Rocks as recommended in House Document No. 231. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging. The mean stage of the river for the fiscal year 1944 was 12.13 feet, St. Louis gage. The mean stage of the river for the fiscal year 1945 was 13.25 feet.

The following table gives condition of the channel during the fiscal year 1945:

Section	Length of section	Channel affording 1—								Controlling depth
		9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		
		Length	Period	Length	Period	Length	Period	Length	Period	
Ohio River to Commercial Point	Miles	Miles	Days	Miles	Days	Miles	Days	Miles	Days	Feet
Commercial Point to Commerce	32.7	32.7	365	0	0	0	0	0	0	10.0
Commerce to Grays Point	6.7	6.7	365	0	0	0	0	0	0	9.0
Grays Point to Grand Tower	6.6	6.6	365	0	0	0	0	0	0	10.0
Grand Tower to Fort Gage	33.7	33.7	365	0	0	0	0	0	0	9.0
Fort Gage to Little Rock	30.3	30.3	365	0	0	0	0	0	0	9.0
Little Rock to River des Peres	9.5	9.5	365	0	0	0	0	0	0	10.5
River des Peres to Merchants Bridge	46.5	46.5	365	0	0	0	0	0	0	9.0
Merchants Bridge to northern boundary city of St. Louis <sup>2</sup>	11.2	11.2	365	0	0	0	0	0	0	13.5
Northern boundary city of St. Louis to mouth of Missouri River <sup>1</sup>	8.0	7.9	364	0.1	1	0	0	0	0	8.0
	3.8	3.8	365	0	0	0	0	0	0	10.5

<sup>1</sup> Project width is 800 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.  
<sup>2</sup> This is known as the "Chain of Rocks Reach."

The costs and expenditures under the existing project to June 30, 1945, have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular				
Public Works	\$33,040,022.70	\$27,614,808.48	\$60,654,831.18	\$60,768,833.99
Emergency Relief	3,162,154.46		3,162,154.46	3,462,154.46
	996,747.95		996,747.95	996,747.95
Total	37,198,925.11	27,614,808.48	64,813,733.59	65,227,736.40

**Proposed operations.**—The unexpended balance at the end of the fiscal year, plus additional amounts to be made available, will be applied as follows:

Accounts payable, June 30, 1945	\$35,997.19
New work:	
By contract (completion of existing contracts), Aug. 1, 1945, to June 30, 1946:	
Piling dikes:	
Hurricane Field-Thompson Tow-head	\$58,000.00
Kaskaskia Island-Ste. Genevieve, Ill.	84,300.00
Fish Bend-Pulltight	238,000.00
Bank protection:	
Price Landing-Goose Island	85,500.00
By contract, July 1, 1945, to June 30, 1946:	
Piling dikes:	
Schenmann	140,000.00
Fish Bend	117,000.00
Cornice Island	294,000.00
Bank protection:	
Goose Island	73,700.00
Cape Girardeau-Wilkinson	86,000.00
Danby Landing	71,500.00

RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 1225

By hired labor with United States plant,  
July 1, 1945, to June 30, 1946:

Piling dikes:	
Dogtooth Bend -----	50,000.00
Seventy Six -----	30,000.00
Solid dikes:	
Boston Bar -----	33,000.00
Goose Island -----	50,000.00
Bank protection:	
Dogtooth Bend -----	33,000.00
Giboney Island -----	33,000.00
Advance planning, Chain of Rocks (River and Harbor Act approved Mar. 2, 1946 authorized the modification of project, Mis- sissippi River between the Ohio and Mis- souri Rivers as set forth in H. Doc. No. 231, 76th Cong.) -----	365,000.00

Total for new work ----- 1,842,000.00

Maintenance:

By hired labor with United States plant,  
July 1, 1945, to June 30, 1946:

Dikes and bank protection -----	\$437,830.00
Project channel dredging -----	534,000.00
Safeguarding structures -----	49,000.00
Snagging -----	31,000.00
Surveys, gages and studies -----	85,000.00
Aids to navigation -----	48,000.00
Cooperative stream gaging -----	15,000.00

Total maintenance ----- 1,199,830.00  
Unallocated balance ----- 297.18

Total for all work ----- \$3,078,124.37

The sum of \$4,800,000 can be profitably expended during the  
fiscal year 1947, as follows:

New work:

By contract, July 1, 1946, to June 30, 1947:

Chain of Rocks project:	
Construction of bridge -----	\$680,000
Relocation of utilities -----	240,000
Commencement of channel excavation -	970,000
Commencement of lock construction -	100,000
Dikes -----	448,000
Bank protection -----	350,000

By hired labor:

Chain of Rocks project:	
Land acquisition -----	510,000
Dikes -----	90,000
Bank protection -----	112,000

Total for new work ----- \$3,500,000

Maintenance:

By hired labor with United States plant:

Dikes and bank protection -----	\$565,000
Project channel dredging -----	550,000
Snagging -----	30,000
Aids to navigation -----	50,000
Cooperative stream gaging -----	15,000
Surveys, gages and studies -----	90,000

Total maintenance ----- 1,300,000

Total for all work ----- 4,800,000

It is expected that with the proposed expenditures, the project will be about 80 percent complete.

*Cost and financial summary*

Cost of new work to June 30, 1945 -----	\$38,915,544.77
Cost of maintenance to June 30, 1945 -----	<sup>1</sup> 32,875,413.31
<b>Total cost of permanent work to June 30, 1945 -----</b>	<b>71,790,958.08</b>
Undistributed costs June 30, 1945 -----	150,000.00
<b>Net total cost to June 30, 1945 -----</b>	<b>71,940,958.08</b>
Minus accounts payable June 30, 1945 -----	35,997.19
<b>Net total expenditures -----</b>	<b><sup>1</sup> 71,904,960.89</b>
Unexpended balance June 30, 1945 -----	2,393,124.37
<b>Total amount appropriated to June 30, 1945 -----</b>	<b><sup>1</sup> 74,298,085.26</b>

Fiscal year ending June 30	1941	1942	1943	1944	1945
Cost of new work .....	\$980,732.54	\$558,732.47	\$980,530.26	\$409,208.64	\$643,037.88
Cost of maintenance .....	725,070.05	891,127.03	873,499.97	1,212,468.36	978,187.04
<b>Total cost.....</b>	<b>1,715,773.49</b>	<b>1,440,860.40</b>	<b>1,854,030.23</b>	<b>1,711,677.00</b>	<b>1,621,225.42</b>
Total expended.....	1,569,360.93	1,604,464.40	1,982,642.26	1,215,008.81	1,749,137.27
Allotted.....	1,750,000.00	2,034,400.00	1,574,000.00	-450,000.00	3,800,000.00

Balance unexpended July 1, 1944 -----	\$342,261.64
Amount allotted from War Department Civil Appropriation Act approved June 26, 1944 \$2,000,000.00	
Amount allotted from War Department Civil Appropriation Act approved Mar. 31, 1945 1,800,000.00	
	<b>3,800,000.00</b>
Amount to be accounted for -----	4,142,261.64
Gross amount expended -----	1,749,137.27
<b>Balance unexpended June 30, 1945 -----</b>	<b>2,393,124.37</b>
Outstanding liabilities June 30, 1945 -----	\$1,030.03
Amount covered by uncompleted contracts - 381,259.66	
	<b>382,289.69</b>
<b>Balance available June 30, 1945 -----</b>	<b>2,010,834.68</b>
Amount allotted in July 1945 -----	150,000.00
<b>Unobligated balance available for fiscal year 1946 ---</b>	<b>2,160,834.68</b>
Amount (estimated) required to be appropriated for comple- tion of existing project <sup>2</sup> -----	13,925,000.00
<b>Amount that can be profitably expended in fiscal year ending June 30, 1947:</b>	
For new work <sup>2</sup> -----	3,500,000.00
For maintenance <sup>2</sup> -----	1,300,000.00
<b>Total <sup>2</sup> -----</b>	<b>4,800,000.00</b>

<sup>1</sup> Includes \$5,200,604.83 from permanent indefinite appropriation covering snagging operations of which \$280,672.72 pertained to Vicksburg and Memphis districts.

<sup>2</sup> Exclusive of available funds.

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<i>Flood control—Continued</i>		<i>Flood control—Continued</i>	
	Page		Page
22. East St. Louis and vicinity, Illinois.....	1373	27. Emergency protection for Illinois Approach Chain of Rocks Bridge (sec. 12, Flood Control Act approved December 22, 1944).....	1381
23. Wood River drainage and levee district, Illinois.....	1375	28. Preliminary examinations, surveys, and contingencies for flood control.....	1381
24. Upper Mississippi River Basin, St. Louis district..	1377	29. Snagging and clearing under authority of section 2 of the Flood Control Act approved August 28, 1937, as amended.....	1382
25. Emergency flood control work under authority of the Flood Control Act approved August 18, 1941....	1379	30. Other flood control projects for which no estimates are submitted.....	1383
26. Emergency flood control work under authority of Public Laws Nos. 138 and 318, Seventy-eighth Congress and Public Law No. 75, Seventy-ninth Congress....	1380		

1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

*Location.*—The Mississippi River rises in Lake Itasca, Minn., and from that lake flows in a southerly direction about 2,350 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 980 to 1,175 miles from the Gulf.

*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a board of engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

*Existing project.*—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 980 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; to be obtained: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency; second, by dredging or other temporary expedients to maintain channels of project dimensions; third, by construction of works authorized for the Chain of Rocks reach in the River and Harbor Act of March 2, 1945, which approved a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river

RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 1343

channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. No. 231, 76th Cong., 1st sess.).

