FHWA-IN-EIS-04-01-D

Interstate 69

Henderson, Kentucky to Evansville, Indiana

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Prepared By:

FEDERAL HIGHWAY ADMINISTRATION
AND
INDIANA DEPARTMENT OF TRANSPORTATION
KENTUCKY TRANSPORTATION CABINET

Submitted pursuant to National Environmental Policy of Act 1969 Section 102(2)(C), 42 U.S.C. § 4332(2)(c); Department of Transportation Act of 1966, as amended 49 U.S.C. § 303

Robert F Tally Jr.
Robert F. Tally, Jr., PE, Indiana Division Administrator
Federal Highway Administration

Date 1/27/2004

J. Bryan Nicol
J. Bryan Nicol, Commissioner
Indiana Department of Transportation

Maxwell C Bailey
Maxwell Clay Bailey, Secretary
Kentucky Transportation Cabinet

The following persons may be contacted for additional information concerning this document.

Janice Osadczuk, Chief
Environment, Planning and Engineering Division
Indiana Department of Transportation
100 North Senate Avenue, Room N848
Indianapolis, IN 46204

Anthony DeSimone, PE
Environmental Engineer
Federal Highway Administration
Indiana Division
575 North Pennsylvania St., Room 254
Indianapolis, IN 46204

This is a *Draft Environmental Impact Statement (DEIS)* for I-69 between Henderson, Kentucky and Evansville, Indiana. A series of alternatives have been analyzed for environmental, social, and economic impacts, and Alternative 2 is the preferred alternative. The highway would be a freeway facility with interchanges providing the only access. A new Ohio River bridge crossing is also part of this evaluation.

Comments on this document are due **Monday, April 19, 2004**. Comments should be directed to Tim Miller, HNTB Corporation, 111 Monument Circle, Suite 1200, Indianapolis, IN 46204. Comments may also be submitted through the I-69 project website at www.i69in-ky.com.

EXECUTIVE SUMMARY

S.1 INTRODUCTION

The Indiana Department of Transportation (INDOT), the Kentucky Transportation Cabinet (KYTC), the regional Metropolitan Planning Organization (MPO) known as the Evansville Urban Transportation Study (EUTS), and the Federal Highway Administration (FHWA) are proposing a route for Interstate 69 (I-69) through the Evansville, Indiana and Henderson, Kentucky area. It is proposed to extend north from the Edward T. Breathitt Parkway (or simply the Breathitt Parkway, formerly known as the Pennyrile Parkway) in Kentucky to Interstate 64 (I-64) in Indiana. This Draft Environmental Impact Statement (DEIS) has been prepared to aid in the decision-making process by identifying potential impacts of constructing a new Interstate facility in the project study area. This Executive Summary provides a brief description of the alternatives and their associated design characteristics as well as their potential environmental, social, and economic impacts.

S.2 INFORMATION SOURCES

Several sources of information were utilized in preparing the document. Sources for information contained within the document included but were not limited to literature searches, public involvement, modeling techniques, field surveys, professional expertise and GIS data.

FHWA policies and sponsored studies are included within the document. Tables, graphs, and charts displaying potential design characteristics, estimated construction cost, and alternative-related impacts are included throughout the document.

Individuals from many areas of expertise contributed to the development of this project. Persons who contributed information to the document are recognized in **Chapter 9**.

Supporting documentation is provided in the attached Appendices. Information found in the Appendices includes worksheet analyses, state and federal agency correspondence, cultural documentation, and other related documents.

S.3 PROJECT LOCATION

The proposed project is located in Southwestern Indiana and Northwestern Kentucky, beginning south of the City of Henderson, Kentucky, and extending north of the City of Evansville, Indiana. It involves completing one segment of the I-69 National Corridor, shown in **Figure S-1**, from the Breathitt Parkway in Kentucky to I-64 in Indiana. The project study area is bounded by I-64 in the north, Breathitt Parkway in the south, the Sloughs Wildlife Management Area in the west, and the Green River National Wildlife Refuge in the east. All the townships, parks, wetlands, roads, rivers, etc. in this region were considered part of the project study area. **Figure S-2** depicts the project study area.

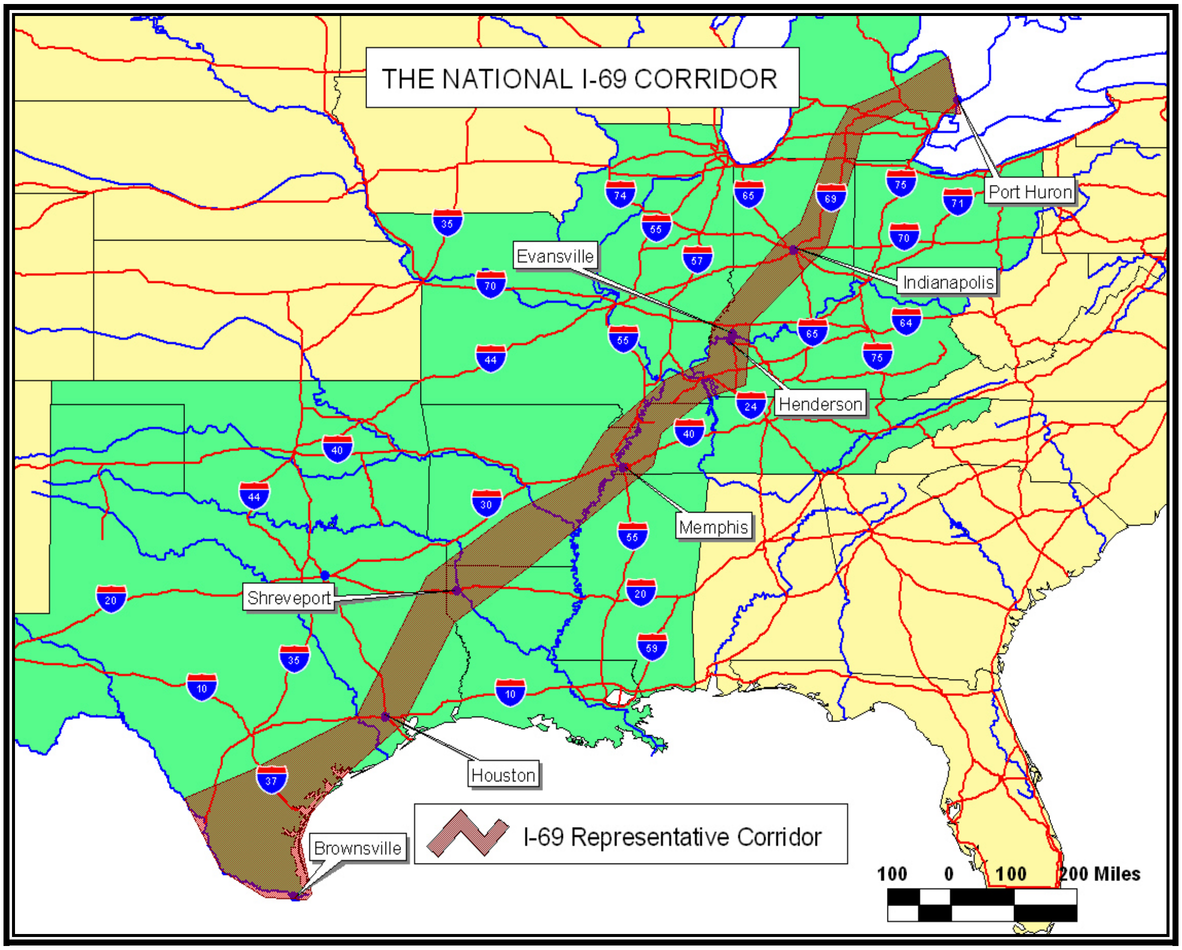


Figure S-1: National I-69 Corridor

S.4 THE I-69 NATIONAL CORRIDOR

The concept of constructing a north-south Interstate between Canada and Mexico has been considered for many years. In 1991, the United States Congress introduced the concept by passing the Intermodal Surface Transportation Efficiency Act (ISTEA). ISTEA was the federal transportation bill that provided funds to the 50 states for transportation improvements, including highway, bridge, rail, air and transit projects. In addition to providing transportation funding, ISTEA also contained language that designated specific highway corridors of *national significance* be included in the National Highway System (NHS). The NHS is comprised mainly of principal arterials, such as Interstates, national routes, and some multi-lane state roads. One of the high-priority corridors identified in ISTEA legislation was "Corridor 18," which extended from Indianapolis, Indiana to Memphis, Tennessee via Evansville, Indiana. Corridor 18, later renamed as National I-69, is a part of a larger, national proposal to connect the three North American trading partners of Canada, the United States and Mexico, by means of an Interstate highway located in the states of Michigan, Indiana, Kentucky, Tennessee, Mississippi, Arkansas, Louisiana and Texas.

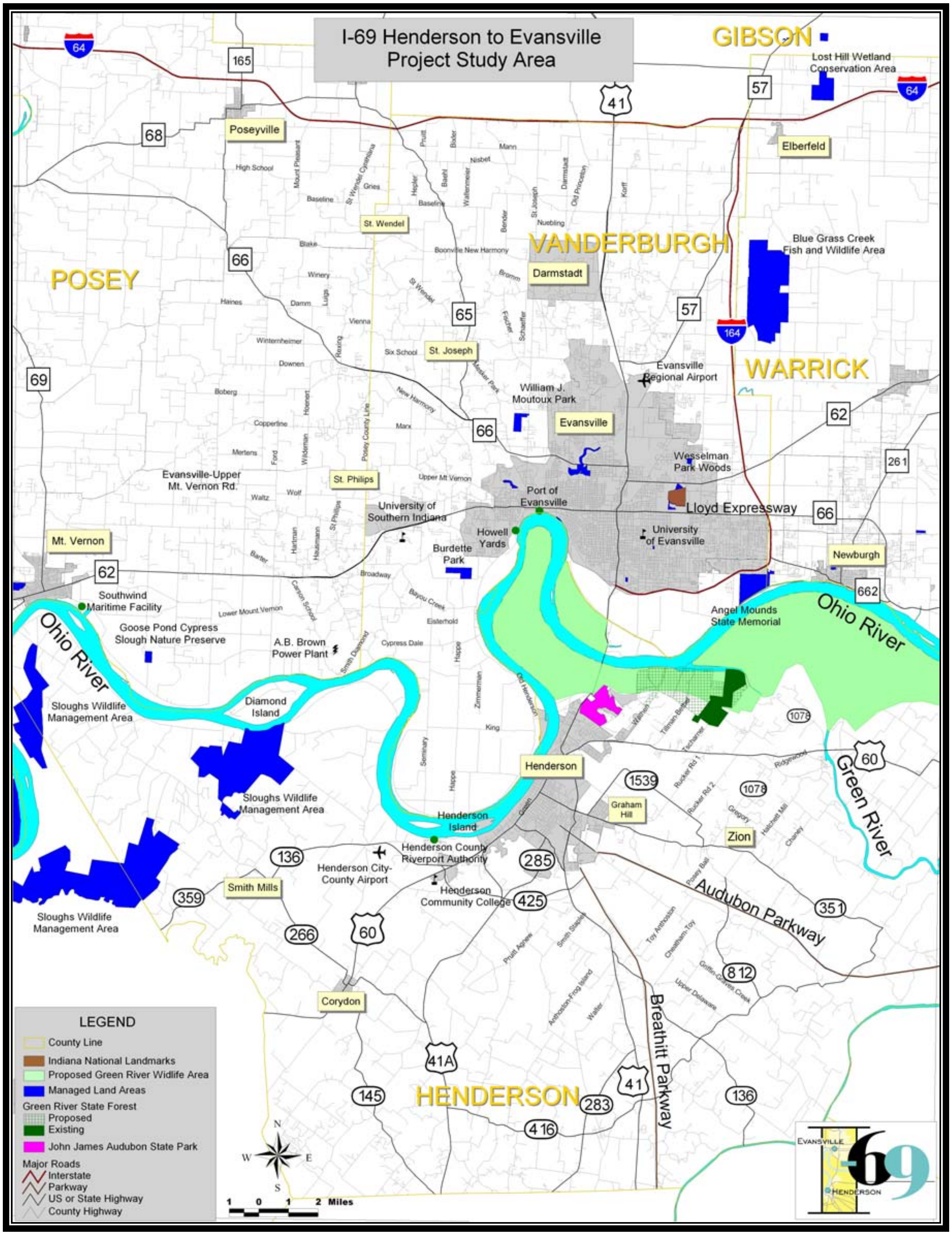


Figure S-2: Project Study Area

According to the current Federal legislation the National I-69 corridor will serve the following cities:

- Port Huron, MI
- Indianapolis, IN
- Evansville, IN
- Memphis, TN
- Shreveport/Bossier City, LA
- Houston, TX

Studies and analyses were conducted during the 1990s to determine the feasibility of the National I-69 Corridor and are discussed in **Chapter 1**.

S.4.1 Sections of Independent Utility

The entire National I-69 project consists of 32 Sections of Independent Utility (SIU), as shown in **Figure S-3**. A SIU is a designated constructible segment of the National Corridor that can function independently within its own termini while providing benefits to those it serves. The proposed I-69 between the cities of Henderson and Evansville is identified as SIU #4. SIU #3 is to the north and SIU #5 is to the south. However, it is important to recognize that SIU #4 can function effectively regardless of whether sections #3 or #5 are constructed.

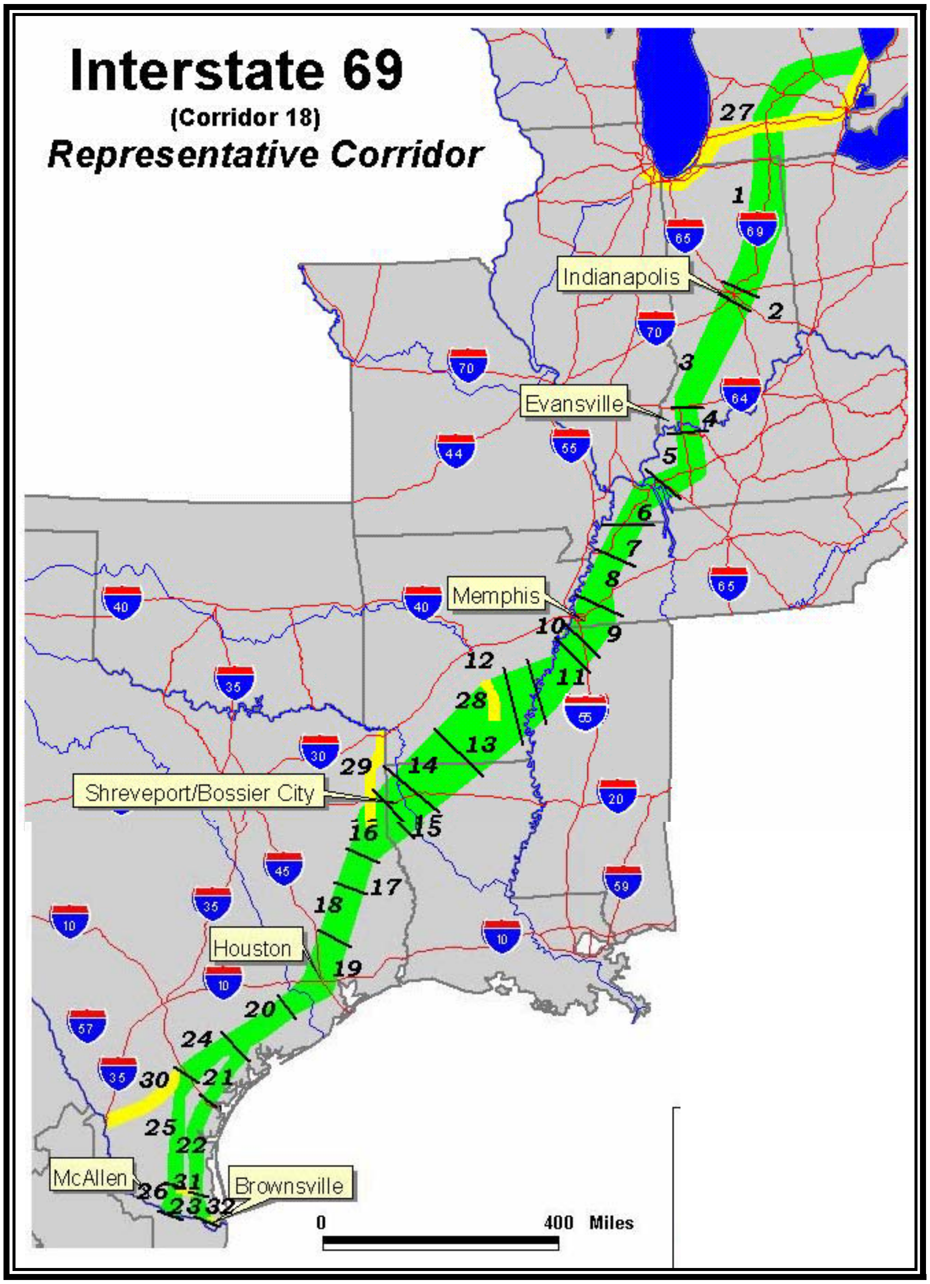


Figure S-3: Map of Sections of Independent Utility

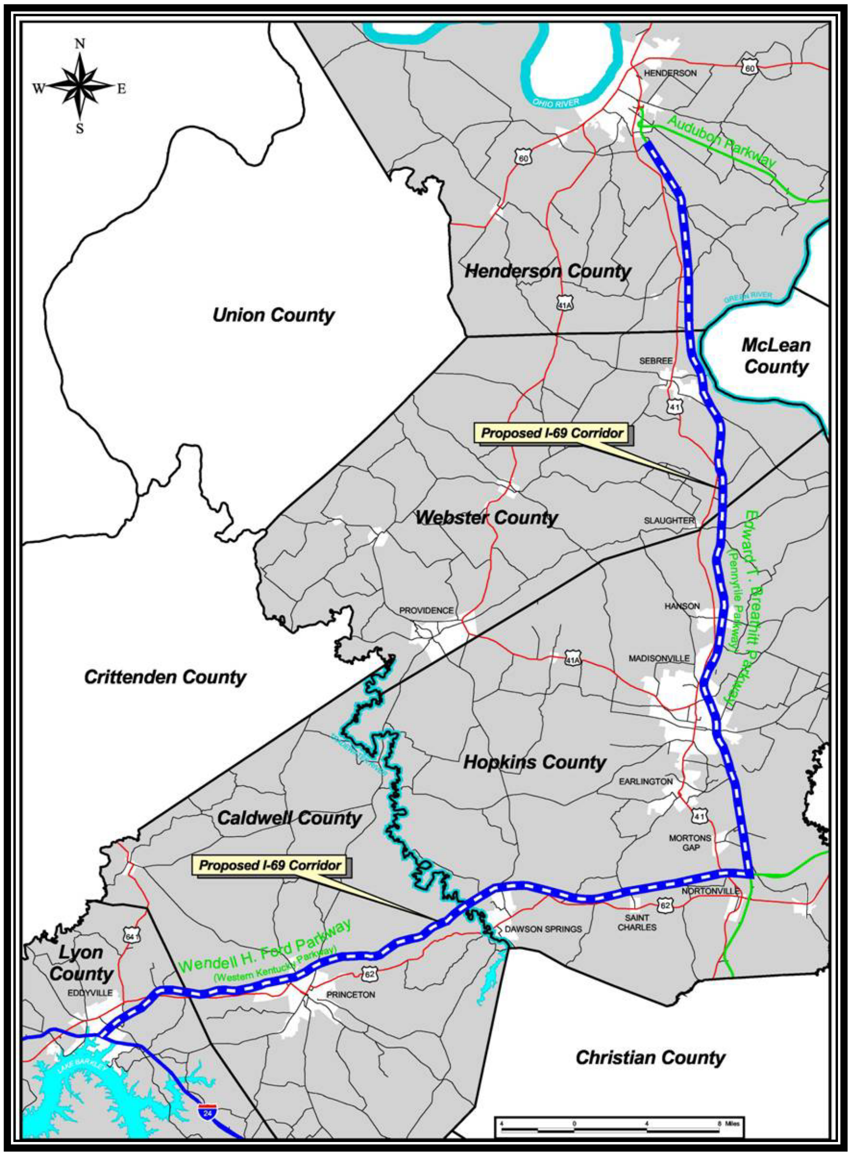


Figure S-4: Section of Independent Utility #5

Section of Independent Utility #5 – Eddyville, KY to Henderson, KY
It is anticipated that SIU #5, will connect Eddyville to Henderson. Specifically, this SIU provides southwest-to-northeast Interstate routing across western Kentucky connecting I-24 and the Henderson bypass (KY 425). Transportation officials are currently evaluating utilizing the existing Kentucky Parkway system for this SIU; **Figure S-4** depicts an SIU #5 alignment using the existing Breathitt Parkway and Wendell H. Ford Western Kentucky Parkway corridors.

Section of Independent Utility #4 – Henderson, KY to Evansville, IN
SIU #4, which is addressed in this document, consists of constructing I-69 between Henderson, KY and Evansville, IN. Specifically, the termini are I-64 to the north and the Breathitt Parkway to the south, which are depicted in **Figure S-5**. The *Purpose and Need Statement* for this SIU is based on both the local need for a new transportation corridor as well as the goals for the I-69 National Corridor. This *Draft Environmental Impact Statement (DEIS)* identifies the potential impacts to this section.

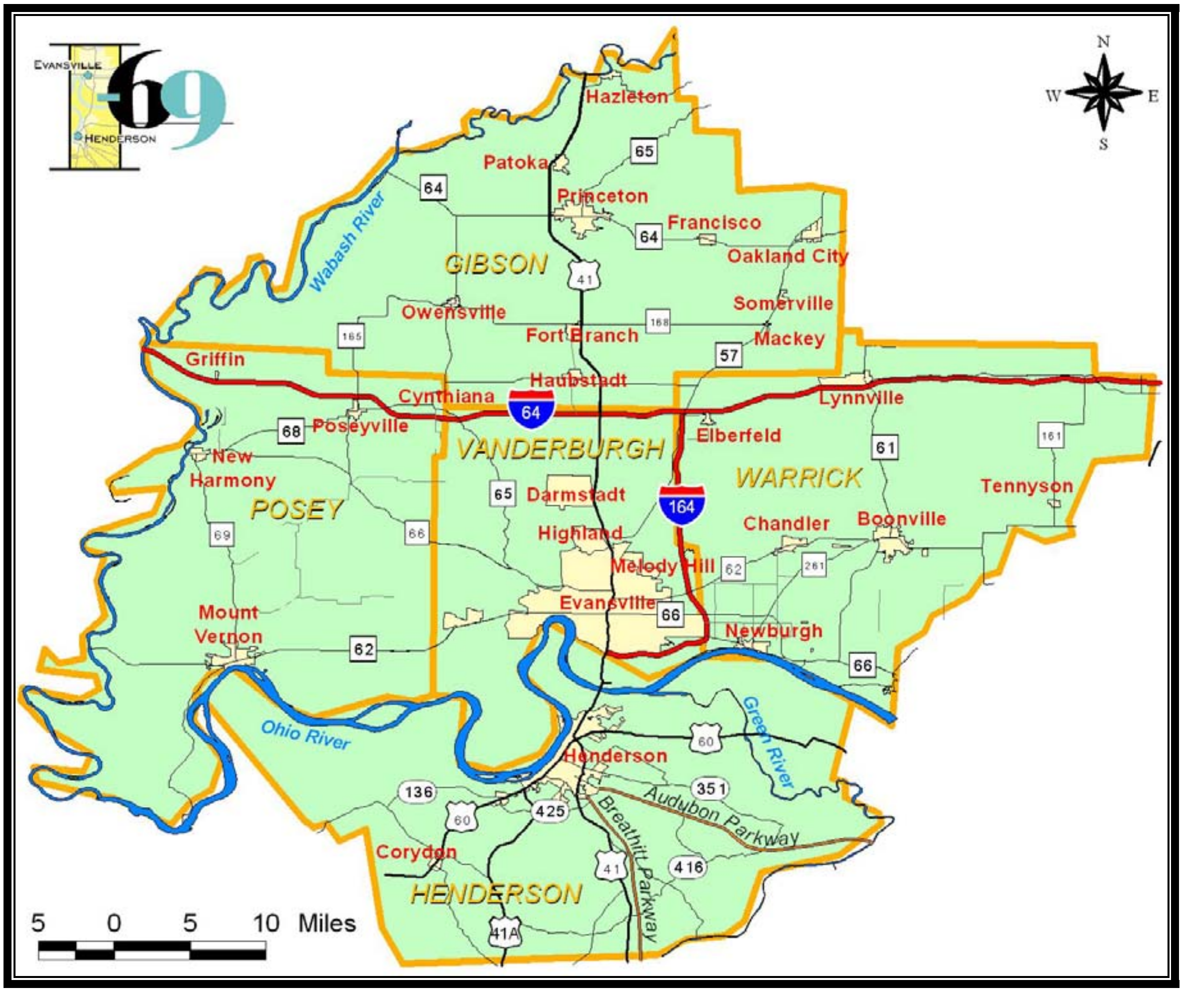


Figure S-5: Section of Independent Utility #4

Section of Independent Utility #3 – Evansville, IN to Indianapolis, IN
SIU #3 consists of constructing I-69 between the cities of Indianapolis and Evansville. On January 9, 2003, Indiana officials announced Alternative 3C as the preferred alternative for SIU #3. Alternative 3C, as shown in **Figure S-6**, approximately follows SR 57 from the I-64/SR 57 interchange in Vanderburgh County to Washington, IN. The alignment then proceeds through Daviess County on new alignment to the Monroe-Greene county line and then east to connect with SR 37 just south of Bloomington. The proposed freeway then travels north on existing SR 37 through the cities of Bloomington and Martinsville and terminates at I-465 on the south side of Indianapolis.

The environmental documentation for SIU #3 is being pursued as a two-staged "Tiered" approach. In the first tier, the broad corridor is established, while taking into account the full range of impacts. After the corridor issues are resolved during the selection of a corridor in Tier 1, the focus shifts in Tier 2 NEPA studies to the selection of an alignment and issues associated with a more exact measurement of impacts, and the avoidance and mitigation of adverse impacts. The Tier 1 FEIS has been approved. A Record of Decision (ROD) will be issued for the Tier 1 EIS and each Tier 2 EISs. The Tier 1 ROD is anticipated to be issued in early 2004. Once the Tier 1 ROD is issued, Tier 2 studies will begin.

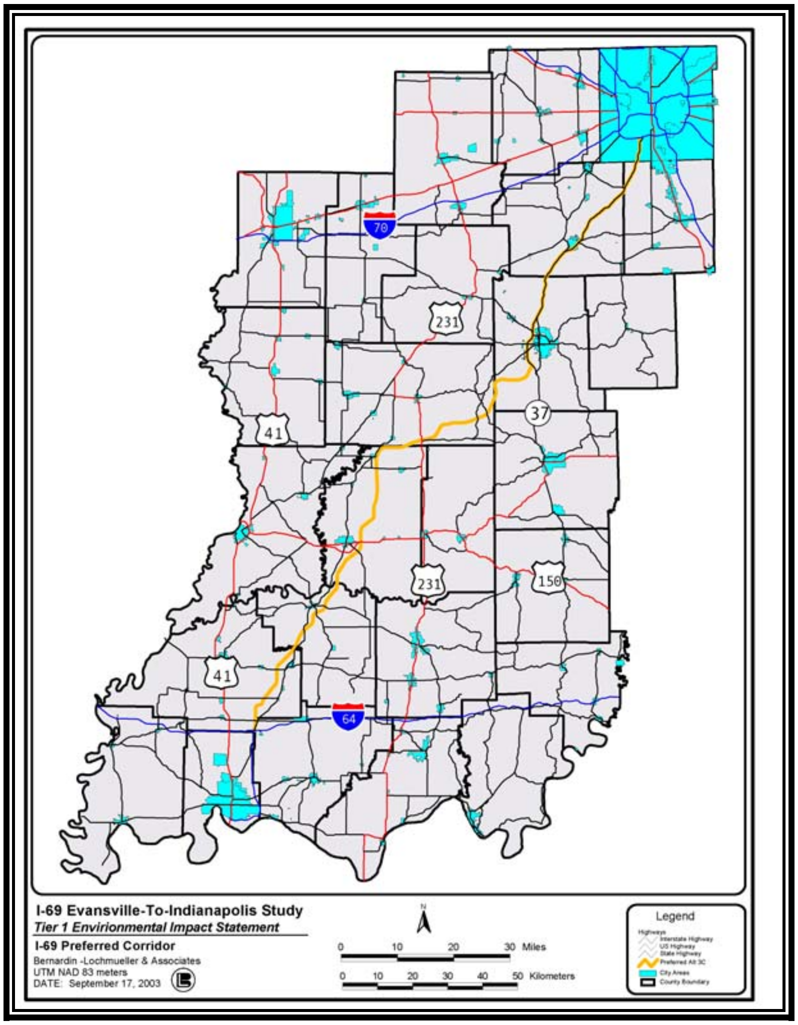


Figure S-6: Section of Independent Utility #3
Preferred Alternative 3C

The development and study of SIU #4 is being performed independently of SIU #3 and SIU #5. Although the I-64/SR 57 interchange is the preferred southern terminus for SIU #3, this location will be taken into consideration for SIU #4, but will not be a determining factor for the northern terminus of SIU #4.

S.5 PURPOSE AND NEED

The general purpose and need of this project is to provide a critical link in the I-69 National Corridor that would provide sufficient capacity for design year traffic flow within the region. This traffic flow is inclusive of both Interstate and international traffic that will ultimately be using the facility.

The proposed action was identified in the *Transportation Equity Act for the 21st Century of 1998 (TEA-21)* as a component of the I-69 Corridor. As such, the purpose of this project is to provide a critical link in the Interstate system, and to provide an important regional facility that will serve traffic.

The purpose of this project primarily involves the need to complete the National I-69 Corridor, but also involves regional elements including providing sufficient cross-river mobility and strengthening the regional transportation network. The purposes and needs of this project are as follows:

- <u>Support the completion of the National I-69</u>. There is a need to provide an Interstate link connecting Henderson, KY to Evansville, IN as a part of this National Corridor (SIU #4).
- <u>Provide sufficient cross-river mobility in the Evansville/Henderson area</u>. There is a need to provide a new or enhanced river crossing because the only existing Ohio River crossing in the area – US 41 – is inadequate to meet existing local traffic and future National I-69 traffic demands under normal working conditions. In the event of an accident or other event involving the existing US 41 bridge, the bridge may be partially closed, affecting both local and National I-69 traffic.
- <u>Strengthen the transportation network in the Evansville/Henderson area</u>. There is a need to strengthen the local transportation network because the existing network will not be able to meet the local forecasted travel demand as well as the additional demand resulting from the completion of the National I-69.

S.6 RANGE OF ALTERNATIVES CONSIDERED

The project study area limits were determined by the FHWA as part of the overall National I-69 corridor planning efforts. Geographic Information System (GIS) mapping, aerial photographs, and other means were used to develop reasonable corridors based on known/existing transportation and environmental conditions in the project study area. Environmental data were collected from the United States Geological Survey (USGS), Kentucky and Indiana Geological Surveys (KGS and IGS), Environmental Systems Research Institute (ESRI), and other state and federal agencies, and supplemented through field reconnaissance. Roadway design criteria used in Indiana and Kentucky, existing utilities, potential bridge crossing conditions, Intelligent Transportation Systems (ITS), and Transportation Systems Management (TSM) measures were also considered. This information was used to develop feasible corridors that avoided or minimized impacts to the natural and man-made environment.

Developing corridors located east of I-164 was considered. However, the Newburgh Lock and Dam is located to the east on the Ohio River. Any new Interstate facility situated east of I-164 would require a location well east of the Town of Newburgh and, therefore, even farther east of I-164 and the Evansville-Henderson area. Consequently, any new facility constructed east of I-164 would fail to address transportation needs within the Evansville-Henderson area, which are identified in the *Purpose and Need Statement*. By contrast, the existing I-164 roadway provides a freeway connection with sufficient potential capacity to accommodate both local and through traffic for the proposed I-69 in the 2030 Future Year. Considering these factors, corridors located far east of I-164 would not be reasonable, and, therefore, were not developed. Corridors located far west of the Evansville/Henderson would not adequately satisfy the *Purpose and Need Statement* for SIU #4. These corridors would not provide an efficient connection between the termini for SIU #4, would not provide sufficient cross-river mobility in the Evansville-Henderson area, and would not strengthen the area's transportation network.

S.7 REASONABLE ALTERNATIVES

Alternatives were developed to satisfy the project needs (outlined in the *Purpose and Need Statement*) while avoiding potential environmental impacts. Where such avoidance was not possible, efforts have been made to minimize the potentially negative impacts of constructing a new Interstate facility.

S.7.1 Design Characteristics

The proposed facility is anticipated to provide a highway designed to freeway standards and would be signed I-69. Typical roadway sections were prepared for the purpose of evaluating the potential environmental impacts of each of the build alternatives and are shown in **Figure S-7**. More refined typical sections will be developed during subsequent phases of the project. These conceptual design characteristics include 12-foot-wide travel (driving) lanes, and 12-foot-wide inner and outer shoulders. In rural areas, the proposed I-69 would be constructed as a four-lane divided freeway, with an 80-foot-wide depressed median. An Ohio River bridge crossing would be designed to accommodate a future six-lane section (*i.e.*, three lanes each direction), and 14-foot-wide inside and outside shoulders. Four Build Alternatives and a No-Build Alternative are being considered. The proposed project length ranges from approximately 30 to 32 miles.

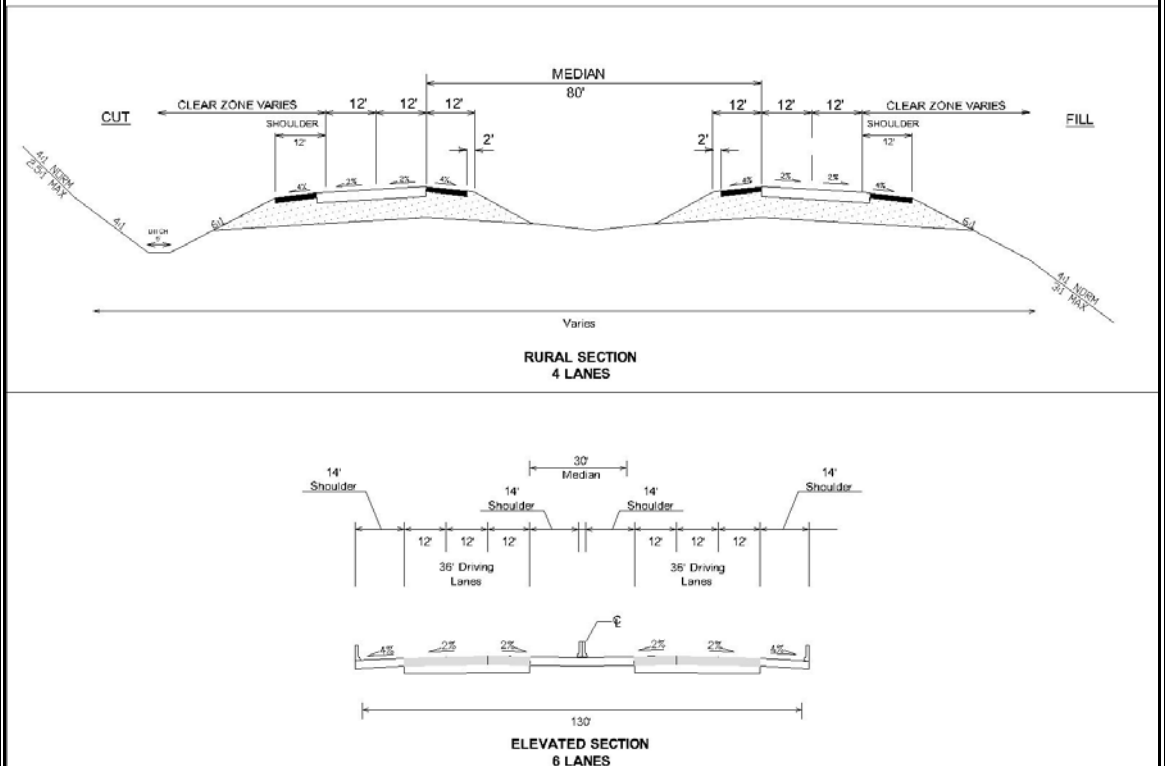


Figure S-7: Typical Sections

S.7.2 Alternative Description

The study process initially identified ten alternatives, including six alternatives west of the Evansville/Henderson area; one alternative following existing US 41; one alternative using the Breathitt Parkway north to US 41 and continuing north on US 41 to I-164; and two alternatives east of the Evansville/Henderson area. Both eastern alternatives assumed a northern terminus at the existing I-164 interchange with I-64. The western alternatives had various northern termini at I-64 in Indiana. In Kentucky, each alternative tied into the Breathitt Parkway near its northern terminus, just south of Henderson. The ten alternatives, as shown in **Figure S-8**, were designated from west to east as Alternatives A through J. The *Level 1 Alternatives Analysis Report* recommended that Alternatives H, I, and J be pursued for more detailed study. These alternatives best satisfied the goals and performance measures outlined in the *Draft Purpose and Need Statement* and would result in the fewest impacts to environmentally sensitive resources. An additional alternative, named J1, was added to determine if the traffic performance of Alternative J, the best western alternative, could be improved by providing an I-64 connection closer to US 41. The Alternatives carried forward for further study were refined and renamed as follows and are shown in **Figure S-9**:

No-Build (not shown)
Alternative J – Alternative 1
Alternative J1 – Alternative 1A
Alternative H – Alternative 2
Alternative I – Alternative 3

Alternative 1

Alternative 1 connects to I-64 in Posey County, approximately four miles east of Poseyville and proceeds south to Evansville-Upper Mt. Vernon Road, paralleling the Vanderburgh-Posey County line. From there, the route turns and travels southeast, crossing SR 62 and proceeds through the "oxbow" area of the Ohio River. The corridor crosses the Ohio River near the eastern edge of Henderson Island. The corridor then proceeds southeast to its southern terminus at the Breathitt Parkway located at the existing KY 425 (Henderson Bypass) interchange, approximately 4.5 miles south of the US 60/US 41 interchange in Henderson. Potential interchange locations included I-64, SR 66, Evansville-Upper Mt. Vernon Road, and SR 62 in Indiana, and US 60, KY 285, and the Breathitt Parkway in Kentucky. The alternative is 31.8 miles in length.

Alternative 1A

Alternative 1A connects to I-64 west of its interchange with US 41 and proceeds southwest to SR 66 just north of Wadesville, and then follows the same alignment as Alternative 1. Alternative 1A is approximately 35.2 miles in length.

Alternative 2

Alternative 2 utilizes the existing I-164 alignment from its northern terminus at I-64 in Warrick County, to just east of the Green River Road interchange and west of Angel Mounds State Memorial Site. From that location, the alternative leaves the existing I-164 alignment and heads south to cross the Ohio River immediately west of the mouth of the Green River. The route continues south to KY 351, then proceeds southwest to the Breathitt Parkway. Existing interchanges are located at I-64, County Road 950 (New Harmony Road), Lynch Road, Morgan Avenue (SR 62), Lloyd Expressway (SR 66), Covert Avenue (SR 662), and Green River Road in Indiana. Potential interchanges include a relocated Green River Road interchange (to avoid the cemetery located in the southwest quadrant of the existing interchange) in Indiana, and US 60, KY 351, Audubon Parkway, and the Breathitt Parkway in Kentucky. The alternative is 30.2 miles in length and utilizes 18.6 miles of existing I-164.

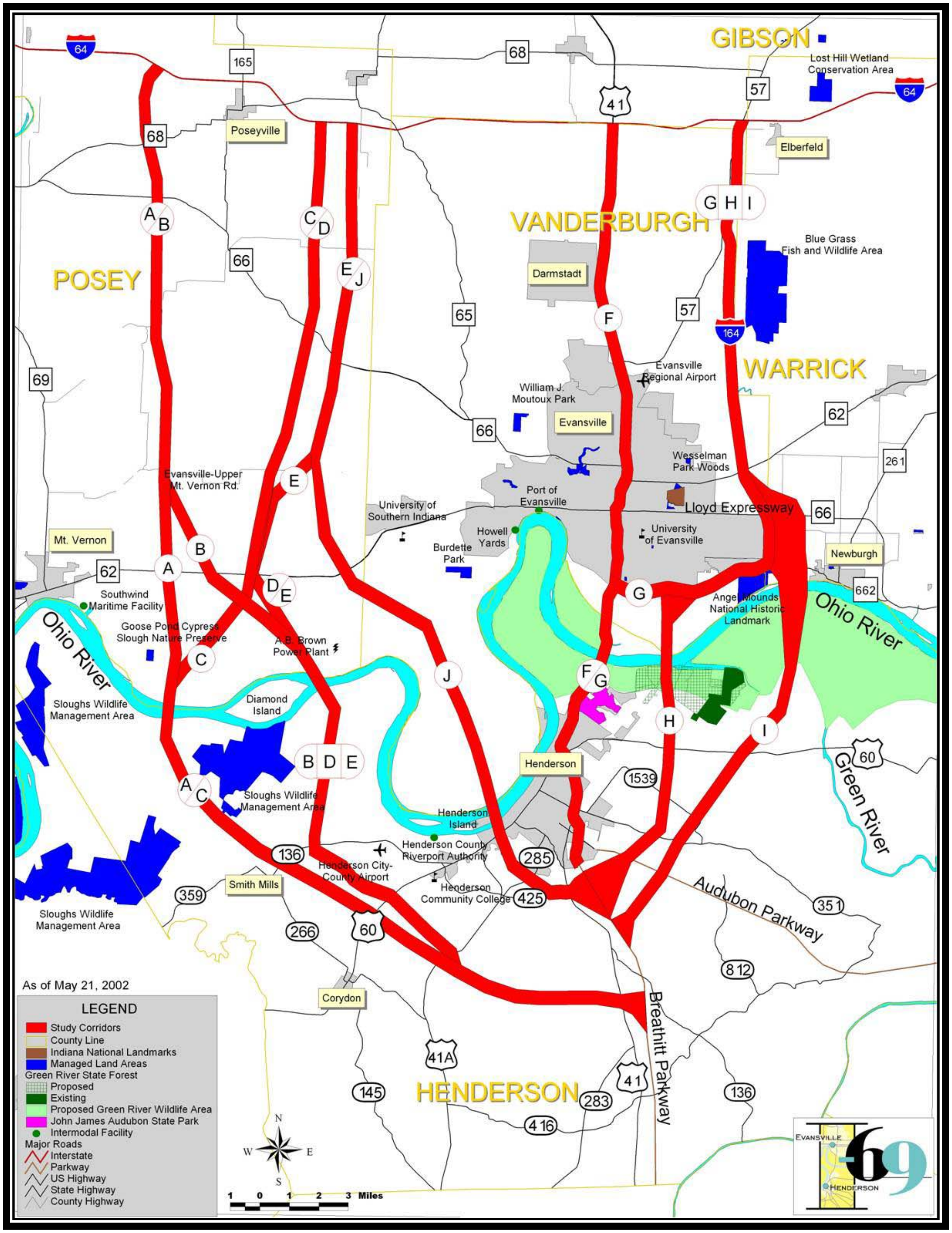


Figure S-8: Study Corridors

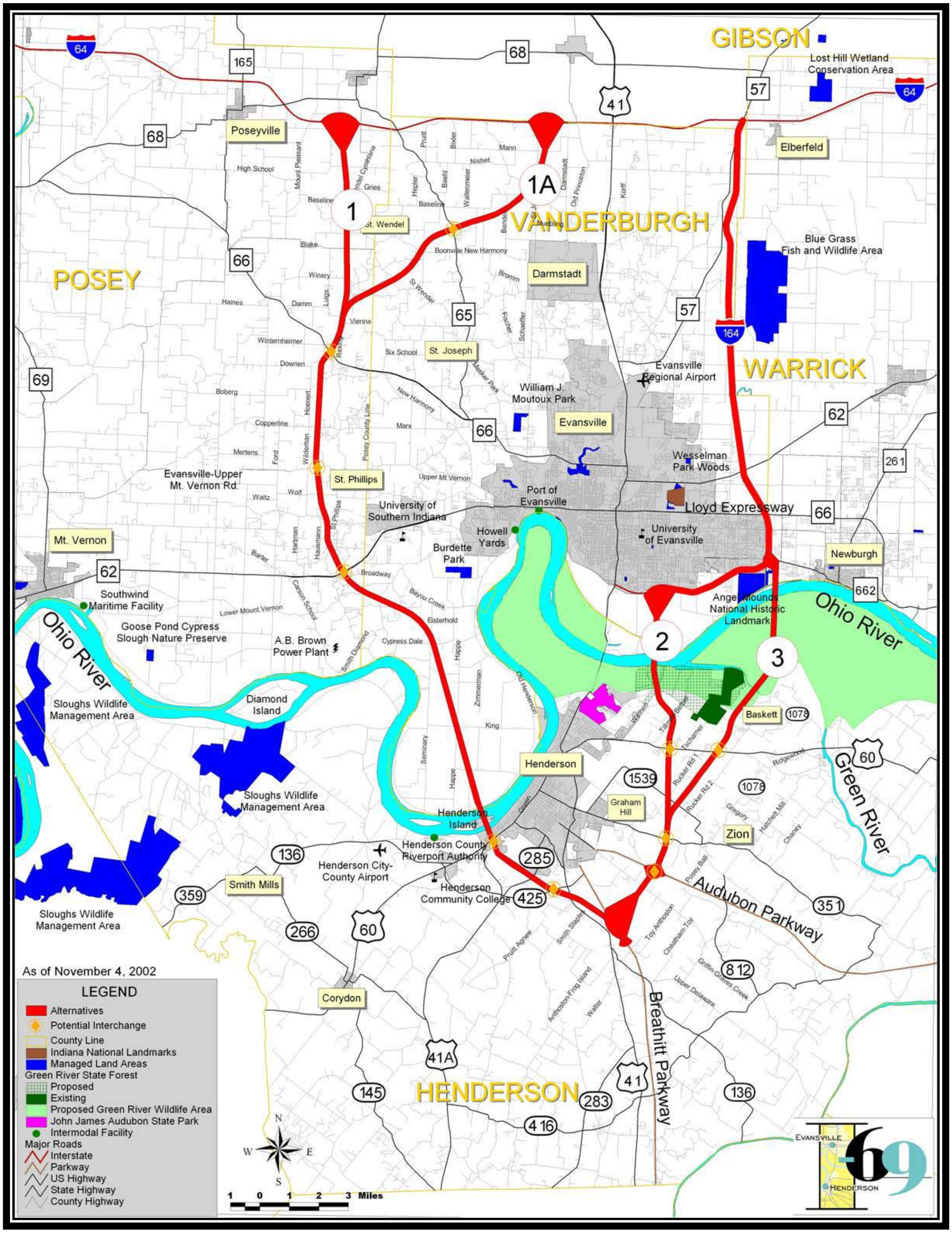


Figure S-9: Alternatives

Alternative 3

Alternative 3 utilizes the existing I-164 alignment from its northern terminus at I-64 in Warrick County, to just north of the Covert Avenue interchange north of Angel Mounds State Memorial. From that location, the alternative turns and travels southeast to cross the Ohio River east of Angel Mounds. The alternative continues south crossing the Green River, then heads southwest to its connection to the Breathitt Parkway. Existing interchanges are located at I-64, County Road 950 (New Harmony Road), Lynch Road, Morgan Avenue (SR 62), Lloyd Expressway (SR 66),and Covert Avenue (SR 662) in Indiana. Potential interchanges include a new interchange immediately north of Covert Avenue in Indiana, and US 60, KY 351, Audubon Parkway, and the Breathitt Parkway in Kentucky. The alternative is 31.9 miles in length and utilizes 17.2 miles of existing I-164.

No-Build Alternative

The No-Build alternative assumes no new Interstate link is constructed between Henderson, KY and Evansville, IN. It also assumes that National I-69 has NOT been completed. Thus, this alternative does not include traffic resulting from the construction of the National I-69. The No-Build alternative includes committed transportation projects in the Henderson-Evansville area.

Following publication of the *Level 1 Alternatives Analysis Report*, more detailed analyses of the alternatives began. Alternatives 1, 1A, 2, and 3 were then narrowed to 1,000’ wide through investigation of data gathered during field inspections and site visits, coupled with more in-depth engineering analyses.

S.8 PUBLIC AND AGENCY INVOLVEMENT

S.8.1 Public Meetings

Public information meetings were conducted in November 2001, June 2002, and September 2002. The purpose of these meetings was to inform the public of the project’s status, provide information on the corridors, and to gather public input. The November 2001 meetings focused on the Project Study Area and *Draft Purpose and Need Statement*, whereas the June meetings focused on the screening process. The September 2002 meetings focused on modifications that were made to Alternatives 1, 1A, 2 and 3 after the June meetings.

Numerous comments were received as a result of the six public information meetings. All comments submitted were compiled in a public information meeting transcript and reviewed for consideration. Meeting participants provided both supporting and opposing views of the project. At both the June and September, 2002 Public Information Meetings held in Henderson, a number of citizens raised the question of why an alternative east of Alternative 3 in Kentucky was not under consideration. The perceived impact to currently flood-prone areas east and southeast of Henderson by Build Alternatives 2 and 3 was one issue brought up by local citizens supporting the considerations of a further east alternative. Developing an alternative east of I-164 was considered. However, in order to avoid impacts to the Newburgh Historic District, an alternative east of I-164 would require the location to be east of the town of Newburgh. This location would result in the inability of the alternative to meet the *I-69 Henderson to Evansville Purpose and Need.* (See Section 1.2*)* Further discussion concerning the public meetings is addressed in **Chapter 10**.

S.8.2 Resource Agency Comments

Resource agencies were encouraged to provide comments at the December 13, 2001 and July 30, 2002 meetings, and were given a 30-day period following each of the meetings to provide additional written or oral comments. Letters were received from the following tribes/agencies:

- Cherokee Nation
- Indiana Department of Natural Resources (IDNR)
- United States Coast Guard
- United States Fish and Wildlife Service (USFWS)

The U.S. Coast Guard provided some clarification of information included in the *Level 1 Alternatives Analysis* relative to Ohio River bridge clearances. IDNR noted that final agency approval must be received before construction can begin within any floodway. IDNR comments noted that the initial western corridors (Corridors A-E) would result in the highest level of impacts to fish, wildlife, and botanical resources, mimicking the results of the *Level 1 Alternatives Analysis*. Additionally, it was noted that of the Build Alternatives under consideration, Alternative 1 (and consequently Alternative 1A) would have the most severe impacts to fish and wildlife habitat.

The USFWS noted that the selection of Corridors J, H, and I (now known as Alternatives 1, 2, and 3, respectively) eliminated those alternatives with the greatest impacts on wildlife resources from further consideration.

The Cherokee Nation stated it was not presently aware of or able to identify any cultural resources affiliated with the Cherokee Nation within the project study area.

S.8.3 Community Organization Comments

Various civic and community organizations have been represented in a number of ways throughout the study process. This representation has varied from membership on the SAC Committee to verbal and written comments. The following local or regional agencies have provided written feedback for consideration in the development of this document:

- Henderson County Conservation District
- Henderson Economic Development Council
- Henderson – Henderson County Chamber of Commerce
- Indiana Port Commission
- Mt. Vernon Area Chamber of Commerce
- Posey County Commission
- The Chamber of Commerce and Industry, Inc. (Owensboro-Daviess County)
- The Voices for I-69
- University of Southern Indiana

Many community leaders have expressed support for the project. There are some differences of opinion with respect to preferred location for an eventual I-69 corridor (i.e. west of Evansville-Henderson versus east).

S.8.4 Public Official Comments

Elected and public officials were encouraged to submit comments at the public information meetings. Comments were received from:

- City of Evansville, Mayor’s Office
- City of Mt. Vernon, Mayor’s Office
- City of Owensboro, Mayor’s Office
- Daviess County Fiscal Court

Much like the comments received from community organizations, the public officials' comments demonstrated strong support for the construction of I-69 between Evansville and Henderson. The City of Evansville and Mt. Vernon representatives stated a preference for a western corridor, while the City of Owensboro and Daviess County Fiscal Court favored Corridor 2.

S.9 EVALUATION OF ALTERNATIVES

The four Build Alternatives analyzed in this document would each impact the natural and manmade environments in a number of ways. The most direct manner these impacts would occur is through the conversion of existing land uses into a transportation corridor. Throughout the development of the alternatives, efforts have been made to avoid and/or minimize impacts to known environmental resources. Thus, the Build Alternatives were modified to further avoid and/or minimize impacts. The September 2002 public information meetings were utilized to gather public input relative to these alternative modifications. These coordination efforts are discussed below and are followed by a discussion of the impacts.

S.9.1 Engineering and Traffic

The following engineering topics were considered in evaluating alternatives:

- Traffic Impacts
- Pedestrian/ Bicycle Impacts
- Construction Impacts
- Seismic Considerations
- Permits
- Access and Interchange Locations
- Right-of-way Constraints
- Hydraulics and Floodplain Impacts

Alternatives 2 and 3 require significantly less new construction than the western alternatives, primarily due to the use of existing I-164. As such, these corridors also cost significantly less. The proposed Pigeon Creek Greenway Passage southeast of Evansville may be impacted by the eastern alternatives; however, at the present time, there will be no impact upon the future Pigeon Creek Greenway Passage that would impede its development.

Each Build Alternative will not only influence the local transportation system, but the regional system as well. The development of SIU #3 (Evansville to Indianapolis) and SIU #5 (Eddyville to Henderson) in conjunction with the I-69 Evansville to Henderson project will provide significant benefits in terms of regional traffic performance and freight movement.

The design of structures associated with I-69 will require careful consideration of the potential for seismic activity in the region. Southwest Indiana and Northwest Kentucky are known for seismic activity. Additionally, the potential for liquefaction through floodplains and areas characterized by alluvial deposits must be considered during subsequent design phases, if any.

The impacts of the proposed Build Alternatives include providing a safe and efficient Interstate facility for the cities of Henderson and Evansville to accommodate existing and future traffic volumes. The proposed Build Alternatives would improve the system linkage in Southern Indiana and Western Kentucky, and provide improved access to other major transportation routes, including enhanced access to multi-modal facilities. A Build Alternative would reduce travel time and improve the economy of travel by lowering operating costs.

Locally, the eastern corridors tend to provide the most significant improvements to the Evansville-Henderson transportation system. A new bridge over the Ohio River on Alternative 2 would carry the most traffic of any of the build alternatives and provide the greatest amount of traffic relief from reassignment of trips from the existing US 41 bridges. Alternatives 1 and 1A would not provide significant reductions to future traffic volumes on the US 41 bridges.

Transit alternatives, including Transportation Demand Management resources, were considered during as alternatives. However, after consideration, it was determined that transit alternatives would not meet the Purpose and Need of the project, including federal legislation.

In ISTEA, Congress designed Corridor 18 as a “high-priority corridor” on the NHS. Because the NHS is, by definition, a highway system, the designation of Corridor 18 as part of the NHS reflected a clear intention the Corridor 18 be developed as a highway. However, the original ISTEA legislation did not specify any design standards or requirements for Corridor 18; not only did it not designate Corridor 18 as an Interstate, it did not even specifically require the corridor to be completed as a multi-land highway.

In TEA-21, following the completion of a series of feasibility studies for Corridor 18, Congress specifically designated Corridor 18 as an Interstate highway; the law stated that Corridor 18 (and Corridor 20) “shall be designed as Interstate 69 (I-69). TEA-21, 1211 (i)(3)(c)(“The routes referred to in subsection (c)(2){of ISTEA} shall be designated as Interstate Route I-69”). The legislation means that future planning for Corridor 18 should proceed on the assumption that it will be developed as a continuous Interstate highway (I-69) linking Canada to Mexico.

In light of federal legislation designating the National I-69 corridor and national FHWA policies, FHWA, INDOT and KYTC have concluded that this study should focus on the proposal to complete I-69 as an Interstate highway between Henderson and Evansville.

The No-Build Alternative would not impact the existing transportation system, and would require no consideration for engineering impacts.

S.9.2 Environmental

The following environmental topics were considered in evaluating the four Build Alternatives:

- Land Use Impacts
- Social Impacts
- Relocation Impacts
- Residential and Neighborhood Impacts
- Environmental Justice
- Economic Considerations
- Air Quality Impacts
- Highway Noise Impacts
- Wild and Scenic Rivers Impacts
- Historic Impacts
- Archaeology Impacts
- Visual Impacts
- Hazardous Waste Site Impacts
- Threatened and Endangered Species Impacts
- Wetlands Impacts
- Agricultural Impacts
- Forest Impacts
- Water Body Modifications
- Water Quality Impacts
- Ecosystem Impacts
- Energy Impacts
- Irretrievable and Irreversible Commitment of Resources
- Short Term Use vs. Long Term Productivity
- Mineral Resource Impacts
- Use of 4(f) Resources

The areas east of Henderson are primarily characterized as agricultural with dispersed residential development. The same can be said for the Indiana portions of the western alternatives, with more industrial and commercial development in Kentucky as the western corridors approach southwest Henderson. Given these characterizations, each Build Alternative is anticipated to impact substantial amounts of farmland, wetlands, and forested areas.

Many of the environmental concerns discussed in the document are minimized by the eastern alternatives, primarily due to the use of existing I-164 with those corridors. Residential and business relocations are minimized in Alternative 2. Alternatives 1 and 1A span greater lengths than Alternatives 2 and 3, thereby causing more impacts to floodplain acreages and requiring longer structures to traverse the Ohio River. Ambient standards are not substantial for any of the Build Alternatives, as the project is in the Statewide Transportation Improvement Plans (STIPs) of both Indiana and Kentucky. The alternatives meets the emissions budget of EUTS and will not result in appreciable air quality impacts. The preferred alternative has successfully undergone conformity analysis in the EUTS Long Range Plan. Through coordination with numerous local, state, and federal resource agencies, uses of 4(f) resources have been avoided. Coordination with the KY Division of Forestry and the U.S. Fish and Wildlife Service has avoided negative impacts to the proposed expansion areas of the Green River State Forest and the Proposed Green River National Wildlife Refuge. In addition, corridor modifications have been made in order to minimize significant direct and indirect impacts to historic properties both listed in and deemed eligible for listing in the National Register of Historic Places. Further analysis will assist in the avoidance of unknown archaeological resources.

Where practical, impacts to important resources have been avoided or minimized through the corridor development process and subsequent modifications. Where such measures are not possible, mitigation efforts will be pursued to diminish the negative effects that may result from the construction of I-69. Mitigation efforts at this point focus on general themes more than specific measures focusing on particular site impacts. More detailed mitigation measures will be developed in the FEIS.

The principal adverse socio-economic impacts associated with any of the proposed Build Alternatives would be a result of: (1) right-of-way acquisition requirements – the potential acquisition of 423 to 1,521 acres of land; (2) the potential relocation 6 to 74 residences and the acquisition of up to 7 commercial establishments; and (3) changes to existing communities in the project corridor.

The positive impacts of the proposed Build Alternatives include providing a safe and efficient Interstate facility for the cities of Henderson and Evansville to accommodate existing and future traffic volumes. The proposed Build Alternatives would improve the system linkage in Southern Indiana and Western Kentucky, and provide improved access to other major transportation routes, including enhanced access to multi-modal facilities. A Build Alternative would reduce travel time and improve the economy of travel by lowering operating costs. **(see Chapter 3)**

Cumulative impacts are defined by the Council on Environmental Quality (CEQ) Regulations as "*the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.*" Cumulative impacts include the direct and indirect impacts of a project together with the reasonably foreseeable future actions of others. The assessment of cumulative impacts is required to ensure that the proposed I-69 project and other federal, state, and private actions will be evaluated with regard to cumulative impacts.

The methodology for determining cumulative impacts of the proposed I-69 project follows an eleven step process for conducting the cumulative impacts analysis. The methodology focuses on identifying the existing, baseline conditions within the project study area and then forecasting potential impact scenarios that are likely to result both in conjunction with and exclusive of the development of the I-69 project.

S.9.3 Summary of Impacts

The following sections discuss the findings with respect to the engineering, traffic, and environmental considerations.

- Each Build Alternative represents an alignment where an Interstate is currently deemed reasonable for construction. Additional data collection (i.e. survey information, geotechnical explorations, etc.) and further analyses are necessary to carry any alternative through preliminary design phases.
- Each Build Alternative has some impact on historic properties. Historic properties along each of the three Build Alternatives have been identified and evaluated whether the proposed project will have an effect on these properties. It is estimated that Alternative 1A contains the most adverse impacts whereas Alternative 2 creates the least number of adverse impacts to historical properties.
- Alternative 3 will have adverse visual and noise impacts on Angel Mounds.
- Residential and business relocations are minimized with Alternative 2, with six residences and no businesses displaced. The remaining alternatives impact from 61 to 74 homes and six to seven businesses.
- The eastern Build Alternatives provide the greatest improvement to traffic performance, compared to the No-Build scenario. Alternative 2 is forecasted to carry the highest traffic volume across the Ohio River (32,000 vehicles per day in 2025 assuming I-69 SIU #3 is constructed in the SR 57 Corridor) and provide the greatest reduction in traffic on the existing US 41 bridges (reduction of 52% in 2025, LOS C). The western build alternatives would attract less traffic, and so are less effective at relieving demand and congestion on the existing highway and street network.
- Air quality impacts are not substantial for any of the four Build Alternatives under consideration.
- All of the alternatives experience some noise impacts. Alternatives 1 and 1A adversely effect 3 and 5 historic properties, respectively. Project noise levels along Alternative 3 will result in an Adverse Effect on a National Landmark (Angel Mounds). Finally, approximately three receiver locations are expected to experience a slight increase in noise along Alternative 2 (less than 3db).
- Impacts to known archaeological resources range from five and six sites for Alternative 3 and 2 respectively, to twelve sites for Alternative 1 and 1A. Additional field work will be conducted on the preferred corridor, and the results will be included in the Final Environmental Impact Statement.
- Potential hazardous material (HazMat) sites consist of abandoned gasoline stations, one salvage yard, and railroad lines. Additional field work will be necessary prior to construction to determine the nature of these and currently unknown sites, as both above ground and underground storage tanks (AST's and UST's) may be in existence.
- Gas and mineral resources underlie significant lengths of each of the Build Alternatives. Coal is found under 52% of Alternative 3's length, 63% of Alternative 2, 72% of Alternative 1, and 75% of Alternative 1A. Oil and gas well occurrences range from three for both Alternatives 2 and 3 to nine for both Alternatives 1 and 1A.

- There are no known environmental justice issues with the four Build Alternatives under consideration.
- Anticipated right-of-way requirements range from 723 to 1,737 acres. Total farmland within the estimated right-of-way includes 1,077 acres for Alternative 1, 1,292 acres for Alternative 1A, 592 acres for Alternative 2 and 538 acres for Alternative 3 .
- Impacts to endangered or threatened wildlife habitat are minimal for any Build Alternative. The alternatives were developed and have been modified to minimize the potential for impacts to important habitats. Where construction-related intrusion is unavoidable in areas where important habitats may exist, efforts will be made to minimize losses of the resource. Information consultation with the USFWS concluded that the project has the potential to impact Indiana bat summer maternity roost habitat, and possible federally listed mussel species (namely the fat pocketbook mussel). As part of the Section 7 Endangered Species Act coordination process, the USFWS indicated on March 12, 2003 that formal consultation was not required for the I-69 project at this time, but suggested mitigation measures be implemented.
- Each Build Alternative will require significant lengths of structure or series of structures to traverse the Ohio River and adjacent floodplains. These lengths vary from 3.4 miles on Alternative 2 to 9.0 miles on Alternative 1 and Alternative 1A. Construction of these sections will require analyses with respect to geotechnical and hydraulic data collection and seismic considerations.
- The lengths of floodplain traversed by each alternative ranges from 7.0 miles for Alternative 2 to 14.6 miles for Alternative 1A. Floodplain acreage impacts range from 352 acres for Alternative 3 to 521 acres for Alternative 1A.
- Wetland impacts have been largely avoided through the development and modification of the alternatives. Jurisdictional wetland impacts are estimated to be between 22 and 27 acres for Alternative 1, 20 to 24 acres for Alternative 1A, 29 to 35 acres for Alternative 2, and 35 to 39 acres for Alternative 3. These impacts are estimated in ranges since actual delineations have not yet been performed. Field inspections will be conducted to delineate wetlands for the alternatives and the results will be available in the FEIS.
- The most significant change in land use will result from the conversion of agricultural lands to transportation right-of-way. Alternative 1A will impact the most prime and unique farmland (1,235 acres), with Alternative 2 impacting the least (623 acres). Alternative 3 also impacts the most statewide and locally important farmland (41.0 acres) with Alternative 1A impacting the least (0 acres).
- Alternative 1A will result in the largest loss of existing total forest habitat (258 acres) whereas Alternative 2 and 3 impact 55 and 44 acres of forested lands, respectively. Alternative 1A impacts the greatest acres of core forest (20.1 acres) while Alternative 3 does not impact any existing core forests.
- Alternative 2 encroaches upon the fewest streams (41). Alternative 1A impacts the largest number of streams (66).

Table S-1 presents a summary of the considerations discussed in this document.

Table S-1: Alternative Performance

	ALTERNATIVE				
	No-Build	1	1A	2	3
PURPOSE AND NEED CONSIDERATIONS					
Meet current freeway design standards	NO	YES	YES	YES	YES
Provide sufficient capacity for new bridge and new bridge approaches	NO	YES	YES	YES	YES
Provide additional Ohio River crossing	NO	YES	YES	YES	YES
Decrease congestion on existing US 41 river crossing (LOS on existing bridges)	F	F	F	C	D
Improve safety by providing cross-river transportation that meets freeway design standards	NO	YES	YES	YES	YES
Traffic Performance					
Reduction of VHT on arterials (rank)[1]	--	+9.4% (4)	+5.2% (1)	+6.2% (2)	+6.3% (3)
Reduction of VHT on US 41 (rank)[1]	--	-8.7% (4)	-12.3% (3)	-29.3% (1)	-28.9% (2)
Reduction of truck VHT (rank)[1]	--	+5.5% (4)	+1.7% (3)	+1.1% (2)	+0.3% (1)
ENVIRONMENTAL CONSIDERATIONS					
Total Right-of-Way (acres)	0	1524.9	1737.4	747.2	723.4
Potential Hazardous Material Sites (HazMat)	N/A	4	5	1	4
Total Forest (net loss in acres)	N/A	243	258	55	44
Core Forest (net loss in acres)	N/A	14.7	20.1	13.4	0
Total Wetlands (acres)	N/A	25.85-30.40	24.55-28.85	30.15-36.40	36.45-40.35
USACE Jurisdictional Wetlands (acres)	N/A	22.74-27.29	20.40-24.70	29.35-35.60	35.16-39.06
USACE Non-jurisdictional Welands (acres)	N/A	3.11	4.15	0.8	1.29
Total Floodplains Crossed (mi)	N/A	12.9	14.6	7.0	7.9
4(f) Property Uses	N/A	0	0	0	0
Total Farmland[2] (acres)	N/A	1,077.90	1,292.70	592.8	538.1
Prime & Unique[3] (acres)	N/A	977.4	1,235.40	623.9	645.2
Total Homes/Apartment Units Relocations	N/A	61	71	6	74
Business Relocations	N/A	6	6	0	7
Potential Archaeological Impacts (sites)	N/A	12	12	6	5
Environmental Justice Issues	N/A	NO	NO	NO	NO
Number of Streams Encroached	N/A	58	66	41	42
Number of Noise Impacted Receivers	41	51	51	39	19
Adversely Effected Historic Properties	0	9	9	4	7
Adversely Effected National Historic Landmarks	0	0	0	0	1
Exceed Ambient Air Quality Standards	NO	NO	NO	NO	NO
ENGINEERING CONSIDERATIONS					
Total length (miles)	N/A	31.8	35.2	31.5	29.7
New construction (miles)	N/A	31.8	35.2	13.2	14.7
Structure length (miles)	N/A	9.0	9.0	4.0	7.0
Estimated Total Cost (In 2003 Millions)	$0	$1,058	$1,088	$652	$799
Constructability (High, Moderate, or Low)	N/A	L	L	H	M

The information included in this chart is based upon the most recent available data. As such, it is subject to change during the development of the FEIS.

1. VHT=Vehicle Hours of Travel. Compares the 2025 Build Network including I-69 SIU #3 in the SR 57 corridor to the No-Build Scenario. This information pertains to the Henderson-Evansville regional transportation network.
2. Farmland includes currently used agricultural land, including row crop production.
3. Prime & Unique farmland includes some woodlands based on soil types.

S.10 REGULATORY ACTIONS ASSOCIATED WITH THIS PROJECT

Coordination with several state and federal resource agencies has been initiated. Inventories and coordination with consulting parties pursuant to Section 106 of the National Historic Preservation Act are ongoing for both historic and archaeological evaluations. Preliminary discussions regarding permitting under Section 404 of the Clean Water Act have been undertaken with the U.S. Army Corps of Engineers and consultation under Section 7 of the Endangered Species Act has been initiated with the U.S. Fish and Wildlife Service. Both the Indiana Department of Environmental Management (IDEM) and the Kentucky Department of Fish and Wildlife Resources (KDFWR) have been contacted for a 401 Water Quality Certification on wetlands and water quality.

The Indiana Department of Natural Resources (IDNR) and the Kentucky State Nature Preserve Commission (KSNPC) have provided information on significant, ecological, and protected lands in the vicinity of the corridors, as well as information related to the existence of state-listed threatened and endangered species within the project study area. IDNR and the Kentucky Division of Water (KYDOW) have provided information on water quality and publicly managed lands. Finally, the U.S. Environmental Protection Agency (USEPA) provided valuable input on the original ten corridors. Coordination with these agencies will continue throughout the documentation process in the study.

S.11 PREFERRED ALTERNATIVE

Based on the information contained within this DEIS and information gathered to date, Alternative 2 is the preferred alternative. This initial identification of the preferred alternative is based on the project's purpose and need, potential impacts, construction costs, utilization of existing highways, and data provided by public input.

The comparison of eastern (Alternatives 1 and 1A) versus western (Alternatives 2 and 3) alternatives identified different types of impacts. The western alternatives generally perform poorer in meeting the project's purpose and need than the eastern alternatives. Moreover, the western alternatives do not utilize existing roadways and therefore require more new right-of-way. This new right-of-way will likely change the existing landscape and setting of many of the rural and historic areas on the west side of Evansville, in contrast to the eastern alternatives, which utilize existing I-164 and thus have fewer modifications to the existing landscape within the area north of the Ohio River. As a result, the western alternatives tend to have relatively more impacts to environmental resources. The western alternatives also travel through a large portion of floodplain through the oxbow area just north of the Ohio River. When comparing the miles of floodplain traversed, Alternatives 1, 1A, 2, and 3 travel through 12.9, 14.6, 7, and 7.9 miles of floodplain, respectively. Although the design phase will determine the exact miles of bridge structure, this study assumed a bridge would be required over floodplain, particularly the Ohio River's floodway. Finally, cost was considered when evaluating the western and eastern alternatives. It is estimated the western alternatives are expected to cost at least $200 million more than the eastern alternatives. Alternatives 1 and 1A are considered non-preferred relative to Alternatives 2 and 3 because of their generally lower performance, higher right-of-way impacts, higher environmental impacts, and higher cost.

Alternatives 2 and 3 are more similar in performance and cost and share some similar environmental impacts. Both alternatives require approximately 700 acres of right of way, including approximately 600 acres of farmland. Both alternatives utilize portions of existing I-164, and both alternatives may impact a similar number of archaeological sites. However, Alternatives

2 and 3 differ in their impact to Angel Mounds State Historic Site. Angel Mounds is a significant archaeological resource that is designated as a National Landmark and is on the National Register of Historic Places. The nearest construction limits of Alternative 2 are over four miles southwest of Angel Mounds while Alternative 3 comes within 1,000 feet from Mound G within Angel Mounds. Given the proximity of Alternative 3 to Angel Mounds, consultation between the Indiana State Historic Preservation Officer, Angel Mounds staff, local historians, and archaeologists determined that an adverse effect on Angel Mounds will occur with the construction of Alternative 3. Alternative 2 was shown to have no adverse effect on Angel Mounds.

Other issues associated with Alternative 3 relative to Alternative 2 include its relocation impacts, its cost, and constructability. In addition to the impact on Angel Mounds, Alternative 3 is expected to have over 70 residential/apartment relocations and approximately seven business relocations while Alternative 2 is estimated to have approximately six residential/apartment relocations and no business relocations. Also, the cost for Alternative 3 is approximately $140 million greater than for Alternative 2. This increased cost is a result of the greater length of Alternative 3 (including a longer structure traversing the Ohio River and its floodway) and its required relocation of a greater number of residential housing and businesses units. Alternative 3 would also require a complicated urban interchange for the proposed I-164/I-69/SR 662 interchange. Although Alternative 3 has fewer high quality wetland impacts than Alternative 2, it is non-preferred relative to Alternative 2 for its impacts to Angel Mounds (a National Historic Landmark), its relocation impacts, and its cost.

In summary, Alternatives 1, 1A, 2, and 3 each have their own unique impacts. However, Alternative 2 performs strongly in meeting the project purpose and need, requires fewer acres of right-of-way and farmland than the western alternatives, utilizes 18 miles of existing Interstate highway, requires the fewest residential and business relocations, has the fewest number of adverse historical impacts, and is the least costly alternative. Given this comprehensive evaluation of impacts, Alternative 2 is identified as the preferred alternative.

Chapter 1 – PURPOSE AND NEED

The proposed action was identified in the *Transportation Equity Act for the 21st Century of 1998 (TEA-21)* as a component of the I-69 Corridor. As such, the purpose of this project is to provide a critical link in the Interstate System and to provide a safe facility that will serve traffic.

The purpose of this project primarily involves the need to complete the National I-69 Corridor, but also involves regional elements including providing sufficient cross-river mobility and strengthening the regional transportation network. The purposes and needs of this project are as follows:

- <u>Support the completion of the National I-69</u>. There is a need to provide an Interstate link connecting Henderson, KY to Evansville, IN as a part of this National Corridor (SIU #4).
- <u>Provide sufficient cross-river mobility in the Evansville/Henderson area</u>. There is a need to provide a new or enhanced river crossing because the only existing Ohio River crossing in the area – US 41 – is inadequate to meet existing local traffic and future National I-69 traffic demands under normal working conditions. In the event of an accident or other event involving the existing US 41 bridge, the bridge may be partially closed, affecting both local and National I-69 traffic.
- <u>Strengthen the transportation network in the Evansville/Henderson area</u>. There is a need to strengthen the local transportation network because the existing network will not be able to meet the local forecasted travel demand as well as the additional demand resulting from the completion of the National I-69.

The needs are explained more fully below, along with several objectives and measures for determining the effectiveness of any proposed alternative.

1.1 HISTORY OF INTERSTATE 69 (CORRIDOR 18)

In addition to the routes recommended by states, the U.S. Congress has specifically designated 43 “high-priority corridors” as part of the National Highway System (NHS). The NHS consists of highway routes and connections to transportation facilities that are depicted on a map approved by Congress.[1] These routes include all Interstates, principal arterial routes, connector highways, and the strategic highway network (STRAHNET) and its major connectors. These routes serve major population centers, international border crossings, ports, airports, public and other intermodal transportation facilities, major travel destinations, and interstate and interregional travel. In addition, these routes serve as a national defense transportation network.

One of the high-priority corridors designated in the Intermodal Surface Transportation Efficiency Act (ISTEA) was a route from Indianapolis to Memphis via Evansville – the route that soon became known as Corridor 18 and has been designated I-69. ISTEA was the federal transportation bill that provided funds to the 50 states for transportation improvements, including highway, bridge, rail, and transit projects. In ISTEA and several subsequent laws, Congress addressed both the location and the Interstate status of Corridor 18.

Route Definition

In ISTEA, Congress defined Corridor 18 as simply a corridor “from Indianapolis, Indiana to Memphis, Tennessee via Evansville, Indiana.” (TEA-21 § 1211(i)). In 1993, Congress extended the corridor south to Houston, and in 1995, it extended the corridor all the way to the border with Mexico in the Lower Rio Grande Valley. Finally, in 1998, as part of TEA-21, Congress extended the corridor north to the border with Canada at Port Huron, Michigan; added a spur connecting

[1] The map, which is referenced in 23 U.S.C. § 103(b), is entitled “Pulling Together: The National Highway System and Its Connection to Major Intermodal Terminals” and is dated May 24, 1996.

the corridor eastward to Detroit and westward to Chicago via I-94; and adopted the route shown in the 1995 Corridor 18 Special Issues Study as the legislatively mandated route in four states – Tennessee, Mississippi, Arkansas, and Louisiana. (TEA-21 § 1211(i)).

Interstate Designation
In ISTEA, Congress designated Corridor 18 as a "high-priority corridor" on the NHS. Because the NHS is, by definition, a highway system, the designation of Corridor 18 as part of the NHS reflected a clear intention that Corridor 18 be developed as a highway. However, the original ISTEA legislation did not specify any design standards or requirements for Corridor 18.

In TEA-21, following the completion of a series of feasibility studies for Corridor 18, Congress specifically designated Corridor 18 as an Interstate highway: the law stated that Corridor 18 (and Corridor 20) "shall be designated as Interstate 69 (I-69)."[1] The legislation means that Corridor 18 will be developed as a continuous Interstate highway (I-69) linking Canada to Mexico.

Following TEA-21, FHWA issued further guidance concerning the Interstate status of Corridor 18. In a Federal Register notice published on December 8, 2000, FHWA announced that it "has initiated the project planning, development, and decision making process for numerous transportation projects related to a transcontinental highway corridor, designated as I-69." (FHWA, "Announcement of I-69 Status," Federal Register, Vol 65, No. 237 (Dec. 8, 2000)).

1.2 SUMMARY OF PROPOSED ACTION

The Indiana Department of Transportation (INDOT), the Kentucky Transportation Cabinet (KYTC), the regional Metropolitan Planning Organization (MPO) known as Evansville Urban Transportation Study (EUTS), and the Federal Highway Administration (FHWA) are evaluating a section of the proposed National I-69 Corridor in the Evansville, Indiana-Henderson, Kentucky area (Evansville/Henderson area) shown in **Figure 1-1**. The project study area, shown in **Figure 1-2** is located between the northern terminus of the Edward T. Breathitt Parkway, or simply Breathitt Parkway (formerly known as the Pennyrile Parkway) south of Henderson, and I-64, approximately 10 miles north of Evansville. The approximate eastern boundary parallels I-164 east of Evansville, and the western boundary is between the Posey-Vanderburgh County line and the City of Mt. Vernon. The proposed action includes constructing an Interstate facility with a new or enhanced Ohio River bridge crossing between the termini.

This proposed project represents one of the Sections of Independent Utility (SIU) that has been identified as part of the nationally designated I-69 Corridor that reaches from Port Huron, Michigan, to the Texas/Mexico border. The project was identified in the *I-69 Corridor Special Environmental Study – Sections of Independent Utility* as SIU No. 4.

The proposed action would provide an Interstate connection between these termini. Henderson, Kentucky and Evansville, Indiana are currently linked by US 41, a four-lane NHS facility connecting to I-64 north of the Ohio River. Other than US 41, the closest crossing of the river is approximately 30 miles upstream at Owensboro, Kentucky. The nearest downstream crossing is over 40 miles southwest of Evansville/Henderson, carrying KY 56 between Old Shawnee Town, Illinois and Blackburn, Kentucky, as shown in **Figure 1-3**.

[1] TEA-21 § 1211(i)(3)(C). ("The routes referred to in subsections (c)(18) and (c)(20) [of TEA-21] shall be designated as Interstate Route I-69.").

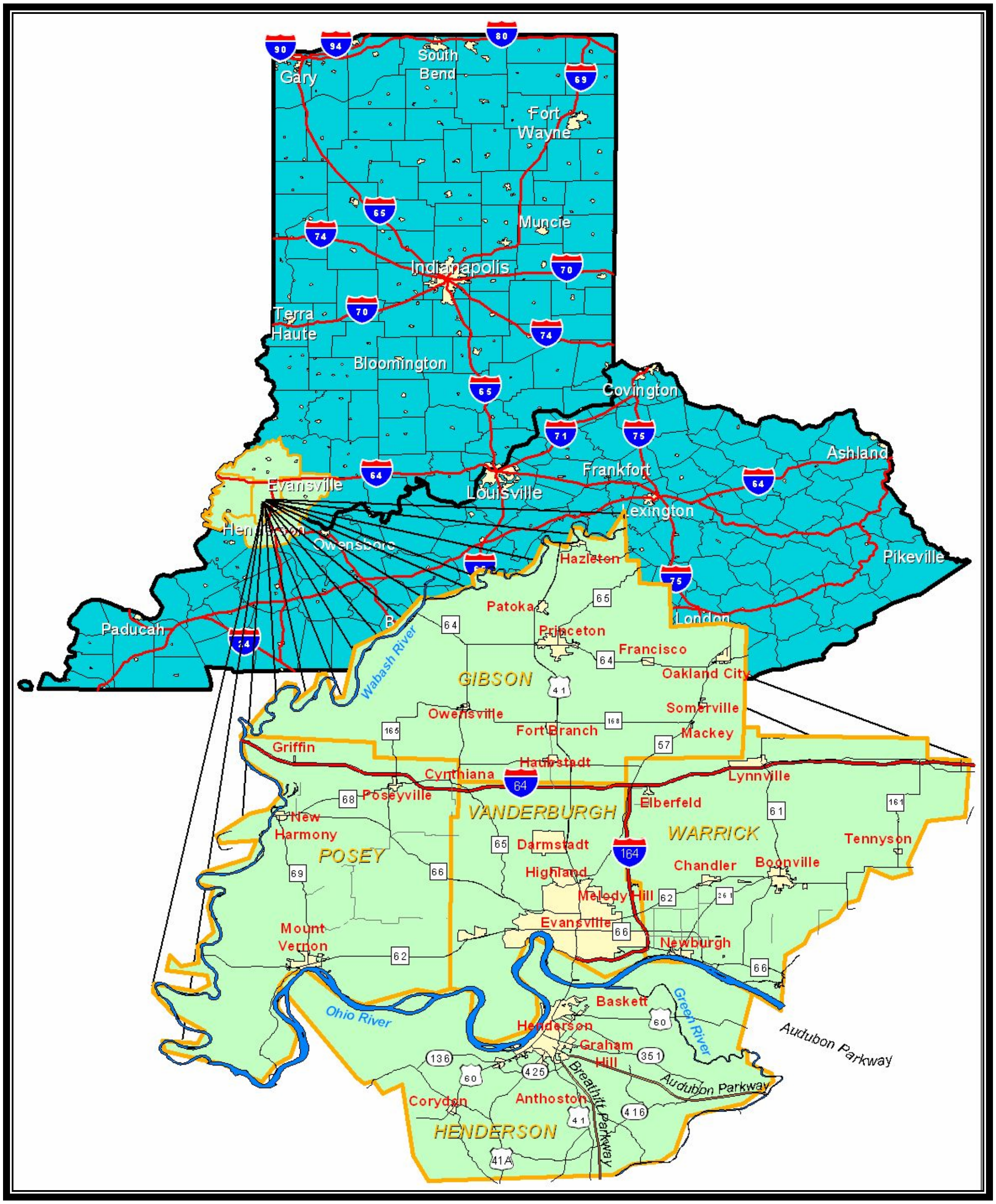


Figure 1-1: I-69 Henderson/Evansville Region

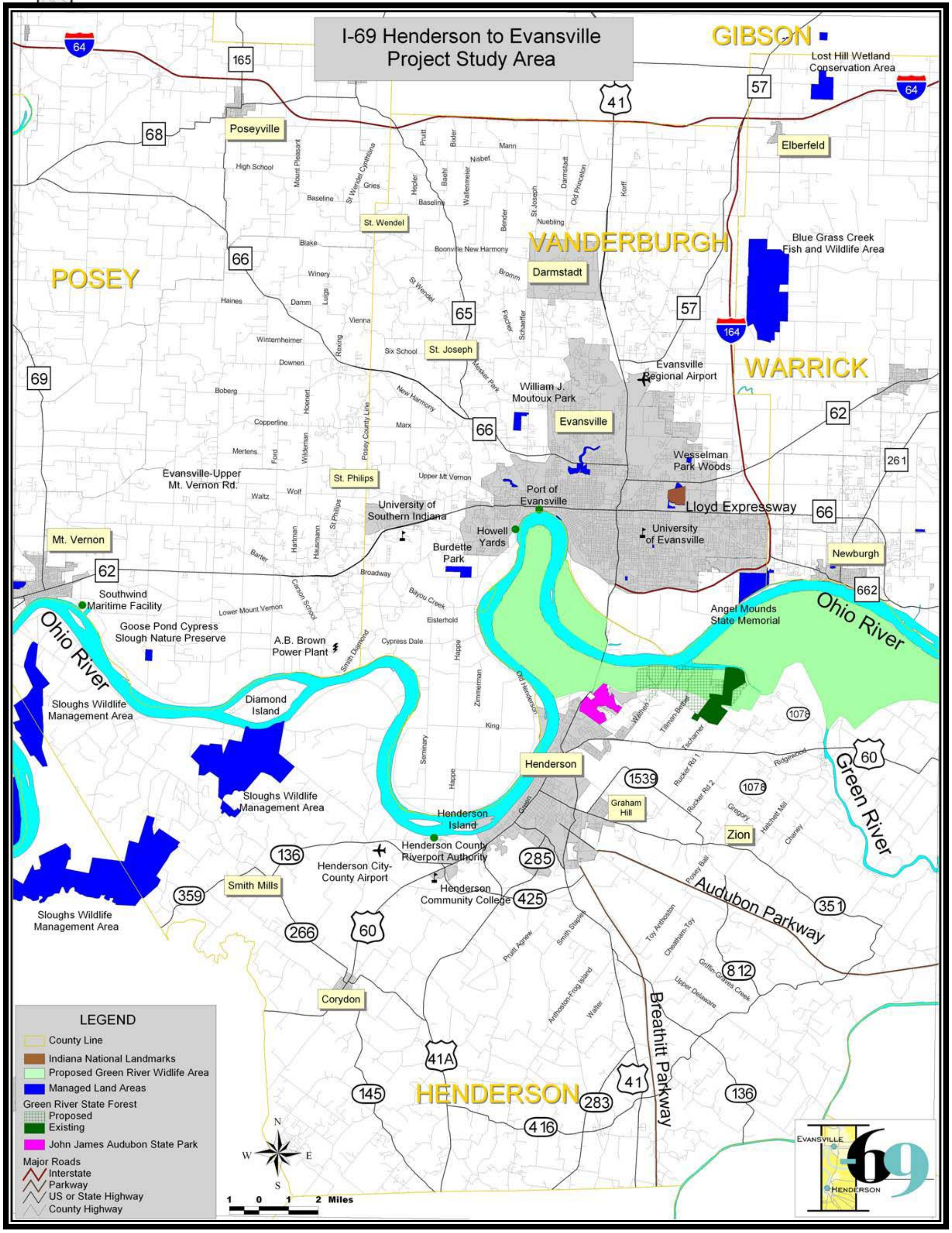


Figure 1-2: Project Study Area

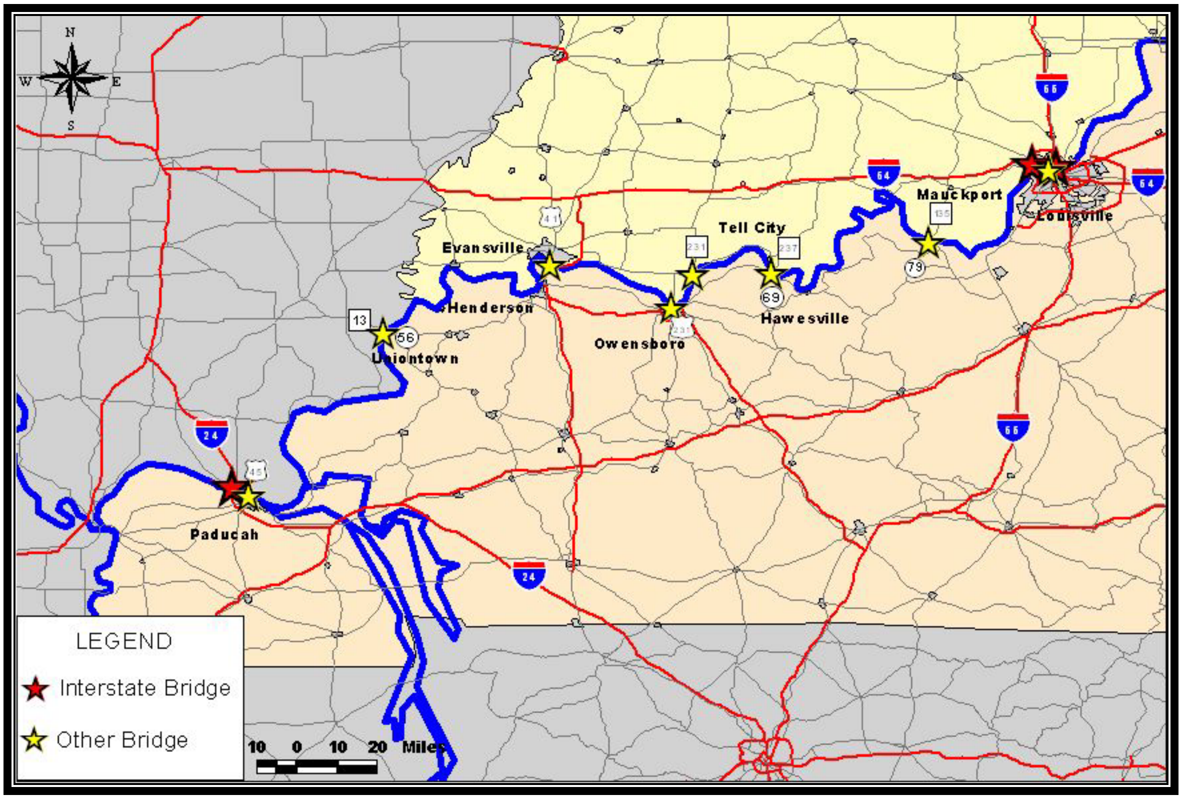


Figure 1-3: Ohio River Bridge Crossings

1.2.1 National I-69

Legislative Acts

During the 1990s, important policy decisions were made at the federal level in reference to I-69 between Port Huron, MI to the Lower Rio Valley in Texas. These policy decisions influenced the Segment of Independent Utility #4, Henderson, KY to Evansville, IN.

The Henderson to Evansville highway is now part of a national, border-to-border, National I-69 Interstate (see **Figure 1-4**). The Interstate highway has been designated, in a series of Congressional actions, as a *national priority* and will travel through eight states, connecting the Michigan/Ontario border with the Texas/Mexico border.

The following is a summary of major federal actions relating to National I-69 and thus, to the Henderson to Evansville project:

> **1991: Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).** Congress passed the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). Congress designated certain highway corridors of national significance to be included in the National Highway System (NHS). One of the high-priority corridors designated under ISTEA was “Corridor 18,” which extended “from Indianapolis, Indiana to Memphis, Tennessee via Evansville, Indiana.” Subsequent legislative changes (described below) have greatly expanded this corridor.

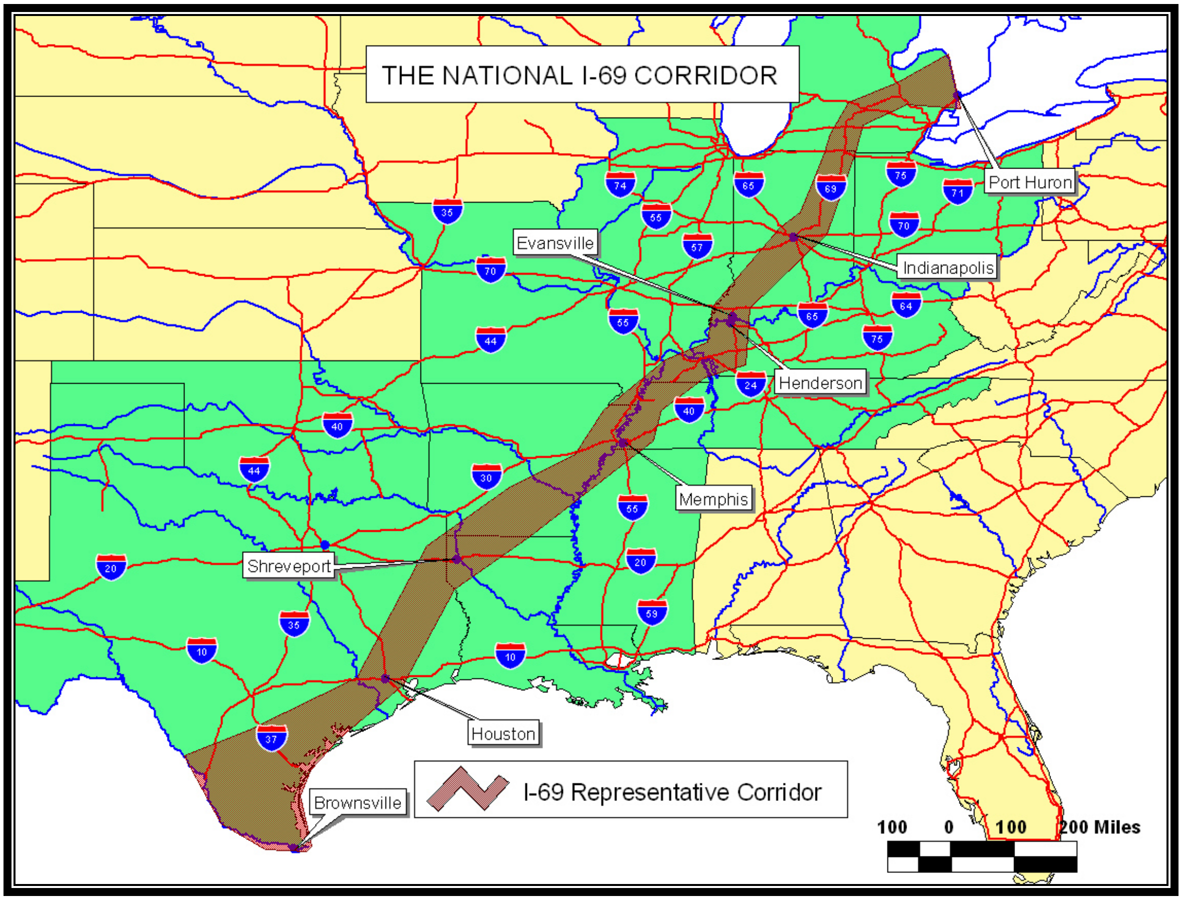


Figure 1-4: The National I-69 Corridor

The NHS is intended to "focus a portion of the limited Federal assistance on strategic investments, with a goal of overall system efficiency and performance."[1] As the USDOT explained in a 1993 report to Congress:

ISTEA called for the designation of a new category of highways – the National Highway System ("NHS") – which would include not only the Interstate System, but also other major principal arterial highways across the country. As a frame of reference, the Interstate System contains approximately 40,000 miles of roadway; by contrast, the NHS contains approximately 160,000 miles (including all of the Interstates). Although the NHS includes less than 5 percent of the United States' 3.9 million miles of public roads, it carries over 40 percent of the nation's highway traffic. (Rodney Slater, FHWA Administrator, *The National Highway System: The Backbone of the National Transportation System*, Dec. 9, 1993).

"...the rationale for designation of an NHS is to focus Federal attention on a subset of the Nation's 3.9 million miles (6.3 million kilometers) of public roads. The NHS will include roads that serve and will continue to serve a large percentage of the Nation's highway travel and associated strategic priorities. It will also emphasize connections from the

[1] U.S. Department of Transportation, Report to Congress on the Proposed National Highway System Required by Section 1006(a) of the Intermodal Surface Transportation Efficiency Act of 1991, Public Law 102-240 at 7 (Dec. 1993) (hereinafter "DOT Report"), p. 7.

NHS to major military installations, border crossings, airports, ports, and rail-highway transfer facilities..." (DOT Report, p. 1)

Indiana NHS routes in the Evansville region are shown in **Figure 1-5**. NHS routes, not including Intermodal Connectors, which provide access between NHS routes and intermodal facilities within the Evansville urbanized area include the following:

- I-164 between US 41 and I-64
- US 41 between Vigo/Vermillion County line and Ohio River
- SR 62 between US 41 in Evansville and Mt. Vernon to the west
- SR 66 between US 41 in Evansville and US 231 to the east

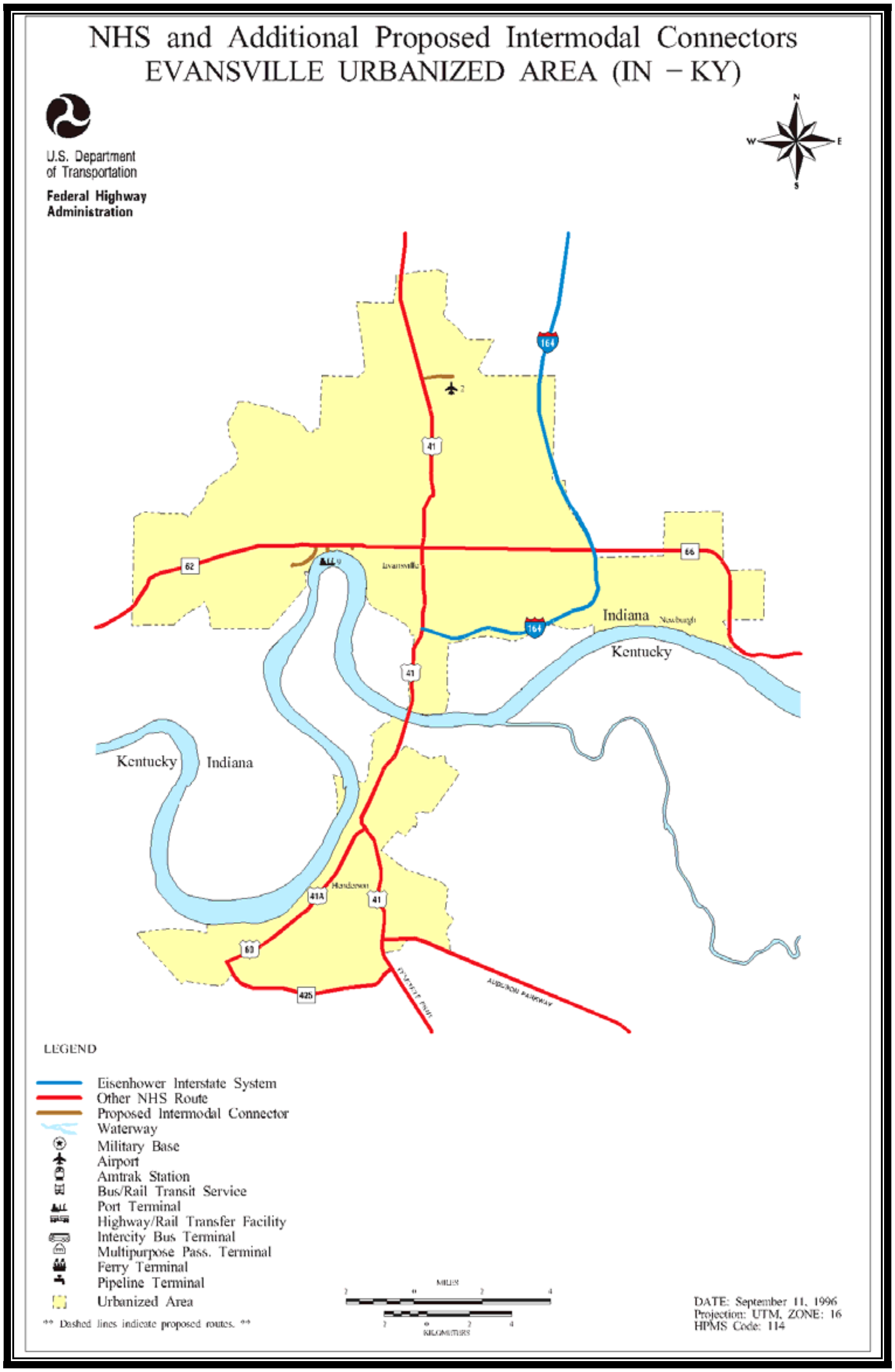
The routes currently included on the NHS in the Henderson region in Kentucky are also shown in **Figure 1-5**. NHS routes within Henderson County include the following:

- Audubon Parkway
- Breathitt Parkway
- US 41
- Green Street (US 60) from US 41 to KY 425
- KY 425 from Green Street (US 60) to the Breathitt Parkway

1995: National Highway System Designation Act (1995). In 1995, Congress passed the National Highway System Designation Act (NHSDA, Public Law 104-5) The NHSDA approved maps showing the NHS routes in each state, and also extended Corridor 18 to the south. The Act also gave FHWA the authority to approve modifications to the NHS map, as long as FHWA determines that the modifications are consistent with the purposes of the NHS. FHWA has issued regulations listing the factors that it considers in deciding whether to approve requests for changes to the NHS[1].

1998: Transportation Equity Act for the 21st Century (TEA-21). In 1998, Congress enacted the Transportation Equity Act of the 21st Century (TEA-21). TEA-21 modified Corridor 18 in several ways: (1) it extended the corridor northward to the Canadian border at Port Huron, Michigan; (2) it included spurs connecting the corridor to Detroit and Chicago; and (3) it adopted a specific route for Corridor 18 in Tennessee, Mississippi, Arkansas, and Louisiana. In addition, TEA-21 also designated Corridor 18 as "Interstate Route I-69."

[1] 23 CFR Part 470- Highway Systems.



Source: http://www.in.gov/dot/pubs/maps/nhs/list.htm

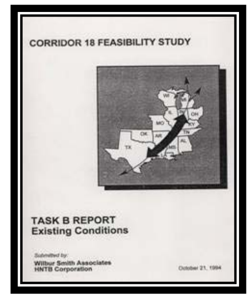
Figure 1-5: NHS Routes in the SIU #4 Study Area

1.3 NATIONAL I-69 STUDIES

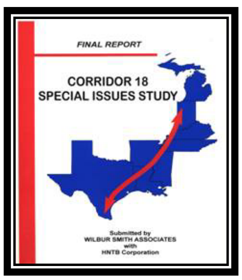
I-69 Steering Committee

Once President Clinton signed the ISTEA legislation, a National I-69 Steering Committee was established. This Committee is composed of the state Departments of Transportation (DOTs) along the I-69 Corridor, with Arkansas DOT as the lead agency. The I-69 DOTs have been working together successfully through the Steering Committee since 1993 and have guided I-69 through all stages of development.

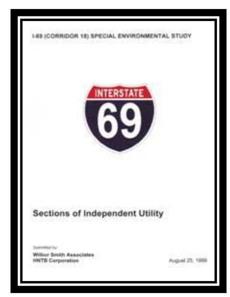
The I-69 Steering Committee has managed several studies that investigate the need and feasibility of the National I-69. The following is a summary of some of the National I-69 studies since 1995:



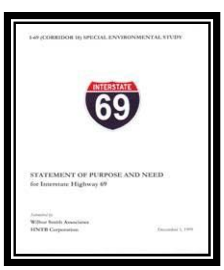
1995 - Corridor 18 Feasibility Study – The Corridor 18 Feasibility Study, initiated by the Steering Committee, investigated whether Corridor 18 was a feasible project based on its potential cost, impacts, and benefits. This study concluded that such a corridor contained feasible termini and Corridor 18 was indeed feasible.



1997 - Corridor 18 Special Issues Study – The Corridor 18 Special Issues Study, based on the direction of the Steering Committee, identified potential traffic impacts, potential river crossings, state crossings and other economic information.



