

3.0 Affected Environment

This section describes the existing environmental resources that would be affected by implementation of the proposed action.

3.1 Social/Economic Characteristics and Land Use

3.1.1 Demographic Characteristics

3.1.1.1 Regional Population Trends

As a basis for characterizing the affected environment, demographic information was compiled for the City of Maryland Heights, the City of Chesterfield, St. Louis County, and the State of Missouri. The vast majority of the study area (90 percent) is located in the City of Maryland Heights and the remaining 10 percent of the study area is located in the City of Chesterfield.

The population contained within the Howard Bend study area is very low due to a history of flooding coupled with widespread agricultural and recreational use beginning in the early 1900s. Persons most likely to utilize the recreational facilities within the study area, in most cases, reside in the City of Maryland Heights or within the St. Louis metropolitan area. The population statistics presented below characterize these populations.

Table 3-1 illustrates population trends in the City of Maryland Heights, the City of Chesterfield, St. Louis County, and the State of Missouri from 1980 until 2000. Although there was an increase in population in the state, each city and the county, the increase in population in the City of Chesterfield (23.2 percent) was disproportionately higher than that in Maryland Heights, the County or the State (1.2 percent, 2.3 percent and 9.3 percent respectively).

As is detailed in Table 3-2, the median age of persons living in the City of Maryland Heights in 2000 (34.2) is somewhat lower than the median age of persons living in St. Louis County (37.5) or in the State of Missouri (36.1). The median age of persons has increased slightly in all three locations since 1990. In the City of Maryland Heights, the population of persons 18 and under as well as those 65 and older both increased from 1990 to the year 2000. This general trend was also present in St. Louis County, although the increase was smaller (Table 3-2).

Table 3-1. Population Trends

Demographic Area	1980	1990	2000	% Change 1990-2000
City of Maryland Heights*	NA	25,402	25,756	1.2%
City of Chesterfield*	NA	37,991	46,802	23.2%
St. Louis County	973,896	993,529	1,016,315	2.3%
State of Missouri	4,916,686	5,117,073	5,595,211	9.3%

* 1980 census data was not available for the Cities of Maryland Heights or Chesterfield as these cities were incorporated in 1985 and 1988, respectively.

Source: Missouri State Census Data Center and the United States Census Bureau.

Table 3-2. Age Characteristics

Demographic Area	Year	Median Age	18 and Under	65 and Older
City of Maryland Heights	1990	31.4	20.0%	7%
	2000	34.2	21.5%	9.5%
City of Chesterfield	1990	37.1	27.1%	9.2%
	2000	41.8	24.6%	14.7%
St. Louis County	2000	34.7	24.5%	13.1%
	2000	37.5	25.2%	14.1%
State of Missouri	1990	33.6	25.7%	14.0%
	2000	36.1	25.5%	13.5%

Source: Missouri Census Data Center and the United States Census Bureau.

In terms of racial characteristics in 2000, those who are white accounted for approximately 85 percent of the demographic in both the City of Maryland Heights and the State of Missouri. That percentage was lower in St. Louis County, at approximately 77 percent (Table 3-3). The percentage of black residents was highest in St. Louis County, at 19 percent, followed by the State of Missouri at approximately 11 percent. The City of Maryland Heights, comparatively, had a lower percentage of black residents at around 6 percent. In contrast, the percentage of residents of other races was comparatively higher in the City of Maryland Heights, at 8 percent, whereas the percentage of residents of other races in both St. Louis County and the State of Missouri was 2.4 percent.

Table 3-3. Racial Characteristics, 2000

Demographic Area	Race		
	White	Black	Other
City of Maryland Heights	85.4%	5.6%	8.0%
City of Chesterfield	91.3%	1.9%	6.8%
St. Louis County	76.8%	19.0%	2.7%
State of Missouri	84.9%	11.2%	2.4%

Source: The United States Census Bureau.

3.1.1.2 Housing

In the year 2000, both the City of Maryland Heights and St. Louis County had a high rate of owner occupied housing units (approximately 95 percent) when compared with the State of Missouri, at around 90 percent (Table 3-4). The median housing unit value in the State of Missouri (\$89,900) was substantially lower than that in either the City of Maryland Heights or St. Louis County (\$107,900 and \$116,600 respectively).

As discussed above, the residential base of the study area is extremely low. An inventory of the study area was conducted which resulted in the identification of 22 houses and 282 apartment units located within the study area. In addition, 19 houses are located along the east side of Creve Coeur Mill Road (just north of Olive Boulevard) immediately adjacent to the study area boundary.

Table 3-4. Housing Characteristics, 2000.

Demographic Area	Housing Units	Occupied Housing Units	Vacancy Rate	Average Household Size	Median Housing Unit Value
City of Maryland Heights	11,846	11,302	4.6%	2.25	\$107,900
City of Chesterfield	18,738	18,060	3.6%	2.59	\$238,300
St. Louis County	423,749	404,312	4.6%	2.47	\$116,600
State of Missouri	2,442,017	2,194,594	10.1%	2.48	\$89,900

Source: The United States Census Bureau.

3.1.2 Economic Characteristics

3.1.2.1 Income

There was an increase in income from 1990 to the year 2000 in the City of Maryland Heights, the City of Chesterfield, St. Louis County, and the State of Missouri (Table 3-5). The average per capita income in the City of Maryland Heights increased from \$17,785 in 1990 to \$24,918 in the year 2000. Likewise, the average per capita income in Chesterfield increased from \$28,019 to \$43,288 during the same 10-year period. The same trend was evident in St. Louis County and the State of Missouri in which the average per capita income increased from \$18,625 and \$12,989 in 1990 to \$27,595 and \$19,936 in the year 2000, respectively.

Table 3-5. Economic Characteristics, 1990 and 2000

Demographic Area	Per Capita Income		Median Household Income		Percentage of Persons Below Poverty Level	
	1990	2000	1990	2000	1990	2000
City of Maryland Heights	\$17,785	\$24,918	\$43,920	\$48,689	3.6%	5.3%
City of Chesterfield	\$28,019	\$43,288	\$66,930	\$83,802	2.1%	2.6%
St. Louis County	\$18,625	\$27,595	\$45,214	\$50,532	5.6%	6.9%
State of Missouri	\$12,989	\$19,936	\$26,362	\$37,934	13.3%	11.7%

Source: Missouri State Census Data Center and the United States Census Bureau.

Likewise, the median household income increased in the City of Maryland Heights from \$43,920 in 1990 to \$48,689 in the year 2000. This trend also occurred in St. Louis County, in which the median household income was \$45,214 in 1990 and increased to \$50,532 in the year 2000. In the State of Missouri, the median household income also increased from \$26,362 in 1990 to \$37,934 in the year 2000. By comparison, the median income in Chesterfield was higher in both 1990 and 2000 as compared to the other demographic areas examined (\$66,930 and \$83,802, respectively).

The percentage of persons below the poverty level remained roughly the same in Chesterfield but increased slightly in the City of Maryland Heights from 3.6 percent in 1990 to 5.3 percent in the year 2000. Likewise, the percentage of persons below the poverty level increased in St. Louis County from 5.6 percent in 1990 to 6.9 percent in the year 2000. The percentage of persons below the poverty level decreased in the State of Missouri from 13.3 percent in 1990 to 11.7 percent in the year 2000. Despite a decreasing trend in the State of Missouri, the percentage of persons below the poverty level was higher in the State than in the City or the County in both census years.

3.1.2.2 Labor Force Characteristics

There was a dramatic decline in unemployment in St. Louis County and in the State of Missouri from 1980 to the year 2000 (Table 3-6). In 1980, the unemployment rate was lower in St. Louis County (5.4 percent) than in the State of Missouri. In 1990 and 2000, the unemployment rate was the lowest in the City of Chesterfield (2.3 and 1.6 percent) followed by the City of Maryland Heights (2.7 and 2.0 percent). In comparison, the unemployment rate was somewhat higher in St. Louis County for both years (4.5 and 3.1 percent, respectively). In all three census years, 1980, 1990 and 2000, the unemployment rate was higher in the State of Missouri (6.9, 6.2 and 3.4 percent, respectively) than in the Cities or the County.

Table 3-6. Unemployment Rate

Demographic Area	1980	1990	2000
City of Maryland Heights*	NA	2.7%	2.0%
City of Chesterfield*	NA	2.3%	1.6%
St. Louis County	5.4%	4.5%	3.1%
State of Missouri	6.9%	6.2%	3.4%

* 1980 census data was not available for the Cities of Maryland Heights or Chesterfield as these cities were incorporated in 1985 and 1988, respectively.

Source: Missouri State Census Data Center and the United States Census Bureau.

Table 3-7 presents a distribution of the labor force within each demographic area by employment category. In the year 2000, the highest percentage of workers were in the field of educational, health and social services for the City of Maryland Heights, St. Louis County and the State of Missouri with percentages of 17.1 percent, 21.7 percent, and 20.4 percent respectively. For the City of Maryland Heights, the next highest percentage of workers were in professional, scientific, management, administrative and waste management services; followed by manufacturing; retail trade; and finance, insurance and real estate. For St. Louis County and the State of Missouri, the next highest percentage of workers were in manufacturing, then retail trade. Despite the prevalence of widespread agricultural land use, the actual labor force involved with agricultural production is rather low.

Employment data are available for the Harrah's Casino complex and the Riverport mixed use development. It is currently estimated that these two development areas contain approximately 11,500 full-time jobs. Of these 11,500 jobs, the major employers include the following:

<u>Employers</u>	<u>Number of Employees</u>
Harrah's Casino complex	2,800
Express Scripts Inc.	1,700
Magellan Health Services	1,050
United Healthcare	850
Unigraphics	450
Lambert Field Construction Office	200
University of Phoenix	100
Midwest Casualty	110

For the City of Chesterfield, the highest percentage of workers were in the areas of educational, health and social services followed by manufacturing; professional, scientific, management, administrative and waste management services; finance, insurance, and real estate; and retail trade. These employment sectors accounted for 22.8, 14.2, 13.9, 12.3, and 10.9 percent,

respectively. These five categories account for approximately 75 percent of employed persons living in Chesterfield in the year 2000.

3.1.2.3 Tax Base

Tax information for the Howard Bend study area are presented in Table 3-8. The assessed total is a percentage of the appraised total and this percentage differs depending upon land usage. The estimated tax generated in the study area is \$8,477,550.11 per year.

Table 3-7. Labor Force Characteristics by Job Type

Land Use Category	City of Maryland Heights		City of Chesterfield		St. Louis County		State of Missouri	
	Employed Persons (#)	Employed Persons (%)	Employed Persons (#)	Employed Persons (%)	Employed Persons (#)	Employed Persons (%)	Employed Persons (#)	Employed Persons (%)
Agriculture, Forestry, Fisheries	50	0.3	82	0.3	1,146	0.2	58,415	2.2
Construction	806	5.3	579	2.5	24,817	4.9	182,858	6.9
Manufacturing	2,041	13.5	3,346	14.2	64,212	12.7	393,440	14.8
Transportation, Warehousing and Utilities	775	5.1	702	3.0	27,141	5.4	150,641	5.7
Wholesale Trade	711	4.7	1,240	5.3	21,290	4.2	97,021	3.7
Retail Trade	1,797	11.9	2,573	10.9	57,061	11.3	315,872	11.9
Information	582	3.9	853	3.6	19,021	3.8	80,623	3.0
Finance, Insurance and Real Estate	1,656	11.0	2,913	12.3	45,603	9.0	177,651	6.7
Professional, Scientific, Management, Administrative and Waste Management Services	2,110	14.0	3,270	13.9	56,101	11.1	198,547	7.5
Educational, Health and Social Services	2,590	17.1	5,383	22.8	109,440	21.7	541,715	20.4
Arts, Entertainment, Recreation, Accommodation and Food Services	1,107	7.3	1,471	6.2	38,345	7.6	206,295	7.8
Other Services	511	3.4	787	3.3	24,398	4.8	132,940	5.0
Public Administration	367	2.4	407	1.7	16,675	3.3	121,906	4.6
Total	15,103	100	23,606	100	505,250	100	2,657,924	100

Source: United States Census Bureau, 2000.

Table 3-8. Tax Base for the Howard Bend Study Area

Acres	Approximate Appraised Total	Assessed Total	Estimated Tax
6,834.87*	\$300,241,320*	\$94,254,910*	\$8,477,550.11*

* Values do not include a small number of parcels for which no information was available from the database.

Source: St. Louis County Department of Revenue.

3.1.3 Land Use

3.1.3.1 Existing Land Use and Zoning

Existing Land Use

The Howard Bend study area consists of an approximately 8,624-acre area. Predominant land use is dedicated green space, agricultural lands, office, warehouse and various other industrial uses. Of this total, approximately 1,852 acres are located riverside of the levee. Agricultural lands, consisting of cultivated fields used for row crop production and nurseries (Lucky Girl Nursery, Thies Farm, Schmittel's Nursery, and Baxter Farm and Nursery) account for over 45 percent of existing land use, which is the highest percentage of land use in the Howard Bend study area (Table 3-9).

Table 3-9. Distribution of Existing Land Uses, 2002

Land Use	Acres	Percent
Agriculture	3,906.85	45.30
Parks and Recreation	1,960.13	22.73
Vacant	845.36	9.80
Utility and Public Service	609.65	7.07
Commercial	569.30	6.60
Transportation	542.01	6.29
Arts and Entertainment	116.73	1.35
Residential	39.44	0.46
Industrial	28.78	0.33
Accommodation/Hospitality	5.52	0.06
Total	8,623.77	100.0

Source: City of Maryland Heights Land Use and City of Chesterfield Zoning Map modified to reflect existing land use.

Parks and recreational areas and dedicated green space also account for a substantial percentage of land use within the Howard Bend study area (nearly 23 percent). Recreational facilities include CCLMP located in the eastern portion of the study area, Crystal Springs Quarry Golf Course, Creve Coeur Baseball Athletic Association, Seeger West County Golf Driving Range, and Sportport Soccer complex (Figure 3-1, see Section 3.1.4.1).

Utilities and public services (which account for 7 percent of the land) include MSD Missouri River Wastewater Treatment Plant, the Missouri American Water Company, and the City of St. Louis Water Treatment Plant, which are located within the study area. These utilities provide infrastructure to service the floodplain area and surrounding West St. Louis County area.

Commercial uses account for approximately 7 percent of the land in the study area. Dominant uses include the Riverport business center, Harrah's Casino complex, and Creve Coeur Airport. Harrah's Casino complex, located in the extreme northwestern portion of the study area, contains two casinos as well as a hotel with 291 guest rooms. Riverport business center is located just east of Harrah's. This consolidated business district, which contains a variety of businesses, is owned and managed primarily by Duke Realty. Businesses located in Riverport include the UMB Bank Pavilion (a large amphitheater complex), Express Scripts, Magellan Behavioral Health, Citi Mortgage and EDS, among others. A trust was formed and a Board of

Trustees oversees development within Riverport in order to maintain building standards that meet the agreed-upon guidelines for development.

Vacant land accounts for approximately 10 percent of the land use in the Howard Bend study area. Transportation-related land accounts for 6 percent.

There is very little land in the study area that is designated for residential land use (only 0.46 percent of the study area). The small number of residences within the floodplain consist of isolated single farm houses (not all of which are inhabited), and the densest concentration of houses is located in the southeastern portion of the study area along Creve Coeur Mill Road (just north of Olive Boulevard). Accommodation/hospitality (i.e., primarily hotels) and industrial land use account for just 0.06 and 0.33 percent, respectively.

Other miscellaneous uses within the study area include such industrial facilities as Smith Brothers Auto Salvage, Southard Construction, and West Continental Auto Parts and Salvage which collectively account for less than 1 percent of the overall land use.

As previously noted, the majority of the study area (90 percent) is located within the City of Maryland Heights. All areas could be subject to future land use alteration but predominantly include areas that are currently used for agriculture as well as open space (i.e., those areas that have not yet been developed). Agriculture represents the most prominent land use in the study area (45 percent) that accounts for approximately 3,907 acres that would be available for future development.

The two areas that are located in the City of Chesterfield are located in the most southeastern portion of the study area (just north of Olive Boulevard) and the most southwestern portion of the study area just east of Bonhomme Creek. The former area (north of Olive Boulevard) currently consists of single-family residential, multi-family residential, vacant/agricultural lands, and commercial and industrial/utility areas. The area just east of Bonhomme Creek is comprised of vacant/agricultural uses as well as industrial/utility uses.

Existing Zoning

With the exception of some planned industrial areas (i.e., Riverport and Harrah's complex) much of the lands within the study area that are located within the City of Maryland Heights have been zoned as non-urban (Figure 3-2). Development within these lands is subject to approval by the City as reviewed by the City of Maryland Heights' Planning Commission and approved by City Council. Future development shall occur in accordance with the permissible uses identified by the City of Maryland Heights' zoning code (Table 3-10)(City of Maryland Heights, 1989), and as guided by the City of Maryland Heights' Future Land Use Plan (City of Maryland Heights, 2002).

Existing Zoning in the City of Chesterfield

Existing zoning in the City of Chesterfield consists primarily of residential, floodplain, planned commercial and a shopping district in the southeastern portion of the study area (north of Olive Boulevard abutting Creve Coeur Mill Road) (see Figure 3-2).

The extreme southwestern portion of the study area that falls within the City of Chesterfield (east of Bonhomme Creek) is zoned as floodplain non-urban (see Figure 3-2). Permissible uses are detailed in the City of Chesterfield's zoning code (available from the City of Chesterfield).

3.1.3.2 Future Land Use

City of Maryland Heights

In conjunction with an ongoing effort to update its Community Comprehensive Plan, the City of Maryland Heights has adopted a Future Land Use Plan for the Howard Bend Planning Area (City of Maryland Heights, 2002). In the context of the assessment of cumulative impacts, this Future Land Use Plan may be used to predict the potential land use type and extent of future development within the Howard Bend study area. The City of Maryland Heights' planning initiative takes into account existing conditions as well as present and predicted market factors, and is intended to establish guidelines and strategies to direct overall infrastructure development and land use in the Howard Bend study area. In conjunction with this effort, the City has subdivided the Howard Bend Planning Area into five districts (see Figure 2-10) and established permissible land uses within each of these districts as indicated in Table 2-6. The five districts are discussed in detail in Section 2.2.5. Areas will be developed in accordance with the designated land use as well as the zoning ordinances as established by the City of Maryland Heights and defined in its zoning codes (1989).

Table 3-10. Land Uses Permitted in Non-Urban Zoned Areas within the City of Maryland Heights

Land Use Category	Land Use Description	Use*
Agriculture	Crop Farming	P
	Nursery and Tree Production	P
	Composting Plants	C
	Agricultural Related Activities	P
	Riding Stables	C
Residential Uses	Dwelling, Single Family Attached	P
	Adult Retirement Housing	C
Utilities		C
Retail Trade	Nursery and Garden Centers	C
	Fruits and Vegetable Markets	C
Transportation Services		C
Professional	Veterinary Services	C
Arts and Recreation	Fairgrounds	C
Museums and Parks	Privately-Owned Parks	C
	Publicly-Owned Parks and Recreational Facilities	P
Recreation	Commercial Amusement and Recreation Facilities	C
	Golf Courses and Country Clubs	C
	Golf Instruction Centers	C
	Miniature Golf Centers	C
	Golf Driving Ranges	C
	Municipal Amusement and Recreation Facilities	P
Personal Services	Cemeteries and Crematories	C
	Animal Kennels	C
	Parking Lots and Garages	C
Public Administration	Fire Protection	C

* Permitted (P) or Conditional (C).

Source: City of Maryland Heights Zoning Code, 1989.

City of Chesterfield

The total area contained within the City of Chesterfield accounts for approximately 10 percent of the study area. The two areas that are located in the City of Chesterfield are in the most southeastern portion of the study area (just north of Olive Boulevard) and the most southwestern portion of the study area just east of Bonhomme Creek. Future land use within these areas is expected to be limited by floodplain and floodway constraints. Some of the lands in association with Creve Coeur Creek are development-limited by floodplains, floodway, and wetlands. However, as discussed in Sections 2.2.6 and 2.2.7, two residential developments have been recently proposed in this area (Terra Vista Estates, Mill Ridge Villas). Lands east of Bonhomme Creek lack a 100-year levee system and are, therefore, unprotected by flooding from the Missouri River.

3.1.4 Public Services and Community Facilities

3.1.4.1 Recreational Facilities

Recreational land uses are the second most prominent land use, after agricultural use. CCLMP is centrally located within the study area and is administered by the St. Louis County Parks Department (Figure 3-3). The park contains 2,242 acres (1,937 acres within the study area) that surround a 300-acre lake. The park provides various recreational opportunities such as picnicking, walking, sightseeing, bird watching, rollerblading, bicycling, and fishing in a heavily wooded area that contains a mixture of woodland and wetland habitats. This is one of the few remaining natural areas in the St. Louis metropolitan area.

The St. Louis County Parks Department currently manages 1,937 acres of park land in the study area. In order to guide future land use within CCLMP, St. Louis County Parks Department is in the process of developing a Master Plan to include areas in the park dedicated to both active and passive recreational use. The majority of recreational land within the park district is comprised of land designated for passive recreational use (see Figure 3-3), 4(f) and 6(f) land, and MoDOT wetland mitigation land. The northern two-thirds of the park is primarily used for active recreation such as archery, softball, tennis, sailing, rowing, golf, disc golf, and jogging. Special events such as power boat racing occasionally take place at various times throughout the summer months. Swimming is prohibited in Creve Coeur Lake. A 44-acre parcel of land, located directly southwest of the lake is used for polo, field hockey, lacrosse, and other field games.

The St. Louis County Parks is preparing a Creve Coeur Park Master Plan in recognition of the dramatic impacts to the park both from a land acquisition and development perspective (Creve Coeur Park Master Plan Pre-Final, April 16, 2003). As a result of the Page Avenue Extension mitigation, the Park has doubled in size from 1,140 acres to 2,242 acres. The long-term vision for the improvements and new developments encompasses a 20-year planning period with an implementation focus over the next 7 years until 2010.

