3.12 ECONOMICS AND DEMOGRAPHICS

3.12.1 Introduction

In addition to potential effects on environmental resources, changes in commercial dredging activity on the Missouri River could generate a range of socioeconomic impacts or benefits. Potential socioeconomic effects would result from changes in the production of commercial sand and gravel associated with changes in the annual amount of permitted dredging. This would not only result in direct economic impacts on current dredging operations but also would affect market prices for construction sand and gravel, and the local and regional economy—in particular, industries that are dependent on sand and gravel as an input to production. Changes in dredging could result in fiscal impacts from changes in royalties or tax revenues generated by sand and gravel production. Conversely, ongoing commercial dredging could result in continuation of indirect economic impacts associated with direct effects on agricultural production, recreation use levels, infrastructure repair and maintenance, shoreline maintenance, water supply availability, water quality, and maritime (barge shipping) activity.

This section describes the regulatory setting related to socioeconomics and the existing economic and demographic conditions in those regions affected by commercial sand and gravel dredging in the Missouri River. The section focuses on the socioeconomic resources likely to be affected by the Proposed Action or the alternatives, including cessation of commercial dredging under the No Action Alternative or continued dredging at recent, increased, or reduced levels under the other alternatives. The description of existing conditions begins with information on the economic, demographic, and social characteristics of the study area, which is useful in understanding the affected population and is used to evaluate the Project in the context of environmental justice. Next is an overview of the regional economy and local economic conditions, including information on major industries and trends in employment and income levels. The remainder of the section focuses on the sand and gravel industry, specifically the economic parameters associated with existing sand and gravel dredging operations and the markets they serve. This section also addresses alternate sources of sand and gravel in the region.

3.12.2 Regulatory Setting

The regulatory environment related to socioeconomic resources is limited to NEPA requirements for economic analyses and policies and regulations related to environmental justice[1]. In the context of NEPA, Section 1502.1 of the CEQ Regulations for Implementing NEPA describes as one of the purposes of NEPA to "inform decision-makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment," where the human environment "shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment." Further, the regulations state that "when an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment" (Section 1508.14). The relationship between the physical effects of commercial dredging (sand and gravel production) and the commercial sand and gravel market warrants consideration of economic effects in this EIS.

The regulatory environment related to environmental justice is tied primarily to EO 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations) dated February 11, 1994. EO 12898 requires each federal agency to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." The CEQ has oversight responsibility of the federal government's compliance with EO 12898 and NEPA. The CEQ, in consultation with the USEPA and other agencies, has developed guidance to assist federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed. This guidance is presented in Environmental Justice Guidance under the National Environmental Policy Act (CEQ 1997). (This section presents a range of socioeconomic information for the population in the study area, while Section 4.10 provides the analysis of whether the Proposed Action or alternatives could result in a disproportionately high and adverse effect on minority or low-income populations.)

3.12.3 Study Area

The focus of this EIS is on commercial dredging of sand and gravel in the Missouri River between RM 0 and RM 498, which extends from the confluence with the Mississippi River (adjacent to the state of

[1] All other regulations, such as permits, licenses, and approvals, for mining operations in Missouri are presented in Chapter 7.

Illinois) to Rulo, Nebraska. The area studied for the economic and demographic analysis also captures the primary market area[2] served by commercial sand and gravel produced from the LOMR. For this analysis, the "primary market area" is defined as the area encompassing an approximately 25-mile-wide radius[3] from the processing facilities (sand plants) associated with existing and proposed dredging operations (Figure 3.12-1). This area is also representative of the functional economic area associated with commercial dredging. Conceptually, a "functional economic area" is a semi-sufficient economic unit. In the context of potential impacts of the Project, it can be based on the location of affected people and businesses (e.g., consumers of sand and gravel products, employees of dredging operations, and support industries that provide inputs and services to existing dredging operations). It can be further defined by the geographic extent of potential indirect impacts associated with commercial dredging on affected parties, such as cities that rely on potentially endangered water intakes for their drinking water, residents that rely on potentially endangered levees for their protection from flood damage, and electric power customers whose electricity supply may be cut back if a power plant is unable to obtain cooling water for its intakes.

The "primary market area" represents the total of the five individual market areas serving each segment. Based on the 25-mile-radius criterion,[4] the study area for the socioeconomic analysis covers a 40-county region that extends across Missouri and into portions of Kansas and Illinois, capturing the major metropolitan areas of St. Louis/St. Charles, Jefferson City, Kansas City, and St. Joseph.[5] Table 3.12-1 identifies the counties included in the primary market area[6].

Based on the proximity of the Missouri River to the major urban areas in Missouri and adjacent states, commercial sand and gravel production has a substantial role in the statewide and regional economies. Accordingly, the regional economic analysis, which measures the indirect (and induced) economic effects associated with sand and gravel production from the LOMR, has been conducted at the state level for the purposes of the affected environment. This macro-level analysis serves a key role because it allows decision makers to realize the regional importance of sand and gravel production.

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2 It is acknowledged that commercial aggregate produced from the LOMR is used throughout Missouri and in other states; however, the majority of customers are local manufacturers or contractors within the primary market area.

3 The 25-mile radius was selected based on discussions with existing dredge operators and is indicative of the relative low-value product and high transportation costs required to ship aggregates longer distances.

4 The study area includes all counties with at least 25 percent of their land area within a 25-mile radius of existing or proposed sand plants on the LOMR.

5 The study area includes counties in Kansas and Illinois that are likely served primarily by sand and gravel production in the Kansas and Mississippi Rivers, respectively; however, they are included in the analysis based on their proximity to LOMR dredging activity.

6 Several counties are recognized as being in the same market area served by processing facilities in different river segments but were assigned to only one market area for presentation purposes.

Table 3.12-1 Primary Market Area for Sand and Gravel Production in the Lower Missouri River[a]

Market Area	States and Counties
St. Joseph	Missouri: Andrew, Buchanan, Clinton, DeKalb, Holt
	Kansas: Atchison, Doniphan
	Illinois: none
Kansas City	Missouri: Clay, Jackson, Platte
	Kansas: Johnson, Leavenworth, Wyandotte
	Illinois: none
Waverly	Missouri: Carroll, Lafayette, Ray
	Kansas: none
	Illinois: none
Jefferson City	Missouri: Boone, Callaway, Chariton, Cole, Cooper, Howard, Moniteau, Osage, Randolph, Saline
	Kansas: none
	Illinois: none
St. Charles	Missouri: Franklin, Gasconade, Jefferson, Lincoln, Montgomery, St. Charles, St. Louis, St. Louis City, Warren
	Kansas: none
	Illinois: Calhoun, Jersey, Macoupin, Madison, St. Clair

[a] The "primary market area" represents the total of the five individual market areas serving each segment.

The analysis also includes those areas that produce and use sand and gravel, acknowledging that many stakeholders are concerned about economic impacts at the local level. The analysis of regional economic impacts at the local (county) level is presented where relevant and data are available. Finally, the socioeconomic impact analysis covers the production of sand and gravel from not only the LOMR but also from alternate sources that may extend into nearby states, such as Illinois and Kansas; the regional economic effects anticipated in these neighboring states are assessed qualitatively.

