

CHAPTER 8 - MIDDLE MISSOURI SUBBASIN

SUBBASIN DESCRIPTION

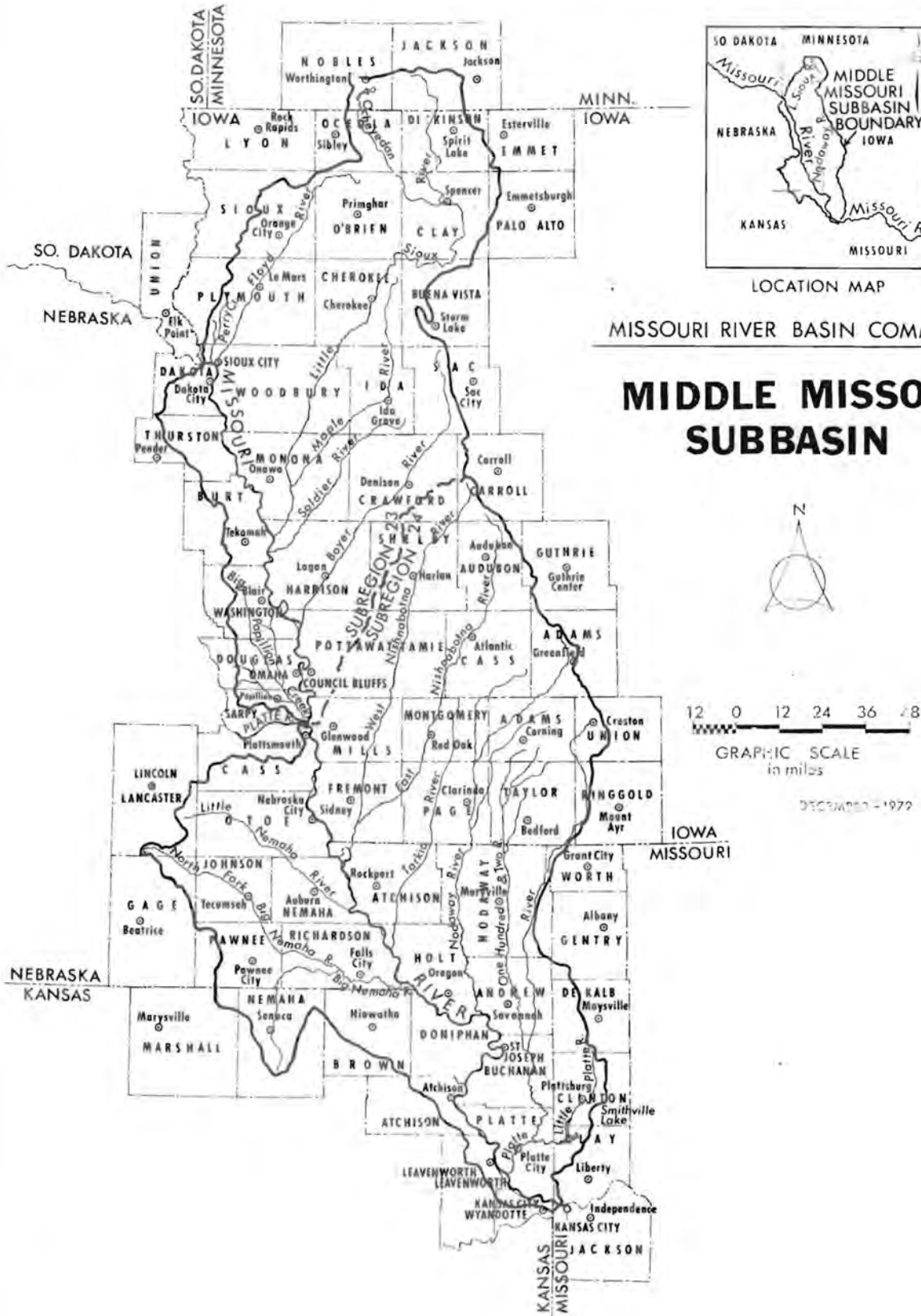
The Middle Missouri Subbasin covers an area of 14.8 million acres in the east-central portion of the Missouri River Basin. As shown in figure 8-1, it includes lands drained by all of the direct tributaries of the Missouri River from Sioux City, Iowa, to Kansas City, Missouri, except Nebraska's Platte River. Principal among these are the Little Sioux River draining the northern portion southwestward, the Nishnabotna River flowing southward from the center of the subbasin, and the Nemaha River flowing southward along the eastern boundary.

The topography in general is a rolling, irregular plain. Along the main stem of the Missouri River and its principal tributaries are flat bottomlands with bluffs often having several hundred feet of local relief. The elevation of the Missouri River varies from 1,220 feet (mean sea level) at Sioux City, Iowa, to 750 feet at Kansas City, Missouri. The subbasin drains generally north to south and extends about 325 miles north-south, and 175 miles east-west.

Average annual precipitation varies from 26 inches in the northwest to 36 inches in the south but annual precipitation often varies greatly from those averages. July is normally the subbasin's warmest month and January the coldest. Mean daily maximum temperatures in January range from 26 degrees in the north to 40 degrees in the south, and in July, range from 86 to 92 degrees. The average frost-free period varies from approximately 150 days in the north to over 180 days in the extreme south.

Although most lands in this subbasin have been either agriculturally or industrially developed, native ecosystems such as eastern deciduous forests or grasslands persist in areas where dominant natural features have inhibited

Figure 8-1-Middle Missouri Subbasin



development. However, most of these lands are in private ownership and survival is uncertain.