1999 - Sections of Independent Utility – The Sections of Independent Utility report established the sections of independent utility (SIU) along the entire length of the National I-69 corridor. This report further identified two sections within Indiana and two sections within Kentucky. A section between Indianapolis and Evansville was identified as SIU #3, the section between Evansville, IN and Henderson, KY was identified as SIU #4, and the section between Henderson and Eddyville was identified as SIU #5.



2000 - I-69 Statement of Purpose and Need – In 2000, a National Purpose and Need Statement was published. The document identified seven goals of the National I-69 corridor as well as the needs of the highway. The following is a summary of the goals of National I-69:

Goals of National I-69 Project

Goal 1: To improve international and interstate movement of freight by ensuring a safe transportation system that is accessible, integrated, and efficient while offering flexibility of transportation choices in mid-America.

Goal 2: To enhance the regional and local transportation systems by providing transportation capacity to meet current and future needs.

Goal 3: To facilitate economic development and enhance economic growth opportunities domestically and internationally through efficient and flexible transportation with particular emphasis being given to economic growth in the Lower Mississippi Delta Region.

Goal 4: To facilitate connections to intermodal facilities and major ports along the corridor.

Goal 5: To facilitate the safe and efficient movement of persons and goods by fostering a reduction in incident [crash] risk.

Goal 6: To upgrade existing facilities to be utilized as I-69 within the corridor to design standards suitable for an Interstate highway and commensurate with projected demand.

Goal 7: To directly connect the urban areas named by Congress (the "named cities" of Indianapolis, Evansville, Memphis, Shreveport/Bossier City, Houston and the Lower Rio Grande Valley with an Interstate highway connection. (*I-69 (Corridor 18) Special Environmental Study: Statement of Purpose and Need for Interstate Highway 69* (Feb. 7, 2000), at 2.)

In its December 8, 2000 announcement, the FHWA provided a more concise summary of the goals of the National I-69 project. The FHWA described the goals of I-69 as follows:

> The I-69 Corridor has been identified to address the transportation needs associated with the increase in goods movement between the three partners (U.S.A., Mexico, and Canada) to the North American Free Trade Agreement of 1992. It is also a key component of the Clinton Administration's Delta Initiative, which is aimed at the revitalization and economic development of the Lower Mississippi Delta region. The overall purpose of I-69 corridor is to improve international and Interstate trade in accordance with national and state goals; and to facilitate economic development in accordance with state, regional, and local policies, plans, and surface transportation consistent with national, state, regional, local needs and with congressional designation of the corridor." (FHWA, "Announcement of I-69 Status," Federal Register, Vol 65, No. 237 Dec. 8, 2000).

The announcement also provided that the National I-69 goals shall be considered by NEPA studies on individual sections. It stated:

> Each state will study viable sections identified above (national sections of independent utility), addressing state and local needs, schedules, and funding constraints in accordance with the FHWA NEPA process. State and local needs for any particular project will be considered, as well as the national legislative and administrative objectives for the movement of goods across the county. The FHWA will partner with the state departments of transportation to facilitate the examination of alternatives and impacts within the proposed corridor, and to ensure consistency in addressing the national transportation objectives relative to transcontinental trade put forth by Congress.

In addition to defining these overall goals for the National I-69 project, the FHWA stated in the December 2000 announcement that the national project would be divided into 32 sections of independent utility (SIUs) – 26 sections along I-69 itself, and an additional 6 sections on connecting routes. The Henderson to Evansville proposed action is known as SIU #4. The FHWA stated that the environmental document for each section should consider not only the national and international goals of I-69 as a whole, but also the state and local needs to be addressed by that particular section.

1.4 PROJECT PURPOSE AND NEED

Purpose and Need Statement

The general purpose and need of this project is to provide a critical link in the I-69 National Corridor, which is identified in the Transportation Equity Act for the 21st Century of 1998 (TEA-21) as a high priority corridor. The proposed action is a component of the National I-69 Corridor that would provide sufficient capacity for design year traffic flow within the region. This traffic flow is inclusive of both Interstate and international traffic that will ultimately be using the facility. The purposes and needs of this project are as follows:

- Support the completion of the National I-69.
- Provide sufficient cross-river mobility in the Evansville/Henderson area.
- Strengthen the transportation network in the Evansville/Henderson area.

The needs are explained in full below, along with several objectives and measures for determining the effectiveness of any proposed alternative.

1.4.1 Support the Completion of the National I-69

There is not an existing Interstate facility within Corridor 18 that provides a direct link between the Canadian and Mexican borders with the United States. Addressing Congressional legislation, as outlined above, is one motive for the need for an international freeway. Constructing SIU #4 will support this need. To support the completion of I-69 as a National and International Trade Corridor, two objectives have been defined.

Objective #1: Complete an Interstate connection between the Breathitt Parkway in Kentucky and I-64 in Indiana.

Performance Measure: Meet current Interstate design standards.

There is currently no Interstate facility connecting the cities of Henderson and Evansville. Both the cities of Henderson, KY and Evansville, IN have independent access to Interstate highways on the perimeter of the more densely developed urban areas, but the only Interstate facilities connecting Indiana and Kentucky are in Louisville over 120 roadway miles away. The nearest Interstate crossing the Ohio River west of the Evansville-Henderson area is I-24 west of Paducah, Kentucky, approximately 110 roadway miles away. (See **Figure 1-3**.)

The current geometric standards to accommodate Interstate travel and projected volume of traffic in this corridor are not met on the existing river crossing. US 41 provides existing linkage within this segment of I-69, is classified as an urban principal arterial and is constructed as a four-lane highway from the terminus at the Breathitt Parkway to I-164; and operates with partial, not full, access control. It is characterized by numerous at-grade intersections with public crossroads and private drives, many controlled by traffic signals. US 41 travels through the City of Evansville, and has one section that widens from four to six through travel lanes. Two bridge structures carrying north and southbound US 41 with 34-foot wide decks (having 30 feet of horizontal clearance) provide the only local crossing of the Ohio River.

Numerous intersections exist throughout the length of the existing section of US 41 between the termini of the Breathitt Parkway and I-164. At-grade intersections involve intersecting roads and railroads without bridges. The section of US 41 immediately south of the Ohio River is characterized by traffic signals located at approximately ½ mile spacing and frequent driveway access. Access is more restrictive (i.e. partial access control), but is not fully controlled north of the Ohio River.

I-164 is a fully controlled access four-lane facility that provides a connection to I-64 north and east of Evansville. The interchange of I-164 with US 41 is a full cloverleaf interchange with substandard merge and weaving lengths. Beginning on the south side of Evansville at US 41 and terminating at I-64, I-164 meets current design standards and provides sufficient capacity to accommodate both current and projected future volumes of I-164.

While I-164 provides the region with a facility meeting current federal Interstate design standards, the only Ohio River crossing (the US 41 twin bridges) fail to meet current freeway design standards. For example, the bridges have inadequate shoulders and lane widths. In order to meet this performance measure, the existing US 41 bridge would need to be reconstructed to current standards or a new structure would need to be built in the Evansville/Henderson area.

Reconstruction of facilities to meet freeway design standards is necessary because Congress specifically designated Corridor 18 as an Interstate highway. The law stated that Corridor 18 (and Corridor 20) “shall be designated as Interstate 69 (I-69).”[1] The legislation means that future planning for Corridor 18 should proceed on the assumption that it will be developed as a continuous Interstate highway (I-69) linking Canada to Mexico.

Objective #2: Facilitate connections of I-69 with existing routes serving major freight origin, destination, or transfer facilities in the Henderson/Evansville area.

Performance Measure: Reduce freight travel times from project termini in the Evansville/Henderson metropolitan area.

The North American Free Trade Agreement (NAFTA) went into effect on January 1, 1994. The I-69 Corridor is one of several high priority corridors being evaluated to address the needs associated with the increase in goods movements between the three NAFTA partners: Mexico, the United States, and Canada.

[1] TEA-21, § 1211 (i) (3) (C) (“The routes referred to in subsections (c)(18) and (c)(20) [of ISTEA] shall be designated as Interstate Route I-69.”).

Currently most of the major intermodal facilities in the project study area are not located along an existing Interstate or NHS facility. The potential National I-69 Corridor would connect major urban areas, port facilities, industrial centers, airports, and intermodal transportation facilities. The potential corridor would serve local, regional, statewide, and national freight travel needs. For example, the route would connect major rail/truck intermodal facilities in Evansville with other rail/truck facilities and ports located in Indianapolis and Memphis, Tennessee, via fully controlled access facilities. The development of I-69 in the Evansville/Henderson area could potentially contribute to reduced travel costs by connecting to other freight facilities located further away.

This performance measure provides a means for comparing the ability of alternatives to reduce freight travel times within the project study area. This performance measure, which compares the relative ability of alternatives to reduce freight travel times, was used during the screening process to narrow the range of corridors and is being used to evaluate the alternatives currently under consideration.

1.4.2 Provide Sufficient Cross-River Mobility in Henderson/Evansville Area

SIU #4 is a key link in the I-69 National Corridor. In order to accommodate interstate traffic generated by an international border-to-border facility while addressing the needs of regional and local traffic, a new or enhanced crossing of the Ohio River will be needed. While no existing Ohio River crossing in the region meets contemporary seismic criteria, any new or upgraded crossing must be designed according to current seismic standards, since the project study area is within the zone of influence of the New Madrid Fault.

In the event of a major incident on or near the existing US 41 bridge, cross-river traffic ceases on this already congested segment of the transportation system. The lack of another nearby river crossing means that a major incident on or near the existing US 41 bridge would lead to the interruption of travel. (See **Figure 1.3**.)

Objective #1: Provide sufficient capacity for bridge and bridge approaches.

Performance Measure: Provide at least the minimum level-of-service (LOS) of D (C is preferable).

Assessing the need for an improved connection between Henderson and Evansville requires a capacity analysis to determine the LOS for US 41. LOS is a performance measure used to quantify the efficiency of a roadway. LOS is defined in categories from A to F. LOS A represents the highest quality of service with free flowing conditions, while LOS F represents heavy congestion or traffic breakdown conditions.

The data utilized to evaluate capacity and LOS for US 41 included (1) daily traffic forecasts obtained using the current Evansville Urban Transportation Study (EUTS) traffic model using the Existing plus Committed network; and (2) existing and projected traffic volumes without consideration of the completion of the other segments of I-69.

The results of the traffic analysis indicate that US 41 south of I-164 (including the twin Ohio River bridges) currently operates primarily at LOS E or F during peak travel period. By year 2025, the completion of the currently committed transportation projects are assumed to be completed, and forecasted LOS is projected to be LOS E or F but will worsen near the Breathitt Parkway due to the additional traffic growth in the area. Current LOS of the Breathitt Parkway near its northern terminus are LOS A and B. These data, which list traffic volumes and current and projected LOS of major facilities that may intersect the proposed action within the project study area, are included in **Table 1-1**. The data also include the current plans to widen US 41 and exclude any projected National I-69 traffic. Modeling indicates that volumes in the future will decrease on these segments of US 41 primarily as a result of traffic diversion to less congested routes (where committed roadway improvements are programmed) and as a result of the decline in population and employment in the immediate area.

Meeting these performance criteria will require all crossings and approaches to be at a minimum LOS of D in year 2025.

Objective #2: Provide adequate facilities to accommodate regional and National I-69 traffic in the event of whole or partial closures of the US 41 bridges.

Performance Measure: Provide an additional river crossing within the Evansville/Henderson area.

The existing river crossing and its approaches lie along US 41 between the interchange with I-164 and the Breathitt Parkway. The nearest Ohio River crossing is the William Natcher Bridge in Owensboro, KY, approximately 30 miles east of the Evansville-Henderson area. The nearest crossing west is the Shawneetown Highway Bridge connecting KY 56 with Illinois SR 13, approximately 70 miles west of the US 41 river crossing. (See **Figure 1-3**.)

The US 41 twin structures provide a significant mechanism to provide cross-river mobility. Approximately 40,000 vehicles use these structures on a daily basis. Any incident that would require the closure of either one or both bridge structures would cause negative impacts in vehicular and freight movement. The lack of an additional river crossing in the Evansville/Henderson area limits system redundancy, thereby hindering the ability of governmental authorities to respond to crashes, emergencies, and breakdowns, and to perform routine maintenance on the existing bridges.

Several events can lead to the need to close one or all lanes on the existing US 41 bridge. Closure of lanes in one direction may be necessary for bridge maintenance or for crash removal and subsequent investigation. The closure of the bridges in both directions could result from damage sustained by a barge accident, an earthquake, or other events.

Some of the needs for an additional bridge crossing include the following:

- **Access to Jobs**: A large number of commuters between Henderson and Evansville rely on the US 41 bridge for access to workplaces.

- **Access to Schools**: Four area universities and one state college serve students from both states. The University of Southern Indiana has a total student body of 9,300 students, approximately 400 or 4.3 percent of which reside in Kentucky. The Community College of Indiana has 4,600 students, the University of Evansville has 2,900 students, and Ivy Tech State College Southwest has 2,900 students. In Kentucky, Henderson Community College has an enrollment of 1,400 students, and approximately 4.5 percent of these students reside in Indiana. (2001 enrollment data)

Table 1-1: Level of Service in the Year 2025 for the Existing-Plus-Committed Network of Year 2000[1]

Route	Begin Point	End Point	Lanes	Functional Class	2000 ADT[2] (two-way)	Year 2000 LOS[3]	2025 ADT (two-way)	Year 2025 LOS
I-164	I-64	SR 57 (interchange)	4	Rural Interstate	20,793	A	21,976	A
	SR 57	Boonville-New Harmony Rd. (interchange)	4	Rural Interstate	18,349	A	23,452	A
	Boonville-New Harmony Rd.	Lynch Rd. (interchange)	4	Rural Interstate	23,759	A	34,307	B
	Lynch Rd.	Morgan Ave. (SR 62) interchange	4	Rural Interstate	23,759	A	36,766	B
	Morgan Ave. (SR 62)	Lloyd Expressway (SR 66) interchange	4	Urban Interstate	19,640	A	42,335	C
	Lloyd Expressway (SR 66)	Newburgh Rd. (SR 662) interchange	4	Urban Interstate	17,159	A	40,483	C
	Newburgh Rd. (SR 662)	Green River Rd. (interchange)	4	Urban Interstate	18,101	A	31,279	B
	Green River Rd.	US 41 (interchange)	4	Urban Interstate	23,207	A	31,824	B
US 41	I-64	Baseline Rd. (signal)	4	Rural principal arterial	23,412	C	18,670	B
	Baseline Rd.	Boonville-New Harmony Rd. (signal)	4	Rural principal arterial	21,246	C	28,488	D
	Boonville-New Harmony Rd.	Hillsdale Road (no signal yet)	4	Urban principal arterial	27,237	C	22,292	C
	Hillsdale Rd.	Mt. Pleasant Rd. (signal)	4	Urban principal arterial	23,566	C	24,120	C
	Mt. Pleasant Rd.	SR 57 (signal)	4	Urban principal arterial	25,813	C	32,917	D
	SR 57	Petersburg Rd. (signal)	4	Urban principal arterial	33,574	D	46,013	F
	Petersburg Rd.	St. George Rd. (signal)	4	Urban principal arterial	29,265	C	44,829	F
	St. George Rd.	Lynch Rd. (signal)	4	Urban principal arterial	37,548	E	45,980	F
	Lynch Rd.	Diamond Ave. (interchange)	4	Urban principal arterial	41,639	E	41,839	E
	Diamond Ave. (SR 66 West)	Morgan Ave. (SR 62 East) signal	6	Urban principal arterial	36,435	C	37,494	C
	Morgan Ave. (SR 62 East)	Columbia St. (signal)	6	Urban principal arterial	40,231	C	38,839[4]	C
	Columbia St.	Virginia St. (signal)	6	Urban principal arterial	52,406	E	36,200[4]	C
	Virginia St.	Lloyd Expressway (interchange)	4	Urban principal arterial	55,272	F	37,560[4]	E
	Lloyd (SR 62 West/66 East)	Walnut St. (signal)	4	Urban principal arterial	48,612	F	41,157[4]	F
	Walnut St.	Lincoln Ave. (signal)	4	Urban principal arterial	37,353	F	32,178[4]	E
	Lincoln Ave.	Bellmeade Ave. (signal)	4	Urban principal arterial	39,628	F	32,333[4]	E
	Bellmeade Ave.	Washington Ave. (signal)	4	Urban principal arterial	34,302	F	29,227[4]	E

Table 1-1 Con't: Level of Service in the Year 2025 for the Existing-Plus-Committed Network of Year 2000[1]

Route	Begin Point	End Point	Lanes	Functional Class	2000 ADT[2] (two-way)	Year 2000 LOS[3]	2025 ADT (two-way)	Year 2025 LOS
US 41	Washington Ave.	Covert Ave. (signal)	4	Urban principal arterial	27,069	D	25,703[4]	D
	Riverside Dr.	I-164 (interchange)	4	Urban principal arterial	18,671	B	22,155	C
	I-164	Waterworks Rd. (no signal yet)	4	Urban principal arterial	45,463	F	46,847	F
	Waterworks Rd. (Indiana)	Stratman Rd. (KY 414) no signal yet	4	Urban principal arterial	51,112	F	56,993	F
	Stratman Rd. (KY 414)	Watson Lane (signal)	4	Urban principal arterial	48,918	E	49,429	F
	Watson Lane	Harmony Lane (signal)	4	Urban principal arterial	41,024	F	36,755[4]	E
	Harmony Lane	Rettig Rd. (signal)	4	Urban principal arterial	41,024	F	38,188[4]	E
	Rettig Rd.	Barrett Blvd. (signal)	4	Urban principal arterial	47,595	F	36,864[4]	E
	Barrett Blvd.	US 60	4	Urban principal arterial	47,595	F	39,612[4]	E
Breathitt Parkway	US 60	KY 351/US 41	4	Urban freeway	31,429	B	38,810	B
	KY 351/US 41	Audubon Parkway	4	Urban freeway	19,516	A	26,725	B
	Audubon Parkway	KY 425	4	Urban freeway	17,631	A	23,025	A
	KY 425	KY 416	4	Rural principal arterial	12,437	A	17,135	A

Source: EUTS Travel Model (developed in 2000)

NOTE: 1. Existing and projected traffic volumes do not include traffic resulting from the I-69 National Corridor.
2. ADT = Average Daily Traffic
3. LOS = Level of Service
4. Modeling indicates that volumes will decrease on these segments of US 41 as traffic diverts to less congested routes and because of a forecasted decline in population and employment in the immediate vicinity.

- **Airports**: The Evansville Regional Airport is the only airport serving commercial traffic in the region. The Henderson City-County Airport serves general aviation.

- **Barge Crashes**: According to the U.S. Coast Guard, the US 41 twin bridges were struck by barges (or associated craft) ten times between 1972 and 2002. Although there are no records detailing the severity of these crashes, any collision requires a temporary closure of the crossing while its structural integrity can be ascertained by the KYTC.

- **Maintenance**: When significant maintenance activities are required on the existing US 41 bridges, local travel between Henderson and Evansville as well as regional travel between Kentucky and Indiana may be significantly impacted.

- **Tourism**: Ellis Park race track and John James Audubon State Park are two local attractions that draw regional traffic and have been associated with long queues of traffic on US 41 during major events, such as opening day at Ellis Park and the Big Rivers Arts and Crafts Festival at Audubon State Park.

- **Safety/Hazardous Materials Routing**: There is no designated hazardous materials route through the project study area. All trucks carrying hazardous materials utilize the US 41 bridges.

- **Local Evacuation**: In the event of a need to evacuate the area due to disaster, such as an earthquake, the effort would be slowed with only one bridge crossing.

- **Defense**: The US 41 bridge is part of the National Defense Highway System. The loss of a bridge could delay various military deployments. However, there are no transportation facilities in the Evansville-Henderson metropolitan area on the Strategic Highway Corridor Network (STRAHNET).

- **Emergency Services**: While both sides of the river are served by local hospitals, the regional trauma center is located in Evansville.

- **Business**: There are delivery businesses located on both sides of the river. A closure of the bridge would also sever these services. Additionally, many companies have offices and/or distribution centers located on both sides of the river. The loss of access to US 41 would disrupt these business operations and provide a negative impact on many other local businesses as well.

- **Vehicular Crash Rates**: Crashes on the existing US 41 bridges decrease traffic capacity and can result in the closure of travel lanes. From January 1, 2000 to December 31, 2002, there were 113 crashes on US 41 between KY 414 and the entrance to Ellis Park, this section comprising the Ohio River bridges and approach structures. Twenty-four of these crashes resulted in injuries. (There were no fatalities during this time period.)

- **Seismic Events**: Seismic events are known to occur in and near the project study area. The current Ohio River bridge crossing is not designed to meet current American Associate of Highway and Transportation Officials (AASHTO) design standards for seismic activity. A new Ohio River bridge crossing would provide a crossing that meets current seismic design criteria.

To meet this performance measure, a new structure would need to be built in the Evansville/Henderson area. While an additional river crossing is a desirable component, no alternative will be dismissed solely on the grounds that it fails to include an additional river crossing.

Objective #3: Provide an acceptable level of safety for bridge and bridge approaches.

Performance Measure: Improve safety by providing cross-river transportation that meets federal Interstate design standards.

Providing reliable cross-river movement of traffic is closely tied to lessening the occurrence and severity of crashes as well as the desire for providing options for crossing the Ohio River in the event of an incident on or near the existing bridge. Additionally, many of the freight operations are “just in time” deliveries and any delays in their movement impact local and regional industries.

Crash statistics for the existing US 41 bridges were analyzed and compared to the average Indiana and Kentucky statewide average crash rates for urban arterial roadway classifications shown in **Table 1-2** and **Table 1-3**. The Indiana data is from 1996 to 1998. The Kentucky data is from January 1, 1996 through June 30, 2001.

This analysis found that the relevant segments of US 41 in Indiana have crash rates below the Indiana statewide average for injury crashes (which is 59.95 per 100 million vehicle miles of travel for this facility type) and for fatality crashes (which is 0.60 per 100 million vehicle miles of travel for this facility type). However, the analysis found that the interchange of US 41 and I-164 had a higher than state average fatality crash rate. The Kentucky portion of US 41 is shown to have a rate about equal to the Kentucky statewide average for a divided urban arterial in the category of injuries (where the statewide average is 79.0), and is above the average for fatalities.

Given that the interchange between US 41 and I-164 has a higher than average crash rate, safety is a concern that may be improved with this proposed segment of I-69. The number of crashes could be expected to increase in the future as traffic volumes increase on US 41 and I-164. A new or improved facility designed to federal Interstate standards would result in an overall increase in motorist safety, due to lower crash rates typically associated with freeway facilities.

This performance measure would be met if the proposed action conformed to current roadway design standards, as specified by AASHTO, INDOT and KYTC. These standards are set forth in the book entitled *A Policy on Geometric Design of Highways and Streets*, published by AASHTO, and complemented by “Interstate Guidelines”. Standards relate to such factors as roadway and shoulder widths, horizontal and vertical geometry, and merging movements. Alternatives were evaluated to determine their ability to comply with all current roadway design standards.

1.4.3 Strengthen the Transportation Network in the Henderson/Evansville Areas

Another need for this project provides for additional capacity to meet the transportation demand at the local level. The proposed action could potentially affect traffic levels and therefore, travel and delay times in both north-south and east-west directions.

Objective: Provide an acceptable capacity to meet forecasted travel demand based on the EUTS travel demand model in conjunction with the National I-69 through traffic forecasts.

Performance Measure: Reduce the vehicle hours of travel on arterial roadways.

The proposed action is included as part of the National I-69 Corridor, and the planning and travel demand forecasts for through traffic developed as part of that study was used as an input in the analysis of effects of this project on the local roadway system as shown in **Figure 1-6**. This project is included the *Evansville Urban Transportation Study (EUTS, the MPO) 2025 Transportation Plan* and is noted in both the Indiana and Kentucky statewide transportation plans.

The primary source of travel demand forecasts was the current EUTS travel demand model in accordance with 23 USC 134 (Section 134) Planning Process. This model was used for Vanderburgh, Henderson, and Warrick counties. Travel forecasts produced from the INDOT Statewide Travel Demand Model was used for year 2025 traffic conditions in Gibson and Posey counties due to the need for additional detail outside the EUTS model area.

Table1-2: Crash Rates for US 41

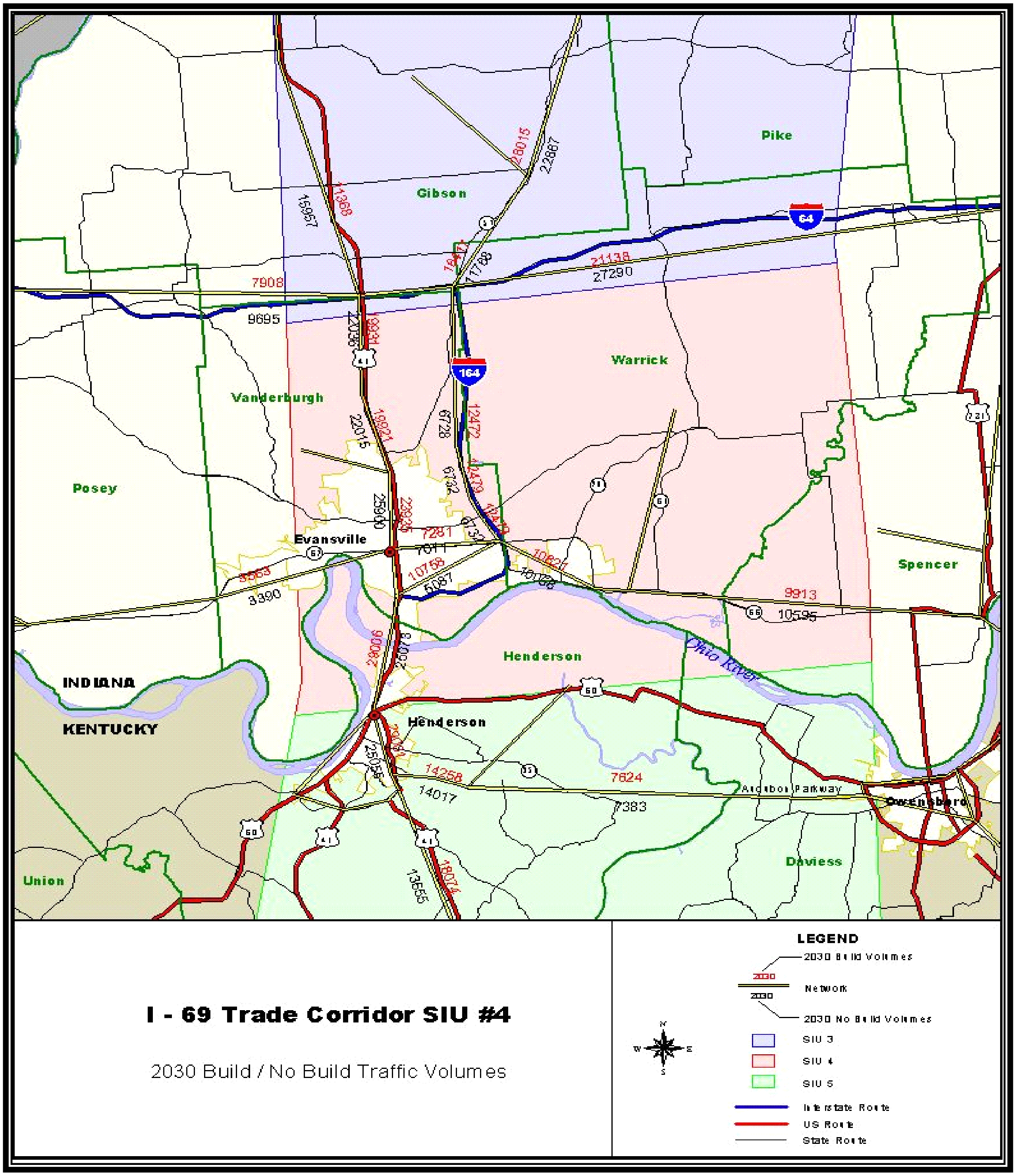
Termini		Length (miles)	Number of Injuries	Injury Rate[a]	State Rate	% Difference	Number of Fatalities[b]	Fatality Rate[a]	State Rate	% Difference
US 60	Indiana/Kentucky State Line	5.0	89	70.85	79	-10.3%	1	0.8	0.6	33.3%
Indiana/Kentucky State Line	North of I-164	1.20	11	24.99	59.95	-58.3%	0	0.00	0.6	N/A
North of I-164	North of the Lloyd Expressway	2.60	88	76.74	59.95	28.0%	0	0.00	0.6	N/A
North of the Lloyd Expressway	North of Morgan Ave.	1.09	37	64.45	59.95	7.5%	0	0.00	0.6	N/A
North of Morgan Ave.	North of Diamond Ave.	0.56	10	52.31	59.95	-12.7%	0	0.00	0.6	N/A
North of Diamond Ave.	North of Lynch Rd.	1.17	21	47.75	59.95	-20.4%	0	0.00	0.6	N/A
North of Lynch Rd.	North of SR 57	2.34	38	40.86	59.95	-31.8%	1	1.08	0.6	79.2%
North of SR 57	Vanderburgh/Gibson County Line	8.04	29	12.43	59.95	-79.3%	3	1.29	0.6	114.3%

a. Per 100 million annual vehicle miles of travel
b. Three-year total (1998-2000)

Table 1-3: Crash Rates for I-164

Termini		Length (miles)	Number of Injuries	Injury Rate[a]	State Rate	% Difference	Number of Fatalities[b]	Fatality Rate[a]	State Rate	% Difference
US 41 (interchange)	Green River Rd.	2.85	2	3.62	10.81	-66.5%	2	3.62	0.48	655.0%
Green River Rd. (interchange)	SR 662 (Newburgh Rd.)	2.71	3	7.65	10.81	-29.2%	0	0.00	0.48	N/A
SR 662 interchange (Newburgh Rd.)	SR 66 (Lloyd Expressway)	1.44	2	10.61	10.81	-1.8%	0	0.00	0.48	N/A
SR 66 interchange (Lloyd Expressway)	SR 62 (Morgan Ave.)	2.00	3	8.44	10.81	-22.0%	0	0.00	0.48	N/A
SR 62 (Morgan Ave.) interchange	Boonville-New Harmony Rd.	5.92	11	10.85	14.72	-26.3%	0	0.00	0.65	N/A
Boonville-New Harmony Rd. (interchange)	SR 57	3.41	1	1.86	14.72	-87.4%	0	0.00	0.65	N/A
SR 57 (interchange)	I-64	2.13	0	0.00	14.72	N/A	0	0.00	0.65	N/A

a. Per 100 million annual vehicle miles of travel
b. Three-year total (1998 -2000)



Source: Corridor 18 Special Issues Study

Figure 1-6: National I-69 Traffic Volumes

This performance measure quantified the impact of a particular alternative on the overall transportation network and the ability of a particular alternative to improve the overall movement of traffic within the existing transportation network. The screening process used this performance measure to compare the overall ability of alternatives to strengthen the transportation network.

1.5 Conclusion

The proposed Henderson, Kentucky to Evansville, Indiana highway is a component of the National I-69 Corridor, which is identified in the Transportation Equity Act for the 21st Century of 1998 (TEA-21) as a high priority corridor. This proposed project may include a new Ohio River Crossing. The purposes and needs of this project are as follows:

- Support the completion of the National I-69..
- Provide sufficient cross-river mobility in the Evansville/Henderson area.
- Strengthen the transportation network in the Evansville/Henderson area.

The following chapters will identify the project's potential natural and human impacts.

Chapter 2 – ALTERNATIVES

2.1 DEVELOPMENT OF CORRIDOR ALTERNATIVES

2.1.1 Methodology

The development of alternatives for the segment of I-69 from Henderson to Evansville has been accomplished through a methodology outlined in **Figure 2-1**. More detailed discussion on the development process is found below.

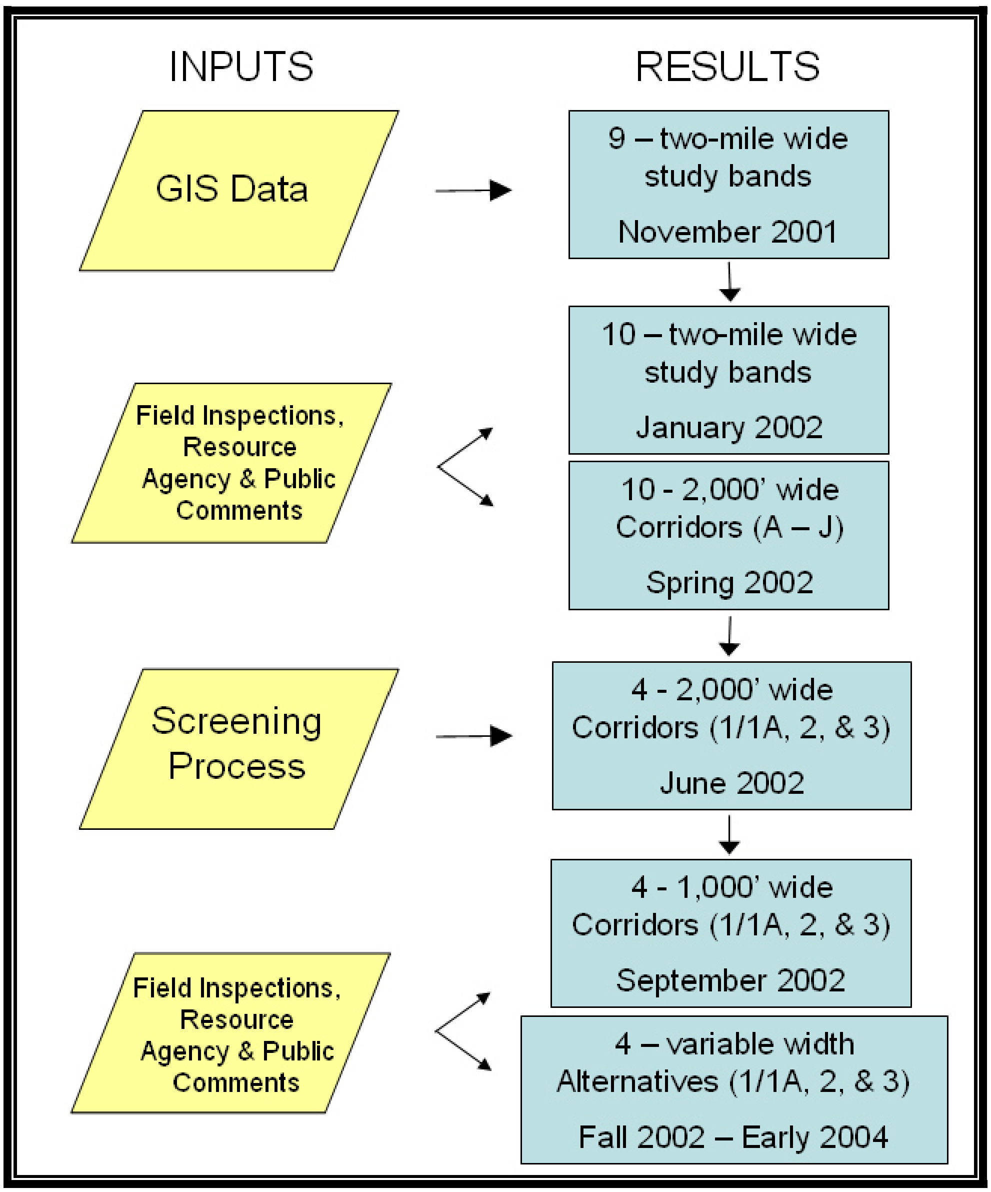


Figure 2-1: I-69 Henderson to Evansville Alternative Development Process

1. Geographic Information System (GIS) data, U.S. Geological Survey (USGS) aerial photos and topographic maps, and other data were utilized to develop two-mile wide study bands. Nine such bands were initially developed and presented to the public in November 2001.

2. Field inspections, resource agency comments, and public comments were utilized to refine the two-mile wide study bands into 2,000' wide study corridors. One additional corridor was added, bringing the total to ten corridors.

3. The screening process, discussed in detail in *Level 1 Alternatives Analysis Report,* was used to reduce the number of corridors for further analysis to three. (A variation of one of those corridors was also included, bringing the total to 4.) These 2,000' wide study corridors, along with the methodology used in the screening process, were presented to the public in June 2002.

4. The 2,000' wide study corridors were subjected to more in-depth field inspections. Using information from these inspections, the corridors were narrowed to 1,000' wide corridors, and were presented to the public in September 2002.

5. Preliminary alignments (referred to as "I-69 Build Alternatives", or simply "alternatives") were developed within the 2,000' corridors, and were later refined within the 1,000' corridors. The alternatives, representing a preliminary design based on the available data, were used to develop cost estimates and to determine potential impacts to environmental resources. These alternatives vary in width from approximately 350' to just under 600'.

6. The I-69 Build Alternatives were modified to 1) avoid direct impacts to known environmental resources; and 2) reflect comments from resource agencies.

7. Engineering and environmental data have been collected on the I-69 Build Alternatives, and are discussed in this document. A discussion of the traffic forecasts for the 2025 Future Year is included in **Chapter 3**. Discussion of the existing conditions throughout the affected environment is found in **Chapter 4**, and potential impacts from the proposed action in **Chapter 5**.

The driving force behind the development of the alternatives was to satisfy the project needs (outlined in the *Purpose and Need Statement*) while avoiding potential environmental impacts. Where such avoidance was not possible, efforts have been made to minimize the potentially negative impacts of constructing a new Interstate facility.

The project termini were determined by the FHWA as part of the overall planning effort for the National I-69 Corridor. As part of that effort, FHWA identified 32 Sections of Independent Utility (SIU) within the National I-69 Corridor. These SIU provide logical termini and adjacent utility. The Henderson-to-Evansville section of I-69 is Section of Independent Utility #4 (or SIU #4). This SIU extends from the Breathitt Parkway near its terminus south of Henderson to I-64 north of Evansville. Nine two-mile wide study bands were initially developed for SIU #4. These preliminary study bands, released for public and agency review in November 2001, included five corridors west of the Evansville/Henderson area, two eastern corridors utilizing portions of I-164, and two corridors requiring improvements to the existing US 41 and I-164 corridors. Improvements to the existing US 41 corridor included upgrades along the facility, as well as the construction of a new Ohio River crossing to replace the existing twin bridges.

2.1.2 Preliminary Concepts Not Carried Forward

The possibility of developing an additional alternative consisting of a loop around the cities of Evansville and Henderson was recommended by some of the public and therefore considered. A loop would require two crossings of the Ohio River and nearly doubles the study length, relative to the other alternatives being considered. As a result, the cost of building a loop and the impacts to sensitive resources are nearly double those associated with any single route. In addition, the purpose of this project is to provide a corridor between the northern and southern termini. Given these reasons, INDOT, KYTC, and FHWA decided not to pursue the loop alternative as part of this project. Although a loop is not being considered as an alternative for this project, this study will not restrict the future consideration of such a facility. In its long range transportation plan (approved on December 4, 2003), Evansville Urban Transportation Study (EUTS) included two bridges over the Ohio River- one to the west of the Henderson/Evansville area and one to the east- effectively creating a loop around the two cities. However, the SIU #4 study will result in a single preferred alternative to be constructed as part of the I-69 National Corridor if a Build alternative is selected.

The possibility of developing additional alternatives consisting of corridors located east of I-164 was considered. Given the existence of the Newburgh Lock and Dam on the Ohio River, any new freeway (Interstate) facility located east of I-164 would have to be located well to the east of the City of Newburgh and, therefore, well to the east of I-164 and the Evansville-Henderson area. As a result, any new facility constructed to the east of I-164 would not adequately meet the transportation needs within the Evansville/Henderson area, which are identified in the *Purpose and Need Statement*. By contrast, I-164 itself provides an existing Interstate connection with sufficient capacity to handle both local and through-traffic resulting from the completion of I-69 in the 2025 Future Year.

Additionally, the development of a corridor or corridors farther west from the Evansville-Henderson area was also considered. However, it was determined that a farther west corridor would not adequately address the goals outlined in *Draft Purpose and Need Statement.* Such a corridor would not provide an efficient connection between the predetermined termini for SIU #4, would not provide sufficient cross-river mobility in the Evansville-Henderson area, and would it not strengthen the area transportation network.

Transit alternatives, including Transportation Demand Management resources, were considered as alternatives. However, after consideration, it was determined that transit alternatives would not meet the Purpose and Need of the project, including federal legislation.

In ISTEA, Congress designed Corridor 18 as a “high-priority corridor” on the NHS. Because the NHS is, by definition, a highway system, the designation of Corridor 18 as part of the NHS reflected a clear intention the Corridor 18 be developed as a highway. However, the original ISTEA legislation did not specify any design standards or requirements for Corridor 18; not only did it not designate Corridor 18 as an Interstate, it did not even specifically require the corridor to be completed as a multi-lane highway.

In TEA -21, following the completion of a series of feasibility studies for Corridor 18, Congress specifically designated Corridor 18 as an Interstate highway; the law stated that Corridor 18 (and Corridor 20) “shall be designed as Interstate 69 (I-69).”[1] The legislation means that future planning for Corridor 18 should proceed on the assumption that it will be developed as a continuous Interstate highway (I-69) linking Canada to Mexico.

In light of federal legislation designating the National I-69 corridor and national FHWA policies, FHWA, INDOT and KYTC have concluded that this study should focus on the proposal to complete I-69 as an Interstate highway between Henderson and Evansville.

2.1.3 Study Corridors

The development of the I-69 study corridors involved utilizing Geographic Information System (GIS) mapping, aerial photographs, and other data to develop feasible corridors based on known/existing transportation and environmental conditions in the Evansville-Henderson area.

[1] TEA-21, 1211 (i)(3)(c)(“The routes referred to in subsection (c)(2){of ISTEA} shall be designated as Interstate Route I-69”)

Environmental data was collected from the United States Geological Survey (USGS), Kentucky and Indiana Geological Surveys (KGS and IGS), and Environmental Systems Research Institute (ESRI), and supplemented through field reconnaissance. Using this information, feasible corridors were developed that avoid or minimize impacts to the natural and man-made environment. Also, in developing these corridors, the design criteria in Indiana and Kentucky, existing utilities, potential bridge crossing conditions, Intelligent Transportation Systems (ITS), public transportation systems, and Transportation Systems Management (TSM) measures were considered.

Through consideration of the environmental and engineering data collected, the two-mile wide study corridors were then narrowed to 2,000-foot wide corridors. As a result of public and resource agency comments, an additional western corridor alternative crossing the Ohio River in the "oxbow" west of Evansville was added in December 2001, bringing the total to ten build alternatives. These 2000-foot wide corridors, named A-J, with A being the westernmost alternative. The only exception to the west-to-east order is Corridor J, which was added after the original nine corridors were drafted.

The results of these efforts included the following initial ten 2,000' wide corridors:

- Six corridors west of the Evansville/Henderson area (A, B, C, D, E, J)
- One corridor following the existing US 41 corridor (F)
- One corridor utilizing the existing I-164 corridor to US 41 and then US 41 south to the Breathitt Parkway (G)
- Two corridors east of the Evansville/Henderson area (H, I)

These 2,000' wide corridors are shown in **Figure 2-2**. Both eastern corridors assumed a northern terminus at the existing I-164 interchange with I-64. The western corridors had various northern termini at I-64 in Indiana. In Kentucky, each corridor tied into the Breathitt Parkway near its northern terminus, just south of Henderson.

The initial ten 2,000'-wide corridors are discussed below.

Corridor A

Corridor A connected to I-64 in Indiana between the SR 165 and SR 69 interchanges near Stewartsville (west of Poseyville) and proceeded south, crossing the Ohio River east of the Southwind Maritime Facility and the Goose Pond Cypress Slough Nature Preserve, and west of Diamond Island. Once in Kentucky, the corridor turned southeast and traveled between the Sloughs Wildlife Management Area purchase units paralleling KY 136 to the area east of Smith Mills. Corridor A continued in a southeast direction to its terminus at the Breathitt Parkway approximately nine miles south of the US 60/US 41 interchange in Henderson. Potential interchange locations included I-64, SR 66, Evansville-Upper Mt. Vernon Road, and SR 62 in Indiana, and KY 136, US 60, US 41A, and Breathitt Parkway in Kentucky. The corridor was approximately 42.5 miles in length.

Corridor B

Corridor B connected to I-64 in Indiana between the SR 165 and SR 69 interchanges near Stewartsville (west of Poseyville) and proceeded south to a point approximately three miles north of SR 62 (just south of County Road 670). At that location, the corridor traveled southeast, crossing the Ohio River west of the A.B. Brown Power Plant and east of Diamond Island. Once in Kentucky, the corridor headed south, intersecting KY 136 about two miles west of the Henderson City-County Airport. From there, the route proceeded southeast, connecting to the Breathitt Parkway approximately nine miles south of the US 60/US 41 interchange in Henderson. Potential interchange locations included I-64, SR 66, Evansville-Upper Mt. Vernon Road, and SR 62 in

Indiana, and KY 136, US 60, US 41A, and the Breathitt Parkway in Kentucky. The corridor was approximately 42.0 miles in length.

Corridor C

Corridor C connected to I-64 in Indiana approximately 2.8 miles east of Poseyville and proceeded south to SR 66. At that location, the corridor turned and traveled southwest to the area immediately east of the Goose Pond Cypress Slough Nature Preserve. Corridor C then headed due south to cross the Ohio River west of Diamond Island. Once in Kentucky, the corridor turned southeast and traveled between the Sloughs Wildlife Management Area purchase units paralleling KY 136 to the area east of Smith Mills. Corridor C continued traveling southeast to its terminus at the Breathitt Parkway approximately nine miles south of the US 60/US 41 interchange in Henderson. Potential interchange locations included I-64, SR 66, Evansville-Upper Mt. Vernon Road, and SR 62 in Indiana, and KY 136, US 60, US 41A, and the Breathitt Parkway in Kentucky. The corridor was approximately 41.7 miles in length.

Corridor D

Corridor D connected to I-64 in Indiana approximately 2.8 miles east of Poseyville and proceeded south to SR 66. At that location, the corridor turned and traveled southwest to SR 62, where it turned southeast to cross the Ohio River west of the A.B. Brown Power Plant and east of Diamond Island. Once in Kentucky, the corridor headed south, intersecting KY 136 about two miles west of the Henderson City/County Airport. From there, the route proceeded southeast, connecting to the Breathitt Parkway approximately nine miles south of the US 60/US 41 interchange in Henderson. Potential interchange locations included I-64, SR 66, Evansville-Upper Mt. Vernon Road, and SR 62 in Indiana, and KY 136, US 60, US 41A, and the Breathitt Parkway in Kentucky. The corridor was approximately 38.8 miles in length.

Corridor E

Corridor E connected to I-64 in Posey County, approximately four miles east of Poseyville and proceeded south to Evansville-Upper Mt. Vernon Road, paralleling the Vanderburgh-Posey county line. From there, the route traveled southwest to SR 62, where it headed southeast to cross the Ohio River west of the A.B. Brown Power Plant and east of Diamond Island. Once in Kentucky, the corridor traveled south, intersecting KY 136 about two miles west of the Henderson City/County Airport. From there, the route proceeded southeast, connecting to the Breathitt Parkway approximately nine miles south of the US 60/US 41 interchange in Henderson. Potential interchange locations included I-64, SR 66, Evansville-Upper Mt. Vernon Road, and SR 62 in Indiana, and KY 136, US 60, US 41A, and the Breathitt Parkway in Kentucky. The corridor was approximately 39.4 miles in length.

Corridor F

Corridor F utilized the existing US 41 alignment in both Indiana and Kentucky. US 41 was to substantially remain at-grade, with grade-separated interchanges at major intersections from I-64 in Indiana to just north of the Diamond Avenue (SR 66 north junction) interchange. From Diamond Avenue to its southern connection at the Breathitt Parkway, the corridor was most likely be elevated (on embankment contained within retaining walls) to minimize right-of-way requirements. Frontage/collector-distributor (C-D) roads and overpasses were anticipated in order to provide access between interchanges. US 41 currently had interchanges at I-64, Diamond Avenue, Lloyd Expressway (SR 66 south junction) and I-164 in Indiana, and at US 60 in Kentucky. Potential new interchanges included Lynch Road, SR 57 and Base Line Road in Indiana, and KY 414/Stratman Road in Kentucky. The corridor was approximately 26.1 miles in length.

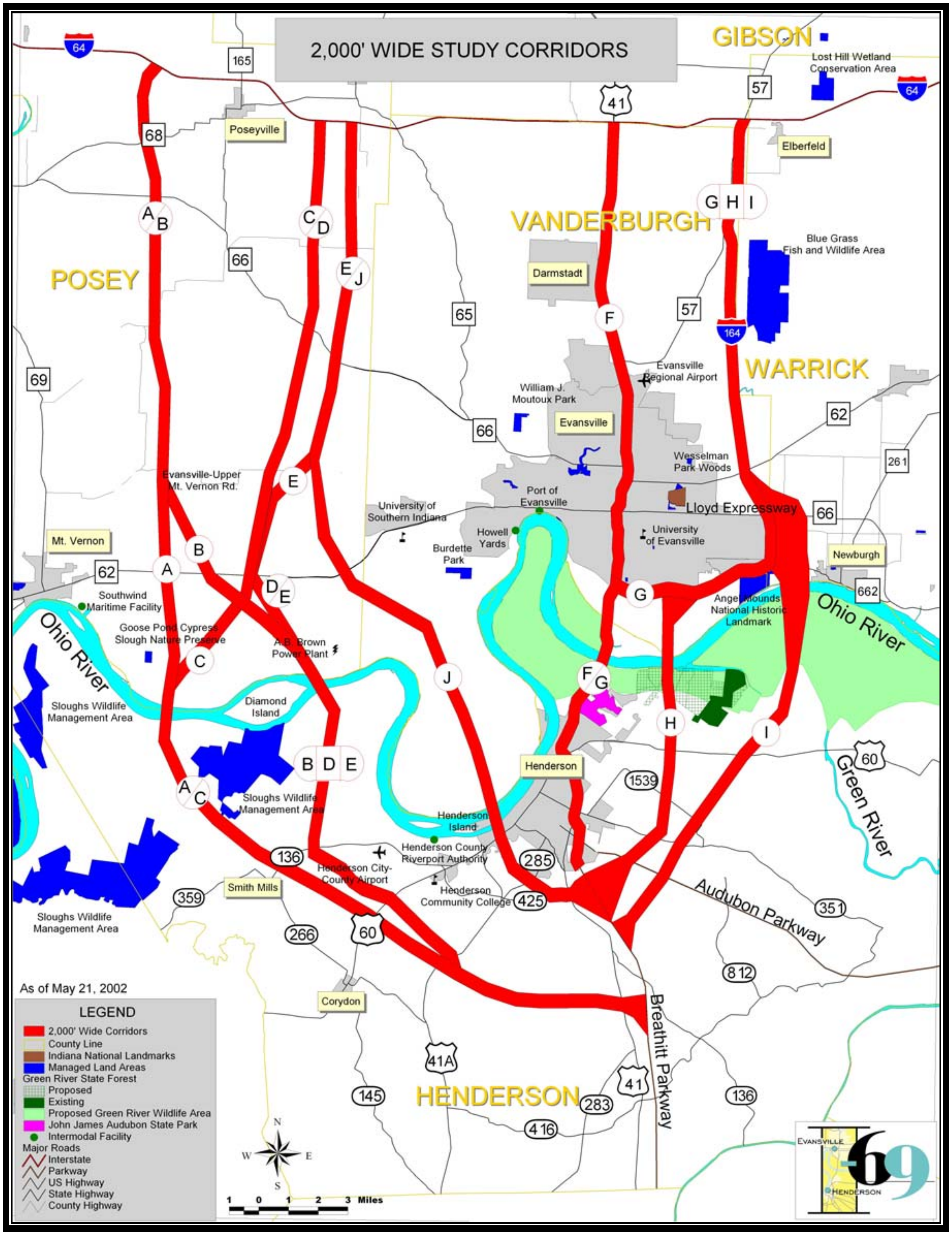


Figure 2-2: Initial 2,000' Wide Study Corridors

Corridor G

Corridor G utilized the existing I-164 alignment from I-64 in Indiana south to its US 41 terminus, then followed the existing US 41 alignment south across the Ohio River to its connection at the Breathitt Parkway. Similar to Corridor F, the corridor was anticipated to be elevated on embankment with frontage/C-D roads between interchanges. Existing interchanges included I-64, County Road 950 (New Harmony Road), Morgan Avenue (SR 62), Lloyd Expressway (SR 66), Covert Avenue (SR 662), Green River Road, and US 41 in Indiana, and US 60 in Kentucky. Potential new interchanges included KY 414/Stratman Road in Kentucky. The corridor was approximately 31.4 miles in length.

Corridor H

Corridor H utilized the existing I-164 alignment from its northern terminus at I-64 in Warrick County, to just east of the Green River Road interchange and west of Angel Mounds State Historic Site. From that location, the corridor left the existing I-164 alignment and headed south to cross the Ohio River immediately west of the mouth of the Green River. The route continued south to KY 351, then proceeded southwest to the Breathitt Parkway. Existing interchanges were located at I-64, County Road 950 (New Harmony Road), Morgan Avenue (SR 62), Lloyd Expressway (SR 66), Covert Avenue (SR 662), and Green River Road in Indiana. Potential interchanges included a relocated Green River Road interchange (to avoid the cemetery located in the southwest quadrant of the existing interchange) in Indiana, and US 60, KY 351, Audubon Parkway, and the Breathitt Parkway in Kentucky. The corridor was approximately 30.2 miles in length and utilized approximately 18.6 miles of existing I-164.

Corridor I

Corridor I utilized the existing I-164 alignment from its northern terminus at I-64 in Warrick County, to just north of the Covert Avenue interchange north of Angel Mounds State Memorial. From that location, the corridor turned and traveled southeast to cross the Ohio River east of Angel Mounds. The corridor continued south crossing the Green River, then headed southwest to its connection to the Breathitt Parkway. Existing interchanges were located at I-64, County Road 950 (New Harmony Road), Morgan Avenue (SR 62), Lloyd Expressway (SR 66), and Covert Avenue (SR 662) in Indiana. Potential interchanges included a new interchange immediately north of Covert Avenue in Indiana, and US 60, KY 351, Audubon Parkway, and the Breathitt Parkway in Kentucky. The corridor was approximately 31.9 miles in length and utilized approximately 17.2 miles of existing I-164.

Corridor J

Corridor J connected to I-64 in Posey County, approximately four miles east of Poseyville and proceeded south to Evansville-Upper Mt. Vernon Road, paralleling the Vanderburgh-Posey County line. From there, the route turned and traveled southeast, crossing SR 62 and proceeded through the "oxbow" area of the Ohio River. The corridor crossed the Ohio River near the eastern edge of Henderson Island. The corridor then proceeded southeast to its southern terminus at the Breathitt Parkway located at the existing KY 425 (Henderson Bypass) interchange, approximately 4.5 miles south of the US 60/US 41 interchange in Henderson. Potential interchange locations included I-64, SR 66, Evansville-Upper Mt. Vernon Road, and SR 62 in Indiana, and US 60, KY 285, and the Breathitt Parkway in Kentucky. The corridor was approximately 30.9 miles in length.

2.1.4 No-Build Alternative

The No-Build (or no action) alternative includes the existing (for the year 2000) roadway network plus roadway projects completed since 2000 and currently planned or committed transportation facilities (referred to as the Existing-plus-Committed, or "E+C" transportation network). Major roadway investments are defined as "capacity expansion" improvements such as new arterial/collector roadways, the addition of through lanes to existing arterial/collector roadways, a major realignment of an existing roadway that substantially alters daily traffic volume capacity and travel times, and a new interchange. In addition to completed major roadway investments since year 2000, committed roadway improvements include major investment projects programmed for completion.

For purposes of the I-69 Henderson to Evansville study, projects are considered committed when the NEPA process is completed. The Indiana Statewide Transportation Improvement Program, the KYTC 2000 Six Year Highway Plan, and the Evansville-Henderson Urbanized Area Transportation Improvement Program provide sources for major roadway investments that are considered "committed." **Table 2-1** lists the committed capacity expansion projects that are part of the regional "existing-plus-committed" roadway network constituting the No-Build alternative. It should be noted that SR 69 from SR 62 east of Mt. Vernon to I-64 near Griffin was included in the year 2000 existing roadway network as substantial portions of the route had been completed by the year 2000. The final phase is currently under construction, and the capacity of the reconstructed roadway will be not be significantly different than in year 2000. However, the reconstructed facility will clearly improve traffic flow and reduce travel times from Mt. Vernon to I-64.

Table 2-1: Evansville Regional Travel Model: Committed Projects List
(capacity expansion projects only)

Route	County	Termini	Project Type	Source	Status
Burkhardt Rd.	Vanderburgh	Morgan Ave. to Lynch Rd.	Added Travel Lanes (widen to 4 lanes)		completed in 2003
Fulton Ave.	Vanderburgh	Columbia Ave. to Diamond Ave.	Added Travel Lanes (widen to 4 lanes)	TIP (FY1998-2002) TIP (FY1999-2003)	completed in 2001
Lynch Rd.	Vanderburgh/ Warrick	Burkhardt Rd. to Morgan Ave.	New Road (4 lanes) with I-164 Interchange	TIP (FY1998-2002) TIP (FY2001-2003)	Burkhardt to I-164 completed, I-164 to Morgan in right-of-way acquisition
SR 62	Vanderburgh/ Warrick	I-164 to SR 61	Added Travel Lanes (widen to 4 lanes)	TIP (FY2001-2003) INDOT LRP Project	under construction
SR 66	Warrick	Epworth Rd. (near I-164) to SR 261	Added Travel Lanes (widen to 6 lanes)	TIP (FY2001-2003) INDOT LRP Project	under construction
SR 66	Warrick	SR 261 to Yankeetown Rd.	Added Travel Lanes (widen to 4 lanes)	TIP (FY2001-2003) INDOT LRP Project	in right-of-way acquisition
SR 662	Warrick	I-164 to Ellerbusch Rd.	Added Travel Lanes (widen to 4 lanes)	TIP (FY2001-2003)	completed in 2003
US 60 East	Henderson	Wathen Ln. to 0.4 miles east	Added Travel Lanes (widen to 4 lanes)	TIP (FY2001-2003) KYTC 2000 Six Year Highway Plan	completed in 2002
US 60 West	Henderson	KY 425 to Henderson/Union county line	Added Travel Lanes (widen to 4 lanes)	TIP (FY2001-2003) KYTC 2000 Six Year Highway Plan	construction in 2004

Source: Bernardin-Lochmueller & Associates, Inc.

The No-Build alternative assumes that National I-69—both within and outside of the project study area—has NOT been completed. Thus, the No-Build alternative does not include any traffic resulting from the construction of the National I-69.

The existing major north-south facilities serving the project study area in Indiana are I-164 and US 41. I-164 begins at US 41 north of the Indiana/Kentucky state line and terminates at its interchange with I-64 northeast of Evansville. In Kentucky, the only available existing major north-south route for study is US 41.

US 41 in Henderson, KY

I-164 is a fully controlled access, four-lane facility that provides a connection from US 41 to I-64 northeast of Evansville. This section of roadway was constructed in the 1980s and meets current freeway design standards. One exception is the interchange at I-164 and US 41, which has substandard merge and weaving lengths.

US 41 between the Breathitt Parkway and the Ohio River is classified as an urban principal arterial and is a four-lane highway. This section has fully controlled access between the Breathitt Parkway and US 60, access by permit between US 60 and KY 414 (just south of the Ohio River twin bridge crossings), and partially controlled access from KY 414 to the bridges. Through Henderson, US 41 is characterized by traffic signals located at approximately ½-mile spacings and frequent driveway access points.

The US 41 Ohio River crossing consists of two steel-truss structures with 34-foot wide decks (having 30 feet of horizontal clearance), and provides the only crossing of the Ohio River within 30 miles of the Evansville/Henderson area. Neither of the bridge structures on US 41 is constructed to freeway standards and neither is wide enough to provide adequate shoulders. Given the attributes of steel truss bridges, it is not possible to upgrade the existing bridges to freeway standards. Therefore, the construction of a new bridge near the existing location would be required in order to provide an Ohio River crossing that meets current freeway design standards. It should be noted that the northbound bridge, constructed in 1937, is considered eligible for the National Register of Historic Places (NRHP).

I-164 in Evansville, IN

Through Evansville, US 41 is a partially controlled access, divided highway with traffic signals and interchanges only at major roadways. These interchanges include SR 66 (Lloyd Expressway) and SR 62 (Diamond Avenue). Between these interchanges, US 41 is a divided highway with six lanes. The remainder of the corridor is four lanes with turn-lanes at intersections. Approaching the Evansville Regional Airport, US 41 becomes a divided highway with partial access control.

The study portion of the roadway terminates at the I-64 interchange, approximately 8.5 miles north of the Evansville Regional Airport.

I-164 is currently operating at Level of Service (LOS) A. LOS is a performance measure used to quantify the efficiency of a roadway. LOS ranges from A to F, with LOS A indicating free flow traffic conditions and LOS F indicating severe congestion. By year 2025, the LOS will decrease in some locations to LOS B or LOS C, under the No-Build condition. US 41 in Indiana is currently operating at LOS F south of I-164, and varies from C to E through and north of Evansville. Given that traffic along some segments of US 41 is expected to increase by 2025, without improvements a lower LOS could be expected by that year. Additionally, the ramps at the I-164 interchange with US 41 south of Evansville are substandard.

Vehicle crash statistics for I-164 and US 41 were analyzed and compared to the average statewide crash rates for Indiana (1996 to 1998) and Kentucky (January 2000 to June 2001) for urban arterial roadway classifications. Currently, neither I-164 nor US 41 is experiencing higher than average crash rates when compared to similar facilities. US 41 from north of Lynch Road to the Vanderburgh County line is experiencing a slightly higher than average rate for fatal crashes. Further details regarding the crash analyses are included in **Chapter 1, Purpose and Need**.

Even if committed transportation improvements were open to traffic in the year 2000, about 8.2 percent of the vehicle-miles of travel would be on facilities operating at LOS F and another 8.8 percent of the vehicle-miles of travel would be on facilities operating at LOS D or E. Thus, in the No-Build scenario, 17 percent of the vehicle-miles of travel would be on facilities with operating conditions below LOS C. By the year 2025, about 11.4 percent of vehicle-miles of travel would be on facilities operating at LOS F and another 9.2 percent of the vehicle-miles of travel would be on facilities operating at LOS D or E. Thus, 20.6 percent of the vehicle-miles of travel would be on facilities with operating conditions below LOS C. In contrast, I-164 from I-64 to US 41 will operate at LOS C or better in years 2000 and 2025. In particular, the US 41 Corridor is extremely congested during the peak-hours. **Table 2-2** presents the 2000 and 2025 LOS values for US 41.

Table 2-2: Present and Future LOS along US 41 in Proposed Project Study Area

US 41 Segment	2000 LOS	2025 LOS
I-64 to Baseline Rd.	C	B
Baseline Rd. to Boonville-New Harmony Rd.	C	D
Boonville-New Harmony Rd. to Hillsdale Road	C	C
Hillsdale Rd. to Mt. Pleasant Rd.	C	C
Mt. Pleasant Rd. to SR 57	C	D
SR 57 to Petersburg Rd.	D	F
Petersburg Rd. to St. George Rd.	C	F
St. George Rd. to Lynch Rd.	E	F
Lynch Rd. to Diamond Ave.	E	E
Diamond Ave. (SR 66 West) to Morgan Ave. (SR 62 East)	C	C
Morgan Ave. (SR 62 East) to Columbia St.	C	C
Columbia St. to Virginia St.	E	C
Virginia St. to Lloyd Expressway	F	E
Lloyd (SR 62 West/66 East) to Walnut St.	F	F
Walnut St. to Lincoln Ave.	F	E
Lincoln Ave. to Bellmeade Ave.	F	E
Bellmeade Ave. to Washington Ave.	F	E
Washington Ave. to Covert Ave.	D	D
Riverside Dr. to I-164	B	C
I-164 to Waterworks Rd.	F	F
Waterworks Rd. (Indiana) to Stratman Rd. (KY 414)	F	F
Stratman Rd. (KY 414) to Watson Lane	E	F
Watson Lane to Harmony Lane	F	E
Harmony Lane to Rettig Rd.	F	E
Rettig Rd. to Barrett Blvd.	F	E
Barrett Blvd. to US 60	F	E

NOTE: **Bold** LOS values indicate that the segment operates are less than minimum LOS.

2.2 SCREENING MEASURES

In order to narrow the number of build alternatives for further analysis, screening measures were developed for use in evaluating the overall performance and impacts of the Level 1 Corridor relative to one another. The screening measures used for this project were grouped into three distinct, yet interrelated categories. These categories include the following:

1) Purpose and Need
2) Environmental
3) Engineering

2.2.1 Purpose and Need Measures

The need for this project involves completing the National I-69 Corridor and on a regional level provide sufficient cross-river mobility and strengthening the regional transportation network. The purpose and need is summarized in the following statements:

- Support the completion of the National I-69.
- Provide sufficient cross-river mobility in the Evansville/Henderson area.
- Strengthen the transportation network in the Evansville/Henderson area.

2.2.2 Environmental Measures

Environmental data in the project study area were collected and documented for use in the screening process. A 400-foot wide area (using the approximate centerline of each of the 2000-foot wide corridors) was investigated for potential impacts to a variety of environmental resources. The environmental data were collected from a variety of sources including National Wetland Inventory (NWI) mapping, Federal Emergency Management Agency (FEMA) floodplain maps, existing GIS data sources, field reconnaissance, and other professional expertise.

The following environmental resources and/or issues, listed in no particular order, were considered in the screening analysis:

- Wetlands
- Floodplains
- Wildlife Habitats
- Section 4(f) Properties
- Managed Lands
- Farmland
- Neighborhood Impacts and Residential Relocations
- Business Relocations
- Archaeology
- Environmental Justice Issues
- Wellhead Protection
- Oil Wells
- Streams
- Noise

2.2.3 Engineering Measures

Throughout the development of corridors, engineering data were continually collected and documented. Engineering considerations included items such as the following:

- Construction Feasibility/Constructability
- Cost Estimates
- Length of Corridor
- Length of Structure (Ohio River crossing and floodplain structures)
- Utility Concerns
- Intelligent Transportation Systems (ITS) Components
- Right of Way Impacts
- Maintenance of Traffic
- Drainage and Earthwork Requirements

2.3 EVALUATION OF INITIAL 2,000' CORRIDORS

The three categories of screening measures were utilized to develop screening criteria. These criteria were then used to provide an evaluation of how each alternative performs with respect to a specific measure.

Where quantitative evaluation was possible, the alternatives were evaluated based on each criterion, and then rated based on that evaluation. The rating system used for the evaluations was based on a normalized 1.0-10.0 scale. The poorest performer (or performers if more than one alternative received the same evaluation) for each criterion was given a rating of 1.0 with the best performer(s) given a rating of 10.0. The alternatives falling between the best and worst performers were given a normalized rating based upon how well each performs with respect to the best and worst performers for the subject criterion. This normalized rating was calculated by interpolating the evaluation measure based on the best and worst performers, and then correlating that interpolated value to a rating between 1.0 and 10.0.

In situations where a quantitative evaluation was not possible, two types of qualitative evaluations were utilized. This methodology included the evaluation of criteria generating a “yes” or “no” response, and for criteria generating a relative response of “low”, “moderate”, or “high”. For criteria that can be evaluated with a “yes” or “no” response, the alternatives were assigned a 1.0 or a 10.0, depending on the nature of the criterion. If “yes” indicated that the criterion was satisfied, a 10.0 rating was assigned to the affirmative response. If “yes” indicated that issues were present, the alternative received a 1.0 rating. For criteria that lend themselves to relative levels, a low-to-high evaluation was used. “High” responses were given a rating of 1.0 or 10.0, “moderate” responses a 5.5, and “low” responses a 1.0 or 10.0, each depending on the criterion. For example, high impacts were given a 1.0 whereas a high level of constructability (or relative ease of construction) was given a 10.0.

A summary of the data is shown in **Table 2-3**. Where applicable, the values evaluated as being best for each criterion are highlighted in green, and the poorest values are highlighted in red. In cases where more than one corridor shared the best or poorest value (or very nearly the best or poorest value), each is appropriately shaded.

Table 2-3: *Level 1 Alternatives Analysis Report* Evaluation Data Summary
(as of June 2002)

	Western Corridors						Existing Corridors		Eastern Corridors	
	A	B	C	D	E	J	F	G	H	I
PURPOSE AND NEED SCREENING MEASURES										
Meet current Interstate design standards	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Improve freight travel time	-4.80%	-4.30%	-6.30%	-6.40%	-6.20%	-7.30%	-10.80%	-6.80%	-6.90%	-7.60%
Provide sufficient capacity for new bridge and new bridge approaches	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Provide additional river crossing	YES	YES	YES	YES	YES	YES	NO	NO	YES	YES
Decrease congestion on existing US 41 river crossing (LOS on existing bridges)	F	F	F	F	F	F	C	C	C	D
Improve safety by providing cross-river transportation that meets interstate design standards	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Decrease vehicle hours of travel on arterials	-2.90%	-2.80%	-4.00%	-3.60%	-3.50%	-4.40%	-7.40%	-6.20%	-6.10%	-6.50%
ENVIRONMENTAL SCREENING MEASURES										
Wetlands (acres)	100.2	104.8	88.3	97.4	116.4	27.7	50.8	47.6	31.3	20.2
Total Floodplains Crossed (miles)	14.5	14.6	11.5	10.8	10.6	11.9	9.0	12.3	4.8	7.9
Endangered Wildlife Habitat (species)	13	14	12	14	14	5	11	21	16	11
4(f) Property Impacts (average)*	6.4	5.1	7.3	5.9	5.9	9.0	7.5	8.5	8.4	9.1
Managed Lands (average)**	7.3	9.1	8.2	10.0	9.1	4.6	8.2	10.0	8.2	10.0
Farmland (acres)	1739	1788	1695	1648	1610	1140	495	148	487	647
Total Homes/Apartment Units Relocations	24	22	36	39	46	153	378	155	14	44
Business Relocations	1	0	1	1	2	3	120	53	0	0
Potential for Archaeological Impacts (High, Moderate, or Low)	H	H	H	H	H	M	M	M	M	M
Environmental Justice Issues	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO
Wellhead Protection Impacts	M	L	L	L	L	L	L	L	L	H
Oil Wells	16	7	17	6	6	4	2	0	1	3
Streams Crossed	68	59	60	52	46	27	29	11	10	13
Potential Noise Barrier Length (feet)	3,000	3,000	1,000	1,000	6,000	9,500	27,800	27,700	11,300	7,000
ENGINEERING SCREENING MEASURES										
Estimated Cost (in Millions)	$982.9	$989.9	$979.8	$974.9	$964.1	$958.9	$1,281.1	$778.4	$580.8	$685.1
Constructability (High, Moderate, or Low)***	M	M	M	M	M	M	L	L	H	H

* These scores were taken from the Level 1 Study Report and were determined by average different types of 4(f) properties.

** These scores were taken from the Level 1 Study Report and were determined by average different types of Managed Lands

*** A high level of constructability indicates relative ease of construction whereas a low level indicates anticipated difficulty with respect to construction

Note: These values were preliminary as of June 2002. Green shading indicated the best performers and red the poorest performers.

The following sections discuss the general evaluations (advantages and disadvantages) of each corridor. It should be noted that any and all impacts discussed in these sections are "potential impacts", as the study corridors were 2,000 feet wide.

No-Build
The No-Build Corridor consists of the existing and programmed transportation facilities in the Henderson-Evansville area.

Advantages:
The No-Build Corridor would require no new construction and would have no cost.

Disadvantage:
The No-Build Corridor would not address the goals or objectives discussed in the *Purpose and Need Statement*.

Corridor A
This corridor was the longest at 42.5 miles, and had a preliminary cost estimate of approximately $983 million.

Advantages:
This corridor met all performance measures of the *Purpose and Need Statement*. Corridor A would have had minimal home and business relocations compared to the other nine corridors. It did not impact a high concentration of minority and/or low income populations. It provided a western alternate and created a new Ohio River crossing. The location of this alternate may have allowed economic development west of the City of Evansville.

Disadvantages:
The corridor traversed environmentally sensitive areas. The corridor would be located between two managed units of the Sloughs Wildlife Management Area and would have required taking approximately 104 acres of quality wetlands and 100 acres of high quality wetlands. It would have potentially impacted up to 68 streams. It could have impacted the habitat of the highest concentration of the Copperbelly Water Snake in the nation. The corridor had a very high probability of impacting significant archaeology sites. It would have impacted 16 oil wells. It would have required approximately 2,000 acres of new right of way, approximately 1,740 acres of which is agricultural land. It had the second highest wellhead impacts of the ten build corridors. Corridor A was estimated to divert fewer than 4,000 vehicles per day from US 41.

Given the significant environmental impacts and poor traffic performance, Corridor A was not advanced for further study.

Corridor B
This corridor was approximately 42.0 miles in length, with preliminary costs estimated at $990 million.

Advantages:
This corridor met all performance measures of the *Purpose and Need Statement*. Corridor B traveled east of the Sloughs Wildlife Management Area. It had limited residential and business relocations. It did not impact a high concentration of minority and/or low income populations. It provided a western alternate and created a new Ohio River crossing. Corridor B impacted the fewest noise sensitive sites. The location of this alternate may have allowed economic development west of the City of Evansville.

Disadvantages:
Corridor B had significant impacts on the local environment. The corridor would have required taking approximately 105 acres of high quality wetlands. It would have potentially impacted up to 59 streams. Fourteen state-listed species were located within 1 mile of the centerline of Corridor B. Corridor B impacted approximately 94 known historic and archaeology sites, and had a high probability of impacting additional archaeology and historic sites. It would have impacted 7 oil wells. The corridor would have required over 1,780 acres of agricultural ground with a total right of way acquisition of approximately 2,000 acres. Corridor B was estimated to divert fewer than 5,000 vehicles per day from US 41.

Given the significant environmental impacts and poor traffic performance, Corridor B was not advanced for further study.

Corridor C
Corridor C was approximately 41.7 miles in length, and had a preliminary cost estimate of $980 million.

Advantages:
This corridor met all performance measures of the *Purpose and Need Statement*. It provided a western alternate and created a new Ohio River crossing. It had limited residential and business relocations. It did not impact a high concentration of minority and/or low income populations. The location of this alternate may have allowed economic development west of the City of Evansville.

Disadvantages:
The corridor traversed environmentally sensitive areas. The corridor would be located between two managed units of the Sloughs Wildlife Management Area and would have required approximately 90 acres of high quality wetlands. Twelve state-listed species were located within 1 mile of the centerline of Corridor C. It would have potentially impacted up to 60 streams. It could have impacted the habitat of the highest concentration of the Copperbelly Water Snake in the nation. The corridor would have impacted 3 known archaeology sites in Indiana, and over 40 historic/archaeology sites in Kentucky. It would have impacted 17 oil wells. It would have required approximately 2,000 acres of new right of way, approximately 1,694 acres of which is agricultural land. From a traffic perspective, Corridor C was estimated to divert fewer than 5,000 vehicles per day from US 41.

Given the significant environmental impacts and poor traffic performance, Corridor C was not advanced for further study.

Corridor D
Corridor D was approximately 38.8 miles in length, and had a preliminary cost estimate of $975 million.

Advantages:
This corridor met all performance measures of the *Purpose and Need Statement*. It provided a western alternate and created a new Ohio River crossing. Corridor D traveled east of the Sloughs Wildlife Management Area. Corridor D provided the Evansville/Henderson area a new Ohio River bridge crossing west of the city of Evansville. It had limited residential and business relocations. It did not impact a high concentration of minority and/or low-income populations. The location of this alternate may have allowed economic development west of the city of Evansville. Corridor D impacted the second fewest number of noise sensitive sites.

Disadvantages:
It would have potentially impacted up to 52 streams. It would have required taking approximately 98 acres of high quality wetlands. Fourteen state-listed species were located within 1 mile of the

centerline of Corridor D. It may have disturbed up to 77 known historic and archaeology sites with a very high probability of impacting unknown archaeology sites. The corridor would have required approximately 1,900 acres of right of way, approximately 1,648 acres of which is agricultural land. Corridor D did not accommodate predicted traffic projections, as it diverted less than 6,000 vehicles per day from US 41.

Given the significant environmental impacts and poor traffic performance, Corridor D was not advanced for further study.

Corridor E
Corridor E was approximately 39.4 miles in length, and had a preliminary cost estimate of $964 million.

Advantages:
This corridor met all performance measures of the *Purpose and Need Statement*. It provided a western alternate and created a new Ohio River crossing. Corridor E traveled east of the Sloughs Wildlife Management Area. It had limited residential and business relocations. This corridor would have impacted the fewest low income and/or minority populations. The location of this alternate may have allowed economic development west of the City of Evansville.

Disadvantages:
It would have potentially impacted up to 46 streams. It would have required taking approximately 116 acres of high quality wetlands. Fourteen state-listed species were located within 1 mile of the centerline of Corridor E. It would have impacted approximately 78 known historic/archaeology sites. It would have required over 1,900 acres of right of way, approximately 1,610 acres of which is agricultural land. This corridor was a relatively poor traffic performer, diverting approximately 5,700 vehicles from US 41.

Given the significant environmental impacts and poor traffic performance, Corridor E was not advanced for further study.

Corridor F
Corridor F was approximately 26.1 miles in length, and had a preliminary cost estimate of $ 1.274 billion.

Advantages:
Corridor F, basically an upgrade of the existing US 41 facility to interstate standards, outperformed the other alternatives in decreasing freight travel time through Evansville/Henderson area. The alternate also outperformed the other alternatives when comparing acceptable traffic capacity for future demand. It had minimal impacts to farmland.

Disadvantages:
This corridor did not meet all performance measures of the *Purpose and Need Statement*, since it did not provide an additional river crossing to US 41. It would have been difficult to construct while keeping it open to traffic and would likely have had adverse impacts on businesses along the corridor during construction. Corridor F would have bisected/disrupted Henderson commercial district. This corridor would have required the relocation of approximately 500 homes, businesses, and apartment units. This was the highest number of relocations of all corridors studied. Corridor F contained approximately 1,136 noise sensitive sites within 800 feet of the centerline. It is estimated that approximately 14.8% of the population within the corridor were minorities and that 10.5% of the population were low-income families. Corridor F had the greatest impact on minority and low-income populations of the ten build corridors. It required taking approximately 51 acres of wetlands. Ten state-listed species were located within 1 mile of the centerline of Corridor F. It also impacted 1 federally endangered species. There were 22 archived

archaeology and historic sites within the 400-foot boundaries of Corridor F Corridor F would have impacted over 1,100 noise sensitive sites. These sites were determined within 800 feet of centerline and would have required approximately 28,000 feet of noise barrier wall. It could have required the relocation of approximately 13 Resource Conservation Recovery Act (RCRA) sites. Corridor F was the only corridor containing such sites. It had the most railroad grade separations (4) per alternative. Corridor F was estimated to cost approximately $1.27 billion to construct. The cost of this corridor was more than double the least expensive corridor (Corridor H).

Given the moderate environmental impacts, significant socio-economic impacts, high costs, low level of constructability under traffic, and failure to provide an additional river crossing, Corridor F was not advanced for further study.

Corridor G
Corridor G was approximately 31.4 miles in length, and had a preliminary cost estimate of $778 million.

<u>Advantages:</u>
This corridor did not impact a high concentration of minority and/or low-income populations. Corridor G utilized the existing I-164 and travels south on the existing US 41 corridor to just north of the Ohio River. It performed well with respect to traffic operations. It would have impacted the second fewest number of streams (11). It did not impact oil wells. It had the lowest impact on farmlands (147 acres) of the ten build corridors. It would have required the least amount of right of way acquisition.

<u>Disadvantage:</u>
This corridor did not meet all performance measures of the *Purpose and Need Statement*, since it did not provide an additional river crossing to US 41. It would have been difficult to construct while keeping it open to traffic and would likely have had adverse impacts on businesses along the corridor during construction. Corridor G would have bisected/disrupted the Henderson commercial district. The corridor would have impacted the socio-economic environment in Henderson with the relocation of approximately 115 residences, 40 apartments, and 53 businesses anticipated. Compared to the other corridors, Corridor G had the greatest number of state listed species (21 varieties) within 1 mile of its centerline. It required taking approximately 48 acres of high quality wetlands. It impacted eleven archived historical/archaeology sites in Indiana and Kentucky. The corridor could have impacted up to 5 federally endangered species. Corridor G would have impacted almost 1,400 noise sensitive sites. These sites were determined within 800 feet of centerline, and would require approximately 28,000 feet of noise barrier wall.

Given the significant socio-economic and environmental impacts, low level of constructability under traffic, and failure to provide an additional river crossing, Corridor G was not advanced for further study.

Corridor H
Corridor H utilized I-164 and was approximately 30.2 miles in length. The preliminary cost estimate for Corridor H was $581 million.

<u>Advantages:</u>
This corridor met all performance measures of the *Purpose and Need Statement*. It had the fewest residential and business relocations of the ten corridors under consideration. Corridor H provided an eastern alternate that created an additional Ohio River Crossing. It utilized existing I-164. It did not impact a high concentration of minority and/or low income population. Corridor H would attract approximately 27,000 vehicles to a new Ohio River crossing, more than any other corridor. It performed well with respect to traffic operations. Corridor H crossed the fewest miles of floodplain (4.8 miles) and impacted the fewest number of streams (10) when compared to all

other corridors. Corridor H was the most cost-effective of the ten build corridors. Corridor H provided the shortest Ohio River bridge (3.4 miles in structure) of all ten corridors.

<u>Disadvantages:</u>
Corridor H would require taking approximately 31 acres of wetlands. It may impact up to four federally endangered species and 16 state-listed species within 1 mile of the centerline of the corridor. There were 13 archived archaeology and historic sites within the 400-foot boundaries of Corridor H. Approximately 559 acres of right of way would be required for the construction of Corridor H.

Corridor H was carried forward for further study given the relatively low estimated cost, existing roadway and right of way utilization, relatively minor environmental impacts, and good traffic performance.

Corridor I
Corridor I utilized I-164 and was 31.9 miles in length. The preliminary cost estimate for Corridor I was $685 million.

<u>Advantages:</u>
This corridor met all performance measures of the *Purpose and Need Statement*. It had limited residential and business relocations. Corridor I provided an eastern alternate that created an additional Ohio River Crossing. It utilized existing I-164. It performed well with respect to traffic operations. It was projected to impact the least percentage of low income and minority population. Corridor I would have impacted the fewest acres of wetland among the ten alternatives (20.2 acres). The 400-foot boundary of Corridor I contained 8 archaeology/historic sites. Corridor I would have required approximately 713 acres of new right of way. The new Ohio River crossing with Corridor I was expected to attract approximately 20,000 vehicles per day. No apartment units or businesses were anticipated to be relocated within this corridor.

<u>Disadvantages:</u>
Corridor I would have required approximately 44 residences to be displaced. It may impact up to 4 federally endangered species. Eleven state-listed species were located within 1 mile of the centerline of Corridor I. Although minimal archaeology and historic sites were located along Corridor I, it was likely additional sites would be discovered.

Corridor I was carried forward for further study given the relatively low cost, existing roadway utilization, low environmental impacts, and good traffic performance.

Corridor J
Corridor J was approximately 30.9 miles in length, and had a preliminary cost estimate of $959 million.

<u>Advantages:</u>
This corridor met all performance measures of the *Purpose and Need Statement*. It provided a western alternate and created a new Ohio River crossing. This corridor outperformed the other western corridors when evaluating environmental factors. It required taking the second fewest acres of wetlands (27.7) of the ten build corridors. Corridor J required the least amount of new right of way (1,492 acres) when compared to all western corridors. This corridor would have carried approximately 7,900 vehicles per day across the Ohio River, the most of any western corridor.

<u>Disadvantages:</u>
Corridor J required the longest structure length over the Ohio River and adjacent flood prone area (8.0 miles). The corridor required over 1,490 acres of new right of way, of which 1,140 acres was

considered agricultural. Approximately 61 residences, 92 apartment units, and 3 businesses were anticipated to require relocation. The affected minority population within Corridor J could have been as much as 13% of the total impacted population. It would have potentially impacted up to 27 streams. It crossed 11.9 miles of floodplain. It would have impacted up to 27 archaeology/historic sites. Five state listed species were located within 1 mile of the centerline of Corridor J.

Corridor J was carried forward for further study given its modest environmental impacts and good traffic performance.

2.4 STUDY ADVISORY COMMITTEE INPUT

An I-69 Study Advisory Committee (SAC) was established in early 2001. The purpose of establishing a SAC was to provide an additional mechanism of public involvement during the project study. Invitation for SAC participation was open to the general public. The first SAC meeting took place on February 14, 2001, and members have been asked to provide input throughout the study process.

On May 1, 2002, the SAC participated in a criteria-rating exercise. SAC members were asked to indicate the importance of 19 criteria from the screening measures discussed in **Section 2.3**. Two boards listing the criteria were located in the meeting room and the SAC members were given 18 color-coded dots, six each representing high, medium, and low priorities. They were then asked to strategically place their dots on those criteria that they and their constituency consider important.

Twenty-nine SAC members attended and participated in the exercise. An absentee survey form containing the same criteria presented at the meeting was sent to those SAC members who were unable to attend. The absent members were given two weeks to return the absentee form in a postage-paid envelope. Eight members returned the absentee surveys, resulting in a total of 37 responses.

The priority rating (or weight) for each criterion was determined by first assigning a numeric value to each of the three types of dots. A value of 10.0 was assigned to high priority dots, 5.5 to medium priority dots, and 1.0 to low priority dots. The number of responses for each criterion was then tallied and multiplied by the number of priority points. The final criterion priority rating was determined by calculating the average priority (dividing the total number of priority points by the total number of responses the criterion received). **Table 2-4** presents the results of the SAC criteria rating exercise.

2.4.1 Corridor Evaluation with SAC Rating

The priority ratings assigned to each criterion by the SAC were converted to a percentage (by dividing by the highest possible rating of 10.0), and multiplied by the normalized ratings developed for the associated evaluation measure and discussed in **Section 2.3** to develop the SAC rating. **Table 2-5** shows both the normalized ratings from **Section 2.3** and the SAC rating. The SAC criteria-rating exercise provided an additional tool to gauge public support/opinion of each criterion. The criteria are listed in order of priority and the source of the criteria (the associated category of evaluation measure) is provided.

The third criterion, "*Meet Goals of National I-69 Corridor (Complete National I-69)"*, is satisfied by all corridors. Therefore, each corridor received a rating of 10.0, which was multiplied by the SAC priority rating for a final SAC rating of 7.7. Two screening measures were added at the SAC meeting and two screening measures were evaluated based on a combination of evaluation measures, or a measure that has not yet been discussed. These measures are as follows:

- Maximize Economic Benefits (added by SAC)
- Strengthen the Transportation Network between Evansville and Henderson (added by SAC)
- Improve Service of Neighborhoods and the Proximity to Neighborhoods
- Provide Access to Planned Developments

Table 2-4: Study Advisory Committee Criteria Rating Exercise Results

Criterion Source	Criterion	High Priority		Medium Priority		Low Priority		Number of Responses	Priority Rating
		Number	Points (10)	Number	Points (5.5)	Number	Points (1)		
Purpose & Need	Provide Additional River Crossing to the Existing US 41 Bridge	36	360	8	44	4	4	48	8.50
Purpose & Need	Improve Area Freight Travel Times	37	370	16	88	4	4	57	8.11
Purpose & Need	Meet Goals of National I-69 Corridor (Complete National I-69)	28	280	5	27.5	8	8	41	7.70
SAC*	Maximize Economic Benefits	18	180	9	49.5	5	5	32	7.33
SAC*	Strengthen the Transportation Network between Evansville and Henderson	13	130	17	93.5	5	5	35	6.53
Engineering	Minimize Construction Cost	15	150	10	55	10	10	35	6.14
Environmental	Avoid Minimize Wetland Impacts	14	140	15	82.5	9	9	38	6.09
Environmental	Avoid/Minimize Section 4(f) Properties	4	40	10	55	2	2	16	6.06
Environmental	Avoid/Minimize Archeological Features	7	70	9	49.5	8	8	24	5.31
Environmental	Avoid/Minimize Farmland Impacts	9	90	8	44	12	12	29	5.03
Environmental	Avoid/Minimize Residential Impacts	6	60	11	60.5	10	10	27	4.83
Purpose & Need/ Environmental	Improve service of Neighborhoods and the Proximity to Neighborhoods	5	50	10	55	12	12	27	4.33
Environmental	Avoid/Minimize Business Locations	5	50	7	38.5	11	11	23	4.33
Other	Provide Access to Planned Developments	1	10	11	60.5	7	7	19	4.08
Environmental	Avoid /Minimize Wellhead Protection Impacts	2	20	6	33	7	7	15	4.00
Environmental	Avoid/Minimize Impacts to Historic Structures	2	20	9	49.5	11	11	22	3.66
Environmental	Avoid/minimize Significant Habitats	2	20	8	44	13	13	23	3.35
Environmental	Minimize Floodplain Impacts	2	20	11	60.5	16	16	29	3.33
Environmental	Avoid/Minimize Managed Lands	1	10	5	27.5	12	12	18	2.75
	TOTALS	**207**	**2070**	**185**	**1017.5**	**166**	**166**		

*Note: Criterion was added at the SAC meeting at the request of the SAC members.

Table 2-5: Study Advisory Committee Evaluation Results

	Western Corridors						Existing Corridors		Eastern Corridors	
	A	B	C	D	E	J	F	G	H	I
Provide Additional River Crossing to the Existing US 41 Bridge	10.0	10.0	10.0	10.0	10.0	10.0	1.0	1.0	10.0	10.0
SAC rating - 8.5	8.5	8.5	8.5	8.5	8.5	8.5	0.9	0.9	8.5	8.5
Improve Area Freight Travel Times	1.7	1.0	3.8	3.9	3.6	5.2	10.0	4.5	4.6	5.6
SAC rating - 8.11	1.4	0.8	3.1	3.2	2.9	4.2	8.1	3.6	3.7	4.5
Meet Goals of National I-69 Corridor (Complete National I-69)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
SAC rating - 7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
Maximize Economic Benefits	4.3	4.0	5.7	5.5	5.3	6.4	7.0	6.0	7.4	7.9
SAC rating - 7.33	3.1	2.9	4.2	4.0	3.9	4.7	5.1	4.4	5.4	5.8
Strengthen Transportation Network between Evansville & Henderson	1.1	1.0	2.2	1.8	1.7	2.6	10.0	8.8	8.7	7.6
SAC rating - 6.53	0.7	0.7	1.4	1.2	1.1	1.7	6.5	5.8	5.7	5.0
Minimize Construction Cost	4.8	4.7	4.9	4.9	5.1	5.1	1.0	7.5	10.0	8.7
SAC rating - 6.14	3.0	2.9	3.0	3.0	3.1	3.2	0.6	4.6	6.1	5.3
Avoid Minimize Wetland Impacts	2.5	2.1	3.6	2.8	1.0	9.3	7.1	7.4	9.0	10.0
SAC rating - 6.09	1.5	1.3	2.2	1.7	0.6	5.7	4.3	4.5	5.5	6.1
Avoid/Minimize Section 4(f) Properties	4.1	1.0	5.9	3.0	2.9	9.8	6.4	8.7	8.4	10.0
SAC rating - 6.06	2.5	0.6	3.6	1.8	1.7	5.9	3.9	5.2	5.1	6.1
Avoid/Minimize Known Archeological Features	1.0	1.0	1.0	1.0	1.0	5.5	5.5	5.5	5.5	5.5
SAC rating - 5.31	0.5	0.5	0.5	0.5	0.5	2.9	2.9	2.9	2.9	2.9
Avoid/Minimize Farmland Impacts	1.3	1.0	1.5	1.8	2.0	4.6	8.1	10.0	8.1	7.3
SAC rating - 5.03	0.6	0.5	0.8	0.9	1.0	2.3	4.1	5.0	4.1	3.7
Avoid/Minimize Residential Impacts	9.8	9.8	9.5	9.4	9.2	6.6	1.0	6.5	10.0	9.3
SAC rating - 4.83	4.7	4.7	4.6	4.5	4.5	3.2	0.5	3.1	4.8	4.5
Improve service of Neighborhoods & Proximity of Neighborhoods	5.5	5.4	6.4	6.0	5.8	5.3	5.5	7.1	8.7	8.7
SAC rating - 4.33	2.4	2.3	2.8	2.6	2.5	2.3	2.4	3.1	3.8	3.8
Avoid/Minimize Business Relocations	9.9	10.0	9.9	9.9	9.9	9.8	1.0	6.0	10.0	10.0
SAC rating - 4.33	4.3	4.3	4.3	4.3	4.3	4.2	0.4	2.6	4.3	4.3
Provide Access to Planned Developments	1.0	1.0	1.0	1.0	1.0	1.0	10.0	5.5	5.5	5.5
SAC rating - 4.08	0.4	0.4	0.4	0.4	0.4	0.4	4.1	2.2	2.2	2.2
Avoid /Minimize Wellhead Protection Impacts	5.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	1.0
SAC rating - 4.0	2.2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.4
Avoid/Minimize Impacts to Historic Structures	4.7	1.0	6.3	2.8	2.7	8.0	8.5	9.7	9.5	10.0
SAC rating - 3.66	1.7	0.4	2.3	1.0	1.0	2.9	3.1	3.5	3.5	3.7
Avoid/Minimize Impacts to Significant Habitats	5.5	4.9	6.1	4.9	4.9	10.0	6.6	1.0	3.8	6.6
SAC rating - 3.35	1.8	1.7	2.0	1.7	1.7	3.3	2.2	0.3	1.3	2.2
Minimize Floodplain Impacts	1.1	1.0	3.8	4.4	4.6	3.4	6.2	3.1	10.0	7.2
SAC rating - 3.33	0.4	0.3	1.3	1.5	1.5	1.1	2.1	1.0	3.3	2.4
Avoid/Minimize Managed Land Impacts	5.5	8.5	7.0	10.0	8.5	1.0	7.0	10.0	7.0	10.0
SAC rating - 2.75	1.5	2.3	1.9	2.8	2.3	0.3	1.9	2.8	1.9	2.8
TOTAL (out of a possible 190)	49.0	46.9	58.5	55.2	53.2	68.5	64.8	67.4	83.9	81.8
Average of Ratings (10 is best)	**2.58**	**2.47**	**3.08**	**2.91**	**2.80**	**3.61**	**3.41**	**3.55**	**4.42**	**4.31**
Rank (1 is best)	**9**	**10**	**6**	**7**	**8**	**3**	**5**	**4**	**1**	**2**

2.5 SUMMARY OF INITIAL CORRIDOR EVALUATION

A summary of the corridor rankings from the Purpose and Need, Environmental, and Engineering Evaluations is found in **Table 2-6**. These ranks provide a general indicator of which corridors performed well in each of the evaluation categories, and which corridors performed well overall. Corridor H ranked 1st in all three categories, and Corridor I finished 2nd in two of the three categories. Corridor F ranked 10th in Engineering Evaluation, and 9th with respect to the Environmental Evaluation. For comparison, the SAC rating for all the corridors is also included in

Table 2-6. When compared to the average rank from the individual evaluations, the SAC rankings (and therefore priorities) closely resemble the overall results of the evaluation process.

Table 2-6: Evaluation Measure Rank Summary

	Western Corridors						Existing Corridors		Eastern Corridors	
	A	B	C	D	E	J	F	G	H	I
PURPOSE AND NEED RANK	9	10	6	7	8	5	2	4	1	3
ENVIRONMENTAL RANK	10	8	7	5	6	4	9	3	1	2
ENGINEERING RANK	7	8	6	5	4	3	10	9	1	2
Average of Rankings (1.0 is best)	8.7	8.7	6.3	5.7	6.0	4.0	7.0	5.3	1.0	2.3
Overall Rank (1 is best)	9	9	7	5	6	3	8	4	1	2
SAC RANK	9	10	6	7	8	3	5	4	1	2

2.6 CORRIDORS CARRIED FORWARD FOR FURTHER STUDY

As discussed in **Section 2.2** many factors comprised the evaluation process. Each corridor was analyzed with respect to the three categories of screening measures. The results of the evaluations indicated that Corridors H and I were the strongest performers, Corridors F, G, and J were moderate performers, and Corridors A through E were the poorest performers.

Corridors A through E performed poorly with respect to Environmental and Traffic Evaluations, and were considered difficult to construct. Therefore, these corridors were dismissed from further consideration. Corridors F, G, and J performed well on given evaluations, with J and G receiving slightly higher rankings than F. From an engineering standpoint, both Corridors F and G would be difficult to construct under traffic. Neither corridor would provide an additional river crossing for the region. Both alternatives would have significant negative impacts on property and business owners, both as a result of relocations and construction activities. Corridor F would cost considerably more than the other proposed corridors and Corridor G has the greatest potential impacts to state listed species. For these reasons, Corridors F and G were not recommended for further study.

Corridors H, I, and J were determined to be the highest ranking corridors and were carried forward to the next phase of the project. Additionally, a variation of Corridor J (named Corridor J1) that considered a more direct connection to the US 41 corridor near I-64 north of Evansville, was also carried forward to the next level of analysis. J1 was included in order to determine if the traffic performance of J, the best of any western corridor, could be improved by changing its terminus at I-64 to be nearer to the Evansville urbanized area. Corridor J1 connected to I-64 near its interchange with US 41 and proceeded southwest to SR 66 just north of Wadesville, and then followed the same corridor as J.

Resource Agency comments, in general, confirmed the findings from the *Level 1 Alternatives Analysis Report*. IDNR's Division of Water, Environmental Unit noted that the western corridors (Corridors A – E) would have the highest potential for impacts to fish, wildlife, and botanical resources. Much of the loss of habitat was attributed to the potential for forest fragmentation. The USFWS stated that the selection of Corridors H, I, and J eliminated the alternatives with the greatest potential for impacts to wildlife resources.

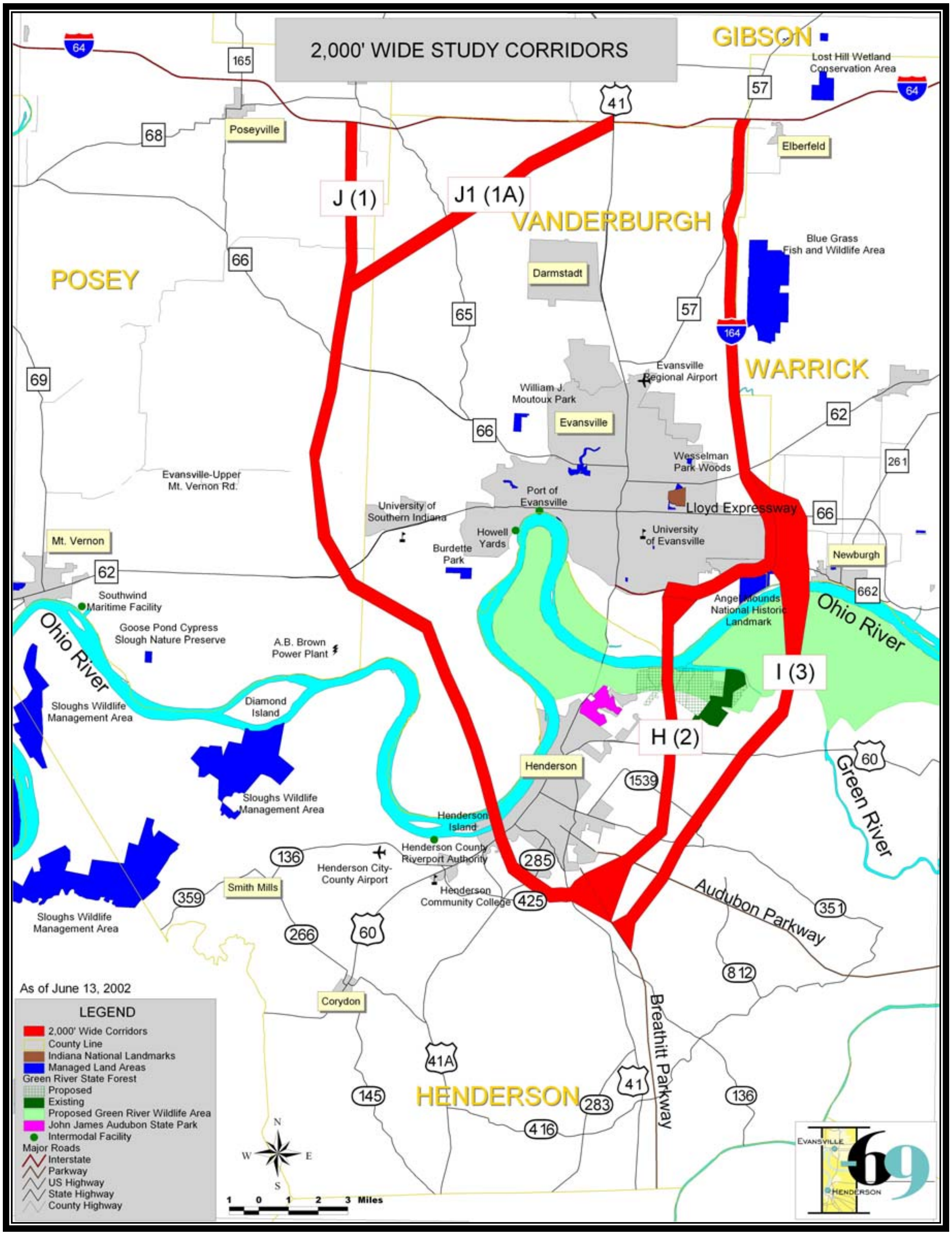
Corridors that were carried forward for further study are shown in **Figure 2-3.** These corridors were then renamed, proceeding in order from west-to-east. Corridor J was referred to as Alternative 1 (and J1 as 1A), Corridor H as Alternative 2, and Corridor I as Alternative 3.

2.7 REVISIONS TO CORRIDORS

The corridors carried forward for further study were refined from the 2,000' wide corridors presented to the public in June 2002 to 1,000' wide study corridors. These refinements, based on a combination of GIS-level data, in-depth field investigations, and engineering considerations, typically fell within the boundaries of the 2,000' corridors. The only significant exceptions are portions of Alternative 1A and Alternative 3. The northern terminus of Alternative 1A moved to the west in order to better accommodate the development of an interchange with I-64 (the previous location was at or near the existing US 41 interchange with I-64). Alternative 3 shifted to the west from the Ohio River to south of US 60 in order to avoid impacts to historic properties and Section 4(f) resources, which will be discussed in greater detail in **Chapter 5**. From that point, Alternative 3 joined the same alignment as Alternative 2.

The collection and analysis of data is an ongoing process throughout the development of the *Environmental Impact Statement*. As new information becomes available, modifications to the alternatives are sometimes necessary to avoid or minimize impacts to previously unknown resources or to conform to engineering limitations. As such, adjustments to two corridors were made after the September 2002 public meetings. The location of the Ohio River crossing on Alternative 1/ Alternative 1A was shifted slightly to the west in order to minimize potential impacts to residences in the Henderson area. Alternative 2 was revised between the Ohio River and US 60 to avoid impacts to a historic property. The 1,000' corridors, as of the publication of this document, are shown in **Figure 2-4**.

The 1,000' wide study corridors comprise areas within which existing data suggest that a roadway alignment is feasible. Within these corridors, alternatives have been developed, as discussed in **Section 2.8**.



Note: Letters represent the 2,000' Corridor designation and numbers the 1,000' Corridor designation.