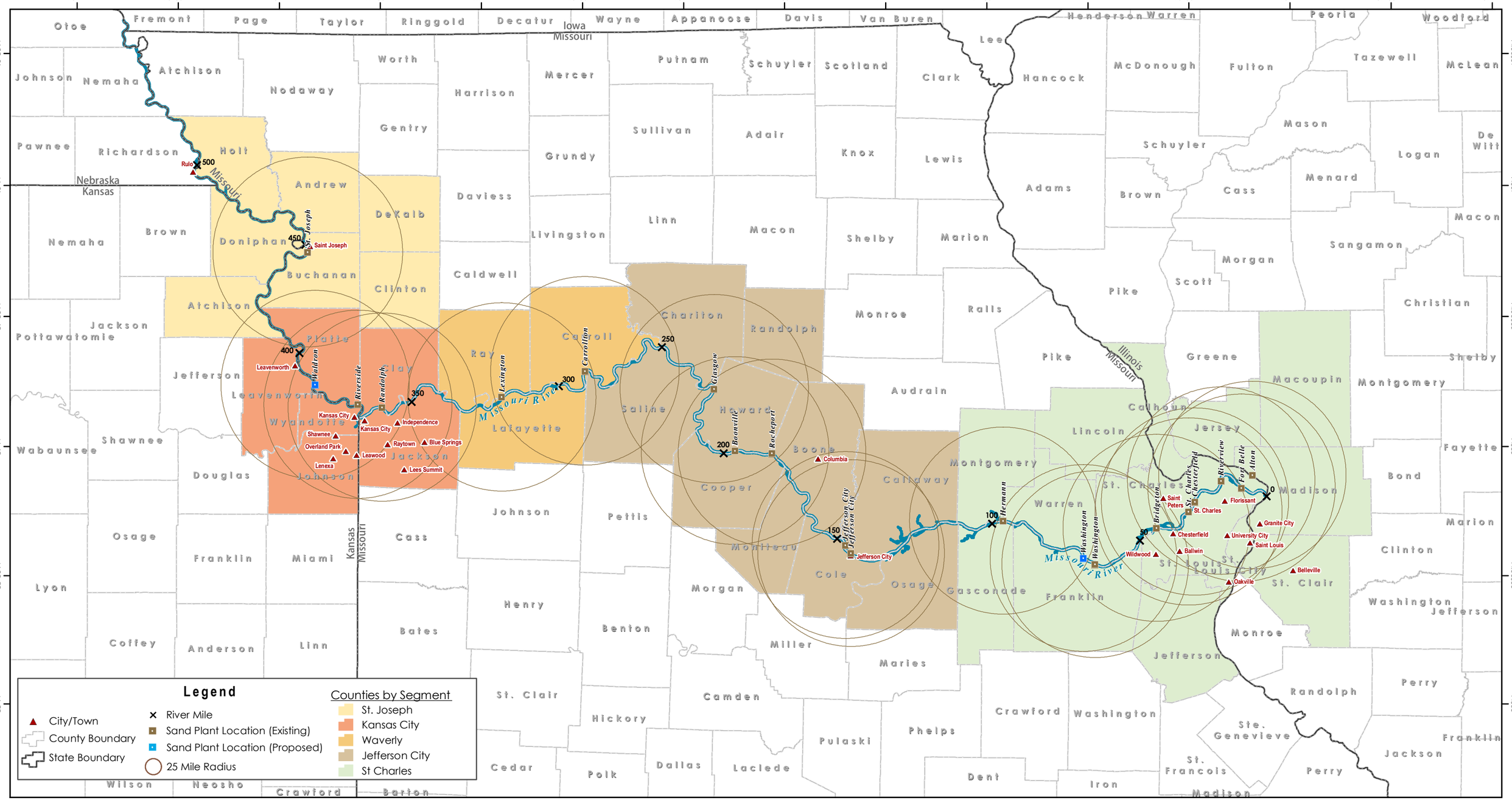

Figure 3.12-1
Primary Market Area Served by Commercial Sand and Gravel Produced from the Lower Missouri River

Missouri River Commercial Dredging EIS

July 2010

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Map Projection: Mercator, WGS84

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3.12.4 Demographic and Social Characteristics

3.12.4.1 Population

Commercial sand and gravel produced from the LOMR is used primarily to support the construction industry, but also supports other industries that serve the population in the primary market area and throughout the state of Missouri. Population estimates, organized by market area, are presented in Table 3.12-2. As shown in the table, the population in the primary market area along the LOMR represents a substantial component of the population base in Missouri, indicative of the large urban centers that are located proximate to the river. In 2008, approximately 5.1 million people lived in the 40 counties comprising the primary market area. Across market areas, the largest population is found in the counties comprising the St. Charles market area (approximately 2.7 million people), followed by the Kansas City market area (1.7 million people), Jefferson City market area (384,000 people), St. Joseph market area (169,000 people), and Waverly market area (66,000 people). To provide context, the total population in the state of Missouri was just over 5.9 million in 2008. Accounting for counties in Missouri only, the primary market area represents approximately 62 percent of the total statewide population. In terms of population trends, population in the primary market area has grown at an average rate of 0.7 percent annually between 2000 and 2008.

Table 3.12-2 Population Estimates for the Study Area

Market Area	Population (2000)[a]	Population (2008)	Population Growth (Annual)
St. Joseph	165,089	168,839	0.3%
Kansas City	1,596,155	1,732,676	1.0%
Waverly	66,662	66,114	-0.1%
Jefferson City	359,865	384,149	0.8%
St. Charles	2,624,685	2,731,459	0.5%
Primary market area[b]	4,812,456	5,083,237	0.7%
State of Missouri	5,605,868	5,911,605	0.7%

[a] Based on population estimates dated July 1, 2000.

[b] Includes counties in Missouri, Kansas, and Illinois; the "primary market area" represents the total of the five individual market areas serving each segment.

Sources: U.S. Census Bureau 2009a, 2009b, 2009c.

Population projections can provide insight about future demand for commercial sand and gravel in the region. Population projections for the primary market area through 2030 are shown in Table 3.12-3. Between 2000 and 2030, population is projected to grow by approximately 0.7 percent annually in the primary market area, increasing from approximately 4.8 million in 2000 to nearly 6.0 million by 2030. The Kansas City market area is expected to experience the greatest population growth increasing by approximately 1.2 percent annually during the 30-year projection period, followed by the Jefferson City market area (0.8 percent), St. Charles market area (0.4 percent), St. Joseph market area (0.3 percent), and Waverly market area (0.0 percent). These population projections are comparable to statewide estimates that show population growing at an annual rate of 0.6 percent for the state of Missouri as a whole. Although population is projected to increase over time, it is difficult to estimate the effect on demand for construction sand and gravel, which is driven in large part by economic conditions and trends in the construction industry.

Table 3.12-3 Population Projections for the Study Area (2000–2030)[a]

Market Area	Population (2000)[b]	Population (2010)	Population (2020)	Population (2030)
St. Joseph	164,920	167,802 (0.2%)	174,955 (0.3%)	181,128 (0.3%)
Kansas City	1,590,719	1,771,349 (1.1%)	1,994,120 (1.1%)	2,265,598 (1.2%)
Waverly	66,599	66,184 (-0.1%)	66,113 (0.0%)	66,113 (0.0%)
Jefferson City	359,245	389,988 (0.8%)	426,958 (0.9%)	459,621 (0.8%)
St. Charles	2,623,051	2,746,023 (0.5%)	2,882,674 (0.5%)	2,983,194 (0.4%)
Primary market area[c]	4,804,534	5,141,346 (0.7%)	5,544,820 (0.7%)	5,955,653 (0.7%)
State of Missouri	5,596,687	5,979,344 (0.7%)	6,389,850 (0.7%)	6,746,762 (0.6%)

[a] Numbers in parentheses represent average annual percentage changes from base period (2000).

[b] Based on population estimates dated April 1, 2000 (U.S. census data).

[c] Includes counties in Missouri, Kansas, and Illinois; the "primary market area" represents the total of the five individual market areas serving each segment.

Sources: State of Missouri, Office of Administration, Budget and Planning undated; State of Illinois, Department of Commerce and Economic Opportunity undated; University of Kansas, Institute for Policy and Social Research 2009.

3.12.4.2 Race and Ethnicity

Knowledge of the racial and ethnic composition of the primary market area is an important component in understanding whether the Project would result in environmental justice-related effects. The race and ethnicity of the population in the primary market area is presented in Table 3.12-4. The two largest racial groups are White and Black/African American; together, these groups comprise approximately 95.4 percent of the total population in the primary market area. Other racial groups primarily represent

the remaining 4.6 percent of the regional total, led by people identifying with more than one race and Asians. The proportion of people of Hispanic ethnicity living in the primary market area is 2.9 percent, greater than the statewide average. Generally, the racial/ethnic composition in the primary market area is more diverse than in the state.