Eastern deciduous forests and flood plain forests are extensive along the Missouri River and, to a lesser extent, along some of the major tributaries. The Loess Hills region of Iowa contains the greatest acreage of eastern deciduous forest. In other scattered areas, particularly in northwestern Missouri, southeastern Nebraska, and northeastern Kansas, relics of the former oak-hickory-prairie savanna occur in upland regions several miles from the river bottoms.

Forested lands occupy less than 5 percent of the total subbasin landscape but provide a large portion of the habitat base for deer, quail, squirrel, cottontail, and wild turkey. They are also the last refuges for regionally threatened, rare, or declining fauna such as the woodchuck, southern flying squirrel, whip-poor-will, pileated woodpecker, several species of warblers, several raptors, and several reptiles and amphibians. Several species of plants also depend upon the hardwood forest for survival.

Widely scattered relics of the tall-grass prairie ecosystem persist in the upper reaches of the Little Sioux River, including the prairie lakes region in Iowa, and along the Loess Bluffs of the Missouri River. These lands support much of the original native prairie flora and fauna including many species which are naturally rare or are regionally declining. Examples include the northern greater prairie chicken (Nebraska and Kansas only), white-tailed jackrabbit (extinct in Kansas), spotted skunk, Franklin ground squirrel, prairie falcon, and certain reptiles. Populations of the endangered white lady-slipper, an orchid, may persist in certain remote areas. Certain agricultural regions, especially where good interspersed land uses occur, afford excellent upland habitat and provide key habitat for wildlife.

Aquatic resources, although limited both in diversity and quantity, include natural prairie lakes and prairie potholes of Iowa, the farm ponds and small reservoirs throughout the subbasin, free-flowing reaches of the Missouri River, major tributary streams, and various stream-related ponds and wetlands.

Fishery resources are of variable quality. Good fisheries occur in some of the natural glacial lakes of Iowa, in certain small farm ponds and small reservoirs, and in some oxbow lakes along the Missouri River. Populations of fishes in most streams are dominated by rough fish, but in some reaches channel catfish can be harvested. Certain rare, threatened, or endangered fish persist in the Missouri River, including the unique paddlefish, the lake pallid and shovelnose sturgeons, and several native forage species.

Waterfowl habitat is even more limited and is largely confined to the natural wetlands region in Iowa. Existing water resources including oxbow lakes, ponds, and reservoirs along the Missouri River are used heavily by waterfowl during migration. Such resources in the southern portion of the subbasin provide a wintering range. Large geese populations and small numbers of the northern bald eagle are also common around Federal wildlife refuges during winter.

The Missouri River corridor, especially the bluffs, forests, islands, and oxbow lakes, contribute much to the diverse landscape quality of this region. The corridor is nationally significant as part of the Lewis and Clark National Historic Trail. The Loess Bluffs and prairie lakes landscapes in Iowa and the Nemaha, Nishnabotna, and Little Sioux bottomland forests are also significant natural and aesthetic resource areas.

The subbasin contained the basin's third largest population in 1975. Future projections indicate the total subbasin population should continue stable growth and reach approximately 1.65 million persons, an increase of 25 percent, by the year 2000.

Three Standard Metropolitan Statistical Areas with a combined 1975 population of 792,800, are located within the Middle Missouri Subbasin. The three, Omaha, Nebraska-Iowa (572,900), Sioux City, Iowa-Nebraska (120,000), and St. Joseph, Missouri (99,700), collectively constitute 60 percent of the total subbasin population, and 86 percent of its total urban population.

Approximately 2,200 native American Indians live in the subbasin. Highly variable out migration and return migration rates among Indians complicate accurate estimates of demographic data for this group.

In 1975, about 36 percent of the total population or 471,000 persons were employed. Of this total, only 12 percent or 56,200 persons was engaged in agriculture. This figure has continually declined over the last few decades. Employment in nonagricultural economic pursuits has, however, enjoyed a continued rise. Approximately 415,000 persons, or 88 percent of the work force are employed in nonagricultural sectors. Total employment is projected to reach 586,900 persons, an increase of 25 percent over the 1975 level, by the year 2000.

Agriculture is the dominant land use in the subbasin but the major use of water is for thermal electric power generation. Other major water uses include municipal and industrial and irrigation.

Depletions to streamflow within the subbasin are relatively low, totaling only 232,000 acre-feet in 1975. This level is expected to increase to 430,000 acre-feet by the year 2000. However, withdrawals total nearly 10 times depletions due to large diversion for once-through cooling at several steam-electric plants located along the Missouri River.

The 1975 average annual outflow from the subbasin, measured at Kansas City, Missouri, was estimated to be about 28 million acre-feet. Remaining

flows are projected to decline by some 3.2 million acre-feet by 1985 and by another 3.7 million by the year 2000.

Most of the streams within the subbasin are comparatively small, and seasonal water shortages are common. Because the streams drain primarily agricultural areas, runoff causes high concentrations of nitrates, phosphates, and insecticides. Normally, concentrations of inorganic salts are low.

Most streams carry heavy loads of suspended sediment. Turbidity is high most of the time. All have experienced undesirably low levels of dissolved oxygen due to inadequately treated waste waters, low flows, and warm water temperatures. Low dissolved oxygen levels also occur after heavy runoff because of high turbidity.

The States of the Middle Missouri Subbasin govern the use of water through several different legal systems. Minnesota and Missouri recognize the riparian doctrine. Kansas and Nebraska depend upon prior appropriation systems but acknowledge riparian doctrine in varying degrees. Iowa makes substantially all uses of water subject to permit and administrative regulations governing diversion, storage, and withdrawal over a period of time not exceeding 10 years.