The Master Plan identifies eight planning areas: the Bluffs, Greensfelder, Fisherman's Wharf, the Fairgrounds, Sailboat Cove, the Meadows, Mallard Lake (Siltation Basin), and Little Creve Coeur Lake. Each planning area is being evaluated for improvements to such things as vehicle/pedestrian access, parking, day use structures (picnic tables and grills, shelters, restrooms), historic structures, playgrounds, ball fields, lake use, trails, and trail links. In addition, each planning area will provide unique recreation experiences by the nature of the

natural resource development within the park. Following are some key features that have been identified as objectives of the Master Plan:

- Improve/construct boat launch, piers, docks, and concession facilities to maximize the use of lake surfaces for active recreation boating.
- Construct walking/bike trails around the lake, with connection to surrounding neighborhoods and to the Katy Trail across the Missouri River.
- Develop a natural area use component utilizing existing natural and created wetland park areas that focus on wildlife habitat restoration, interpretive and educational activities, and restoration of the floodplain.
- Improve existing traditional day-use recreation facilities and infrastructure to accommodate special events.
- Preserve and restore historic buildings and structures within the Park such as the Trolley Station, Greensfelder Memorial Pavilion, stone fire pits, Ice House Building, and the Dripping Springs site.

Sportport is a 64-acre recreational facility located northwest of Creve Coeur Lake. This facility is comprised of 12 full-size soccer fields and one stadium field with accompanying locker rooms, concession stand, benches, bleachers, and parking areas. There are year-round organized events such as a soccer academy, tournaments, and a summer sports camp. In addition to soccer, this facility is also utilized for playing lacrosse, rugby, and field hockey. This facility is owned and operated by the City of Maryland Heights Parks and Recreation Department.

Other recreational facilities in the study area include Golfport which includes a driving range and a recreational complex, Creve Coeur Athletic Association's baseball fields, Crystal Springs Quarry Golf Course, and the Seeger West County Driving Range.

3.1.4.2 Churches

Only one church is located within the study area. The First Baptist Church of Creve Coeur is located at 1553 Creve Coeur Mill Road (north of Olive Boulevard) in Chesterfield.

3.1.4.3 Cemeteries

There are no cemeteries located in the study area.

3.1.4.4 Schools

There are no schools located in the study area; however there is one daycare located in Riverport near the Earth City Expressway. Schools within the vicinity of the study area include Rose Acres Elementary and Pattonville High School which are located just outside the study area (northeast of Crystal Springs Quarry Golf Club), at 2905 Rose Acres Lane and 2497 Creve Coeur Mill Road, respectively.

3.1.4.5 Hospitals and Nursing Homes

While there are no hospitals or nursing homes located in the study area, two hospitals are located in close proximity and are equipped to provide both emergency and extended care medical treatment. Barnes-Jewish West County Hospital is located at 12634 Olive Boulevard in Creve Coeur (1 mile west of I-270). DePaul Health Center is located just northeast of the intersection of I-270 and I-70 at 12303 DePaul Drive in Bridgeton.

3.1.4.6 Emergency Services

Emergency services provided to the study area include fire departments, ambulance services, and police departments. Fire protection in St. Louis County is provided by 23 fire protection districts and 20 municipal fire departments. The Howard Bend study area falls within four different fire districts: Creve Coeur, Chesterfield, Pattonville, and Maryland Heights. Each department has numerous engine houses located within their various fire protection districts. These four districts function as a team, and vehicles that respond to a fire may come from a variety of districts, depending upon the location and extent of the fire. Additional districts from nearby areas may also respond to a fire, if needed. Each fire department has its own ambulance that is available to respond to an emergency. Districts coordinate with each other and, if an ambulance from one district is being utilized, an ambulance from a nearby district will be dispatched to provide assistance during an emergency.

Many municipalities in St. Louis have their own police department that respond to calls within their areas. The Cities of Maryland Heights and Chesterfield have jurisdiction within the Howard Bend study area. In addition, the St. Louis County Police Department, which is divided into six districts, is also available to provide additional support to unincorporated areas or to municipalities, as needed. Law enforcement in CCLMP is provided by the St. Louis County Park Police and is supplemented by the police department of the City of Maryland Heights.

3.1.4.7 Libraries and Museums

There are no libraries or museums located in the study area. However, there are two branches of the St. Louis County Library located just outside of the study area. The Bridgeton Trails branch is located northeast of the study area at 3455 McKelvey Road. The Thornhill Branch is located just east of the southeastern most point of the study area at 12863 Willowyck Drive (off Fee Fee Road, 1-mile north of Olive Boulevard).

3.1.4.8 Water and Wastewater Treatment

Sanitary Sewer Treatment Capacity

MSD owns and operates the Missouri River Treatment Plant located in the central portion of the study area north of Creve Coeur Mill Road at Marine Avenue. This plant serves a watershed of approximately 150 square miles, and includes the Cities of Maryland Heights, Chesterfield, and parts of Creve Coeur, Hazelwood, Bridgeton, St. Ann, Ellisville, Ballwin, and unincorporated St. Louis County.

This facility is designed to treat approximately 28 mgd of wastewater and is currently at capacity. During periods of peak demand, often correlating with significant rainfall events, the plant has treated up to 80 mgd by storing excess stormwater and subsequently treating it during off-peak periods. MSD has conducted a preliminary study to increase plant capacity to 39 mgd. The funds necessary for this improvement, however, have not been secured.

Water Supply

The water supply for the Howard Bend area is provided by the Missouri American Water Company's Central Plant, located on Hog Hollow Road. This facility currently has the capacity to treat and pump 217 mgd and has an agreement with the City of St. Louis to purchase an additional 30 mgd, if needed for peak demand. Normal demand is between 120 and 140 mgd. The City of St. Louis Water Division, located in the Howard Bend study area, does not supply water to this area with the exception of additional supply during peak demand via the Missouri American water system.

3.1.5 4(f)/6(f) Lands

CCLMP is a part of the St. Louis County Park system that has received Federal financial assistance from the Land and Water Conservation Fund (LWCF) Act grant-in-aid program (NPS, 1995b). As such, the CCLMP is a land that is subject to protection under Section 6(f)(3) of the LWCF Act. Any request to convert such lands must be in accord with the Statewide Comprehensive Outdoor Recreation Plan (SCORP) and subject to such conditions as are necessary to assure the substitution of other recreation properties of at least equal fair market value and reasonably equivalent usefulness and location. Development and management of these substitution properties must be for outdoor recreation purposes and in accord with the explicit purpose for which the properties are acquired (NPS, 1995b). Additionally, Section 4(f) of the Department of Transportation Act of 1966 provides protection for parks, wildlife refuges, and historic sites.

The original portion of CCLMP totaled 1,140 acres. However, as a result of impacts associated with the Page Avenue Extension, a total of 1,102 acres were added to park land as mitigation pursuant to the requirements of Section 4(f) (209 acres) and Section 6(f) (893 acres). The actual distribution and extent of each of these lands are presented in Figure 3-3.

CCLMP, administered by the St. Louis County Parks and Recreation Department, is a 2,242-acre park mostly located on the Missouri River's Howard Bend floodplain (see Figure 3-3). The park includes a 300-acre lake and provides outdoor recreation activities for the residents of St. Louis County, St. Charles County, and visitors to metropolitan St. Louis. CCLMP provides numerous outdoor recreation opportunities for both active and passive pursuits. Opportunities exist for activities such as picnicking, walking, sunbathing, sightseeing, bird watching, and fishing. The northern portion of the park is primarily used for active recreation. Active recreation in this area includes such activities as archery, softball, tennis, sailing, rowing, sail-boarding, ice skating, disc golf, and jogging. Special events such as power boat racing take place at occasional times throughout the year. Swimming is not allowed in the lake. In contrast, the southern portion of the park, including the Page Avenue mitigation lands is used for passive forms of recreation including bird watching and walking. This area is being used for the development of outdoor recreational areas which includes the development of wetland and wildlife habitats. St. Louis County Parks Department is currently developing the master plan for the park to guide its future development and use.

3.2 Cultural Resources

3.2.1 Prehistoric and Historic Summary

The Howard Bend study area has been inhabited for thousands of years. The long sequence of human interaction with the natural environment can be characterized by an increase in cultural complexity, beginning with small egalitarian hunting and hunting/foraging societies culminating many years (and cultures) later with socially stratified, agriculturally-based societies. Prehistoric subsistence practices in eastern North America have traditionally revolved around the collection of native plant foods as an adjunct to hunting and fishing. Evidence from both archaeological and ethnological investigations indicate that prior to the European settlement, Native Americans had developed uses for many plant species (Yarnell, 1976). Table 3-11 illustrates the primary characteristics of the early inhabitants of the study area.

The History of Creve Coeur Lake

Creve Coeur Lake was one of the region's most popular recreational attractions around the turn of the century and after. The lake was the site of the St. Louis County Fair in the late 1800s, and has over the years been the site of such activities as carnivals, fireworks, boat and motorcycle races, and picnicking. In 1910, approximately 15,000 people crowded the shores of the lake for a boat regatta. The Missouri Pacific Railroad and the Creve Coeur Lake streetcar line provided transportation from St. Louis to the lake. Citizens from St. Louis would drive to the lake via horse-drawn wagons and carriages over distances of up to 20 miles (Citizens Historical Committee, 1968; Thomas, 1911).

In the early twentieth century, such attractions as Hickory and Dripping Springs, Studt's Park, Electric Park, Eldorado, the Hellrung and Grimm Outing Club, and the Creve Coeur Yacht Company's clubhouse could be enjoyed around the lake area. During the prohibition period of the 1920s, gangsters and racketeers frequented the clubs and resorts around the lake. By the late 1930s, however, the lake's popularity declined, perhaps because of economic hardships or the availability of the automobile which could take the traveler to new, more distant vacation areas. In 1950, the last streetcar made its way from St. Louis to Creve Coeur Lake, and by then, silt in the lake had reduced its depth to a few inches. Since then, the county has dredged the lake and razed what was left of the old buildings around its shore (Citizens Historical Committee, 1968; Hannon, 1986; Thomas, 1911).

Table 3-11. Summary of Prehistoric Occupation Periods

Period	Dates	Description
Paleo-Indian Period	ca. 15,000-8000 B.C.	Big-game hunters who subsisted on both present-day animal and plant foods. Nomadic camps of low population densities were located on ridges or slopes overlooking reliable sources of water. The environment was undergoing changes as a result of retreating glaciers.
Dalton	ca. 8600-7000 B.C.	This period is characterized by a shift from forest to prairie communities in the Midwest; settlement shift from nomadic hunter to semi-nomadic hunter/forager.
Archaic	ca. 8000-1000 B.C.	Shift in diet from large game to small game, fish, nuts, and wild vegetables. Settlement shift from nomadic to sedentary; smaller territories were exploited for food resources.
Woodland	1000 B.C.-A.D. 900	The appearance of pottery and an agricultural society that was congregated in smaller, more permanent settlements.
Mississippian	A.D. 900-ca. A.D. 1600	Increased reliance upon agriculture as a subsistence base and increased social complexity. Settlement patterns are less nomadic and were characterized by large regional population centers surrounded by a radiating network of agricultural and special purpose sites.

Source: American Resource Group (ARG), 2002.

3.2.2 Archaeological Resources

A total of 18 investigations of archaeological resources in the Howard Bend study area have been conducted and have been summarized by ARG (2002). As a result of these previous investigations, 16 sites were identified within the study area (Figure 3-4, Table 3-12). Each of these sites was either determined to be ineligible for inclusion on the NRHP or was not formally evaluated as to its NRHP eligibility. In some instances, recommendations were made to avoid the site or to conduct further testing on the site prior to conducting any activities that would impact the site.

Table 3-12. Previously Recorded Archaeological Sites Located within the Study Area

Site ID No.	Description	NRHP Status	Further Recommendations
23SL376	Prehistoric (indeterminate age) and historic materials (1910)	Ineligible	Completely destroyed by the construction of Riverport.
23SL428	Prehistoric site	Ineligible	Site was destroyed.
23SL734	Prehistoric special function camp/historic residence/farmstead	Not evaluated	Further work needs to be conducted at the site prior to any activities that would adversely impact potential subsurface features.
23SL736	Special function camp with nondiagnostic prehistoric debris	Not evaluated	The site was destroyed by recent construction; no further recommendations.
23SL737	Historic recreation facility	Not evaluated	Highly probable that subsurface features are present; further testing needs to be conducted prior to any activities that would impact the site.
23SL738	Historic farmstead	Ineligible	Buried beneath a layer of sediment after the flood of 1993.
23SL739	Historic farmstead	Not evaluated	The structure has been razed; although it is possible that subsurface features are present; no recommendations for further work were made.
23SL740	Historic recreational facility	Not evaluated	As of 1989 the associated buildings were still in use; no recommendations for further work were made.
23SL741	Historic dwelling	Not evaluated	Highly probable that subsurface features are present; further testing needs to be conducted prior to any activities that would impact the site.
23SL742	Historic limestone quarry	Not evaluated	The site did not appear to have been disturbed since it was last utilized; no recommendations for further work.
23SL746	Historic residence	Not evaluated	Site was destroyed; no further recommendations.
23SL768	Prehistoric campsite or habitation area	Not evaluated	The site has been heavily impacted by clearing and agricultural activities.
23SL776	Historic midden	Not evaluated	Site is in poor condition and artifacts present are limited to the plow zone.
23SL883	Historic farmstead (turn of the twentieth century)	Ineligible	Destroyed during the razing of surface structures and by flooding.
23SL884	Historic farmstead (turn of the twentieth century)	Ineligible	Destroyed during the razing of surface structures and by flooding.
23SL885	Historic farmstead (turn of the twentieth century)	Ineligible	Destroyed during the razing of surface structures and by flooding.

Source: ARG, 2003.

Shipwrecks

Previously recorded shipwrecks are a common feature along the lower Missouri River and its floodplain. A total of seven shipwreck sites are recorded to have occurred within the Missouri River channel in the vicinity of the study area (see Figure 3-4). Additionally, one shipwreck is recorded to have occurred within the present Howard Bend study area (The USACE's *Abandoned Shipwrecks on Missouri River Channel Maps of 1879 and 1954*). The shipwreck of the Carrier was recorded in two locations in the same year (1858). As a result, its exact location is difficult to ascertain. Neither the site of the Carrier wreck nor other reported shipwreck

locations have been formally investigated to confirm their location and characteristics (i.e., NRHP eligibility).

3.2.3 Historic Architectural Resources

A windshield survey of extant architectural resources was conducted during January and February 2001 (ARG, 2002). The architectural resources of the Howard Bend study area include a mixture of farmsteads, landscape product suppliers, recreational facilities, airport installations (both active and abandoned), and public water treatment facilities.

Twelve locations were identified as containing buildings that appear to be at least 50 years of age (Figure 3-4). Most of the architectural resources on the farmsteads are of wood-frame construction. The farmsteads include houses, barns, machine sheds, steel grain silos and miscellaneous outbuildings. They date from the late 1800s to the late 1900s and are described in summary form in Table 3-13.

Table 3-13. Historic Architectural Sites Located within or Adjacent to the Study Area

Site No.	Site Name	Date	NRHP Status
1	Dussault Farm	1920	NRHP Eligible
2	Dauster Farm (Thies Farm Products)	1940	Farmstead buildings in fair to poor condition. Property has minor local significance, although probably not NRHP eligible
3	Knobbe Farmstead	1940	Not likely to be NRHP eligible
4	Seeger West County Golf Range	1930s	Potentially NRHP eligible
5	Armina Lodge Cemetery*	1885	Not known
6	John Prestien Farmstead*	1930s	Not likely to be NRHP eligible (buildings may have local historical significance because of their association with early farming activities in the county; however, buildings are abandoned and in poor condition)
7	Abandoned House	Not known	House and garage are in poor condition; unlikely to be eligible for the NRHP
8	Timber Country Mulch/Cordell Quethem Farmstead	1880s	Site may have local significance and may be potentially NRHP eligible
9	St. Louis County Waterworks/ Missouri American Water Company's Central Plant	1929/ 1933- 1938	It is likely that these buildings are architecturally significant and would be potentially eligible for the NRHP
10	City of St. Louis Howard Bend Water Plant	ca. 1926- 1927	The water intake plant complex is architecturally significant and would likely be considered NRHP eligible
11	Burkhardt Tenant Farmstead	Not known	The buildings are of standard design and construction; not likely to be NRHP eligible
12	Marie Burkhardt Farmstead	ca. 1940	The buildings are of standard design and construction; not likely to be NRHP eligible

* Located outside the study area near Olive Boulevard.

Source: ARG, 2002.

The following sites are located in the Howard Bend study area. Although not formally evaluated for NRHP eligibility, they were deemed potentially significant historically based upon a site visit and/or an initial review.

Dussault Farm (ca. 1920)

This site consists of a house and a garage, and is potentially NRHP eligible (ARG, 2002). The house may have been built for Maud Smith by Mr. Quatum, a successful farmer in the bottoms around 1920. The property may be considered locally significant because of its association with recreation and prohibition historic themes in the early development of the river bottoms. Additionally, the bricks used in its construction may have been made in the City of St. Louis. The exterior of both the house and the garage have been restored, and are in very good condition.

Seeger West County Golf Range (ca. 1930s)

The Seeger West County Golf Range site is comprised of a practice range and one structure, a golf pro shop. The estimated construction date of this structure is ca. 1930s. The exterior of the building has been modified somewhat by an addition to the rear of the building, the installation of vinyl siding, and enclosure of the porch. The building and the site may be historically significant because of the association with the recreational and prohibition activities of the period from the 1920s to the 1930s.

Timber Country Mulch/Cordell Quethem Farmstead (ca. 1880s)

This site is comprised of a house, two barns, a machine shed, a pump house, a garage, corrugated metal silos, and a sales shed. Nothing is known of the history or background of this property. Based on the apparent age of the house (ca. 1880s), it is possible that the site may have local significance and may potentially be NRHP eligible.

The City of St. Louis Howard Bend Water Plant (ca. 1926-1927)

The City of St. Louis Howard Bend Water Plant is comprised of a complex of four major buildings and several smaller ones. They are all built of small rock-faced stones laid in broken courses. The trim is made of ashlar stone. The buildings were designed in 1926 and 1927 by the staff of the St. Louis City Water Division, with the assistance of the Board of Public Service. The water intake plant complex is architecturally significant and would likely be considered eligible for listing on the NRHP.

St. Louis Water Company's St. Louis County Waterworks (1929)/Missouri American Water Company's Central Plant (ca. 1933-1938)

The St. Louis Water Company's St. Louis County Waterworks is currently located south of the study area along Waterworks Road (see Figure 3-4). The plant was constructed in 1929 to provide a potable water supply to the expanding development in St. Louis County. Subsequent expansions were made in 1931 and 1954-55 (Schworm, 1968).

The Missouri American Water Company's Central Plant is a complex of buildings in mostly a matching style of yellow brick with stone or cast concrete trim. The dates of construction of these buildings are estimated to be ca. 1933-1938 (ARG, 2002). It is likely that this complex of buildings would be considered architecturally significant and would be potentially eligible for the NRHP.

3.3 Traffic and Transportation

3.3.1 Roadway Network

The Howard Bend study area is located within a complex and often congested urban transportation network. The major components of the regional transportation system in proximity to the study area include major interstate freeways, urban arterial, collector, and local roads, railroad facilities, and a general aviation airport. Additionally, a well developed hike and bike trail system associated with CCLMP is in place and utilized by park users.

The study area is situated in the northwestern portion of the St. Louis metropolitan area. I-70 forms the northern boundary of the study area and is an important part of the region's interstate transportation network. I-270 is circumferential roadway system around St. Louis that is located approximately 1 mile to the west of the study area and is a major circumferential interstate for the St. Louis region. In proximity to the study area, I-270 functions as a major north/south arterial connecting I-64, the Page Avenue Extension, and I-70. Each of these interstate highways are fully access controlled freeways. Access to these facilities is provided via grade separation and interchanges with high volume arterials.

Primary access to the study area from I-70 is via the Earth City Expressway South interchange. I-70 crosses the Missouri River at the Blanchette Memorial Bridge into St. Charles County which abuts the northwest corner of the study area. I-70 is characterized by ten lanes in this location and is a major corridor for St. Charles County residents and residents of other surrounding counties commuting to St. Louis County and St. Louis City. Additionally, because I-70 is a major national east-west interstate corridor, it receives significant through traffic passing through the St. Louis region.

MoDOT has recently completed the construction of the Page Avenue Extension. This new facility extends from its existing terminus west of I-270, then crosses CCLMP and the Howard Bend floodplain, the Missouri River, and then extends into St. Charles County. Page Avenue Extension is a divided 10-lane facility providing access to the study area via an interchange just south of River Valley Drive.

North-south movements within the study area are currently served primarily by the Earth City Expressway and Creve Coeur Mill Road. The Earth City Expressway is a primary arterial serving the northern portion of the study area and the Earth City Industrial Park north of I-70 (north of the study area). Access to Earth City Expressway from I-70 is via a partial cloverleaf interchange. Access to the Earth City Expressway is typically achieved via signalized intersections with other larger volume roadways. The Earth City Expressway currently extends from State Route (SR) 370, north of Earth City, across I-70 and south to Prichard Farm Road. It consists of two through lanes in each direction in this segment with associated turn lanes into Riverport and Harrah's Casino complex.

Creve Coeur Mill Road is a north-south roadway in the study area. The roadway is classified as a minor arterial for the segment extending from Prichard Farm Road to Olive Boulevard and is one lane in each direction in this segment. Because of its low topographic position within the floodplain, Creve Coeur Mill Road is often subject to localized flooding and becomes impassable. Prichard Farm Road, located in the vicinity of Harrah's Casino and Riverport is a north-south connector roadway that links Creve Coeur Mill Road with the Earth City Expressway. Prichard Farm Road is also classified as a primary arterial.

