CHAPTER 3

AFFECTED ENVIRONMENT


Courtesy of IDNR

MISSOURI RIVER FISH AND WILDLIFE MITIGATION PROJECT

FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY AND OMAHA DISTRICTS

Chapter 3
Affected Environment

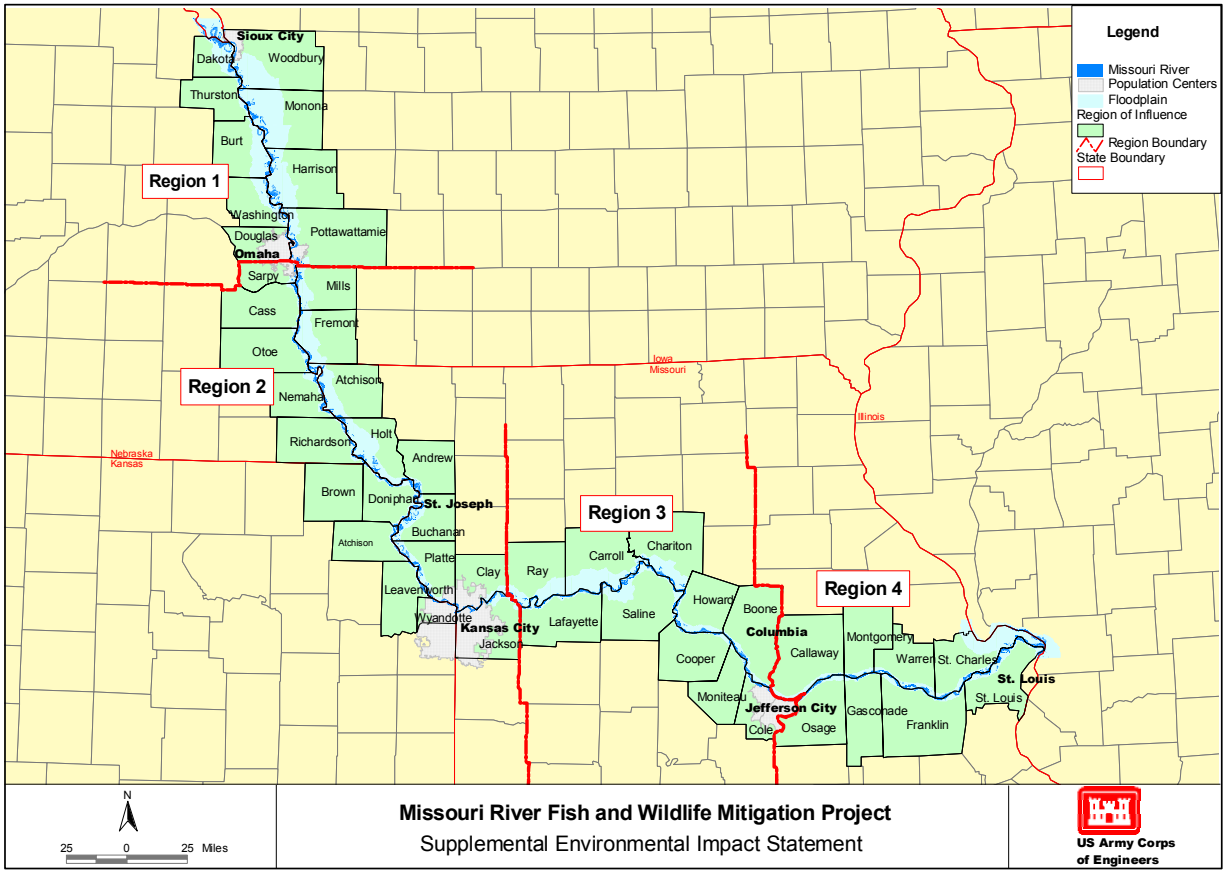
3.1 PROJECT AREA AND REGIONAL SETTING

The modified Mitigation Project would occur on the reach of the Missouri River between Sioux City, Iowa and the mouth at St. Louis, Missouri. This segment of the Missouri River is usually described as the Lower Missouri River. The Lower Missouri River Valley, a 735-mile corridor below Sioux City encompasses an area of more than 2,180,000 acres; this is the general project area for the SEIS. Project activities could also occur on tributary floodplains. Specific analyses consider a defined Region of Influence (ROI) as the floodplain of the Lower Missouri River, or for some resources (e.g., socioeconomics) the 46 counties contiguous to the Lower Missouri River in Nebraska, Iowa, Kansas, and Missouri as shown on Figure 3.1-1.

For purposes of description of existing environmental conditions and for evaluating potential impacts of certain natural and human environmental resources, the ROI has been divided into four regions as follows:

- Region 1: Sioux City, Iowa to Omaha, Nebraska
- Region 2: Omaha, Nebraska to Kansas City, Missouri
- Region 3: Kansas City, Missouri to Jefferson City, Missouri
- Region 4: Jefferson City, Missouri to St. Louis, Missouri

Figure 3.1-1
Region of Influence



Counties included in the Regions are as follows:

Region 1:

Iowa:	Harrison, Monona, Pottawattamie and Woodbury
Nebraska:	Burt, Dakota, Douglas Thurston and Washington

Region 2:

Iowa:	Fremont and Mills
Kansas:	Atchison, Brown, Doniphan, Leavenworth and Wyandotte
Missouri:	Andrew, Atchison, Buchanan, Clay, Holt, Jackson and Platte
Nebraska:	Cass, Nemaha, Otoe, Richardson and Sarpy

Region 3:

Missouri:	Boone, Carroll, Chariton, Cole, Cooper, Howard, Lafayette, Moniteau, Ray and Saline

Region 4:

Missouri:	Callaway, Franklin, Gasconade, Montgomery, Osage, St. Charles, St. Louis and Warren

The following subsections describe the physical and human environment of the ROI as well as the history and use of the Lower Missouri River. These subsections provide an introduction to the current

environment of the Lower Missouri River and describe the historical events that have changed that environment.

3.1.1 PHYSICAL ENVIRONMENT

The Missouri River Basin encompasses much of the Great Plains of the central United States and drains an area of approximately 530,000 square miles in ten states, namely: Montana, Wyoming, North Dakota, South Dakota, Minnesota, Iowa, Colorado, Nebraska, Kansas, and Missouri as shown on Figure 3.1-2. The Missouri River Basin extends eastward from the continental divide in Montana, Wyoming, and Colorado to the topographic divide of the Red River in North Dakota and South Dakota, and the Mississippi Basin divide in Minnesota, Iowa, and Missouri. The Missouri River generally flows east and southeast, and most of the tributaries enter from the west or southwest.

The Lower Missouri River floodplain comprises approximately 2,180,000 acres. Of this, approximately 2,069,000 acres fall within the ROI for the modified Mitigation Project. Originally, the meandering Missouri River was characterized by a wide, unconstrained floodplain. The frequent changes in the channel resulted from the continuous processes of erosion and deposition. The dynamics of the Missouri River created the diverse wildlife habitats

Figure 3.1-2
Missouri River Basin

within the meander belt and formed a natural Missouri River floodplain ecosystem that included open shallow and deep water, sandbars, wetlands, willow thickets, and riparian woodlands.

The BSNP significantly changed the ecosystem of the Missouri River floodplain. Bank stabilization, channelization and construction of levees removed or eliminated most of the natural habitat. Present habitat is generally limited to deepwater, confined narrow strips of riparian woodlands and wetlands along river oxbows and other cutoff areas, and some isolated wetlands. The willow thicket is the most common remaining natural plant community. Exposed sandbars are very few. Agriculture has replaced diverse wildlife habitats as the dominant feature of the Missouri River floodplain. Recent conservation efforts (e.g., original Mitigation Project, Section 1135 projects, and various state agency and private projects) have restored some habitat acreage.

3.1.2 HUMAN ENVIRONMENT

The modified Mitigation Project ROI includes 46 counties in four states. The total population of the ROI counties was approximately 4,073,000 in 2000, nearly 32 percent of the population of the four states (U.S. Bureau of Census, 2001a, 2001b, 2001c, 2001d). Of this total, approximately 239,800 live in the six Iowa counties, approximately 262,300 live in the five Kansas counties, 2,874,000 live in the 25 Missouri counties, and 697,000 live in the ten Nebraska counties.

The primary cities along the 735-mile corridor are Sioux City and Council Bluffs, Iowa, Omaha, Nebraska, Leavenworth and Kansas City, Kansas, and St. Joseph, Kansas City, Jefferson City, and St. Louis, Missouri. Some river towns became important railroad cities such as Omaha, St. Joseph, Kansas City, and St. Louis. Historically, the economy of the region has been primarily based on agriculture and agribusiness. Agricultural products and byproducts dominate the regional economy. Grains, beef cattle, and hogs are important farm products.

3.1.3 MISSOURI RIVER HISTORY AND USE

The Missouri River is a product of the glacial period, carrying glacial melt water and runoff from the Rocky Mountains across the plains. The present Missouri River was largely developed following the Wisconsin glaciation, the last of four glacial advances. Since before European horses arrived on the Great Plains around 1700,

the Missouri River was important in providing natural resources such as fish, water, wood, and willows. Its riparian habitat also provided game necessary for Native American subsistence.

Early French trappers used the Missouri River for transportation in trading with the Native American tribes in the 1700s. Transportation and availability of natural resources (e.g., furs from wildlife) characterized the early importance of the Missouri River. Following the Louisiana Purchase in 1803 and the Lewis and Clark Corps of Discovery Expedition from 1804-1806, the Missouri River grew in importance as a resource to the United States. In the following decades, more than 20 trading and military posts were constructed along the Missouri River to facilitate early commerce, navigation, and settlement. Keelboats supplanted canoes as the means to transport supplies up the river and bring furs down the river from the posts. Expanded utilization of resources involved mining and a requirement to move larger amounts of materials along rivers. Steamboat use increased as mining operations for silver, mercury, and gold developed in the 1800s. However, the swift and ever changing currents and snags made navigation hazardous, resulting in hundreds of steamboats being sunk on the Lower Missouri River. As early as 1829, the first efforts to improve navigation on the Missouri River were done by removing snags that presented a hazard to navigation. As the desire for westward expansion and the demand for increased transportation of goods to the new settlements grew, railroads were built and by 1900 rail transportation had overtaken steamboat use. Barge shipment began in the early 1900s on the Lower Missouri River. Refer to Section 3.8, Cultural Resources, for additional discussion of historic use of the Missouri River.

However, the U.S. Congress recognized a continuing need for river navigation and commerce to move large quantities of raw and manufactured materials and set forth a plan of improvement for the Missouri River that was authorized by RHA of 1912, 1925, 1927, and 1945 (see Section 1.1). Generally, management of the river reflected societal values and needs of the time.

Transportation of freight commodities (not including sand and gravel) between Sioux City and St. Louis grew through about 1980. The last two decades has seen a decline to levels less than was transported

in 1960 (Corps, 1998a). The reach of the Missouri River between Sioux City and Omaha has accounted for approximately ten percent of the Missouri River origin and destination freight tonnage. The reach between Omaha and Kansas City has accounted for approximately 40 percent and the Kansas City to St. Louis reach has accounted for approximately 50 percent (Corps, 1998a). Present navigation occurs during the normal ice-free months of April through November.

3.2 WATER RESOURCES

3.2.1 MISSOURI RIVER HYDROLOGY

The hydrology of the Lower Missouri River, below Gavins Point Dam, has been greatly changed from its natural state by the BSNP. Numerous Congressional authorizations (RHA of 1912, 1925, 1927, and 1945) directed the Corps to undertake numerous projects collectively known as the BSNP. The intent of the BSNP was to maintain a nine-feet deep by 300-feet wide navigation channel between Sioux City and the mouth at St. Louis and to prevent general migration of the channel across the floodplain. Channelization and stabilization of the banks has been accomplished by an intricate system of dikes and revetments. These structures were designed to provide a continuous navigation channel without using locks and dams. Description of the hydrology of the Missouri River south of Gavins Point Dam is incorporated by reference per 40 CFR 1502.21 from the Master Manual (Corps, 2001). The following text is a brief summary of some key hydrology information from the Master Manual.

Releases from Gavins Point Dam generally fall in three categories: navigation, flood evacuation, and non-navigation releases. During the navigation season (typically April through November), releases are generally 25 to 35 thousand cubic feet per second (kcfs). During December through March, non-navigation releases are typically in the 10 to 20 kcfs range. In wet years, releases are higher to evacuate flood control storage space in upstream reservoirs. During drought periods, minimum non-navigation releases have been approximately 8 kcfs to protect downstream water supply intakes.

Streambank erosion occurs throughout the study area; the rate of erosion has diminished since 1980 due to armoring of the riverbed. Armoring is a process where some of the silt and sand has eroded downstream and the cobbles and gravel become more compact. Coarse material

from the tributaries downstream from Omaha, except at Kansas City, keep most of the downstream reaches (Regions 2, 3, and 4) from degrading. Below Ponca, which is where the channelized portion of the Missouri River begins, there are few sandbars and side channels. Floodplain levees along these reaches reduce overbank flooding, and consequently minimize water flows to old sloughs and chutes.

The formation of river ice during the winter months is important because it can contribute to the cause of floods by reducing the channel's water carrying capacity and backing water upstream of ice jams or dams and may also reduce downstream flows (Corps, 2001). Ice dynamics are related to the sequence of air temperatures, water surface elevations, and discharge rates that occur at a particular location (Corps, 2001). Ice bridges typically form when the amount of ice in the river at a particular location becomes greater than the channel's ability to transport. Ice bridges typically occur when there are obstructions such as bridge piers that impede the normal flow of floating ice.

3.2.2 GROUNDWATER HYDROLOGY

The hydrologic cycle involves interaction between surface water, groundwater, precipitation, evaporation, and vegetation uptake of water. Groundwater is water beneath the ground surface. A water table is the unconfined surface at depth where groundwater saturates the pore spaces in sediments and rocks or the fractures in rocks. Typically, tributary stream flow and groundwater discharge feed the Missouri River. During low flow periods, groundwater can recharge the Missouri River. Consequently, the depth to groundwater can vary throughout the year. Depth to groundwater in the floodplain is primarily influenced by distance from the river channel. In some areas, typically near the Missouri River, the water table is just beneath the surface. The depth to the water table at the outer boundary of the floodplain can be tens of feet below the ground surface.

Aquifers are a formation, group of formations, or part of a formation that contains enough groundwater to yield economical quantities of water. Generally, the aquifers beneath the floodplain along the Missouri River consist of a 10-foot thick layer of fine silty soils overlaying 100 feet of progressively coarser sands with depth.

Aquifers provide a potable water supply to communities, including Reservations, along the floodplain. The overall flow of groundwater parallels the flow of the Missouri River. Typical flow rates through Missouri River alluvium are on the order of 400 feet per day (Corps, 2001).

As part of the review and update of the Master Manual, the Corps conducted groundwater hydrology investigations at four sites along the Lower Missouri River in the ROI (Corps, 1998b). The intent of these studies was to determine the potential effects on groundwater in response to various Missouri River flow alternatives. The studies included data collection, development of a conceptual model of the groundwater hydrology, model calibration, validation and sensitivity, and simulation. The investigation sites are located along the left descending bank as follows: Leveed Area 575 near Hamburg, Iowa; Unleveed Area at RM 691 in Monona County, Iowa; Levee Unit L488/497 in Holt County, Missouri; and Tri-County Levee District 2 in Montgomery and Warren Counties, Missouri. Information from these sites provides information sufficient to characterize the groundwater hydrology along the Missouri River in the ROI.

The L575 study area (approximately 72 square miles) is used for agriculture and has a series of ditches. The site included layers of sandy alluvium and silty clay. The upper layer is silty clay of approximately 20 feet deep, underlain by about 40 feet of a fine to medium sand, which is underlain by about 60 feet of medium to coarse sand. Bedrock underlies the site and is exposed at the surface at the loess hills to the east. The depth to the water table is approximately 2 to 10 feet. A groundwater divide lies between 0.66 to 3.03 miles east of the Missouri River; groundwater to the west of the divide flows away from, and is not influenced by, the river.

The RM 691 study area (approximately 76,000 acres) consists of alluvium overlying a shale bedrock at a depth of 85 to 120 feet below ground surface. In some areas, bedrock valleys are present where the bedrock may be over 200 feet below the surface. The alluvium is generally a stratified sequence of clays and silts overlying progressively coarser sands and gravels. The water table is generally within 10 to 15 feet of ground surface, except in depressional lake areas where the groundwater may be at the surface. A groundwater divide varied from 20,000 feet to 40,000 feet east of the channel. West of

the divide, closer to the Missouri River, groundwater level is influenced directly by the river. This influence decreases moving east, away from the river channel. Groundwater level response to high frequency changes in the river also decrease with distance from the Missouri River. The seasonal variation in the water table depth was reported to be between five and eight feet; however, short-term (e.g., a few weeks) fluctuations may also occur. Soils also affect the groundwater response to the river. The southern part of the study area is comprised of glacial till at depth, indicating a relatively low hydraulic conductivity with a corresponding reduction in groundwater response to river change. The northern part of the study area consists of coarser materials with relatively higher hydraulic conductivities.

Levee Unit L488/497 protects farmland that is bound to the north by the loess hills and to the south by the Missouri River. The study area is approximately 32 square miles in size. Recharge to the shallow aquifer occurs primarily through precipitation and overland runoff. The study area includes a series of drainage ditches. An approximately 10-foot thick layer of silt and clay comprises the upper layer of the stratigraphy and is underlain by approximately 20 feet of fine to medium sand, then 40 feet of medium to coarse sand. Bedrock is beneath the coarse sand and becomes shallower to the north and is exposed beneath the loess hills. Seasonal fluctuations show lower groundwater levels during fall and winter, and higher levels of groundwater during spring and summer. The water table generally occurs within a depth range from ground surface to between 2 and 8 feet. General groundwater flow is to the southwest, starting at the hills and ending at the river.

Tri-County Levee District 2 in Montgomery and Warren Counties, Missouri is approximately 6,100 acres in size. This unit is the smallest and farthest downstream of the four areas studied. It has a more humid climate than other sites and was included to evaluate conditions of downstream sites. The groundwater flow is dominantly from the uplands near the bluff line; the bluffs serve as a groundwater divide. The area is flat and the groundwater rises and falls with the river, with inflow from the Ozark Aquifer. The surficial unit includes approximately 30 feet of clay and silt. Approximately 75 feet of sand, transitioning at lower depths to sand and gravel underlies the top unit. A basal sand unit of approximately 25 feet thick separates the gravel from bedrock.

The majority of the area has water table depths of 4 or more feet from the ground surface. The upland areas have the lowest depth to groundwater of less than 2 feet.

Generalized findings of the four studies noted that ditches may influence local groundwater levels, but were not found to influence the regional response of groundwater to changes in the river. The study concluded that the influence of the Missouri River stages dominates the seasonal response of groundwater levels, and recharge and drainage from the major interior ditches have a secondary effect. Throughout the study area, the influence of the Missouri River is limited to the area between the bank and the groundwater divide. The farther downstream from Sioux City, the smaller the groundwater fluctuations based on surface water flow changes of the Missouri River. Effects of tributary flows and local precipitation are the primary groundwater flow modifiers.

3.2.3 WATER QUALITY

The individual states have jurisdiction for managing water quality of the Lower Missouri River. Section 303(d) of the Water Quality Act requires each state to identify waters for which existing required pollution controls are not stringent enough to meet state water quality standards. States are required to establish total maximum daily loads (TMDLs) for these waters (see 40 CFR 130.7). Iowa, Missouri, and Nebraska have placed the Missouri River on the 303(d) List of Impaired Water Bodies (EPA, 1996a, 1996b, 1996c).

Sediment in the Missouri River has decreased since construction of the Mainstem Reservoir System that inhibits downstream transport of sediment loads. While this has led to improved water quality of the Missouri River it should be noted that it has affected the Missouri River's aquatic ecology. This is discussed further in Section 3.3.4, Fisheries. Prior to regulation, the amount of sediment transported past Omaha, Nebraska ranged from 39,909,297 metric tons in 1931 to 228,570,000 metric tons in 1944 (NRC, 2002). The sediment load has been reduced to a post-1954 average of 29,487,600 metric tons (NRC, 2002).

Lower Missouri River water quality gradually deteriorates progressing downstream because of pollution entering from tributaries and point and non-point sources. At Gavins Point Dam, summer temperature is in the range of 24 to 26 degrees C, with saturated levels of

dissolved oxygen and low nutrient and sediment levels. As distance from Gavins Point Dam increases downstream, water temperature, nutrient levels, and biological oxygen-demanding materials increase, peaking in the vicinity of Kansas City. Organic nitrogen, nitrate, total phosphorus, and ortho-phosphorus are the primary nutrient concentrations that increase in a downstream direction. Sewage treatment plant effluents contribute only a small flow, typically less than 0.1 kcfs per plant and have relatively high concentrations of nutrients and oxygen-demanding materials. Additionally, tributaries provide warm, turbid waters with elevated levels of nutrients and other oxygen-demanding materials. Power plants use river water for cooling and release up to 2.2 kcfs of heated water back to the river. Heated water could be as much as 10 degrees to 15 degrees C above the ambient river temperature. At some locations, power plant discharges raise the ambient river temperature by one to two degrees C.

The water quality standards' criteria for water temperature downstream of Sioux City are a maximum of 32 degrees C and no more than 3 degrees C rise above the ambient river temperature in the mixing zone. The dissolved oxygen criterion is a minimum concentration of 5 mg/l.

3.2.4 FLOOD CONTROL

The first moderately well recorded Missouri River flood occurred in 1844 when crests exceeded flood stage at various points from 12 to 17 feet. Subsequent major floods of the Missouri River occurred in 1881, 1903, 1908, 1943, 1947, 1951, 1952, 1993, and 1997. The flood stage in 1993 was exceeded by 1.2 feet near Omaha, 9.2 feet at Nebraska City, 15.1 feet at St. Joseph, 16.9 feet at Kansas City, 16.1 feet at Boonville, and 16.0 feet at Hermann, near the mouth (Corps, 2001).

Flood control along the Lower Missouri River is primarily accomplished by constructed levees, storage capacity of the Mainstem Reservoir System, tributary flood control structures and impoundments, and the controlled release of water from Gavins

Point Dam. The Corps is responsible for flood control regulation of all Federally financed reservoirs with allocated flood control space. The Corps operates the Mainstem Reservoir System to prevent Missouri River flows from contributing to flood damage in the reaches downstream from the dams. During periods of flooding, the upstream tributary storage reduces mainstem flood volumes. The amount of reduction is dependent on antecedent conditions and rainfall. Mainstem reservoir flows are reduced by tributary reservoir storage.

An extensive system of levees also protects land in the floodplain of the Lower Missouri River as shown on Figures 3.2-1 through 3.2-4. The Flood Control Acts of 1941 and 1944 authorized construction of a series of levees to protect agricultural land. Construction began in 1947, with most existing Federal levees between Omaha and Kansas City. These Federal levees are designed to hold discharges in the range of 250 kcfs at Omaha, 295 kcfs at Nebraska City, 325 kcfs at St. Joseph, 425 kcfs at Kansas City, and up to 620 kcfs at Hermann, Missouri (Corps, 2001). In addition, numerous other levees have been constructed to protect large urban areas such as Omaha, Council Bluffs, and Kansas City. Numerous local entities and private individuals and organizations have constructed about 500 non-Federal levees to protect agricultural land and residences. Most of these levees (located primarily within Regions 3 and 4) are inadequate to withstand major floods, but are generally sufficient to protect against floods smaller than a 20-year magnitude flood.

Federal levees, as well as non-Federal levees enrolled in the Corps PL84-99 program, are eligible for repair following damaging flood events. Levee repairs to non-Federal levees, under PL84-99, are cost-shared and subject to a cost-benefit analysis.

Levees within the Lower Missouri River floodplain were originally mapped by the U.S. Geological Survey (USGS) and made available by the USGS in Geographic Information Systems (GIS) format. Tables 3.2-1 and 3.2-2 summarize the type and acreage of levees within the ROI by state and by region, respectively.