The estimated cost of new work, revised in 1946, is \$84,207,000, with \$1,370,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
-----	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.)	Annual Report, 1881, p. 1336.
June 3, 1890 June 13, 1902 Mar. 2, 1907 Mar. 3, 1905 Mar. 2, 1907 <sup>1</sup>	Dredging introduced as part of the project.....  These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. No. 50, 61st Cong., 1st sess. and H. Doc. No. 108, 58th Cong., 2d sess.
Jan. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc. No. 9, 69th Cong., 2d sess.
July 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. No. 12, 70th Cong., 1st sess.
Mar. 2, 1945	Modified to provide for construction of a lateral canal with lock at Chain of Rocks, at an estimated first cost to the United States of about \$10,290,000, with \$70,000 annually for maintenance and operation.	H. Doc. No. 231, 76th Cong., 1st sess.

<sup>1</sup> Also joint resolution, June 29, 1906.

See House Document No. 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

*Terminal facilities.*—Most of the water terminal and transfer facilities of the district are described in volumes 1 and 4 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled,



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"Survey of Terminals and Landings on the Inland Waterways of the United States." Data covering additional terminals are:

Locality	Distance above Cairo	Distance above Passes	Bank	Purpose for which used
Sohio Petroleum Dock, Birds Point, Mo.	Miles 1.8	Miles 966.8	R	Transfer of gasoline and oil from barge to bank. Transfer of crude oil from bank to barge. Marine ways for handling heavy towboats.
Allied Oil Terminal Co., Gale, Ill.	46.5	1,010.5	L	
Eddie Erlbacher, Boat Opr., Machine Shop, Cape Girardeau, Mo.	52.5	1,016.5	R	

Operations and results during fiscal year.—Construction works were carried on by contract and hired labor with Government plant throughout the year with river stages suitable for construction 9 months of the year. Regulating works were maintained and project dimensions of channels were secured by dredging. The district's standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>New work by contract:</b>				
Hurricane Field-Thompson Towhead.....	8.3-17.5	3	1,555	\$55,095.40
Schoufmann.....	60.4	8	3,345	168,045.92
Kaskaskia Island-St. Genevieve, Ill.....	112.7-123.0	2	1,685	75,033.01
Fish Bend.....	130.8	1	1,640	74,355.72
Fish Bend-Pulltight.....	150.0	8	4,015	199,682.39
Cornico Island.....	149.7	8	5,685	290,462.33
Danby Landing.....	143.7			447.90
<b>Total.....</b>		<b>30</b>	<b>17,905</b>	<b>863,122.67</b>
<b>New work by United States plant and hired labor:</b>				
Dogtooth Bend.....	23.4	2	.635	44,011.39
Pulltight.....	164.7	1	100	4,235.20
<b>Total.....</b>		<b>3</b>	<b>735</b>	<b>48,246.59</b>
<b>Maintenance by United States plant and hired labor.....</b>				
			10,220	1 299,711.53

1 Includes cost of screening 7,225 linear feet of dikes with mattress lumber.

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetment)				Cost	
		Number	Linear feet bank protection	Squares (100 square feet)			Toe piles bank protection
				Mattress	Paving		
<b>New work by contract:</b>							
Price Landing-Goose Island.....	27.9				569	\$60,597.47	
Cape Girardeau-Wilkinson.....	48-91	2	2,110	2,066	698	114,409.91	
Danby Landing.....	138	1	1,115	1,115	538	64,364.32	
<b>Total.....</b>		<b>3</b>	<b>3,225</b>	<b>3,181</b>	<b>1,805</b>	<b>239,371.70</b>	
<b>Maintenance by United States plant and hired labor.....</b>							
			11,760	424	3,905	1 190,697.41	

1 Includes cost of building 1,350 linear feet of abatis dike.

*New work.*—Three dikes, totaling 735 feet in length, were built by hired labor with Government plant, at a cost of \$48,246.59. A total of 381,751 cubic yards of material was handled by a United States hydraulic dredge in preparing three localities for new regulating works at a cost of \$41,267.37. Thirty dikes, totaling 17,905 feet in length, were built under contract at a cost of \$863,122.67. Three revetments, totaling 3,225 feet in length, consisting of 3,181 squares of mattress and 1,805 squares of paving, were built under contract at a cost of \$239,371.70. In addition to complete work there was under construction, by contract, six dikes to total about 2,400 linear feet. The costs incurred on the improvement at Chain of Rocks were as follows: Design of bridge by contract, \$22,037.80, and by hired labor, advance planning, \$283,531.35; engineering designs and studies, \$40,060.51; abstracts of title to land, \$509.91; and administrative expense, \$8,828.45. The total cost of new work was \$1,546,976.35, from regular funds.

*Maintenance.*—Dikes and revetments were repaired at a cost of \$490,408.94. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by three United States hydraulic dredges. During the year 27 shoals developed, of which 22 were dredged once, 1 was dredged twice, and 2 were dredged 3 times. There were 3,210,617 cubic yards of sand and gravel removed by these dredges from the channel through 27 bars; 33,531 cubic yards of material were removed in outside-the-channel dredging at a cost of \$18,005.33. The channels dredged had a combined length of 16.3 miles, an average width of 280 feet, and an average gain in depth of 6.8 feet. The total cost of maintenance dredging was \$296,818.20.

Hydrographic surveys were made covering approximately 110 miles of river, costing \$37,276.45. Aids to navigation were installed at a cost of \$44,421.68. Other miscellaneous costs were: Snagging, \$138.51; cooperative stream gaging, \$7,385.14; discharge observations at miscellaneous localities, \$1,604.41; stream flow forecasting, \$3,575.65; rock removal, \$1,518.61; gages, \$11,372.84; establishment of third order triangulation points, \$743.09; releasing grounded vessels, \$1,446.78; and safeguarding structures, \$7,148.63, all charged to maintenance. The total cost of all maintenance was \$903,858.93. The expenditures were \$2,553,928.39 from regular funds.

*Condition at end of fiscal year.*—Work under this project (including recently authorized Chain of Rocks improvement) is about 46 percent complete. The quantities required to complete the project are estimated at 180 dikes, 164,000 linear feet, 85 revetments, 86,000 linear feet, and the canal, lock, levees, etc., at Chain of Rocks as recommended in House Document No. 231. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued

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throughout the winter, except when the river is actually blocked by running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging. The mean stage of the river for the fiscal year 1945 was 13.25 feet, St. Louis gage. The mean stage of the river for the fiscal year 1946 was 10.42 feet.

The following table gives condition of the channel during the fiscal year 1946:

Section	Length of section	Channel affording— <sup>1</sup>								Controlling dept
		9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		
		Length	Period	Length	Period	Length	Period	Length	Period	
	Miles	Miles	Days	Miles	Days	Miles	Days	Miles	Days	Feet
Ohio River to Commercial Point.....	32.7	32.7	365	0	0	0	0	0	0	12.0
Commercial Point to Commerce.....	6.7	6.7	365	0	0	0	0	0	0	10.5
Commerce to Grays Point.....	6.8	6.8	365	0	0	0	0	0	0	12.0
Grays Point to Grand Tower.....	33.7	33.7	365	0	0	0	0	0	0	9.0
Grand Tower to Fort Gage.....	36.3	36.3	365	0	0	0	0	0	0	9.0
Fort Gage to Little Rock.....	9.5	9.5	365	0	0	0	0	0	0	10.0
Little Rock to River des Peres.....	40.5	40.5	365	0	0	0	0	0	0	9.0
River des Peres to Merchants Bridge.....	11.2	11.2	364	0.1	1	0	0	0	0	8.0
Merchants Bridge to northern boundary city of St. Louis <sup>2</sup> .....	8.0	7.9	362	0.1	3	0	0	0	0	8.6
Northern boundary city of St. Louis to mouth of Missouri River <sup>2</sup> .....	3.8	3.8	365	0	0	0	0	0	0	11.0

<sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.

<sup>2</sup> This is known as the Chain of Rocks Reach.

The costs and expenditures under the existing project to June 30, 1946, have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$34,580,999.05	\$28,518,667.41	\$63,105,000.46	\$63,322,762.38
Public Works.....	3,462,154.46		3,462,154.46	3,462,154.46
Emergency Relief.....	996,747.95		996,747.95	996,747.95
Total.....	39,045,901.46	28,518,667.41	67,564,568.87	67,781,664.79

*Proposed operations.*—The unexpended balance at end of fiscal year, plus \$764,000 allotted in July 1946, plus \$300,000 advanced to plant allotment will be applied as follows:

RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 1347

Accounts payable, June 30, 1946-----		\$82, 904. 08
New work:		
By contract (completion of existing contracts), July 1 to Nov. 1, 1946:		
Piling dikes:		
Schenimann-----	\$44, 000. 00	
Danby Landing-----	196, 000. 00	
Cornice Island-----	46, 500. 00	
Bank protection:		
Cape Girardeau-Wilkinson-----	13, 300. 00	
By contract, July 1, 1946, to June 30, 1947:		
Piling dikes:		
Dogtooth Bend-----	99, 000. 00	
Chester-----	114, 000. 00	
Ste Genevieve, Mo-----	165, 000. 00	
Bank protection:		
Cape Girardeau-Wilkinson-Danby Landing-----	115, 000. 00	
Bridge over canal for Chain of Rocks: Bridge Highway (U. S. No: 66) con- tinuing contract, July 1, 1946, to June 30, 1947-----	1, 200, 000. 00	
Lock at Chain of Rocks, continuing con- tract, July 1, 1946, to June 30, 1947--	1, 264, 000. 00	
Changing 10-inch gas pipe line of Missis- sippi River Fuel Corp., Aug. 15, 1946, to May 15, 1947-----	165, 000. 00	
Changing one 10-inch and one 16-inch oil pipe line of Shell Petroleum Corp., Aug. 1, 1946, to May 1, 1947-----	220, 000. 00	
By hired labor with United States plant, July 1, 1946, to June 30, 1947:		
Piling dikes:		
Pulltight-----	42, 300. 00	
Bank protection:		
Liberty Bend-----	35, 000. 00	
Dredging with United States dredge in connection with new bank protection by contract and hired labor-----	58, 500. 00	
Partial land acquisition, Chain of Rocks improvement, July 1, 1946, to June 30, 1947-----	300, 000. 00	
Partial dredging downstream approach to lock, Chain of Rocks improvement, Sept. 1 to Dec. 31, 1946-----	288, 000. 00	
Design and studies, Chain of Rocks im- provement, July 1, 1946, to June 30, 1947-----	120, 000. 00	
Total for new work-----		4, 485, 600. 00
Maintenance:		
By hired labor with United States plant, July 1, 1946, to June 30, 1947:		
Dikes and bank protection-----	\$300, 000. 00	
Project channel dredging-----	400, 000. 00	
Surveys, gages, and studies-----	47, 000. 00	
Aids to navigation-----	34, 000. 00	
Establishment of third order triangula- tion points-----	22, 000. 00	
Snagging-----	17, 300. 00	
Cooperative stream gaging-----	14, 000. 00	
Discharge observations-----	5, 091. 90	
Stream flow forecasting-----	2, 300. 00	
Total maintenance-----		841, 691. 90
Total for all work-----		5, 410, 195. 98

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The sum of \$16,673,000 can be profitably expended during the fiscal year 1948, as follows:

New work:

By contract, July 1, 1947, to June 30, 1948:

Chain of Rocks improvement:	
Construction of bridge.....	\$600,000
Relocation of utilities.....	759,000
Construction of lock.....	6,000,000
Construction of canal.....	4,500,000
Bank protection.....	914,000

By hired labor with United States plant:

Chain of Rocks improvement:	
Land acquisition.....	600,000
Dredging.....	300,000

By contract:

Dikes.....	850,000
Bank protection.....	475,000

By hired labor with United States plant:

Dikes.....	250,000
Bank protection.....	125,000

Total for new work..... \$15,373,000

Maintenance:

By hired labor with United States plant:

Dikes and bank protection.....	\$610,000
Project channel dredging.....	455,000
Surveys, gages, and studies.....	85,000
Establishment of third order triangulation points.....	55,000
Aids to navigation.....	35,000
Snagging.....	30,000
Cooperative stream gaging.....	18,000
Discharge observations.....	7,000
Stream flow forecasting.....	5,000

Total maintenance..... 1,300,000

Total for all work..... 16,673,000

It is expected that with the proposed expenditures, the project (including Chain of Rocks improvement) will be about 70 percent complete.

Cost and financial summary

Cost of new work to June 30, 1946.....	\$40,462,521.12
Cost of maintenance to June 30, 1946.....	1,333,779,272.24
Total cost of permanent work to June 30, 1946.....	74,241,793.36
Undistributed costs June 30, 1946.....	300,000.00
Net total cost to June 30, 1946.....	74,541,793.36
Minus accounts payable June 30, 1946.....	82,904.08
Net total expenditures.....	1,74,458,889.28
Unexpended balance June 30, 1946.....	4,346,195.98
Total amount appropriated to June 30, 1946.....	1,78,805,085.26

Fiscal year ending June 30	1942	1943	1944	1945	1946
Cost of new work.....	\$558,732.47	\$980,530.26	\$499,208.64	\$643,637.88	\$1,546,976.35
Cost of maintenance.....	891,127.93	673,499.97	1,212,468.36	978,187.64	903,858.93
Total cost.....	1,449,860.40	1,654,030.23	1,711,677.00	1,621,825.42	2,450,835.28
Total expended.....	1,594,454.40	1,982,642.26	1,216,608.81	1,749,137.27	2,553,928.39
Allotted.....	2,034,400.00	1,574,000.00	-450,000.00	3,800,000.00	4,507,000.00

<sup>1</sup> Includes \$5,260,604.83 from permanent indefinite appropriation covering snagging operations, of which \$280,572.72 pertained to Vicksburg and Memphis districts.

RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 1349

Balance unexpended July 1, 1945.....		\$2, 393, 124. 37
Amount allotted during fiscal year.....		4, 515, 000. 00
Amount to be accounted for.....		6, 908, 124. 37
Deductions on account of revocation of allotment.....		8, 000. 00
Net amount to be accounted for.....		6, 900, 124. 37
Gross amount expended.....		2, 553, 928. 39
Balance unexpended June 30, 1946.....		4, 346, 195. 98
Outstanding liabilities, June 30, 1946.....	\$173, 830. 36	
Amount covered by uncompleted contracts.....	304, 503. 66	
		478, 334. 02
Balance available June 30, 1946.....		3, 867, 861. 96
Amount allotted in July 1946.....		764, 000. 00
Unobligated balance available for fiscal year 1947.....		4, 631, 861. 96
Amount (estimated) required to be appropriated for completion of existing project <sup>1</sup> .....		40, 675, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1948:		
For new work <sup>1</sup> .....		15, 373, 000. 00
For maintenance <sup>2</sup> .....		1, 300, 000. 00
Total <sup>3</sup> .....		16, 673, 000. 00

<sup>1</sup> Exclusive of available funds.

2. MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1385.

3. ILLINOIS WATERWAY, ILL. (ST. LOUIS DISTRICT)

See report, "Illinois Waterway, Ill.," page 1972.

4. EXAMINATIONS, SURVEYS, AND CONTINGENCIES (GENERAL)

The cost of work during the year was \$79,093.66, and the expenditures were \$71,396.27. The balance unexpended at the end of the fiscal year, including accounts receivable, will be applied as needed during the fiscal year 1947 to payment of expenses to be incurred under this heading. The additional sum of \$97,000 can be profitably expended during the fiscal year ending June 30, 1948.

*Cost and financial summary*

Cost of new work to June 30, 1946.....		
Cost of maintenance to June 30, 1946.....		\$814, 039. 69
Total cost of permanent work to June 30, 1946.....		814, 039. 69
Plus accounts receivable June 30, 1946.....		1, 387. 68
Gross total costs to June 30, 1946.....		815, 427. 37

<i>Flood control—Continued</i>		<i>Flood control—Continued</i>	
	Page		Page
20. Harrisonville and Ivy Land- ing drainage and levee district No. 2, Illinois	1373	28. Emergency flood-control work under authority of Public Laws Nos. 138 and 318, Seventy-eighth Congress, and Public Law No. 75, Seventy-ninth Congress, and Public Law No. 102, Eightieth Congress	1386
21. Columbia drainage and levee district No. 3, Illinois	1375	29. Preliminary examinations, sur- veys, and contingencies for flood control	1388
22. Wilson and Wenkel and Prairie du Pont drainage and levee districts, Illinois	1377	30. Snagging and clearing under authority of section 2 of the Flood Control Act approved August 28, 1937, as amended	1388
23. East St. Louis and vicinity, Illinois	1379	31. Other flood-control projects for which no estimates are submitted	1390
24. Chouteau, Nameoki, and Ven- ice drainage and levee district, Illinois	1381		
25. Wood River drainage and levee district, Illinois	1381		
26. Upper Mississippi River Bas- in, St. Louis district	1383		
27. Emergency flood-control work under authority of the Flood Control Act ap- proved August 18, 1941	1385		

### 1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

*Location.*—The Mississippi River rises in Lake Itasca, Minn., and from that lake flows in a southerly direction about 2,350 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 984 to 1,179 miles from the Gulf.

*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a board of engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

*Existing project.*—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 980 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence Missouri River, 4 miles; to be obtained: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency; second, by dredging or other temporary expedients to maintain channels of project dimensions; third, by construction of works authorized for the Chain of Rocks reach in the River and Harbor Act of March 2, 1945, which approved a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is under-

RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 1345

taken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. 231, 76th Cong., 1st sess.).

The estimated cost of new work, revised in 1947, is \$93,521,000, with \$1,370,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
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June 13, 1902	Dredging introduced as part of the project.....	
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Mar. 3, 1905	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	H. Doc. 50, 61st Cong., 1st sess., and H. Doc. 168, 58th Cong., 2d sess.
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June 25, 1910		
Jan. 21, 1927	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	
July 3, 1930	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc. 9, 69th Cong., 2d sess.
Mar. 2, 1945	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. 12, 70th Cong., 1st sess.
	Modified to provide for construction of a lateral canal with lock at Chain of Rocks, at an estimated first cost to the United States of about \$10,200,000, with \$70,000 annually for maintenance and operation.	H. Doc. 231, 76th Cong., 1st sess.

<sup>1</sup> Also joint resolution, June 29, 1906.

See House Document 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

*Terminal facilities.*—Most of the water terminal and transfer facilities of the district are described in volumes 1 and 4 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled "Survey of Terminals and Landings on the Inland Waterways of the United States."