The MHE is a project that extends a four-lane expressway facility from the terminus of the Earth City Expressway at Pritchard Farm Road, south to River Valley Drive. This 2.9-mile facility is an important central arterial facility within the Howard Bend study area that effectively provides service to local traffic within the area as well as more regional movements. The roadway has also been constructed at an elevation that will be above the 100-year flood elevation of the Fee Fee Creek and Creve Coeur Creek systems. Consequently, north-south traffic movement within the study area will not be interrupted during conditions of localized flooding. The roadway is currently open for traffic but is still undergoing final construction.

An additional secondary arterial within the planning area is Marine Avenue that provides a link between the central portion of the study area and the upper, urbanized portion of the City of Maryland Heights and is the primary access road to CCLMP.

River Valley Drive is a two-lane primary collector road providing the principal access to the Hog Hollow Road and Waterworks Road in the southwestern portion of the planning area. Roadways of this classification are designed to collect and distribute traffic between specified areas and the arterial roadways and expressways. River Valley Drive connects at Creve Coeur Mill Road and proceeds west to a grade separated overpass with Page Avenue Extension. It then proceeds south toward the Missouri American Water Company where it turns to the southeast and proceeds up the river bluff through a residential area to Olive Boulevard. River Valley Drive from Page Avenue Extension south to Hog Hollow Road is on a recently completed new alignment constructed in 2000-2001. The previous alignment was parallel to the old levee system, and the road was relocated after the levee was reconstructed further to the east.

Hog Hollow Road is a two-lane facility which provides access from its connection with River Valley Drive through the existing plant operations of the Missouri American Water Company and then proceeds south up the bluff and connects with Olive Boulevard.

Other existing road systems within the study area consist of major and minor arterials and local roads. Pritchard Farm connects to the MHE at Casino Drive and serves as an arterial for vehicles accessing the northern areas of Maryland Heights and Bridgeton via McKelvey Road. It provides access to residential areas of Bridgeton and Maryland Heights, Pattonville High School, Fred Weber, Inc. construction services operations, and a variety of light industrial uses in the northeast sections of the study area.

Casino Drive is a four-lane access road that serves Harrah's Casino and Hotel complex. This elevated roadway is built on a flood protection berm and terminates in the Harrah's Casino complex.

Riverport Drive serves as the only connection to the Riverport development from Earth City Expressway. This loop road has two signalized access points with Earth City Expressway. Riverport Drive serves as a collector/distributor road to the numerous office buildings and business service centers within the Riverport development and the UMB entertainment complex.

Waterworks Road is segmented and exists in two locations. The southeast segment provides access from Creve Coeur Mill Road along the southern boundary of the study area to River Valley. The southwestern section of Waterworks Road provides access to the City of St. Louis Missouri River Water Plant. The two segments of Waterworks Road are connected via a platted and unconstructed right of way (Paper Street) which parallels the Union Pacific Railroad single track line and the base of the Missouri River bluffs which form the southern boundary of the study area.

Other roadways within the study area include a number of local roads that provide access to various developments from the existing collector and arterial system. These include roads within the Riverport Development, minor streets serving the light industrial uses within the northern study area, and Airport Road which serves the Creve Coeur Airport users and operations.

Other transportation components within the study area include the Union Pacific Railroad, Creve Coeur Airport, and a trail system. The Union Pacific is a single track facility which traverses the entire study area. It enters the study area in the most southwestern corner and proceeds east along the base of the Missouri River bluff. At its intersection with Creve Coeur Mill Road, the Union Pacific parallels along the east side of Creve Coeur Mill Road in a north-south direction through the study area. The Union Pacific Railroad averages two trains per day.

Creve Coeur Airport is a privately owned public use airport with services and facilities for general aviation aircraft of single and twin engine piston aircraft. The Creve Coeur airport has been designated by the East-West Gateway Coordinating Council (EWGCC) in 1991 as a regional reliever airport. *"A reliever airport provides facilities and services for attracting and diverting general aviation activity from major air carrier airports."* The airport is located on 160 acres in the central part of the study area and has approximately 250 aircraft based at the facility. The airport serves predominantly privately owned aircraft and is served by two existing runways. The current runways are planned for improvements of the primary runway to a 4,500-foot length and the extension of the crosswind runway to 2,800 feet. These improvements will require the purchase of an additional 145 acres of land and 13 acres of land for aviation clearances, respectively. The proposed long range improvement plan for the airport includes expanded parking, lighting of runways, expanded taxiways, and various air navigational devices. Facilities include hangars, tie downs, and service and fueling operations (Crawford, Murphy & Tilly, Inc, 1996).

The CCLMP bicycle and trail system that exists within the study area is generally confined within the limits of the park and the Page Avenue Extension mitigation lands. These various trails are approximately 4.5 miles in length.

3.3.2 Existing Traffic Volumes

Existing traffic volumes on the principal arterials are based upon AADT and consists of average number of vehicles that travel these roadways on an average day throughout the year. The AADT accounts for vehicles traveling in both directions on a given roadway. For many of the roadways, AADT was determined by actual traffic counts on specific locations of the roadways. A summary of known traffic volumes within the study area in year 2000 is provided on Table 3-14.

Table 3-14. Existing AADT

Roadway and Segment	AADT (2000)
Creve Coeur Mill Road (north of Olive)	12,200
Creve Coeur Mill Road (north of River Valley)	9,000
Marine Avenue (south of Creve Coeur Mill Road)	6,700
Earth City Expressway (north of Pritchard Farm)	27,900

Source: CBB, 2001.

3.4 Air Quality

3.4.1 Air Quality Standards

Air quality is regulated by the USEPA. The USEPA delegates authority to the MDNR for monitoring and enforcing air quality regulations in Missouri. The MDNR then delegates some authority to local municipalities having air quality control agencies. In Maryland Heights, this agency is the City of St. Louis Air Pollution Control Department (APCD).

Air quality in Missouri is defined with respect to conformity with the National Ambient Air Quality Standards (NAAQSs). These standards were developed and promulgated by the USEPA (Table 3-15). The six priority air pollutants constituting the NAAQSs are ozone (O₃), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂, often reported as part of nitrogen oxides, NO_x), particulate matter less than 10 microns in aerodynamic diameter (PM₁₀), and lead (Pb).

MDNR has adopted the standards for the criteria pollutants listed in Table 3-15 in its air quality program. The USEPA and MDNR classify geographic regions of Missouri as having air quality better or equal to (attainment) or worse than (non-attainment) these standards.

Table 3-15. USEPA Criteria Pollutant Emission Standards

Pollutant	Averaging Period	Primary	Secondary
CO	1 hour	35 ppm	35 ppm
	8 hour	9 ppm	None
Pb	3 month	1.5 µg/m ³	1.5 µg/m ³
NO ₂	1 year	0.053 ppm	0.053 ppm
O ₃	1 hour	0.12 ppm	0.12 ppm
	8 hour	0.08 ppm	0.08 ppm
SO ₂	24 hour	0.14 ppm	None
	1 hour	0.03 ppm	None
	3 hour	None	0.5 ppm
PM ₁₀	1 year	50 µg/m ³	50 µg/m ³
	24 hour	150 µg/m ³	150 µg/m ³
PM _{2.5}	1 year	15.0 µg/m ³	15.0 µg/m ³
	24 hour	65 µg/m ³	65 µg/m ³

µg/m³ = micrograms per square meter.

ppm = parts per million.

Source: Missouri Department of Natural Resources.

The USEPA and MDNR have classified St. Louis County as being in attainment with all the criteria pollutant NAAQS, except that of ozone. Ozone levels in St. Louis County are designated as being in non-attainment with the ozone NAAQS. Tropospheric ozone is a secondary pollutant that forms when ultraviolet radiation catalyzes a reaction between volatile organic compounds and oxides of nitrogen.

The Clean Air Act and Amendments (CAAA) of 1990 requires states with areas that are not in compliance with any NAAQS to develop state implementation plans (SIPs). The CAAA classifies the areas by magnitude of noncompliance for the Ozone Non-Attainment areas in five

categories (marginal, moderate, serious, severe, and extreme). The St. Louis ozone non-attainment area has been classified as a bi-state moderate non-attainment area. Section 181 of the CAAA requires states with moderate non-attainment areas to achieve attainment by 1996. Currently the attainment date for the 1-hour ozone standard in the St. Louis area is established as November 15, 2004.

3.4.2 Air Quality Conditions

There are 11 air monitoring stations within the St. Louis, Missouri area which are operated by MDNR. Among these the Orchard Farm, Weidman-Queeney Park, and Ladue monitoring sites are representative of the study area and can be used to describe existing air quality of the area. Table 3-16 presents the air quality measurement for ozone for each of these locations. Ozone monitoring data shows that in general, violations are no longer occurring within the St. Louis region (see Table 3-16). The St. Louis metropolitan area has recorded 3 years of complete, quality assured ambient air quality monitoring data (2000-2002), demonstrating attainment with the 1-hour ozone standard. Based on emission trends, it is expected that the air quality will continue to meet the 1-hour ozone NAAQS throughout the maintenance period (2014).

Table 3-16. 2002 One-Hour Ozone Emissions from Selected Monitoring Stations in the St. Louis Area

Monitoring Site	1-Hour Highs (ppm)			
	1 st	2 nd	3 rd	4 th
Orchard Farm	0.145*	0.125*	0.117	0.114
Weidman-Queeney Park	0.114	0.113	0.110	0.108
Ladue	0.114	0.111	0.111	0.109

* Exceeds air quality standard.

Source: Missouri Department of Natural Resources.

The MDNR developed a transportation emission budget as required in the maintenance plan for conformity determinations. The budget establishes a cap on emissions that cannot be exceeded by predicted highway and transit vehicle emissions. Emissions expected from implementation of highway plans and programs should be consistent with estimates of emissions from motor vehicles and necessary reduction contained in the applicable SIP. The St. Louis area meets the five criteria as outlined in Section 107 (d)(3)(E) of the CAAA for redesignation status.

For the maintenance plan, the USEPA Air Quality Model, MOBIL6, transportation emission model was used to predict emissions and develop the budget. The mobile source budget is defined as the motor vehicle related portion of the project emission inventory that is used to demonstrate reasonable further progress milestones, attainment or maintenance for a particular year specified in the SIP. The mobile source budget establishes a limit on emissions that cannot be exceeded by predicted highway and transit vehicle emissions.

3.4.3 Emission Sources

Three basic types of sources of NO_x and volatile organic compound (VOC) emissions exist in the area: mobile sources, area sources (which consist of light industrial sources such as asphalt plants) and major point sources in the area. Total emissions in the St. Louis area are made up of approximately 60 percent from mobile sources, with the remainder area and major point sources. Table 3-17 presents the estimated amount of pollutants emitted in the St. Louis region in tons per day of the types of sources.

Table 3-17. St. Louis Area VOC and NO_x Emissions, 2000 (Tons of Ozone Per Season Weekday)*

Source Category	VOC	NO _x
Point Sources	46.59	165.96
Area Sources	57.38	32.27
On-Road Mobile Sources	103.79 / 84.56†	181.75 / 134.45†
Off-Road Mobile Sources	40.59	73.16
Total	248.35 / 229.12	453.14 / 405.84

* The ozone season is from April 1st through October 31st.

† Mobile 5.b.

3.5 Noise

Existing noise conditions within the study area were investigated in detail by MoDOT as part of the Page Avenue Extension EIS (TCT-St. Louis, Inc, 1992). Noise levels are measured using equipment that expresses the noise energy of the environment in units of L_{eq} on an A-weighted scale (measured in decibels-dB). The L_{eq} is the steady-state sound level which, in a given period of time, contains the same acoustic energy as the time-varying sound level during the same period. The A-weighted scale (dBA) emphasizes frequencies that approximate the response of the human ear.

Baseline conditions were established by measuring noise levels at each of 17 locations along the proposed route. A total of seven monitoring locations were located along various alternatives within the Howard Bend floodplain. Results of this baseline noise monitoring are presented in Table 3-18. Common sources of noise within the study area include that from ground transportation, occasional aircraft noise emissions, and the operation of agricultural equipment. These latter sources of noise, however, are generally more intermittent in their occurrence and therefore do not contribute significantly to the noise environment of the study area. Other common sources of noise are natural sounds such as wind, insects (crickets, etc.), birds, and calling amphibians. Automobile and truck traffic on roadways of the study area represent the primary sources of noise as the noise emission from such facilities is generally constant during daytime hours.

Table 3-18. Page Avenue Extension Noise Measurement Locations

Location Identification	Description	Noise Level (dBA)
Q	Open field, east of Creve Coeur Mill Road, south of Page Avenue Extension	65.8
QG	Creve Coeur Mill Road south of River Valley Drive	66.9
QH	CCLMP, near beach area at northern end of Creve Coeur Lake	63.6
QI	CCLMP, along Creve Coeur Creek south of Page Avenue Extension	47.8
QK	Creve Coeur Mill Road at Waterworks Road	67.4
QJ	CCLMP, along east side of Creve Coeur Lake along Page Avenue Extension	53.0
5	Residence along River Valley Drive, west of Creve Coeur Airport	46.6

Source: TCT-St. Louis, Inc. 1992.

In general, noise levels within the study area vary in their intensity in accordance to the nature of the surrounding land use and the relative distance from roadways. Areas that are characterized by high activities and close proximity to established roadways have been recorded to have baseline noise levels of over 60 dBA. In contrast, other areas more distant from arterial roadways exhibit baseline noise levels in the range of 45 to 50 dBA.

In addition to the above monitoring locations, MoDOT performed baseline noise monitoring at 25 locations in the vicinity of CCLMP to document the noise environment of the park. Results of this monitoring effort documented baseline noise levels of approximately 62 dBA in the vicinity of Creve Coeur Mill Road along the west side of the park and approximately 53 dBA along the protected east end of the park near the bluffs.

In general, the relationship between noise levels and land use are expected to be similarly applicable to other portions of the study area. High intensity use areas within the northern portion of the study area (i.e., Riverport, Harrah's, Earth City Expressway) are expected to have existing noise levels in the mid to upper 60s (dBA). In contrast, lower activity areas such as that of cultivated fields along River Valley Drive, Waterworks Road, and the undeveloped lands along the Missouri River, are expected to be characterized by noise levels ranging from 45 to 55 dBA.

3.6 Natural Resources

3.6.1 Geologic Setting

3.6.1.1 Geology and Topography

Geology

The Howard Bend study area geology consists of a thick sequence (approximately 100 feet) of alluvial sediments, which is underlain by limestone and shale (Rockaway and Lutzen, 1970; Lutzen and Rockaway, 1971; Miller et. al., 1974; Miller and Vandike, 1997; Brill, 1991; USACE, 2000; and Booker Associates, 1992). The alluvial sediments consist of sand, silt, clay, and gravel. The sediment from the glaciers was deposited within the river valley, and along with more recent deposits from the Missouri River, combined to form the alluvial sediments that exist today.

Typically the percent of fine-grained material (clay and silt) is higher in the upper part of the sediments, with coarser material (sand/gravel) dominating in the lower part of the sequence. The Missouri River alluvium forms an important and widely used water source as is discussed in Section 3.8.2.

Alluvial sediments within the study area are noted as having some limitations for development. For example, low-lying sediments associated with swamps and backwaters contain a high organic content and frequent flooding that renders them unsuitable for certain kinds of development such as waste disposal (landfills, sewage lagoons, etc.) and construction (foundations, roads, etc.). Other alluvial sediments with a higher percentage of sand, gravel, silt and clay, are better suited to development, particularly when flood risk is reduced (Rockaway and Lutzen, 1970 and Lutzen and Rockaway, 1971).

Geologic formations of the adjacent uplands consist primarily of limestone with minor amounts of shale and other lithologies. Dominant formations within the surrounding bluffs include the following:

- Ste. Genevieve Limestone;
- St. Louis Limestone;
- Salem Formation (limestone);
- Warsaw Formation (shale and limestone); and
- Cherokee Group (shale, clay, limestone, coal, sandstone).

The most significant seismically active feature in the region is the New Madrid Fault, located in the southeast Missouri boot heel. Minor tremors are relatively common in this area. The potential effect zones of a large earthquake (8.6 Richter magnitude) in the New Madrid seismic zones were developed by Thenhaus (1990). These effect zones are classified in the terms of a Modified Mercalli Intensity Scale, which generally decreases with distance from the New Madrid Fault. The subsurface geology is (in part) also considered, resulting in irregular shapes for the intensity zones. According to that scale, the most severe effects would be associated with zone XI and the lowest effects would be associated with zone VII. The study area is located in a moderate effect zone (VIII).

The potential earthquake effects (liquefaction/amplification, landslide, and collapse) depend on the subsurface geology. Liquefaction potential is mapped based on thick cohesionless soils (mostly sand) with a high water table (river valleys). Soil amplification potential, which causes increased ground shaking, is based on thick, soft, cohesive soils (mostly clay) combined with a high moisture content (river valleys). Landslide potential is mapped based on significant stretches of high local relief (river bluffs). Collapse potential is mapped based on karst features (sinkholes, caves, etc.) and /or shallow mine openings (MDNR, 1993). Due to the high sand and clay content, and high water table in the Missouri River floodplain within the study area, the potential for liquefaction/amplification is considered severe (MDNR, 1993 and 1995). The Missouri River bluffs surrounding the study area are (in part) identified as having landslide potential. Due to the lack of karst features, no collapse potential is identified in the study area.

Topography

The topography of the study area is characteristic of the Missouri River floodplain and is relatively flat, with surface elevations typically at about 440 to 450 feet mean sea level (msl). Agricultural use coupled with the construction of levees and drainage ditches have resulted in an alteration of the surface topography. The normal pool elevation of Creve Coeur Lake is 442.2 feet msl, whereas the elevation of many of the drainage ditches and small streams in the study area floodplain is approximately 435 to 440 feet msl.

Uplands to the east and south of the study area have a terrain that is more variable and dissected. Typical elevations of the bluffs range from 550 to 600 feet msl. Elevations of the numerous streams and ravines that dissect the uplands range from about 450 to 500 feet msl.

3.6.1.2 Mineral Resources

The mineral resources (sand/gravel and limestone) within the study area are limited, with no known mines or quarries located within the study area [MDNR-Inventory of Mines, Occurrences, and Prospects (IMOP) Database, 2002].

The Weber Quarry (approximately 80 acres in size) extracts limestone from the St. Louis and Salem Formations; however, it is located just outside (northeast) of the study area boundary (Weber Quarry personal communication, 2002).

Sand and gravel is periodically extracted from the Missouri River during dredging operations. The location and extent of these operations vary and are permitted by the USACE. St. Charles Sand Company operates regularly within the Missouri River in the vicinity of the study area.

3.6.2 Soils

The soils within the study area were formed in recently deposited alluvium and consist of mixtures of silt, clay, and sand. The study area soils were deposited by a meandering river and have been altered by erosion (in conjunction with periodic flood events) and anthropogenic sources (i.e., farming, construction, etc.). Therefore, soil profiles encountered in the field may not match the “typical” profiles listed by the Soil Conservation Service (SCS, 1982, now NRCS). The following soils have been mapped in the study area [U.S. Department of Agriculture (USDA), 1982]:

- *Wilbur Silt Loam* -- The Wilbur series consists of deep, moderately well drained, moderately permeable soils on floodplains. The typical Wilbur soil profile consists of 0 to 6 inches of layered dark grayish brown and brown silt loam, and 6 to 50 inches of layered brown silt loam.
- *Eudora Silt Loam* -- The Eudora series consists of deep, well drained, moderately permeable soils on floodplains. The typical Eudora soil profile consists of 0 to 12 inches of very dark grayish brown silt loam, 12 to 23 inches of brown and dark grayish brown silt loam, and 23 to 37 inches of brown very fine sandy loam.
- *Booker Clay* -- The Booker series consists of deep, very poorly drained, very slowly permeable soils on floodplains. The typical Booker profile consists of 0 to 37 inches of dark gray clay.
- *Blake Silty Clay Loam* -- The Blake series consists of deep, somewhat poorly drained, moderately permeable soils on floodplains. The typical Blake profile consists of 0 to 9 inches of very dark grayish brown silty clay loam, and 9 to 23 inches of layered dark grayish brown silty clay loam and brown very fine sandy loam.
- *Waldron Silty Clay* -- The Waldron series consists of deep, somewhat poorly drained, slowly permeable soils on floodplains. The typical Waldron profile consists of 0 to 23 inches of dark grayish brown silty clay and 23 to 39 inches of layered dark grayish brown silty clay and grayish brown silt loam.
- *Sarpy Loamy Fine Sand, rarely flooded (#44) and Sarpy Loamy Fine Sand, frequently flooded* -- The Sarpy series consists of deep, excessively drained, rapidly permeable soils on floodplains. The typical Sarpy profile consists of 0 to 31 inches of loamy fine sand.
- *Blake to Eudora to Waldron Complex* -- This complex consists of mixtures of these three soils (described above) that were not separated in the field mapping.

Due to the potential for flooding, wetness and shrink-swell, the mapped soils within the study area have moderate to severe limitations for most building site developments (e.g., dwellings with or without basements, small commercial buildings, and roads) (USDA, 1982).

Only two of the study area soils are currently listed by the NRCS as hydric soils: the Booker Clay and the Sarpy Loamy Fine Sand, frequently flooded. Inclusions of hydric soils have been observed in most of the other mapped soils. As an example, the Wilbur Silt Loam is a listed non-hydric soil but was observed to have inclusions that meet the hydric soil criteria in proximity to Creve Coeur Lake.

3.6.3 Ecological Resources

3.6.3.1 Land Cover

Vegetative land cover within the Howard Bend study area was identified using a combination of photo-interpretation of 2001 aerial photography coupled with field reconnaissance. Results of this effort are presented in Figure 3-5 and Table 3-19.

Table 3-19. Summary of Land Cover

Land Cover Type	Acres	Percent
Cultivated Field	3,182	36.9
Developed Lands	1,284	14.9
Grassland	1,178	13.7
Deciduous Forest	934	10.8
Old Field	817	9.5
Wetlands	708	8.2
Water	516	6.0
Mud/Sand	4	<0.1
Total	8,623	100.0

Source: MACTEC, 2003.