Figure 3.2-1
Areas Protected by Levees, Region 1

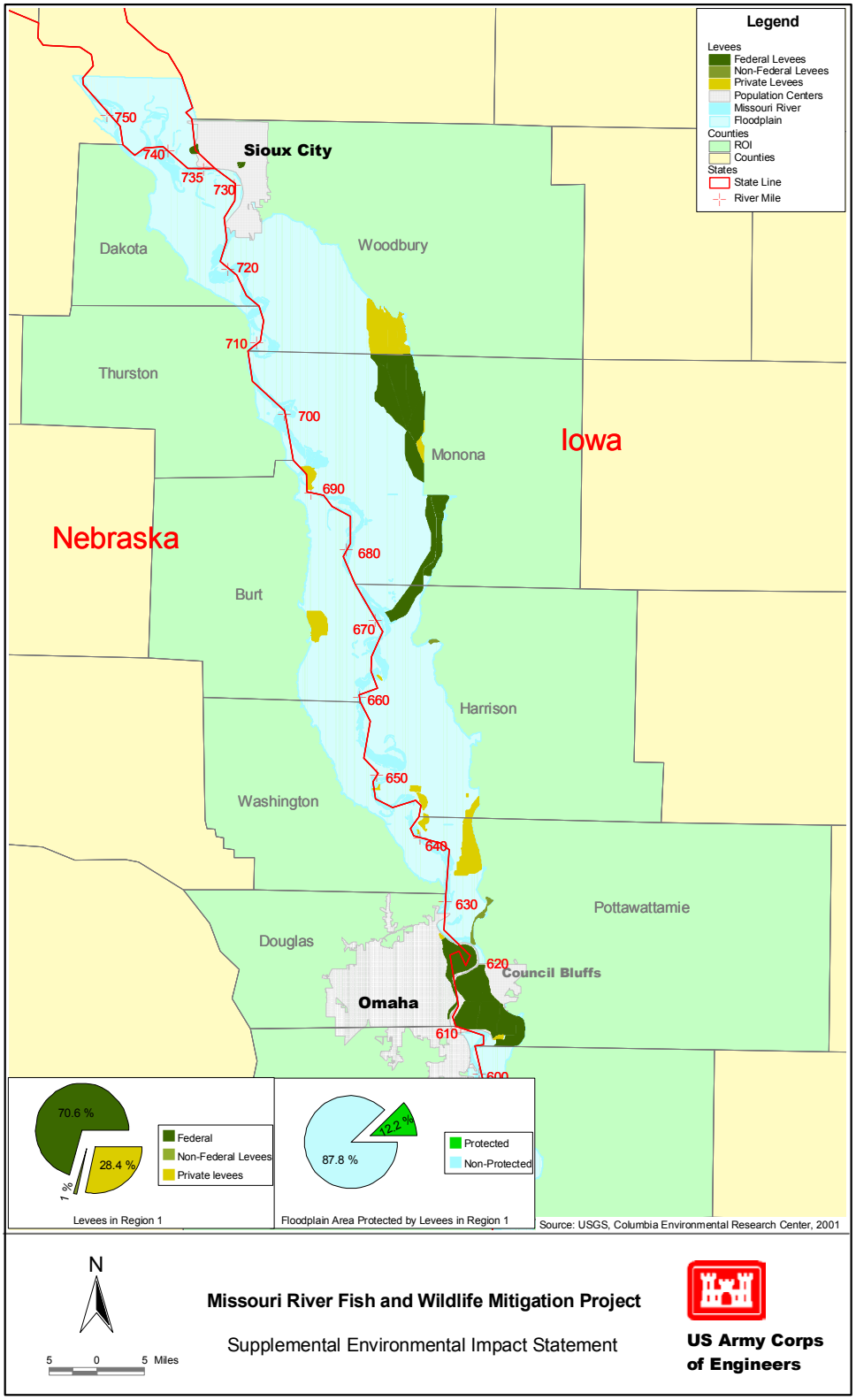


Figure 3.2-2
Areas Protected by Levees, Region 2

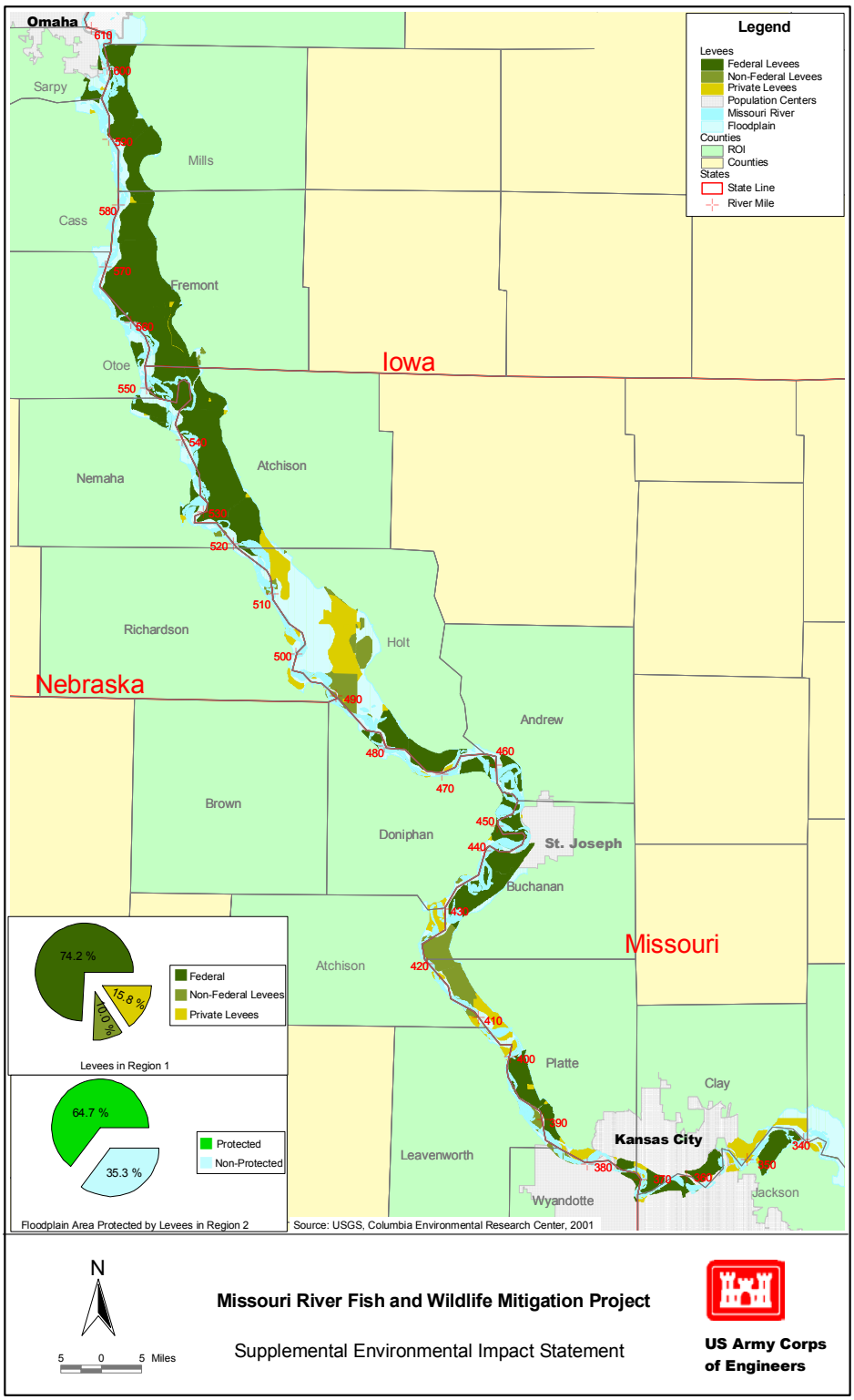


Figure 3.2-3
Areas Protected by Levees, Region 3

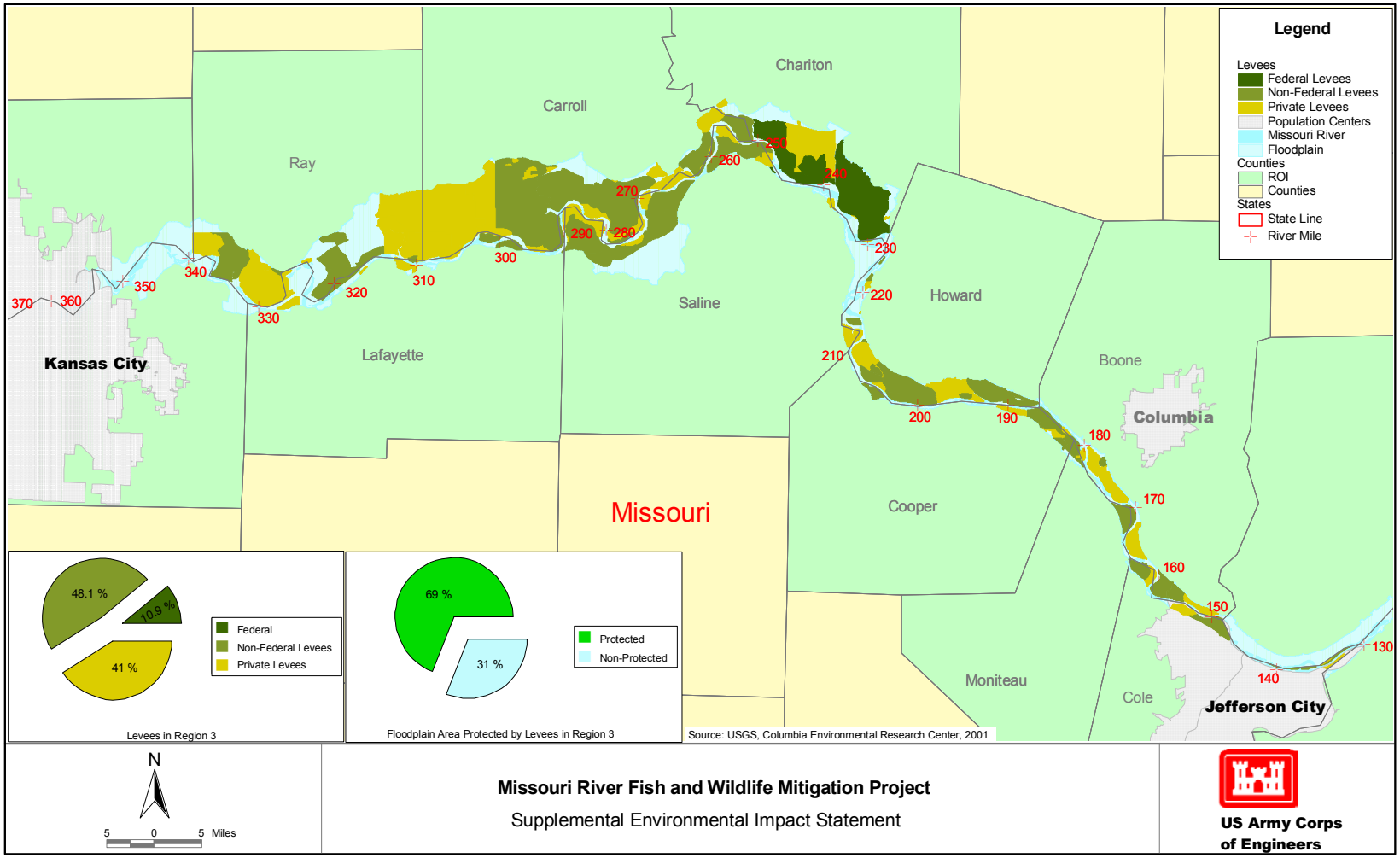


Figure 3.2-4
Areas Protected by Levees, Region 4

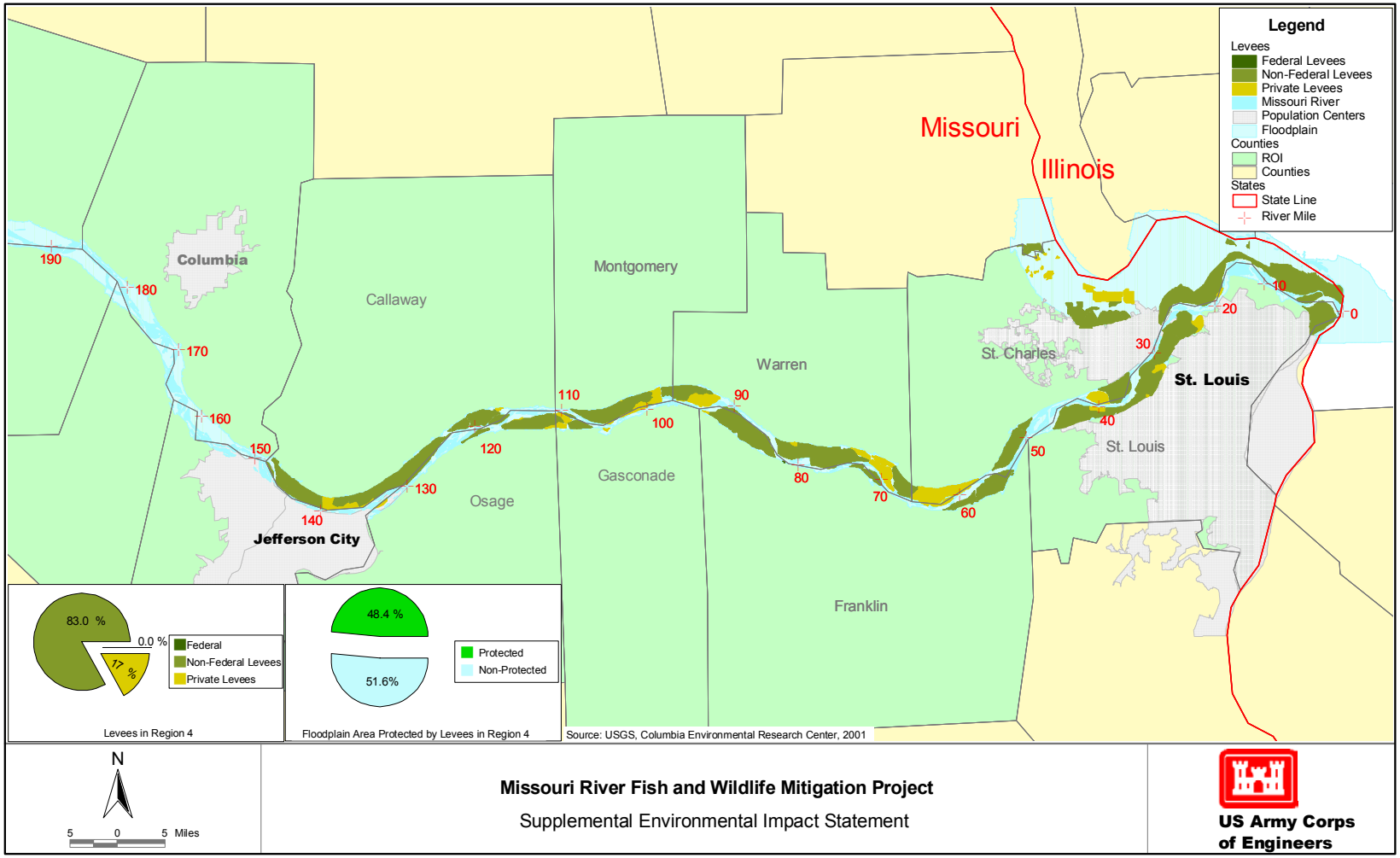


Table 3.2-1
Summary of Levees By State

	Iowa	Kansas	Missouri	Nebraska	ROI
Total Federal Levee Acres	163,571	4,685	77,403	21,258	266,917
Total Non-Federal Levee Acres	1,204	1,313	188,674	981	192,172
Total Private Levee Acres	22,703	24,991	414,816	7,123	469,633
Total Protected Acres	187,478	30,989	680,892	29,362	928,722
Percent Protected by Levees	29.6	57.7	62.4	10.1	44.9
Floodplain Acres	**632,667**	**53,668**	**1,091,694**	**291,373**	**2,069,403**

Adapted from USGS, 2001.

Table 3.2-2
Summary of Levees by Region

	Region 1	Region 2	Region 3	Region 4	ROI
Total Federal Levee Acres	62,661	203,572	0	684	266,917
Total Non-Federal Levee Acres	930	10,714	91,581	88,947	192,172
Total Private Levee Acres	25,205	173,795	217,550	53,083	469,633
Total Protected Acres	88,796	388,081	309,131	142,714	928,722
Percent Protected by Levees	12.2	64.7	69.0	48.4	44.9
Floodplain Acres	**727,389**	**599,674**	**447,777**	**294,563**	**2,069,403**

Adapted from USGS, 2001.

The floodplain within the ROI encompasses over 2,069,000 acres of which approximately 929,000 acres are protected by levees. Nebraska has the least total acreage of floodplains protected by levees at approximately 29,000 acres (10 percent), while Missouri has the most acreage protected by levees at approximately 681,000 acres (62 percent).

Within the ROI, the Corps estimated that approximately 1,245,000 acres of agricultural land are subject to flooding (Corps, 1998c). This includes some 21,000 residences valued at nearly $602 million, and over 4,700 commercial and industrial buildings with an estimated value of approximately $14.8 billion dollars. This represents a combined value of $15.4

Table 3.2-3
General Characteristics of Land Subject to Flooding

	Agricultural Land (acres)	Residential Buildings	Estimated Value [1]	Non-Residential Buildings	Estimated Value [1]
Sioux City to Blair	359,000	8,563	$533,000	1,561	$1,633,000,000
Blair to Platte River	54,200	7,724	$416,000,000	700	$2,800,000,000
Platte River to Rulo	208,500	1,480	$73,000,000	321	$1,000,000,000
Rulo to Kansas City	151,700	688	$22,000,000	165	$496,000,000
Kansas City to Crooked River	250,100	2,068	$66,000,000	1,144	$5,875,000,000
Crooked River to Osage River	102,500	259	$8,000,000	248	$86,000,000
Osage River to Mouth	119,200	491	$16,000,000	575	$2,956,000,000
Total	**1,245,200**	**21,273**	**$601,533,000**	**4,714**	**$14,846,000,000**

[1] Includes building and contents.
Note: Table includes Tribal resources of the Winnebago, Omaha, Iowa, and Sac and Fox Reservations.
Source: Corps, 1998c

billion dollars. Table 3.2-3 summarizes the land by reach of river.

3.3 BIOLOGICAL RESOURCES

The pre-channelized Missouri River provided a variety of habitat important to the floodplain ecosystem. The NRC (2002) offered the following description: *"A typical cross-section of the pre-regulation Missouri River contained a deep channel, multiple side channels, oxbow lakes, islands, sandbars and dunes, and backwater habitats interspersed by areas of higher land. These channels and backwater areas provided slower-moving waters critical for reproduction, shelter, and feeding of fish species. Higher lands contained rich forests, prairie grasses, and thick underbrush that contained a myriad of plant species*." An important habitat type that has been greatly reduced is shallow water habitat. This habitat type often occurred in association with sandbars and side channels. The continual processes of erosion and deposition created habitats in various stages of succession, including the creation and elimination of sandbars and associated shallow water habitat. Rises in flow scoured some sandbars, keeping them clear of vegetation, while others became vegetated until eventually flows washed them away introducing snags into the river channel. The diversity of biological resources that existed within the floodplain ecosystem of the pre-regulation river has been greatly altered.

Biological resources include native or naturalized plants and animals and the habitats in which they occur. These resources include vegetation communities, fish and wildlife populations, wetlands, and species that are candidates for, or listed as, federal or state threatened or endangered species.

Data was collected from existing sources, including published literature, reports, and survey results. Contacts with federal and state agencies were used to supplement this information. State and federal databases, in particular natural heritage databases, were queried to obtain species inventory lists.

3.3.1 WETLANDS

Wetlands are lands that are transitional between terrestrial and aquatic systems (Cowardin et al., 1979). Wetlands are characterized by three attributes: hydric soils, vegetation adapted to such soils, and soils that are saturated with water or covered by shallow water at some point during the growing season (Cowardin et al., 1979). Wetlands along the Missouri River serve a variety of important functions, including wildlife habitat, fish breeding and foraging habitat, nutrient/sediment trapping, flood control, and recreation (Corps, 2001). The Missouri River below Sioux City is characterized by the construction of dikes and levees that provide a narrow, sinuous channel with few islands, backwaters, or side channels. As a result of bank stabilization, channelization, and bed degradation, drainage has improved on the floodplain and accreted lands have been developed for agricultural purposes (Corps, 2001). In addition, the elimination of the natural meandering of the Lower Missouri River by the BSNP has reduced wetland habitat.

The Cowardin System, the USFWS wetland classification system, classifies wetland and deep-water habitats into five different systems: palustrine, lacustrine, riverine, estuarine, and marine. The discussion of wetlands in this section will focus on those classified as palustrine wetlands. Although riverine wetlands occur in and adjacent to the Missouri River channel, available studies have focused on palustrine wetlands and riverine wetland data is not available. Palustrine wetlands include areas traditionally called wetlands, such as marshes, swamps, and bogs, and usually support vegetation (Cowardin et al., 1979). Forest, scrub/shrub, emergent, and aquatic bed are the most common types of palustrine wetlands along the Missouri River (Corps, 1994).

Estimations of the number of acres of wetlands in the Missouri River floodplain have typically been based on National Wetland Inventory (NWI) maps and the USFWS wetland classification system. The Corps completed an Environmental Resource Inventory for the Upper Mississippi River, Lower Missouri River, and major tributaries in 1995 (Corps, 1995). As part of this inventory, the Corps used two data sources to estimate the acres of wetlands within the floodplain of the Lower Missouri River from Gavins Point Dam to St. Charles, Missouri. The first data source was the land use/land cover information provided by the Scientific Assessment and Strategy Team (SAST). This information was developed from Landsat satellite images. The second data source was NWI data developed by the USFWS, but was not available for all segments of the Lower Missouri River. Where coverage amounted to 60 percent or more, data was extrapolated to estimate 100 percent coverage (Corps, 1995). The accuracy of these estimates was affected by the lack of complete coverage for portions of the Lower Missouri River and also by the effects of the 1993 flood, which increased the acreage of wetlands in the ROI. It should also be noted that the estimates shown on Table 3.3-1 included the reach of the Missouri River between Gavins Point Dam and Sioux City, which is not included in the ROI. Consequently, the acreages estimated are relatively higher than actual wetland acreages in the ROI.

The total wetland acreage (palustrine wetlands) in the Lower Missouri River floodplain downstream of Gavins Point Dam was estimated with SAST land use/land cover data to be 124,230 acres (Corps, 1995). The study area was divided into four

Table 3.3-1
Wetlands in the Lower Missouri River Floodplain

River Reach	Wetland Estimate (acres)		Wetland Class*		
	SAST Land use / Land cover estimate	NWI estimate	Forested (%)	Shrub/scrub (%)	Emergent (%)
Gavins Point Dam to Omaha	27,810	30,720	18	18	64
Omaha to Rulo	21,900	21,900	NA	NA	NA
Rulo to Glasgow	39,220	59,630	49	4	47
Glasgow to St. Charles	35,300	34,940	67	4	29
Total	124,230	147,190	NA	NA	NA

* Composition of wetland class based on NWI estimate.
Source: Corps, 1995.

river reaches: Gavins Point Dam to Omaha, Omaha to Rulo, Rulo to Glasgow, and Glasgow to St. Charles (Corps, 1995). Of the 124,230 wetland acres in the Lower Missouri River floodplain, 27,810 acres were within the Gavins Point dam to Omaha reach, 21,900 acres were within the Omaha to Rulo reach, 39,220 acres were within the Rulo to Glasgow reach, and 35,300 acres were within the Glasgow to St. Charles reach (Corps, 1995). Wetlands comprise 5.5 percent of the Lower Missouri River floodplain based on land use/land cover data (Corps, 1995).