Table 3.12-4 Race and Ethnicity of the Study Area Population (2000)

	Race (Percentage of Total Population)							Ethnicity
Market Area	White	Black/ African American	American Indian/ Alaska Native	Asian	Native American/ Pacific Islander	Other Race	Multi-Racial	Hispanic/ Latino
St. Joseph	93.7%	3.8%	0.5%	0.3%	0.0%	0.5%	1.2%	1.8%
Kansas City	79.1%	14.1%	0.5%	1.8%	0.1%	2.5%	2.1%	5.7%
Waverly	96.1%	1.9%	0.3%	0.2%	0.0%	0.4%	1.1%	1.1%
Jefferson City	88.5%	7.5%	0.4%	1.5%	0.0%	0.6%	1.5%	1.6%
St. Charles	78.4%	18.1%	0.2%	1.4%	0.0%	0.5%	1.3%	1.5%
Primary market area [a, b]	80.1%	15.3%	0.3%	1.5%	0.0%	1.2%	1.5%	2.9%
State of Missouri	84.9%	11.2%	0.4%	1.1%	0.1%	0.0%	1.5%	2.1%

[a] Includes counties in Missouri, Kansas, and Illinois; the "primary market area" represents the total of the five individual market areas serving each segment.

[b] Represents an average for the primary market area counties, weighted by population.

Source: U.S. Census Bureau 2000.

Racial composition varies among the market areas. The Kansas City market area is the most racially diverse, having the lowest White population at 79.1 percent, highest Asian population at 1.8 percent, highest Native Hawaiian/Pacific Islander population at 0.1 percent, highest Other Race population at 2.5 percent, highest Multi-Race population at 2.1 percent, and the highest Hispanic population at 5.7 percent; the racial composition of this market area is representative of areas with large urban centers. Similarly, the St. Charles Segment is racially diversified, with the highest Black/African American population (18.1 percent). Conversely, the St. Joseph, Waverly, and Jefferson City market areas have relatively higher White populations and lower minority populations, representative of their more rural character.

3.12.4.3 Economic Indicators of Social Well-Being

Several key economic indicators of the status of social well-being within a geographic region are unemployment, per-capita income, and poverty rates. Table 3.12-5 presents a summary of these three indicators for the primary market area and the state of Missouri.

Table 3.12-5 Economic Indicators of Social Well-Being in the Study Area

Market Area	Unemployment (2008–2009)[a]		Per-Capita Income (2007)	Poverty Rate (2007)
	Labor Force	Unemployment Rate		
St. Joseph	88,735	5.5%	$28,589	13.6%
Kansas City	901,549	6.2%	$40,505	10.4%
Waverly	32,327	6.6%	$30,698	12.1%
Jefferson City	206,334	5.0%	$30,967	14.2%
St. Charles	1,386,329	7.1%	$39,475	11.2%
Primary market area[b]	2,615,274	6.6%	$38,707	11.2%
State of Missouri	3,007,020	8.3%	$33,964	13.3%

[a] October 2008 to November 2009.

[b] Includes counties in Missouri, Kansas, and Illinois; the "primary market area" represents the total of the five individual market areas serving each segment.

Sources: Bureau of Labor Statistics 2009a, Bureau of Economic Analysis 2007a, U.S. Census Bureau 2007.

Unemployment within the primary market area averaged 6.6 percent between October 2008 and November 2009, which was lower than the statewide average of 8.3 percent for the same period. Unemployment patterns varied among market areas. The highest unemployment rate was in the St. Charles market area (7.1 percent); followed by the Waverly market area (6.6 percent) and the Kansas City market area (6.2 percent). Unemployment rates were lowest in the St. Joseph and Jefferson City market areas at 5.5 and 5.0 percent, respectively.

Per-capita personal income in the primary market area (on a weighted average basis) was $38,707 in 2007, which was higher than the statewide figure of $33,964. Across market areas, per-capita income levels were highest in the Kansas City ($40,505) and St. Charles ($39,475) market areas and were lowest in the Jefferson City ($30,967), Waverly ($30,698), and St. Joseph ($28,589) market areas.

Poverty rates represent the percentage of an area's total population living at or below the poverty threshold established by the U.S. Census Bureau. Overall, the poverty rate in the primary market area was 11.2 percent, which is lower than the statewide rate of 13.3 percent and consistent with other economic indicators. The poverty rate was highest in the Jefferson City market area (14.2 percent),

followed by the St. Joseph (13.6 percent), Waverly (12.1 percent), St. Charles (11.2 percent), and Kansas City (10.4 percent) market areas.

3.12.5 Overview of the Regional Economy

This section presents an economic overview of the primary market area and the state of Missouri, based primarily on measures of employment and income. In addition, information at the industry level is presented to provide an understanding of which industries represent the significant sources of jobs and income throughout the state. This information is intended to provide a general understanding of the economic climate characterizing the various regions of the state and to place perspective on the role that commercial sand and gravel production plays in the economy.

3.12.5.1 Employment and Major Industries

Data on total employment and employment by industry provide insights into the size, strength, and diversity of a local economy. These data are presented in Table 3.12-6. In 2007, almost 3.3 million part-time and full-time jobs were supported in the primary market area (across three states), and nearly 3.7 million jobs in the state of Missouri. The largest concentration of employment was in the St. Charles market area, with 1.7 million jobs constituting 51.8 percent of the primary market area, followed closely by the Kansas City market area with nearly 1.2 million jobs. The Jefferson City, St. Joseph, and Waverly market areas had the smallest employment bases with 259,800 jobs, 96,500 jobs, and 30,200 jobs, respectively. Based on the information on employment by industry, the economy in the primary market area is diverse. The largest economic sectors in the primary market area were Other Services, Wholesale and Retail Trade, and Government (federal and state/local); the Natural Resources and Mining sector accounts for a relatively small proportion (less than 1 percent) of total employment in the primary market area and the state. The Construction sector that relies on sand and gravel as a production input supports over 235,200 jobs in Missouri and represents approximately 6.4 percent of the employment base in the state.

3.12.5.2 Earnings and Income

Table 3.12-7 presents earnings by industry (a component of total personal income) in the primary market area in 2007. The measure of earnings by industry is more relevant than total personal income in evaluating the potential impacts of changes in commercial dredging on the local economy because it focuses on the wages and salaries of employees and the business income of proprietors. In addition, it

excludes factors such as transfer payments that are unlikely to be affected by changes in commercial dredging.

Total earnings in the primary market area were $155.1 billion in 2007, which includes counties in Missouri, Kansas, and Illinois. In the state of Missouri alone, earnings totaled approximately $153.3 billion. Earnings by place of work across market areas were the highest in the St. Charles market area (approximately $81.4 billion), followed by the Kansas City ($60.6 billion), Jefferson City ($9.2 billion), St. Joseph ($3.2 billion), and Waverly ($0.7 billion) market areas. Following patterns similar to employment, the level of earnings was highest in the Other Services sector. Other sectors that provided a relatively high proportion of employment earnings include Government, Manufacturing, and Wholesale and Retail Trade. The Natural Resources and Mining and the Construction sectors generated relatively limited employment earnings relative to all other sectors in the primary market area and the state.

3.12.6 Overview of the Construction Sand and Gravel Industry

The purpose of commercial dredging in the Missouri River is the production of construction sand and gravel. This section provides a general overview of the construction sand and gravel industry, focusing on production characteristics and levels, economic benefits, and the markets for sand and gravel materials. The information presented in this section primarily addresses the state (Missouri) level. The following section describes the economic conditions of existing commercial dredging operations on the Missouri River.

3.12.6.1 Industry Background

The principal activities of the construction sand and gravel industry are operating sand and gravel pits and dredges and washing, screening, or otherwise preparing sand and gravel for construction uses. Construction sand and gravel is a traditional basic building material that is used by the construction industry for concrete and asphalt manufacturing, road base, fill, and other miscellaneous uses. A key feature of construction sand and gravel is that it is a relatively accessible natural resource found in rivers and streams and associated floodplains and in natural glacial deposits. As a primary input to the construction industry, the production of sand and gravel is tied heavily to construction trends, which in turn fluctuate with economic conditions.