*Operations and results during fiscal year.*—River stages were favorable to construction work by contract and hired labor with Government plant during the fall of 1946. However, due to high river stages



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between April and June 1947 work was carried on only intermittently. Regulating works were maintained and project dimensions of channels were secured by dredging. The districts standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>New work by contract:</b>				
Dogtooth Bend.....	26			\$162.31
Schenilmann.....	59-61			41,564.49
Chester-St. Genevieve, Mo.....	119-124	4	1,575	176,171.66
Danby Landing.....	143-146	6	2,690	223,993.17
Cornice Island.....	150	1	60	40,876.90
<b>Total.....</b>		<b>11</b>	<b>4,325</b>	<b>482,767.53</b>
<b>New work by United States plant and hired labor: Pulltight.....</b>	<b>164-165</b>	<b>2</b>	<b>550</b>	<b>32,808.80</b>
<b>Maintenance by United States plant and hired labor.....</b>			<b>6,305</b>	<b>171,539.06</b>

<sup>1</sup> Includes cost of screening 3,325 linear feet of dikes with mattress lumber.

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetment)				Cost	
		Number	Linear feet bank protection	Squares (100 square feet)			Toe piles bank protection
				Mattress	Paving		
<b>New work by contract: Cape Girardeau-Wilkinson.....</b>	<b>90.5</b>	<b>1</b>			<b>56</b>	<b>\$14,663.71</b>	
<b>New work by United States plant and hired labor:</b>							
Liberty Bend.....	99.5	1	595	541	391	31,148.69	
Danby Landing.....	138.5	1	720	715	292	31,856.04	
<b>Total.....</b>		<b>2</b>	<b>1,315</b>	<b>1,256</b>	<b>683</b>	<b>63,004.73</b>	
<b>Maintenance by United States plant and hired labor.....</b>			<b>13,404</b>	<b>1,228</b>	<b>3,985</b>	<b>4,920</b>	
						<b>195,978.00</b>	

New work: Two dikes, totaling 550 feet in length, were built by hired labor with Government plant, at a cost of \$32,808.80. Two revetments, totaling 1,315 feet in length, consisting of 1,256 squares of mattress and 683 squares of paving were built by hired labor with Government plant, at a cost of \$63,004.73. A total of 354,231 cubic yards of material was handled by a United States hydraulic dredge in preparing two localities for new regulating works at a cost of \$43,503. Eleven dikes, totaling 4,325 feet in length, were built under contract at a cost of \$482,767.53. One revetment, consisting of 56 squares of paving was completed under contract at a cost of \$14,663.71. In addition to complete work there was under construction

RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 1347

by contract, 12 dikes to total about 9,340 linear feet. Costs of \$1,389,330.40 were incurred on the improvement at Chain of Rocks as follows: By contract, relocation of utilities, \$70,995.02 and construction of bridge over canal, \$251,338.91. By hired labor, dredging lower approach to canal, removing 2,953,583 cubic yards of material, \$530,765.89, dredging 41,106 cubic yards for relocation of utilities, \$7,889.34; purchase of 1,513.22 acres of land, \$236,491.77; abstract of titles, \$11,500.34, appraisals and negotiations, \$9,161.97, legal and administrative expense \$3,322.96 and miscellaneous office and field costs in connection with land acquisition, \$32,711.84; engineering, design and studies, \$221,370.34 and miscellaneous construction surveys, \$13,782.02. The total cost of new work was \$2,026,078.17, from regular funds.

Maintenance: Dikes and revetments were repaired at a cost of \$367,517.08. The required 9-foot channel was maintained, except for the short periods needed to move a dredge to the shoal, by four United States hydraulic dredges. During the year 21 shoals developed, of which 17 were dredged once and 2 were dredged twice. There were 2,007,447 cubic yards of sand and gravel removed by these dredges from the channel through 21 bars. The channels dredged had a combined length of 9.8 miles, an average width of 350 feet, and an average gain in depth of 5.4 feet. The total cost of maintenance dredging, was \$222,502.53.

Hydrographic surveys were made covering approximately 200 miles of river, costing \$88,951.87. Aids to navigation were installed at a cost of \$23,133.47. Other miscellaneous costs were: Snagging, \$1,952.99; cooperative stream gaging, \$8,691.69; discharge observations at miscellaneous localities, \$1,146.04; stream flow forecasting, \$6,708.85; removal of 4,124 cubic yards of rock, \$1,851.08; gages, \$11,875.76 and releasing grounded vessels, \$1,399.09, all charged to maintenance. The total cost of all maintenance was \$735,730.45. The expenditures were \$2,678,477.94 from regular funds.

*Condition at end of fiscal year.*—Work under this project (including the authorized Chain of Rocks improvement), is about 49 percent complete. The quantities required to complete the project are estimated at 170 dikes, 159,000 linear feet; 82 revetments, 85,000 linear feet, and the canal, lock, levees, etc., at Chain of Rocks as recommended in House Document 231. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February

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to latter part of August, during which time project channel depths generally prevail without dredging. The mean stage of the river for the fiscal year 1946 was 10.42 feet, St. Louis gage. The mean stage of the river for the fiscal year 1947 was 12.42 feet.

The following table gives condition of the channel during the fiscal year 1947:

Section	Length of section	Channel affording— <sup>1</sup>								Controlling depth
		9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		
		Length	Period	Length	Period	Length	Period	Length	Period	
Ohio River to Commercial Point	Miles 32.7	Miles 32.7	Days 365	Miles 0	Days 0	Miles 0	Days 0	Miles 0	Days 0	Feet 10.0
Commercial Point to Commerce	6.7	6.7	363	0.1	2	0	0	0	0	8.0
Commerce to Grays Point	6.6	6.6	365	0	0	0	0	0	0	10.5
Grays Point to Grand Tower	33.7	33.7	364	0.1	1	0	0	0	0	8.0
Grand Tower to Fort Gage	36.3	36.3	365	0	0	0	0	0	0	10.0
Fort Gage to Little Rock	9.5	9.5	365	0	0	0	0	0	0	9.0
Little Rock to River des Peres	46.5	46.5	365	0	0	0	0	0	0	9.0
River des Peres to Merchants Bridge	11.2	11.2	365	0	0	0	0	0	0	13.5
Merchants Bridge to northern boundary city of St. Louis <sup>2</sup>	8.0	7.9	364	0.1	2	0	0	0	0	8.6
Northern boundary, city of St. Louis, to mouth of Missouri River <sup>3</sup>	3.8	3.8	365	0	0	0	0	0	0	9.0

<sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.

<sup>3</sup> This is known as the Chain of Rocks Reach.

The cost and expenditures under the existing project to June 30, 1947, have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular	\$36,613,077.22	\$29,254,397.86	\$65,867,475.08	\$66,001,240.32
Public Works	3,462,154.46		3,462,154.46	3,462,154.46
Emergency Relief	996,747.95		996,747.95	996,747.95
Total	41,071,979.63	29,254,397.86	70,326,377.49	70,460,142.73

*Proposed operations.*—The unexpected balance at the end of the fiscal year, plus \$5,527,000 allotted in August 1947, and \$168,243.03 advanced to plant allotment, will be applied as follows:

**RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 1849**

Accounts payable, June 30, 1947	824,477.79
<b>New work:</b>	
<b>Regulating works:</b>	
By contract (completion of existing contracts), July 1, 1947, to June 30, 1948:	
Piling dikes:	
Dogtooth Bend	887,862.00
Chester-Ste. Genevieve, Mo.	252,233.00
By contract, July 1, 1947, to June 30, 1948:	
Piling dikes:	
Goose Island	113,100.00
Schenimann	203,000.00
Grand Tower and Hanging Dog Island	110,700.00
Ste. Genevieve, Mo.	223,864.00
Bank protection: Dogtooth Bend	54,000.00
<b>Chain of Rocks improvement:</b>	
Bridge Highway (U. S. No. 66) continuing contract: July 1, 1947, to June 30, 1948	1,453,661.00
Lock, continuing contract: July 1, 1947, to June 30, 1948	3,700,000.00
Utilities, relocation of 54-inch water line, continuing contract: Nov. 1, 1947, to June 30, 1948	200,000.00
Utilities, complete relocation of gas-pipe line: July 1, 1947, to Aug. 30, 1947	11,115.00
Utilities, payment to East St. Louis and Interurban Water Co., for purchase of 2 water lines: July 1, 1947, to Oct. 10, 1947	195,000.00
Utilities, payment to Mississippi River Fuel Corp. for relocation of Shell Oil line: July 1, 1947, to Apr. 30, 1948	150,000.00
By hired labor with United States plant:	
Regulating works, July 1, 1947, to June 30, 1948: piling dikes, Cornice Island	24,000.00
<b>Chain of Rocks improvement:</b>	
Partial land acquisition, July 1, 1947, to Feb. 1, 1948	50,000.00
Construction surveys, July 1, 1947, to June 30, 1948	50,000.00
Advance planning, July 1, 1947, to June 30, 1948	80,000.00
<b>Total for new work</b>	<b>6,958,535.00</b>
<b>Maintenance:</b>	
By hired labor with United States plant, July 1, 1947, to June 30, 1948:	
Dikes and bank protection	\$537,000.00
Project channel dredging	450,000.00
Surveys, gages, and studies	90,000.00
Aids to navigation	35,000.00
Snagging	20,000.00
Cooperative stream gaging	18,000.00
Discharge observations	3,000.00
Stream flow forecasting	3,000.00
<b>Total maintenance</b>	<b>1,156,000.00</b>
Unallocated balance	1,948.28
<b>Total for all work</b>	<b>8,150,961.07</b>

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The sum of \$14,620,000 can be profitably expended during the fiscal year 1949, as follows:

New work:	
By contract, July 1, 1948, to June 30, 1949:	
Chain of Rocks improvement:	
Construction of lock	\$8,570,000
Relocation of utilities	500,000
Construction of canal	2,000,000
Advance planning (dam)	110,000
Construction surveys	80,000
By hired labor with United States plant: Chain of Rocks improvement, land acquisition	360,000
By contract:	
Dikes	707,000
Bank protection	525,900
By hired labor with United States plant:	
Dikes	290,600
Bank protection	176,500
Total for new work	\$13,320,000
Maintenance:	
By hired labor with United States plant:	
Dikes and bank protection	661,000
Project channel dredging	450,000
Surveys, gages, and studies	95,000
Aids to navigation	45,000
Snagging	20,000
Cooperative stream gaging	18,000
Discharge observations	3,000
Stream flow forecasting	8,000
Total maintenance	1,300,000
Total for all work	14,620,000

It is expected that with the proposed expenditures, the project (including revised Chain of Rocks improvement) will be about 51 percent complete.