Using NWI data, the total wetland acreage within the Lower Missouri River floodplain downstream of Gavins Point Dam was estimated to be 147,190 acres (Corps, 1995). Of the total wetland acres, 30,720 acres were within the Gavins Point Dam to Omaha reach, 21,900 were within the Omaha to Rulo reach, 59,630 acres were within the Rulo to Glasgow reach, and 34,940 were within the Glasgow to St. Charles reach (Corps, 1995).

Emergent wetlands comprised 64 percent of all wetlands between Gavins Point Dam and Omaha. Forested and scrub/shrub wetland types each comprised 18 percent of all wetlands in this river reach (Corps, 1995). NWI data was limited for the Omaha to Rulo river reach and estimates of wetland types are not available (Corps, 1995). In the Rulo to Glasgow river reach, forested wetlands comprised 49 percent of all wetlands, emergent wetlands comprise 47 percent, and scrub/shrub 4 percent (Corps, 1995). Forested wetlands comprised 67 percent of all wetlands between Glasgow and St. Charles. Emergent wetlands and scrub/shrub wetlands comprised 29 percent and 4 percent of all wetlands in this river reach, respectively (Corps, 1995).

Weaver (1960) found that the dominant emergent wetland species in the Missouri River floodplain was cattail (*Typha latifolia*). Other important wetland species included bulrush (*Scirpus* spp.), spike-rush (*Eleocharis* spp.), smartweed (*Polygonum* spp.), and sedges (*Carex* spp.). In wetlands with higher water levels, cattails were often associated with arrowhead (*Sagittaria latifolia*), water lily (*Nymphaea* spp.), and pondweed (*Potamageton* spp.; Weaver, 1960).

The Corps conducted field investigations of several wetland study sites as part of the Master Manual Review Study (Corps, 1994; Corps, 2001). Emergent wetlands north of St. Joseph are dominated by reed canarygrass (*Phalaris arundincea*) or

common reed (*Phragmites australis*), but sedges, rushes, and rice cutgrass (*Leersia oryzoides*) are also common (Corps, 2001). Scrub/shrub wetlands are characterized by peachleaf willow (*Salix amygaloides*) and cottonwood (*Populus deltoids*), or by a mix of black willow (*Salix nigra*) and young cottonwoods, with some sandbar willow (*Salix interior*). The amount of forested wetlands increases downstream of St. Joseph to the mouth. Forested wetlands in this portion of the Lower Missouri River are dominated by black willow mixed with silver maple (*Acer saccharinum*) and sycamore (*Platanus occidentalis*). Emergent wetlands are characterized by flatsedges (*Cyperus* spp.), smartweeds, and less commonly, cattails. Other emergent wetlands in this reach may support rice cutgrass, green bulrush (*Scirpus atrovirens*), skullcap (*Scutellaria* sp.), and smartweeds (Corps, 2001).

3.3.2 VEGETATION

The plant communities of the Missouri River floodplain from Sioux City to the mouth have changed drastically during the last century. The study area lies within the plains grasslands and oak-hickory forest ecosystems (Corps, 2001). Westward expansion in the 1800s resulted in row crop cultivation of fertile floodplain soils (Hesse et al., 1988). Floodplain forests were destroyed and replaced with crops, such as corn and soybeans. Prairies were mowed, grazed, and plowed. Flood control, bank stabilization, and channelization of the river created accreted lands and allowed for increased agricultural production in the floodplain, resulting in the conversion of aquatic habitat to native vegetation then to domestic crops. Hesse et al. (1988) estimated the vegetation coverage changes in the channelized portion of the Missouri River floodplain between 1892 and 1982. During that period, deciduous vegetation declined by 41 percent, grasslands by 12 percent, wetlands by 39 percent, and sandbars by 97 percent. During the same time period, agriculture increased by 4,278 percent (Hesse et al., 1988).

Historically, grasslands characterized the northern portion of the Lower Missouri River above St. Joseph, Missouri (Corps, 2001). Prairies on the floodplain were dominated by prairie cordgrass (*Spartina pectinata*), Canada wildrye (*Elymus canadensis*), switchgrasses (*Panicum* spp.), and reed canarygrass in wet areas adjacent to the river (Hesse et al., 1988). Drier sites were dominated by big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), and needlegrasses (*Stipa* spp.; Hesse et al., 1988). Where native prairies

remain, they may also include species such as porcupine grass (*Stipa spartea*) and sideoats grama (*Bouteloua curtipendula*; Corps, 1995). Beginning at St. Joseph and continuing to the mouth of the river, the floodplain was historically bordered by rolling hills forested with oak (*Quercus* spp.), hickory (*Carya* spp.), and maple (Corps, 2001). Floodplain forests were comprised of elms (*Ulmus* spp.), hackberry, maples, sycamore, oaks, pecan (*Carya illinoensis*), and a diverse shrub and under story.

In the northern portion of the Lower Missouri River, bottomland forests contain cottonwood, elm, honey locust (*Gleditsia tricanthos*), sycamore, box elder (*Acer negundo*), and black walnut (*Juglans nigra*). Basswood (*Tilia americana*), red oak (*Quercus rubra*), bur oak (*Quercus macrocarpa*), and shagbark hickory (*Carya ovata*) can be found on upland slopes (Corps, 1995). Other species include green ash (*Fraxinius pennsylvanica*), mulberry (*Morus* sp.), and red cedar (*Juniperus virginiana*; Corps, 2001). A mix of cottonwood, silver maple, box elder, dogwood (*Cornus* spp.), and mulberry characterize the floodplain forest south of St. Joseph (Corps, 2001). The understory may include wild grape (*Vitis* sp.) and clematis (*Clematis* spp.; Corps, 2001). One of the largest, undisturbed areas of floodplain forest on the Lower Missouri River occurs at Fort Leavenworth, Kansas and includes many species that are rarely seen along the Lower Missouri River, such as pecan, pawpaw (*Carica papaya*), Kentucky coffeetree (*Gymnocladus dioica*), and swamp chestnut oak (*Quercus michauxii*; Corps, 2001). Wetland vegetation was previously described in Section 3.3.1, Wetlands.

3.3.3 WILDLIFE

The floodplain of the Lower Missouri River historically provided a great diversity of wildlife habitat (Hesse et al., 1988). Currently, productive wildlife habitat in the Lower Missouri River is largely restricted to the old oxbows and chutes that were partially or entirely cut off from the river by dikes and revetments (Corps, 2001) and the remaining stands of timber. The increases in agriculture in the floodplain, along with the effects of bank stabilization and channelization, have reduced the once abundant and diverse wildlife habitat in the floodplain. However, the Lower Missouri River floodplain still provides important habitat for many wildlife species. The Missouri River provides important habitat for a wide diversity of wildlife, including at least 60 species of mammals, 301 species

of birds, and 52 species of reptiles and amphibians (Corps, 2001).

Remnant bottomland forests and agricultural fields provide habitat for mammals such as gray squirrel (*Sciurus carolinensis*), fox squirrel (*Sciurus niger*), cottontail rabbit (*Sylvilagus floridanus*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), and coyote (*Canis latrans*). Common furbearers along the river's bank include mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), beaver (*Castor canadensis*), otter (*Lontra canadensis*), and raccoon (*Procyon lotor*; USFWS, 1999). Other furbearers in the

ROI include opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), and weasel (*Mustela frenata*). White-tailed deer (*Odocoileus virginianus*) is a common big game species found in the floodplain. Six ROI counties in Missouri were ranked in the top 25 deer harvest counties for the state (USFWS, 1999). The Nebraska ROI counties are located within the Blue,

Elkhorn, and Wahoo NGPC deer harvest units. These three units recorded the top three deer harvests for the state in 1999 (NGPC, 2001). Deer harvest information was not readily available for ROI counties in Iowa or Kansas; however, deer populations in those counties are assumed to be equally productive.

The Lower Missouri River is located within the Central and Mississippi North American migratory waterfowl flyway (Corps, 2001). Waterfowl use the Missouri River and its floodplain for resting, feeding, and nesting. Numbers of waterfowl are greatest during the spring and fall migration seasons. Common dabbling duck species include mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), northern shoveler (*Anas clypeata*), northern pintail (*Anas acuta*), gadwall (*Anas strepera*), blue-winged teal (*Anas discors*), green-winged teal (*Anas crecca*), and American widgeon (*Anas americana*). Wood ducks are probably the most common nesting species in the study

area (USFWS, 1999). Common species of diving ducks are ring-necked (*Aythya collaris*), lesser scaup (*Aythya affinis*), ruddy (*Oxyura jamaicensis*), redhead (*Aythya americana*), common golden-eye (*Bucephala clangula*), and bufflehead (*Bucephala albeola*; USFWS, 1999). Other waterfowl in the study area include hooded merganser (*Lophodytes cucullatus*),

common merganser (*Mergus merganser*), red-breasted mergansers (*Mergus serrator*), Canada geese (*Branta canadensis*), snow geese (*Chen caerulescens*), and white-fronted geese (*Anser albifrons*). During migration stops, dabbling ducks and geese rest on islands and sandbars and forage in grain fields, whereas diving ducks use large open water areas for loafing and foraging (Corps, 2001).

Other migratory birds that can be found in the study area include wading birds, shorebirds, passerines, and raptors. Wading birds such as the great blue heron (*Ardea herodias*), black-crowned (*Nycticorax nycticorax*) and yellow-crowned night heron (*Nycticorax violaceus*), and green heron (*Butorides striatus*) use the river corridor to forage for fish, amphibians, and invertebrates (USFWS, 1999). Shorebirds that are regular breeders in the area include killdeer (*Charadrius vociferous*) and American woodcock (*Scolopax minor*). Passerines are the largest group of migratory bird species within the study area and include thrushes, warblers, flycatchers, vireos, hummingbirds, swallows, wrens, tanagers, orioles, sparrows, as well as others (USFWS, 1999). Floodplain forests and wetlands are important breeding and migratory habitats for passerines. Hawks, falcons, eagles, vultures, and owls are also found in floodplain habitats.

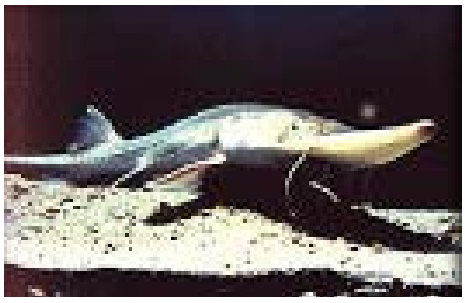
Important species of upland game birds in the ROI include wild turkey (*Meleagris gallopavo*), ring-necked pheasant (*Phasianus colchicus*), and bobwhite quail (*Colinus virginianus*). Migratory game birds, other than waterfowl, include mourning dove (*Zenaida macroura*), woodcock, and common snipe (*Gallinago gallinago*; USFWS, 1999). Upland game birds are especially dependent on emergent

wetlands, grasslands, and riparian forest (Corps, 2001).

3.3.4 FISHERIES

At least 156 native fish species are known to exist in the Missouri River basin (Hesse et al., 1988). The USFWS (1999) developed a list of 91 fish species that are currently found in the Lower Missouri River (Table 3.3-2). Impoundment, channel-ization, degradation, and unnatural hydrologic conditions have changed the fish species composition in nearly all reaches of the river (Hesse et al., 1988). Construction of dikes and revetments have narrowed and deepened the channel into a fixed location, which has greatly eliminated shallow water habitat and increased water depth and current velocity (NRC, 2002). The lowest velocities are found in eddies that form behind dikes and along channel margins (Corps, 2001). Sediment loads in the river have also diminished. The ecological impact of these river changes has been strongly negative for native fishes (NRC, 2002). Native fish species are adapted to a highly turbid river with an abundance of backwater and side channel habitats important for spawning (Corps, 2001).

Principal fish species in the Lower Missouri River include emerald shiner (*Notropis atherinoides*), river carpsucker (*Carpiodes carpio*), channel catfish (*Ictalurus punctatus*), gizzard shad (*Dorosoma cepedianum*), red shiner (*Notropis lutrensis*), shorthead redhorse (*Moxostoma macrolepidotum*), carp (*Cyprinus carpio*), and goldeye (*Hiodon alosoides*). Pallid and shovelnose sturgeon and paddlefish (*Polyodon spathula*) are also found in the Lower Missouri River (Corps, 2001). In the channelized reaches of the river, fish are associated with revetments and dikes. Side channels yield the greatest species richness and greatest numbers of fish, however, few natural side channels remain (Corps, 2001).



Sport fish include channel catfish, crappie (*Pomoxis* spp.), sauger (*Stizostedion canadense)*, flathead catfish (*Pylodictus olivaris)*, white bass (*Morone chrysops*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), walleye (*Stizostedion vitreum*), northern pike (*Esox lucius*), and paddlefish (Corps, 1995). Species important to the commercial fishery on the Lower Missouri River include buffalo

Table 3.3-2
Fish species of the Lower Missouri River (USFWS, 1999)

Common name	Scientific name	Common name	Scientific name
Chestnut lamprey	*Icthyomyzon castaneus*	Western silvery minnow	*Hybognathus argyritis*
Lake sturgeon	*Acipenser fulvescens*	Plains minnow	*Hybognathus placitus*
Shovelnose sturgeon	*Scaphirhyncus platorynchus*	Brassy minnow	*Hybognathus hankinsoni*
Pallid sturgeon	*Scaphirhyncus alba*	Bluntnose minnow	*Pimephales notatus*
Paddlefish	*Polyodon spathula*	Fathead minnow	*Pimephales promelas*
Shortnose gar	*Lepisosteus platostomus*	Central stoneroller	*Campostoma anomalum*
Longnose gar	*Lepisosteus osseus*	Blue sucker	*Cycleptus elongates*
Bowfin	*Amia calva*	Bigmouth buffalo	*Ictiobus cyprinellus*
American eel	*Anguilla rostrata*	Black buffalo	*Ictiobus niger*
Rainbow smelt	*Osmerus mordax*	Smallmouth buffalo	*Ictiobus bubalus*
Skipjack herring	*Alosa chrysochloris*	River carpsucker	*Carpiodes carpio*
Alabama shad	*Alosa alabamae*	Quillback	*Carpiodes cyprinus*
Gizzard shad	*Dorosoma cepedianum*	White sucker	*Catostomus commersoni*
Goldeye	*Hiodon alosoides*	Golden redhorse	*Moxostoma erythrurum*
Mooneye	*Hiodon tergisus*	Shorthead redhorse	*Moxostoma macrolepidotum*
Northern pike	*Esox lucius*	Black bullhead	*Ameiurus melas*
Carp	*Cyprinus carpio*	Yellow bullhead	*Ameiurus natalis*
Goldfish	*Carassius auratus*	Channel catfish	*Ictalurus punctatus*
Grass carp	*Ctenopharyngodon idella*	Blue catfish	*Ictalurus furcatus*
Bighead carp	*Hypophthalmicthys nobilis*	Freckled madtom	*Noturus flavus*
Silver carp	*Hypophthalmicthys molitrix*	Flathead catfish	*Pylodictus olivaris*
Golden shiner	*Notemigonus crysoleucas*	Stonecat	*Noturus flavus*
Creek chub	*Semotilus atromaculatus*	Burbot	*Lota lota*
Silver chub	*Hybopsis storeriana*	Plains killifish	*Fundulus kansae*
Gravel chub	*Hybopsis x-punctata*	Mosquitofish	*Gambusia affinis*
Speckled chub	*Hybopsis aestivalis*	Brook silverside	*Labidesthes sicculus*
Flathead chub	*Hybopsis gracilis*	White bass	*Morone chrysops*
Sicklefin chub	*Macrhybopsis meeki*	Striped bass	*Morone saxatilis*
Sturgeon chub	*Macrhybopsis gelida*	Hybrid striped bass	*Morone chrysops x saxatilis*
Suckermouth minnow	*Phenacobius mirabilis*	Largemouth bass	*Micropterus salmoides*

Table 3.3-2 *(continued)*
Fish species of the Lower Missouri River (USFWS, 1999)

Emerald shiner	*Notropis atherinoides*	Spotted bass	*Micropterus punctulatus*
Silverband shiner	*Notropis shumardi*	Green sunfish	*Lepomis cyanellus*
Redfin shiner	*Notropis umbratilis*	Orangespotted sunfish	*Lepomis humilis*
Common shiner	*Notropis cornutus*	Longear sunfish	*Lepomis megalotis*
Striped shiner	*Notropis chrysocephalus*	Bluegill	*Lepomis macrochirus*
River shiner	*Notropis blennius*	Rock bass	*Ambloplites rupestris*
Bigmouth shiner	*Notropis dorsalis*	White crappie	*Pomoxis annularis*
Bigeye shiner	*Notropis boops*	Black crappie	*Pomoxis nigromaculatus*
Spotfin shiner	*Notropis spilopterus*	Walleye	*Stizostedion vitreum*
Red shiner	*Notropis lutrensis*	Sauger	*Stizostedion canadense*
Sand shiner	*Notropis stramineus*	Slenderhead darter	*Percina phoxocephala*
Mimic shiner	*Notropis v.volucellus*	Logperch	*Percina caprodes*
Ghost shiner	*Notropis buchanani*	Johnny darter	*Etheostoma nigrum*
Rosyface shiner	*Notropis rubellus*	Orangethroat darter	*Etheostoma spectabile*
Channel shiner	*Notropis v. wickliffi*	Freshwater drum	*Aplodinotus grunniens*
Central silvery minnow	*Hybognathus nuchalis*		

(*Ictiobus* spp.), carp, carpsucker, freshwater drum (*Aplodinotus grunniens*), and catfish (Corps, 1995). However, a moratorium on the commercial harvest of catfish is currently in effect for the Lower Missouri River (Corps, 2001). Funk and Robinson (1974) documented that the commercial fish catch in the Missouri River declined by 80 percent between 1947 to 1963.

3.3.5 THREATENED AND ENDANGERED SPECIES

Species classified as endangered under the ESA are species that are in danger of extinction throughout all or a significant portion of their range. Species classified as threatened are species that are likely to become endangered within the foreseeable future. Plants or animals that the USFWS is reviewing for possible listing as threatened or endangered species are classified as candidate species.

The natural heritage databases of the four affected states were searched to determine federal and state listed threatened and endangered species that may occur within the ROI. These species are listed in Table 3.3-3.

Table 3.3-3
Federal and State Threatened and Endangered Species with Potential to Occur in the ROI

Common Name	*Scientific Name*	Federal Status*	State Status*			
			MO	KS	IA	NE
Plants:						
Mead's milkweed	*Asclepias meadii*	T	E		E	
Eared milkweed	*Asclepias engelmanniana*				E	
Western prairie fringed orchid	*Platanthera praeclara*	T	E		T	T
Running buffalo clover	*Trifolium stoloniferum*	E	E			
Decurrent false aster	*Boltonia decurrens*	T	E			
Biscuit root	*Lomatium foeniculaceum*				E	
Slender penstemon	*Penstemon gracilis*				T	
Silver buffalo-berry	*Shepherdia argentea*				T	
Red globe-mallow	*Sphaeralcea coccinea*				T	
Spring ladies'-tresses	*Spiranthes vernalis*				T	
American ginseng	*Panax quinquefolius*					T
Birds:						
Bald eagle	*Haliaeetus leucocephalus*	T, PDL	E	T	E	T
Eskimo curlew	*Numenius borealis*	E		E		E
Interior least tern	*Sterna antillarum*	E	E	E	E	E
Peregrine falcon	*Falco peregrinus*	DL	E	E	E	
Piping plover	*Charadrius melodus*	T		T	E	T
Snowy plover	*Charadrius alexandrinus*			T		
White-faced ibis	*Plegadis chihi*			T		
Barn owl	*Tyto alba*		E		E	
Northern harrier	*Circus cyaneus*		E		E	
Greater-prairie chicken	*Tympanuchus cupido*		E			
American bittern	*Botaurus lentiginosus*		E			
King rail	*Rallus elegans*		E		E	
Bachman's sparrow	*Aimophila aestivalis*		E			
Snowy egret	*Egretta thula*		E			
Swainson's warbler	*Limnothlypis swainsonii*		E			
Mammals:						
Eastern spotted skunk	*Spilogale putorius interrupta*		E	T	T	
Gray bat	*Myotis grisescens*	E	E	E		
Indiana bat	*Myotis sodalis*	E	E		E	

Table 3.3-3 *(continued)*
Federal and State Threatened and Endangered Species with Potential to Occur in the ROI

Common Name	*Scientific Name*	Federal Status*	State Status*			
			MO	KS	IA	NE
Mammals:						
Black-tailed jackrabbit	*Lepus californicus*		E			
River otter	*Lontra canadensis*				T	T
Southern flying squirrel	*Glaucomys volans*					T
Bobcat	*Lynx fufus*				E	
Northern grasshopper mouse	*Onychomys leucogaster*				T	
Plains pocket mouse	*Perognathus flavescens*				E	
Reptiles and Amphibians:						
Northern redbelly snake	*Storeria occipitomaculata*			T		
Smooth earth snake	*Virginia valeriae elegans*			T		
Western fox snake	*Elaphe vulpina vulpina*		E			
Eastern massasauga	*Sistrurus catenatus catenatus*	C	E		E	T
Blanding's turtle	*Emydoidea blandingii*		E			
Western worm snake	*Carphophis amoenus*				T	
Great plains skink	*Eumeces obsoletus*				E	
Ornate box turtle	*Terrapene ornate*				T	
Fishes:						
Chestnut lamprey	*Ichthyomyzon castaneus*			T	T	
Flathead chub	*Platygobio gracilis*		E	T		
Pallid sturgeon	*Scaphirynchus albus*	E	E	E	E	E
Sicklefin chub	*Macrhybopsis meeki*			E		
Silverband shiner	*Notropis shumardi*			T		
Sturgeon chub	*Macrhybopsis gelida*			T		E
Western silvery minnow	*Hybognathus argyritis*			T		
Lake sturgeon	*Acipenser fulvescens*		E		E	T
Topeka shiner	*Notropis topeka*	E	E	T	T	E
Crystal darter	*Crystallaria asprella*		E			
Niangua darter	*Etheostoma nianguae*	T	E			
Blacknose shiner	*Notropis heterolepis*				T	T
Mussels:						
Elephant-ear	*Elliptio crassidens*		E			

Table 3.3-3 *(continued)*
Federal and State Threatened and Endangered Species with Potential to Occur in the ROI

Common Name	*Scientific Name*	Federal Status*	State Status*			
			MO	KS	IA	NE
Mussels:						
Pink mucket	*Lampsilis abrupta*	E	E			
Sheepnose	*Plethobasus cyphyus*		E			
Ebonyshell	*Fusconaia ebena*		E			
Scaleshell mussel	*Leptodea leptodon*	E				
Other:						
American burying beetle	*Nicrophorus americanus*	E	E	E		E
Slender walker snail	*Pomatiopsis lapidaria*			E		
Dakota skipper	*Hesperia dacotae*				E	
Powesheik skipperling	*Oarisma powesheik*				T	

* T = threatened, E = endangered, C = candidate, DL = delisted, PDL = proposed for delisting.

3.3.5.1 Federally Listed Species

The Federal listing of a species is derived from the provisions of the ESA, as amended, which is administered by the USFWS. The primary objective of the USFWS's Endangered Species Program is to protect threatened and endangered species and to restore them to the point where their existence is no longer jeopardized. Four plants, four birds, two mammals, three fish, one reptile, two mussels, and one insect are Federally listed as threatened, endangered, or a candidate for listing within the Lower Missouri River floodplain ecosystem (Table 3.3-3).

Mead's milkweed (*Asclepias meadii*) and western prairie fringed orchid (*Platanthera praeclara*) are Federally listed plant species that utilize dry mesic and mesic upland prairie habitats. Both species have declined due to the loss of prairie habitat throughout their ranges (MDC, 2000a). Decurrent false aster (*Boltonia decurrens*) is found in low areas subject to flooding, such as ditches, mud flats, sloughs, and agricultural fields. This species requires periodic disturbance such as prolonged standing water (MDC, 2000a). Currently, this species is only found near the confluence of the Missouri and Mississippi rivers and along the Mississippi (USFWS,2002). Running buffalo clover (*Trifolium stoloniferum*) is found in moist, partially shaded woodlands, sometimes

along stream or river terraces. The reason for this species' decline is not known; however, it may be related to competition from exotic clover species (MDC, 2000a).

