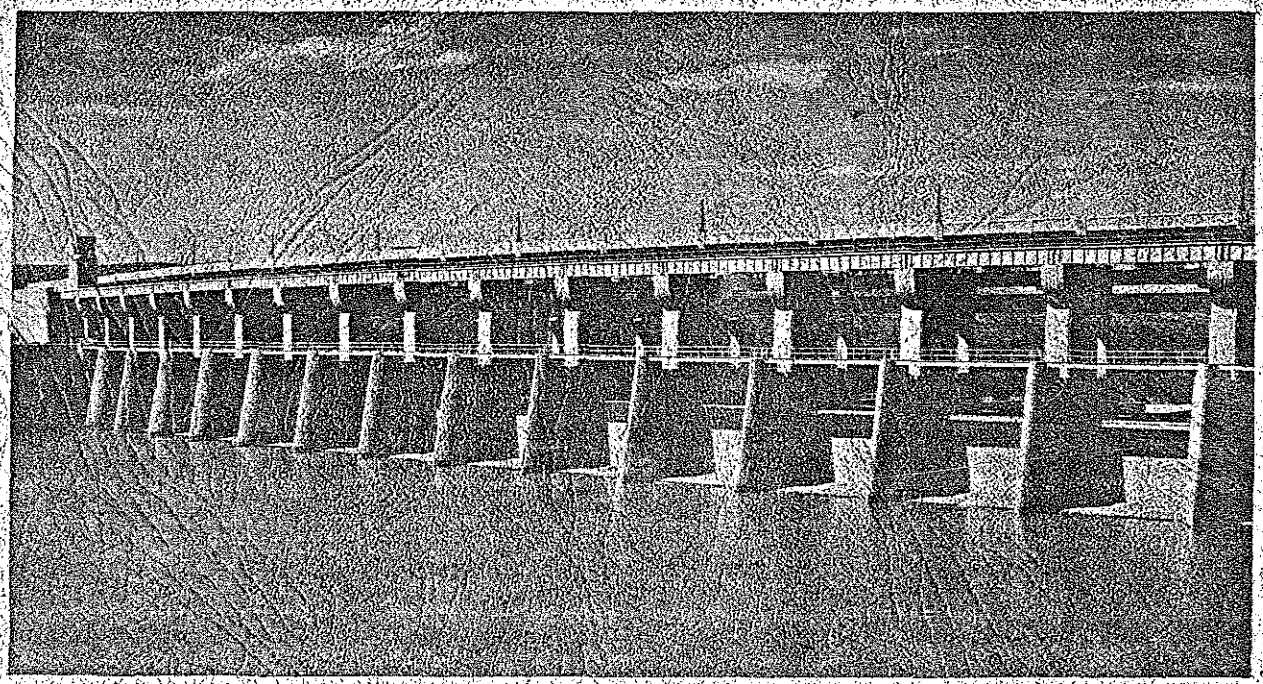
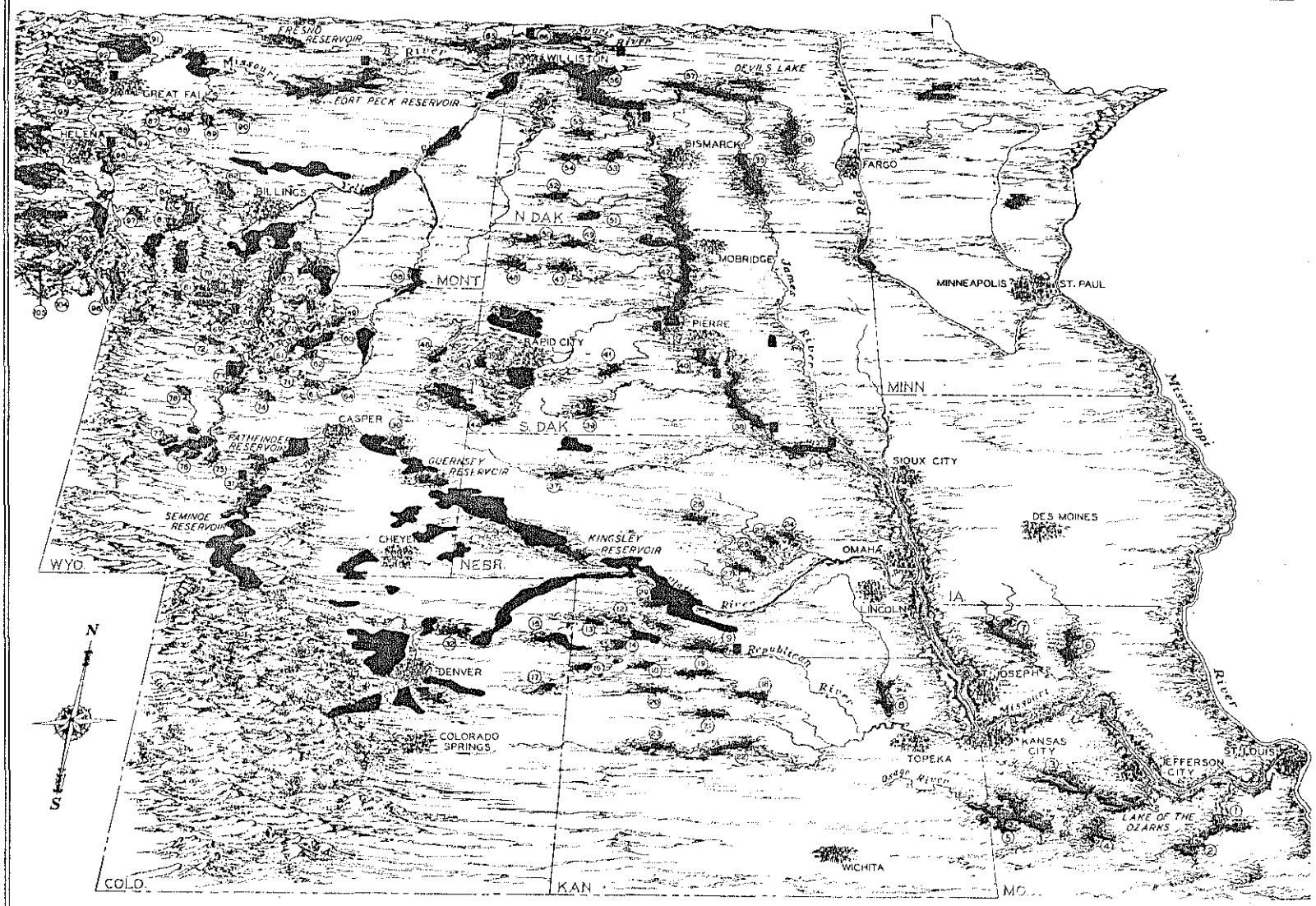
# The Development and Control of The Missouri River



Spillway Gate Structure—Fort Peck Dam and Reservoir Project, Montana

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
MISSOURI RIVER DIVISION
OMAHA, NEBRASKA




## PROPOSED RESERVOIRS

| | RESERVOIR | STREAM |
|---|---|---|
| 1. | Arlington | Gasconade River |
| 2. | Richland | Gasconade River |
| 3. | South Grand | South Grand River |
| 4. | Pomme De Terre | Pomme De Terre River |
| 5. | Osceola | Osage River |
| 6. | Hickory* | Thompson River |
| 7. | Pattonsburg* | Grand River |
| 8. | Tuttle Creek | Big Blue River |
| 9. | Harlan County | Republican River |
| 10. | Norton | Prairie Dog Creek |
| 11. | Medicine Creek | Medicine Creek |
| 12. | Red Willow | Red Willow Creek |
| 13. | Enders | Frenchman Creek |
| 14. | Culbertson | Republican River |
| 15. | Wray | N. Fork Republican River |
| 16. | Pioneer | Arikaree River |
| 17. | Bonny | S. Fork Republican River |
| 18. | Glen Elder | Solomon River |
| 19. | Kirwin | N. Fork Solomon River |
| 20. | Webster | S. Fork Solomon River |
| 21. | Wilson | Saline River |
| 22. | Kanopolis | Smoky Hill River |
| 23. | Cedar Bluff | Smoky Hill River |
| 24. | Loretto | Beaver Creek |
| 25. | Erickson | Cedar River |
| 26. | Davis | North Loup River |
| 27. | Boelus | South Loup River |
| 28. | Dismal | Dismal River |
| 29. | Plum Creek | Plum Creek |
| 30. | Glendo | North Platte River |
| 31. | Kortes | North Platte River |
| 32. | Narrows | South Platte River |
| 33. | Cherry Creek | Cherry Creek |
| 34. | Gavins Point | Missouri River |
| 35. | Jamestown | James River |
| 36. | Bald Hill | Sheyenne River |
| 37. | Box Butte | Niobrara River |
| 38. | Fort Randall | Missouri River |
| 39. | Rocky Ford | White River |
| 40. | Big Bend | Missouri River |
| 41. | Philip | N. Fork Bad River |
| 42. | Oahe | Missouri River |
| 43. | Deerfield | Rapid Creek |
| 44. | Angostura | Cheyenne River |
| 45. | Edgemont | Beaver Creek |
| 46. | Keyhole | Belle Fourche River |
| 47. | Green Grass | Moreau River |
| 48. | Bixby | Moreau River |
| 49. | Blue Horse | Grand River |
| 50. | Shade Hill | Grand River |
| 51. | Thunder Hawk | Cedar River |
| 52. | Cannon Ball | Cannon Ball River |
| 53. | Heart Butte | Heart River |
| 54. | Dickinson | Heart River |
| 55. | Broncho | Knife River |
| 56. | Garrison | Missouri River |
| 57. | Sheyenne | Sheyenne River |
| 58. | Moorehead | Powder River |
| 59. | Lake De Smet | Piney Creek |
| 60. | Willow Park | S. Fork Piney Creek |
| 61. | Triangle Park | Rock Creek |
| 62. | Bull Creek | Clear Creek |
| 63. | Smith | N. Fork Powder River |
| 64. | Middle Fork | Middle Fork Powder River |
| 65. | South Fork | S. Fork Tongue River |
| 66. | Little Horn | Little Horn River |
| 67. | Yellowtail | Big Horn River |
| 68. | Kane | Big Horn River |
| 69. | Oregon Basin | Shoshone R. Offstream |
| 70. | Red Gulch | Shell Creek |
| 71. | Lake Solitude | Paintrock Creek |
| 72. | Anchor | S. Fork Owl Creek |
| 73. | Boysen | Big Horn River |
| 74. | Badwater | Badwater Creek |
| 75. | Onion Flat | Little Popo Agie River |
| 76. | Soral Creek | N. Fork Popo Agie River |
| 77. | Raft Lake | N. Fork Little Wind River |
| 78. | Du Noir | Wind River |
| 79. | Sunlight | Sunlight Creek |
| 80. | Thief Creek | Clark Fork |
| 81. | Hunter Mtn. | Clark Fork |
| 82. | Sweetgrass | Sweetgrass Creek |
| 83. | Mission | Yellowstone River |
| 84. | Antelope | Shields River, Offstream |
| 85. | Medicine Lake | Big Muddy Creek |
| 86. | Crosby | Missouri R. Offstream |
| 87. | Stanford | Skull Creek |
| 88. | Hobson | Judith River |
| 89. | Ross | Ross Fork |
| 90. | Snowy | Cottonwood Creek |
| 91. | Tiber | Marias River |
| 92. | Wilson | N. Fork Sun River |
| 93. | Nilan | S. Fork Sun River |
| 94. | Newland | Newland Creek |
| 95. | Wells | Rock Creek |
| 96. | Canyon Ferry | Missouri River |
| 97. | Bridger | Bridger Creek |
| 98. | Taylor | Taylor Fork, Gallatin River |
| 99. | Terry | Boulder River |
| 100. | Whitetail | Whitetail Creek |
| 101. | Apex | Birch Creek |
| 102. | Kelley | Rattlesnake Creek |
| 103. | Landon | Blacktail Creek |
| 104. | Clark Canyon | Beaverhead River |
| 105. | Brenner | Horse Prairie Creek |

*Alternate for Chillicothe Reservoir

## LEGEND

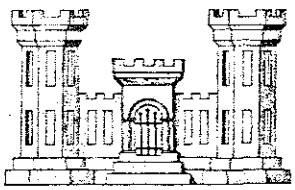
- POWER PLANT
- SYSTEM OF LEVEES
- RESERVOIRS
- EXISTING IRRIGATED LAND
- ARABLE LAND TO BE IRRIGATED UNDER BUREAU OF RECLAMATION PLAN

# *Pick-Sloan Plan for Missouri River Basin*

Showing Corps of Engineers and Bureau of Reclamation projects as described in H.D. 475 and S.D. 191, 78th Congress and approved by Congress in the 1944 Flood Control Act.