Table 3.12-6 Total Employment and Employment by Industry in the Study Area (2007)

Segment/ Area	Industry / Sector[a]											
	Farm / Agriculture	Natural Resources and Mining	Construction	Manufacturing	Wholesale and Retail Trade	Transportation and Warehousing	Utilities	Finance and Insurance	All Other Services[b]	Government	Not Disclosed	Total
St. Joseph	5,408	249 [c]	5,768	13,158 [c]	14,740 [c]	1,837 [c]	225 [c]	3,625 [c]	31,072 [c]	13,479 [c]	6,910	96,471
Kansas City	4,695	2,571 [c]	67,036	80,696	170,951 [c]	47,375	4,160 [c]	72,953	582,146	150,648	6,263	1,189,494
Waverly	3,487	55 [c]	2,706	1,925	3,907 [c]	670 [c]	0	1,157	7,083 [c]	4,684	4,548	30,222
Jefferson City	11,732	411 [c]	15,191 [c]	13,439 [c]	24,027 [c]	3,416 [c]	241 [c]	9,708	87,153 [c]	66,843	17,642	259,803
St. Charles	12,326	2,942 [c]	96,260 [c]	137,047 [c]	243,051[c]	44,723 [c]	2,743 [c]	82,000	854,106 [c]	183,257	32,254	1,690,709
Primary market area[d]	37,648	6,228 [c]	188,961 [c]	246,265 [c]	466,676 [c]	98,021 [c]	7,369 [c]	169,443 [c]	1,561,560[c]	418,911 [c]	67,617	3,266,699
State of Missouri	114,477	20,741	235,206	312,651	534,971	128,932	12,705	163,104	1,653,795	486,709	0	3,663,291

[a] Industry/Sectors are based on a summary of North American Industry Classification Systems categories.

[b] All Other Services include Information; Real Estate and Leasing; Professional; Professional, Scientific, and Technical Services; Management of Companies and Enterprises; Administrative and Waste Services; Educational Services; Health Care and Social Assistance; Arts, Entertainment, and Recreation; Accommodation and Food Services; and Other Services except Public Administration.

[c] Does not represent actual total due to missing estimates for counties avoiding disclosure of confidential information; included in market area and state totals.

[d] Includes counties in Missouri, Kansas, and Illinois; the "primary market area" represents the total of the five individual market areas serving each segment.

Source: Bureau of Economic Analysis 2007b.

Table 3.12-7 Earnings by Industry in the Study Area (2007)[a]

Segment / Area	Industry / Sector[b]											
	Farm / Agriculture	Natural Resources and Mining	Construction	Manufacturing	Wholesale and Retail Trade	Transportation and Warehousing	Utilities	Finance and Insurance	All Other Services[c]	Government	Not Disclosed	Total
St. Joseph	$58,747	$9,591 [d]	$214,237	$670,940 [d]	$415,634 [d]	$77,174 [d]	$13,756 [d]	$143,479 [d]	$875,206 [d]	$562,572 [d]	$207,437	$3,248,773
Kansas City	$23,634	$218,667 [d]	$3,770,212	$6,031,012	$7,308,868 [d]	$2,348,156	$415,882 [d]	$4,802,480	$26,533,770	$8,784,620	$363,253	$60,600,554
Waverly	$39,285	$87 [d]	$60,814	$79,042	$91,500 [d]	$18,043 [d]	$872 [d]	$38,130	$109,203 [d]	$180,904	$127,783	$745,663
Jefferson City	$92,668	$12,761 [d]	$554,236 [d]	$636,009 [d]	$914,276 [d]	$135,201 [d]	$22,336 [d]	$438,294	$2,515,121 [d]	$3,107,299	$729,107	$9,157,308
St. Charles	$88,696	$257,932 [d]	$4,990,542 [d]	$11,152,290	$9,709,463 [d]	$2,107,050 [d]	$284,119 [d]	$4,969,154	$35,840,742 [d]	$10,269,190	$1,699,453	$81,368,631
Primary market area[e]	$303,030	$499,038 [d]	$9,590,041 [d]	$18,569,293 [d]	$18,439,741 [d]	$4,685,624 [d]	$736,965 [d]	$10,391,537 [d]	$65,874,042 [d]	$22,904,585	$3,127,033	$155,120,929
State of Missouri	$941,008	$949,889	$10,136,133	$19,837,452	$18,875,112	$5,878,761	$1,259,667	$9,154,011	$61,800,372	$24,451,390	$0	$153,283,795

[a] Values in thousands ($1,000) of dollars.

[b] Industry/sectors based on a summary of North American Industry Classification Systems categories.

[c] All Other Services include Information; Real Estate and Leasing; Professional; Professional, Scientific, and Technical Services; Management of Companies and Enterprises; Administrative and Waste Services; Educational Services; Health Care and Social Assistance; Arts, Entertainment, and Recreation; Accommodation and Food Services; and Other Services except Public Administration.

[d] Does not represent actual total due to missing estimates for counties avoiding disclosure of confidential information; included in market area and state totals.

[e] Includes counties in Missouri, Kansas, and Illinois; the "primary market area" represents the total of the five individual market areas serving each segment.

Source: Bureau of Economic Analysis 2007c.

The different grades of construction sand and gravel reflect the different specifications required for end use. Sand and gravel are graded for commercial use by passing the material through standardized sieves, which yield varying classifications of materials. Acceptable sizes for commercial sand and gravel vary according to the applicable standards set by the construction industry, highway department, or government agency. The term “fine aggregate” is often used to describe commercial sand and “coarse aggregate” to describe gravel. The optimal sand and gravel deposit contains a wide range of particle sizes (from fine to coarse), is free of organic matter, lacks substantial overburden (overlaying soil), and contains sufficient quantities to justify extraction from an economic perspective. Ideally, the deposit is also located near transportation routes and a permanent source of demand for the processed product. In certain cases, manufactured sand and gravel (crushed stone) made from crushed bedrock serves as an alternative to natural sand and gravel deposits.

The sand and gravel mining industry is distinguished from other mining industries by the number and size of its mining operations. Other mining operations, including metal and other industrial mineral mines, are typically fewer in number and larger in size than sand and gravel operations because they have a larger market area. Conversely, the market for construction sand and gravel and other aggregates is highly localized (generally within 25–50 miles of the operation), which is due in part to the relatively low value of the material and the associated high transportation costs. In addition, developing a metal mine generally requires greater capital investment, time, and financial risk than developing a sand and gravel operation.

Because of its high availability and low unit value, the economic viability of commercial sand and gravel operations is generally determined by operating costs (e.g., labor and equipment) and transportation costs to final markets. In fact, transportation costs in the construction sand and gravel industry as a whole has averaged approximately 50 percent of the price paid by customers. As a result, deposits located far from transportation options or large markets might not be economically viable. Typical transportation options are truck, rail, or barge. According to the USGS, approximately 80 percent of construction sand and gravel was transported by truck, 3 percent by waterway, and 1 percent by rail; the remaining 15 percent was not transported and was used at or near the production site (USGS 2009a).

In addition, start-up costs and time must be considered when evaluating the economic viability of sand and gravel operations. The USGS reports that the length of time needed to put a new operation into production is, on average, approximately 5–10 years. The extended start-up period is attributed to time required to develop reserves, acquire zoning and permit approvals, and deliver and install the

necessary production equipment. Other factors to be considered for new mining operations include local community opinions and permit or zoning constraints.

3.12.6.2 Sand and Gravel Production and Value

According to the USGS, 1.23 billion metric tons of construction sand and gravel was produced in the United States in 2007 by nearly 6,700 active operations (USGS 2009a). Production in 2007 represents an approximate 6.6-percent decline relative to record-high production levels in 2006. The decline is attributed primarily to the economic downturn that resulted in reductions in demand from home builders and road and highway projects, which were partially offset by increased demand in the commercial and public sectors.

At the state level, production of construction sand and gravel, masonry cement, industrial sand and gravel, and common clays occurs throughout Missouri. Specifically, approximately 17 million metric tons[7] of construction sand and gravel were produced in Missouri in 2006 with a value of $92.1 million; this equates to an average value (price) of $5.41 per metric ton. In 2007, sand and gravel production declined to approximately 14 million metric tons valued at $77.4 million, with an associated slight increase in price of 1.5 percent to $5.51 per metric ton. To put these figures in context, the Missouri Economic Research and Information Center (MERIC) estimates that the gross state product (GSP) in Missouri fluctuated between $220.1 and $229.5 billion between 2006 and 2007 (MERIC 2008). Based on these figures, construction sand and gravel production contributes less than 0.1 percent to the Missouri GSP. Table 3.12-8 provides historical production and values for construction sand and gravel in Missouri.