PROBLEMS AND OPPORTUNITIES

Nonpoint source pollution is the major water resources problem in the Middle Missouri Subbasin. Other major problems include flooding along many of the tributary streams, consumptive use and diversion by upstream States which decreases the amount of water available for downstream use, drinking water of poor or unacceptable quality, oxbow lake elimination and channel straightening, and demand for water access and recreational facilities.

Steep slopes and soil types in Iowa and northwest Missouri cause severe gully erosion. Streambank erosion is a principal problem in the Nemaha Basin in Nebraska, and in the Nishnabotna and Nodaway Basins in Iowa. Nebraska

counties between South Sioux City and Omaha have the highest soil loss in the State. In some areas in northwest Missouri, the problem has evolved a full cycle. The natural winding streams were straightened and channelized some 30 to 40 years ago; severe streambank erosion has since occurred, and the streams have returned to the natural course.

Flooding problems in this subbasin have many aspects. Flooding is still a problem along several tributary streams in the Middle Missouri Basin. In many of the smaller communities, there is at present no feasible and acceptable structural solution. Problems in a number of smaller communities have been studied in the past by various State and Federal agencies. Potential structural solutions have not been found to be economically acceptable in most instances, and suggested alternatives have not generally been accepted by local people. Even though levees have been constructed along the Missouri River, flooding continues to be a problem in Nebraska downstream of the Missouri's intersection with the Platte River in Nebraska. Private levees are being moved or constructed too close to the river, infringing on the floodway and shifting flood damage to other areas. Tieback levees on some tributary streams were designed and constructed to provide 50-year protection from flooding on both the main stem and tributaries. Due to numerous factors, including aggradation of the stream beds of the tributaries, this level of protection has dropped to a 10-year or 25-year event.

The energy crisis of the 1970's has spotlighted the fact that projected power demands nationally will necessitate the construction of additional power plants in the subbasin. New power plants will need to be located on the major rivers in order to permit the assimilation of discharged cooling water and to cause the least possible adverse environmental effect. Disposal of power plant cooling waste into smaller bodies of water where thermal pollution can be controlled would provide an opportunity for improved production of fish.

Drinking water quality problems occur in Otoe and Cass County, Nebraska, in the Sioux City, Iowa, area, and in southwest Iowa. Ground water has historically been the source of most of the rural domestic water in the subbasin. While the quality and quantity of these sources has generally been sufficient in the past, conflicts between rural domestic and urban water uses have begun to occur. In some rural households, drinking water does not meet standards established by the Federal Safe Drinking Water Act. This is due to the naturally poor quality of available water and to continued quality degradation from both point and nonpoint sources of pollution in the area.

Oxbow lake elimination and channel straightening on the Missouri River main stem and tributary streams are reducing and changing the fisheries habitat in the Middle Missouri Subbasin. Lost wetlands are not being replaced by maturing wetlands in these areas, and fish and wildlife are being adversely affected by man's activities, including cropping all available lands.

There is a documented demand for water access and recreational facilities in the metropolitan areas such as Sioux City, and Council Bluffs, Iowa, and St. Joseph, Missouri, and in all of southwestern Iowa. While there is some fishing on the main stem, there has been a demand for flat water or lake recreation. Population growth of the metropolitan areas in the Middle Missouri Subbasin has overtaxed existing facilities. Some work has been done to improve recreation such as the Lake Manawa Project in the Council Bluffs area, but there is a need for more active development of recreation areas, facilities, and public access.

PLANNING OBJECTIVES

Each of the five States located of the Middle Missouri Subbasin has comprehensive planning programs for the wise and beneficial development, management, and use of water resources. Most have mechanisms to develop a

State water plan, and methods for continually updating information for decisionmaking. All five States have the concrete objective to minimize or reduce flood damages and losses resulting from floods. The States of Iowa, Nebraska and Minnesota emphasize the use of nonstructural measures.

For fish and wildlife, the States have programs involving conservation and management in a general sense. The State of Iowa recognizes certain designated streams as having exceptional recreation and fish and wildlife uses, and provides for their special protection against low flows and water withdrawals. In the State of Kansas, while fish and wildlife protection is required by law, there is no State policy in effect for preserving habitat. The State does maintain a list of protected flora and fauna, however.

Irrigation objectives in the Middle Missouri Subbasin differ from State to State. The objective of Nebraska and Kansas is to develop irrigation potential and provide an adequate supply of water for irrigation. Minnesota and Iowa objectives are tempered by the qualification that water permits for irrigation should be issued on a case-by-case basis. Iowa encourages private funding of individual farm irrigation development, reserving the use of public funds for cases where increased food and fiber production are considered in the public interest. In Missouri, irrigation is not as commonly practiced as in the other States. The State's goal is to protect and foster development of agricultural resources, including the State's limited irrigation opportunities.

Improvement of land treatment and land conservation and management in this subbasin are clearly recognized objectives. Protection of the productivity of soils, control of erosion, and reduction of sediment loading in streams are all actively pursued. Four of the States in the subbasin have objectives of meeting the municipal, industrial, rural domestic, and livestock water quality needs wherever feasible. Nebraska and Kansas generally support all methods of

providing water, especially to small communities. Iowa and Minnesota modify their support by encouraging water users to adopt water conservation measures. Missouri has an objective to implement training and technical assistance programs to assist in water conservation, and will strive to monitor the quality of finished water, review plans for construction of water supply facilities, and inspect such facilities in an effort to maintain the purity of drinking water.

Power and energy objectives vary somewhat from State to State. Minnesota opposes actions that would severely impair hydropower generation in the Missouri River or its delivery to current Minnesota users. Location of power plants is of major concern to Iowa, Kansas, and Missouri for many reasons. Thermal and other pollution at power plant sites is basically limited to major waterways such as the Missouri River.