# The Development and Control of The Missouri River

*Information on development of projects for control of floods, improvement for navigation and related uses of the water resources of the Missouri River Basin*



OFFICE OF THE DIVISION ENGINEER
MISSOURI RIVER DIVISION
OMAHA, NEBRASKA
December, 1947

# PREFACE

*The Congress initiated the most comprehensive and far-reaching river basin development plan ever undertaken in America, in the passage of the Flood Control Act of 1944 (Public Law 534, 78th Congress). This act authorized a broad program for flood control and development of the Missouri River system. It established a flexible engineering framework for the development of all water resources of the Missouri River basin—control of destructive floods, irrigation, development of hydro-electric power, navigation, soil erosion control, fish and wildlife conservation and public recreation.*

*This vast region comprising about one sixth of the land area of the United States is called the nation's "breadbasket." Yet in drought years of the 1930s it failed to raise sufficient food to be self-sustaining. The Federal Government in those years spent millions of dollars in relief measures. Thousands abandoned their lands for lack of water to raise crops and sustain their cattle. Paradoxically in those same years some sections of the valley suffered destructive floods.*

*Thus two basic problems, flood and drought, confront the seven million people who make their homes in the valley. These exert tremendous influence upon the economy of the region and indirectly upon the nation as a whole. In the lower basin the problem is generally too much water in the form of destructive floods. In the ten year period, 1938 to 1947 inclusive, floods in the Missouri River basin took a toll of over $300,000,000 in property destruction and at least 90 human lives. In 1935, a disastrous flood on one tributary—the Republican River—took a toll of 105 lives. In the arid and semi-arid basin untold millions of dollars of loss have resulted through the years because of crop failures due to insufficient water.*

*The unruly Missouri River and its tributary system hold the key to solution of many of these problems imposed by nature. Engineering studies by the Corps of Engineers of the Department of the Army and other cooperating Federal and local agencies have paved the way for the great undertaking to harness the "Big Muddy." The project has been blue-printed. Engineering skill has shown the way. Modern machines and men are at work on the most vital projects of the program to put the river to work for the valley and the nation. They are building great reservoirs which ultimately will impound in aggregate 100 million acre-feet of water, the heretofore virtually unused valley resource which can be converted into irrigation water for five million additional acres of thirsty soil, millions of kilowatt hours of electric power for agricultural and industrial development, a stable river channel for water borne commerce, control of destructive floods and many other conservation purposes.*

*Today the Corps of Engineers is at work on five great multiple-purpose reservoirs in the basin and a number of urgent flood control levees and floodwalls. The Bureau of Reclamation of the Department of the Interior is constructing a number of important irrigation and power projects. The Department of Agriculture is cooperating with a vital soil conservation program. The Federal Power Commission is making extensive studies for utilization of potential electric power. Other Federal Departments are cooperating on fish and wildlife and recreational plans. The people of the valley through their state and local governments are helping in this great undertaking.*

*The Missouri Basin Inter-Agency Committee has performed a valuable service in effecting the coordination of planning, construction and administration for the comprehensive basin program approved by Congress. Authorized by resolution of the Federal Inter-Agency Committee in Washington, March 29, 1945, the Missouri Basin Inter-Agency Committee meets monthly, rotating among the basin states. It has provided the means through which the Federal Agencies have effectively coordinated their activities among themselves and with those of the states.*

*This Committee is composed of one representative of each of the five participating Federal Agencies and five governors representing the ten Missouri Basin States, (The Federal Agencies represented are Corps of Engineers, Department of Interior, Department of Agriculture, Department of Commerce and Federal Power Commission). Governor members of the Committee are selected by the Missouri River State Committee which is made up of the governor and two members from each of the ten Missouri Basin States. Inclusion of these governors on the Committee gives representation to the states and assures that the local viewpoint on all problems will be given fullest consideration.*

*The present membership on the committee consists of the following:*

*Maj. Gen. Lewis A. Pick (Chairman)*
*Corps of Engineers*

*W. G. Sloan*
*Department of Interior*

*Gladwin E. Young*
*Department of Agriculture*

*William R. Davlin*
*Department of Commerce*

*B. H. Greene*
*Federal Power Commission*

*Honorable Fred G. Aandahl*
*Governor of North Dakota*

*Honorable Sam C. Ford*
*Governor of Montana*

*Honorable Phil M. Donnelly*
*Governor of Missouri*

*Honorable Val Peterson*
*Governor of Nebraska*

*Honorable L. C. Hunt*
*Governor of Wyoming*

*The information presented in the following pages is not intended to cover all the functions of the Corps of Engineers in the Missouri Basin. It does attempt to describe briefly the scope and purpose of river and harbor and flood control projects in the basin.*

## DEPARTMENT OF THE ARMY

SECRETARY OF THE ARMY
Kenneth C. Royall

CORPS OF ENGINEERS
Office, Chief of Engineers
Lt. Gen. Raymond A. Wheeler
Chief of Engineers
Washington, D.C.

MISSOURI RIVER DIVISION
Maj. Gen. Lewis A. Pick
Division Engineer
Omaha, Nebraska

DENVER DISTRICT
Lt. Col. Craig Smyser
District Engineer
Denver, Colorado

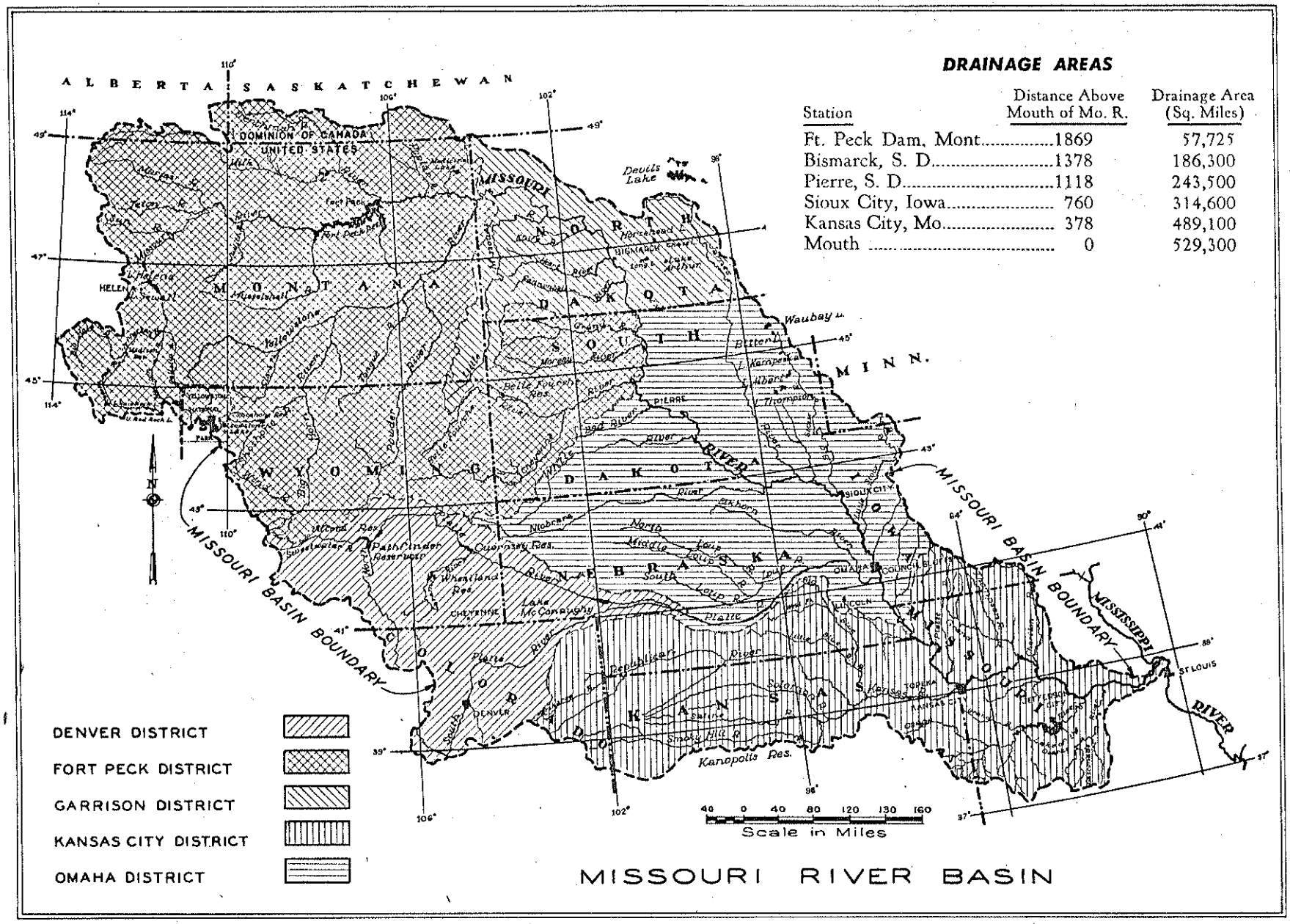
FT. PECK DISTRICT
Col. Edward H. Walter
District Engineer
Ft. Peck, Montana

GARRISON DISTRICT
Col. John S. Seybold
District Engineer
Bismarck, North Dakota

KANSAS CITY DISTRICT
Col. William E. Potter
District Engineer
Kansas City, Missouri

OMAHA DISTRICT
Col. Louis W. Prentiss
District Engineer
Omaha, Nebraska

CONTENTS




## DRAINAGE AREAS

| Station | Distance Above Mouth of Mo. R. | Drainage Area (Sq. Miles) |
|---|---|---|
| Ft. Peck Dam, Mont. | 1869 | 57,725 |
| Bismarck, S. D. | 1378 | 186,300 |
| Pierre, S. D. | 1118 | 243,500 |
| Sioux City, Iowa | 760 | 314,600 |
| Kansas City, Mo. | 378 | 489,100 |
| Mouth | 0 | 529,300 |

# MISSOURI RIVER BASIN

# Early Development of the Missouri

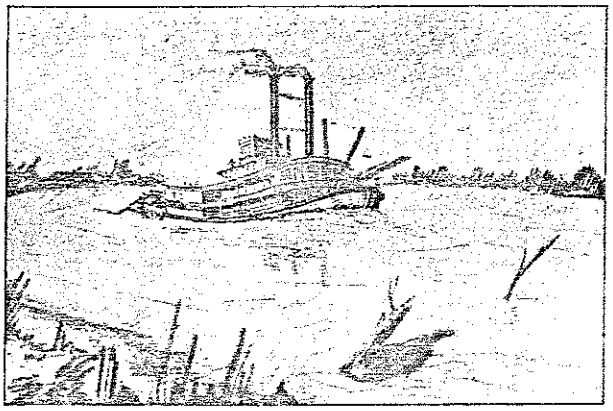
THE WATERWAY formed by the Mississippi River from its mouth to its confluence with the Missouri River in the vicinity of St. Louis and thence up the Missouri River to its headwaters is the longest in the world. The Missouri River is by a considerable margin the longer of the two rivers which form this waterway. Over 2,400 miles in length, the Missouri River originates on the slopes of the Continental Divide in Yellowstone National Park and southwestern Montana, and courses its way through or along seven states; it has an average slope of slightly less than one foot per mile downstream from the Montana-North Dakota State line, and below Sioux City, Iowa winds along a valley 1½ to 17 miles wide, flanked on both sides by bluffs. It has thirty tributaries varying in length from 100 to 1,000 miles and draining areas varying in size from 2,000 square miles to 90,000 square miles; it has countless minor tributaries. The area drained by the Missouri River and its tributaries covers 529,300 square miles, including 9,700 square miles in Canada.

## THE LOUISIANA PURCHASE

At the turn of the nineteenth century, the area between the Mississippi River and the Rocky Mountains was primitive land which had successively been the property of the Spanish and the French Governments. In the year 1803, ownership of the vast region known as the Louisiana Territory was transferred once again, this time to the United States. Involved in an imminent European War, Napoleon undoubtedly considered the sale of the Louisiana Territory to the American government a matter of political expediency, but at the same time a profitable transaction. The government of this country, on the other hand, regarded the acquisition of the area now known as the Missouri River Basin, which formed a part of the Louisiana Territory, as secondary in importance to the control of the trade outlet at the mouth of the Mississippi River. The portent of the purchase was glimpsed in the following years, 1804 to 1806, when Captains Meriwether Lewis and William Clark of the Corps of Engineers made their memorable exploration of the Missouri River basin.

## EARLY RIVER USES

In the century which followed the Lewis and Clark expedition the Missouri River and its tributaries played an important part in the development of the basin. As a natural traffic-way, it early became a carrier for commerce, first for keel boats and flat boats, later for shallow draft steamers. It provided the only conveyance for many commodities, and furnished a profitable livelihood for rivermen who plied their craft upstream as far as Fort Benton, Montana, in spite of frequent Indian attacks, treacherous currents, floating debris and other hazards. The advent of the railroad, however, brought a decline in river traffic on the Missouri.



*Early river scene. Steamboats made frequent trips far up the Missouri in the post Civil War era, often carrying thousands of tons of merchandise in a single season. Probably the record load to be carried on the upper river in the early days was that of the Missouri River packet "Montana," which conveyed 600 tons of commodities into Fort Benton, Montana in June 1879.*

In the year 1884, the Federal Government established the Missouri River Commission and endowed it with responsibility for improvement work in the interest of navigation on the Missouri River. After extensive experimentation and study, the Commission initiated regulation work adapted to the characteristics of the Missouri River. In 1902 the improvement work was assigned to the Corps of Engineers. However, appropriations were limited and work in the nineteenth century and the early twentieth century was confined principally to scattered regulation work, the removal of snags to reduce navigation hazards on the Missouri River, and navigation structures on certain tributaries.

IRRIGATION PRACTICES on the western tributaries of the Missouri River date back to the year 1860. They mushroomed rapidly thereafter, and provided an important contribution to food supplies of the western portion of the basin. Early projects consisted merely of small ditches from streams to easily accessible tracts of land. As projects became larger and extended farther from the source of supply, cooperative organizations were formed. Many of these projects suffered financial setbacks, but nevertheless new lands were constantly being brought under irrigation. Irrigation diversion on a large scale from the main stem of the Missouri River was not successfully attempted until recent years.

Numerous dams have been constructed on tributaries of the Missouri River for storage and diversion of irrigation water, for the development of hydroelectric power, and for water supply. Several dams have been constructed on the upper Missouri River, in western Montana, for the production of hydroelectric power. With the exception of irrigation development (in which the Bureau of Reclamation has in the past 40 years exerted a great influence) and navigation work, these projects were generally constructed and operated by private means or by local government.

The Missouri basin as a whole is sparsely inhabited, with the greatest concentrations of population along the main stem of the Missouri River. The population of the larger cities is shown in the table below. Agriculture is the principal pursuit of the basin's populace. Dry farming and stock raising predominate, but in the west, considerable irrigation is practiced. Manufacturing, including food processing, is highly important at the larger towns along the Missouri River. The basin and adjacent areas have valuable mineral resources, among which are copper, zinc, iron, manganese, chromium, lead, and many others. Large reserves of bituminous and lignite coal, petroleum and natural gas are found in the basin states.