*Cost and financial summary*

Cost of new work to June 30, 1947	\$42,488,599.29
Cost of maintenance to June 30, 1947	134,515,002.69
Total cost of permanent work to June 30, 1947	177,003,601.98
Undistributed costs June 30, 1947	168,243.03
Net total cost to June 30, 1947	77,171,845.01
Minus accounts payable June 30, 1947	34,477.79
Net total expenditures	177,137,367.22
Unexpended balance June 30, 1947	2,455,718.04
Total amount appropriated to June 30, 1947	179,593,085.26

<sup>1</sup> Includes \$5,200,004.83 from permanent indefinite appropriation covering snagging operation of which \$280,572.72 pertained to Vicksburg and Memphis districts.

**RIVERS AND HARBORS—ST. LOUIS, MISSOURI, DISTRICT 1351**

	Fiscal year ending June 30—				
	1943	1944	1945	1946	1947
Cost of new work.....	\$980,530.26	\$499,208.64	\$643,637.88	\$1,546,976.35	\$2,026,078.17
Cost of maintenance.....	673,499.97	1,212,468.36	978,187.54	903,858.93	735,730.45
<b>Total cost.....</b>	<b>1,654,030.23</b>	<b>1,711,677.00</b>	<b>1,621,825.42</b>	<b>2,450,835.28</b>	<b>2,761,808.62</b>
<b>Total expended.....</b>	<b>1,082,642.26</b>	<b>1,215,608.81</b>	<b>1,749,137.27</b>	<b>2,553,928.39</b>	<b>2,678,477.94</b>
<b>Allotted.....</b>	<b>1,574,000.00</b>	<b>-450,000.00</b>	<b>3,800,000.00</b>	<b>4,507,000.00</b>	<b>788,000.00</b>

Balance unexpended July 1, 1946.....	\$4,346,195.98
Amount allotted during fiscal year.....	788,000.00
<b>Amount to be accounted for.....</b>	<b>5,134,195.98</b>
Gross amount expended.....	\$2,679,258.58
Less reimbursed expenditures.....	780.64
<b>Balance unexpended June 30, 1947.....</b>	<b>2,455,718.04</b>
Outstanding liabilities, June 30, 1947.....	\$34,477.79
Amount covered by uncompleted contracts.....	2,421,240.25
<b>Amount allotted in August 1947.....</b>	<b>5,527,000.00</b>
Unobligated balance available for fiscal year 1948.....	5,527,000.00
<b>Amount (estimated) required to be appropriated for completion of existing project<sup>2</sup>.....</b>	<b>45,489,477.00</b>
<b>Amount that can be profitably expended in fiscal year ending June 30, 1949:</b>	
For new work <sup>2</sup> .....	13,320,000.00
For maintenance <sup>2</sup> .....	1,300,000.00
<b>Total.....</b>	<b>14,620,000.00</b>

<sup>2</sup> Exclusive of available funds.

**2. MISSISSIPPI RIVER BETWEEN THE MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)**

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1393.

**3. ILLINOIS WATERWAY, ILL. (ST. LOUIS DISTRICT)**

See report, "Illinois Waterway, Ill.," page 2035.

**4. EXAMINATIONS, SURVEYS, AND CONTINGENCIES (GENERAL)**

The cost of work during the year was \$121,771.22, and the expenditures were \$121,083.54. The balance unexpended at the end of the fiscal year, plus \$127,500 which was allotted in August 1947, will be applied as needed during the fiscal year 1948 to payment of expenses incurred under this heading.

The additional sum of \$203,600 can be profitably expended during the fiscal year ending June 30, 1949.

<i>Flood-control—Continued</i>		<i>Flood control—Continued</i>	
	Page		Page
21. Columbia drainage and levee district No. 3, Illinois.....	1535	28. Emergency flood-control work under authority of Public Laws Nos. 138 and 318, Seventy-eighth Congress, Public Law No. 75, Seventy-ninth Congress, and Public Law No. 102, Eightieth Congress.....	1547
22. Wilson and Wenkel and Prairie du Pont drainage and levee districts, Illinois.....	1537	29. Preliminary examinations, surveys, and contingencies for flood control.....	1549
23. East St. Louis and vicinity, Illinois.....	1539	30. Snagging and clearing under authority of section 2 of the Flood Control Act approved August 28, 1937, as amended.....	1550
24. Chouteau, Nameoki, and Venice drainage and levee district, Illinois.....	1541	31. Inactive flood-control projects.....	1551
25. Wood River drainage and levee district, Illinois.....	1542		
26. Upper Mississippi River Basin, St. Louis district.....	1544		
27. Emergency flood-control work under authority of the Flood Control Act approved August 18, 1941.....	1546		

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*Existing project.*—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 980 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; to be obtained: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency; second, by dredging or other temporary expedients to maintain channels of project dimensions; third, by construction of works authorized for the Chain of Rocks reach in the River and Harbor Act of March 2, 1945, which approved a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is undertaken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the

present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. 231, 76th Cong., 1st sess.).

The estimated cost of new work, revised in 1948, is \$93,173,000, with \$1,370,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

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June 13, 1902		
Mar. 2, 1907	These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	
Mar. 3, 1905 <sup>1</sup>		
Mar. 2, 1907 <sup>1</sup>	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. 50, 61st Cong., 1st sess., and H. Doc. 168, 58th Cong., 2d sess.
June 25, 1910		
Jan. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc. 9, 69th Cong., 2d sess.
July 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. 12, 70th Cong., 1st sess.
Mar. 2, 1945	Modified to provide for construction of a lateral canal with lock at Chain of Rocks, at an estimated first cost to the United States of about \$10,200,000, with \$70,000 annually for maintenance and operation.	H. Doc. 231, 76th Cong., 1st sess.

<sup>1</sup> Also joint resolution, June 29, 1906.

See House Document 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

*Terminal facilities.*—Most of the water terminal and transfer facilities of the district are described in volumes 1 and 4 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled "Survey of Terminals and Landings on the Inland Waterways of the United States."

*Operations and results during fiscal year.*—River stages were favorable to construction work by contract and by hired labor with Government plant the entire year, except during July 1947 and March and April 1948. Regulating works were maintained and project dimensions of channels were secured by dredging. The dis-



tricts standard specifications for construction work were used. Location, quantities, and costs of open river regulating works follow:

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
New work by contract:				
Dogtooth Bend .....	20	1	1,970	\$86,282.31
Goose Island .....	37-39	4	1,740	91,170.04
Schenmann-Hungling Dog Island-Grand Tower Island .....	57-60	4	2,035	182,889.41
Chester-Stc. Genevieve, Mo. ....	111-125	7	5,220	256,605.67
Stc. Genevieve, Mo. ....	116-119	5	3,230	204,132.04
Total .....		21	14,195	821,080.37
New work by United States plant and hired labor:				
Cornice Island .....	148.3	1	500	28,819.97
Maintenance by United States plant and hired labor .....			7,800	290,611.21

\* Includes cost of screening 7,700 linear feet of dikes with mattress lumber.

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetment)*				Cost	
		Number	Linear feet bank protection	Squares (100 square feet)			Toe piles bank protection
				Mat-tress	Paving		
New work by contract:							
Dogtooth Bend .....	24	1	885	885	610	\$62,017.95	
Maintenance by United States plant and hired labor .....			12,021	1,406	4,096	3,385	198,182.34

New work: One dike, totaling 500 feet in length, was built by hired labor with Government plant, as a cost of \$28,819.97. A total of 72,022 cubic yards of material was handled by a United States hydraulic dredge in preparing one locality for new regulating works at a cost of \$5,674.83. Cost of model studies by hired labor amounted to \$11,509.94. Twenty-one dikes, totaling 14,195 feet in length, were built under contract at a cost of \$821,080.37. One revetment, consisting of 885 squares of mattress and 610 squares of paving was completed under contract at a cost of \$62,017.95. In addition to completed work there were under construction by contract, 8 dikes to total about 3,935 linear feet. Costs of \$4,865,228.52 were incurred on the improvement at Chain of Rocks as follows: By contract, construction of lock, \$3,326,934.25; construction of bridge over canal, \$1,256,971.90; relocation of utilities, \$202,349.10; abstract of titles, (includes \$9,946.10 transferred from hired labor) \$10,998.94; appraisals, \$2,662.54; and design of bridge, \$2,479.79. By hired labor, advance planning, \$44,043.06; engineering, designs and estimates, \$18,525.73; purchase of 137.54 acres of land (minus sale of structures), \$17,773.20; appraisals and negotiations, \$2,324.74; abstracts of title to land, (minus) \$9,946.10; legal and administrative expense, \$4,592.71; miscellaneous office and field costs in connection with land acquisition, \$4,275.80; miscellaneous

construction surveys, \$34,508.80; model studies, \$1,258.64; and design of lock and bridge, while under construction, \$31,319.73 and \$4,155.69, respectively. The total cost of new work was \$5,794,331.58.