Figure 2-3: 2000' Wide Corridors Carried Forward for Further Study

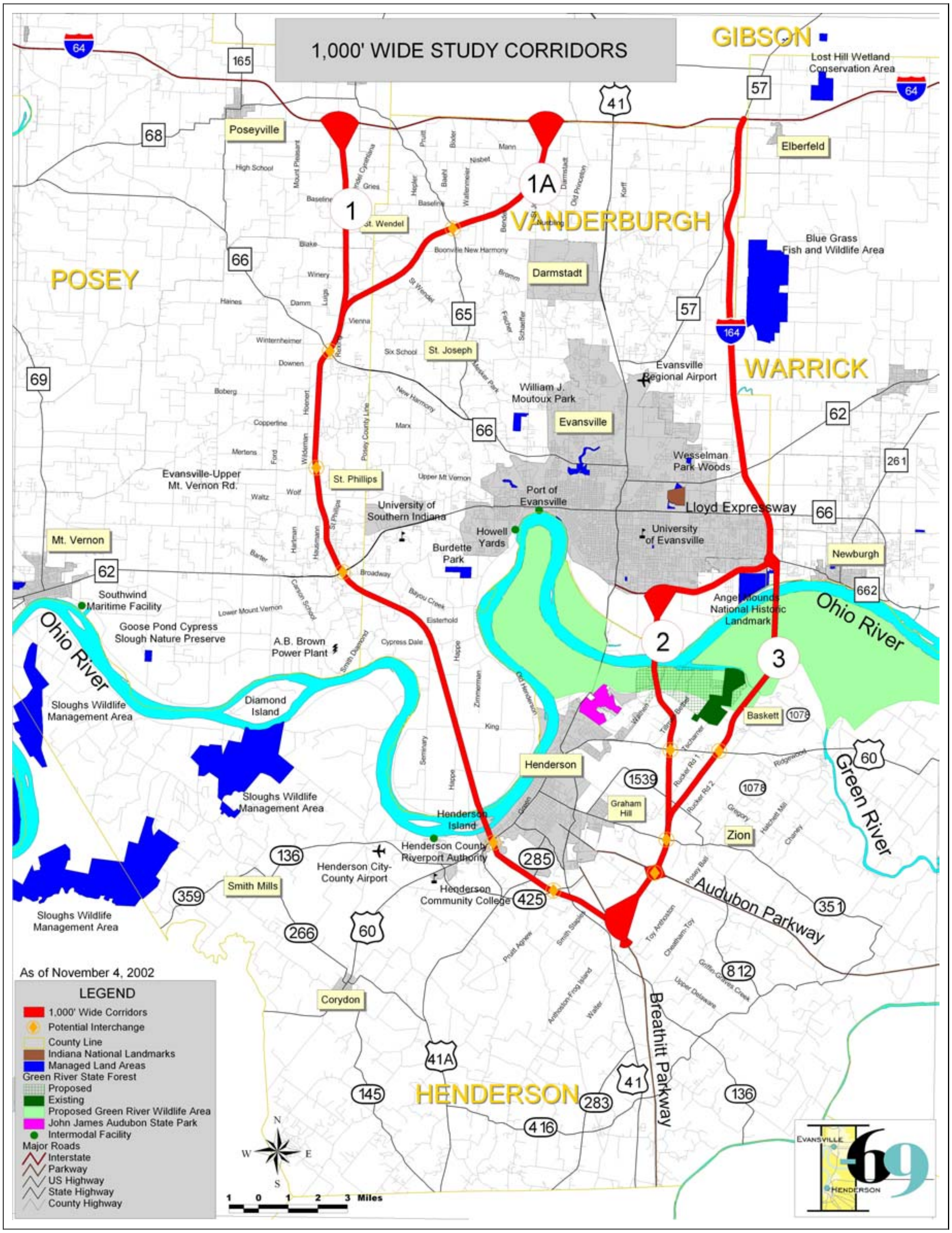


Figure 2-4: 1000' Wide Corridors

2.8 DEVELOPMENT OF ALTERNATIVES

Build alternatives were developed within the 2,000' wide corridors and were later refined in the 1,000' wide corridors. The alignments of these alternatives are based on the guidelines established by the American Association of State Highway and Transportation Officials (AASHTO) in *A Policy on the Geometric Design of Highways and Streets,* supplemented by INDOT and KYTC Design Manuals. **Appendix A-1** contains a summary of the design characteristics utilized in the development of these alternatives.

The proposed facility is anticipated to provide a highway designed to freeway standards and would be signed I-69. Typical, conceptual roadway sections were developed for the determination of costs and potential impacts to environmental resources, and are shown in **Figure 2-5**. Refined roadway sections, as approved by INDOT for Indiana segments of I-69 and KYTC for Kentucky segments, will be determined during subsequent project phases. However, for purposes of this study, design characteristics on this Interstate include 12-foot wide travel lanes, and 12-foot wide inner and outer shoulders. In rural areas, the proposed I-69 would be constructed as a four-lane divided freeway, with an 80-foot wide depressed median. For purposes of this study, a new Ohio River bridge crossing would be designed to accommodate a future six-lane section (*i.e.*, three lanes in each direction), and 14-foot inside and outside shoulders (including a two-foot offset to the bridge rails). Refinement to the bridge(s) designs will occur during subsequent project phases.

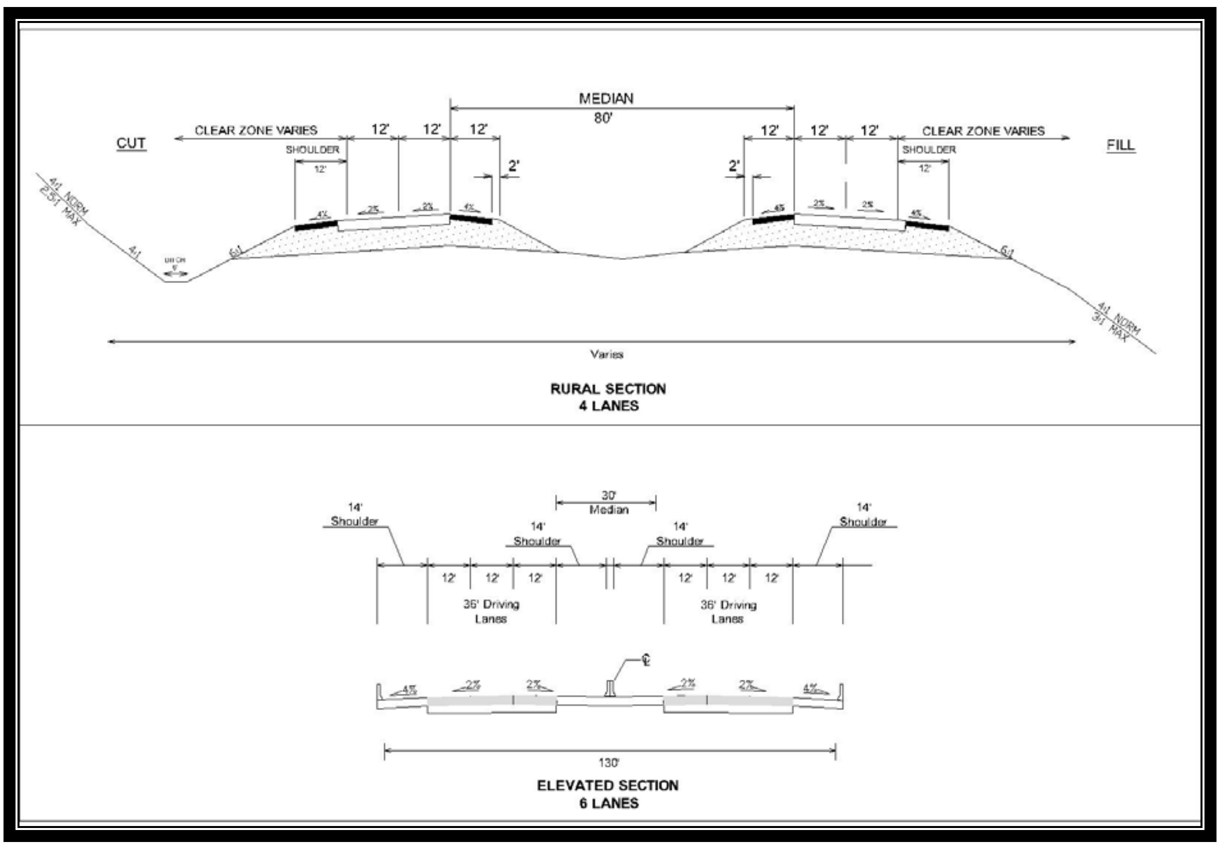


Figure 2-5: Typical Sections

In the absence of detailed survey data, horizontal and vertical alignments, based on the centerlines of the relevant 1,000' wide corridors, were approximated using U.S. Geological Survey Digital Elevation Models (DEMs). A DEM is a digital file consisting of terrain elevations for ground positions at regularly spaced horizontal intervals.[1] The horizontal interval for the 18 DEMs used in this study is 30 meters, or just under 100 feet. Given the relative coarseness of these intervals, these alignments and the subsequent estimated construction limits developed from them should be considered conceptual designs only, and do not represent a final design. **Figure 2-6** demonstrates the relationship between the 2,000' corridors, the 1,000' corridors, and the alternatives.

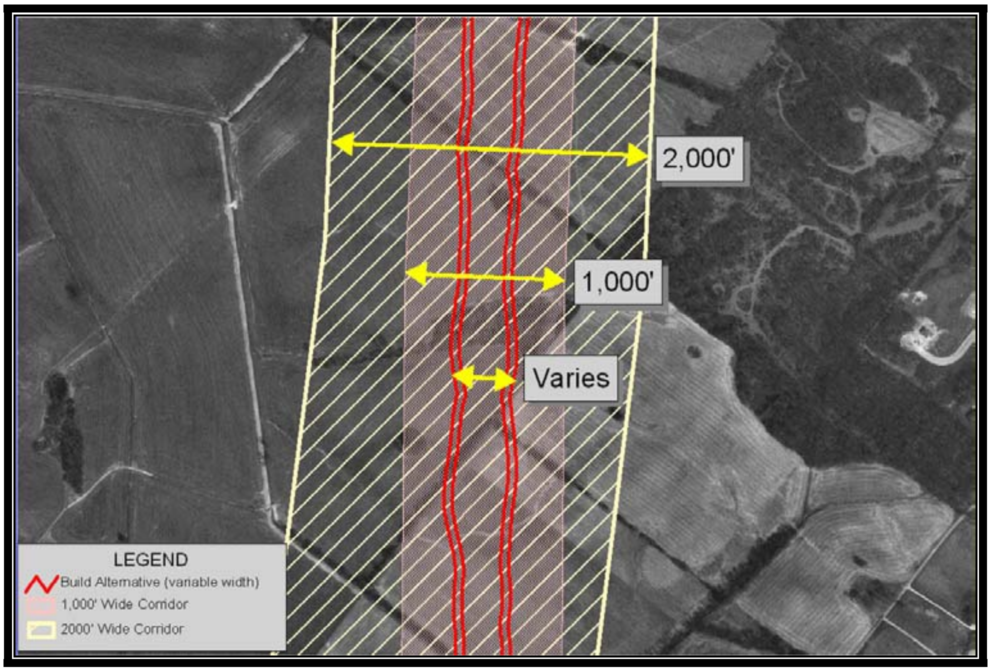


Figure 2-6: Typical 2,000' Corridor, 1,000' Corridor, and Build Alternative

The alternatives are variable in width. The inner lines are the estimated construction limits and represent the estimated limits of earthwork for the construction of an alignment (i.e. toe of cut slopes or tops of embankment). In consideration of the error in vertical accuracy within a DEM, and the potential for error in the resultant vertical alignments, the construction limits were "buffered" by an additional 50 feet on each side. The resulting widths for the alternatives are between 350 and just under 600 feet, depending on the terrain traversed. The 1,000' corridors and Build Alternatives are shown in **Appendix A-2**.

2.9 INTERCHANGES

Each of the I-69 Build Alternatives includes a number of interchanges, including both system (Interstate/freeway-to-Interstate/freeway) and service/non-freeway (surface street) interchanges provide the sole means of local vehicular access to freeway facilities given their full access control level. As such, the number and location of interchanges is critical to the overall performance of a transportation system. System interchanges typically provide non-stop traffic flow from one facility to another. Service interchanges may provide unimpeded flow (in the case

[1] http://rmmcweb.cr.usgs.gov/elevation/dpi_dem.html

of loop ramps, for example), but may also have traffic control devices at ramp terminals on non-freeway facilities.

Table 2-7 presents the locations for interchanges along the I-69 Build Alternatives. Alternatives 1 and 1A each have two system interchanges, and Alternatives 2 and 3 have three. Alternative 1 has five service interchanges (two in Kentucky and three in Indiana) and Alternative 1A has six (two in Kentucky and four in Indiana). Alternatives 2 and 3 have two service interchanges. The KY 351 location was removed from this study prior to the September 2002 public meetings because of its proximity to the Audubon Parkway and historic properties. However, due to public comment in favor of an interchange at that location, it was reassessed and is again considered as an interchange. Alternative 3 also provides local access to SR 662 through the system interchange between I-69 and I-164.

Table 2-7: Interchange Locations

	Alternative 1	Alternative 1A	Alternative 2	Alternative 3
System Interchanges	Breathitt Parkway	Breathitt Parkway	Breathitt Parkway	Breathitt Parkway
	I-64	I-64	Audubon Parkway	Audubon Parkway
			I-164	I-164
Service Interchanges	KY 425	KY 425	KY 351	KY 351
	US 60	US 60	US 60	US 60
	SR 62	SR 62		SR 662 (Covert Avenue)*
	Evansville-Upper Mt. Vernon Road	Evansville-Upper Mt. Vernon Road		
	SR 66	SR 66		
		SR 65		

*Note: SR 662 (Covert Avenue) is served by the I-69 interchange with I-164.

Where interchanges are not anticipated for existing roadways crossed by a Build Alternative, there exist a number of options. Partial roadway closures, overpasses/underpasses (grade separations), and roadway realignments are some of these possibilities. **Table 2-8** presents a summary of the roadways severed by an I-69 Build Alternative where an interchange or an overpass/underpass is not anticipated. Where possible, other means of access (i.e. local service roads, alternate routes, etc.) may be provided where roadway closures are deemed necessary during subsequent project phases.

2.10 OHIO RIVER CROSSING

The I-69 Henderson to Evansville study will result in a single preferred alternative for SIU #4. Should a Build Alternative be found the preferred alternative, the study will identify the location of a new Ohio River crossing. However, this study will not address the type of structure that is to be constructed. The only assumptions made relative to this new river crossing include its length and size (width) for purposes of estimating potential impacts and to determine engineering feasibility.

Assumptions relative to structure limits were developed based on the limits of the Ohio River floodway. Bridge(s) design requirements will be determined after the completion of the NEPA process. Based on discussions with KYTC Division of Bridge Design staff (the State of Kentucky will own and maintain the bridge crossing), an additional 25 feet of right-of-way beyond the width of the structure was considered desirable for future maintenance purposes.

Table 2-8: Roadways Severed by Build Alternatives

Alternative 1	Alternative 1A	Alternative 2	Alternative 3
Schissler	Schissler	Weinbach	Spry
Old Lower Mt. Vernon	Old Lower Mt. Vernon		
Adams Dr.	Adams Dr.		
Middle Mt. Vernon	Middle Mt. Vernon		
Boberg	Boberg		
Downen	Downen		
Damm	Damm		
Diamond Island	Motz		
Spahn	Emge		
John Will	Lutterbach		
Emge	Maaseberg		
Water Tank Rd.	Bender		
	Owensville		
	Adler		

2.11 COMMERCIAL VEHICLE MONITORING STATION

The KYTC Study entitled *Commercial Vehicle Monitoring Station Infrastructure Review Report*, dated April 9, 1998, states that "every interstate should have a port of entry station as near as possible to the state line." A port of entry station, or a weigh station located near a jurisdictional boundary such as a state line, is currently located in Kentucky on US 41, just north of the Ohio River. With a new bridge over the Ohio River, the Henderson to Evansville I-69 corridor is expected to divert from 16% to 48% (depending on the build alternative considered) of the forecasted commercial traffic from the existing US 41 twin bridges. As such, a commercial vehicle monitoring station (CVM) on the Kentucky portion of I-69, near to the Indiana border, was considered necessary to monitor that traffic.

It is desirable to construct a CVM as close as possible to the state line to minimize the potential for trucks to circumvent the station. However, locating a CVM between US 60 and the Ohio River would be problematic, due to the terrain and the relatively short distance between these features along each of the study alternatives. While the potential will exist for circumventing a CVM station should it be located south of the I-69 connection to the Breathitt Parkway, the same or greater potential will exist for circumventing a new alignment station via existing US 41 as it is unlikely the existing station would remain in operation.

Based on these findings, the inclusion of a CVM station for I-69 entering Kentucky from Indiana and/or any associated rest areas will be considered. Additionally, the inclusion of ITS equipment to supplement enforcement of commercial vehicle regulations may be addressed after the conclusion of the NEPA process.

2.12 COMPARISON OF ALTERNATIVES

Throughout **Chapter 3** and **Chapter 5**, information regarding the engineering characteristics and potential environmental impacts relative to each of the I-69 Build Alternatives and the No-Build Alternative are discussed. This section provides a summary of those discussions.

Cost estimates, based on the assumptions found in the *Level 1 Alternatives Analysis Report,* were revised based on modifications to the alternative alignments. These revised cost estimates are found in **Appendix A-3**. Given the large number of unknown design variables/considerations in this study (i.e. detailed geotechnical and hydraulic conditions, number of bridges and their characteristics, topographic survey data, etc.), these costs should be considered only in relative terms and not considered as absolute costs. As such, a 25% contingency has been included to account for these unknowns. These costs were estimated in Year 2003 dollars.

A brief summary of the preliminary engineering considerations for the four build alternatives is shown in **Table 2-9**. These considerations include total length, structure length, new roadway length, estimated cost, interchanges, and railroad crossings. Total length is the entire length of the alternative, from the Breathitt Parkway south of Henderson to I-64 north of Evansville. Structure length includes the primary bridge crossing the main channel of the Ohio River and the associated structures spanning the Ohio River floodway. New roadway length refers to the new alignment portions of Alternatives 2 and 3, as opposed to the sections utilizing existing I-164. Interchanges include system interchanges between two freeways/Interstate facilities and service interchanges where the cross road is a non-freeway.

Table 2-9: Engineering Considerations

	Alternative 1		**Alternative 1A**		**Alternative 2**		**Alternative 3**	
Length (mi)	31.8		35.2		30.2		31.9	
Structure length (mi)	9.0		9.0		3.4		7.0	
New roadway length (mi)	31.8		35.2		11.6		14.7	
Cost	$1,058,000,000		$1,088,000,000		$652,000,000		$799,000,000	
Interchanges	**Kentucky**	**Indiana**	**Kentucky**	**Indiana**	**Kentucky**	**Indiana**	**Kentucky**	**Indiana**
System	1	1	1	1	2	1	2	1
Service	2	3	2	3	2	0	2	1
Railroad crossings	2	2	2	2	1	0	1	0

Table 2-10 presents an overall summary of the considerations and impacts discussed for each of the Build Alternatives as well as the No-Build Alternative. The following sections present an overall summary of each alternative.

Table 2-10: Alternative Performance

	ALTERNATIVE				
	No-Build	1	1A	2	3
PURPOSE AND NEED CONSIDERATIONS					
Meet current freeway design standards	NO	YES	YES	YES	YES
Provide sufficient capacity for new bridge and new bridge approaches	NO	YES	YES	YES	YES
Provide additional Ohio River crossing	NO	YES	YES	YES	YES
Decrease congestion on existing US 41 river crossing (LOS on existing bridges)	F	F	F	C	D
Improve safety by providing cross-river transportation that meets freeway design standards	NO	YES	YES	YES	YES
Traffic Performance					
Reduction of VHT on arterials (rank)[1]	--	+9.4% (4)	+5.2% (1)	+6.2% (2)	+6.3% (3)
Reduction of VHT on US 41 (rank)[1]	--	-8.7% (4)	-12.3% (3)	-29.3% (1)	-28.9% (2)
Reduction of truck VHT (rank)[1]	--	+5.5% (4)	+1.7% (3)	+1.1% (2)	+0.3% (1)
ENVIRONMENTAL CONSIDERATIONS					
Total Right-of-Way (acres)	0	1524.9	1737.4	747.2	723.4
Potential Hazardous Material Sites (HazMat)	N/A	4	5	1	4
Total Forest (net loss in acres)	N/A	243	258	55	44
Core Forest (net loss in acres)	N/A	14.7	20.1	13.4	0
Total Wetlands (acres)	N/A	25.85-30.40	24.55-28.85	30.15-36.40	36.45-40.35
USACE Jurisdictional Wetlands (acres)	N/A	22.74-27.29	20.40-24.70	29.35-35.60	35.16-39.06
USACE Non-jurisdictional Welands (acres)	N/A	3.11	4.15	0.8	1.29
Total Floodplains Crossed (mi)	N/A	12.9	14.6	7.0	7.9
4(f) Property Uses	N/A	0	0	0	0
Total Farmland[2] (acres)	N/A	1,077.90	1,292.70	592.8	538.1
Prime & Unique[3] (acres)	N/A	977.4	1,235.40	623.9	645.2
Total Homes/Apartment Units Relocations	N/A	61	71	6	74
Business Relocations	N/A	6	6	0	7
Potential Archaeological Impacts (sites)	N/A	12	12	6	5
Environmental Justice Issues	N/A	NO	NO	NO	NO
Number of Streams Encroached	N/A	58	66	41	42
Number of Noise Impacted Receivers	41	51	51	39	19
Adversely Effected Historic Properties	0	9	9	4	7
Adversely Effected National Historic Landmarks	0	0	0	0	1
Exceed Ambient Air Quality Standards	NO	NO	NO	NO	NO
ENGINEERING CONSIDERATIONS					
Total length (miles)	N/A	31.8	35.2	31.5	29.7
New construction (miles)	N/A	31.8	35.2	13.2	14.7
Structure length (miles)	N/A	9.0	9.0	4.0	7.0
Estimated Total Cost (In 2003 Millions)	$0	$1,058	$1,088	$652	$799
Constructability (High, Moderate, or Low)	N/A	L	L	H	M

The information included in this chart is based upon the most recent available data. As such, it is subject to change during the development of the FEIS.

1. VHT=Vehicle Hours of Travel. Compares the 2025 Build Network including I-69 SIU #3 in the SR 57 corridor to the No-Build Scenario. This information pertains to the Henderson-Evansville regional transportation network.
2. Farmland includes currently used agricultural land, including row crop production.
3. Prime & Unique farmland includes some woodlands based on soil types.

Alternative 1, at 31.8 miles in length, is the second most expensive alternative at an estimated cost of $1.06 billion. Other points of interest concerning Alternative 1, shown in **Figure 2-7**, are as follows:

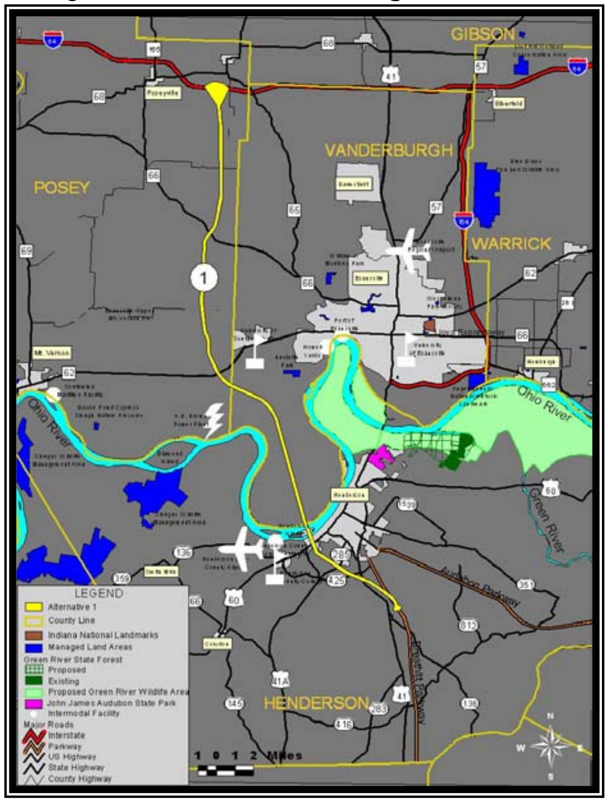


Figure 2-7: Alternative 1

- Structure length: Requires the longest structure (approximately 9.0 miles in length).
- Anticipated right-of-way: Requires approximately 1,524.9 acres new of right-of-way.
- Potential relocations: Requires 61 residential and 6 business relocations.
- Traffic: 1) Results in the lowest Efficient Service Performance Index (ESPI) of the four build alternatives for all forecast scenarios (no I-69 north, I-69 north in the US 41 Corridor, and I-69 north in the SR 57 Corridor).
  2) Provides the least amount of traffic relief on US 41 bridge (reduces 2025 No-Build bridge traffic by only 17.4%).
  3) Diverts less traffic from the US 41 bridges (23.3% assuming I-69 North in the SR 57 corridor) than the eastern alternatives.
- Air quality: Significantly reduces level of air pollutants compared to the No-Build scenario (i.e. no I-69). Typically speaking, reduction levels are higher than for the eastern alternatives.
- Noise: Exceeds noise abatement criteria for three sensitive sites in Indiana.
- Historic resources: Nine historic properties adversely affected by noise and/or visual impacts (6 in Indiana, 3 in Kentucky).
- Archaeology: Impacts 12 known archaeological sites (10 in Indiana, 2 in Kentucky).
- Mineral resources: Has the second-longest length overlaying coal (23.1 miles or approximately 72% of its length).
- Oil and Gas: Impacts up to nine petroleum or gas wells.
- Hazardous Material Sites (HazMat): Impacts four potential HazMat sites.
- Floodplain: Impacts the second-longest length of floodplain (12.9 miles) and the second-highest area (481 acres).
- Wetlands: Impacts between 26 and 30 acres of wetlands, including the highest level of forested wetlands (13.8 – 17.1 acres).
- Farmland: Impacts second-greatest amount of prime and unique farmland (977.4 acres). Alternative 1 has the second highest AD-1006 impact rating in Indiana (133), but ties with Alternative 1A for the lowest in Kentucky (147).
- Forests: Results in the second-highest loss of existing core forests (35.3%).
- Streams: Encroaches upon 58 streams.
- Energy: Results in the highest increase in energy consumption (2.8%) of all the build alternatives.

Alternative 1A, at 35.2 miles in length, is the most expensive build alternative at an estimated cost of $1.09 billion. Other facts concerning Alternative 1A, shown in **Figure 2-8**, are as follows:

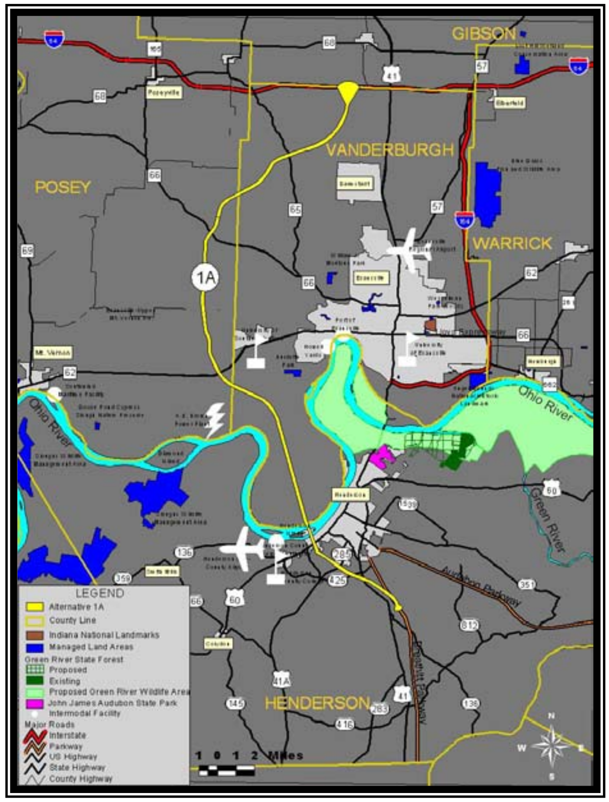


Figure 2-8: Alternative 1A

- Structure length: Requires the longest structure (approximately 9.0 miles in length).
- Anticipated right-of-way: Requires the greatest total amount of new right-of-way (1,737.4 acres).
- Potential relocations: Requires 71 residential and 6 business relocations.
- Traffic: 1) Provides the best Efficient Service Performance Index (ESPI) for vehicle-hours of travel (VHT) of all the build alternatives for all forecast scenarios.
  2) Diverts less traffic from the US 41 bridges (23.0% assuming I-69 North in the SR 57 Corridor) than the eastern alternatives.
  3) Carries less traffic across the Ohio River than the eastern alternatives (12,669 vehicles per day assuming I-69 North in the SR 57 Corridor) than the eastern alternatives.
- Air quality: Significantly reduces level of air pollutants compared to the No-Build scenario. Typically speaking, reduction levels are higher than for the eastern alternatives.
- Noise: Exceeds noise abatement criteria for three sensitive sites in Indiana.
- Historic resources: Ten historic properties adversely affected by noise and/or visual impacts (9 in Indiana, 1 in Kentucky).
- Archaeology: Impacts 12 known archaeological sites (10 in Indiana, 2 in Kentucky).
- Mineral resources: Has the longest length overlaying coal (26.4 miles or approximately 75% of its length).
- Oil and gas: Impacts up to nine petroleum or gas wells.
- Hazardous Material Sites (HazMat): Impacts five potential HazMat sites.
- Floodplain: Impacts the longest length of floodplain (14.6 miles) and the largest area (521 acres).
- Wetlands: Impacts between 24 and 28 acres of wetlands, including the second-highest level of forested wetlands (13.6 – 16.9 acres).
- Farmland: Impacts highest amount of prime and unique farmland (1,235.4 acres). Alternative 1A has the highest AD-1006 impact rating in Indiana (135), but ties with Alternative 1 for the lowest in Kentucky (147).
- Forests: Results in the highest percentage loss of existing core forests (40.3%).
- Streams: Encroaches upon the highest number of streams (66).
- Energy: Results in the second-highest increase in energy consumption (2.4%) compared to the No-Build scenario.

Alternative 2, at 31.5 miles in length (13.2 miles of new roadway plus existing I-164), is the least expensive build alternative at an estimated cost of $652 million. Other facts concerning Alternative 2, shown in **Figure 2-9**, are as follows:

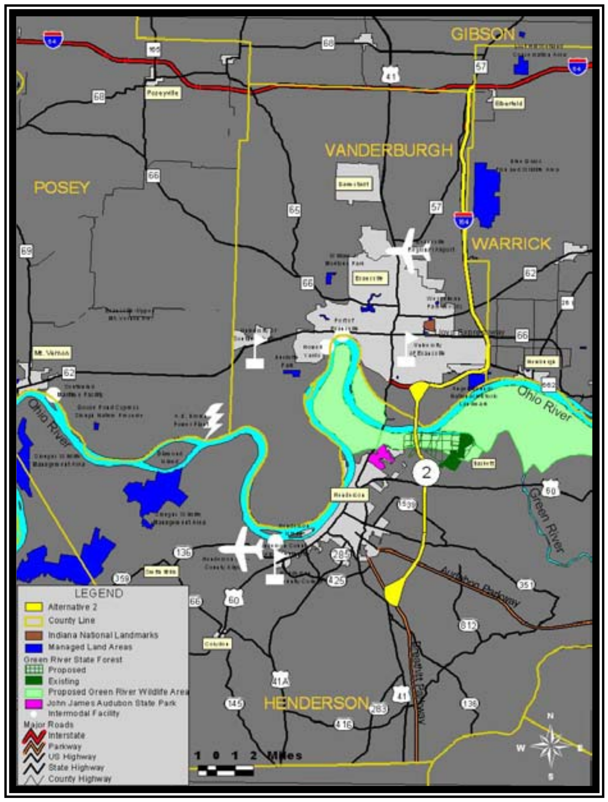


Figure 2-9: Alternative 2

- Structure length: Requires the shortest structure over and adjacent to the Ohio River (approximately 4.0 miles in length).
- Anticipated right-of-way: Requires the second-lowest total amount of new right-of-way (747.2 acres).
- Potential relocations: Requires six residential and no business relocations.
- Traffic: 1) Is the best overall performer with respect to traffic.
  2) Provides the best ESPI for vehicle-miles of travel (VMT) and the highest reduction in traffic on US 41 (in terms of both VHT and VMT) of all the build alternatives for all forecast scenarios.
  3) Diverts the highest percentage of traffic from the US 41 bridges (58.6% assuming I-69 North in the SR 57 Corridor) of all the build alternatives.
  4) Carries the most traffic across the Ohio River (31,397 vehicles per day assuming I-69 North in the SR 57 Corridor) of all the build alternatives.
- Air quality: Reduces level of air pollutants compared to the No-Build scenario. Typically speaking, reduction levels are lower than for the western alternatives.
- Noise: Exceeds noise abatement criteria for two sensitive sites in Indiana.
- Historic resources: Four historic properties adversely affected by visual impacts (all in Kentucky).
- Archaeology: Impacts six known archaeological sites (4 in Indiana, 2 in Kentucky).
- Mineral resources: Has the second-shortest length overlaying coal (8.2 miles or approximately 63% of its length).
- Oil and gas: Impacts up to three petroleum or gas wells.
- Hazardous Material Sites (HazMat): Impacts one potential HazMat site.
- Floodplains: Impacts the shortest length of floodplain (7.0 miles) and the second-smallest area (440 acres).
- Wetlands: Impacts between 30 and 36 acres of wetlands, including 6 to 7.3 acres of forested wetlands.
- Farmland: Impacts the lowest amount of prime and unique farmland (623.9 acres) and lowest area of statewide and locally important farmland (38.6 acres). Alternative 2 has the second-lowest AD-1006 impact rating in Indiana (117), but the highest in Kentucky (156).
- Forests: Results in the loss of approximately 13.4 acres of existing core forests (11.7%).
- Streams: Encroaches upon the lowest number of streams (41).
- Energy: Results in the lowest increase in energy consumption (0.51%) compared to the No-Build scenario.

Alternative 3, at 29.7 miles in length (14.7 miles of new roadway plus existing I-164), is the second-least expensive build alternative at an estimated cost of $799 million. Other facts concerning Alternative 3, shown in **Figure 2-10**, are as follows:

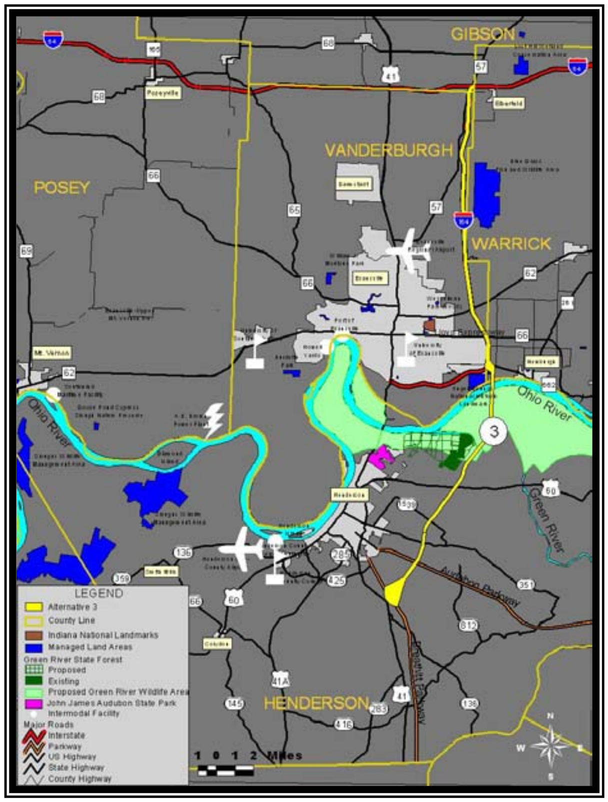


Figure 2-10: Alternative 3

- Structure length: Requires approximately 7.0 miles of structure over and adjacent to the Ohio River.
- Anticipated right-of-way: Requires the lowest total amount of new right-of-way (723.4 acres).
- Potential relocations: Requires 74 residential and 7 business relocations, primarily in the Newburgh area.
- Traffic: 1) Provides the highest reduction in truck hours of travel of all the build alternatives for all forecast scenarios.
  2) Diverts more traffic from the US 41 bridges (45.5% assuming I-69 North in the SR 57 Corridor) than the western alternatives.
  3) Carries the second-highest volume of traffic across the Ohio River (25,071 vehicles per day assuming I-69 North in the SR 57 Corridor) of all the build alternatives.
- Air quality: Reduces level of air pollutants compared to the No-Build scenario. Typically speaking, reduction levels are lower than for the western alternatives.
- Noise: Exceeds noise abatement criteria for two sensitive sites in Indiana.
- Historic resources: Six historic properties adversely affected by noise and/or visual impacts (3 in Indiana, 3 in Kentucky). Affected sites include Angel Mounds, a National Historic Landmark.
- Archaeology: Impacts five known archaeological sites (3 in Indiana, 2 in Kentucky).
- Mineral resources: Has the shortest length overlaying coal (7.7 miles or approximately 52% of its length).
- Oil and gas: Impacts up to three petroleum or gas wells.
- Hazardous Material Sites (HazMat): Impacts four potential HazMat sites.
- Floodplains: Impacts the second-shortest length of floodplain (7.9 miles) and the smallest area (352 acres).
- Wetlands: Impacts the between 36 and 40 acres of wetlands, including only 0.75 to 1 acre of forested wetlands.
- Farmland: Impacts the second-lowest amount of prime and unique farmland (645.2 acres). Alternative 3 has the second-highest AD-1006 impact rating in Kentucky (154), but the lowest in Indiana (78).
- Forests: Results in no net loss of existing core forests.
- Streams: Encroaches upon 42 streams.
- Energy: Results in the second-lowest increase in energy consumption (0.81%) compared to the No-Build scenario.

2.13 Preferred and No-Build Alternative

Based on the information contained within this DEIS and information gathered to date, Alternative 2 is the preferred alternative. This initial identification of the preferred alternative is based on the project's purpose and need, potential impacts, construction costs, utilization of existing highways, and data provided by public input.

The No-Build alternative assumes that National I-69—both within and outside of the project study area—has NOT been completed. This alternative would not include any new freeway construction in the project study area nor would it include a new Ohio River bridge crossing in the Evansville/Henderson area. This alternative would not address those needs identified in the project's Purpose and Need Statement. This alternative would not have any direct impacts to the natural environment and would not require funds for construction. Although this alternative will continue to be a viable alternative throughout the development of the Environmental Impact Statement, it not considered the preferred alternative at this time.

The comparison of eastern (Alternatives 1 and 1A) versus western (Alternatives 2 and 3) alternatives identified different types of impacts. The western alternatives generally perform poorer in meeting the project's purpose and need than the eastern alternatives. Moreover, the western alternatives do not utilize existing roadways and therefore require more new right-of-way. This new right-of-way will likely change the existing landscape and setting of many of the rural and historic areas on the west side of Evansville, in contrast to the eastern alternatives, which utilize existing I-164 and thus have fewer modifications to the existing landscape within the area north of the Ohio River. As a result, the western alternatives tend to have relatively more impacts to environmental resources. The western alternatives also travel through a large portion of floodplain through the oxbow area just north of the Ohio River. When comparing the miles of floodplain traversed, Alternatives 1, 1A, 2, and 3 travel through 12.9, 14.6, 7, and 7.9 miles of floodplain, respectively. Although the design phase will determine the exact miles of bridge structure, this study assumed a bridge would be required over floodplain, particularly the Ohio River's floodway. Finally, cost was considered when evaluating the western and eastern alternatives. It is estimated the western alternatives are expected to cost at least $200 million more than the eastern alternatives. Alternatives 1 and 1A are considered non-preferred relative to Alternatives 2 and 3 because of their generally lower performance, higher right-of-way impacts, higher environmental impacts, and higher cost.

Alternatives 2 and 3 are more similar in performance and cost and share some similar environmental impacts. Both alternatives require approximately 700 acres of right of way, including approximately 600 acres of farmland. Both alternatives utilize portions of existing I-164, and both alternatives may impact a similar number of archaeological sites. However, Alternatives 2 and 3 differ in their impact to Angel Mounds State Historic Site. Angel Mounds is a significant archaeological resource that is designated as a National Landmark and is on the National Register of Historic Places. The nearest construction limits of Alternative 2 are over four miles southwest of Angel Mounds while Alternative 3 comes within 1,000 feet from Mound G within Angel Mounds. Given the proximity of Alternative 3 to Angel Mounds, consultation between the Indiana State Historic Preservation Officer, Angel Mounds staff, local historians, and archaeologists determined that an adverse visual and noise effect on Angel Mounds will occur with the construction of Alternative 3. Alternative 2 was shown to have no adverse impact on Angel Mounds.

Other issues associated with Alternative 3 relative to Alternative 2 include its relocation impacts, its cost, and constructability. In addition to the impact on Angel Mounds, Alternative 3 is expected to have over 70 residential/apartment relocations and approximately seven business relocations while Alternative 2 is estimated to have approximately six residential/apartment relocations and no business relocations. Also, the cost for Alternative 3 is approximately $140 million greater than for Alternative 2. This increased cost is a result of the greater length of Alternative 3 (including a longer structure traversing the Ohio River and its floodway) and its required relocation of a greater number of residential housing and businesses units. Alternative 3 would also require a complicated urban interchange for the proposed I-164/I-69/SR 662 interchange. Alternative 3 is non-preferred to Alternative 2 due to its largest impacts to jurisdictional wetlands (35 to 39 acres compared to Alternative 2 which impacts 29 to 36) its impacts to Angel Mounds (a National Historic Landmark), its relocation impacts, and its cost.

In summary, Alternatives 1, 1A, 2, and 3 each have their own unique impacts. The No-Build alternative has no impacts but does not address the needs of the project. Alternative 2 performs strongly in meeting the project purpose and need, requires fewer acres of right-of-way and farmland than the western alternatives, utilizes 18 miles of existing Interstate highway, requires the fewest residential and business relocations, has the fewest number of adverse historical impacts, and is the least costly alternative. Given this comprehensive evaluation of impacts, Alternative 2 is identified as the preferred alternative.

Chapter 3 – TRAFFIC IMPACTS

The purpose of this chapter is to describe the traffic impacts of the four Build Alternatives. These traffic impacts affect the five-county Evansville/Henderson region (Gibson, Posey, Vanderburgh, and Warrick counties in Indiana and Henderson County in Kentucky) and its major highways. Accordingly, this chapter identifies possible regional land use impacts and the traffic performance for the build alternatives.

3.1 INTRODUCTION

This section provides an overview of the Evansville Regional Travel Demand Model and methodology used to identify traffic impacts.

3.1.1 Regional Travel Demand Model

In anticipation of the need to assess the traffic impacts of an I-69 connection between I-64 and the Breathitt Parkway beyond the limits of the urbanized area, the Evansville Urban Transportation Study (EUTS) directed the development of a new regional travel demand model for the replication of travel patterns and the examination of transportation improvement options. The new regional travel demand model provided the following improvements over the previous urbanized area travel demand model:

(1) Expansion of the geographic area of the travel model to cover the five-county region of Gibson, Posey, Vanderburgh, and Warrick counties in Indiana and Henderson County in Kentucky;
(2) Incorporation of new household trip-generation features based on the *Year 2000 Household Travel Survey*;
(3) Identification of regional through-travel patterns based on an origin-destination survey at major regional entry points using video-camera license-plate matching;
(4) Determination of truck travel patterns for inclusion of a truck movement component into the regional travel model;
(5) Utilization of the most current socio-economic data – the year 2000 Census and year 2000 address-specific employment information;
(6) Determination of a year 2025 land use pattern for the travel analysis zones within each county based on development trends and adopted comprehensive plans;
(7) Creation of time-of-day travel patterns for examining different peak-hour periods of the day; and
(8) Generation of separate truck and automobile traffic volume assignments.

In the year 2000, the new regional travel model replicates actual traffic counts with less than a plus/minus 2.2 percent error and a 30.3 percent root mean square error. In particular, the regional travel model assignment of daily traffic on the US 41 Bridge over the Ohio River was extremely close to actual traffic counts (a plus/minus 0.4 percent error and 1.9 percent root mean square error). For further information on the Regional Model Development (prepared for and available from EUTS) refer to a series of technical memoranda: *Evansville/Henderson Year 2000 Household Travel Survey, External Travel Survey, Regional Truck Patterns Survey, Regional Socio-Economic Forecasts, Travel Model Development, Travel Model User's Guide,* and *Regional Transportation Needs Analysis.*

For purposes of this study, three distinct traffic scenarios relative to the development of I-69 north and south of SIU #4 were developed for the Build Alternatives in addition to the No-Build Alternative which excludes any improvement to I-69 inside or outside the Evansville Region. These scenarios are as follows:

- **Scenario 1**: The Build Alternative built as a Section of Independent Utility (*i.e.* independent of and without the sections of I-69 north or south of the project study area).
- **Scenario 2**: The Build Alternatives with I-69 to the south completed and I-69 to the north entering at US 41.
- **Scenario 3**: The Build Alternatives built with I-69 to the south completed and I-69 to the north entering at SR 57.

3.1.2 No-Build Definition

The No-Build (do nothing or no action) Alternative was defined to establish the base condition for the identification of traffic impacts and the evaluation of the Build Alternatives. It reflects the existing roadway network in the year 2000 plus completed "major roadway investments" since the year 2000 and "committed roadway improvements." "Major roadway investments" are defined as "capacity expansion" improvements such as:

- new arterial or collector roadways,
- the addition of through lanes to existing arterial or collector roadways,
- a major realignment of an existing roadway that substantially alters daily traffic volume capacity and travel times, or
- a new interchange.

Among the recently completed major roadway investments within the study corridors are as follows:

(1) the reconstruction of Indiana SR 69 from SR 62 (east of Mt. Vernon) to I-64 near Griffin;
(2) the widening of Burkhardt Road to four lanes from Morgan Avenue (SR 62) to Lynch Road;
(3) the widening of Fulton Avenue to four lanes from Columbia Avenue to Diamond Avenue (SR 66);
(4) the widening of SR 662 to four lanes from I-164 to Ellerbusch Road;
(5) the four-lane extension of Lynch Road from Burkhardt Road to I-164; and
(6) the construction of the new Lynch Road interchange with I-164.

"Committed roadway improvements" are defined as major roadway investments programmed for completion in the immediate future. Projects are considered committed when the project has reached the stage of a Finding of No Significant Impact (FONSI) or a later stage such as final design, right-of-way acquisition, utility relocation, or construction. In addition, projects are considered committed only if the project development process has proceeded and the project is scheduled for construction letting. "Committed roadway improvements" were derived from the *Indiana Statewide Transportation Improvement Program (2000),* the *Kentucky Transportation Cabinet 2000 Six Year Highway Plan,* and the *Evansville/Henderson Urbanized Area Transportation Improvement Program (July, 2000).* Among the "committed" projects are, as shown in **Table 2-1**:

(1) the four-lane extension of Lynch Road from I-164 to SR 62 (Morgan Avenue);
(2) the widening of SR 62 (Morgan Avenue) to four lanes from I-164 in east Evansville to SR 61 in west Boonville;
(3) the widening of SR 66 to six lanes from Epworth Road (just east of I-164) to SR 261 (State Street) in Newburgh;

(4) the widening of SR 66 to four lanes from SR 261 (State Street) in Newburgh to Yankeetown Road (to the east of SR 61);
(5) the widening of US 60 East in Henderson from Wathen Lane eastward 0.4 mile; and
(6) the widening of US 60 West in Henderson from KY 425 to the Henderson-Union County Line.

Subsequent to the definition of the No-Build Alternative for this study, the *Evansville/Henderson Urbanized Area Transportation Improvement Program* was updated in November of 2003. This update scheduled the construction of the four-lane Eickhoff-Koressel Road improvement from SR 62 to Upper Mt. Vernon Road in 2003 and the widening of St. Joseph Avenue to four lanes from SR 62 (Lloyd Expressway) to SR 66 (Diamond Avenue) in 2003 and 2004. While these improvements have not been added to the previously defined list of "committed roadway improvements" constituting the No-Build Alternative, the traffic impact implications of these improvements are discussed later in this chapter.

3.1.3 Traffic Impacts Methodology

Several refinements have been made to the traffic assignments in the four Build Alternatives to reflect the interaction with future land use patterns. These include the following:

(1) The inclusion of induced traffic (additional daily trips) resulting from the additional Ohio River crossing capacity and change in proximity of areas on opposite sides of the Ohio River due to the proposed second Ohio River bridge.
(2) A shift in the location of forecasted regional growth pattern (referred to as the base regional growth pattern) due to changes in relative accessibility to the regional highway network (including highway services shifting to new freeway service interchanges).
(3) An increase in total regional growth (referred to as a change in regional growth without I-69 from Evansville to Indianapolis or I-69 Scenario 1) due to increased accessibility provided by a new freeway within the region, as determined by the REMI (Regional Economic Models, Inc.) macro-economic model.
(4) A further increase in total regional growth (referred to as a change in regional growth with I-69 from Evansville to Indianapolis or I-69 Scenarios 2 and 3) due to increased accessibility by I-69 from Mexico to Canada (i.e., completion of Corridor 18) to/from the region, as determined by the REMI model (including the increase in through traffic passing through the region).

3.2 REGIONAL LAND USE IMPACTS

Changes in the relative accessibility of property to the regional highway network will occur as a result of the new freeway connection from the Breathitt Parkway to I-64. Accordingly, a shift in the location of forecasted regional growth (referred to as the base regional growth pattern) is expected for the four Build Alternatives. This shift in regional growth includes "highway services" development likely to occur at new freeway service interchanges along the Build Alternatives. When I-69 is completed within the Evansville region from Henderson to Evansville, an increment in regional growth will occur as a result of increased accessibility provided by the freeway within the region. When I-69 is completed from Mexico to Canada (including from Evansville to Indianapolis), a further increment of regional growth will occur as a result of the increased accessibility of the region to North America.

3.2.1 Regional Growth Shift

Table 3-1 records the Base Regional Socio-Economic Forecasts by county prior to the shift in regional growth. While the total growth for the five-county region would not change **under this condition**, the location of growth would change due to the proposed major freeway investment.

In the case of Alternatives 1 and 1A, regional growth is assumed to shift from the US 41 Corridor and I-164 Corridor in Vanderburgh County to Posey County. Because Alternatives 2 and 3 reinforce the Base Regional Growth Pattern in Indiana, no regional growth shift is anticipated on the Indiana side of the Ohio River. For Henderson County, the location of growth is assumed to shift from the US 41 Corridor in Henderson County to the Build Alternatives in Henderson County. **Table 3-2** summarizes the growth shift by county for the Build Alternatives.

Alternatives 1 and 1A Regional Growth Shift
Alternative 1 or 1A is expected to improve accessibility to available industrial sites in Posey County. The shift in 1,750 jobs (representing 154 acres) from Vanderburgh County to Posey County includes an industrial component and a commercial component driven by different location considerations. Of the 2,521 new industrial jobs (construction, manufacturing, transportation/communications/utilities, and wholesale) in Vanderburgh County locating in industrial areas by the year 2025, 1,435 jobs were assumed to shift to Posey County. These jobs were allocated to industrial sites in Posey County that were identified through interviews of economic development officials by the Economic Development Research Group, Inc. These sites included the A.B. Brown site, the Southwind Port and Industrial Park, the GE Plastics area southwest of Mt. Vernon and the industrial area on the north side of SR 62 near the SR 69 bypass.

Table 3-1: Base Regional Socio-Economic Forecasts

County	Year	Population	Households	Personal Vehicles	School Enrollment	Total Employment
Vanderburgh	2000	171,922	70,623	130,207	45,877	120,900
	2025	176,305	74,919	138,044	52,057	143,894
	Change	**4,383**	**4,296**	**7,837**	**6,180**	**22,994**
Warrick	2000	52,383	19,438	45,251	9,853	14,620
	2025	67,873	26,864	57,623	11,879	16,992
	Change	**15,460**	**7,426**	**12,372**	**2,026**	**2,372**
Henderson	2000	44,829	18,095	35,983	9,553	21,051
	2025	49,696	21,742	40,100	9,793	24,603
	Change	**4,867**	**3,647**	**4,117**	**240**	**3,552**
Gibson	2000	32,500	12,847	28,740	6,934	15,083
	2025	37,836	15,559	32,759	7,970	19,726
	Change	**5,336**	**2,712**	**4,019**	**1,036**	**4,643**
Posey	2000	27,061	10,205	25,423	5,222	11,852
	2025	29,952	11,837	28,621	5,222	13,280
	Change	**2,891**	**1,632**	**3,198**	**0**	**1,428**
Region	2000	328,695	131,208	265,604	77,439	183,506
	2025	361,662	150,921	297,147	86,921	218,495
	Change	**32,967**	**19,713**	**31,543**	**9,482**	**34,989**

Because residential growth (stimulated by industrial growth) and new freeway service interchanges generate commercial growth, 315 jobs (retail, finance and services) were shifted from Vanderburgh County based on the ratio of population to commercial employment and on freeway service interchange characteristics attracting highway-oriented retail services. Using the methodology developed by Hartgen and Kim[1] for freeway service interchange development, the proposed freeway service interchanges along Alternatives 1 and 1A in Indiana might generate the following highway services:

- SR 62 – two gas/convenient stores, four fast food restaurants and four motels = 18 acres and 180 jobs.
- Upper Mt. Vernon Road – one gas/convenient store = 2 acres and 10 jobs.
- SR 66 – one gas/convenient store, one gas station, one fast food restaurant and two motels = 9 acres and 90 jobs.
- SR 65 (Alternative 1A only) – no development due to proximity of US 41/I-64 and SR 66/I-69 interchanges.

Table 3-2: Regional Socio-Economic Growth Shift

County/Land Use	Alternatives 1 and 1A	Alternative 2	Alternative 3
Vanderburgh County			
employment (jobs/acres)	-1750 jobs /154 acres	No change	No change
population (persons)	- 3978 persons	No change	No change
households (dwellings/acres)	- 1586 dwellings/161 ac.	No change	No change
Posey County			
employment (jobs/acres)	+1750 jobs /154 acres	No change	No change
population (persons)	+ 3978 persons	No change	No change
households (dwellings/acres)	+ 1586 dwellings/161 ac.	No change	No change
Henderson County			
employment (jobs/acres)	+-520 jobs/43 ac.	+-515 jobs/41 ac.	+-325 jobs/28 ac.
population (persons)	No change	No change	No change
households (dwellings/acres)	No change	No change	No change

The remaining commercial employment shift for Alternatives 1 and 1A was allocated on the basis of the allocation of additional residential growth in Posey County. Some commercial growth was located on SR 62 to the west of McFadden Creek on the east side of Mt. Vernon, but the majority was located at the proposed SR 62/I-69 interchange where significant residential growth shift is located.

Stimulated by industrial growth, the shift in population growth from Vanderburgh County to Posey County under Alternative 1 or 1A results in 1,586 addition dwelling units being built in Posey County. This will shift about 161 acres of residential development from Vanderburgh County (in the vicinity of Green River Road and Millersburgh Road) to Posey County growth areas northwest and northeast of Mt. Vernon and the SR 62 Corridor west of the Posey/Vanderburgh County Line.

In Henderson County, 540 jobs (representing 43 acres) were shifted from the US 41 Corridor to the Alternative 1 or 1A. Of the 850 new industrial jobs in Henderson County between the years 2000 and 2025, 250 industrial jobs were relocated. Based on the interviews of the Economic Development Research Group and the Kentucky Cabinet for Economic Development's inventory

[1] Hartgen, David T. and Ji Youn Kim. "Commercial Development at Rural and Small Town Interstate Exits"; Transportation Research Record 1649, Paper No. 98-0307.

of industrial sites in Henderson County, industrial jobs were reallocated to the Dannline Industrial Development, Henderson Corporate Park, Mile Stretch Industrial Park and Henderson Riverport Industrial Park. (The 4 Star Regional Industrial Park on US 41 at the Henderson/Webster County Line is expected to primarily attract new employers rather than accommodate the shift of existing employers. Thus, this industrial park will benefit primarily from the increase in total regional employment as opposed to shift of employment within the region.)

Using the methodology developed by Hartgen and Kim for freeway service interchange development, the proposed freeway service interchanges along Alternatives 1 and 1A in Henderson County might generate the following highway services:

- US 60 – one gas/convenient store, one gas station, one fast food restaurant and two motels = 9 acres and 90 jobs.
- KY 452/US 41 – two gas/convenient stores, four fast food restaurants and four motels = 18 acres and 180 jobs.

Alternatives 2 and 3 Regional Growth Shift
Alternatives 2 and 3 are expected to conform to the Base Regional Growth Pattern in Indiana, but are assumed to result in commercial development shifts in Henderson County from the US 41 Corridor to the service interchanges of the freeway alternatives. Using the methodology developed by Hartgen and Kim for freeway service interchange development, Alternative 2 might generate the following highway services:

- US 60 – two gas/convenient stores, one gas station, four fast food restaurants and two motels = 14 acres and 140 jobs.
- KY 351 – one gas/convenient store, one gas station, one fast food restaurants and one motel = 6.5 acres and 65 jobs.

Because US 60 is a major residential growth area west of Alternative 2, the residential population is forecasted to grow by nearly 4,000 persons within one-mile of the proposed US 60/I-69 interchange. Thus, the proposed US 60/I-69 interchange is anticipated to attract commercial development supporting the surrounding residential area amounting to 20 additional acres (310 jobs). Thus, Alternative 2 will shift 515 commercial jobs (41 acres) away from the US 41 Corridor.

Using the methodology developed by Hartgen and Kim for freeway service interchange development, Alternative 3 might generate the following highway services:

- US 60 – one gas/convenient store, one gas station, three fast food restaurants and two motels = 11 acres and 110 jobs.
- KY 351 – one gas/convenient store, one gas station, one fast food restaurants and one motel = 6.5 acres and 65 jobs.

The residential population is forecasted to grow by 2,000 persons within one-mile of the proposed US 60/I-69 interchange on Alternative 3. Thus, the proposed US 60/I-69 interchange is anticipated to attract commercial development supporting the surrounding residential area amounting to 10.5 additional acres (150 jobs). Thus, Alternative 3 will shift 325 commercial jobs (28 acres) away from the US 41 Corridor.

3.2.2 Regional Growth Increment without I-69 Outside the Region (Scenario 1)

In addition to the shift in the base regional growth pattern, an increment in total regional growth would occur as a result of completion of a new freeway within the Henderson-Evansville region. This will define the impact of the construction of I-69 within the region if I-69 were not completed outside the region. To determine the increment in total regional growth, regional traffic assignments for the four Build Alternatives with induced travel (i.e., additional internal trips across the Ohio River resulting from a second bridge) and the applicable shift in regional growth were plugged into a net benefits-cost program (know as NET_BC) to determine travel user benefits. In turn, the incremental change in travel user benefits associated with each alternative was input to the REMI macro-economic model for the five-county region to determine changes in employment and population from the No-Build condition. The increment in regional growth was then allocated taking into consideration the location of the Build Alternatives, and the regional travel model was then rerun with the change in socio-economic data to determine year 2025 traffic assignments for the alternatives.[2]

Table 3-3 shows the changes in employment by major business sector and in population for the four Build Alternatives over the No-Build Alternative. The employment and population is translated into additional regional land consumption of urban uses based on population per acre and employee per acre standards. Alternative 2 results in the greatest increase in employment and population, followed by Alternative 3, Alternative 1A and Alternative 1.

Table 3-4 summarizes the allocation of the increment of regional growth to each county as appropriate for the Build Alternatives. The percent of additional growth allocated to each county depends on the location of the Build Alternative and on the county's share of regional employment.

In the case of Alternatives 1 and 1A, Posey County captures the Indiana share of the regional growth at 80% and Henderson County receives 20% of the additional regional growth. In the case of Alternatives 2 and 3, Vanderburgh County captures 70% of the additional regional growth, and Warrick County and Henderson County each capture 15% of the additional regional growth.

The allocation of additional county growth to specific locations (i.e., travel analysis zones) followed a similar pattern to the regional growth shift reallocation. Accordingly, in the case of Alternatives 1 and 1A, the proposed interchanges at SR 62/I-69, KY 425/US 41/I-69 and SR 66/I-69 (in rank order) were allocated additional regional commercial growth to support additional residential growth allocated to areas near the interchanges. For Alternatives 1 and 1A, additional industrial growth was allocated to the areas southwest of Mt. Vernon and the area near SR 62/SR 69 Bypass in Indiana and to the Dannline Industrial Development near the US 60/I-69 interchange in Kentucky.

In the case of Alternatives 2 and 3, additional industrial and commercial growth in Indiana was allocated to I-164 Corridor (including the Northern Warrick County Industrial Park, the Vanderburgh County Industrial Park, the Lynch Road area, the Morgan Road area, the east side of Epworth in Warrick County, the Lloyd Expressway area and the Warrick County Industrial Park on SR 62). For Alternatives 2 and 3 in Henderson County, additional industrial and commercial growth was allocated to the US 60/I-69 interchange area.

[2] The NET_BC program reflects information on the value of travel time, vehicle-operating cost and accident costs and travel pattern characteristics appropriate to the Evansville region relative to trip purposes, vehicle occupancy rates and the mix of vehicle types. The NET_BC program identifies the change in mobility benefits (reduction in travel time costs), change in vehicle operating costs, and reduction in accident costs for the Build Alternatives over the No-Build Alternative from opening of the proposed facility to traffic through the year 2025. The reduction in travel time, vehicle operating and accidents costs translates into a reduction in the cost of doing business in the region; this reduction in the cost of business makes the region more attractive to businesses. The REMI economic model for the region translates the annual reductions in travel user costs to an increase in employment and population over the No-Build.

Table 3-3: Scenario 1 -- I-69 Henderson to Evansville: Regional Population, Employment and Land Use Changes without I-69 Outside Region

	1999	2025 Population/Employment				
	REMI Baseline	REMI Baseline	Change from Baseline			
			Alt. 1	Alt. 1A	Alt. 2	Alt. 3
Population	323,411	363,376	1,072	1,123	1,304	1,182
Industry (i.e., business sector)						
Durable Manufacturing	18,617	20,175	18	19	24	22
Non-Durable Manufacturing	17,086	14,918	15	16	20	18
Mining	2,253	1,658	2	2	2	2
Construction	14,526	13,067	46	48	56	53
Trans., Communication & Public Utilities	9,856	10,175	17	19	23	21
Finance, Insurance & Real Estate	13,327	13,346	27	28	34	31
Retail Trade	38,348	37,756	148	155	179	165
Wholesale Trade	9,167	8,341	16	16	17	16
Services	61,202	92,101	242	252	292	.265
Agricultural/Forest/Fish Services	13,800	2.,217	8	8	10	9
Government	17.483	19,976	50	52	61	55
Farm	3,261	2,272	0	0	0	0
Total Employment	**206,506**	**236,002**				
Total Employment Change			**587**	**617**	**717**	**658**

			2025			
			Change from Baseline (Acres)			
			Alt. 1	Alt. 1A	Alt. 2	Alt. 3
Population	**persons per acre***					
		9.83	109	114	133	120
Industry (I.e., business sector)	**employees per acre**					
	ITE Code**	**Rate*****				
Durable Manufacturing	140	18.5	1	1	1	1
Non-Durable Manufacturing	140	18.5	1	1	1	1
Mining	120	8.2	0	0	0	0
Construction	120	8.2	6	6	7	7
Trans., Communication & Public Utilities	120	8.2	2	2	3	3
Finance, Insurance & Real Estate	750	55.8	0	1	1	1
Retail Trade	814	8.7	17	18	21	19
Wholesale Trade	150	14.7	1	1	1	1
Services	750	55.8	4	5	5	5
Agricultural/Forest/Fish Services	120	8.2	1	1	1	1
Government	750	55.8	1	1	1	1
Farm	n/a	0.02	0	0	0	0
Total Employment Acreage Change			**34**	**37**	**42**	**40**

Notes: * Persons per acre is based on a) the regional household size (persons per dwelling unit) derived by weighting the household size by county by households **times** (b) the regional dwelling units per acre derived by weighting 3 single-family units per acre (*Trip Generation - 6th Edition*, Institute of Transportation Engineers, 1997) and 7 multi-family dwelling units per acre (*Community Builders Handbook*, Urban Land Institute) by the percent single-family dwelling units in each county from the 2000 Census.

** ITE Code per *Trip Generation - 6th Edition*, Institute of Transportation Engineers, 1997.

*** Floor area ratio of 0.1 assumed for retail per *Planning Design Criteria* (Chiara and Koppelman).

Table 3-4: Scenario 1 -- Regional Growth without I-69 Outside the Region (add to regional growth shift)

County/Land Use	Alternative 1	Alternative 1A	Alternative 2	Alternative 3
Vanderburgh County				
employment (jobs/acres)	No change	No change	+500 jobs /29 acres	+460 jobs /28 acres
population (persons)	No change	No change	+ 910 persons	+ 830 persons
households (dwellings/acres)	No change	No change	+ 374 dwellings/93ac.	+ 341 dwellings/84ac.
Warrick County				
employment (jobs/acres)	No change	No change	+110 jobs /8 acres	+100 jobs /6 acres
population (persons)	No change	No change	+ 200 persons	+ 180 persons
households (dwellings/acres)	No change	No change	+ 82 dwellings/20ac.	+ 74 dwellings/18ac.
Posey County				
employment (jobs/acres)	+470 jobs /27 acres	+490 jobs /30 acres	No change	No change
population (persons)	+ 860 persons	+ 900 persons	No change	No change
households (dwellings/acres)	+ 354 dwellings/87ac.	+ 370 dwellings/91ac.	No change	No change
Henderson County				
employment (jobs/acres)	+117 jobs/7 acres	+127 jobs/7 acres	+107 jobs /7 acres	+ 98 jobs /18 acres
population (persons)	+ 212 persons	+ 223 persons	+ 194 persons	+ 172 persons
households dwellings/acres)	+ 87 dwellings/22 ac.	+ 92 dwellings/23 ac.	+ 80 dwellings/20ac.	+ 71 dwellings/20ac.

3.2.3 Regional Growth Increment with I-69 Outside the Region (Scenarios 2 and 3)

In addition to the shift in the base regional land use pattern and increment in region growth resulting from the completion of a new freeway inside the Henderson-Evansville region (Scenario 1), a further increment of regional growth would result from the completion of I-69 outside the region. Scenario 2 assesses the implications of the completion of I-69 in the US 41 Corridor from Evansville to Indianapolis, and Scenario 3 assesses the implications of the completion of I-69 in the SR 57 Corridor from Evansville to Indianapolis. To determine the increment in regional employment and population, the results of the REMI analysis for Alternative 2C (highest daily traffic volume entering the Evansville region in the US 41 Corridor) and Alternative 4B (highest daily traffic volume entering the Evansville region in the SR 57 Corridor) of the I-69 Evansville to Indianapolis Tier 1 Draft EIS were expanded to five counties. This was based on the ratio of the five-county regional REMI employment for year 2025 to that for the four-county region (so that the impacts on Henderson County – the fifth county – are included).

With the announcement of Alternative 3C as the preferred route for I-69 from Evansville to Indianapolis, Alternative 3C forecasts about 4 percent more population and about 3 percent more employment than Alternative 4B for the Evansville region; however, Alternative 4B results in about one percent more daily traffic than Alternative 3C as proposed I-69 crosses I-64. Thus, the traffic impacts of Scenario 3 are comparable to the preferred route for I-69 from Evansville to Indianapolis.

Table 3-5 shows the additional increment of regional population and employment growth that may occur if I-69 were completed outside the region. Greater regional growth occurs when I-69 entering the Evansville region is located in the SR 57 Corridor (Scenario 3) than in the US 41 Corridor (Scenario 2).

Table 3-6 summarizes the allocation of the additional regional growth to each county as appropriate for the Build Alternatives. The percent of additional growth allocated to each county depends on the location of the Build Alternative and on the county's share of regional employment. In the case of Scenario 2 for Alternatives 1 and 1A, Vanderburgh County captures 65% of the additional regional growth; Posey County and Henderson County each capture 15% of the additional regional growth; and Warrick County receives 5% of the additional regional growth. In the case of Scenario 2 for Alternatives 2 and 3, Vanderburgh County captures 70% of the additional regional growth; Henderson County captures 15% of the additional regional growth; Warrick County captures 10% of the additional regional growth; and Posey County receives 5% of the additional regional growth.

In the case of Scenario 3 for Alternatives 1 and 1A, Vanderburgh County captures 65% of the additional regional growth; Henderson County captures 15% of the additional regional growth; and Warrick County and Posey County each receive 10% of the additional regional growth. In the case of Scenario 3 for Alternatives 2 and 3, Vanderburgh County captures 65% of the additional regional growth; Warrick County and Henderson County each capture 15% of the additional regional growth; and Posey County receives 5% of the additional regional growth.

The allocation of additional county growth to specific locations (i.e., travel analysis zones) followed a similar pattern to the regional growth without I-69 outside the region. Accordingly, in the case Scenario 2 or 3 for Alternatives 1 and 1A, the proposed SR 62/I-69 interchange, the US 41/I-64 interchange, and the SR 62/I-164 interchange were allocated additional regional commercial growth to support additional residential growth allocated to areas near the interchanges. For Alternatives 1 and 1A under Scenario 2 or 3, additional industrial growth was allocated to:

- the A.B. Brown site, the area southwest of Mt. Vernon and the area near the SR 62/SR 69 Bypass in Posey County;
- the US 41 and I-164 Corridors in Vanderburgh County restoring the industrial development previously shifted to Posey County;
- the Northern Warrick County Industrial Park; and
- the Dannline Industrial Development, the Henderson Corporate Park, the Mile Stretch Industrial Park, the Henderson Riverport Industrial Park and the 4 Star Regional Industrial (half of Henderson County growth).

In the case of Scenario 2 or 3 for Alternatives 2 and 3, additional regional commercial growth is allocated to the US 41/I-64 interchange, US 41 at Boonville-New Harmony Road, the SR 62/I-164 interchange, the SR 66/ I-164 interchange area. For Alternatives 2 and 3 under Scenario 2 or 3, additional industrial growth was allocated to:

- the area southwest of Mt. Vernon and the area near the SR 62/SR 69 Bypass in Posey County;
- the US 41 and I-164 Corridors in Vanderburgh County
- the Northern Warrick County Industrial Park, the east side of Epworth Road north of SR 66, and the Warrick County Industrial Park on SR 62; and
- the Mile Stretch Industrial Park, the north side of US 60 east of Rucker Road (near the proposed US 60/I-69 interchange), Henderson Riverport Industrial Park and the 4 Star Regional Industrial (half of Henderson County growth).

Table 3-5: Scenarios 2 and 3 -- I-69 Henderson to Evansville: Regional Population, Employment and Land Use Changes with I-69 to Indianapolis

(incremental change above alternatives without I-69 to Indianapolis)

	1999	2025 Population/Employment		
	REMI Baseline	REMI Baseline	Change from Baseline	
			US 41 Corridor*	**SR 57 Corridor****
Population	323,411	363,376	2,032	2,112
Industry (i.e., business sector)				
Durable Manufacturing	18,617	20,175	341	357
Non-Durable Manufacturing	17,086	14,918	158	163
Mining	2,253	1,658	1	0
Construction	14,526	13,067	91	91
Trans., Commun. & Public Utilities	9,856	10,175	60	60
Finance, Insurance & Real Estate	13,327	13,346	52	57
Retail Trade	38,348	37,756	304	292
Wholesale Trade	9,167	8,341	170	171
Services	61,202	92,101	273	325
Agricultural/Forest/Fish Services	1,38	2,217	015	16
Government	17,483	19,976	79	86
Farm	3,261	2,272	10	10
Total Employment	**206,506**	**236,002**		
Total Employment Change			**1,554**	**1,629**

Notes: * US 41 Corridor based on final Alternative 2c of the I-69 Evansville to Indianapolis Tier 1 EIS REMI analysis

** SR 57 Corridor based on final Alternative 4b of the I-69 Evansville to Indianapolis Tier 1 EIS REMI analysis

			2025	
			Change from Baseline (Acres)	
			US 41 Corridor	**SR 57 Corridor**
Population	**persons per acre***			
		9.83	207	215
Industry (i.e., business sector)	**employees per acre**			
	ITE Code**	**Rate*****		
Durable Manufacturing	140	18.5	18	19
Non-Durable Manufacturing	140	18.5	9	9
Mining	120	8.2	0	0
Construction	120	8.2	11	11
Trans., Commun. & Public Utilities	120	8.2	7	7
Finance, Insurance & Real Estate	750	55.8	1	1
Retail Trade	814	8.7	35	34
Wholesale Trade	150	14.7	12	12
Services	750	55.8	5	6
Agricultural/Forest/Fish Services	120	8.2	2	2
Government	750	55.8	1	2
Farm	n/a	0.02	0	0
Total Employment Acreage Change			**101**	**103**

Notes: * Persons per acre is based on a) the regional household size (persons per dwelling unit) derived by weighting the household size by county by households **times** (b) the regional dwelling units per acre derived by weighting 3 single-family units per acre (*Trip Generation - 6th Edition*, Institute of Transportation Engineers, 1997) and 7 multi-family dwelling units per acre (*Community Builders Handbook*, Urban Land Institute) by the percent single-family dwelling units in each county from the 2000 Census.

** ITE Code per *Trip Generation - 6th Edition*, Institute of Transportation Engineers, 1997.

*** Floor area ratio of 0.1 assumed for retail per *Planning Design Criteria* (Chiara and Koppelman).

Table 3-6: Scenarios 2 and 3 -- Regional Growth with I-69 Outside the Region
(add to incremental regional growth without I-69)

	Scenario 2 —I-69 in US 41 Corridor		Scenario 3 —I-69 in SR 57 Corridor	
County/Land Use	Alternatives 1 & 1A	Alternatives 2 & 3	Alternatives 1 & 1A	Alternatives 2 & 3
Vanderburgh County				
employment (jobs/acres)	+1010 jobs /66 acres	+1090 jobs /71 acres	+1060 jobs /67 acres	+1060 jobs /67 acres
population (persons)	+ 1321 persons	+ 1422 persons	+ 1373 persons	+ 1373 persons
households (dwellings/acres)	+544 dwellings/135ac.	+585 dwellings/145ac.	+565 dwellings/139ac.	+565 dwellings/139ac.
Warrick County				
employment (jobs/acres)	+80 jobs /5 acres	+150 jobs /10 acres	+168 jobs /11 acres	+248 jobs /16 acres
population (persons)	+ 101 persons	+ 84 persons	+ 211 persons	+ 316 persons
households (dwellings/acres)	+ 42 dwellings/10 ac.	+ 84 dwellings/21ac.	+ 87 dwellings/22ac.	+ 130 dwellings/32ac.
Posey County				
employment (jobs/acres)	+230 jobs /15 acres	+80 jobs /5 acres	+160 jobs /10 acres	+80 jobs /5 acres
population (persons)	+ 305 persons	+ 102 persons	+ 211 persons	+ 106 persons
households (dwellings/acres)	+ 126 dwellings/31ac.	+ 42 dwellings/10 ac.	+ 87 dwellings/22ac.	+ 44 dwellings/12 ac.
Henderson County				
employment (jobs/acres)	+230 jobs /15 acres	+230 jobs /15 acres	+240 jobs /15 acres	+240 jobs /15 acres
population (persons)	+ 305 persons	+ 305 persons	+ 317 persons	+ 317 persons
households dwellings/acres)	+ 126 dwellings/31ac.	+ 126 dwellings/31ac.	+ 130 dwellings/32ac.	+ 130 dwellings/32ac.

3.3 TRAFFIC PERFORMANCE

3.3.1 Traffic Performance Measures

To assess the regional performance of the alternatives, the following traffic performance measures (refer to Section 2.3) were based on performance measures:

(1) For Goal 1/Objective 2, a decrease in freight travel time in the study is evaluated on the basis of a decrease in truck vehicle-hours of travel (VHT) over the No-Build Alternative.

(2) For Goal 2/Objective 1, a desirable level of service (LOS) in urban and rural areas is evaluated by the Efficient System Performance Index (ESPI) for vehicle-miles of travel (VMT) and for vehicle-hours of travel (VHT) comparing the Build to the No-Build condition. The higher the ESPI value, the better. When the lane-miles and the total trip-making vary between alternatives, ESPI enables an “apples-to-apples” comparison of alternatives rather than a direct comparison of VMT or VHT. ESPI is equal to 10 times the total VMT or VHT divided by the VMT or VHT greater than a volume-to-capacity ratio (v/c) of 0.75 and greater than a v/c ratio of 0.99. Congestion is rated LOS A through F. LOS E is the maximum traffic flow capacity of the facility and LOS F represents a breakdown in traffic flow. LOS C is the minimum level of service for rural areas although LOS B is desirable, and LOS D is the minimum level of service for urban areas although LOS C is desirable. A v/c ratio greater than 0.75 includes facilities with a LOS of D, E, or F. A v/c ratio greater than 0.99 includes only facilities with a LOS F.

(3) Under Goal 3/Objective 1, an acceptable capacity for forecasted demand is evaluated on the basis of a reduction in vehicle-hours of travel (VHT) for arterials over the No-Build Alternative.

In addition to the regional performance measures, the following performance measures were also identified to assess traffic conditions on the US 41 Corridor through Evansville and Henderson:

(1) A decrease in vehicle-miles of travel (VMT) and vehicle-hours of travel (VHT) in the US 41 Corridor over the No-Build Alternative.

(2) The amount of daily traffic diverted from the existing US 41 Ohio River Bridge and attracted to any new bridge over the Ohio River.

The following sections describe the regional traffic performance of the Build Alternatives to the No-Build Alternative and each other, US 41 Corridor and Ohio River Bridge traffic impacts, traffic impacts to other regional highway facilities, and multi-modal systems impacts.

3.3.2 Regional Traffic Performance Summary

Table 3-7 shows the percentage change in the performance measures for the four Build Alternatives compared to the No-Build Alternative. The No-Build alternative involves severe congestion in the US 41 Corridor from I-64 to the Breathitt Parkway and across the existing US 41 Ohio River Bridge in both years 2000 and 2025. Despite the increment in regional growth and regional trip-making created by the Build Alternatives over the No-Build Alternative, all Build Alternatives provide some improvement over the No-Build Alternative, but there are differences in their performance.

In limiting the increase of regional vehicle-hours of travel (VHT) for trucks, Alternative 3 is the best performer without National I-69 (Scenario 1), with National I-69 in the US 41 Corridor north of the Evansville region (Scenario 2) or with National I-69 in the SR 57 Corridor north of the Evansville region (Scenario 3). Without National I-69, Alternative 1A is the second best performer because it provides a new freeway on the west side of Evansville where none exists. However, with National I-69 entering the Evansville region from the north in the US 41 Corridor or SR 57 Corridor, Alternative 2 becomes the second best performer because it better handles the additional truck traffic entering and passing through the region (as a result of National I-69) than Alternatives 1 and 1A.

Examining the extent to which each alternative relieves congestion in the region over the No-Build Alternative, the Efficient System Performance Indices (ESPI) for vehicle-miles of travel (VMT) and vehicle-hours of travel (VHT) are used to gauge the reduction in facilities with operating conditions of LOS D or worse. VMT is also an indicator of the directness of actual travel routes compared to travel desires lines (i.e., a direct line from the origin to the destination of each trip). Thus, lower VMT also implies more direct travel and lower vehicle-operating costs for trucks and cars. VHT is an indicator of travel time, and lower VHT translates into travel-time savings for trucks and cars.

For the No-Build Alternative, 20.6% of the VMT in the region are on facilities with operating conditions below LOS C in the year 2025. Without or with National I-69, Alternative 2 is the most effective alternative in reducing congestion weighted by VMT. In fact, Alternative 2 shows a reduction to 18.6 percent of the VMT on facilities operating below LOS C, despite the greatest increment in regional growth and trip-making in Scenario 3 (National I-69 entering the Evansville region from the north in the SR 57 Corridor) over the No-Build alternative. Alternative 3 is the second most effective alternative without or with National I-69. Alternative 1A is the second most effective alternative only under Scenario 2.

Table 3-7: Year 2025 Percent Change in Performance Measures from No-Build Alternative
(best performer highlighted in bold)

Alternative	Truck VHT	ESPI for VMT	ESPI for VHT	Arterial VHT	US 41 VMT	US 41 VHT
Scenario 1 = without National I-69						
Alternative 1	-14.5%	+19.3%	14.6%	-12.3%	-8.1%	-30.2%
Alternative 1A	-17.4%	+19.6%	**+17.7%**	-15.1%	-8.4%	-31.6%
Alternative 2	-16.3%	**+22.4%**	+14.6%	-14.1%	**-22.0%**	**-45.6%**
Alternative 3	**-18.2%**	+21.7%	+16.9%	**-16.2%**	-16.3%	-45.4%
Scenario 2 = National I-69 in US 41 Corridor north of Evansville region						
Alternative 1	-5.4%	+21.3%	+10.3%	-6.2%	-1.5%	-19.8%
Alternative 1A	-10.6%	+24.0%	**+15.4%**	-11.1%	-3.2%	-27.6%
Alternative 2	-10.9%	**+27.4%**	**+15.4%**	**-12.3%**	**-16.3%**	**-43.1%**
Alternative 3	**-11.7%**	+23.3%	+14.7%	-11.9%	-11.9%	-40.0%
Scenario 3 = National I-69 in SR 57 Corridor north of Evansville region						
Alternative 1	+5.5%	+9.6%	-0.1%	+9.4%	-3.4%	-8.7%
Alternative 1A	+1.7%	+10.0%	**+2.5%**	**+5.2%**	-3.8%	-12.3%
Alternative 2	+1.1%	**+12.2%**	+0.7%	+6.2%	**-18.4%**	**-29.3%**
Alternative 3	**+0.3%**	+10.4%	+0.5%	+6.3%	-12.8%	-28.9%

For the No-Build Alternative, 62.3 percent of the VHT in the region are on facilities operating below LOS C. If congestion is weighted by VHT, Alternative 1A shows the best performance for all traffic scenarios. Alternative 2 shows a reduction to 60.7 percent of the VHT on facilities operating below LOS C, despite the greatest increment in regional growth and trip-making in Scenario 3 (National I-69 entering the Evansville region from the north in the SR 57 Corridor) over the No-Build alternative. The second most effective build alternative varies with the National I-69 scenario. Without National I-69 (Scenario 1), Alternative 3 is second best. Under Scenario 2 (National I-69 entering the Evansville region from the north in the US 41 Corridor), Alternative 2 matches the performance of Alternative 1A Alternative 2 is the second best performer under Scenario 3 (National I-69 entering the Evansville region from the north in the SR 57 Corridor).

Limiting the increase in VHT on arterial routes reflects travel-time savings on higher functional class facilities. The best performer varies with the National I-69 scenario. Without National I-69 (Scenario 1), Alternative 3 is the best performer followed by Alternative 1A. Under Scenario 2 (National I-69 entering the Evansville region from the north in the US 41 Corridor), Alternative 2 emerges as the best performer because National I-69 concentrates more traffic in the US 41 Corridor, and is followed by Alternative 3. Under Scenario 3 (National I-69 entering the Evansville region from the north in the SR 57 Corridor), the increment in regional growth and trip-making results in greater VHT on arterial routes than the No-Build alternative. Under Scenario 3, Alternative 1A results in the least increase in VHT on arterial routes followed by Scenario 2.

3.3.3 Regional Traffic Performance Detail by Scenario

In addition to the No-Build Alternative for the year 2025, four travel model runs were made for the Build Alternatives without I-69 from Evansville to Indianapolis (Scenario 1) to compare the No-Build condition. Another eight model runs were made for the build alternatives for “what if” I-69 from Indianapolis were built in the US 41 Corridor to I-64 (Scenario 2) and for “what if” I-69 from Indianapolis were built in the SR 57 Corridor to I-64/I-164 (Scenario 3).

Build Alternatives (without I-69 to Indianapolis) – Scenario 1
The No-Build Condition involves severe congestion in the US 41 Corridor from I-64 to the Pennyrile Parkway and across the US 41 Ohio River Bridge both in years 2000 and 2025. Accordingly, all build alternatives (without I-69 to Indianapolis) provide some improvement over the No-Build Alternative, but there are dramatic differences in the performance as shown in **Table 3-8** Scenario 1 reflects induced travel due to an additional crossing of the Ohio River, the shift in the regional growth pattern due to changing relative accessibility, and the increment in regional growth due to user cost savings, improved productivity or efficiency within the region.

Limiting the increase in regional vehicle-hours of travel (VHT) for trucks, Alternative 3 is the best performer because its provides the most direct route for truck traffic in and through the region. Alternative 1A is the second most effective option in reducing truck VHT.

Table 3-8: Scenario 1 -- Performance Comparison of Build to No-Build Alternatives in Year 2025
(without I-69 from Evansville to Indianapolis)

Alternatives (length)	Truck VHT (hours)	ESPI for VMT	ESPI for VHT	Arterial VHT (hours)	US 41 VMT (miles)	US 41 VHT (hours)
No-Build	**48,353**	**31.30**	**8.48**	**383,329**	**980,427**	**75,733**
1 (30.9 miles)	41,300	37.34	9.72	336,349	901,034	52,836
% over No-Build	-14.5%	+19.3%	+14.6%	-12.3%	-8.1%	-30.2%
rank	**4**	**4**	**3.5**	**4**	**4**	**4**
1A (35.8 miles)	39,953	37.42	9.98	325,606	897,949	51,816
% over No-Build	-17.4%	+19.6%	+17.7%	-15.1%	-8.4%	-31.6%
rank	**2**	**3**	**1**	**2**	**3**	**3**
2 (30.2 miles)	40,450	38.31	9.72	329,213	764,612	41,207
% over No-Build	-16.3%	+22.4%	+14.6%	-14.1%	-22.0%	-45.6%
rank	**3**	**1**	**3.5**	**3**	**1**	**1**
3 (31.9 miles)	39,546	38.09	9.91	321,273	820,789	41,372
% over No-Build	-18.2%	+21.7%	+16.9%	-16.2%	-16.3%	-45.4%
rank	**1**	**2**	**2**	**1**	**2**	**2**

Examining the extent to which each build alternative relieves congestion over the No-Build Alternatives, the Efficient System Performance Indices for VHT and VMT are used to gauge the reduction in facilities with operating conditions of LOS D or worse. Alternative 2 is the most effective in reducing congestion weighted by VMT; this translates into lower vehicle-operating costs for trucks and cars. Alternative 3 is second in reducing congestion weighted by VMT. On the other hand, if congestion is weighted by VHT, Alternative 1A shows the best performance; this translates into greater travel-time savings. Alternative 3 is second relative to reducing congestion weighted by VHT.

Limiting the increase in vehicle-hours of travel on arterial routes also reflects travel-time savings on higher functional class facilities. Alternative 3 is ranked first, followed by Alternative 1A.

If consideration is given to relief of US 41 congestion (relative to VHT and VMT along existing US 41), Alternative 2 is the best performer, followed by Alternative 3. This relief of US 41 is also reflected in the relief of congestion on the existing US 41 Ohio River Bridge offered by each alternative as shown later in **Table 3-11**. Alternative 2 diverts sufficient traffic to achieve a LOS C on the existing US 41 Bridge in the year 2025. Somewhat less effective, Alternative 3 results in a future LOS D on the existing US 41 Bridge. On the other hand, while Alternatives 1 and 1A divert traffic from the existing US 41 Bridge, the existing US 41 Bridge remains at a LOS F.

Build Alternatives (with I-69 to Indianapolis in US 41 Corridor) – Scenario 2

If I-69 to Indianapolis were to begin on I-64 in the vicinity of the US 41 interchange, there would be an increase in trips in the region, and an increased concentration of traffic in the US 41 Corridor. Scenario 2 also reflects an increase in total regional growth (reflecting increased regional accessibility from the completion of I-69 from Mexico to Canada) above that of Scenario 1. Thus, the transportation performance of build alternatives closer to existing US 41 are enhanced and those farther from existing US 41 are placed at a greater disadvantage as shown in **Table 3-9.**

Table 3-9: Scenario 2 -- Performance Comparison of Build to No-Build Alternatives in Year 2025 with I-69 North along US 41 from I-64
(with I-69 from Evansville to Indianapolis in US 41 Corridor)

Alternatives (length)	**Truck VHT (hours)**	ESPI for VMT	**ESPI for VHT**	**Arterial VHT (hours)**	US 41 VMT (miles)	US 41 VHT (hours)
No-Build	**48,353**	**31.30**	**8.48**	**383,329**	**980,427**	**75,733**
1 (30.9 miles)	45,728	37.96	9.35	359,637	966,098	60,718
% over No-Build	-5.4%	+21.3%	+10.3%	-6.2%	-1.5%	-19.8%
rank	**4**	**4**	**4**	**4**	**4**	**4**
1A (35.8 miles)	43,223	38.80	9.79	340,727	949,000	54,835
% over No-Build	-10.6%	+24.0%	+15.4%	-11.1%	-3.2%	-27.6%
rank	**3**	**2**	**1.5**	**3**	**3**	**3**
2 (30.2 miles)	43,073	39.89	9.79	336,119	820,169	43,055
% over No-Build	-10.9%	+27.4%	+15.4%	-12.3%	-16.3%	-43.1%
rank	**2**	**1**	**1.5**	**1**	**1**	**1**
3 (31.9 miles)	42,677	38.58	9.73	337,610	864,069	45,419
% over No-Build	-11.7%	+23.3%	+14.7%	-11.9%	-11.9%	-40.0%
rank	**1**	**3**	**3**	**2**	**2**	**2**

In limiting the increase of vehicle-hours of travel (VHT) for trucks under Scenario 2, Alternative 3 remains the best performer because it provides the most direct route for truck traffic in and through the region. Due to addition growth throughout the region, Alternative 2 follows Alternative 3; and Alternative 1A slips to the third most effective option in reducing truck VHT.

Examining the extent to which each build alternative relieves congestion over the No-Build Alternative, the Efficient System Performance Indices for VHT and VMT are used to gauge the reduction in facilities with operating conditions of LOS D or worse. Under Scenario 2, Alternative 2 remains the most effective in reducing congestion weighted by VMT; this translates into lower vehicle-operating costs for trucks and cars. Alternative 1A follows Alternative 2 as the most effective in reducing congestion weighted by VMT, and Alternative 3 trails Alternative 2 in reducing congestion weighted by VMT. On the other hand, if congestion is weighted by VHT, Alternative 2 improves such that Alternative 2 and Alternative 1A show comparable performance; and Alternative 3 trails the other two Alternatives in limiting congestion weighted by VHT.

Limiting the increase in vehicle-hours of travel on arterial routes also reflects travel-time savings on higher functional class facilities. Alternative 2 is considered the best performer; Alternative 3 follows; and Alternative 1A trails both alternatives.

If consideration is given to relief of US 41 congestion (relative to VHT and VMT along existing US 41), Alternative 2 remains the best performer, followed by Alternative 3. This relief of US 41 is also reflected in the relief of congestion on the existing US 41 Ohio River Bridge offered by each alternative as shown later in **Table 3-11**. Alternative 2 diverts sufficient traffic to achieve a LOS C on the existing US 41 Bridge in the year 2025. Somewhat less effective, Alternative 3 results in a future LOS D on the existing US 41 Bridge. On the other hand, while Alternatives 1 and 1A divert traffic from the existing US 41 Bridge, the existing US 41 Bridge remains at a LOS F.

Build Alternatives (with I-69 to Indianapolis in SR 57 Corridor) – Scenario 3

If I-69 to Indianapolis were to begin on I-64 in the vicinity of the I-164/SR 57 interchange, there would be an increase in trips in the region; however, there would be a diversion in traffic from the US 41 Corridor as shown in **Table 3-10** Like Scenario 2, Scenario 3 also reflects an increase in total regional growth (reflecting increased regional accessibility from the completion of I-69 from Mexico to Canada) above that of Scenario 1, but Scenario 3 also involves a greater increment in regional growth than Scenario 2. The transportation performance of the east-side build alternatives is enhanced over the west-side alternatives because of the location of I-69 entering the region from the north in Scenario 3.

In limiting the increase of regional vehicle-hours of travel (VHT) for trucks under Scenario 3, the additional regional truck traffic and the entry of I-69 truck traffic in the SR 57 Corridor result in greater truck VHT than the No-Build Alternative. However, Alternative 3 remains the best performer with the least increase in VHT. Due to addition growth throughout the region, Alternative 2 follows Alternative 3 in the least increase in VHT compared to Scenario 2; and Alternative 1A trails Alternative 2.

Examining the extent to which each build alternative relieves congestion over the No-Build Alternative, the Efficient System Performance Indices for VHT and VMT are used to gauge the reduction in facilities with operating conditions of LOS D or worse. Under Scenario 3, Alternative 2 remains the most effective in limiting the increase of congestion weighted by VMT (as in Scenario 1 or Scenario 2); this translates into lower vehicle-operating costs for trucks and cars. Alternative 3 follows Alternative 2 (as in Scenario 1), and Alternative 1A trails both alternatives (as in Scenario 1) in limiting the increase of congestion weighted by VMT.

If congestion is weighted by VHT, Alternative 1A is considered the best performer. Alternative 2 shows improvement over Scenario 1 but slips somewhat relative to Scenario 2 for VHT. Alternative 3 trails both alternatives in Scenarios 2 and 3 relative to limiting congestion weighted by VHT.

Limiting the increase of vehicle-hours of travel (VHT) on arterial routes also reflects travel-time savings on higher functional class facilities. However, all the build alternatives have greater VHT than the No-Build Alternative because of additional regional traffic and the entry of traffic in the SR 57 Corridor. Alternative 1A results in the least increase in VHT on arterials under Scenario 3. Alternative 2 follows Alternative 1A in Scenario 3. Alternative 3 trails both alternatives in Scenario 3.

Table 3-10: Scenario 3 -- Performance Comparison of Build to No-Build Alternatives in Year 2025 with I-69 North along SR 57 from I-64
(with I-69 from Evansville to Indianapolis in SR 57 Corridor)

Alternatives (length)	Truck VHT (hours)	ESPI for VMT	ESPI for VHT	Arterial VHT (hours)	US 41 VMT (miles)	US 41 VHT (hours)
No-Build	**48,353**	**31.30**	**8.48**	**383,329**	**980,427**	**75,733**
1 (30.9 miles)	51,021	34.29	8.47	419,389	947,374	69,121
% over No-Build	+5.5%	+9.6%	-0.1%	+9.4%	-3.4%	-8.7%
rank	**4**	**4**	**4**	**4**	**4**	**4**
1A (35.8 miles)	49,184	34.42	8.69	403,299	942,972	66,509
% over No-Build	+1.7%	+10.0%	+2.5%	+5.2%	-3.8%	-12.3%
rank	**3**	**3**	**1**	**1**	**3**	**3**
2 (30.2 miles)	48,906	35.12	8.54	407,286	800,479	53,559
% over No-Build	+1.1%	+12.2%	+0.7%	+6.2%	-18.4%	-29.3%
rank	**2**	**1**	**2**	**2**	**1**	**1**
3 (31.9 miles)	48,475	34.57	8.52	407,414	854,945	53,817
% over No-Build	+0.3%	+10.4%	+0.5%	+6.3%	-12.8%	-28.9%
rank	**1**	**2**	**3**	**3**	**2**	**2**

If consideration is given to relief of US 41 congestion (relative to VHT and VMT along existing US 41), Alternative 2 remains the best performer for all scenarios. This relief of US 41 is also reflected in the relief of congestion on the existing US 41 Ohio River Bridge offered by each alternative as shown later in **Table 3-11.** Alternative 2 diverts sufficient traffic to achieve a LOS C on the existing US 41 Bridge in the year 2025. Somewhat less effective, Alternative 3 results in a future LOS D on the existing US 41 Bridge. On the other hand, while Alternatives 1 and 1A divert traffic from the existing US 41 Bridge, the existing US 41 Bridge remains at a LOS F.

3.3.4 US 41 Corridor and Ohio River Bridge Traffic Impacts

The No-Build Alternative results in severe congestion in the US 41 Corridor from I-64 to the Breathitt Parkway and across the existing US 41 Ohio River Bridge in both years 2000 and 2025. Accordingly, a reduction in VMT and VHT in the US 41 Corridor is an indicator of how effective the build alternatives are in relieving the corridor. As can be seen in **Table 3-7**, regardless of the National I-69 scenario, Alternative 2 is the most effective in diverting traffic from the US 41 Corridor because it is closest to the existing US 41 Corridor. For the same reason, Alternative 3 is the second most effective alternative in diverting traffic from the US 41 Corridor.

For the No-Build Alternative, existing year, 2000, and future year, 2025, daily traffic volumes result in peak-hour operating conditions on the existing Ohio River Bridge and its approaches of level-of-service (LOS) F. The extent to which the Build Alternatives improve traffic flow operations on the existing Ohio River Bridge is also an indicator of the improvement of traffic flow in the US 41 Corridor. **Table 3-11** summarizes the residual daily traffic on the existing US 41 Bridge and the amount of daily traffic attracted to any new bridge. To relate the daily traffic volumes to traffic operating conditions during the peak-hours, the maximum daily traffic volume thresholds are 28,400 vehicles per day for LOS C, 33,800 vehicles per day for LOS D and 39,800 vehicles per day for LOS E.

For comparative purposes, induced daily trip-making has been added to the No-Build Alternative to better understand the shift in travel patterns across the Ohio River. The introduction of a second bridge across the Ohio River increases the traffic movement capacity across the river while altering the proximity of geographic areas, thereby increasing the attractiveness of opposite sides of the river. Accordingly, induced daily trip-making increases Ohio River crossings by about 11 percent (55,120 vehicles per day compared to 49,752 vehicles per day without induced traffic). For the new bridge over the Ohio River, induced traffic increases total daily traffic volumes by 24% for Alternative 1, 26% for Alternative 1A, 13% for Alternative 2 and 10% for Alternative 3.

Build Alternatives (without I-69 to Indianapolis) – Scenario 1 Without National I-69 (Scenario 1), the traffic assignments for the Build Alternatives include induced daily traffic due to increased river-crossing capacity and geographic proximity, reflect a shift in the location of forecasted regional growth due to changes in relative roadway accessibility within the region, and consider an increment in total regional growth resulting from business expansions stimulated by a new freeway internal to the region. In Indiana, Alternatives 1 and 1A result in a shift of growth from Vanderburgh County to Posey County, but Alternatives 2 and 3 reinforce the prevailing regional growth pattern. In Kentucky, all Build Alternatives result in a shift of growth to the freeway corridors from other locations in Henderson County. To determine the increment in total regional growth, changes in mobility for the build alternatives were fed into the five-county REMI macro-economic model to generate additional population and employment due to business expansions. This increment in regional growth was allocated on the basis of the alternatives to the impacted counties.

Referring to **Table 3-11**, Alternatives 1 and 1A attract about 12,000 vehicles per day to the new Ohio River Bridge, but leave nearly 46,000 vehicles per day on the existing US 41 Ohio River Bridge. Thus, the existing US 41 Ohio River Bridge continues to have a LOS F in future years despite the construction of a new bridge crossing to the west under Alternatives 1 and 1A. In contrast, the residual traffic on the existing US 41 Ohio River Bridge results in a LOS C under Alternative 2 and LOS D under Alternative 3.

Build Alternatives (with I-69 to Indianapolis in US 41 Corridor) – Scenario 2
For Scenario 2 (National I-69 entering the Evansville region from the north in the US 41 Corridor), the results of the REMI analysis for Alternative 2C of the I-69 Evansville to Indianapolis Tier 1 Draft EIS were used to determine the additional regional population and employment. (Alternative 2C resulted in the highest traffic volumes entering the Evansville region in the US 41 Corridor.) This additional regional growth was allocated on the basis of the location of the alternatives to the impacted counties, and results in a greater concentration of traffic in the existing US 41 Corridor in Gibson County. Referring to **Table 3-11**, Alternatives 1 and 1A attract about 14,000 vehicles per day to the new Ohio River Bridge, but leave 47,000 to 48,000 vehicles per day on the existing US 41 Ohio River Bridge. Thus, the existing US 41 Ohio River Bridge continues to have a LOS F in future years despite the construction of a new bridge crossing to the west under Alternatives 1 and 1A. In contrast, the residual traffic on the existing US 41 Ohio River Bridge results in a LOS C under Alternative 2 and LOS D under Alternative 3.

Build Alternatives (with I-69 to Indianapolis in SR 57 Corridor) – Scenario 3
For Scenario 3 (National I-69 entering the Evansville region from the north in the SR 57 Corridor), the results of the REMI analysis for Alternative 4B of the I-69 Evansville to Indianapolis Tier 1 Draft EIS were used to determine the additional regional population and employment. (Final Alternative 4B resulted in the highest traffic volumes entering the Evansville region in the SR 57 Corridor.) This additional regional growth was slightly greater than that of Scenario 2, and was likewise allocated on the basis of the location of the alternatives to the impacted counties, and diverts traffic from the US 41 Corridor to the SR 57 Corridor in Gibson County.

Table 3-11: Average Daily Traffic Volumes on Ohio River Bridges

Alternative (year)	Existing US 41 Bridge				I-69 Ohio River Bridge			
	Auto	truck	Total	**LOS**	auto	Truck	Total	**LOS**
No-Build (2000)	34,901	5,117	40,018	**F**				
No-Build (2025)	42,052	7,700	49,752	**F**				
No-Build (2025) if induced traffic	46,050	9,070	55,120	**F**				
Scenario 1 without I-69 (includes induced traffic and regional growth shift traffic)								
Alternative 1 (2025)	37,868	7,688	45,556	**F**	10,921	1,427	12,348	A
Alternative 1A(2025)	38,025	7,437	45,462	**F**	10,321	1,676	11,997	A
Alternative 2 (2025)	21,709	4,712	26,421	C	24,498	4,393	28,891	**D**
Alternative 3(2025)	28,120	4,834	32,954	**D**	18,181	4,262	22,443	B
Scenario 2 with I-69 in US 41 Corridor (includes induced traffic and regional growth shift traffic)								
Alternative 1 (2025)	38,965	8,640	47,605	**F**	11,247	2,449	13,697	A
Alternative 1A (2025)	38,918	8,301	47,219	**F**	11,089	2,789	13,878	A
Alternative 2 (2025)	22,373	5,552	27,875	C	26,731	5,585	32,316	**D**
Alternative 3(2025)	28,270	5,225	33,495	**D**	20,928	5,853	26,781	C
Scenario 3 with I-69 in SR 57 Corridor (includes induced traffic and regional growth shift traffic)								
Alternative 1 (2025)	38,410	9,156	47,566	**F**	11,127	1,728	12,855	A
Alternative 1A (2025)	38,385	8,920	47,305	**F**	10,709	1,960	12,669	A
Alternative 2 (2025)	21,562	5,147	26,709	C	25,668	5,729	31,397	**D**
Alternative 3(2025)	28,042	5,113	33,154	**D**	19,321	5,750	25,071	C

Referring to **Table 3-11**, Alternatives 1 and 1A attract about 13,000 vehicles per day to the new Ohio River Bridge, but leave 47,000 to 48,000 vehicles per day on the existing US 41 Ohio River Bridge. Thus, the existing US 41 Ohio River Bridge continues to have a LOS F in future years despite the construction of a new bridge crossing to the west under Alternatives 1 and 1A. In contrast, the residual traffic on the existing US 41 Ohio River Bridge results in a LOS C under Alternative 2 and LOS D under Alternative 3.

With the announcement of Alternative 3C as the preferred route for I-69 from Evansville to Indianapolis in January of 2003, Alternative 3C forecasts about 4 percent more population and about 3 percent more employment than Alternative 4B for the Evansville region; however, Alternative 4B results in about one percent more daily traffic than Alternative 3C as proposed I-69 crosses I-64. Thus, the traffic impacts of Scenario 3 are comparable to the preferred route for I-69 from Evansville to Indianapolis.