BASIN CITIES WITH POPULATION EXCEEDING 40,000 (1940 Census)

| | |
|---|---|
| Denver, Colo. | 322,412 |
| Sioux Falls, S. Dak. | 40,832 |
| Lincoln, Nebr. | 81,984 |
| Omaha, Nebr. | 223,844 |
| Sioux City, Iowa | 82,364 |
| Council Bluffs, Iowa | 41,439 |
| Waterloo, Iowa | 51,743 |
| Topeka, Kans. | 67,833 |
| Kansas City, Kans. | 121,458 |
| Kansas City, Mo. | 399,178 |
| St. Joseph, Mo. | 75,711 |

## *PROBLEMS CAUSED BY THE RIVER*

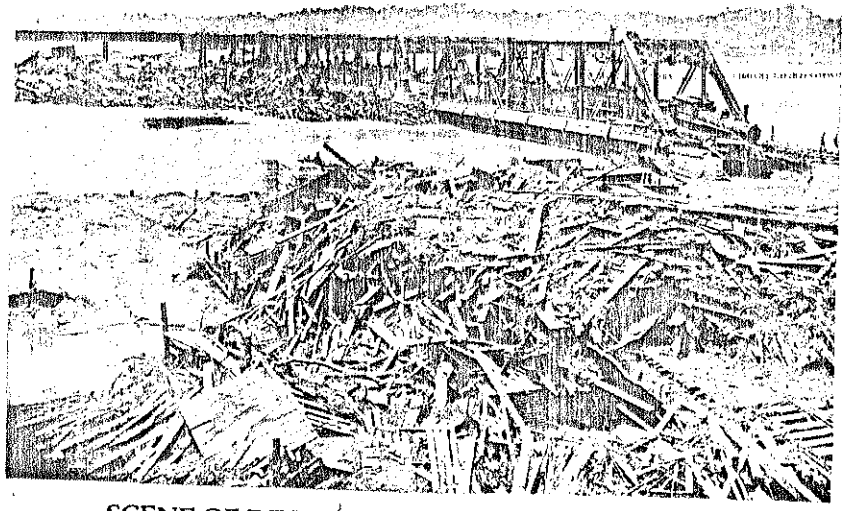
Although the Missouri River has served many useful purposes in the past, it has also introduced problems which have become more serious with increased basin development. Many towns and cities are vulnerable to floodwaters. Along the main stem and its tributaries are millions of acres of farm lands ravaged by floods which erode valuable top soil and cover the bottom lands with worthless sand. These floods destroy or prevent planting of crops. They destroy livestock, farm equipment and homes. The financial effect of the farmer's loss is felt by the surrounding trade area. These losses are real and definite and of national concern. The catastrophic flood of 1943 alone inundated over two million acres of land in the basin, caused damages estimated at $68,000,000 and destroyed 17 human lives. Flood losses in 1944 and 1945 were almost as severe. Again, in 1947, severe flooding hit the middle and lower basin, inundating 3,000,000 acres of land, causing damages of $111,000,000 and taking 26 human lives.

Many miles of levee have been constructed along stream banks by private landowners and by organized districts. These levees have been constructed in piecemeal fashion, and in general provide partial and uncertain protection and increase the flood hazard in adjacent areas. Industries and municipalities settling in river bottoms have further restricted the flood flows and increased the hazards.

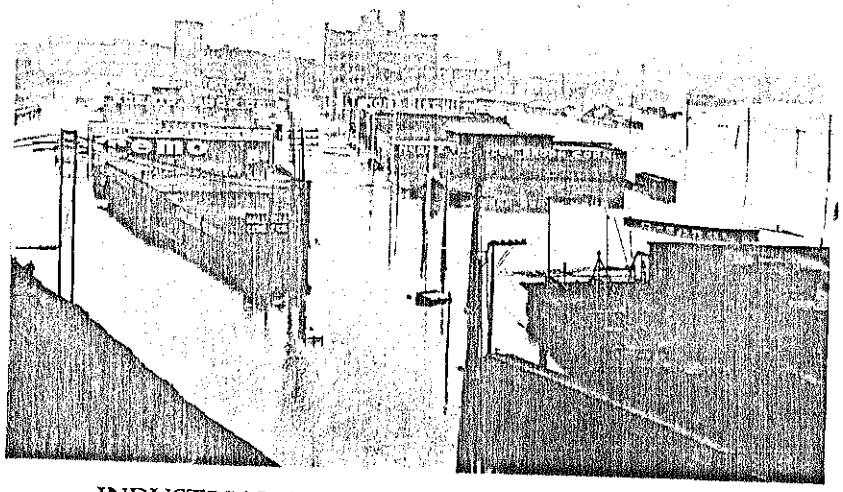
During periods of extreme low flow, a water supply problem is often created, and sewage and industrial wastes also introduce a pollution problem. A low discharge also deters navigation. Even during ordinary flows the river in its natural state meanders, cuts into banks and erodes or isolates agricultural lands.

Millions of acres of land in the western and central part of the basin have inadequate water for production of crops. Although much of the needed water can be supplied from streams within practical delivery distance, the deep intrenchment of the Missouri River complicates the diversion problem.

THE TASK, essentially, is to conserve the water supply and redistribute the flow so as to provide water for irrigation in the west and central portions of the basin; hold back and control flood waters; and provide sufficient water for navigation, water supply, sanitation and other needs in the eastern part of the basin.

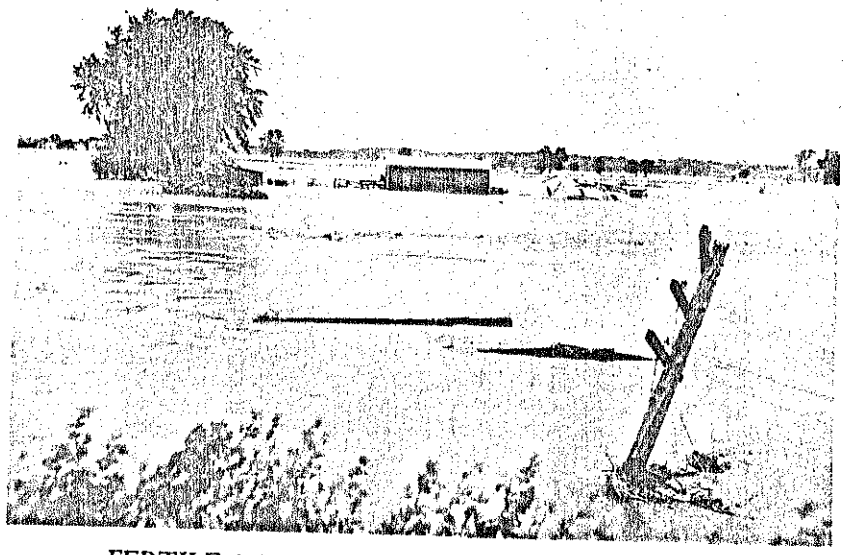


SCENE OF DESTRUCTION—Sole remaining bridge across the Kansas River at Kansas City after the disastrous flood of 1903.

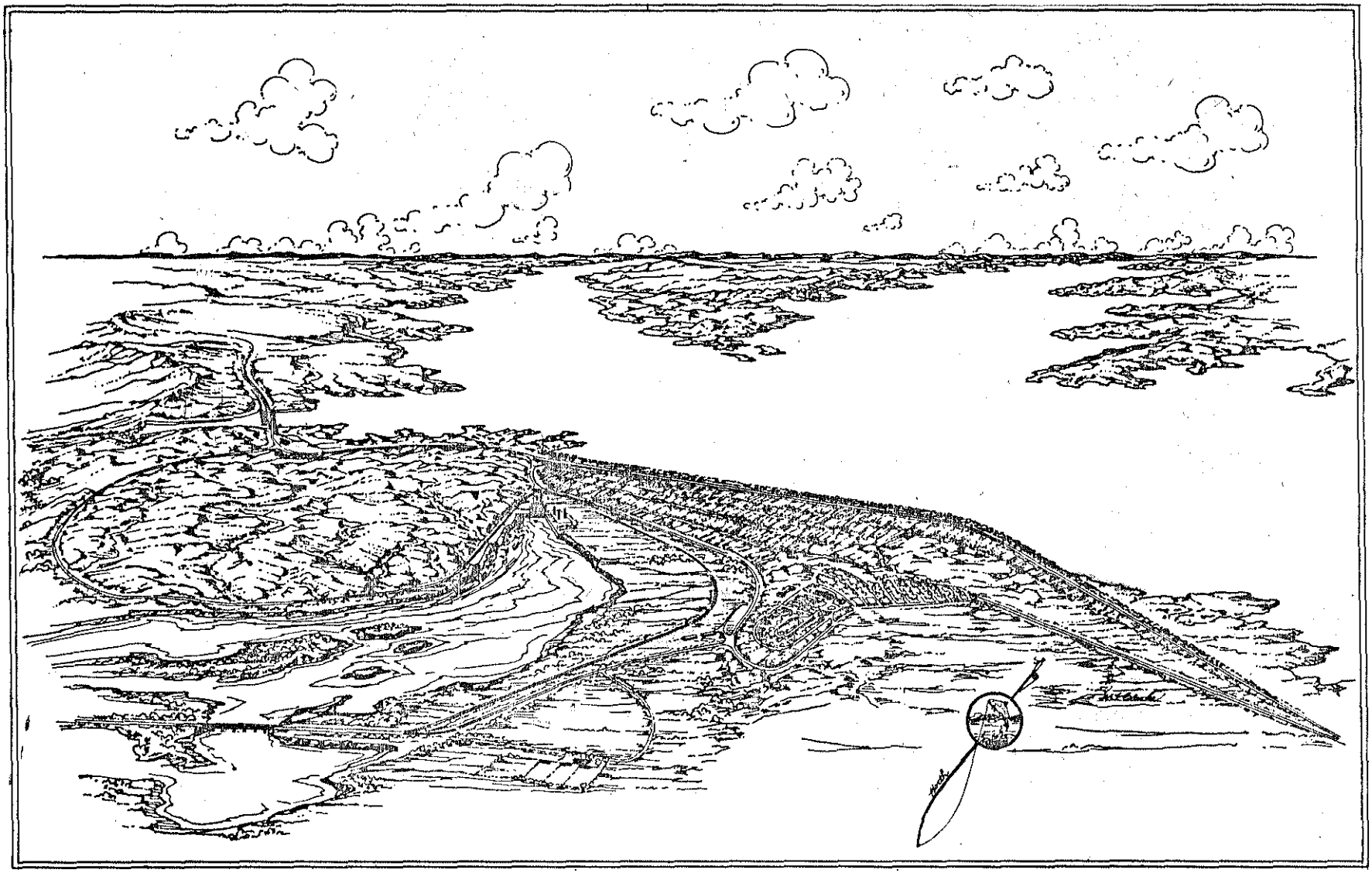


INDUSTRIAL PLANTS UNDER WATER in the flood of 1903 at Kansas City.

MILES CITY, MONTANA flooded by the Tongue and Yellowstone Rivers in March 1944.



FERTILE AGRICULTURAL LANDS flooded by the rampaging Missouri River.



FORT PECK DAM AND RESERVOIR, MONTANA—Artist's panoramic drawing shows two-mile long earthen dam and dike extension another two miles long. Control towers, at left end of dam, house machinery which operates tunnel gates. Power plant building is shown at downstream tunnel outlets. At extreme left is mile-long concrete spillway. Sixteen vertical-lift gates (partially shown on cover page) control spillway water releases.

# Development of a Constructive Program

### FORMATION OF FEDERAL POLICY

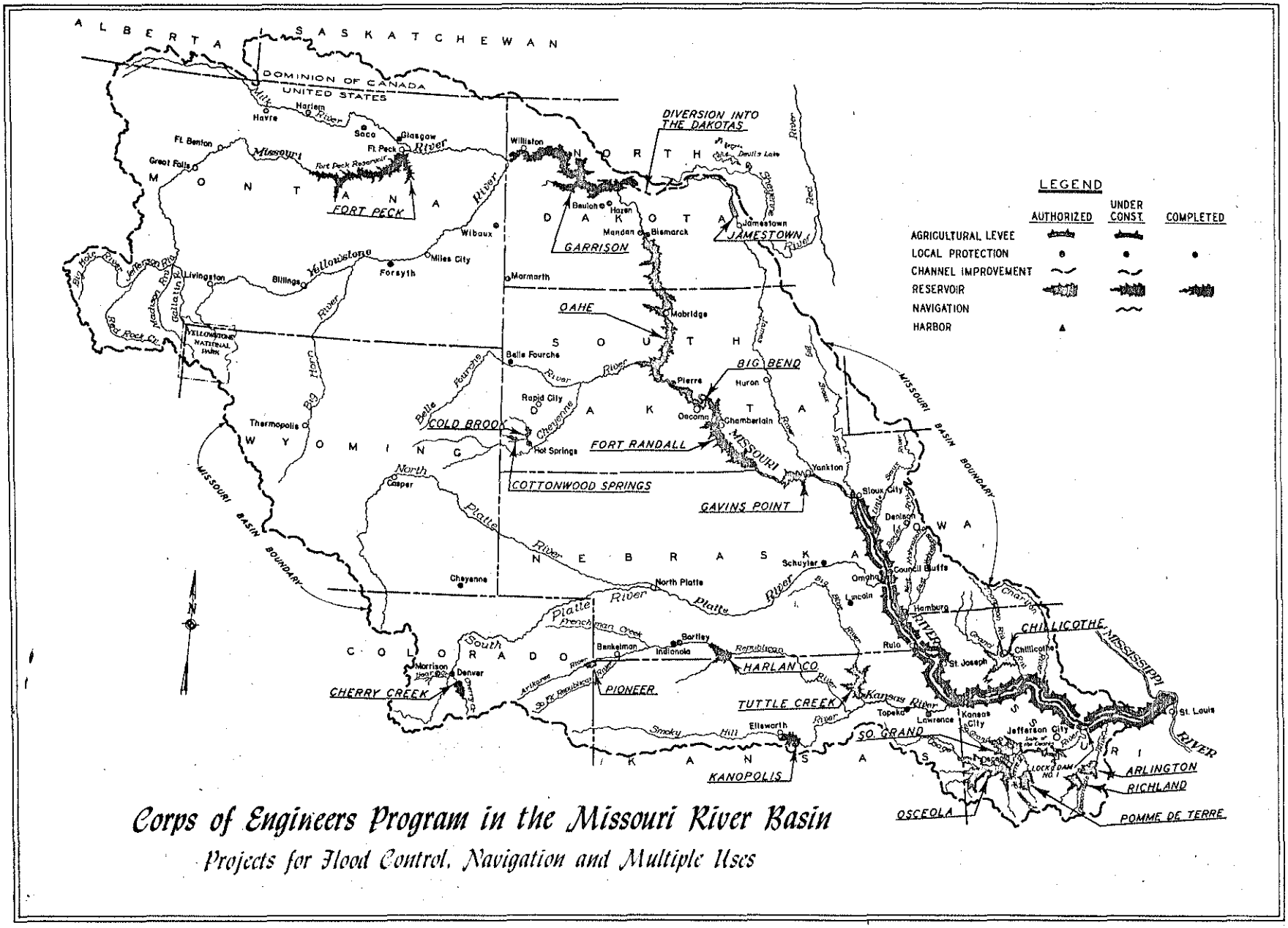
THE CORPS OF ENGINEERS has been responsible for river and harbor work in the nation since 1824. However, it was not assigned improvement work for navigation on the Missouri River until the year 1902, and vigorous prosecution of the navigation project was not affected until the year 1927.