Maintenance: Dikes and revetments were repaired at a cost of \$488,793.55. The required 9-foot channel was maintained by four United States hydraulic dredges. During the year 41 shoals developed, of which 36 were dredged once, 2 were dredged twice and one was dredged three times. There were 4,671,597 cubic yards of sand and gravel removed by these dredges from the channel through 21 bars; 143,217 cubic yards of material were removed in outside-the-channel dredging at a cost of \$23,443.73. The channels dredged had a combined length of 22.6 miles, an average width of 303 feet, and an average gain in depth of 5.8 feet. The total cost of maintenance dredging was \$479,259.87.

Hydrographic surveys were made covering 75 miles of river, costing \$36,514.87. Aids to navigation were installed at a cost of \$29,966.38. Other miscellaneous costs were: Snagging, \$24,183.88; cooperative stream gaging, \$8,109.89; discharge observations at miscellaneous localities, \$1,667.03; stream flow forecasting, \$4,545.38; gages, \$14,491.25; and releasing grounded vessels, \$3,766.09; all charged to maintenance. The total cost of all maintenance was \$1,091,293.19.

The total expenditures under this project were \$6,135,389.52 from regular funds.

*Condition at end of fiscal year.*—Work under this project (including the authorized Chain of Rocks improvement), is about 51 per cent complete. The quantities required to complete the project are estimated at 140 dikes, 145,000 linear feet; 81 revetments, 84,000 linear feet; and the canal, lock, levees, etc., at Chain of Rocks, as recommended in House Document 231. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, the project dimensions of channels have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years navigation has continued throughout the winter, except when the river is actually blocked by running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging. The mean stage of the river for the fiscal year 1947 was 12.42 feet, St. Louis gage. The mean stage of the river for the fiscal year 1948 was 9.45 feet.

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The following table gives condition of channel during the fiscal year 1948:

Section	Length of section	Channel affording—1								Controlling depth
		9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		
		Length	Period	Length	Period	Length	Period	Length	Period	
Ohio River to Commercial Point.....	Miles 32.7	Miles 32.7	Days 364	Miles 0.2	Days 1	Miles 0	Days 0	Miles 0	Days 0	Feet 8.0
Commercial Point to Commerce.....	6.7	6.7	361	.1	4	0	0	0	0	8.0
Commerce to Grays Point.....	6.6	6.6	365		0	0	0	0	0	11.0
Grays Point to Grand Tower.....	33.7	33.7	364	.1	1	0	0	0	0	8.0
Grand Tower to Fort Gage.....	36.3	36.3	362	.2	2	.1	1	0	0	7.0
Fort Gage to Little Rock.....	9.5	9.5	359	.3	6	0	0	0	0	8.0
Little Rock to River des Peres.....	46.5	46.5	359	.6	6	0	0	0	0	8.0
River des Peres to Merchants Bridge.....	11.2	11.2	363	.1	2	0	0	0	0	7.5
Merchants Bridge to northern boundary, City of St. Louis <sup>2</sup> .....	8.0	7.9	335	.3	30	.1	16	0	0	6.6
Northern boundary, City of St. Louis, to mouth of Missouri River <sup>3</sup> .....	3.8	3.8	363	.2	2	0	0	0	0	8.5

<sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.

<sup>2</sup> This is known as the Chain of Rocks Reach.

The costs and expenditures under the existing project to June 30, 1948, have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$42,407,408.80	\$30,345,696.05	\$72,753,104.85	\$72,136,029.84
Public Works.....	3,462,154.46		3,462,154.46	3,462,154.46
Emergency Relief.....	996,747.95		996,747.95	996,747.95
Total.....	46,866,311.21	33,345,696.05	77,212,007.26	76,595,532.25

*Proposed operations.*—The balance unexpended June 30, 1948, \$1,847,328.52, plus \$9,860,000 allotted in July 1948, a total of \$11,707,328.52 will be applied as follows:

Accounts payable, June 30, 1948.....	\$616,475.01
New work:	
Regulating works:	
By contract (completion of existing contract)	
July 1, 1948 to Sept. 9, 1948:	
Piling dikes:	
Schenimann-Hanging Dog Island-Grand Tower Island.....	\$151,720
By contract, July 1, 1948 to June 30, 1949:	
Piling dikes:	
Cairo Protection.....	154,000
Crain Island.....	174,000
Chester.....	120,000

New work—Continued	
Bank protection:	
Cape Girardeau .....	42,000
Wilkinson .....	105,000
Chain of Rocks Improvement:	
Bridge over highway (U. S. No. 66):	
Continuing contract:	
July 1, 1948 to Nov. 8, 1948 .....	192,534
Lock, continuing contract:	
July 1, 1948 to June 30, 1949 .....	6,800,000
Utilities, relocation of 54-inch water line, continuing contract:	
Sept. 1, 1948 to May 31, 1949 .....	555,000
Utilities, payment to East St., Louis and Interurban Water Co., for purchase of 2 water lines:	
July 15, 1948 .....	195,000
Relocation of roads and utilities:	
Jan. 1, 1949 to June 1, 1949 .....	165,000
Power control and lighting, continuing contract:	
Oct. 1, 1948 to June 30, 1949 .....	200,000
Construction of canal and levees, continuing contract:	
Nov. 15, 1948 to June 30, 1949 .....	1,100,000
By hired labor with United States plant:	
Complete land acquisition:	
July 1, 1948 to Dec. 1, 1948 .....	574,790
Construction surveys:	
July 1, 1948 to June 30, 1949 .....	62,500
Advance planning:	
July 1, 1948 to June 30, 1949 .....	72,286
Total for new work .....	10,163,830.00
Maintenance:	
By hired labor with United States plant, July 1, 1948 to June 30, 1949:	
Dikes and bank protection .....	222,000
Project channel dredging .....	559,000
Surveys, gages, and studies .....	65,000
Aids to navigation .....	30,500
Snagging .....	20,000
Cooperative stream gaging .....	18,000
Discharge observations .....	3,000
Stream flow forecasting .....	8,000
Total maintenance .....	925,500.00
Unallocated balance .....	1,523.51
Total for all work .....	11,707,328.52

The sum of \$17,500,000 can be profitably expended during the fiscal year 1950, as follows:

New work:	
By contract, July 1, 1949 to June 30, 1950:	
Chain of Rocks improvement:	
Construction of lock .....	\$9,900,000
Construction of canal and levees .....	4,600,000
Power control and lighting .....	500,000
Regulating works, by contract:	
Dikes .....	314,000
Bank protection .....	567,000
By hired labor with United States plant:	
Dikes .....	174,000
Bank protection .....	145,000
Total for new work .....	16,200,000

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Maintenance:

By hired labor with United States plant:

Dikes and bank protection	470,000
Project channel dredging	574,000
Surveys, gages, and studies	95,000
Aids to navigation	45,000
Snagging	20,000
Cooperative stream gaging	18,000
Discharge observations	3,000
Stream flow forecasting	8,000
Establishment of 3d. order triangulation	67,000

Total maintenance ..... 1,300,000

Total for all work ..... 17,500,000

It is expected that with the proposed expenditures, the project (including Chain of Rocks improvement) will be about 78 percent complete.

*Cost and financial summary*

Cost of new work to June 30, 1948	\$48,282,930.87
Cost of maintenance to June 30, 1948	35,606,300.88
Total cost of permanent work to June 30, 1948	83,889,231.75
Minus accounts payable, June 30, 1948	616,475.01
Net total expenditures	83,272,756.74
Unexpended balance, June 30, 1948	1,847,328.52
Total amount appropriated to June 30, 1948	85,120,085.26

Fiscal year ending June 30	1944	1945	1946	1947	1948
Cost of new work	\$499,208.64	\$643,637.88	\$1,546,976.35	\$2,026,078.17	\$5,794,331.68
Cost of maintenance	1,212,468.36	978,187.54	903,858.93	735,730.45	1,091,288.19
Total cost	1,711,677.00	1,621,825.42	2,450,835.28	2,761,808.62	6,885,620.77
Total expended	1,215,608.81	1,749,137.27	2,553,928.39	2,678,477.94	6,135,389.52
Allotted	-450,000.00	3,800,000.00	4,507,000.00	788,000.00	5,527,000.00

Balance unexpended, July 1, 1947	\$2,455,718.04
Amount allotted during fiscal year	5,527,000.00
Amount to be accounted for	7,982,718.04
Gross amount expended	\$6,136,706.02
Less reimbursed expenditures	1,316.50
	6,135,389.52
Balance unexpended, June 30, 1948	1,847,328.52
Outstanding liabilities, June 30, 1948	616,475.01
Amount covered by uncompleted contracts	1,165,211.37
	1,781,686.38
Balance available, June 30, 1948	65,642.14
Amount allotted in July 1948	9,860,000.00
Unobligated balance available for fiscal year 1949	9,925,642.14
Amount (estimated) required to be appropriated for completion of existing project	36,141,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1950:	
For new work	16,200,000.00
For maintenance	1,300,000.00
Total	17,500,000.00

<sup>1</sup> Includes \$5,260,604.83 from permanent indefinite appropriation covering snagging operation, of which 280,572.72 pertained to Vicksburg and Memphis districts.