Table 3.12-8 Construction Sand and Gravel Production and Value in Missouri (2005–2007)

	2005	2006	2007
Quantity (thousand metric tons)	12,200	17,000	14,000
Value (thousand dollars)	$61,600	$92,100	$77,400
Price (dollars/metric ton)	$5.05	$5.43	$5.51

Sources: USGS 2009b, USGS undated.

[7] USGS reports volumes in metric tons, while extraction data from the LOMR are presented in U.S. tons. For this analysis, a conversion factor of 1.1023 U.S. tons per metric ton is used.

3.12.6.3 Economic Benefits of Construction Sand and Gravel Production

Production of construction aggregate (which includes sand and gravel and crushed stone) provides an array of economic benefits at the national level and in producing states. In this section, the economic benefits on sand and gravel production are described, including the value of production, and employment and income parameters. These benefits are attributed not only to direct production but also to the inter-industry linkages implicit in the production process. Specifically, the full economic impact of construction sand and gravel production must account for the subsequent economic benefits resulting from the purchases by these industries in support of their operations (indirect impacts) and re-spending of payroll income and proceeds of the industry's sales throughout the national economy (induced impacts). The construction sand and gravel industry also produces primary inputs for many other industries (e.g., agriculture, manufacturing, and construction) across the national and regional economies, thereby supporting additional economic activity. The contribution of construction sand and gravel to the intermediate and final products of these industries (forward-linkages) is an important component of the total economic benefits generated by commercial dredging and is noted accordingly; however, these benefits are not quantified as part of the benefit estimates presented in this section.

As shown in Table 3.12-9, the value of construction aggregate at the national level was an estimated $14.44 billion in 2003, which includes the production of crushed stone ($8.63 billion in total sales) and sand and gravel ($5.81 billion in total sales); these are the direct output benefits of the industry (or contribution to gross domestic product [GDP]). The indirect and induced benefits of the construction aggregate industry are founded on the "multiplier" effect, which represents the additional economic activity generated through inter-industry purchases. Accounting for these indirect and induced effects, the total output supported by the construction aggregate industry represents a contribution of approximately $37.2 billion to the national economy (GDP). It also supports over 281,200 jobs in all sectors of the economy, with personal earnings totaling $10.64 billion.

At the state level, the construction aggregate industry also contributes substantially to the Missouri economy but is driven primarily by the production of crushed stone rather than construction sand and gravel. The total value of construction sand and gravel produced in Missouri in 2001 was approximately $46 million, which accounted for approximately 11 percent of the total production value of construction aggregates statewide. Taking into account inter-industry linkages, construction sand and gravel production supported approximately $89 million in total output, $25 million in personal income, and 733 jobs in Missouri.

Table 3.12-9 Economic Benefits of the Construction Aggregate Industry[a]

Industry	Total Sales (Direct Output)	Total Output	Total Personal Income	Total Employment
United States[b]				
Crushed stone	$8.63	$22.55	$6.24	165,600
Sand and gravel	$5.81	$14.63	$4.40	115,612
Total	$14.44	$37.18	$10.64	281,212
State of Missouri[c]				
Crushed stone	$0.41	$0.82	$0.21	6,247
Sand and gravel	$0.05	$0.09	$0.03	733
Total	$0.46	$0.90	$0.23	6,980

[a] Reported in billions ($1,000,000,000) of dollars.

[b] Estimates for the United States are based on 2003 production and reported in 2003 dollars.

[c] Estimates for the state of Missouri are based on 2001 production and reported in 2001 dollars.

Source: George Mason University, Center for Regional Analysis, School of Public Policy 2004.

3.12.6.4 Markets for Construction Sand and Gravel Materials

As described elsewhere, construction sand and gravel generally are used in the production of other intermediate products and, eventually, final products for consumers and businesses. Sand and gravel are primarily used by private construction firms and government agencies in construction (residential and non-residential) and paving activities. Because of the reliance on construction sand and gravel in the production of other goods, fluctuations in the construction sand and gravel industry is considered a reliable indicator of the economic activity in any particular region.

Based on USGS data (2009a) on reported uses in 2007, construction sand and gravel at the national level was primarily used for concrete production (44.3 percent), followed by road base and coverings and road stabilization (23.6 percent), construction fill (13.8 percent), asphaltic and other bituminous mixtures (11.7 percent), plaster and gunite sands (2.6 percent), and concrete products (1.0 percent). The remaining 3.0 percent was for miscellaneous uses, including filtration, railroad ballast, roofing granules, snow and ice control, and related uses (USGS 2009a). In the state of Missouri, the use of construction sand and gravel is concentrated in the production of concrete, accounting for 79.1 percent of total reported use (USGS undated).

3.12.7 Economic Activity from Missouri River Dredging Operations

This section describes the economic activity and other economic factors related to commercial sand and gravel production by existing commercial dredging operations on the LOMR. The section discusses an overview of existing operations, including operating costs and employment; production levels and values; markets and demand for Missouri River sand natural river sand; tax benefits; and the regional economic benefits of existing dredging operations. The information presented here is based on information collected from dredge operators, supplemented by data collected from public agencies and other standardized sources of economic information.

3.12.7.1 Overview of Existing Dredge Operators

Five commercial operators (with six active permits) dredge in the LOMR. These operators use varying techniques to extract sand and gravel from the river channel for commercial sale. Most of the saleable product is high-quality natural sand that serves the concrete and asphalt manufacturing market. Overall, based on information collected from the dredge operators, it is estimated that natural sand accounts for approximately 90–95 percent of all saleable product extracted from the river[8]. Based on its quality, Missouri River sand generally meets most technical specifications for inputs to concrete and asphalt production, including specifications maintained by the MoDOT for use in road construction projects. Other saleable by-products that come from commercial dredging include mason sand, fill sand, pea gravel, and other landscape-grade gravel products that vary based on material size.

Commercial sand and gravel extracted from the LOMR are processed and distributed at sand plants adjacent to the river. A total of 18 existing sand plants process and distribute the sand and gravel extracted from the Missouri River; two additional facilities are proposed by new permit applicants who do not currently dredge in the LOMR (see Figure 3.12-1). Based on the costs associated with barging sand and gravel, sand plants generally are located in proximity to market areas that have historically been permitted for dredging. After the sand and gravel is processed, sorted, and stored, these facilities also serve as the distribution point for sales to customers. Customers typically are responsible for shipping the sand and gravel they purchase, thereby incurring shipping costs. As such, the price paid to dredge operators represents the free-on-board (FOB) price of sand and gravel at any given location.

[8] Because natural sand production represents the bulk of commercial product extracted from the river, it is the focus of this section and the associated economic analysis.

3.12.7.2 Existing Sand and Gravel Production and Values

The volume of commercial sand and gravel dredged on the LOMR fluctuates annually based on economic conditions (primarily market demand), availability of materials in the river system, and other factors. Table 3.12.10 provides a summary of historical production of construction sand and gravel from the LOMR. Over the 5-year period between 2004 and 2008, commercial dredging on the LOMR averaged 6.89 million tons annually and ranged from a low of 5.48 million tons in 2008 to a high of 7.68 million tons in 2005. Across market areas, sand and gravel production has been concentrated in the Kansas City market area (38.6 percent), followed by the St. Charles (23.9 percent), Jefferson City (22.9 percent), Waverly (9.8 percent), and St. Joseph (4.7 percent) market areas.

Table 3.12-10 Annual Production of Construction Sand and Gravel from the Lower Missouri River (2004–2008)

	Production (tons)					
Market Area[a]	2004	2005	2006	2007	2008	Average
St. Joseph	327,260	362,520	364,830	298,440	281,592	326,928
Kansas City	3,215,385	2,611,848	2,819,465	2,526,890	2,120,567	2,658,831
Waverly	530,540	1,148,373	866,665	247,000	597,355	677,987
Jefferson City	1,627,600	1,507,323	1,645,550	1,734,829	1,378,990	1,578,858
St. Charles	1,875,720	2,054,620	1,771,782	1,444,750	1,099,758	1,649,326
Total	7,576,505	7,684,684	7,468,292	6,251,909	5,478,262	6,891,930

[a] Represents location of dredging in the LOMR based on river segments.