Bald eagles are known common migrants and regular winter residents along the Missouri River. Bald eagles are becoming regular breeders in much of the project area (Corps, 1999) and utilize riparian woodlands along rivers, lakes, and streams for nesting, perching, and roosting sites. Bald eagles are currently listed as threatened, however the species was proposed for delisting in 1999. The decision for delisting has been delayed until the USFWS determines how the species would be managed if it is delisted. The Eskimo curlew (*Numenius borealis*) was once an abundant spring migrant in the Great Plains region, but is now rare (Corps, 2001). Extensive hunting and habitat changes are thought to be responsible for the decline of the Eskimo curlew. Eskimo curlew use of the Missouri River corridor is unknown, but likely is limited to very rare visits of short duration during spring migration (Corps, 2001). The last report of an Eskimo curlew in Kansas was in 1902 (KDWP, 2001). The least tern and piping plover were Federally listed as endangered and threatened, respectively, in 1985. These two species rely heavily on Missouri River sandbar and island habitat, primarily upstream of the ROI, for nesting and shallow water habitat for foraging (Corps, 2001). The decline of these species is due to loss of habitat and human disturbance. In 2000, the USFWS issued a BiOp regarding the Corps' operation of the Mainstem Reservoir System, BSNP, and Kansas River operations. The BiOp stated that the Corps' operations of these Missouri River projects jeopardize the continued existence of the least tern and piping plover. The USFWS recently designated critical habitat for the Great Plains population of the piping plover.

The Indiana bat (*Myotis sodalis*) and gray bat (*Myotis grisescens*), two Federally endangered species, have experienced serious population declines due to habitat loss and human disturbance (Corps, 2001). The gray bat lives in caves all year long (MDC, 2000b), while the Indiana bat hibernates in caves during the winter and roosts in trees with loose bark in the spring

and summer. Both species are known to occur in Boone County, Missouri and use Missouri River bluff caves for hibernation (Corps, 2001). The loss of wetland and riparian communities along the Missouri River contribute to the loss of foraging and roosting habitat for these species.

The Federally endangered pallid sturgeon occurs in the main channel of the large, turbid, free-flowing Missouri River, the Mississippi River downstream of St. Louis, and the lower segments of some major tributaries. Modification of the natural Missouri River hydrograph, habitat loss, fish migration blockage, pollution, hybridization, and overharvesting are probably responsible for pallid sturgeon decline (USFWS, 1993). Side channels and chutes that provide shallow water habitat for pallid sturgeon spawning have been greatly reduced in the channelized Missouri River. Grady et al. (2001) found that pallid sturgeon populations in the Lower Missouri River and Middle Mississippi River appear to have declined. The ratio of wild pallid sturgeon to all river sturgeon dropped from one in 398 (0.25 percent) collected by Carlson et al. (1985) to one in 647 (0.15 percent) collected by Grady et al. (2001).

The Federally threatened Niangua darter (*Etheostoma nianguae*) is restricted to upland creeks and small to medium-sized rivers with silt-free gravel or rock bottoms (MDC, 2000b). It has a very localized distribution and occurs only in a few tributaries of the Osage River in central Missouri (Pflieger, 1991). The species has declined due to reservoir construction and stream channelization. The Osage River is a tributary to the Lower Missouri River. The Federally endangered Topeka shiner (*Notropis topeka*) is also a fish species of the tributaries of the Lower Missouri River. The Topeka shiner lives in pools of small prairie streams with good water quality and gravel stream-beds (MDC, 2000b) and at present is restricted to direct tributaries of the Missouri River having sufficient gradient to prevent extensive deposition of silt (Pflieger, 1991). Land use changes resulting in loss or alteration of stream habitat and diminished water quality have caused this species to decline (MDC, 2000b). The USFWS has recently proposed critical habitat for the Topeka shiner. The Niangua darter and Topeka shiner are restricted to the tributaries of the Missouri River.

The eastern massasauga (*Sistrurus catenatus*) is a candidate for Federal listing

under the ESA. The eastern massasauga is a rattlesnake that lives in natural marsh and moist prairie habitats (MDC, 2000b). These habitats have been extensively drained and plowed for row crop agriculture. Loss of habitat is the primary reason for the decline of this species (MDC, 2000b).

The MDC Natural Heritage database lists two Federal endangered freshwater mussel species, the pink mucket (*Lampsilis abrupta*) and scaleshell (*Leptodea leptodon*), as having the potential to occur in the Missouri River, however, it is unlikely that they occur there. The pink mucket lives in large rivers in substrate mixtures of sand, gravel, and cobble (MDC, 2000b). The scaleshell is usually found in riffle areas with substrates consisting of mixed gravel, cobble, boulder, and sometimes mud or sand. Freshwater mussels go through a larval stage called the glochidium, which requires attachment to a host that may be a fish or other object. The only suitable host fish for the scaleshell is the freshwater drum (MDC, 2000b).

The reasons for the decline of the Federal endangered American burying beetle (*Nicrophorus americanus*) are not fully understood; however, it once ranged throughout the eastern United States (MDC, 2000b). American burying beetles are thought to occur wherever small mammal or bird size carrion is available and suitable substrate for burying the carrion is present in forest or grassland habitats (MDC, 2000b). Today, it is known from only a few locations (Corps, 2001). The riparian and wetland forest and grasslands along the Missouri River could potentially support isolated populations of American burying beetles. However, no observations of the beetles have been made on the Missouri River to date (Corps, 2001).

3.3.5.2 State Listed Species

In addition to those species on the Federal list, the states of Missouri, Kansas, Iowa, and Nebraska also maintain lists of protected species that are threatened or endangered at the state level. The natural heritage databases of each state were searched to determine the state threatened and endangered species that may occur or have potential to occur within the ROI counties. Forty-seven species, in addition to those listed Federally, are listed as threatened or endangered at the state level. These species include, 7 plants, 11 birds, 7 mammals, 7 reptiles and amphibians, 9 fish, 3 mussels, 1 snail, and 2 butterflies (Table 3.3-2). Many of these species are associated with habitats that are found or

were associated with the Lower Missouri River floodplain ecosystem.

3.3.6 EXISTING FISH AND WILDLIFE MITIGATION SITES

This section describes the existing mitigation sites that were acquired and developed under the original Mitigation Project authorized by WRDA86.

3.3.6.1 Columbia Bottom, Missouri

The Columbia Bottom mitigation site (Figure 3.3-1) is located on the Columbia Bottom Conservation Area. The area is existing public land owned and operated by the MDC. Columbia Bottom is approximately 4,300 acres in size. The site is on the right descending bank of the Missouri River, at the confluence with the Mississippi River. The land at the Columbia Bottom mitigation site was previously farmed. The area is being improved so that wetlands, native grasses, and bottomland hardwood forest habitats can be restored to the area. Due to the size of the site, the mitigation will occur in several phases.

Phase I is currently under construction. Phase I consists of an 8,000 linear foot setback of an existing agricultural levee. The setback will move the existing levee approximately 800 feet from the Mississippi River bank to create an additional 145 acres of land on the riverside of the levee. In the future, this riverward area will be planted with bottomland hardwood trees and shore area may be evaluated for shallow water habitat potential. Construction of Phase I was completed in April 2002. Phase II of the mitigation is development of approximately 800 acres of constructed wetlands. The work will include construction of 15 low dikes, a pump station, and a water delivery system. Once completed, Phase II will allow development of high quality migratory waterfowl habitat. Phase II is currently under design. Construction of Phase II is scheduled to start in fall 2002.

Figure 3.3-1
Columbia Bottom

View looking south at the land now on the riverside of a newly constructed levee setback at Columbia Bottom.

3.3.6.2 Deroin Bend, Missouri

The Deroin Bend mitigation site (Figure 3.3-2) is located at RM 516 to 520, on the left descending bank of the river. The site contains 1,082 acres of state of Missouri land.

Figure 3.3-2
Deroin Bend

View looking downstream of the restored chute at the Deroin Bend mitigation site.

The construction was completed in December 2001 and includes restoration of a side channel plus planting of several hundred trees. The three-mile channel has a 70-foot bottom width. Upon completion, the MDC will manage the site.

3.3.6.3 Eagle Bluffs, Missouri

The Eagle Bluffs mitigation site (Figure 3.3-3) is located adjacent to the Eagle Bluffs Conservation Area (EBCA) near Columbia, Missouri. The EBCA is existing public land owned and operated by the MDC. The area is bounded by the Missouri River to the west and Perche Creek to the East. The mitigation site is 592 acres in size. The area has been historically used for row crop production. The planned mitigation at this site will include converting the farmed lands to additional seasonally flooded wetlands and a backwater fish nursery. The project scope includes two wetland pools and an additional riparian area by constructing new levees and berms and new water control structures.

There will be two "fish friendly" structures constructed, which were specifically designed to allow fish to spawn within the wetland area and effectively reach Perche creek and the Missouri River. The additional wetlands and backwater nursery

Figure 3.3-3
Eagle Bluffs

View looking south at the new backwater outlet area and fish friendly structure at the Eagle Bluffs mitigation site.

area are currently under construction. The project was completed in January 2002.

3.3.6.4 Grand Pass, Missouri

This mitigation site (Figure 3.3-4) was located at the Grand Pass Conservation Area on land owned by MDC. The area is adjacent to the right descending bank of the Missouri River, at RM 263 to 266.

Figure 3.3-4
Grand Pass

View looking upstream of the restored chute at the Grand Pass mitigation site.

The Grand Pass chute was closed in conjunction with the BSNP. Work associated with the chute closure began in 1934 and was completed by the early 1960s. The main project element for the mitigation at the Grand Pass site was restoration of the historic chute.

Restoration of the chute was completed in 1991. The work included modification of existing river structures, excavation and dredging of the chute, installation of submerged brush piles, and construction of rock hard points. The restored chute is now approximately 50 feet wide and has restored 130 acres of high quality shallow water habitat.

3.3.6.5 Overton Bottoms North, Missouri

Overton Bottoms is approximately 5,000 acres of land purchased by the Corps. The USFWS purchased 747 acres that are part of Overton Bottoms North. The area is adjacent to the right descending bank of the Missouri River at RM 181 to 189. Interstate 70 cuts the bottoms into two sites, Overton Bottoms North (Figure 3.3-5), and Overton Bottoms South (Figure 3.3-6).

Figure 3.3-5
Overton Bottoms North

View looking at the inlet to the constructed river chute at Overton Bottoms North.

Until these lands were purchased for the original Mitigation Project, the area was heavily used for agricultural purposes. With implementation of the mitigation at this site, the agricultural lands have been taken out of production and native grasses and trees have been planted.

In 2000, the Corps designed and constructed a river chute at the Overton Bottoms North site. The 3,000 foot long chute is currently 40 feet wide. The chute has created opportunities for new aquatic habitat. The chute was constructed at higher elevations so that it is only inundated on a seasonal basis. It is anticipated that the chute will continue to widen during periods of flood flow and will eventually scour itself out to a full 150-foot width.

Since completion of chute construction, the area has been turned over to the USFWS to manage as part of their Bid Muddy NFWR. The USFWS has implemented low maintenance operation plans for the area and plans to let the land recover to pre-agricultural conditions on its own. The Corps and USFWS will continue monitoring the chute development and make necessary adjustments to assure it's future development.

3.3.6.6 Overton Bottoms South, Missouri

The Overton Bottoms South site (Figure 3.3-6) is located just to the south of I-70 from the Overton Bottoms North site described above. Together these sites comprise about 5,000 acres. The main project element for the planned mitigation at the Overton Bottoms South site is the setback of an existing levee. The levee setback will create opportunities on the additional riverward land of the levee in which future shallow water and/or bottomland hardwood forest habitats can be restored. The borrow area for the construction of the new levee is being constructed so as to allow opportunistic wetlands to form.

Figure 3.3-6
Overton Bottoms South

View looking at the borrow site for the levee setback project.

After completion of construction, MDC will assume operation and management of the

constructed features. The construction of the levee setback at Overton Bottoms South is currently 65 percent complete and is scheduled to be completed by June 2002.

The Overton Bottoms South site contains about 500 acres of existing bottomland hardwood trees that will be preserved along the river corridor. Additional opportunities will be created when an existing levee is relocated back from the river, creating opportunities on the additional land on the riverside of the levee in which future shallow water and/or bottomland hardwood forest habitats can be restored.

3.3.6.7 Plowboy Bend, Missouri

The Plowboy Bend mitigation site (Figure 3.3-7) is one of several efforts to complete within river structural changes for fish habitat improvements. This site is located adjacent to the Plowboy Bend Conservation Area, which is owned and operated by MDC. The work at this site included notching an existing dike in several locations and reversing the direction of a second existing dike. The structural modifications were used to direct the natural force of the river against the adjacent riverbank. The eroded riverbank and area within the dike field created an area of diverse shallow and deep-water fish habitat. The diversity created at this site is essential to pallid sturgeon recovery.

Figure 3.3-7
Plowboy Bend

View looking at the shallow water habitat created within the river by structure modification at Plowboy Bend.

3.3.6.8 Tate Island, Missouri

The Tate Island mitigation site (Figure 3.3-8) is located at RM 110 to 113 on the left descending bank of the river, near Morrison Bend. The site contains 422 acres, but is

Figure 3.3-8
Tate Island

View of Tate Island and side channel.

situated in the middle of the river. Access to the site is limited only to boat. The site is located two miles east of Portland, Missouri. No construction is planned for the site at this time, however, opportunities to complete shoreline and/or within river improvements to increase and diversify the shallow water habitat at this site may be undertaken in the future.

3.3.6.9 Rocheport Cave, Missouri

Rocheport Cave (Figure 3.3-9) is located 20 miles southwest of Columbia in Cole County, Missouri. The area was purchased in 1996 by MDC to enhance hibernation, nursery, and migratory habitat for the Federally endangered Indiana and gray bats. The Corps is working with MDC, as part of the Mitigation Project, to build a bat-safe gate at the cave entrance. The gate will serve to protect the bats using the cave from human disturbance. Construction is targeted for summer 2002, after the nesting season of the endangered bats.

Figure 3.3-9
Rocheport Cave

View looking out through the entrance to Rocheport Cave.

3.3.6.10 Berger Bend, Missouri

The Berger Bend mitigation site is currently 414 acres located at RM 93-90 in Franklin County, Missouri. The site is on the right descending bank of the Missouri River. Mitigation work at this site has been limited to habitat preservation.

3.3.6.11 Benedictine Bottoms, Kansas

The Benedictine Bottoms mitigation site (Figure 3.3-10) is 2,111 acres in size and is located just north of Atchison, Kansas. The site is at RM 425 to 429 on the right descending bank at Rushville Bend. At this site, the Corps has completed installation of seasonal wetlands, planting of native hardwood trees and prairie grasses.

Benedictine Bottoms has been turned over to KDWP for their management as a wildlife refuge. Benedictine College in Atchison, Kansas, has been conducting monitoring of plants, mammals, birds, reptiles and amphibians, and aerial and terrestrial invertebrates on the Benedictine Bottoms.

Figure 3.3-10
Benedictine Bottoms

View looking across the constructed wetland habitat at Benedictine Bottoms.

Figure 3.3-11
California Bend

Aerial view of California Bend side chute and wetlands,

Courtesy of IDNR

3.3.6.12 Auldon Bar, Iowa

This site is at RM 577 to 580 on the left descending bank. Currently 588 acres have been purchased at this site. A goal of 1,028 acres is desired prior to restoration of habitat at this location. There are apparently no additional willing sellers at this time. No plans to improve this site have been prepared yet. The IDNR is managing the 588 acres of land as a wildlife area.

3.3.6.13 California Bend, Iowa

The California Bend mitigation site (Figure 3.3-11) is 420 acres in size and is located at river miles 649 to 652 on the left descending bank. This project included opening up a historic side channel, which has restored connectivity to the river and created shallow water habitat. The site is owned and managed by the IDNR.

3.3.6.14 Copeland Bend, Iowa

The Copeland Bend site is at RM 565 to 571 on the left descending bank. Land is still being acquired at this site, as it becomes available. Currently, 1,069 acres have been purchased but are scattered throughout the 2,306-acre site. No plans to improve this site have been prepared yet. The IDNR is managing the 1,069 acres of land currently purchased as a wildlife area.

3.3.6.15 Louisville Bend, Iowa

Louisville Bend (Figure 3.3-12) is at RM 682 to 685 on the left descending bank. This site was developed primarily as a

waterfowl area. Of the total area of 1,096 acres, 270 acres are open water.

This site was completed in 1995 and consists of a controlled opening at the inlet and outlet, plus a pump at the inlet. Water is pumped into the area as needed and the outflow is regulated to maintain the water surface elevation. The IDNR manages this site.

Figure 3.3-12
Louisville Bend

View of the inlet of the restored side channel at Louisville Bend.

Courtesy of IDNR

3.3.6.16 Noddleman Island, Iowa

The Noddleman Island mitigation site is located at RM 583 to 587 on the left descending bank. Currently, 1,235 acres of the 2,542 acres desired for this site have been purchased. It appears that there are no additional willing sellers at this time. No plans to improve this site have been prepared. The IDNR is managing the 1,235 acres of land currently purchased as a wildlife area.

3.3.6.17 Tieville-Decatur Bends, Iowa and Nebraska

This mitigation site consists of 3,148 acres and is located at RM 686 to 694 on the left descending bank (Figure 3.3-13). Although these bends are on the Iowa side of the river, some of the land belongs to Nebraska. Construction at this site began in March 2002. The mitigation at this site includes opening several side channels and interconnected backwater areas. Also, pumps are included to maintain a waterfowl area on part of the site.

Figure 3.3-13
Tieville-Decatur Bends

View of a reopened side channel.

3.3.6.18 Winnebago Bend, Iowa

Construction of the Winnebago Bend site (Figure 3.3-14) was completed in 2001. The site consists of 1,300 acres on the left descending bank at RM 708 to 713.

Figure 3.3-14
Winnebago Bend

View of the restored wetland at Winnebago Bend.

Courtesy of IDNR

This site features a reopened side channel with control structures at the inlet, outlet, and middle of the site. Due to the current configuration of the river, it was necessary to install a pump at the upstream end to maintain water flowing through the site. The IDNR manages this area.

3.3.6.19 Hamburg Bend, Nebraska

The Hamburg Bend mitigation site (Figure 3.3-15) is located at RM 552 to 556 on the right descending bank, just south of Nebraska City, Nebraska. The site consists of 1,544 acres of side channels and backwater areas that mimic the historic meander belt and floodplain. The increase in number and variety of fish at this location indicate that high quality habitat has been created at this site. The mitigation at Hamburg Bend was completed in 1996. The site is managed by NGPC.

Figure 3.3-15
Hamburg Bend

Aerial view of the meandering floodplain and chutes at Hamburg Bend.

3.3.6.20 Kansas Bend, Nebraska

Kansas Bend consists of 1,056 acres in two separate areas on the right descending bank at RM 544 to 547 (Figure 3.3-16). It is located near Peru, Nebraska. The plans and specifications for the construction of two chutes are being prepared. It is anticipated the construction will start at this site in December 2002.

Figure 3.3-16
Kansas Bend

Aerial view of Kansas Bend.

Figure 3.3-17
Langdon Bend

Aerial view of Langdon Bend.

3.3.6.21 Langdon Bend, Nebraska

The Langdon Bend mitigation site is located at RM 520 to 532 on the right descending bank near the town of Brownsville, Nebraska (Figure 3.3-17). The site consists of 921 acres of former agricultural land. At this site, a 10-foot bottom width pilot channel and backwater area was constructed. The channel is connected to the river at the outlet, but stops before meeting the river at the upstream end. Flow into this area will occur by water backing up the channel and will allow overland flow at the times when the Missouri River is at flood stage.

3.3.6.22 Tobacco Island, Plattsmouth, Nebraska

Tobacco Island (Figure 3.3-18) is located south of Plattsmouth, Nebraska at RM 586 to 590 on the right descending bank of the river. The site consists of 1,604 acres of former agricultural land. The mitigation at this site included reopening an old side channel and reconnecting it with the river. The mitigation has created additional shallow water aquatic habitat. The channel

Figure 3.3-18
Tobacco Island

View of the restored side channel at Tobacco Island.

is three miles long with a 10-foot bottom width. Construction of the site has been completed.

3.4 LAND USE AND OWNERSHIP

3.4.1 LAND USE

Land use on the Missouri River floodplain has changed significantly during modern times. Prior to channelization, the meander belt of the floodplain consisted primarily of natural aquatic and terrestrial habitat and a braided channel. After settlement, farming practices began in areas that were dry enough for crop production. However, because of settlement density and the natural conditions that existed, agriculture was somewhat limited prior to channelization and construction of flood control structures. The BSNP led to the significant alteration of land use in the ROI over the past 90 years through the construction of revetments and transverse dikes to stabilize the river into a single channel. This caused the accretion of land that was formerly part of the braided channel. Construction of the BSNP has allowed the conversion of a dynamic river ecosystem to predominately new agricultural land during the 1900s.

Consistent and verified land use information for the 46 ROI counties was not available. However, preliminary information from a land cover mapping project currently underway was available (USGS, 2002). This information covers the entire ROI including the floodplain, but had not been verified at the time of this analysis. The preliminary USGS land cover categories were compared with available information for the Missouri counties from another study (USFWS, 1999). The preliminary information appeared consistent in terms of general land cover types and was determined to be suitable for this analysis. Land use and land cover information from the Environmental Resource Inventory for the Upper Mississippi River, Lower Missouri River, and Major Tributaries was also reviewed (Corps, 1995). This information was presented by specific reaches of the river, which generally correspond to the four Lower Missouri River Regions used herein for descriptive purposes. These various sources are generally consistent in terms of relative abundance of land cover types.

Within the entire ROI, agriculture (including cropland, grassland, and pasture) is the primary land use, and generally comprises between 60 and 90 percent of the total land within the ROI counties. Cultivated cropland (e.g., row crops and small grains) within the ROI counties varies from approximately 30 percent (Missouri) to

approximately 70 percent (Iowa) of the total land in the counties. For the entire ROI, grass/pasture is the second most abundant land cover, followed by forest, urban and built-up areas, and wetlands (USGS, 2001).

The Lower Missouri River floodplain encompasses approximately 2,069,000 acres in the ROI (USGS, 2001). Floodplain land use information for each ROI county in the four states is not available, but data is available for each of the four regions of this study. Based on a land use analysis conducted by the USGS for the USFWS Big Muddy EIS (USGS, 1999), the amount of cropland within the Missouri River floodplain in Missouri averaged approximately 76 percent, with some counties having less than 60 percent of the floodplain used for cropland, while some have nearly 90 percent of floodplain under cultivation.

As previously discussed, for descriptive purposes the Lower Missouri River has been divided into four regions. The floodplain characteristics and land use patterns of each region are presented in this and subsequent paragraphs. The Missouri River floodplain in Region 1 is very narrow at Sioux City and then widens dramatically south of Sioux City and the Floyd River. The floodplain is approximately 15 miles wide in Monona County, Iowa, with relatively little floodplain in Nebraska. The floodplain is well defined as the topography breaks sharply at the base of loess hills on both sides of the river. Several small communities are located on the floodplain such as Sloan, Whiting, Onawa, Mondamin, and Missouri Valley, Iowa. Except for transportation facilities and some water, the remainder of the floodplain is under agricultural land use as summarized on Table 3.4-1, Floodplain Land Use. The primary crops are corn, soybeans, and some small grains. Most of this reach of the Missouri River floodplain is not protected by levees; however, extensive levees have been constructed along many of the tributaries.