During the period 1929 to 1934, comprehensive studies were made by the Corps of Engineers of the principal river basins in the Missouri River watershed. These studies, prepared under the provisions of House Document 308, Sixty-ninth Congress, formed a basis for later, more detailed, investigation and planning. Construction of the Fort Peck Dam and Reservoir was authorized in 1933, and in the River and Harbor Acts of August 30, 1935 and May 18, 1938, Congress approved construction of the dam and appurtenant works and a suitable power plant for the production of hydroelectric power, for the purpose of improving navigation on the Missouri River between Sioux City, Iowa, and the mouth, and for other purposes incidental thereto.

Prior to 1936, the Corps of Engineers had no authority to construct flood control works in the Missouri Basin. In the Flood Control Act of June 22, 1936, Congress took cognizance of the fact that destructive floods constitute a menace to the national welfare, and that the Federal Government should improve or participate in the improvement of navigable waters or their tributaries, for flood control purposes, if the benefits accruing exceed the estimated costs and if the lives and social security of people are otherwise adversely affected. The act designated that on local protection projects, local interests must provide without cost to the Federal Government all lands, easements and rights-of-way required for construction of the project, hold and save the Federal Government free from damages due to the construction work, and maintain the project after completion. In accordance with the policy set forth in the Flood Control Act, the Corps of Engineers was authorized to construct several projects for the protection of municipalities in the Missouri Basin. Under this authority, levee and flood wall projects were constructed at Belle Fourche, South Dakota; Glasgow, Montana; and Topeka, Kansas. In 1938 a system of reservoirs on tributaries in the lower Missouri Basin was authorized for the benefit of navigation and the control of destructive floodwaters and other purposes.

### 1944 FLOOD CONTROL ACT

Under the direction of the Division Engineer, Missouri River Division, a comprehensive basin-wide plan was formulated in 1943 which expanded the previous plan to include additional multiple purpose reservoirs on the main stem and tributaries of the Missouri River, and flood protection works for municipalities and agricultural lands. In the following year, the Bureau of Reclamation recommended a plan for basin-wide development for irrigation, power, and other purposes. These reports were integrated and Congress, in the Flood Control Act of December 22, 1944, approved the coordinated plan, commonly known as the Pick-Sloan plan, which included 105 reservoirs; levees for protection of agricultural lands in the Missouri Valley below Sioux City, Iowa; levees for municipal areas; systems for distribution of irrigation water for new lands totaling 4,700,000 acres, and supplemental water for another 500,000 acres; hydroelectric plants having an eventual installed capacity of 1,600,000 kilowatts of power and an annual output estimated at ten billion kilowatt hours of electrical energy; and related works. In the Flood Control Acts of December 22, 1944 and July 24, 1946, Congress authorized a total amount of $350,000,000 to be expended by the Corps of Engineers and $350,000,000 to be expended by the Bureau of Reclamation for partial accomplishment of the program.




# *Corps of Engineers Program in the Missouri River Basin*

*Projects for Flood Control, Navigation and Multiple Uses*

# The Comprehensive Plan for Flood Control and Other Purposes

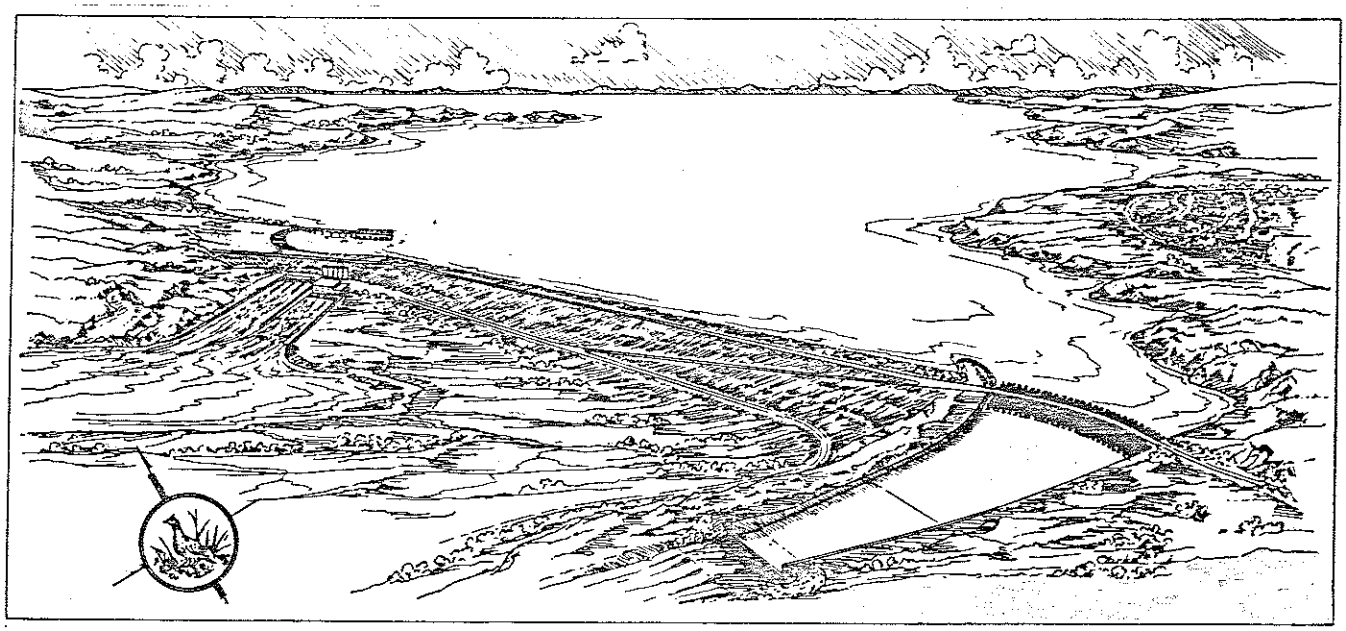
### DAM AND RESERVOIR PROJECTS

FLOODS OF THE PAST have demonstrated that an enormous volume of water amounting to many millions of acre feet( one acre-foot of water would cover one acre of land to a depth of one foot) can surge down the Missouri River Valley in a single flood. The dams selected for construction on the Missouri River in the reach between Sioux City, Iowa, and the Montana-North Dakota State line are well located to impound these waters. Supplemented by the Fort Peck Dam, they will control a vast drainage area, and the storage capacity available behind the dams will enable the projects to supply water to large areas of thirsty land and supply electrical energy to power markets within feasible transmission distance, in addition to capacity reserved for flood control and navigation. The location of these dams is shown on the map on the opposite page.

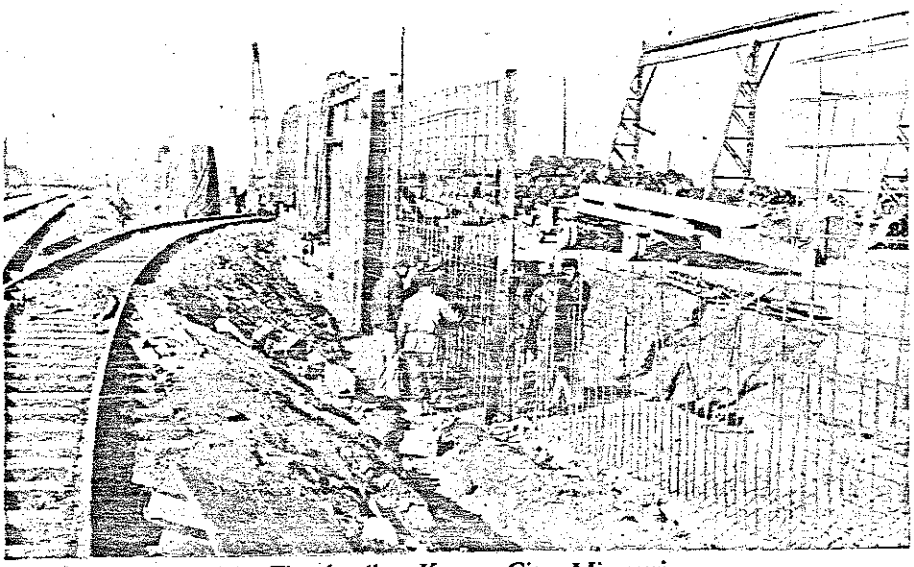
The Garrison, Oahe and Fort Randall dams will be high head structures, with maximum heights of 210 ft., 227 ft., and 160 ft., respectively.

Based on careful study of foundation conditions in the Missouri Valley, these dams will be constructed of compacted earth fill. Conduits through one of the valley walls at each of the dams will be utilized for diversion of the river during construction of the dam, and afterwards will be used for release of reservoir waters for navigation and irrigation, generation of power, and for other purposes. To safely handle unprecedented discharges which might conceivably occur, a gated chute type spillway will be constructed in the abutment at one extremity of each dam.

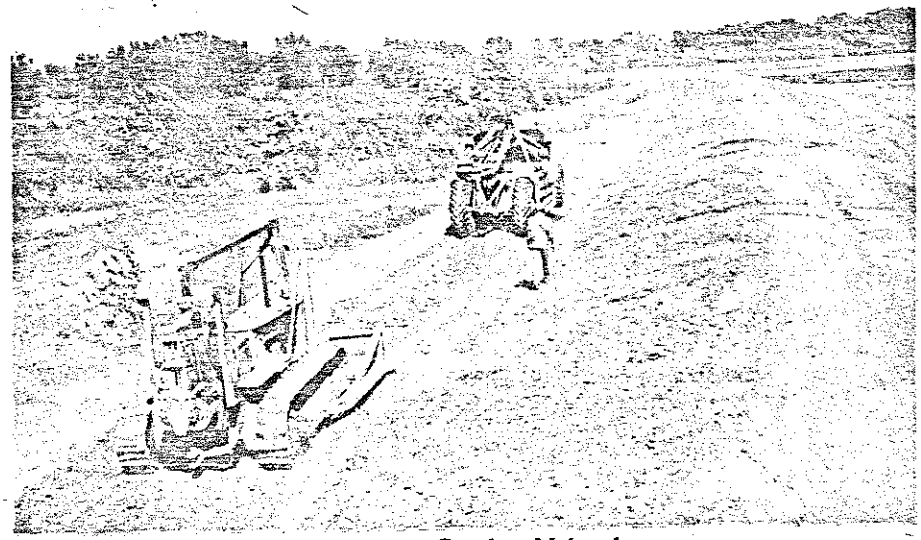
The Gavins Point and Big Bend Dams, which complete the series of dams above Sioux City, will be comparatively low head structures. The Gavins Point project will re-regulate stream releases below the Fort Randall reservoir to provide a more uniform flow downstream. The Big Bend project will utilize a long bend in the river for the full development of the river for hydroelectric purposes.



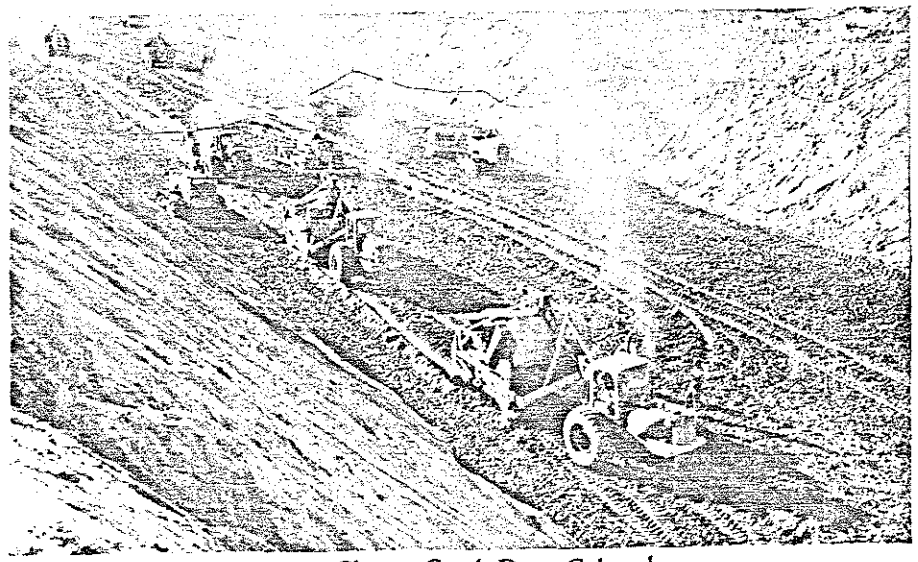
GARRISON DAM. Under construction in North Dakota. The artist's sketch shows the dam and appurtenant structures. Over-all length along the crest is approximately 12,000 feet. The outlet works and powerhouse are shown at left, spillway chute at right. The dam will create a lake having a length of 200 miles when reservoir is full.



1. Floodwall at Kansas City, Missouri.



2. Levee at Omaha, Nebraska



3. Cherry Creek Dam, Colorado

# CONSTRUCTION ACTIVITY IN T
## BASIN STATE

Explanation of photographs:

(1) Shows construction of the floodwall in the C Kansas Citys project. Progressing from left are shown: Curing of concrete (on far side forms in place; and placing of reinforcing s

(2) Embankment being placed on toe of levee at

(3) Equipment placing backfill in cutoff trench for the Cherry Creek Dam.

(4) Pipe piling for a pier of the construction bridge across the Missouri River at the Garrison damsite. The fifty-foot long section of 24 inch piling is being hoisted into position in the pile driver leads.