For each scenario, Alternative 2 results in LOS D in 2025, which is acceptable. However, for each alternative, a new Ohio River bridge would be designed to accommodate additional future capacity. (See Section 2.8)

3.3.5 Traffic Impacts on Other Regional Highway Facilities

Build Alternative Traffic Impacts on I-64 Corridor

For the No-Build Alternative, traffic volumes on I-64 are 11,000 vehicles per day west of US 41, 25,000 vehicles per day between US 41 and I-164, and 23,000 vehicles per day east of I-164 in the year 2025 shown refer to **Table 3-12**. These future daily traffic volumes result in operating conditions of LOS B on I-64 from US 41 to SR 61 and LOS A westward from US 41. Among the Build Alternatives, Alternative 1 shows the most dramatic change in daily traffic volumes between

SR 165 and SR 65 where the new freeway draws significant traffic from the east and west along I-64. Because Alternative 1A ends in the vicinity of the I-64/US 41 interchange and continues around the west side of Evansville, it diverts traffic from SR 65 by pulling traffic off of I-64 between US 41 and SR 65. Alternative 1A also draws significant traffic from the SR 57 Corridor in light of the increase in traffic between US 41 and I-164. Regardless of the build alternatives and the National I-69 scenarios, I-64 as a four-lane freeway continues to achieve a LOS A or B on all segments.

Table 3-12: Average Daily Traffic Volumes on I-64 (year 2025)

Alternative (year)	I-64 Segments			
	SR 165 to SR 65	SR 65 to US 41	US 41 to I-164	I-164 to SR 61
No-Build (2000)	8,697	8,607	19,539	19,894
No-Build (2025)	10,604	10,627	25,327	22,610
Scenario 1 without I-69				
Alternative 1 (2025)	16,786	12,800	25,320	22,387
Alternative 1A (2025)	10,371	9,300	27,568	22,967
Alternative 2 (2025)	10,288	10,288	24,952	22,144
Alternative 3(2025)	10,591	10,620	25,215	22,183
Scenario 2 with I-69 in US 41 Corridor				
Alternative 1 (2025)	16,317	14,214	25,810	21,388
Alternative 1A (2025)	9,784	8,113	28,346	21,832
Alternative 2 (2025)	10,460	9,960	27,597	21,003
Alternative 3(2025)	10,706	10,285	28,731	21,003
Scenario 3 with I-69 in SR 57 Corridor				
Alternative 1 (2025)	18,077	12,985	25,084	20,667
Alternative 1A (2025)	10,679	9,113	27,981	21,288
Alternative 2 (2025)	10,393	10,151	24,255	20,415
Alternative 3(2025)	10,855	10,646	24,847	20,433

Build Alternative Traffic Impacts on I-164 Corridor

For the No-Build Alternative, the highest traffic volume segment on I-164 falls between the new Lynch Road interchange and the SR 62 (Morgan Avenue) interchange. Referring to **Table 3-13** this segment has 48,424 vehicles per day in the year 2025 equating to a LOS C. Segments of I-164 will also operate at LOS C between I-64 and SR 57 and between Boonville-New Harmony Road and Lynch Road. The remaining segments of I-164 between I-64 and US 41 will operate at LOS B. [The maximum daily traffic volumes of LOS C is 56,727 vehicles per day based on a four-lane freeway with level terrain, 15% trucks, 9% daily traffic in peak hour, 55%/45% directional split and free flow speed of 65 mph. See the review of alternative assumptions at the end of this section.]

Referring to **Table 3-13** the additional traffic resulting from National I-69 in the SR 57 Corridor (Scenario 3) results in a significant increase in the I-164 Corridor for all build alternatives although LOS C is still achieved. The additional traffic resulting from National I-69 in the US 41 Corridor (Scenario 2) has little impact on the I-164 Corridor.

Under the National I-69 scenarios, Alternatives 1 and 1A result in minor traffic diversion on I-164 between I-64 and SR 62 (Morgan Avenue), but has no impact south of SR 62. **Table 3-13** also shows that Alternatives 1 and 1A result in the greatest traffic diversion from I-164 under Scenario 2 (when National I-69 enters the Evansville region from the north in the US 41 Corridor) and the least traffic diversion under Scenario 3 (when National I-69 enters the Evansville region from the north in the SR 57 Corridor). However, the traffic diversions from I-164 are not sufficient to improve the LOS over the No-Build Alternative.

Under the National I-69 Scenarios 1 and 2, Alternative 2 to I-164 attracts slightly more traffic than the No-Build alternative between SR 62 and SR 66. West of where Alternative 2 departs the existing I-164 Corridor, the daily traffic volumes on I-164 drop over the No-Build Alternative. Under Scenario 3, the daily traffic volumes along the I-164 Corridor are comparable to Alternatives 1 and 1A until Alternative 2 departs existing I-164 west of Green River Road. Under all National I-69 scenarios, Alternative 2 achieves a LOS C in the I-164 Corridor.

Under the National I-69 scenarios, Alternative 3 attracts more traffic than the No-Build Alternative and other build alternatives between SR 62 and SR 66, and shows a dramatic increase in traffic between SR 66 and SR 662 where Alternative 3 departs existing I-164. Accordingly, traffic on I-164 drops dramatically on I-164 west of SR 662 to US 41 for Alternative 3. However, a LOS C is maintained on all segments of I-164 for Alternative 3 even when higher traffic volumes are drawn through the I-164 Corridor as a result of Scenario 3 (where National I-69 enters from the north along the SR 57 Corridor).

Regardless of the Build Alternatives and the National I-69 scenarios, I-164 as a four-lane freeway continues to achieve a LOS C on all segments. This LOS C is based on the assumption of 9% of the daily traffic falling in the peak hour and a 55%/45% directional split, yielding a maximum flow of 56,727 vehicles per day. Table 3-14 shows maximum daily traffic volumes by LOS for different assumptions. Actual traffic counts on I-164 in the year 1999 reveal:

- Between SR 662 and SR 66 – 9.1 percent of the daily traffic with a 34.9%/65.1% directional split.
- Between SR 66 and SR 62 -- 7.9 percent of the daily traffic with a 51.3%/48.7% directional split.
- Between SR 62 and Boonville-New Harmony Road – 8.5 percent of the daily traffic with a 55.7%/44.3% directional split.

Trucks account for about 15% for the daily traffic based on a year 2002 traffic count of INDOT on I-164. Thus, actual traffic counts validate the use of the assumption of 9% of the daily traffic falling in the peak hour and a 55/45% directional split for the high volume segment on I-164 between SR 62 and Lynch Road. The Indiana Statewide Travel Demand Model uses 8% for the percent of daily traffic falling in the peak hour based on statewide traffic data. The Kentucky Transportation Cabinet (KYTC) *Traffic Forecasting Report* (year 2002) uses 10.2% for the percent of daily traffic in the peak hour with a directional split of 59.5%/40.5% for urban interstates. The latest post-processor for the Evansville Regional Travel Model allows the user to specify the peak hour percent ranging from 8.7 percent to 12.8 percent with a directional split of 55%/45% or 60%/40%.

Past experience indicates that the peak-hour percent and directional split of an urban freeway decreases as traffic grows. However, if a 10% percent of daily traffic in the peak hour and 60%/40% directional split were assumed (consistent with the KYTC *Traffic Forecasting Report*), the highest daily traffic volume for I-164 of 56,476 for Alternative 3 under Scenario 3 (see **Table 3-13**) between SR 62 and Lynch Road would result in a LOS D (see **Table 3-14**) in the year 2025. As a LOS D is the minimum acceptable LOS in an urban area according to the INDOT and KYTC Design Manuals, I-164 will still be adequate to accommodate the traffic of Alternative 3 with I-69 from Evansville to Indianapolis in the SR 57 Corridor. Further, EUTS is in the process of updating their Long Range Transportation Plan to the year 2030, and assigned traffic volumes to I-164 with the completion of I-69 inside and outside the region have only been in the mid 40,000 vehicles per day range. Finally, as a matter of INDOT practice, timing for freeway expansion is related to pavement condition. The pavement of I-164 is currently rated as excellent, and the 30-year pavement life will extend into the next decade. In conclusion, for the immediate future, I-164 remains adequate as a four-lane freeway to accommodate any of the Build Alternatives with the completion of I-69 from Evansville to Indianapolis and National I-69 traffic passing through the Evansville region for all reasonable assumptions regarding the peak hour characteristics.

Table 3-13: Average Daily Traffic Volumes on I-164 (year 2025)

Alternative	I-164 Segments							
	I-64 to SR 57	SR 57 to B-N Rd.*	B-N Rd. to Lynch Rd.	Lynch Rd. to SR 62	SR 62 to SR 66	SR 66 to SR 662	SR 662 to Green R.**	Green R. to US 41
No Build (2000)	37,885	31,663	32,921	34,966	24,296	20,766	18,909	25,486
No Build (2025)	41,115	36,121	42,159	48,424	38,339	33,579	27,674	35,307
Scenario 1 without I-69 (year 2025)								
Alternative 1	39,130	34,354	39,119	46,261	44,247	32,121	27,892	36,288
Alternative 1a	39,117	34,486	39,138	46,343	43,765	31,143	27,209	35,752
Alternative 2	39,925	34,896	40,504	46,459	41,454	29,883	27,277	29,716
Alternative 3	40,255	34,980	40,647	47,551	44,253	41,759	23,221	27,157
Scenario 2 with I-69 in US 41 Corridor (year 2025)								
Alternative 1	37,218	33,242	38,473	45,251	43,107	30,910	27,134	35,632
Alternative 1a	37,297	33,674	38,911	45,334	42,649	31,624	27,930	36,626
Alternative 2	39,984	35,691	42,081	48,231	48,359	32,062	29,376	29,130
Alternative 3	41,312	36,783	43,320	49,440	46,299	45,246	22,718	26,522
Scenario 3 with I-69 in SR 57 Corridor (year 2025)								
Alternative 1	52,135	44,315	47,873	54,849	47,078	36,109	28,044	33,860
Alternative 1a	51,957	44,155	47,843	54,865	46,606	35,505	27,452	33,340
Alternative 2	53,246	45,452	50,269	55,497	46,862	36,828	30,098	29,824
Alternative 3	53,858	46,108	50,952	56,476	48,028	48,303	22,822	25,959

Notes: * Boonville-New Harmony Road ** Green River Road

Table 3-14: Maximum Daily Traffic Volumes by LOS for Four-Lane Freeway*

K factor**	8%		9%		10%		11%		12%	
D factor***	55/45	60/40	55/45	60/40	55/45	60/40	55/45	60/40	55/45	60/40
LOS A	27,227	24,958	24,202	22,185	21,782	19,927	19,802	18,152	18,152	16,639
LOS B	44,477	40,771	39,535	36,241	35,582	32,617	32,347	29,652	29,652	27,181
LOS C	63,818	58,500	56,727	52,000	51,055	46,800	46,413	42,545	42,545	39,000
LOS D	79,318	72,708	70,505	64,630	63,455	58,167	57,686	52,879	52,879	48,472
LOS E	109,159	100,063	97,030	88,944	87,327	80,050	79,388	72,773	72,773	66,708

Source: HiCAP 2000 software program of Catalina Engineering, Inc. based on Highway Capacity Manual 2000
Notes: * Four-lane freeway with level terrain, 15% trucks, 65 mph free flow speed, and 90% peak-hour factor.
** K factor is the percent of daily traffic in the peak hour.
*** D factor is the directional split of traffic during the peak hour.

Build Alternative Traffic Impacts on the Breathitt Parkway Corridor

Under the No-Build alternative in the year 2025, the highest daily traffic volume on the Breathitt Parkway is 41,300 vehicles per day between US 60 and KY 351, equating to LOS C. Under Scenario 1 (without National I-69), Alternatives 1, 1A and 3 improve the LOS on this segment to LOS B; and Alternative 2 results in a LOS A for this segment.

Under Scenario 2 (with National I-69 entering the Evansville region in the US 41 Corridor from the north) and Scenario 3 (with National I-69 entering the Evansville region in the SR 57 Corridor from the north), Alternatives 1, 1A and 3 divert sufficient traffic from US 41 to achieve a LOS B on the Breathitt Parkway between US 60 and KY 425. Alternative 2 continues to achieve a LOS A for the Breathitt Parkway between US 60 and KY 425 under Scenarios 2 and 3.

South of KY 425, the daily traffic volume in the year 2025 on the Breathitt Parkway is 23,400 vehicles per day, near the lower threshold of LOS A. Under Scenario 1 (without National I-69), Alternatives 1, 1A and 2 result in daily traffic volumes on the Breathitt Parkway south of KY 425 comparable to the No-Build Alternative. However, Alternative 3 draws slightly more traffic up the Breathitt Parkway dropping traffic operations to LOS B. Under Scenarios 2 and 3, with additional traffic due to National I-69 and additional regional growth, traffic flow conditions drop to LOS B on the Breathitt Parkway for all build alternatives.

Build Alternatives' Traffic Impacts on the Eickhoff-Koressel Road Corridor

The construction of Eickhoff-Koressel as a four-lane divided highway from SR 62 to Upper Mt. Vernon Road has been scheduled for construction in year 2004, and is anticipated to be open to traffic in 2006. While the segment of Eickhoff-Koressel from Upper Mt. Vernon Road to SR 66 has been designed as a four-lane roadway, no subsequent phases have been programmed at this time; and, according to the Evansville Urban Transportation Study's *2025 Long Range Transportation Plan,* this segment is not proposed for completion until 2015. The last segment of Eickhoff-Koressel from SR 66 to I-64 at the SR 65 interchange received environmental clearances in 1995, but no further phases have been scheduled. The *2025 Long Range Transportation Plan* proposes completion of this two-lane segment by the year 2025. In view of the I-69 freeway alternatives being examined on the west side of Evansville, the traffic implications of the Eickhoff-Koressel improvement were reviewed.

Under the No-Build Alternative, the Eickhoff-Koressel improvement from SR 62 to SR 66 would provide no relief to severe congestion in the US 41 Corridor and would draw traffic from existing parallel roadways close to the improvement. Under Scenario 2 (with I-69 entering the Evansville region in the US 41 Corridor from the north), the Eickhoff-Koressel improvement from SR 62 to SR 66 was found to divert about 20 to 25 percent of the daily traffic from Alternative 1A between SR 62 and SR 66 and 10 to 15 percent of the daily traffic from Alternative 1A between SR 66 and I-64. Alternative 1A is the best performing build alternative west of Evansville, and attracts higher traffic volumes between SR 62 and SR 66 than Alternative 1. Between SR 66 and I-64, Alternative 1 attracts higher traffic volumes than Alternative 1A. Even if the Eickhoff-Koressel improvement were completed entirely between SR 62 and I-64, it would only reduce the traffic attracted to Alternative 1 by 20 to 25 percent. Thus, the completion of Eickhoff-Koressel would result in only a reduction of 20 to 25 percent of the forecasted daily traffic volumes for Alternatives 1 and 1A, and would have no impact on Alternatives 1 and 1A south of SR 62 because the Eickhoff-Koressel improvement does not extend south of SR 62 nor crosses the Ohio River.

3.3.6 Multi-Modal Systems' Impacts

Both Alternatives 1 and 1A bridge over two rail lines in Kentucky and Indiana. Alternatives 2 and 3 in Kentucky bridge a CSX line, but no rail lines in Indiana. Coordination between the respective freight rail providers and the state departments of transportation has been ongoing to address design and construction issues.

Both airports are outside of any of the Build Alternatives, but would benefit from the project in the form of an overall enhanced highway transportation network.

The project will not adversely impact any port facility, but will lead to the development of enhanced intermodal cross-docking and trans-loading operations.

3.3.7 Traffic Impact Conclusions

Relative to the performance measures associated with the project goals, Alternative 2 is the best in overall performance ranking for all National I-69 Scenarios. Alternative 2 ranks second in limiting the increase of truck vehicle-hours of travel (VHT) for all scenarios, first in the Efficient System Performance Index (ESPI) in limiting the increase of vehicle-miles of travel (VMT) on facilities falling below LOS C for all scenarios, first with Alternative 1A in the Efficient System Performance Index in the reduction of vehicle-hours of travel (VHT) on facilities falling below LOS C for Scenario 2, first in reduction of VHT on arterial facilities for Scenario 2, and second in reduction of VHT on arterial facilities for Scenario 1.

Alternative 3 ranked second best overall relative to performance measures associated with the project goals. Alternative 3 ranks first in limiting the increase of truck vehicle-hours of travel (VHT) for all scenarios, second in the Efficient System Performance Index in limiting the increase of vehicle-miles of travel (VMT) on facilities falling below LOS C for two of the three scenarios, second in the Efficient System Performance Index in limiting the increase of vehicle-hours of travel (VHT) on facilities falling below LOS C for two of the three scenarios, and first in reduction of VHT on arterial facilities for Scenario 1.

Alternative 1A ranked first in limiting the increase of vehicle-hours of travel (VHT) on facilities falling below LOS C for all scenarios, tied with Alternative 2 in the case of Scenario 2, and ranked first in limiting the increase of VHT on arterial facilities for Scenario 3. In other categories, Alternative 1A ranked third. Alternative 1 ranked last in all the performance measures associated with the project goals.

In addition to the regional performance measures associated with the achievement of project goals, the alternatives were also evaluated relative to relief provided to the US 41 Corridor. Alternative 2 provided the greatest relief to the US 41 Corridor in reducing VMT and VHT in the US 41 Corridor, and diverted sufficient traffic from the existing US 41 Ohio River Bridge to achieve a LOS C on the existing bridge. Alternative 3 provided the second best relief to the US 41 Corridor and achieved a LOS D on the existing US 41 Ohio River Bridge. Alternatives 1 and 1A provided far less relief to the US 41 Corridor, and resulted in the continuation of LOS F traffic flow operations on the existing US 41 Ohio River Bridge.

With the announcement of Alternative 3C as the preferred route for I-69 from Evansville to Indianapolis, Alternative 3C forecasts about 4 percent more population and about 3 percent more employment than Final Alternative 4B for the Evansville region; however, Alternative 4B results in about one percent more daily traffic than Alternative 3C as proposed I-69 crosses I-64. Thus, the traffic impacts of Scenario 3 are comparable to the preferred route for I-69 from Evansville to Indianapolis.

Chapter 4 – ENVIRONMENTAL SETTING

This chapter gives an overall description of the current social and economic characteristics as well as the natural environment of the project study area. These descriptions set a baseline condition for the social and environmental settings of the project study area and provide a basis of comparison for the determination of the impacts and environmental consequences of the proposed action, presented in **Chapter 5- Environmental Consequences**.

The project study area, shown in **Figure 4-1**, is located in southwestern Indiana and western Kentucky, beginning south of the City of Henderson, Kentucky, and extending north of the City of Evansville, Indiana. This includes the eastern portion of Posey County, Vanderburgh County, western Warrick County, and southern Gibson County in Indiana; and Henderson in Kentucky. The only portion of Gibson County that will be directly impacted by any of the build alternatives is the northern terminus (the interchange between I-69 and I-64) of SIU #4. Therefore, Gibson County's affected environment is only discussed as appropriate.

4.1 SOCIAL AND ECONOMIC SETTING

The following sections discuss the existing socioeconomic characteristics of four counties within the project study area, and compare these characteristics to regional and statewide levels. The Evansville/Henderson Metropolitan Statistical Area (MSA), as defined by the United States Office of Management and Budget (OMB), consists of the same four counties as defined in the project study area, with Vanderburgh County being the central county. The project study area is shown in **Figure 4-1**.

4.1.1 Population

Between 1990 and 2000, the overall population growth in the states of Indiana and Kentucky were very similar at 9.7 and 9.6 percent, respectively. The Evansville/Henderson MSA grew at a somewhat slower pace of 6.2 percent. The Evansville/Henderson area is one of 318 metropolitan areas in the United States, and its 2000 Census population ranked it as 159^{th} in the nation. Within the MSA, three counties (Posey, Vanderburgh, and Henderson) grew at similar rates of 4.1 to 4.2 percent. In sharp contrast, Warrick County grew 16.6 percent, making it the fastest growing jurisdiction in the project study area. The two cities exhibited divergent population growth, with Evansville losing 3.7 percent of its population, and Henderson increasing by 5.5 percent, as shown in **Table 4-1**.

Over the past thirty years, Warrick's 10-year growth rate has consistently been the highest, even growing at 8.3 percent during the non-growth to low-growth years between 1980 and 1990. Henderson County's growth rate has also been respectable when compared to the other counties in the project study area, but its decennial growth rate is projected to slow over the next thirty years. And while the City of Henderson has been steadily increasing its population, the Evansville population has been steadily declining over the past thirty years.

The racial composition of both states, the MSA, the counties, and the cities has always been a higher percentage of whites than non-whites. The method of collecting racial information changed with the 2000 Census. The 2000 Census, for the first time, allowed individuals to report one or more race categories. Therefore, 2000 Census race information (see **Table 4-2**) is not comparable to 1990 and earlier census years.

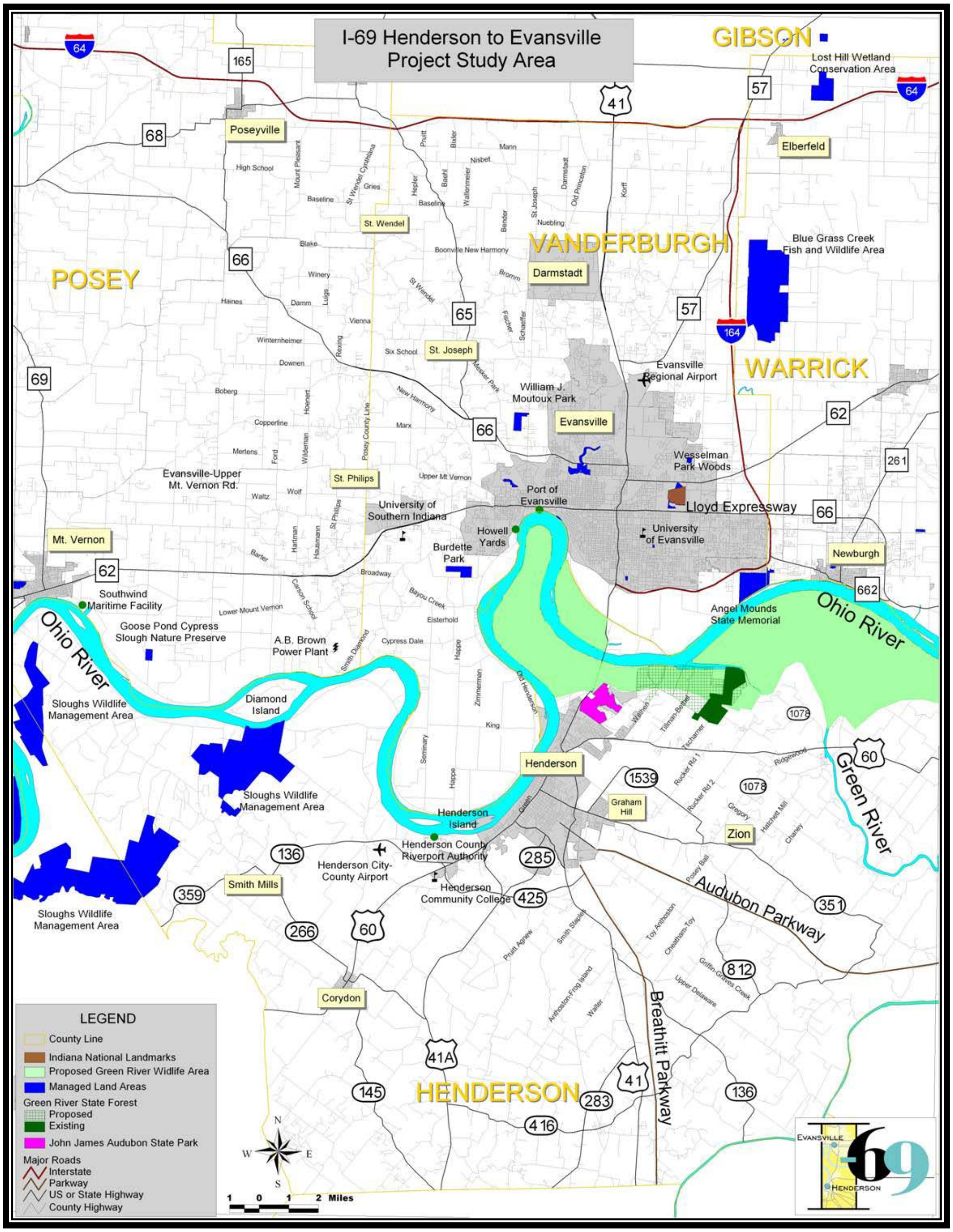


Figure 4-1: I-69 Henderson to Evansville Project Study Area

Table 4-1: Population Trends and Projections[1]

Population Area	Census 1980	Census 1990	Census 2000	Projected 2010	Projected 2020	Projected 2030
Indiana	5,490,210	5,544,159	6,080,485	6,295,226	6,590,364	6,885,501
Change in Population	294,818	53,949	536,326	214,741	295,138	295,138
Percent Change	5.7%	1.0%	9.7%	3.8%	4.7%	4.7%
Kentucky	3,660,777	3,686,891	4,042,209	4,442,374	4,843,219	5,235,685
Change in Population	442,071	26,114	355,318	400,165	400,845	392,466
Percent Change	13.7%	0.7%	9.6%	9.9%	9.0%	8.1%
Evansville/Henderson MSA[2]	276,252	278,990	296,195	303,171	311,784	319,245
Change in Population	21,737	2,738	17,205	6,976	8,613	7,462
Percent Change	8.5%	1.0%	6.2%	2.4%	2.9%	2.5%
Posey County, IN	26,414	25,968	27,061	27,128	27,452	27,775
Change in Population	4,674	-446	1,093	67	324	324
Percent Change	21.5%	-1.7%	4.2%	0.2%	1.2%	1.2%
Vanderburgh County, IN	167,515	165,058	171,922	172,572	174,776	176,979
Change in Population	-1,257	-2,457	6,864	650	2,204	2,204
Percent Change	-0.7%	-1.5%	4.2%	0.4%	1.3%	1.3%
Warrick County, IN	41,474	44,920	52,383	57,168	62,623	68,077
Change in Population	13,502	3,446	7,463	4,785	5,455	5,455
Percent Change	48.3%	8.3%	16.6%	9.1%	9.5%	8.7%
Henderson County, KY	40,849	43,044	44,829	46,303	46,933	46,414
Change in Population	4,818	2,195	1,785	1,474	630	-519
Percent Change	13.4%	5.4%	4.1%	3.3%	1.4%	-1.1%
Evansville, IN (city)	130,496	126,272	121,582			
Change in Population	-8,268	-4,224	-4,690	n/a	n/a	n/a
Percent Change	-6.0%	-3.2%	-3.7%			
Henderson, KY (city)	24,834	25,945	27,373			
Change in Population	1,858	1,111	1,428	n/a	n/a	n/a
Percent Change	8.1%	4.5%	5.5%			

[1] Kentucky year 2010, 2020, and 2030 projections are 2002 edition population projections obtained from the Kentucky State Date Center. Indiana state and county projections are provided by Qk4, Inc., based on a straight-line methodology using historical census data. Population projections below the county level are generally not available.
[2] Metropolitan Statistical Area - An area defined by the Office of Management and Budget (OMB) as a Federal statistical standard. An area qualifies for recognition as an MSA if it includes a city with a population of at least 50,000, or an urbanized area of at least 50,000 with a total metropolitan area population of at least 100,000.
Source: U.S. Bureau of the Census, 1970, 1980, 1990, 2000 Censuses.

Indiana appears to be slightly more racially diverse than Kentucky, and the cities of Evansville and Henderson more racially diverse than the other jurisdictions in the project study area. Overall, the populations of the four counties appear less racially diverse than their respective state populations, with Posey and Warrick Counties having a lower percentage of non-white persons than the state average. The Evansville/Henderson MSA appears to be more closely aligned with Kentucky's racial characteristics than with Indiana's.

Table 4-2: 2000 Census Race Information

Geographic Area	Total Population	One Race							Population of Two or More Races	Hispanic or Latino Origin
		Population of One Race	White Alone	Black or African American Alone	American Indian & Alaska Native Alone	Asian Alone	Native Hawaiian & Other Pacific Islander Alone	Some Other Race Alone		
Indiana										
Total	6,080,485	6,004,813	5,320,022	510,034	15,815	59,126	2,005	97,811	75,672	214,536
Percent	100%	98.8	87.5	8.4	0.3	1.0	0.03	1.6	1.2	3.5
Kentucky										
Total	4,042,209	3,999,326	3,640,889	295,994	8,616	29,744	1,460	22,623	42,443	59,939
Percent	100%	98.9	91.0	7.4	0.2	0.7	0.04	0.6	1.1	1.5
Evansville/Henderson MSA										
Total	296,195	293,399	271,949	18,018	525	1,816	99	992	2,796	2,570
Percent	100%	99.1	91.8	6.1	0.2	0.6	0.03	0.3	0.9	0.9
Posey County, IN										
Total	27,061	26,904	26,511	234	72	42	1	44	157	118
Percent	100%	99.4	98.0	0.9	0.3	0.2	0.00	0.2	0.6	0.4
Vanderburgh County, IN										
Total	171,922	169,953	153,519	14,078	305	1,296	70	685	1,969	1,679
Percent	100%	98.9	89.3	8.2	0.2	0.8	0.04	0.4	1.1	1.0
Warrick County, IN										
Total	52,383	52,097	51,053	525	78	330	25	86	289	340
Percent	100%	99.5	97.5	1.0	0.1	0.6	0.05	0.2	0.5	0.6
Henderson County, KY										
Total	44,829	44,445	40,866	3,181	70	148	3	177	384	433
Percent	100%	99.1	91.2	7.1	0.2	0.3	0.00	0.4	0.9	1.0
Evansville, IN (city)										
Total	121,582	119,913	104,585	13,275	257	870	55	598	1,669	1,392
Percent	100%	98.6	86.2	10.9	0.2	0.7	0.05	0.5	1.4	1.1
Henderson, KY (city)										
Total	27,373	27,087	23,885	2,883	48	110	2	159	286	347
Percent	100%	99.0	87.3	10.5	0.2	0.4	0.01	0.6	1.0	1.3

Source: U.S. Bureau of the Census, 2000 Census.

4.1.2 Economic Conditions

A 1999 income characteristics summary is presented in **Table 4-3**. The residents of Indiana, have a higher average income than those of Kentucky, with a median household income almost 19 percent higher ($41,567 vs. $33,672), and a per capita income about 11 percent higher ($20,397 vs. $18,093). Overall, the Evansville/Henderson MSA has a median household income ($39,307) that is above the mid-point between the two states, and a per capita income ($20,439) slightly larger than either state. Warrick County ($48,814) and Posey County ($44,209) have median household incomes well above the other jurisdictions, and Henderson County is slightly above the Kentucky average. Both cities have median household incomes below their state averages, with Evansville ($31,963) about 23 percent below the Indiana state average, and Henderson ($30,427) almost 10 percent below the Kentucky average.

In terms of per capita income, the jurisdictions are more evenly balanced and range from $17,925 to $21,893. The Evansville/Henderson MSA per capita income ($20,439) is slightly higher than either state average (Indiana $20,397, Kentucky $18,093), with the two cities exhibiting the lowest values (Evansville $18,388, and Henderson $17,925). Among the Indiana counties, Warrick had the highest per capita income, exceeding the state average; while Posey had the lowest, indicating a larger percent of families and/or family size. Henderson had the lowest county average, but was slightly above the Kentucky state average. **Figure 4-2** shows the median household income in blue and the per capita income in red.

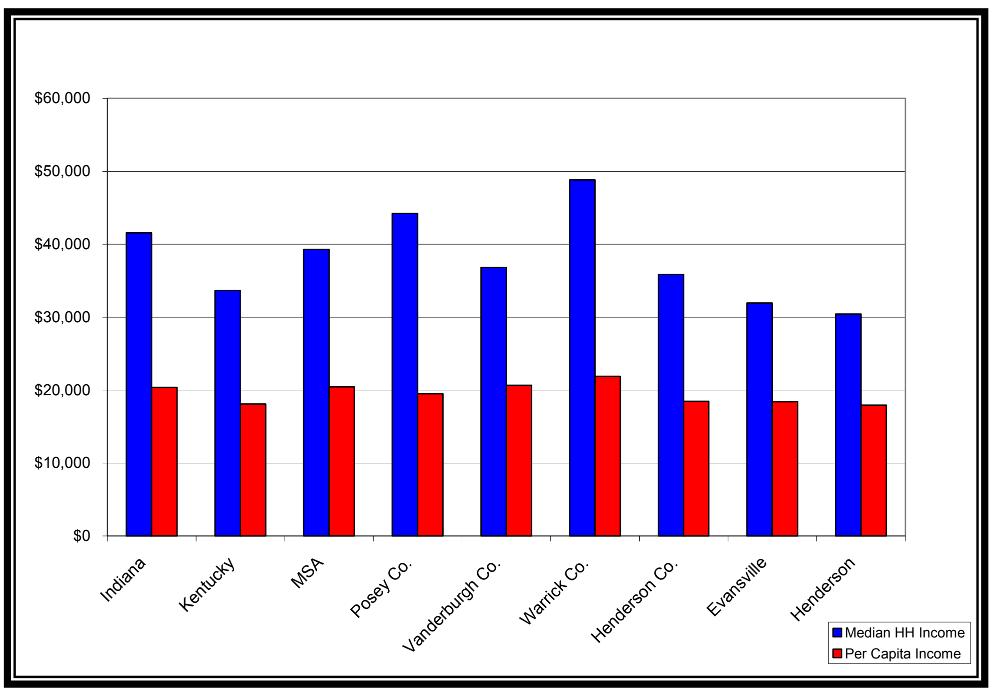


Figure 4-2: Income Characteristics

Table 4-3: 1999 Income Data and Current Unemployment Rates

	Indiana	Kentucky	Evansville/Henderson MSA	Posey County, IN	Vanderburgh County, IN	Warrick County, IN	Henderson County, KY	Evansville, IN (city)	Henderson, KY (city)
Median Household Income									
Total	$41,567	$33,672	$39,307	$44,209	$36,823	$48,814	$35,862	$31,963	$30,427
Per Capita Income									
Total	$20,397	$18,093	$20,439	$19,516	$20,655	$21,893	$18,470	$18,388	$17,925
Percent Living Below Poverty Level (Individuals)									
Total	9.5%	15.8%	9.9%	7.4%	11.2%	5.3%	12.3%	13.7%	16.5%
% of All Youths (Ages 0-17) Below Poverty Level	11.7%	20.4%	12.8%	8.5%	14.4%	7.3%	17.2%	19.0%	24.6%
% of All Elderly (Ages 65+) Below Poverty Level	7.7%	14.2%	7.8%	10.0%	7.3%	6.1%	10.1%	8.4%	11.3%
Current Unemployment Rates									
October 2002	148,000 (4.7%)	95,270 (4.8%)	6,550 (4.1%)	590 (4.2%)	3,760 (4.1%)	990 (3.4%)	1,222 (5.2%)	N/A	N/A

Sources: U.S. Bureau of the Census, 2000, Summary File 3 (SF 3), which is based upon data from a sample population, Indiana Department of Workforce Development, Kentucky Department for Employment Services. In addition to the data published by the U.S. Census Bureau, descriptions of county and MSA economics can be obtained from the U.S. Bureau of Economic Analysis' (BEA) Regional Economic Information System. Below are selected statements from the most recent BEA Regional analysis of the economics concerning the Evansville, IN-Henderson, KY MSA.

In 2000, Evansville/Henderson had a per capita personal income (PCPI) of $28,048. This PCPI ranked 108th in the United States [out of 318] and was 95 percent of the national average, $29,469. In 1990, the PCPI of Evansville/Henderson was $18,303 and ranked 125th in the United States. The average annual growth rate of PCPI over the past 10 years was 4.4 percent. The average annual growth rate for the nation was 4.2 percent.

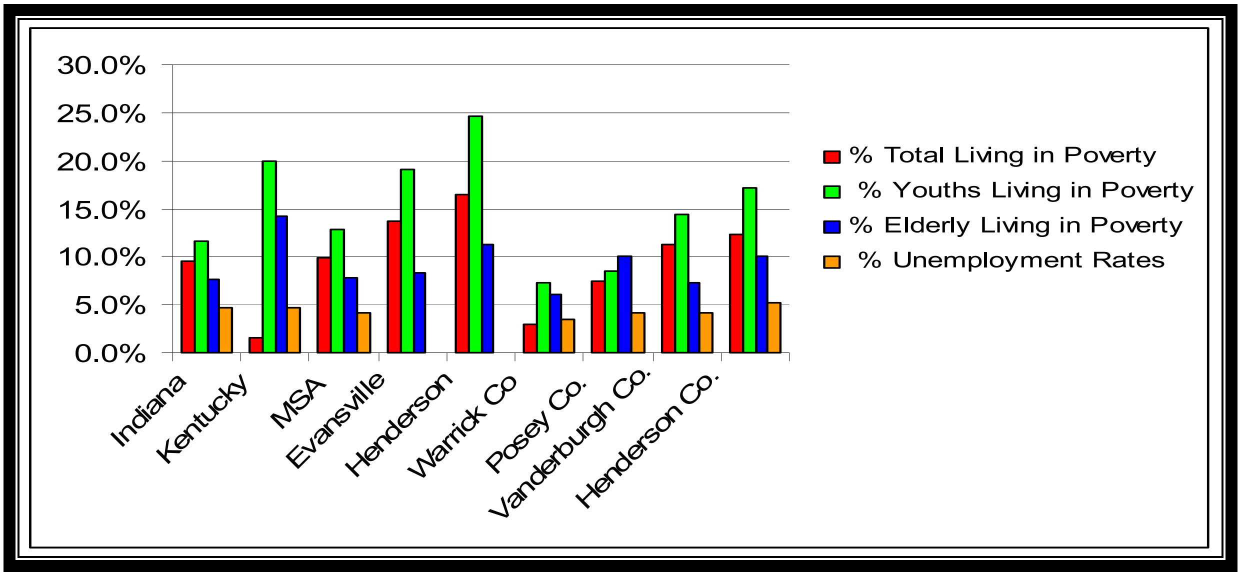
The largest industries, in terms of overall earnings in 2000, were services, durable goods manufacturing, and nondurable goods manufacturing with 25.2% of earnings. The slowest growing industry from 1990 to 2000 was durable goods manufacturing; the fastest growing industries were finance, insurance, and real estate (combined, these industries accounted for 6.4 percent of earnings in 2000), which increased at an average annual rate of 10.9%.

Regarding the population percentages living below the poverty level, Indiana (9.5 percent) has fewer individuals living below the poverty level than Kentucky (15.8 percent). The Evansville/Henderson MSA poverty level rate (9.9 percent) is more closely aligned with that of Indiana, reflecting its greater percentage of the overall population. However, within the MSA, individual poverty levels cover a broad range from 5.3 to 16.5 percent. Evansville (13.7 percent) and Henderson (16.5 percent) have the highest percentages, and each exceeds their respective state and county averages. Among Indiana counties, Warrick (5.3 percent, the lowest) and Posey (7.4 percent) are below the state average, while Vanderburgh (11.2 percent) is the highest and exceeds the Indiana average. Henderson County (12.3 percent) is below the Kentucky average.

An examination of the percentages of youths living below the poverty level reveals a distribution pattern similar to that for individuals. Indiana (11.7 percent) has fewer than Kentucky (20.4 percent), and the MSA (12.8 percent) demographics are closer to that of Indiana. Evansville (19.0 percent) and Henderson (24.6 percent) have the highest percentages, and exceed their state averages. For Indiana counties, Warrick (7.3 percent, the lowest) and Posey (8.5 percent) are both below the Indiana average, while Vanderburgh (14.4 percent) is the highest and exceeds the state average. Henderson County (17.2 percent) is less than the Kentucky average.

The percentage of elderly people living below the poverty level indicates there are fewer in Indiana (7.7 percent) than in Kentucky (14.2 percent), and the MSA is very close to the Indiana average. Elderly living in the two cities appear to be less impoverished, in contrast to individuals and youth. Evansville (8.4 percent) is only a little more than the state average (7.7 percent), yet has the highest elderly population percentage of all the jurisdictions. Henderson city (11.3 percent) is less than the Kentucky state average (14.2 percent), as is Henderson County (10.1 percent). Posey County (10.0 percent) has the highest percentage among the Indiana jurisdictions and exceeds the Indiana average, while Warrick County (6.1 percent, the lowest) and Vanderburgh County (7.3 percent) are both below the state average.

The most recent data available from the Indiana Department of Workforce Development and the Kentucky Department of Employment Services indicates the overall unemployment rates of Indiana (4.6 percent) and Kentucky (4.7 percent) are comparable. Furthermore, the unemployment rate for the MSA is less than either state's, with only Henderson County (4.9 percent) exceeding the state of Kentucky's unemployment rate. The unemployment in all jurisdictions is currently less than it was at the 2000 Census. Unemployment rates below the county level are not available. **Figure 4-3** graphically explains this data.



(NOTE: Statistics not available below county level)

Figure 4-3: Percent of Population Living in Poverty

4.1.3 Employment

The three major industry employers are the same in all jurisdictions, but with varying percentages of employment: "manufacturing" (16.5 – 25.7 percent), "retail trade" (10.1 – 13.9 percent), and "education, health and social services" (18.1 – 20.4 percent). Posey County, Henderson County, and the City of Henderson have a greater reliance upon the manufacturing sector than the other areas, especially Evansville, which has the lowest manufacturing employment as shown in **Table 4-4**. In contrast, Vanderburgh County, Warrick County, and Evansville demonstrate a greater employment in the retail trade industry. Overall, the project study area has a larger percentage employed in retail trade than either state averages.

Another category is "agriculture, forestry, fishing and hunting, and mining." Kentucky (3.3 percent) is much more dependent upon industries in this category than Indiana (1.4 percent). However, within the project study area, Posey County (4.4 percent) has the largest industry sector employment, while Vanderburgh County and Evansville (0.7 and 0.3 percent) have the least.

Table 4-4: 2000 Census Employment by Industry

	Indiana		Kentucky		Evansville/ Henderson MSA		Posey County, IN		Vanderburgh County, IN		Warrick County, IN		Henderson County, KY		Evansville, IN (city)		Henderson, KY (city)	
Industry	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Agriculture, forestry, fishing and hunting, and mining	42,041	1.4	59,729	3.3	2,100	1.4	578	4.4	595	0.7	337	1.3	590	2.8	202	0.3	217	1.7
Construction	196,152	6.6	129,618	7.2	10,151	6.9	987	7.5	5,650	6.6	2,254	8.4	1,260	5.9	3,367	5.8	709	5.7
Manufacturing	678,078	22.9	315,774	17.6	28,346	19.4	3,328	25.3	14,455	17.0	5,109	19.1	5,454	25.7	9,616	16.5	3,181	25.4
Wholesale trade	101,505	3.4	60,854	3.4	5,353	3.7	441	3.4	3,219	3.8	971	3.6	722	3.4	2,234	3.8	490	3.9
Retail trade	349,133	11.8	217,164	12.1	18,533	12.7	1,330	10.1	11,375	13.4	3,579	13.3	2,249	10.6	8,072	13.9	1,495	11.9
Transportation and warehousing, and utilities	153,421	5.2	108,738	6.0	8,390	5.7	865	6.6	4,831	5.7	1,461	5.4	1,233	5.8	3,441	5.9	533	4.2
Information	62,714	2.1	39,303	2.2	3,389	2.3	139	1.1	2,305	2.7	604	2.3	341	1.6	1,559	2.7	206	1.6
Finance, insurance, real estate, and rental & leasing	167,715	5.7	97,350	5.4	9,230	6.3	599	4.6	5,452	6.4	1,847	6.9	1,332	6.3	3,708	6.4	847	6.8
Professional, scientific, management, administrative, & waste management services	186,104	6.3	111,878	6.2	9,326	6.4	786	6.0	5,825	6.8	1,639	6.1	1,076	5.1	4,082	7.0	674	5.4
Educational, health and social services	572,921	19.3	365,605	20.3	28,910	19.8	2,444	18.6	17,330	20.4	5,249	19.6	3,887	18.3	11,584	19.9	2,268	18.1
Arts, entertainment, recreation, accommodation and food services	217,830	7.3	129,973	7.2	11,532	7.9	871	6.6	7,503	8.8	1,722	6.4	1,436	6.8	5,877	10.1	946	7.5
Other services (except public administration)	139,079	4.7	85,150	4.7	6,979	4.8	468	3.6	4,280	5.0	1,251	4.7	980	4.6	2,913	5.0	594	4.7
Public administration	98,481	3.3	77,128	4.3	4,004	2.7	313	2.4	2,260	2.7	792	3.0	639	3.0	1,558	2.7	383	3.1
Total	**2,965,174**	**100**	**1,798,264**	**100**	**146,243**	**100**	**13,149**	**100**	**85,080**	**100**	**26,815**	**100**	**21,199**	**100**	**58,253**	**100**	**12,543**	**100**

Source: U.S. Bureau of the Census, 2000 Census.

4.1.4 Land Use

Figure 4-4 shows the general land use patterns for northern Posey, Vanderburgh, and Warrick Counties, and southern Gibson County. **Figure 4-5** shows the general land use patterns for Henderson County and southern Vanderburgh and Posey Counties. At present, the dominant land use in the vicinity of the four proposed project corridors is residential and farmland land (primarily crop production, hayfield, and pasture). The project would require the direct conversion of open, agricultural, residential, and commercial land to a transportation land use. Outside the right-of-way, the project would be expected to generate both new growth and shift existing growth from existing locations to locations in proximity to the proposed Interstate. The land use was identified during a walk through of each project alignment, and then incorporated into a Geographical Information System (GIS) for mapping and analysis.

Northeastern Posey and northwestern Vanderburgh Counties are predominantly rural areas where much of the land is in agricultural use. The southeastern part of Posey and the southwestern part of Vanderburgh County transition from agricultural to woodland. Southeastern Vanderburgh and southwestern Warrick Counties are dominated by dense residential areas along with some commercial and remnant woodland and agricultural areas.

This area is being consumed by development between the City of Evansville in Vanderburgh County and the town of Newburgh in Warrick County. The remnant woodlands are typically small and include scattered residential development. There are a few small communities in these areas, some of which are in the vicinity of the proposed alternatives. These areas include St. Wendel, Parker Settlement, and St. Phillips in Posey County. These communities are surrounded by agricultural land and scattered residences.

The north central section of Henderson County, Kentucky, is an urban area with many businesses and residential neighborhoods within the City of Henderson. East of Henderson lies a more rural landscape characterized by agricultural fields periodically interrupted by patches of woodlands. The communities of Baskett, Graham Hill, and Anthoston are near the project study area boundaries (see **Figure 4-1**).

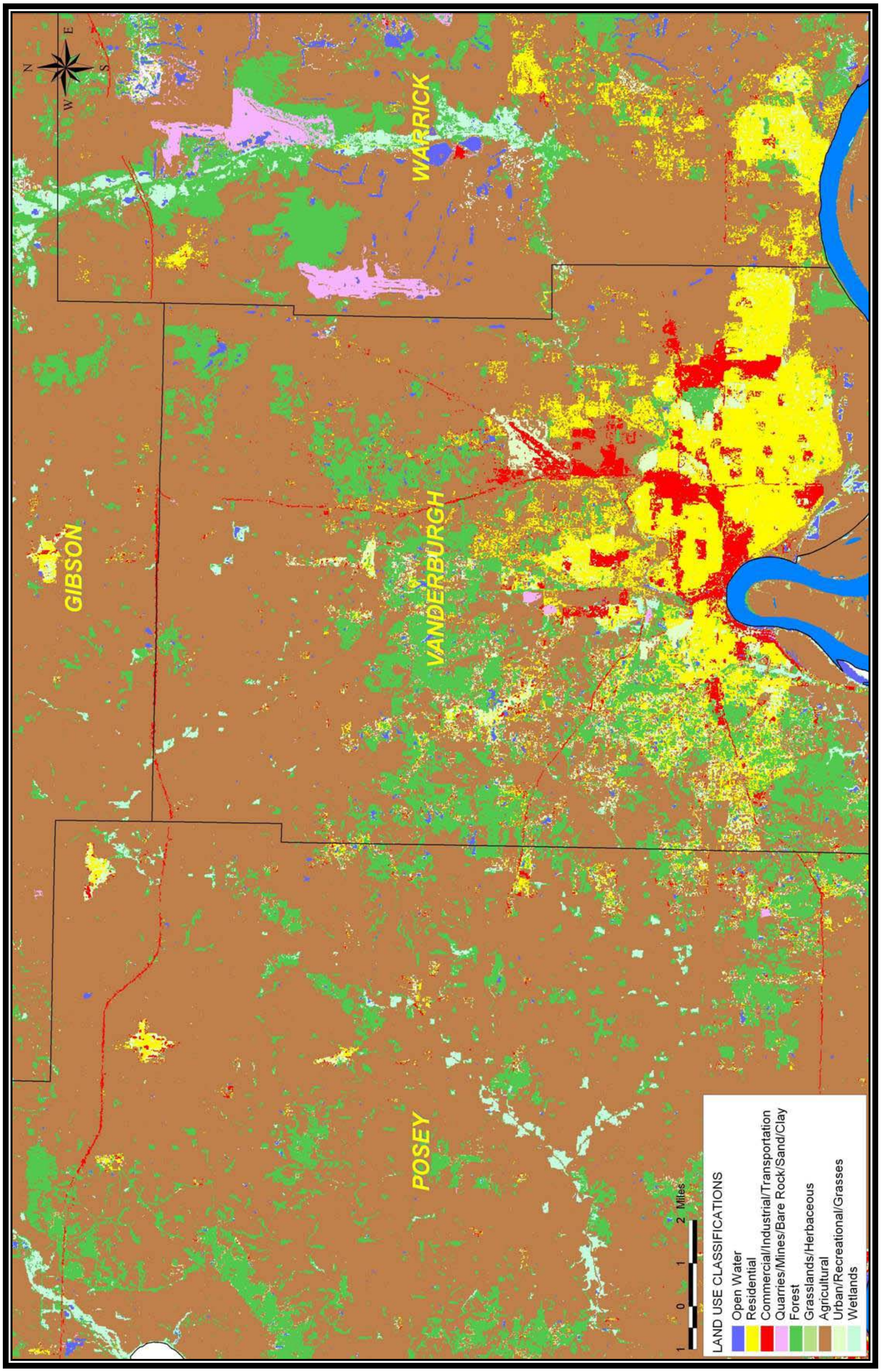


Figure 4-4: Existing Land Use in Northern Portion of Study Area

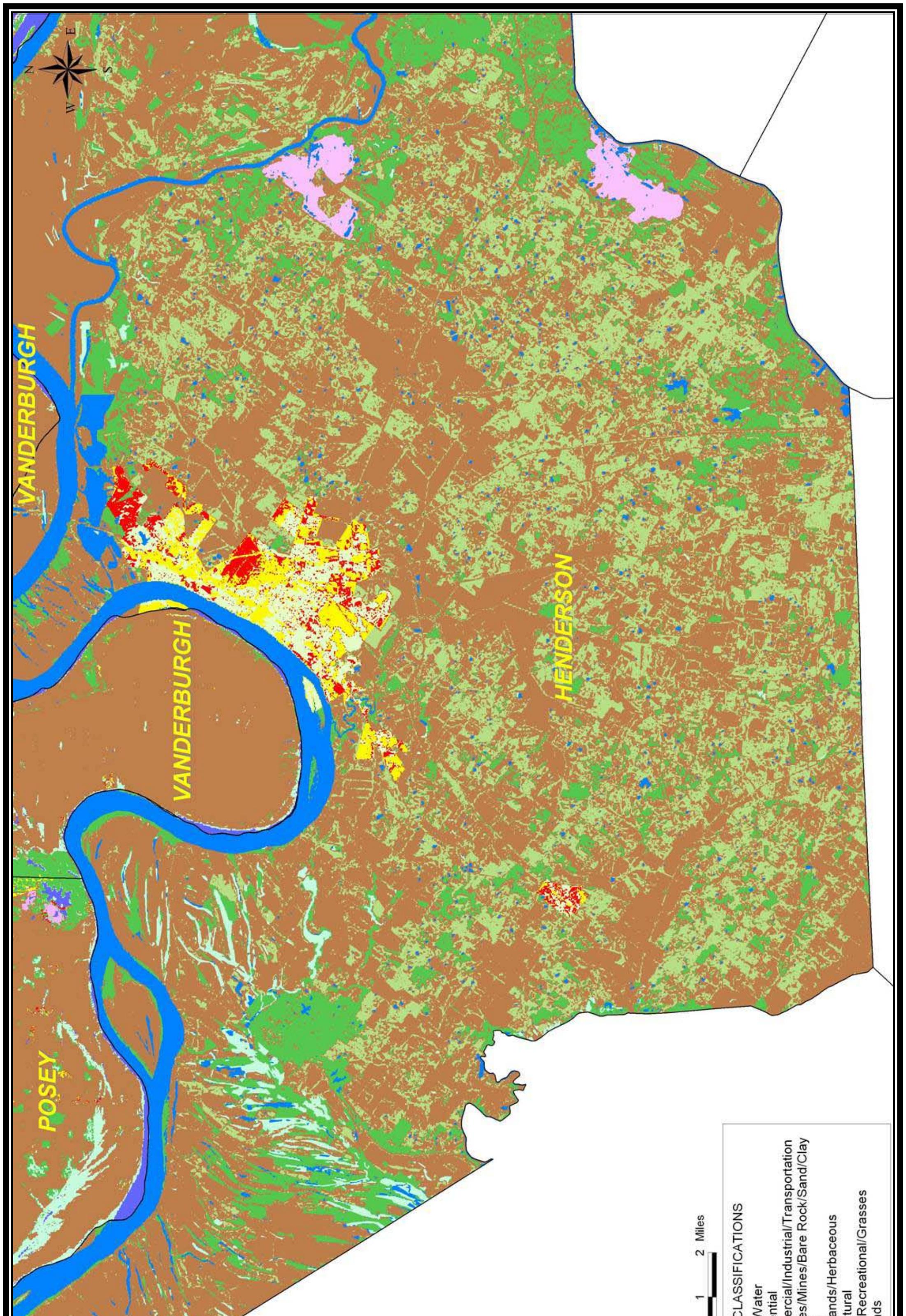


Figure 4-5: Existing Land Use in Southern Portion of Study Area

4.1.5 Housing

A summary of the 2000 census-derived housing occupancy is shown in **Table 4-5.** The percent of total vacant housing units in the Evansville/Henderson MSA (7.1 percent) is less than the Indiana and Kentucky statewide averages (7.7 percent and 9.2 percent, respectively). Likewise, the MSA rental vacancy rate (8.3 percent) is slightly less than the Indiana and Kentucky statewide averages (8.8 and 8.7 percent).

Table 4-5: 2000 Census Housing Occupancy

Housing Occupancy	Indiana	Kentucky	MSA	Vanderburgh County	Warrick County	Posey County	Henderson County	Evansville	Henderson (city)
Total housing units	2,532,319	1,750,927	107,922	76,300	20,546	11,076	19,466	57,065	12,652
Occupied housing units	2,336,306	1,590,647	100,266	70,623	19,438	10,205	18,095	52,273	11,693
Vacant housing units	196,013	160,280	7,656	5,677	1,108	871	1,371	4,792	959
Percent vacant	7.7%	9.2%	7.1%	7.4%	5.4%	7.9%	7.0%	8.4%	7.6%
Seasonal, recreational, or occasional use	33,803	30,420	614	327	98	189	103	239	57
Homeowner vacancy rate (percent)	1.8%	1.8%	1.9%	2.1%	1.3%	1.6%	1.4%	2.2%	1.9%
Rental vacancy rate (percent)	8.8%	8.7%	8.3%	8.0%	8.7%	12.4%	7.0%	8.1%	7.2%

Sources: US Census Bureau, Kentucky State Data Center (http://cbpa.louisville.edu/ksdc/), and STATS Indiana (http://www.stats.indiana.edu/)

With respect to the four I-69 project study area counties of the Evansville/Henderson MSA, Vanderburgh, Warrick, and Henderson Counties have a total housing vacancy percentage (7.4, 5.4, and 7.0 percent, respectively) and rental vacancy percentage rates (8.0, 8.7 and 7.0 percent) less than their associative statewide averages. Warrick County has the lowest percentage of housing vacant at 5.4 percent. Posey County has a higher percentage of total housing vacancy (7.9 percent) and rental properties vacant (12.4 percent) than either the MSA or Indiana state average. For the homeowner's vacancy percentage rate in Indiana, Warrick and Posey County have a lower percentage (1.3 and 1.6 percent) than either the MSA or state averages, while the Vanderburgh County percentage (2.1 percent) is greater. The Henderson County homeowner vacancy percentage rate (1.4 percent) is less than the Kentucky state average.

A comparison of the two cities – Evansville and Henderson – indicates that Evansville has a higher percentage of total available housing (8.4 percent) and available rental properties (8.1 percent) than Henderson. The percentage of total available housing in Evansville is also higher than either the Indiana or MSA averages, but the rental vacancy percentage rate (8.1 percent) is less than the state average. The total housing vacancy percentage for Henderson (7.6 percent) and the rental vacancy percentage rate (7.2 percent) are both less than the Kentucky statewide average, whereas the homeowner vacancy percentage rate (1.9 percent) is greater than the state average.

4.1.6 Transportation Facilities

I-69 will link communities and improve access to multi-modal transportation centers in the region. Highway, rail, airport, port and other transportation-related facilities in and/or serving the project study area include the following:

Highways: Two Interstate facilities traverse the Indiana portion of the project study area, I-64 and I-164. I-64 runs from near St. Louis, MO to Chesapeake, VA, and provides the only regional Interstate access to the project study area. Running near the northern borders of Warrick, Vanderburgh, and Posey Counties, I-64 connects the Evansville area to St. Louis and Louisville, KY, and indirectly to Indianapolis via I-65. Locally, interchanges are found at I-164, US 41, SR 65, and SR 165. I-164, a local freeway connecting the eastern portions of Evansville and the community of Newburgh to I-64, was built in the 1980's. Running from US 41 just north of the Kentucky-Indiana State line to I-64 northeast of Evansville, I-164 has interchanges at Green River Road, SR 662, SR 66, SR 62, Lynch Avenue, Boonville-New Harmony Road, and SR 57.

Other significant roadways in Indiana include SR 66 and SR 62. SR 66, also known as the Lloyd Expressway through Evansville, is partially access controlled with both grade-separated interchanges and signalized intersections. The Lloyd Expressway serves a great deal of both local and regional traffic as it provides access to downtown Evansville and the surrounding commercial areas. SR 62, also known as Morgan Avenue in Evansville, serves Mt. Vernon, the Southwind Maritime Facility, and the University of Southern Indiana west of Evansville.

US 41 provides the only direct connection between Evansville and Henderson in the form of the twin Bistate Vietnam Gold bridges. According to the KYTC Highway Information System (HIS) database, approximately 40,000 vehicles cross the US 41 bridges each day. Through Evansville, US 41 is a partially-controlled access, divided highway with traffic signals and interchanges only at major roadways. These interchanges include SR 66 (Lloyd Expressway) and SR 62 (Diamond Avenue). Through Henderson, US 41 is characterized by traffic signals located at approximately ½-mile spacing and frequent driveway access points. US 41 provides access to the Evansville Regional Airport, the University of Evansville, and John James Audubon State Park.

Kentucky's parkway system consists of predominately rural freeways outside of the Interstate system. The Henderson project study area is served by two such parkways, which are fully access controlled, four-lane divided highways. The Audubon Parkway connects Henderson to Owensboro in Daviess County, Kentucky, and to the Natcher Bridge east of Owensboro on US 231. The Edward T. Breathitt Parkway (formerly known as the Pennyrile Parkway) connects the Evansville/Henderson metropolitan area to areas to the south. Portions of the Breathitt are likely to become integrated into I-69 (from Henderson to the Wendell H. Ford Western Kentucky Parkway).

Other significant Kentucky highways in the Henderson area include US 60 and US 41A. US 60 serves as a parallel companion road to the Audubon Parkway east of Henderson. Through Henderson, US 60 (known as Green Street) is characterized by both commercial and residential development, and is comprised of a four-to-five lane roadway. US 60 provides access to the Henderson City-County Airport, Henderson Community College, and the Henderson Riverport Authority, as well as the nearest downstream Ohio River bridge at Uniontown in Union County. US 41A serves as an alternate route to US 41 and the Breathitt Parkway and connects Henderson to the communities of Providence in Webster County, and Madisonville in Hopkins County, where it ties into the Breathitt Parkway.

Rail Service: No passenger rail service is provided in the Evansville/Henderson Metropolitan Planning Area. CSX as well as the Norfolk Southern rail line, the Indiana Southwestern rail line and the Indiana Southern rail line provide freight rail service.

Airports: The Henderson City-County Airport and the Evansville Regional Airport provide the primary air service in the region. The Evansville Regional Airport is located on 1,300 acres just north of Evansville. It is run by the Evansville-Vanderburgh Airport Authority District and provides over 35 daily departures to seven hub airports. The Henderson City-County Airport has one runway and provides charter airplane and helicopter services.

Port Facilities: There are two major port facilities for major water carriers along the Ohio River in the project study area—the Henderson County Riverport Authority/Port of Henderson and the Southwind Maritime Center in Posey County, Indiana east of Mt. Vernon.

4.1.7 Utilities

The following utility companies are the primary providers of utilities within the project corridor:

- Electric—Henderson Municipal Power and Light; Vectren Energy Delivery in Evansville and Newburgh
- Gas—Henderson Municipal Gas; Vectren Energy Delivery in Evansville and Newburgh
- Water/Wastewater—Henderson Municipal Water Utility, Henderson County Water District; Evansville Water Sewer Utility; Newburgh Sewer Department; and Indiana-American Water Company, Inc in Newburgh, Chandler Water Utility

4.1.8 Parks and Recreational Facilities

Numerous local parks and recreational facilities exist within both Evansville and Henderson ranging from small neighborhood parks consisting simply of green space or playground equipment to substantial complexes of sports fields, golf courses, an indoor ice rink, indoor and outdoor pools, nature preserve areas (including walking trails) and dedicated bicycle and pedestrian trails. Both Evansville and Henderson have riverside parks, which include boat launching facilities on the Ohio River. The Ohio River receives substantial recreational boating use throughout the project study area in the summer months and is also used extensively for recreational fishing.

Outlying county parks are primarily limited to Burdette Park in southwest Vanderburgh County. The facilities at Burdette Park include an outdoor pool with waterslides; miniature golf; campground; cabins and shelters; BMX bicycle track; and a fishing lake.

The only Kentucky state park within the project study area is John James Audubon State Park, located just north of Henderson between US 41 and Green River Road. Comprising approximately 700 acres, the park includes a nature preserve (325 acres); 6.5 miles of hiking trails including 2.7 miles of back country trails; two lakes including a 28 acre recreational lake open to fishing, swimming and paddle boats; a beach and bathhouse; campground; cottages; 9-hole golf course; tennis court; and the John James Audubon Museum and Nature Center.

The only Indiana state historic site located within the project study area is Angel Mounds State Historic Site, located on Pollack Avenue between Evansville and Newburgh. This National Landmark encompasses approximately 500 acres and is primarily devoted to the preservation of the artifacts from a Native American village site, which once occupied the location. Angel Mounds includes a museum and interpretive center and interpretive trails that lead around some of the mounds at the site. In addition, the site includes recreational trails for walking and bicycling as well as a nature preserve (63 acres).

Other state owned and managed properties, which provide outdoor recreational opportunities in the project study area, include the Sloughs Wildlife Management Area west of Henderson, the Green River State Forest northeast of Henderson, and the Blue Grass Fish and Wildlife Area northeast of Evansville. These properties are managed for outdoor recreation such as hunting, fishing, hiking, and wildlife observation. The Sloughs Wildlife Management Area is owned by the Kentucky Department of Fish and Wildlife Resources and the U. S. Army Corps of Engineers and all tracts are managed by the Kentucky Department of Fish and Wildlife Resources. The Wildlife Management Area contains approximately 10,000 acres in six separate units primarily in northwest Henderson County and northeast Union County, Kentucky. The area contains 41 permanent waterfowl hunting blinds, nine (9) boat launching facilities and six (6) wildlife observation towers. The majority of the Sauerheber Unit along KY 268 is closed to the public from November 1 through March 15 to serve as a waterfowl refuge. This unit serves as a wintering area for approximately 25,000 geese and 15,000 ducks.

The Blue Grass Fish and Wildlife Area is owned and managed by the Indiana Department of Natural Resources Division of Fish and Wildlife. The Fish and Wildlife Area includes approximately 2,500 acres in western Warrick County, Indiana located approximately a half mile from I-164. The area contains approximately 600 acres of water in 28 lakes and pits and includes multiple boat launching facilities.

The Green River State Forest is still in the development stage and currently includes two tracts totaling approximately 840 acres located along Green River Road and Tscharner Road in north central Henderson County, Kentucky. The property is owned and managed by the Kentucky Division of Forestry. The currently owned property is managed for multiple uses and is open to the public for recreational uses including hiking, hunting, and fishing. There are currently no facilities on the property. Other management goals for the property include protection and re-establishment of bottomland hardwood forests for wildlife habitat including the copperbelly water snake and the protection of the unique habitat of the cypress slough located near the mouth of the Green River. Currently, approximately 112 acres have been planted with trees for reforestation. The planned purchase area for the forest includes nine additional tracts that would expand the State Forest to a total area of approximately 2,820 acres encompassing the majority of the existing Cypress Slough.

National wildlife refuges currently do not exist in the project study area. However, the proposed Green River National Wildlife Refuge is located in northern Henderson County, Kentucky. The proposed acquisition boundary for the Refuge encompasses approximately 23,000 acres divided into three units with varying priority. This boundary stretches along the Ohio River from the Horseshoe Bend north of Henderson east nearly to the Henderson/Daviess County line and also includes a large portion of the Green River Island on the north bank of the Ohio River. This boundary also encompasses a majority of the property identified in the Green River State Forests acquisition plans. The Final Environmental Assessment and Land Protection Plan for the Proposed Establishment of Green River National Wildlife Refuge has been approved with a Finding of No Significant Impact (FONSI). However, the Refuge has not been formally created by the U.S. Fish and Wildlife Service, and no property has been purchased. Once developed, the Refuge would provide outdoor recreational opportunities such as hunting, fishing, and wildlife observation.

4.1.9 Neighborhoods and Communities

Evansville, Indiana, is the county seat of Vanderburgh County and Henderson, Kentucky, is the county seat of Henderson County. As the seats of local government and the largest cities in their respective counties, they are home to the majority of the region's public/community resources and services.

The Evansville-Vanderburgh School Corporation operates a total of 42 public elementary, middle and high schools, and learning centers in Evansville. The Roman Catholic Diocese of Evansville has 27 elementary, middle and high schools, 13 of which are in Evansville, one of which is in Newburgh (just west of the project study area), and the remainder being outside the project study area. The Lutheran Schools of Indiana maintain 3 facilities for preschool/kindergarten through grade eight. In addition, there are 11 non-public schools ranging from preschool through grade 12. The city is also home to the University of Southern Indiana, enrollment approximately 9,400; the University of Evansville, enrollment approximately 2,900; and Ivy Tech State College, enrollment approximately 2,900.

The Henderson County Board of Education operates a total of 13 public elementary, middle, and high schools, all but two are located within the City of Henderson. Also located in the city are a parochial elementary school, a Christian school, a vocation school, and Henderson Community College, enrollment approximately 1,600, and a member of the Kentucky Community and Technical College System.

The Methodist Hospital, Henderson's largest health care facility, provides a full range of medical services from its main campus on Elm Street and several other locations in the community. The hospital's services include a rehabilitation center, a childcare facility, an ambulance service, and a counseling center; as well as a wide range of other community and regional outreach programs. With more than 1,000 beds, Evansville's two other major hospital systems—Deaconess Hospital and St. Mary's Hospital—provide a full range of medical services to the city and the region. Deaconess Hospital is an acute care, teaching hospital, serving residents of southern Indiana, southeastern Illinois, and western Kentucky. St. Mary's Medical Center is a 392-bed tertiary care center that offers a wide range of inpatient services as well as outpatient and ambulatory care. In addition, Evansville has two psychiatric hospitals—the Evansville Psychiatric Children's Center and the Evansville State Hospital—which provide services on an inpatient or outpatient basis. Various diagnostic centers and medical facilities throughout the area offer specialized care.

There are a number of cultural attractions in the project study area—including theaters, parks, art centers, libraries, and museums in Evansville and Henderson. Henderson, located on the Ohio and Green Rivers, is a popular location for boating, fishing, and waterfowl hunting. The Hays and Water Street boat ramps provide public access for water sports activities on the Ohio River. The Sloughs Wildlife Management Area, a total of nearly 10,000 acres at three locations along the Ohio River, is a popular destination for hunting, fishing, camping, and hiking. Other recreational venues in the area include: the 700-acre Audubon State Park, Museum and Nature Center, and Golf Course; Central Park, Community Park; Ellis Park Racetrack (thoroughbred horse racing); Atkinson Park, River Walk and Municipal Golf Course; and Green River State Forest. In Indiana, recreational areas include Burdette Park, William J. Moutoux Park, Wesselman Park Woods, Blue Grass Creek Fish and Wildlife Area, and Angel Mounds State Historic Site.

4.2 HISTORIC SETTING

4.2.1 National Landmarks

The Angel Mounds State Historic Site, a National Landmark, consists of approximately 600 acres listed on the National Register of Historic Places (NRHP) as well as approximately 10 acres northeast of the NRHP boundary and approximately 98 acres west of the NRHP boundary. While the NRHP boundary will be included as a Section 4(f) resource, the recreational aspects of the entire State Historic Site are considered for Section 4(f) resource potential. During the development of alternatives, regular coordination occurred with Angel Mounds State Historic Site regarding the location of I-69 alternatives. Currently, recreational use including hiking and bicycling trails exists within the area identified as the NRHP boundary. This recreational use would be considered as a Section 4(f) resource, regardless of the historic status of the property. Additionally, the 98 acres recently purchased west of the NRHP boundary may potentially be converted to recreational use in the future. The development of recreational trails within this additional property would expand Section 4(f) applicability to this tract as well. Currently there is no recreational use and no plan for recreational use in the tract located northeast of the National Register boundary. No land currently owned by Angel Mounds State Historic Site will be used by the proposed project.

4.2.2 Historic and Archaeological Resources

Section 106 of the National Historic Preservation Act (NHPA) of 1966 regulates properties that are listed in, or eligible for, the National Register of Historic Places (NRHP), also referred to as simply the “National Register”. According to the opening paragraph of the NHPA, “the historical and cultural foundations of the nation should be preserved as part of our community life and development in order to give a sense of orientation to the American people.” Further, the federal government has a responsibility “to foster conditions under which our modern society and our prehistoric and historic resources can exist in productive harmony.” [16 U.S.C. 470b(2)] As a result of the NHPA, as amended, and 36 CFR Part 800 (Revised January 2001), federal agencies are required to take into account the impact of federal undertakings upon historic properties in the area of the undertaking.

The following sections discuss the existing historic and archaeological resources in the I-69 Henderson to Evansville project study area, including data sources and data collection methodology.

Historic Resources

Kentucky
In order to locate individual sites or structures on the National Register within the I-69 project study area in Kentucky, a records examination was conducted. This included reviews of the Henderson County files at the Kentucky Heritage Council in Frankfort and the Department of the Interior’s National Register Information Service (NRIS) Internet site.

A literature search on the Kentucky portion of the proposed project study area was conducted in Special Collections and Map Collection in the Margaret King Library at the University of Kentucky, the library of the Kentucky Historical Society in Frankfort, and the Henderson County Public Library in Henderson. To locate sites with National Register potential, a windshield survey was conducted on the Kentucky side of the project study area, in the summer of 2002.

Indiana
In Indiana, Interim Reports were searched as a baseline for information pertaining to possible historic properties. Interim Reports, published on a county-by-county basis by the Indiana Department of Natural Resources Division of Historic Places and Archaeology, evaluate historic properties as Outstanding, Notable, and Contributing. The literature search for Indiana properties was conducted at the Indiana State Library, local libraries, historical societies, and local government offices. While conducting fieldwork for this portion of the proposed project, photographs were taken for further determination of properties.

Historic properties currently listed on the National Register are mapped on **Figure 4-6** and tabulated in **Appendix C-5.**

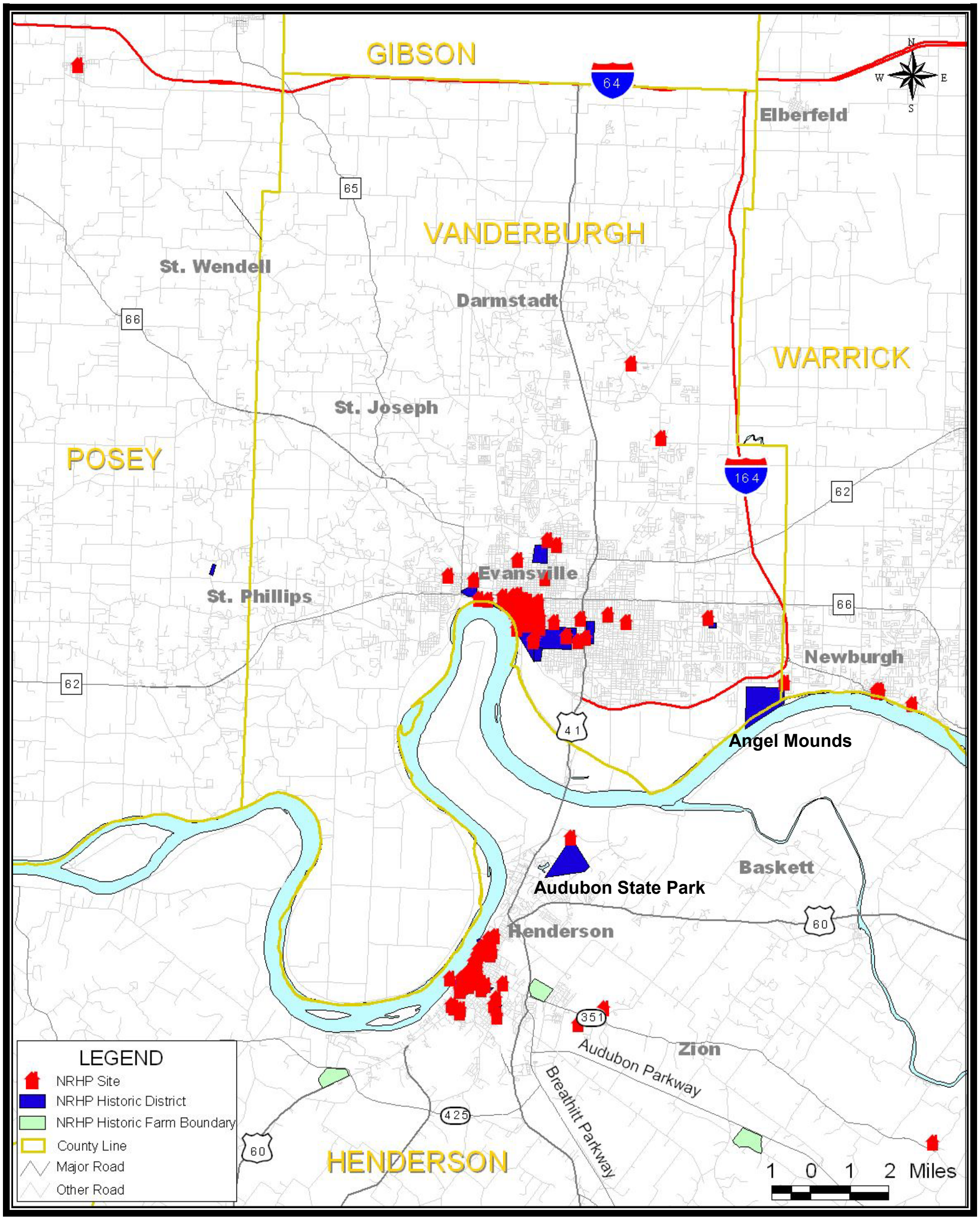


Figure 4-6: National Register of Historic Places (NRHP) Sites

Archeological Resources

Kentucky

To assess the archaeological potential of the proposed action, a search of several databases was made in order to determine the extent of previous research both in and around the project study area. Background research was initially conducted for the 10 initial 2,000' wide study corridors (A-J) under consideration. The complete collection of archaeological reports for Henderson County at the Office of the State Archaeology (OSA), the State Historic Preservation Plan (Pollack 1990), and portions of the collections of microfiche, reports, and curation collections at the University of Kentucky, were examined in order to locate references to previous archaeological work in the project study area. Other research was conducted at the Special Collection and Archives and the Map Collection at the King Library, University of Kentucky. Resources at the Geological Sciences Building, University of Kentucky were also examined. Finally, historical materials were also examined at the Kentucky Historical Society in Frankfort.

Documents examined at the Special Collections and Archives included published histories, such as *Starling's History of Henderson County, Kentucky* (1887), and Dannheiser and Hazelwood's *The History of Henderson County, Kentucky* (1980). Other documents examined included Griffings' *An Illustrated Historical Atlas of Henderson and Union Counties, Kentucky* (1880). Documents examined at the Map Collection included 15' USGS Quadrangle maps for the region, as well as the 1937 and 1952 county highway maps for Henderson County. Documents examined at the Kentucky Historical Society included the Henderson County Historical Society's publication *Gone But Not Forgotten, Cemetery and Grave Plots in Henderson County, Kentucky* (1982). These documents were used to assess the potential for historic archaeological sites, including farmsteads, house sites, and cemeteries within the proposed corridors.

The Kentucky Office of State Archaeology files record 865 sites in Henderson County. Background research indicates that 105 archaeological sites are recorded within 2.0 km of the project study area. Eighty of these archaeological sites are prehistoric, 17 are historic, and 8 are of mixed prehistoric and historic sites.

Based on the results of the archaeological site file review, there is a higher potential for prehistoric archaeological sites of all periods in upland contexts; fewer sites are found in valley bottom settings. However, sites dating to the Late Prehistoric are more likely to be found in valley bottom settings on floodplains, terraces, or along the margins of sloughs. Because soils in the upland context are either eroded, or derived from loess, the potential for buried archaeological sites in this area is low. Therefore, prehistoric archaeological sites are most likely to occur in-surface or near-surface contexts. There is a higher potential for buried archaeological deposits in valley bottom settings, subject to periodic flooding from the Ohio and Green rivers. Also, the potential for buried archaeological sites increases near transitional landforms between valley bottom and upland contexts. Colluvial deposition may result in burying prehistoric archaeological sites.

Indiana

The archaeological records check and literature search for this project utilized the resources of several organizations and facilities in order to provide a complete and comprehensive view of the existing known prehistoric and historic archaeological sites present within the I-69 project study area. In addition, previous archaeological research and compliance projects within and around the proposed corridors were examined in order to facilitate the determining of the archaeological potential for the current project study area.

The primary data for this project was obtained from the archaeological site forms, computer database, topographic maps, and report files at the Indiana Department of Natural Resources and the Kentucky Division of Historic Preservation and Archaeology (IDNR and DHPA). Reports concerning previous archaeological work in the area on file at Landmark Archaeological and Environmental Services, Inc., which would contribute to the understanding of the archaeological nature and potential of the project study area, were also examined.

The cemetery data for Posey, Vanderburgh, and Warrick Counties was obtained from the cemetery database records at the IDNR, DHPA, the USGS 7.5 Minute topographic maps, and the County Interim Reports. This was done in order to assist in the recommendations of avoidance for the known historic cemeteries affected by the study corridors. The cemetery database has to date only been completed for Vanderburgh County, so the records for Posey and Warrick Counties are rather limited at this time. The database is currently in progress for Posey County.

From searching the previously recorded databases approximately 236 archaeological sites are recorded within one mile of the project study area. Two hundred and two of these archaeological sites are prehistoric, 15 are historic, and 19 are of mixed prehistoric and historic sites. With respect to landforms, 39 percent of the sites are located on bottomlands or on floodplains. Forty-one percent of the sites are located on terraces or side slopes and 20 percent of the sites are located on uplands. Background research indicates that several prehistoric and historic archaeological sites have been recorded within the boundaries of the proposed alternatives.

4.3 PHYSICAL FEATURES AND NATURAL ENVIRONMENT SETTING

4.3.1 Climate and Physiography

The I-69 project study area is mid-continental and can experience great contrasts in temperature. Generally, summers are warm and winters mild, but extremes in temperature occur. In Henderson County, the average daily maximum temperature is 90 degrees F in July and the average daily minimum temperature is 27 degrees in January. For the four counties that comprise the Indiana project study area, the average daily maximum temperature is also 90 degrees F in July, but the average daily minimum temperature is 26 degrees in January.

The average length of the growing season in Henderson County, from the last freezing temperature in spring to the first in fall, is about 198 days. On the Indiana side of the project study area, the average length of the growing season is about 189 days.

Average rainfall on both sides of the Ohio River is very similar. Henderson County has an average annual rainfall of almost 46 inches while the Indiana side of the Ohio River experiences approximately 41.6 inches of rainfall. While the rainfall is slightly heavier in spring and summer than in fall and winter, the rainfall is fairly well distributed throughout the year. As with rainfall, the average yearly snowfall is similar on both sides of the Ohio River. Henderson County experiences an average snowfall of 11 inches per year while the Indiana side experiences an average of 13 inches.

Most of Posey and Gibson County and a small part of Vanderburgh is located within the Wabash Lowland physiographic region of Indiana. A great deal of Vanderburgh and all of Warrick County is located in the Boonville Hills physiographic region. Much of the overall land uses and landscapes remain the same throughout the project study area.

The Wabash Lowland region consists of portions of 12 southwestern Indiana Counties. This region is the largest of the southern Indiana regions and was completely covered by the Illinoian Glacier. Land use is essentially agriculture, with some forestland (mostly floodplain forests), extensive wetlands, and coal mining in the southern counties.

The Boonville Hills region extends into six counties in southern Indiana. This region is slightly hillier than the adjacent Wabash Lowland Region, possibly because it has not been glaciated.

Strip mining has been extensive in this region, and there are large areas of reclaimed or modified land in the eastern portion. Land use in Boonville Hills includes farmland, forest, and mining.

The Western Coal Field region encompasses 17 counties in western Kentucky and covers an area of 16,576 square kilometers (6,400 square miles). The terrain is rolling to hilly, but the topography is much less rugged and the elevations much lower than the eastern Kentucky counterpart (Mc Grain, 1983). Land use in this region includes farming, forestlands, and mining.

Posey County is located at the southern tip of Indiana where the Wabash and Ohio Rivers converge. This county is typified by gradual rolling hills and flat plains. Farming is the largest land use in the county. The elevations range from 400 to 550 feet (Clements, 1987). Major drainage basins in the county are the Big Creek, Wabash, and Ohio rivers.

Gibson County is located directly north of Posey County. This county is characterized by mostly level terrain along with moderate to steep slopes surrounding these flat areas. Elevations range from 400 to 550 feet (Clements, 1987). Major drainages in the county include the Wabash, White, and Patoka rivers.

Vanderburgh County is located in the southwest portion of Indiana bordered by the counties of Warrick, Posey, Gibson, and the state of Kentucky to the south. This county is mostly uplands with a small amount of bottomlands near the Ohio River. Elevations range from 375 to 500 feet (Clements, 1987). Major drainages include Pigeon Creek and the Ohio River.

Warrick County is located east of Vanderburgh County and bordered by the Ohio River to the south. This county's landscape is slightly hillier than the other three Indiana counties with flat level land around drainage areas. The elevations range from 350 to 550 feet. Drainage basins in the county include Pigeon Creek and the Ohio River.

Henderson County is located in the southern region of Kentucky bordered to the north by the Ohio River. This county is a rolling to hilly area, well dissected by normal stream erosion (McGrain and Currens, 1978). Elevations range from 331 to 588 feet. Major drainage basins are Canoe Creek and the Ohio River.

4.3.2 Soils and Geology

In southern Indiana, the I-69 project study area is underlain by Pennsylvanian age bedrock of the McLeansboro and Carbondale Groups, consisting primarily of shale, sandstone, shaly sandstone, and thin layers of limestone and coal. Nowhere in the project study area is bedrock exposed, having been overlain by lacustrine, alluvial, and unconsolidated loess deposits. In general, the lower part of the McLeansboro Group outcrops in eastern Posey County as well as west, central, and northern Vanderburgh County. It is within this strata that the West Franklin Limestone Member defines the contact between the Patoka and Shelburn Formations. There are as many as fourteen coal seams in the McLeansboro group, but most have not been mined (Camp, 1999). The Carbondale Group is comprised of shale, sandstone, limestone, clay and includes four of the five most productive coal seams in the state (Camp, 1999). Within this group the Springfield Coal Member (Coal V) defines the contact between the Dugger and Petersburg Formations, while the Survant Coal Member (Coal IV) forms the contact between the Petersburg and Linton Formations. The Carbondale Group forms the uppermost bedrock layer in the Union Township area of southwestern Vanderburgh County, southeast and eastern Vanderburgh County and nearly all of southwestern Warrick County. In northern Henderson County, the Lisman formation is mapped as the upper strata bedrock layer (Johnson, 1973). This strata is also almost completely concealed by alluvium and loess.

Two principal fault systems are located within or near the project study area. The Wabash Valley Fault System extends from Illinois and Kentucky northeastward into Posey and Gibson counties. It consists of subparallel high-angle normal faults with vertical displacements up to 480 feet. The east-west oriented Rough Creek Fault Zone consists of wrench, normal, and reverse faults, and extends roughly 100 miles across western Kentucky and on into southern Illinois. Faults of this system traverse the northern half of Webster County, but do not extend into Henderson County.

Unconsolidated lacustrine deposits from ancient lakes consisting of clay, silt, and sand blanket various areas of southwest Indiana and Henderson County in Kentucky. A large portion of southeastern Vanderburgh County (including the east side of Evansville) and southwestern Warrick County is covered by lacustrine deposits (Gray et al., 1970). These deposits extend northward through both counties within the Locust Creek, Little Pigeon Creek, Bluegrass Creek and Pigeon Creek watersheds. Lacustine deposits are also associated with the Big Creek and Barr Creek watersheds in Posey County and northwestern Vanderburgh, the Little Creek/Wolf Creek drainages of Posey and Vanderburgh counties, as well as Bayou Creek tributaries in southwestern Vanderburgh County.

Alluvial deposits from rivers and streams occur throughout the Ohio River and Green River floodplains as well as the within the valleys of most moderate to large streams within the project study area. In Indiana, these silt, sand, and gravel deposits are most extensive throughout the oxbow region of southwestern Vanderburgh County, and the floodplain south of I-164 in southeastern Vanderburgh County (Gray et al., 1970). In Kentucky, alluvium up to 135 feet thick covers the Lisman Formation and encompasses most of the City of Henderson as well as the stream valleys formed by Canoe Creek, Wilson Creek, Elam Ditch, North Fork, and Race Creek. The rolling hill areas of Posey, Vanderburgh, Warrick, and Henderson counties are covered with loess (windblown) deposits of silt, fine sand, and clay. In Henderson County, this layer is between 30 and 50 feet thick (Johnson, 1973).

Soil associations within the Indiana portion of the I-69 project study area include Zipp-Patton-McGary, Wakeland-Stendal-Birds, Huntington-Lindside, Weinbach-Wheeling, Weinbach-Ginat-Elkinsville, Nolin-Newark-Petrolia, and Wakeland. The Kentucky portion of the project study area encompasses portions of five different soil associations: Huntington-Egam-Newark, Ginat-Melvin, Uniontown-Dekoven-Henshaw, Loring-Grenada, and Memphis-Wakeland.

In general, the bottomland areas associated with the Ohio River and Green River are typified by deep, level to nearly level, moderately well drained to poorly drained soils formed in alluvium. These soils are typically fine grained ranging from fine sandy loams to silty clay loams. The native vegetation was mixed hardwoods; however, the majority of these soils have been cleared and converted to agricultural use with the exception of some of the poorly drained areas where sloughs are prevalent.

The soils associated with the larger tributaries in the project study area such as Canoe Creek, Pigeon Creek, and Big Creek are medium to fine textured silty soils. They are nearly level moderately poorly drained to poorly drained soils formed in alluvium and lacustrine sediments. Native vegetation included grasses, sedges, swamp forests, and mixed hardwoods. These soils are also extensively used for agriculture.

The upland areas are predominantly deep, well drained, nearly level to strongly sloping soils formed primarily in loess with the underlying material consist typically of sandstone and shale. These medium textured soils typically have a silt loam surface layer. In Kentucky, loess covering the broad ridgetops, flats, and gently rolling hills of the Loring-Grenada association is as much as 50 feet thick. In Indiana, loess is generally 4 to 8 feet thick in most of the associations. These loess based soils vary in composition and structure depending on topography (e.g. broad, gently rolling ridgetops in Posey County and northern Vanderburgh County versus steeper, more strongly dissected ridges in central Vanderburgh County). Nearly all of these upland soils are utilized widely for agriculture where slopes are not excessive. Steeper sloped areas are typically wooded but are sometimes maintained as pasture.

4.3.3 Water Resources

Watersheds

The Ohio River drains 203,910 square miles in all or portions of 14 states (Alabama, Georgia, Kentucky, Indiana, Illinois, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia). The river traverses some 981 miles in a generally southwesterly direction from its beginning at the confluence of the Monongahela and Allegheny Rivers in Pittsburgh, Pennsylvania to the mouth near Cairo, Illinois where it flows into the Mississippi River. A series of 20 locks and dams constructed and operated by the U.S. Army Corps of Engineers are used to control the river elevations and maintain navigability of the entire 981 mile length. In addition to the series of locks and dams, dredging of the channel is also performed by the USACE to facilitate navigation.

The growth of cities such as Evansville and Henderson are due much to the historic use of the Ohio River as a transportation route. The Ohio remains an important artery for the shipment of bulk products such as coal, gravel and petroleum products. The Ohio carried 215 million metric tons of cargo in 1994.

The Ohio River ultimately drains the entire project study area; it is a low gradient stream that meanders through a broad alluvial floodplain valley. Flow in the river is controlled by the series of locks and dams. The section of the river within the project study area is controlled by the Uniontown Dam, with a normal pool elevation maintained at 342 feet above mean sea level. Monthly average flows at Evansville ranged from 70,561 to 201,143 cubic feet per second (cfs) over the first half of 2001. Flows during the first half of 2001 were below the 10-year average; however, they were close to the long-term averages of the river.

The Green River is a major tributary that flows into the Ohio River in the project study area at Ohio River Mile (RM) 784. The Green River drains a large portion of central Kentucky with a drainage area of 9,230 square miles extending into northern Tennessee. The Green River is also level controlled by a series of locks and dams. Lock and Dam Number 1 is within the project study area located just south of the US 60 crossing near Spottsville at Green RM 9.1. The primary area of study for this project is downstream of this dam where the pool level is controlled by the Ohio River. The pool elevation of the Green River in this location is also 342 feet above mean sea level.

Other larger tributaries draining the project study area include Canoe Creek, Pigeon Creek, and Big Creek. Canoe Creek drains 120 square miles in central Henderson County, including the majority of the project study area in Kentucky. Canoe Creek flows into the Ohio River just southwest of Henderson, near the west end of Henderson Island. Pigeon Creek drains the majority of the northeast portion of the project study area. Its drainage area is 375 square miles and the majority of the existing I-164 is contained within this drainage. Pigeon Creek flows into the Ohio River just west of downtown Evansville at the north point of Horseshoe Bend. Big Creek drains the majority of the northwest portion of the project study area within its 302 square mile drainage area. The Big Creek drainage area is the only portion of the project study area that is not directly a tributary to the Ohio or Green rivers. Big Creek flows west into the Wabash River prior to becoming tributary to the Ohio River.

Other smaller tributaries within the project study area include Race Creek, Lick Creek, Eagle Creek, and Bayou Creek. Race Creek and Lick Creek are both direct tributaries to the Green River and drain the eastern portion of the project study area in Kentucky. Eagle Creek drains a large portion of the floodplain area on the southeast side of Evansville. Bayou Creek drains the northern portion of the floodplain area that makes up southwest Vanderburgh County as well as the adjacent uplands.

The primary threats to surface water quality in the project study area include siltation and nutrient loading from agricultural runoff, petroleum products and heavy metals from urban runoff, nutrients, Biochemical Oxygen Demand (BOD) and bacteria from municipal wastewater, and brine from oil and gas extraction. The large volume of agricultural land in the project study area generate significant portions of the total runoff discharge to surface waters providing an opportunity for erosion and fertilizer runoff to affect surface waters in the absence of conservation tillage, filter strips, and grassed waterways. The large urban areas of Evansville, Indiana and Henderson, Kentucky include high percentages of impervious surfaces such as roofs, parking lots, and roadways that increase the runoff rate and incorporate automobile contaminants such as oil, grease, and heavy metals as well as industrial pollutants in the runoff discharging to surface waters. Additionally, municipal sewage discharges from these large cities generate discharges to surface waters from both treated effluent discharges and untreated discharges from combined sewer overflows, which contain both nutrient loading and pathogenic organisms. Oil fields in the western portion of the project study area both south and north of the Ohio River present the opportunity for brine contamination from mineral extraction.

Impaired Streams

Indiana and Kentucky have each developed a surface water quality monitoring strategy to assess the quality of each states ambient waters. Five basin management units established for each state will sequentially enter a five-year rotating schedule to gather data, assess the results, identify and prioritize troubled watersheds, develop Action Plans and execute the recovery strategies recommended in the plans.

The Ohio River has experienced point and nonpoint source pollution pressures due to land use practices along its banks throughout much of its post-settlement history. Within the I-69 project study area there is a fixed monitoring station at Evansville that continuously records water quality data on the river. Kentucky's 2002 303(d) Report listed the entire 664 mile reach of the Ohio River along its border as either a 1st Priority or 2nd Priority impaired segment, citing polychlorinated biphenyls (PCBs), dioxin, mercury and pathogens as parameters of concern. In Kentucky's 1998 303(d) Report the Ohio River was designated as "partial support" for fish consumption due to levels of chlordane and PCBs in fish. Fish that are most affected by these contaminants are scavengers or bottom feeders that sift through these sediments to find food (i.e., carp, paddlefish, channel catfish, flathead catfish, freshwater drum). In their 2002 303(d) Report Kentucky documents their request to EPA and subsequent approval to delist the Ohio River along Kentucky's border for chlordane. Indiana's 2002 303(d) Report also lists the entire 356 miles along its border as impaired, citing PCBs, dioxins and pathogens as the parameters of concern. According to the 1998 Indiana 303(d) the severity of the impairment is "medium". Despite delisting for chlordane, fish consumption advisories on the Ohio River continue to be in effect in both states for elevated levels of PCBs.

The I-69 project study area segment of the Ohio River from Newburgh, Indiana (RM 791.5) to Uniontown, Kentucky (RM 846.0) is one of three segments of the river that have been designated as a 1st Priority impairment by the Kentucky Division of Water. The impaired uses within this 54.5 mile section include swimming (nonsupport) and fish consumption (partial support). PCB's and pathogens (i.e., *E. coli.*) are listed as the parameters of concern. Suspected sources leading to impairment are combined sewer overflow, urban runoff/storm sewers, land disposal, agriculture, municipal point sources, industrial point sources, and contaminated sediments (sediment resuspension). **Table 4-6** lists the 303(d) listing in the project study area.

Groundwater

Most water in the project study area comes from local precipitation, which either evaporates, runs off into streams, or soaks into the soil. Water that moves through the soil is partially evaporated and partially intercepted by plant roots and transpired. The remainder continues downward to the water table and becomes part of the groundwater body. Under natural conditions, this is discharged by two main methods: (1) through springs or seeps into surface water bodies; or (2) through evapotranspiration. In dry weather, the principal source of stream flow is the discharge of groundwater.

Table 4-6: 303(d) Listings within Project Study Area

Waterbody	Major Basin	County	Parameter of Concern	Year Placed on 303(d)	Designated Uses
Indiana					
Little Creek- Lower	Lower Wabash	Posey	Nutrients pH	2002	N20, X21, X42
Little Creek- Wolf Creek	Lower Wabash	Posey	Impaired Biotic Comm.	2002	N20, X21, X42
Pigeon Creek- Harper Creek	Ohio Trib.	Vanderburgh	PCBs DO TDS Pathogens	1996	N20, N42, P21
Pigeon Creek- Kleymeyer Park	Ohio Trib.	Vanderburgh	PCBs Sulfate DO TDS Pathogens	1996	N20, N42, N21
Pigeon Creek- Crawford Brandies Ditch	Ohio Trib.	Vanderburgh	PCBs	1996	N20, P21, X42
Pigeon Creek- Locust Creek	Ohio Trib.	Vanderburgh	PCBs	1996	N20, P21, X42
Ohio River- Green River to Evansville	Ohio River	Vanderburgh	PCBs	1998	P21, X20, X42
Ohio River- Evansville to Uniontown	Ohio River	Vanderburgh/ Posey	PCBs Pathogens	1998	N42, X21, X20
Kentucky					
Ohio River – RM 776.1 to 791.5	Ohio River	Henderson	PCBs Pathogens	1998	PS, PF
Ohio River - RM 791.5 to 846.0	Ohio River	Henderson/ Union	PCBs Pathogens	1998	NS, PF
Lick Creek	Ohio River	Henderson	Siltation	1998	NA

Indiana		Kentucky	
F = full support P = partial support N = non-support X = not evaluated	20 = aquatic life use 21 = fish consumption 42 = recreation use	P = partial support N = non-support	A = aquatic life F = fish consumption S = swimming

Groundwater occurs in openings of consolidated sedimentary Pennsylvanian age rock and unconsolidated Quaternary age sediments. The amount of water that can be stored in the rocks and the rate at which it can flow to replenish wells and springs depends on the nature of the material (i.e., unconsolidated sand and gravel, sandstone, siltstone, shale, limestone, and coal) and the extent of fracturing, jointing or faulting of consolidated bedrock. The primary aquifer for major water production in the project study area is the unconsolidated, buried sand and gravel aquifer associated with the Ohio River. The zone of outwash and alluvium that contain this aquifer are limited to the Ohio River valley and along the lower reaches of some of the major tributaries. The aquifer is 35 to 150 feet thick and is typically covered by 10 to 30 feet of silt, fine sand, and clay. However, the depth to the aquifer can be as much as 100 feet. The aquifer thins near the edges of the river valley and in the vicinity of the tributaries, and is non-producing because of fine grained deposits in these areas. Some low-yielding units do however occur in these areas. This aquifer is the most productive in the project study area and good wells can produce up to 2000 gallons per minute; however, yields are typically only several hundred gallons per minute. This aquifer is used for both municipal and industrial water supplies in and around the project study area.

Sandstone aquifers with laterally discontinuous sandstones in the Mansfield Formation at the base of the Raccoon Creek Group are also substantial sources of water. Yields of as much as 75 gallons per minute have been produced by some wells; however, typical values are less than 20 gallons per minute. The quality of this ground water typically decreases with depth, but the depth can be highly variable. Freshwater has been found in Vanderburgh County in sandstone at depths of 500 feet, but at 800 feet depth the water was too highly mineralized for domestic consumption. Additionally, some sandstone aquifers are available at the bedrock surface for water production. These aquifers are typically smaller and are recharged more quickly by precipitation infiltration than the deeper sandstone aquifers. Another much less productive aquifer is in complexly interbedded sandstone, shale, limestone, and coal. The production units are highly variable across this aquifer with yields typically less than two (2) gallons per minute ranging up to 20 gallons per minute.

Water Supply

Sole source aquifer areas are designated by the USEPA for aquifers which are the sole or principal drinking water source for the area and, which if contaminated, would create a significant hazard to public health. In Indiana the St. Joseph Aquifer System in northern Indiana was entered into the program in 1988 (53FR23682) and is currently the only designated sole source aquifer in Indiana. This area is well outside the I-69 project study area and there are currently no sole source aquifers designated within Kentucky.

The water supply for the project study area is currently provided by three public water utilities and private wells. The Henderson Municipal Water Utility is the only water producer in Henderson County and serves 1,704 total residents. An additional 19,629 residents are served by the Henderson County Water District which purchases wholesale water from the Henderson Municipal Water Utility and then distributes and resells the water to outlying areas of the county. Between these two utilities, essentially all of the Kentucky project study area is provided with public water service.

The current design capacity of the Henderson Water Treatment Plant is 12.0 million gallons per day. The original Henderson Waterworks was constructed in 1875-1876. The current plant was originally constructed in 1961 and expanded in 1990. Treated water is pumped into the distribution system, which has a total combined storage capacity of 7.58 million gallons in six tanks. In addition, the Henderson County Water District has 1.65 million gallons of total combined storage capacity.

The Evansville Water Utility produces water for the majority of the project study area in Indiana. It serves 150,000 residents of the Evansville area. The Evansville Water Utility also wholesales water to four other water utilities that distribute and resell the water to outlying areas of Vanderburgh County as well as to western Warrick County, southern Gibson County, and into eastern Posey County, comprising the majority of the project study area in Indiana.

The current design capacity of the Evansville Water Filtration Plant is 60 million gallons per day, with current demand and production at about 32 million gallons per day. The Evansville water distribution system has approximately 8.5 million gallons of storage capacity. Additional storage capacity is also included in the secondary systems distributing water from the Evansville Water Utility.

The Chandler Water Utility is the third water producer in the project study area. It serves 15,700 residents in southwestern Warrick County. The raw water supply is provided by 6 wells drawing water from the Ohio River Aquifer. The capacity of the treatment plant is 3.0 million gallons per day. The distribution system includes 1.434 million gallons of storage capacity.

No wellhead protection area has currently been developed for the Chandler Water Treatment Plant; however, a default buffer distance of 3,000 feet has been used to approximate potential wellhead protection area limits.

The primary portion of the project study area that is not currently served by a public water utility is the southwestern portion of Vanderburgh County and the southeastern portion of Posey County in Indiana. Residents in this area are dependant on private single household wells or other sources for water.

Floodplains

Floodplains are a vital part of the river or stream ecosystem. They act as flood buffers, water filters, nurseries, and are major centers of biological life in the river or stream ecosystem. They are important for maintenance of water quality as they provide fresh water to wetlands and backwaters, dilute salts and nutrients, and improve the overall health of the habitat of many species of birds, fish, and plants. They are important biologically as they represent areas where many species reproduce and are important for breeding and regeneration cycles.

Figure 4-7 shows floodplains identified within the I-69 project study area by the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP). These floodplains are divided into zones referred to as Special Flood Hazard Areas (SFHA) that are based on the estimated risk associated with an area being inundated based on historic, meteorologic, hydrologic, and hydraulic data, as well as open-space conditions, flood control works, and development[1]. With respect to **Figure 4-7**, SFHA Zones A and AE depict 100-year floodplains (1% annual chance). Zone AE is based on the known elevation of the 100-year flood event (known as the base flood elevation, or BFE) and Zone A is approximated without a known flood elevation. The 500-year floodplain (0.2% annual chance) is also shown.

There are six major floodplains areas within the project study area including Big Creek, Pigeon Creek, Bayou Creek, Eagle Creek, Ohio River, Green River, and Canoe Creek. Each of these floodplains support vast sections of highly productive farmland and provide habitats for many types of animal species.