Throughout Region 2 between Omaha and Kansas City, the floodplain is considerably narrower. The floodplain is typically between three and six miles wide. However, in certain areas it may reach ten miles, such as in the vicinity of the Squaw Creek National Wildlife Refuge south of Craig, Missouri and east of Rulo, Nebraska. Agriculture is the predominant land use with approximately 85 percent of the floodplain used for production of corn, soybeans, and hay. Levees protect almost the entire floodplain and major tributary floodplains in Region 2. Most of the floodplain is on the

Table 3.4-1
Floodplain Land Use

Land Cover Type	Region 1 Sioux City to Omaha	Region 2 Omaha to Kansas City	Region 3 Kansas City to Jefferson City	Region 4 Jefferson City to St. Louis
Urban/Built-up	6%	5%	4%	2%
Agriculture	87%	85%	82%	71%
Range	2%	1%	1%	0%
Forest	< 1%	< 1%	1%	< 1%
Wetland	2%	6%	6%	13%
Water	3%	3%	5%	12%
Barren	< 1%	< 1%	< 1%	< 1%

Source: Adapted from Corps, 1995.

Iowa and Missouri side of the Missouri River, with relatively little floodplain in Kansas and Nebraska.

The floodplain in Region 3 is generally less than six miles wide east of Kansas City, Missouri and east of Boonville generally narrows to two to three miles wide. The floodplain has developed primarily on the north, left descending bank of the Missouri River. Although Region 3 includes the Kansas City metropolitan area and much urban development occurs, agricultural land use still dominates over 80 percent of the floodplain of the region. Corn and soybeans are the dominant crops with some sorghum and small grain produced. Wetlands, urban and built-up land, and water comprise most of the remaining floodplain acreage.

The floodplain east of Jefferson City is primarily on the north bank of the Missouri River and is generally two to three miles wide. Levees have been constructed along the entire reach of the river for flood protection. Agricultural land use in the floodplain declines slightly moving east across Missouri. The floodplain in Region 4 is generally comprised of approximately 70 percent agricultural use, followed by wetlands and water. Corn is the dominant crop, and soybeans ranks second; production of sorghum and small grains are significantly less and comprise most of the remaining agricultural acreage.

3.4.2 LAND OWNERSHIP

Mapped land ownership information for the entire 46 ROI counties was not available. The USGS Columbia Environmental Research Center is conducting

identification and mapping of publicly owned lands within the Missouri River floodplain (2001). This information was considered suitable for this analysis because publicly owned land in the upland parts of the counties is anticipated to be minimal, and land acquisition for the modified Mitigation Project would be within the floodplain. In addition, most government conservation programs on agricultural land that may occur in upland areas are accomplished through leases, and the land is not owned in fee title by the government.

Private parties own most of the land within the 46 ROI counties. Federal and state governments own approximately 0.7 percent (114,550 acres) of the total land area in the ROI, not including Department of Defense (DoD) lands, as shown on Table 3.4-2, Public Lands in Floodplain (USGS, 2001). Private landowners and local governments own the remainder of the approximately 15.76 million acres.

Public land in the floodplain is shown on Figures 3.4-1 through 3.4-4. Public lands in the floodplain include both Federal and state owned lands and are shown only on the regional map in which they occur.

Table 3.4-2
Public Lands in Floodplain and ROI

	Iowa	Kansas	Missouri	Nebraska	ROI
Federal Acres	8,093	2,172	32,453	12,587	55,305
State Acres	18,813	0	37,575	2,857	59,245
Percent Federal of Public Lands	30.1	100.0	46.3	81.5	48.3
Percent State of Public Lands	69.9	0.0	53.7	18.5	51.7
Total Acres Public Land	26,906	2,172	70,028	15,444	114,550
Floodplain Acres	**632,667**	**53,668**	**1,091,694**	**291,373**	**2,069,403**
Percent Public Lands in Floodplain	**4.3**	**4.0**	**6.4**	**5.3**	**5.5**
Total Land in ROI	**2,687,996**	**1,286,527**	**9,086,525**	**2,695,563**	**15,756,611**
Percent Public Land in ROI Counties	**1.00**	**0.17**	**0.77**	**0.57**	**0.73**

Note: Does not include municipal lands, Tribal lands, DoD lands, or NRCS easement lands.
Source: USGS, Columbia Environmental Research Center, 2001.

Figure 3.4-1
Public Lands in Region 1

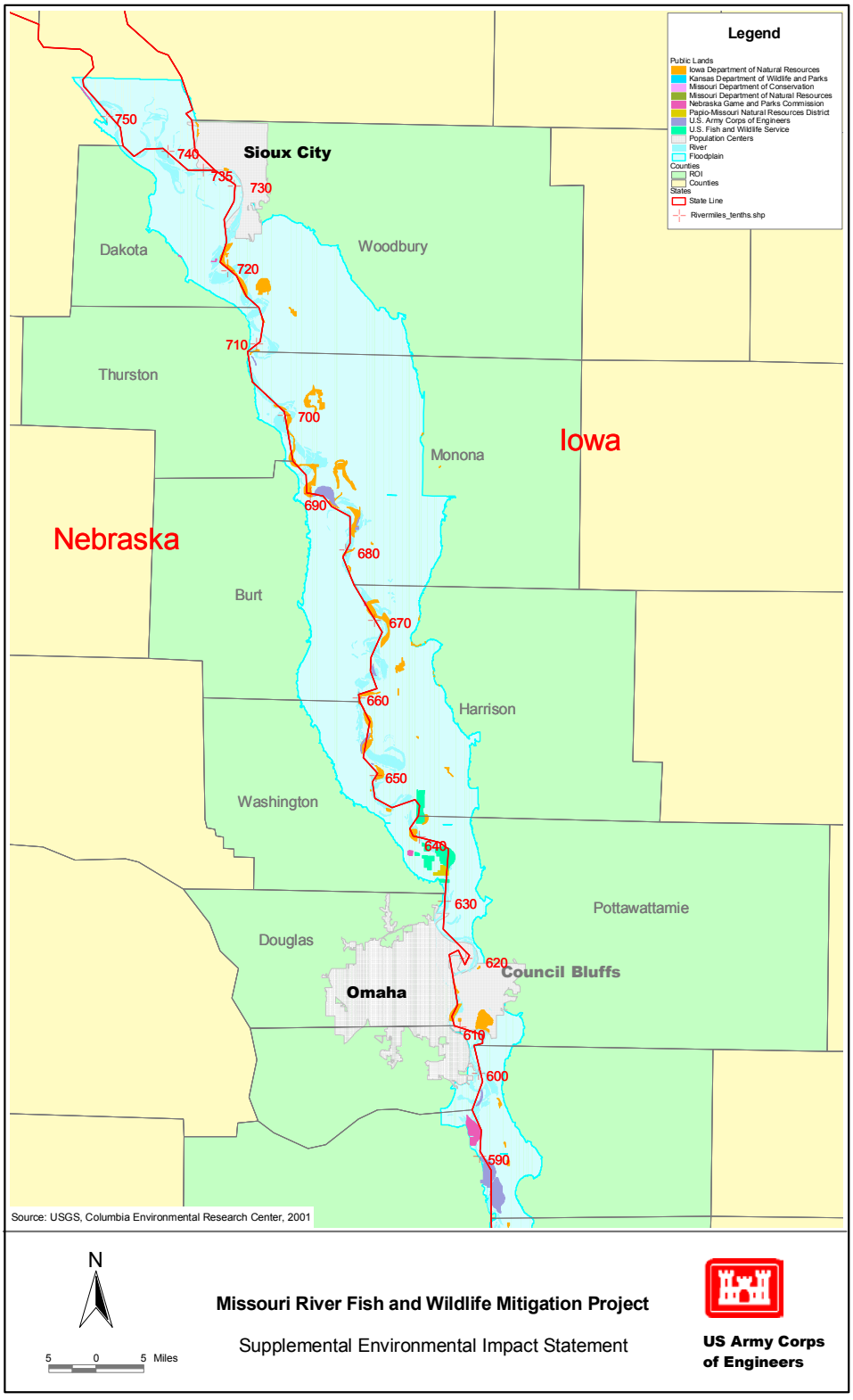


Figure 3.4-2
Public Lands in Region 2

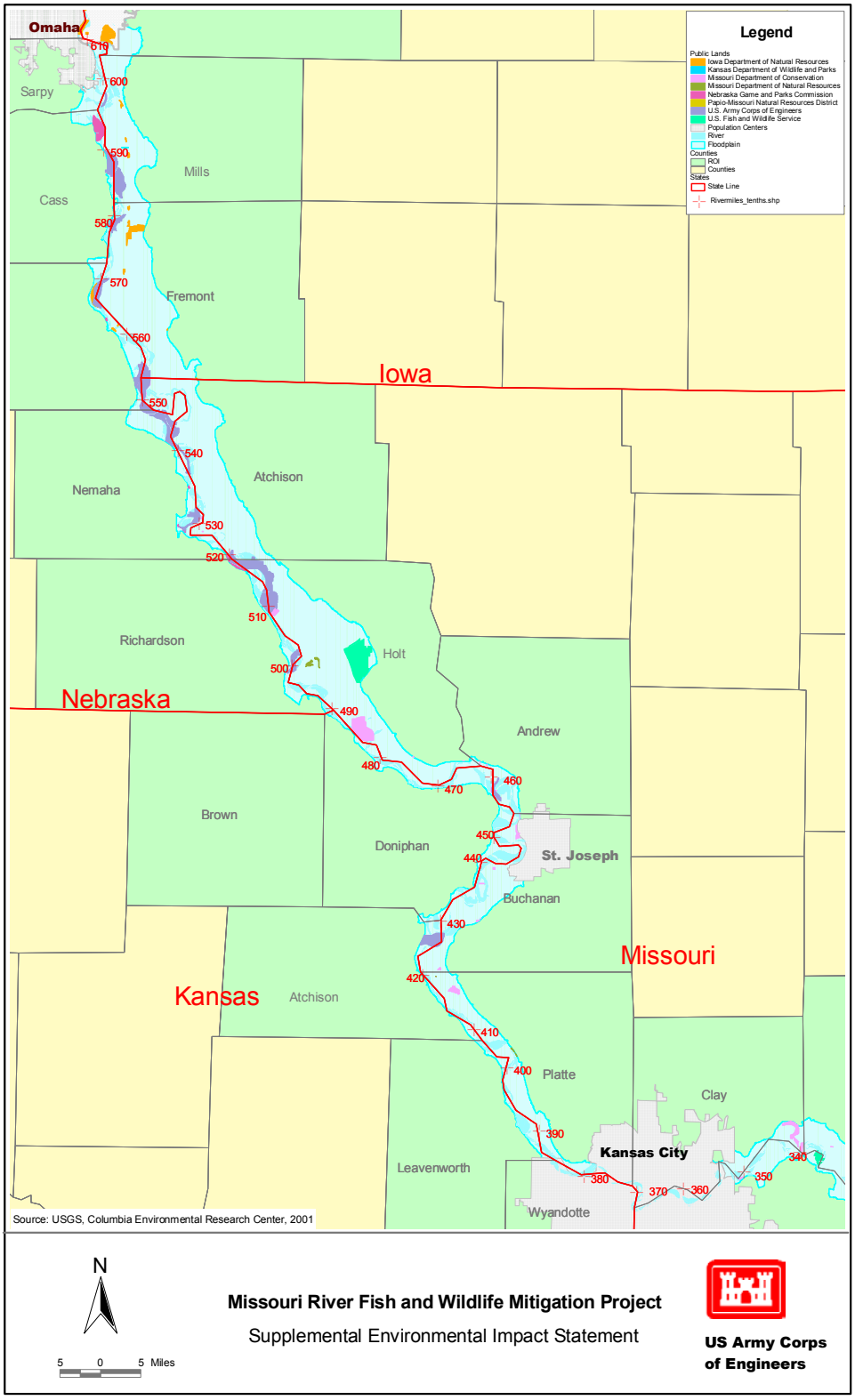


Figure 3.4-3
Public Lands in Region 3

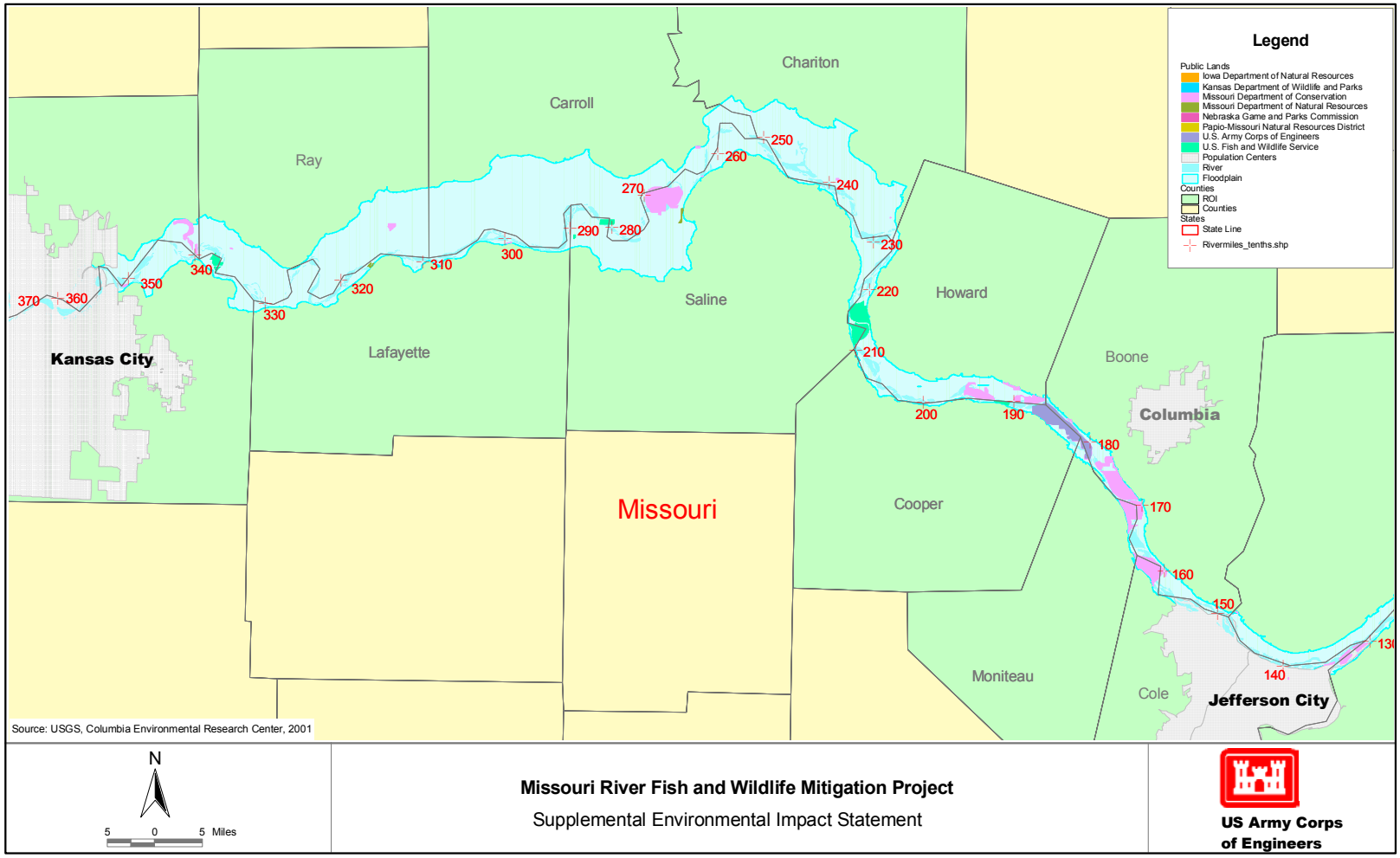
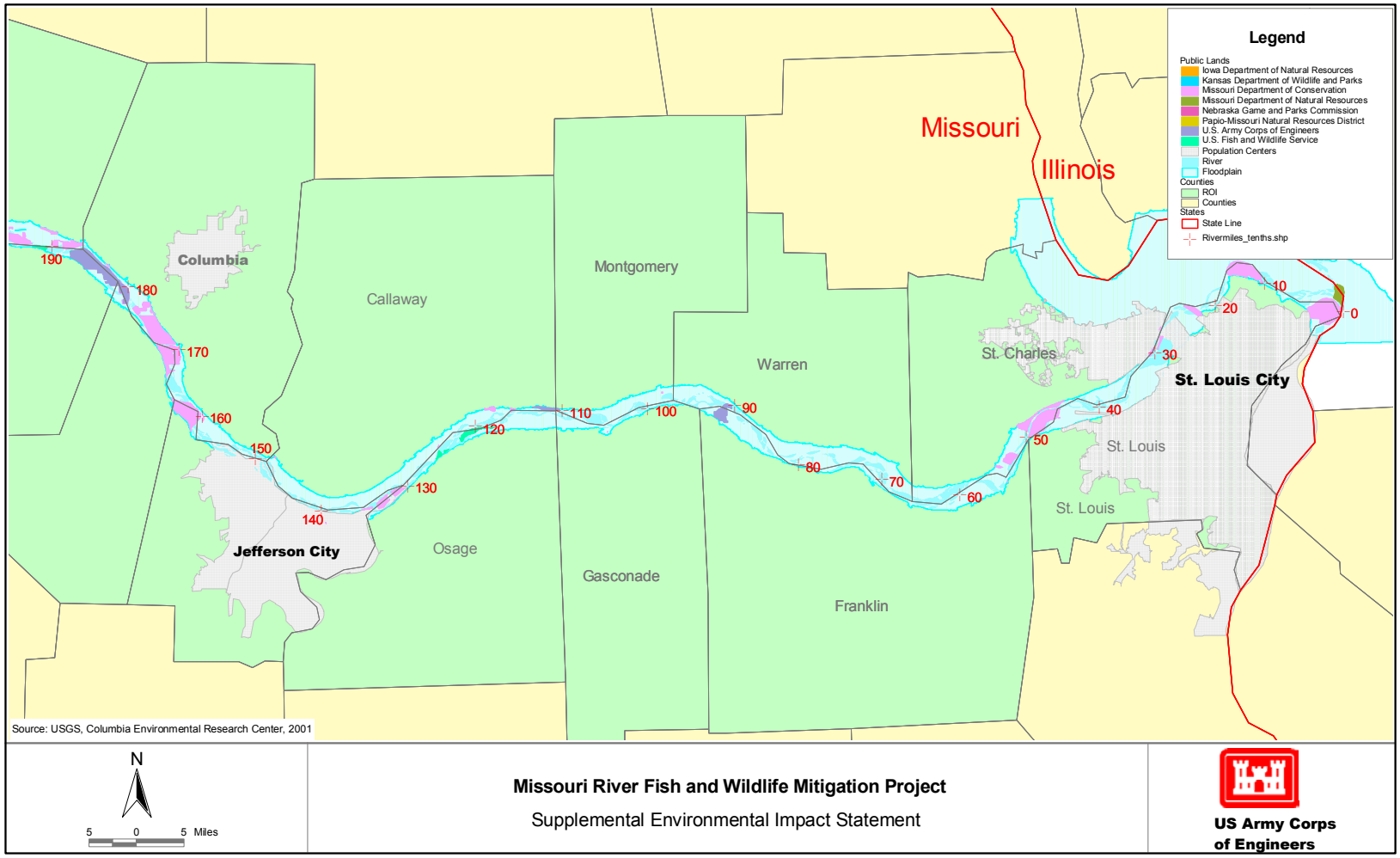


Figure 3.4-4
Public Lands in Region 4



Within the Lower Missouri River floodplain, land ownership is similar to the ROI counties. Approximately 2,069,000 acres comprise the floodplain between Sioux City and St. Louis. In 2001, Federal and state governments owned approximately 115,000 acres (5.5 percent) of the floodplain as shown on Table 3.4-2. Within the floodplain, the Federal government owns approximately 55,304 acres (48 percent of public land) and the four states own approximately 59,245 acres (52 percent of public land; USGS, 2001).

It should be pointed out that the NRCS has easements on 60,788 WRP acres within the ROI (NRCS, 2002). NRCS purchases easements for the WRP and EWRP programs, but does not hold fee title on the properties.

3.4.3 PRIME FARMLAND

Prime farmland includes several types of farmland that is of major importance in providing the nation's short- and long-range needs for food and fiber. Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, oilseed crops, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion (7 U.S.C. 4201 (c)(1)(A)). Generally, prime farmlands are available for these uses, and have the soil quality, growing season, and moisture supply needed to produce economically sustained high-yields of crops when treated and managed according to acceptable farming methods, including water management. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. Prime farmlands are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding (USDA, 1993). The Farmland Protection Policy Act (PL 97-98; 7 U.S.C. 4201 et seq.) was passed by Congress with the stated purpose of minimizing the unnecessary and irreversible conversion of farmland to nonagricultural uses by Federal programs.

Within the floodplain of the Missouri River, and based on the definition, most agricultural land would be considered as prime farmland if it is protected from flooding. Some areas that are poorly

drained or frequently flooded would not be considered prime farmland including forested and non-forested wetlands. In the mid-1990s, there was approximately 7.03 million acres of cropland (i.e., row crops and small grains) in the ROI, of which approximately 1.58 million acres are estimated to be within the Missouri River floodplain as shown in Table 3.4-3. This does not include pasture, hay, or other agricultural uses. Analysis of levees in the four states of the ROI indicated that between approximately 10 percent (Nebraska) to approximately 62 percent (Missouri) of the floodplain are protected by levees. Within the ROI, approximately 45 percent of the floodplain is protected by levees as shown on Table 3.4-3. Cropland acreage within the floodplain for each county was not available. However, preliminary land cover data for each county was available (USGS, 2002). Previous studies in Missouri (USGS, 1999) indicated that about 76.3 percent of the floodplain was in cropland. This assumption was applied to the entire ROI by multiplying it by the amount of calculated floodplain acres to estimate the total cropland in the floodplain (Table 3.4-3).

The amount of protected farmland was then estimated by multiplying the total protected acres by the percentage of the floodplain

Table 3.4-3
Cropland Acres Protected by Levees

	Iowa	Kansas	Missouri	Nebraska	ROI
Floodplain Acres	632,667	53,668	1,091,694	291,373	2,069,403
Total Protected Acres	187,478	30,989	680,892	29,362	928,722
Percent Protected by Levees	29.6	57.7	62.4	10.1	44.9
Total Cropland in ROI [1]	1,873,307	565,190	2,782,868	1,804,944	7,026,309
Total Floodplain Cropland [2]	482,725	40,949	832,963	222,318	1,578,954
Cropland Protected by Levees	**143,046**	**23,645**	**519,521**	**22,403**	**708,615**
Percent of Floodplain Cropland Protected by Levees	**22.6**	**44.1**	**47.6**	**7.7**	**34.3**

[1] All cropland in the ROI counties; from USGS, EROS Data Center, EROS Mid-1990s Land Cover Mapping, 2002; preliminary data not verified.
[2] Adapted from USGS, Biological Research Center, USFWS Big Muddy Final Environmental Impact Statement, 1999, and USGS, 2002. Assumes that 76.3 percent of the floodplain is cropland (row crops and small grains).

assumed to be cropland (76.3 percent), and is considered for this analysis to be prime farmland. It was estimated that a total of 708,615 acres of prime farmland exist in the floodplain of the ROI. This is approximately 34 percent of the floodplain.