Transportation objectives of the subbasin States recognize the importance of Federal participation. Iowa specifically encourages the Federal Government to finance and maintain the navigation on the Missouri River.

PLAN OVERVIEW

The plan for the Middle Missouri Subbasin includes the programs recommended in this chapter, the programs recommended basinwide in chapter 2, and the statewide programs that are recommended for the five States of Minnesota, Nebraska, Iowa, Kansas, and Missouri in chapter 2.

As stated earlier, nonpoint source pollution is a major subbasin problem. An important recommendation of the Middle Missouri Subbasin plan is, therefore, to actively address agricultural runoff problems through implementation of the Rural Clean Water Program, established by Section 208(j) of the Clean Water Act of 1977, which would control agriculturally nonpoint sources of pollution on private lands.

Flooding problems cited above are addressed in the plan by many recommended Army Corps of Engineers programs. Flooding occurs in many small communities where presently no feasible and acceptable structural solutions are available. To address these problems, a number of studies are recommended for the post-1986 period, by which time social or economic conditions may have changed enough to warrant new investigation. These studies involve the Boyer River, Floyd River Basin, Little Sioux River Basin, Nishnabotna River Basin, Soldier River Basin, and Papillion Creek and tributaries.

Many small watershed projects are recommended for rural areas, although many rural flooding problems remain unaddressed. Because watershed planning and construction costs are quite high and the funding level for this program is relatively low, the need for this program will exist for a good many years.

The important problem of loss of wetlands and effects on fish and wildlife caused by construction, operation, and maintenance of the navigation on the Missouri River main stem is addressed by the Corps of Engineers' Missouri River Fish and Wildlife Mitigation Study. Another important recommendation concerns the problem of municipal, industrial, and rural water supply. In recreation orientated growth areas, utility systems have not kept up with the demand. Coordinated region-wide, water-delivery systems are needed. The plan recommends that restrictions in the Farmers' Home Administration's rural water supply program preventing the design of rural water and wastewater disposal systems for future expansion be removed.

RECOMMENDED PROGRAMS - MIDDLE MISSOURI

NAME, LEAD AGENCY, AND FUNCTIONS ADDRESSED

DESCRIPTION

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

- 1-NORTHERN MISSOURI TRIBES COOP STUDY, MISSOURI, IOWA
 USDA/Soil Conservation Service
 Comprehensive
 Also in Lower Missouri Subbasin

 Ongoing river basin planning thru FY 82; eleven reports completed; develop alternate plans on major streams; study cost \$2.2 million.

- 2-MO RIVER TRIB, SIOUX CITY, KANSAS CITY, SUBREGIONAL ANAL
 Missouri River Basin Commission
 Comprehensive

 New start river basin planning beginning in FY 84; tributaries of Missouri River between Sioux City and Kansas City; IA, KS, MO, NE; cost \$300,000.

- 3-SOUTHWEST IOWA WATER RESOURCES STUDY
 Iowa Geologic Survey
 Comprehensive
 Also in Lower Missouri Subbasin

 New start data collection & research beginning in FY 82; five year comprehensive water supply availability study; cost \$750,000.

- 4-NORTHWEST IOWA WATER RESOURCES STUDY
 Iowa Geologic Survey
 Comprehensive

 Ongoing data collection thru FY 82; five year test drilling program for stratigraphic model water availability; cost \$750,000.

- 5-SOUTHERN IOWA RESOURCE CONSERVATION & DEVELOPMENT PROJECT, IA
 USDA/Soil Conservation Service
 Comprehensive
 Also in Lower Missouri Subbasin

 Ongoing program implementation thru FY 82; Adair Adams, Taylor, Ringold, Decatur, Wagner, & Clark counties; cost \$2,080,000.

- 6-GOLDEN HILLS RESOURCE CONSERVATION & DEVELOPMENT PROJECT, IA
 USDA/Soil Conservation Service
 Comprehensive

 New start, program implementation; Harrison Shelby, Pottawattamie, Cass, Mills, Montgomery, Fremont & Page counties; application only, no funding.

7-NEBRASKA RIVER BASINS SPECIAL STUDIES
USDA/Soil Conservation Service
Comprehensive
Also in E. and W. Dakotas & Platte-Niobrara Subbasins

Ongoing special studies of erosion, sediment,
rural water and flooding in Missouri tribs and
White-Hat basins; prime farmland mapping in Platte
critical habitat areas; cost \$1.3 million; FY 79-84.

8-STATEWIDE RIVER BASIN STUDY, MISSOURI
USDA/Soil Conservation Service
Comprehensive
Also in Lower Missouri Subbasin

New start special study beginning in FY 82;
statewide comprehensive study in water and land
resources; involves SCS, ESCS & FS; study cost
\$925,000.

FLOODING

9-FLOOD PLAIN MANAGEMENT PROGRAM FOR THE MISSOURI RIVER
Missouri River Basin Commission
Flooding, Land Conservation & Management
Also in Lower Missouri and Eastern Dakotas Subbasins

New start special study beginning in FY 82;
Missouri River mainstem from near Sioux City, IA,
to the mouth near St. Louis, Missouri; study cost
\$400,000.

10-MISSOURI RIVER LEVEE SYSTEM
Army Corps of Engineers
Flooding, Land Conservation & Management
Also in Lower Missouri Subbasin

Ongoing program implementation detailed study;
flood protection mainstem Sioux City, Iowa, to
mouth; active L-611, L-614, R-616; thru 81;
\$6.7 million bal. to complete \$85.3 million.

11-BOYER RIVER BASIN LEVEL C STUDY, IOWA
Army Corps of Engineers
Flooding, Land Conservation & Management

Deferred feasibility study; post FY 86; no
feasible solutions under existing program for
flood & bank erosion control and related purposes;
cost \$294,000.