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<i>Flood Control—Continued</i>		<i>Flood Control—Continued</i>	
	Page		Page
21. Columbia drainage and levee district No. 3, Illinois.....	1383	Public Law 75, Seventy-ninth Congress, and Public Law 102, Eightieth Congress.....	1395
22. Wilson and Wenkel and Prairie du Pont drainage and levee districts, Illinois.....	1385	29. Emergency protection for certain highway and railroad facilities from flood damage in the vicinity of Price Landing, Mo. (section 12, Flood Control Act approved Dec. 22, 1944).....	1396
23. East St. Louis and vicinity, Illinois.....	1387	30. Preliminary examinations, surveys, and contingencies for flood control.....	1397
24. Chouteau, Nameoki, and Venice drainage and levee district, Illinois.....	1389	31. Snagging and clearing under authority of section 2 of the Flood Control Act approved August 28, 1937, as amended.....	1397
25. Wood River drainage and levee district, Illinois.....	1390	32. Inactive flood-control projects.....	1398
26. Upper Mississippi River Basin, St. Louis district.....	1392		
27. Emergency flood-control work under authority of the Flood Control Act approved August 18, 1941.....	1394		
28. Emergency flood-control work under authority of Public Laws 138 and 318, Seventy-eighth Congress,			

1. MISSISSIPPI RIVER BETWEEN THE OHIO AND MISSOURI RIVERS

*Location.*—The Mississippi River rises in Lake Itasca, Minn., and, from that lake flows in a southerly direction about 2,350 miles and empties into the Gulf of Mexico. The portion included in this report embraces the 195-mile section known as the middle Mississippi, between the tributary Ohio and Missouri Rivers, about 984 to 1,179 miles from the Gulf.

*Previous projects.*—The original project for the improvement of the Mississippi River between the Ohio and Missouri Rivers was recommended by a board of engineers in a report, dated April 13, 1872, and concurred in by the Chief of Engineers. For further details see page 1879 of the Annual Report for 1915 and page 1014 of the Annual Report for 1938.

*Existing project.*—This provides for obtaining and maintaining a minimum channel depth of not less than 9 feet, a minimum width of not less than 300 feet at low water, with additional width in bends from the mouth of the Ohio River (about 984 miles from the Gulf) to the northern boundary of the city of St. Louis, 191 miles; thence 200 feet wide, with additional width in bends to the mouth of the Missouri River, 4 miles; to be obtained: First, by regulating works, for closing sloughs and secondary channels, and narrowing the river; by building new banks where the natural width is excessive and protecting new and old banks from erosion where necessary to secure permanency; second, by dredging or other temporary expedients to maintain channels of project dimensions; third, by construction of works authorized for the Chain of Rocks reach in the River and Harbor Act of March 2, 1945, which approved a comprehensive plan for development of the Mississippi River at Chain of Rocks so as to provide for construction of a lateral canal at an estimated first cost to the United States of approximately \$10,290,000, with annual maintenance and operation cost of \$70,000, subject to such modification as the Chief of Engineers may find necessary when the project is under-

taken; and to authorize the relocation of the river channel and reclamation of the area in Sawyer Bend for airport, park, recreational, and similar purposes at a cost to local interests of approximately \$17,555,000; provided that any modification of the present river channel required by the civic development be deferred until completion of the lateral canal in the interest of navigation and that the river diversion work connected with such civic development be under the supervision of the Chief of Engineers in order to insure that the interests of interstate and foreign commerce be properly protected; and further provided that local interests hold and save the United States free from any claims for damages that might be incurred due to the construction, maintenance, or operation of such civic development or any part thereof (H. Doc. 231, 76th Cong., 1st sess.).

The estimated cost of new work, revised in 1949, is \$93,173,000, with \$1,370,000 for annual maintenance.

The existing project was authorized by the following river and harbor acts:

Acts	Work authorized	Documents
June 3, 1881 June 13, 1882 Mar. 2, 1907 Mar. 3, 1905 <sup>1</sup> Mar. 2, 1907 <sup>1</sup>	Project for regulating works adopted in 1881. (To obtain a minimum depth of 8 feet.) Dredging introduced as part of the project. These acts practically abrogated that part of the project for the middle Mississippi which proposed regulating works.	Annual Report, 1881, p. 1536.
June 25, 1910	Regulating works restored to the project and appropriations begun with a view to the completion of the improvement between the Ohio and Missouri Rivers within 12 years at an estimated cost of \$21,000,000, exclusive of amounts previously expended.	H. Doc. 50, 61st Cong., 1st sess., and H. Doc. 168, 58th Cong., 2d sess.
Jan. 21, 1927	For a depth of 9 feet and width of 300 feet from the Ohio River to the northern boundary of the city of St. Louis, with the estimated cost of maintenance increased to \$900,000 annually.	Rivers and Harbors Committee Doc. 9, 69th Cong., 2d sess.
July 3, 1930	Project between the northern boundary of the city of St. Louis and Grafton (mouth of Illinois River) modified to provide for a channel 9 feet deep and generally 200 feet wide with additional width around bends, at an estimated cost of \$1,500,000, with \$125,000 annually for maintenance.	Rivers and Harbors Committee Doc. 12, 70th Cong., 1st sess.
Mar. 2, 1945	Modified to provide for construction of a lateral canal with lock at Chain of Rocks, at an estimated first cost to the United States of about \$10,290,000, with \$70,000 annually for maintenance and operation.	H. Doc. 231, 76th Cong., 1st sess.

<sup>1</sup> Also joint resolution, June 29, 1906.

See House Document 669 (76th Cong., 3d sess.) for report of Chief of Engineers dated February 27, 1940, containing a general plan for improvement of the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River for purposes of navigation, power development, the control of floods, and the needs of irrigation.

*Terminal facilities.*—Most of the water terminal and transfer facilities of the district are described in volumes 1 and 4 of the four-volume report of the Board of Engineers for Rivers and Harbors, entitled "Survey of Terminals and Landings on the Inland Waterways of the United States."

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*Operations and results during fiscal year.*—River stages were favorable to construction work by contract and by hired labor with Government plant during the fall of 1948 but were unfavorable during the spring of 1949, work being carried on only intermittently. Regulating works were maintained and project dimensions of channels were secured by dredging. Location, quantities, and costs of open river regulating works were as follows:

Class of work and locality	Miles above mouth of Ohio River	Dikes (hurdles)		
		Number	Linear feet	Cost
<b>New work by contract:</b>				
Calro protection.....	6-8	0	2185	\$148,392.27
Schenfmann — Hanging Dog Island — Grand Tower Island.....	57-83	10	3010	150,315.50
Crain Island—Chester.....	103-116	10	5145	302,770.01
Total .....		26	11240	601,477.78
<b>Maintenance by United States plant and hired labor:</b>				
			8710	1 285,932.30

<sup>1</sup> Includes cost of screening 9,460 linear feet of dikes with mattress lumber.

Class of work and locality	Miles above mouth of Ohio River	Bank protection (revetment)				Cost	
		Number	Linear feet bank protection	Squares (100 square feet)			Toe piles bank protection
				Mattress	Paving		
<b>New work by contract:</b> Cape Girardeau-Wilkinson .....	47-94	2	2,055	2,055	861	\$92,643.22	
<b>Maintenance by United States plant and hired labor:</b> .....			1,635	164	699	450	34,048.40

**New work:** A total of 24,249 cubic yards of material was handled by a United States hydraulic dredge in preparing one locality for new regulating works at a cost of \$9,817.32. Twenty-six dikes, totaling 11,240 feet in length, were built under contract at a cost of \$601,477.01. Two revetments, consisting of 2,055 squares of mattress and 861 squares of paving, were completed under contract at a cost of \$92,643.22. Costs of \$5,996,995.36 were incurred on the improvement at Chain of Rocks as follows: By contract, construction of lock, \$5,265,333.37; construction of bridge over canal, \$176,795.42; relocation of utilities, \$245,252.01; advance planning, \$709.70; abstracts of title to land, \$421.37; and construction of canal and levees, \$915.56. By hired labor, advance planning, \$108,810.80; abstracts of title to land, legal and administrative expense and appraisals and negotiations, \$30,631.43; purchase of 387.47 acres of land (minus sale of structures), \$67,747.64; design of bridge, \$1,878.29; design of lock, \$42,916.55; miscellaneous construction surveys, \$35,621.83; model studies, \$18,881.55; and design of power control and lighting, \$1,079.84.



The total cost of new work was \$6,700,933.68, of which \$307,567.93 was by hired labor.

**Maintenance:** Dikes and revetments were repaired at a cost of \$319,975.70. The required 9-foot channel was maintained by three United States hydraulic dredges. During the year 41 shoals developed, of which 37 were dredged once and 2 were dredged twice, removing 3,910,501 cubic yards of sand and gravel from the channel at a cost of \$456,558.62. The channels dredged had a combined length of 22.8 miles, an average width of 280 feet, and an average gain in depth of 5.9 feet.

Hydrographic surveys were made covering 65 miles of river, costing \$32,230.26, of which \$3,686.54 was by contract. Aids to navigation were installed at a cost of \$37,377.67. Other miscellaneous costs were: Snagging, \$13,731.63; cooperative stream gaging, \$8,969.84; discharge observations at miscellaneous localities, \$991.28; stream flow forecasting, \$4,890.05; gages, \$15,974.48; and releasing grounded vessels, \$2,185.16; all charged to maintenance. The total cost of all maintenance was \$892,884.69. The total costs for the fiscal year were \$7,593,818.37 and the expenditures were \$7,089,899.37, all from regular funds.