Source: USACE 2009.

The value of commercial sand and gravel produced from the LOMR is based on production levels and price estimates for construction sand and gravel across the state[9]. Table 3.12-11 presents a summary of historical production values and prices for construction sand and gravel. Generally, the price for construction sand and gravel used in concrete and asphalt production has remained relatively constant between 2004 and 2008, at approximately $4 to $5 per U.S. ton, although sand and gravel prices have trended upward during this period. Overall, the weighted average price of construction sand and gravel in the state of Missouri is $4.40 per U.S. ton for the period between 2004 and 2008. Applying statewide prices to production levels from the LOMR provides estimates of the total production value. The

[9] The unit value (or price) of construction sand and aggregate was obtained from the USGS Minerals Yearbook for the state of Missouri for the years 2004 through 2007 and was adjusted to reflect values per U.S. ton. For 2008, prices were projected based on the national price trends as reported by the USGS (2009a).

average nominal value of commercial sand and gravel from the LOMR is approximately $30.3 million annually, and has fluctuated between $26.6 and $33.4 million from 2004 to 2008. For comparative purposes, the GSP in the state of Missouri was approximately $237.8 billion in 2008 (MERIC 2008).

Table 3.12-11 Annual Production Value of Construction Sand and Gravel from the Lower Missouri River (2004–2008)[a]

	Production (tons)					
Market Area[b]	2004	2005	2006	2007	2008	Average
St. Joseph	$1,330,503	$1,513,158	$1,633,928	$1,363,960	$1,365,828	$1,441,475
Kansas City	$13,072,419	$10,901,853	$12,627,255	$11,548,639	$10,285,565	$11,687,146
Waverly	$2,156,955	$4,793,307	$3,881,446	$1,128,863	$2,897,401	$2,971,594
Jefferson City	$6,617,145	$6,291,568	$7,369,760	$7,928,685	$6,688,631	$6,979,158
St. Charles	$7,625,898	$8,575,983	$7,935,102	$6,602,937	$5,334,248	$7,214,834
Total	$30,802,919	$32,075,869	$33,447,491	$28,573,084	$26,571,673	$30,294,207
Average price ($/U.S. ton)[c]	$4.07	$4.17	$4.48	$4.57	$4.85	$4.40

[a] Nominal dollars.

[b] Represents location of dredging in the LOMR based on river segments.

[c] Average prices for construction sand and gravel are based on statewide data reported by the U.S. Geological Survey and adjusted to reflect prices of sand and gravel used specifically in concrete and asphalt production.

Source: USACE 2009.

3.12.7.3 Costs of Production

As with most businesses, the costs of commercial dredging on the Missouri River can be organized into start-up, capital, and operating costs. Typical start-up expenditures are associated with planning and engineering, environmental compliance and permitting, and land acquisition (for sand plants). Further, commercial dredging is a capital-intensive activity requiring major equipment, including dredges, barges (used to transport sand and gravel to the plant), processing equipment, and other heavy machinery. During operations, the primary components of production costs are labor payments and expenditures on fuel, miscellaneous parts and equipment, and related maintenance activities.

Based on industry data for the sand mining sector in state of Missouri, it is estimated that value-added[10] factors, including labor payments, account for the majority (55.6 percent) of production costs, while the

[10] Value-added factors include employee compensation, proprietor income, other property-type income, and indirect business taxes. Source: IMPLAN data and software.

purchase of input commodities and services account for the remaining 44.4 percent of costs (Minnesota IMPLAN Group 2008). (However, because each mining operation is unique and such information is proprietary, it is not possible to estimate production costs for each dredging operation or market area.)

Although not a cost of production, shipping costs represent a large component of the delivered price of construction sand and gravel from the LOMR. As indicated above, most commercial dredging operations do not provide transportation of materials to customers; customers arrange for their own truck transportation and incur the related costs. Shipping costs vary based on location, length of trip, availability of return loads, and fuel costs. Generally, shipping costs for construction sand and gravel in the market area range between $0.10 and $0.25 per ton per mile, as estimated by dredgers on the LOMR.

3.12.7.4 Employment and Income Supported by Dredging Operations

Estimated employment supported by existing dredging operations is based on operations data provided by the permit applicants. In total, existing commercial dredging operations on the LOMR directly support an estimated 196 jobs in the mining industry. The types of job opportunities provided by these operations include dredge operators, barge captains, heavy machinery operators, mechanics and machinery service technicians, and administrative and management staff. The associated labor income attributed to these jobs, including wage earnings and proprietor income, is estimated at approximately $13.9 million. Additional jobs and income are indirectly supported by commercial dredging operations, such as the trucking operators who deliver sand and gravel to customers.

3.12.7.5 Market and Demand for Missouri River Sand and Gravel

Commercial sand and gravel produced from the LOMR are used primarily in the construction industry, including road and highway construction undertaken by local transportation agencies. The MoDOT represents one of the largest customers for natural sand produced from the Missouri River based on MoDOT specifications for Class A (natural) sand. As such, sand and gravel from the LOMR serve as one the primary inputs required for infrastructure development throughout the state. Similarly, construction sand and gravel from the LOMR, specifically the Kansas City market area, is used by the KDOT in some of its transportation projects in eastern Kansas.

The MoDOT estimates that it used an average of approximately 872,140 tons of natural river sand on an annual basis between 2004 and 2008, of which approximately 240,969 tons (27.6 percent) is asphalt

sand and approximately 631,171 tons (62.4 percent) is concrete sand (MoDOT 2009). However, not all sand used is obtained from the LOMR; it also comes from the Mississippi River and elsewhere. Accounting for only those MoDOT districts that rely on sand from the LOMR (Districts 1, 2, 4, 5, 7, 8, and 9), approximately 57 percent of total sand used by the MoDOT comes from the LOMR. Applying this figure to average sand use between 2004 and 2008 suggests that the MoDOT has average demand for sand from the LOMR of approximately 497,000 tons annually. The KDOT use of Missouri River sand is substantially more limited. Between 2005 and 2009, the KDOT used an average of 56,076 tons of sand dredged from the LOMR on an annual basis (KDOT 2010). Most sand from the LOMR used by the KDOT comes from the Kansas City market area (92.9 percent, or approximately 52,090 tons/year); the remaining 7.1 percent (or approximately 3,986 tons/year) is obtained from the St. Joseph market area. Overlaying the demand for construction sand and gravel by state transportation departments on the total production from the LOMR provides insight into the market allocation of sand and gravel across end uses and consumers. Overall, it is estimated that approximately only 8.0 percent of the total tonnage of commercial sand and gravel dredged from the LOMR (or approximately 553,100 tons/year) is used by state transportation departments for roadway construction projects. Due to the material specifications required for transportation projects, the market area serving these types of projects is relatively large, thereby resulting in potentially longer transportation distances and higher delivered costs.

Although road construction represents a significant source of demand, the data suggest that the majority of construction sand and gravel from the LOMR is used to meet demand generated by general construction activities in the market area. In total, approximately 6.34 million tons (92.0 percent) of commercial sand and gravel from the LOMR is used by the general public for residential and non-residential construction (excluding state transportation projects). According to the commercial dredgers and industry research, the primary market area served by existing dredging operations is generally 20–50 miles from the sand plants. The size of the market area is generally driven by transportation costs, particularly because of the low-unit value of sand and gravel. Assuming that the market area is generally defined by a 25-mile radius around each distribution point, commercial sand and gravel production primarily serves 40 counties across three states, with a primary population of nearly 5.1 million (see Section 3.12.1 for details on the study area).

3.12.7.6 Tax Benefits

The tax benefits of existing dredging operations are several-fold. Typical taxes paid as part of ongoing operations include sales taxes (on taxable inputs to production), payroll taxes in accordance with the

Federal Insurance Contributions Act (FICA) (on employee compensation and labor payments), income taxes (on profits and wages earned), excise taxes (on specific products produced or used), franchise taxes (payments for doing business within the state), and property taxes (on property used in conducting business). In addition, royalty payments are levied on producers of sand adjacent to and within the state of Kansas; no royalty payments are required in Missouri. Aside from royalty payments, the tax benefits from existing dredging operations have not been quantified in this EIS, although it is acknowledged that commercial dredging does generate substantial tax revenue for local, state, and federal governments.