Cultivated Field

Cultivated fields accounted for 3,182 acres and represent the predominant cover type within the area. The predominance of this cover type reflects a long history of agricultural use within the study area dating back to the early 1800s. Vegetative communities associated with this cover type are generally low in quality and are dominated by cultivated crops (corn, soybeans, specialty crops), and weedy species such as foxtail (*Setaria* sp.), ragweed (*Ambrosia* spp.), amaranth (*Amaranthus* sp.), and velvetleaf (*Abutilon* sp.), among others.

Grasslands

Grasslands are the second-most abundant land cover type, accounting for 1,178 acres (13.7 percent). Lands included in this cover type consist of recreational areas (e.g., soccer fields, golf course, driving ranges, etc.), airport grassed runway and clear zones, levees, and maintained open space around industrial facilities such as the Missouri American Water Company and the MSD plant. In general these areas are low-quality habitats that are dominated by species such as fescue (*Festuca elatior*), bluegrass (*Poa pratensis*), foxtail (*Setaria* spp.), and other ornamental grass species. Areas within the vicinity of Little Creve Coeur Lake, however, are grasslands that are more valuable for wildlife. These areas represent lands that have recently been removed from cultivation and are being developed as mitigation areas and passive recreational areas by MoDOT and St. Louis County Parks Department.

Wetlands

Wetlands represent approximately 8.2 percent of the study area and encompass a total of 708 acres. Wetland types vary in vegetative form and water permanence and are generally associated with lands along the Missouri River, in the upper regions of Creve Coeur Lake, and at various other locations within the study area. A detailed discussion of wetland types, representative vegetation, and function is provided in Section 3.7.

Deciduous Forests

Deciduous forests cover approximately 934 acres within the study area. Given the study area's location on the Missouri River floodplain, all of the forests are considered bottomland forests, as compared to the upland forests located on the adjacent hills and bluffs. Natural bottomland forest communities are characterized by the presence of alluvial soils (sand/silt/clay) and frequent flooding or ponding water (Nelson, 1985). The vegetative composition and structure of this community type varies with local topography, hydrology, soils, and level of disturbance.

In general, the forests in the study area can be classified as mesic to wet-mesic bottomland forests (Nelson, 1985). The mesic bottomland forests are located on level to gently sloping natural levees or higher elevations on the floodplain. The soil is moderately well drained, with the soil profile generally moist for most of the year, but wet for only a short time (usually spring) of the year. The wet-mesic forests are located on level to gently sloping bottomlands, at slightly lower elevations than the mesic forests. The soils are somewhat poorly drained and are seasonally or intermittently wet for significant periods. The water table is usually near the surface for part of the year. The vegetation in the wet-mesic forests typically meets the wetland vegetation criteria (USACE, 1987), but may not meet the hydrology or soils criteria. These forests are typically interspersed with, or grade into wetlands.

The principle areas of mesic and wet-mesic forests within the study area occur as a relatively narrow strip along the Missouri River (river side of the levee), Jane Downing Island and associated areas, and at the southern end of CCLMP (see Figure 3-5). Smaller isolated tracts are located throughout the study area.

The mesic and wet-mesic communities within the study area have a tree canopy that is characterized by cottonwood (*Populus deltoides*), sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), box elder (*A. negundo*), hackberry (*Celtis occidentalis*), slippery elm (*Ulmus rubra*), green ash (*Fraxinus pennsylvanica*), and persimmon (*Diospyros virginiana*). Common shrub and vine species include deciduous holly (*Ilex decidua*), dogwood (*Cornus* spp.), poison ivy (*Toxicodendron radicans*), trumpet creeper (*Campsis radicans*), moonseed (*Menispermum canadense*), grape (*Vitis* spp.), green briar (*Smilax* spp.), Virginia creeper (*Parthenocissus quinquefolia*), and Japanese honeysuckle (*Lonicera japonica*). Stinging nettle (*Urtica dioica*), false nettle (*Boehmeria cylindrica*), pokeweed (*Phytolacca americana*), sedges (*Carex* spp.), white snake root (*Ageratina altissima*), giant ragweed (*Ambrosia trifida*), white avens (*Geum canadense*), spotted touch-me-not (*Impatiens capensis*), and wood sage (*Teucrium canadense*) are representative of the herbaceous layer.

Old Field

Old fields consist of fallow farm fields or abandoned developed areas. Approximately 817 acres of old field were identified in the study area. Typical old field plant species include goldenrod (*Solidago* spp.), ragweed (*Ambrosia* spp.), grape (*Vitis* spp.), Queen Anne's lace (*Daucus carota*), Johnson grass (*Sorghum halepense*) and various tree saplings (cottonwood, box elder, etc.). Primary areas mapped as old field include areas outside of the 500-year levee in the vicinity of Jane Downing Island, vacant lands in the vicinity of the MSD plant, and various parcels scattered in Riverport and other locations. Old field habitats can provide wildlife functions, such as cover and forage.

Developed Lands

Developed lands within the study area include areas that are either under construction or exist as established residential, commercial and industrial uses, roadways, and parking lots. In general, these areas consist of landscape and drainage features that are peripheral to developed, impervious land surfaces. Approximately 1,284 acres of developed lands were

identified in the study area. In general, this cover type offers little in the way of habitat value, although peripheral areas may be used intermittently by songbirds, waterfowl and other fauna that are tolerant to high levels of human activity.

3.6.3.2 Wildlife

Wildlife occurring within the study area has been documented by a number of previous studies:

- Page Avenue Extension Wintering Bald Eagle Study (Dunstan, 1989);
- Page Avenue Extension Biological Survey and Reconnaissance of Vertebrate Species (Dunstan and LaCross, 1989);
- Little Creve Coeur Lake Bird Atlas for 1999 (St. Louis County Parks, unpublished data); and
- Indiana Bat Habitat Survey, Howard Bend Levee District Proposed Borrow Site, Maryland Heights, Missouri (Burns & McDonnell, 2000a).

In general, the results of these inventories revealed wildlife communities that correspond to the quality and distribution of cover types within the study area. As discussed in Section 3.6.3.1, general cover types within the study area included cultivated fields, grassland, wetlands, deciduous forest, old field, developed lands, and open water.

Birds

A total of 152 bird species were documented from all habitats within the study area (St. Louis County Parks and Recreation, 1999). Historical bird use within the study area and adjacent bluff area is relatively high as reported by Dunstan and LaCross (1989). In addition to field studies performed as part of the Page Avenue Extension project, they compiled a list of birds identified from the area by field biologists and birders from 1974 to 1989. In total, 212 bird species were included on their list. The largest number of bird species was documented from woodland and wetland habitats. Lesser numbers of species occurred in cropland, old field, and urban areas.

Representative birds identified within forested habitats included blue jay (*Cyanocitta cristata*), black-capped chickadee (*Parus atricapillus*), tufted titmouse (*Parus bicolor*), common crow (*Corvus brachyrhynchos*), and American robin (*Turdus migratorius*). In contrast, water-dependant species such as wood duck (*Aix sponsa*), killdeer (*Charadrius vociferous*), great blue heron (*Ardea herodias*), and red-winged blackbird (*Agelaius phoeniceus*) were frequently observed within emergent wetlands, the open water areas of Creve Coeur Lake, and Little Creve Coeur Lake. Species that were more commonly associated with cropland and pasture included barn swallow (*Hirundo rustica*), purple finch (*Carpodacus purpureus*), mourning dove (*Zenaida macroura*), chimney swift (*Chaetura pelagica*), and northern mockingbird (*Mimus polyglottos*). Notable or uncommon bird species observed within the study area included American bittern (*Botaurus lentiginosus*), northern harrier (*Circus cyaneus*), white pelican (*Pelecanus erythrorhynchos*), ruddy duck (*Oxyura jamaicensis rubida*), and black-necked stilt (*Himantopus mexicanus*).

Nineteen bird species identified from the study area are currently assigned a state status or rank by the MDC (see Section 3.6.3.3, Sensitive Species).

Mammals

A total of 16 mammal species were documented from all habitats within the study area. A proportionate number of species were documented in both wetland and nonwetland cover types. Woodland and wetland habitats were highly utilized. Representative species included white-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis marsupialis*), raccoon (*Procyon lotor*), muskrat (*Ondatra zibethica*), and eastern gray and eastern fox squirrels (*Sciurus*

carolinensis and *S. niger*). Cropland and old field habitats were utilized to a lesser extent, but a larger proportion of small mammal species occurred in these habitats including eastern mole (*Scalopus aquaticus*), meadow vole (*Microtus pennsylvanicus*), and eastern cottontail rabbit (*Sylvilagus floridanus*).

Reptiles and Amphibians

Previous studies conducted for the Page Avenue Extension also evaluated the study area for the presence of reptile and amphibian (herpetile) species. A total of 10 species were documented from all habitats within the study area. With the exception of the eastern box turtle (*Terrapene carolina*), all herpetile species were documented in pond, river, creek, ditch and wetland habitats, and adjacent riparian areas. Woodland, streambed, and old field habitats contained fewer herpetile species than wetland and aquatic cover types. Commonly found amphibian species included bullfrog (*Rana catesbeiana*), green frog (*R. clamitans*), cricket frog (*Acris crepitans*), northern leopard frog (*R. pipiens*), Fowler's toad (*Bufo woodhousii fowleri*), and southern leopard frog (*R. sphenoccephala*). Frequently encountered turtles included eastern box turtle and false map turtle (*Graptemys pseudogeographica*). No snake species were inventoried during the survey. Based upon the kinds of cover types represented within the study area, it is likely that typical snake species may include eastern garter snake (*Thamnophis sirtalis sirtalis*), black rat snake (*Elaphe obsoleta*), northern water snake (*Nerodia sipedon sipedon*), and western ribbon snake (*Thamnophis proximus proximus*).

3.6.3.3 Sensitive Species

The Endangered Species Act of 1973 (16 USC 1531-1543) provides for the protection of threatened and endangered species, and the conservation of designated critical habitat. The potential occurrence of Federal and state listed species in the vicinity of the study area was determined through literature review, field observation, and agency consultation with USFWS and MDC. As is summarized in Table 3-20, MDC identified 11 sensitive species that have the potential to occur in the study area (see Appendix A, MDC agency letter dated September 6, 2002). No response was received from the USFWS. Several of these species have been observed to occur within the study area (e.g., many of the bird species, several plants). However, other species have a distribution that may encompass the study area, but have not been reported from the study area. The following discussion is limited to those Federal or state listed species that have been reported to occur within the study area.

No species of conservation concern, including state and Federal listed threatened and endangered species, were observed during field reconnaissance of the study area. There is no designated critical habitat within the study area.

Federal and State Listed Species

Indiana bat (*Myotis sodalis*)

The Indiana bat is a Federal and state listed endangered species that utilizes summer habitats within mature floodplain, riparian, and adjacent upland forests. Indiana bats roost and establish maternity colonies primarily beneath the loose bark of dead, dying or live hickory, oak and other trees. Foraging areas of Indiana bats are primarily tree canopies of floodplain, riparian, and upland forests. Indiana bat winter habitat consists exclusively of caves and mines with specific temperature and humidity ranges (USFWS, 1999).

Table 3-20. Federal and State Listed Species and Species of Conservation Concern within the Howard Bend Study Area

Common Name	Scientific Name	Status*		Reported in Study Area	Status in Study Area*
		Federal	State		
Birds					
Bald eagle	<i>Haliaeetus leucocephalus</i>	T	E, S2	N (1)	I
American bittern	<i>Botaurus lentiginosus</i>		E, S1	Y (2)	I
Snowy egret	<i>Egretta thula thula</i>		E, S1	Y (3)	I
Northern harrier	<i>Circus cyaneus</i>		E, S1S2	Y (3)	I
King rail	<i>Rallus elegans</i>		E, S1	Y (3)	I
Peregrine falcon	<i>Falco peregrinus tundrius</i>		E, S1	Y (3)	I
Loggerhead shrike	<i>Lanius ludovicianus</i>		S1S2	Y (3)	I
Pied-billed grebe	<i>Podilymbus podiceps</i>		S2	Y (3)	I
Least bittern	<i>Ixobrychus exilis</i>		S2	Y (3,4)	O
Little blue heron	<i>Egretta caerulea</i>		S2	Y (3)	O
Black-crowned night heron	<i>Nycticorax hoactli</i>		S2	Y (3)	I
Sora rail	<i>Porzana carolina</i>		S2	Y (3)	O
Common gallinule	<i>Gallinula chloropus</i>		S2	Y (3)	I
Marsh wren	<i>Cistothorus palustris</i>		S2	Y (3)	O
Henslow's sparrow	<i>Ammodramus henslowii</i>		S2	Y (3)	I
Virginia rail	<i>Rallus limicola</i>		S2?	Y (3)	I
Great egret	<i>Ardea alba</i>		S3	Y (3)	O
Cooper's hawk	<i>Accipiter cooperii</i>		S3	Y (3)	I
Yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>		S3	Y (3)	I
Black tern	<i>Chlidonias niger</i>		SX	Y (3)	I
Interior least tern	<i>Sterna antillarum athalassus</i>	E	S1	N	Along Missouri River
Piping plover	<i>Charadrius melodus</i>	T	--	N	Along Missouri River
Mammals					
Indiana bat	<i>Myotis sodalis</i>	E	E	N (5)	†
Fishes					
Pallid sturgeon	<i>Scaphirhynchus albus</i>	E	E	N	Present in the Missouri River
Sicklefin chub	<i>Macrhybopsis meeki</i>		S3	N	
Sturgeon chub	<i>Macrhybopsis gelida</i>		S3	N	
Silver chub	<i>Macrhybopsis storeriana</i>		S3	N	
Plains minnow	<i>Hybognathus placitus</i>		S2	N	
Ghost shiner	<i>Notropis buechanani</i>		S2	N	
Plants					
Dwarf burhead	<i>Echinodorus tennellus</i>		S1	Y (2)	Present in CCLMP Lands
Yellow-flowered leafcup**	<i>Smallanthus uvedalius</i>		S4	Y (2)	
Large-seeded mercury‡	<i>Acalypha deamii</i>		SH	Y (2)	

* E – Endangered

S1 – Critically imperiled in the state

S1S2 – Rank of the species is between S1 and S2

S2 – Imperiled in the state

S3 – Rare and uncommon in the state

S4 – Rare and uncommon in the state

SH – Occurred historically in the state

SX – Element is believed extirpated from the state

? – Denotes inexact or uncertain ranks

Status in Study Area:

I – Infrequently observed

O – Occasionally observed

† Potential habitat along Missouri River and CCLMP.

** Last observed in 1881 (Smith, personal communication).

‡ Last observed in 1930 (Smith, personal communication).

Sources: (1) Dunstan and Lacrosse, 1989.

(2) MDC, 2002.

(3) St. Louis County Parks, 1999.

(4) St. Louis County Parks, 2002.

(5) Burns & McDonnell, 2000a.

A previous survey was conducted within the study area to assess the presence and quality of potential summer Indiana bat habitat. This survey was performed on a 275-acre parcel (the former Chesterfield Golf Course) that was proposed for use as a borrow site (Burns & McDonnell, 2000a). Potential habitat suitability was assessed by examining vegetative composition and structure within the area. As a result of this analysis, the site was determined to have a low suitability for roosting and foraging. No maternity roosting sites were observed (Burns & McDonnell, 2000a).

Suitable summer roosting and foraging habitat for the Indiana bat may, however, occur within the study area along the riparian corridors along the Missouri River, Fee Fee Creek, and Creve Coeur Lake. These riparian corridors also contain varying amounts of snags, cavities, and trees with exfoliating bark that may be used by Indiana bat as summer roost sites. There is no suitable winter habitat for Indiana bats within the study area.

Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagle is a Federally listed threatened species and is listed by the state of Missouri as an endangered species. Previous surveys in the study area were conducted in conjunction with the Page Avenue Extension project from November 19, 1988 through March 8, 1989 to evaluate winter use of the area by bald eagle (Dunstan, 1989). Two sightings of adult bald eagles occurred during the study. One bald eagle was observed foraging near Missouri RM 36.3 on December 20, 1998 (St. Louis County) and a second individual was observed flying over Green's Bottom and Catfish Island in St. Charles County on February 24, 1989. Suitable bald eagle habitat within the study area was determined to be sparse due to the lack of mature trees clumped or located in places likely to be used for foraging, eating, resting or night roosting.

An analysis of habitat within the vicinity of the Page Avenue Extension indicated that a minimum amount of adequate perch tree habitat was available for bald eagle foraging, eating, resting, and night roosting. No adequate abundant food sources in the form of fish or waterfowl were identified. However, areas that were determined to be suitable to bald eagle winter use (feeding, roosting, etc.) were the habitats in association with Creve Coeur Lake and along the Missouri River at Jane Downing Island (RM 33.5, see Figure 3-6). It is likely that other areas containing sufficient forested composition and suitable perching/roosting trees are also located along the Missouri River within the Howard Bend study area.

Pallid Sturgeon (*Scaphirhynchus albus*)

The pallid sturgeon is a Federally endangered species that inhabits the Missouri and Mississippi rivers. The pallid sturgeon is a benthic (bottom-dwelling) fish that prefers turbid, swift-flowing water of various depths. Earlier studies indicated that the pallid sturgeon does not have a restricted home range and may move long distances (USFWS, 1993). Side channels, wing dams, and other channel training structures provide important habitat diversity under conditions of normal and high river stage, including over-wintering and nursery areas for benthic invertebrates, and riverine fish species including the pallid sturgeon (Atwood, 2000; Pitlo, 1998; USACE, 1999; Dunn and Johnson, 2000; Jacobson and Laustrup, 2000). Dike systems contribute to habitat diversity because they are comprised of a mosaic of steep bank, sandbar, deep channel habitat types, and a variety of microhabitats (USACE, 1999). Both dike fields and side channels occur in the vicinity of Jane Downing Island (see Figure 3-6) and may be suitable to pallid sturgeon use.

Interior Least Tern (*Sterna antillarum*)

The interior least tern is a small bird listed by the USFWS as endangered. Formerly well distributed in the Mississippi basin, the interior tern has been eliminated from most stretches of

the Mississippi River and its tributaries. It nests on barren or sparsely vegetated alluvial islands or sandbars maintained by periodic inundation from large rivers. Little is known about the interior tern's specific food preferences, but small fish such as minnows constitute its prey. While there is no documentation of occurrence, there is potential for periodic occurrence of the interior least tern along exposed sand bars of the Missouri River or Creve Coeur Lake in the study area.

Piping Plover (*Charadrius melodus*)

The piping plover is a Federally endangered bird species in the Great Lakes Region, and is listed as Federally threatened elsewhere in the U.S. Breeding sites are generally found on islands, lake shores, coastal shorelines, and river margins, with preferred substrates including open sand, gravel, or cobble. Piping plovers winter in coastal areas where they spend the majority of their time foraging. Primary prey for wintering plovers includes polychaete marine worms, various crustaceans, insects, and occasionally bivalve mollusks. Foraging usually takes place on moist or wet sand, mud, or fine shell. Piping plovers are not known to occur in the study area, but there is a potential for the small birds to periodically use the shorelines (e.g., Missouri River, Creve Coeur Lake) within the study area.

American Bittern (*Botaurus lentiginosus*)

This bird species is listed by the state of Missouri as endangered and primarily inhabits wet prairies, and a variety of nonforested wetlands including marsh, fen, and swamp habitats. Additional habitats include remnant basins, sloughs, and unfarmed, temporary wetlands in the Missouri River floodplain (MDC, 2002). Emergent wetland vegetation including cattail, bulrush, sedge, and rush species are vital habitat components for the foraging and breeding requirements of this species. Foraging strategies consist of stalking, hovering over, and plunging into water for small fish and frogs. Additional prey items include small reptiles, mollusks, and insects. The American bittern is documented to occasionally occur west of Creve Coeur Lake within the study area.

Snowy Egret (*Egretta thula*)

The snowy egret inhabits marshes, swamps, and lowland forests vegetated with shrubs and dense emergent vegetation including buttonbush, willow, and bulrush. This state listed endangered species forages in shallow water by stalking aquatic insects, small fish, and amphibians. This species has been reported infrequently as foraging within the study area. Nesting frequently occurs in vegetation measuring a height of approximately 13 feet and 7 centimeters at diameter breast height (dbh).

Northern Harrier (*Circus cyaneus*)

The northern harrier is listed by the state of Missouri as endangered and is reported to nest and hunt in a variety of habitats including grassland, old field, cropland, prairie, and non-forested wetlands with dense herbaceous vegetation measuring about 10 inches high. In contrast to other birds of prey, this species perches and hunts low to the ground (10 to 30 feet high) for prey items including small mammals, birds, reptiles, and amphibians.

King Rail (*Rallus elegans*)

The king rail is listed by the state of Missouri as endangered that is reported to occasionally utilize the habitats of the study area. This species inhabits wetlands dominated by emergent vegetation, preferably associated with riverine floodplain systems. Nesting and feeding activities occur in stands of emergent vegetation including cattails, rushes, smartweed, sedges, burreed, and cutgrass. Prey items include terrestrial and aquatic insects, crustaceans, and fruits and seeds depending on seasonal availability. King rails may occur where muskrats have created pathways through dense emergent vegetation.

Peregrine Falcon (*Falco peregrinus*)

The peregrine falcon was de-listed by the USFWS in 1994, but remains listed as a state endangered species in Missouri. Perching and nesting sites include cliffs, ledges, buildings, and smokestacks. Small mammals and birds are hunted over open habitat types including woodland and grassland. This species is usually observed in areas of shorebird and waterfowl concentrations in Missouri during spring and fall migrations to prey on geese, ducks, and swans. Limestone outcroppings within the bluffs immediately east of the Howard Bend floodplain are in the form of cliffs and ledges in some areas that may be suitable for use by peregrine falcon. Individuals of this species have been occasionally observed in the vicinity of Little Creve Coeur Lake.

3.6.3.4 Species of Special Concern

Animals of Special Concern

A number of birds listed as species of special concern are known to occasionally occur within the study area (see Table 3-20). Many of these species are water-dependent species that have been observed in the vicinity of Little Creve Coeur Lake and other wetland habitats. For example, herons, egrets, rails, terns, grebes, yellow-headed blackbirds, and marsh wrens are water-dependent species that utilize wetland and shallow water habitats for feeding, cover, and nesting.