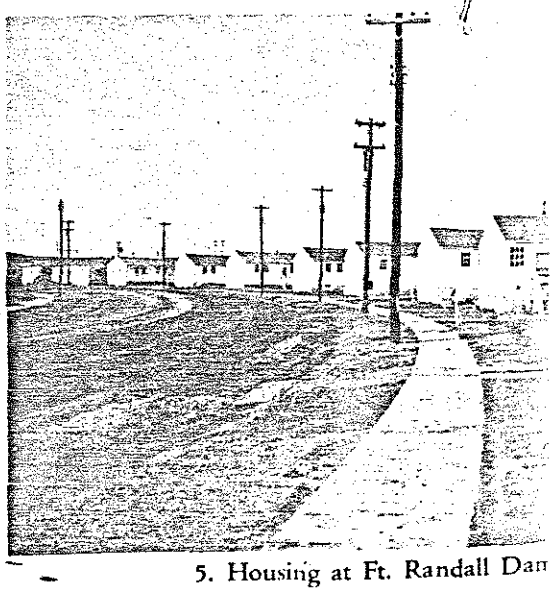
(5) Shows part of the construction town being built in connection with the Fort Randall Reservoir project.

(6) Spreading rock spalls on the upstream face of Kanopolis Dam.

(7) Standard revetment under construction along a bank of the Missouri River showing lumber mattress prior to ballasting, and bank being prepared for paving.

(8) Excavation to permit construction of base of floodwall at Council Bluffs, Iowa.

4. Br

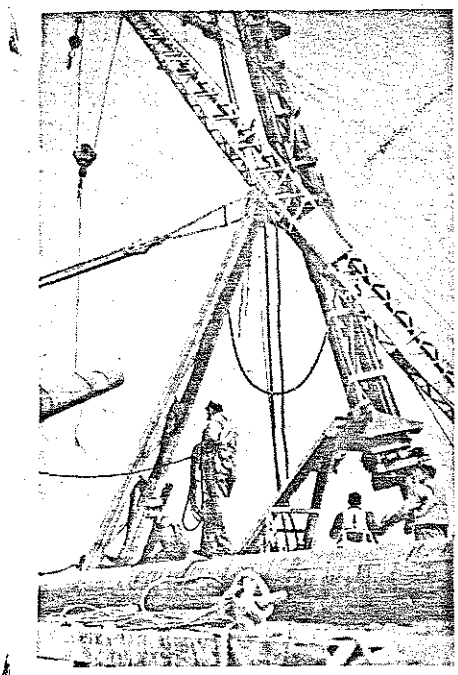


5. Housing at Ft. Randall Dam

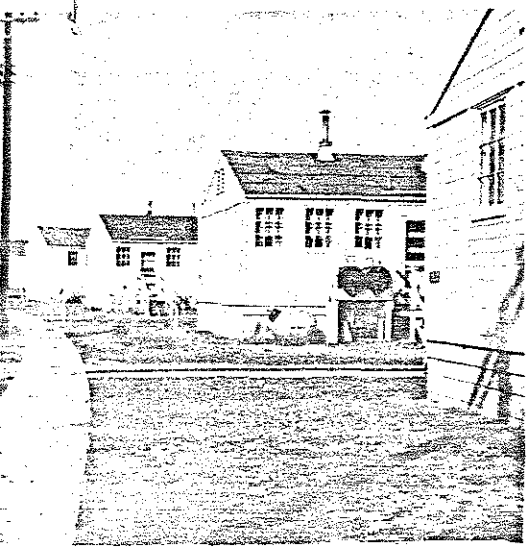
## ITY IN THE MISSOURI RIVER
## N STATES

dwall in the Central Industrial District of the
sing from left to right, following operations
(on far side of opening for railroad tracks);
reinforcing steel.

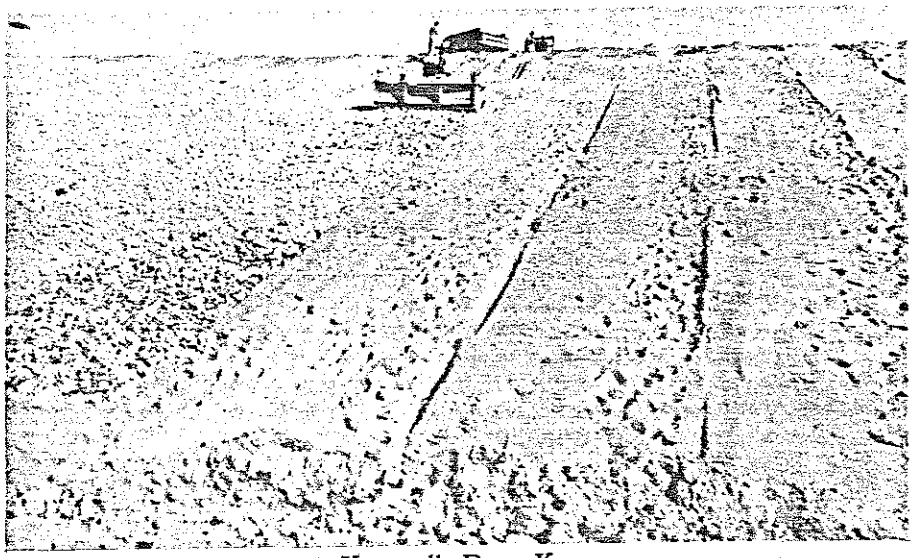
toe of levee at Omaha, Nebraska.



4. Bridge at Garrison Dam, N. Dak.



Randall Dam, South Dakota



6. Kanopolis Dam, Kansas

7. Navigation project, Missouri River

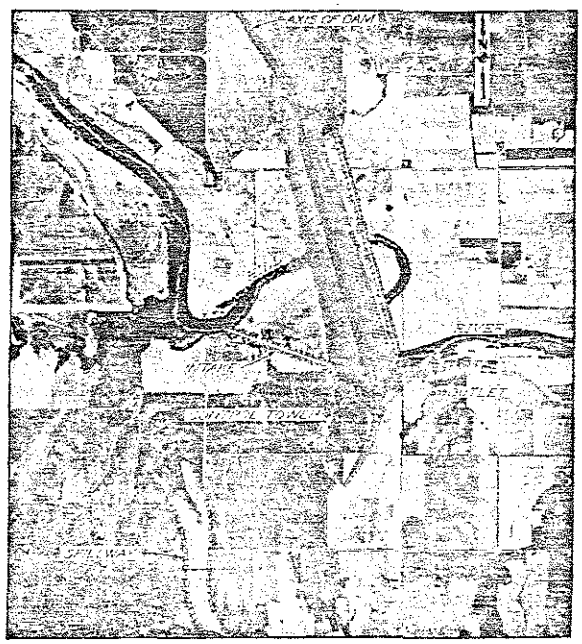
8. Excavation for floodwall, Council Bluffs, Iowa

OTHER DAM AND RESERVOIR projects in the authorized comprehensive plan are located on various tributaries of the Missouri River. These reservoirs are an integral part of the reservoir and levee system required for comprehensive flood protection. Due to the flood producing potentialities of major streams in the lower basin, adequate blocks of flood storage in these reservoirs are required for proper control. The dams will generally be constructed of earth embankment with side channel chute spillway, similar to the high Missouri River dams. Where foundation conditions permit, the dams will be built of concrete when such construction is more feasible and economical. Pertinent data on all authorized dam and reservoir projects is tabulated in Appendix D.

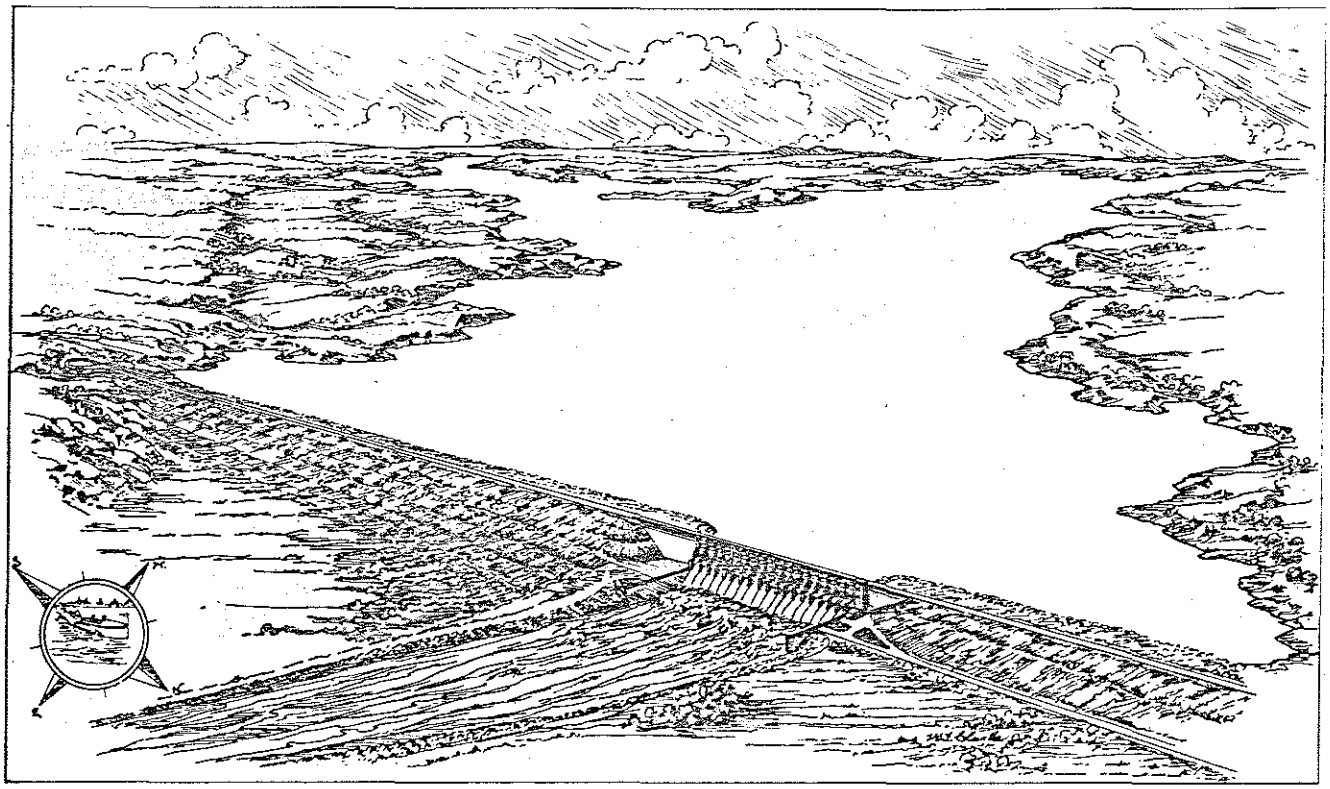
### POWER

Hydroelectric power developments will be installed at all of the dams on the main stem of the Missouri River, and at certain dams on tributary streams, in accordance with recommendations of the Federal Power Commission. Provision is made at certain other dams for the future construction of power plants to meet the increasing demand for electric energy and the increasing need for conservation of fuel resources.

The production of power at dam and reservoir projects listed in Appendix D is incidental, and will be accomplished by utilizing the water which is released from reservoirs primarily for other beneficial uses.



**An aerial view of Kanopolis dam-site. Project features are shown superimposed on the photograph.**



HARLAN COUNTY DAM—Artist's conception of the project, under construction in southern Nebraska. Over-all length, including the overflow section, is 12,000 feet. The reservoir will store water for the irrigation of lands and for the control of floods.

## LANDS AND RELOCATIONS

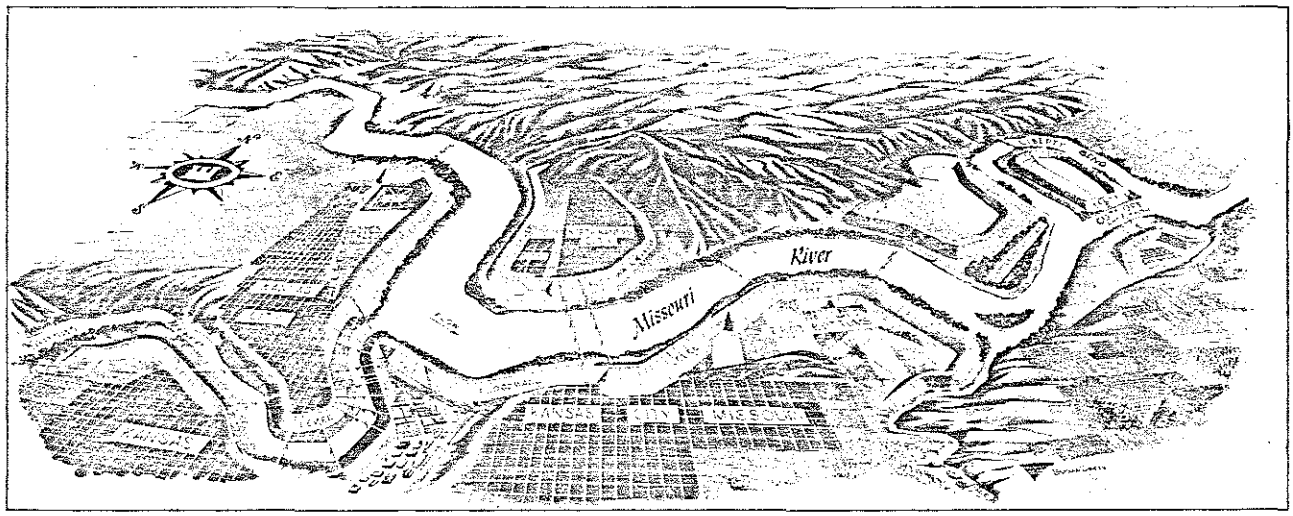
Reservoirs when filled to maximum levels will inundate valley lands behind the dams. These lands will be purchased at a price determined by competent appraisers to be a fair market value. Relocations required of railroads, highways or other utilities situated in reservoirs will be made at Federal cost. Relocated facilities will be equivalent to those which are to be replaced.

A portion of the lands acquired by the Federal Government in connection with reservoir projects may be subject to infrequent flooding. These lands will be leased by the Government for recreational, agricultural or other uses. In accordance with existing law, seventy-five percent of the money received from such leasing will be returned to the State in which the property is situated, to be expended for public schools and roads in the counties in which the property is located.