The fiscal benefits accruing to the state of Kansas from sand production have been estimated based on production levels and royalty rates (see Table 3.12-12). Based on information obtained from the Kansas Department of Revenue (KDOR), total production of sand obtained from the LOMR adjacent to the state of Kansas (and thereby subject to royalty payments) has averaged approximately 754,100 tons annually between 2004 and 2008 (KDOR 2009).

Table 3.12-12 Annual Royalty Payments to the State of Kansas for Sand Production from the Lower Missouri River

	Royalty Payments					
Market Area[a]	2004	2005	2006	2007	2008	Average
St. Joseph[b]	$51,400	$57,500	$55,500	$44,100	$36,600	$49,000
Kansas City[b]	$67,200	$75,100	$72,600	$57,700	$47,900	$64,100
Waverly	$0	$0	$0	$0	$0	$0
Jefferson City	$0	$0	$0	$0	$0	$0
St. Charles	$0	$0	$0	$0	$0	$0
Total	$118,600	$132,500	$128,100	$101,800	$84,500	$113,100

[a] Represents location of dredging in the LOMR based on river segments.

[b] Sand production data and royalty payments paid to the state of Kansas are not available by market area. For this analysis, it was assumed that all sand production from the St. Joseph market area and approximately 16 percent of sand production from the Kansas City market area is subject to sand royalties.

Source: KDOR 2009.

The royalty rate on sand production in or adjacent to Kansas is $0.15 per ton removed. Based on these figures, royalty payments generated by sand production in the LOMR have averaged approximately $113,100 per year. Sand production subject to royalty payments comes exclusively from

two market areas on the LOMR – Kansas City and St. Joseph.[11] It is estimated that production in the Kansas City and St. Joseph market areas, on average, generate approximately $64,100 and $49,000, respectively, in royalty payments on an annual basis.

3.12.7.7 Regional Economic Benefits of Existing Dredging Operations

This section presents estimates of the regional economic impacts of ongoing commercial dredging of construction sand and gravel in the LOMR, focusing on the output, income, and employment parameters. The economic costs and benefits described above focus on the direct effects of existing dredging operations based on the location of production across market areas. This section builds on those direct effects by identifying the market area where benefits are expected,[12] and utilizing a regional economic model, estimating additional economic activity that is generated throughout the state of Missouri by sand and gravel production from the LOMR.[13]

Economic Model

The regional economic impacts of existing dredging were estimated using IMPLAN (IMpact Analysis for PLANning), an economic input-output (I-O) model[14]. The I-O framework within IMPLAN allows users to estimate the total economic activity generated by projects and policies, as measured by changes in economic output, labor income, and employment. Total economic effects include direct[15] effects attributed to the activity being analyzed and the additional indirect[16] and induced[17] effects resulting from money circulating throughout the economy. These multiplier (or "ripple") effects are based on inter-industry linkages and household spending patterns in the study area. For this analysis, a 2008 economic model for the state of Missouri was constructed and used to estimate economic impacts.

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11 For this analysis, it was assumed that all sand production from the St. Joseph market area is subject to sand royalties. Based on this assumption, it was estimated that sand royalties are paid on approximately 16 percent of sand production in the Kansas City market area.

12 The regional economic benefits of dredging are attributed to the location of sand and gravel plants that serve as distribution points to the market. Accordingly, the economic activity associated with production that occurs in one market area, but is distributed in another market area, is assigned to the market area where distribution occurs.

13 The regional economic analysis focuses on sand and gravel production within the state of Missouri. Accordingly, it excludes production associated with the existing sand plant in Alton, Illinois.

14 IMPLAN is a computer-based system of software and data that was originally developed by the U.S. Forest Service to assist in land and resource management planning and is now a widely used tool for applied economic analysis.

15 "Direct economic effects" refer to changes in output, income, and employment attributed to the expenditures and/or production values specified as direct final demand changes.

16 "Indirect economic effects" refer to changes in output, income, and employment resulting from the iterations of businesses in some industries purchasing from businesses in other industries and initially caused by the direct economic effects.

17 "Induced economic effects" refer to changes in output, income, and employment caused by the expenditures associated with new household income generated by direct and indirect economic effects.

Model Results and Analysis

The ongoing economic benefits of commercial dredging to the state of Missouri are founded on the value of production; expenditures made in the statewide economy in support of dredging operations; and the size, location, and estimated payroll associated with the operations workforce. Table 3.12-13 presents the results of the regional economic analysis for all industries, and Table 3.12-14 presents the results across affected industries.

Table 3.12-13 Statewide Economic Benefits of Sand and Gravel Production from the Lower Missouri River[a]

	Direct Impacts			Total Impacts (Statewide)		
Market Area[b]	Output	Jobs	Income	Output	Jobs	Income
St. Joseph	$1,615,000	9	$489,000	$2,594,000	16	$807,000
Kansas City	$14,087,000	82	$5,853,000	$23,863,000	153	$9,018,000
Waverly	$1,824,000	11	$663,000	$3,015,000	19	$1,049,000
Jefferson City	$8,244,000	48	$3,165,000	$13,761,000	88	$4,952,000
St. Charles[c]	$7,512,000	44	$3,533,000	$13,143,000	85	$5,353,000
Total	$33,281,000	193	$13,703,000	$56,377,000	361	$21,178,000

[a] Monetary values reported in 2008 dollars.

[b] Represents the market area served by sand and gravel production from the LOMR and captures the economic activity associated with sand and gravel distribution rather than location of production across river segments.

[c] Excludes production associated with the existing sand plant in Alton, Illinois because it is located outside the state of Missouri.

Direct Economic Effects

The direct economic effects of commercial dredging in the state of Missouri are presented in Tables 3.12-13 and 3.12-14. The estimated value of commercial sand and gravel produced in the LOMR is approximately $33.3 million annually[18], which represents the direct output effect of existing dredging. This level of production supports approximately 193 jobs and $13.7 million in annual labor payments within Missouri. All of the direct economic impacts occur exclusively within the mining sector.

[18] This figure is calculated using the average annual production between 2004 and 2008 and the estimated 2008 price for construction sand and gravel for use in concrete and asphalt manufacturing in the primary market areas in Missouri. This value differs from Table 3.12-11, which considers price fluctuations over the 5-year period and does not exclude production outside the state of Missouri.

Total Economic Effects

The total economic effects of Project operations include the direct, indirect, and induced economic impacts. As explained above, the indirect effects are generated by expenditures on goods and services needed to support ongoing dredging operations, the proportion of inputs that are procured locally (as estimated by the I-O model), and inter-industry linkages throughout the state. The induced effects are associated with existing operation payrolls and labor earnings generated from indirect effects. The total ongoing benefits attributed to economic activity generated by the commercial dredging operations are substantial.

Table 3.12-14 Statewide Economic Benefits of Sand and Gravel Production from the Lower Missouri River by Economic Sector[a, b]

	Direct Impacts			Total Impacts (Statewide)		
Economic Sector	Output	Jobs	Labor Income	Output	Jobs	Labor Income
Agriculture	$0	0	$0	$65,000	1	$8,000
Mining	$33,281,000	193	$13,703,000	$34,362,000	197	$13,964,000
Utilities	$0	0	$0	$1,559,000	2	$276,000
Construction	$0	0	$0	$147,000	2	$72,000
Manufacturing	$0	0	$0	$1,131,000	3	$157,000
Wholesale Trade	$0	0	$0	$1,054,000	6	$398,000
Retail Trade	$0	0	$0	$1,573,000	25	$649,000
Transportation & Warehousing	$0	0	$0	$1,094,000	8	$400,000
Services	$0	0	$0	$14,607,000	116	$5,022,000
Government	$0	0	$0	$784,000	3	$232,000
Total	$33,281,000	193	$13,703,000	$56,377,000	361	$21,178,000

[a] Monetary values reported in 2008 dollars.

[b] Excludes production associated with the existing sand plant in Alton, Illinois because it is located outside the state of Missouri.