The following is a description of other animal species of special concern that have previously been observed to occur within the study area.

The loggerhead shrike inhabits open areas with scattered trees and shrubs. Preferred foraging habitat includes old field, crop field, and hayfield. Perching and nesting is provided by a patchy distribution of thorny trees and shrubs within foraging areas, or fencerows and hedgerows adjacent to foraging areas comprised of honey locust, Osage orange, eastern red cedar, and multiflora rose. Prey items include large insects (beetles, dragonflies, butterflies), small mammals, birds, and reptiles. This species has been observed at Little Creve Coeur Lake within the study area.

Henslow's sparrow is a S2 ranked species of special concern that occurs in grasslands, old fields and cropland dominated by herbaceous vegetation 1 to 2 feet tall. This species prefers cool season grasses and forbs such as tall fescue, orchard grass, clover, and sedges with dense litter coverage for nesting and foraging for insects and seeds. Although Henslow's sparrow prefers damp conditions, it may inhabit dry upland fields. This species has been documented within the study area at Little Creve Coeur Lake.

Cooper's hawk is associated with terrestrial habitats and usually inhabits pine and oak-hickory forests. Snags, stumps, and logs are used as perches for spotting prey. Cooper's hawk feeds on a variety of insects, small mammals, birds, and amphibians and reptiles as a juvenile. Adult food habits primarily include birds such as thrushes, starlings, sparrows, and others which are found at the edges of woodlands, fields, and grasslands. This species is state-ranked S3, and has been documented within the study area at Little Creve Coeur Lake.

Four fish species are listed as species of special concern and have been reported to occur within the vicinity of the study area. They include the sicklefin chub (S3), sturgeon chub (S3), silver chub (S3), plains minnow (S2), and ghost shiner (S2). These species do not occur within the interior of the study area. Rather, they are restricted to the Missouri River, and its tributaries and side channels, outside the Howard Bend Levee system.

Plants of Special Concern

Dwarf burhead is an emergent aquatic species that colonizes the receding, sandy or rocky shorelines of artificial and natural sinkhole ponds (Yatskievych, 1999). This species is reported to exist in only St. Louis, Howell, and Scott counties in Missouri and is considered critically imperiled in Missouri (S1). Dwarf burhead has recently been documented within the mitigation lands of CCLMP in 2000.

According to the USDA-NRCS Plants Database, yellow-flowered leaf cup is synonymous with *Polymnia uvedalia* var. *densipilis*. This species inhabits low woods, wooded valleys, alluvial and upland thickets, and the base of bluffs (Steyermark, 1963). The historic distribution of this species primarily included the southern one-third of Missouri, and counties located south of the Missouri River and bordering the Mississippi River. Yellow-flowered leaf cup was last observed in 1881 and was observed within the CCLMP lands (Smith, personal communication) but may no longer be extant in the study area.

Large-seeded mercury occurs in wet or dry woodlands with tree canopy openings, moist alluvial soils, and gravel bars along streams, and prairies. This species may also occur in fallow and cultivated fields, thickets, waste ground, roadsides, and along railroads (Steyermark, 1963). Extant sites are located in Greene, Pike, and St. Louis counties. Historical records of this species are from Clay, Jackson, Pulaski, and St. Louis (Valley Park and Pacific) counties (Tim Smith, MDC, personal communication). This species was historically reported from CCLMP in 1930 (Smith, personal communication) but may no longer be extant in the study area.

3.7 Wetlands

3.7.1 Mapping of Study Area Wetlands

The USACE and the USEPA jointly define wetlands as *“those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.”* The accurate mapping of the wetland resource of the Howard Bend study area entailed a varied approach that included the review and integration of existing data from a number of sources, agency file review, and field reconnaissance as described in the following narrative.

3.7.1.1 Review of Existing Mapping

Existing sources of mapping were used as a basis for the preliminary identification of study area wetlands. This review included the following:

- National Wetland Inventory (NWI) maps;
- U.S. Geological Survey (USGS) topographic mapping;
- FEMA Flood Insurance Rate Maps (FIRMs);
- 2001 black and white aerial photography;
- City of Maryland Heights 2-foot topographic mapping;
- NRCS current and historic hydric soil maps; and
- NRCS certified wetland maps.

NWI maps developed by the USFWS are available in a GIS data base and were used as an initial base map of the wetlands in the Howard Bend study area. The classification system used by the NWI (Cowardin et al., 1979) is based on vegetative type (i.e., emergent, scrub shrub, forested, unconsolidated bottom) and water regime. Wetlands identified by NWI are generally

considered as a useful planning tool but are generally recognized as being an inadequate predictor of wetland and waters of the United States that may be subject to USACE jurisdiction.

3.7.1.2 Previous USACE Jurisdictional Wetland Determinations

The results of all previous wetland delineations were reviewed and incorporated into the project base map. Numerous wetland delineations have been performed using USACE's 1987 Wetland Delineation Manual in support of both past and present projects within the area. Data from jurisdictional wetland determinations and permits issued since 1984 were obtained from the St. Louis District (in the form of previously prepared project reports and permit file data) and were integrated into the wetland base map. Information obtained from these records was used to identify jurisdictional wetland limits, previous wetland impacts, and mitigation requirements as summarized in Table 1-1 (see Section 1.0).

Projects for which existing documentation was available for incorporation into the wetland map included the following:

- Riverport development (USACE Regulatory Branch file data);
- Harrah's Casino Complex (USACE Regulatory Branch file data);
- Page Avenue Extension (TCT-St. Louis, Inc. 1991; Booker Associates, Inc., 1992; National Park Service 1995a, 1995b);
- Howard Bend 500+ Year Levee, (McKinney Associates and D.G. Purdy and Associates, 1994; Burns & McDonnell, Inc., 1999a, 1999b, 2000b, 2000c, 2001);
- MSD Howard Bend Plant Expansion (USACE Regulatory Branch file data);
- Missouri American Water Company expansion (USACE Regulatory Branch file data);
- Creve Coeur Mill Reliever Road (QST Environmental, 1998);
- Creve Coeur Airport Expansion (Crawford, Murphy & Tilly, Inc., 1996); and
- Sportport Development (USACE Regulatory Branch file data).

3.7.1.3 Incorporation of 15-Day Flood Elevation Data

The primary source of riverside wetland hydrology is flooding from the Missouri River. Consequently, hydrologic data from the USACE was utilized to plot the 15-day elevation of continuous inundation throughout the riverside portion of the study area. Hydrologic data demonstrated that the 15-day flood elevation followed a gradient (1-foot vertical drop per river mile) from Missouri RM 39 to 29. Two-foot contour mapping was used in conjunction with hydrologic data to identify wetlands riverside of the levee. These contours were further correlated to known elevations of delineated wetlands to aid in identifying riverside wetlands. These elevations were used as a guide and field checked in the vicinity of Jane Downing Island and the Missouri American Water Company areas (see Figure 3-6).

3.7.1.4 NRCS Certified Wetlands/NRCS Slide Review

In accordance with an interagency Memorandum of Agreement (dated January 6, 1994) between USEPA, USACE, United States Department of the Interior (USDOI), and USDA-NRCS, the NRCS has been given the authority to map wetlands in agricultural lands. Accordingly, wetlands in agricultural areas were incorporated from NRCS map data for certified farm tracts. Wetlands identified by NRCS are classified into one of the following categories: farmed wetland (FW), prior converted wetland (PC), non-wetland (NW), wooded wetland (WW) or non-inventoried (NI). Because NRCS does not certify wetlands unless requested by the landowner, not all agricultural lands within the study area contained an NRCS-certified wetland determination. Consequently, a slide review of a 10-year period was conducted using NRCS methodology to identify areas within farm tracts that showed a consistent indication of wetlands

as reflected by observable inundation and crop stress. Slide interpretation was performed by a project team consisting of representatives from the USACE, NRCS, and MACTEC.

3.7.1.5 Field Reconnaissance

Areas in non-agricultural lands and not covered by previous studies were examined in the field by MACTEC personnel. A reconnaissance level effort was employed using USACE's 1987 Wetland Delineation Manual. Areas where field determinations were performed include wetlands near Louiselle Creek, along lower Creve Coeur Creek, near the Missouri American Water Company plant, and riverside of the levee on Jane Downing Island.

3.7.2 Study Area Wetlands

As a result of the aforementioned mapping effort, a total of approximately 708 acres of wetlands have been identified within the Howard Bend study area (Table 3-21 and Figure 3-6).

Table 3-21. Wetlands within the Howard Bend Study Area

Wetland Type	Acres	Percent
Palustrine Forested (PFO)	461.3	65.2
Farmed Wetland (FW)	95.2	13.4
Palustrine Emergent (PEM)	57.3	8.1
Palustrine Emergent/Scrub Shrub Complex (PEM/PSS)	39.2	5.5
Palustrine Scrub Shrub (PSS)	27.8	3.9
Palustrine Scrub Shrub/Forested Complex (PSS/PFO)	24.0	3.4
PEM/PSS/PFO	3.2	0.5
Total	708.0	100

Forested wetlands (PFO1-palustrine forested broadleaved deciduous) comprise approximately 461 acres (65.2 percent) and are the most abundant wetland type within the study area. These wetlands are primarily associated with the following three areas:

- Floodplain of Creve Coeur Creek upstream of the Creve Coeur Lake;
- Areas adjacent to Louiselle Creek, and
- Low-lying forested areas on the riverside of the 500-year levee.

Dominant tree species associated with these wetlands include black willow (*Salix nigra*), cottonwood (*Populus deltoides*), sycamore (*Platanus occidentalis*), slippery elm (*Ulmus rubra*), green ash (*Fraxinus pennsylvanica*), and silver maple (*Acer saccharinum*).

Farmed wetlands (FW) are emergent wetlands that are subject to regular disturbance from cultivation. These wetlands are located in agricultural fields throughout the study area, and are often characterized by reduced water permanence, low species richness, and a predominance of weedy plant species. Typical plant species of these wetlands include amaranth (*Amaranthus* sp.), curly leaved dock (*Rumex crispus*), panic grass (*Panicum dichotomiflorum*), barnyard grass (*Echinochloa crus gali*), and foxtail (*Setaria glauca*). Approximately 95 acres of farmed wetlands (13.4 percent) were identified in the study area.

Emergent wetlands (PEM, palustrine emergent) account for approximately 57 acres and are the third most well represented type (8.1 percent). Emergent wetland communities are located in smaller isolated areas, and are composed variously of smartweeds, spikerushes, nutsedge, false nettle, cattail, and sedges. In some deep marsh areas [e.g., Little Creve Coeur Lake and near the Page Avenue sedimentation basin (see Figure 3-6)], bulrushes, arrowhead, and floating-leaved species such as American lotus are also present.

Lesser-well represented wetland types within the study area include scrub shrub wetlands (PSS, palustrine scrub shrub) and various emergent, scrub shrub, and forested wetland complexes. Scrub shrub wetlands account for approximately 3.9 percent of the wetland resource (27.8 acres), whereas other complexes account for a similar or lesser amount of wetlands within the study area. In general, scrub shrub wetlands and other complexes are most commonly found in the vicinity of upper Creve Coeur Creek (upstream of Creve Coeur Lake), in the vicinity of Little Creve Coeur Lake, and at scattered locations on the riverside of the 500-year levee. Dominant species within scrub shrub wetlands include buttonbush (*Cephalanthus occidentalis*), rose mallow (*Hibiscus laevis*), and various tree species (e.g., willows).

3.7.3 Functional Characterization

The following presents a general functional characterization of the wetlands within the study area. For the purposes of discussion, wetlands are grouped according to overall landscape position and dominant hydrology source. Accordingly, wetlands of the study area have been divided into the following groups:

- Creve Coeur Lake complex,
- Little Creve Coeur Lake wetlands,
- Missouri Riverfront wetlands,
- Stream Corridor wetlands, and
- Miscellaneous interior wetlands.

3.7.3.1 Creve Coeur Lake Wetland Complex

As is described in Section 3.8.1.2, Creve Coeur Lake is an oxbow of the Missouri River. This is a relatively large open water area (approximately 300 acres) that is classified by NWI as a lacustrine deep water habitat. Creve Coeur Lake, coupled with fringing wetlands along its shoreline and wetlands within the floodplain of Creve Coeur Creek upstream of Creve Coeur Lake, form an open water/wetland complex totaling approximately 424 acres. Channel flow from Creve Coeur Creek provides the primary source of water to the lake and this complex of wetlands. However, as discussed in Section 3.8, locally intense storm events can result in circumstances in which backwater from Fee Fee Creek flows upstream into Creve Coeur Lake via Creve Coeur Creek.

The associated vegetated wetlands consist predominantly of forested wetlands, but also include minor areas of scrub shrub and emergent wetlands. Typical species in the Creve Coeur Lake forested wetlands include willow, silver maple, green ash, cottonwoods, and box elder. Only small areas of emergent and scrub shrub wetlands have been mapped in the Lake area. The emergent wetland vegetation includes cattails, smartweed, nut sedge, false nettle, and various sedges. The scrub shrub wetland vegetation includes buttonbush, rose mallow, and various tree saplings.

The close juxtaposition of open water zones (Creve Coeur Lake and the Page Avenue sedimentation basin, the channel of Creve Coeur Creek) with various classes of vegetated wetlands (emergent, scrub shrub, and forested) results in a complex that performs a number of valuable wetland functions. Notable functions performed by these wetlands include wildlife function support (cover for nesting, feeding/foraging habitat, etc.), flood storage, and water quality improvement (as a result of nutrient retention/removal and erosion and sedimentation control). This area also provides important flood control (large water storage volume) as it receives and stores runoff from upland areas subsequent to storm events. In addition, due to its landscape position (within the bottomland at the base of an upland stream) it also performs

important nutrient retention and removal functions in conjunction with other water quality improvement (sediment reduction) functions. However, channelization of Creve Coeur Creek within the floodplain reduces the extent of flooding within these wetlands and therefore limits the overall wetland extent.

3.7.3.2 Little Creve Coeur Lake Wetlands

The term "Little Lake" refers to a 275-acre depressional area located west of Creve Coeur Lake. Like Creve Coeur Lake, Little Lake was once an oxbow of the Missouri River. Currently, the wetlands of the Little Lake area are limited to approximately 30 acres of emergent and scrub shrub communities located on the south side of Page Avenue Extension. The typical plants observed in the emergent areas consist of spike rush (*Eleocharis* sp.), smartweed (*Polygonum lapathifolium* and *pennsylvanicum*), cattail (*Typha angustifolia*), arrowhead (*Sagittaria* sp.), and sedges (*Cyperus* sp.). Scrub shrub communities include tree saplings such as silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), and cottonwood (*Populus deltoides*), as well as various sedges.

Historically wetlands of the Little Lake were supported by channel flow from Creve Coeur Creek coupled with runoff from overland flow/runoff from adjacent lands. However, sometime between 1930 and 1933, Creve Coeur Creek was diverted to entirely flow into Creve Coeur Lake. This diversion eliminated the dominant water supply to Little Lake and facilitated its conversion to farm land. However, due to its lower topographic position in the floodplain, Little Lake still collects storm water runoff from adjacent areas. As a closed depression, the only way water is removed from the area is through evaporation, transpiration, and the slow percolation to groundwater.

Little Lake provides both stormwater retention and water quality improvement functions. However, because it is located in a closed depression that has been isolated from channel flow from Creve Coeur Creek, these functions are somewhat limited. Cessation of agricultural uses within the Little Lake area is also increasing the area's wildlife support functions as more natural habitats are developed.

3.7.3.3 Missouri Riverfront

The Missouri Riverfront represents a predominantly undeveloped flood-prone area located outside of the 500+ year primary levee. The area is at its widest point in the vicinity of Jane Downing Island and narrows along the Missouri River both upstream and downstream (see Figure 3-6). Wetlands associated with the Missouri Riverfront consist of approximately 330 acres and are characterized as having a hydrology that is dependant upon periodic flooding from the Missouri River. Ponding of direct precipitation and/or local runoff may also be important in some of the wetlands in this area.

The dominant cover type within this area is deciduous forest that is interspersed by forested, emergent, and scrub shrub wetlands. Riverine wetlands are also represented in association with the Missouri River side channel in the vicinity of Jane Downing Island. Wetlands within this area are typically developed in Missouri River overflow channels and shallow depressions. Several areas have been established as a result of the creation of depressional areas (i.e., borrow pits). The typical plant species in the forested wetlands include willows, silver maple, cottonwood, box elder, and green ash. Characteristic species within scrub shrub wetlands include buttonbush, rose mallow and various tree saplings; dominant species within emergent wetlands include smartweed, nut sedge, and false nettle. Plant species which colonize the channels during the dry season include sedges (e.g., *Cyperus strigosus*), cocklebur (*Xanthium strumarium*), fog-fruit (*Phyla lanceolata*), and purple ammannia (*Ammannia coccinea*).

The Missouri Riverfront area consists of a mosaic of wetland types that provide functional value through flood attenuation and storage, groundwater discharge/recharge, seasonal/temporary fish and wildlife values (forage/cover/spawning), and sediment retention and nutrient removal. However, such functions as fish and wildlife habitat, and sediment retention and nutrient removal, are reduced for those wetlands that have been converted to agricultural use. Riverine wetlands associated with the side channel along Jane Downing Island also offer seasonal open water habitat and snags/dead wood that may provide important fish spawning/nursery habitat and wildlife functions.

3.7.3.4 Stream Corridor Wetlands

Several wetland areas are associated along the riparian corridors (i.e., streams) within the interior of the floodplain. These areas are primarily found along Louiselle Creek, Fee Fee Creek, and upper Creve Coeur Creek, north of Olive Boulevard. Forested and emergent wetlands are the dominant community types along Louiselle and Fee Fee creeks, whereas scrub shrub and forested wetlands are more prevalent along upper Creve Coeur Creek. In the case of Louiselle Creek and Fee Fee Creek, the streams have been channelized and are currently bordered by low flank levees. As a result, hydrology of these wetlands is primarily driven by the ponding of interior drainage behind flank levees, coupled with periodic overbank flooding.

The plant communities in these forested, scrub shrub, and emergent wetlands were similar to those found along the Missouri River (e.g., cottonwood, green ash, silver maple, smartweed, sedges, etc.) but also included a greater abundance of pin oak (*Quercus palustris*) and deciduous holly, and a reduced frequency of willows.

Wetlands associated with these interior stream systems provide varying degrees of wetland function depending on the nature and extent of representative plant communities and the opportunity for and degree of flooding. Existing flank levees along Fee Fee Creek and Louiselle Creek reduce the incidence of overbank flooding and therefore, reduce the flood storage function. In contrast, flank levees do retard drainage of the land behind the levees and therefore, provide some limited storage of locally ponded rainfall. Wildlife habitat is another important function performed by the wetlands as they provide valuable habitat and cover (concealment, nesting, foraging, etc.) and may also be corridors for faunal movement between the Missouri River and natural habitats within the uplands.

3.7.3.5 Miscellaneous Interior Wetlands

The remaining wetlands within the study area consist of relatively isolated wetlands associated with small channel scars and closed depressions. Hydrology of these wetlands is predominantly the result of stormwater runoff from adjacent land areas and results in a perched water table over relatively impervious soil.

In many cases these wetlands are of low quality, as they are often relatively small, isolated, and, in the case of farmed wetlands, impacted by cultivation. Consequently, these wetlands are not expected to exhibit high functional value for commonly recognized wetland functions such as flood storage, wildlife habitat, nutrient retention and removal, groundwater recharge/discharge, or erosion control.

3.8 Water Resources

3.8.1 Surface Water and Water Quality

Surface water resources of the study area consist of both flowing water systems (streams and rivers) and non-flowing systems (lakes and ponds). The surface water resources within the Howard Bend floodplain are discussed in the following subsections.

3.8.1.1 Streams and Rivers

Missouri River

The Missouri River forms the western boundary of the study area and is the dominant flowing water feature in the region. It is a dynamic riverine system that is characterized by the main channel, main channel border areas, and side channels (e.g., those in the vicinity of Jane Downing Island, Figure 3-7) that are connected to the main river under high flow conditions. The Missouri River is the longest river in the United States (2,714 miles) with a watershed of approximately 580,000 square miles (Collier's Encyclopedia, 1969). The Missouri River meanders along the western edge of the Howard Bend study area from RM 29.6 to 38.4, a distance of 8.8 miles. This portion of the Missouri River near St. Louis is referred to as the lower Missouri River. It is characterized as a large river and is used variably for recreation, municipal water supply (e.g., Missouri American Water Company), navigation, commercial sand dredging, and commercial fishing.

The dominant physical features in the study area are the Missouri River bottomlands and the adjacent rolling hills. Because the Missouri River is a navigable river, activities that would entail construction in, over and under the river are regulated by Section 10 of the Rivers and Harbors Act of 1899. Additionally, such activities are also regulated under Section 401 of the CWA by the MDNR and under Section 404 of the CWA by the USACE. For all other surface water resources within the floodplain, activities impacting the waters below ordinary high water are only regulated by Sections 401 and 404 of the CWA.

The Missouri River is a turbid river characterized by a strong current, a shifting sand bottom, and rapidly fluctuating water levels. Past channelization of the river for navigation and flood control purposes has resulted in changes that have reduced its overall quality and productivity as a riverine ecosystem. The Missouri Water Quality Standards designate the Missouri River in the study area for the following uses: Irrigation (IRR), Livestock and Wildlife Watering (LWW), Protection of Warm Water Aquatic Life and Human Health – Fish Consumption (AQL), Boating and Canoeing (BTG), Drinking Water Supply (DWS), and Industrial (IND) (MDNR, 10 CSR 20-7, Stream Classifications and Use Designation).