*Condition at end of fiscal year.*—Work under this project (including the Chain of Rocks canal), is about 57 percent complete. The quantities required to complete the project are estimated at 133,760 linear feet of dikes, 66,135 linear feet of revetment, 607,000 cubic yards of construction dredging, 270,000 cubic yards of rock removal, and the canal, locks, levees, etc., at Chain of Rocks, as authorized by the River and Harbor Act of March 2, 1945. Dikes and revetments are now in good repair and the channel has been greatly improved by the work that has been done. Dredging is required at low stages to remove temporary shoals and maintain the required channel depths.

In recent years, the project dimensions of channel have generally been maintained throughout the navigation season. The navigation season formerly extended from the middle of February to the middle of December, the river being generally closed by ice the remainder of the year. However, in recent years increased demands of commerce and more general use of steel-hull boats have combined to extend the navigation season throughout the year except when blocked by heavy running ice or gorges. The river is generally above the 10-foot stage, St. Louis gage, for 6 months of the year, latter part of February to latter part of August, during which time project channel depths generally prevail without dredging. The mean stage of the river, St. Louis gage, was 9.45 feet for the fiscal year 1948 and 9.25 feet for the fiscal year 1949.

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The following table gives condition of channel during the fiscal year 1949:

Section	Length of section	Channel affording— <sup>1</sup>								Controlling depth
		9 feet or more		Less than 9 feet		7 feet or less		6 feet or less		
		Length	Period	Length	Period	Length	Period	Length	Period	
Miles	Miles	Days	Miles	Days	Miles	Days	Miles	Days	Feet	
Ohio River to Commercial Point.....	32.7	32.7	365	0	0	0	0	0	0	9.5
Commercial Point to Commerce.....	6.7	6.7	364	.1	1	0	0	0	0	8.0
Commerce to Grays Point.....	6.6	6.6	365	0	0	0	0	0	0	10.5
Grays Point to Grand Tower.....	33.7	33.7	365	0	0	0	0	0	0	9.0
Grand Tower to Fort Gage.....	36.3	36.3	362	.2	3	0	0	0	0	8.0
Fort Gage to Little Rock.....	9.5	9.5	363	.1	2	0	0	0	0	8.5
Little Rock to River des Peres.....	46.5	46.5	362	.2	2	0	0	0	0	8.0
River des Peres to Merchants Bridge.....	11.2	11.2	356	2	9	0	0	0	0	8.0
Merchants Bridge to northern boundary, city of St. Louis <sup>2</sup> .....	8.0	8.0	302	.4	63	.2	10	.2	1	5.9
Northern boundary, city of St. Louis, to mouth of Missouri River <sup>1</sup> .....	3.8	3.8	365	0	0	0	0	0	0	9.0

<sup>1</sup> Project width is 300 feet from Ohio River to northern boundary of St. Louis and 200 feet from that point to Missouri River, with additional width in bends throughout.<sup>1</sup>

<sup>2</sup> This is known as the Chain of Rocks Reach.

The costs and expenditures under the existing project to June 30, 1949 have been as follows:

Kind of funds	Costs			Expenditures
	New work	Maintenance	Total	
Regular.....	\$49,108,342.48	\$31,238,580.74	\$80,346,923.22	\$79,226,529.21
Public Works.....	3,462,154.46	.....	3,462,154.46	3,462,154.46
Emergency Relief.....	996,747.95	.....	996,747.95	996,747.95
<b>Total.....</b>	<b>53,567,244.89</b>	<b>31,238,580.74</b>	<b>84,805,825.63</b>	<b>83,685,431.62</b>

*Proposed operations.*—The balance unexpended June 30, 1949, \$4,617,429.15 plus \$32,757.45 amount advanced to plant account, plus \$10,725,000 allotted in fiscal year 1950, a total of \$15,375,186.60, will be applied as follows:

Accounts payable, June 30, 1949.....	\$1,153,151.46
New work:	
Regulating works:	
By contract:	
Bank protection, July 1949 (completion of existing contract), Cape Girardeau-Wilkinson.....	20,361.00
Piling dikes: July 1949 to June 1950:	
Powers Island-Schenimann.....	275,000.00
Fish Bend.....	96,000.00

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New work—Continued	
Bank protection: July 1949 to June 1950:	
Liberty.....	145,750.00
Kaskaskia Island.....	72,000.00
Chain of Rocks Improvement:	
Lock, continuing contract: July 1949 to June 1950.....	7,877,570.00
Power control and lighting, continuing contract: July 1949 to June 1950.....	308,920.00
Canal and levees, continuing contract: July 1949 to June 1950.....	3,056,084.00
Utilities, payment to East St. Louis and Interurban Water Co., for purchase of 2 water lines: July 1949 to August 1949.....	10,557.00
Utilities, relocation of 54-inch water line: July 1949 to August 1949.....	572,292.00
Relocation of roads and utilities: July 1949 to December 1949.....	165,000.00
Relocation of telephone and telegraph lines: July 1949 to June 1950.....	14,658.00
By hired labor with United States plant: July 1949 to June 1950:	
Piling dikes:	
Cairo protection.....	52,500.00
Chesley Island.....	23,000.00
Solid dikes:	
Seventy Six.....	45,500.00
Wilkinson.....	39,500.00
Dredging with United States dredge in connection with new bank protection by contract and hired labor.....	23,000.00
Chain of Rocks improvement: July 1949 to June 1950:	
Partial land acquisition.....	249,680.00
Construction surveys.....	118,000.00
Advance planning.....	48,690.00
Total for new work.....	14,367,213.66
Maintenance:	
By hired labor with United States plant, July 1949 to June 1950:	
Dikes and bank protection.....	\$322,000.00
Project channel dredging.....	541,000.00
Surveys, gages and studies.....	57,000.00
Aids to navigation.....	38,000.00
Snagging.....	20,000.00
Cooperative stream gaging.....	18,000.00
Discharge observations.....	3,000.00
Stream flow forecasting.....	8,000.00
Total maintenance.....	1,007,000.00
Unallocated balance.....	973.14
Total for all work.....	15,375,186.60

The additional sum of \$11,867,000 is needed to be appropriated for the following schedule of work during the fiscal year 1951:

New work:	
Chain of Rocks improvement: By contract, July 1950 to June 1951:	
Construction of lock.....	\$3,759,260
Construction of canal and levees.....	4,768,442
Bank protection.....	650,000
Power control and lighting.....	466,000
By hired labor with United States plant:	
Right-of-way for canal and levees.....	226,298
Advance planning.....	70,000
Construction surveys.....	60,000

\$10,000,000

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## New work—Continued

### Regulating works:

#### By contract:

Dikes.....	104,000	
Bank protection.....	557,000	
By hired labor with United States plant:		
Dikes.....	60,000	
Bank protection.....	19,500	
Dredging.....	109,500	850,000
Total for new work.....		10,850,000

### Maintenance:

#### By hired labor with United States plant:

Dikes and bank protection.....	340,500	
Project channel dredging.....	378,500	
Surveys, gages, and studies.....	95,000	
Aids to navigation.....	45,000	
Snagging.....	20,000	
Cooperative stream gaging.....	18,000	
Discharge observations.....	3,000	
Stream flow forecasting.....	8,000	
Establishment of 3d order triangulation.....	67,000	
Total maintenance.....		975,000
Operating and care, Lock 27.....		
Chain of Rocks improvement.....	30,000	
Ordinary maintenance and repair.....	7,000	
Improvement and reconstruction.....	5,000	
Total operating and care.....		42,000
Total for all work.....		11,867,000

### Cost and financial summary

Total amount appropriated to June 30, 1949.....	1 \$94,980,085.26
Cost of new work to June 30, 1949.....	54,983,864.55
Cost of maintenance to June 30, 1949.....	1 36,499,185.57
Total net expenditures to June 30, 1949.....	1 90,862,656.11
Unexpended balance, June 30, 1949.....	4,617,429.15
Unobligated balance available, June 30, 1949.....	
Amount appropriated for fiscal year ending June 30, 1950.....	10,725,000.00
Total unobligated balance available for fiscal year 1950.....	10,725,000.00
Estimated additional amount required to be appropriated for completion of existing project.....	26,391,477.42

	Fiscal year ending June 30—				
	1945	1946	1947	1948	1949
Appropriated.....	\$3,800,000.00	\$4,507,000.00	\$788,000.00	\$6,527,000.00	\$9,860,000.00
Cost of new work.....	643,637.88	1,546,970.35	2,026,078.17	6,794,331.68	6,700,933.68
Cost of maintenance.....	978,187.54	903,868.93	735,730.45	1,091,296.19	892,884.69
Total expended.....	1,749,137.27	2,553,928.39	2,678,477.94	6,135,389.52	7,069,899.37

<sup>1</sup> Includes \$3,260,604.83 from permanent indefinite appropriation covering snagging operation, of which \$280,572.72 pertained to Vicksburg and Memphis districts.

## 2. MISSISSIPPI RIVER BETWEEN THE MISSOURI RIVER AND MINNEAPOLIS, MINN. (ST. LOUIS DISTRICT)

See report, "Mississippi River between the Missouri River and Minneapolis, Minn.," page 1403.

## 3. ILLINOIS WATERWAY, ILL. (ST. LOUIS DISTRICT)

See report, "Illinois Waterway, Ill.," page 2051.