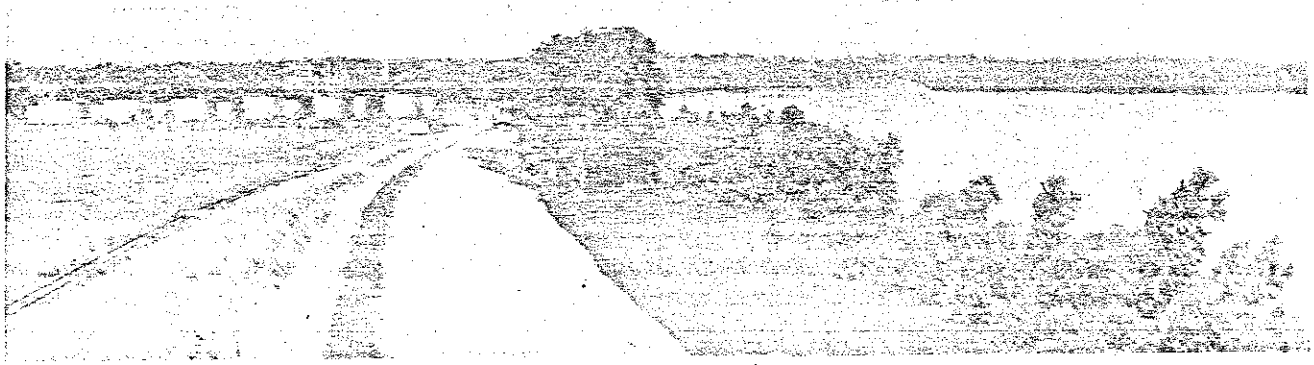
## LOCAL FLOOD PROTECTION WORKS

Repetition of a flood such as that of 1903 would cause damages at the Kansas Citys, Kansas and Missouri, estimated conservatively at $60,000,000 under present day conditions. Municipal and industrial areas at the Kansas Citys which will be provided with flood protection extend along the banks of the Missouri River for about 16 miles, and up the Kansas River a distance of 9½ miles. The protective works will consist of thirteen distinct units which form a unified protection system consisting principally of levees and floodwalls, a channel cutoff, and bridge modifications.

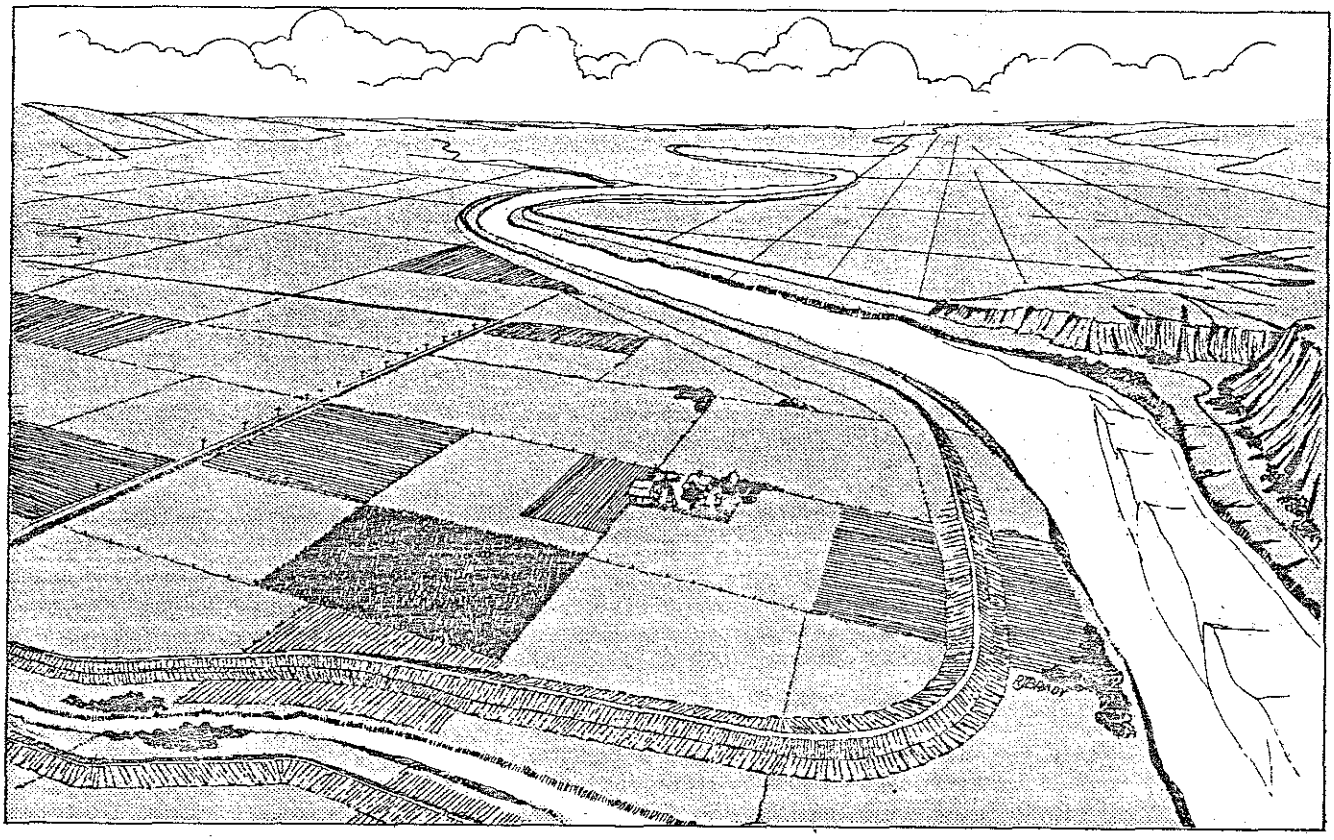
At the cities of Omaha, Nebraska and Council Bluffs, Iowa, which suffered great damage in the flood of 1943, and at other communities and agricultural areas on the tributaries of the Missouri River, the Corps of Engineers is authorized by Congress to provide flood protective works. These will generally consist of a combination of levees and floodwalls, and channel improvement works. Data pertaining to these local protection projects is given in Appendix E.




FLOOD PROTECTION PLAN FOR the Kansas Citys of Missouri and Kansas



LEVEE AT FAIRFAX DISTRICT, KANSAS—One unit of the Kansas Citys protection system.



MISSOURI RIVER LEVEES—Artist's conception of a unit of the Missouri River agricultural levee system.

### *MISSOURI RIVER AGRICULTURAL LEVEES*

Supplemented by reservoirs on the Missouri River and its tributaries, levees built to practicable height will confine anticipated flood flows on the Missouri River within a comparatively narrow channel. This levee system will be constructed for the protection of agricultural areas and small communities along both banks of the Missouri between Sioux City, Iowa and the mouth of the Missouri River, a distance of 760 miles. The floodway width between levees will vary from 3,000 feet at Sioux City, to 5,000 feet in the lower river. The system will consist of a series of individual protective units, tying back to high ground at major drainage courses or at bluff contact with the river. The levees will have a crest width of 10 feet, and side-slopes of 1 on 3 and will be generally constructed of semi-compacted earth fill. The total length of the proposed levee system will be approximately 1,500 miles. The levees will provide protection for approximately 1½ million acres of agricultural land (now subject to flooding) in the Missouri River valley between Sioux City and St. Louis.

### *FARM LANDS PROTECTED BY PROPOSED MISSOURI RIVER LEVEES*

| State | Area Protected |
|---|---|
| Nebraska | 190,000 Acres |
| Iowa | 620,000 Acres |
| Kansas | 25,000 Acres |
| Missouri | 613,000 Acres |

### *MAINTENANCE OF LOCAL PROTECTION WORKS*

Local flood protection projects (including all units of the Missouri River agricultural levee system) constructed by the Corps of Engineers are turned over to the responsible local agency for operation and maintenance after completion. To assist the local agency in administering the project in accordance with regulations prescribed by the Secretary of the Army, the District Engineer ordinarily provides a manual containing a set of plans of the projects and supplemental instructions to guide the administrating agency in maintaining and operating the project.

## OPERATION OF RESERVOIR PROJECTS

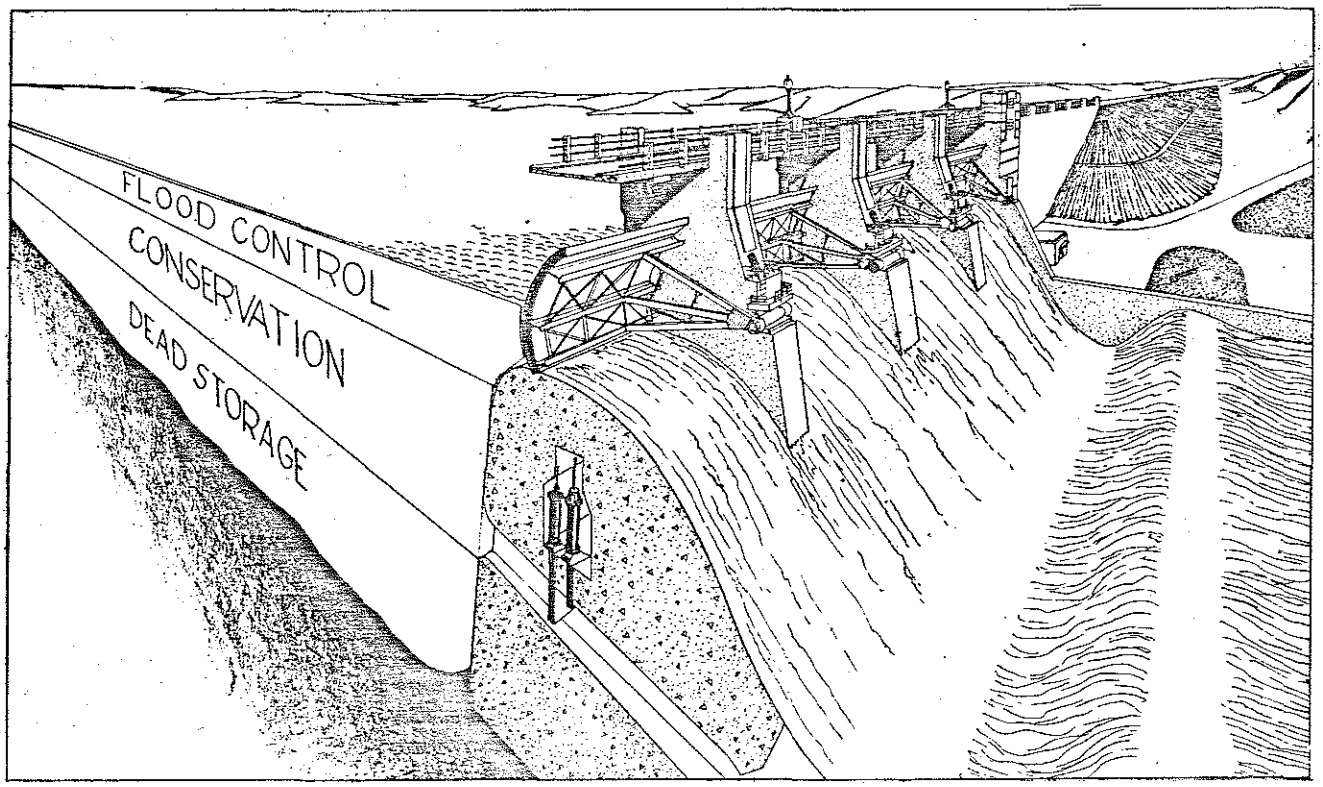
Each of the multiple purpose reservoirs on the main stem of the Missouri River will be operated in coordination with other reservoirs of the system to regulate the natural widely varying flow to the requirements of flood control and allied beneficial uses. Excess water impounded during floods and periods of abundant natural stream supply will be put to useful purpose whenever it may be safely released. During the several seasons of each year water will be stored in such a manner as to adjust the natural flow to the beneficial uses during that year. This seasonal plan of operation will be adjusted to conform to a long range program, planned to accumulate natural stream flows during wet year, and to hold this excess water for drouth years, when it will be drawn out of the reservoir to supplement the deficient natural water supply of those years. A similar plan of operation will be used for multiple purpose reservoirs on tributary streams.

Water stored in reservoirs for irrigation will be released in accordance with Bureau of Reclamation plans. Electric energy generated in excess of that needed for operation of the project will be delivered to the Secretary of the Interior for marketing at rate schedules approved by the Federal Power Commission.

Under the provision of the 1944 Flood Control Act, as amended by the 1946 Flood Control Act, the Corps of Engineers is authorized to construct, operate and maintain public park and recreational facilities on project lands, or it can permit these functions to be performed by others. In accordance with this responsibility, a master recreation plan for recreational and related development at each Corps of Engineers reservoir is now being prepared or will be studied when project planning is initiated. The advice and assistance of federal, state, and local government agencies and other interested parties is obtained in preparing these plans, in developing recreational facilities and in protecting and managing the fish and wildlife resources.

## MISSOURI BASIN INTER-AGENCY COMMITTEE

Cooperative procedures, and the coordination of problems and responsibilities of the various interested agencies and parties concerned with the development, are facilitated by the Missouri Basin Inter-Agency Committee, on which are represented the Departments of Interior, Commerce and Agriculture; the Federal Power Commission; the Corps of Engineers; and the ten Missouri Basin states.