[1] http://www.msc.fema.gov

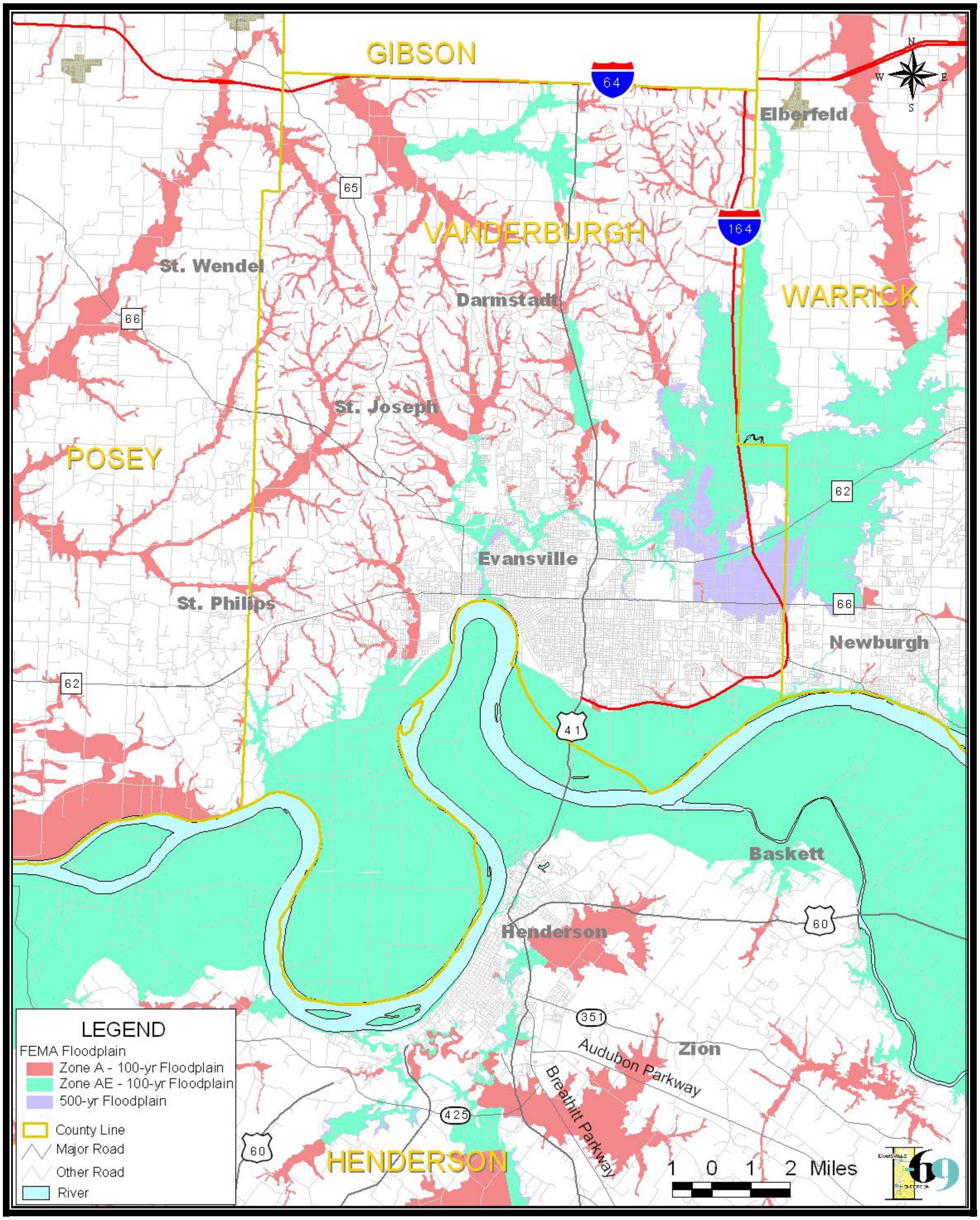


Figure 4-7: Federal Emergency Management Agency (FEMA) Floodplains

The Ohio River Floodplain extends throughout the Indiana and Kentucky borders. Within the project study area this floodplain is extensively used for farming practices. The floodplains associated with the project study area can range in width from approximately 8 miles in the oxbow area of southwest Vanderburgh County to approximately 3.2 miles between the mouth of the Green River and Horseshoe Bend. The Ohio River floodplain also encompasses the Eagle Creek and Bayou Creek floodplains in Indiana, and the northern portion of the Green River floodplain in the project study area. The floodplain landscape varies from open farmland to bottomland forest and wetlands.

The Pigeon Creek floodplain extends as far north as Princeton and extends to the Ohio River near the downtown area of Evansville. It also extends to the west beyond Ft. Branch and to the east just beyond Lynnville, and to the southeast to Chandler. Most of this floodplain has been cleared and used for agriculture. The floodplain is the most expansive ranging from approximately 2 to 4 miles wide near I-164 extending to the east nearly to Chandler. In contrast, the southern reaches of this floodplain are dominated by more tree cover and surrounded by urban areas with a much narrower floodplain area.

Canoe Creek floodplain lies to the south of Henderson and includes Elam Ditch, which is located southeast of Henderson. The Canoe Creek floodplain is characterized by large stretches of farmland separated by small tracks of woodlands. This floodplain reaches its widest point of approximately two miles near the Elam Ditch area.

The Big Creek floodplain stretches across northwestern Vanderburgh County and throughout northeastern, central and western Posey County until it empties into the Wabash River. This floodplain has been almost completely cleared and used for agriculture. The Big Creek floodplain is much narrower than the Ohio River and Pigeon Creek floodplains with most areas being one mile wide.

Wetlands

Wetlands are very important ecosystems which are instrumental in primary production and nutrient transport, and function as wildlife breeding and foraging habitat, sanctuaries for animals, hydrological support for adjacent ecological communities, storm/flood storage and peak reduction, groundwater recharge, and water purification. Because of their significant positive contributions, wetlands are protected by federal and state laws which were enacted to regulate activities that can be detrimental to their existence. The major federal laws protecting wetlands include the Federal Water Pollution Control Act Amendments of 1972 (amended in 1977 and subsequently referred to as the Clean Water Act) and the River and Harbors Act of 1899. **Figure 4-8** shows wetlands in the I-69 project study area, as identified by the National Wetland Inventory (NWI).

A large percentage of wetlands that once occurred within the Ohio and Green River floodplains in Indiana and Kentucky and within the Big Creek and Canoe Creek watersheds have been cleared, drained, and/or otherwise converted into agricultural or other uses. However, despite this fact there still remain a few relatively large tracts of palustrine forested wetlands and sloughs within the Ohio and Green River floodplain in Kentucky east of US 41 and north of Wolf Hills and Baskett, Kentucky. There is also a complex of palustrine forested wetlands, sloughs, and open water borrow pits associated with Eagle Creek within the Ohio River floodplain in Indiana immediately south of I-164 in southeastern Vanderburgh County. Bayou Creek and the lower portions of its tributaries also support a nearly contiguous chain of various bottomland wetland communities across the northern edge of the Ohio River floodplain in Union Township of southwestern Vanderburgh County. Elsewhere numerous small, fragmented wetland remnants may be found in the upper portions of the Big Creek watershed and in isolated areas of the Canoe Creek and Race Creek watershed.

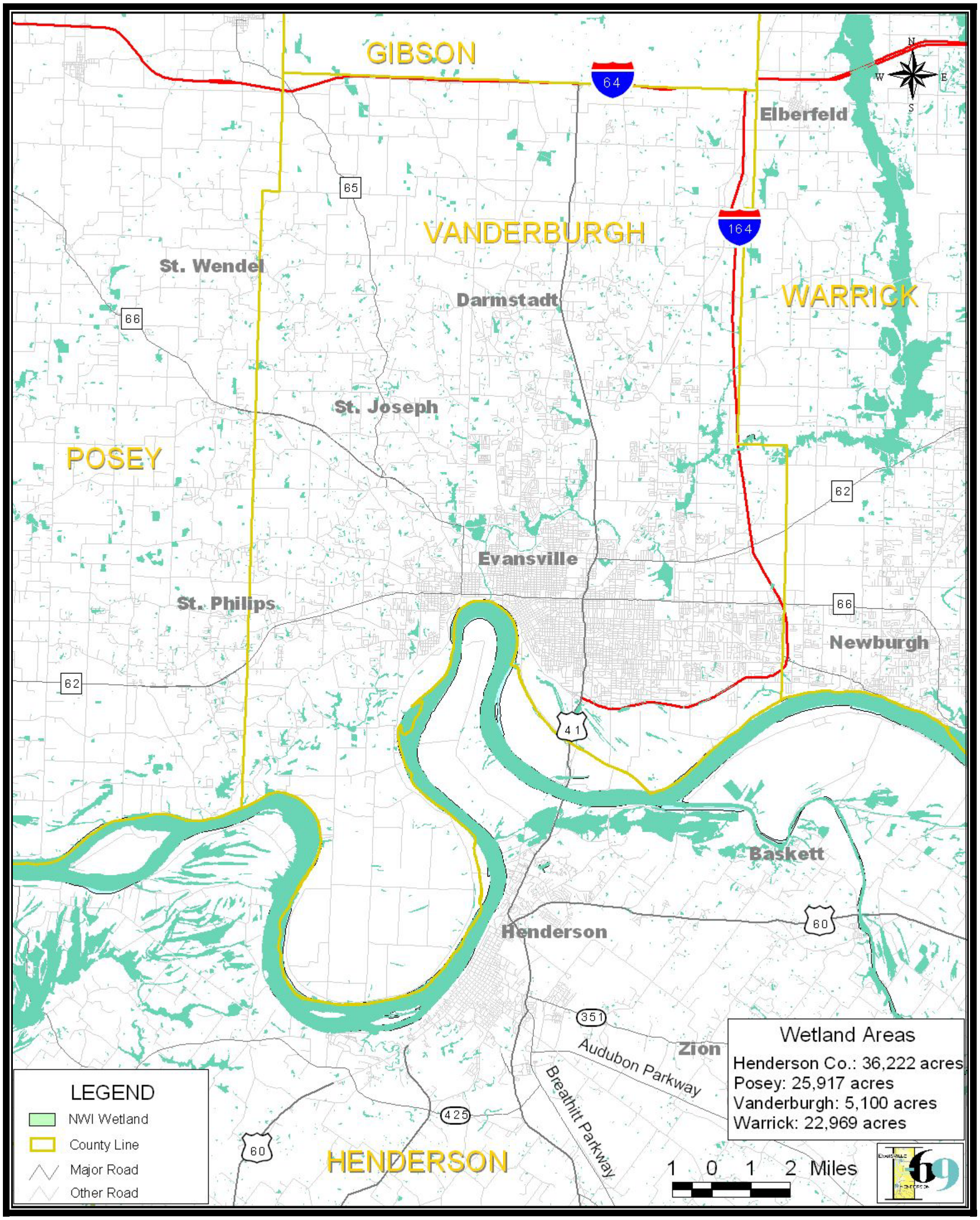


Figure 4-8: National Wetland Inventory (NWI) Wetlands

Numerous open water wetlands in the form of ponds and lakes are also scattered throughout the I-69 project study area landscape. National Wetland Inventory mapping suggests pond and lake densities of 2.5/mi.^{2} for rural Posey County, 6.3/mi.^{2} for rural Vanderburgh County, and approximately 2.0/mi.^{2} for rural Henderson County. The open water resources of the project study area are of various size and form, but are typically created through the construction of dams and dikes across intermittent headwater streams or shallow swales, excavation of depressions in upland or bottomland terrain, or a combination of both. Ponds and lakes encountered within the right-of-way for the I-69 alternatives displayed various morphological characteristics resulting from their type of creation, size, surrounding land uses, age, and current stage of succession.

The majority of the ponds and lakes identified within the project study area are considered to be used for residential/recreation, either swimming and/or fishing. Several of these have likely been stocked with game fish in the past. This class includes ponds/lakes which are adjacent or very near one or more residences with well maintained perimeters and surrounded by lawn-type cover. A number of ponds exist within wooded habitat, the origin or intended use of which is uncertain. The project study area also includes a few old farm ponds and small farm ponds currently used as cattle watering holes. The final pond/lake type identified are the borrow pits along I-164 in Vanderburgh County and along KY 425 in Henderson County.

Some of these ponds possess shallow shelves along the banks which support emergent and submerged aquatic vegetation. Aside from their intended uses, most of these aquatic resources provide valuable breeding habitat for birds and amphibians, assure a water supply for wildlife during periods of drought and migration, and function to some degree in flood and erosion control.

In general, farmed wetlands (FW) and farmed wetland pastures (FWP) are designated areas that were partially drained or altered to improve crop production before Swampbuster was enacted as part of the December 23, 1985 farm bill. However, unlike prior converted cropland (PC), farmed wetlands often remain wet enough to provide valuable wetland functions despite clearing for agricultural purposes. Farmed wetlands and farmed wetland pastures may be farmed or used for forage if maintained to their pre-12/23/85 condition and not “abandoned” for a period of five years such that they demonstrate wetland characteristics. Just as with all other wetland classifications, farmed wetlands and farmed wetland pastures are potentially subject to Section 404 requirements of the Clean Water Act as administered through the U.S. Army Corps of Engineers.

4.3.4 Natural Communities

Indiana can be divided into 12 natural regions, each constitutes a major, generalized unit of the landscape where a distinctive assemblage of natural features are present. The climate, soils, glacial history, topography, bedrock geology, presettlement vegetation, species composition, physiography, and flora and fauna distribution are characteristics which define these regions. Indiana’s natural regions have been further subdivided into sections where sufficient differences concerning natural features are evident.

The I-69 project study area occurs within portions of the Southern Bottomlands and Southwestern Lowlands natural regions. The Southern Bottomlands region encompasses the alluvial bottomlands along the rivers and larger streams of southwestern Indiana, namely the Ohio River floodplain, and the floodplain areas associated with the mainstem of Pigeon Creek and Big Creek. The soils are mostly neutral to acid silt loams and are subject to frequent flooding. The natural communities of this region include bottomland forest, swamp, pond, slough, and formerly marsh and prairie. The bottomland forest, the major community of this region, is characterized by pecan, sugarberry, swamp chestnut oak, pin oak, swamp white oak, red maple, silver maple, honey locust, catalpa, shellbark hickory, sycamore, and green ash.

Swamp and slough communities are characterized by bald cypress, swamp cottonwood, water locust, pumpkin ash, and overcup oak. Other distinctive species (many of which are restricted to this region) include American featherfoil, bloodleaf, acanthus, climbing dogbane, catbird grape, woolly pipe-vine, swamp privet, American snowbell, climbing hempweed, spiderlily, mistletoe, and giant cane. Distinctive southern animals include: cottonmouth, hieroglyphic turtle, diamondbacked watersnake, eastern mud turtle, northern copperbelly watersnake, swamp rabbit, mosquitofish, harlequin darter, spottail darter, and yellow-crowned night heron.

Within the I-69 project study area, the Southwestern Lowlands is further divided into the Driftless Section and the Glaciated Section. The Driftless Section includes the remaining portions of Vanderburgh, Warrick, and southern Posey County that are not part of the Southern Bottomlands. This section is south of the Illinoian glacial border and is characterized by low hills, broad valleys, predominantly acidic soils, a long growing season and comparatively high average summer temperatures. Natural communities include upland forest, occupying the well drained slopes, and southern flatwoods, occupying the lacustrine plains and river terraces. Flatwoods species typically include cherrybark oak, sweetgum, shellbark hickory, pin oak, swamp white oak, Shumard's oak, green ash, black gum and locally post oak. The upland forests are relatively dry oak-hickory dominated communities. Other natural community types include marsh, swamp, sandstone cliff, and low to medium gradient streams.

The Glaciated Section includes a large portion of northern Posey County and a small part of northwestern Vanderburgh County within the I-69 project study area. This area was subjected to ice cover during the Illinoian Age glaciation. Natural communities are mostly forests, but several types of former prairies are also known. The flatwoods community is common, although species composition differs from that of the Driftless Section. Common flatwoods species include shagbark hickory, shellbark hickory, pin oak, shingle oak, hackberry, green ash, red maple, and silver maple. Black ash swamps are near their southern border in this section. This section also appears to have the largest amount of prairie south of the Wisconsinan glacial border in Indiana. Additional community types include swamp, marsh, pond, and low-gradient streams. The prairie kingsnake and the crawfish frog are characteristic animal species of this region.

The I-69 project study area exhibits a variety of landscapes, including agricultural fields, woodland, transitional scrub/shrub tracts, herbaceous fields, large wetland complexes, ponds, streams, and rivers. Outside the urban areas of Evansville and Henderson, the I-69 project study area is generally dominated by agricultural plant communities in the form of corn, soybeans, wheat, and other minor crop commodities. These expansive uniform habitats are utilized for food and shelter by many common wildlife species that have adapted to this established community type following settlement.

Prior to European settlement, forests covered about 85 percent of the state. Forested land was converted to farmland as agriculture became a central part of Indiana's economy. The acreage of forested land reached its low during the early 1900's and increased until the 1990's where it appears to have reached a plateau. Today forested communities comprise roughly 16 percent of the project study area. With a few exceptions, forests in Vanderburgh, Posey, Warrick, and Henderson County are highly fragmented. The greatest concentrations of forestland in the project study area occur in central and southwestern Vanderburgh County, as well as northern and eastern Warrick County in Indiana. In Kentucky, forestland occurs in eastern Henderson County as well as larger blocks of bottomland forests that exist near the mouth of the Green River and in the vicinity of Sloughs Wildlife Management Area (WMA) in northwestern Henderson County. Elsewhere in the project study area, forestland exists as small fragmented woodlots.

The Forest Inventory Analysis established by the USDA Forest Service in 1950 divided Indiana into four forest survey units (Tormehlen *et al.*, 2000). These units have remained consistent throughout the years in order to more accurately track changes in forests from survey to survey. Indiana has been divided into four forest survey units based on various natural features. Posey and Vanderburgh County are within the Lower Wabash Unit, while Warrick County is included within the Knobs Unit. Abundant tree species common to both units include sugar maple, yellow poplar, sassafras, white ash, white oak, American elm, black oak, sycamore, pignut hickory, and red maple. The oak-hickory forest type accounts for roughly half (49 percent) of the timberland found within the project study area counties. The elm-ash-cottonwood, maple-beech, loblolly-shortleaf pine, oak-gum-cypress, and oak-pine associations comprise the remaining forest types commonly found in southwestern Indiana and northwestern Kentucky. Moderately open deciduous hardwood forests with understories of varying densities consisting of shrubs, grasses, forbs, ferns, and non-vascular plants are available to species such as woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, opossum, wild turkey and white-tailed deer. While some timberland harvesting does occur in the project study area, it is not a primary element of the natural resource economy in the project study area.

The extensive floodplains and bottomlands associated with the Ohio River and Green River as well as their larger tributaries (Pigeon Creek and Canoe Creek) provide suitable wetland habitat for wildlife such as wading and shorebirds, mink, muskrat and beaver are also abundant in wetlands associated with these drainages. Many of the larger wetland communities that once existed in southwest Indiana and northwestern Kentucky have been cleared and drained for agricultural purposes. The few remaining such communities within the I-69 project study area include the vast network of wetlands at Sloughs Wildlife Management Area, floodplain wetland woods and sloughs along the Ohio and Green Rivers east of US 41, wetland woods closely associated with Pigeon Creek in eastern Vanderburgh and western Warrick County, the Cypress Slough area of southeastern Posey County, wetland woods along Big Creek and Little Creek in east-central Posey County, and to a lesser extent a collection of wetland woods and sloughs along Bayou Creek in southwestern Vanderburgh County.

A unique habitat of the I-69 project study area is the bald cypress community that exists primarily in the sloughs and backwater areas of the floodplains associated with major rivers (i.e. Ohio, Green, and Wabash). Southwestern Indiana generally represents the northern extent of this habitat type. In addition to being an important habitat for many species of waterfowl and other wetland dependant wildlife, these sloughs play an active role in improving water quality by retaining floodwaters, removing sediments and providing groundwater recharge. A prime example of this community type exists in Henderson County at the Sloughs WMA and along Green River Road just east of US 41.

Interspersed among the agricultural fields and forestland within the rural landscape of the I-69 project study area, open land in the form of meadows, pasture and old fields can be found. The vegetative composition of these lands varies depending on soil type, moisture availability, age of the field, maintenance regiment, if any, as well as other factors. Typically these areas consist of grasses (fescues, wildrye, barnyard grass, panicgrass, little bluestem, Johnson grass, foxtail), sedges, goldenrods, asters, milkweed, smartweed, ragweed, mints, wild onion, thistles, and others. It is not uncommon for these open areas to be invaded by multiflora rose and blackberries. Bobwhite quail, meadowlark, dove, field sparrow, cottontail rabbit, and red fox are typical species found in the open land habitat of the gently rolling upland areas.

4.3.5 Threatened and Endangered Species

Species currently listed as endangered or threatened by the U. S. Fish and Wildlife Service are legally protected under the Endangered Species Act of 1973, as amended, and therefore subject to the consultation and biological assessment requirements outlined in Section 7 of the Act. Federal agencies, in accordance with the Act, and as amended, “shall, in consultation with and with the assistance of the Secretary, utilize their authority in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered or threatened species.”

Sections 7(a) and (b) require Federal agencies to consult with the U. S. Fish and Wildlife Service (USFWS) when the agency determines their action "may affect" listed species or critical habitat.

Section 7(d) of the 1978 Amendment to the Endangered Species Act underscores the requirement that the Federal agency and the permit or license applicant shall not make irreversible or irretrievable commitment of resources during the implementation of reasonable alternatives regarding their actions on any endangered or threatened species. The effects of any highway project upon federally listed species depends on the resulting loss, fragmentation, and /or alteration of available habitat. The sensitivity of an organism to a particular change will vary by species. It is therefore necessary to be familiar with the habitat requirements, residency, and status of a species before potential impacts can be assessed.

The I-69 Evansville to Henderson project includes two United States Fish and Wildlife Service (USFWS) regions (Region 3 for Indiana and Region 4 for Kentucky). Early coordination for the project involved contact with the Bloomington, Indiana office (Region 3) and the Cookeville, Tennessee office (Region 4). Coordination with the USFWS office in Bloomington identified five species of concern for the I-69 project study area (see **Appendix B-1** for copy of April 1, 2002 letter.) The USFWS Cookeville office, in a communication to the FHWA, identified two species that would be subject to Section 7 review and a third species which is not officially listed in southern Indiana and Kentucky, but will be reviewed as though it were threatened. (See copperbelly water snake discussion.) Collectively, six federally listed species were identified by the two field offices for evaluation with regards to potential affect resulting from the I-69 project. During the course of project development, a new USFWS office in Frankfort, Kentucky was made operational and designated as the primary contact (lead) through which all subsequent Section 7 coordination on the I-69 project would be conducted. **Table 4-7** includes the USFWS federally listed species addressed in this study.

Table 4-7: Endangered and Threatened Species for USFWS Section 7 Consideration within the Project Study Area

Species Name Common name	USFWS Status	IN Status	KY Status	Global Rank
Myotis sodalis Indiana Bat	E	E	E	G2
Myotis grisescens Gray Bat	E	E	E	G2
Haliaeetus leucocephalus Bald Eagle	T	E	E	G4
Nicrophorus americanus American Burying Beetle	E	X	H	G1
Potamilus capax Fat Pocketbook Mussel	E	E	E	G1

Status	Global Rank	
E - Endangered	G1 – Extremely Rare	T1 – Subspecies Extremely Rare
T - Threatened	G2 – Rare	T2 – Subspecies Rare
X - Extirpated	G3 – Uncommon	T3 – Subspecies uncommon
H – Historical	G4 – Many Occurrences	T4 – Subspecies Many Occurrences
	G5 – Very Common	T5 – Subspecies Very Common
	GU – Uncertain	

Source: Natural Heritage Database (IDNR & KSNPC)

The USFWS uses the following categories to designate the status of a species or sub-species with regard to the Endangered Species Act of 1973.

Endangered (E)	"any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of this Act would present an overwhelming and overriding risk to man."
Threatened (T)	"any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."
Proposed Endangered (PE)	"Taxa proposed for listing as endangered"
Proposed Threatened (PT)	"Taxa proposed for listing as threatened"
Candidate (C)	"Taxa for which we [USFWS] have on file sufficient information on biological vulnerability and threats to support proposals to list them as endangered or threatened."

Although state listed species are not afforded protection under the Endangered Species Act of 1973, as amended, measures to avoid impacts to these species should be implemented whenever possible in an effort to minimize loss of preferred habitat and prevent future population declines of such valuable state natural resources. Through KRS 150.183 the Kentucky Department of Fish and Wildlife Resources has the authority to create a list of state endangered animals. Similarly the Kentucky State Nature Preserves has authority under KRS 146.600-619 (Rare Plant Recognition Act of 1994) to designate endangered and threatened plants for the Commonwealth. Collectively, the following categories are utilized by Kentucky to designate the status of animal and/or plant species.

Endangered (E)	A taxon in danger of extirpation and/or extinction throughout all or a significant part of its range in Kentucky.
Threatened (T)	A taxon likely to become endangered within the foreseeable future throughout all or a significant part of its range in Kentucky.
Special Concern (S)	A taxon that should be monitored because (a) it exists in a limited geographic area, (b) it may become threatened or endangered due to modification or destruction of habitat, (c) certain characteristics or requirements make it especially vulnerable to specific pressures, (d) experienced researchers have identified other factors that may jeopardize it, or (e) it is thought to be rare or declining but insufficient information exists for assignment to the threatened or endangered status categories.
Historical (H)	A taxon that has not been reliably reported in Kentucky since 1975.

The Division of Fish and Wildlife and the Division of Nature Preserves of the Indiana Department of Natural Resources use the following categories to designate the status of a species or sub-species:

Endangered (E) Any animal species whose prospects for survival or recruitment within the state are in immediate jeopardy and are in danger of disappearing from the state. This includes all species classified as endangered by the federal government which occur in Indiana. Plants known to occur currently on five or fewer sites in the state are considered endangered.

Threatened (T) Any animal species likely to become endangered within the foreseeable future. This includes all species classified as threatened by the federal government which occur in Indiana. Plants known to occur currently on from 6 to 10 sites are considered threatened.

Figure 4-9: Indiana Bat
photo credit: Bat Conservation International

Special Concern (S) Any animal species about which some problems of limited abundance or distribution in Indiana are known or suspected and should be closely monitored.

Rare (R) Any plant species about which some problems of limited abundance or distribution in Indiana are known or suspected and should be closely monitored. Plants known to occur currently on from 11 to 20 sites are considered rare.

Watch List (WL) An uncommon species in the state (21 to 100 sites known).

Extirpated (X) Any animal species that has been absent from Indiana as a naturally occurring breeding population for more than 15 years, but exists outside Indiana as a wild population. Any plant species that has not been seen in Indiana for over 50 years and for which the site(s) where it occurred historically has been field surveyed.

Indiana Bat (*Myotis sodalis*)

The Indiana bat is a medium-sized bat usually with a dull, dark pinkish gray color above and paler below. A few individuals have a brownish cast to the dorsal fur, as shown in **Figure 4-9**. It resembles the little brown bat, but differs in having a duller color to the dorsal fur, smaller feet, fewer and shorter hairs on the toes, and has a calcar (Mumford and Whitaker, 1982). The Indiana bat occurs throughout much of the United States in the summer, yet hibernates in just a few large caves and mines during the winter. Nearly 85 percent of the known population winters in only seven caves and mines in Missouri, Indiana, and Kentucky, and approximately one-half of the population uses only two of these hibernacula (Brady *et al*., 1983). The Recovery Plan for the Indiana Bat estimates the total known population (1980-1981) to be 550,000 for a ten state region containing eight Priority 1 and thirty-seven Priority 2 hibernacula caves (U.S. Fish and Wildlife Service, 1983). By definition, Priority 1 caves support winter populations exceeding 30,000 bats. Priority 2 caves included populations between 1,000 and 30,000 individuals. In Kentucky, three Priority 1 caves and twelve Priority 2 caves served as hibernacula for 109,000 Indiana bats or nearly 20 percent of the total known population in 1980-81. Only one Priority 1 cave exists in southern Indiana. Located within the Mitchell Karst Plain region, winter populations at this site have increased from about 12,500 in 1981 to approximately 48,200 in 2001. "Critical habitat" is defined in the Endangered Species Act of 1973 as "a specific geographic area(s) that is essential for the conservation of a threatened or endangered species and that may require special management and protection." Two caves, in eastern Kentucky have been designated as critical habitat for the Indiana bat. In Indiana, the Greene County Priority 1 cave is the only hibernaculum designated as critical habitat. There are no critical habitat areas of concern for the Indiana bat in Warrick, Vanderburgh, Posey Counties in Indiana, or Henderson County in Kentucky.

The Indiana bat selects caves meeting specific temperature and humidity criteria for winter hibernacula. Stable temperatures of 4° to 8° C allow bats to maintain a low rate of metabolism and conserve fat reserves. The typical relative humidity at hibernacula roost sites is above 74 percent (Humphrey, 1978; LaVal et al., 1977; Hall, 1962). These microclimate conditions are a function of cave configuration and adequate air flow.

During the summer, Indiana bat maternity colonies typically roost under the exfoliating bark of dead trees, although some have been located beneath the bark of living trees and in cavities of dead trees (Garner and Gardner, 1992). In Illinois, Garner and Gardner (1992) found 48 Indiana bat roost trees in eight counties from May 14, 1986 to July 11 1989. Trees with a dbh (diameter at breast height) between 8 and 83 centimeters of the following species were utilized: *Carya ovata* (192 bats), *Quercus rubra* (59 bats), Ulmus rubra (40 bats), *Populus deltoides* (21 bats), *Quercus stellata* (15 bats), *Sassafras albidum* (5 bats), *Carya cordiformis* (4 bats), *Acer saccharinum* (1 bat), *Quercus alba* (1 bat), *Quercus imbricaria* (1 bat), and *Ulmus americana* (1 bat). Brack and Tyrell (1990) showed similar roosting sites with 95.8 percent located in riparian habitat. In atypical situations, individuals have been found roosting in buildings and under a concrete bridge (Mumford and Whitaker, 1982). Indiana bats occupy riparian habitat from mid-May until mid-September (Humphrey et al., 1977).

Maternity colonies are formed in riparian and floodplain areas of small to medium-sized streams (Humphrey, 1977). Cope et al. (1974) described a maternity colony discovered under the loose bark of a dead American elm (*Ulmus americana*) in Wayne County, Indiana in 1971. In 1974 a nursery colony was located under the loose bark of a dead bitternut hickory (*Carya cordiformes*) near the Nolands Fork River in Indiana (Humphrey et al., 1977). Eleven dead female Indiana bats were found by a felled dead shagbark hickory (*Carya ovata*) in Knox County, Indiana in 1984 (Gardner, 1992). Garner and Gardner (1992) reported that in Illinois summer nursery colonies of Indiana bats were found in habitat meeting the following criteria: (1) in dead trees more often than live trees (97 percent versus 3 percent); (2) under closed or intermediate forest canopy and not under open canopy; (3) on uplands near floodplains; (4) near streams; (5) at distances greater than 930 meters (adult males) or 1,621 meters (pregnant females) from paved roads; and (6) at distances greater than 564 meters (adult males) or 774 meters (pregnant females) from non-paved roads. **Figure 4-10** shows the distribution of Indiana bat records in Kentucky indicating that maternity colony records exist for Union and Daviess counties to the west and east of Henderson County. **Figure 4-11** shows the locations where the species has been recorded in Indiana.

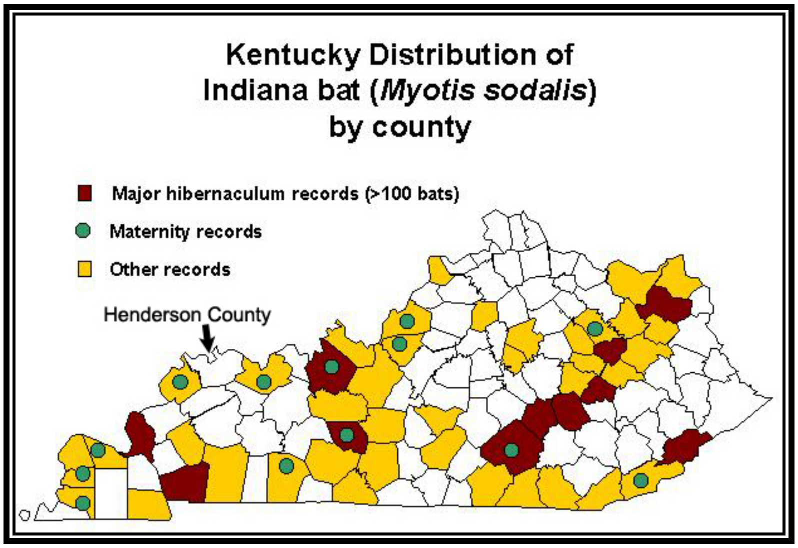


Figure 4-10 Distribution of Indiana Bat in Kentucky

Humphrey et al. (1977) described the foraging habitat of the Indiana bat (maternity population) in Indiana as confined to the foliage of riparian floodplain trees (e.g., sycamore, cottonwood, black walnut, black willow, and oak species) and floodplain forest edge. Optimum foraging zone was given as the air space 2 to 30 meters above the water of small streams lined by mature trees that provide stream cover of three meters or more on both sides. During the early summer the foraging range was restricted to a 1.47 hectare area, but expands to over 4.54 hectares by mid-summer. Males, however, forage up to 2 kilometers from their summer roosts. Information on fall foraging ranges prior to hibernation appears to be lacking. Studies on prey preference in Indiana, Illinois and Missouri suggest Lepidoptera (water moths) is the food of choice for Indiana bat. Coleoptera (water beetles), Diptera (true flies) and other groups have also been identified as prey items (Gardner, 1992). As a consequence of their limited distribution, specific summer and winter habitat requirements, and tendency to congregate in large numbers during winter, Indiana bats are particularly vulnerable to rapid population reductions resulting from habitat change, environmental contaminants, and other human disturbances (Bradey et al., 1983). Additionally, because females produce only one young per year, recovery following a population reduction occurs slowly.

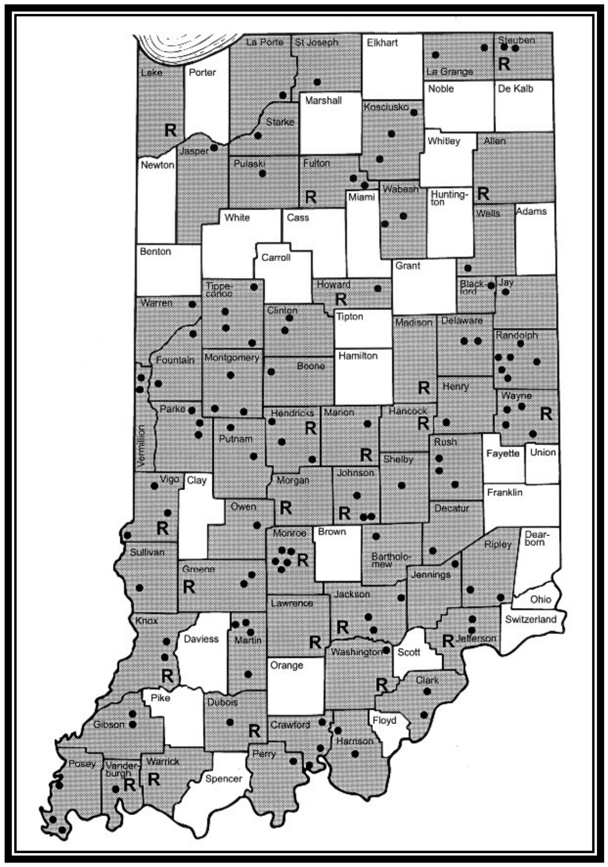


Figure 4-11: Localities where Indiana bat has been identified in Indiana
R = rabies lab records
(Source: John O. Whitaker, ISU)

Before the 1970's, the population of Indiana bats was poorly understood. A 1975 census established a benchmark of nearly 450,000 bats using Priority 1 hibernacula. Since 1983, the number of bats tallied has declined significantly, reaching a low of 347,890 in 1993 (Drobney and Clawson – http://biology.usgs.gov/s+t/frame/c164.htm). Causes for decline in the Indiana bat are many, but the primary reason is human disturbance during hibernation. The disturbance of a hibernating Indiana bat may cause a loss of 10 to 30 days fat supply per average disturbance (Brady *et al.*, 1983). These fat reserves are needed to get the bat through hibernation. Other causes are natural hazards (i.e. flooding, cave ceiling collapse, and freezing); deforestation from stream channelizations and surface mining; and pesticide poisoning.

Gray Bat (Myotis grisescens)

Figure 4-12: Gray Bat
photo credit: Bat Conservation International

The gray bat, shown in **Figure 4-12**, is a gregarious species that is almost exclusively dependant on cave habitats throughout the year. Gray bats utilize caves, or sometimes similar structures (i.e. storm sewers, tunnels, and cave-like quarries), meeting specific microclimate conditions for nursery colonies and roost sites in the summer and as hibernacula in the winter (Barbour and Davis, 1974; Elder and Gunier, 1978; Sealander and Heidt, 1990). Fewer that 5 percent of available caves are suitable for gray bats (United States Fish and Wildlife Service, 1982). They typically migrate to wintering caves in September and October with the females arriving prior to the males (Sealander and Heidt, 1990; Elder and Gunier, 1978). Most females enter winter hibernation by September or early October, while adult males and juveniles may not begin until mid-November (Tuttle and Stevenson, 1977; United States Fish and Wildlife Service, 1982).

Gray bat movements and seasonal populations in Kentucky and Missouri have been studied by Hall and Wilson (1966), Elder and Gunier (1978) and Tuttle (1976). In 1967 Gunier and Tuttle (1971) studied homing of gray bat to a rare barn maternity colony in Missouri. Tuttle and Stevenson (1977) studied patterns of increase mortality with respect to peak migration periods (April and September) for the species. In 1989-90, the KDFWR monitored 26 caves in Kentucky for the presence of gray bats in the summer. Fourteen of these sites were considered maternity sites at least once since 1985, and are shown in **Figure 4-13**.

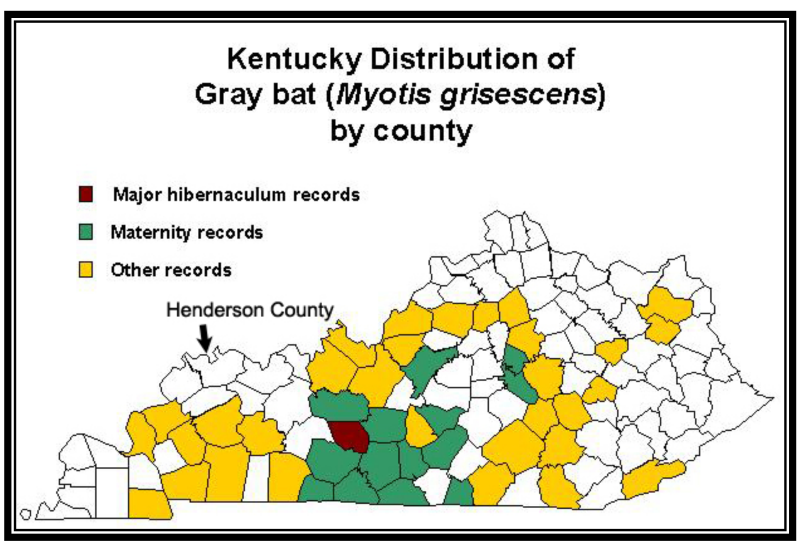


Figure 4-13: Gray Bat Distribution in Kentucky

In Indiana, the gray bat is generally considered a spring, summer, and fall resident, although a few have been noted hibernating in caves as evidenced by February and March reports from Wyandotte Cave in Crawford County and Twin Domes Cave in Harrison County. The work of Whitaker *et al*. (2001) represents the most recent documentation regarding gray bat distribution in

Indiana. **Figure 4-14** shows the known distribution of the gray bat in Indiana. Whitaker *et al.* hypothesize that gray bats became established in Clark County in the 1950's. Prior to 1978 the gray bat had been reported from Donaldson's and Donnehue's Cave in Lawrence County, Wyandotte Cave in Crawford County, and Biehle Cave in Jennings County. In 1978 Cope and Richter captured six lactating female gray bats along Muddy Fork Creek (Clark County), evidence of the first known gray bat maternity roost in the state. Additional studies by Brack *et al*. in 1984 resulted in the capture of seven lactating females on the Muddy Fork Creek, which ultimately lead to the discovery of a maternity colony in an abandoned limestone quarry at Sellersburg (Clark County). In 1998, Pruitt (1998) produced evidence of a second possible maternity colony at the Indiana Army Ammunition Plant at Charlestown, about four miles from Sellersburg. During mid-summer of 1980, three males were netted at Twin Domes Cave in Harrison County. In the mid to late 1990's additional gray bat records documented along creeks and rivers included Stinking Fork Creek in Harrison County (Brack *et al*.,1998), Knob Creek (Perry County), Crooked Creek and Anderson River (Perry County), Buck Creek (Harrison County), Knob Creek (Floyd County) and Silver Creek (Clark County). To date, the species has been reported from eight counties in southern Indiana, including each of the six central counties along the Ohio River. The two adult males and single juvenile female from Spencer County in 1997 are the nearest recorded captures to the I-69 project study area. Crooked Creek, the closer of the two drainages were the gray bat was found in Spencer County, is approximately 29 miles east of I-164 in Evansville.

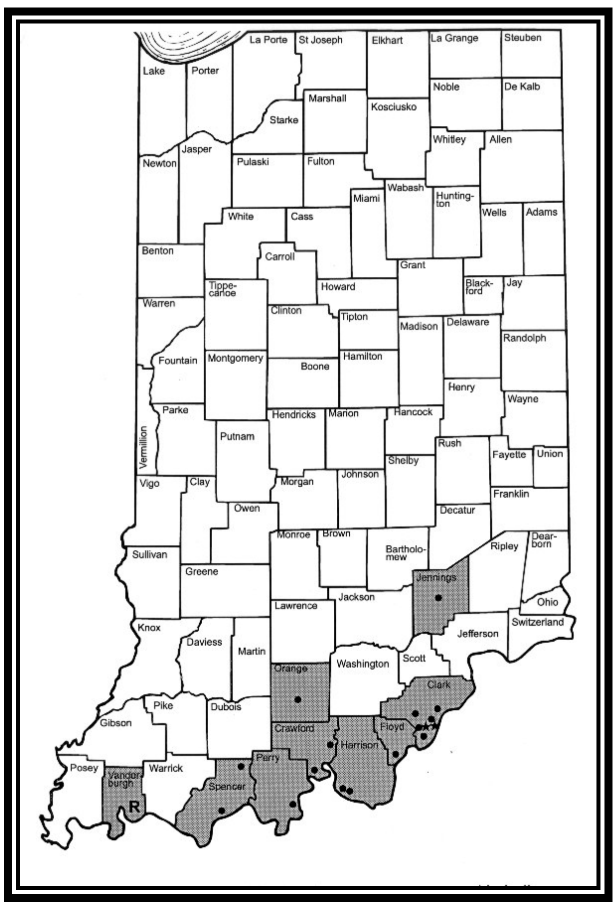


Figure 4-14: Localities where gray bat has been identified in Indiana

R = rabies lab records
(Source: John O. Whitaker, ISU)

By late March and early April of the following year, the females have emerged from their winter hibernacula and have begun to migrate to nursery and bachelor caves throughout their populational home range (Barbour and Davis, 1974; Sealander and Heidt, 1990; Hall and Wilson, 1966). The juveniles and adult males usually leave between mid-April and mid-May (United States Fish and Wildlife Service, 1982). The gray bat establishes nursery colonies in caves usually containing water and high humidity (Elder and Gunier, 1978). Pregnant females give birth to single young from late May to early or mid-June (Sealander and Heidt, 1990; United States Fish and Wildlife Service, 1982). By July the young-of-the-year are learning to fly, and once they are weaned the colony begins to break-up and disperse (Tuttle and Stevenson, 1977; Sealander and Heidt, 1990). Elder and Gunier (1978) suggest that young-of-the-year of both sexes remain with the females in the nursery colonies during July and August, whereas Barbour and Davis (1974) report that sometimes nursery colonies in Kentucky are deserted in August. Tuttle and Stevenson (1977) considered August a relatively sedentary period with peak autumn migration taking place in September.

The gray bat is extremely intolerable to disturbances, especially stress caused by humans (Sealander and Heidt, 1990; Barbour and Davis, 1974; Gardner, 1982). Disturbances at summer nursery colonies (especially from late May through mid-July) may result in trauma induced abortions, the dislodgement of non-volant young from the ceiling when females suddenly take to flight and the abandonment of maternity colony caves (Sealander and Heidt, 1990; Elder and Gunier, 1978; United States Fish and Wildlife Service, 1982). Additional factors adversely affecting gray bat populations include: natural disasters (i.e. flooding, freezing, and collapse of mines and caves), disturbance at hibernacula, stream channelization, siltation, deforestation, and pesticide poisoning (Clark *et al*., 1983; Tuttle, 1979; United States Fish and Wildlife Service, 1982). Lacki (1994) suggests that metal contamination in gray bats from unknown sources may also play a role in declining population numbers.

The gray bat population in an eleven state range in the eastern and southern United States is thought to be divided into populational home ranges based on aggregation in the winter and dispersal in the summer (Hall and Wilson, 1966). The majority of individuals in each populational home range are believed to enter in a centrally located cave hibernacula. Elder and Gunier (1978) make note of nine large wintering concentrations for the gray bat throughout its range. One such site in Kentucky is the Coach-James Cave system near the Mammoth Cave National Park. Hall and Wilson (1966) reported a winter population of about 100,000 for this site. The winter population of Jesse James Cave was recently estimated to be in excess of 200,000 (KDFWR, unpublished data). Summer-to-winter and winter-to-summer movements within this populational home range suggest that this area of Kentucky represents about 7percent of the total range of the species.

Summer caves for the gray bat are almost always located within four kilometers of a river or reservoir where they forage over the water along the edges. Foraging at an east Tennessee reservoir was restricted to within five meters of the water surface, although gray bats in Missouri have been observed foraging higher in the forest canopy associated with river edges (United States Fish and Wildlife Service, 1982). Forest canopy cover along streams and rivers is also a key habitat component providing protection against predators while feeding or moving from cave to cave. Foraging territories for the population at the Tennessee reservoir were up to 20.3 river kilometers from the roost. LaVal *et al.* (1977) suggest a foraging range of up to 20 kilometers or more for a maternity colony studied in Missouri. Nightly foraging distances for colonies in the Tennessee River Drainage ranged from 15.8 to 52 kilometers, with an average of about 18.1 km/night (Tuttle, 1976). Mayflies are a prominant prey item of the gray bat (Gardner, 1992). The study population in the Tennessee reservoir was found to forage only in areas where mayflies were relatively abundant versus nearby reservoirs where mayflies were not as plentiful. Since most mayflies are pollution intolerant, the success of local gray bat populations could be directly related to the water quality of their available foraging habitat. Caddisflies and stoneflies are identified as a preferred prey item for the gray bat (United States Fish and Wildlife Service, 1982).

Mumford and Whitaker (1982) identified Lepidoptera (water moths), Trichoptera (caddisfly), and Chironomidae (midges) in a single bat collected in Indiana. In an April to November 1999 study involving analysis of guano from gray bats at a maternity colony in Indiana, it was noted that they favored chironomids and other dipterans early during their tenure, but switched to primarily coleopterans, trichoperans, and leptopterans in the summer and early fall (Whitaker *et al*., 2001). In late fall, their diet seemed to switch back to primarily chironomids, including pupae.

Bald Eagle (*Haliaeetus leucocephalus*)

The adult bald eagle, shown in **Figure 4-15**, is named for its white head. The rest of the bird is dark brown with the exception of the tail feathers that are white. At maturity (4 to 5 years of age) the body of an adult is 3 to 3½ feet in length with a wingspan of 6 to 7½ feet. Eagles mate for life and select nesting sites near where they were raised as young. Bald eagle life span is as much as 48 years in captivity and 21 years in the wild.

Figure 4-15: Bald Eagle

Their nesting period is usually from October 1 to May 15 in the Southeast; however, in the northern portion of their range, nesting has occurred as late as August (USFWS, 1987). Breeding and nesting habitat typically involves isolated large bodies of clear and clean water (i.e., lakes, bays, marshes, rivers) with adjacent mature tall trees for nesting and roosting. Lakes with more than seven miles of shoreline have been reported as primary breeding habitat (Peterson, 1991). Nest trees may be living or dead and branches are added in the uppermost crotch year after year, prior to breeding. Eagles may also build nests in several trees and then alternative nest trees from year to year. Nests are usually located within one mile of water (Peterjohn and Rue, 1991) and within open forests. Nests are typically substantial structures "composed of large sticks and lined with finer twigs and soft plant material' (Palmer-Ball, 1996).

The Northern States Bald Eagle Recovery Plan (USFWS, 1983) provides management zones for each bald eagle nest. The primary zone (or circular ring around nest) is the most critical area and must be maintained to promote acceptable conditions for eagles. The size of this zone should be 330 feet from the nest. All land use activities are prohibited in this primary zone except, actions necessary to protect or improve the nest site. Human entry and low-level aircraft operations should be prohibited during the most critical and moderately critical period, unless performed in connection with eagle research or management by qualified individuals. Motorized access into this zone should be prohibited. Restrictions on human entry at other times should be addressed in the breeding area management plan, considering the types, extents, and durations of proposed or likely activities.

The secondary management zone should extend 660 feet from the nest. Restrictions for this zone are land use activities that result in significant changes in the landscape, such as clear cutting, land clearing, or major construction, should be prohibited. Actions such as thinning tree stands or maintenance of existing improvements can be permitted, but not during the most critical and moderately critical periods. Human entry and low-level aircraft operations should be prohibited during the most critical period unless performed in connection with necessary eagle research and management by qualified individuals.

The third zone or tertiary zone is the least restrictive zone. It should extend one-quarter mile from the nest, but may extend up to one-half mile if topography and vegetation permit a direct line of sight from the nest to potential activities at that distance. The configuration of this zone may be variable. Some activities are permissible in this zone except during the most critical period. Each breeding area management plan may identify specific hazards that require additional constraints.

The most critical period is defined as that time when bald eagles engage in courtship activities and nest building, egg laying, and incubation. During this period, they are most intolerant of external disturbances and may readily abandon the area. The most critical period for disturbances therefore extends from approximately one month prior to egg laying through the incubation period. The moderately critical period includes the time interval from approximately one month prior to the critical period and about 4 weeks after hatching.

The Indiana Department of Natural Resources Non-game Wildlife Program has been working to restore bald eagle populations in Indiana. Between 1985 and 1989, 73 young eagles were released at the Monroe Reservoir in Monroe County (Castrale, 1991). The number of active nests and young fledged has increased yearly. Since 1988, a total of 67 eagles have been fledged in Indiana. In the 2001 breeding season, Indiana had 27 occupied territories, 27 active nests, and a total of 27 eagles fledged from 20 nests. In contrast, surveys in 1989 showed only 2 nesting territories, 1 active nest, and no young fledged. The number of bald eagles in Indiana has increased 35 percent since 1989. The 1992 winter state survey reported 101 bald eagles. Within recent years, nesting bald eagles in southwestern Indiana have only been documented from Martin, Monroe, Green, and Vigo counties.

In the 1960's breeding pairs of bald eagles had apparently disappeared in Kentucky, in part due to loss of habitat and in part because of the ill effects of DDT on the species reproductive success. However, a nest constructed at the Sauerheber Unit of the Sloughs WMA in 1991 produced two young the following year (Palmer-Ball, 1992). The Kentucky State Nature Preserves Commission Natural Heritage Program Database also includes a late-April 2000 record of a bald eagle from the Sauerheber Unit site. Even more recently, a single bald eagle was spotted during the early screening phase of the I-69 project at the Sauerheber Unit site in the winter of 2001. Since its discovery in 1991, the Sauerheber Unit nest has produced 20 hatchlings, 19 of which have fledged, as of 2001. The location of this nest is approximately 7.5 air-miles west of the Alternative1 and 1A alignment across the oxbow portion of southern Vanderburgh County, Indiana. Although breeding bald eagles have also been documented in Fulton County, along the Mississippi River in Hickman County, at Ballard WMA in Balland County, at Land Between the Lakes and even Laurel River Lake (Laurel County) and Yatesville Lake (Lawrence County) in eastern Kentucky, most sightings within the state are typically of uncommon transients or winter residents. Winter bald eagle residents tend to be more gregarious and have consistently been reported yearly from many of the larger reservoir lakes in Kentucky.

American Burying Beetle (*Nicrophorus americanus*)

American burying beetle belongs to the carrion beetle family, a group of scavenging beetles. At 1 to 1½ inches in length, it is the largest carrion insect in North America. Like many other carrion beetles of the genus *Nicrophorus*, it is shiny black in color with wing covers showing four, relatively large red, yellow or orange markings (spots), as shown in **Figure 4-16**. Unlike any other species, however, the pronotum (the shield-like area just behind the head) of the American burying beetle is red or reddish-orange, and there may be a small orange patch on the face between the eyes. The species has been historically recorded from 35 states in the eastern and central United States, but now appears to be found in only four states: Nebraska, Rhode Island, Oklahoma, and Arkansas (Raithel, 1991). The USFWS proposed it as an endangered species in 1988, and placed it on the endangered list in 1989.

Figure 4-16: American Burying Beetle
photo credit: USFWS

Adult American burying beetles are nocturnal and search widely for carrion by detecting the odor of recently killed animals. Using the organs of smell located on their antennae, they can find a dead mouse within an hour of death, and from as far away as two miles. After flying to the vicinity of the carcass, they drop to the ground and crash through the litter to find the carcass. They go under the body, turn over onto their backs and move the carcass to a spot with soil to bury it. After burial, the beetles strip away fur or feathers and work the mass into a compact ball.

The species is regarded as a carrion specialist and is dependant on dove or chipmunk size carrion to reproduce. As the larvae feed off the carcass and develop, both adults provide parental care, an extremely rare and highly developed behavior among insects. Brood sizes generally range from 1 to 30, but usually average 12 to 15. If the size of the brood is too large to be successfully reared, both adults will cannibalize small larvae. After feeding off the carcass for about a week, the larvae crawl into soil and pupate. American burying beetles only live for one season (12 months) and die soon after they leave the developing pupae. Approximately 45 to 60 days after their parents buried the carcass and mated, the next generation of mature American burying beetles emerge to start the cycle again.

Today, the American burying beetle seems to be largely restricted to areas mostly undisturbed by human influence, having disappeared from 99 percent of its previous range. The Recovery Plan for the American Burying Beetle (Raithel, 1991) reports that little is known about the habitats associated with most historical collections. Until recent investigations of the conditions at the Block Island and eastern Oklahoma sites, there was only one published description of the vegetational characteristics of a *N. americanus* capture locality (Walker, 1957). In 1952, Walker collected nine individuals from a forested area described as "a park-like stand of large deciduous tress with little shrub layer and a few small trees," which was associated with the Badger Creek floodplain in Benton County, Tennessee. Dominant canopy tree species included *Quercus falcata*, *Quercus alba*, *Liquidamber styraciflua*, *Carya ovata*, *Nyssa sylvatica*, and *Liriodendron tulipifera*, with *Caprinus carolinus* comprising most of the tree understory. Grasses and sedges were dominant in the sparse ground cover.

Contrary to the earlier belief that the insects were associated with eastern deciduous woodlands, it now seems that carrion availability (appropriate in size and numbers) is more important than the type of vegetation or soil structure. The prevailing theory regarding the species' decline involves habitat fragmentation. Fragmentation of large expanses of natural habitat that historically supported high densities of indigenous species may have been a contributing factor in the decline of *N. americanus* by changing the species composition and lowering the reproductive success of prey species required for optimum reproduction. By increasing edge habitat there may have been a concomitant increase in the occurrence and density of vertebrate predators and scavengers such as the American crow, raccoon, fox, opossum, and skunk, which compete with *N. americanus* for available carrion. Windbreaks, hedgerows, park development, and urban plantings have all provided new "edge" habitat for these scavengers, including dogs. All of these animals take carrion that may be suitable for *N. americanus*. Fragmented habitats not only support fewer or lower densities of indigenous species that historically may have supported *N. americanus* populations, but there is a great deal more competition for those limited resources among the newly established predator/scavenger community. Critical habitat for this species has not been designated.

Fat Pocketbook Mussel (*Potamilus capax*)

The fat pocketbook is a medium sized mussel up to 5 inches with a rounded, greatly inflated thin to moderately thick shell, S-shaped hinge line, tan or light brown, rayless, and shiny outer surface (Cummings and Mayer, 1992), as shown in **Figure 4-17**. The species lacks sexual dimorphic characters. It inhabits large rivers in slow-flowing water of only a few inches to over 8 feet with mud or sand bottoms (Parmalee, 1967). The host fish for the larval stage of the species is not known (Cummings and Mayer, 1992).

Distribution for the fat pocketbook mussel once included the upper Mississippi River (above St. Louis), the White River in Missouri and Arkansas, the St. Francis River in Arkansas, the Illinois River in Illinois and the White River, lower Wabash River, and lower Ohio River in Indiana and Illinois (Oesch, 1984; Cummings and Mayer, 1992; Starrett, 1971). Today, it is thought to be restricted to the lower Wabash and White Rivers (Indiana), the St. Francis River, and the lower Cumberland River (Threatened and Endangered Species Institute, 1993; http://midwest.fws.gov/endangered/clams/fatpo_fc.html).

Figure 4-17: Fat Pocketbook Mussel

The Indiana Natural Heritage Program database system includes several accounts of the species from the Wabash River in Gibson and Posey counties dating from 1976 to 1995. The single record of the species from the Ohio River in Kentucky's Natural Heritage Program database is based on a pre-1957 museum record listing Evansville as the location. A single unverified report of the fat pocketbook from the Green River by Williams (1969) is believed to actually be a mislabeled specimen of *Potamilus purpuratus* Lamarck (*Proptera purpurata*) or bleufer. Cicerello *et al*. (1991) describe the Kentucky distribution of the fat pocketbook as "the Ohio River from the Wabash River, Union County, downstream to Ballard County (KNP), and the extreme lower Cumberland River, Livingston County."

The principal threat to the fat pocketbook mussel throughout its historic range has been navigation and flood control measures such as impoundment with dams and channel dredging (USFWS, 1985). Dredging can adversely affect many species of unionids by actual removal of individuals, physical destruction of stable bed habitat, erosion and deposition of loose and unstable material downstream, and alteration of flow patterns within the river channel which may change distribution or movement patterns of fish species serving as hosts (USFWS, 1985). Heavy silt deposition can have a smothering effect on unionids, while high suspended silt levels can interfere with respiration causing unionids to suffocate and/or disrupt feeding (USFWS, 1985). These factors are generally believed to affect many species of unionids; however, the fat pocketbook mussel may be less tolerant of such degrading conditions and more susceptible to demise as a result of the physical changes that have taken place within the large rivers of its historic range throughout the 20th century.

IDNR & KSNPC State Listed Species

Although state listed species are not afforded protection under the Endangered Species Act of 1973, as amended, measures to avoid impacts to these species should be implemented whenever possible in an effort to minimize loss of preferred habitat and prevent future population declines of such valuable state natural resources.

Table 4-8 provides a listing of Indiana endangered and threatened species previously documented for Posey, Vanderburgh, and Warrick counties by the Indiana Department of Natural Resources Division of Nature Preserves. **Table 4-9** is a similar listing of Kentucky endangered and threatened species obtained through the Kentucky Nature Preserves Commission's Natural Heritage Database.

I-69 field studies in 2002 identified and documented the presence of seven state listed species within or near the alignments of one or more of the proposed alternatives. These included two species of mammals, one species of bird, one species of fish, and three species of plant. Although the copperbelly water snake was not observed during I-69 field studies, it is known to inhabit the project study area and its continued conservation is of interest to the USFWS, KDFWR and IDNR. The following commentary provides a brief assessment of project impacts for each of these eight species.

Evening Bat (*Nycticeius humeralis*)

Figure 4-18: Evening Bat

photo credit: Bat Conservation International

The evening bat, shown in **Figure 4-18**, is regarded primarily as a summer resident and is apparently absent during the winter in Kentucky and Indiana (Mumford and Whitaker, 1980; Barbour and Davis, 1974). It leaves the northern portion of its range in late summer and returns in spring (Gardner, 1992). This colonial species has been found inhabiting buildings (attics and walls), the cavities of trees, and loose bark of trees, but does not appear to use caves for summer nursery colonies or roost sites. Nursery colonies of over 100 individuals have been recorded in Indiana and Illinois. Barbour and Davis (1974) refer to only one similar colony from Webster County in Kentucky. Hendricks *et al*. (1991) cite additional summer occurrence locations in the Jackson Purchase Region of Kentucky. **Figure 4-19** depicts the evening bat distribution in Kentucky. **Figure 4-20** shows the known distribution of the evening bat in Indiana.

Table 4-8: Indiana State Endangered and Threatened Species Previously Documented from Posey, Vanderburgh, and Warrick Counties

Taxonomic Group	Species name	Common name	IN Status	IN Rank	Global Rank	Last observed
Mammals	*Lutra canadensis*	River Otter	E	S?	G5	1991
	Lynx rufus	Bobcat	E	S1	G5	1989
	Sylvilagus aquaticus	Swamp Rabbit	E	S1	G5	1989
	Taxidea taxus	American Badger	E	S2	G5	1992
Birds	*Ardea alba*	Great Egret	S	S1B/SZN	G5	1986
	Ardea herodias	Great Blue Heron	E	S2	G5	1993
	Bartramia longicauda	Upland Sandpiper	E	S3B	G5	1954
	Botaurus lentiginosus	American Bittern	E	S2B	G4	1995
	Buteo lineatus	Red-shouldered Hawk	S	S3	G5	1976
	Certhia americana	Brown Creeper	WL	S2B/SZN	G5	1983
	Dendroica cerulea	Cerulean Warbler	S	S3B	G4	1996
	Falco peregrinus	Peregrine Falcon	E	S2B/SZN	G4	1995
	Helmitheros vermivorus	Worm-eating Warbler	S	S3B	G5	1993
	Lanius ludovicianus	Loggerhead shrike	E	S3B/SZN	G5	1982
	Rallus elegans	King Rail	E	S1B/SZN	G4G5	1991
	Rallus limicola	Virginia Rail	E	S3B/SZN	G4G5	1991
Reptiles	*Kinosternon subrubrum*	Eastern Mud Turtle	E	S2	G5	1977
	Nerodia erythrogaster neglecta	Copperbelly watersnake	E	S2	G5T2T3	
Amphibians	*Cryptobranchus a. allegniensis*	Hellbender	E	S1	G4T4	
Fish	*Etheostoma squamiceps*	Spottail Darter	E	S1	G4G5	1998
Arthropods	*Orconectes indianaensis*	Indiana crayfish	S	S2	G2G3	1990
	Cyllopsis gemma	Gemmed Satyr	R	S2	G5	1994
Mollusks	*Plethobasus cyphus*	Sheepnose	E	S1	G3	1994
	Pleurobema cordatum	Ohio Pigtoe	S	S2	G3	1994
	Quadrula c. cylindrica	Rabbitsfoot	E	S1	G3T3	1982
Plants	*Carex socialis*	Social Sedge	R	S2	G4	1991
	Catalpa speciosa	Northern Catalpa	R	S2	G3G4	1942
	Chamaelirium luteum	Devil's-bit	E	S1	G5	1918
	Cratagus viridis	Green Hawthorn	T	S2	G5	1980
	Cyperus pseudovegetus	Green Flatsedge	R	S2	G5	1925
	Didiplis diandra	Water-Purslane	R	S2	G5	1980
	Hottonia inflata	Featherfoil	T	S2	G4	1941

Table 4-8 (continued): Indiana State Endangered and Threatened Species Previously Documented from Posey, Vanderburgh, and Warrick Counties

Taxonomic Group	Species name	Common name	IN Status	IN Rank	Global Rank	Last observed
Plants	*Isoetes melanopods*	Blackfoot Quillwort	E	S1	G5	1985
	Krigia oppositifolia	Dwarf Dandelion	T	S2	G?	1985
	Ludwigina decurrens	Primrose Willow	R	S2	G5	1999
	Ludwigia glandulosa	Cylindric-Fruited Seedbox	T	S2	G5	1925
	Monarda bradburiana	Eastern Bee-balm	E	S2	G5	1992
	Nothoscordum bivalve	Crow-Poison	R	S2	G4	1985
	Orobanche ludoviaciana	Louisiana Broomrape	T	S2	G5	1942
	Passiflora incarnata	Purple Passion-flower	R	S2	G5	1961
	Perideridia americana	Eastern Eulophus	E	S1	G4	1985
	Phacelia ranunculacea	Blue Scorpion-weed	E	S1	G3G4	1983
	Ranunculus laxicaulis	Mississippi Buttercup	E	S1	G5?	1929
	Rhexia mariana var. mariana	Maryland Meadow Beauty	E	S1	G5T5	1944
	Silene ovata	Ovate Catchfly	E	S1	G2G3	1996
	Taxodium distichum	Bald Cypress	T	S2	G5	1994
	Vitis palmata	Catbird Grape	R	S2	G4	1967

Global Rank		State Rank	
G1 – Extremely Rare	T1 – Subspecies Extremely Rare	S1 – Extremely Low	S1B – Extremely Rare/Breeding
G2 – Rare	T2 – Subspecies Rare	S2 – Rare	S2B – Rare/Breeding
G3 – Uncommon	T3 – Subspecies uncommon	S3 – Uncommon	S3B – Uncommon/Breeding
G4 – Many Occurrences	T4 – Subspecies Many Occurrences	S4 – Many Occurrences	S4B – Many Occurrences/Breeding
G5 – Very Common	T5 – Subspecies Very Common	S5 – Very Common	S5B – Very Common/Breeding
GU – Uncertain		SX – Extirpated	SZN – Widely dispersed/Migratory or non-breeding
		SH – Historical	
		S? - Unranked	

Table 4-9: Kentucky State Endangered and Threatened Species Previously Documented from Henderson County

Taxonomic Group	Species name	Common name	KY Status	KY Rank	Global Rank	Last observed
Mammals	*Sorex cinereus*	Masked Shrew	S	S3	G5	1978
	Nycticeius humeralis	Evening Bat	T	S2S3	G5	2001
Birds	*Actitis macularia*	Spotted Sandpiper	E	S1B	G5	2000
	Ardea alba	Great Egret	E	S1B	G5	2000
	Ardea herodias	Great Blue Heron	S	S3B/S4N	G5	1999
	Cistothorus platensis	Sedge Wren	S	S3B	G5	1999
	Corvus ossifragus	Fish Crow	S	S3B	G5	1988
	Gallinula chloropus	Common Moorhen	T	S1S2B	G5	1986
	Hictinia mississippiensis	Mississippi Kite	S	S2B	G5	2000
	Ixobrycnus exilis	Least Bittern	T	S1S2B	G5	1996
	Lophodytes cucullatus	Hooded Merganser	T	S1S2B,S3	G5	1998
	Rallus elegans	King Rail	E	S1B	G4G5	1996
	Riparia riparia	Bank Swallow	S	S3B	G5	1940
Reptiles	*Apalone m. mutica*	Midland Smooth Softshell	S	S3	G5T5	1999
	Nerodia erythrogaster neglecta	Copperbelly watersnake	SC	S3	G5T2T3	2000
	Thmanophis sauritus	Eastern Ribbon Snake	S	S3	G5T5	1996
Amphibians	*Hyla avivoca*	Bird-voiced Treefrog	T	S2S3	G5	1996
	Hyla cinerea	Green Treefrog	S	S3	G5	1995
Fish	*Erimyzon sucetta*	Lake Chubsucker	T	S2	G5	1980
	Ictiobus niger	Black Buffalo	S	S3	G5	1976
Arthropods	*Traverella lewisi*	Leptophlebid Mayfly	H	SH	G2	1967
Mollusks	*Obovaria retusa*	Ring Pink	E	S1	G1	1988
	Pleurobema rubrum	Pyramid Pigtoe	E	S1	G2	1988
Plants	*Chelone obliqua var. speciosa*	Rose Turtlehead	S	S3	G4T3	1995
	Echinodurs berteroi	Burhead	T	S2	G5	1998
	Hydrocotyle ranunculoides	Floating Pennywort	E	S1S2	G5	2000
	Nemophila aphylla	Small-Flower Baby-Blue-Eyes	T	S2?	G5	1998
	Phacelia ranunculacea	Blue Scorpion-Weed	S	S3	G3G4	2000
	Polymnia laevigata	Tennessee Leafcup	E	S1S2	G3	1996
	Pontederia cordata	Pickerel Weed	T	S1S2	G5	1998
	Scirpus fluviatilis	River Bulrush	E	S1S2	G5	1998
	Sparganium eurycarpus	Large Bur-Reed	E	S1?	G5	1973

Global Rank		State Rank	
G1 – Extremely Rare	T1 – Subspecies Extremely Rare	S1 – Extremely Low	S1B – Extremely Rare/Breeding
G2 – Rare	T2 – Subspecies Rare	S2 – Rare	S2B – Rare/Breeding
G3 – Uncommon	T3 – Subspecies uncommon	S3 – Uncommon	S3B – Uncommon/Breeding
G4 – Many Occurrences	T4 – Subspecies Many Occurrences	S4 – Many Occurrences	S4B – Many Occurrences/Breeding
G5 – Very Common	T5 – Subspecies Very Common	S5 – Very Common	S5B – Very Common/Breeding
GU – Uncertain		SX – Extirpated	SZN – Widely dispersed/Migratory or non-breeding
		SH – Historical	
		S? - Unranked	

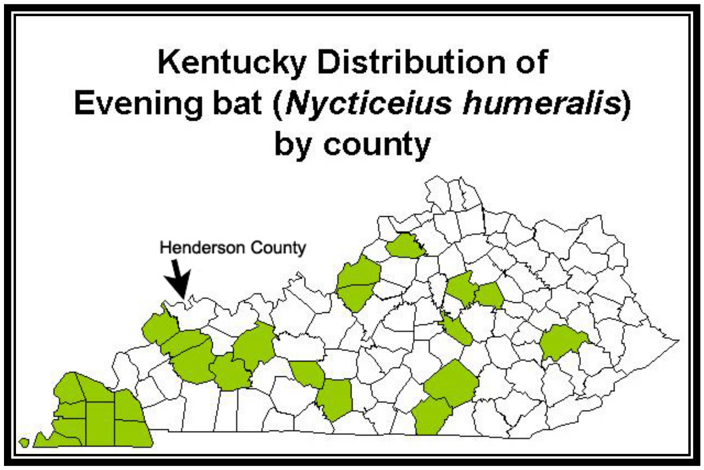


Figure 4-19: Kentucky Distribution of Evening Bat

In Arkansas, evening bat nursery colonies are established in the first half of March. By early July the colonies begin to thin out, and by September or October the bats have migrated south (Sealander and Heidt, 1990). In northern Indiana, nursery colonies do not appear to begin forming until early May. Female and immature male bats that were banded in Indiana (July and August) and recaptured in Webster, Wayne, and Henry Countries in Kentucky (early to mid-August) strongly suggest migratory movements as early as July and August (Mumford and Whitaker, 1980). The evening bat emerges early in the evening to begin foraging for insects above and around the crowns of trees scattered in pastured woodlots. Later in the evening it descends to lower levels where it feeds over ponds and streams or among trees (Sealander and Heidt, 1990). In Indiana, the evening bat has been captured over streams associated with pastures, pastures next to woods, over ponds in pastured woodlots, in open pastured oak/hickory woodlots, oak stands adjacent to swamps, and along a road crossing a swampy pin oak/sweet gum woods (Mumford and Whitaker, 1980). In the summer, peak activity periods for the evening bat are the first hour after leaving the roost and a second one hour period about 9 to 10 hours after leaving the roost (Sealander and Heidt, 1990).

Mist netting records of Whitaker and Gummer (2001) from 1992 to 1999 over bayous, swamps, and streams of the Ohio and Wabash River bottomlands meet with success in capturing evening bats within the lower Wabash River in Posey County, but did not result in any evening bats from counties bordering the Ohio River. Thirteen previous maternity colonies have been documented from buildings in Indiana, although none are currently thought to be active. Despite its affinity for buildings as roosts, individuals have been repeatedly radio-tagged and tracked to silver maple trees in the bottomland areas of the Wabash River.

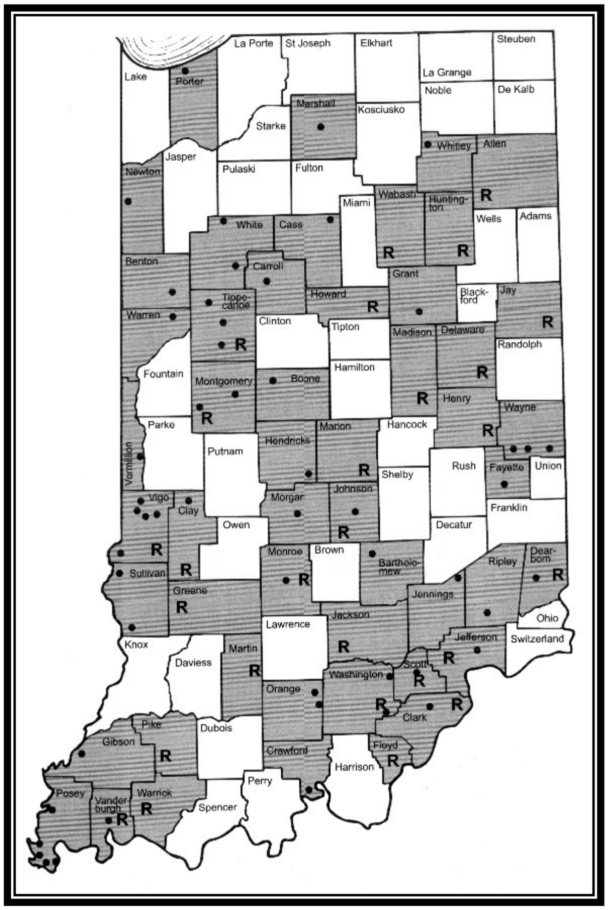


Figure 4-20: Localities where evening bat has been identified in Indiana

R = rabies lab records
(Source: John O. Whitaker, ISU)

Masked Shrew (*Sorex cinereus*)

The masked shrew, shown in **Figure 4-21**, is a diminutive, insectivorous mammal typically with grayish fur and silvery colored undersides, a long, sharp-pointed snout, minute eyes and ears nearly concealed in the fur (Mumford and Whitaker, 1982; Barbour, 1974). It prefers moist habitats with good ground cover. Specific habitats documented in Indiana include swampy deciduous woods, marshy areas covered with grasses and brush, tamarack bogs, weedy and grassy fencerows bordering bluegrass pastures, rank weedy growths along the floodplain of small creek and ditch banks, young pine plantations in old field, fairly dense grasses on sandy prairies, and around the border of a cypress pond (Mumford and Whitaker, 1982).

Figure 4-21: Masked Shrew
photo credit: James F. Parnell

Distribution as documented by Mumford and Whitaker (1982) suggest that the species is more common in the northern part of Indiana, although accounts from Posey, Vanderburgh, and Spencer counties exist. A Special Concern species in Kentucky, Barbour noted that it had only been taken from Black Mountain in Harlan County as of the early 1970's, but noted that in Indiana and Ohio it had been collected in counties bordering the Ohio River, and therefore might occur in northern Kentucky as well.

Great Blue Heron (*Ardea herodias*)

Figure 4-22: Great Blue Heron
photo credit: Illinois Natural History Survey

The great blue heron, shown in **Figure 4-22** is a large, but lean wading bird with a blue-gray body, long folded neck and a daggerlike bill used for feeding on fish, amphibians, insects, reptiles, and small mammals (Peterson, 1980; Castrale *et al*., 1998). It can be found in a variety of habitats associated with water including ditches, small creeks, farm ponds, large lakes, rivers, and floodplain swamps. In Indiana it is considered a fairly common migrant, rare nester, and a rare to casual winter resident (Castrale *et al*., 1998). Nests are platforms loosely fabricated from sticks and branches high inside the outer crown of foliage or in stands of dead or dying trees. They nest in colonies ranging from as few as two to over 500 (Palmer-Ball, 1996; Castrale *et al*., 1998). Typically, colonies are in or closely associated with water, but can occur in bottomland and upland terrain far from large bodies of water. The great blue heron is known to breed throughout Indiana, although a larger number of heronries occur in the northern part of the state than in the south. In Kentucky, heronries are usually found along the lower Ohio River and Mississippi River southwest of Henderson County (Palmer-Ball, 1996). Over the past two decades they have also begun to establish colonies on reservoirs too.

Copperbelly Water Snake (*Nerodia erythrogaster neglecta*)

The copperbelly water snake is a subspecies of the more common plain-belly water snake (*Nerodia erythrogaster*). It has a dark back and is distinguished from other subspecies by its bright orange-red underside and proportionally larger head and eyes compared to other species, as shown in **Figure 4-23**. The known historic range of the species is "south central Michigan and northwestern Ohio, southwestward through Indiana to extreme southeastern Illinois and adjacent Kentucky." Copperbelly water snake wetland habitat loss from early settlement of the Midwest to the late 1900's has been attributed primarily to agricultural land conversion. Current distributional data indicates that a hiatus of approximately 180 miles through central Indiana has divided the subspecies into two populations. The northern population segment, possibly a relict of the more expansive southern population, consists of just eight local clusters from southern Michigan, northwestern Ohio, and northeastern Indiana. The southern population is comprised of 36 local clusters: five in southeastern Illinois, thirteen in southwestern Indiana, and eighteen in western Kentucky. These clusters consist of snakes within connected, or nearly connected, habitat units which are able to interbreed because of this proximity. Because the northern and southern populations meet the criteria of discreteness, significance, and conservation status outlined in the USFWS Policy Regarding the Recognition of Distinct Vertebrate Population Segments under the Endangered Species Act, the Service recognizes two distinct population segments for the species. In so doing, this enabled the Service to treat each population segment as a species and make separate determinations (FR 62 4183-4192).

Figure 4-23: Copperbelly Water Snake
photo credit: Robert Rold Photography

The copperbelly water snake was proposed for listing as threatened on August 18, 1993 (58 FR 43860) with the final rule published January 17, 1997 (62 FR 4183-4192). Today, dredging, coal mining, stream channelization, road construction, and commercial and residential development are the principal causes of habitat loss throughout its known range. The northern segment has been listed as threatened because of extensive habitat loss and pronounced habitat fragmentation and degradation impacts. The eight small clusters of the northern population are separated by incompatible land use, namely agriculture, rural residential sites, and roads. This isolation has forced the clusters to function independent of one another, thus increasing the likelihood of extirpation. Many of the clusters are located on property not owned by the state or private conservation organizations capable of providing protection. As of the late 1990's it was uncertain as to whether the northern population was trending toward an increase or decrease. However, without additional protection it was believed that the northern population may become extirpated within the next few decades.

The southern segment is more widespread than the northern one and consists of larger and more numerous local clusters (FR 62 4183-4192). Range wide western Kentucky harbors the largest number of copperbelly water snakes with 18 isolated subpopulations (clusters), although the long-term viability of 16 of these is regarded as tenuous (Copperbelly Water Snake Conservation Team and Technical Advisors, 1996). In 1996 and 1997 Kingsbury (1998) described 26 habitat complexes which he grouped into 12 management units for western Kentucky. The wetland and bottomland hardwood core habitat of the southern population segment has been adversely affected by activities such as surface coal mining, drainage and damming of wetlands, channelization, damming and diversion of streams and rivers, farmland conversion of the past, and residential and commercial development of upland habitat (Copperbelly Water Snake Conservation Team and Technical Advisors, 1996). Within the tri-state area these intrusions have disrupted and fragmented the distribution of this species to the point where the once-connected local clusters are now mostly isolated.

Unlike the northern population, the principal threat to the southern population segment is habitat destruction and degradation resulting from surface coal mining. The USFWS believes that coal mining can be compatible with the existence of the copperbelly water snake if the extent, timing of mining, and reclamation design are modified to incorporate snake conservation measures. Through the cooperative efforts of federal, state, and private interests, two Conservation Agreements have been drafted that provide regulatory protection to the southern population against habitat loss and degradation from coal mining activities, while at the same time safeguarding the coal resource industry. The first Agreement focuses specifically on coal mining in Indiana, while the second concerns coal mining in Illinois and Kentucky and discusses conservation measures for all three states. Together, the Conservation Agreements precluded the need to list the southern population segment as threatened. Nonetheless, the U.S. Fish and Wildlife Service "will continue to consider the copperbelly water snake habitat to be that of unusually high value for fish and wildlife during performance of environmental review" and expects the natural resource departments of all three states to "emphasize land acquisition, management, and law enforcement to manage and conserve the copperbelly water snake as if it were a federally listed species."

The USFWS felt it prudent not to designate critical habitat for the species out of concern that publication of critical habitat maps and other specific location information might assist would-be collectors and aid in the intentional killing of snakes by those opposed to the conservation efforts of the species.

In the spring, copperbelly water snakes migrate from their upland and bottomland hibernation sites to wetland areas such as ditches, river swamps, and woodland edges of streams, ponds, and lakes. The approach of summer and the drying of woodland swamps results in dispersal of the snakes through wooded or vegetated corridors to summer habitats, primarily forests and forest edges. Despite its wetland affinities, upland habitat is essential for the snake's summer foraging activities. In the fall, this species seeks out bottomland hibernation sites such as felled tree-root networks, crayfish burrows, brush piles, fieldstone piles, and mammal lodges. Upland hibernation sites are also critical to the long-term survival of copperbelly water snake populations when life threatening conditions such as mid-winter floods and freezing temperatures exist.

Spottail Darter (*Etheostoma squamiceps*)

The spottail darter is a robust darter reaching a maximum length of 3.3 to 3.4 inches and is one of 50 or more species of the genus *Etheostoma* in Kentucky. It inhabits small headwater and medium sized streams, but may also be found in large river backwaters. The spottail may be found in various habitats, frequently encountered in quiet pools with slabrock substrates, slab riffles, in brush and aquatic vegetation, or undercut banks (Page, 1983; Kuehne and Barbour, 1983; Etnier and Starnes, 1993). Although tolerant of murky conditions, they do not persist in waters with excessive silt. The males are territorial and entice females to spawn beneath stone slabs in pools or riffles with slow flow after which eggs are deposited on the underside of the rock. Males guard the eggs through a 5 to 11 day incubation period until the larvae hatch (Page, 1983; Kuehne and Barbour, 1983; Etnier and Starnes, 1993).

Earlier works by Page (1983) and Kuehne and Barbour (1983) suggested a range encompassing northern Alabama, central Tennessee, most of western Kentucky and just enters southwestern Indiana, and southeastern Illinois. Specific drainages within this range included the lower and middle portions of the Cumberland and Tennessee Rivers, Green River, and Ohio River tributaries in Illinois and Indiana. The *E. squamiceps* complex was revised by Braasch and Mayden (1985) and resulted in two new species, *E. crossopterum* and *E. nigripinne* for southern populations of the complex. They also now consider *E. neopterum* to be a sister species of *E. squamiceps.* Burr and Warren (1986) follow this division of the E. squamiceps complex and provide distributions of the species within Kentucky as such: *E. squamiceps* – middle portion of the Green River including Rough River and Barren River, middle Cumberland River drainage, upper Tradewater River and Ohio River tributaries in Crittenden and Livingston Counties; *E. crossopterum* – lower Cumberland River drainage; *E. neopterum* – lower Tennessee River and Bayou du Chien.

Gerking (1945) noted that “no specimens of the spottail darter were taken” from southwestern Indiana, but noted Jordan’s 1890 account of the species from Gresham’s Creek in Posey County. The species has since been captured repeatedly in the Bayou Creek drainage (Cervone *et al*., 1989; Grannan and Lodato, 1986; Bandoli *et al.*, 1991). Carpentier Creek of the Bayou Creek watershed has been used by Bandoli *et al*. (1991) as a field laboratory for studies concerning artificial versus natural nest site selection by the spottail darter. As previously noted, the spottail darter reaches the northern extent of its range in extreme southwestern Indiana, and although it appears regularly in collections within its limited range in Indiana, it has been placed on the IDNR state endangered species list.

Green Flatsedge (*Cyperus pseudovegetus*)

The green flatsedge, shown in **Figure 4-24**, is a perennial sedge up to 2.5 feet tall with long, narrow smooth leaves with strongly compressed spikelets subtended by 4-6 leaflike bracts. Its habitat includes various wet locations like roadside ditches, marshes, wet prairies, swamps, and pond and lake margins. It is a southeastern species reaching its northern limits in southern Illinois, southern Indiana, and north-central Kentucky. Deam (1940) considered it infrequent in Indiana, but noted accounts of the species from Posey, Gibson and Pike counties, as well as Jefferson County farther up the Ohio River valley. Beal and Thieret (1986) also considered it rare in Kentucky with distributional records primarily from the Jackson Purchase area of western Kentucky. Its presence in southern Illinois is equally spotty (Mohlenbrock and Voight, 1959; Jones and Fuller, 1955).

Figure 4-24: Green Flatsedge
photo credit: Texas Vascular Plant Image Library

Northern Catalpa (*Catalpa speciosa*)

The northern catalpa is a tree capable of reaching a height of 90 to 120 feet tall and a diameter of 6 feet, although usually much smaller. Shown in **Figure 4-25**, it has a large heart-shaped leaf with circular to oval shaped leaf scars (Grimm, 1983; Wharton and Barbour, 1973; Harlow, 1991). The characteristic fruit is a long cylindrical thick-walled pod up to 20 inches long containing numerous flattened, fringed seeds. It naturally occurs in bottomlands, but has been planted in various habitats, including residential property. The wood has historically been used primarily for fence posts with lesser usage as railroad ties, interior finish, and cheap furniture. Its native range includes southern Indiana, southern Illinois, western Kentucky, western Tennessee, southeastern Missouri, and northeastern Arkansas. Despite its rare classification in Indiana, it is not uncommon to find the species growing in various habitats.

Figure 4-25: Northern Catalpa
photo credit: Ottoni Vivai Italia Nurseries

Bald Cypress (*Taxodium distichum*)

A deciduous conifer reaching heights of 150 feet with diameters exceeding 6 feet, the bald cypress, shown in **Figure 4-26**, is easily recognized by its swollen and fluted trunk and conical structures known as “knees” which protrude from the ground surrounding the base. Although many theories exist, their true purpose or function is still unknown. The bald cypress bares small cones up to one inch in diameter and unlike many conifers, loses its leaves in the winter. It is typically associated with southern swamps where it is commonly found growing with water tupelo (*Nyssa aquatica*). Today, it reaches the northern extent of its range in southern Illinois and southern Indiana, although historically it is known to have grown naturally much farther north. It does best in deep, fine sandy loams with an abundance of water. Though it does occur in drier environments on slightly higher elevations, it is often susceptible from associated bottomland species such as sweetgum, green ash, maples, American elm, and certain oaks (Harlow, 1991).

Figure 4-26: Bald Cypress
photo credit: University of Connecticut

Within the I-69 project study area, large stands can be found in Henderson County in the sloughs along the Ohio River. Although less abundant, individuals are also found in the remnant floodplain woods of the Eagle Creek drainage south of I-164 and east of US 41 in Vanderburgh County. There are a few large naturally occurring bald cypress within a wetland woods along the south side of Eagle Creek, roughly midway between Weinbach Avenue and South Green River Road.

4.3.6 Farmland

Farmland is one of the most important natural resources of Indiana and Kentucky. Prior to European settlement, most of this region was forest and wetland with very little farmland. Progressive increases in farmland acreage in both states reached its zenith in the early 1900's and has subsequently declined on average throughout the 20th century. Despite this decline, farmland production continues to increase due to improved yield rates and more efficient farming practices.

Although agriculture is locally an important land use element within the four counties which comprise the project study area, relative to other counties in the state, Vanderburgh and Warrick counties rank 76th and 84th respectively out of 92 in regards to the percentage of the county that was classified as "land in farms" in the 1997 agriculture census. For Vanderburgh County, this is a function of its relatively small size and the high degree of urban and suburban development within the county. For Warrick County, this is in part attributed to its terrain and extensive coal mining development. In contrast, with roughly 75 percent of its area declared as "land in farms", Posey County ranks 33rd in the state. Within Vanderburgh County the largest expanses of farmland occur in Union Township (southwestern oxbow portion of the county), portions of German and Perry Township in the Little Creek watershed, and Armstrong and Scott Townships in the northern third of the county. Farmland within the Posey County portion of the I-69 project study area is generally equally distributed. Within the project study area portion of Warrick County, large farmland tracts generally occur within a few miles of the Vanderburgh/Warrick county line between SR 66 and I-64, although some of this farmland continues to be developed commercially. Henderson County ranks 51st out of 120 in Kentucky for percentage of "land in farms". With the exception of John James Audubon State Park, the Wolf Hills area, and the small communities and subdivisions surrounding the city of Henderson, farmland is widespread throughout the I-69 project study area in central and northern Henderson County. **Table 4-10** provides statistical information regarding agricultural land, harvested acreage, livestock, and rankings within the state for each of the I-69 project study area counties.

The principal crops produced in Indiana and Kentucky are corn, soybeans, and wheat. Based on county rankings, corn and soybean production in Vanderburgh and Warrick counties are below average in the state with respect to total acres harvested. In contrast, Posey County is one of the top 20 producers of corn and one of the top 40 producers of soybeans in the state. Vanderburgh and Posey counties are two of the top ten wheat producers in the state. In Kentucky, Henderson County is one of the top three leading producers for both corn and soybeans due to its relatively large size and large amount of "land in farms". Additional food crops grown in southwestern Indiana and northwestern Kentucky on smaller scales include small grains, beans, sweet corn, tomatoes, watermelon, cantaloupe, and apples.

In addition to grain and oil crops, tobacco continues to be a key cash crop in Kentucky's agricultural economy. Kentucky ranks 2nd to North Carolina nationally in total tobacco production, yet is the number one producer of burley tobacco, air-cured types 22 and 23, and fire-cured types 35 and 36. Henderson County ranks relatively low in burley tobacco production within the state, but was the 7th largest dark air-cured producer in 2001.

Table 4-10: Summary of Farmland, Cropped Acreage, and Livestock for Project Study Area Counties.

		Vanderburgh Co.		Posey Co.		Warrick Co.		Henderson Co.	
		Value	State Rank	Value	State Rank	Value	State Rank	Value	State Rank
Land (acres for 1997)	No. of farms	271	87	437	73	356	81	526	74
	Land in farms	72,112	83	195,305	31	98,549	77	196,277	15
	Cropland	66,532	81	180,104	23	80,901	73	*	*
	Harvested Cropland	64,540	75	175,881	21	73,939	71	145,238	4
	Pastureland	1,925	92	4,173	83	6,873	69	*	*
	Woodland	2,037	92	9,066	62	7,468	73	*	*
Principal crops (acres harvested 2001)	**Corn**	41,300	63	98,000	18	38,700	67	69,000	**3**
	Soybean	34,000	69	85,700	37	37,900	71	81,500	**2**
	Wheat	8,400	**10**	28,600	**1**	3,700	37	3,700	22
	Alfalfa Hay	1,200	91	2,300	87	4,600	64	1,400	56
	Other Hay							11,000	75
	Burley Tobacco	*	*	*	*	*	*	190	92
	Dark Air-cured Tobacco	*	*	*	*	*	*	285	**7**
Livestock (head number)	**Beef Cows** (2002)	300	91	900	80	1,300	63	6,300	66
	Milk Cows (2002)	*	*	900	38	500	56	**	**
	Hogs (1997)	3,804	79	12,359	69	11,829	70	*	*
	Sheep (1997)	81	86	101	82	95	84	*	*
	Chickens (1997)	*	*	204	30	103	34	*	*
	Turkeys (1997)	*	*	39,003	12	*	*	*	*

Bold numbers indicates categories for which the county was ranked in the top 10 for its respective state
* Not applicable or no data available from the respective state Agricultural Statistics Service
** Data not available at the county level

Livestock production is also an important element of Indiana and Kentucky's agricultural industry. However, as illustrated in **Table 4-11**, the three Indiana I-69 project study area counties are generally ranked 50th or greater in the state with respect to the number of cattle, hogs, and sheep. The one exception to this relatively low livestock presence is the number of dairy cows reported for Posey County, placing it 38th in the state. Beef cattle numbers reported for Henderson County are about average relative to the rest of the state.

The agricultural industry not only provides food for the U.S. and abroad, it also generates income through employment. The Indiana Land Resource Council (1999) estimated that agriculture and food processing contribute $17 billion annually to Indiana's economy and supports approximately 500,000 jobs within the state. Posey, Vanderburgh, and Warrick counties form part of the 12 county southwest agricultural statistics district in Indiana. In 2000, cash receipts for these three counties totaled $105.6 million, or 13.7 percent of the southwest district total receipts for that year. The $9.0 million realized income (cash receipts and other income less expenses) for these counties in 2000 represents approximately 11.2 percent of that reported for the district. Similarly, Henderson County is part of a 15 county agricultural district in northwestern Kentucky. In 2001, its cash receipts totaled $39.0 million, or 9.5 percent of the district total receipts for that year.

Table 4-11: Cash Receipts and Agricultural Statistics for Project Study Area Counties

	Posey Co.		Vanderburgh Co.		Warrick Co.		Henderson Co.	
	Year 2000	State rank	Year 2000		Year 2000		Year 2001	
Total Cash Receipts	$57,142,000	34	$23,712,000	74	$24,723,000	72	$48,906,000	21
Other Income	$21,997,000	21	$8,696,000	73	$8,857,000	72	*	*
Total Income	$79,139,000	32	$32,408,000	73	$33,580,000	72	*	*
Realized Net Income	$3,742,000	42	$1,828,000	60	$3,424,000	49	*	*

* Not available from the respective state Agricultural Statistics Service

The Natural Resources Conservation Service (NRCS) defines prime farmland as "land best suited for producing food, feed, forage, fiber, and oilseed crops, and also available for these uses." In other words, the land could be crop, pasture, range, forest or other land, but not built-up land or water. It has the soil quality, growing season, and moisture supply needed to produce sustained yields of crops economically if treated and managed according to modern farming methods. **Figure 4-27** depicts the percentage of prime farmland in Indiana.

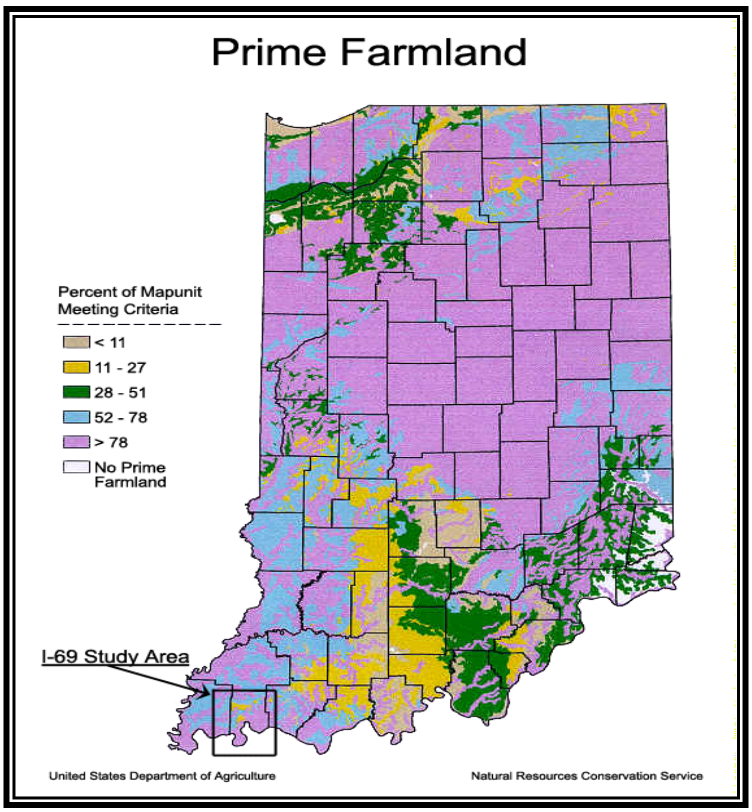


Figure 4-27: Prime Farmland

Data from the 1997 National Resources Inventory (NRI) ranked Indiana 9th in the nation in terms of total acreage of prime farmland, yet it has the second highest percentage of prime farmland in the nation at 56 percent (USDA-NRCS, 2000). Kentucky ranked 22nd in the country in terms of total acreage of prime farmland and 17th in the country in terms of percentage of farmland considered prime. In Indiana, approximately 84 percent of the 12.9 million acres of prime farmland was used as cropland. The remaining 16 percent was pastureland (6 percent), forestland (6 percent), Conservation Reserve Program (CRP) property (2 percent), or miscellaneous rural land (2 percent). In contrast, the 5.7 million acres of Kentucky prime farmland is 57 percent cropland and 26 percent pastureland. Prime farmland in forest, CRP, and miscellaneous rural use comprises the remaining 17 percent.

Nationwide there are growing concerns regarding the loss of prime farmland to rural residential, commercial, and industrial development. This is of particular concern to states such as Illinois and Indiana in which a large percentage of land developed each year is prime farmland. Often, land that is best suited to agriculture (level, well drained, good soil properties) is also easiest to develop. According to the NRI, Indiana had the 7th highest average annual loss of prime farmland due to development from 1992 to 1997, and the 2nd highest percent of total land developed from 1992 to 1997 that was prime farmland (63.6 percent). In Indiana, the NRCS estimates that prime and important farmland is being converted at a rate of 3 to 4 times that of less productive non-prime farmland. From 1982 to 1992, prime farmland in Kentucky declined by nearly 200,000 acres from 5.93 million to 5.74 million acres, a reduction of 3.2 percent. However, prime farmland within the Western Coalfields region was reduced by only 1.9 percent for this ten year period, the least of all five of the regions that comprise Kentucky (Vantresse et al., 1998). In southern Indiana, residential, commercial and industrial development around Evansville and Newburgh in Vanderburgh and Warrick counties, and to a lesser extent in Posey County, continues to irreversibly convert prime farmland resources. Residential and industrial development surrounding Henderson also poses a continued threat to the rural high quality prime farmland property in Henderson County as illustrated in **Figure 4-28.**

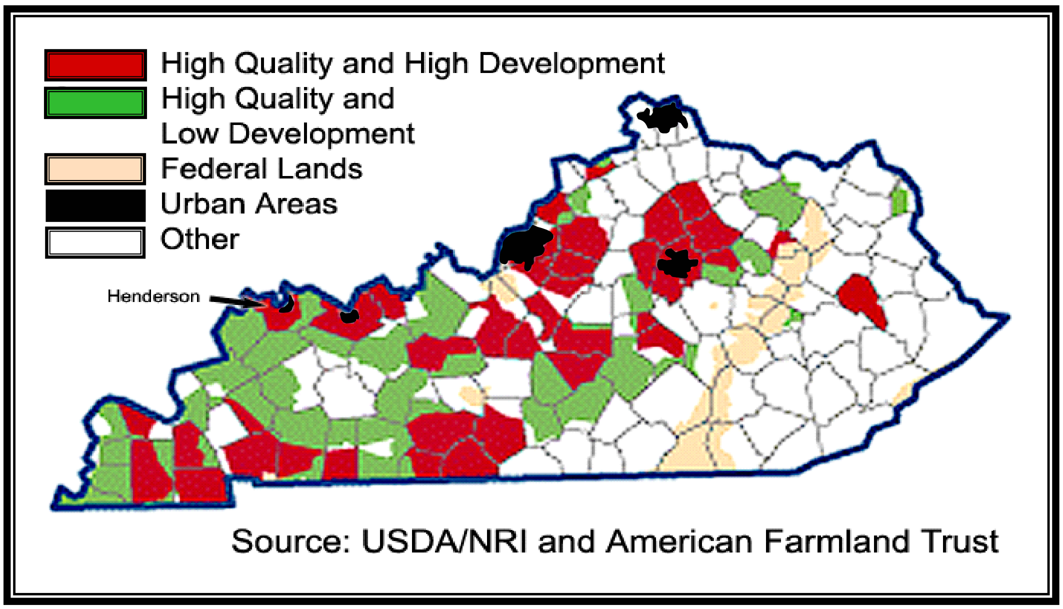


Figure 4-28: Kentucky Counties Designated With High Quality Farmland Potentially Threatened By Development

Development concerns are not focused so much on general farmland conversion as they are on the indiscriminant conversion of high quality farmland land resources. The Purdue Cooperative Extension Service note that "food is produced on prime farmland more efficiently and with less soil erosion, resulting in less pollution from sediment, nutrients and pesticides" (Wheeler et al., 1983). The Service concludes that when prime farmland is lost "it not only takes more non-prime land to produce the same amount of food, but also results in lower returns per unit of production input" which translates into "higher domestic prices or less product to export." Increased pressure to export quality crops to balance payments for imports from other countries may force into production land previously considered marginal as prime farmland becomes less available. In Indiana and Kentucky, the Conservation Reserve Program and the Wetlands Reserve Program, tax incentive programs, exclusive agricultural zoning, right-to-farm laws, certified agricultural districts, land trust purchase, agricultural easements, and transfer of development rights are the principal mechanisms through which farmland can currently be preserved.

4.3.7 Hazardous Waste Sites

Site inspections were conducted in August 2002. Observations were made relative to contamination concerns including, but not limited to: polychlorinated biphenyls (PCBs), underground storage tanks (USTs), aboveground storage tanks (AST), special and hazardous waste, and visible or suspected site contamination. The database search reports included an 800-meter (0.5-mile) radius search relative to the project. The following database reports were searched:

Federal Agency Reports

- EPA Toxic Release Inventory (TRI)
- EPA Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS); EPA CERCLIS No Further Remedial Action Planned (NFRAP)
- EPA Resource Conservation and Recovery Information System (RCRIS)
- EPA Emergency Response Notification Systems (ERNS)
- EPA National Priority List (NPL); EPA Proposed National Priority (PNPL)
- EPA Corrective Action Reports (CORRACTS)

The federal report review found several records for the proposed project study area or abutting properties. Six ERNS files, four TRI sites, one RCRIS large quantity generator, fifteen (15) RCRIS small quantity generators, one Federal Insecticide, and Fungicide and Rodenticide facility registration were identified in the database search area. Additional information on the above listings can be found in the government agency database reports. Some sites may be listed in more than one database.

State Agency Reports

- EPA State Priority Listing (SPL)
- EPA State Registered Underground Storage Tank Listing (UST Branch)
- EPA State Landfill List (SLL)

There were thirty-seven registered UST listings found in the State listing in the project study area. The tank systems with potential to impact the proposed project are discussed in the report herein. One Solid Waste Facilities/Landfill listings SLL was identified in the review of state agency databases. The listings include landfills, recycling facilities, and transfer stations. The SLL listing identified an operating land farm facility in Kentucky on Tscharner Road. The remainder of the state database listings detected in the search area was single listings in the following databases: Material Licensing Tracking System (MLTS) and the Mines Master Index File (Mines). Each of these facilities are outside the disturb limits of the proposed alternatives for I-69. Some sites may be listed in more than one database.

Aerial photography of the majority of the project study area from 1955 and 1989 was reviewed. Aerial photographs were viewed with the naked eye. Land uses surrounding the site in the 1950s were very similar to the current conditions. Distinguished developments near the project study area are within the city limits of Evansville. There is no evidence to indicate obvious or potential sources of site contamination and no other information was obtained.

Chapter 5 – ENVIRONMENTAL CONSEQUENCES

This section describes the potential environmental consequences of the proposed I-69 Henderson to Evansville project. This chapter assesses social, economic, natural environmental, construction, and cumulative impacts the proposed action may potentially have on the surrounding environment.

All direct impacts discussed in this chapter are based on the alternatives' estimated right-of-way. The alternatives vary in width depending on landscape and other various design aspects. Indirect impacts are generally discussed in **Section 5.25 Indirect and Cumulative Impacts**.