12-FLOYD RIVER BASIN REVIEW REPORT, IOWA
Army Corps of Engineers
Flooding, Land Conservation & Management

Deferred feasibility study; post FY 86; no
feasible solutions under existing program for
flood control and related purposes;
cost \$365,000.

13-LITTLE SIOUX RIVER BASIN REVIEW REPORT, IOWA
Army Corps of Engineers
Flooding, Land Conservation & Management

Deferred feasibility study; post FY 86; no
feasible solutions under existing program for
flood control and related purposes;
cost \$327,000.

14-NISHNABOTNA RIVER BASIN REVIEW REPORT, IOWA
Army Corps of Engineers
Flooding, Land Conservation & Management

Deferred feasibility study; post FY 86; no
feasible solutions under existing programs for
flood control and related purposes;
cost \$432,000.

15-SOLDIER RIVER BASIN REVIEW REPORT, IOWA
Army Corps of Engineers
Flooding, Land Conservation & Management

Deferred feasibility study; post FY 86; no
feasible solutions under existing programs for
flood control and related purposes;
cost \$310,000.

16-PAPILLION CREEK AND TRIBUTARIES PROJECT, NEBRASKA
Army Corps of Engineers
Flooding, Land Conservation & Management

Inactive program implementation; reservoirs for
flood control, recreation and fish & wildlife
facilities, inactive pending resolution of con-
flicts and litigation; cost to date \$74.5 million.

17-METROPOLITAN SIOUX CITY AND MISSOURI RIVER, IOWA,
NEBRASKA AND SOUTH DAKOTA
Army Corps of Engineers
Flooding, Land Conservation & Management

Ongoing feasibility study-program implementation
for flood control and related purposes on
Perry Creek, Sioux City, IA, cost \$20,500,000.

18-PLATTE RIVER RESTUDY, MISSOURI
Army Corps of Engineers
Flooding, Land Conservation & Management

New start feasibility study beginning FY 81;
restudy of authorized Platte River channel improve-
ments to determine feasibility;
cost \$160,000.

19-MAIN DITCH NO. 6 NEAR HAMBURG, IOWA
Army Corps of Engineers
Flooding, Land Conservation & Management

New start special study; local flood protection
reconnaissance study. Completion scheduled
FY 81; study cost \$150,000.

20-EAST NISHNABOTNA RIVER AT RED OAK, IOWA
Army Corps of Engineers
Flooding, Land Conservation and Management

Resumption feasibility study; local flood
protection-detailed progress report. Construction
started, expected completion FY 81; project
cost estimate \$900,000.

- 21-KANSAS AND OSAGE RIVERS, KANSAS STUDY
 Army Corps of Engineers
 Flooding, Land Conservation & Management

 Ongoing special study thru FY 83; streambank stab. on KS River & tribbs, mineral pollution control in KS River Basin & additional water supply & distrib. in KS & Osage; study cost \$4.5 million.

- 22-A&T LONG BRANCH WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Adams & Taylor counties; recommended for planning; project envisions 25 grade stabilization structures; cost \$2 million.

- 23-ALLEN-STEER CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Harrison & W. Pottawattamie counties; recommend for planning; project envisions 21 grade stabilization structures; cost \$9.8 million.

- 24-CBS WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Page County; recommended for planning; project envisions 40 grade stabilization structures; cost \$5.5 million.

- 25-CUBE CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Harrison County; recommended for planning; project envisions 8 grade stabilization structures; cost \$500,000.

- 26-EAST 102 RIVER WATERSHED PROJECT, IOWA, MISSOURI
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Taylor County; recommended for planning; project envisions 5 flood detention structures; cost \$2.7 million.

- 27-ELK CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Harrison & Monona counties; recommended for planning; project envisions 40 grade stabilization structures; cost \$2.4 million.

- 28-JAMES CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Plymouth & Woodbury counties; recommended for planning; project envisions 12 grade stabilization structures; cost \$600,000.

- 29-LONG BRANCH WATERSHED PROJECT, IOWA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in Audubon & Shelby counties; recom-
mended for planning beginning in FY 83; project
envisions 4 grade stabilization structures;
cost \$1 million.
- 30-MAINE CREEK WATERSHED PROJECT, IOWA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in W. Pottawattamie County; recommended
for planning; project envisions 10 grade
stabilization structures; cost \$600,000.
- 31-MIDDLE 102 RIVER WATERSHED PROJECT, IOWA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in Taylor County; recommended for
planning; project envisions 2 flood detention
structures; cost \$2 million.
- 32-MILL CREEK WATERSHED PROJECT, IOWA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in Page County; recommended for planning
project envisions 30 grade stabilization
structures; cost \$1.8 million.
- 33-PACS INDIAN CREEK WATERSHED PROJECT, IOWA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in Audubon, Cass, Pottawattamie & Shelby
counties; recommended for planning; project
envisions 5 flood detention structures;
cost \$6 million.
- 34-PLATTE RIVER WATERSHED PROJECT, IOWA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in Adams, Ringold, Taylor & Union
counties recommended for planning; project
envisions 7 flood detention structures;
cost \$5.2 million.
- 35-ROCKY BRANCH OF PAGE WATERSHED, IOWA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in Page County, recommended for
planning project envisions 22 grade stabilization
structures; cost \$2.5 million.

- 36-ROSS WATERSHED, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Page County, recommended for planning;
 project envisions 11 grade stabilization structures
 cost \$600,000.

- 37-SOLDIER, BEAVER WATERSHED, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Crawford and Ida counties; recommended
 for planning; project envisions 70 grade
 stabilization structures; cost \$4.5 million.