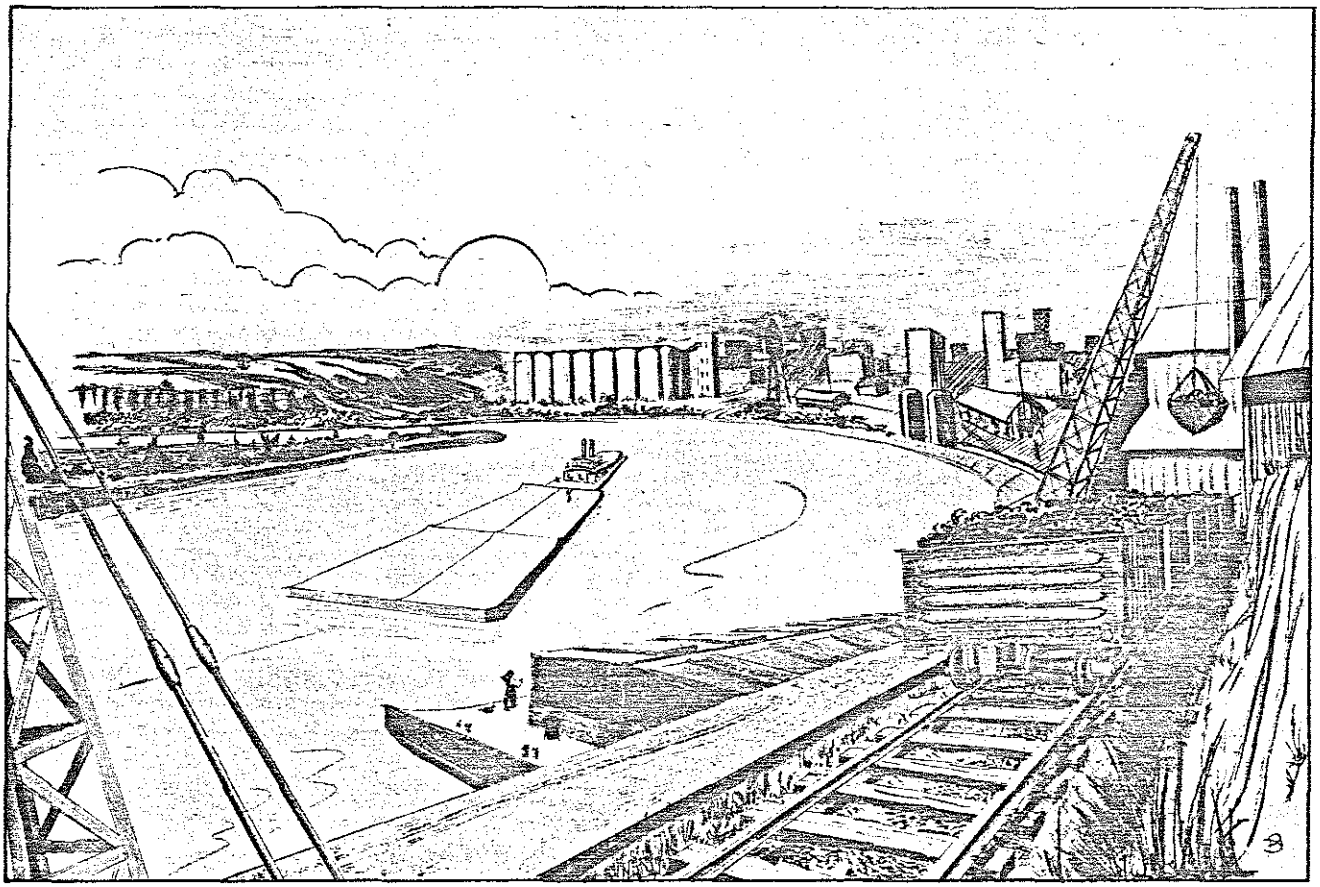



RESERVOIR STORAGE CAPACITY may be utilized for various purposes such as irrigation, flood control, navigation, public water supply, power, pollution abatement, recreation pool and sedimentation.

### *NAVIGATION PROJECT*

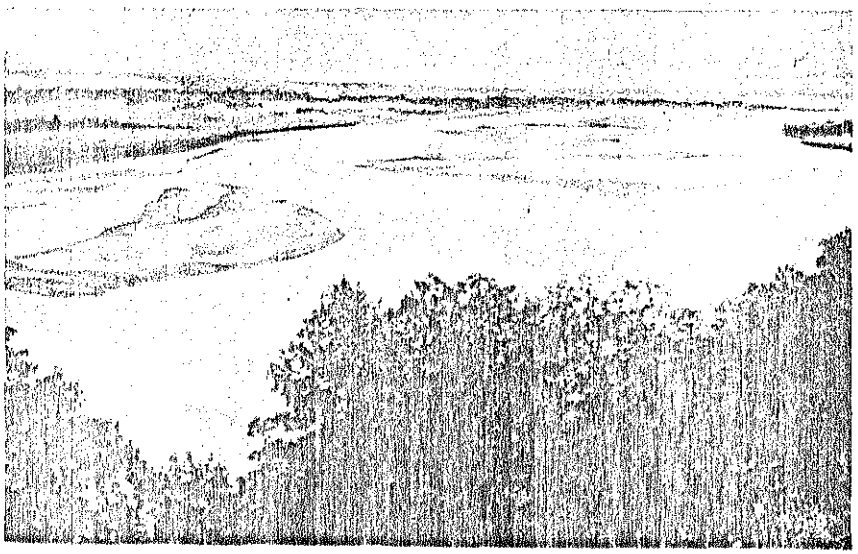
Construction of the navigation project on the Missouri River between Sioux City and the mouth has been prosecuted continuously since 1928, with the exception of the war years. The 760 mile long navigable channel is being secured by means of pile dikes and revetment, the most practical and economical method of controlling the lower Missouri River. The dikes direct and control the river; the revetment stabilizes its banks. These principal structural features are supplemented where necessary by cut-offs to eliminate long bends and minor channels, and by dredging and snagging operations. The improved river will have a navigable channel with a minimum width of 300 feet and a minimum depth of 9 feet.

The recent World War resulted in a reduction in river traffic on the Missouri River due to the transfer of towboat and barge equipment to other waterways, but a growing interest in navigation and the establishment of commercial barge service is becoming increasingly apparent. Facilities for handling commodities shipped by water are available at several cities and many others are considering installation of such terminal facilities. Navigation between Kansas City and the mouth is now well established. Commercial navigation to Omaha, Nebraska, was initiated in the spring of 1947 and extension of service to Sioux City, Iowa is expected in the immediate future. A project for improvement of the Big Sioux River in the vicinity of Sioux City, Iowa as a boat harbor was authorized in 1946. Engineering studies have been made which show that extension of navigation on the Missouri River above Sioux City will be feasible when prospective tonnage estimates warrant its development.

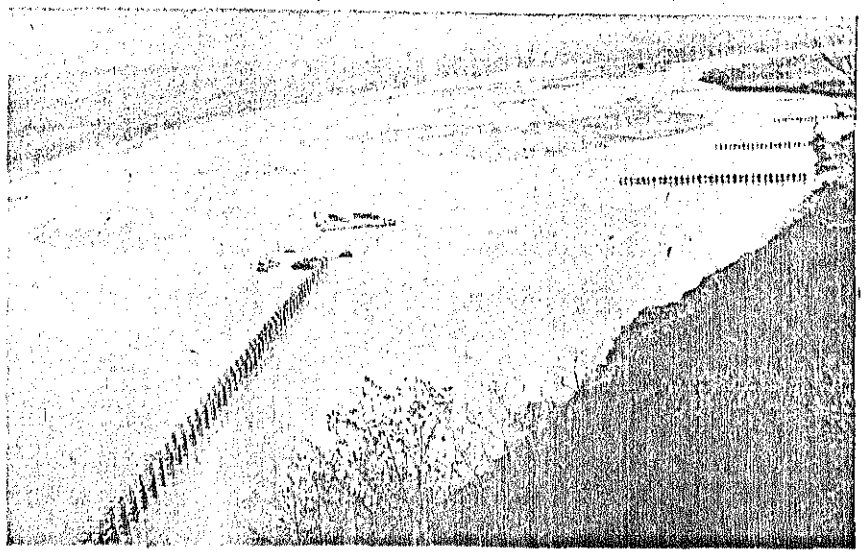


TYPICAL BARGE SCENE on the Missouri River.

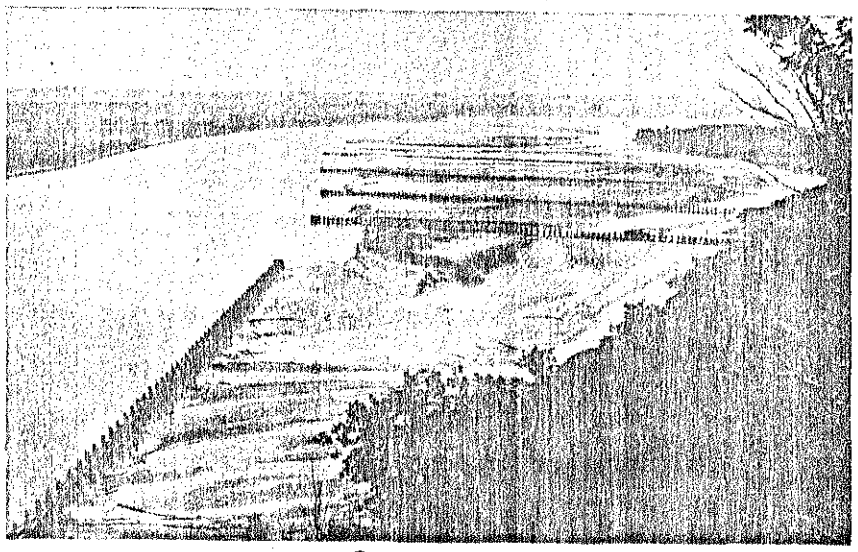
The navigation structures on the Missouri River below Sioux City are stabilizing the river course, preventing shifting of the channel and erosion of farm lands and farm levees, and reducing the damage to highways, railroads, and public works. The deposition of silt behind the dikes is also permitting the reclamation of formerly useless channel areas for agricultural use and creating thousands of acres of excellent wildlife habitat.



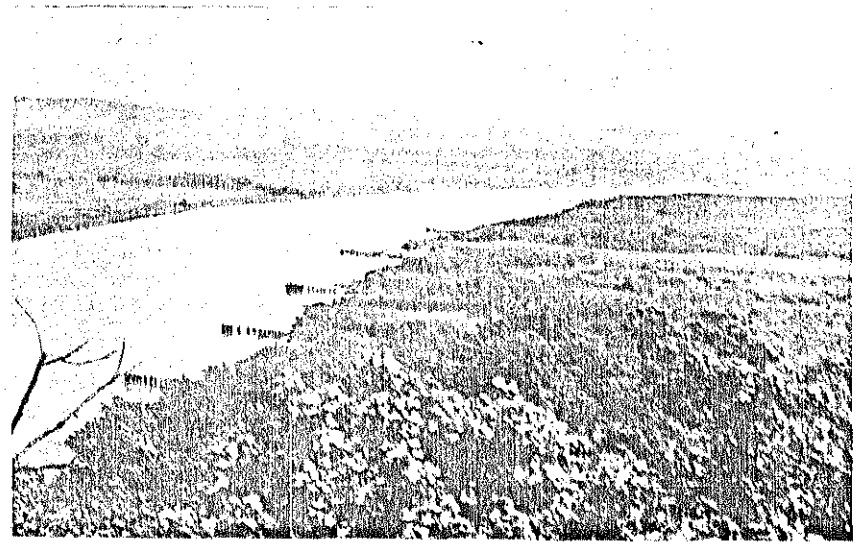
August 1934



November 1934



October 1935



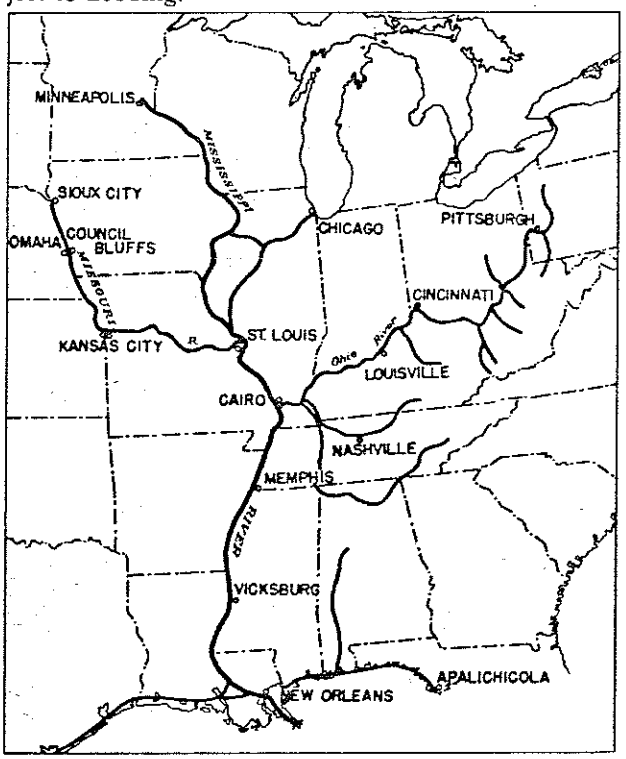
May 1946

PROGRESSIVE EFFECT OF RIVER REGULATION WORK is shown in above photographs. Top left view shows a typical Missouri River bend before improvement work started. Top right view shows the completed structures in place. The bottom photographs demonstrate the effect of the dikes in stabilizing the channel and reclaiming land behind the dikes.

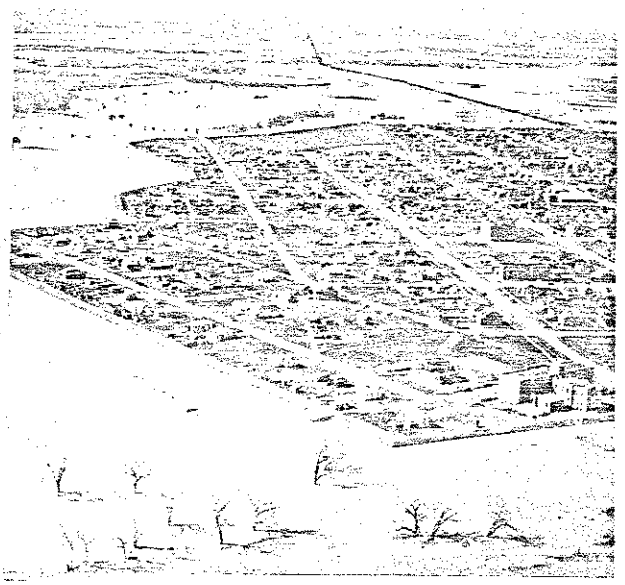
# Services Performed by Controlled River

### *FLOOD PROTECTION AND RIVER REGULATION*

RESERVOIRS and localized protection works now authorized by Congress will assure protection for over 2,000,000 acres of agricultural land and many communities in the Missouri River Basin. The flood curbing effect of the approved reservoir system will also be felt in the Mississippi River valley, where river stages during major floods will be reduced. The value of flood protection is vividly illustrated in the photograph shown at the right. These flood control works will undoubtedly prevent the future loss of many lives, and will permit the operation of transportation facilities and communication and other utility systems without costly interruption. They will enable waste lands and other lands of low productivity to be restored to the normal, most beneficial usage, and will generally enhance land values and crop incomes. They will encourage industry to develop sites suitable for manufacturing in bottom lands which previously were subject to flooding.