Interior Creeks

Streams dissecting the hills adjacent to the Missouri River are generally high-gradient streams with steep, eroded banks. They are subject to extreme flow variation, with many being intermittent in flow. Those streams flowing through the bottomlands and the topographically gentler uplands are more meandering, are of lower gradient, and have broad streambeds with heavy bed-loads. These variations in morphometry, flow, and associated bed-load movement are the primary characteristics determining the existing water quality of the streams.

Bonhomme, Creve Coeur, Fee Fee and Louiselle creeks are the perennial creeks within the study area. Bonhomme Creek forms the southwestern edge of the study area and carries water from the Chesterfield Valley bluffs to the Missouri River. Creve Coeur Creek and Fee Fee Creek

are the two major upland watersheds that carry water into and through the Howard Bend floodplain to the Missouri River.

Creve Coeur Creek has a watershed area of approximately 15,000 acres and drains the predominantly developed uplands located southeast of the study area. Upper Creve Coeur Creek enters the study area as it crosses Olive Boulevard and is characterized by a meandering channel that is bordered by a relatively well established riparian zone. Within the floodplain, upper Creve Coeur Creek becomes a channelized stream as it conveys drainage from the uplands to the MoDOT sedimentation basin and ultimately to Creve Coeur Lake. Lower Creve Coeur Creek is formed by the outlet of Creve Coeur Lake. From this location it is generally flanked by a low levee system and has a deeply incised channel. Banks have been stabilized by riprap in some locations. In the vicinity of the MSD plant, Creve Coeur Creek is joined by Fee Fee Creek and flows approximately 3,000 feet before discharging to the Missouri River through a closure structure constructed in approximately 1963. When river stage is elevated, the structure is closed causing water within the creek system to back up within the interior of the floodplain. The Missouri Water Quality Standards (MWQS) designates the following uses for Creve Coeur Creek: LWW and AQL (MDNR, 10 CSR 20-7, Stream Classification and Use Designation).

Fee Fee Creek is a perennial stream located in the northern portion of the study area and has a total watershed area of approximately 9,350 acres. Like Creve Coeur Creek, Fee Fee Creek has a channel that is meandering within the dissected uplands but has been channelized within the study area. Prior to the development of I-70, the natural channels of Creve Coeur and Fee Fee creeks flowed north and discharged to the Missouri River in the area that is currently the Earth City development. Concurrent with the time at which I-70 was constructed, Fee Fee and Creve Coeur creeks were rerouted and channelized to discharge to the river at its current location. Low flank levees along its length within the floodplain provide temporary storage and conveyance of surface water during smaller (approximately 20-year frequency) storm events. In contrast to that of lower Creve Coeur Creek, the gradient of Fee Fee Creek within the uplands is very steep, resulting in a rapid delivery of runoff in response to localized storm events. At times when the river stage is elevated (resulting in the blockage of the outlet of lower Creve Coeur Creek), this rapid runoff from the Fee Fee Creek watershed results in an unusual flow pattern in which stormwater from Fee Fee Creek flows upstream within lower Creve Coeur Creek and subsequently, into Creve Coeur Lake. The MWQS designates the following uses for Fee Fee Creek: LWW and AQL (MDNR, 10 CSR 20-7, Stream Classification and Use Designation).

Louiselle Creek is a tributary of Fee Fee Creek that enters the floodplain from a watershed south of Fee Fee Creek. Like Creve Coeur and Fee Fee creeks, Louiselle Creek is a low quality channelized stream that is flanked by a low levee system. Overbank flooding occurs in response to intense localized storm events.

3.8.1.2 Lakes and Ponds

Creve Coeur Lake

Creve Coeur Lake (see Figure 3-7), located in CCLMP, is considered to be the “jewel” of the St. Louis County Parks and Recreation Department. The 300-acre lake located within the 2,242-acre park is administered by the St. Louis County Parks and Recreation Department. Historically, Creve Coeur Lake has been used for recreation, and in the late 1880s it was the site of the St. Louis County Fair. The lake is currently used recreationally for fishing, sail boating, and row boating (except by permit by the County parks system, no gasoline engines are allowed). Fish commonly harvested within allowable limits include largemouth bass, catfish, sunfish, and crappie. No swimming is allowed.

Creve Coeur Lake is a natural oxbow lake that was formed when the Missouri River's course was diverted. Through the years, the lake has trapped sediment eroded from the upper Creve Coeur Creek watershed and has required dredging. In the late 1970s several million cubic meters of accumulated sediment were dredged from the lake. Since that time, a large delta has formed at the south end of the lake. The lake is scheduled to be dredged again in 2004. Water depths currently average approximately 5 feet in areas that have a high amount of silt accumulation, but normally range from 5 to 10 feet. Recently excavated siltation basins on the upstream side of Creve Coeur Lake were created by MoDOT to intercept and trap sediment within Creve Coeur Creek prior to its deposition within Creve Coeur Lake. These siltation basins, totaling 64 acres, are designed to protect Creve Coeur Lake from future siltation thereby resulting in less frequent dredging.

The lake is also important in storing storm water. Approximately 2,340 acre-feet of storage is provided within the lake from elevation 442.2 (normal pool elevation) to elevation 450.0 msl (stage at which point Marine Avenue is inundated although several points along the road flood at lower elevations).

Creve Coeur Lake is designated for the following uses: LWW, AQL, and BTG (MDNR, 10 CSR 20-7, Stream Classification and Use Designation). The lake and creek south of Creve Coeur Lake are designated Metropolitan No-Discharge Streams. This means that *"no water contaminant except uncontaminated cooling water, permitted storm water discharges in compliance with permit conditions, and excess wet-weather bypass discharges not interfering with beneficial uses, shall be discharged to streams."*

Due to chlordane contamination, the Department of Health (DOH) issued an advisory for consuming fish from Creve Coeur Lake in 1985. The criteria for removing the advisory require that concentrations within sampled fish tissue be below the action level for two consecutive sample years. Based upon results of samples taken from carp in 1998 and 2000, the amount of chlordane was below the Federal Drug Administration (FDA)'s action level of 0.3 milligrams per kilogram (mg/kg or ppm) and the advisory was subsequently lifted from Creve Coeur Lake in 2001. Creve Coeur Lake was included on the 1998 list of waters designated under sections 303(d) of the Federal CWA due to chlordane contamination. The MDNR has proposed that Creve Coeur Lake be de-listed in the most recent 303(d) list which was submitted to the USEPA and has not yet been approved or finalized.

An analysis of sediment samples from Creve Coeur Lake was conducted in March 2000. Contaminants tested were pesticides/polychlorinated biphenyls (PCBs) and heavy metals with an emphasis on chlordane and mercury. Results indicated that there are no contaminants in the sediment over background levels. Further testing and disposal of dredge material will be in accordance with MDNR requirements and will be at the sites identified in Section 2.0.

Siltation Basin

The 64-acre siltation basin was excavated by MoDOT as part of the Page Avenue Extension mitigation to alleviate the chronic siltation problem of Creve Coeur Lake. The siltation basin is located on mitigation land that has been incorporated in CCLMP. Flow from Creve Coeur Creek passes through the sedimentation basin prior to its discharge to Creve Coeur Lake. The Parks Department owns and maintains the siltation basin. The siltation basin is designed to trap an average of two-thirds of the sediment that would otherwise be deposited in Creve Coeur Lake. This will, therefore, increase the life span of Creve Coeur Lake and keep it functioning as a recreation lake. The basin was constructed with a varying depth of 5 to 20 feet and will require dredging at 10-year intervals as it becomes filled with sediment.

Aquatic ecological communities within the siltation basin are likely to be similar to that of Creve Coeur Lake due to its open water connection to the lake and to Creve Coeur Creek. Likely fish species within the basin include largemouth bass, catfish, crappie, and sunfish.

Crystal Springs Quarry Golf Course Lakes

The Crystal Springs Quarry 9-hole golf course was constructed in 1996 and later expanded to 18 holes in 1999. The lakes were created to serve a dual function as water hazards for the golfer and to provide storm water retention. The lakes also receive localized runoff from the golf course and may, therefore, function as a water quality sink in capturing excess nutrients contained in golf course fertilizers and herbicides.

HBLD Borrow Areas

To obtain the necessary borrow material for the construction of the 500-year levee, the HBLD excavated several areas within the study area that have subsequently filled with water. These ponded areas include an 18-acre area located inside the levee system in the vicinity of the Missouri American Water Company plant (the Reising borrow site) and a 14-acre open water area associated with the Stolte borrow site (see Figure 3-7). Other open water areas are associated with the 60-acre area old golf course borrow site and the 60-acre Moore borrow site. With the exception of the Reising borrow site, each of these open water areas are located on the outside of the 500-year levee system and are, therefore, subject to periodic flooding by the Missouri River.

Adjacent lands around several of these ponds are actively cultivated. Extensive shallow areas are exposed under low water conditions along the shoreline of these waterbodies, resulting in the formation of mud flats that are used by shorebirds and many other migratory species. Fish communities of these surface water resources are believed to be relatively poor as they are recently formed. However, the pond on the Reising borrow site has been stocked and has shown evidence of fish communities.

3.8.2 Groundwater Resources

The groundwater resources within the study area can be divided into the (1) alluvial aquifer and (2) bedrock aquifer(s).

3.8.2.1 Alluvial Aquifer

The Missouri River alluvium within the study area forms an important and widely used water source (aquifer). Typically water well yields are higher in the deeper (greater than 50 feet) sand and gravel sediments. Groundwater levels in the alluvial aquifer typically range from 5 to 20 feet below the ground surface. As a result of the coarse alluvial sediments within the floodplain, the alluvial aquifer is directly interconnected with the Missouri River in some areas. Consequently, groundwater levels often rise and fall over a period of several days in response to the fluctuation of river stage. In contrast, there is typically a lower response of the alluvial aquifer to local rainfall events, as compared to the bedrock aquifers. During periods of flooding, the groundwater surface elevation can be high enough to allow alluvial wells to flow at the surface. When the Missouri River is under normal flow conditions, groundwater typically flows towards the river and in a generally downstream direction.

The Missouri River alluvium receives water recharge from several sources: infiltration from the Missouri River, direct precipitation, recharge from bedrock aquifers adjacent to the alluvium, and infiltration of stream or lake water.

The groundwater elevation is usually higher in the bedrock aquifers adjacent to the alluvial aquifer. Therefore, there is groundwater flow and recharge from the bedrock aquifers to the alluvial aquifer. The water recharge from streams and lakes depends, in part, on the nature of the sediments in proximity to these sources. In sandy, permeable soils the recharge is significant. In contrast, the recharge is less in clay soils with low permeability,

As stated above, the grain size of the alluvial sediments typically increase with depth, with finer grained materials directly near the surface, and sands/gravels at greater depth. Because these sediments were deposited over time by the meandering Missouri River channel (and associated side channels), there is no definitive sequence of deposition at any particular area. As a result, the recharge characteristics of the alluvium can vary significantly across the study area. In areas with a clay/silt cap, the alluvial aquifer may be under confined conditions, and in sandy areas the aquifer would be under unconfined (water table) conditions.

The Missouri River alluvial aquifer is used for potable water (in some areas), irrigation, and industrial uses. Both the City of St. Louis and St. Louis County withdraw surface water from the Missouri River to treat, store, and distribute to their customers. The City of St. Charles uses this aquifer as a potable water source; however, its well field is located in the alluvium on the west side of the Missouri River (outside of the study area).

In general, the alluvial aquifer water quality can be described as a moderately mineralized calcium (Ca)-magnesium (Mg)-bicarbonate type. The hardness (Ca, Mg, etc.) is typically high [300 to 500 milligrams per liter (mg/L)] and the total dissolved solids (TDS) typically range from 450 to 750 mg/L (Miller and Vandike, 1997). The iron (0.29 to 5.1 mg/L) and manganese (0.05 to 4.4 mg/L) levels generally exceed public drinking water standards (Miller and Vandike, 1997), and sulfate levels may be high (Miller et al., 1974). Minimum and maximum ranges for a variety of water quality parameters (nitrate, hardness, iron, pH, etc.) for the Missouri River alluvium are reported in Miller et al. (1974). Groundwater from the alluvial aquifer usually requires extensive treatment before it can be used to supply a public water system.

3.8.2.2 Bedrock Aquifers

Several of the groundwater wells in proximity to the study area produce from bedrock below the alluvial aquifer. These wells are completed in the following Mississippian Age formations: Ste. Genevieve Formation, St. Louis Limestone, Salem Formation, and Warsaw Formation. These formations consist predominantly of limestone. Typically, yields from these aquifers are significantly lower than the alluvial aquifer. Typical yields are in the 5 to 50 gpm range, but higher yields are reported locally (Miller and Vandike, 1997). Most bedrock wells are constructed with several aquifers open to the well, therefore, it is not feasible to determine yields or water quality from specific formations. The Ste. Genevieve, St. Louis, Salem, and Warsaw formations are included in what is called Group 1 aquifers (Miller et al., 1974). Groundwater from these formations varies from calcium-magnesium-bicarbonate type to a sodium-bicarbonate or a sodium-chloride type. The dissolved solids content ranges from 246 to 6,880 mg/L. The water is generally low in iron and very hard (Miller et al., 1974). The high levels of sulfate and dissolved solids may be due to the overlying Pennsylvanian age shales, sandstones, and siltstones.

3.8.2.3 Howard Bend Water Wells

A search for groundwater wells within (and in proximity to the study area) was conducted by contacting the MDNR Well Head Protection Department (Rolla, Missouri). The results provided by MDNR indicated several bedrock and alluvial wells within or in proximity to the study area. However, most of the wells had poor location information and could not be precisely located

within the study area. The latitude and longitude was available for eight groundwater wells in the vicinity of the study area, but only two of the wells are located within the study area boundary:

- Creve Coeur Airport Well, with a total depth of 42 feet; and
- Hale Irwin Golf Learning Center Well, with a total depth of 65 feet.

These wells are screened in the alluvial aquifer and are likely just used as non-potable water (watering lawn, etc.).

Several of the wells located just outside of the study area boundary, however, are screened in the bedrock aquifers (i.e., Salisbury Well, Henry Cook Well, and the Kellman and Sons Dairy Well, etc.). These wells are open to several bedrock formations (e.g., St. Louis and Salem Formations).

3.8.3 Floodplains

Flooding by the Missouri River has historically been a recurring characteristic of the Howard Bend floodplain. Recent major flood events resulted in flooding across the area to a depth of more than 10 feet in 1993 and approximately 2 feet in 1995. In response to a 1986 flood event, the HBLD was organized in 1987 as the successor to the Howard Bend Levee Association to reduce the risk of future flood loss and minimize the impact of floods on human safety, health and welfare. In 1997 the HBLD began work to raise the existing levee to a height that would provide 500-year flood protection. The completion of this work in 2004 will provide substantial protection of the study area from flooding by the Missouri River and has also resulted in a re-mapping of the 100-year floodplain. Figure 3-8 identifies 100-year floodplains within the study area as reflected by a CLOMR issued by the FEMA. The term "Conditional" reflects the incomplete status of several on-going projects within the study area. Subsequent to the completion of the Missouri River levee improvements currently under construction, the finalized Letter of Map Revision will be issued. For this EIS, the base condition identifies all these projects as essentially complete and therefore the 100-year floodplain is that as represented by the CLOMR in Figure 3-8.

As is evident in Figure 3-8, large land areas within the study area have been removed from the floodplain. However, the areas within the vicinity of Little Creve Coeur Lake, Fee Fee Creek, Louiselle Creek and lower Creve Coeur Creek retain their designation as 100-year floodplain due to localized flooding from these interior stream systems.

Creve Coeur Creek and Fee Fee Creek are the primary watersheds of the floodplain that drain largely urbanized areas. Watershed areas of Creve Coeur Creek and Fee Fee Creek are approximately 15,000 acres and 9,350 acres, respectively. Low flank levees along each of these creeks provide protection from an approximate 10- to 20-year flood frequency. In response to significant storm events, the increased storm water volumes exceed the storage capacity of the creeks and Creve Coeur Lake, resulting in localized flooding as is indicated in Figure 3-8. Roadways that are flooded under such conditions include all or a portion of River Valley Drive, Prichard Farm Road, Marine Avenue, and Creve Coeur Mill Road. This also results in a reduction or loss of access to and/or use of CCLMP, the MSD Missouri River Wastewater Treatment Plant, Sportport, and Creve Coeur Airport. Agricultural, transportation, and recreational uses are also restricted.

The Cities of Maryland Heights and Chesterfield are approved to administer the Federal flood insurance program per FEMA. As such, both municipalities have ordinances in place under which to review and administer any proposed development within the regulatory floodplain as defined by FEMA Flood Insurance Rate Maps. Specifically, floodplain permits and flood studies are required for any changes via the removal or filling of earth within the designated floodplain.

Development within the floodplain must demonstrate a no “net rise” to the stream or river floodway conveyance area, if applicable. All habitable structures must demonstrate a minimum 1-foot free board or elevation to their finished elevation above the 100-year flood levels.

3.9 Agricultural Resources

3.9.1 Agricultural Characteristics

According to the Missouri Agriculture Statistics Service (MASS), approximately 65 percent of the land in Missouri is used for agricultural purposes (MASS, 1997). The average farm size in Missouri is 275 acres. Dominant crops in Missouri are soybeans and corn (MASS, 2000).

Detailed agricultural statistics are not readily available for the study area but are available for both St. Louis County and the State of Missouri (Table 3-22). Both St. Louis County and statewide statistics demonstrate a declining trend in the number of farms, and in the case of St. Louis County, the total number of acres of cropland harvested. This clearly reflects the effects of expanding residential and commercial development within the region. Trends within both the county and the state reflect a general consolidation of farm operations into somewhat fewer but larger units. Economic value of the agricultural products and the value of farm land within the county and the state have generally increased in recent decades in parallel to general inflationary trends.

Table 3-22. 1997 Agricultural Statistics

Statistic	St. Louis County [*]		Missouri [†]	
	Number	Historical Trend (since 1970)	Number	Historical Trend (since 1970)
Number of Farms	291	Declining	109,000	Declining
Average Farm Size (acres)	155	Increasing	275	Increasing
Total Harvested Cropland (in 1,000 acres)	22	Declining	28,826	Stable
Percent Agricultural Lands	12	Not available	68	Not available
Market Value of Agricultural Products Sold (\$ in millions)	21.3	Increasing	5,367.8	Increasing
Value of Land and Buildings per Acre (\$/acre)	2,789	Increasing	1,069	Increasing
Prime Farmland (acres)	50,190	Not available	14,310,200	Not available

* MASS, 1997.

† MASS, 2000.

Agriculture represents the predominant land use within the study area (see Section 3.1.3). In total, approximately 3,907 acres of land are used for agriculture and includes cultivated fields used for the production of common crops such as corn and soybeans, specialty crops (cabbage, pumpkins, and squash), and growing fields for landscape nursery products.

3.9.2 Prime Farmland

The USDA defines prime farmland as soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is available for these uses. In 1997, Missouri had a total of 14,310,200 acres of prime farmland within the state (National Resource Inventory, revised 2000).

Prime farmland within the study area was quantified using soil types and slopes specified as prime by the USDA NRCS. Prime farmland occurred within cropland, forested areas, old field, and pasture. Total prime farmland within the study area is estimated to be 3,303 acres. State and county information is summarized in Table 3-22.

3.10 Special Waste

3.10.1 Potential Site Identification

The USEPA and state databases on environmental problem sites and activities were consulted to identify potential sites.

Two operating automobile salvage yards were identified on Creve Coeur Mill Road: Smith Brothers Auto Sales and Salvage at 2079 Creve Coeur Mill Road; and West Continental Auto Parts and Salvage Company at 2050 Creve Coeur Mill Road. Although these sites were not listed on any databases, the activities and waste disposal practices on-site could impact the study area.

In order to assess the current environmental conditions within the Howard Bend study area, a third party database search was conducted for the study area by EDR, Inc. (formerly Environmental Data Resources). In addition, a drive-by survey was conducted to verify the location and identification of the sites identified within the database report and to identify any sites which are not found within the databases searched. The databases searched conform to the American Society for Testing and Materials (ASTM) Standard E 1527-00. However, it is likely that complete Phase I Environmental Assessments will be conducted by any prospective property buyer or developer. Table 3-23 summarizes the facilities that were identified as a result of the database search and the drive-by survey.

3.10.2 Potentially Contaminated Sites

As a result of the database search and subsequent field reconnaissance, several sites were identified that represent an on-going concern. These sites are described below and vary from those which are currently undergoing remedial action to those that remain suspect and warrant further investigation.

3.10.2.1 Howard Bend Water Treatment Plant

The City of St. Louis Water Department owns and operates this facility. A total of three underground storage tanks (USTs) were removed from this site. One of the USTs had leaked and is shown as being an active remediation site although the site cleanup began in 1993. Based on the database report, only soil was impacted.

3.10.2.2 Arrowhead Airport

Arrowhead Airport is a small decommissioned airport which has not been in operation since the flood of 1993. There are currently three storage buildings, one office area/repair building, and

one repair shed at this site. In addition, it appears that there are two USTs near the south end of the facility near the storage building and one UST at the northwest corner of the site adjacent to the office/repair structure. None of these USTs appear on the MDNR UST or leaking UST (LUST) databases.