- 38-SHOW CREEK WATERSHED, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Adams County; recommended for planning
 project envisions 1 flood retention structure and
 3 grade stabilization structures; cost \$350,000.

- 39-UPPER MOSQUITO WATERSHED, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Crawford & Shelby counties;
 recommended for planning; project envisions 50
 grade stabilization structures; cost \$3.5 million.

- 40-WEST 102 RIVER WATERSHED, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Adams & Taylor counties; recommended
 for planning; project envisions 3 flood detention
 structures; cost \$5.7 million.

- 41-WEST NODAWAY WATERSHED, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Adams, Cass, Adair & Montgomery
 counties project envisions 6 flood control
 structures; cost \$3.7 million.

- 42-WEST TARKIO WATERSHED, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Fremont, Page & Montgomery counties;
 project envisions 8 grade stabilization structures;
 cost \$10 million.

- 43-PONY CREEK WATERSHED, KANSAS
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Brown & Nemaha counties; recommended
 for planning beginning FY 80; project envisions 52
 flood detention structures; cost \$3.2 million.

44-CLEAR, CAYHOGA, MUDDY CREEKS, WATERSHED, MISSOURI
USDA/Soil Conservation Service
Flooding, Land Conservation & Management

Watershed in Nodaway County; recommended for
planning post FY 84; project envisions 4 flood
detention structures & 30 grade stabilization
structures; cost \$2.1 million.

45-LOWER 102 RIVER, WATERSHED, MISSOURI
USDA/Soil Conservation Service
Flooding, Land Conservation & Management

Watershed in Nodaway County; recommended for
planning post FY 84; project envisions 30 grade
stabilization structures; cost \$1.4 million.

46-WESTON'S BEAR CREEK WATERSHED, MISSOURI
USDA/Soil Conservation Service
Flooding, Land Conservation & Management

Watershed in Platte County; recommended for
planning post FY 84; project envisions 10 grade
stabilization structures; cost \$700,000.

47-LOWER BIG NEMAHA WATERSHED, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management

Watershed in Pawnee County; recommended for
beginning in FY 84; project envisions 4 flood
detention structures & 20 grade stabilization
structures; cost \$3 million.

48-BIG MUDDY WATERSHED, NEBRASKA
USDA/Soil Conservation
Flooding, Land Conservation & Management

Watershed in Richardson County; recommended for
planning beginning in FY 81; project envisions 12
flood detention structures & 1 multipurpose
structure; cost \$3.9 million.

49-SQUAW-CAMP WATERSHED, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management

Watershed in Otoe County; recommended for planning
beginning FY 82; project envisions 14 grade
stabilization structures; cost \$1.6 million.

50-PERU-BROWNVILLE WATERSHED, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management

Watershed in Nemaha County; recommended for
planning beginning FY 84; project envisions 12
grade stabilization structures; cost \$1.5 million.

<p>51-LOWER LITTLE NEMAHA WATERSHED, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management</p>	<p>Watershed in Otoe & Nemaha counties; recommended for planning beginning in FY 80; project envisions 9 flood detention structures & 40 grade stabilization structures; cost \$3 million.</p>
<p>52-TURKEY CREEK WATERSHED, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management</p>	<p>Watershed in Pawnee County; recommended for planning beginning in FY 81; project envisions 19 flood detention structures, 1 multipurpose structures & 15 grade stabilization structures; cost \$4 million.</p>
<p>53-WEeping WATER WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management</p>	<p>Watershed in Cass County; recommended for planning beginning in FY 83; project envisions 22 grade stabilization structures; cost \$2 million.</p>
<p>54-HACKLEBARNEY WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management</p>	<p>Watershed in Adams & Montgomery Counties; planning underway FY 80; project envisions 150 grade stabilization structures; cost \$6.3 million.</p>
<p>55-TWIN PONIES WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management</p>	<p>Watershed in Mills & W. Pottawattamie counties; planning underway FY 82; project envisions 16 flood detention structures; cost \$4.8 million.</p>
<p>56-ROY'S CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation & Management</p>	<p>Watershed in Brown County; active planning underway; project envisions 48 flood retention structures; cost \$2.8 million.</p>
<p>57-WOLF RIVER WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation & Management</p>	<p>Watershed in Brown & Doniphan counties; active planning underway; project envisions 180 grade stabilization structures; cost \$18 million.</p>

- 58-MOZINGO WATERSHED PROJECT, MISSOURI
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in Nodaway County; planning underway
FY 79 project envisions 1 multipurpose structure &
4 grade stabilization structures;
cost \$12.4 million.

- 59-SOUTH BRANCH LITTLE NEMAHA WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in Johnson, Lancaster & Otoe counties;
planning underway FY 80; cost \$6.8 million.

- 60-MIDDLE BIG NEMAHA WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in Johnson County; planning underway
FY 81 project envisions 19 flood detention
structures 1 multipurpose structure & 25 grade
stabilization structures; cost \$4 million.

- 61-UPPER LITTLE NEMAHA WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in Lancaster & Otoe counties; planning
underway FY 82; project envisions 18 flood
detention structures, 1 multipurpose structure &
35 grade stabilization structures; cost \$3.5 million.

- 62-BACON CREEK WATERSHED PROJECT, IOWA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in Plymouth & Woodbury counties; con-
struction completing FY 85; project involves 5
flood detention structures, 1 multipurpose struc.
& 31 grade stabilization struc.; cost \$4.5 million.

- 63-BEE-JAY WATERSHED PROJECT, IOWA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in E. Pottawattamie County; construction
underway FY 79; project involves 17 grade
stabilization structures; cost \$668,000.