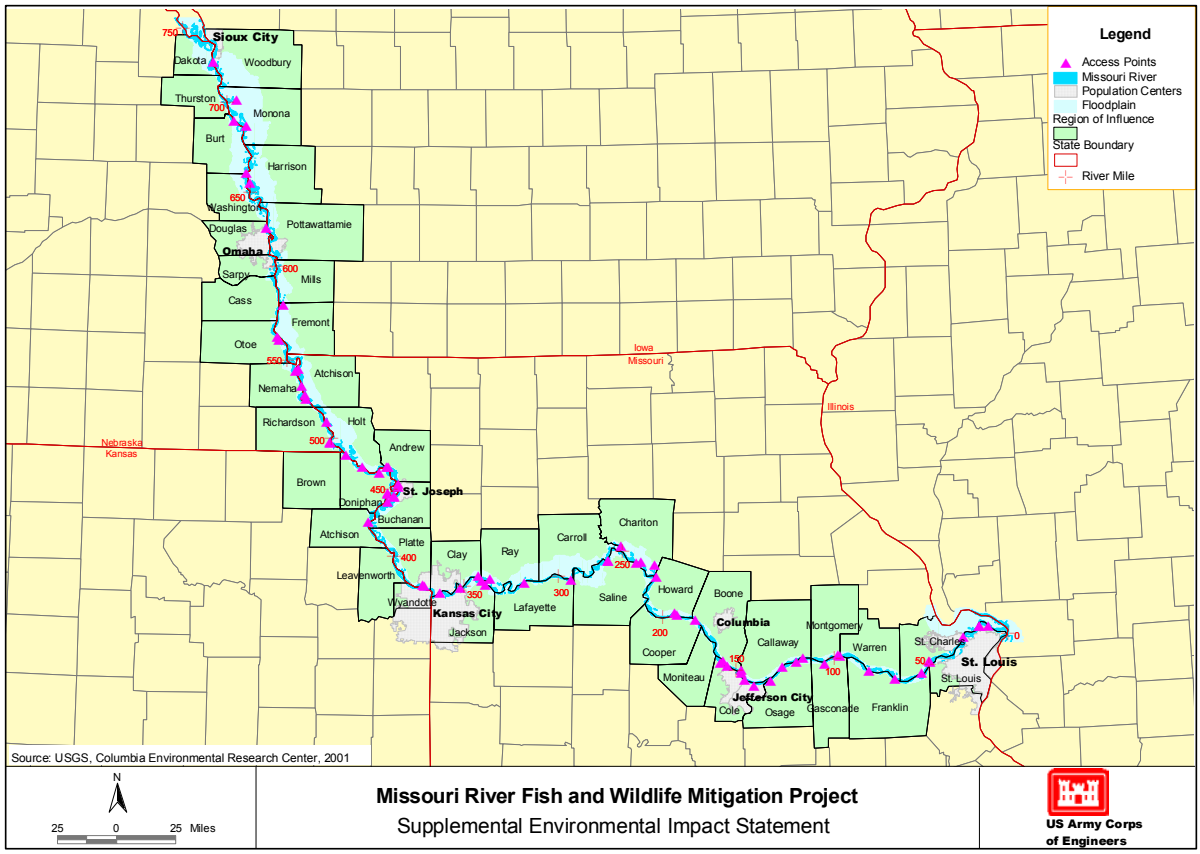
3.4.4 ACCESS AND RECREATION

Public facilities for recreation are somewhat limited within the ROI floodplain. While there are numerous public access locations within the ROI for general recreation as described herein, public use of the Missouri River is limited by the number of boat ramps. There are, however, some public facilities within the floodplain such as state parks and local parks that offer opportunities for such activities as fishing, hiking, biking, camping, picnicking, wildlife observation, and sites of historic interest. In addition to the public land discussed previously in Section 3.4.2, much of which are fish and wildlife management and conservation areas, 18 designated natural areas and 46 recreation areas exist within the ROI floodplain (Corps, 1995). These include a total of 26 state parks, state forests, and state recreation areas, ten of which are in Iowa, ten in Missouri, and six in Nebraska. The remaining facilities are owned and operated by local governments. The known public access points are shown on Figure 3.4-5, Public Access Locations. Other public access locations may be present. There are 74 public access points on the Lower Missouri River (USGS, 2001), or approximately one per ten miles of river channel.

Table 3.4-4 summarizes existing public access along the Lower Missouri River. Nebraska and Kansas have the least access opportunities at 2.5 and 2.6 access points, respectively, per 100 river miles. Iowa has 4.5 access points per 100 river miles and Missouri has the highest at 12.2 per 100 river miles. However, access opportunities are also limited by convenience determined by the side of the river where the access is located and the availability of bridges. Table 3.4-4 shows that on the left descending bank Iowa has 4.5 and Missouri has 6.2 access points per 100 river miles. On the right descending bank Nebraska has 2.5, Kansas 2.6, and Missouri 5.9 per 100 river miles.

Table 3.4-4 also summarizes existing public access by region in the ROI. Region 1 has the least access opportunities at 5.5 access points per 100 river miles. Region 4 has

Figure 3.4-5
Public Access Locations



the most opportunities at 13.4 access points per 100 river miles. River access from the right descending bank in Region 1 is limited with only 0.8 access points per 100 river miles, while left bank access is comparable to that of the other regions. The left bank in Region 2 and from either bank in Region 4 have the most access opportunities at 6.6 to 6.9 access points per 100 river miles. Approximately one-third of the public access locations have facilities for launching boats, some of which are rather unimproved and suitable only for small boats. Most of the public access is walking only from a park or unimproved access area. The Katy Trail State Park provides hiking and biking opportunities in two sections along the Lower Missouri River. Approximately 150 miles of the Katy Trail lies along the Missouri River floodplain from Boonville to St. Charles, Missouri. The Missouri Department of Natural Resources

Table 3.4-4
Public Access by State and Region

	Iowa	Kansas	Missouri	Nebraska	ROI
Number of Access Points	8	3	57	6	74
River Miles	175	115	469	242	1,001
Average Number per 100 miles	**4.6**	**2.6**	**12.2**	**2.5**	**10.1**
Number on Left Bank	8	NA	35	NA	43
Left Riverbank Miles	175	NA	559	NA	734
Average Number per 100 Miles on Left Bank	**4.6**	NA	**6.3**	NA	**5.9**
Number on Right Bank	NA	3	22	6	31
Right Riverbank Miles	NA	115	379	242	736
Average Number per 100 Miles on Right Bank	NA	**2.6**	**5.8**	**2.5**	**4.2**
	Region 1	**Region 2**	**Region 3**	**Region 4**	**ROI**
Number of Access Points	7	30	18	19	74
River Miles	126	269	199	141	735
Average Number per 100 miles	**5.6**	**11.2**	**9.0**	**13.5**	**10.1**
Number on Left Bank	6	18	9	10	43
Left Riverbank Miles	130	260	195	149	734
Average Number per 100 Miles on Left Bank	**4.6**	**6.9**	**4.6**	**6.7**	**5.9**
Number on Right Bank	1	12	9	9	31
Right Riverbank Miles	123	279	203	131	736
Average Number per 100 Miles on Right Bank	**0.8**	**4.3**	**4.4**	**6.9**	**4.2**

USGS, 2001.
NA means not applicable

(MDNR) manages the Katy Trail. Public lands within the floodplain of the ROI are discussed in Section 3.5.2, Land Ownership.

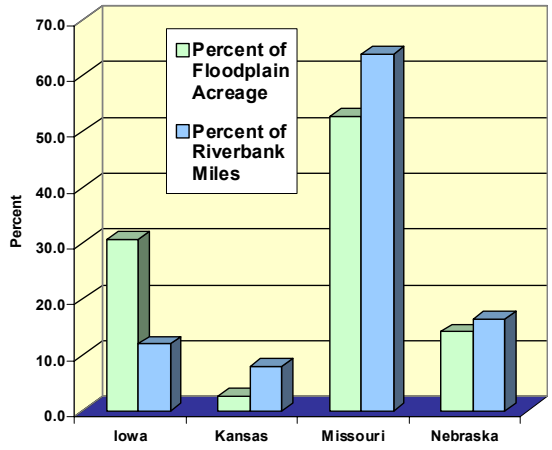
There are a relatively few number of privately owned river access locations such as marinas and hunting clubs. However, information on privately owned access locations was not available. Although information on existing recreational

opportunities is limited, known recreational uses available along the Lower Missouri River include hunting, fishing, boating, berry and mushroom picking, photography, and wildlife observation. Most recreational uses, of which hunting and fishing are the most popular, occur on private lands. Deer, waterfowl, small game, turkey and upland game bird hunting are popular on private and public lands. Fishing is somewhat limited due in part to limited access and limited fishery.

3.5 SOCIOECONOMIC RESOURCES

The purpose of this section is to provide a baseline of socioeconomic conditions for the four-region, 46 county ROI. Of the 46 counties located in the ROI, approximately half or 25 counties are located in Missouri, 10 are in Nebraska, 6 in Iowa, and 5 in Kansas. The potential for beneficial and adverse socioeconomic impacts resulting from the modified Mitigation Project can occur along the 735-mile portion of the Missouri River including both sides or along 1,470 miles of riverbank. The study area also includes approximately 2,069,000 million acres of floodplain. The state of Missouri has 63 percent of the riverbank and 53 percent of the floodplain area. Nebraska has the second highest percent of riverbank with 16 percent, Iowa has the second largest share of land use in the floodplain with 31 percent (Figure 3.5-1).

Figure 3.5-1
Percent of Floodplain and Riverbank by State in ROI



The nine scoping meetings held in November and December of 2001 (see Section 1.4) identified local taxes, agriculture, and natural resource habitat enhancement as key issues to be addressed in the SEIS. This section presents population, income, retail trade, employment, agriculture, and county government finance characteristics for both rural and urban counties located in the ROI. The socioeconomic baseline analysis is designed to identify counties in the ROI that have either high or low economic trends or characteristics. This section will provide a

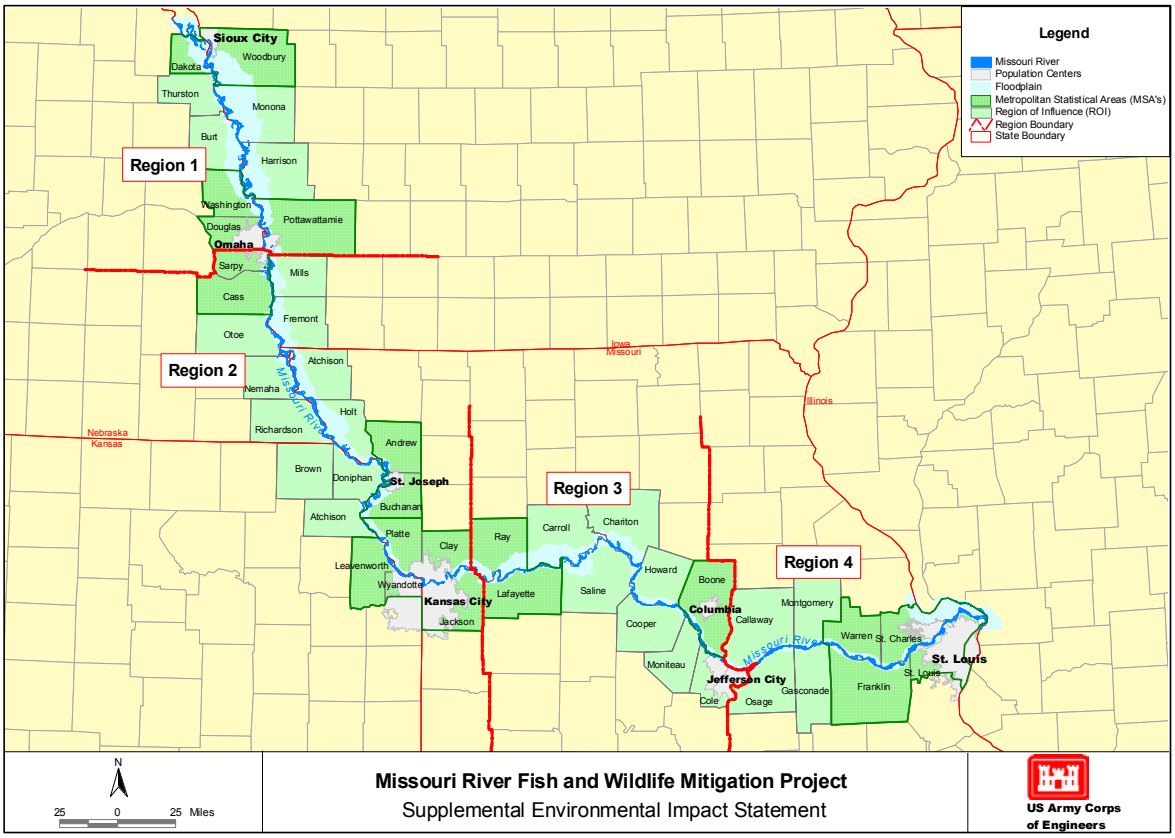
basis for analyzing the potential significance and magnitude of the impacts evaluated in Chapter 4, Environmental Consequences. Appendix F provides detailed socioeconomic tables for the study that supports the socioeconomic baseline analysis.

3.5.1 POPULATION

The 46-county ROI has a total population of approximately 4 million people. The ROI has 25 counties that are primarily rural and 21 counties located in six Metropolitan Statistical Areas (MSAs) that have socioeconomic ties to urban economic centers (Figure 3.5-2).

The MSAs include: Sioux City, Iowa; Omaha, Nebraska; St Joseph, Missouri; Kansas City, Missouri; Columbia, Missouri; and St. Louis, Missouri. Counties included in MSAs are determined by the U.S. government based on commuting patterns

Figure 3.5-2
Metropolitan Statistical Areas (MSAs)



and other economic ties that are evident among counties located near major metropolitan areas. With the exception of Cole (72,397), Callaway (40,766), and Saline (23,756) counties in Missouri, the remaining 22 rural or non-MSA counties had total population levels of less than 17,000; nine of these counties had populations of less than 10,000 residents.

As shown in Table 3.5-1, the larger MSA counties experienced population growth over the past decade and the smaller, more rural based counties, experienced

Table 3.5-1
Population Growth 1990 to 2000

Highest Growth Rate				Lowest Growth Rate			
County	Region	Total Population[1]	Compound Growth Rate of Total Population (1990 to 2000)	County	Region	Total Population[1]	Compound Growth Rate of Total Population (1990 to 2000)
St. Charles, Missouri **	4	283,883	2.92%	Atchison, Missouri	2	6,430	-1.47%
Platte, Missouri **	2	73,781	2.46%	Holt, Missouri	2	5,351	-1.19%
Warren, Missouri**	4	24,525	2.30%	Chariton, Missouri	3	8,438	-0.86%
Callaway, Missouri	4	40,766	2.20%	Nemaha, Nebraska	2	7,576	-0.52%
Dakota, Nebraska **	1	20,253	1.92%	Carroll, Missouri	3	10,285	-0.44%
Moniteau, Missouri	3	14,827	1.89%	Richardson, Nebraska	2	9,531	-0.42%
Boone, Missouri **	3	135,454	1.89%	Brown, Kansas	2	10,724	-0.37%
Clay, Missouri **	2	184,006	1.84%	Fremont, Iowa	2	8,010	-0.27%
Sarpy, Nebraska **	2	122,595	1.80%	Wyandotte, Kansas **	2	157,882	-0.26%
Franklin, Missouri **	4	93,807	1.53%	Burt, Nebraska	1	7,791	-0.10%

ROI Counties by Region			ROI Counties by State		
Region 1	734,847	0.92%	Iowa	239,824	0.55%
Region 2	1,491,247	0.66%	Kansas	262,320	-0.01%
Region 3	347,353	1.17%	Missouri	2,874,127	0.85%
Region 4	1,499,836	0.86%	Nebraska	697,012	1.17%

** Metropolitan Statistical Area (MSA) Counties
[1] 2000 U.S. Census Bureau
Source: U.S. Census Bureau 1990 and 2000

population declines. The annual population decrease in rural counties ranged from-0.10 percent to -1.47 percent during the 1990 to 2000 decade. In total, all four regions experienced population growth during the 1990-2000 decade. However, the five ROI Kansas counties combined experienced a very slight decline of -0.01 percent, while other ROI counties in Iowa, Missouri, and Nebraska experienced annual growth rates of between 0.55 percent and 1.17 percent.

As shown in Table 3.5-2, the minority population percentage in the ROI ranged from less than 3 percent in the majority of the smaller rural counties to between 14 percent and 48 percent for the larger, primarily urban counties. Thurston County, Nebraska was the exception among small rural counties, with a minority population of 55 percent. This represented a year 2000 Native American population of 3,900 in a total County population of approximately 7,200. Region 2 had the highest percent

Table 3.5-2
Minority Population Characteristics

Highest Percent Minorities			Lowest Percent Minorities		
County	**Region**	**Percent Minorities[1]**	**County**	**Region**	**Percent Minorities[1]**
Thurston, Nebraska	1	54.5	Gasconade, Missouri	4	1.6
Wyandotte, Kansas **	2	48.4	Osage, Missouri	4	1.8
Jackson, Missouri **	2	32.3	Holt, Missouri	2	1.8
Dakota, Nebraska **	1	29.1	Harrison, Iowa	1	1.8
St. Louis, Missouri **	4	24.0	Monona, Iowa	1	2.1
Douglas, Nebraska **	1	21.8	Andrew, Missouri **	2	2.2
Leavenworth, Kansas **	2	18.0	Washington, Nebraska **	1	2.5
Woodbury, Iowa **	1	16.4	Mills, Iowa	2	2.8
Boone, Missouri **	3	15.6	Nemaha, Nebraska	2	2.9
Brown, Kansas	2	13.9	Franklin, Missouri **	4	3.0
ROI Counties by Region			**ROI Counties by State**		
Region 1		18.3	Iowa		9.7
Region 2		23.8	Kansas		35.2
Region 3		11.8	Missouri		19.4
Region 4		18.0	Nebraska		18.6

** Metropolitan Statistical Area (MSA) Counties
[1] 2000 U.S. Census Bureau
Source: U.S. Census Bureau 2000

minority population of the four regions with 23.8 percent, and Kansas had the highest percent minority population of the four states with 35.2 percent. The high minority population of 48.4 percent in Wyandotte County, Kansas, influenced the high minority population in Region 2.

The ten counties with the highest percent of population age 65 and over were located primarily in small rural areas and comprised from 19 to 24 percent of the county's total population (Table 3.5-3). In comparison, the urban MSA counties had a population of 65 and over ranging from 6 to 11 percent of the total. The two non-MSA counties of Callaway and Cole in Missouri also had a low percentage of older population with 11 percent. In these counties, the larger communities of Fulton and Jefferson City influenced the lower percentage of residents over 65.

Table 3.5-3
Population Age 65 and over

Highest Percent Population 65-Plus			Lowest Percent Population 65-Plus		
County	**Region**	**Percent of Population 65 Years and Over[1]**	**County**	**Region**	**Percent of Population 65 Years and Over[1]**
Monona, Iowa	1	23.9	Sarpy, Nebraska**	2	6.6
Chariton, Missouri	3	22.3	Boone, Missouri**	3	8.6
Burt, Nebraska	1	21.8	St. Charles, Missouri**	4	8.8
Richardson, Nebraska	2	21.5	Platte, Missouri**	2	8.8
Holt, Missouri	2	21.5	Leavenworth, Kansas**	2	9.8
Atchison, Missouri	2	21.1	Dakota, Nebraska**	1	9.9
Carroll, Missouri	3	20.1	Clay, Missouri**	2	10.8
Fremont, Iowa	2	19.8	Douglas, Nebraska**	1	11.0
Brown, Kansas	2	19.5	Callaway, Missouri	4	11.0
Gasconade, Missouri	4	18.8	Cole, Missouri	3	11.3
Percent by Region			**Percent by State**		
Region 1		15.28	Iowa		16.85
Region 2		15.11	Kansas		14.68
Region 3		15.20	Missouri		14.63
Region 4		13.71	Nebraska		14.59

** Metropolitan Statistical Area (MSA) Counties
[1] 2000 U.S. Census Bureau
Source: U.S. Census Bureau 2000

3.5.2 INCOME, EMPLOYMENT, AND RETAIL TRADE

Income levels in the ROI were characterized as generally higher in MSA urban counties and lower in the more isolated rural areas (Table 3.5-4). Only two non-MSA counties (Mills County, Iowa and Cole County, Missouri) were among the ten highest per capita income counties in the ROI. Per capita income is defined as the average income computed for every man, woman, and child in a particular group.

Among the lower income ROI counties, nine out of ten were rural counties, with the exception being urban Wyandotte County, Kansas. Thurston County, Nebraska and Moniteau County, Missouri had the lowest income levels in the ROI, and by region, Region 4 had the highest income level and Region 3 had the lowest. Missouri had the highest and Kansas had the lowest income level among counties in individual states.

Table 3.5-4
Per Capita Income

Highest Per Capita			Lowest Per Capita		
County	**Region**	**Per Capita Income 2000**	**County**	**Region**	**Per Capita Income 2000**
St. Louis, Missouri **	4	$3,812	Thurston, Nebraska	1	$1,725
Douglas, Nebraska **	1	$3,297	Moniteau, Missouri	3	$1,836
Platte, Missouri **	2	$3,182	Howard, Missouri	3	$1,903
Washington, Nebraska **	1	$2,859	Wyandotte, Kansas **	2	$1,946
Jackson, Missouri **	2	$2,824	Cooper, Missouri	3	$1,953
Clay, Missouri **	2	$2,790	Chariton, Missouri	3	$1,957
Mills, Iowa	2	$2,733	Callaway, Missouri	4	$1,971
St. Charles, Missouri **	4	$2,725	Atchison, Kansas	2	$1,988
Cole, Missouri	3	$2,715	Harrison, Iowa	1	$1,997
Cass, Nebraska **	2	$2,609	Montgomery, Missouri	4	$2,005

Per Capita Income by Region		Per Capita Income by State	
Region 1	$2,950	Iowa	$2,383
Region 2	$2,600	Kansas	$2,021
Region 3	$2,386	Missouri	$3,053
Region 4	$3,394	Nebraska	$2,996

** Metropolitan Statistical Area (MSA) Counties
Source: U.S. Census Bureau 2000

Table 3.5-5 shows the percent of total county personal income that is based on the farming sector. This table provides an indication of the counties' reliance on agriculture for its economic base. Key rural agricultural counties show that from 7 to 15 percent of the counties' income was based on income generated from farming. Burt County, Nebraska and Holt County, Missouri had the highest relative percent of income that was derived from agriculture. At the regional level, Region 3 had the highest reliance on agriculture with approximately 1 percent of the income being agricultural based. Of the four states, Iowa had the highest percent of farming sector personal income reliance with 1.69 percent.

Unemployment levels provide an indication of the strength of an area's economy. As shown in Table 3.5-6, rural Gasconade County, Missouri had the highest unemployment level with 11.2 percent followed by urban - based counties of Pottawattamie County, Iowa with 6.9

Table 3.5-5
Personal Income from Farming

Highest Percentage of Personal Income from Farming		
County	**Region**	**Average Percent of Personal Income from Farming**
Burt, Nebraska	1	15.28
Holt, Missouri	2	12.95
Richardson, Nebraska	2	12.20
Thurston, Nebraska	1	11.73
Doniphan, Kansas	2	9.45
Atchison, Missouri	2	8.46
Fremont, Iowa	2	7.64
Brown, Kansas	2	7.32
Chariton, Missouri	3	7.19
Nemaha, Nebraska	2	7.08

Region	Average Percent of Personal Income from Farming	State	Average Percent of Personal Income from Farming
Region 1	0.72	Iowa	1.69
Region 2	0.50	Kansas	0.86
Region 3	0.97	Missouri	0.17
Region 4	0.04	Nebraska	0.77

Source: U.S. Census Bureau, Economics and Statistical Administration, 1999.