Table 3-23. Results of Database Search and Drive-By Survey to Identify Potential Sites of Environmental Contamination Located within the Howard Bend Study Area

Site Identification	Site Location	Federal/State Program List*	Comments
Howard Bend Water Treatment Plant	14765-14769 Olive Boulevard	RCRIS-SQG UST LUST	Owned by City of St. Louis, listed as having had three USTs removed, one of which had leaked and impacted soils; currently in remediation phase.
Missouri-American Water Company (St. Louis County)	901 Hog Hollow	UST/LUST	LUST was removed in 1990, granted closure by MDNR. Two 10,000-gallon USTs (diesel) are still in use at the site.
Breezy Point Stable	Southwest corner of study area	CERC/NFRAP	Investigated for dioxin; none found.
CCLMP, St. Louis County Parks Department	Marine Avenue at Creve Coeur Mill Road	RCRA-SQG UST	St. Louis County Parks Department formerly had a small shed on-site for maintenance and storage. The shed was flooded but was not rebuilt; UST was subsequently removed.
Creve Coeur Airport	3127 Creve Coeur Mill Road	UST	The USTs at the airport have been removed. Fueling is now from secondarily contained ASTs.
MSD Missouri River Treatment Plant	3455 Creve Coeur Mill Road	AIRS PCS UST LUST AST	MSD has had two USTs removed and currently stores used oil in a UST which meets the 1998 USEPA requirements. MSD also utilizes an AST for the storage of gasoline. A previously discovered LUST has been removed and remediated. Closure was completed in June 1994.
MSD-Creve Coeur Mill Road Pump Station	2150 Creve Coeur Mill Road	UST	Pump station equipped with an emergency generator supplied by a 4,000-gallon diesel fuel UST.
Mobil Mart	13553 Riverport Road	UST	This Mobil station is an active station which lists three USTs in service. The tanks meet the USEPA tank regulations of 1998 for leak detection and overfill protection.
Sverdrup Investments	13736 Riverport Road	UST	550-gallon diesel tank.
Arrowhead Airport†	850 Hog Hollow Road	UST	At least three unregistered USTs are present at this site. Airport has not been in operation since 1993.
Southard Construction†	2133 Creve Coeur Mill Road	RCRA-SQG	Repair/storage yard for asphalt paving equipment.
West Continental Auto Parts and Salvage†	2050 Creve Coeur Mill Road	RCRA	Auto salvage yard containing typical metals, petroleum hydrocarbons, and antifreeze.
Former Smith Brothers Salvage Yard†	2079 Creve Coeur Mill Road	RCRA	Currently undergoing remediation and awaiting closure. Auto salvage yard containing typical metals, PAHs, petroleum hydrocarbons, and antifreeze.

* Notes:

- AIRS – Aerometric Information Retrieval System
- AST – aboveground storage tank
- CERCLIS – Comprehensive Environmental Response, Compensation, and Liability Information System
- CERC/NFRAP – CERCLIS No Further Remedial Action Planned
- FTTS – FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act) Tracking System
- LUST – Leaking Underground Storage Tank
- MDNR – Missouri Department of Natural Resources
- PAHs – polynuclear aromatic hydrocarbons
- PCS – Permit Compliance System
- RCRIS-SQG – Resource Conservation and Recovery Index System-Small Quantity Generator
- UST – underground storage tank

† These sites were not listed on the databases consulted but were identified by MACTEC as a result of drive-by survey. The Federal/State Program List classification represents the category this site would fall under.

3.10.2.3 Southard Construction, Inc.

Southard Construction does not appear on any of the databases searched under the ASTM standard for Phase I Environmental Assessments. However, the facility is utilized for the storage and repair of asphalt paving equipment and dump trucks and probably qualifies for listing as a Resource Conservation and Recovery Act (RCRA)-Small Quantity Generator (SQG) or a conditionally exempt SQG.

3.10.2.4 West Continental Auto Parts and Salvage

West Continental Auto Salvage yard is not registered in any of the ASTM databases. Based on a casual observation of the property from the entrance and on past experience with salvage yards, probable soil contaminants include metals; polynuclear aromatic hydrocarbons (PAHs); petroleum hydrocarbons (gasoline, motor oil, diesel fuel); and antifreeze. In addition, it is possible that groundwater has been impacted due to careless handling of motor oil, gasoline, and antifreeze. The presence of waste tires is also probable. Until further investigations are completed, the extent of any impacts to soil and groundwater cannot be determined.

3.10.2.5 Former Smith Brothers Salvage Yard

This former salvage yard was purchased as right of way for the new MHE. In order to achieve closure of the site due to impacts from past practices, approximately 3,000 cubic yards of soil have been removed, a 3-foot soil cap has been installed over a portion of the site, and a deed restriction has been placed on the property limiting future use. The contaminants that were above cleanup levels included benzo-a-pyrene, petroleum hydrocarbons, and minor amounts of PCBs and mercury.

3.10.2.6 Fred Weber Sanitary Landfill, Fred Weber North Quarry, and Fred Weber Service Facility

This site is not located within the study area but is located within the surrounding area and has the potential to impact groundwater in the study area. These three facilities are co-located at 2320 Creve Coeur Mill Road approximately 0.25-mile east of the intersection of Prichard Farm Road and Creve Coeur Mill Road. The sanitary landfill was permitted in 1993 and occupies approximately 70 acres. The north quarry is a registered LUST and UST facility with no active tanks listed on the MDNR database. The service facility is a registered UST site. Four tanks have been removed from the facility.

3.11 Visual Resources

The Howard Bend floodplain study area is located in its entirety within the Missouri River floodplain. This floodplain area can be generally characterized as relatively flat with little topographic relief, bounded by upland tree-lined bluffs or the large natural tree stands abutting the Missouri River.

With the exception of developed areas, many views are expansive across existing or previously existing agricultural fields delineated by tree lines that define creek systems, the CCLMP, or the forested areas abutting the bluffs and Missouri River.

For purposes of defining the visual character of the study area, the Howard Bend floodplain has been divided into distinct visual units or viewsheds. These units are generally unique in their visual character or visually contained by treelines or roadways. Figure 3-9 delineates the

various visual units as described for this analysis. The visual units can be characterized as follows:

- Riverport/Harrah's Casino complex development area including Earth City Expressway;
- Creve Coeur Airport/MSD Area;
- Creve Coeur Mill Road/MHE;
- Creve Coeur Lake Area;
- River Valley/Page Avenue Mitigation Lands Area;
- Upper Creve Coeur Creek Valley Area;
- Bonhomme Creek Area; and
- Missouri River Viewshed.

Table 3-24 provides a summary of each existing viewshed's major visual features.

Table 3-24. Visual Unit Summary

Viewshed/Visual Unit	General Visual Characteristics and Features
Riverport/Harrah's Casino Complex	Significantly developed with 1- to 12-story buildings; includes Riverport development, Harrah's Casino complex, and eight-lane Earth City Expressway.
Creve Coeur Airport/MSD Plant Area	Open and expansive areas of agriculture and airport; MSD plant lagoons and Creve Coeur Creek form northern limits; levee and new Missouri River Bridge visible to west; Page Avenue Extension forms southern limit; Sportport lighting very visible.
Creve Coeur Mill Road/MHE (North of Page)	Generally defined as long and narrow; sparse development of small one-story structures associated with businesses to north; includes Creve Coeur Mill Road and newly constructed MHE and associated bridges; southern limit at Page Avenue Extension.
Creve Coeur Lake Area (CCLMP)	Open expanses of water, very contained by tree masses on all sides; includes roadways, parking, trails, and golf course; portion of elevated Page Avenue Extension visible to south.
River Valley Drive/Page Avenue Mitigation Lands	Large open expanses of agricultural land; elevated Page Avenue Extension highly visible to north; includes Missouri American Water Company.
Upper Creve Coeur Creek Valley	Narrow corridor along Creve Coeur Creek and Creve Coeur Mill Road; defined by numerous residential and several small commercial structures.
Bonhomme Creek Area	Open agricultural fields; tree masses of Bonhomme Creek; Missouri River and upland bluffs define visual limits north, south, and west; City of St. Louis Water Treatment Plant defines eastern visual limits.
Missouri River Viewshed/Visual Corridor	Channel of Missouri River visible; major visual features include new Page Avenue Bridge and Blanchette Memorial Bridge over Missouri River. Large natural stands of trees dominate the landscape.

3.11.1 Riverport/Harrah's Casino Complex

The Riverport/Harrah's Casino complex visual unit is characterized by 1- to 12-story buildings with associated roadways, parking, and commercial landscapes. The eastern portion of this area is a six-lane expressway and visually terminates with a large earthen berm that buffers existing landfill and quarry operations. The northern boundary of this viewshed is characterized by an elevated freeway (I-70). The western limits are defined by forested undeveloped lands adjacent to Riverport and Harrah's at the Missouri River.



View of Riverport development from south.



View of Harrah's Casino complex from east.



Riverport development from Earth City Expressway at Prichard Farm Road and Casino Drive.

3.11.2 Creve Coeur Airport/MSD Drive

This viewshed is characterized by expansive views of the Creve Coeur Airport and agricultural fields. Smaller structures associated with the airport and/or local farms are visible. The northern boundary of the viewshed contains the MSD Treatment Plant operations and is characterized by berms surrounding the plant and its associated lagoons, and tree masses aligning lower Creve Coeur Creek. The southern limits of the viewshed are established by the elevated Page Avenue Extension and the new bridge over the Missouri River. The western limits are characterized by the new Howard Bend Levee and large deciduous tree stands abutting the Missouri River. Other visual features include Sportport and its associated lighting.



Page Avenue at south end of Creve Coeur Airport.



Creve Coeur Airport.



View of agricultural fields in proximity to Creve Coeur Airport.



View of MSD Treatment Plant.

3.11.3 Creve Coeur Mill Road/MHE Corridor (North of Page)

This roadway corridor is long and linear and extends from Prichard Farm Road south to the underpass with Page Avenue Extension. Generally the area is visually contained by tree lines associated with the CCLMP and the Fee Fee Creek and Creve Coeur Creek systems. Other visual features within this corridor include small one-story structures associated with businesses along Creve Coeur Mill Road, portions of the newly constructed MHE west of Creve Coeur Mill Road, and a parallel, slightly elevated railroad bed. The southern limit of the viewshed is defined by the Page Avenue Extension overpass of Creve Coeur Mill Road.



Creve Coeur Mill Road north of Page Avenue Extension.

Creve Coeur Mill Road under Page Avenue Extension.

MHE at Marine Avenue.

3.11.4 Creve Coeur Lake Area

The Creve Coeur Lake area is a very self-contained visual unit characterized by the open expanses of water bounded by natural but well defined tree masses of the Missouri River bluffs on the east. The southern limits are characterized by large natural tree masses and a portion of the elevated Page Avenue Extension. Other visual features of the lake area include a two-lane road system, pedestrian trails, parking areas associated with the CCLMP, and open grass areas with intermittent tree planting which includes a portion of the Crystal Springs Quarry Golf Club. The Creve Coeur Lake area is historically considered a highly sensitive visual resource given the extensive mitigation associated with the Page Avenue Extension.



Creve Coeur Lake – View to south toward Page Avenue Extension.



View of east shore of Creve Coeur Lake.

3.11.5 River Valley Drive/Page Avenue Mitigation Lands

This is the largest contiguous visual unit within the study area and is generally characterized by large open views of existing or previously existing agricultural lands. This viewshed's northern limits are defined by the elevated roadway and overpasses associated with the Page Avenue Extension. The western limits are established by the Howard Bend Levee and the large natural

tree stands abutting the Missouri River. The eastern and southern visual boundaries are generally associated with the abutting trees massed along the bluffs. Other visual elements within the viewshed include the Missouri American Water Company, River Valley Drive, Creve Coeur Mill Road, the interchange of Page Avenue Extension with MHE, and the elevated railroad bed of the Union Pacific Railroad.



View of River Valley Drive at Waterworks Road.



River Valley Drive at Page Avenue Extension



View of Page Avenue mitigation lands west of Creve Coeur Mill Road.



Page Avenue mitigation lands (south of Page Avenue Extension).



River Valley Drive near Missouri American Water Company treatment plant.



Relocated River Valley Drive (south of Page Avenue Extension).



View of levee from River Valley Drive.

3.11.6 Upper Creve Coeur Creek Valley

This area is located at the southern limits of the study area. It is characterized by large tree stands abutting Creve Coeur Creek, numerous one-story residential and/or commercial structures abutting the Creve Coeur Mill roadway, partial open areas of agricultural fields, and scrub shrub wetlands. Views within this area are generally more narrow and confined than other viewsheds within the study area.



View of Creve Coeur Mill Road.



Commercial use along Creve Coeur Mill Road.



View of Creve Coeur Creek.

3.11.7 Bonhomme Creek Viewshed

This viewshed can be described as open and is characterized by agricultural fields. The boundaries of this visual unit include the tree massed bluffs to the south, and the large tree masses associated with the Missouri River and Bonhomme Creek systems to the north and west. The eastern limits of this viewshed are defined by the one- to four-story buildings of the City of St. Louis Water Treatment Plant.



City of St. Louis Water Treatment Plant.



View of agricultural lands west of City of St. Louis Water Treatment Plant.

3.11.8 Missouri River Viewshed

This visual unit is characterized by the actual view to the Missouri River channel, large natural stands of trees between the Howard Bend Levee, and the river channel. The most predominant feature within this linear viewshed is the new bridge crossing of the Missouri River for the Page Avenue Extension and the I-70 Blanchette Memorial Bridge at the northern limits of the visual corridor. The Missouri River viewshed can be characterized as a highly sensitive visual resource by the large expanses of natural areas which abut the Missouri River channel. This viewshed forms the westernmost boundary of the study area.



U.S. Army Corps of Engineers
St. Louis District

Howard Bend Floodplain EIS



Legend

Accomodation/ Hospitality	Parks & Recreation
Agricultural	Residential
Arts & Entertainment	Utility & Public Services
Commercial	Vacant
Industrial	Transportation

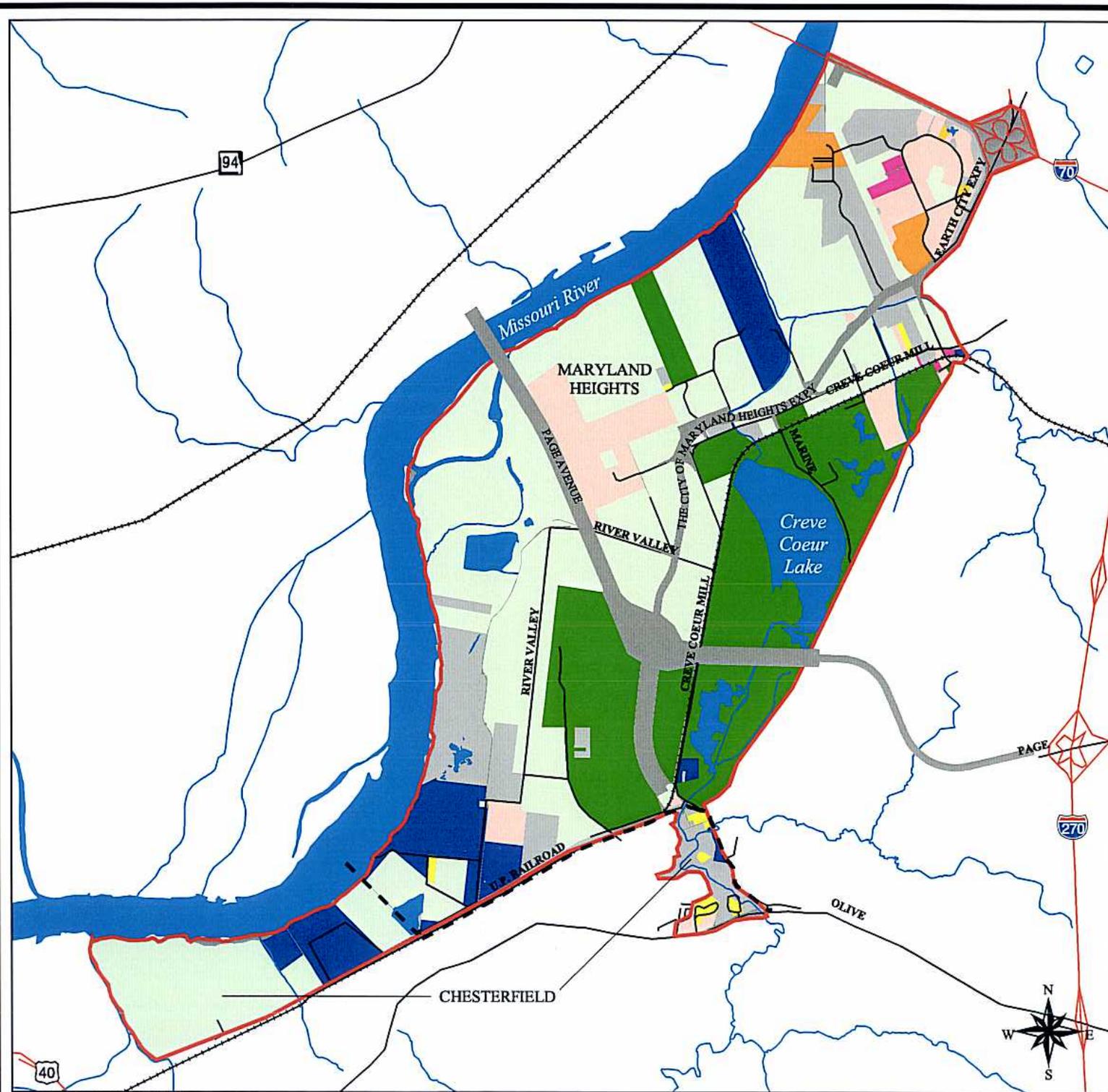
Sources: Chesterfield Zoning, modified to reflect current land use and City of Maryland Heights Land Use.

Study Area	City Limit
Interstate Hwy	Railroad
US Hwy	Stream
State Hwy	Water
Road	

1:60000
0.5 0 0.5 1 Miles

March 12, 2004

Figure 3-1
Existing Land Use within
the Howard Bend Area





U.S. Army Corps of Engineers
St. Louis District

Howard Bend Floodplain EIS



Legend

- Non-Urban and Non-Urban Floodplain
- Commercial
- Manufacturing
- Residential
- Mixed Use
- Planned Development Manufacturing

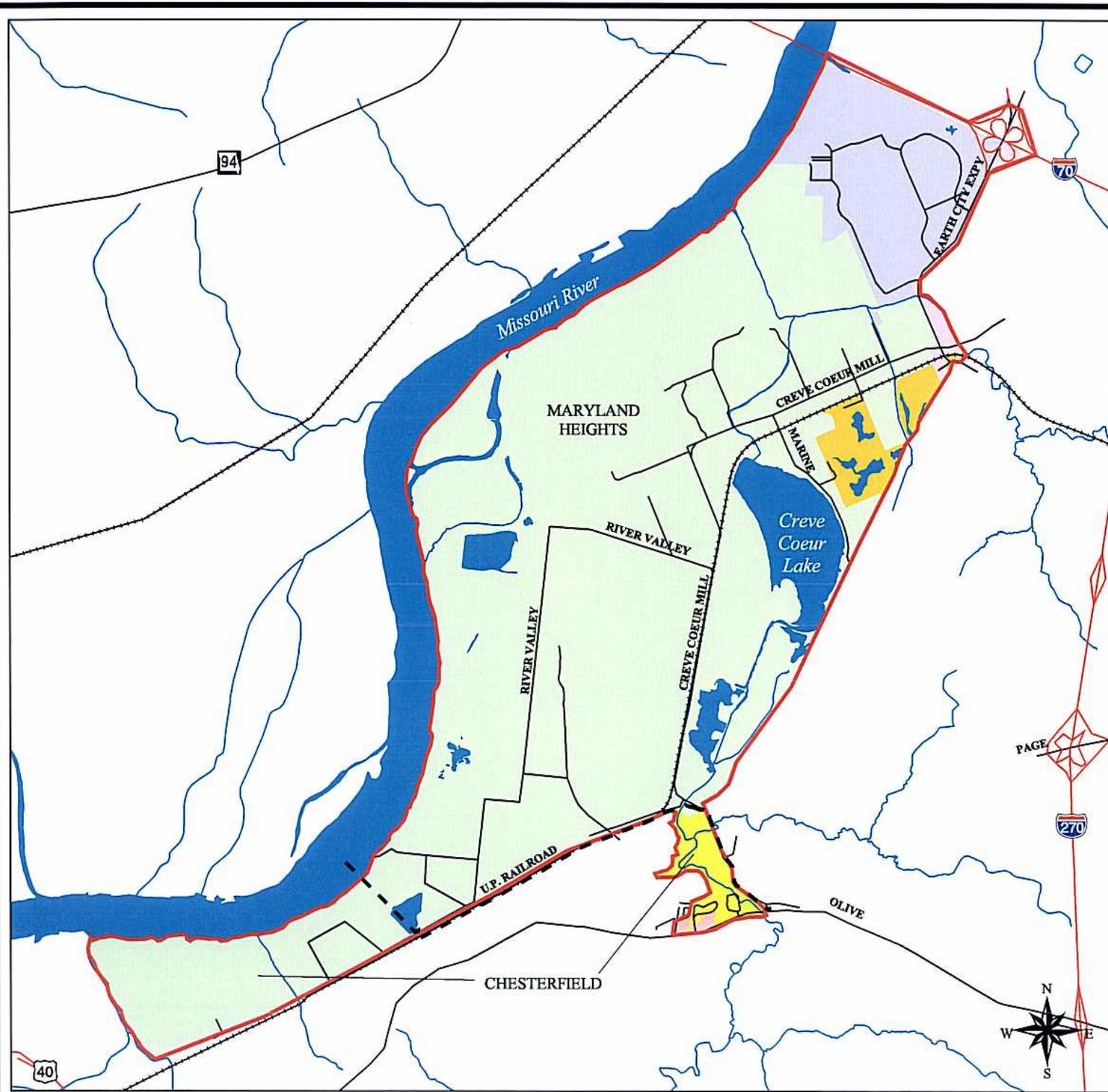
Source: Cities of Maryland Heights and Chesterfield

- Study Area
- Interstate Hwy
- US Hwy
- State Hwy
- Road
- Railroad
- City Limit
- Stream
- Water