THE MISSOURI RIVER WATERWAY is potentially an important arm of the Mississippi navigation system.



COMPLETE FLOOD PROTECTION—Aerial photograph of Glasgow, Montana, taken during the flood of March, 1939, on the Milk River. The levee was constructed in 1938 by the Corps of Engineers.

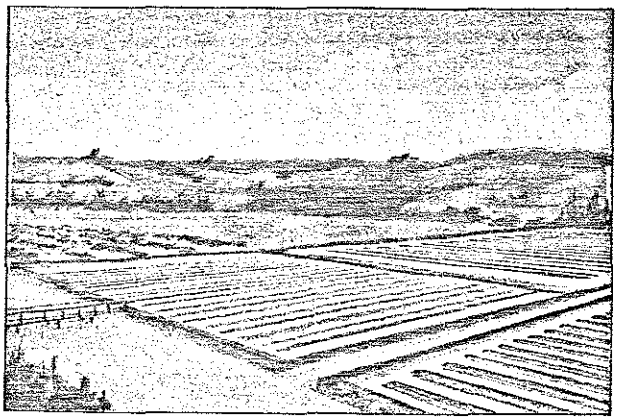
The conservation and readjustment of river discharges will increase low water flows which are responsible for serious shortage of water supply at certain municipalities in and contiguous to the Missouri basin. The increased uniformity of flow will have a beneficial effect in alleviating stream pollution.

By providing increased releases of water during periods of low flow in the Missouri River and the Mississippi River in the vicinity of and downstream from St. Louis, the reservoir system will decrease navigation maintenance costs and permit passage of river craft which otherwise would have to proceed at reduced draft unless other more expensive means were utilized to provide adequate channel depths for navigation.

Millions of tons of commodities are potentially available annually for transportation on the Missouri River. It is natural that the Missouri River should eventually assume a position as one of the great waterway commerce carriers of the nation.

### IRRIGATION

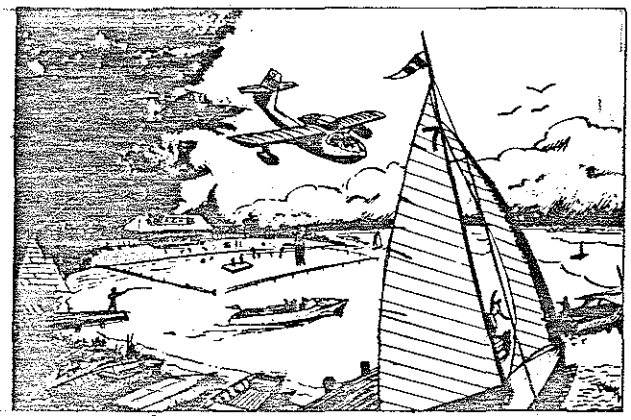
The multiple purpose reservoir system on the main stem of the Missouri River will conserve millions of acre feet of water annually for irrigation purposes. It will permit gainful production of crops and will stabilize agriculture in the arid and semi-arid regions of the Missouri basin, and in areas beyond the drainage limits of the Missouri River.



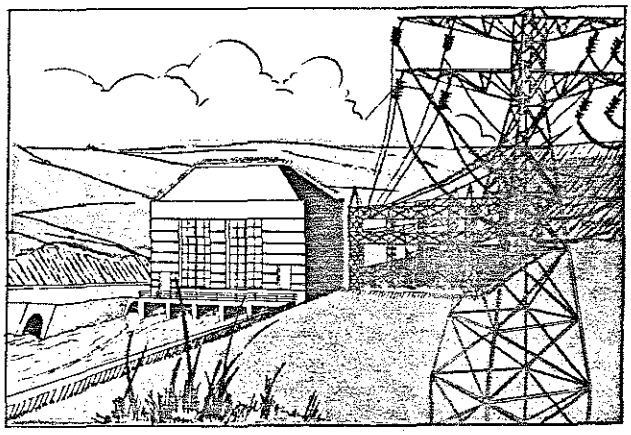
WATER WHEN NEEDED on farm lands.

### RECREATION

The vast system of artificial lakes to be created by the proposed construction will provide the Midwest with a valuable recreation asset. Facilities for fishing, boating, camping and other recreational activities will be developed, in cooperation with local authorities, and shore areas will be protected for the propagation of wildlife. Residents of the valley will benefit from the vacationist and tourist trade, and people in and out of the basin can enjoy the recreational facilities which will be made accessible as the demand develops.



RESERVOIR AREAS AND ADJACENT LANDS will offer attractive opportunity for recreation, and for the preservation and propagation of fish, water fowl and wildlife.



ABUNDANT POWER for all users.

### POWER

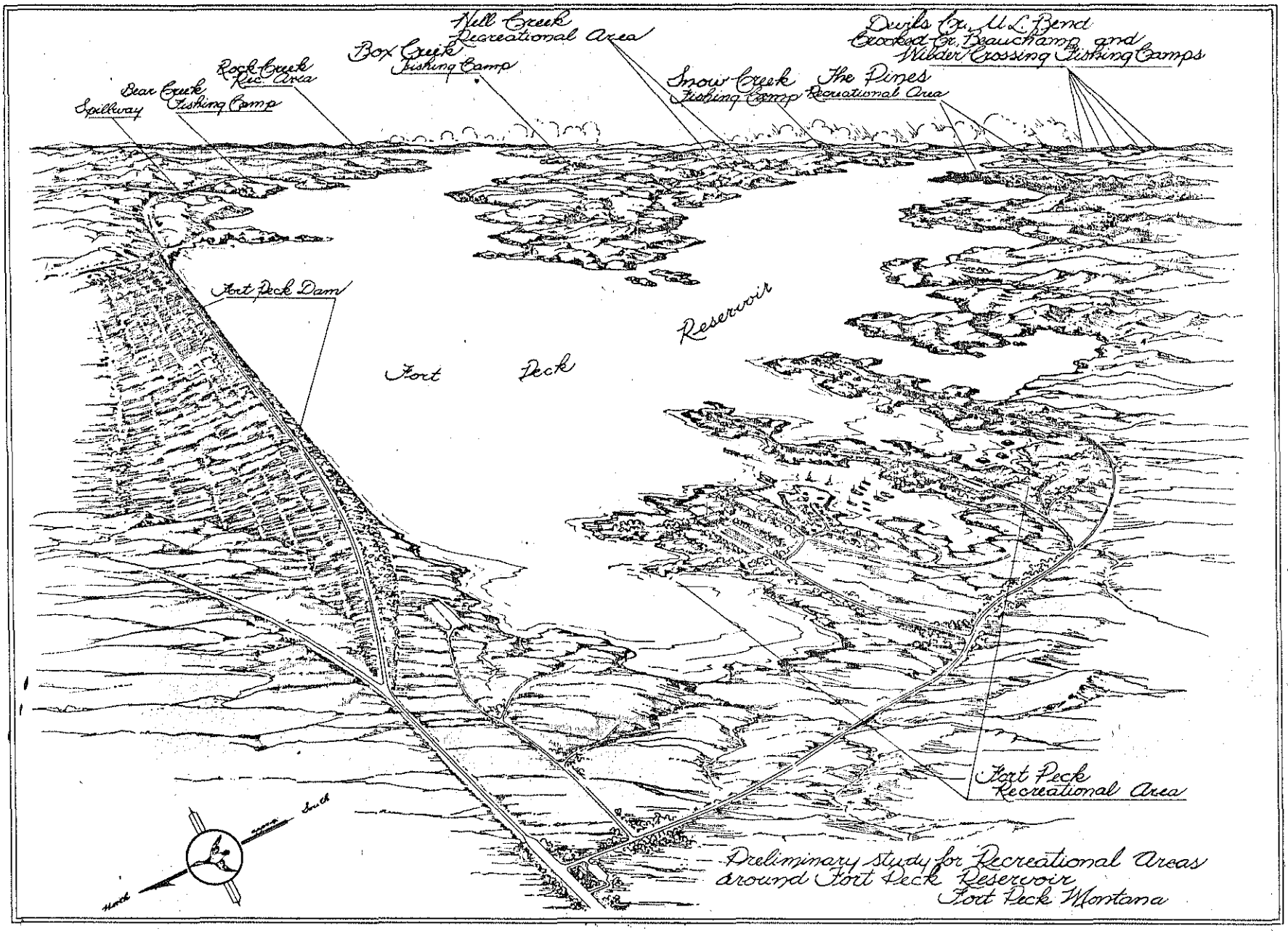
Electric power developed at dam sites will be distributed by the Department of the Interior, at the lowest possible rates consistent with sound business principles. It will be transmitted to farms and to cities, for domestic, commercial and industrial uses. It will be made available to municipal, cooperative and private utilities.

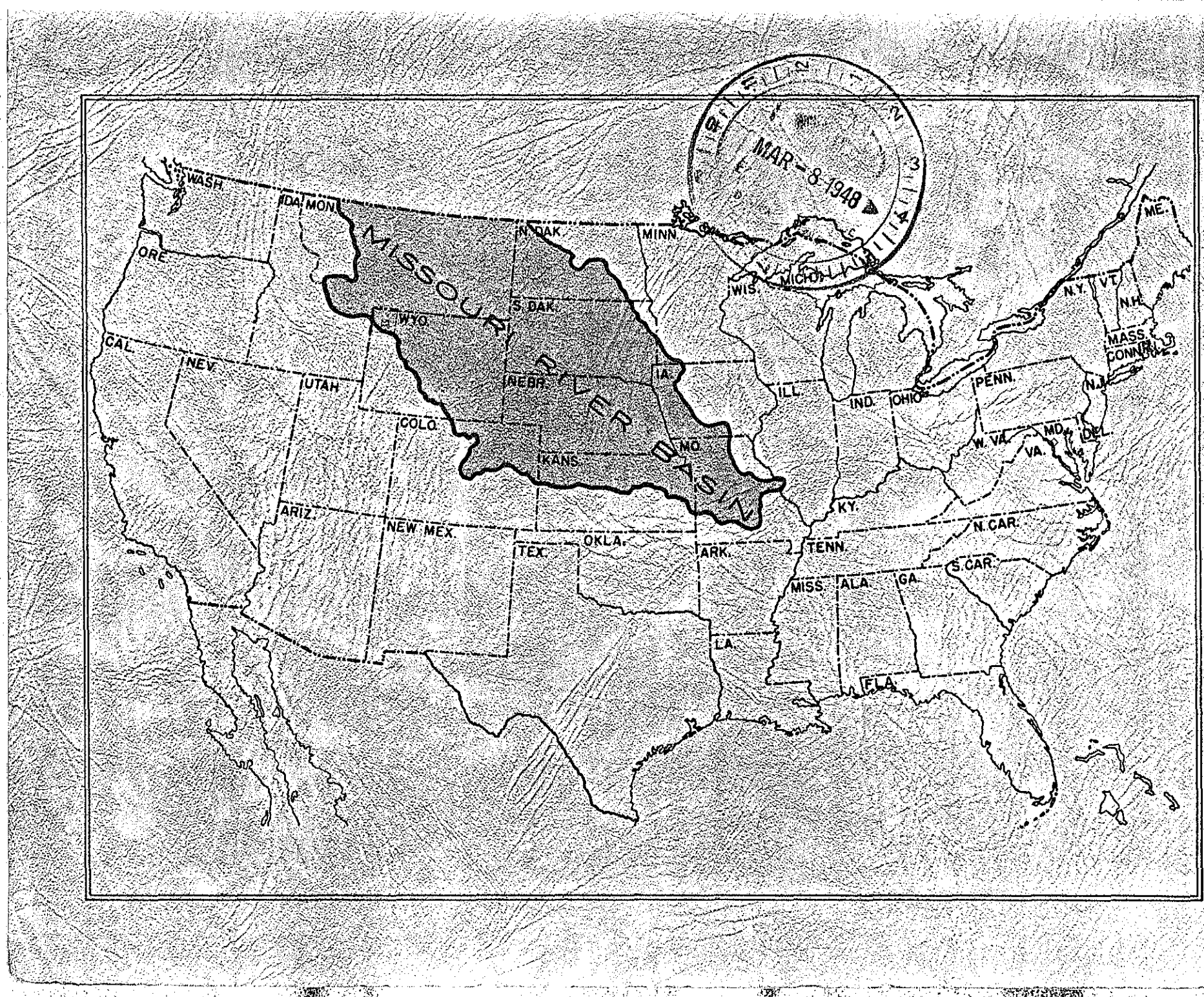
### NEW OPPORTUNITIES

The comprehensive program of stream basin development being undertaken by the Missouri River Division, in coordination with Federal, State and local agencies, will produce direct, initial benefits exceeding the cost of the work by a considerable margin. The stimulus to agricultural, industrial and municipal growth and prosperity should ultimately outstrip these initial benefits. Opportunities available to the people living in the Missouri River basin will be greater than ever before in our history and the economy of the entire nation will be immeasurably benefited.

### FLEXIBILITY OF BASIN PLAN

The approved comprehensive plan for flood control and related water uses is a flexible plan, subject to modification and expansion by Congressional action. Undoubtedly there are many rural and metropolitan areas in the Missouri basin which are inadequately protected from floods and are not currently provided with authorized river improvement or protective works. Whenever the need arises, the people in these areas, acting through the Congress, may ask for an investigation of possible flood protective measures, for the purpose of determining the advisability of such projects. A report covering the investigation may then be submitted to Congress, and projects which are favorably reported are usually included in a river and harbor or flood control bill. Upon enactment of the bill into law, projects included therein become authorized, and construction may be prosecuted as funds are appropriated by Congress.


Hell Creek
Recreational Area
Box Creek
Fishing Camp
Rock Creek
Rec. Area
Bear Creek
Fishing Camp
Spillway
Snow Creek
Fishing Camp
The Pines
Recreational Area
Dunks Ex. U.L. Bend
Crooked Ex. Beauchamp and
Wilder Crossing Fishing Camps
Fort Peck Dam
Reservoir
Fort Peck
Fort Peck
Recreational Area
Preliminary Study for Recreational Areas
around Fort Peck Reservoir,
Fort Peck Montana


MISSOURI RIVER BASIN
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