5.1 LAND USE IMPACTS

Introduction

The dominant land use in the construction limits of the four Build Alternatives is residential and farmland land (primarily crop production, hayfield, and pasture). **Figures 4-4** and **4-5** in **Chapter 4** show the current land use pattern for the proposed project study area. The project would require the direct conversion of open, agricultural, residential, and commercial land to a transportation land use. Outside the right-of-way, the project may both generate new growth and shift existing growth from existing locations to locations in proximity to the proposed Interstate, particularly to areas adjacent to proposed interchanges.

Methodology

The dominant land use within the construction limits of the four potential project alternatives is residential and farmland. The primary agricultural use is row crops. The land use was identified during a walk through of each project alignment, and then incorporated into a Geographical Information System (GIS) for mapping and analysis.

The land use was separated into 11 classes, as defined below.

1. Existing right-of-way – state or municipally owned property such as roadways (includes ditches and vegetated backslopes)
2. Residential – any portion of a parcel or lot that supports a single or multi-family household structure, including areas maintained as lawn
3. Commercial/Industrial – includes all non-agricultural commercial and/or industrial business operations
4. Rivers – Ohio and Green
5. Ponds – includes small lakes, farm ponds, and any other impoundment of water
6. Open water – any body of open water (includes rock quarries and barrow pits)
7. Agriculture – land used specifically for crop production, or land that directly supports the production of a crop such as equipment barns or tobacco storage
8. Pasture – all agricultural land set aside and fenced in to support grazing animals
9. Woodland – all measurable areas of land that supports a predominance of secondary growth trees forming a reasonably well developed canopy (exclusive of residential property with trees)
10. Shrub/woodland mix – all measurable areas of land displaying thick shrubby or thicket growth with a predominance of young sapling trees and shrubs; these areas may contain a few mature trees
11. Herbaceous cover – includes all non-residential areas consisting of grasses, weeds and/or forbs; includes old unused pastures, power utility corridors, and weedy fields not observed to be utilized for agricultural purposes at the time of field reconnaissance

Analysis

Table 5-1 summarizes the approximate cumulative amount and relative composition of right-of-way land use impacts for the proposed alternatives.

Table 5-1: General Direct Land Use Impacts

Land Use Classification	Alternative 1		Alternative 1A		Alternative 2		Alternative 3	
	Acres	%	Acres	%	Acres	%	Acres	%
Existing right-of-way	69.1	4.5%	62.1	3.6%	36.1	4.8%	56.5	7.8%
Residential	28.8	1.9%	44.2	2.5%	10.8	1.4%	59.1	8.2%
Commercial/Industrial	9.3	0.6%	9.3	0.5%	0.00	0.0%	2.5	0.3%
Rivers	10.8	0.7%	10.8	0.6%	8.5	1.1%	10.7	1.5%
Ponds	8.6	0.6%	8.6	0.5%	0.5	0.1%	0.8	0.1%
Open water	1.0	0.0%	1.0	0.1%	12.9	1.8%	0.0	0.0%
Agriculture	1,069.2	70.0%	1,286.8	74.1%	573.3	76.7%	495.4	68.5%
Pasture	8.7	0.6%	5.9	0.3%	19.5	2.6%	42.7	5.9%
Woodland	243.2	16.0%	257.9	14.9%	55.5	7.5%	44.3	6.1%
Shrub/woodland mix, and/ or herbaceous	77.2	5.1%	51.6	2.9%	30.1	4.0%	11.4	1.6%
Totals (does not include acreage within existing I-164)	**1,524.9**	**100%**	**1,737.4**	**100%**	**747.2**	**100%**	**723.4**	**100%**

<u>**No-Build**</u>

The No-Build alternative would have no impact on existing land uses.

<u>**Alternatives 1 and 1A**</u> begin at I-64 in the highly rural areas of Posey and Vanderburgh Counties. Alternatives 1 and 1A follow approximately the same alignment and the impacted land uses are similar. Much of the land in northeast Posey and northwest Vanderburgh Counties is in agricultural use, primarily row crops. This accounts for 70 percent of the land use encountered by Alternative 1 and 74 percent encountered by Alternative 1A. There are also intermittent patches of woodlands surrounded by agricultural fields in these areas. Alternative 1 traverses croplands in Posey County until it reaches the fringes of the St. Wendel community. Alternative 1A begins in the agriculturally-dominated area of Vanderburgh County. As it travels southwestward toward the Posey County line, woodlands become slightly more abundant. At the county line Alternative 1A joins with Alternative 1 just north of IN 66 and north of the Parker Settlement community. The shared alignment continues due south toward the community of St. Philips, which begins just north of Upper Mt. Vernon Road and stretches south to Wolf Creek. The land use south of St. Philips is predominantly woodland with scattered single-family residences. In the vicinity of SR 62 the land use is more developed with single-family residences and clusters of subdivisions. Subdivisions located in this area are Ryan Place, Fox Hollow, Pine Hill, Woods Lake, and Woodford Green Estates. The region south of St. Philips in Posey County to Bayou Creek in Vanderburgh County contains the largest concentration of woodlands impacted by Alternatives 1 and 1A. The above calculations do not include right-of-way within existing I-164. Since no additional right of way would be required along I-64, no additional direct impacts will occur.

South of the Ohio River is the City of Henderson, which is the county seat for Henderson County. The northwest side of Henderson, where Alternatives 1 and 1A cross, has many commercial businesses including gas stations, hotels, restaurants, and cleaners, along with distribution centers, retail stores, and housing developments. The Henderson wastewater facility and the Henderson Industrial Park are also located near this area along the Ohio River. Outside of Henderson, Alternatives 1 and 1A encounter primarily rural residential and agricultural land uses until their connection with the Breathitt Parkway.

Alternative 2 begins in the rural area south of Evansville. This area is a low-lying floodplain completely dominated by agriculture land use with the exception of a mobile home community that is directly south of I-164. This development is expanding to the west, but direct impacts are not expected based on the current location of Alternative 2. Angel Mounds State Historic Site is located just east of the alignment of Alternative 2. In Henderson County and just south of the Ohio River is the Green River State Forest, which is dominated mostly by a bottomland forest in the floodplain. The woodland area extends south, past Green River, to the uplands area where agriculture becomes dominant from just north of US 60 south to the Breathitt Parkway. Communities near this alternative include Graham Hill and Anthoston. Both are small communities that include a few service related businesses. The above calculations do not include right-of-way within existing I-164. Since no additional right of way would be required along I-64, no additional direct impacts will occur.

Alternative 3 begins on the southeastern side of Evansville and the southwestern portion of Warrick County. This area is densely developed with single-family residences encompassed by woodlands. Businesses are primarily service related such as gas stations, dry cleaners, accounting firms, etc. There are also retirement communities, churches, and sports recreation facilities in the area, some, but not all of which would be impacted by this alignment. Angel Mounds State Memorial Site is located just west of this alignment. Once across the Ohio River the dominant land use is agriculture, which accounts for 68.5 percent of the land use along this alternative. Henderson County communities in this portion of the project study area include Baskett, Graham Hill, and Anthoston. Southwest of Baskett on US 60 is the Henderson Country Club golf course, which will not be impacted by the project. The above calculations do not include right-of-way within existing I-164. Since no additional right of way would be required along I-64, no additional direct impacts will occur.

Summary

Land use impacts are expected to occur with the proposed project. These impacts will range from residential to farmland. Stated below are further discussions on direct impacts of specific land uses.

5.2 SOCIAL IMPACTS

Introduction

The construction of a new Interstate facility will have both positive and negative impacts on the social aspects of the community. Accessibility along the new facility will create a number of social impacts on the surrounding communities, and will alter the existing travel patterns.

Community cohesion refers to the attitudes and feelings of the residents of a neighborhood or geographical area. Ties can be somewhat amorphous and may change over time. New residents can feel differently than longtime residents. Historical actions or traditions may also have a role in determining community cohesion. Rural areas often have a different sense of community than more urban or even suburban neighborhoods or subdivisions. Rural residential communities often derive their sense of place more from geographic isolation and /or the need to be near the fields that were worked than from a conscious desire to live in proximity to others.

As the seats of local government and the largest cities in their respective counties, Evansville and Henderson are home to the majority of the region's public/community resources and services. More information on the existing social and economic settings of the project study area is discussed in **Section 4.1**.

Social impacts that were considered were relocation impacts, impacts on residential and neighborhoods, environmental justice and economic considerations.

5.2.1 Relocation Impacts

Introduction
The relocation impacts associated with the proposed action vary according to the alternative. Relocation of both residents and businesses is anticipated. Nearly all of the relocations could be accomplished within their respective county, if not within their respective community.

Methodology
Interviews were conducted with most of the home and/or business owners likely to be relocated or displaced by any of the three build alternatives. Attempts were made to contact as many tenants/landowners as possible. During each interview, information on the existing facilities was obtained, as well as any personal or business needs were identified.

Analysis
A summary of the residential relocations and commercial displacements is presented in **Table 5-2**, below. The residential relocation is specific with each alternative. About eleven percent of the residential dwellings are assumed to be renter-occupied, the remaining are assumed to be owner-occupied. The renter-occupied dwellings along each alternative include one four-unit apartment building along Alternatives 1 and 1A, none along Alternative 2, and one to four houses and two to three duplexes along Alternative 3. Final roadway and bridge design will determine the exact number of relocations. The No-Build Alternative would result in no displacements. **Table 5-3** shows the potential residential relocations.

The potential business displacements are shown in **Table 5-4**. As with residential relocation, potential business relocations are specific to each alternative. No commercial or industrial displacements would occur with the selection of Alternative 2. The No-Build Alternative would also result in no displacements.

Summary

Residential displacements are expected to be relocated into the same general area; therefore, indirect impacts to other businesses by the displacement of customers are expected be minimal. Census data indicate that adequate housing is available for potentially displaced residents.

The adverse impacts caused by any commercial displacements are expected to be minimal, when compared with the anticipated beneficial industrial and commercial economic impacts from a build alternative. It should be noted that if displaced businesses choose to relocate, each would be required to comply with zoning and subdivision controls of the local community. Adverse proximity impacts to commercial establishments (i.e., parking, access, relocation of patrons, etc.,) are expected to be minimal. No impacts to parking areas or access points, without a direct displacement of the building, were identified based on the level of design available.

Table 5-2: Summary of Potential Relocations and Displacements

	Alternative 1	Alternative 1A	Alternative 2	Alternative 3
Estimated No. of Residential Relocations (Including Residences that are also businesses or farmsteads)	Kentucky 4 Indiana 57 **Total 61**	Kentucky 4 Indiana 67 **Total 71**	Kentucky 6 Indiana 0 **Total 6**	Kentucky 4 Indiana 70 **Total 74**
Number of Residential Relocations That Are Also Businesses (Total included in top row)	Kentucky 0 Indiana 1 **Total 1**	Kentucky 0 Indiana 1 **Total 1**	Kentucky 0 Indiana 0 **Total 0**	Kentucky 0 Indiana 1 **Total 1**
Number of Residential Relocations That Are Also Farmsteads (Total included in top row)	Kentucky 0 Indiana 3 **Total 3**	Kentucky 0 Indiana 6 **Total 3**	Kentucky 1 Indiana 0 **Total 1**	Kentucky 1 Indiana 0 **Total 1**
Estimated No. of Business Displacements (Including those that are residences too)	Kentucky 5 Indiana 1 **Total 6**	Kentucky 5 Indiana 1 **Total 6**	Kentucky 0 Indiana 0 **Total 0**	Kentucky 0 Indiana 7 **Total 7**

Table 5-3: Potential Residential Relocations

Residential Relocations	Alt. 1	Alt. 1A	Alt. 2	Alt. 3
Number of residential displacements	61	71	6	74
Number of owners/tenants being displaced	6	6	0	8
Percentages of displaced residences that are minorities	0	0	0	0
Number of displaced residences that are elderly	14	18	2	14
Number of displaced residences that are handicapped	1	0	0	0
Number of displaced residences with five or more family members	7	7	0	2

The adverse impacts caused by any commercial displacements are expected to be minimal, when compared with the anticipated beneficial industrial and commercial economic impacts from a build alternative. It should be noted that if displaced businesses choose to relocate, each would be required to comply with zoning and subdivision controls of the local community. Adverse proximity impacts to commercial establishments (i.e., parking, access, relocation of patrons, etc.,) are expected to be minimal. No impacts to parking areas or access points, without a direct displacement of the building, were identified based on the level of design available.

Table 5-4: Potential Business Displacements

Name / Type	Type	Approximate Number of Employees	Owner or Tenant	Notes (Unique attributes, likelihood of relocation, cultural orientation, etc.)
Alternatives 1 and 1A				
Weiss Excavating	Construction / Light Industrial	2	Owner	Would relocate in area.
Joy Technologies, Inc.	Service Mining Equipment	8	Tenant	Would move from Henderson.
Country Cupboard / Fast Fuel	Gasoline Retail	12	Owner	Would likely relocate in area.
Hunan's Restaurant	Chinese Restaurant	10	Owner	Unable to contact.
Holiday Motel / Restaurant	50+ /- Units	20+/-	Owner	Unable to contact.
Vacant, Former Restaurant	Vacant	0	Owner	For sale
Alts 1 and 1A Totals		52+/-	Tenant - 1, Owner - 5	
Alternative 2				
No displacements				
Alternative 3				
Off The Wall Sports	Indoor Soccer and gymnastics	30	Owner	Teams from numerous counties travel to the facilities to play. Would relocate in area.
Vibronics, Inc.	Mining Consultants	7	Owner	Mostly work at mining sites, not at the office. Would relocate in area.
Vacant, Commercial	Vacant	0	Tenant	For sale
The Yoga Studio	Yoga Classes	3 (approx)	Tenant	Unable to contact.
Schaloco Construction and Garage Doors	Sales and Maintenance	8	Owner	Would likely relocate in area.
Unnamed Storage	Storage	0	Owner	Isolated metal shop
Bill Henson Enterprise	Real Estate	2	Owner	Works from home.
Alternative 3 Totals		50+/-	Tenant - 2, Owner - 5	

5.2.2 Residential and Neighborhood Impacts

Introduction

The proposed action has the potential to impact existing communities. The following communities are located along Alternatives 1 and 1A: St. Wendel, Parker Settlement, and St. Philips, Indiana; and Henderson, Kentucky. The following communities are located along Alternative 2: Graham Hill and Anthoston, Kentucky. And the following communities are located along Alternative 3: Newburgh, Indiana; and Anthoston and Baskett, Kentucky. These communities are mapped on **Figure 5-1**, and described in the following sections.

Methodology

Information pertaining to these communities came from a review of available mapping, literature research, field visits and meetings with local citizens and leaders. The available mapping included aerial photography, USGS maps, road maps, and others. Literature research included newspaper articles, Census data, tourism information, available plans, and information found on the internet. Field visits included windshield surveys, and interviews of local residents. Meetings with local leaders and representatives throughout the development of the project provided information on the existing conditions and anticipated changes. Information was also used from the interviews from the relocation impacts for these communities.

Analysis

St. Wendel, Indiana, (no population available) is located along the Posey/Vanderburgh County line. This small community contains a few small service businesses, a large landscaping company, and a Catholic Church and school, all near the center of the community. The community of St. Wendel consists of clusters of homes and new housing developments that extend from St. Wendel Road to Rexing Road. Two housing developments that lie on the edge of the St. Wendel community are Walnut Hills subdivision on Diamond Island Road and Das Wunderbar Deutschland on Rexing Road. Alternative 1 would bypass St. Wendel approximately 1 mile to the west of the community, and Alternative 1A would bypass the community approximately 1.4 miles to the southeast. These distances from town will avoid direct adverse impacts to the community. Indirect impacts to travel patterns, accessibility, mobility, and economic vitality of the established businesses are expected to occur. New development and increased traffic would be expected to occur between the community and the Interstate access. No road closures with, to or from St. Wendel will occur.

Parker Settlement, Indiana, (no population available) is located in east Posey County at the junction of SR 66 and Boberg Road. This community has a convenience store and two green house businesses, and several residences along St. Philips Road between Parker Settlement and the community of St. Philips. Parker Settlement would be located approximately 0.6 mile east of the proposed interchange with SR 66 and Alternatives 1 and 1A, as they share a common alignment in this portion of the project corridor. Because of the distance to the interchange area, the community as a whole is not expected to experience any direct adverse impacts. Indirect impacts to travel patterns, accessibility, mobility, and economic vitality of the established businesses are expected to occur. Similar to St. Wendel, new development and increased traffic would be expected to occur between the community and the Interstate access on SR 66. No road closures to or from Parker Settlement will occur.

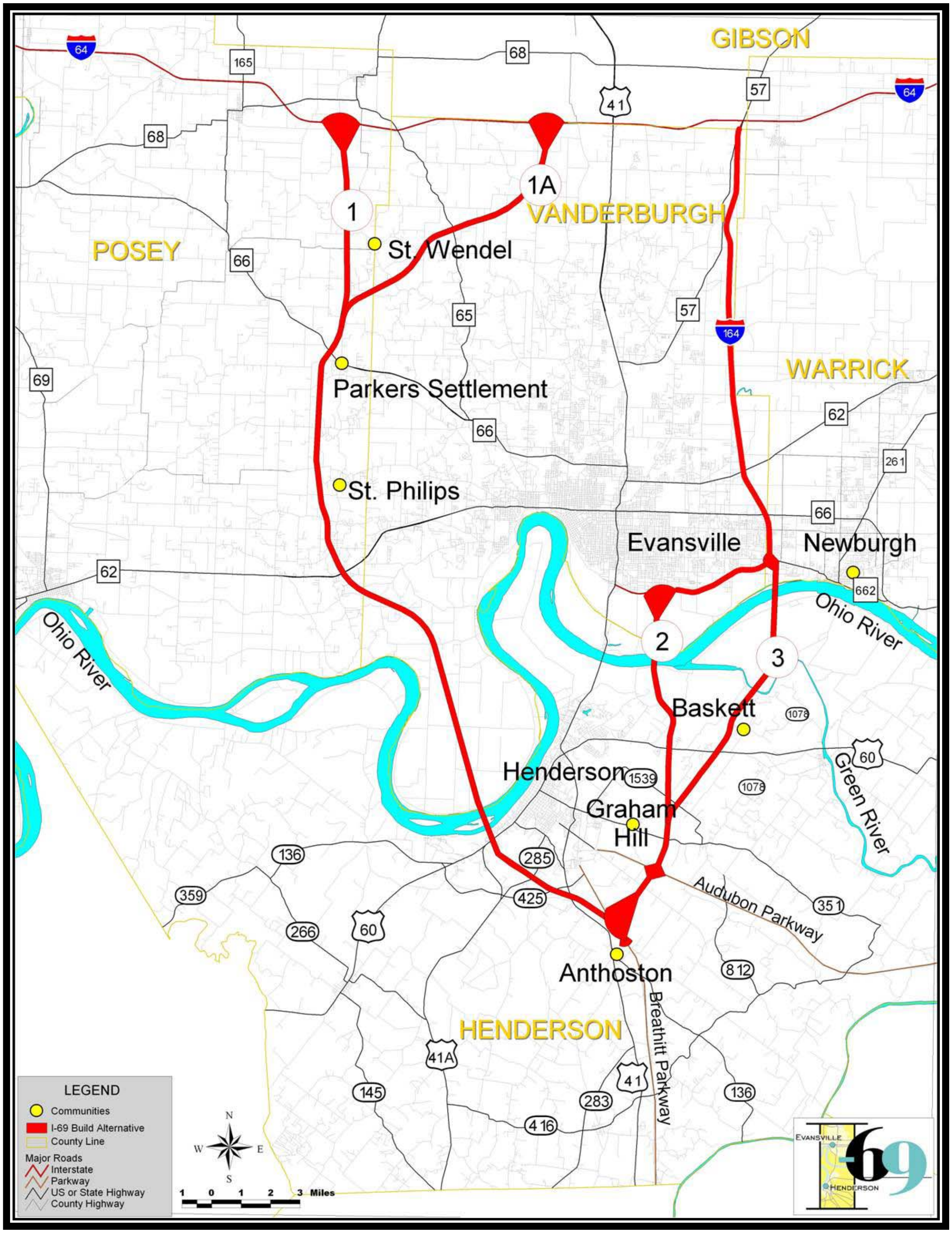


Figure 5-1: I-69 Project Study Area Communities

St. Philips, Indiana, (no population available) is located approximately 4 miles due south of Parker Settlement, at the junction of Upper Mt. Vernon Road and St. Philips Road. St. Philips begins just north of Upper Mt. Vernon Road and stretches south to Wolf Creek. Businesses residing here are small service related entities including two restaurants, a bank, and a toiletry supplier. This community is also home to St. Peters Methodist Church, St. Philips Catholic Church and School, and the St. Philips Volunteer Fire Department. Alternatives 1 and 1A would provide an interchange with Mt. Vernon Road approximately 0.6 mile west of St. Philips and then continue south, to the west of the community. Direct community impacts to St. Philips are expected to be negligible due to the western location of the interchange and the distance between the community and the Interstate. Travel patterns, accessibility, mobility, and economic vitality of the established businesses, will not be adversely impacted, directly or indirectly.

Henderson, Kentucky (population 27,373) constitutes 17 square miles located along the Ohio River. Alternatives 1 and 1A would traverse the western portion of the city. An earlier alignment of Alternatives 1 and 1A impacted numerous residential areas, including a large multi-family development. However, a detailed review of the existing land use surrounding that alignment identified the alternatives currently proposed to minimize community impacts. With Alternatives 1 and 1A, an urban-diamond interchange with US 60 is proposed in order to minimize impacts to the surrounding businesses and residences. Because I-69 would be elevated through the west portion of Henderson, no pedestrian facilities, travel patterns, or other means of mobility would be closed. Additionally, no non-commercial community resources (i.e., governmental buildings, churches, parks, etc.) would be impacted. Alternatives 2 and 3 would bypass the city limits of Henderson to the east and, therefore, avoid direct community impacts. Indirect community impacts could result from changed travel patterns along US 41, which traverse through Henderson and would be bypassed, and US 60, which will have an interchange with I-69. Increased traffic on US 60, and subsequent traffic related development could be expected.

The Township of Newburgh, Indiana (population 3,088) lies east/southeast and adjacent to Evansville in Warrick County. The central business district (and associated historic district) of Newburgh is approximately 3 miles east of I-164, Evansville and the corridor of Alternative 3. Alternative 3 would, however, traverse a residential area of Newburgh that is directly south and southeast of I-164, and east of Angel Mounds State Historic Site. This section of Newburgh is densely residential, with some commercial establishments along SR 662. All but two of the residences are single-family dwellings; the remaining two are duplexes. No community facilities, including churches, parks, schools, sidewalks, retirement communities, or governmental buildings, would be directly impacted by Alternative 3. Indirect impacts may occur. Much of Alternative 3 in this section would be elevated, as it approaches the Ohio River crossing, therefore, the main east-west access to this area, Pollock Avenue, would be bridged and remain open. The main north-south road, Stacer Road, however, would not remain open, and north-south access would be rerouted either east to Morningside Road, which connects to SR 662, or west to Fuquay Road, which bridges I-164.

Approximately 70 residential relocations west of the community of Newburgh are anticipated. The majority of these are along Stacer Road (26) and Spry Road (16). All five residences along Short Road and the 10 residences along Ferguson Road would be relocated. Attempts were made to contact and interview the majority of the residents who would be relocated, or located adjacent to the proposed alignment of Alternative 3.

Graham Hill, Anthoston, and Baskett, Kentucky, are small communities located in east Henderson County. Each has small service related businesses. Anthoston also has two churches. Baskett has a few small service businesses, two churches, and a volunteer fire department. Alternatives 2 and 3 are not located near these communities, and will not impact travel patterns, accessibility, mobility, and economic vitality of the existing businesses.

Summary

With these well established neighborhoods and communities the proposed action will directly and/or indirectly affect them. Some area's residents and business will be directly affected from this proposed action; information pertaining to these relocations was addressed in **Section 5.2.1**. The proposed action is typically not located in the immediate vicinity of these communities; therefore, the build alternatives will not directly impact the communities, but may adversely affect these communities through impacts to travel patterns, accessibility, mobility, and economic vitality of the established businesses. The No-Build Alternative will have no impacts on these communities.

5.2.3 Environmental Justice

Introduction

The U.S. EPA's Office of Environmental Justice defines environmental justice as follows:

> "The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations and policies. Fair treatment means that no group of people, including racial, ethnic, or socio-economic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local and tribal programs and policies."

Recognizing that the impacts of federal programs and activities may raise questions of fairness to affected groups, President Clinton, on February 11, 1994, signed Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. The Executive Order states that "each federal agency shall make achieving environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations".

The Executive Order also refocuses attention on the National Environmental Protection Act (NEPA), a 25-year old law that set policy goals for the protection, maintenance, and enhancement of the environment. Environmental justice also strengthens Title VI by requiring federal agencies to achieve environmental justice goals. The principles it embodies are rooted in Title VI of the Civil Rights Act of 1964 and previous civil rights legislation. The lead Federal agency for this project is the Federal Highway Administration (FHWA). Therefore, the assessment of low-income and minority populations in the project study area is based on the policies and procedures of that agency. Pursuant to the executive order, FHWA has adopted FHWA Order 6640.23, FHWA Actions to Address Environmental Justice in Minority Populations and Low-income Populations, December 2, 1998.

Executive Order 12898 does not define the terms "minority" or "low-income." However, guidance provided by the FHWA Order 5610.2 defines these terms and the basis for the methodology that follows.

Minority Population

Minority – a minority individual is classified as belonging to one of the following groups: American Indian or Alaskan Native, Native Hawaiian or Other Pacific Islander, Asian, Black, and Hispanic.

Black – a person having origins in any of the black racial groups of Africa.
Hispanic – a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.
Asian – a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent.
American Indian and Alaskan Native – a person having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition.
Native Hawaiian or Other Pacific Islander – a person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

Minority Populations – a minority population is classified as any readily identifiable group of minority persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as immigrant workers or Native Americans) who would be similarly affected by a proposed FHWA program, policy, or activity. Under FHWA Order 6640.23, the following minority populations must be addressed in an analysis in Environmental Justice issues:

The number of Black, Asian and Hispanic, American Indian/Alaskan Native, and Native Hawaiian/Other Pacific Islander populations in the project study area were all combined and referred to as "minorities".

Low-Income Population

Low-income – a household income at or below the U.S. Department of Health and Human Services Poverty Level Guidelines as defined by the U.S. Department of Health and Human Service (DHHS). For example persons whose household income is at or below DHHS guidelines of $6,280 for an individual, $3,140 per additional person or $12,700 for a household of four, are considered low-income.

Low-income Population – a low-income population is classified as any readily identifiable group of low-income persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as immigrant workers or Native Americans) who would be similarly affected by a proposed FHWA program, policy, or activity.

Methodology

In order to address environmental justice (EJ) for each of the proposed I-69 alternatives to Evansville, IN, a preliminary "First Level Screening Addressing Environmental Justice" was undertaken. The purpose was to assess whether there were disproportionately high and adverse impacts on low-income and minority populations resulting from the I-69 project. This process served as a basis for the 2002 EIS Level 1 EJ Analysis. The Level 1 EJ Analysis ensured environmental justice considerations were properly integrated into the I-69 assessment process. The Level 1 EJ Analysis addressed FHWA Directive 6640.23 through each of the following four principles:

1) The identification of low-income and minority populations and the analysis of information relating to engineering, environmental, or planning activities impacting these populations;

2) The evaluation and analysis of the impacts of the corridor selection process on target populations and assessing whether target communities would receive a disproportionate share of the adverse impacts resulting from the proposed routes;

3) Community outreach and input from environmental justice populations; and

4) Incorporating the recommendations of the environmental justice analysis into the corridor selection process through the Environmental Impact Statement.

Copies of the "First Level Screening Addressing Environmental Justice" were included in Appendix E of the "*Level I Alternatives Analysis Report*", June 2002.

Executive Order 12898 and the associated DOT orders and memoranda offer guidance regarding appropriate measures to analyze transportation impacts. Such guidance was followed in the Level 1 EJ Analysis and subsequent field surveys to evaluate potential EJ issues. The results of the evaluation provided a comparative assessment of route alternatives and environmental justice principles as part of the selection process. One of the key principles to achieving the intent of the Executive Order is "consideration of the effects" on minority and low-income population. The primary methodology that was utilized for this process is outlined below:

- Development of low-income and minority location maps;
- Compilation of low-income and minority census data depicting estimated population and percentage of population for each corridor;
- Reviewed Census Data with a focus on identifying the location of the target populations;
- Analysis and review of aerial photographs to determine location of apartment buildings and mobile home parks in the Evansville MSA; and
- Windshield surveys to confirm the existence and condition of the apartment buildings and mobile home parks.
- Conducted on-site visits to mobile home parks and apartment complexes in Evansville, Newburgh, IN and Henderson, KY to verify existing and identify potentially new EJ communities;
- Reviewed the public involvement comments for EJ input;

Analysis

The initial assessment of potential Environmental Justice impacts associated with each of the proposed alternatives was conducted via an analysis of census information. U.S. Census Block and Block Group data was collected for the Evansville, IN-Henderson, KY MSA as source data for assessing potential impacts to minority and low-income populations. This included (1) the total population, (2) the total minority population, and (3) the population living below the poverty level (poverty data were available for each Block Group, but were not available for single Blocks). Using this data, the percentage of persons classified as minority and the percentage of persons below the poverty level were determined to assess the potential for disproportionate impacts to these populations.

Figure 5-2 is a map of the project study area overlaid with the proposed alternatives and the percentage of minorities by census block. The maximum percentage of minorities is noted in the legend on the map. The combined non-white population for the Evansville MSA is 8.19 percent. Higher percentages of minority populations were located in the central parts of the cities than in the outlying areas. These areas include the Fairlawn Center neighborhood around downtown Evansville and the downtown area of Henderson, KY.

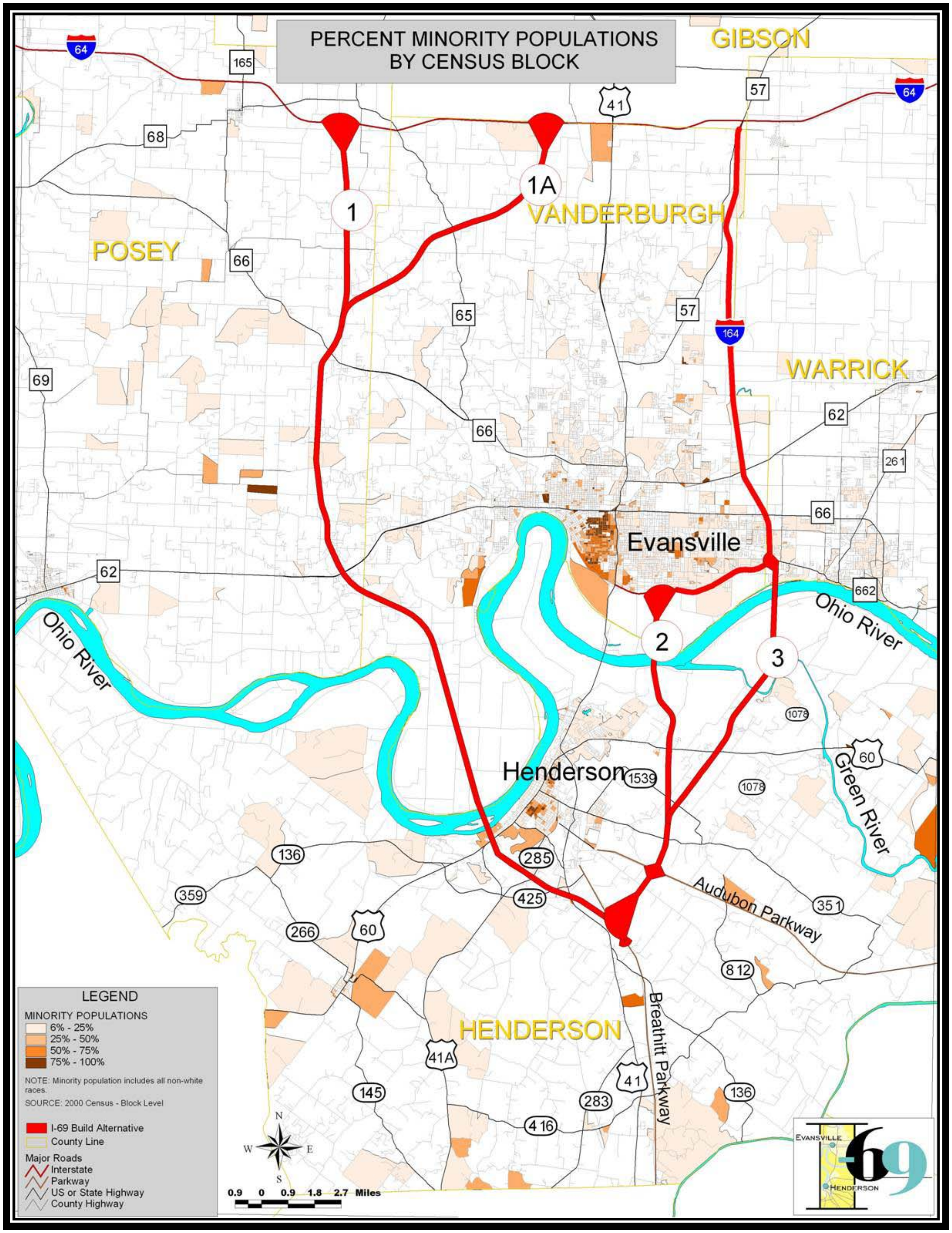


Figure 5-2: Percent Minority Population

Figure 5-3 is a map of the project study area overlaid with the proposed alternatives and the percentage of those living in poverty by block group. The maximum percent of persons living in poverty in the project study area is noted in the legend. 2000 Census data indicate that 10.97 percent of the population in the Evansville MSA is at or below the poverty threshold. The highest concentration of people living in poverty was in various areas of Evansville west of US 41, the community centered around the University of Southern Indiana and the Fairlawn Center area in Evansville, IN, as well as the Henderson central business district, Weaverton neighborhood and the neighborhoods between US 60 and the Ohio River southwest of Henderson.

Once the baseline minority and low-income populations were classified, specific Block Groups, or Blocks, that met the threshold were identified. Any area that met this threshold was classified as an environmental justice area. Because income status of individual Blocks was not reported and could not be established, all blocks in low-income Block Groups were treated as environmental justice areas. For this reason, it was unnecessary to analyze minority Block Groups by Block if the Block Group qualified as an environmental justice area based on income.

Groups of minority and low-income populations are located throughout the project study area. However, the minority populations appear to be more concentrated (mainly in the urban areas of Evansville and Henderson) than are the low-income populations (**Figures 5-2 & 5-3)**. Areas of environmental justice concern are concentrated in the center and west of Evansville, IN and the center of Henderson, KY. Each of the proposed alternatives cross through, or adjacent to, Census Block or Block Group communities where higher percentages of minority and/or low-income populations were identified. These alternatives have the potential to directly impact environmental justice communities.

Following the initial assessment of census tract data, field reconnaissance observations and a door to door survey were conducted to determine potential environmental justice impacts and/or benefits to residents along specific alignment areas. An area observed during field reconnaissance was the Eastbrook Mobile Home Park. This recently developed community is situated in a largely agricultural landscape area contiguous to some isolated free standing homes. Census tract data did not indicate this area as containing a high concentration of low income or minority populations. However, it was observed that significant new expansions were occurring on the site. Information was gathered at the Evansville Area Planning Commission to determine the limits of the Eastbrook Mobile Home Park proposed expansion.

Additional fieldwork identified the Chapelwood Place Apartments as a specific environmental justice area of concern along the Ohio River in Henderson, KY. The Chapelwood Place Apartments located along Main Street contained 30 percent low-income and 50 percent minority residents. This apartment complex was within the Alternate 1 and 1A potential area of impact. The US 60 interchange with Alternatives 1 and 1A slightly west of the Chapelwood Place Apartments was adjusted so as to avoid any potential impacts to the minority and low-income residents. The subsequent shift in the alignment of Alternative 1 and 1A resulted in the avoidance of potential impacts such as access to schools, employment, daycare, recreation, shopping, churches, medical facilities and other family services for the residents within the Chapelwood Place Apartments neighborhood.

The Alternative 1 and 1A alignment passes just west of a Census Block Group south of SR 62 in western Vanderburgh County with a reported low-income population of greater than 50 percent. This high percentage of low-income is attributed to the large transient student population at the University of Southern Indiana which was included in the census data. Field reconnaissance observations of permanent non-student residents elsewhere within this geographic Census Block Group produced little or no evidence of a low-income population outside of the university student population.

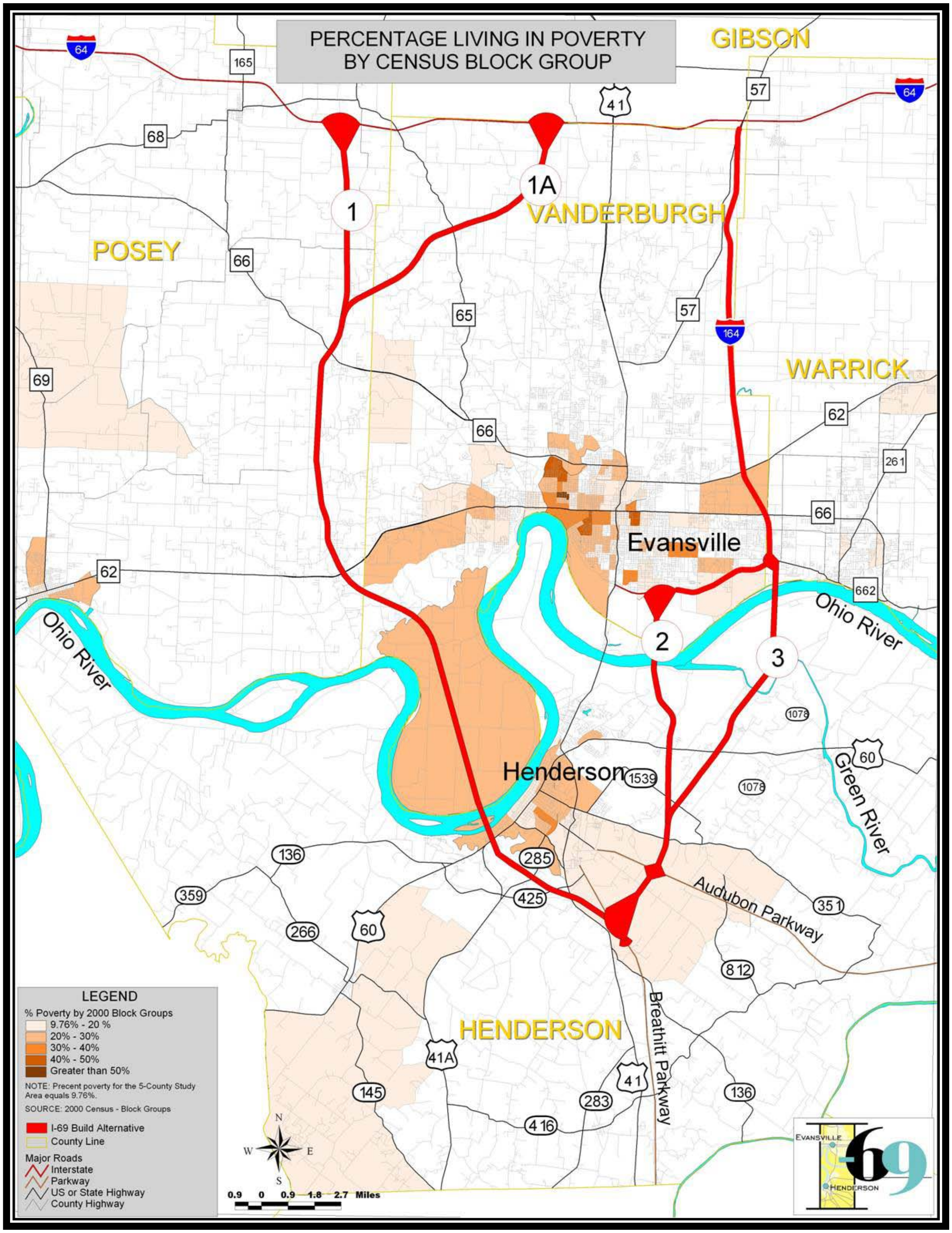


Figure 5-3: Low Income Population

Low-income (i.e., below poverty level) Census Block Group data also identified a rural area of Henderson County between US 41 and KY 351 as an area where 20 to 30 percent of the population is considered low-income. Alternatives 2 and 3 both cross through this largely agricultural landscape displaying scattered clusters of residential developments and several more isolated homes. Through field reconnaissance observations and interviews with potential displaced residents, it was determined that neither alignment would directly disproportionately affect low-income families or communities.

The No-Build alternative would have no impact on low income or minority populations.

Summary

The purpose for Environmental Justice is to avoid or minimize disproportionate adverse impacts to minority and low-income populations. Even a very small minority or low-income population affected by an alternative does not eliminate the possibility of a disproportionately high or adverse effect of a proposed action or project. It is especially important in cases where a project impacts a very small area of low-income or minority population such as the Chapelwood Place Apartments.

Environmental Justice issues and concerns identified in the alternatives were addressed. This report documents the various measures taken to identify and avoid potential impacts to target populations at Chapelwood Place and other communities throughout the project study area. After completing this environmental justice review, it was determined that none of the proposed alternatives would have a disproportionately high and adverse effect on minority and low-income populations in the project study area. The No-Build Alternative would have no effect on minority and low-income populations.

5.2.4 Economic Considerations

Introduction

Economic considerations include:

1. The shift in highway-oriented retail businesses as a result of the shift in traffic volumes from the existing route to the new alternatives, and
2. The stimulation of additional regional growth due to improved accessibility within and to/from the region.

Highway-Oriented Business Impacts

Methodology for Existing Route The impact of the Build Alternatives on highway-oriented retail businesses (gas stations, convenient stores, fast food restaurants and motels) is proportional to the diversion of traffic from the existing US 41 corridor. Over the 25-year period from year 2000 to year 2025, daily traffic volumes grow about 25 percent in the existing US 41 corridor under the No-Build Alternative.

Analysis of Existing Route Of the Build Alternatives, Alternatives 1 and 1A have the least impact on existing highway-oriented retail businesses. Along the US 41 Corridor, daily traffic growth ranges from 12.5 percent to 25.0 percent (comparable to the No-Build Alternative) without the completion of National I-69 outside the Evansville region, and ranges from 18.75 percent to 25.0 percent (comparable to the No-Build Alternative) with the completion of National I-69 (entering from the north in the US 41 corridor or SR 57 corridor and from the south via the Breathitt Parkway). Thus, existing highway-oriented retail businesses will experience varying impacts depending upon their location along the US 41 Corridor, and some highway-oriented businesses may experience somewhat slower growth as a result of Alternatives 1 and 1A.

In contrast to Alternatives 1 and 1A, Alternatives 2 and 3 tend to have a more significant impact on existing highway-oriented retail businesses because 2025 daily traffic volumes along existing US 41 may be reduced below year 2000 levels on some segments (generally along US 41 from I-164 to US 60). Alternative 2 may have the greatest impact on existing highway-oriented businesses by reducing year 2000 daily traffic volumes by up to 33 percent on some segments, with or without the completion of National I-69. Alternative 3 may reduce year 2000 daily traffic volumes by up to 17.5 percent on some segments, with or without the completion of National I-69.

Methodology for New Routes Hartgen and Kim (Hartgen, David T. and Ji Youn Kim; "Commercial Development at Rural and Small Town Interstate Exits; Transportation Research Record 1649, Paper No. 98-0307) have developed a methodology for forecasting possible highway services development at Interstate interchanges after the interchange is open to traffic for 20 years. Development prediction models are based on daily traffic volumes on the Interstate and crossroad, the distance and population of the nearest town, and the distance to nearby exits and major cities.

Analysis of New Routes Based on the Hartgen and Kim predictive models, Alternatives 1 and 1A may generate the following highway services development by interchange:

- SR 65 – no development due to proximity to other freeway service interchanges,
- SR 66 – one gas/convenient store, one gas station, one fast food restaurant and one motel,
- SR 62 – two gas/convenient stores, four fast food restaurants and four motels,
- US 60 – one gas/convenient store, one gas station, one fast food restaurant and two motels, and
- KY 425/US 41 – two gas/convenient stores, four fast food restaurants and four motels.

Alternatives 2 and 3 are expected to reinforce the existing growth pattern in Indiana along I-164. In Kentucky, Alternative 2 may generate the following highway services development by interchange:

- US 60 – two gas/convenient stores, one gas station, four fast food restaurants and two motels, and
- KY 351 – one gas/convenient store, one gas station, one fast food restaurant and one motel

In Kentucky, Alternative 3 may generate the following highway services development by interchange:

- US 60 – one gas/convenient store, one gas station, three fast food restaurants and two motels, and
- KY 351 – one gas/convenient store, one gas station, one fast food restaurant and one motel.

Regional Growth Impacts

The remainder of this section describes the impacts of business expansion and business attraction associated with the development of I-69 within the region and National I-69.

Methodology for Estimating Growth Impacts. An assessment for the Evansville Region was conducted to identify the expected magnitude of economic growth impacts based on the four alternatives recommended in the *I-69 Level 1 Alternative Analysis Report*. The project study area encompasses four counties: Posey, Vanderburgh,and Warrick and counties in Indiana, and Henderson County, Kentucky. The analysis is based on a National I-69, or at minimum an I-69 that traverses the industrial Midwest, and considers the following questions:

- With development of I-69, will industry be attracted to the project study area over locations elsewhere in Kentucky or Indiana?
- Is an industry growing regionally and/or nationally, and is there likelihood that the study-area will gain a greater share of the national industry with development of the highway?
- Given the two questions above, how many jobs might be expected if land along I-69 were developed in a twenty-year timeframe from the opening of the highway?

By themselves, highways do not automatically create private sector investments and jobs. Highways create opportunities for development in concert with other factors. These factors include, but are not limited to, local land use regulations, availability of appropriate land and infrastructure, a labor force that is appropriate for the new/expanded industries under consideration, and local factors that generally fall under the headings of "quality of life" and "business climate."

As part of the impacts analysis of I-69, site visits and interviews were conducted, economic structure of the project study area was analyzed, county and regional planning documents by public agencies were reviewed and documents were prepared for INDOT, KYTC, FHWA and EUTS as part of the impacts analysis of I-69. These multiple approaches were combined to develop a balanced understanding of the regional economy.

1. Twenty-eight interviews were conducted with stakeholders in the Evansville region. These stakeholders included ten representatives of the public sector or public sector oriented non-profit corporations, such as planning commissions, and 18 representatives of the private sector, such as major employers and chambers of commerce.
2. A site visit allowed first hand observations of economic development and transportation conditions in the region.
3. A location quotient (LQ) analysis was calculated to compare the Evansville region to the states of Indiana and Kentucky by employment.[1] The LQ analysis shows whether various industries under existing conditions tend to locate in the project study area in greater or lesser concentrations than in the overall economies of Indiana and Kentucky. 2000 data, the most recent year available, was used from County Business Patterns (CBP). The Toyota plant was completed in January, 2003 and only half the plant is represented in the 2000 data. The Toyota plant provides a major boost to the Evansville regional economy, and any analysis requires that the full measure be counted, though 2000 is the most recent year that CBP is available. Accordingly, 2,550 jobs were added to the 2000 transportation equipment manufacturing sector and 125 jobs each were added to plastics and fabricated metals sector to the 2000 totals of the Evansville project study area and the two-state region to represent the full expansion of the Toyota plant and its local suppliers expected in 2003 (predicted, conservatively, at 4,600 for January 2003 and with 1,000 jobs for suppliers in the region).

[1] The Chair of the Economics Department of Southern Indiana University agreed that the two states were a valid comparison area.

4. By undertaking an industrial shift share analysis, the industry growth and contraction for the project study area was measured, compared to the United States, from 1995 to 2000. This part of the analysis measures how an industry is growing or failing compared to trends nationally. It helps to determine if it is likely the study area can capture a larger market share of given industries, and if the probable content of that market share will represent faster growth of robust sectors of the national economy or slower decline of fading industries. The County Business Patterns were used for these two target years, and adjustments were made to the 2000 North American Industrial Classification System (NAICS) data to place them in equivalent groupings to the 1995 data, which was reported in the Standard Industrial Classification (SIC) format. As in the LQ analysis, the full Toyota expansion was added to the 2000 data for both the Evansville region and the national totals.
5. The transportation costs were examined and applied per industry, by mode, from the 1997 U.S. Transportation Satellite Accounts (TSA).[2] These are national data that report the dependence of economic sectors on different modes of transportation by measuring how much of production costs are invested in each mode. TSA is used to estimate how the project study area's competitive position per industry might be affected by construction of I-69. Accessibility to Ohio River ports was taken into consideration when evaluating I-69.
6. Cost factors were considered in the project study area with the states of Indiana and Kentucky, including comparative manufacturing labor costs (County Business Patterns), electricity costs for industry (Energy Information Administration of the U.S. Department of Energy) and taxation (U.S. Census of Governments). The bottom line is that the region has slightly higher manufacturing wages (but lower general wages), lower utility costs, and virtually equivalent per capita tax burden as the two states, combined.
7. From interviews and the site visit, the availability of raw land was assessed, including industrial land with infrastructure and potential office/commercial sites. It appears that ample supplies of land are available in the project study area for each of these categories, based on information gathered through interviews and a site visit. However, infrastructure development is more prevalent and is easier to develop on the east side.
8. Interviews and transportation reports allowed the changes in accessibility that the Interstate will foster to be estimated, including the potential to increase the project study area's labor, customer and business-to-business markets, potential expansion of the visitor/tourist markets and changes in access to airports, seaports and rail centers.
9. A review of planning and economic documents from the region buttressed data gathered from interviews.

Summary of Regional Growth Impacts

Regional growth impacts are forecasted for the year 2025 to be consistent with the socioeconomic database of the travel demand model. Travel forecasts for the Build Alternatives compared to the No-Build Alternative are input into the Net Benefit/Cost Analysis model to forecast users benefits associated with travel time. These travel time benefits serve as inputs to

[2] The U.S. Transportation Satellite Accounts are generated jointly by the U.S. Bureau of Transportation Statistics and the U.S. Bureau of Economic Analysis to assess each industry's use of transportation services in the production process.

the five-county REMI macro-economic model to forecast business expansion benefits for the major business sectors.

Alternative 1 or 1A is expected to improve accessibility to available industrial sites in Posey County. A shift in 1,600 to 1,700 jobs (representing 154 acres) from Vanderburgh County to Posey County is expected and includes an industrial component and a commercial component driven by different location considerations. Approximately 2,500 to 3,000 new industrial jobs may be created in Vanderburgh County by the year 2025. Nearly one-half of these jobs are expected to shift to Posey County. These jobs were allocated to industrial sites in Posey County—the A.B. Brown site, Southwind Port and Industrial Park, GE Plastics area southwest of Mt. Vernon and industrial area on the north side of SR 62 near the SR 69 bypass.

Because residential growth (stimulated by industrial growth) and new freeway service interchanges generate commercial growth, 250 to 300 jobs in retail, finance, and services would be expected to shift from Vanderburgh County based on the ratio of population to commercial employment and on freeway service interchange characteristics attracting Interstate-oriented retail services.

The shift in population growth caused by Alternative 1 or 1A would be expected to shift 1,500 to 2,000 dwellings from Vanderburgh to Posey County. This will shift about 161 acres of residential development from Vanderburgh County (in the vicinity of Green River Road and Millersburgh Road) to Posey County growth areas northwest and northeast of Mt. Vernon and the SR 62 corridor west of the Posey/Vanderburgh County Line.

In Henderson County, approximately 500 to 650 jobs representing 43 acres would be expected to shift from the US 41 corridor to the Alternative 1 or 1A corridor. Of the estimated 800 to 900 new industrial jobs forecasted to occur in Henderson County between the years 2000 and 2025, approximately 200 to 300 industrial jobs would be expected to relocate. Based on the interviews with local officials, industrial jobs would be expected to relocate to the Dannline Industrial Development, Henderson Corporate Park, Mile Stretch Industrial Park, and Henderson Riverport Industrial Park. The 4 Star Regional Industrial Park on US 41 at the Henderson/Webster County Line is expected to attract new employers rather than accommodate the shift of existing employers. Thus, this industrial park will benefit primarily from the increase in total regional employment as opposed to shift of employment within the region.

Alternatives 2 and 3 are expected to reinforce the existing conditions in Indiana, but are assumed to result in commercial development shifts in Henderson County from the US 41 corridor to the service interchanges of the Interstate alternatives.

Because US 60 is a major residential growth area west of Alternative 2, the residential population is forecasted to grow by nearly 4,000 persons within one-mile of the proposed US 60/I-69 interchange by the year 2025. Thus, the proposed US 60/I-69 interchange is anticipated to attract commercial development supporting the surrounding residential area amounting to 20 additional acres. Thus, Alternative 2 is estimated to shift approximately 500 to 550 commercial jobs (41 acres) away from the US 41 corridor.

The residential population is forecasted to grow by 2,000 persons within one-mile of the proposed US 60/I-69 interchange on Alternative 3. Thus, the proposed US 60/I-69 interchange is anticipated to attract commercial development supporting the surrounding residential area amounting to 10.5 additional acres. Therefore, Alternative 3 will shift approximately 300 to 350 commercial jobs (28 acres) away from the US 41 corridor.

5.3 PEDESTRIAN/BICYCLE IMPACTS

Introduction

Bicycle and pedestrian trails provide people access to the region's outdoors, scenic areas, wildlife and recreational areas. This evaluation focused on designated trail facilities; however, consideration was given to additional routes as well.

Methodology

Various resources were used to investigate bicycle and pedestrian paths in the project study area. The Internet resources used were the Indiana Trail Study by the Eppley Institute for Parks and Public Lands at Indiana University (Eppley Institute, 2001) and the IDNR Outdoor Recreation Indiana Bicycling Facilities (Indiana Department of Natural Resources, 2002) and books entitled *Indiana Outdoor Recreation* (Indiana Department of Natural Resources, 1989), and *Mountain Bike America-Indiana* (Cameron, 2000), GIS data on the trails came from the Indiana Department of Recreation, Division of Outdoor Recreation. The data included the routes taken by existing trails and if they were county roads, natural trails or single lane paved trails. Additional information regarding trails was derived from coordination with the Evansville and Henderson Departments of Parks and Recreation. The information was then compared with the proposed alternatives and additional coordination with the managers of the trails was conducted to determine if any of these trails would be impacted by the proposed I-69 project.

Analysis

The proposed I-69 from I-64 north of Evansville to the Breathitt Parkway south of Henderson will not directly impact any trails within the project study area. The proposed future Pigeon Creek Greenway Passage route to Angel Mounds, shown in **Figure 5-4**, will be crossed by Alternative 2, and other potential future routes could be crossed by Alternative 3. An agreement between the Evansville Board of Park Commissioners and the Indiana Department of Transportation (INDOT), which allows the bicycle and pedestrian facility to be built on the I-164 limited access right-of-way, currently exists for this section of the trail. This agreement states that all reasonable efforts shall be made by INDOT to minimize any damage to the facility during maintenance of its facilities. This agreement does not grant any interest in land, nor does it establish a permanent park, recreation area or wildlife or waterfowl refuge facility that would become subject to Section 4(f) of the Federal-Aid Highway Act of 1968, nor does it establish a shared use facility which would require replacement pursuant to INDOT use of the property for highway purposes. A copy of the referenced agreement is included in **Appendix C-1**. Additionally, coordination with the Evansville Department of Parks and Recreation regarding the proposed future Pigeon Creek Greenway Passage extensions has identified that none of the future routes potentially impacted meet all of the criteria for Section 4(f) consideration (**Appendix C-2**). At the present time, the level of planning for the future Greenway extensions potentially impacted does not constitute a significant recreation facility that would be subject to Section 4(f). Furthermore, there will be no impact upon the future Pigeon Creek Greenway Passage that would impede its future development.

There may be many rural road routes impacted in the project study area where many bicycle club routes are located and several racing events are held annually. Many of these routes are not formally marked. Residents from the Evansville and Henderson areas and students from the nearby universities routinely use these routes. The only designated bicycle routes that have been identified are along US 60 and KY 351, both of which are crossed by Alternatives 2 and 3 in Henderson County. However, none of these routes have separate dedicated bicycle facilities and it is not anticipated that the current use of these facilities will be altered by the project. US 60 and KY 351 will pass over the Interstate and remain open, therefore, the identified routes along these roads will not be affected. Additionally, any roads closed because of the Interstate will be provided with alternative connectivity and it is not anticipated that their utilization for bicycling will be affected.

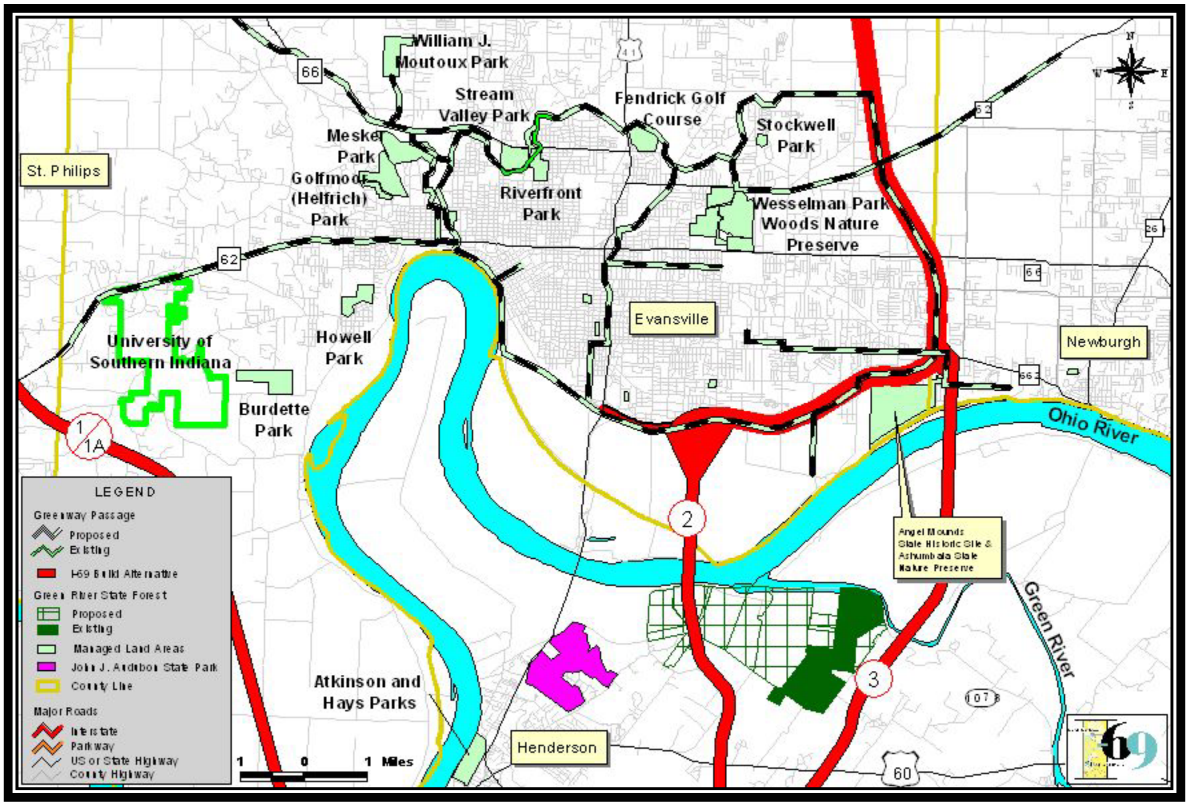


Figure 5-4: Pigeon Creek Greenway Passage

Summary

No publicly owned bicycle and pedestrian paths were found that would be impacted by any of the alternatives. The proposed route will be designated as an Interstate; therefore, pedestrians and bicyclists are prohibited from using the roadway itself. However, per a July 11, 2001 agreement between the Indiana Department of Transportation and the City of Evansville Board of Park Commissioners, the City of Evansville has permission to construct a pedestrian and bicycle trail between Veterans Memorial Parkway and Pollack Avenue within the right-of-way of existing I-164. This bicycle and pedestrian trail is not associated with this I-69 project. Although Alternative 2 would utilize a portion of this section of I-164, the construction of Alternative 2 would not preclude the future development of the trail. In addition, due to the potential for connectivity between future Evansville and Henderson trails, the final design of the bridge across the Ohio River should consider accommodations for bicycle and pedestrian facilities. The No-Build Alternative would have no effect on potential bicycle and pedestrian facilities.

5.4 AIR QUALITY

Introduction

The primary source of air pollutants associated with either the construction of a new highway, or the improvement of an existing highway, is from motor vehicle use. The major pollutant emitted by motor vehicles is carbon monoxide (CO), which originates as a byproduct from the combustion of fuel associated with transportation.

A microscale "hot spot" analysis comparing existing (2002) and future (2025) conditions was performed for a 1,000-foot (300-meter) section of roadway carrying the highest traffic volume in the project corridor. The locations of these hot spots are found in **Table 5-5**. The hot spots vary for each build alternative depending on the traffic forecast scenario. As discussed in **Chapter 3**, Scenario 1 includes no I-69 outside the Henderson-Evansville region, Scenario 2 examines the impacts of I-69 from Evansville to Indianapolis (SIU #3) terminating at US 41, and Scenario 3 examines the impacts of I-69 from Evansville to Indianapolis in the SR 57 Corridor. This analysis is conducted to determine if CO emissions generated by the proposed project would cause or contribute to an exceedance of the National Ambient Air Quality Standards (NAAQS) as promulgated by the U.S. Environmental Protection Agency (EPA). The state and federal ambient air quality standards for CO are:

One hour: 35 ppm or 40 mg/m^3
Eight hour: 9 ppm or 10 mg/m^3
Note: ppm= parts per million
mg/m^3 = milligrams per cubic meter

These concentration values may not be exceeded more than once per year. Any computer-modeled concentration that occurs above either the one-hour or eight-hour standard is considered a violation. Since CO is a product of combustion, relatively inert, and emitted near the ground surface, the highest concentrations are typically found near the source. CO concentrations were evaluated at locations 10 feet (3 meters) from the edge of the roadway. For this project, the "hot spot" for each of the analyses is indicated in the *Air Quality Analysis Report* on Tables 1 through 4 in Appendix A and Tables 1A through 4A in Appendix B.

Methodology

The dispersion of CO in the project study area was simulated using CAL3QHC, a microcomputer dispersion model developed to predict the level of CO, or other inert pollutant concentrations, from motor vehicles traveling near roadway intersections. For the purposes of this project, the CAL3QHC model was adapted to perform as a line source model in order to predict and compare CO concentrations along the free-flow "hot spot" sections of the project.

Data inputs to the CAL3QHC computer model include: motor vehicle emission factors, worst-case meteorological conditions, and receptor and roadway site geometry. Emission factors for the project study area were generated by the MOBILE 6.2 computer model based on input. CO emission factors were based on various assumptions that include ambient temperature, vehicle mix, vehicle speed, vehicle registration distribution, and percent cold and hot starts.

Table 5-5: Air Quality "Hot Spot" Locations

		Indiana	Kentucky
	EXISTING	US 41 between the Lloyd and Diamond Expressways	US 41 between US 60 and Watson Ln.
	NO-BUILD	US 41 between the KY State Line and I-164	US 41 between US 60 and Watson Ln.
Scenario 1	Alternative 1	US 41 between the Lloyd and Diamond Expressways	US 41 between Ellis Park and the IN State Line
	Alternative 1A	I-164 between IN 62 and Lynch Rd.	US 41 between Ellis Park and the IN State Line
	Alternative 2	US 41 between the Lloyd and Diamond Expressways	US 41 between US 60 and Watson Ln.
	Alternative 3	I-164 between IN 62 and Lynch Rd.	US 41 between US 60 and Watson Ln.
Scenario 2	Alternative 1	US 41 between the Lloyd and Diamond Expressways	US 41 between Ellis Park and the IN State Line
	Alternative 1A	US 41 between the KY State Line and I-164	US 41 between Ellis Park and the IN State Line
	Alternative 2	I-164 between IN 62 and Lynch Rd.	Build Alt. 2 between US 60 and the IN State Line
	Alternative 3	I-164 between IN 62 and Lynch Rd.	US 41 between Ellis Park and the IN State Line
Scenario 3	Alternative 1	I-164 between IN 62 and Lynch Rd.	US 41 between Ellis Park and the IN State Line
	Alternative 1A	I-164 between IN 62 and Lynch Rd.	US 41 between Ellis Park and the IN State Line
	Alternative 2	I-164 between IN 62 and Lynch Rd.	Build Alt. 2 between US 60 and the IN State Line
	Alternative 3	I-164 between IN 62 and Lynch Rd.	US 41 between Ellis Park and the IN State Line

The analysis was conducted under simulated meteorological conditions designed to yield "worst-case" CO concentrations. These conditions include:

Wind Speed. The wind speed was assumed to be one meter per second, which represents very little or no dispersion of the pollutants.

Stability Class. Pasquill's stability class is a measure of the atmospheric turbulence and ranges from "A" (very turbulent) to "F" (very stable). Stability class "E" (slightly stable) was used to model the project study area.

Wind Angle. The wind angle may vary from 0° to 360°, depending on the location of the receptors. The flexibility of the model simplifies this process by requiring the program to conduct a worst-case wind angle search. A wind angle search in increments of 10° was used for this analysis.

Surface Roughness. Surface roughness can affect the dispersion of pollutants and ranges from 1 cm for flat, level terrain to 500 cm for urban areas (CBD). A roughness height of 108 cm was assumed.

Mixing Height. The mixing height algorithm is intended for the study of nocturnal inversions. It was assigned a value of 1,000 meters.

Background Concentrations. All concentrations of CO not emitted by the modeled sources are considered background concentrations. They originate from either nearby parking lots or nearby adjacent intersections. For the purposes of this study, a one-hour background concentration of 2.0 ppm and an eight-hour concentration of 1.2 ppm were used for the project corridor.

In addition to meteorological input data, the CAL3QHC computer model requires the roadway and receptor site geometries to be defined within a Cartesian coordinate system. Roadway segments are defined as free-flow links each having a constant width, height, traffic volume, and emission factor. Receptors are located where the maximum total projected pollutant concentration is most likely to occur, with the exception of within the roadway itself. Generally, the receptor is located at the outer boundary of the "mixing zone" (*i.e.*, 10 feet or 3 meters from the nearest travel lanes), along either the existing or the proposed right-of-way, or at specific land uses such as residences.

The air quality impacts analysis associated with the highest level of existing traffic, the No-Build, and the Build Alternatives was based on average daily traffic (ADT) and design hourly volume (DHV) projections for the year 2025.

The speed for a free flow link represents the speed experienced by drivers traveling along the link when there are no delays caused by traffic signals. The vehicle speeds used to define free flow links in the “hot spot” analysis was based on the posted speeds limits of 40 mph (64 kph), 45 mph (72 kph), 55 mph (88 kph), and 65 mph (104 kph) along existing roadways. These vehicle speeds were used for existing conditions and the No-Build alternative. The planned posted speed limits were used for the Build alternatives.

The CAL3QHC modeling procedure described above was used to predict hourly "worst-case" CO concentrations. One-hour and eight-hour concentrations were calculated to permit comparison with NAAQS. Eight-hour concentrations were determined by subtracting the one-hour background concentration from the total one-hour concentration, then multiplying this value by the persistence factor. A persistence factor of 0.70 was used to account for the variation in traffic and meteorological conditions over an eight-hour period. The eight-hour background concentration was added to arrive at the total eight-hour concentration. The maximum one-hour and eight-hour CO concentrations are listed in **Table 5-6**.

For each of the four build alternatives, three traffic scenarios were developed: the build alternative built independent of the sections of I-69 north or south of the project study area; the build alternative built with I-69 to the south completed and I-69 to the north entering at US 41; and the build alternative built with I-69 to the south completed and I-69 to the north entering at SR 57. These are identified in this report as Scenarios 1, 2, and 3, respectively.

CO concentrations generated along the free flow sections of the existing roadway network and the proposed project were predicted using the CAL3QHC computer model. 1,000-foot (300-meter) roadway segments representing the “hot spot” for the Existing, No-Build, and Build Alternatives were modeled as line segments plotted on a Cartesian coordinate system. The X, Y, and Z coordinates for four sites were entered into the model as representative receptors at the edges of the mixing zones. A graphical representation of the roadways and receptors used in the model is presented in **Figure 5-5**. The results of the analyses conducted for the Existing, No-Build, and Build Alternatives are summarized in **Table 5-6**. A brief summary of the results is presented in the following section.

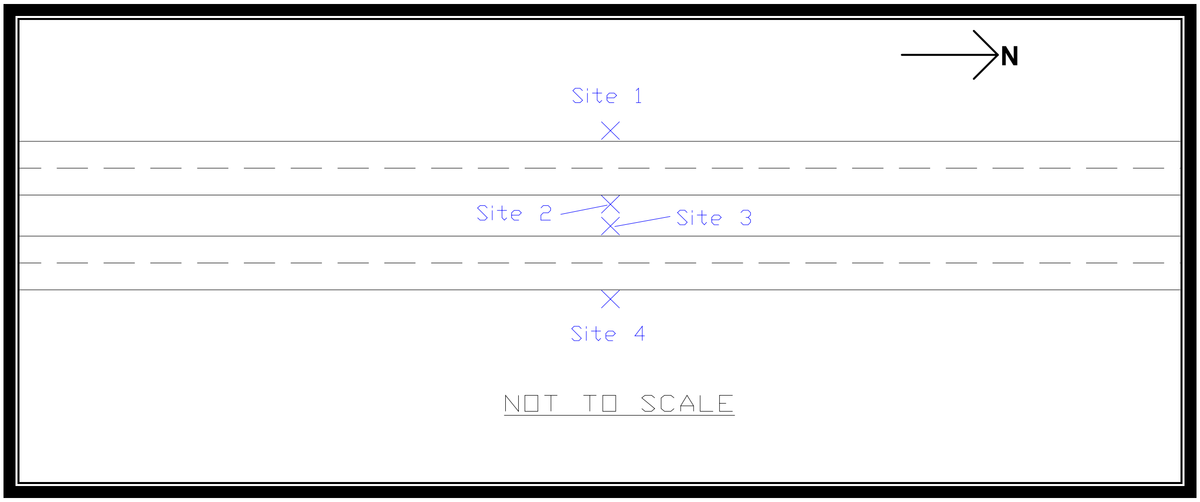


Figure 5-5: Roadway/Receptor Site Diagram

Analysis

No-Build Alternative The results of both the Indiana and Kentucky No-Build Alternatives analyses indicate that the highest one-hour concentration is 5.3 ppm, while the highest eight-hour concentration is 3.5 ppm. These concentrations occur at receptor site 1 in both Indiana and Kentucky, located at the mixing zone boundary of the outside southbound lane. When compared to existing levels, the one-hour and eight-hour CO concentrations for the No-Build Alternative are predicted to decrease at all four receptor sites in Indiana. When compared to existing levels, the one-hour and eight-hour CO concentrations for the No-Build Alternative are predicted to decrease at all four receptor sites in Kentucky.

Build Alternatives The maximum CO concentrations for all of the Build alternatives under all traffic scenarios occur at receptor site 1 in both Indiana and Kentucky, located at the mixing zone boundary of the outside southbound lane. In Indiana, the one-hour and eight-hour CO concentrations for the Build alternatives are predicted to be lower than those for the No-Build alternative for all of the alternatives and traffic scenarios **except:** Scenario 1, Alternative 3, where CO levels will decrease at receptors 1-3 and remain the same at receptor 4; Scenario 2, Alternative 2, where CO levels will decrease at receptor 2 and remain the same at receptors 1, 3, and 4; Scenario 2, Alternative 3, where one-hour CO levels will increase at receptors 1 and 4 and remain the same at receptors 2 and 3, while eight-hour CO levels will increase at receptor 1 and remain the same at receptors 2, 3, and 4; and Scenario 3, in which CO levels will increase at all receptors for all of the alternatives. In Kentucky, the one-hour and eight-hour CO concentrations for the build alternatives are predicted to be lower than those for the No-Build alternative for all of the alternatives and traffic scenarios **except:** Scenario 2, Alternative 1A, where CO levels will decrease at receptor 1, remain the same at receptors 2 and 3, and increase at receptor 4.

None of the CO values pertaining to I-69, either now or in 2025, exceeds the ambient air quality standards mandated by the Environmental Protection Agency in both Indiana and Kentucky.

Table 5-6: Maximum One-Hour and Eight-Hour CO Concentrations (PPM) - Indiana

I 69 - Hot Spot Analysis	Existing Alignment		2025 No-Build Alternative		2025 Build Corridor 1 Scenario 1		2025 Build Corridor 1A Scenario 1		2025 Build Corridor 2 Scenario 1		2025 Build Corridor 3 Scenario 1	
	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.
Site 1	8.2	5.5	5.3	3.5	4.7	3.1	5.2	3.4	4.8	3.2	5.2	3.4
Site 2	7.5	5.1	5.0	3.3	4.4	2.9	4.8	3.2	4.5	3.0	4.9	3.2
Site 3	5.7	3.8	4.0	2.6	3.6	2.3	3.9	2.5	3.7	2.4	3.9	2.5
Site 4	6.8	4.6	4.5	3.0	4.1	2.7	4.4	2.9	4.1	2.7	4.5	3.0
Max. Value (ppm) 1 Hr.	8.2		5.3		4.7		5.2		4.8		5.2	
Max. Value (ppm) 8 Hr.	5.5		3.5		3.1		3.4		3.2		3.4	

I 69 - Hot Spot Analysis	2025 Build Corridor 1 Scenario 2		2025 Build Corridor 1A Scenario 2		2025 Build Corridor 2 Scenario 2		2025 Build Corridor 3 Scenario 2	
	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.
Site 1	4.8	3.2	5.1	3.4	5.3	3.5	5.4	3.6
Site 2	4.5	3.0	4.8	3.2	4.9	3.2	5.0	3.3
Site 3	3.7	2.4	3.8	2.5	4.0	2.6	4.0	2.6
Site 4	4.1	2.7	4.4	2.9	4.5	3.0	4.6	3.0
Max. Value (ppm) 1 Hr.	4.8		5.1		5.3		5.4	
Max. Value (ppm) 8 Hr.	3.2		3.4		3.5		3.6	

I 69 - Hot Spot Analysis	2025 Build Corridor 1 Scenario 3		2025 Build Corridor 1A Scenario 3		2025 Build Corridor 2 Scenario 3		2025 Build Corridor 3 Scenario 3	
	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.
Site 1	5.8	3.9	5.8	3.9	5.8	3.9	5.9	3.9
Site 2	5.3	3.5	5.3	3.5	5.4	3.6	5.4	3.6
Site 3	4.2	2.7	4.2	2.7	4.3	2.8	4.3	2.8
Site 4	4.9	3.2	4.9	3.2	4.9	3.2	4.9	3.2
Max. Value (ppm) 1 Hr.	5.8		5.8		5.8		5.9	
Max. Value (ppm) 8 Hr.	3.9		3.9		3.9		3.9	

Table 5-6 Continued: Maximum One-Hour and Eight-Hour CO Concentrations (PPM) - Kentucky

Background CO concentrations: 1-Hour, 2.0 ppm; 8-Hour, 1.2 ppm
National Ambient Air Quality Standards: 1-Hour, 35.0 ppm; 8-Hour, 9.0 ppm

I 69 - Hot Spot Analysis	Existing Alignment		2025 No-Build Alternative		2025 Build Corridor 1 Scenario 1		2025 Build Corridor 1A Scenario 1		2025 Build Corridor 2 Scenario 1		2025 Build Corridor 3 Scenario 1	
	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.
Site 1	9.6	6.5	5.3	3.5	5.0	3.3	4.9	3.2	3.9	2.5	4.1	2.7
Site 2	9.3	6.3	5.0	3.3	4.6	3.0	4.6	3.0	3.7	2.4	3.9	2.5
Site 3	6.8	4.6	4.0	2.6	3.7	2.4	3.7	2.4	3.1	2.0	3.3	2.1
Site 4	7.3	4.9	4.5	3.0	4.3	2.8	4.2	2.7	3.5	2.3	3.6	2.3
Max. Value (ppm) 1 Hr.	9.6		5.3		5.0		4.9		3.9		4.1	
Max. Value (ppm) 8 Hr.	6.5		3.5		3.3		3.2		2.5		2.7	

I 69 - Hot Spot Analysis	2025 Build Corridor 1 Scenario 2		2025 Build Corridor 1A Scenario 2		2025 Build Corridor 2 Scenario 2		2025 Build Corridor 3 Scenario 2	
	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.
Site 1	5.1	3.4	5.0	3.3	4.2	2.7	4.2	2.7
Site 2	4.7	3.1	4.7	3.1	3.9	2.5	3.9	2.5
Site 3	3.8	2.5	3.8	2.5	3.3	2.1	3.3	2.1
Site 4	4.4	2.9	4.8	3.2	3.6	2.3	3.7	2.4
Max. Value (ppm) 1 Hr.	5.1		5.0		4.2		4.2	
Max. Value (ppm) 8 Hr.	3.4		3.3		2.7		2.7	

I 69 - Hot Spot Analysis	2025 Build Corridor 1 Scenario 3		2025 Build Corridor 1A Scenario 3		2025 Build Corridor 2 Scenario 3		2025 Build Corridor 3 Scenario 3	
	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.	1 Hr.	8 Hr.
Site 1	5.1	3.4	5.0	3.3	4.1	2.7	4.2	2.7
Site 2	4.7	3.1	4.7	3.1	3.9	2.5	3.9	2.5
Site 3	3.8	2.5	3.8	2.5	3.2	2.0	3.3	2.1
Site 4	4.4	2.9	4.4	2.9	3.6	2.3	3.6	2.3
Max. Value (ppm) 1 Hr.	5.1		5.0		4.1		4.2	
Max. Value (ppm) 8 Hr.	3.4		3.3		2.7		2.7	

Summary

Pursuant to the 1990 Clean Air Act Amendments, Vanderburgh County in Indiana was designated as being in maintenance for all transportation related pollutants. The other counties in the project study area, both in Indiana and Kentucky, were designated as being in attainment for all transportation related pollutants. According to the calculated existing and future emissions of CO, the proposed extension of I-69 is not expected to adversely affect the air quality within the Evansville-Owensboro-Henderson Interstate Air Quality Control Region. All existing and predicted carbon monoxide concentrations are below the one-hour and eight-hour NAAQS.

The preferred alternative has been included in the EUTS MPO transportation plan and will demonstrate conformity prior to FHWA approving the ROD.

5.5 HIGHWAY NOISE IMPACTS

Introduction

Noise is a vibrational energy form that causes pressure variations in elastic media such as air or water. The human ear perceives these variations as sound. The ear can discern different levels of loudness as the intensity of pressure variations fluctuate. These pressure differences are commonly measured in decibels (dB). The decibel scale audible to humans ranges from 0 to 140 dBs. A level of zero decibels corresponds to the lowest limit of audibility, while a level of 140 decibels represents the threshold of pain. The noise levels of many common appliances and events are listed below for reference:

Refrigerator	40-43 dBA	Clothes Washer	65-70 dBA
Typical Living Room	40 dBA	Phone	66-75 dBA
Forced Hot Air Heating System	40-52 dBA	Lawn Mower	88-94 dBA
Normal Conversation	55-65 dBA	Inside Car	68-73 dBA
Dishwasher	63-66 dBA	(Windows Closed, 30 mph)	

To closely resemble the non-linear sensitivity of human hearing, the “A-weighted” scale is used to define the relative loudness of different frequencies. Sound levels measured using the A-weighted scale are often expressed as dBA. For the purposes of this study, all references to sound levels will reflect dBA measurements.

The procedures set forth by the Federal Highway Administration (FHWA) permit performing noise analyses in terms of either L_{10} or L_{eq}. L_{10} is the sound level exceeded 10 percent of the time. L_{eq} is defined as the equivalent, steady state sound level, which in a given period of time contains the same acoustical energy as the time-varying sound level during the same time period. The L_{eq} noise descriptor was used in this study because of its relative ease to monitor and compare with FHWA's noise abatement criteria (NAC) as shown in **Table 5-7**.

Traffic noise impacts occur when noise levels generated by the proposed project approach or exceed the NAC, or when predicted noise levels substantially exceed existing noise levels. Both Indiana and Kentucky define “approach” as coming to within 1 dBA of the applicable NAC. Indiana defines “substantial exceedance” as 15 dBA over existing noise levels. Kentucky defines “substantial exceedance” as 10 dBA over existing noise levels. In addition, the City of Evansville has an ordinance restricting the noise level from the operation of a “lightmotor vehicle” (gross vehicular weight of less than 8,000 pounds) within city limits to 80 dBA as measured at no less than 15 feet from the vehicle.

Table 5-7: Noise Abatement Criteria

Hourly A-Weighted Sound Level - Decibels (dBA)			
Activity Category	**L_{eq}(h)**	**L_{10}(h)**	**Description of Activity**
A	57 (Exterior)	60 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	70 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals.
C	72 (Exterior)	75 (Exterior)	Developed lands, properties, or activities not included in categories A or B.
D	--	--	Undeveloped lands.
E	52 (Interior)	55 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

Source: Federal Highway Administration

Methodology

For the purposes of this study, the noise analysis methodology required by the Kentucky Transportation Cabinet's Noise Abatement Policy was used. However, mitigation of any noise impacts identified will follow the requirements of the state in which they occur.

Noise levels were measured and recorded in October and December 2002 using a QUEST M-27 Noise Dosimeter/Datalogger. The datalogger has multiple functions, and integrates noise levels on a continuous basis to produce an equivalent (i.e., average or L_{eq}) sound level for any desired test duration. Noise levels were measured directly by a sound level meter for two reasons: establish existing noise levels and calibrate the FHWA noise prediction computer model. FHWA recommends validating the computer model predicted noise levels with actual measured levels to account for any deficiencies. Existing noise levels are used to calibrate the computer model to existing conditions before using it to predict future noise levels.

The noise measurements were made during peak traffic periods and under meteorologically acceptable conditions. Traffic data was simultaneously recorded with the noise measurements and classified as one of five vehicle types (i.e., motorcycle, bus, automobile/light truck, medium truck, and heavy truck) for subsequent entry into the noise prediction computer model. Field observations indicate the dominant noise source appears to originate from local traffic and residential noise.

The FHWA's Traffic Noise Model (TNM) is a computer-modeling program used to predict noise levels in environments where the dominant noise source originates from motor vehicles. The TNM computer model is considered calibrated and validated when the measured and modeled existing noise levels agree to within ±3 dBA for the L_{eq} descriptor at the monitored sites. The computer model is calibrated on a site-specific basis by comparing a particular site's measured existing noise levels with those predicted by the model based upon the traffic counts obtained during noise measurement periods. During the calibration process, additional adjustments are applied to the model to account for speed, a site's distance from the roadway, grade, roadway segment length, and shielding. The differences obtained are used to determine the site's peculiarities for existing and predicted noise levels for which the model might not account. The TNM computer model then estimates vehicle noise emissions based on reference energy mean emission levels for the five classes of vehicles: motorcycle, automobile and light truck, bus, medium truck (two axles and six wheels), and heavy truck (three or more axles).

Ambient noise measurements were taken at 12 sites along the corridor, as shown in **Figure 5-6**. Six of the twelve sites experienced noise directly related to traffic on adjacent roadways. These six sites were used to calibrate the TNM computer model. The resulting measured and modeled existing noise levels agreed to within ±3 dBA for the L_{eq} descriptor at these six sites. Since the measured and modeled noise levels were within the generally accepted standard for calibration, the TNM computer model was considered validated and capable of predicting future noise levels within the project study area. Descriptions of these 12 sites are included in **Table 5-8** below. **Table 5-8** also includes descriptions for 28 sites in or deemed eligible for inclusion in the National Register of Historic Places (NRHP), as discussed in **Section 5.9.2, Historic Resource Impacts**. No background noise readings were taken at these sites, but they were included in the noise modeling. The discussion of the results is included here, as well as in **Section 5.9.2, Historic Resource Impacts**.

The remaining 6 ambient noise receptors were not included in determining the overall calibration of the computer model because traffic on major roadways was either not visible or countable from those locations. A summary of future noise levels is shown in **Table 5-9**.

For each of the four build alternatives, three traffic scenarios were developed:

1. The Build alternative built as a Section of Independent Utility (*i.e.* independent of the sections of I-69 north or south of the project study area);

2. The Build alternative built with I-69 to the south completed and I-69 to the north entering at US 41; and

3. The Build alternative built with I-69 to the south completed and I-69 to the north entering at SR 57.

These are identified in this report as Scenarios 1, 2, and 3, respectively.

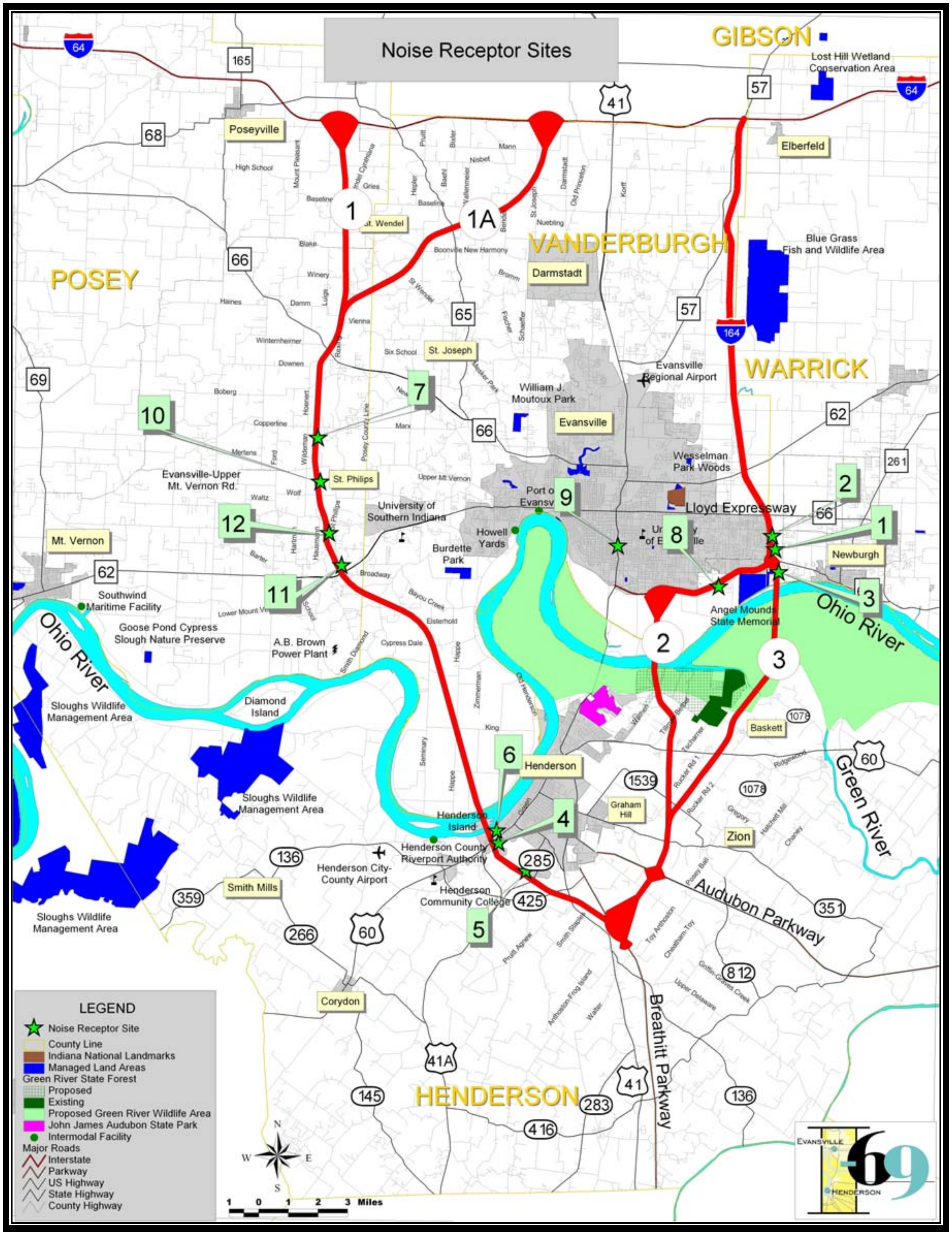


Figure 5-6: Noise Measurement Sites

Table 5-8: Noise Receptor Sites

Receptor Site No.	Site Description
1 IN	The rear façade of a row of 15 single-family residences located approximately 680 feet (207 meters) east of the existing I-164, which will be used by Build Alternatives 2 and 3. The site is classified as land use category B.
2 IN	The side (west) façade of a single-family residence located approximately 100 feet (30 meters) east of the existing I-164, which will be used by Build Alternatives 2 and 3. This site represents 6 homes. The site is classified as land use category B.
3 IN	The driveway of a single-family residence located approximately 2600 feet (792 meters) southeast of the existing I-164, 220 feet (67 meters) north of Pollack Rd, and 800 feet (244 meters) east of Build Alternative 3. This site represents 24 homes. The site is classified as land use category B.
4 KY	The front façade of the Haven Pentecostal Church, located approximately 580 feet (177 meters) south of US 41A/US 60 and 1000 feet (305 meters) east of Build Alternatives 1 and 1A. This site represents one church and 15 homes. The site is classified as land use category B.
5 KY	The side (west) façade of 2 single-family residences located approximately 1840 feet (561 meters) northwest of KY 285 and 700 feet (213 meters) east of Build Alternatives 1 and 1A. This site represents 9 homes. The site is classified as land use category B.
6 KY	The side (north) facade of a multi-family apartment building located approximately 430 feet (131 meters) north of Main St. and 1500 feet (457 meters) east of Build Alternatives 1 and 1A. This site represents 20 individual apartments. The site is classified as land use category B.
7 IN	The side (west) façade of 2 single-family residences located approximately 2000 feet (610 meters) south of Copperline Rd. and 200 feet (61 meters) east of Build Alternatives 1 and 1A. This site represents 7 homes. The site is classified as land use category B.
8 IN	The north curb of a street in a mobile home park under expansion, located approximately 300 feet (91 meters) south of the existing I-164, which will be left undisturbed by the build corridors. This site represents 20 homes. The site is classified as land use category B.
9 IN	The rear yard of a single-family residence on the northwest corner of Harlan and Madison Streets, located approximately 60 feet (18 meters) east of the existing US 41. The site is 2396 meters (7796 feet) from Build Alternative 2. This site represents 12 homes. The site is classified as land use category B.
10 IN	The rear yard of a single-family farmhouse located approximately 2550 feet (777 meters) south of Upper Mt. Vernon Rd. and 500 feet (152 meters) east of Build Alternatives 1 and 1A. This site represents 8 homes. The site is classified as land use category B.
11 IN	The driveway of a single-family house located approximately 1560 feet (475 meters) north of Indiana State Road 62, 2100 feet (640 meters) east of St. Phillips Rd., and 235 feet(72 meters) east of Build Alternatives 1 and 1A. This site represents 5 homes. The site is classified as land use category B.
12 IN	The side (west) façade of a single-family residence located approximately 2100 feet (640 meters) south of Middle Mt. Vernon Rd. and 400 feet east of Build Alternatives 1 and 1A. This site represents 6 homes. The site is classified as land use category B.
13 IN	The St. James Church and Cemetery located on CR 50 W in St. James. The site is located approximately 5490 feet (1670 meters) north of the existing I-64, and 6820 feet (2080 meters) northeast of the north terminus of Build Alternative 1A. The site is classified as land use category B.
14 IN	The Dr. Wilhelmus House and Office, located approximately 222 feet (67 meters) south of Boonville-New Harmony Rd., 431 feet (131 meters) east of County Line Rd., 5359 feet (1633 meters) east of Alternative 1, and 7140 feet (2176 meters) northwest of Build Alternative 1A. The site is classified as land use category B.
15 IN	The Craig House and Barn, located approximately 3304 feet (1007 meters) south of Boonville-New Harmony Rd., 3161 feet (963 meters) east of County Line Rd., 8727 feet (2660 meters) east of Build Alternative 1, and 3039 feet (926 meters) northwest of Build Alternative 1A. The site is classified as land use category B.
16 IN	The Luigs Farm, located approximately 1905 feet (580 meters) east of Rexing Rd., 2380 feet (725 meters) east of Build Alternative 1, and 2360 feet (720 meters) east of Build Alternative 1A. The site is classified as land use category B.
17 IN	The Jacob Damm Farmstead, located approximately 1130 feet (344 meters) north of State Route 66, and 3730 feet (1137 meters) west of Build Alternatives 1 and 1A. The site is classified as land use category B.
18 IN	The Doll - Winternheimer Farmstead, located approximately 128 feet (39 meters) west of Rexing Rd., 2362 feet (720 meters) notheast of State Route 66, and 980 feet (298 meters) east of Build Alternatives 1 and 1A. The site is classified as land use category B.
19 IN	The Posey County School No. 4, located approximately 369 feet (112 meters) south of State Route 66, 1173 feet (357 meters) west of Rexing Rd., and 1703 feet (520 meters) east of Build Alternatives 1 and 1A. The site is classified as land use category B.
20 IN	The Roesner Farmstead, located approximately 332 feet (101 meters) east of St. Phillips Rd., and 4200 feet (1280 meters) east of Build Alternatives 1 and 1A. The site is classified as land use category B.

Table 5-8 Continued: Noise Receptor Sites

Receptor Site No.	Site Description
21 IN	The Fischer House, located approximately 2080 feet (634 meters) north of Upper Mt. Vernon Rd., 5700 feet (1737 meters) west of St. Phillips Rd., and 1522 feet (464 meters) west of Build Alternatives 1 and 1A. The site is classified as land use category B.
22 IN	The Wolf Road Farmstead, located approximately 3256 feet (992 meters) north of Middle Mt. Vernon Rd., and 3579 feet (1090 meters) west of Build Alternatives 1 and 1A. The site is classified as land use category B.
23 IN	The Hausmann Farmstead, located approximately 1500 feet (457 meters) north-west of St. Phillips Rd., 4100 feet (1250 meters) north of State Route 62, and 2246 feet (685 meters) west of Build Alternatives 1 and 1A. The site is classified as land use category B.
24 KY	The Bohleber Road Farmstead, located approximately 1190 feet (362 meters) east of St. Phillips Rd., and 2924 feet (891 meters) east of Build Alternatives 1 and 1A. The site is classified as land use category B.
25 KY	The Uebelhack Farmstead, located approximately 2790 feet (850 meters) south of State Route 62, and 5026 feet (1532 meters) west of Build Alternatives 1 and 1A. The site is classified as land use category B.
26 KY	The Frank Nurrenbern Farmstead, located on Bayou Creek Rd. approximately 12285 feet (3744 meters) southeast of State Route 62, and 3373 feet (1028 meters) northeast of Build Alternatives 1 and 1A. The site is classified as land use category B.
27 IN	The Mann House, located approximately 1857 feet (566 meters) west of the existing I-164, which will be used by Build Alternatives 2 and 3. The site is classified as land use category B.
28 IN	The Joseph Angel House, located approximately 113 feet (34 meters) north of Pollack Rd., and 550 feet (167 meters) south of I-164, which will be left undisturbed by the Build Alternatives, and 3880 feet (1183 meters) west of Build Alternative 3. The site is classified as land use category B.
29 IN	The Glenn Black House and Library, located approximately 61 feet (18 meters) north of Pollack Rd., 1045 feet (318 meters) south of I-164, which will be left undisturbed by the Build Alternatives, and 2034 feet (620 meters) west of Build Alternative 3. The site is classified as land use category B.
30 IN	The top of Mound G of Angel Mounds National Historic Site, located approximately 114 feet (35 meters) north of Pollack Rd., 1529 feet (466 meters) southeast of I-164, which will be left undisturbed by the Build Alternatives, and 1003 feet (306 meters) west of Build Alternative 3. The site is classified as land use category A.
31 IN	The Short - Tillman House, located approximately 64 feet (19 meters) northeast of Jennings Street (State Route 662), and 10504 feet (3202 meters) east of Build Alternative 3. The site is classified as land use category B.
32 KY	An eligible residence on Tscharner Road, located approximately 7417 feet (2260 meters) north of US 60, 9662 feet (2945 meters) east of Build Alternative 2, and 1888 feet (575 meters) west of Build Alternative 3. The site is classified as land use category B.
33 KY	An eligible residence on Tilman Bethel Road, located approximately 4644 feet (1415 meters) from US 60, and 9827 feet (2995 meter) west of Build Alternative 3. The site lies within the median of Build Alternative 2, and has been demolished. The site is classified as land use category B.
34 KY	The McClain House, located approximately 201 feet (61 meters) north of US 60, 7167 feet (2184 meters)west of Build Alternative 2, and 13798 feet (4205 meters) northwest of Build Alternative 3. The site is classified as land use category B.
35 KY	The Lee Baskett House, located approximately 227 feet (69 meters) north of US 60, 3922 feet (1195 meters) west of Build Alternative 2, and 10949 feet (3337 meters) northwest of build Alternative 3. The site is classified as land use category B.
36 KY	The John S. McCormick House, "Forest Grove," located approximately 244 feet (74 meters) south of KY 351, and 2043 feet (623 meters) west of Build Alternatives 2 and 3. The site is classified as land use category B.
37 KY	The White - Priest House, "Stagecoach House," located approximately 175 feet (53 meters) south of KY 351, and 2803 feet (854 meters) east of Build Alternatives 2 and 3. The site is classified as land use category B.
38 KY	The White - Goehring House, located 1100 feet (335 meters) south of the Audubon Parkway, and 5955 feet (1815 meters) southeast of Build Alternatives 2 and 3. The site is classified as land use category B.
39 KY	A foursquare residence located 227 feet (69 meters) south of KY 285, and 924 feet (282 meeters) southwest of Build Alternatives 1 and 1A. The site is classified as land use category B.
40 KY	The Riverdale Subdivision, located approximately 1452 feet (442 meters) north-west of US 60/41, and 5386 feet (1641 meters) northeast of Build Alternatives 1 and 1A. The site is classified as land use category B.

Table 5-9: Summary of Future Noise Levels

Measurement Site No.	Number of Recievers Represented	Activity Category	Existing Measured dBA L_{eq}	Noise Abatement Criterion	Substantial Increase Criterion	2025 Noise Levels (dBA L_{eq})												
							Scenario 1				Scenario 2				Scenario 3			
						No-Build	Alt. 1	Alt. 1A	Alt. 2	Alt. 3	Alt. 1	Alt. 1A	Alt. 2	Alt. 3	Alt. 1	Alt. 1A	Alt. 2	Alt. 3
1 - IN	15	B	63	67	78	62	62	62	62	63	62	62	62	64	62	62	63	64
2 - IN	6	B	70	67	85	73	73	73	73	75	73	73	73	75	74	74	74	75
3 - IN	24	B	48	67	63	51	49	49	49	61	49	49	50	62	50	50	50	62
4 - KY	16	B	54	67	64	57	60	60	56	56	61	61	56	57	60	60	56	56
5 - KY	9	B	51	67	61	47	56	57	45	46	58	58	46	46	58	59	46	46
6 - KY	20	B	54	67	64	53	54	55	52	53	55	55	52	53	54	54	52	53
7 - IN	7	B	56	67	71	44	60	61	34	44	62	62	34	44	62	62	34	44
8 - IN	20	B	67	67	82	66	66	66	66	65	66	66	66	65	66	66	67	65
9 - IN*	12	B	67	67	82	70	69	69	69	69	69	69	69	69	70	70	69	69
10 - IN	8	B	53	67	68	33	61	61	33	33	62	63	33	33	63	63	33	33
11 - IN	5	B	51	67	66	49	-68-	-68-	49	49	-69-	-70-	49	49	-69-	-70-	49	49
12 - IN	6	B	50	67	65	37	64	-65-	37	38	-66-	-66-	38	38	-66-	-66-	38	38
13 - IN	1	B	(51)	67	(66)	42	43	43	42	43	44	43	42	42	44	43	42	43
14 - IN	1	B	(51)	67	(66)	47	48	47	51	47	48	47	47	47	48	47	47	47
15 - IN	1	B	(51)	67	(66)	34	37	47	39	35	37	49	35	35	37	49	35	35
16 - IN	1	B	(51)	67	(66)	42	54	52	42	42	54	54	43	42	55	54	42	42
17 - IN	1	B	(54)	67	(69)	54	54	55	54	54	54	55	56	54	55	55	54	54
18 - IN	1	B	(51)	67	(66)	51	58	57	52	51	59	58	52	51	60	58	51	51
19 - IN	1	B	(60)	67	(75)	60	62	61	60	60	62	61	62	60	62	61	60	60
20 - IN	1	B	(51)	67	(66)	44	46	47	44	44	48	48	44	44	48	48	44	44
21 - IN	1	B	(51)	67	(66)	34	55	55	33	33	56	57	34	34	56	57	34	34
22 - IN	1	B	(51)	67	(66)	32	47	48	33	32	49	49	33	32	49	49	33	33
23 - IN	1	B	(51)	67	(66)	42	49	49	42	42	50	51	42	42	50	51	42	42
24 - IN	1	B	(51)	67	(66)	40	49	49	40	40	50	50	40	40	50	51	40	40
25 - IN	1	B	(51)	67	(66)	45	47	47	45	45	47	48	45	45	48	48	45	45
26 - IN	1	B	(51)	67	(66)	38	45	45	37	37	46	47	38	38	46	47	38	38
27 - IN	1	B	(53)	67	(68)	55	55	55	55	56	55	55	55	57	55	55	55	57
28 - IN	1	B	(60)	67	(75)	62	61	61	61	61	61	61	61	61	61	61	62	61
29 - IN	1	B	(57)	67	(72)	61	58	58	59	59	58	58	59	59	58	58	57	59
30 - IN	1	A	(55)	57	(70)	59	55	55	55	62	55	55	55	63	55	55	55	63
31 - IN	1	B	(65)	67	(80)	66	64	65	64	65	65	65	65	65	64	64	64	64
32 - KY	1	B	(51)	67	(61)	41	41	41	42	51	41	41	43	52	41	41	43	52
33 - KY**	1	B	(51)	67	(61)	44	44	44	79	45	44	44	80	45	44	44	80	46
34 - KY	1	B	(66)	67	(76)	68	68	68	65	65	68	68	65	65	68	68	66	65
35 - KY	1	B	(63)	67	(73)	65	65	65	63	62	65	65	63	63	65	65	63	63
36 - KY	1	B	(51)	67	(61)	49	49	49	56	55	49	50	56	56	49	49	56	57
37 - KY	1	B	(52)	67	(62)	53	53	53	55	54	53	53	56	54	52	53	56	57
38 - KY	1	B	(51)	67	(61)	50	51	51	52	51	51	51	52	52	51	51	52	52
39 - KY	1	B	(51)	67	(61)	49	60	60	49	43	-61-	-61-	49	49	-61-	-62-	52	52
40 - KY	1	B	(51)	67	(61)	51	51	51	50	51	52	52	50	51	50	50	50	51

#

- # -

erion and

NOTE: Sites 13 - 40 represent individual properties deemed eligible for the National Register of Historic Places. Existing noise measurements were not taken at these sites; the existing noise levels were calculated by the noise model based on existing traffic estimates on nearby roadways, where available.

*- Site 9 is located along the existing US 41 in Evansville, and is not adjacent to any of the build alternatives. Noise levels for the build alternatives are generally lower than the No-Build level, except for Alternatives 1 and 1A under Scenario 3, where they are the same as the No-Build level.