- 64-BLOCKTON WATERSHED PROJECT, IOWA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management
.....
Watershed in Taylor County; construction underway;
project involves 3 flood detention
structures & 27 grade stabilization structures;
cost \$2.3 million.

- 65-DANE RIDGE WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Crawford County; construction
 underway FY 79; project involves 40 grade
 stabilization structures; cost \$3.4 million.
- 66-DAVID'S CHECK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Audubon & Guthrie counties;
 construction underway FY 79; project involves
 58 grade stabilization structures;
 cost \$3.9 million.
- 67-HELD WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Plymouth County; construction
 underway FY 79; project involves 23 grade
 stabilization structures; cost \$1.7 million.
- 68-INDIAN CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in W. Pottawattamie County; construction
 underway FY 79; project involves 15 grade
 stabilization structures; cost \$2.3 million.
- 69-LEDGEWOOD CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Fremont County; construction underway;
 project involves 14 grade stabilization structures;
 cost \$1.3 million.
- 70-MILL-PICAYUNE CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Crawford, Harrison & Shelby counties;
 construction underway; project involves 6 flood
 detention structures, 155 grade stabilization
 structures; cost \$15.2 million.
- 71-MOSQUITO OF HARRISON WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Harrison & Shelby counties;
 construction underway; project involves
 57 grade stabilization structures;
 cost \$4.7 million.

72-NORTH PIGEON WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in W. Pottawattamie County;
 construction underway; project involves 18 grade
 stabilization structures; cost \$2.1 million.

73-PIERCE CREEK #2 WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Page & Montgomery Counties;
 construction underway; project involves
 9 grade stabilization structures; cost \$466,000.

74-PONEY CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Mills & W. Pottawattamie counties;
 construction underway; project involves
 2 flood detention structures, 21 grade stabili-
 zation struc. & 4.3 mi. channel; cost \$4.4 million.

75-RYAN-HENSCHAL WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in W. Pottawattamie County; construction
 underway FY 79; project involves 17 grade
 stabilization structures; cost \$1.9 million.

76-SIMON RUN WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in W. Pottawattamie County; construction
 completion FY 85; project involves 11 grade
 stabilization structures; cost \$1.1 million.

77-TURKEY CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Adair, Audubon, Cass & Guthrie
 counties construction completion FY 87; project
 includes 10 flood detention structures & 103
 grade stabilization structures; cost \$11.7 million.

78-TWELVE MILE CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Adair & Union counties; construction
 completion FY 87; project involves 22 flood
 detention structures, 1 multipurpose structure & 11
 grade stabilization structures; cost \$6.8 million.

- 79-WALTERS CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Adams County; construction underway; project involves 2 flood detention structures, 1 multipurpose structure & 37 grade stabilization structures; cost \$5.5 million.

- 80-WAUBONSIE CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Mills & Fremont counties; construction completion FY 85; project involves 32 grade stabilization structures; cost \$4.3 million.

- 81-TROUBLESOME CREEK WATERSHED PROJECT, IOWA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Audubon, Cass & Guthrie counties; construction completion FY 90; project involves 2 flood detention structures, 2 multipurpose structures & 135 grade stab. structures; cost \$8.8 million.

- 82-LAKES OKABENA AND OCHEDA WATERSHED PROJECT, MINNESOTA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Nobles County; constr. underway; project envisions land treatment, 1 desilting basin, 1 wildlife struc., 1 multipurpose struc., 5.4 mi. channel improve. & 1 mile water divert; \$1.5 million.

- 83-LONG BRANCH WATERSHED PROJECT, NEBRASKA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Johnson, Nemaha, Pawnee & Richardson counties; construction to begin FY 87; cost \$3.1 million.

- 84-PAPILLION CREEK WATERSHED PROJECT, NEBRASKA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Douglas & Washington counties, construction to begin FY 86; project envisions 52 grade stabilization structures; cost \$3.9 million.

- 85-ROCK CREEK WATERSHED PROJECT, NEBRASKA
 USDA/Soil Conservation Service
 Flooding, Land Conservation & Management

 Watershed in Pawnee County; construction to begin FY 82; project involves 5 flood detention structures & 12 grade stabilization structures; cost \$1 million.

86--SOUTH FORK WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management

Watershed in Pawnee & Richardson counties; construction to begin FY 86; project envisions 2 flood detention structures, 1 multipurpose structure & 14 grade stabilization structures; cost \$1.7 million.

87--SPRING CREEK WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management

Watershed in Johnson, Otoe & Nemaha counties; construction to begin FY 82; project involves 7 flood detention structures & 21 grade stabilization structures; cost \$1.8 million.

88--TEKAMAH/MUD WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management

Watershed in Burt County; construction to begin FY 84; project envisions 4 flood detention structures, 1 multipurpose structure & 10 grade stabilization structures; cost \$2.8 million.

89--UPPER BIG NEMAHA WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management

Watershed in Gage, Johnson, Lancaster & Otoe counties; construction to begin FY 87, project includes 38 flood detention structures & 59 grade stabilization structures; cost \$7.3 million.

90--WILSON CREEK WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management

Watershed in Cass & Otoe counties; construction to begin FY 85; project envisions 22 flood detention structures & 67 grade stabilization structures; cost \$5.8 million.

91--WINNEBAGO-BEAN WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management

Watershed in Richardson County; construction to begin FY 82; project includes 16 grade stabilization structures; cost \$1.4 million.

FISH AND WILDLIFE

92--MISSOURI RIVER FISH & WILDLIFE MITIGATION STUDY
Army Corps of Engineers
Fish and Wildlife
Also in Lower Missouri Subbasin

Ongoing special study thru 81; all counties bordering main stem Missouri; NE, IA, KS, MO; compensation for F&W loss & habitat improvement; cost \$273,000.