1:60000
0.5 0 0.5 1 Miles

June 12, 2003

Figure 3-2
Zoning Districts within
the Howard Bend Area





U.S. Army Corps of Engineers
St. Louis District

Howard Bend Floodplain EIS



Legend

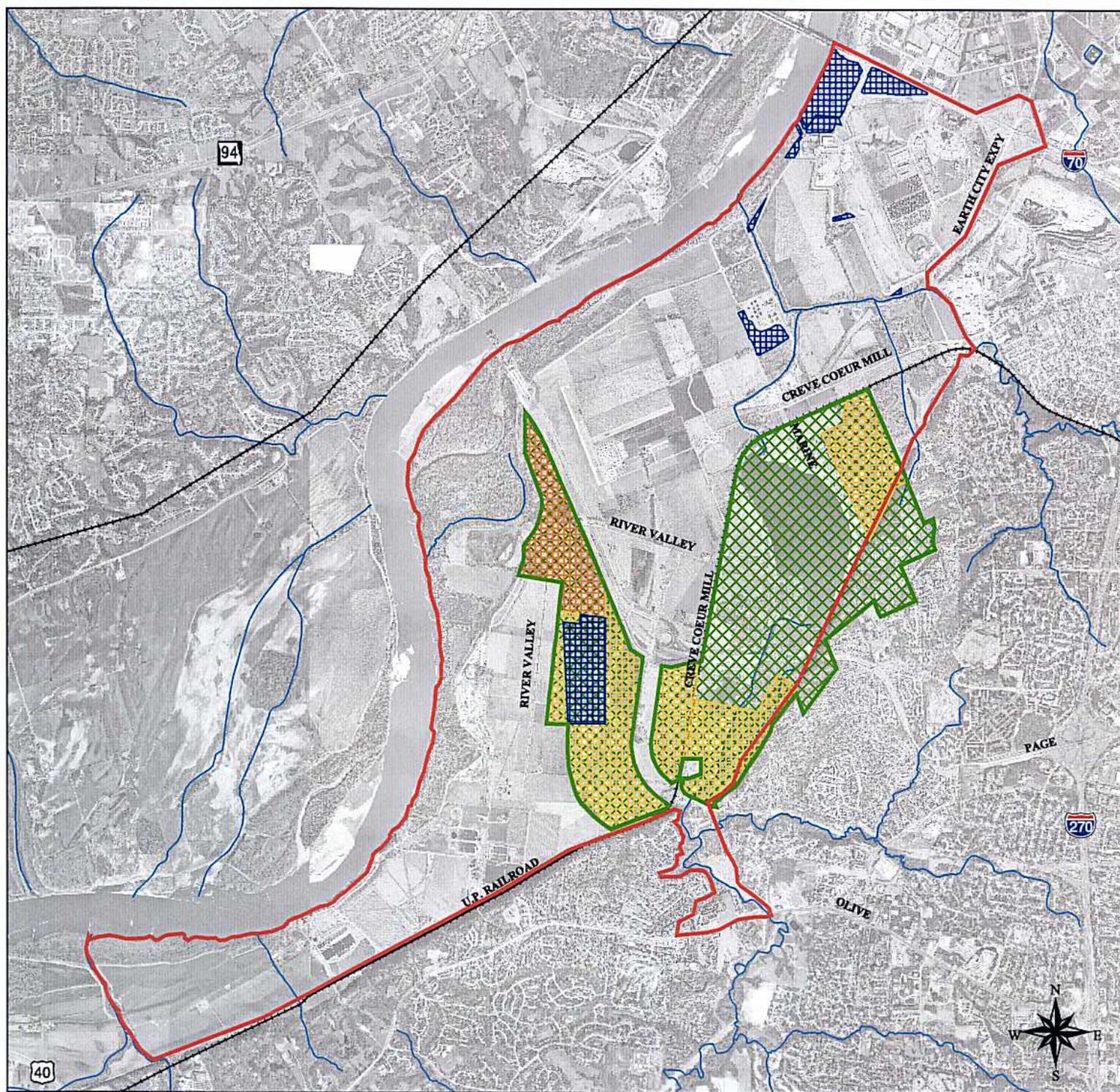
- Wetland Mitigation Land
- 4(f) Mitigation Land From Page Ave.
- 6 (f) Mitigation Land from Page Ave.
- Creve Coeur Park

- Study Area
- Railroad
- Interstate Hwy
- US Hwy
- State Hwy
- Stream



March 15, 2004

Figure 3-3
Creve Coeur Lake Memorial Park
and Mitigation Lands within
the Howard Bend Area





U.S. Army Corps of Engineers
St. Louis District

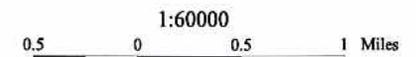
Howard Bend Floodplain EIS



Legend

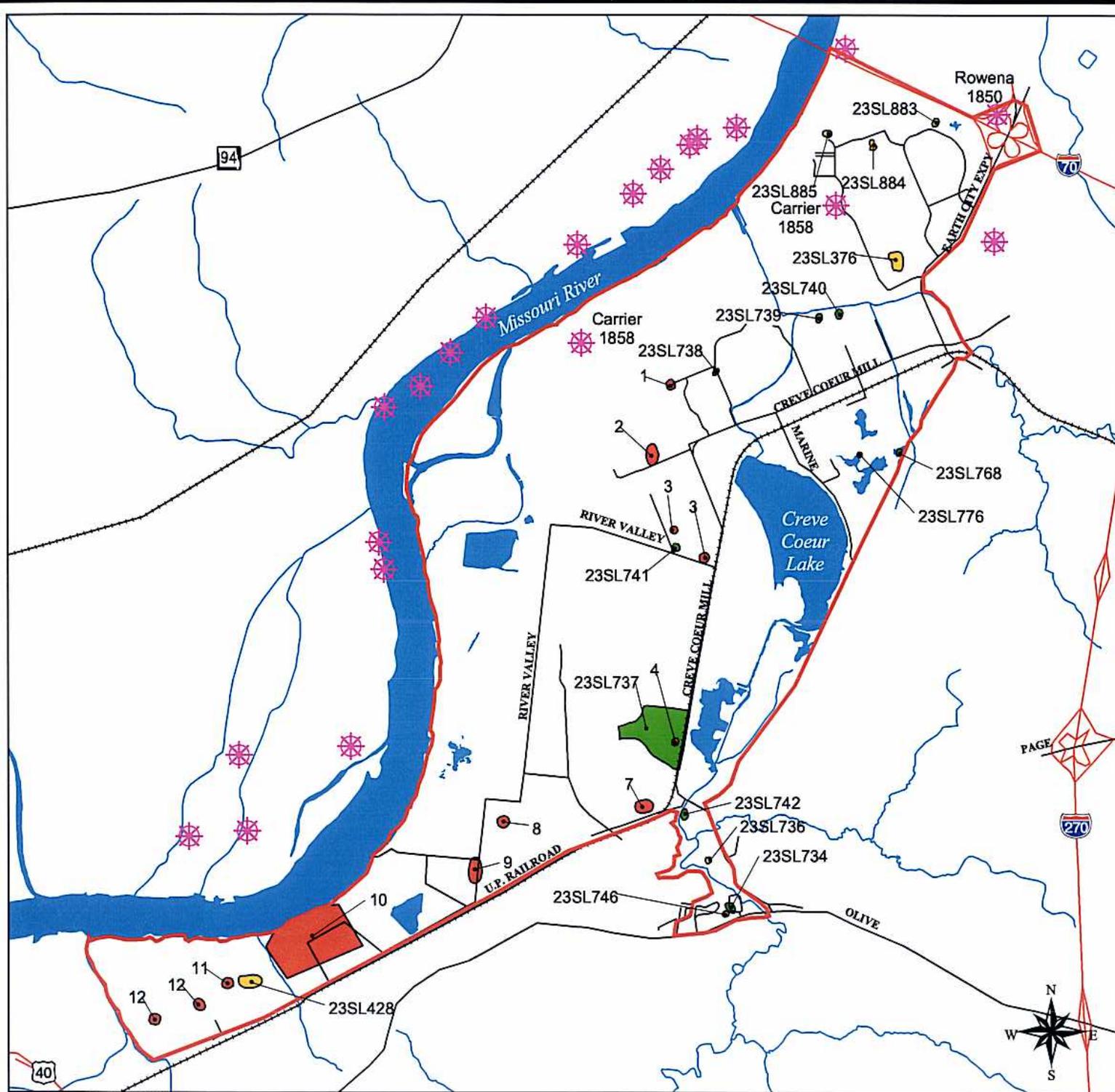
- Shipwreck
- Previously Located Archeological Site
- Architectural Structure
- Archeological Site Impacted by a Past Project
- 23SL### - Previously Recorded Site Number

- Study Area
- Interstate Hwy
- US Hwy
- State Hwy
- Road
- Railroad
- Stream
- Water



June 12, 2003

Figure 3-4
Cultural Resources within
the Howard Bend Area





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Howard Bend Floodplain EIS



Legend

- Study Area
- Active Farmfield
- Construction
- Deciduous Forest
- Grassland
- Mud/Sand
- Oldfield
- Farmed Wetland
- Emergent Wetland
- Scrub Shrub Wetland
- Forested Wetland
- Urban/Developed
- Water

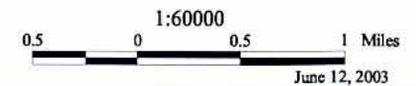
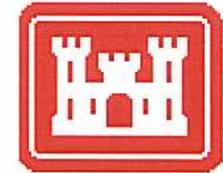


Figure 3-5
2001 Cover Types within
the Howard Bend Area





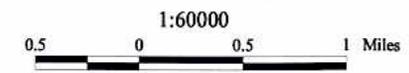
U.S. Army Corps of Engineers
St. Louis District

Howard Bend Floodplain EIS



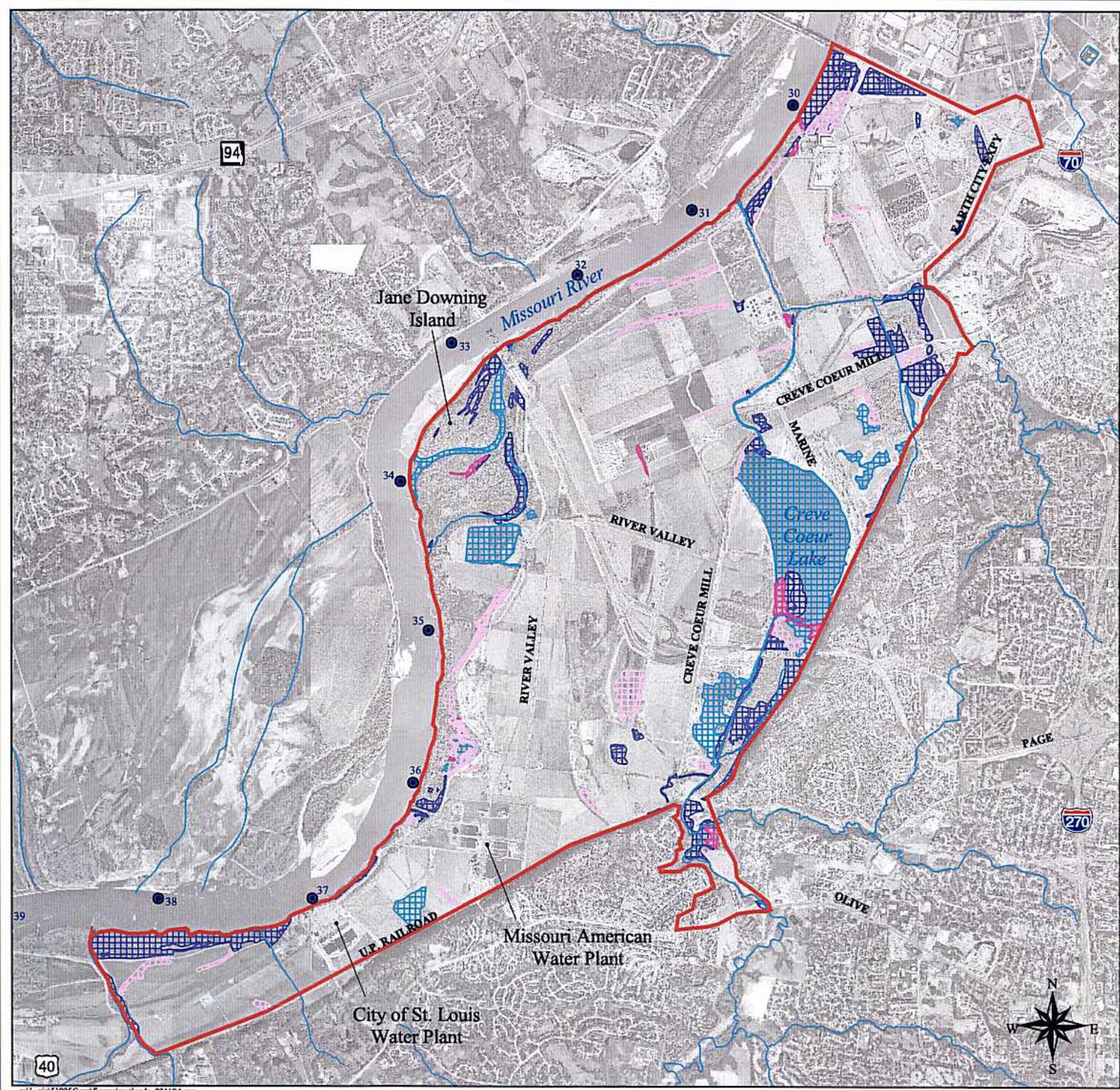
Legend

- Emergent Wetland
- Scrub Shrub Wetland
- Forested Wetland
- Open Water
- River Mile
- Study Area
- Stream
- Interstate Hwy
- US Hwy
- State Hwy



November 4, 2003

Figure 3-6
Wetland and Aquatic Resources
within the Howard Bend Area





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St. Louis District

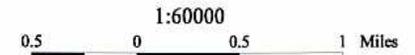
Howard Bend Floodplain EIS



Legend

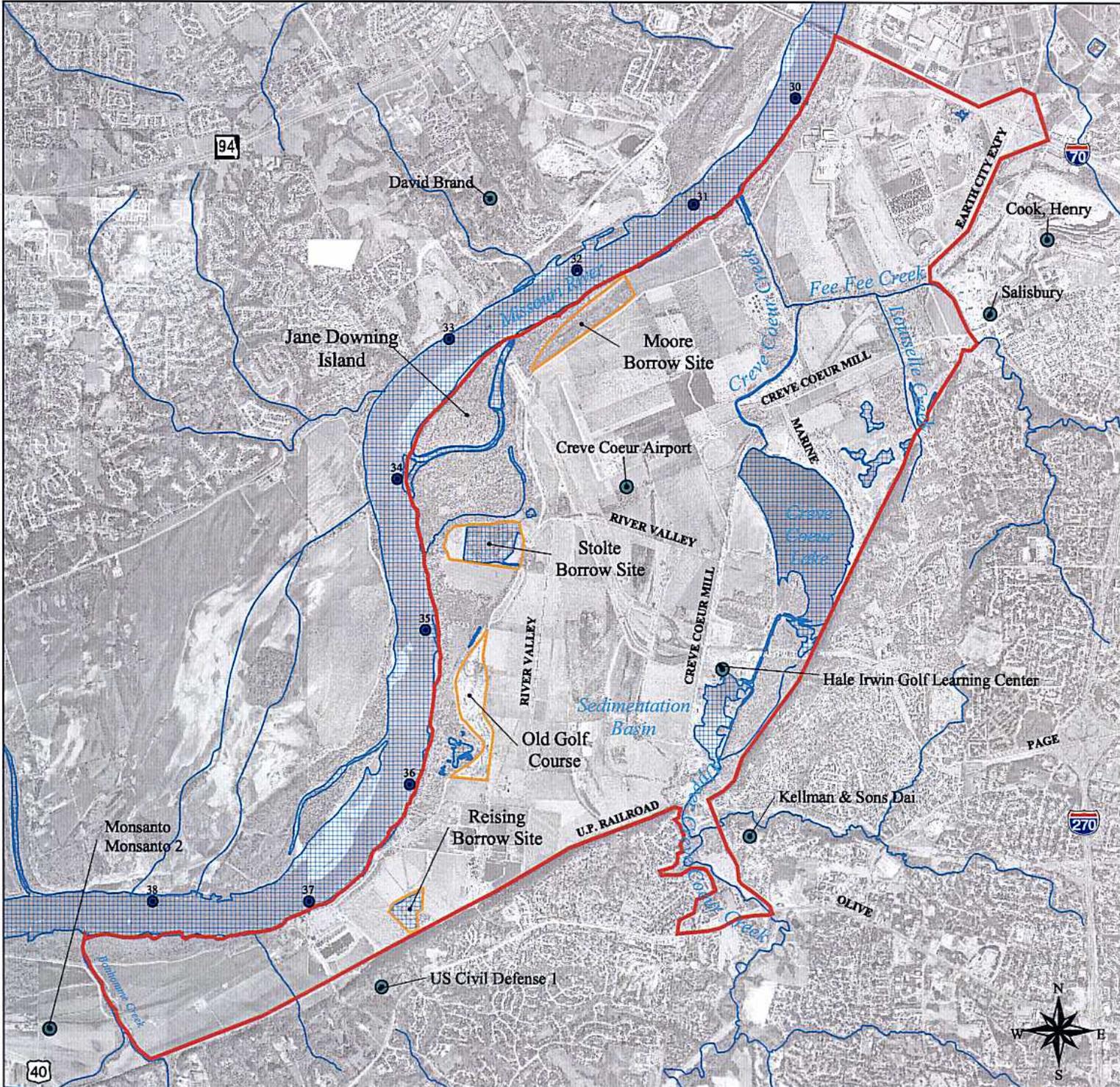
- River Mile
- Well
- Stream/River
- Lake/Pond/River
- Borrow Site

- Study Area
- Interstate Hwy
- US Hwy
- State Hwy



March 15, 2004

Figure 3-7
Water Resources within the
Howard Bend Area





U.S. Army Corps of Engineers
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Howard Bend Floodplain EIS



Legend

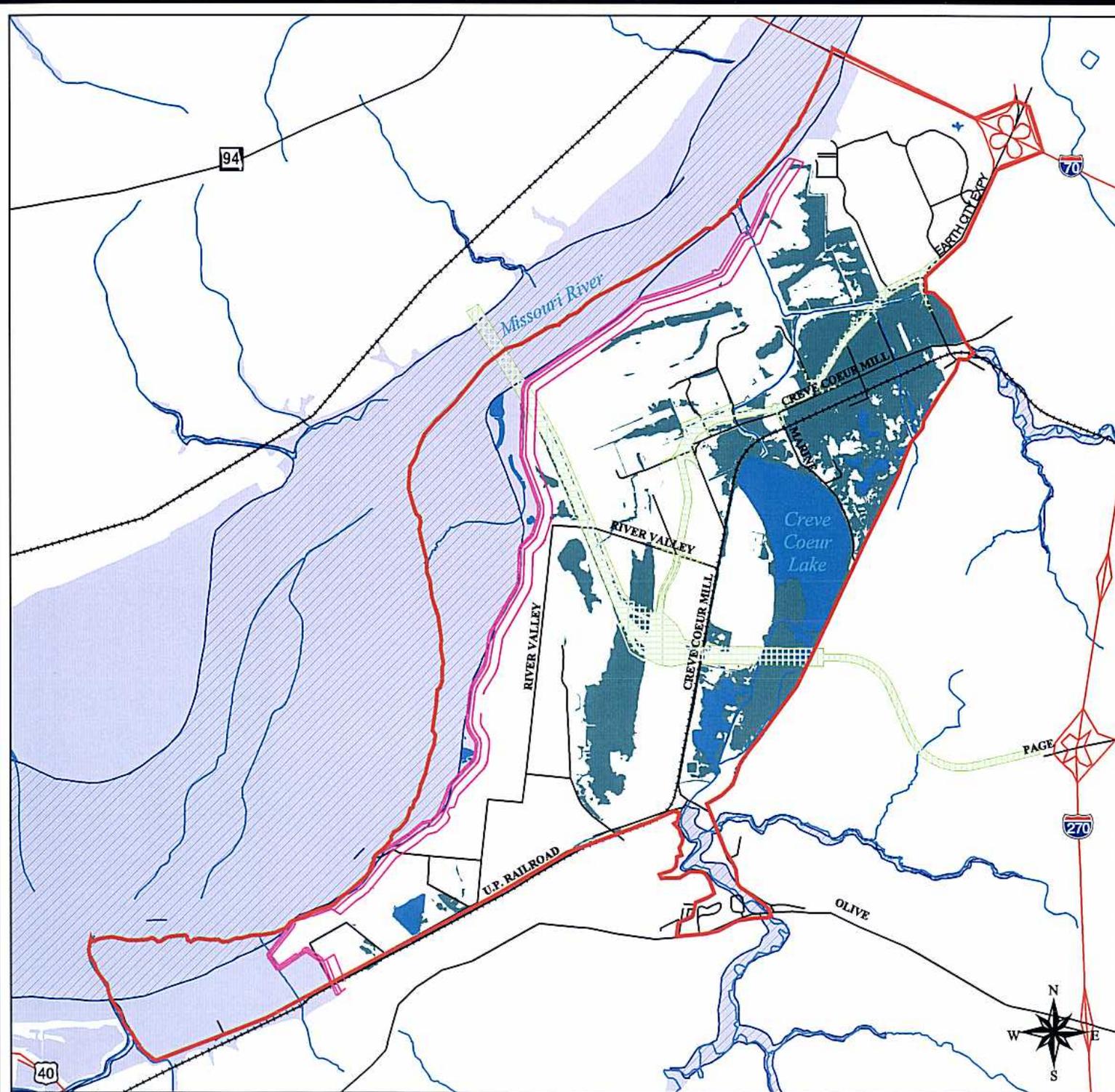
- New 500 Year Levee
- Remaining FEMA Floodway
- CLOMR Floodplain
- Remaining FEMA Floodplain
- Existing ROW

- Study Area
- Interstate Hwy
- US Hwy
- State Hwy
- Road
- Railroad
- Stream
- Water

1:60000
0.5 0 0.5 1 Miles

September 12, 2003

Figure 3-8
Howard Bend Area
Floodplain/Floodway
with CLOMR Floodplain





U.S. Army Corps of Engineers
St. Louis District

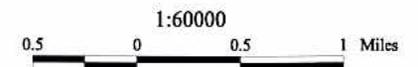
Howard Bend Floodplain EIS



Legend

 Viewshed/Visual Unit

-  Interstate Hwy
-  US Hwy
-  State Hwy



June 12, 2003

Figure 3-9
Visual Landscape Units
within the Howard Bend Area