**- Site 33 is located within the median of Alternative 2.

Analysis

No-Build Alternative. The results of the noise analysis conducted in Indiana for the No-Build Alternative indicate that year 2025 noise levels without the project would range from 33 dBA L_{eq} at Site 10 to 73 dBA L_{eq} at Site 2. Future noise levels are predicted to differ from existing measured noise levels by up to +3 dBA L_{eq}.

Five modeled sites in Indiana (2, 8, 9, 30, and 31; accounting for 40 residential receivers and a National Landmark) have noise levels approaching or exceeding the Noise Abatement Criterion (NAC) of 67 dBA L_{eq}.

The results of the noise analysis conducted for the No-Build Alternative in Kentucky indicate that year 2025 noise levels without the project would range from 47 dBA L_{eq} at Site 5 to 57 dBA L_{eq} at Site 4. Future noise levels are predicted to differ compared to existing modeled noise levels by -4 to +3 dBA L_{eq}. Generally, a 3-dBA L_{eq} change is considered as the minimum average increase perceived by most people. One of the modeled sites in Kentucky approaches or exceeds the NAC (34, accounting for 1 receiver).

Three historic sites (two in Indiana, and one in Kentucky) would experience noise levels above the NAC under the 2025 No-Build scenario. These sites include Angel Mounds State Historic Site and National Historic Landmark (Site 30), the Short-Tilman House (site 31), and the McClain House (Site 34). The McClain House currently encounters a noise level that approaches the NAC (66 dBA L_{eq}).

Build Alternative 1. For all of the traffic scenarios in Indiana, this alternative will generally experience noise level increases from existing levels, with predicted levels within 2 dBA L_{eq} compared to those of the traffic-related receptors for the No-Build Alternative. Noise levels are predicted to range from 49 dBA L_{eq} (Site 3) to 73 dBA L_{eq} (Site 2) for Scenarios 1 and 2, and from 50 dBA L_{eq} (Site 3) to 74 dBA L_{eq} (Site 2) for Scenario 3. These levels represent a difference from existing noise levels ranging between -1 and 20 dBA L_{eq}, and a difference from No-Build noise levels ranging between -2 and 30 dBA $L_{eq.}$

The reason for the large difference between Build and No-Build noise levels at those model sites not used for calibration is that the modeled No-Build levels are much lower than those measured in the field during the existing noise analysis, due to the fact that TNM does not account for background noise sources other than vehicular traffic. <u>This applies to all of the Build alternatives under all of the traffic scenarios.</u>

Under Traffic Scenario 1 in Indiana, four of the modeled sites (2, 8, 9 and 11, accounting for 43 residential receivers) approach or exceed the NAC standard of 67 dBA L_{eq}. In addition, Site 11 will experience a substantial increase over the existing noise level. Under Traffic Scenarios 2 and 3, the same noise impacts occur, with the addition of modeled site 12 (accounting for 6 residential receivers), which will experience a substantial increase and an approach to the NAC standard.

For all of the traffic scenarios in Kentucky, this alternative will experience noise level increases from existing and No-Build noise levels. Noise levels are predicted to range from 54 dBA L_{eq} (Site 6) to 61 dBA L_{eq} (Site 4). These levels represent an increase from existing and No-Build noise levels ranging between 0 and 7 dBA L_{eq}. One site (34, accounting for 1 residential receiver) approaches or exceeds the NAC standard under all traffic scenarios. In addition, Site 39 (accounting for 1 residential receiver) would experience a substantial increase over the existing noise level for Traffic Scenarios 2 and 3 only.

One historic site in Kentucky would experience noise levels above the NAC. Site 34, the McClain House, would experience a noise level of 68 dBA L_{eq} under all three traffic scenarios. One site in

Kentucky, the Foursquare south of KY 285 (Site 39) would experience noise levels at or above the substantial increase criterion in Scenarios 2 and 3 (61 dBA L_{eq} for both). No other historic resources would be impacted by Alternative 1.

Build Alternative 1A. For all of the traffic scenarios in Indiana, this alternative will generally experience noise level increases from existing levels, with predicted levels within 2 dBA L_{eq} compared to those of the traffic-related receptors for the No-Build Alternative. Noise levels are predicted to range from 49 dBA L_{eq} (Site 3) to 73 dBA L_{eq} (Site 2) for Scenarios 1 and 2, and from 50 dBA L_{eq} (Site 3) to 74 dBA L_{eq} (Site 2) for Scenario 3. These levels represent a difference from existing noise levels ranging between -1 and 20 dBA L_{eq}, and a difference from No-Build noise levels ranging between -2 and 30 dBA L_{eq}.

Under Traffic Scenario 1 in Indiana, four of the modeled sites (2, 8, 9 and 11, accounting for 43 residential receivers) approach or exceed the NAC standard of 67 dBA L_{eq}. In addition, Site 12 will experience a substantial increase over the existing noise level. Under Traffic Scenarios 2 and 3, the same noise impacts occur; however, Site 12 (accounting for 6 residential receivers) also would approach or exceed the NAC.

For all of the traffic scenarios in Kentucky, this alternative will experience noise level increases from existing and No-Build noise levels. Noise levels are predicted to range from 54 dBA L_{eq} (Site 6) to 61 dBA L_{eq} (Site 4). These levels represent an increase from existing and No-build noise levels ranging between 0 and 7 dBA L_{eq}. One site (34, accounting for 1 residential receiver) approaches or exceeds the NAC standard under all traffic scenarios. In addition, Site 39 (accounting for 1 residential receiver) would experience a substantial increase over the existing noise level for Traffic Scenarios 2 and 3 only.

One historic site in Kentucky would experience noise levels above the NAC. Site 34, the McClain House, would experience a noise level of 68 dBA L_{eq} under all three traffic scenarios. One site in Kentucky, the Foursquare south of KY 285 (Site 39) would experience noise levels at or above the substantial increase criterion in Scenario 2 (61 dBA L_{eq}) and Scenario 3 (62 dBA L_{eq}). No other historic resources would be impacted by Alternative 1A.

Build Alternative 2. For all of the traffic scenarios in Indiana, this alternative will generally experience noise levels similar (within 4 dBA L_{eq}) to those of the traffic-related receptors for the existing conditions and the No-Build Alternative. Noise levels are predicted to range from 33 dBA L_{eq} (Site 10) to 73 dBA L_{eq} (Site 2) for Scenarios 1 and 2, and from 33 dBA L_{eq} (Site 10) to 74 dBA L_{eq} (Site 2) for Scenario 3. These levels represent a difference from existing noise levels ranging between -22 and 4 dBA L_{eq}, and a difference from No-Build noise levels ranging between -10 and 1 dBA L_{eq}. Again, the reason for the large apparent decreases compared to existing and No-Build noise levels is that the noise levels calculated for the ambient (non-traffic-related) noise receptors are much lower than those measured in the field during the existing noise analysis.

For all of the traffic scenarios in Indiana, three of the modeled sites (2, 8 and 9; accounting for 38 residential receivers) will experience noise levels that approach or exceed the NAC standard.

For all of the traffic scenarios in Kentucky, this alternative will experience noise level decreases from existing noise levels at sites 5 and 6, an increase from existing noise levels at site 4, and decreases from No-Build noise levels at all of the sites. Noise levels are predicted to range from 45 dBA L_{eq} (Site 5) to 56 dBA L_{eq} (Site 4). These levels represent a difference from existing and No-Build noise levels ranging between -6 and 2 dBA L_{eq}. One of the sites (34, accounting for 1 residential receiver) approaches or exceeds the NAC standard under Traffic Scenario 3 only.

One historic site in Kentucky would experience noise levels approaching the NAC. Site 34, the McClain House, would experience a noise level of 66 dBA L_{eq} under traffic Scenario 3. However, that noise level would be unchanged from existing conditions, and would be below the No-Build condition. No other historic resources would be impacted by Alternative 2.

Build Alternative 3. For all of the traffic scenarios in Indiana, this alternative will generally experience noise levels similar (within 5 dBA L_{eq}) to those of the traffic-related receptors for the existing conditions and the No-build Alternative, except for site 3, which would experience an increase of up to 13 or 14 dBA L_{eq}. Noise levels are predicted to range from 33 dBA L_{eq} (Site 10) to 75 dBA L_{eq} (Site 2) for all of the traffic scenarios. These levels represent a difference from existing noise levels ranging between -20 and 14 dBA L_{eq}, and a difference from No-Build noise levels ranging between -1 and 11 dBA $L_{eq.}$ Again, the reason for the large apparent decreases compared to existing noise levels is that the levels calculated for the ambient (non-traffic-related) noise receptors are much lower than those measured in the field during the existing noise analysis.

For all of the traffic scenarios in Indiana, three modeled sites (2, 9, and 30; accounting for 18 residential receivers and a National Landmark) will experience noise levels that approach or exceed the applicable NAC standard.

For all of the traffic scenarios in Kentucky, this alternative will experience noise level decreases from existing noise levels at sites 5 and 6, an increase from existing noise levels at site 4, no change from No-Build levels at site 6, and a decrease from No-Build noise levels at site 5. For site 4, noise levels will decrease from No-Build levels under Scenarios 1 and 3, and remain the same under Scenario 2. Noise levels are predicted to range from 46 dBA L_{eq} (Site 5) to 57 dBA L_{eq} (Site 4). These levels represent a difference from existing and No-build noise levels ranging between -6 and 3 dBA L_{eq}. None of the sites approach or exceed the NAC standard under any traffic scenario.

One historic site in Indiana would experience noise levels exceeding the NAC. Site 30, the Angel Mounds State Historic Site and National Historic Landmark, would experience a noise level of 62 dBA L_{eq} under traffic Scenario 1, and 63 dBA L_{eq} under Scenarios 2 and 3. Since this site is considered activity category A, the NAC is 57 dBA $L_{eq.}$ No other historic resources would be impacted by Alternative 2.

Noise Abatement

INDOT and KYTC have developed policies consistent with FHWA guidelines to determine the need, feasibility, and reasonableness of noise abatement measures for all major highway projects (*INDOT's Highway 1997 Traffic Noise Policy* and *Noise Abatement Policy* respectively). In 23 CFR Part 772, the FHWA offers a number of measures for abating or eliminating noise impacts. The primary means of mitigating noise impacts, as offered by the FHWA, are as follows:

- Traffic management measures (e.g. traffic control devices and signing for prohibition of certain vehicle types, modified speed limits, and exclusive lane designations).
- Alteration of horizontal and vertical alignments.
- Construction of noise barriers (including landscaping for aesthetics) whether within or outside the highway right-of-way.
- Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development that would be adversely impacted by traffic noise.
- Noise insulation of public use or non-profit institutional structures.
- Coordination among local authorities to govern future development along the selected corridor.

Noise abatement will be considered for all receivers along the preferred alternative to be selected in the FEIS which have predicted noise levels approaching or exceeding the NAC or experience a substantial increase (see Table 5-9).

Traffic Management Measures. Traffic management measures were not considered feasible for abating noise impacts for any receptor. Measures such as installation of additional traffic control devices, prohibition of vehicle types, time-use restrictions, speed limit reductions, and exclusive lane designations would be adversely detrimental to the proposed project's ability to function as a principal arterial and major north-south route.

Alteration of Horizontal and Vertical Alignments. The final design of an alternative may include shifting the alternative both vertically and horizontally, wherever feasible, to minimize impacts to adjacent land uses. Both vertical and horizontal alignments may be altered to minimize noise impacts where other factors are not prohibitive.

Acquisition of Property Rights or Acquisition of Property. The purchase of property and/or buildings for noise barrier construction or the creation of a "buffer zone" to reduce noise impacts was considered. The amount of property required for this option to be effective would create significant additional impacts (*e.g.*, in terms of residential displacements) which were determined to outweigh the benefits of land acquisition. Visual screening may be proposed to help reduce the psychological impacts of the proposed project.

Construction of Noise Barriers. The construction of noise barriers between the shoulder and the right-of-way limits is generally one of the most feasible and/or reasonable abatement measures available. The term feasible means that it is structurally and acoustically possible to reduce noise at a given receiver by at least 5 dBA; the term reasonable means that based on consideration of several factors (including the number of benefited receivers, the cost of abatement, the severity of the noise impact, and the views of impacted residents), noise abatement would be prudent. A typical concrete noise barrier along a freeway is shown in Figure 5-7.

The Final Environmental Impact Statement (FEIS) will identify the preferred build alternative. For those receivers experiencing a noise impact from the preferred alternative, the reasonableness and feasibility of noise abatement will be evaluated according to the noise policy of the state in which each receiver is located. In other words, abatement for impacted receivers in Indiana will be evaluated using the Indiana Department of Transportation's noise policy. These evaluations and their findings (that is, identification of any reasonable and feasible noise abatement measures for each impacted receiver) will also be included in the FEIS.

Figure 5-7: Typical Concrete Noise Barrier

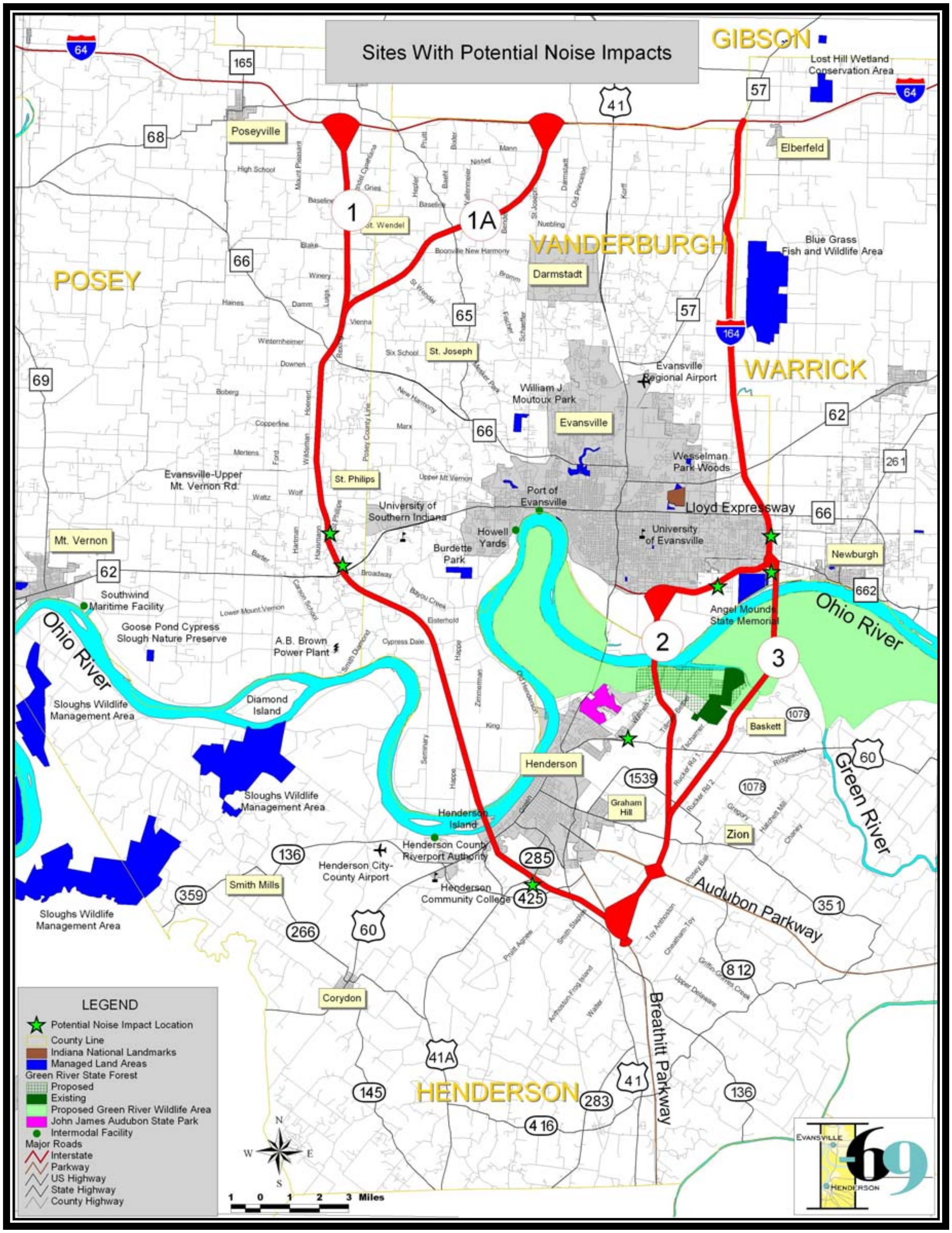


Figure 5-8: Sites with Potential Noise Impacts

Noise Insulation of Public Use or Nonprofit Institutional Structures. This noise abatement measure option applies only to public institutional use buildings. Since no public use or institutional structures are anticipated to have interior noise levels exceeding the FHWA's interior NAC, this noise abatement option will not be applied.

Coordination Among Local Planning Authorities. Since at least a portion of the proposed project would be located on a new roadway, the potential does exist for local officials and developers to help minimize adverse noise impacts through the use of careful land use planning. With regard to currently undeveloped land, the creation of a "buffer zone" or locating noise sensitive developments a reasonable distance away from the project would help minimize future noise impacts. A minimum setback distance for each of the build alternatives that will provide a buffer zone consistent with a maximum 66 dBA noise level can be viewed in **Table 5-10**. Local planning authorities will be provided with 66 dBA noise contour and can utilize this to develop noise compatible land is the buffer zones the 66 dBA.

Table 5-10: Minimum Setback Distances

		Alt. 1	Alt. 1A	Alt. 2	Alt. 3
Scenario 1	KY IN	125' 175'	125' 125'	175' 300'	175' 300'
Scenario 2	KY IN	150' 200'	150' 150'	200' 300'	200' 300'
Scenario 3	KY IN	150' 225'	175' 150'	200' 325'	200' 325'

Construction Noise Impacts
Project construction would result in additional noise from construction vehicles, driving of piles and/or blasting (if necessary), etc. Refer to **Section 5.7 Construction Impacts** for more information relative to probable impacts and suggested abatement measures.

Summary

The noise analysis predicts that depending on the alternative ultimately chosen, a range from 19 to 51 receivers may potentially experience noise impacts by either approaching or exceeding the Noise Abatement Criteria, substantially exceed the existing noise levels, or both. The FEIS will identify likely reasonable and feasible noise abatement measures for the preferred alternative. Noise barriers and other abatement measures will be analyzed in more detail during the design of the project.

As shown in **Table 5-11**, the major source of the noise impacts will come from the proposed build Alternatives 1 and 1A in 2025. Average noise levels for the Build Alternatives will be higher than the No-Build Alternative. This results from highway traffic on new alignment, which, in general, is closer to receptors than under the existing and No-Build scenarios.

Table 5-11: Summary of Noise Impacts

Receptor Type	No-Build	Scenario 1				Scenario 2				Scenario 3			
		Alt. 1	Alt. 1A	Alt. 2	Alt. 3	Alt. 1	Alt. 1A	Alt. 2	Alt. 3	Alt. 1	Alt. 1A	Alt. 2	Alt. 3
Residences *	38	43	49	38	18	49	49	38	18	49	49	38	18
Churches	0	0	0	0	0	0	0	0	0	0	0	0	0
Schools	0	0	0	0	0	0	0	0	0	0	0	0	0
Parks	0	0	0	0	0	0	0	0	0	0	0	0	0
Historic Sites*	2	1	1	0	0	2	2	0	0	2	2	1	0
Nat'l. Historic Landmarks	1	0	0	0	1	0	0	0	1	0	0	0	1
Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	41	44	50	38	19	51	51	38	19	51	51	39	19

* For purposes of this EIS, historic resisidences are counted as a "Historic Site", not as a "Residence".

5.6 WILD AND SCENIC RIVERS

Introduction

The rivers of the United States are a valuable resource, which provide a variety of scenic, recreational, geological, wildlife, historic, and cultural values. Many of these rivers are protected under federal and state laws. The National Wild and Scenic Rivers System, which includes the nation's premier rivers, and the Nationwide Rivers Inventory both act to protect rivers at the national level. Programs such as the Indiana Department of Environmental Management (IDEM) Water Designated for Special Protection, the Indiana Department of Natural Resources (IDNR) Natural and Scenic River Segments Act, and Kentucky Division of Water (KYDOW) Special Use Waters act to protect Indiana and Kentucky rivers at the state level.

Methodology

The National Park Service (NPS) National Wild and Scenic Rivers System website, the Kentucky Division of Water website, and the Geographic Information Systems (GIS) data layer, "Designated Rivers in Southwestern Indiana", were reviewed to identify any Wild and Scenic Rivers in the project study area as well as state designated waters.

Analysis

No National Wild and Scenic Rivers or state protected rivers were identified within the project study area.

Summary

Because there are no National Wild and Scenic Rivers or state protected rivers within the project study area, the proposed action, regardless of which alternative is selected, will have no adverse impacts to these resources. The No-Build alternative would likewise have no impact on these resources.

5.7 CONSTRUCTION IMPACTS

Introduction

Each I-69 Build alternative will result in construction related impacts. The majority of these impacts will be temporary in nature, and will be contained within, or adjacent to, the anticipated right-of-way.

Methodology

The four Build Alternatives, as well as the No-Build Alternative, were evaluated based on the potential for construction-related impacts. Most of these potential impacts are temporary, lasting only for the duration of the construction process. Where applicable, quantitative analyses were performed.

Analysis

The following sections discuss the potential impacts from each of the Build alternatives.

Maintenance of Traffic

Maintenance of traffic is a potential issue where existing highways are impacted, through the construction of interchanges and/or overpasses, or due to the eventual closures of some local roads. Temporary increases in traffic congestion can lead to loss of productivity, motorist frustration, and unsafe driving conditions. Additionally, traffic issues can lead to business losses unless adequate street access is maintained where existing businesses may be impacted. During the design phase of the preferred alternative, proper maintenance of traffic measures will be developed. Such measures may include, but are not necessarily limited to the following:

- Provide adequate construction signage in accordance with the *Manual on Uniform Traffic Control Devices* (MUTCD).
- Minimize the use of temporary road closures. Where closures are unavoidable, develop recommended detour routes to assist motorists in avoiding construction areas.
- Utilize ITS technologies and local media outlets to assist motorists in avoiding construction-related congestion and travel delays.
- Coordinate relevant construction activities (i.e. temporary lane closures, etc.) to avoid peak hours of travel.

Railroad crossings

Given that I-69 is to be an Interstate facility, all railroad crossings will be grade-separated. However, the construction of overpasses and underpasses must be accomplished in a manner such that railroad traffic operations are not significantly impacted. Any construction over or adjacent to an existing in-service rail line will require coordination with the relevant rail company to ensure undisrupted service. Alternatives 1 and 1A cross four (4) rail lines. Alternatives 2 and 3 each cross one (1) in Kentucky.

Water

The development of the I-69 alternatives focused on avoidance of regulated environmental resources, where possible. As such, adjustments have been made to the Build alternatives to minimize impacts to wetlands, which provide valuable ecosystems and floodwater storage, have been largely avoided. The segments of each of the Build alternatives adjacent and through the Ohio and Green River Floodplains are to be constructed on bridged sections. These segments traverse areas conducive to wetland conditions; the construction of an elevated section minimizes the loss of this resource by minimizing the construction footprint to pier locations only, and allows existing water flow to remain largely uneffected. Where such construction is not feasible and wetlands are involved, steps will be taken to mitigate for any losses.

Much of the anticipated construction of I-69 is within flood-prone areas. Care must be taken to minimize soil loss and stream bank erosion. Regardless of the location of construction, Best Management Practices (BMPs) should be utilized to minimize erosion and runoff of sediments. These practices may include, but are not necessarily limited to the following:

- Avoid construction activities during periods of peak stream flow.
- Minimize disturbance to existing vegetation.
- Develop site-specific revegetation plans to provide adequate post-construction ground cover.

Air

The most significant construction-related impact to air quality deals with the potential for increased levels of dust where activities involving earthwork, demolition, or aggregate handling is involved. Particularly during prolonged dry periods, dust from such activities can spread beyond the right-of-way to adjacent areas, resulting in nuisance and in some cases damage.

Temporary BMPs that can be used to minimize the spread of dust particles include spraying aggregate with adhesives (emulsions), irrigating loose soils with water or calcium chloride, and providing barriers where soil blowing is problematic. Permanent solutions include the replacement of disturbed vegetation to near pre-existing conditions, covering erosion-prone soils with topsoil, and covering surfaces with crushed stone or coarse gravel (*Kentucky Best Management Practices for Construction*, NREPC).

Construction Noise Impacts

There would be unavoidable short-term noise impacts as a result of project construction. The primary source of noise expected would be generated from construction activities such as earth removal, hauling, grading, and paving. Noise abatement measures may be necessary during construction to restrict noise levels in the vicinity of noise sensitive sites. These measures may include, but are not necessarily limited to the following:

- Provide noise-dampening equipment housing or enclosures for stationary noise producing machinery such as drills and augers, cranes, derricks, compactors, pile drivers, generators, etc.
- Provide efficient silencers on air intakes of equipment.
- Provide efficient intake and exhaust mufflers on internal combustion engines.
- Perform proper maintenance on all noise producing equipment to prevent excessive rattling and vibration of metal surfaces.
- Take other measures as necessary to prevent construction noise from becoming a public nuisance or detrimental to human health.

Vibration

Construction activities may result in heightened vibration levels, particularly if driving of structural piles and/or blasting is necessary. However, such vibration is most often not perceivable by humans and does not pose a problem for nearby structures. Traffic level increases can also result in increased vibration levels adjacent to the roadway. Normally, traffic induced vibration "is not an environmental consideration beyond 200 to 300 feet from a roadway"[3]. However, there are

[3] Engineering Guidelines for the Analysis of Traffic-Induced Vibration, Science Applications, Inc., Office of Research and Development, Federal Highway Administration, Washington, DC, FHWA-RD-78-166, February 1978.

conditions where traffic induced vibration can effect specialized laboratory equipment, fragile buildings and historic sites. One such site, Angel Mounds State Historic Site in Indiana, was suggested by IDNR as potentially incurring negative vibrational impacts from both construction activities and traffic movement along Build Alternative 3. Given this concern, the site was subjected to detailed analysis to determine the potential for impacts. This analysis is discussed in detail in **Section 5.9.3 Archaeological Impacts**.

5.8 SEISMIC CONSIDERATIONS

Introduction

Seismic considerations for the I-69 Evansville-to-Henderson study are based on potential impacts from the New Madrid Fault, and to a lesser extent to faults in the much smaller Wabash Valley Fault System and the Rough Creek Fault Zone. **Figure 5-9** depicts the seismic occurrences in the New Madrid seismic zone between 1990 and early 2002.

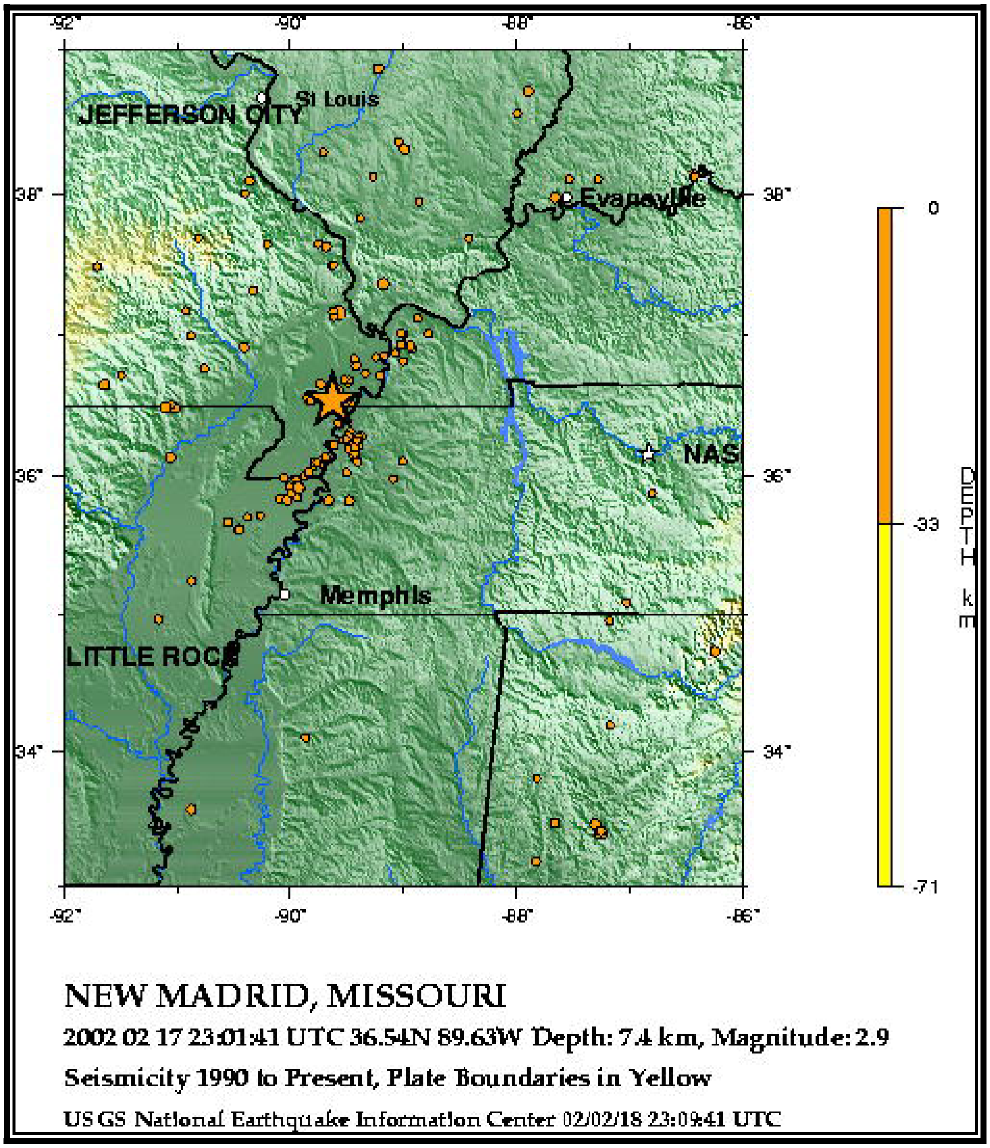


Figure 5-9: Seismicity in the New Madrid Seismic Zone (1990 – February 2002)

Methodology

The design of structures with regards to seismicity will conform to the basic concepts upon which the American Association of State Highway and Transportation Officials (AASHTO) *Standard Specifications for Highway Bridges* is based. These general concepts are as follows:

- Hazard to life to be minimized.
- Bridges may suffer damage but have low probability of collapse due to earthquake motions.
- Function of essential bridges to be maintained.
- Ground motions used in the design should have low probability of being exceeded during the normal lifetime of the bridge.
- Ingenuity of design not to be restricted.

Structures will be designed in accordance with methods in the current edition of the AASHTO specifications. With regards to seismicity, the specifications are applicable to bridges of conventional construction with spans not exceeding 500 feet in length. The only structure that AASHTO seismic methodology may not be applicable to within this project study area may be the main Ohio River crossing. In the event that the structure exceeds AASHTO methodology limitations, a more detailed analysis of seismic forces will be required. Nonetheless, the structure will be designed to provide adequate strength and flexibility to meet the basic concepts outlined above.

Analysis

The No-Build Alternative would require no consideration for potential seismic activity. The Kentucky Transportation Research Center (KTC) conducted an evaluation of the north- and southbound US 41 bridges in 1999 indicating that the main bridge superstructures of both will survive the projected 50-year earthquake without any damage and no loss-of-span[4]. However, it was noted that all supports on the piers of the main bridges required additional anchor bolts or seismic isolation bearings.

It is assumed all approach structures for the build alternatives, including those within the 100-year floodplain, will meet the AASHTO methodology limitations. AASHTO determines the degree of seismic activity based on the acceleration coefficient at the bridge site. The acceleration coefficient is a dimensionless constant used to describe ground motion with a 90 percent probability of not being exceeded in 50 years. AASHTO defines the acceleration coefficient for the project study area as approximately 0.09. However, in accordance with INDOT Design Memorandum No. 213, bridge structures within the three-county area of southwestern Indiana, including Posey, Gibson, and Vanderburgh Counties, should be designed considering a maximum coefficient of 0.10. Additionally, the KYTC *Bridge Design Manual* classifies Henderson County with a coefficient of 0.15. Structures at a location with an acceleration coefficient greater than 0.19 are considered to be in an area of high seismic activity. An acceleration coefficient between 0.09 and 0.19 places the approach structures in Seismic Performance Category B under the AASHTO specifications. Seismic Performance Category B requires some consideration for seismic design requirements applying to the following:

- Superstructure, expansion joints, and the connections between the superstructure and the supporting substructure,
- Supporting substructure down to the base of the columns and piers but not including the footing, pile cap, or piles,
- Components connecting the superstructure to the abutment.

Response to seismic events will not only be dependent on the resistance to the seismic forces by the structure itself, but also by the subsurface ability to maintain integrity in the event of an earthquake. Within the project study area, the most significant subsurface consideration involves the potential for liquefaction. Liquefaction occurs when the water pressure in saturated soils is increased by severe shaking, such as in an earthquake, or through rapid loading. In the absence of detailed geotechnical data, it is assumed that all lands within the 100-year floodplain, as defined by the Federal Emergency Management Agency (FEMA), are subject to liquefaction. Given the possibility that liquefaction can cause failures in earthen fill materials or structures located upon soils undergoing liquefaction, and that liquefaction-capable soils can only be accurately identified through detailed geotechnical analyses, it is assumed for purposes of this

[4] "Seismic Evaluation of the US 41 NORTHBOUND Bridge over the Ohio River at Henderson, Ky" (KTC-99-16), Issam E. Harik
"Seismic Evaluation of the US 41 SOUTHBOUND Bridge over the Ohio River at Henderson, Ky" (KTC-99-17), Issam E. Harik

study that all roadway facilities traversing the 100-year floodplain will be on elevated structure with piers founded on bedrock (if possible) or on piles. This design detail is subject to modification based on the findings of geotechnical explorations that should take place prior to the commencement of roadway design.

Summary

Each Build Alternative will require special consideration during design for the potential for seismic activity. However, none of the alternatives are located directly above a known fault line.

5.9 Section 106

Section 106 of the National Historic Preservation Act (NHPA) of 1966 requires consideration for the preservation of cultural-historic resources during the development and implementation of a Federal action. Section 106 requires the implementation of Advisory Council on Historic Preservation (ACHP) review for properties listed on or deemed eligible for listing in the National Register (NR). The following sections discuss the Section 106 process throughout the development of the Draft Environmental Impact Statement (DEIS) for I-69 Henderson to Evansville.

5.9.1 Coordination

Section 106 of the NHPA requires FHWA and the project applicant, INDOT and KYTC, to identify those consulting parties who may be entitled to participate in the historic preservation review process because of their interest in historic properties that may be affected by the project. Consulting parties include representatives of local governments, as well as other individuals or organizations with an interest in the project.

Potential consulting parties were identified and invited to join the project in a mailing to seventy-four parties on January 16, 2002. The letter contained a postcard for each potential consulting party to return to initiate consultation. Twenty-seven organizations/institutions returned the postcards and requested to become a consulting party. Three more entities/individuals requested consulting party status after public interest meetings were held in June 2002, and an additional request was received in November 2002.

The following Native American tribes were mailed invitations to become consulting parties:

- Cherokee Nation of Oklahoma
- Eastern Band of Cherokee Indians
- Peoria Indian Tribe of Oklahoma
- Miami Tribe of Oklahoma
- United Keetoowah Band of Cherokee Indians
- Delaware Tribe of Western Oklahoma

Only the Delaware Tribe of Western Oklahoma indicated that they wished to be a Consulting Party. However, invitations to all consulting party meetings have been mailed to representatives of each of the tribes listed above.

On January 17, 2003, a consulting party meeting was held in Henderson, Kentucky, to discuss the Area of Potential Effects (APE) and preliminary determination of eligibility for the National Register of Historic Places (NRHP). The invitation to this meeting included a map of the APE and a description of potentially eligible properties. (See invitation and meeting minutes in **Appendix C-3**.) Six consulting parties attended from both Kentucky and Indiana.

The project historians for INDOT contacted those consulting parties that had provided information to Indiana's consultants but that did not attend the meeting. No concerns about eligibility were expressed. Historic Landmarks Foundation of Indiana did ask the INDOT project historians if they had considered a large rural district in Marrs Township of Posey County. (That had been one of the first areas evaluated for a historic district).

On September 23, 2003, a second consulting party meeting was held at Angel Mounds State Historic Site in Evansville, Indiana, to discuss the effects findings for properties listed on or considered eligible for the NRHP. (See invitation and meeting minutes in **Appendix C-3**.) The meeting focused on the work completed since the first meeting, particularly the preliminary findings of effect and how those findings were analyzed. Two consulting parties were in attendance.

In addition to coordination with consulting parties, agency coordination has been an ongoing process throughout the development of the DEIS. In particular, coordination with the Indiana State Historic Preservation Officers (SHPO) or their representatives has been undertaken to ensure that the Section 106 review process is successfully completed. Documentation concerning this coordination is found in **Appendix C-4**.

5.9.2 Historic Resource Impacts

Introduction

Congress set forth the importance of historic properties upon the fabric of American life as part of the NHPA, which states that "the historical and cultural foundations of the Nation should be preserved as part of our community life and development in order to give a sense of orientation to the American people." [16 U.S.C. 470b(2)]. As a result of the NHPA, as amended, and 36 CFR Part 800 (2001), federal agencies are required to take into account the impact of federal undertakings upon historic properties in the area of the undertaking. Historic properties include buildings, structures, sites, objects, and/or districts. The Area of Potential Effects (APE), which is established by FHWA for this undertaking, is "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties. The area of potential effects is influenced by the scale and nature of an undertaking …" [36 CFR 800.9(a)].

The Section 106 process is conducted to identify historic resources and determine the eligibility of those resources for the National Register of Historic Places (NHRP). In accordance with that process, an inventory of the historic resources in the project study area has been developed. All historic resources listed in or determined eligible for inclusion in the NRHP within the APE have been identified, mapped and evaluated for potential effects. The APE, developed through coordination with the Kentucky and Indiana State Historic Preservation Officers, is discussed in detail below. The development and refinement of the build alternatives has included consideration for the avoidance of historic sites.

In accordance with Section 106, NHPA of 1966, as amended, and 36 CFR Part 800 (2001) and Final Rule on Revision of Current Regulations dated 12 December 2000, historic properties were identified and evaluated, eligibility determinations were made, and then preliminary findings of the effects of the undertaking upon eligible properties were assessed. The identification, evaluation, and determination parts of the process were divided into four phases: fieldwork, documentary research, deliberation, and decision-making. (Note that work on some of these phases occurred simultaneously.) These processes are discussed in detail below.

Methodology

Establishing an APE

The following sections discuss the process utilized in the development of the APE for I-69 Henderson to Evansville. **Appendix C-4** contains correspondence from the Indiana and Kentucky SHPOs relative to the development and approval of the final APE.

Indiana

The Area of Potential Effects (APE) for Indiana was established through an ongoing dialogue between the State Historic Preservation Office (SHPO) and the consultants of the agency. The SHPO initially suggested the development of a variable-width APE, and consultants experimented with the idea of using a computer-generated viewshed from the centerline of the undertaking, which established a “jagged-edge” APE. In August 2002, a trip was taken to assess the viewshed and audible changes from existing I-164 (as a test case). After discussion, it was decided that while the computer-generated viewshed APE was a useful tool, the SHPO and the consultants were more comfortable with an approach that created a larger fixed-width APE and therefore, raised the assurance level that properties would not be missed. Therefore, for alternatives passing though new terrain, the APE is one mile from the centerline except for proposed (or possible) raised sections where the APE extends to one mile plus 1,500 feet. For alternatives using existing I-164, the APE is 1000 feet. The APE is shown in **Figure 5-10**.

Kentucky

The first step in developing the APE for Kentucky was the use of a model generated “viewshed” of the project study area from the proposed alternatives. The viewshed APE was then reviewed on-site and modified to consider on-site conditions which had not been factored into the viewshed model. The APE which resulted from this process is considered a working boundary which may be modified further as the more detailed field work proceeds.

The viewsheds were created by using ArcView GIS software by ESRI with the Spatial Analyst extension. United States Geological Survey (USGS) Digital Elevation Models (DEMs) were used as the basis of ground elevation information. The viewsheds for I-69 were generated from a series of points along the centerlines set at 100-foot intervals. The observation points were given a height above the existing ground level of 6.56 feet. The model calculated the viewshed for each point by identifying the ground elevation of the point based upon the DEM and adding the observation height, then scanned the horizon based on the DEM elevations and assigned values of visible or not visible to the grid points on the DEM. This analysis did not account for any vegetative or man-made obstructions that had the potential to obscure the visibility of some areas. It also did not account for the curvature of the earth.

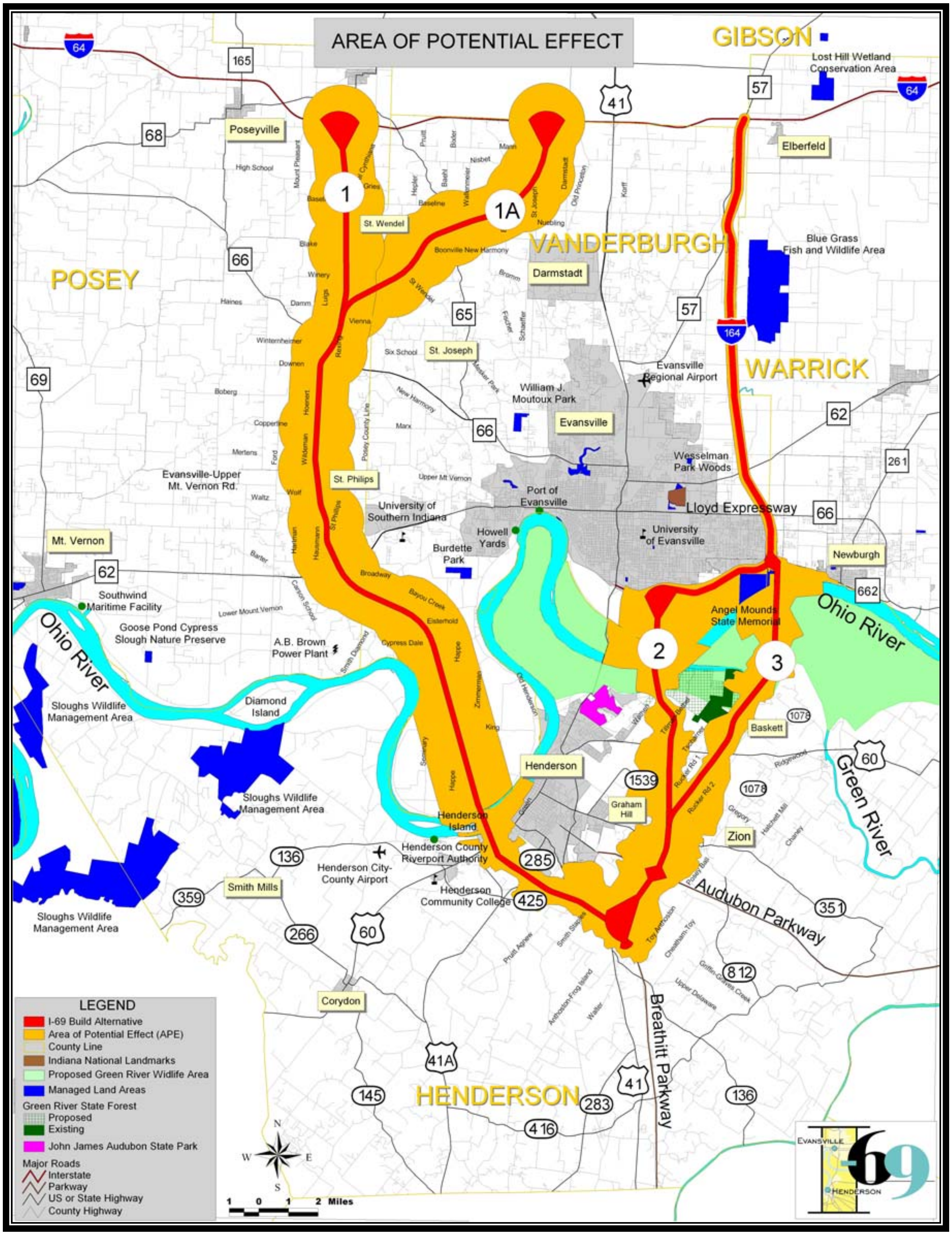


Figure 5-10: Area of Potential Effect for Proposed Project

The visible values generated by viewshed analysis were extracted and plotted along with the centerlines of each alternative. An APE boundary was then drawn for each alternative based upon the visible viewshed model and a general knowledge of the area land use. Based upon these factors, the APE boundary was drawn to encompass the concentrations of the viewshed around the centerline. Areas of the viewshed which were remote from the centerline or separated by some known obstructive feature were excluded. The APE boundaries developed around each centerline were then combined into a comprehensive preliminary APE for all alternatives.

Maps of the preliminary viewshed APE were used on-site to examine the effect of manmade and natural elements which obscured the visibility of the proposed alternatives from points within the proposed viewshed APE. Where these existing elements blocked the visibility of the alternatives, the viewshed APE was modified accordingly. The APE is shown in **Figure 5-10.**

Identification of Historic Properties

The field work and examination of standing structures was conducted in the summer and fall of 2002. Within the APE, buildings which appeared to be greater than 60 years of age were photographed and evaluated to assess their ability to meet National Register criteria. Historic properties within the APE were evaluated to determine their eligibility for listing in the NRHP based on their integrity and their ability to meet one or more National Register criteria for evaluation.

Analysis

National Register Criteria

Historic properties within the APE were evaluated to determine their eligibility for listing in the NRHP based on their integrity and their ability to meet one or more criteria for evaluation. These criteria are as follows:

Criterion A: Properties can be eligible for the National Register if they are associated with events that have made a significant contribution to the broad patterns of our history. Properties can be associated with specific events or with a pattern of events.

Criterion B: Properties may eligible for the National Register if they are associated with the lives of persons significant in our past.

Criterion C: Properties may be eligible for the National Register if they embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

Criterion D: Properties may be eligible for the National Register if they have yielded, or may be likely to yield information important in prehistory or history.

Since the NRHP is a federal program, the eligibility criteria are the same for both states. A historic property need only meet one criterion to be eligible for listing in the National Register (NR). In accordance with NRHP terminology, “integrity is the ability of a property to convey its significance” through the retention of seven elements: location, design, setting, materials, workmanship, feeling, and association. A property need not retain all seven elements to possess integrity.

As part of the evaluation process, historians took into account seven exemptions specified in 36 CFR 60.4. “Ordinarily cemeteries, birthplaces, or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years…" are not eligible for listing in the National Register. Although the exemptions are applicable, the presence of documented cemeteries was verified whenever practical and churches were included whenever they illustrated an architectural or historical theme. A list of all the sites surveyed in the project study area can be viewed in **Appendix C-5**.

Buildings or groups of buildings within potential districts must not only meet National Register criteria, but must also possess integrity. Aspects of integrity which were considered in assessing buildings within the project corridors are described below.

The building or groups of buildings must possess an integrity of location. Buildings which have been moved from the site for which they were built lose information in regard to orientation, views, approach, all which may have been either significant design considerations or may have contributed to the historic significance of the site.

The building or buildings must retain the relationship to the site which they had during the period of significance. Factors to be considered for their impact on integrity of setting include reductions of setbacks from roadways or property lines: the addition of other buildings to the site after the period of significance; grading practices which have changed the elevations or nature of the land surrounding the building, such as the introduction of parking lots; and views from the building to public thoroughfares as well as views from the public thoroughfares to the building.

"Architectural form" refers to the building's configuration. Additions are only acceptable if they preserve an integrity of design. Successful additions must be placed so that they do not obscure the historic form of the building from its main public view. Buildings with additions which do obscure the historic form from the main approach will not meet National Register criteria.

Successful non-historic additions must reflect the scale of the architectural form in height, roof shape, and size of openings for windows and doors of original dwelling. Materials used on the exterior of the addition must he compatible in texture, scale, color, and character to that of the main block of the dwelling and must preserve an integrity of material and workmanship found on the historic structure. The square footage of the addition(s) must not be greater than or equal to the square footage of the dwelling during the period of significance.

If the porch was an important element of the architectural form, it must be present. Enclosure of the porch on the main facade will cause the building not to meet registration requirements. Porches must retain roof shape, but can reflect some change in terms of materials, such as the replacement of a wood floor with concrete, provided that the original stone or brick foundation is retained. Wood posts may be replaced, provided that the replacement material retains the same form and scale as the original posts.

If the original exterior fabric is brick or stone, those materials must be visible. If the original exterior fabric is wood weatherboarding, then the application of aluminum siding or vinyl siding which retain the scale of the weatherboarding could affect the integrity of a site. If the architectural style during the period of significance is usually found with ornamentation, but that ornamentation subsequently has been removed from the building, then the building would not meet the registration criteria. A building which has numerous modern alterations which render the building more modern than historical in appearance will not meet NR integrity requirements.

Figure 5-11 depicts sites within the APE of one or more Build Alternatives that are on or were deemed eligible for inclusion in the NRHP. The following sections discuss these sites, the rationale behind the determination of eligibility, and the findings of effect. Each respective state's SHPO offices have concurred with the findings of eligibility and the findings of effect.

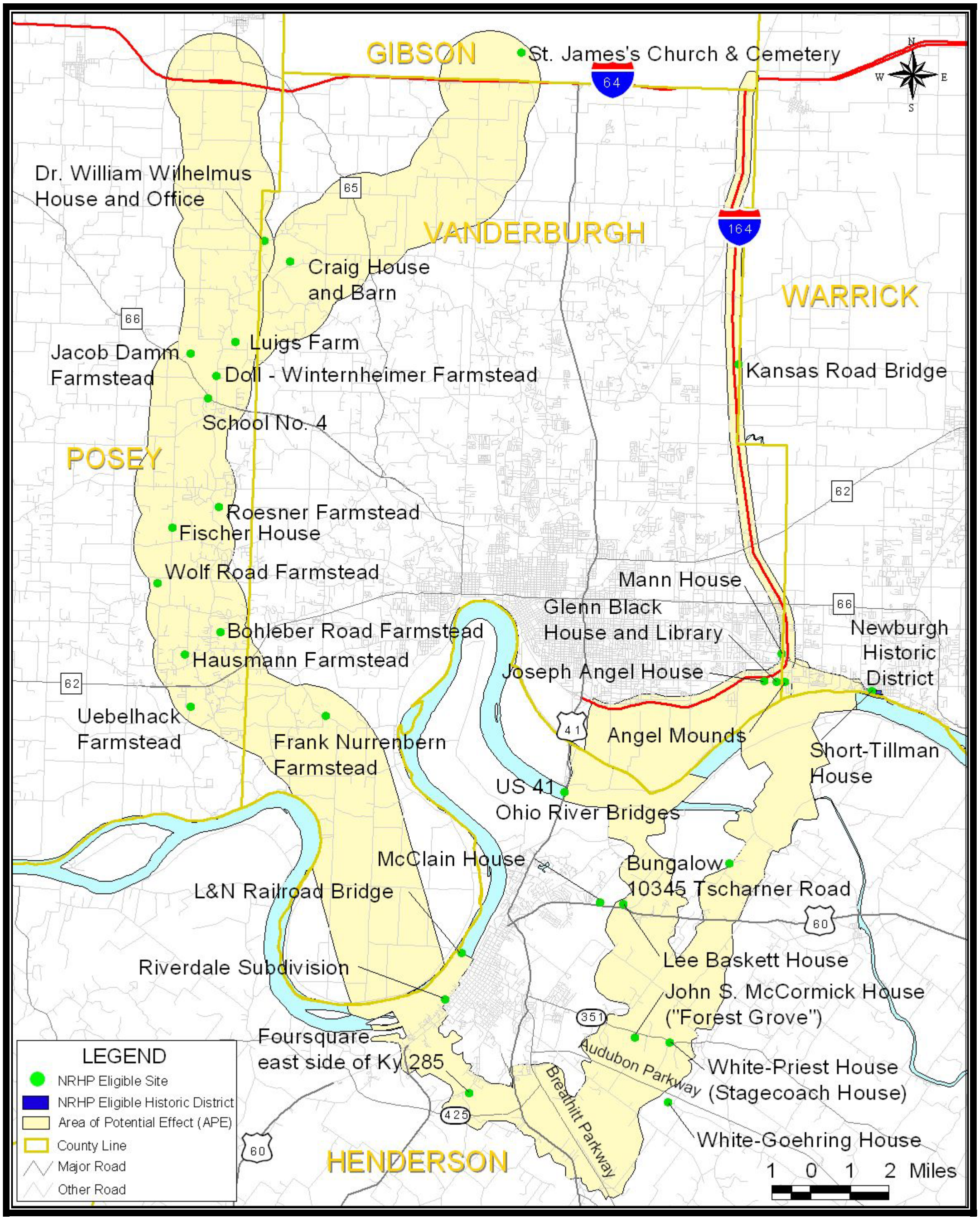


Figure 5-11: Sites On or Eligible for the National Register of Historic Places and Within the Area of Potential Effect of One or More Build Alternatives

Kentucky Historic Resources

L&N Railroad Bridge

In 1866, the Henderson and Nashville Railroad was incorporated. By March 1869, the track had been completed to Madisonville. In 1871, rail lines were finished to Tennessee line at Guthrie where the railroad connected to the Edgefield and Kentucky Railroad, which completed the line, known as the St. Louis and Southeastern, between Henderson and Nashville.

In Henderson a round house, machine shop, carpenter shop, blacksmith shop, and a paint shop were built to service the railroad, but there was no bridge across the Ohio River at Henderson. Passengers and freight had to be ferried across by boat, an operation which was cancelled by ice in the winter.

L&N Railroad Bridge

The Henderson Bridge Company was incorporated by the Kentucky General Assembly in 1872 to construct a bridge between Evansville and Henderson. No action was taken, however, until the St. Louis and Southeastern became the Henderson Division of the Louisville and Nashville (L&N) Railroad in 1879. The L&N also gained control of the Henderson Bridge Company and started construction of a bridge across the Ohio River in 1881.

Completed in 1885, the railroad bridge and its approaches had a total length of 27,995 feet and a channel span of 525 feet. At the time of its construction, the railroad bridge at Henderson was the largest trestle span in the world.

The original bridge was used for 47 years until 1932, when it was replaced by the present-day, double-tracked structure.

Determination of Eligibility:
This site is eligible for inclusion in the National Register according to Criterion A and C.

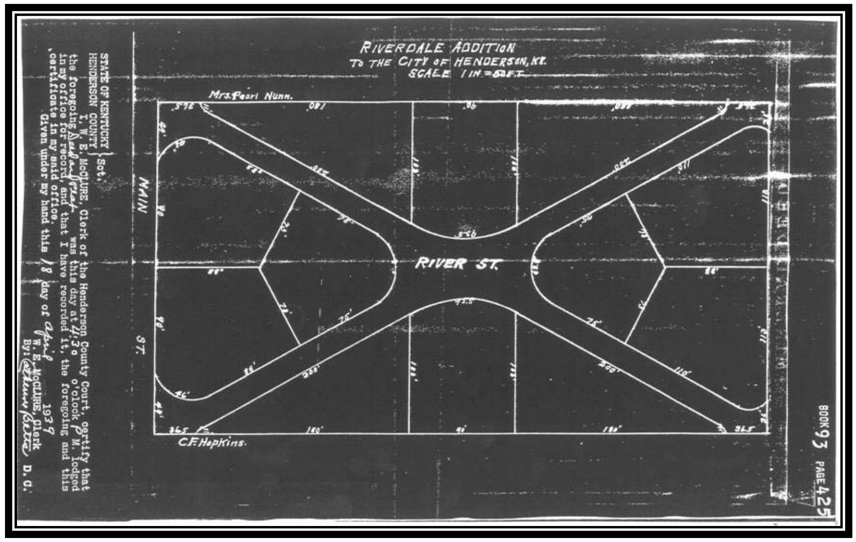
Determination of Effects:
The L&N Railroad Bridge is located near the downtown area of Henderson, KY approximately 10,000 feet upstream from the proposed Alternatives 1 and 1A bridge crossing. This bridge achieves its historical significance as an example of a significant engineering design and its association to the history of the railroad in Henderson.

The bridge is currently in active service, and the development of any of the alternatives will have no effect on the bridge.

Riverdale Court Historic District

As individual sites they are not examples significant architectural forms or the work of a master for Criterion C, but are contributing sites in the proposed Riverdale Court Historic District.

Sites 20 through 32 consist of 14 dwellings. 11 of which are contributing and 3 are non-contributing in the proposed Riverdale Court Historic District. The proposed National Register boundary of the district follows the boundaries of the subdivision plat from 1939. The plat feature two dead-end streets, perpendicular to one another, but set at an angle to South Main on the south and the Ohio River on the north. The streets within Riverdale Court are narrow without sidewalks.



Riverdale Court Historic District

The dwellings, nine of which can be dated through the Henderson County Property Valuation Administrators records to the period between 1938 and 1947, represent the transition from Modern Colonial Revival to Ranch style. The one-story, side-gabled, frame structures typically have a man block flanked by recessed sections containing porches and/or attached one-car garages. Because of the layout, all of the dwellings have an inward orientation instead facing South Main St. or the river. All of the contributing properties are similar in scale, materials, and setback.

Two of the modern, non-contributing sites (adjacent to Site 25 and Site 29) are on the north end of the subdivision, adjacent to the river. The third modern, non-contributing site (#20), a Bedford Stone ranch house from 1959 is adjacent to South Main Street. The dates of the dwellings from the Property Valuation Administrator's office are listed below:

Site 20	1059	Site 27	1938
Site 21	1934	Site 28	No date
Site 22	1945	Site 29	No date, modern
Site 23	1945	Site 30	1935
Site 24	1947	Site 31	1941
Site 25	No Date	Site 32	1940
Modern	house north of #25	Site 26	1944

Determination of Eligibility:
These sites are eligible for National Register according to Criterion C.

Determination of Effects:
The Riverdale Court Historic District consists of 14 dwellings, 11 of which are contributing and 3 are non-contributing. The district is located approximately 4,000 feet northeast of the nearest construction limits of Alternatives 1and 1A. No property listed on or eligible for the NRHP associated with the district will be taken for any of the alternatives.

The district is surrounded by modern development, and the majority of the district would not have an unobstructed view of the proposed bridge for Alternatives 1 and 1A. Any visual impacts from the bridge would be minimal. Alternatives 2 and 3 would have no effect on the district. Modeling indicates that no audible noise effects would be created by any of the alternatives. (See Section 5.5)

Foursquare

Site 5-99 is a one-and-one half story, three bay, hip roofed, framed dwelling which rests upon a concrete block foundation. On the roof are two three-window dormers which have jerkin head roofs. Rafter tails are visible along the eaves of the main roof and dormers. Windows have six over one glazing and are doubled and tripled in the wood facades.

On the main façade, the entry and the west bay are recessed to created a porch which is supported by a battered wood post atop a brick plinth. Associated with the dwelling are a metal-clad barn, office, and silo.

Determination of Eligibility:
This property is eligible for the National Register under Criterion C.

Determination of Effects:
The Foursquare House on KY 285 is located approximately 500 feet from the nearest construction limits of Alternatives 1 and 1A. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives. However, the visual intrusion of Alternatives 1 and 1A would create an adverse effect on the property.

In the vicinity of this house, the proposed elevation of Alternative 1 and 1A will be similar to that of existing KY 285, while the house is slightly elevated in comparison. The view of the proposed Alternatives 1 and 1A will be screened by a wooded ditch near KY 285, but the house would have a view of the alternatives through the open, relatively flat area to the northwest and southeast, which will create a visual effect on the house. Alternatives 2 and 3 would have no effect on the property.

Modeling indicates that noise effects would also be created by Alternatives 1 and 1A; however, these levels would not reach abatement criteria and do not present and adverse effect. Alternatives 2 and 3 would have no effect on the property. (See Section 5.5)

White-Goerhing House

Site 108 is a two-story, three-bay, central passage, side-gabled, log and frame dwelling with exterior brick chimneys in the gable ends. The exterior fabric is board and batten. Over the central entry is a two-story porch with a balustrade.

The property was originally part of the Larkin White farm. The dwelling was built by one of Larkin White's sons. Associated with the dwelling are a tenant house, barns, and a corn crib from the 1940s as well as garage and shop dating from the 1990s.

Determination of Eligibility:
This property is eligible for the National Register under Criterion C.

Determination of Effects:
The White-Goehring House is located approximately 3,500 feet from the nearest construction limit of Alternatives 2 and 3 at their crossing of the Audubon Parkway. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives.

White-Goerhing House

The White-Goehring House is located approximately 1,000 feet from the existing Audubon Parkway and will have a view of the proposed interchange of Alternatives 2 and 3 with the Parkway and of the two alternatives as they continue to the southwest, creating a visual effect on the property. Alternatives 1 and 1A would have no effect on the property.

Modeling indicates that no audible noise effects would be created by any of the alternatives.

<u>**John S. McCormick House**</u>

Site 116 is a two-story, five-bay, hip-roofed, brick dwelling which rests upon a stone foundation. The interior retains Greek Revival detailing in the doorways, mantels, and moldings. Brackets ornament the eaves of the single bay porch as well as that of the main roof. Above the windows are flat lintels.

John S. McCormick House

According to the present owners of the property, the original owner of the house may have been Nancy Farmer who sold the property to John Steele McCormick in 1854. John S. McCormick, a prominent farmer, owner of a tobacco stemmery and general store, was associated with the house from 1854 until his death in 1900.

John Steele McCormick married Martha Elam on March 7, 1848. He is not listed in the 1840 Henderson County census, but is shown in 1850 as being a farmer, age 35 with his wife Martha (age 22) and son Sidney (age 1). In the 1860 census the listing is for the John S. McCormick household is as follows: John S. (age 44); Martha (age 31), Sidney D. (age 11); George H. (age

9); Anne (age 7); and Mattie (age 3). In the 1880 census the John S. McCormick household contained the following people: John S. (age 64); Martha (age 62?); Mattie (age 22); and Perginina (age 16). According to Henderson County death records, John S. McCormick died on April 27, 1900 of pneumonia at the age of 85. His burial place is unknown.

John S. McCormick and his nephew, William W. Shelby, Jr. were engaged as partners in numerous businesses from 1861 until 1882. In 1860, McCormick and Shelby built a tobacco stemmery in Scuffletown to prepare tobacco for European markets. On an average, they processed 400 to 450 hogsheads of tobacco a year. In 1877, they put up 600 hogsheads. Until 1860, the local farmers had never engaged primarily in growing tobacco, but through the encouragement of W.W. Shelby, larger crops of tobacco were grown. In 1877, most of the largest tobacco crop ever grown locally, 1,100,000 pounds, was bought and handled by Shelby and McCormick.

In 1868, Shelby and McCormick built a large general store stocked with groceries, dry goods, and notions near the tobacco stemmery in Scuffletown. A steam-powered grist mill and blacksmith shop were also built. McCormick and Shelby also owned the Dunlop tobacco stemmery on lower Main Street in Henderson. McCormick sold his interests in the business in 1882 (Johnson, Survey Form HE-7; Starling: 733-735; Arnett: 254). Associated with the McCormick House are a brick smokehouse (c. 1847); two barns (1940-1950); horse barn (1940-1950): carport (1980); silos (1980); and swimming pool (1980).

According to the owners, there is a cemetery (with possible associations to the Farmer family who may have been the original owners of the house) which has no standing markers located south of the swimming pool. At present 12 acres are associated with the house and 160 acres are associated with the farm.

Determination of Eligibility:

This property is eligible for the National Register under Criterion B and C.

Determination of Effects:

The John S. McCormick House is located approximately 1,600 feet from the nearest construction limit of Alternatives 2 and 3 at their crossing of KY 351. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives.

Alternatives 2 and 3 would be visible from the John S. McCormick House between KY 351 and the Audubon Parkway. A relatively unobstructed view of the proposed interchange of Alternatives 2 and 3 with KY 351 will also create a visual effect on the property. Alternatives 1 and 1A would have no effect on the property.

Modeling indicates that noise effects on the property would be created by Alternatives 2 and 3. These effects do not reach the abatement criteria and would not be considered and would not be considered and adverse effect. Alternatives 1 and 1A would have no effect on the property.

<u>White-Priest House</u>

Site 119 is a two-story, five-bay, side-gabled, weatherboarded, log dwelling which rests upon a stone foundation. On the gable ends are interior brick chimneys. A hip-roofed porch supported by rounded wood columns covers the central entry and two additional hays. Windows have six over six glazing.

The White-Priest House served as a stage coach stop for the Owensboro- Henderson-Uniontown route, at the five-mile marker between Henderson and Zion. Larkin White (1794-1854), the owner of the house, also had a general store. The farm remained in the Larkin White family until the late nineteenth century.

Associated with the house are a carriage house (dated by one source to 1820 and another source to 1904); ice house (1820); office (1981); and equipment shed (1975). To the south is a cemetery containing the graves of Larkin White and other family members. At present, 444 acres are associated with the farm. On the 1880 Lake Map, 1,040 acres are shown for the White Farm.

White-Priest House

Determination of Eligibility:
This property is eligible for the National Register under Criterion C.

Determination of Effects:
The White-Priest House is located approximately 2,200 feet from the nearest construction limit of Alternatives 2 and 3 at their crossing of KY 351. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives. The preliminary layout of the interchange of Alternatives 2 and 3 with the Audubon Parkway did encompass a small section of property within the boundary of the property well removed from the structures; however, modifications to this interchange eliminated any potential take from this property.

Alternatives 2 and 3 would be visible from the White-Priest House between KY 351 and the Audubon Parkway, although a wooded creek will provide some visual screening of the roadway. A view of the proposed interchange of Alternatives 2 and 3 with KY 351 will also create a visual effect on the property. Alternatives 1 and 1A would have no effect on the property.

Modeling indicates minimal noise effects on the property would be created by Alternatives 2 and 3. These effects would not be considered adverse effects. Alternatives 1 and 1A would have no effect on the property.

<u>**McClain House**</u>

Site 128 is a two-story, five-bay, hip-roofed, brick dwelling with interior brick chimneys. On the main facade is a full-width, colossal, two-story portico which is supported by Ionic columns and topped by a balustrade. There are flat lintels over the doorways and windows.

Associated with the dwelling are a meathouse (c. 1852), tenant house (c. 1900), carriage house and tenant house (c. 1920s). The property consists of approximately 6.4 acres.

McClain House

Determination of Eligibility:
This property is eligible for the National Register under Criterion C.

Determination of Effects:
The McClain House is located approximately 6,800 feet from the nearest construction limit of Alternative 2 near its crossing of US 60. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives.

The view of Alternative 2 from the McClain House would be obstructed by vegetation, terrain and modern development. No visual effects would be created by Alternative 2. Alternatives 1, 1A and 3 would have no effect on the property.

Modeling indicates no audible noise effects on the property would be created by Alternative 2. Alternatives 1, 1A and 3 would have no effect on the property.

<u>Lee Baskett House</u>

Site 129 is a two-and-one-half-story, three-bay, hip-roofed, brick dwelling which rests upon a stone foundation. On the tile roof are three-window, pedimented dormers. The central entrance is flanked by sidelights and stone pilasters.

Lee Baskett House

Over the central entry is a hip-roofed porch which is supported by pairs of battered stone columns atop a brick balustrade. On the east side of the house is a hip-roofed porte cochere supported by brick columns. Beneath the wide roof eaves are brackets.

Associated with the dwelling are a hip-roofed, brick, two-car garage; brick and wood frame mule barn; and a modern concrete block barn.

Determination of Eligibility:
This property is eligible for the National Register under Criterion B and C.

Determination of Effects:
The Lee Baskett House is located approximately 3,700 feet from the nearest construction limit of Alternative 2 at its crossing of US 60. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives.

Alternative 2 would be visible from the Lee Baskett House near the proposed US 60 interchange and to the north. Although some visual screening will be provided by vegetation, terrain and modern development, the view of Alternative 2 will create a visual effect on the property. Alternatives 1, 1A and 3 would have no effect on the property.

Modeling indicates no audible noise effects on the property would be created by Alternative 2. Alternatives 1, 1A and 3 would also have no effect on the property.

Bungalow on Tscharner Road

The bungalow on Tscharner Road is a one and a half story, three bay, side gabled, frame bungalow. Windows are elongated and either doubled or tripled. On the roof is a front-gabled dormer which contains three windows with three over one glazing. The roof has wide eaves, and the porch is supported by brick posts. Flanking the doorway are sidelights.

Determination of Eligibility:
This property is eligible for the National Register under Criterion B and C.

Determination of Effects:
The Bungalow House (Site 148) is located on Tschsarner Road approximately 1,600 feet west of the nearest construction limit of Alternative 3. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives.

Correspondence between the SHPO and the Kentucky historian determined that an adverse visual effect will occur with Alternative 3. Alternatives 1, 1A and 2 would have no effect on the property.

Modeling indicates no noise effects on the property would be created by Alternative 3. Alternatives 1, 1A and 2 would also have no effect on the property.

McCallister/ Claycomb/ Hartung House

Site 133 was a one-story, side gable, frame T-plan which retains a toothed sawn frieze and the original posts on the porch, an outhouse, and a modern barn.

According to information provided by the owner, the dwelling contained two rooms (on the back or north side) which were built after John E. McCallister became the owner of the northeast section of the Talbot Farm circa 1854. The front or south portion of the house was built by the Claycomb family, who purchased the property in 1901.

McCallister/ Claycomb /Hartung House

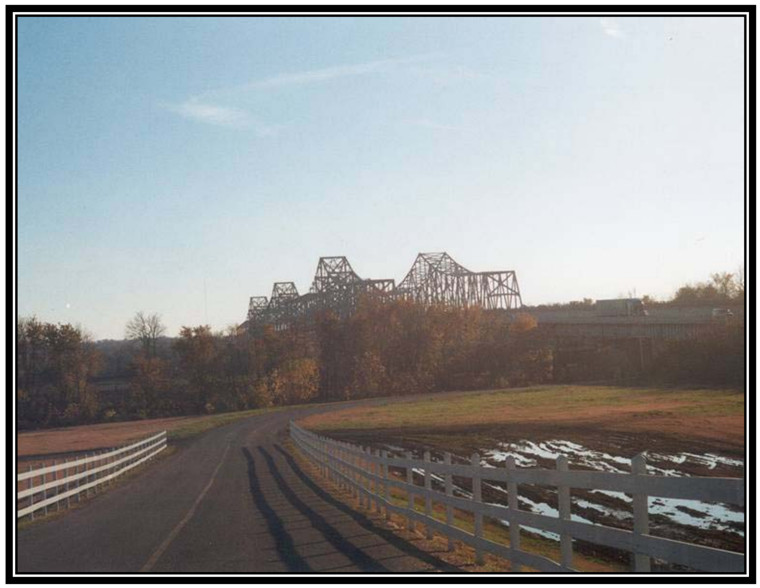
The house was oriented to the south towards present-day Melody Lane instead of to present-day Tillman-Bethel Road which lies to the east of the former dwelling. Present-day Melody Lane is a section of an earlier road used until circa 1900-1905.

The earlier road provides access to the land where the Bethel House once stood as well as three cemeteries: Talbot (burials from 1828 to 1976); Bethel (burials from 1875 to 2001); and Geible-Reeder (burials from 1885 to 1925). According to Mrs. Cooper, there are two other cemeteries in the vicinity, an unmarked one for slaves and Hart (burials from 1818 to 1862 and located on the east side of present-day Tillman Bethel Road).

Determination of Eligibility:
This property was eligible for the National Register under Criterion C.

Determination of Effects: This property would have been adversely affected by Alternative 2. In 2002, the alignment of Alternative 2 was shifted to avoid a direct use of the site. Since that time, the historic structure has been razed by the owner. Correspondence between FHWA, KYTC, INDOT, and the SHPOs concerning this property is found in Appendix C4.

<u>**Henderson to Evansville Bridge**</u>



Henderson to Evansville Bridge

Site 149 is a steel cantilevered bridge completed by the Kentucky and Indiana State Highway Commissions in 1932. Two locations had been proposed for the bridge, one at 12th Street in Henderson and the other near Dade Park (present-day Ellis Park). When the bridge was opened, it was christened the Audubon Memorial Bridge. It was renamed the Bi-State Gold Star Vietnam Memorial Bridge after a second bridge was completed in 1965 to the west of the original one.

The bridge was funded by the second Kentucky Bridge Revenue Bond authorized by the Murphy Toll Bridge Act of 1928. The Murphy Toll Bridge Act authorized the State Department of Highways to build bridges over larger rivers. The state could sell bonds, secured by the bridges and the tolls collected, to construct, acquire, operate and maintain the bridges.

The first Commonwealth of Kentucky Bridge Revenue Bond was issued in 1930 and initiated a vigorous period of bridge construction by the state within Kentucky's boundaries between 1930 and 1931. The bridges built included the following: Boonesboro, Spottsville, and Tyrone bridges over the Kentucky River; Burnside, Canton, and Smithland bridges over the Cumberland River; and the Eggner's Ferry Bridge over the Tennessee River.

The second bond issued later in 1930 was given for Interstate bridges and included Ohio River bridges at Ashland, Maysville, and Henderson (Powell: 40-41).

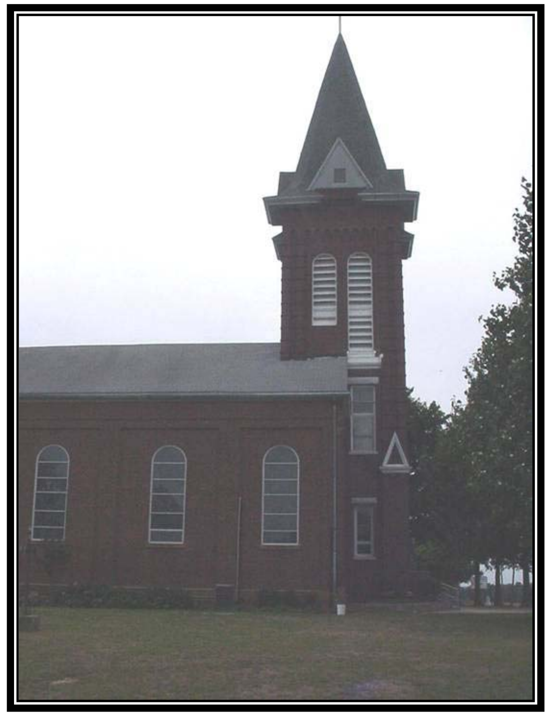
Determination of Eligibility:
Based upon the recommendation of "A Survey of Truss, Suspension, and Arch Bridges in Kentucky", a statewide bridge study completed by Woolpert and Associates in 1988, the Henderson to Evansville Bridge is eligible to meet criterion A.

Determination of Effects:
The Henderson-Evansville Bridge is a steel cantilevered bridge completed in 1932. The bridge is located near Ellis Park approximately 9,000 feet downstream from the proposed Alternative 2 bridge crossing.

The bridge is currently in active service, and the development of any of the current alternatives will have no effect on the bridge.

Indiana Historic Resources

St. James Church
St. James Church is significant in the area of architecture and religious settlement. It is the oldest Catholic congregation in Gibson County; mass was offered for the first time in 1836. The St. James Parish was established in 1847 to serve a community of German immigrants. When these groups of German immigrants arrived in the United States they immediately formed communities. So it was with the families who started St. James Parish.



St. James Church

St James Church symbolizes a larger German settlement. It is representative of a pattern of development that is common in the project study area. St. James Church is a well preserved example of church architecture from the mid-nineteenth century.

The church and its associated cemetery achieve their historical and architectural significance through numerous factors. The church building retains architectural integrity in its Romanesque Revival style and its parish members are the descendants of the oldest Catholic congregation in Gibson County. The cemetery is significant through its association with the church.

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
Situated atop a hill overlooking I-64 to the south and southwest, the property is actually nearer to I-64 than to the proposed construction limits of Alternative 1A. The church and its associated cemetery achieve their historical and architectural significance through numerous factors. The church building retains architectural integrity in its Romanesque Revival style and its parish members are the descendants of the oldest Catholic congregation in Gibson County. The cemetery is significant through its association with the church. No property listed on or eligible for the NRHP associated with the church will be taken for any of the alternatives.

The presence of I-64 and the current volume of traffic along that roadway have raised the threshold of actual effects on this property. Additional road building south of I-64 on Alternative 1A will create no appreciable change (diminution) in the historic context of the property. Alternatives 1, 2 and 3 would have no effect on the property.

Jacob Damm Farmstead

The Jacob Damm Farmstead is significant in the areas of agriculture and architecture. The Damm Family members were early residents of the township; historical atlases located them and their acreage. They came as part of the German Lutheran migration.

The collection of buildings includes a fine example of a circa 1870 two-story Greek Revival house, summer kitchen, barn, granary, and numerous smaller outbuildings. The remoteness of the property, the distribution of buildings within the property boundaries, the integrity of the resources, and the family history associated with the land all combine to weave a contextual fabric that calls to mind an earlier period in Hoosier history.

Jacob Damm Farmstead

The Damm Farmstead is a well-preserved example of the economical distribution of the elements of the working farm: the barn, the summer kitchen, the poultry houses, granary, and well sited on the property to maximize efficiency while seeing separation from other aspects of farm life.

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
The Jacob Damm Farmstead is situated approximately 2,900 feet from the nearest construction limit of Alternatives 1 and 1A. The collection of buildings includes a fine example of a circa 1870 two-story Greek Revival house, summer kitchen, barn, granary, and numerous smaller outbuildings. No property listed on or eligible for the NRHP associated with the farmstead will be taken for any of the alternatives.

Alternatives 1 and 1A will pass to the east of the boundaries of the property more than one-half mile away. At that distance there will be minimal visual effect in almost the full range of consideration (from the northeast to the southeast of the property in an arc of approximately 90 degrees.) The visual impact will be further minimized by a dense stand of trees and a low ridge between the farmstead and construction limits. Masking the highway, the trees extend north and south generally parallel with the right-of-way. One potential exception to this masking effect can occur at the site of a potential interchange at SR 66. Elevating the interchange may expose a portion of the new roadway. Because of this potential visual intrusion, the Jacob Damm Farmstead may be affected visually by the proposed undertaking for Alternatives 1 and 1A. Alternatives 2 and 3 would have no affect on the property.

Noise modeling indicates no audible adverse effects to the Jacob Damm Farmstead will be created by the development of any of the alternatives.

Doll-Winternheimer Farmstead

The Doll family who built the house and many of the buildings were early settlers in the area. Jacob and Caterhine Doll immigrated to the United States from Darmstadt. They had seven children. In the late nineteenth century, the Winternheimer family purchased this property, and since that time has remained in the family. The Winternheimer family was part of the German Lutheran community that centered on St. Peter's Evangelical Reformed Church.

The farmstead, which consists of a nineteenth-century residence, two large barns, and numerous outbuildings, attains its significance due, in part, to its setting.

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
The Doll-Winternheimer Farmstead is located next to St. Philip Road and just north of SR 66. The farmstead, which consists of a nineteenth-century residence, two large barns, and numerous outbuildings, attains its significance due, in part, to its setting. The construction limits for Alternatives 1 and 1A are slightly more than 600 feet away from the site. No property listed on or eligible for the NRHP associated with the farmstead will be taken for any of the alternatives.

Doll-Winternheimer Farmstead

While there are modern buildings nearby and SR 66 runs to the south, the proximity of Alternatives 1 and 1A to the farmstead will adversely affect the context of the property. No intervening terrain features or foliage will mask the view of Alternatives 1 and 1A from the property. The visual impact of Alternatives 1 and 1A will reduce the contextual fabric of the property by altering the feeling, setting, and association of the property. Alternatives 2 and 3 would have no effect on the property.

Noise levels are expected to increase for Alternatives 1 and 1A; however, the increased levels do not exceed the threshold for residential dwellings.

<u>School No. 4</u>

The schoolhouse, which was built in 1892, has a high degree of integrity. School 4 is significant in the area of architecture and education. Although some Hoosiers advocated for compulsory school attendance for all children as early as the mid-nineteenth century, it was not until 1987 that this legislation was enacted. In some counties, it set off a wave of school buildings. In Posey County, there was a significant contingent of parochial schools that educated children but there was still a need for buildings to provide free public education. The Parker Church School or Township School 4 was one of several built during this time. Although the Indiana General Assembly passed legislation to consolidate all of the one-room schools in the state, in 1899, one-room schools in Posey County remained open and in use until 1958. According to the present owner, the interior of this building remains unchanged except for the removal of the desks and chalkboards.

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
School No. 4 is located southeast and approximately 1,500 feet from the new construction of Alternatives 1 and 1A. The schoolhouse, which was built in 1892, has a high degree of integrity.

While other one-room schoolhouses examined as a part of this study effort have been converted to private residences and the interiors have been altered significantly, School No. 4 has not. According to the present owner, the interior of this building remains unchanged except for the removal of the desks and chalkboards. No property listed on or eligible for the NRHP associated with the school will be taken for any of the alternatives.

School No. 4

Field evaluation affirmed that a proposed interchange along Alternative 1 or 1A may be constructed within 1,500 feet of the property. Although the context of the schoolhouse has somewhat already been altered by modern construction and by SR 66 which runs nearby, the setting of the building is still deemed important. However, it has been determined that visual impacts of Alternative 1 or 1A will occur to this property. To the northwest, a slight rise in the terrain will mask the undertaking minimally, but to the west of the schoolhouse the proximity of the construction will afford visual intrusions. Alternatives 2 and 3 would have no effect on the property. Noise modeling indicates that there will be no audible noise impacts to the property from Alternatives 1, 1A, 2 or 3.(See Table 5-9)

Luigs Farm

The Luigs family was part of the German Catholic migration of the mid-nineteenth century. Like other migrants, they came in families or groups rather than as individuals and were better able to sustain elements of their homeland culture, and their language. According to Alfreida Lang, by the 1870s so many Germans had migrated to America that entire villages in Germany were depopulated. The Luigs family originally settled along the Ohio River but suffered ill fortune during a flood. The family lived for a few years in Evansville before moving to Posey County.

Luigs Farm

According to the present owner, Anton Luigs purchased this property around the turn of the century, when all of the buildings were relatively new. In a history of Posey County published in 1882 Anton Luigs is listed as a farmer in Robins Township in 1900. His holdings included 20-

acres and a160-acre plot of land in the township. Unlike other farms in the area and across the state, the Luigs Farm still has small fields (12 to 14 acres) reminiscent of the late nineteenth and early twentieth century farm.

Determination of Eligibility:
This property is considered eligible for the National Register under Criterion A and C.

Determination of Effects:
The Luigs Farm is the most contextually significant farm evaluated during this study. Located approximately 1,200 feet from the nearest construction limit of Alternative 1 and 1A, which passes west of the property boundary, the Luigs Farm, unlike other properties evaluated in this project study area, encompasses the original eighty acres purchased by Anton Luigs at the turn of the twentieth century. No property listed on or eligible for the NRHP associated with the farm will be taken for any of the alternatives.

Setting is key to the integrity of the Luigs Farm. Located in rolling terrain, the farm consists not only of the house and outbuildings, but also enclosed agricultural fields, ten to fourteen acres in size. The landscape of the farm buildings, treelines, fencing, and nearby farms evoke a sense of historic rural Hoosier properties. It is a landscape that is rapidly vanishing from sight.

Given the proximity of the Luigs Farm to Alternatives 1 and 1A, terrain features and seasonal foliage will mask visual intrusion of the new roadway. The impact of elevated sections of new construction, in the northwest and southwest quadrants, may present visual effects. Alternatives 2 and 3 would have no effect on the property.

Modeling indicates that there will be minimal noise impacts from Alternatives 1 and 1A. Alternatives 2 and 3 would have no effect on the property.

Roesner Farmstead

The Roesner Farmstead is significant in the areas of agriculture and architecture. While little historical documentation exists on Roesners in this area, the Roesner Farmstead is a well-preserved example of the economical distribution for the elements of the working farm- the barn, the summer kitchen, the poultry house, and the privy sited on the property to maximize efficiency while seeking separation from other aspects of farm life. The house and outbuildings, minus the ubiquitous insulbrick, demonstrate a high degree of integrity that evokes an image of the past in Hoosier agriculture. This farmstead retains an exceptionally high level of integrity.

Roesner Farmstead

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
The Roesner Farmstead is located approximately 4,300 feet east of the nearest construction limit of Alternatives 1 and 1A. Setting is key to the integrity of the Roesner Farmstead and the collection

of buildings is significant in both architectural and contextual integrity. The property will not likely be affected by visual or noise intrusion from the undertaking. No property listed on or eligible for the NRHP associated with the farmstead will be taken for any of the alternatives.

Surrounded by rolling terrain, the farmstead is situated such that, excluding any major elevated sections of roadway, the visual impact of the new construction will be minimized to the northwest and west, but it may be visible at a distance of nearly a mile to the southwest. Seasonal foliage and the built environment will provide some limits to the visual intrusion. Alternatives 2 and 3 would have no effect on the property.

Modeling indicates that there will be minimal noise impacts from Alternatives 1 and 1A. Alternatives 2 and 3 would have no effect on the property.

Wolf Road Farmstead

The farm consists of a house, a large summer kitchen, a large English barn, a poultry house, a utility building, and a period building used as a garage. There is a capped well and hand pump near the summer kitchen. The vernacular house is a T-plan, two- story and has a one-story ell addition on the southeast side of the building. Comparison with a historical photograph indicates that the farmstead has lost a few buildings but the farmstead continues to evoke the sense of settings, feeling, and association with that significant period in Hoosier history.

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
The Wolf Road Farmstead will be adversely affected by the undertaking of Alternatives 1 and 1A. Located on a rural country road surrounded by farmland, the farmstead is 3,800 feet from the nearest construction limit of Alternatives 1 and 1A to the east. No property listed on or eligible for the NRHP associated with the farmstead will be taken for any of the alternatives.

Wolf Road Farmstead

During field reconnaissance it became apparent that the lack of masking terrain features to the northeast and east would result in visual intrusion into the relative serenity of the farmstead, diminishing its contextual integrity, which is integral to the significance of the property. Seasonal foliage may lessen the visual impact of the new construction. Alternatives 2 and 3 would have no effect on the property.

The farmstead is near an active railroad line and Wolf Road, but additional traffic from the undertaking of Alternatives 1 and 1A certainly will increase the ambient noise level within the boundaries of the property. Modeling indicates that noise levels will increase but it will still remain below the level for Activity Category B as identified by INDOT. Alternatives 2 and 3 would have no effect on the property

Fischer House

The Fischer House is a two-story, brick, Italianate style renaissance with some changes in basic style characteristics.

One local account of the family noted that Valentine Fischer, an immigrant from Hesse, Germany, “erected one of the finest” brick houses in the country in 1880. Married to Barbra Soellner in 1855 he was farming 598 acres and had properties in Evansville. In 1901 Barbra owned 320 acres of land just south of the township line and two other farms in the township of 78.5 and 40 acres. One of the children, Henry Fisher (spelling changed) took over the running of the family farm, which was noted as having “a fine herd of stock and valuable flock of thoroughbred chickens.” For a time Henry moved to Mount Vernon when he was the county treasurer but returned to the brick house on John Spain/Wildeman Road in 1906.

Fischer House

Determination of Eligibility:
This property is eligible for the National Register under Criterion C.

Determination of Effects:
The Fischer House is located slightly less than 1,100 feet west of the nearest point of the construction limits of Alternatives 1 and 1A. The house is an example of a brick Italianate residence built circa 1880 that is eligible because of the limited number of this style of house in the township and county. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives.

No intervening terrain (such as a hill or rise) and limited trees mask Alternatives 1 and 1A from this site. Based on the field reconnaissance, there is little doubt that visual and audible intrusion will affect this property. In addition, modeling suggests an increase in noise levels from Alternatives 1 and 1A, but this noise level falls below the 67 decibel level considered for abatement (for residences as defined by INDOT). Alternatives 2 and 3 would have no effect on the property.

Bohleber Road Farmstead

The county road divides the farm proper; on the west side are two barns and a granary and on the east side are the house, a summer kitchen, a poultry house, and a utility building. This one- and one-half story house was built in 1860. With its mixture of materials and details, the house illustrates the nineteenth-century evolution of farmhouses. The house is unique because of its below grade cellar, the only one encountered in this period residence in the county, and in its demonstration of the building and architectural evolution employed by one family in the township. The collection of buildings retains much of the spatial organization of a late nineteenth century Hoosier farmstead and evokes a corresponding contextual image.

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
The farmstead on Bohleber Road will not be affected by any of the alternatives. The nearest construction limit of Alternative 1 and 1A is approximately one-half mile to the west. No property listed on or eligible for the NRHP associated with the farmstead will be taken for any of the alternatives.

Integrity in setting, association, and feeling are critical to the contextual significance of this farmstead; but intervening terrain, the built environment, and dense stands of trees between the roadway and the property will eliminate visual intrusion as a matter of concern.

Bohleber Road Farmstead

Modeling suggests that noise will not be an adverse effect. That is not surprising given the distance from the proposed undertaking and the present ambient noise from St. Philip Road, other traffic in the area, and intervening terrain.

Uebelhack Farmstead

The farmstead consists of a house, a large English barn, a granary/corn crib, a combination summer kitchen/washhouse, two poultry houses, a milk pick-up building, an electric meter building, and a garage. Although the main house has been moderately altered, the Uebelhack Farmstead includes a well-preserved and unusually complete complex of domestic and agricultural buildings.

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
The Uebelhack Farmstead is situated to the southwest and nearly a mile in distance from the nearest construction limit of Alternatives 1 and 1A. It cannot be reasonably foreseen that the Uebelhack Farmstead will suffer adverse effects from the undertaking. No property listed on or eligible for the NRHP associated with the farmstead will be taken for any of the alternatives.

Uebelhack Farmstead

While setting is key to the integrity of the farmstead, it benefits from a number of intervening terrain features, dense tree lines, and clusters of modern housing that will mask the effects of the proposed undertaking even during the winter months.

State Road 66 is located to the north of the farmstead; therefore, the property is subjected presently to some road noise. Modeling indicates that no audible noise effects will be derived by any of the alternatives.

Hausmann Farmstead

The residence, built in 1895, is a one-and one-half story, Folk Victorian building with a brick foundation, clapboard siding, and a slate roof. The house has two porches; a small porch in the northeast ell of the house and a larger porch in the northern elevation. The Hausmann family purchased the family's original homestead of 80 acres in 1845. They have lived and farmed the land since that time. The non-contributing modern house and the 1895 farmhouse are the third and fourth dwellings on this land. This lane is lined in red cedars creating a distinctive vernacular landscape.

Hausmann Farmstead

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
The Hausmann Farmstead will not experience adverse effects as a result of the undertaking. It is located approximately 2,200 feet west of the nearest construction limit of Alternatives 1 and 1A. No property listed on or eligible for the NRHP associated with the farmstead will be taken for any of the alternatives.

Setting is key to the integrity of the Hausmann Farmstead, but intervening terrain features, modern housing, and tree lines will mask the proposed undertaking. Noise modeling indicates that audible intrusions are an unlikely factor.

Nurrenbern Farmstead

The collection of buildings includes a residence, summer kitchen, and non-contributing garage. The two-story cruciform plan, red-brick house built in 1895, has a large period porch in the southeastern ell and a small entry porch in the southwestern ell. The Nurrenbern Farmstead is an example of the economical distribution of elements of the working farm to maximize efficiency while providing separation from other aspects of farm life.

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
The Nurrenbern Farmstead will be affected by the undertaking of Alternatives 1 and 1A. These alternatives pass to the west of the property at a distance of 3,200 feet to the nearest construction limit. No property listed on or eligible for the NRHP associated with the farmstead will be taken for any of the alternatives.

It is anticipated that Alternatives 1 and 1A will be elevated as the alignment leaves the rolling terrain to the north and enters the lowlands of the Oxbow. The elevated portion of Alternatives 1 and 1A crossing the floodplain will be visible from the Nurrenbern Farmstead. Setting is key to the integrity of the farmstead. It is located in a remote area near to, if not part of, the Oxbow. Presently, the viewshed from the property is an arc of approximately 45 degrees in the southwest quadrant and is unencumbered by any intervening terrain features, natural masking from trees, or buildings. This same viewshed contributes significantly to the present contextual integrity of the farmstead. Presently, the Nurrenbern Farmstead is not located near a major highway. Although the nearest construction limit will be more than 3,000 feet away, the absence of masking terrain promises visual intrusion from Alternatives 1 and 1A. Alternatives 2 and 3 would have no effect on the property.

Nurrenbern Farmstead

Modeling indicates that noise is an unlikely adverse effect.

Craig House & Barn

The property consists of a residence, an English barn with a twin-crib log core, and a non-contributing modern garage. The one-and one-half story house, built in 1860, has a saltbox roofline that accentuates it historical image. The two-tiered porch and the fenestration of the facade create an image of the type of French Colonial house that one might encounter in Louisiana. The English barn is constructed with standard timber-framing, mortise-and-tenon joinery and with hewn components. The logs that form the cribs are joined with half-dovetails at the corners.

During the settlement period, settlers lived in log dwellings and used them to shelter animals. When the technique of balloon framing came into common use, log buildings were converted to other uses, or their components parts were incorporated into new construction. The house is an example of the early use of balloon framing to create a large living space while reducing the future maintenance and cost in time involved to build the shelter

Craig House & Barn

and if needed to expand it in the future.

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
The Craig House and Barn are located approximately one-half mile from the nearest construction limit of Alternative 1A. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives.

During the summer months the property cannot be seen from Emge Road (which passes directly in front of it) due to dense foliage. Presently, the house and barn are isolated, a fact that contributes to their contextual integrity. Even during the winter months, the dense stand of trees to the east and to the south will mask Alternative 1A. The house presently has a thick band of vegetation close in, throughout the northeast quadrant; however, if that vegetation is removed there would be a clear viewshed to the northeast (toward the intersection of the Boonville-New Harmony and Buente Roads and beyond) that likely will allow visual intrusion.

According to modeling, the increase of noise with the introduction of the proposed Alternative 1A, the Craig House and Barn will experience some noise effects.

<u>Dr. Wilhelmus House & Office</u>

The Wilhelmus House and Office are significant in the areas of health, medicine, and vernacular architecture. They occupy a special place in the history of St. Wendel and the surrounding community. After graduating from Louisville Medical College, Dr. Wilhelmus moved to the Indiana community and practiced medicine for approximately 50 years; he built the house and office in 1911. The house and medical office combination are rare and the only one of its kind evaluated during this study.

Dr. Wilhelmus House & Office

Determination of Eligibility:
This property is eligible for the National Register under Criterion A.

Determination of Effects:
The Dr. Wilhelmus House and Office is located more than a mile from the nearest construction limit of Alternative 1 and adjacent to the Boonville-New Harmony Road. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives.

Businesses, residences, hills, and trees obscure the view to the highway preventing any visual impacts. Additionally, noise modeling shows no audible effects will be derived from any of the alternatives.

Pratt Pony Truss Bridge

The bridge is located on Kansas Road at its intersection with the Vanderburgh/Warrick county line in Center Township. It spans Pigeon Creek with a skewed alignment. The pinned three-panel bridge has laced verticals and its upper chord and end posts are riveted. The diagonals are flat bars with eyes and the counters are cylindrical eye bars. The deck, which was probably once oak planks, has been replaced with concrete. The configuration of diagonals and counters indicates that the Indiana Bridge Company of Muncie, Indiana may have built the bridge. The bridge possesses integrity.

Pratt Pony Truss Bridge

The bridge is significant in the area of transportation. As the iron and later steel industry developed lighter and stronger materials in the late nineteenth century, the replacement of covered wooden bridges with metal-truss bridges became a standard procedure in most Indiana counties. The metal-truss bridge offered a number of benefits over its predecessor: it could be designed and fabricated off-site and shipped to the nearest railhead for a lower cost and in less time; it could be erected by local contractors with a minimum of supervision; it would not burn; it could be moved (more simply) to another location to meet changing needs; and finally, it was more flexible in terms of meeting special needs such as skewed crossings or multiple spans to extend greater distances. The metal-truss bridge opened the countryside, helping Indiana's early rural roads become all-season by bridging the crossing points of rivers and streams that had been impassable at times.

Whether in a town or in a rural setting, the metal-truss bridge provided an answer to the problem of transporting goods and people during inclement weather when high water in streams and/or rivers had earlier isolated farmsteads or towns. Although it is rapidly disappearing from the landscape, the metal-truss bridge served, and is still serving, in many counties in southwestern Indiana.

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
This bridge is currently located less than 550 feet to the east of I-164 on Kansas Road. This bridge achieves its historical significance as a member of a rapidly decreasing inventory of iron bridges in Indiana.

The bridge is no longer in active service. Present information about construction requirements on this portion of Alternatives 2 and 3 eliminates concerns of potential damage to the bridge by construction equipment.

Glenn Black House & Library

The Glenn Black House is a one-and-one half story bungalow built in 1939. The one-story library is square in plan. In 1939 to 1942 archaeologist Glenn A. Black conducted a systematic excavation of Angel Mounds that resulted in the recovery of over 2 million artifacts. Dr. Black lived and worked on the grounds while setting up his library in the small cottage on the property. The house and library are situated on a portion of the one-time Angel farm. The Glenn Black House and Library are significant in the areas of Government and Politics and Archaeological Studies.

The property is a symbol of the Works Progress Administration (WPA) Archaeology in Indiana during the Great Depression. Bringing financial relief, New Deal programs were prevalent and welcomed in these area. The WPA projects included, but not limited to: tree plantings, public buildings construction, public art, communal farming, home building, irrigation system construction and bridge and road building.

Glenn Black House & Library

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and B.

Determination of Effects:
The Glenn Black House and Library are currently located within 1200 feet of I-164. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives.

Because of its association with Angel Mounds, a National Historic Landmark, the property possesses local, state, and national significance. Setting, feeling, and association are intrinsic to the historical and contextual integrity of this property, as it is for Angel Mounds.

Even with the increased traffic numbers associated with the use of this section of I-164 for Alternative 2, there will be no additional effects from the use of this section for Alternative 2. The Glenn Black House & Library will be affected by the construction of Alternative 3, including a bridge over the Ohio River that will rise to the east of the property. The elevated bridge will be located approximately 1,885 feet from the house and library to the east and to the southeast. Alternatives 1 and 1A would have no effect on the property.

The approach for the new bridge on Alternative 3 will begin at the intersection of I-164 and SR 662 and continue southward to the elevated bridge, which will span the Ohio River; an elevated bridge visible over the trees and bisecting a large part of the eastern and southern viewsheds from the house and library will negatively impact the property.

Modeling indicates that there will be no audible noise effects from any of the alternatives.

Joseph Angel House

The Queen Anne-style house, built in 1913 exhibits many of the characteristics of the style, such as cutaway bays, half-timbering details, a pediment at the entry, and a hipped roof with lower gables.

Members of the Angel family who were farmers in Vanderburgh County were aware of the mounds on the farm. From an article in the Indianapolis Star dated January 15, 1939 relates the following: a heavy rain in the 1870s Angle and his father Silas notices several gravesites that had washed open along the river. The two men covered the gravesites, leaving them as found.

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
The Joseph Angel House will not suffer any additional effect as a result of this undertaking. It is located approximately 400 feet from the edge of the present alignment of I-164 behind a dense stand of trees (north of the house) that mask the present I-164. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives.

Joseph Angel House

There will be no additional effect if Alternative 2 utilizes the existing I-164. Visual screening is provided by the existing trees, and modeling indicates that no audible noise effects would be created by any of the alternatives.

The Mann House

The Mann House is significant in the area of architecture. The architectural details that adorned the basic structure ran the gamut from plain exterior walls, porches, and simple roof lines to highly accentuated details such as spindlework, various designs of shingles to add texture to the edifice, elaborate paint schemes, and irregular-shaped roofs to break the monotony of standard house shapes. The Mann House demonstrates a number of the more high-style details that are indicative of the style. The house has two additions but both are from an early period and do not reduce the level of integrity evident in the rest of the building. A small bathroom addition, circa 1925, was placed in the ell on the west side of the house and a larger addition, circa 1920, extends from the rear of the side porch on the east side of the house.

The façade, which faces Newburgh Road, contains a gable front wing and is flanked on both sides by period porches. The porch on the east elevation shelters the main entry to the interior of the house and the one on the west contains an entry door into a bedroom. The large side porch, in the eastern elevation, provides entry into both the main house and the addition that contains the present kitchen. All of the porches are accentuated with decorative brackets at the frieze/support post junction and spindlework in the frieze. The doors and windows, glazed one-over-one in double-hung sashes, are original. The exterior doors are single glazed in the upper one-half and solid wood in the lower. The interior of the house has been adapted minimally to modern uses and displays original woodwork, doors, and windows. The house possesses a very high level of architectural integrity.

The Mann House

Determination of Eligibility:

This property is eligible for the National Register under Criterion C.

Determination of Effects:

Currently located approximately 700 feet from the edge of I-164, it is near the interchange of that highway and Newburgh Road. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives.

Modern buildings between the property and the highway hide a portion of I-164, but the house presently has a small section of highway and the interchange as part of its viewshed to the northeast and southeast. No additional effects can be reasonably foreseen from the development of Alternative 2. However, with an expanded interchange as part of Alternative 3, there may be some changes in land use in the area that may affect this property. Alternatives 1 and 1A would have no effect on the property.

Modeling indicates no audible noise effects from any of the alternatives.

<u>Short-Tillman House</u>

This two- story, brick Gothic Revival house was rated Outstanding in the Interim Report. The rear wing of the house dates to 1820; however, most of the house was built in 1870.

The residence is a rare example of Gothic Revival architecture in this area. The roof is steeply pitched with a center gable in the façade. The two-story porch has a vergeboard that accentuates the center gable. Windows on the first floor are multi-paned with false-shaping; those on the second floor extend into the roofline. A chimney cuts into the gable end of the roofline on the eastern elevation, and a small window marks the gable end of the western elevation. A small porch has been enclosed on the rear wing.

The Samuel Short house is significant in the area of architecture. Short built the rear wing of the house in 1820. In 1865, Dr. James Tillman, a physician, purchased the house. Tillman was a man of some standing, having served as chair of Newburgh's Independent Military Company and as the supervisor of two Union Hospitals in Newburgh. Tillman's house burned in 1870 and was rebuilt in its present Gothic-Revival style.

Short-Tillman House

Determination of Eligibility:
This property is eligible for the National Register under Criterion C.

Determination of Effects:
The Short-Tillman House is located nearly two miles from the proposed Alternative 3. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives.

Trees and other buildings will mask Alternative 3 from the house. Modeling indicates no audible noise effects will be created. Alternatives 1, 1A and 2 would also have no effect on the property.

St. Philip German Community Settlement

The St. Philip German Community Settlement Historic District is located in rural Posey County on St. Philip Road in Marrs Township, consists of seven contributing properties, one non-contributing property, a contributing site, and contributing field patterns. The integrity of some properties has been compromised; as a result, few are eligible individually however, collectively they constitute a strong district; they create a sense of German community settlement of the nineteenth century.

Determination of Eligibility:
This property is eligible for the National Register under Criterion A and C.

Determination of Effects:
The St. Philip German Community Settlement Historic District consists of four agricultural properties and four individual buildings of the church complex. The nearest construction limit of the proposed Alternatives 1 and 1A is approximately 3,200 feet southwest of the district boundary. No property listed on or eligible for the NRHP associated with the district will be taken for any of the alternatives.