IRRIGATION

93-OTOE-CASS UNIT APPRAISAL STUDY, NEBRASKA
DOI/Water and Power Resources Service
Irrig., F&W, M&I Rural Supply, Rec., Water Qual.

Ongoing feasibility study thru FY 80; potential
for pumping water from Mo River; cost \$200,000.

LAND CONSERVATION AND MANAGEMENT

94-WESTERN IOWA RIVERS COOPERATIVE STUDY
USDA/Soil Conservation Service
Land Cons. & Mgt., Flood, Irrig., Water Qual.
Also in Eastern Dakotas Subbasin

New start regional planning beginning in FY 82;
Iowa tribs to Mo River from Big Sioux to/but
excluding Nishnabotna involves SCS, ESCS & FS;
cost \$1.5 million.

95-NORTHEAST KANSAS WATER QUALITY STUDIES
USDA/Soil Conservation Service
Land Conservation & Management, Water Quality
Also in Kansas Subbasin

New start special study beginning in FY 80; study
of Delaware, Nemaha, Blue Rivers & Stranger Creek
sources & amount of sediment; monitor land
treatment; cost \$205,000.

MUNICIPAL, INDUSTRIAL AND RURAL DOMESTIC WATER SUPPLY

96-SMITHVILLE LAKE, MISSOURI
Army Corps of Engineers
M&I Rural Supply, Flood, F&W, Rec., Water Qual.

Ongoing program implementation of a multipurpose
lake for water supply, flood control, fish and
wildlife, recreation, and improved water
quality; total cost \$83.7 million.

NATURAL, HISTORIC AND CULTURAL RESOURCES

POWER AND ENERGY

WATER-ASSOCIATED OUTDOOR RECREATION

97-LAKE MANAWA, IOWA
Iowa Conservation Comm.
Recreation

Ongoing program implementation thru FY 83;
development of diking & levees near Council
Bluffs, Pottawattamie County; cost \$1.2 million.

TRANSPORTATION

98-MISSOURI RIVER NAVIGATION AND BANK STABILIZATION CONTROL PGM
Army Corps of Engineers
Transportation, Recreation
Also in Lower Missouri Subbasin

Ongoing program implementation thru FY 83; im-
proved navigation channels, bank erosion & stab.
measures & recreation - 95% complete, 2 Oxbow Lakes
& 26 river sites, NE, IA, & MO; cost \$430 million.

WATER QUALITY

LEGAL AND INSTITUTIONAL FACTORS

INSTREAM FLOWS

WEATHER MODIFICATION

CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS

- A. Nonpoint source pollution is a major Middle Missouri Subbasin problem. Steep slopes and loess soils in Iowa, northwest Missouri, southwest Nebraska, and northeast Kansas cause severe gully erosion. Streambank erosion is a particular problem in the Nemaha Basin, Nebraska, and Nishnabotna and Nodaway Basins in Missouri. Nebraska counties between South Sioux City and Omaha have the highest soil loss rates in the State. To address agricultural runoff problems, it is recommended that the Rural Clean Water Program (Section 208(j) of the Clean Water Act of 1977), which would control agricultural related nonpoint sources of pollution on private rural lands, be funded and implemented.
- B. Flooding is still a problem along many of the tributary streams in the Middle Missouri Subbasin. In many of the smaller communities, present planning and evaluation criteria and social preferences preclude formulation of a feasible, acceptable structural solution.
- C. Even though levees have been constructed along the Missouri River, flooding continues to be a problem downstream of the Platte River in Nebraska. Private levees are being moved or constructed too close to the river infringing on the floodway and shifting flood damage to other areas.
- D. Tie-back levees on tributary streams were designed to provide 50-year protection from flooding caused by main stem flooding and tributary flooding. Due to numerous factors, including aggradation of the stream beds of the tributaries, this level of protection has dropped to 10- to 25-year events.
- E. Consumptive use and diversion of upstream States will decrease the amount of water available for downstream uses. It is recommended that an investigation of interstate water allocation be initiated by the Missouri

River Basin Commission. The investigation should be directed toward assessing alternative institutional arrangements for developing an interstate compact for the Missouri River.

- F. Projected power demands will necessitate the construction of additional power plants in the subbasin. The maximum energy potential from water use by low head hydropower should be developed. Power plants should be located on major rivers to permit the assimilation of cooling water with the least possible adverse environmental effects. Disposal of power plant waste water into smaller bodies of water where thermal pollution potential can be controlled would provide an opportunity for improved production of fish.
- G. Drinking water quality problems occur in Otoe and Cass Counties, Nebraska, the Sioux City, Iowa, area and southwest Iowa. Better planning to recognize regional water requirements is needed for rural domestic systems. Coordinated planning to design regional delivery systems is necessary. States should work toward amending legislation and regulations so that new rural development is capable of utilizing the Farmers Home Administration resource which could also be used for rural-water and waste-water disposal systems improvement like consolidation.
- H. Oxbow lake elimination and channel straightening is reducing and changing fisheries habitat. The loss of wetlands is not being replaced by maturing wetlands, which are rapidly being converted to agricultural uses. Fish and wildlife are being adversely affected in the subbasin by many of man's activities. Programs similar to Missouri's "Design for Conservation" should be initiated by other States.
- I. There is a documented demand for water access and facilities in metropolitan areas such as Sioux City and Council Bluffs, Iowa,

St. Joseph, Missouri, and in southwest Iowa. Additional attention needs to be directed toward meeting this need.

- J. The Middle Missouri Subbasin lacks adequate data on land use and associated water use. Such data are necessary for planning and management. A study to obtain such information is recommended. It is specifically recommended that Iowa increase funding for State land-use and water-related program planning.