Table 3.5-6
Unemployment Rate

Highest Unemployment Rate			Lowest Unemployment Rate		
County	**Region**	**Unemployment Rate in 1999 (%)**	**County**	**Region**	**Unemployment Rate in 1999 (%)**
Gasconade, Missouri	4	11.2	Sarpy, Nebraska **	2	1.2
Pottawattamie, Iowa **	1	6.9	Leavenworth, Kansas **	2	1.9
St. Charles, Missouri **	4	5.8	Boone, Missouri **	3	1.9
Harrison, Iowa	1	5.5	Jackson, Missouri **	2	2.0
Montgomery, Missouri	4	5.0	Atchison, Kansas	2	2.0
Moniteau, Missouri	3	4.6	Atchison, Missouri	2	2.0
Cole, Missouri	3	4.5	Dakota, Nebraska **	1	2.1
Callaway, Missouri	4	4.5	Woodbury, Iowa **	1	2.1
Franklin, Missouri **	4	4.4	Cooper, Missouri	3	2.1
Burt, Nebraska	1	4.1	Clay, Missouri **	2	2.1

Unemployment Rate by Region		Unemployment Rate by State	
Region 1	3.73	Iowa	2.32
Region 2	3.50	Kansas	4.90
Region 3	3.04	Missouri	3.06
Region 4	3.26	Nebraska	4.16

** Metropolitan Statistical Area (MSA) Counties
Source: U.S. Bureau of Labor Statistics (1999)

percent and St. Charles County, Missouri with 5.8 percent. Seven of the ten counties in the study area with high unemployment levels were located in rural areas. Rural based economies with very low unemployment rates of 2.1 percent or below included Atchison County, Kansas; and Cooper and Atchison counties in Missouri. Unemployment levels in the individual regions ranged from approximately 3 to 4 percent. The ROI counties within Kansas had the highest unemployment rate (nearly 5 percent) for the four states. Retail sales per establishment in a given region is a baseline socioeconomic characteristic used to evaluate retail trade characteristics, and can serve as a basis for evaluating potential impacts of a given action in a county or region. As shown in Table 3.5-7, the average retail sales per establishment

Table 3.5-7
Retail Sales Per Establishment

Highest Average Retail Sales			Lowest Average Retail Sales		
County	**Region**	**Average Retail Sales Per establishment ($1,000)[1]**	**County**	**Region**	**Average Retail Sales Per establishment ($1,000)[1]**
Clay, Missouri **	2	$3,435	Howard, Missouri	3	$604
Washington, Nebraska **	1	$3,248	Carroll, Missouri	3	$699
Douglas, Nebraska **	1	$2,918	Fremont, Iowa	2	$838
St. Louis, Missouri **	4	$2,889	Richardson, Nebraska	2	$900
Platte, Missouri **	2	$2,850	Burt, Nebraska	1	$965
Jackson, Missouri **	2	$2,711	Chariton, Missouri	3	$977
Pottawattamie, Iowa **	1	$2,562	Gasconade, Missouri	4	$1,086
St. Charles, Missouri **	4	$2,509	Lafayette, Missouri **	3	$1,089
Boone, Missouri **	3	$2,441	Montgomery, Missouri	4	$1,110
Sarpy, Nebraska **	2	$2,390	Otoe, Nebraska	2	$1,129

Average by Region		Average by State	
Region 1	$2,635	Iowa	$2,206
Region 2	$2,513	Kansas	$1,959
Region 3	$1,873	Missouri	$2,588
Region 4	$2,673	Nebraska	$2,590

** Metropolitan Statistical Area (MSA) Counties
Source: U.S. Census Bureau, Economic Census Retail Trade, 1997.

had a wide range from a low in rural counties of approximately $600,000 to over $3 million in selected urban counties. On the average, Region 4 had the highest per establishment sales with $2.7 million, and the lowest was in the more rural Region 3 with $1.9 million. Of the four amount. Smaller retail establishments are states, Nebraska had the highest sales amount and Kansas had the lowest sales generally considered to be more susceptible to economic fluctuations than are larger volume retail stores.

3.5.3 AGRICULTURE

Agriculture is an important part of the 46-county ROI. However, as shown in Table 3.5-8, the number of farms in the ROI has declined from a level of 40,272 in 1987 to a 1997 level of 35,539. This represents a loss rate of about 500 farms per year over the ten-year period. The highest percentage of decline in farms appears in Regions 1 and 2, with a decline of between 15 to 16 percent over the ten-year period. By state, the highest percent of decline in farms in ROI counties was Nebraska with 18 percent. This was almost twice the level of Missouri counties where the number of farms declined by only 9 percent.

While the total number of farms has declined, the average size of farms has increased. As shown in Table 3.5-9, over the ten-year agriculture census period from 1987 to 1997 Regions 1 and 2 also had the greatest increase in farm size over the period with increased farm sizes of 19 percent and 16 percent. These two regions also had the largest farm size in 1997 with 431 acres and 373 acres respectively, as compared to Region 4 with an average of 242 acres per farm. ROI counties in the State of Iowa had the largest farm size with an average of 465 acres per farm.

Table 3.5-8
Number of Farms

Region	1987	1992	1997	Percent Change	State	1987	1992	1997	Percent Change
Region 1	7,727	6,819	6,512	-16	Iowa	6,250	5,595	5,268	-16
Region 2	13,877	12,091	11,764	-15	Kansas	3,295	3,095	2,973	-10
Region 3	10,968	10,168	10,133	-8	Missouri	24,118	22,088	21,908	-9
Region 4	7,700	7,194	7,130	-7	Nebraska	6,609	5,494	5,390	-18
ROI	**40,272**	**36,272**	**35,539**	**-12**	**ROI**	**40,272**	**36,272**	**35,539**	**-12**

Source: USDA, National Agriculture Statistics Service, 1987, 1992, 1997.

Table 3.5-9
Average Farm Size

Average Acres By Region					Average Acres by State				
Region	1987	1992	1997	Percent Increase 1987-1997	State	1987	1992	1997	Percent Increase 1987-1997
Region 1	363	404	431	19	Iowa	382	429	465	22
Region 2	321	352	373	16	Kansas	303	315	338	12
Region 3	291	306	308	6	Missouri	270	289	292	8
Region 4	231	245	242	5	Nebraska	355	396	420	18

Source: USDA, National Agriculture Statistics Service, 1987, 1992, 1997.

Corresponding to the decline in the number of farms and increasing farm size, the number of farm operators listing their principal occupation as farming has declined. Based on the ROI average, the number of farmers listing farming as their principal occupation has declined approximately 21 percent from 511 farmers per county to 404 farmers per county (Table 3.5-10). On average, counties in Regions 1 and 3 had the highest number of full-time farmers with between 450 to 470 farmers per county. The number of part-time farmers has fluctuated over the 1987 to 1997 census period, but overall experienced a slight decline of about 2 percent from 321 farmers working 200 or more days off the farm in 1987 to 314 farmers by 1997.

Table 3.5-10
Farm Operator Characteristics

Principal Occupational Farming					Farm Operators Working 200+ Days off Farm				
Region	1987	1992	1997	Percent Change 1987-1997	Region	1987	1992	1997	Percent Change 1987-1997
Region 1	611	533	457	-25	Region 1	202	189	213	5
Region 2	444	376	333	-25	Region 2	235	208	221	-6
Region 3	577	526	470	-19	Region 3	418	398	428	2
Region 4	412	394	357	-13	Region 4	428	386	395	-8
ROI Average	**511**	**457**	**404**	**-21**	**ROI Average**	**321**	**295**	**314**	**-2**

Source: U.S. Census of Agriculture, 1987, 1992, and 1997.

As shown in Table 3.5-11, the average per farm production expense has increased approximately 45 percent in the 46 county ROI from approximately $40,000 per farm in 1987 to an average of about $58,600 by 1997. Region 1 had the highest per farm production expenses averaging $98,000 per farm, as compared to Region 4 with the lowest at about $34,000 per farm. The average value of farm products sold has also increased from a level of about $54,000 per farm in 1987 to a 1997 level of $81,700 per farm. Region 1 had the highest value of products sold with an average annual per farm amount of $137,500 in 1997. Burt, Thurston, and Sarpy counties in Nebraska had the highest average value of products sold with $194,000, $157,000, and $156,000 per farm, respectively (Table 3.5-12). Gascon-ade County, Missouri had the lowest average value of products sold with approximately $20,000 per farm. The ten counties with the lowest average value of farm production were all located in Missouri and Kansas. The average yield per acre for corn and soybeans is an indicator of land productivity on a comparison basis. As shown in Table 3.5-13, Douglas County, Nebraska and Fremont and Mills counties in Iowa had the highest corn yield with between 130 to 132 bushels per acre.

Table 3.5-11
Farm Production and Operating Expenses

Average per Farm Production Expenses					Average per Farm Products Sold				
Region	**1987**	**1992**	**1997**	**Percent Change 1987-1997**	**Region**	**1987**	**1992**	**1997**	**Percent Change 1987-1997**
Region 1	$65,278	$87,885	$98,294	51	Region 1	$87,790	$119,374	$137,502	57
Region 2	$42,396	$55,012	$57,561	36	Region 2	$57,471	$75,890	$85,491	49
Region 3	$30,118	$39,099	$44,445	48	Region 3	$40,186	$52,097	$59,035	47
Region 4	$23,580	$30,574	$34,191	45	Region 4	$31,642	$40,131	$44,855	42
ROI Average	**$40,343**	**$53,143**	**$58,623**	**45**	**ROI Average**	**$54,272**	**$71,873**	**$81,721**	**51**

Source: USDA, National Agriculture Statistics Service, 1987, 1992, 1997.

Table 3.5-12
Product Sold (Average Per Farm)

Highest Average			Lowest Average		
County	Region	Market Value of Products Sold (Avg. Per Farm)	County	Region	Market Value of Products Sold (Avg. Per Farm)
Burt, Nebraska	1	$194,000	Gasconade, Missouri	4	$19,929
Thurston, Nebraska	1	$157,132	Wyandotte, Kansas **	2	$24,647
Sarpy, Nebraska **	2	$155,882	Cole, Missouri	3	$25,324
Fremont, Iowa	2	$155,256	Franklin, Missouri **	4	$29,293
Monona, Iowa	1	$144,267	Boone, Missouri **	3	$32,684
Pottawattamie, Iowa **	1	$143,397	Jackson, Missouri **	2	$36,060
Washington, Nebraska **	1	$133,736	Ray, Missouri **	3	$36,335
Atchison, Missouri	2	$132,798	Warren, Missouri **	4	$40,525
Harrison, Iowa	1	$128,974	Leavenworth, Kansas **	2	$40,615
Douglas, Nebraska **	1	$119,956	Callaway, Missouri	4	$40,658

** Metropolitan Statistical Area (MSA) Counties
Source: U.S. Census Bureau, 1990 and 2000
U.S. Census Bureau, Census of Agriculture, 1997.

Regions 1 and 2 had the highest yields of 121 and 113 bushels per acre as compared to the regional average of 108 bushels per acre. Soybean productivity ranged from 44 bushels per acre to a low of 31 bushels per acre. As with corn productivity, Regions 1 and 2 were the highest in soybean productivity per acre. Eight of the high producing soybean counties were also listed in the top ten corn producing counties.

3.5.4 GOVERNMENT FINANCE

The analysis of county government finance provides a baseline for evaluating alternative actions associated with the modified Mitigation Project. Such factors as outstanding debt, per capita tax revenue, and per capita general expenditures provide an overview of the general financial characteristics of individual counties. This section also presents the current PILT payments received by ROI counties.

Table 3.5-13
Average Per Acre Yield for Corn and Soybeans for Selected Counties

Corn Production				Soybean Production			
County	**Avg. Yield (bu/ac)**	**County**	**Avg. Yield (bu/ac)**	**County**	**Avg. Yield (bu/ac)**	**County**	**Avg. Yield (bu/ac)**
Moniteau, Missouri	77	Sarpy, Nebraska **	120	Boone, Missouri **	31	Osage, Missouri	40
Montgomery, Missouri	85	Doniphan, Kansas	121	Montgomery, Missouri	31	Doniphan, Kansas	40
Boone, Missouri **	86	Jackson, Missouri **	121	Atchison, Kansas	32	Washington, Nebraska **	40
Gasconade, Missouri	94	Washington, Nebraska **	122	Carroll, Missouri	32	Monona, Iowa	41
Atchison, Kansas	95	Atchison, Missouri	123	Leavenworth, Kansas **	33	Douglas, Nebraska **	41
Leavenworth, Kansas **	95	Pottawattamie, Iowa **	127	Wyandotte, Kansas **	33	Sarpy, Nebraska **	41
Callaway, Missouri	98	Harrison, Iowa	127	Cooper, Missouri	33	Mills, Iowa	42
Richardson, Nebraska	98	Mills, Iowa	130	Thurston, Nebraska	33	Fremont, Iowa	42
Franklin, Missouri **	99	Fremont, Iowa	131	Jackson, Missouri **	33	Harrison, Iowa	42
Warren, Missouri **	99	Douglas, Nebraska **	132	Chariton, Missouri	34	Pottawattamie, Iowa **	44
Region	**Average Corn Yield (bu/ac)**			**Region**	**Avg. Soybean Yield (bu/ac)**		
Region 1	121			Region 1	39		
Region 2	113			Region 2	37		
Region 3	100			Region 3	35		
Region 4	100			Region 4	36		
ROI Average	**108**			**ROI Average**	**37**		

** Metropolitan Statistical Area (MSA) Counties
Source: U.S. Census Bureau, Census of Agriculture, 1997.

Of the 46 ROI counties, nine reported "not applicable" to the government census (U.S. Census Bureau, 1996-97). Of the 37 remaining counties, only 19 reported debt outstanding at the end of the 1997 fiscal year. As shown in Table 3.5-14, outstanding debt ranged from approximately $400 million for St Louis County, Missouri to a low of $17,000 for Buchanan County, Missouri. The top ten counties with debt outstanding were all MSA urban counties. Per capita tax revenue ranged from approximately $300 per person in St. Louis County, Missouri and Freemont County, Iowa to $1,600 in Carroll, Moniteau, and Osage counties in Missouri. High per capita tax revenues appear to occur in the smaller counties

with larger populated counties being in the lower to middle range. Per capita county general expenditures appear to follow a similar pattern with high per capita expenditures occurring among the smaller populated counties. High per capita tax and expenditure revenues for smaller populated counties show the vulnerability of the county government finances of smaller rural areas to changes in the tax base and shifts in economic trends.

Table 3.5-14
Government Finance

County	Population 1996	Per Capita County Tax Revenue	Per Capita General Expenditures	Total Debt Outstanding at End of Fiscal Year $(000)
St. Louis, Missouri **	1,003,807	286	202	399,310
Jackson, Missouri **	646,341	586	414	178,982
St. Charles, Missouri **	255,066	815	381	85,002
Douglas, Nebraska **	438,835	687	307	70,835
Wyandotte, Kansas **	153,427	311	239	38,595
Boone, Missouri **	125,676	679	412	17,960
Sarpy, Nebraska **	116,271	723	349	10,948
Warren, Missouri **	22,873	747	446	6,975
Leavenworth, Kansas **	69,904	627	344	5,615
Platte, Missouri **	67,251	893	563	3,230
Franklin, Missouri **	89,485	722	478	3,205
Ray, Missouri **	22,660	604	157	3,200
Cole, Missouri	68,185	836	433	1,500
Dakota, Nebraska **	18,528	590	411	705
Brown, Kansas	10,965	348	231	590
Atchison, Missouri	7,291	643	260	315
Doniphan, Kansas	7,766	338	252	130
Osage, Missouri	12,396	1,525	770	109
Buchanan, Missouri **	82,066	671	497	17
Moniteau, Missouri	13,047	1,603	726	0
Gasconade, Missouri	14,615	816	680	0
Lafayette, Missouri **	32,259	1,083	622	0
Thurston, Nebraska	7,274	817	446	0
Cooper, Missouri	15,947	977	440	0
Carroll, Missouri	10,273	1,618	435	0

Table 3.5-14 *(continued)*
Government Finance

County	Population 1996	Per Capita County Tax Revenue	Per Capita General Expenditures	Total Debt Outstanding at End of Fiscal Year $(000)
Chariton, Missouri	8,818	1,330	411	0
Cass, Nebraska **	23,478	575	345	0
Richardson, Nebraska	9,689	334	334	0
Otoe, Nebraska	14,515	325	307	0
Washington, Nebraska **	18,175	509	306	0
Holt, Missouri	5,658	453	277	0
Burt, Nebraska	7,944	365	262	0
Atchison, Kansas	16,234	386	231	0
Fremont, Iowa	7,918	297	148	0
Monona, Iowa	9,981	314	133	0
Nemaha, Nebraska	7,878	481	125	0

** Metropolitan Statistical Area (MSA) Counties
Source: U.S. Census Bureau, Government Finances 1996-1997.

PILT is an annual payment by the Federal government to local governments to compensate for the use of lands by the Federal government. These "entitlement lands" include lands in the National Forest System, the National Park System, lands administered by the Bureau of Land Management (BLM), lands dedicated to the use of Federal water resource development projects, and other specialized Federal land categories. Appendix F presents a detailed description of Federal entitlement lands that qualify for PILT payments and the process used to estimate the amount of payments received by local governments (BLM, 2002). The lands used for the modified Mitigation Project would be considered entitlement lands. As shown in Table 3.5-15, there are currently approximately 67,000 entitlement acres in the ROI. The top five counties with the highest entitlement acreage range from 4,355 acres to 12,498 acres and are all located in Missouri including Clay, Callaway, St. Charles, Jackson, and Cooper counties. These counties represent a mixture of both primarily urban and primarily rural counties. The PILT payment averages approximately $0.68 per acre and ranges from $0.52 to $3.05 per acre. Based on the most recent available data, there are currently 31 of the 46 counties in the study area that are entitled to receive PILT payments from the Federal government for the agency lands specified (BLM, 1997).

Table 3.5-15
Entitlement Acres and PILT Payments

County	Region	Entitlement Acres	PILT Payments (1997)	Payment per Acre
Clay, Missouri **	2	12,498	$9,065	$0.73
Callaway, Missouri	4	12,306	$6,444	$0.52
St. Charles, Missouri **	4	8,288	$6,011	$0.73
Jackson, Missouri **	2	7,523	$5,456	$0.73
Cooper, Missouri	3	4,355	$3,159	$0.73
Boone, Missouri **	3	3,762	$2,038	$0.54
Douglas, Nebraska **	1	3,024	$2,193	$0.73
Atchison, Kansas	2	2,111	$1,531	$0.73
Burt, Nebraska	1	1,859	$1,348	$0.73
Otoe, Nebraska	2	1,756	$1,274	$0.73
Nemaha, Nebraska	2	1,366	$991	$0.73
Cass, Nebraska **	2	1,247	$904	$0.73
Sarpy, Nebraska **	2	1,185	$860	$0.73
Dakota, Nebraska **	1	804	$583	$0.72
Fremont, Iowa	2	722	$524	$0.73
Mills, Iowa	2	719	$522	$0.73
Franklin, Missouri **	4	622	$451	$0.73
Moniteau, Missouri	3	533	$387	$0.73
Woodbury, Iowa **	1	415	$301	$0.72
Thurston, Nebraska	1	354	$257	$0.72
Monona, Iowa	1	352	$255	$0.73
Chariton, Missouri	3	256	$186	$0.72
Holt, Missouri	2	237	$172	$0.72
Saline, Missouri	3	209	$151	$0.72
Buchanan, Missouri **	2	174	$126	$0.73
Osage, Missouri	4	84	$61	$0.72
Cole, Missouri	3	83	$60	$0.73
St. Louis, Missouri **	4	77	$56	$0.73
Gasconade, Missouri	4	19	$14	$0.73
Lafayette, Missouri **	3	9	$6	$0.71
Howard, Missouri	3	7	$21	$3.05
Average		**1,456**	**$987**	**$0.68**
Total		**66,956**	**$45,406**	**$0.68**

Region	Average Entitlement Acres	Average PILT Payments (1997)
Region 1	756	$549
Region 2	1,555	$1,128
Region 3	921	$601
Region 4	2,674	$1,630

Region	Total Entitlement Acres	Total PILT Payments (1997)
Region 1	6,808	$4,937
Region 2	29,538	$21,424
Region 3	9,214	$6,009
Region 4	21,396	$13,037

3.5.5 LEVEE AND DRAINAGE DISTRICTS

There are levee and drainage districts located along the 735 miles of the study area that provide flood protection for urban areas, power plants, other river-based industry, and farming operations. The focus of this baseline analysis is identifying the operating and financial characteristics of agriculture levee districts.

There are basically three categories of levees including federal, non-federal, and private levee systems. Federal levees are those built by the Corps on land owned by a local sponsor that agree to maintain the levee to certain Corps standards. Non-federal levees are levees built by levee districts or other government entity. Private levees are built by private individuals or groups of individuals that have not formed an official levee district or taxing jurisdiction for maintaining the levee and drainage systems. Non-federal levee districts that are qualified under Public Law (PL) 84-99 can receive funding to repair flood-damaged levees if the levee meets certain Corps design standards and is maintained to a level that will meet Corps inspections.

Interviews conducted with agricultural levee district presidents (HDR, 2002) indicated that levee membership could range from several to approximately 100 members for the large districts; however, the most common size of levees appeared to be between 10 to 20 members. The length of levees ranged from 1 mile up to 27 miles and the acreage protected was as low as 200 to as high as 25,000 acres (Table 3.5-16).

The average assessment for levee members protected by the levee was between $1 to $5 per acre for conducting the routine maintenance of mowing, weed control, drainage pipe maintenance, and minor repairs. Per acre assessments for levees that were paying off loans for major levee repair could be as high as $8.00 per acre. Selected levee districts do not assess members annually and are inactive until there is flood damage with annual maintenance being on a voluntary basis, with each farmer maintaining the levee adjacent to his farm. One levee district located adjacent to a state conservation area indicated that wildlife and particularly beavers had resulted in increased O&M costs. Individuals had also built duck blinds on the levee assuming it was public property, which required removal by the levee district.

Table 3.5-16
Levee and Drainage Districts' Operation Characteristics

State	Number Of Members	Average Acres per Member	Length of Levee (miles)	Average Acres per Levee Mile	Acres in Levee District	Per Acre		Average Annual Operations & Maintenance Cost	Primary Operation & Maintenance Functions
						5-Year Avg. Assessment to Levee District Members	Real Estate Taxes Paid Within Levee District		
IA	100	250	27.2	919	25,000	$2.00	$18.00	$50,000	• Levee road • Flood gate • Levee maintenance
KS	5	180	3.6	247	900	$1.10	$12.00	$990	• Mowing • Re-rocking top
KS	5	40	2.2	90	200	$1.10	$12.00	$220	• Mowing • Re-rocking top
KS	5	180	4.3	207	900	$1.10	$12.00	$990	• Mowing • Re-rocking top
MO	9	106	3.5	273	960	N/A	$2.75	$2,000	• Fixing water gates • General maintenance
MO	5	81	2.3	175	405	$1.50	$3.00	$600	• Annual General Maintenance
MO	12	430	14.2	363	5,165	$8.00	$2.75	$45,000 (paying on loan)	• Annual General Maintenance
MO	4	750	4.5	659	3,000	Inactive until flood	$2.50	No budget due to inactivity.	• Each farmer does general maintenance on levee area on his land
MO	4	250	3.8	265	1,000	No assessment. Members volunteer for levee maintenance.	$3.00	No budget due to inactivity.	• No taxes for Levee District • Everyone contributes when maintenance or repair is needed
MO	13	638	4.5	1,844	1,863	$4.00	$2.50	$7,452	• Mowing • Drainage pipe maintenance, repairs • Maintenance related to wildlife damage (beavers and other animals)
MO	40	200	12.9	618	8,000	$2.00	$3.00	$16,000	• Mowing • General maintenance

Table 3.5-16 *(continued)*
Levee and Drainage Districts' Operation Characteristics

State	Number Of Members	Average Acres per Member	Length of Levee (miles)	Average Acres per Levee Mile	Acres in Levee District	Per Acre		Average Annual Operations & Maintenance Cost	Primary Operation & Maintenance Functions
						5-Year Avg. Assessment to Levee District Members	Real Estate Taxes Paid Within Levee District		
MO	17	109	4.8	387	1,860	$7.00	$3.78	$3,000 (remainder of funds spent on flood repair loans)	• Mowing • Drainage pipe maintenance & repairs
MO	15	282	7.7	547	4,236	$7.50	$3.70	$32,000	• Annual General Maintenance
MO	4	250	3.8	265	1,000	No assessment. Members volunteer for levee maintenance.	$3.00	No budget due to inactivity	• No taxes for Levee District • Everyone contributes when maintenance or repair is needed
MO	13	638	4.5	1,844	1,863	$4.00	$2.50	$7,452	• Mowing • Drainage pipe maintenance, repairs • Maintenance related to wildlife damage (beavers and other animals)
MO	40	200	12.9	618	8,000	$2.00	$3.00	$16,000	• Mowing • General maintenance
MO	17	109	4.8	387	1,860	$7.00	$3.78	$3,000 (remainder spent on flood repair loans)	• Mowing • Drainage pipe maintenance, repairs
MO	15	282	7.7	546	4,236	$7.50	$3.70	$32,000	• Annual General Maintenance
MO	11	206	1.4	1,575	2,268	$5.00	$3.50	$24,000	• Annual General Maintenance
NE	12	92	8	137	1,100	$5.00	$14.50	$5,400	• Clean silt from drainage pipes • Spray for weeds • Maintain road • Mow weeds

3.6 NATIVE AMERICAN RESOURCES

Historically, the Missouri River has been an important resource for Native American cultures. Presently, four Reservations are located along the Lower Missouri River. The Omaha and Winnebago Reservations are located on the west bank between Dakota City and Decatur, Nebraska. The Omaha Reservation also has some land on the east bank, west of Onawa, Iowa. The Iowa and Sac and Fox Reservations are located on the west bank south of Rulo, Nebraska and extend into Kansas. The Iowa Reservation extends east to the Missouri River and includes floodplain land, however, the Sac and Fox Reservation does not have land within the floodplain. Both the Iowa and Sac and Fox Reservations are along the floodplain of the Big Nemaha River, a direct tributary of the Missouri River. Cultural and natural resources exist on each of the Native American reservations that are critical to the heritage and to the future of the people who reside there. These cultural resources include traditional religious sites and burial grounds, historic archaeological sites and architectural structures, as well as other cultural sites and objects preserved within individual reservations. Besides these cultural resources, one very important natural resource on each of these reservations is the land that is available for agricultural use. This provides the residents with a vital supply of income. An additional natural resource found along the Missouri River is the riparian forest. Riparian resources provide these Tribes with food, timber sources for heating, water for drinking and gardens, wind shelters for residences, and locations for recreational activities. Another example of a naturally occurring resource is the wetland areas found around the Missouri River and its tributaries. These wetlands provide flood control, nutrient/sediment trapping, and wildlife/fish breeding and foraging habitats. Wetlands help maintain wildlife diversity and are important to Native American cultures along the Missouri River.