In addition to the $33.3 million in the direct value of sand and gravel production, the statewide economy of Missouri realizes an additional $23.1 million in economic output annually attributed to the indirect and induced economic activity generated by dredging activities, for a total of $56.4 million in total output. Direct income benefits are supplemented by an additional $7.5 million in annual labor income throughout all industries in the state, for a total of $21.2 million in labor income benefits. Existing dredging also supports a total of 361 jobs throughout the state, which consist of direct employment at

the existing operations (193 jobs) and another 168 jobs in other industries. At the industry level, the total economic benefits are driven primarily by economic activity in the services sector.

3.12.7.8 Other Economic Impacts of Existing Dredging Operations

Ongoing dredging generates a range of other economic impacts that are tied to physical impacts within and adjacent to the LOMR, including effects associated with river bed degradation. Data collected by the USACE over the last 15 years suggest that increased removal of bed sediment, working in concert with the BSNP, has become the dominant cause of river bed degradation. In conjunction with previous reviews of applications for renewed dredging permits, the USACE Kansas City District has determined that significant bed degradation was occurring in portions of the LOMR, and that the most degraded reaches coincided with areas where commercial sand and gravel dredging was the greatest (i.e., the Kansas City, Jefferson City, and St. Charles reaches).

Infrastructure Costs

Several different types of infrastructure in the LOMR are subject to potential damage from river bed degradation, as described in Section 3.5. Infrastructure in the river is organized into six general categories: (1) water intake facilities; (2) water supply wells; (3) levees; (4) BSNP structures, including dikes and revetments; (5) bridge, pipeline, and cable crossings; and (6) wharf and dock facilities. To the extent that existing commercial dredging in the LOMR contributes to river bed degradation, it represents one factor influencing the level of infrastructure damages and related repair, maintenance, and replacement costs incurred by local agencies responsible for these facilities, as well as potential emergency costs and damages associated with catastrophic events such as levee failures. It is difficult to estimate existing costs associated with infrastructure affected by river bed degradation in the LOMR, and even more difficult to ascertain the proportion of these costs attributed directly or indirectly to dredging. Nevertheless, it is likely that river bed degradation and resultant infrastructure costs, including protection of levees at risk and modification of intakes at risk, total many millions of dollars.

The discussion below is based on the representative types of costs associated with river bed degradation as documented in the Degradation Study (USACE 2009) and other planning data collected by the USACE. For more information, refer to Section 3.5.

The 2009 USACE study indicates that ongoing river bed degradation in the Missouri River has resulted in the need to adjust or extend water supply intakes to accommodate changing water surface elevations, thereby increasing capital costs incurred by local municipalities that provide water supplies

to the public and electrical utilities that are dependent on the LOMR for cooling water. For example, in Kansas City, Missouri, low flows have forced the city to spend more than $4 million to extend water intakes and drinking water pumps to reach lower river levels. One municipal water intake in the Kansas City reach was retrofitted in early 2004 with supplemental pumps to draw from lower elevations, at a cost of approximately $2 million; and Kansas City, Kansas, has spent $22.6 million on a cooling tower and emergency pumps to retrofit two electrical generating facilities. It also has been noted that continued river bed degradation may require replacement of intake structures, at even higher capital costs. Moreover, ongoing maintenance and pumping costs associated with water intakes also may increase. Should water levels fall below threshold levels for intake operations, water supplies could be compromised. This could require using higher cost alternative sources (e.g., groundwater wells) or shutting down electrical generation facilities at the expense of utility operators. Ultimately, these costs likely would be passed along to customers in the form of higher water and electricity rates.

In total, there are 31 water intake facilities in the Project area between RM 498 and RM 0. Public drinking water intakes in the Kansas City segment include the intake for Kansas City, Missouri; Kansas City, Kansas; and the Johnson County Kansas Water District 1. These intake facilities serve nearly 1.1 million people. In the St. Joseph segment, water supply facilities supply drinking water to nearly 160,000 persons. In the St. Charles reach, public drinking water is supplied by at least three water plants serving approximately 940,000 persons. Overall, water supply intakes in the Project area provide water to approximately 2.2 million persons (Kelly 2004).

In addition, baseload power plants in the Kansas City segment that withdraw cooling water have a gross capacity of nearly 1,200 MW. In the St. Joseph reach, three baseload plants have a gross capacity of approximately 1,026 MW. In the lowest segment of the Missouri (near St. Charles), power plants at risk have a gross capacity of more than 3,700 MW. Power plant intakes in the Project area account for 41 percent of all the power plant production on the mainstem and LOMR system, generating over 6,000 MW (Kelly 2004). The value of power production at these facilities is substantial.

River bed degradation also can reduce levee stability. Levees are constructed with the minimum distance from the bank or with the revetment armoring the bank needed to have stability under the conditions at the time of construction. As river bed degradation removes bed material from the toe of the bank or revetment, levees become more vulnerable to collapse. Underwater damage to the revetment toe can go undetected and unrepaired without some sort of underwater survey or inspection. If the revetment is an extension of the levee toe or if the bank buffering the levee is eroded away by river bed degradation, the potential for levee failure during high-flow water events increases. Failure of

a levee during a high-flow water event could be sudden and irreparable during the flood and could result in property damages in affected areas, including the Kansas City region. The Kansas City system of levees protects more than $19 billion of investment. Employment in the Kansas City levee units approaches nearly 100,000 jobs. Approximately 23,000 residents (including many minority and low-income individuals) live behind the Kansas City levees. Environmental justice concerns arise if these levees are at risk or fail. In total, federal levees on the LOMR protect approximately $21.4 billion in investment and have prevented approximately $6.1 billion in property damages through 2009 (USACE 2010). Continued river bed degradation could contribute to catastrophic levee failure, resulting in loss of life and potentially substantial economic damages.

Similarly, BSNP structures; bridges, pipeline and cable crossings; and wharf and dock facilities are susceptible to failure and related property damages from river bed degradation and associated headcutting. Because many of these facilities are operated and maintained by private companies, it is difficult to estimate ongoing maintenance costs and damages related to river bed degradation. However, it has been estimated that LOMR bridges typically cost between $1 and $2 million per bridge to remediate scour and river bed degradation problems that arise (Heckman pers. comm.). Continued river bed degradation also could contribute to the sudden catastrophic failure of a bridge or a petro-chemical pipeline, resulting in loss of life or an accidental release of petro-chemicals with various environmental consequences.

Effects on Agricultural Production

Agricultural land uses are found throughout the floodplain adjacent to the Missouri River (see Section 3.11). Agriculture in the area along the river typically relies on natural precipitation, and to a more limited extent, groundwater from private wells for irrigation. River bed degradation could adversely affect groundwater levels based on the hydrologic connection between the river channel and the surrounding water table. A reduction in groundwater levels could increase groundwater pumping depths and increase the associated pumping costs. In cases where costs would be prohibitive, agricultural land could be left unirrigated, resulting in potential economic impacts to farmers in the form of reduced crop yields and agricultural revenues.

Effects on Recreation Use

As described in Section 3.11, recreation facilities are found interspersed along the shore of the LOMR, including boat launches and designated recreation areas. Recreation activity also occurs on the water surface, primarily boating and fishing. Existing dredging operations can affect recreation use in several

ways, including contributing to river bed degradation that may hinder recreation boating access and navigability. The presence of commercial barges in the river also may compromise the overall recreational quality of the river. Such effects could result in a reduction in recreation visitation to the study area, thereby decreasing recreation expenditures and the associated regional economic benefits attributed to recreation spending.

Effects on Missouri River Navigation

Section 3.6 describes the use of the Missouri River for commercial navigation. Although most of the commodity movements and tonnage shipped on the LOMR is associated with commercial dredging of sand and gravel by the permit applicants, other goods also are shipped along the river. Navigation benefits within the LOMR are provided primarily by the BSNP, which was designed and built to create and maintain a self-scouring navigation channel and for management of navigation flows by the USACE using storage in the upstream reservoir system. Limited dredging has been needed at certain points in the river to maintain the river channel, occurring in specific locations on an as-needed basis as determined by the USACE. The navigation benefit provided by commercial dredging is limited to providing dredges that can be used by the USACE when needed. Without these dredges, the cost of occasional maintenance dredging would be somewhat higher due to the costs associated with mobilizing dredging equipment on the LOMR from other locations; these avoided costs realized by the USACE are considered an economic benefit to the public

3.12.8 References

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3.12.8.1 Personal Communication

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