3.7 NAVIGATION

Navigation on the Lower Missouri River has been accomplished by the BSNP authorized by Congress in the RHA of 1912, 1925, 1927, and 1945. Since 1945, the Corps has maintained a navigation channel nine-feet deep and 300-feet wide between Sioux City and the mouth. The Corps declared construction of the BSNP complete in 1981, although corrective work is regularly performed.

Navigation is limited to the eight-month ice-free season, generally April 1st through November 30th. The Corps provides support to navigation through releases from Gavins Point Dam. Navigation service may be reduced by the Corps depending on quantity of water stored in the Mainstem Reservoir System.

Navigation is primarily the transport of freight via tugboats and barges. Freight traffic commodities include various types of agricultural products, chemicals and fertilizers, petroleum products, building products, and river-related materials such as rock, sand, and gravel. Missouri River freight commodities are shown on Table 3.7-1 for the decades 1940 through 2000.

There are 120 docks and terminals within the ROI (Corps, 1998a). Almost all facilities are privately owned and typically serve a specific commodity or commodity sector (e.g., grain such as corn, and soybeans). Region 1 has 22 docks and terminals representing approximately 18 percent of the facilities. Region 2 has the most facilities at 59, representing approximately 49 percent of the total docks and terminals. Region 3 has 20 and Region 4 has 19, representing approximately 17 and 16 percent, respectively. The number of facilities related to agricultural commodities decreases with distance downstream. In Region 1, facilities for shipment of agricultural products dominate, while those for earth materials (e.g., sand, gravel, and rock) are relatively few. In Region 2, agricultural products facilities are somewhat more abundant than those for earth materials. However, moving downstream, Region 3 has approximately twice the number of facilities shipping earth materials as agricultural commodities, and Region 4 is dominated by facilities for earth materials with almost no agricultural facilities present.

Table 3.7-1
Summary of Navigation Traffic (thousands of short tons)

Commodity	1940[1]	1950[1]	1960	1970	1980	1990	2000
Farm Products	53.2	79.9	1061.3	1059.0	1099.8	371.0	487.2
Corn			59.5	143.8	87.8	32.0	197.7
Wheat			649.1	669.0	835.2	171.0	21.2
Soybeans			104.9	208.8	164.1	40.0	153.1
Nonmetallic Minerals	0.0	0.0	33.2	192.0	140.2	28.0	27.7
Food and Kindred			135.5	370.3	570.8	61.0	42.5
Pulp and Paper			0.0	16.7	3.6	6.0	0.0
Chemicals	0.5	0.8	21.3	526.2	501.8	345.0	289.1
Fertilizer			11.3	460.2	455.9	312.0	279.8
Petroleum	46.5	3.5	17.2	50.4	315.6	345.0	256.3
Stone/Clay/Glass			0.0	157.7	146.7	154.0	163.4
Primary Metals	6.3	58.5	164.8	57.8	95.4	11.0	37.4
Other	15.2	54.4	7.7	34.4	35.4	8.0	40.0
Total Commercial	**121.7**	**197.1**	**1,441.0**	**2,464.5**	**2,909.3**	**1,329.0**	**1,343.6**
Waterway Materials[2]	844.8	1,129.5	4,045.8	2,377.2	290.3	272.0	164.4
Sand/Gravel	330.0	282.9	1,462.1	2,677.5	2,715.2	4,240.0	7,225.3
Total Freight	**1,296.5**	**1,609.5**	**6,948.9**	**7,519.2**	**5,914.8**	**5,841.0**	**8,733.3**

[1] Commodity category definition was slightly different before 1960.
[2] Waterway materials are materials used to maintain the BSNP. Source: Corps, 1998a

Table 3.7-2 presents a summary of commodity tonnage shipped on the Lower Missouri River between 1984 and 1996 by river reach. Shipping information by ROI regions was not available.

Table 3.7-2
Commodity Tonnage By Reach between 1984 and 1996

	1984	1986	1988	1990	1992	1994	1996
Sioux City to Omaha							
Farm Prod.	18,433	5,454	4,118	21,000	10,000	30,000	74,000
Food Prod.	263,019	193,779	105,073	28,000	96,000	44,000	36,000
Chemicals	156,761	147,373	165,687	101,000	84,000	99,000	120,000
Building Prod.	0	0	0	0	0	0	0
Petroleum Prod.	37,688	17,951	4,776	0	0	11,000	0
Other Comm.[1]	51,142	21,369	8,304	10,000	8,000	11,000	1,000
Subtotal	**527,043**	**385,926**	**287,958**	**160,000**	**198,000**	**195,000**	**231,000**
Sand/Gravel	0	0	3,700	0	2,000	0	0
Waterway Mat'l.[2]	24,500	50,750	1,950	11,000	18,000	68,000	25,000
Total	**551,543**	**436,676**	**293,608**	**171,000**	**218,000**	**263,000**	**257,000**

Table 3.7-2 *(continued)*
Commodity Tonnage By Reach between 1984 and 1996

	1984	1986	1988	1990	1992	1994	1996
Omaha to Kansas City							
Farm Prod.	627,087	243,840	437,159	192,000	171,000	293,000	308,000
Food Prod.	430,184	318,155	160,434	46,000	107,000	53,000	41,000
Chemicals	489,823	387,057	334,239	203,000	217,000	291,000	304,000
Building Prod.	108,956	106,239	112,883	80,000	103,000	99,000	85,000
Petroleum Prod.	46,836	48,332	65,804	9,000	5,000	125,000	52,000
Other Comm.[1]	126,426	85,180	48,274	44,000	50,000	43,000	33,000
Subtotal	**1,829,312**	**1,188,803**	**1,158,793**	**574,000**	**653,000**	**904,000**	**823,000**
Sand/Gravel	254,763	198,640	294,273	409,000	267,000	379,000	364,000
Waterway Mat'l.[2]	73,766	132,606	20,621	0	12,000	142,000	23,000
Total	**2,157,841**	**1,520,049**	**1,473,687**	**983,000**	**932,000**	**1,425,000**	**1,210,000**
Kansas City to St. Louis							
Farm Prod.	873,297	560,472	697,029	371,000	401,000	487,000	452,000
Food Prod.	480,373	345,908	170,892	56,000	138,000	64,000	51,000
Chemicals	651,882	654,130	533,129	313,000	383,000	547,000	514,000
Building Prod.	150,043	238,537	368,002	154,000	188,000	230,000	214,000
Petroleum Prod.	283,799	333,239	321,130	345,000	213,000	349,000	236,000
Other Comm.[1]	376,571	163,372	119,062	51,000	52,000	69,000	44,000
Subtotal	**2,815,965**	**2,295,658**	**2,109,244**	**1,290,000**	**1,375,000**	**1,746,000**	**1,511,000**
Sand/Gravel	2,939,862	3,963,266	4,126,956	3,831,000	3,853,000	5,765,000	5,914,000
Waterway Mat'l.[2]	230,305	298,917	85,291	261,000	229,000	428,000	316,000
Total	**5,986,132**	**6,557,841**	**6,321,491**	**5,382,000**	**5,457,000**	**7,939,000**	**7,740,000**
Sioux City to St. Louis							
Farm Prod.	873,297	560,472	679,029	371,000	401,000	488.000	452,000
Food Prod.	480,373	350,206	177,576	61,000	138,000	64.000	51,000
Chemicals	713,237	693,425	568,812	345,000	407,000	600.000	551,000
Building Prod.	150,043	238,537	268,002	154,000	188,000	230.000	214,000
Petroleum Prod.	283,779	333,239	325,906	345,000	213,000	349.000	236,000
Other Comm.[1]	377,971	168,020	119,062	53,000	56,000	69,000	44,000
Subtotal	**2,878,720**	**2,343,899**	**2,156,387**	**1,329,000**	**1,403,000**	**1,800,000**	**1,547,000**
Sand/Gravel	3,185,022	4,161,906	4,421,016	4,240,000	4,121,000	6,144,000	6,278,000
Waterway Mat'l.[2]	322,463	484,973	103,475	272,000	259,000	557,000	341,000
Total	**6,386,205**	**6,990,778**	**6,683,178**	**5,841,000**	**5,783,000**	**8,501,000**	**8,165,000**

[1] Other Commercial does not include sand and gravel.
[2] Waterway materials are materials used to maintain the BSNP.
Source: Corps, 1998

3.8 CULTURAL RESOURCES

Cultural resources include historical (including fossil, paleontological, deposits) and archaeological sites or properties. The Advisory Council on Historic Preservation was established in 1966 by the National Historic Preservation Act (NHPA) with the goal of having Federal agencies as responsible stewards of the Nation's historic properties. The National Park Service administers the National Register of Historic Places (NRHP) that was established to record significant historic properties. State Historic Preservation Officers (SHPO) are responsible for locating and nominating eligible sites.

Because this SEIS is programmatic in nature and does not evaluate the potential effects of developing particular sites, the specific locations of eligible or NRHP listed properties are not discussed herein.

The Missouri River was a major transportation corridor during exploration and settlement of the Lower Missouri River valley and the western United States. Use of the Missouri River during the fur trade, exploration of the west, and settlement periods is well documented. The Missouri River was also important to indigenous cultures over the past 10,000 years. Paleoindians and more recent Native American cultures have inhabited the area including the ROI. A rich record of human occupation is present and numerous sites have been identified; however, much of the evidence may have been destroyed by the dynamics of the Missouri River, or in the case of paleontological sites may be buried under loess deposits along the periphery of the floodplain. More recent historical sites are known to exist from identification of artifacts or from historic records.

From a regional perspective, the Missouri River is situated in an area of geologic and climatic transition that provides a variety of natural resources important for early cultures as well as historic peoples. Human occupation in Missouri dates back to 14,000 Before Present (BP). Nomadic, wide-spectrum hunter/gatherers are known to have inhabited the Missouri River areas of Iowa, Kansas, and Nebraska as early as 6,000 to 8,000 years BP. Limited population groups began to appear between 2,000 and 1,000 years BP. A shift from a nomadic lifestyle to a more sedentary lifestyle with small villages and camps occurred during this Woodland Tradition period. Hunting and gathering was still important, but horticulture likely occurred. Bow and arrow and ceramic

pottery also began to be used during this period. Numerous known prehistoric sites are clustered in the vicinity of Kansas City, Jefferson City, and Columbia, and to a lesser extent west of St. Louis.

Native American cultures were somewhat mobile; many of the tribes occupying the interior portion of the U.S. by the 1600s to 1700s had moved from eastern-forested areas. The Euroamerican presence along the Lower Missouri River began around 1700. At that time, Native American cultures along the Missouri included: the Yankton in the vicinity of Sioux City; the Omaha from Sioux City to the vicinity of Omaha; the Oto from the vicinity of Omaha to the Nebraska-Kansas border on both sides of the Missouri River; the Iowa, generally east of the Oto, but extending to the vicinity of the Missouri River in southwest Iowa and northeast Missouri; the Kansa or Kaw generally west of the Missouri River in Kansas; the Sac and Fox cultures in an area where the four states of the ROI meet, the Missouri generally north and east of the Missouri River into southwest Iowa and southeast Nebraska and on both sides of the Missouri River generally between Kansas City and Jefferson City; and the Osage on both sides of the Missouri west of Jefferson City and extending south.

The Lower Missouri River valley is rich in historic resources. The first written accounts are from Father Jacques Marquette and Louis Joliet in 1673. In 1682 LaSalle claimed a large area west of the Mississippi River for France. Fur trappers and explorers first used the Missouri River for transportation and trade in the early 1700s. The French established the first permanent settlement of Ste. Genevieve in the mid-1730s, and St. Louis was established as a fur trading post in 1764. The Louisiana Territory was ceded to Spain in 1762 and in 1802 Spain ceded the Louisiana Territory back to France. The ROI is in the heart of the Louisiana Territory that the U.S. purchased from France in 1803. President Jefferson authorized the Lewis and Clark Corps of Discovery Expedition that left St. Louis in 1804.

The Missouri River was the major transportation system in exploration and settlement of much of the Midwest and western United States for over 100 years. Because of its long and active use, numerous historic sties, including Lewis and Clark encampments, historic settlements, buildings, forts and riverboat

wrecks occur in the ROI floodplain. Westport Landing, later to become Kansas City, Missouri was established at a French fur trading settlement in 1821. In the 1820s, fur trappers followed the Missouri River to explore and trap in the Rocky Mountains. This migration increased fur trade-related settlement.

Beginning in 1819, steamboats began to appear on the Lower Missouri River above St. Louis. Steamboats became important for efficiently transporting goods and people to support the fur trading industry. By the 1850s, interest grew in settling the west. Independence, Kansas City, and St. Joseph became important locations for joining settlers on the Santa Fe Trail, California, and Oregon Trails. Steamboats on the Lower Missouri River enabled the growth of these cities that were primarily based on providing provisions and related services to those embarking on overland wagon trains. During this time, the military also began to establish forts along the Missouri River to assist in the westward expansion of the United States. The United States government relied on steamboat transportation in its new mission.

Settlement along the Missouri River continued to expand. Omaha was established south of Fort Atkinson and became a town in 1854. An expedition of Mormon settlers wintered north of Omaha in 1855-56. Construction of the railroads increased the growth of cities along the Missouri River, such as Omaha because it was the eastern terminus of the first transcontinental railroad. Although the railroads were to later become a competing transportation system, steamboat river transportation continued to flourish after arrival of the railroads during the westward expansion of the rail system.

The discovery of gold in Montana in the 1860s greatly increased the use of steamboats on the entire length of the Missouri River below Great Falls, Montana. Steamboats were a major conveyance of people and goods until around 1900. The railroads had by that time established connections with most cities and became dominant. However, river transportation of goods increased in the early 1900s through the use of propeller driven, steel hulled towboats and barges. This new form of river transportation provided an economical method of shipment of commodities on the Lower Missouri River. The combination of river and railroads increased the growth of the Missouri River urban centers and left

numerous historic places and buildings in the ROI.

3.9 AIR QUALITY AND NOISE

3.9.1 AIR QUALITY

National Ambient Air Quality Standards (NAAQS) have been established by the EPA and cover six "criteria" air pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter, regulated as particles under ten microns in diameter (PM_{10}) and under 2.5 microns in diameter ($PM_{2.5}$), and sulfur dioxide (SO_2). The NAAQS are summarized in Table 3.9-1. While most of these pollutants are emitted directly to the atmosphere by various sources, ozone is a product of photochemical reactions in the atmosphere, caused by interaction of sunlight with nitrogen oxides (NOx) and volatile organic compounds (VOCs). Unfortunately, ozone is an unwanted pollutant at ground level, but in the upper atmosphere, it is a desirable molecule that protects us from ultraviolet radiation.

States are allowed to promulgate their own Ambient Air Quality Standards (AAQS), which can be more stringent than the NAAQS. Of the states bordering the ROI, Iowa and Kansas simply reference the NAAQS as being applicable in their jurisdictions. Nebraska AAQS are identical to the NAAQS for criteria pollutants, but Nebraska also has an AAQS for Total Reduced Sulfur (TRS), which is most typically made up of hydrogen sulfide or other odorous sulfur-containing compounds. Missouri AAQS are identical to the NAAQS for criteria air pollutants, except that Missouri rules do not yet contain the new NAAQS for $PM_{2.5}$ and 8-hour ozone. Also, Missouri has added AAQS for sulfuric acid and hydrogen sulfide.

Air quality in the ROI is in compliance with all NAAQS, except for counties in the St. Louis area, which are not meeting the NAAQS for ozone. EPA has designated the St. Louis area counties bordering the Missouri River (Franklin, St. Charles, and St. Louis) as being in "moderate" non-attainment with respect to the one-hour ozone NAAQS.

Other large urban areas in the ROI, including the Omaha-Council Bluffs area and the Kansas City area, have previously been designated as non-attainment with respect to the NAAQS, but have since come into attainment with all standards. Most of the rural areas in the ROI have not been identified with air quality problems.

Table 3.9-1
National Ambient Air Quality Standards

Pollutant	Primary	Secondary
SO_2		
3-Hour Average[a]		1300 μg/m^3
24-Hour Average[a]	365 μg/m^3	
Annual Average	80 μg/m^3	
PM_{10}		
24-Hour Average[e]	150 μg/m^3	150 μg/m^3
Annual Average	50 μg/m^3	50 μg/m^3
$PM_{2.5}$		
24-Hour Average[c, d]	65 μg/m^3	65 μg/m^3
Annual Average[c]	15 μg/m^3	15 μg/m^3
CO		
1-Hour Average[a]	35 ppm[b]	
8-Hour Average[a]	9 ppm[b]	
O_3		
1-Hour Average[a]	0.12 ppm	0.12 ppm
8-Hour Average[c]	0.08 ppm	0.08 ppm
NO_2		
Annual Average	0.053 ppm	0.053 ppm
Pb		
Calendar Quarter Average	1.5 μg/m^3	1.5 μg/m^3

[a] Not to be exceeded more than once per year.
[b] Equivalent to 40 and 10 milligrams/m^3 for the 1-hour and 8-hour averages, respectively.
[c] New standards effective in September 1997, but attainment status with respect these standards has not yet been determined in the project area by EPA. Thus, implementation of enforcement mechanisms for these standards is not complete.
[d] Attained when 98th percentile value in 3-year period is below standard level.
[e] Attained when 99th percentile value in 3-year period is below standard level.

3.9.2 NOISE

Ambient noise levels are to a great extent dependent on the amount of development-induced activities present in a given area. Most of the land use in the ROI floodplain is dominated by agricultural practices, and as such, most of the existing noise levels are from relatively local activities such as farming, highway traffic, and railroads, as well as from hunting during the fall months. Sensitive receptors occur throughout the ROI, although at relatively low densities (e.g., two to four homes per square mile). Numerous small towns and a few cities are also located within the ROI. Noise monitoring to document ambient conditions was not performed because of the relative low level of ambient noise along the river and because of its generally rural and undeveloped nature. In areas that are absent of development-induced noise such as farming or highway traffic, the primary sound levels will be from natural sources such as wind.

3.10 SOLID AND HAZARDOUS WASTE

3.10.1 SOLID WASTE

The Resource Conservation and Recovery Act (RCRA) of 1976, as amended by the Hazardous and Solid Waste Amendments of 1984, sets the requirements for reduction, control, management, and disposal of solid and hazardous waste. Subtitle D addresses the management of nonhazardous solid waste and Subtitle I regulates underground storage tanks. Individual states can apply for primacy in managing solid and hazardous waste programs under state regulations that are at least as strict as the Federal programs.

Solid waste management and disposal, including mixed municipal solid waste landfills, industrial and special waste landfills, ash landfills, and construction and demolition material landfills, are regulated by the four states within the ROI. Management of industrial wastewater, with its associated solid waste, may be managed through National Pollutant Discharge Elimination System (NPDES) permits, or state-approved permits. Within the ROI, there are approximately 8 licensed landfills in Iowa, 11 in Kansas, 14 in Missouri, and 11 in Nebraska. It is not known how many of these facilities are located in the floodplain of the Missouri River or tributaries. There are also numerous solid waste transfer stations, composting facilities, material recovery facilities, recycling facilities, and underground storage tanks in the ROI.

Identification and description of each facility and tank is beyond the scope of the programmatic nature of this SEIS. Site-specific information will be addressed in DPRs.

3.10.2 HAZARDOUS WASTE

The management of hazardous waste from active facilities is conducted under the regulations of Subtitle C of RCRA, and approved state programs. Proper management of hazardous materials and waste minimizes the potential for future environmental contamination. Hazardous waste regulations address requirements for proper storage, records management, training of personnel designated to manage the waste, and other criteria.

Past contamination from releases of hazardous materials and waste is being addressed through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund and enacted by Congress in 1980. This law created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. Revenues collected went to a trust fund for cleaning up abandoned or uncontrolled hazardous waste sites. CERCLA established prohibitions and requirements concerning closed and abandoned hazardous waste sites; provided for liability of persons responsible for releases of hazardous waste at these sites; and established a trust fund to provide for cleanup when no responsible party could be identified. The law authorizes two kinds of response actions:

- Short-term removals, where actions may be taken to address releases or threatened releases requiring prompt response.

- Long-term remedial response actions, that permanently and significantly reduce the dangers associated with releases or threats of releases of hazardous substances that are serious, but not immediately life threatening. These actions can be conducted only at sites listed on EPA's National Priorities List (NPL).

CERCLA also enabled the revision of the National Contingency Plan (NCP). The NCP provided the guidelines and procedures needed to respond to releases and threatened releases of hazardous substances, pollutants, or contaminants. The NCP also established the NPL. The Superfund Amendments and

Reauthorization Act (SARA) of 1986 amended CERCLA. The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986, sets forth the requirements for emergency planning, including timely notification and response to a release of hazardous substances.

CERCLA is implemented by Section 300.425(c) of the NCP (55 FR 8845, March 8, 1990). Three mechanisms exist for placing sites on the NPL. The first mechanism is EPA's Hazard Ranking System (HRS). Second, the NPL allows states or territories to designate one top-priority site regardless of score. Third, a state is allowed to list a site if it meets all three of the following requirements:

- The Agency for Toxic Substances and Disease Registry (ATSDR) of the U.S. Public Health Service has issued a health advisory that recommends removing people from the site;
- EPA determines the site poses a significant threat to public health; and
- EPA anticipates it will be more cost-effective to use its remedial authority (available only at NPL sites) than to use its emergency removal authority to respond to the site.

Sites are first proposed to the NPL in the *Federal Register*. EPA accepts public comments on the sites, responds to the comments, and places sites on the NPL that continue to meet the requirements for listing.

The EPA has identified 377 sites in the 46 ROI counties that are suspected of having some level of contamination and are listed in the CERCLA Information System (CERCLIS; EPA, 2002). Of these, 11 are on the NPL, none are proposed for the NPL, and two have been removed from the NPL. Eight of the 11 sites are in the floodplain of the Missouri River and two are in floodplains of tributaries to the Missouri River.

Numerous other sites with some level of contamination may be present, such as leaking above ground or underground storage tanks, former or current treatment, storage, or disposal facilities, and state-listed uncontrolled and abandoned properties. As indicated previously, identification and description of each facility and leaking tank is beyond the scope of the programmatic nature of this SEIS; however, further investigation would be performed during preparation of site-specific DPRs.