The majority of the district is set atop a hill that provides a broad viewshed across relatively flat terrain to the southeast and southwest. Trees, intervening terrain, and modern buildings hide Alternatives 1 and 1A from view at the Coresell-Sammet Farmstead, the New Cemetery, and the Schenk Farmstead (properties that form the northern boundary of the district). Due to their positioning on the hill, viewsheds for the other properties, the Church, Convent, School, and Old

Cemetery are also not affected. However, on the southern boundary of the district, Alternatives 1 and 1A will be clearly visible from the Weinzapfel Farmstead. The Deig-Schenk Farmstead will have a view of the proposed Alternatives 1 and 1A as well. Setting, location, and association with the surrounding rural landscape are intrinsic to the significance of the district. The lack of any intervening terrain or any other masking features, natural or manmade, will no doubt result in visual impacts from Alternatives 1 and 1A on the two properties mentioned. Alternatives 2 and 3 would have no effect on the district.

Newburgh Historic District
The Original Newburgh Historic District in downtown Newburgh consists of 44 properties that comprise the traditional commercial center of the city. Most of the brick buildings are commercial vernacular in style with stone details, dating from the mid-nineteenth to the early-twentieth century. The district also contains a Carnegie Library and two contributing residences. The Original Newburgh Historic District was placed in the NRHP in 1983. See **Appendix A-2** for the historic boundary location.

Determination of Eligibility:
This district is currently in the NRHP.

Determination of Effects:
The district is located more than two miles from Build Alternative 3. Modeling determined that noise will not present an adverse effect. Even though the district is located more than two miles from the proposed action, the curvature of the river will provide an unobstructed view of the bridge rising over the river. Setting is not explicitly mentioned in the National Register nomination for the Original Newburgh Historic District, but it is implicit, especially in regard to the trade connections that the river brought. Therefore, Alternative 3 would result in an adverse visual effect for at least part of the district. No other alternative would adversely affect the district.

Angel Mounds

Angel Mounds, also referred to as the Angel Mounds State Historic Site or Angel Mounds State Memorial, consists of over 700 acres in southwestern Warrick County/southeastern Vanderburgh County. The site is a well-known Middle Mississipian (A.D. 1100 – 1450) stockaded village and mound complex located on a terrace overlooking the Ohio River. During its time this site was the economic, religious, and political center of the region and had a population that reached several thousand people making it the largest settlement in what would later become the State of Indiana. The site lies south of I-164 and west of Alternative 3.

Angel Mounds was designated a National Historic Landmark (NHL) in 1964. NHL sites are described by the National Park Service (NPS) as “nationally significant historic places designated by the Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States”. All NHL’s are listed in the NRHP and constitute approximately 3 percent of listed sites.

The original NRHP boundary, formally established in 1966, includes approximately 600 acres. It is bordered by Pollack Avenue to the north, Indian Drive to the east, and the Ohio River to the south. The site also includes 10 acres northeast of the NRHP boundary (north of Pollack Avenue and bounded on the east by Stacer Road) that is deemed eligible for inclusion in the Register. IDNR purchased an additional 98 acres west of the existing NRHP boundary (adjacent to Lynn Road) in 2002 for future use as a part of Angel Mounds State Historic Site. **Figure 5-12** depicts these boundaries for Angel Mounds.

Determination of Eligibility:
Angel Mounds is currently in the NRHP, and is designated as a NHL. An additional 10 acres northeast of the existing NRHP boundary has been deemed eligible for inclusion in the NR.

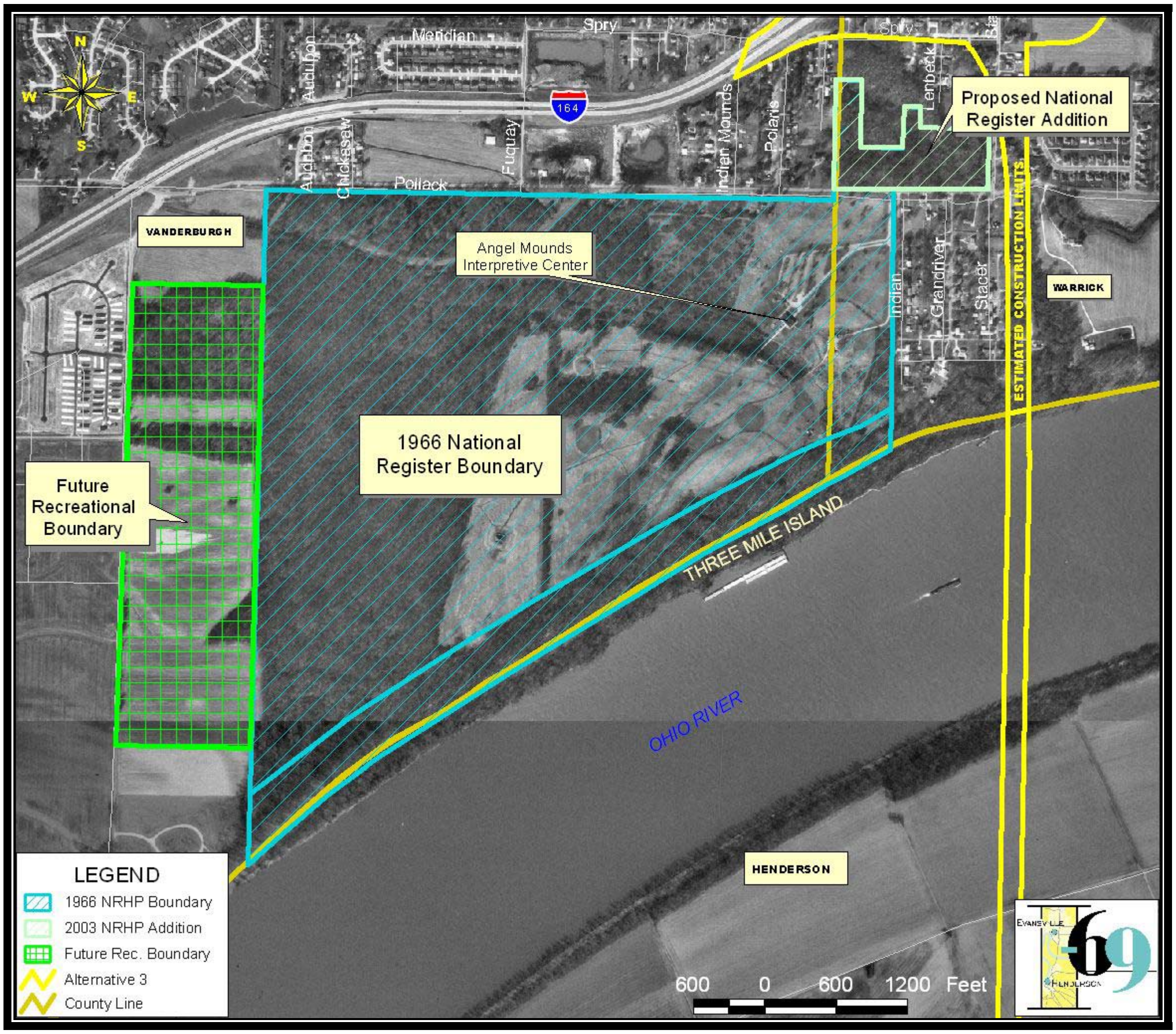


Figure 5-12: Angel Mounds

Determination of Effects:
Because of the proximity of the I-69 Build Alternatives 2 and 3 to Angel Mounds, potential visual, noise, and vibration effects were examined. Mound A located on the complex grounds, and Mound G located just north of Pollack Avenue near the entrance to the complex were designated as reference points from which the studies were based.

Existing noise levels at Mound G (north of and adjacent to Pollack Avenue and within the eligible NRHP boundary) were modeled at 55 dBA $L_{eq.}$ The 2025 projected noise level resulting from Alternative 2 is 55 dBA L_{eq} and from Alternative 3 is 63 dBA $L_{eq.}$ Since Angel Mounds is designated as activity category A, indicating that serenity and quiet are of extraordinary significance, and category A has a NAC of 57 dBA, Alternative 3 will have an adverse noise impact on the resource. Alternative 2 will have no audible effect on noise levels.

Given its proximity to Alternative 3 and its status as a NHL, additional analyses were conducted to ascertain the potential visual impacts Alternative 3 may have on the resource. **Figure 5-13** depicts two estimated views of the main Ohio River crossing for Alternative 3 from within the existing Angel Mounds NRHP boundary.

Figure 5-13: Renderings of Alternative 3 Bridge from Angel Mounds

For purposes of this evaluation, a structure similar to the last two Ohio River bridges constructed (William H. Natcher/US 231 bridge east of Owensboro which opened in 2002 and the William H. Harsha/US 62 bridge west of Maysville which opened in 2001) was developed and inserted into photographs taken from within the Angel Mounds NRHP boundary. The cable-stayed structure's towers are approximately 350' high (from the normal pool elevation of the Ohio River). The upper rendering is looking southeast from a point southwest of the interpretive center, and the lower rendering is looking south/southeast from near the NRHP boundary northwest of the interpretive center and south of Pollack Avenue. As is evident in the photographs, the Alternative 3 bridge crossing the Ohio River will be visible from Angel Mounds. Therefore, there will be an adverse visual effect on the resource from Alternative 3. No other alternative will have an adverse visual effect on the site.

IDNR expressed concerns concerning the potential for vibration impacts to the historic earthworks at Angel Mounds. Given the characteristics of some of the archaeological features at the site, analyses were conducted to estimate the potential for vibration-induced impacts. No alternative is expected to create negative vibration-induced impacts to the site. More discussion on these analyses is found in **Section 5.9.3 Archaeological Impacts**.

Summary

Findings of effect were determined for each property either eligible for or included in the NRHP. The resulting findings, by Build Alternative, are shown in **Tables 5-12 – 5-15**. More information concerning the effects determinations can be found in the 800.11(e) form included in **Appendix C-3**.

In summary, the findings of effects are as follows:

- Alternative 1: Historic Properties Affected-Adverse Effects (Noise, visual,)
- Alternative 1A: Historic Properties Affected- Adverse Effects (Noise, visual)
- Alternative 2: Historic Properties Affected- Adverse Effects (Visual)
- Alternative 3: Historic Properties Affected-Adverse Effects (Noise, visual)

Table 5-12: Findings of Effects, Alternative 1

County	Survey #	Description	Effects Finding
Posey	25017	Jacob Damm Farmstead	Adverse Effect – Visual
Posey	25020	Doll-Winternheimer Farmstead	Adverse Effects – Noise & Visual
Posey	25023	School No. 4	Adverse Effect – Visual
Posey	25048	Luigs Farm	Adverse Effect – Visual
Posey	25051	Roesner Farmstead	Adverse Effect – Visual
Posey	40017	Wolf Road Farmstead	Adverse Effects – Noise & Visual
Posey	40020	Fischer House	Adverse Effects – Noise & Visual
Posey	40060	Bohleber Road Farmstead	No Adverse Effect
Posey	40070	Uebelhack Farmstead	No Adverse Effect
Posey	40104	Hausmann Farmstead	No Adverse Effect
Vanderburgh	06006	Dr. Wilhelmus House & Office	No Adverse Effect
Vanderburgh	25146	Frank Nurrenbern Farmstead	Adverse Effect – Visual
Posey		St. Philip German Community Settlement Historic District	Adverse Effect – Visual
Henderson	Site 1	L&N Railroad Bridge	No Effect
Henderson	Sites 20-32	Riverdale Court Historic District	No Effect
Henderson	Site 99	Foursquare	Adverse Effect –Visual

Table 5-13: Finding of Effects, Alternative 1A

County	Survey #	Description	Effects Finding
Gibson	45024	St. James Church	No Adverse Effect
Posey	25017	Jacob Damm Farmstead	Adverse Effect – Visual
Posey	25020	Doll-Winternheimer Farmstead	Adverse Effect – Noise & Visual
Posey	25023	School No. 4	Adverse Effect – Visual
Posey	25048	Luigs Farm	Adverse Effect – Noise & Visual
Posey	25051	Roesner Farmstead	No Adverse Effect
Posey	40017	Wolf Road Farmstead	Adverse Effect – Noise & Visual
Posey	40020	Fischer House	Adverse Effect – Noise & Visual
Posey	40060	Bohleber Road Farmstead	Adverse Effect - Noise
Posey	40070	Uebelhack Farmstead	No Adverse Effect
Posey	40104	Hausmann Farmstead	No Adverse Effect
Vanderburgh	05078	Craig House & Barn	Adverse Effect - Noise
Vanderburgh	25146	Frank Nurrenbern Farmstead	Adverse Effect - Visual
Posey		St. Philip Historic District	Averse Effect – Visual
Henderson	Site 1	L&N Railroad Bridge	No Effect
Henderson	Sites 20-32	Riverdale Court Historic District	No Effect
Henderson	Site 99	Foursquare	Adverse Effects –Visual

Table 5-14: Finding of Effects, Alternative 2

County	Survey #	Description	Effects Finding
Vanderburgh		Angel Mounds State Historic Site (National Landmark)	No Effect
Vanderburgh	15093	Bridge	No Effect
Vanderburgh	51007	Mann House	No Effect
Vanderburgh	20030	Glenn Black House & Library	No Effect
Vanderburgh	20032	Joseph Angel House	No Effect
Henderson	Site 108	White-Goehring House	Adverse Effect - Visual
Henderson	Site 116	McCormick House	Adverse Effect - Visual
Henderson	Site 119	White-Priest House	Adverse Effect - Visual
Henderson	Site 128	McClain House	No Effect
Henderson	Site 129	Lee Basket House	Adverse Effect - Visual
Henderson	Site 148	Dwelling	No Effect
Henderson	Site 149	Henderson-Evansville Bridge	No Effect

Table 5-15: Finding of Effects, Alternative 3

County	Survey #	Description	Effects Finding
Vanderburgh		Angel Mounds State Historic Site (National Landmark)	Adverse Effects – Noise and Visual
Vanderburgh	15093	Bridge	No Effect
Vanderburgh	51007	Mann House	No Effect
Vanderburgh	20030	Glenn Black House & Library	Adverse Effect – Visual
Warrick	41044	Short-Tillman House	No Adverse Effect
Warrick		Newburgh Historic District	Adverse Effect– Visual
Henderson	Site 108	White-Goehring House	Adverse Effect - Visual
Henderson	Site 116	McCormick House	Adverse Effect – Visual
Henderson	Site 119	White-Priest House	Adverse Effect - Visual
Henderson	Site 128	McClain House	No Effect
Henderson	Site 129	Lee Basket House	No Effect
Henderson	Site 148	Dwelling	Adverse Effect - Visual
Henderson	Site 149	Henderson-Evansville Bridge	No Effect

5.9.3 Archaeological Impacts

Methodology

Based on the results of the archaeological records check and other pertinent data, the areas that have the highest potential for prehistoric archaeological sites are those portions of the alternatives that are located in the bottomlands and terraces of the Ohio River valley and its numerous tributary streams. In addition, the floodplain of the Ohio River and the other major streams in the area have a high potential for containing buried archaeological sites. In regards to historic archaeological sites, the four alternatives have the highest potential to contain these types of resources in those portions of the alternatives that are near existing or mapped historic structures and/or trails, roads, railways, and other transportation corridors.

Analysis

Indiana

Seventeen previously recorded archaeological sites were found to be located within the alignments of the four alternatives. All seventeen of these sites are prehistoric and include seven camps and ten sites of undetermined type. According to the official state site forms, determinations of eligibility to the NRHP or the Indiana Register of Historic Sites and Structures (IRHSS) have not been made for any of these sites.

Alternative 1 and 1A

Ten archaeological sites were found to be within the estimated right-of way for Alternative 1. As can be seen in **Table 5-16**, all ten of these sites are prehistoric and include three camps and seven sites of undetermined type. Furthermore, most of these sites are located in the bottomlands with the exception of Site 12-Vg-0321, which is situated on a terrace. According to the official state site forms, determinations of eligibility to the NRHP or the IRHSS have not been made for any of these sites.

Table 5-16: Previously Recorded Archaeological Sites within Alternative 1 in Indiana

Site #	Site Type	Component	Landform
12-Vg-0320	Unknown	Late Woodland/Mississippian	Bottomlands
12-Vg-0321	Unknown	Unidentified Prehistoric	Terrace
12-Vg-0323	Unknown	Early Woodland	Bottomlands
12-Vg-0328	Unknown	Early Archaic, Late Archaic, Terminal Late Archaic, Early Woodland, Mississippian	Bottomlands
12-Vg-0406	Unknown	Late Archaic	Bottomlands
12-Vg-0409	Unknown	Early Woodland	Bottomlands
12-Vg-0411	Unknown	Mississippian	Bottomlands
12-Vg-0457	Camp	Unidentified Prehistoric	Bottomlands
12-Vg-0458	Camp	Unidentified Prehistoric	Bottomlands
12-Vg-0459	Camp	Mississippian	Bottomlands

In addition to the previously registered archaeological sites, 14 previously recorded cemeteries were also found to be located within one mile of Alternative 1. These cemeteries include individual family burial grounds as well as church affiliated cemeteries and date from as early as 1830 all the way to the present. No cemeteries were found to be located within the working alignment of Alternative 1.

Alternative 1A

Ten archaeological sites were found to be within the estimated right-of way for Alternative 1A. These are the same ten sites that were found to be located within Alternative 1.

No cemeteries were found to be located within the alignment of Alternative 1A.

Alternative 2

Four archaeological sites were found to be within the estimated right-of way for Alternative 2, as described in **Table 5-17**. These sites include a Woodland and Middle Mississippian Camp (12-Vg-0039), an Early Archaic site of undetermined type (12-Vg-0343), and two Prehistoric sites of undetermined type or cultural affiliation (12-Vg-0046 and 0048). All of these sites are located on terraces except for Site 12-Vg-0048, which is situated in the bottomlands. According to the official state site forms, determinations of eligibility to the National Register of Historic Places or the Indiana Register of Historic Sites and Structures have not been made for any of these sites.

One cemetery, known as the James Cemetery (Interim Report #20043), was found to be located within one mile of Alternative 2. This cemetery is located in Knight civil township as shown on the Newburg, Indiana USGS 7.5 minute series topographic quadrangle and dates from circa 1846 through 1940.

Table 5-17: Previously Recorded Archaeological Sites within Alternative 2 in Indiana

Site #	Site Type(s)	Cultural Component(s)	Landform
12-Vg-0046	Unknown	Unidentified Prehistoric	Terrace
12-Vg-0048	Unknown	Unidentified Prehistoric	Bottomlands
12-Vg-0039	Camp	Woodland, Middle Mississippian	Terrace
12-Vg-0343	Unknown	Early Archaic	Terrace

Alternative 3

Three archaeological sites were found to be within the estimated right-of way for Alternative 3, as described in **Table 5-18**. These sites include a Middle Mississippian camp (12-W-0052), a Prehistoric camp of undetermined cultural affiliation (12-W-0178), and a Terminal Middle Woodland camp (12-W-0179). Two of these sites (12-W-0178 and 0179) are located in the uplands while the third (12-W-0052) is located on a terrace. According to the official state site forms, determinations of eligibility to the National Register of Historic Places or the Indiana Register of Historic Sites and Structures have not been made for any of these sites.

Table 5-18: Previously Recorded Archaeological Sites within Alternative 3 in Indiana

Site #	Site Type(s)	Cultural Component(s)	Landform
12-W-0052	Camp	Middle Mississippian	Terrace
12-W-0178	Camp	Unidentified Prehistoric	Uplands
12-W-0179	Camp	Terminal Middle Woodland	Uplands

In addition to the previously registered archaeological sites, five previously recorded cemeteries were also located within one mile of Alternative 3. All of these cemeteries are small family burial grounds, most of them unmarked, dating to the 19th Century. No cemeteries were found to be located within the alignment of Alternative 3.

As discussed in **Section 5.9.2 Historic Resource Impacts**, concern was expressed by the property manager of the Angel Mounds State Historic Site, and in a February 13, 2003 letter from the IDNR Division of Museums and Historic Sites about the proximity of Alternative 3 to the prehistoric earthworks at Angel Mounds. IDNR correspondence noted that professionals at the Cahokia Mounds Site in Illinois believe that highway vibrations from I-70 have caused damaging "slumping" in Monks Mound, the largest prehistoric earthwork in the United States. Although the FHWA has not established vibration criteria, the Federal Transit Administration (FTA) Guidance Manual references two criteria for fragile and extremely fragile buildings. These values were established to avoid cosmetic and/or structural damage to buildings. The criteria, as presented in **Table 5-19**, are expressed in Peak Particle Velocity (PPV, in/sec)[1].

A typical background vibration level in a residential area would be approximately 0.0006 in/sec or even lower. The human threshold of vibration perception is around 0.0036 in/sec. Traffic on smooth roads very seldom creates perceptible vibration unless soil conditions are such that the pavement experiences extreme flexing, which can be experienced adjacent to local roads in

[1] Transit Noise and Vibration Impact Assessment, Harris Miller Miller & Hanson, Inc., Office of Planning, Federal Transit Administration, U.S. Department of Transportation, Washington, D.C., DOT-T-95-16, April 1995.

areas with very high water tables. Construction activities and rough pavement typically create perceptible vibration levels.

Because the burial mounds are not buildings, but are earthen structures, this analysis established that an acceptable criterion for maximum PPV levels should be 0.20 in/sec. Compared to all structural vibration-response situations, this represents a conservative value.

Table 5-19: Ground-Borne Vibration Criteria

Type of Structure	Ground Borne Vibration Impact Levels (PPV)
Commercial / Industrial	2.0 in / sec.
Residential	0.5 in / sec
Fragile	0.2 in / sec
Extremely Fragile (Historical)	0.12 in / sec

The Angel Mounds State Historic Site is divided by Pollack Ave and would be approximately 400 feet of the proposed I-69 corridor as it crosses the Ohio River and intersects with I-164 north of Pollack Ave. Two specific mounds are of concern at the site, Mound G, which is located in the northern section of the site, adjacent to and north of Pollack Avenue, and Mound A which is in the central section of the site, north of the Ohio River. I-69 Build Alternative 3 would be approximately 970 feet east of Mound G and 2,800 east of Mound A. Immediately across from Mound G is the entrance to the Angel Mounds Historic Site visitor's parking lot and the Angel Mounds Interpretive Center (see **Figure 5-12**).

Soil conditions in the area are characterized by alluvium, which is normally fine silty sands with gravel or coarse sand lenses within a deep deposit. Bedrock may be on the order of 50 to 100 feet deep in the area and is not expected to be encountered during construction. Vibration ranges presented below are based on soil conditions that provide average to efficient propagation of vibration energy.

Ranges of both traffic and construction induced vibration levels at Mounds A and G are presented in **Table 5-20**. The vibration levels were developed using the general assessment procedures presented in the FTA's Transit Noise and Vibration Impact Assessment guidance manual. Events analyzed included buses or trucks along Pollack Avenue on smooth pavement and irregular pavement. Buses entering the Angel Mounds Historic Site were assumed to be approaching the site at 20 mph. Vehicles passing the entrance were analyzed at 30 mph. Buses and trucks on I-69 Build Alternative 3 were also analyzed utilizing smooth pavement and an irregularity in the pavement that could be created by an expansion joint. The table also presents potential vibration levels that could be created during construction. All vibration units are in PPV, in/sec.

Comparing the vibration data presented in **Table 5-20** to even the lowest 0.12 in/sec PPV criterion, none of the projected vibration levels approach the standard. Therefore, based upon the information available at this time, vibration impacts from traffic on local streets would be more likely to have an adverse impact than activities associated with I-69 Build Alternative 3.

Table 5-20: Build Alternative 3 Ground-Borne Vibration Levels, PPV

Location	Roadway	Source	Ground Borne Vibration Levels, PPV (in/sec)
Mound G	I-69	Bus/Truck 65 mph	0.0003 – 0.0020
	I-69	Bus/Truck 65 mph/bump	0.0009 – 0.0062
	I-69	Pile Driver (Impact)	0.0026 – 0.0062
Mound A	I-69	Bus/Truck 65 mph	0.0001 – 0.0007
	I-69	Bus/Truck 65 mph/bump	0.0002 – 0.0021
	I-69	Pile Driver (Impact)	0.0005 – 0.0013

To verify the above assumption, it will be necessary to have specific information about the type of soil within each of the earthworks at Angel Mounds, as well as an estimate of the underlying soil type and groundwater conditions, all of which impact predictions of vibration effect. This information will be needed in addition to the project subsurface information obtained in the next phase of the project development process.

During design, it is recommended that vibration propagation tests be made within a range of 100 to 500 feet of the proposed right-of-way for the preferred alternative. It is also recommended that vibration measurements be conducted along Pollack Avenue and I-164 to establish local source data. With the soils data gathered prior to design, the availability of propagation and local source data, a more in-depth analysis of potential vibration impacts on the Angel Mounds Historic Site could be conducted.

Measures which could be incorporated into the construction specifications include: existing condition surveys on the Angel Mounds Historic Site, continuous surveys during construction, short term vibration measurements during construction, continuous vibration measurements during pile driving, the establishment of maximum vibration levels, and requirements to change construction procedures should those levels be exceeded based upon the results of the construction vibration monitoring.

Options to protect the mounds, if determined necessary, include excavating intercepting cutoff trenches to 15-foot depths between the mounds and the project location and backfilling trenches with material dissimilar to the native soils. This type of substructure would be designed to intercept the ground surface (Rayleigh) waves propagated by highway traffic before they reach the mounds. Another option would be to address the base material thickness and composition under pavement to achieve damping at the site of the vibration source. A third would be to provide neoprene isolators at bearing points of bridge girders at abutments to attenuate dynamic forces, impeding their influence into their foundations.

Kentucky

Alternative 1 and 1A

There are two recorded archaeological sites within Alternative 1, both described in **Table 5-21**. One site is historic (15HE138) and the other is prehistoric (15HE137). The historic site (15HE138) is recorded as a house site. Foster, Ray, and Schock (1976) recorded sites 15HE137 and 15HE138 within Alternative 1 during a Phase I archaeological survey for the proposed Henderson Bypass. Site 15HE137, a prehistoric site, was found on an eroded knoll.

Table 5-21: Previously Recorded Archaeological Sites within Alternative 1 and 1A in Kentucky

Site #	Site Type(s)	Cultural Component(s)	Historical Date	Area (m^2)
15HE137	Unknown	L. Prehistoric	--	--
15HE138	House Site	Historic	19th-20th Century	--

Alternative 2

Site 15HE764 has been recorded within the working alignment of Alternative 2, discussed in **Table 5-22**. An unrecorded historic cemetery is also found in this corridor. Site 15HE764 was identified during a Phase I survey for a proposed borrow area (Schock 1993a). The site is a historic farmstead dating between the mid-nineteenth and late twentieth centuries. Artifacts recovered included whiteware and bottle glass. According to Schock (1993a), the house was burned and bulldozed in 1990. The site was determined not eligible for the NRHP under Criterion D, and no further archaeological work was recommended. No additional information is available concerning the historic cemetery.

Table 5-22: Previously Recorded Archaeological Sites within Alternative 2 in Kentucky

Site #	Site Type(s)	Cultural Component(s)	Historical Date	Area (m^2)
15HE764	Farmstead	Historic	1801-1950	7,500
Cemetery	--	--	--	--

Alternative 3

There are two prehistoric sites recorded within Alternative 3, discussed in **Table 5-23**. Site 15HE208 was found in an upland context, while Site 15HE214 was found in a bottomland context.

Site 15HE208 was identified as an open habitation site without mound. The age and/or cultural affiliation of this site is unknown. Site 15HE214 is a prehistoric site of unknown age and/or cultural affiliation and function. Both of these sites were recorded by Janzen (1982) during a Phase I archaeological survey for a proposed coal-to-methanol-to gasoline power plant.

Table 5-23: Previously Recorded Archaeological Sites within Alternative 3 in Kentucky

Site #	Site Type(s)	Cultural Component(s)	Historical Date	Area (m^2)
15HE208	Open habitation w/o mounds	Unknown Prehistoric	--	3,000
15HE214	Unknown	Unknown Prehistoric	--	150

Site 15HE208 is located on the side of a small knoll and consists of a scatter of chipped-stone and groundstone tools of unknown cultural affiliation. This site was determined to be not eligible to the NRHP and no further archaeological investigations were necessary (Janzen 1982).

Conclusion

Indiana

Based on the information available, there will be no vibration-induced impacts to the historic earthworks at Angel Mounds State Historic Site from any of the alternatives.

A Phase Ia archaeological field reconnaissance of the preferred alignment will be conducted prior to the publication of the FEIS. This reconnaissance will include a visual surface inspection of the alternative as well as systematic shovel probing in areas of limited surface visibility. In addition, a Phase Ic archaeological subsurface reconnaissance may be conducted in those portions of the final preferred alternative that are located in floodplains of the Ohio River and any of the larger streams that are crossed by the alternative. This subsurface reconnaissance will include deep trenching of the alluvial portions of the alternative combined with a detailed geomorphological analysis conducted by a qualified geomorphologist. Both the Phase Ia archaeological field reconnaissance and the Phase Ic archaeological subsurface reconnaissance will be conducted in order to determine if any archaeological resources meeting the criteria established for inclusion to the NRHP or IRHSS will be adversely affected by the project.

Kentucky

A Phase I archaeological survey will be conducted prior to the publication of the FEIS in the preferred alignment to identify archaeological resources, with particular attention to area of moderate and high archaeological potential. This survey will include intensive surface reconnaissance followed by a systematic shovel testing within the estimated right-of-way. In addition, undisturbed portions of the preferred alignment crossing of the Ohio River and Green River floodplains should be subjected to deep archaeological testing or examined by a geoarchologist to identify buried surfaces. If buried geomorphological surfaces are found, then deep testing may be conducted to determine if these surfaces contain any cultural resources. The suggested method of deep testing is a measured test unit excavation, which offers the greatest control and therefore increases the probability of identifying archaeological materials that may be present.

Areas of severe disturbance are likely not sensitive for prehistoric and historic resources. Such areas are localized and consist of highway borrow areas, highway construction, residential development, and light industrial development. With the selection of Alternative 2 as the preferred alternative, portions that cross through disturbed parts of the right-of-way can be eliminated from consideration for archaeological resources with surface reconnaissance and limited testing to locate disturbances.

After the survey is completed, a Phase I report should be prepared, which will describe survey methods and results, and characterizing potential eligibility of identified prehistoric or historic archaeological sites for nomination to the NRHP. Recommendations for avoidance or Phase II testing will be included for NRHP-eligible sites.

The No-Build Alternative will have no impacts to archaeological resources in the study area.

5.10 MINERAL RESOURCE IMPACTS

Introduction

Mineral resources have been a vital part of southern Indiana and northwestern Kentucky's economic base for many years. The entire project study area lies upon the Illinois Basin, which is synonymous with large deposits of coal, oil, gas, and aggregate material (i.e. sand and gravel). There are large amounts of mineral deposits that would be crossed by the proposed alternatives, but the impacts upon these resources will be low due to underground mining, drilling techniques, and abundance of resources in the area.

Methodology

Resources used for the evaluation of mineral resources include geologic quad maps and Western Kentucky Coal Resource maps from Kentucky Geological Survey, underground mine maps from the Indiana Geological Survey, oil pool maps from Indiana Geological Survey. In addition to this data, associated GIS data layers from both the Indiana and Kentucky Geological Surveys were utilized. Based on this information each alternative was examined to evaluate the potential impacts to mineral resources that would result from its construction. The alignments were transposed on maps and GIS layers to estimate the resources that lie beneath the proposed alternative. The two main mineral resources in the area are coal and oil along with lesser amounts of sand and gravel.

Analysis

Coal

The most prominent coal bed within the project study area is the Springfield Coal, which consists of Coal Bed V in Indiana and the No. 9 coal bed in Kentucky. The Springfield Coal Bed underlies the entire project study area except for two areas. The first area was channelized by an ancient river approximately a half-mile wide and trends southwest to northeast through the western part of Henderson County, the oxbow of southwestern Vanderburgh County, and through Evansville. The second area is east of the Green River in Henderson County where the coal bed does not persist. Other regional coal resources include the No. 11, 12, and 13 coal beds in Kentucky and the Danville Coal Bed in Indiana. Each of the four I-69 alternatives would cross one or more of these coal deposits. Mining of the Springfield Coal in Vanderburgh and Henderson counties has historically taken place via underground shaft mining.

Most of the coal deposits in the northern portion of the project study area range in depth from approximately 200 to 1,000 feet below the surface. The deeper coal deposits are in northeastern Posey and western Vanderburgh County at depths of 500 to 1,000 feet. This is due to the fact that the Springfield Coal dips farther below the surface as one travels west towards the Wabash fault system. These deposits gently rise toward the surface in the eastern portion of the project study area. Throughout most of Vanderburgh County, the Springfield Coal is 200 to 500 feet below the surface except for areas located in the far southern reaches of the oxbow region along the Ohio River floodplain, where the depth is 150 to 200 feet below the surface. Coal deposits are only 50 to 150 feet below the surface along the Vanderburgh and Warrick County line where Alternative 3 would interchange with I-164.

In Kentucky, the Springfield Coal (a.k.a. No. 9 coal bed) is generally found at shallower depths than in Indiana. Most of the coal deposits in the vicinity of Alternative 1 and 1A range from 150 feet below the surface near Canoe Creek to 200 feet near the community of Rankin. Coal bed depths along the Alternative 2 alignment range from 170 feet below the surface north of the Ohio River to 130 feet beneath the floodplain on the south side of the Ohio River. As the terrain begins to rise south of the Ohio River, the coal depth is between 190 and 230 feet just south of US 60 and once again gradually rises closer to the surface near the Breathitt Parkway at depths of 120 to 140 feet. Alternative 3 only traverses the Springfield Coal south of the Green River. Southwest of the Green River along the floodplain where Alternative 3 crosses, coal is approximately 150 to 200 feet below the surface. Near the community of Baskett, the Springfield Coal ranges from about 140 to 160 feet below the surface. As Alternative 3 turns toward the south where it shares an alignment with Alternative 2, the coal bed is at its shallowest at approximately 120 feet in the Elam Ditch drainage. Alternatives 1 and 1A would traverse a larger quantity of coal resources than Alternatives 2 and 3 by virtue of their longer overall length on new terrain. **Table 5-24** shows the length and the relative thickness of each major coal bed traversed.

There are many abandoned underground mines within Vanderburgh and Henderson counties. Five abandoned mines lie beneath or are immediately adjacent to one or more of the I-69 alternatives. In Indiana, the Epworth #1 Mine located northeast of the existing Covert Avenue/I-164 interchange is just beyond the horizontal limits of the proposed Alternative 3 interchange with I-164. This area was mined between 1908 and 1927 and is approximately 120 feet below the surface. Two small underground mines are located just west and east of the Alternative 2 alignment in northern Henderson County. Kentucky Geologic Survey (KGS) GIS mapping indicates that the horizontal extents of the Wolf Hills mine (approximately 30 acres) is more than 100 feet west of the proposed right-of-way for Alternative 2. However, the mapped extents of the L.H.&W. mine (approximately 15 acres) located in the upper headwater reaches of North Fork Canoe Creek is less than 50 feet from the eastern edge of the proposed right of way. KGS mapping of a fourth larger mine (approximately 440 acres) at the town of Baskett, just east of Alternative 3, extends within 100 feet of the proposed right-of-way.

Canoe Creek is less than 50 feet from the eastern edge of the proposed right of way. KGS mapping of a fourth larger mine (approximately 440 acres) at the town of Baskett, just east of Alternative 3, extends within 100 feet of the proposed right-of-way.

The fifth mine is the Goldsberry Mine located southwest of Henderson. This large (4500+ acres) abandoned mine extends beneath the Audubon and Breathitt Parkways. All four of the alternatives would cross a portion of this mine. Approximately 40 acres of right-of-way for Alternatives 1 and 1A, including the interchange with the Breathitt Parkway, would lie above this mine. For Alternatives 2 and 3, as much as 166 acres of right-of-way would exist over this mine, including the interchanges with the Audubon and Breathitt Parkways.

The potential extraction of these resources beneath the highway may be possible via underground mining; however, such activities would be subject to approval by INDOT and KYTC.

Table 5-24: Length and Percentage of Alternatives Crossing Principal Coal Beds of Southwestern Indiana and Henderson County, Kentucky

Coal Seam		Coal Seam Thickness	Alternative 1		Alternative 1A		Alternative 2		Alternative 3	
			Length (miles)	%	Length (miles)	%	Length (miles)	%	Length (miles)	%
Springfield Coal Member	IN Coal V	does not occur	0.8	2%	0.8	2%	0.0	0%	0.0	0%
		3.2 ft. thick	3.9	12%	3.0	8%	0.0	0%	0.0	0%
		3.8 ft. thick	15.8	49%	16.3	46%	0.0	0%	1.1	7%
		4.4 ft. thick	5.0	16%	8.7	25%	2.2	17%	0.0	0%
	KY No. 9	does not occur	0.0	0%	0.0	0%	0.0	0%	3.1	21%
		3.5 – 4.6 ft. thick	6.6	21%	6.6	19%	10.8	83%	10.7	72%
Total underlain by coal			31.3	98%	34.6	98%	13.0	100%	11.8	79%
Overall Total			32.1	100%	35.4	100%	13.0	100%	14.9	100%
Danville Coal Member	IN Coal VII	does not occur	6.6	21%	6.6	19%	2.2	17%	1.1	7%
		1.5 ft. thick	0.0	0%	0.5	1%	0.0	0%	0.0	0%
		2.0 ft. thick	6.4	20%	13.5	38%	0.0	0%	0.0	0%
		2.6 ft. thick	7.1	22%	4.6	13%	0.0	0%	0.0	0%
		3.2 ft. thick	5.3	17%	3.5	10%	0.0	0%	0.0	0%
	KY No. 13	does not occur	2.4	7%	2.4	7%	2.6	20%	6.1	41%
		2 – 2.3 ft thick	0.0	0%	0.0	0%	8.2	63%	7.7	52%
		4.6 – 5.8 ft thick	4.3	13%	4.3	12%	0.0	0%	0.0	0%
Total underlain by coal			23.1	72%	26.4	75%	8.2	63%	7.7	52%
Overall Total			32.1	100%	35.4	100%	13	100%	14.9	100%

Source: Kentucky Geological Survey Geologic Quadrangle Maps
Indiana Geological Survey

Petroleum

Southwestern Indiana and northern Kentucky contain known areas of petroleum reserves. All of the I-69 alternatives considered would cross petroleum fields that may contain deposits of natural gas and oil. **Table 5-25** identifies the name of each field crossed, the approximate length of each alternative across the field, and the number of wells that currently exist within the proposed right-of-way based on available GIS coverage. This table includes active oil wells, an example of which is shown in **Figure 5-14**, recently permitted wells, and historical wells. Historical wells refer to sites that have been used for different types of extractions over the course of their existence. Petroleum fields crossed by Alternative 1 include St. Wendel Consolidation, Parker Consolidation, Ford South, Heusler Consolidation, and Henderson. Alternative 1A crosses the following petroleum fields: Darmstadt North, St. Wendel Consolidation, Parker Consolidation, Ford South, Heusler Consolidation, and Henderson Field. Alternatives 2 and 3 cross the Elam Flats Field. None of the Build alternatives are expected to have an impact to continued petroleum extraction and/or exploration in the project study area.

Table 5-25: Oil/Gas Fields Crossed and Number of Wells Within Right-of-Way for I-69 Alternatives

State	Petroleum Field Name	Alternative 1		Alternative 1A		Alternative 2		Alternative 3	
		Length (miles)	# of wells	Length (miles)	# of wells	Length (miles)	# of wells	Length (miles)	# of wells
Indiana	Darmstadt North	0.0	0	2.2	0	0.0	0	0.0	0
	St. Wendel Consol.	1.3	2	1.6	2	0.0	0	0.0	0
	Parker Consol.	2.7	1	2.7	1	0.0	0	0.0	0
	Ford South	0.5	0	0.5	0	0.0	0	0.0	0
	Heusler Consol.	3.8	5	3.8	5	0.0	0	0.0	0
	Vaughn Consol.	1.2	0	1.2	0	0.0	0	0.0	0
Kentucky	Henderson	0.7	1	0.7	1	0.0	0	0.0	0
	Elam Flats	0.0	0	0.0	0	0.3	3	0.3	3
Total		10.2	9	12.7	9	0.3	3	0.3	3

Source: Kentucky Geological Survey Geologic Quadrangle Maps
Indiana Geological Survey

Figure 5-14: Oil Well in Union Township Bottoms of Vanderburgh County

Sand and Gravel

Deposits of sand and gravel occur throughout much of the Ohio River floodplain. These deposits also occur to a lesser degree along smaller streams within the project study area. Mulzer Crushed Stone, Inc. operates off-loading facilities along the Ohio River at Newburgh, Evansville, and Mt. Vernon in Indiana and Henderson in Kentucky. However, there is only one currently operating sand and gravel production facility located within the I-69 project study area. Mulzer

Crushed Stone, Inc. dredges sand and gravel from a pit located in the Ohio River floodplain region of southeastern Vanderburgh County, south of I-164 between Weinbach Avenue and South Green River Road, shown in **Figure 5-15**. The facility has been in operation since 1997 and transports product via truck. The preliminary right-of-way for the system-to-system interchange between Alternative 2 and I-164 would clip the northwestern corner of the excavation pit on the Mulzer property, shown in **Figure 5-16**. The current proposed right-of-way footprint would prohibit any expansion of the sand and gravel operation to the west, but would not restrict expansion of the pit to the south.

Figure 5-15: Mulzer Crushed Stone, Inc. Sand and Gravel Operation

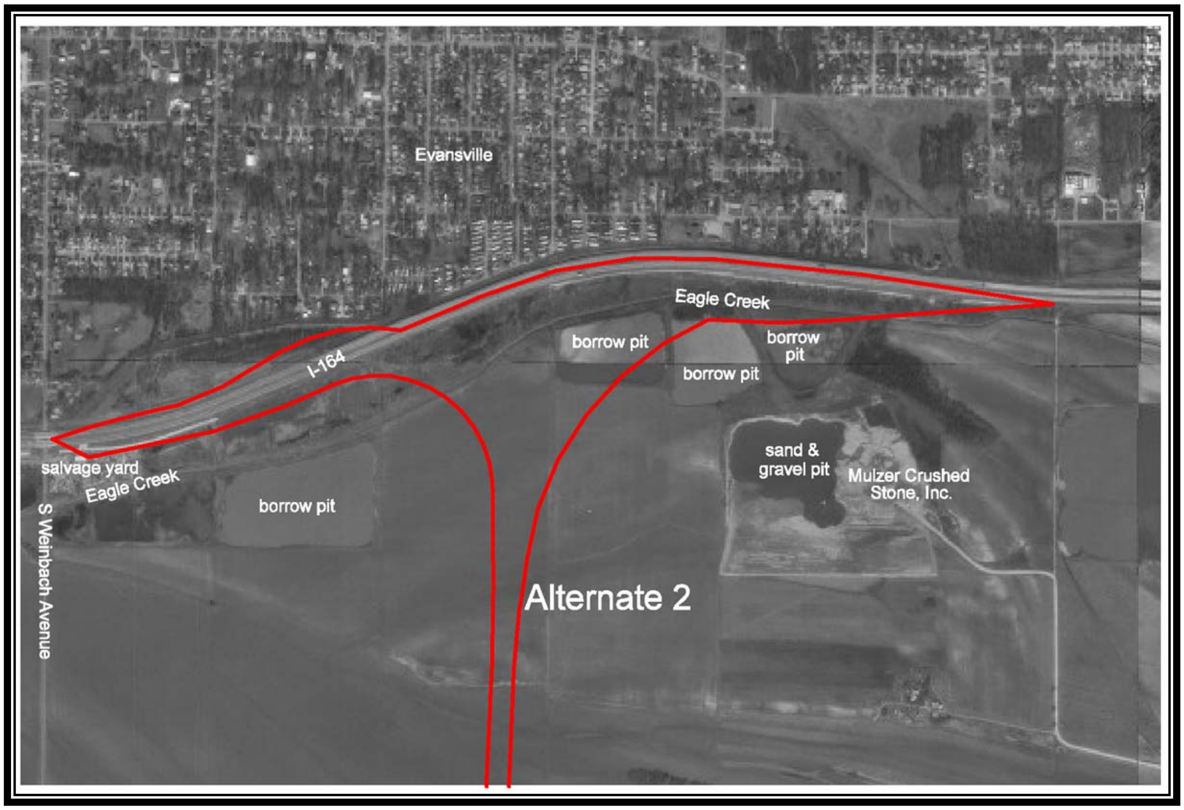


Figure 5-16: Location of Mulzer Crushed Stone, Inc. Sand and Gravel Operation Relative to Alternative 2 Alignment

Summary

The major minerals associated with the project study area are coal, oil, sand and gravel. Sand and gravel resources are extracted at a much lower percent than coal and oil deposits. Alternatives 1 and 1A had the largest impacts to coal and oil deposits. Alternatives 1 and 1A cross over the longest distance of coal and oil deposits largely because they consist of entirely new terrain. In addition, this corridor also must cross over a portion of the abandoned Goldsberry Mine south of Henderson.

Alternatives 2 and 3 have less potential for impacts due to the fact that they utilize significant lengths of existing right-of-way. These alternatives cross significantly less oil fields and coal beds than Alternatives 1 and 1A, but the coal in this portion of the project study area is closer to the surface and easier to extract. Alternative 2 crosses the fringe of Mulzers Crushed Stone Wienbach Pit. The location of Alternative 2 relative to this pit may prevent expansion to the west, but should not impede further expansion to the south. Alternatives 2 and 3 must cross a portion of the Goldsberry Mine as well. Alternative 2 is also in close proximity to two abandoned mines in northern Henderson County, while Alternative 3 crosses two abandoned mines. One mine is located in southwest Warrick County and the other is located near Baskett in Henderson County.

All of the proposed Build alternatives have the potential to impact mineral resources in some way. The impacts that result from these alternatives are anticipated to be minimal based on this analysis. Due to the nature of the minerals involved, the construction of any of these alternatives will not substantially impede future exploration or extraction of these minerals. The No-Build alternative would have no impact on mineral resources

5.11 VISUAL IMPACTS

Introduction

The National Environmental Policy Act (NEPA) requires that consideration be given to determine the effects proposed Federal actions or projects are likely to have on the quality of the human environment. Visual impact is one of the environmental elements that must be considered. Visual impacts could include any alteration of landscape through construction, destruction of woodlands, wetlands, farmland, buildings, etc. It could also consist of increased traffic, lighting, and litter associated with the new facility.

Visual impacts of the proposed I-69 include the "view from the road" and the "view of the road". Such impacts are assessed to design quality, art, and architecture in the project planning. These values are particularly important for facilities in sensitive environmental settings.

Methodology

The following descriptions for each alternative provide a general review of possible visual impacts. Information was gathered from walking each alternative as well as the use of maps and aerial photographs. Commentaries on each alternative begins at I-64 north of Evansville, and end at the Breathitt Parkway south of Henderson.

Analysis

Alternative Descriptions From the Road

Traveling south from I-64 along the proposed Alternatives 1 and 1A, the alternatives are surrounded by a vast upland farm landscape that is very open with gently rolling hills and few concentrations of trees, demonstrated in **Figure 5-17**. These areas where Alternatives 1 and 1A begin would generally be the same. Alternative 1 is approximately 32.1 miles long and Alternative 1A is about 35.4 miles long. These two alternatives converge west of the small community of St. Wendel, which is one of the small farming oriented communities within sight of Alternatives 1 and 1A. Other small communities within sight would include Parker Settlement and St. Philips in Alternative 1. The communities of St. James, Armstrong, St. Wendel, Parker Settlement, and St. Philips would be in the vicinity of Alternative 1A. These small communities have populations of less than a thousand residents and are made up of scattered homes typically surrounding a few small service related businesses.

Figure 5-17: Upland Farm Landscape

South of the community of St. Philips, rolling open farmland begins to decrease and woodlands become the prevalent land feature in the vicinity. This trend continues south across SR 62 until the crossing of Bayou Creek. The woodland area associated with SR 62 is within a few miles of the University of Southern Indiana campus. Once south of Bayou Creek, the vast bottomland farming region along the southern edge of Vanderburgh County becomes the prevailing land feature. This area is a lowland agricultural area with few homes or woodlands and is periodically flooded by the Ohio River. On the east side is an elevated railroad track that would parallel the Interstate throughout this bottomland area. The alternatives then cross the Ohio River, including Henderson Island, and continue on into the southern edge of the City of Henderson, KY (see **Figure 5-18**). While traveling across Henderson Island, a motorist would see a fairly large land mass completely covered by woodlands. In Henderson, motorists would find themselves entering directly into a semi-urban landscape with housing and business developments, factories, etc. Once south of Henderson the landscape returns to a rolling open agricultural setting until the Breathitt Parkway. This area has more trees than the Indiana farming regions and a higher density of homes due to the proximity to Henderson. The small community of Rankin is situated within this agricultural area.

Figure 5-18: Bottomland Farm Landscape

Alternative 2 is approximately 31.5 miles long; however, 18.3 miles will utilize the existing I-164 roadway. From the north end of Alternative 2 south on the existing I-164 the corridor traverses through an upland agricultural setting consisting of open rolling and flat farm ground. The remnants of strip mining activities in the distance include reclaimed mine land along the east side of existing I-164. Before entering the Evansville area, the open farm fields give way to suburban development along both sides of the road. Alternative 2 follows I-164 around to the southern edge of Evansville in proximity to the Angel Mounds state historic site. After continuing along I-164 to just beyond the existing interchange for Green River Road, it breaks off across the open Ohio River floodplain to the south dominated by agriculture and continues toward the Ohio River and Kentucky. Once across the river the roadway would cross a floodplain area dominated with bottomland hardwood forest and wetlands. Continuing south of the floodplain, Alternative 2 crosses rolling agricultural fields and some scattered residences until the alternative approaches US 60. Near the crossing of US 60, relatively small residential subdivisions will be visible to both the east and west. Once south of US 60, Alternative 2 continues through rolling farm ground until it converges with Alternative 3 northeast of Graham Hill.

Alternative 3 is approximately 29.7 miles long and would use 14.8 miles of the existing I-164 roadway. This alternative breaks off from I-164 just north of the Covert Avenue interchange and travels through a predominantly residential area just east of Angel Mounds. This area consists of several residences and a few service business developments; an example of the area is shown in **Figure 5-19**. From here the route would cross the Ohio River into Kentucky. While crossing the bridge the Ohio River and Green River floodplains would be visible to the south. This area, which is dominated by agriculture, is a flat and open plain that extends approximately 2.5 miles to the Green River. On the south side of the Green River is a smaller area of floodplain, comprised of bottomland forest and pastureland. The terrain begins to change as the alternative rises out of the Green River floodplain. The landscape starts to transform into a rolling hilly landscape with several farms dissected by small to medium blocks of woodlands. The community of Baskett, a country club (with golf course), and residential development can be seen in this area. The landscape then changes to the open rolling farm fields that extend to the south until Alternative 3 rejoins Alternative 2 northeast of Graham Hill and continues on to the Breathitt Parkway.

Figure 5-19: Residential Area

View of the Road

Generally, vegetation loss of woodlands, wetlands, and farmland would occur due to the construction of the roadway facility. Other long term impacts would be borrow pits that will be used for soil to elevate the road in certain areas, and lighting from interchanges that may be seen from homes located in close proximity to the roadway. There would also be changes in landscape, which range from leveling the land in some areas to elevating the highway in others, which would cause an obstruction of view in flat, open landscapes. There would also be a visible division between neighborhoods traversed by the roadway. During construction there will be several temporary visual impacts. These short-term impacts would include exposed earth from construction equipment, jobsite trailers, and vegetation loss.

Due to the construction of an entirely new route, Alternative 1 and 1A will have the greatest amount of visual impacts to the surrounding areas. These alternatives will traverse mostly rural areas around some small communities with little screening. In the Ohio River floodplain, the roadway will be an elevated structure, similar in scale to the existing railroad trestle shown in **Figure 5-18**. The bridge will cause a visual impact on both sides of the river. This bridge will have little to no screening on the Indiana side and will be visible from considerable distances in every direction and from elevated points within the city of Henderson. There are only a few scattered residences in the Ohio River floodplain in southern Vanderburgh County. Thus, the amount of people affected would be minimal on the Indiana side of the river. Existing buildings and other structures would also limit the visibility of the bridge within Henderson.

The bridge must also traverse Henderson Island, and into a developed area within Henderson, which will entail the clearing of some trees, homes, and other structures. This area is shown in

Figure 5-20. This crossing would have a greater visible impact to more people in Kentucky than the other alternatives proposed. During the bridge construction, there would be short-term visual effects such as cranes, barges, scrapers, dozers, etc. There would also be permanent visual impact upon the homes and businesses that would surround the roadway.

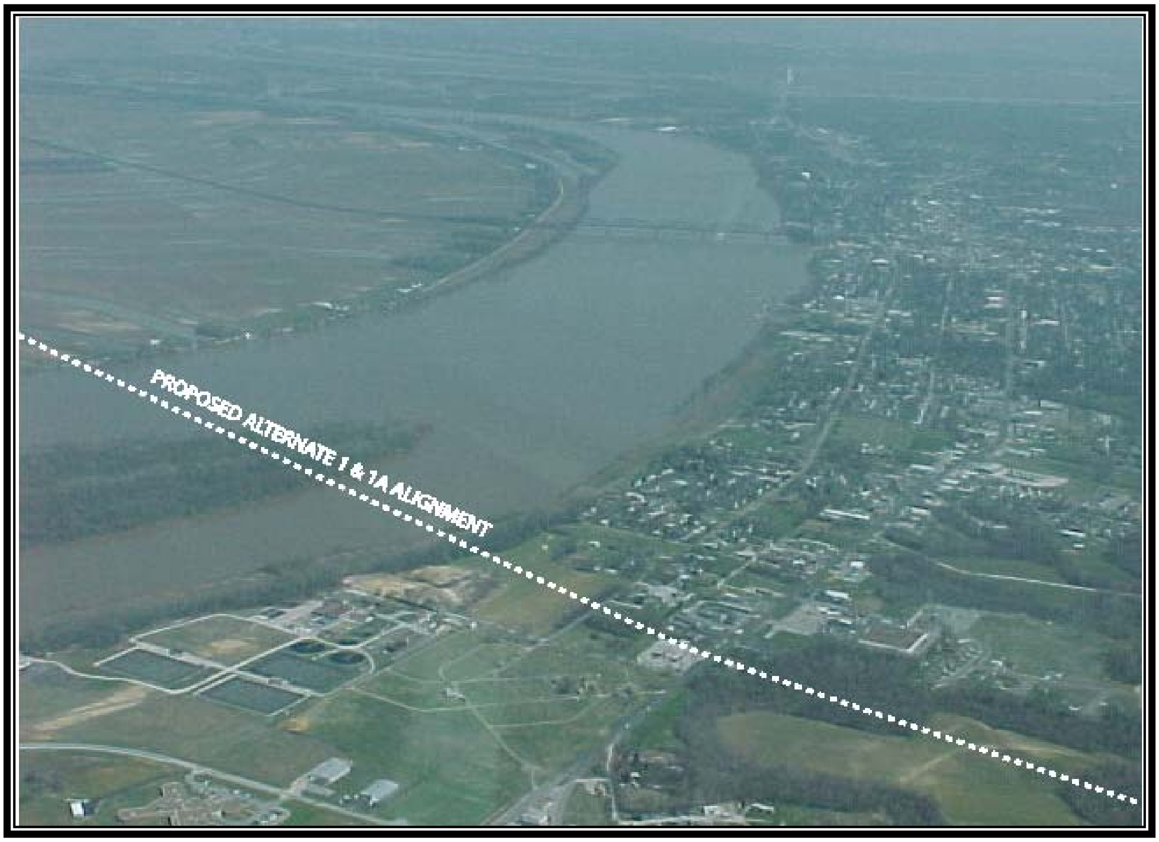


Figure 5-20: Proposed Alternative 1 & 1A Alignment

Alternative 2 visual impacts will be nonexistent while it travels along the existing I-164, as no modifications are planned for this facility. Impacted areas of significance would include areas where the roadway would need to be elevated in the Ohio River floodplain area south of Evansville and across the river in Kentucky. The bridge may be visible for a considerable distance because of the flat terrain associated with this area. The visibility of the bridge could vary significantly depending on the bridge type selected. The bridge would be less visible on the Kentucky side due to the amounts of trees in the area, as shown in **Figure 5-21**, that would partially screen the bridge and the elevated roadway. This alternative would have the least amount of visual impact to people because of the low population associated with this corridor.

Alternative 3 will also have no visual effects along the existing I-164. A visual impact will take place where Alternative 3 interchanges with I-164 to create a new overland route across the Ohio River. The approach to the bridge will be elevated through a residential area to the east of Angel Mounds State Historic Site and clearly visible. The bridge would most likely be at least partially screened from the view of the Angel Mounds area by the existing woodlands that surround the site. The visibility of the bridge from the downtown Newburgh area would also be highly variable depending on the bridge type selected. This bridge would be highly visible on the Kentucky side because it is in the Ohio and Green River floodplains and will need to be elevated above this extensive open agricultural area. However, this area is not highly inhabited and the bridge would not be regularly viewed by a large number of residents. Alternative 3 would also be partially visible from the community of Baskett in the southern part of the town where there are no trees to provide screening.

Figure 5-21: Trees as a Partial Screen for Alternative 2

Summary

All alternatives except for the No-Build alternative will have visual and aesthetic impacts. In areas of new road construction these may be: more open spaces attributable to woodland loss, increased lighting from light emitting sources such as interchange lighting, vehicles or new signage. Where current highways are up-graded to Interstate standards visual and aesthetic impacts maybe attributed to: construction, temporary loss of vegetation, additional signage and interchanges.

5.12 HAZARDOUS WASTE SITE IMPACTS

Introduction

On December 11, 1980 the Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund. This law provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) on October 17, 1986. SARA made improvements and changes to the previous program. SARA also required EPA to update the Hazard Ranking System (HRS) and the National Priorities List (NPL) allowing uncontrolled hazardous waste sites to be placed on the list.

Methodology

The project study area was inspected in August 2002 and again in November 2002 for the existence of potential hazardous waste sites. The inspection included the area within the estimated construction limits of each proposed Build alternative for I-69 and the abutting properties phase I investigation followed ASTM methodology. Areas where the proposed Build alternatives would extend through undeveloped farmland were included in the site inspection. The heavily wooded areas were not included in the site reconnaissance. Certain Build alternatives could require the removal of single-family residential dwellings, outbuildings on area farms, and a limited amount of commercial buildings. These properties were viewed on the exterior during the site inspections and are included in this assessment. However, because the structures were not accessed internally, there may be further hazardous material implications associated with these properties.

Analysis

The following summaries identify hazardous material concerns noted during site investigations conducted in August 2002 in both Kentucky and Indiana. They are also located in **Figures 5-22** and **5-23.**

Kentucky

1. Registered underground storage tanks (USTs) are located at an operating retail gasoline outlet identified as the Country Cupboard. The tanks are situated within the proposed Alternative 1, and leaking petroleum from the tank systems is the potential hazardous material of concern. It should be noted that no known leaky USTs were identified either in the field or from the database research.

2. Abandoned automobiles and farm equipment, junk and waste stockpiling, and corn sludge production on private property are located within the estimated construction limits of Alternative 3. Recognized environmental concerns include special waste such as auto tires, unidentified waste materials among waste stockpiles, leaking fluids from abandoned automobiles and farm equipment, and byproducts generated in fertilizer production from corn stalks.

3. A railroad track runs through the project study area. Usual concerns associated with rail lines include leachate from treated lumber used as cross ties, leaking petroleum products from locomotives, and spills from cargo transported on the rail spur. Determining the level of contamination, if any, can only be done via sampling and analysis.

Indiana

4. Several aboveground storage tanks (ASTs) located within the estimated construction limits of Alternative 1 and 1A on a private property include gasoline, diesel fuel, and propane. Contamination concerns, if any, on this property would include the leaking of contents from within the tanks and spillage from the use of the tanks. It should be noted that no known leaky ASTs were identified.

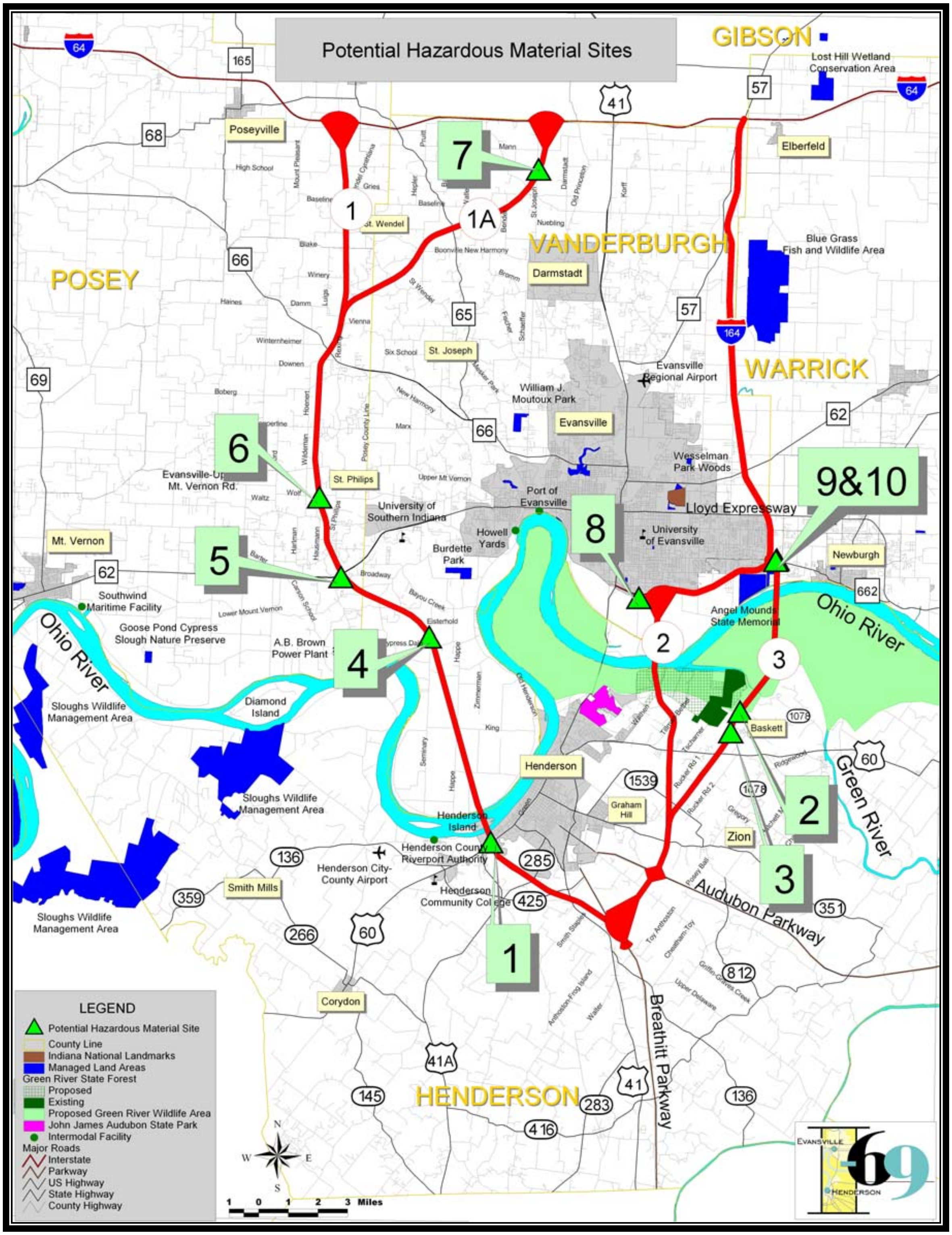


Figure 5-22: Potential Hazardous Material Sites

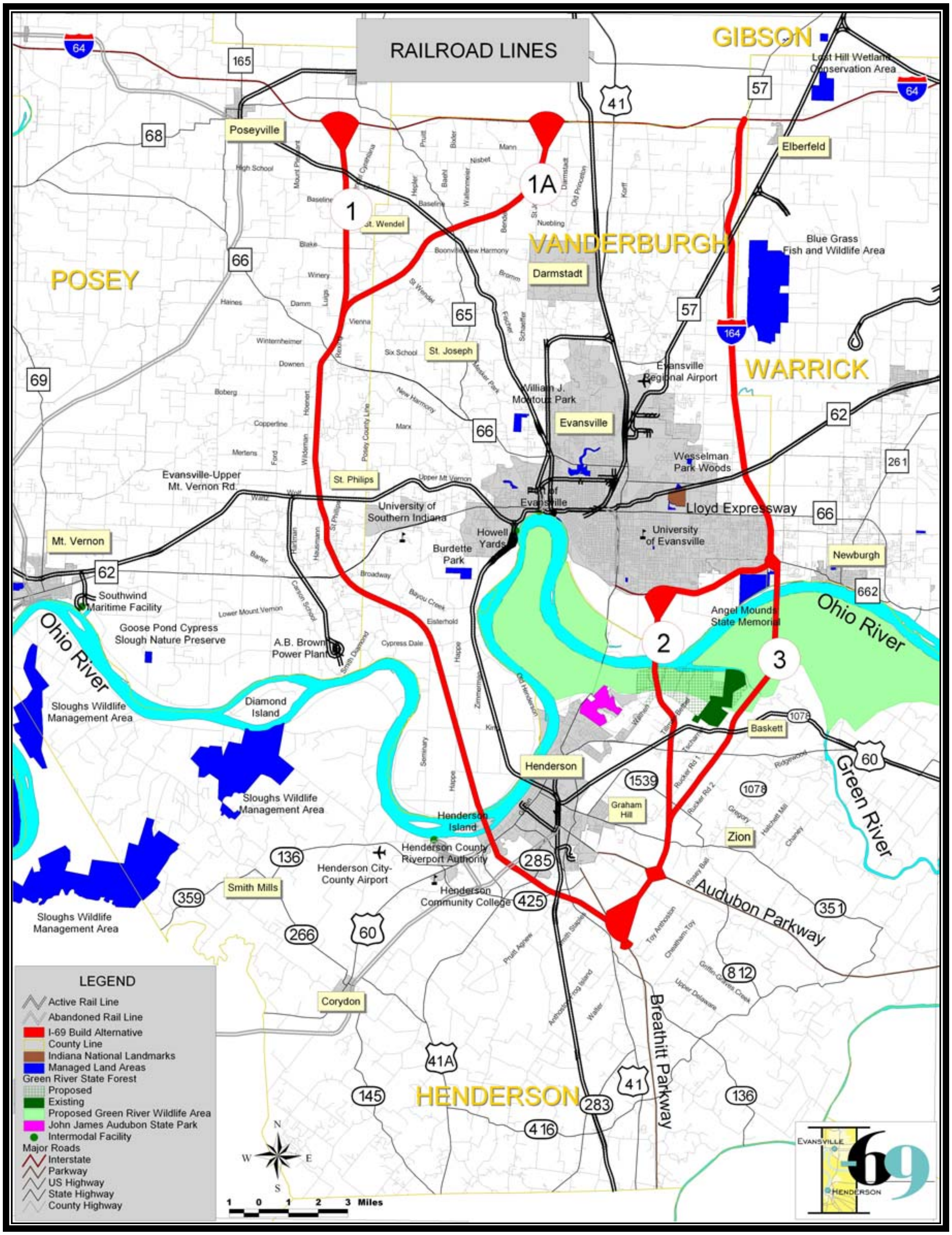


Figure 5-23: Existing Railroad Lines

5. A closed gasoline station is located near proposed Alternatives 1 and 1A on old Highway 62. Contamination concerns associated with this site, if any, would be limited to the potential migration of petroleum products from leaking tank systems, although none was observed or previously documented.

6. A railroad track crosses Alternative 1. Usual concerns associated with rail lines include leachate from treated lumber used as cross ties, leaking petroleum products from locomotives, or spills from cargo transported on the rail spur. Determining the level of contamination, if any, can only be done via sampling and analysis.

7. Multiple large ASTs used to store crude oil extracted in local oil drilling operations are situated on private property within the right-of-way of Alternative 1A. Isolated oil is pooled within a dirt berm that serves as a dike around the tanks. No subsurface investigations were conducted in conjunction with field investigations and, therefore, no determination as to the extent of hazardous material at this site was made. Additional concerns include the removal and handling of the holding tanks that store the oil.

8. An auto salvage operation identified as Mike's Towing and Auto Salvage is located near Alternative 2 along the westbound lanes of I-164 near Weinbach Avenue. The alternative encroaches upon only a portion of this property, and no salvaged autos were located within the alternative at the time of inspections. Leaking petroleum products, antifreeze, heavy metals, mercury, and battery acids would be the primary hazardous material concerns if the estimated construction limits include the locality of the stored salvaged vehicles.

9. A BP gasoline station is located on State Road (SR) 662, beyond the estimated construction limits but near Alternative 3. No notably stained pavement, noxious odors, or stressed vegetation was observed at this location. According to the government database listing, there are two UST systems at this site. No other information was obtained to indicate any contamination associated with the tank usage on this property. Potential petroleum contamination from leaking tanks would be the primary concern, if any, with this location.

10. A closed Marathon gasoline station is located on SR 662, near proposed Alternative 3. Potential contamination concerns associated with this subject site, if any, would be limited to the migration of petroleum products from leaking tank systems, although no evidence of this concern was discovered during the database research or field investigations.

Additional environmental concerns found at multiple locations within Kentucky and Indiana, but not included in the hazardous material screening mapping within this report, include the following:

- Multiple power pole-mounted electrical transformers that are suspected to contain polychlorinated biphenyls (PCBs) were found throughout the project study area. The majority of transformers were inspected and no visible leakage of contents from the transformers was observed; however, several casings exhibited staining and rust from weathering. Due to the quantity of PCBs typically found in these types of transformers, any releases or associated contamination would be minimal.

- Area farms are likely to use pesticides and herbicides. Pesticides or herbicides pose a hazard if they are improperly disposed of or misapplied. No obvious evidence of chemical misapplication or improper storage of chemicals was observed during investigations. No large-scale agricultural crop operations were observed in the project study area that would utilize large quantities of these chemicals.

Summary

It should be noted that no current or past solid waste sites were identified or reported to be within or near the alternatives. Additionally, no ground water contamination is known to occur within the project corridors. **Table 5-26** summarizes the findings of the hazardous material screening and the subsequent recommendations. For more information on this section refer to the *Hazardous Material Screening Assessment.*

Additional study (i.e. Phase II investigations) at these sites will be conducted during subsequent project phases. The amount and degree of additional investigation will vary from site to site, depending on the level of the suspected contamination, if any, and the severity of the impact to the site. Where appropriate, the additional analysis is as described in **Table 5-26**.

Table 5-26: List of Potential Hazardous Material Sites and Recommendations

Site ID #	Site Name or Description	Suspected Hazardous Materials	Recommendation (If a Build Alternative is selected that would impact site)
KENTUCKY			
1	Country Cupboard: Underground Storage Tanks (USTs)	Petroleum products, heavy metals and semi-volatile organic compounds	Site is within the estimated construction limits of Alternative 1. If evidence of soil staining, noxious odors or contamination is detected during demolition and tank removal activities, conduct soil sampling and analysis to profile site. Perform remedial activities and properly close tank system. Upon completion, restore geological conditions on site.
2	Private property; waste stockpiling abandoned automobiles & farm equipment	Leaking petroleum products, solid waste materials and byproducts of corn sludge	Property is within the estimated construction limits of Alternative 3. Inspect ground beneath stored vehicles & farm equipment. Identify discolored soils, classify and test soils if necessary. Properly dispose or recycle any special or hazardous waste materials (soils) identified according to profile. Investigate the handling of waste byproducts generated by fertilizer processing from corn.
3	Railroad track	Oils, greases and chemical substances from leaking freight	The track is within the estimated construction limits of Alternative 3. Inspect for visible contamination at origin of tracks upon removal. Coordinate investigative procedures with railroad's owner.
Not mapped*	Power pole-mounted electrical transformers	Polychlorinated biphenyls (PCBs)	Found throughout project study area. Evaluate the condition of electrical equipment. Inspect for evidence of leaking contents. Coordinate relocation and handling with local utility company.
Not mapped*	Agriculture operations	Pesticides and herbicides	Found throughout project study area. Identify and evaluate the condition of stored pesticides or herbicides. Handle and dispose according to applicable laws and regulations.
INDIANA			
4	Residential property: Aboveground Storage Tanks (ASTs)	Diesel fuel, gasoline and liquid propane	Property is within the estimated construction limits of Alternative 1. Upon verification of affected ASTs, inspect tanks and identify evidence of contamination associated with tank usage.
5	Former gas station (USTs)	Petroleum products, heavy metals and semi-volatile organic compounds	Property is adjacent to Alternative 1. If evidence of soil staining, noxious odors or contamination is detected during construction, perform soil sampling and analysis. Conduct remedial activities according to profile and properly close tank system. Upon completion, restore geological conditions at site.
6	Railroad track	Oils, greases and other unknown chemical substances from leaking freight	The track is within the estimated construction limits of Alternative 1.Inspect for visible contamination at origin of track upon removal. Coordinate investigative procedures with railroad's owner.

Table 5-26 Con't: List of Potential Hazardous Material Sites and Recommendations

Site ID #	Site Name or Description	Suspected Hazardous Material	Recommendation (If a Build Alternative is selected that would impact site)
INDIANA Con't.			
7	Private farm & oil drilling operations: ASTs	Crude oil	Property is located within the estimated construction limits of Alternaive 1-A. Inspect tanks and soils in the vicinity of tanks. Identify evidence of contamination associated with tank usage. Remove contaminated soils and properly dispose in an approved landfill.
8	Mikes Towing and Auto Salvage	Heavy metals, petroleum products, mercury and battery acids	Portion of property is located within the estimated construction limits of Alternative 2. If salvaged autos are relocated as a result of the road expansion, inspect former location of vehicles for evidence of contamination from leaking vehicles, and if found conduct soil sampling and analysis. Conduct remedial activities according to profile and properly dispose of contaminated soils.
9	BP Gas and Food Mart: Active UST Site	Petroleum products, heavy metals and semi-volatile organic compounds	Property is near Alternative 3. If evidence of soil staining or contamination is detected during construction, perform soil sampling and analysis. Investigate and confirm source of contamination and conduct remedial activities according to profile.
10	Marathon Gasoline Station: Inactive UST Site	Petroleum products, heavy metals and semi-volatile organic compounds	Property is near Alternative 3. If evidence of soil staining, noxious odors or contamination is detected during construction, perform soil sampling and analysis. Conduct remedial activities according to profile and properly close tank system. Upon completion, restore geological conditions at site.
Not mapped*	Power pole-mounted electrical transformers	Polychlorinated biphenyls (PCBs)	Found throughout project study area. Evaluate the condition of electrical equipment. Inspect for evidence of leaking contents. Coordinate relocation and handling with local utility company.
Not mapped*	Agriculture operations	Pesticides and herbicides	Found throughout project study area. Identify and evaluate the condition of stored pesticides or herbicides. Handle and dispose according to applicable laws and regulations.
Not mapped*	Commercial Buildings and Dwellings	Asbestos containing building materials (ACBM) and lead containing paints	Found throughout project study area. Conduct asbestos and lead surveys to identify ACBMs & lead paints. Properly abate, handle and dispose of waste stream according to profile prior to demolition activities.

*NOTE: Entities not mapped are found throughout both Indiana and Kentucky.

5.13 THREATENED AND ENDANGERED SPECIES IMPACTS

The primary focus of this section is to discuss potential impacts to federally listed species resulting from the proposed action within the project study area. This section also addresses the potential impacts to Indiana and Kentucky state listed species known to occur within the project study area.

Methodology

The methodology employed in assessing impacts to federal and state listed species was based on coordination with the appropriate agencies (i.e., USFWS, IDNR, KDFWR, KSNPC), review of previous studies and relevant literature concerning endangered and threatened species, and a series of field studies to inventory animal, and plant species (listed and non-listed) within or in close proximity to the proposed alternative and assess potential impacts. **Appendix B-1** includes listings of species of potential and known occurrence within the project study area.

Because the I-69 project involves two USFWS regions (Region 3 for Indiana and Region 4 for Kentucky), early coordination for the project included contact with the Bloomington, Indiana office (Region 3) and the Cookeville, Tennessee office (Region 4). Collectively, five federally listed species were identified for evaluation with regards to potential affect resulting from the I-69 project. **Table 5-27** includes the USFWS federally listed species addressed in this study.

A biological survey of bats was conducted through mist netting at four locations within the project study area according to the USFWS protocol. The two sites in Indiana included Bayou Creek (Vanderburgh County) at the northern end of the Union Township bottoms along Alternatives 1 and 1A and the upper headwater regions of Barr Creek (Vanderburgh County) along Alternative 1A. The two Kentucky sites included Canoe Creek southwest of Henderson in the vicinity of Alternatives 1 and 1A and an unnamed tributary of the Green River near its confluence with the Ohio River (Henderson County), roughly midway between the alignments of Alternatives 2 and 3. A survey for small mammals included live box trapping at nine locations (6 in Indiana and 3 in Kentucky). The presence of medium and large mammals was conducted through direct observation or secondary signs during the field reconnaissance phase of the project.

Biological surveys for birds, reptiles and amphibians were conducted through direct observation and potential habitat assessment during field reconnaissance. Fish communities at perennial stream crossings were inventoried via seining at 15 sites through the project study area (10 in Indiana and five in Kentucky). Ecological Specialists, Inc. (ESI, Inc.) compiled a literature review of unionids (mussels) previously documented within a 55 mile stretch of the Ohio River from river mile 770 to river mile 825 (**Appendix B-1**). ESI, Inc. also conducted qualitative and quantitative investigations for unionids at each of the three proposed Ohio River crossings and the Green River crossing of Alternative 3.

Coordination with the Indiana Department of Natural Resources Division of Nature Preserves provided a listing of Indiana endangered and threatened species for the project study area portions of Posey, Vanderburgh and Warrick Counties, listed in **Table 4-8**. Similarly, Kentucky endangered and threatened species previously documented from Henderson County, Kentucky documented by the Kentucky State Nature Preserves Commission are listed in **Table 4-9.**

An assessment of potential impacts to plant species for each of the proposed alignments was conducted via an inventory of identifiable species within the working alignment during the field reconnaissance phase of the project.

Table 5-27: USFWS Endangered and Threatened Species for Section 7 Consideration within the I-69 Project Study Area

Species Name Common name	USFWS Status	IN Status	KY Status	Global Rank
Myotis sodalis Indiana Bat	E	E	E	G2
Myotis grisescens Gray Bat	E	E	E	G2
Haliaeetus leucocephalus Bald Eagle	T	E	E	G4
Nicrophorus americanus American Burying Beetle	E	X	H	G1
Potamilus capax Fat Pocketbook Mussel	E	E	E	G1

Status	Global Rank	
E - Endangered	G1 – Extremely Rare	T1 – Subspecies Extremely Rare
T - Threatened	G2 – Rare	T2 – Subspecies Rare
X - Extirpated	G3 – Uncommon	T3 – Subspecies uncommon
H - Historical	G4 – Many Occurrences	T4 – Subspecies Many Occurrences
	G5 – Very Common	T5 – Subspecies Very Common
	GU – Uncertain	

Source: Natural Heritage Database (IDNR & KSNPC)

Analysis – Federally Listed Species

Indiana Bat (*Myotis sodalis*)
USFWS Endangered
IDNR Endangered
KDFWR Endangered

Although there are no critical habitat as well as no Priority 1 or Priority 2 caves serving as winter hibernacula for the Indiana bat within the vicinity of the project study area, the potential exists for nursery colony habitat. Mist netting at the Bayou Creek site produced no captures during either night of sampling. Two nights of sampling at the Barr Creek site yielded only one red bat (*Lasiurus borealis*) and minimal bat activity throughout each night. Although bat activity along Canoe Creek was evident via electronic bat detection throughout most of the evening during both sampling nights, this site produced just one big brown bat (*Eptesicus fuscus*) and one red bat capture. In contrast, the Green River tributary site was quite productive with regards to number of individuals and number of species captured on both sampling nights. Collectively, 30 bats representing six species were netted, including: 14 big brown bats, 6 red bats, 4 unidentified escapees, 3 evening bats (*Nycticeius humeralis*), 1 northern myotis (*Myotis septentrionalis*), 1 eastern pipistrelle (*Pipistrellus subflavus*), and 1 Indiana bat (*Myotis sodalis*).

The Indiana bat captured on the evening of July 11, 2002 was identified as an adult lactating female weighing approximately 7.5g. Based on this evidence, it is concluded that Indiana bat summer maternity colony habitat exists within the bottomland floodplain woods and/or adjacent upland woods (Wolf Hills) south of the Ohio and Green Rivers in Henderson County, Kentucky. The female Indiana bat was captured approximately 4,500 feet due east from the center of what was originally the 2,000' wide Corridor H. Subsequent movement of this corridor to the west places Alternative 2 approximately 7,000 feet (1.3 miles) from the capture site. The alignment of Alternative 3 is roughly 2 miles southeast of the capture site.

As currently proposed, Alternative 2 would cross the Ohio River at mile point 785 and follow along the western edge of a Texas Gas pipeline easement across an agricultural field, a bottomland wetland woods, and ascend through a relatively open upland woods before crossing a small ridge line. The section of Alternative 2 that traverses the farm fields and the wetland woods is proposed to be elevated on piers above the floodplain, but would still require the removal of all woody vegetation within the estimated 176 feet right-of-way. At or near the base of the upland woods, Alternative 2 would be constructed on the ground, with cut and fill expanding the anticipated right-of-way to approximately 450 feet. A preliminary review of the landscape and inclusive resources for this section of Alternative 2 revealed that several components considered favorable for Indiana bat nursery colonies exist (i.e., relative isolation, trees with sloughing bark). Although the Indiana bat was not collected along Canoe Creek in Kentucky or along Bayou Creek and Barr Creek in Indiana as a part of this study, this result should not be misinterpreted as evidence that the species does not or could not occur within suitable habitat associated with these resources.

In response to positive evidence of Indiana bat maternity site habitat within the project study area, informal consultation with the USFWS Frankfort office was initiated to discuss the appropriate course of action concerning impacts and possible mitigation. The USFWS recognizes that critical habitat for the Indiana bat does not exist within the I-69 project study area and is therefore not an issue for the project. However, according to Section 9(a)(1)(B) of the Endangered Species Act of 1973, it is unlawful for any person subject to the jurisdiction of the United States to take any such species within the United States or the territorial sea of the United States. Section 3(19) of the Act defines “take” to mean harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. With regards to concerns involving “take” of individuals (especially maternity colony sites) during construction, the USFWS recommends that a seasonal restriction be imposed on the clearing of any suitable maternity colony roost trees so as to avoid the inadvertent “take” of this species. Such a seasonal restriction would prohibit the cutting of potential roost trees between March 31 and October 15. Based on the assumption that maternity roost habitat may potentially occur throughout the project study area, this clearing restriction should apply to all woodland areas associated with each of the proposed alternatives. In the event that the restriction for clearing maternity roost trees cannot be accommodated for construction, it would likely become necessary for a qualified biologist to prepare a Biological Assessment detailing anticipated impacts to the habitat, and, if appropriate, FHWA will request formal consultation with the USFWS. Upon receiving and evaluating the request, the USFWS would complete formal consultation and issue a biological opinion.

In addition to the avoidance of “take”, the USFWS requires that any lost Indiana bat maternity roost habitat within and adjacent to the Ohio River and Green River floodplains be mitigated through creation of replacement habitat at an appropriate site. Recommended tree species for planting as mitigation habitat include, but are not restricted to: shagbark hickory, shellbark hickory, swamp chestnut oak, and swamp white oak. Continued informal consultation is expected to be on-going throughout the project development process.

Gray Bat (*Myotis grisescens*)
USFWS Endangered
IDNR Endangered
KDFWR Endangered

In their April 1, 2002 letter the U.S. Fish and Wildlife Service (see **Appendix B-1**) acknowledges that “there are no records of this species in or near the project study area, however there are several records along the Ohio River.” USFWS goes on to state that “the presence of a summer colony near the project study area is unlikely, however presence of foraging bats from a distant colony cannot be ruled out." The gray bat was not among the six species captured as a result of mist netting efforts at the two locations in Indiana and the two locations in Kentucky previously described for the I-69 project (see Indiana bat section). Furthermore, field observations along each of the proposed alternatives did not note any caves or cave-like structures that could serve as suitable gray bat summer maternity colony sites or winter hibernacula. Based on the results of this study and a review of relevant literature, the occurrence of individual males within the project study area portion of the Ohio River Valley is possible, but not probable given the distance from the Mitchell Plain and Crawford Upland of south-central Indiana, where the species is most commonly found. Species studies indicated that the project would have no adverse effect to gray bat populations or individuals. Continued informal consultation is expected to be on-going throughout the project development process.

Bald Eagle (*Haliaeetus leucocephalus*)
USFWS Threatened
IDNR Endangered
KDFWR Endangered

There has been no critical habitat designated for the bald eagle within the project study area portions of Posey, Vanderburgh, and Warrick Counties in Indiana, or for Henderson County, Kentucky. In assessing potential effects to bald eagle breeding habitat for the project study area, each of the proposed Build alternatives were screened for a distance of approximately one mile on either side of the alignment. Because none of the alternatives encounter or are within the tertiary zone of any large lakes or reservoirs, the principal focus of the assessment shifted to suitable habitat that may exist along the Ohio and Green Rivers. Alternative 1 crosses the Ohio River near the southernmost end of the Vanderburgh County oxbow and on the southwest side of Henderson. The Indiana side is dominated by floodplain agricultural land and has a shoreline with a very thin and fragmented treeline between Old Henderson Road and the river. This area also supports clusters of river camps both up-river and down-river of the proposed crossing. On the Henderson side of the Ohio River, land use in the immediate vicinity of Alternative 1 is principally residential and commercial, including Henderson's wastewater treatment plant. This alignment does however cross the northern tip of Henderson Island, a 7,400 by 1,400 feet wooded island that splits the Ohio into two channels of unequal width, the narrower channel being on the Henderson side. A second, smaller wooded island (5,700 by 1,000 feet), Deadmans Island, is situated approximately 7,700 feet down-river of Alternative 1 and 1A. There is also a 4,500 feet stretch of wooded shoreline associated with the mouth of Canoe Creek, across from the western end of Henderson Island, which begins approximately 2,600 feet down river of Alternatives 1 and 1A. Although these areas display characteristics commonly associated with bald eagle nesting habitat, currently none of them support the tell-tale large platform nest of this species. Given the spatial orientation of Henderson Island and the Canoe Creek woodland relative to development in Henderson, and given the fact that far better breeding habitat appears to exist within the isolated setting of the Sloughs WMA seven to eight miles to the west of Henderson Island, the probability of bald eagles utilizing this habitat for breeding and the rearing of young in the future is considered low.

Alternative 2 crosses the Ohio River south of Evansville approximately 4,000 feet down-river from a river terminal. South of the levee and I-164, land use is exclusively floodplain agriculture. The northern banks of the river support a number of river camps with very few scattered mature trees. The southern banks of the river also support a number of river camps with only minimal tree cover downstream of the proposed crossing. Approximately 1,700 feet up-river of the proposed alignment and just west of the Green River confluence, a wider section of contiguous woodland exists along the southern banks. Although this short stretch of riverbank displays marginal bald eagle habitat, the presence of barges moored for repairs at the mouth of the Green River establishes an intrusion that is perceived to make this location less desirable as a potential nesting site. As of 2002, no bald eagles or nests were observed along the Ohio River in the vicinity of this proposed alignment.

Alternative 3 crosses the Ohio River between Evansville and Newburgh in Indiana, approximately 1,000 feet east of Angel Mounds State Historic Site. Although there are a number of high-density residential neighborhoods within close proximity of the Ohio River on the Indiana side, the northern shore of the river possesses a continuous band of woodland ranging from 150 to over 700 feet wide from approximately 4,000 feet up-river to 7,500 feet down-river of the proposed crossing. This includes a thin, two mile long landform (within Kentucky) known as Threemile Island. Furthermore, the 6,300+ feet long southern boundary of Angel Mounds State Historic Site along the back side of Threemile Island creates additional isolation for this section of the river. Along the southern shoreline of the Ohio River, a continuous band of woodland up to 300+ feet in width exists for more than a mile up and down-river of the proposed crossing. Land use on the back side of this narrow woodland strip is exclusively floodplain agriculture all the way to the Green River. Alternative 3 crosses the Green River at approximately mile point 3.2 where both riverbanks possess a thin tree line up-river and down-river of the proposed crossing. A row of river camps along a gravel road also exists immediately south of the riverbank. Although bald eagle habitat suitability at the Alternative 3 crossing of the Green River is considered very low, there does exist a 6,600+ feet linear cypress slough that parallels the Green River roughly 4,500 feet to the northwest of the alignment that possesses characteristics generally regarded as favorable for bald eagle habitation. Nonetheless, as of 2002 no bald eagles or nests were observed along the Ohio River or the Green River in this vicinity. Species studies indicated that the project would have no adverse effect to bald eagle populations or individuals. Continued informal consultation is expected to be on-going throughout the project development process.

American Burying Beetle (*Nicrophorus americanus*)
USFWS Endangered
IDNR Endangered
KSNPC Historic

Accounts of the American burying beetle in Evansville (Vanderburgh County, Indiana) and Henderson County (Kentucky) date back to 1927 and 1921 respectively. The most recent (1965) account of the species from southern Indiana was documented in Posey County. The species is currently considered extirpated from both Indiana and Kentucky. Because the American burying beetle is a habitat generalist, with a slight preference for grasslands and open understory oak hickory forests, assessment of the effects of the I-69 proposed alternatives on this species' preferred habitat is not possible. Nonetheless, since no individuals were identified during field studies and since the species currently appears to be extirpated from Indiana and Kentucky, it is concluded that none of the proposed alternatives would have an adverse impact upon the American burying beetle. Species studies indicated that the project would have no adverse effect to American burying beetle populations or individuals. Continued informal consultation is expected to be on-going throughout the project development process.

Fat Pocketbook Mussel (*Potamilus capax*)
USFWS - Endangered
IDNR – Endangered
KDFWR - Endangered

The Indiana Natural Heritage Program database system includes several accounts of the species from the Wabash River in Gibson and Posey counties dating from 1976 to 1995. The single record of the species from the Ohio River in Kentucky's Natural Heritage Program database is based on a pre-1957 museum record listing Evansville as the location. A single unverified report of the fat pocketbook from the Green River by Williams (1969) is believed to actually be a mislabeled specimen of *Potamilus purpuratus* Lamarck (*Proptera purpurata*) or bleufer. Cicerello *et al*. (1991) describe the Kentucky distribution of the fat pocketbook as "the Ohio River from the Wabash River, Union County, downstream to Ballard County (KNP), and the extreme lower Cumberland River, Livingston County."

Qualitative sampling for mussels along the south bank of the Ohio River crossing for Alternative 1 and 1A (river mile 805.7) yielded 282 live unionids representing 14 species and an additional two dead individuals of two different species for a total of 16 species. Similar sampling along the south bank of the Ohio River at the Alternative 2 crossing (river mile 785) produced 329 live individuals representing 12 species. Four weathered dead shells representing an additional four species were recovered from the Alternative 2 site as well. One-half hour of qualitative sampling on the north and south banks of the Ohio River at the Alternative 3 crossing (river mile 780.2) yielded no unionids. Nineteen quantitative samples at the Alternative 3 Green River crossing produced just one live unionid and weathered dead shells representing two additional species. Collectively, twenty species of unionids (17 live and 3 species of which only dead individuals were recovered) were identified from the Ohio River sampling along Alternatives 1 and 1A and 2 and the Green River sampling along Alternative 3. Neither the fat pocketbook mussel, nor any other federally listed species were included among those collected.

Through informal consultation, the USFWS conveyed that their primary concern for the I-69 study focused on potential direct or indirect impacts to mussel beds and incidental take of individual listed species in the Ohio and/or Green Rivers. Specifically, pier design and placement, pier construction activities, and bank stabilization were concerns the USFWS feel warrant mitigative controls to protect listed species and habitat at any of the proposed alternative bridge crossings. It is recommended that consideration be given to pier design and placement to minimize scour and that the changing flow of water off the pier not promote sediment deposition upon mussel beds downstream of the bridge crossing. The USFWS is cognizant of the fact that the proposed bridge type and specific location of piers within the Ohio and Green Rivers is not currently known, but cautions that a second detailed mussel investigation focusing on specific pier locations would likely need to be conducted at a later date in the project development process. Once pier locations for the selected alternative are known and the extents of streambed disturbance have been established for the construction technique to be employed, a follow-up survey prior to construction would be warranted to verify that no mussel beds containing federally endangered or threatened species exist within the zone of impact on the river bottom and/or avoid the incidental take of an isolated individual(s) that might occur outside of a mussel bed, but within the pier footprint. The purpose of such a pre-construction survey is to assure the USFWS that the specific area of impact has been intensely investigated and to provide a means of identifying a listed mussel species that may have migrated into the bridge alignment in the intervening time between the initial study for the EIS and construction. The USFWS also feels that bank stabilization during and after construction is key to avoiding adverse indirect effects involving silt deposition upon mussel beds. Species studies indicated that the project would have no adverse effect to fat pocketbook mussel populations or individuals. Continued informal consultation is expected to be on-going throughout the project development process.

USFWS Section 7 Consultation

Because the I-69 project involves two USFWS regions (Region 3 for Indiana and Region 4 for Kentucky), early coordination for the project included contact with the Bloomington, Indiana office (Region 3) and the Cookeville, Tennessee office (Region 4). Coordination with the USFWS office in Bloomington identified five species of concern for the project study area (see **Appendix B-1** for copy of April 1, 2002 letter.) The USFWS Cookeville office, in a communication to the FHWA, identified two species that would be subject to Section 7 review. Collectively, five federally listed species were identified by the two field offices for evaluation with regards to potential affect resulting from the I-69 project. During the course of project development, a new USFWS office in Frankfort, Kentucky was made operational and designated as the primary contact (lead) through which all subsequent Section 7 coordination on the DEIS would be conducted. **Based on this study, it has been concluded that the project would have no adverse effect on federally listed threatened and endangered species given that specific mitigative measures are incorporated into the project.** Such measures include prohibiting the cutting of potential Indiana bat roost trees between March 31 and October 15, as well as additional mussel surveys at specific pier locations prior to construction. **Coordination in the form of informal consultation with the USFWS on March 12, 2003 (Appendix C-6) indicated that formal consultation would not be required for this project to fulfill the Section 7 requirements of the Endangered Species Act.** Continued informal consultation with the USFWS following publication of the DEIS and development of the FEIS will assure that mitigation measures included in the FEIS are implemented at construction.

Analysis – State Listed Species

Evening Bat (*Nycticeius humeralis*)
IDNR – Endangered
KSNPC – Threatened

On the evening of August 2, 2002, three male evening bats were captured along a Green River tributary in Henderson County, Kentucky along with five other species of bat. This Ohio/Green River floodplain area consists of row crops, pastureland, bottomland woods, wetlands, sloughs, and adjacent upland woods and agricultural habitat to the south. The capture of three males is consistent with previous observations by Whitaker and Gummer (2001) which suggest that males may be more common in the southern part of Indiana during the maternity season. The trees of pastures and woodlands within the Ohio and Green River floodplain crossed by Alternatives 2 and 3 are potential roosts for these males. This habitat is abundant throughout this portion of the floodplain. While there were no barns or abandoned buildings within or in close proximity to Alternatives 2 and 3 within the floodplain where the three males were captured, elsewhere along each of these alignments in Kentucky, a few such structures were noted. None of these appear to be currently utilized by evening bats. Although no evening bats were captured at any of the three mist netting sites along Alternative 1 and/or 1A, habitat in the form of woods associated with pastures was identified at several locations. The occasional barn, or barn-like structure occurs within the alignment of Alternative 1 and/or 1A, but as with Alternatives 2 and 3, they do not appear to be utilized by evening bats.

Masked Shrew (*Sorex cinereus*)
IDNR – not listed
KSNPC – special concern

A single masked shrew was captured as part of the I-69 field studies within a deciduous floodplain wetland just west of the Texas Gas pipeline easement adjacent to Alternative 2 in Henderson County, Kentucky. Locally, the site displayed a fair amount of downfall with ground cover that was somewhat intermittent but complete where found. The habitat of which this individual was captured is relatively common within the extensive floodplain forest between Wolf Hills and the Ohio River. Alternative 2 would be elevated on piers through this area and therefore not impede movement of the species within the floodplain. No significant adverse effect to the species or its habitat is anticipated from the proposed action.

Great Blue Heron (*Ardea herodias*)
IDNR – Endangered
KSNPC – Threatened

An occasional great blue heron was observed in flight or standing in water, possibly feeding, in Vanderburgh and Posey Counties during the I-69 field studies in 2002. However, there were no colonies or nesting sites noted within or in close proximity to any of the alternatives evaluated as part of this study. Marginal potential habitat for great blue heron exists on Henderson Island and Deadman's Island in the Ohio River where Alternatives 1 and 1A cross from Indiana to Kentucky. Additional available habitat for breeding colonies is also possible in the cypress sloughs south of the Ohio and Green Rivers in Henderson County, although neither is currently utilized by great blue herons.

Copperbelly Water Snake (*Nerodia erythrogaster neglecta*)
IDNR – Endangered
KDFWR – Special Concern

There are 24 occurrence records in the Indiana Natural Heritage Program database for Posey, Gibson, Vanderburgh, and Warrick counties. The majority of these accounts are from Hovey Lake Fish and Wildlife Area in southwestern Posey County, the middle portion of Pigeon Creek in Warrick County, Black River in Gibson County, and the Cypress Slough area of southeastern Posey County. For the most part these accounts are far removed from any of the proposed alignments under consideration for the I-69 project. There is, however, a single undated record of the species from the largely agricultural landscape of the Union Township bottoms in southwestern Vanderburgh County. The alignment of Alternatives 1 and 1A cuts across the bottoms in a north-northwesterly direction. There appears to be very little suitable habitat within the interior of this oxbow region of the Ohio River due to a general lack of woody or herbaceous cover. The wetlands associated with Bayou Creek along the northern edge of the bottoms and the adjacent wooded upland habitats to the north appear to offer the best potential habitat for the species within the vicinity of Alternatives 1 and 1A in southern Vanderburgh County. The preliminary design for this alignment indicates that the roadway would be elevated for its entire length through the bottoms up to the base of a ridge, some 1,500 feet northwest of Bayou Creek. Such a design would allow for unencumbered movement of species such as the copperbelly water snake within the bottoms. This alignment would, however, require the loss of woody vegetation across a 176 feet section of Bayou Creek and an adjacent wetland to the southeast. As this alignment continues to the west-northwest, it traverses two north-south trending wooded ridges at-grade and passes between two lakes ranging from approximately 15 to 25 acres. The wooded landscape here has been fragmented to some degree by four narrow roads and currently supports several scattered residences. Potential for copperbelly water snake habitat in the Bayou Creek drainage is considered marginal.

Along the south side of I-164 in southeastern Vanderburgh County, the forested wetlands and borrow pits along Eagle Creek between Weinbach Avenue and South Green River Road occur within the proposed interchange area of Alternative 2 and existing I-164. Although this area is surrounded by floodplain and agricultural land to the east and south, Eagle Creek provides a connection between this linear wetland complex and other wetland woods including cypress stands both east and west of US 41. An evaluation of available resources at this site concluded that potential habitat for the copperbelly water snake exists within this stretch of Eagle Creek, although none have previously been documented from within this drainage. Preliminary design indicates that much of the system-to-system interchange between I-164 and Alternative 2 would be elevated on piers above the floodplain, thus allowing free migration throughout the Eagle Creek wetland complex.

The Kentucky Natural Heritage Program database includes nine location records for the copperbelly water snake in Henderson County Kentucky. Many of these sightings are from the Sloughs Wildlife Management Area or wetlands adjacent to the WMA in northwestern Henderson County. There are, however, two accounts within the past 5 years of the species associated with the cypress sloughs and bottomland hardwood wetlands along the south side of the Ohio and Green Rivers east of existing US 41. Coordination with the Sloughs WMA manager revealed that additional research on the southern population by graduate students of Bruce Kingsbury, Ph.D. have verified that the species is established within the sloughs and wetland areas along the Ohio River and Green River. This stretch of the Ohio/Green River floodplain and the adjacent uplands to the south comprise the project study area through which Alternatives 2 and 3 head south and southwest respectively in north-central Henderson County. An assessment of existing habitat in this area indicates that suitable copperbelly water snake habitat appears to be available throughout this portion of the floodplain. The roadway for Alternative 2 would be elevated on piers above the floodplain, thus allowing for free east and west movement of the species through the wetlands and bottomland woods of this region. The upland portion of the alignment would be constructed at ground level (cut and fill) and would pose an obstacle to species moving east-west from one woods to the other. As currently proposed, Alternative 2 follows along the western edge of an easement for a gas pipeline owned by Texas Gas. Clearing of trees from this easement has resulted in fragmentation of a relatively large section of contiguous bottomland floodplain woods and adjacent upland woods. The cleared easement corridor currently consists of heavy and reasonably tall herbaceous vegetation providing concealment for movement of animals from the eastern section of the woods to the west, and vice versa. By running parallel and immediately adjacent to the gas line easement, Alternative 2 would likely more than double the cleared zone through this area, but would keep the fragmentation in one location as opposed to establishing a second fragmentation through a much longer section of woodland to the east or west.

The roadway for Alternative 3 would also be elevated above the extensive floodplain associated with the Ohio and Green Rivers north of Basket, Kentucky. Between the Ohio and Green Rivers, Alternative 3 traverses land cleared of all woody vegetation that is used exclusively for agriculture when hydrologic conditions permit. This area is currently considered to be unsuitable habitat for the copperbelly water snake. On the south side of the Green River, the alignment crosses Green River Road which includes a row of scattered river camp residences and traverses an expansive area that has been cleared of nearly all woodland trees and is currently used for pasture. Roughly 3,200 feet southwest of Green River Road, the floodplain pastureland encounters the base of a moderately steep wooded hillside with additional pastureland above the floodplain continuing on to the southwest. Land clearing activities as well as grazing within the floodplain and upland pasture have eliminated much of the available cover that could be used by the copperbelly water snake for concealment from prey. Land impacted by Alternative 3 or within the immediate vicinity does not appear to possess habitat elements favored by the copperbelly water snake.

In consideration of data indicating that the copperbelly water snake inhabits the Ohio/Green River floodplain regions of north-central Henderson County and the potential occurrence within the Bayou Creek drainage in southern Vanderburgh County and Eagle Creek drainage of southeastern Vanderburgh County, informal consultation with the USFWS recommends that appropriate measures be taken to avoid incidental take of the species during construction, including the maintenance of travel corridors through bottomland habitat. Field personnel will be informed of the potential presence of the copperbelly water snake in these areas and stress avoidance of the indiscriminate “take” of this species.

Spottail Darter (*Etheostoma squamiceps*)
IDNR – Endangered
KSNPC – not listed

The biological survey for fish produced a single individual spottail darter from Sanders Creek at Schissler Road. This collection site is approximately 1,500 feet downstream of the proposed Alternative 1 and 1A crossing of Sanders Creek. There are no adverse impacts anticipated to this species or its habitat within Sanders Creek as a result of bridging the stream.

Green Flatsedge (*Cyperus pseudovegetus*)
IDNR – Rare
KSNPC – not listed

The green flatsedge was identified from just one location in Kentucky, which incidentally is not the state within which it is listed as rare. The species occurs locally in the floodplain emergent wetland within the Texas Gas easement, roughly 2,500 feet south of the Ohio River in the immediate vicinity of the Alternative 2 alignment. Its abundance was noted as sparse.

Northern Catalpa (*Catalpa speciosa*)
IDNR – Rare
KSNPC – not listed

The inventory of plant species for the I-69 study noted several northern catalpa trees at upland (e.g. Schissler Road) and bottomland (e.g. Bayou Creek) locations in Indiana, as well as between the Ohio River and Green River Road in Kentucky. There are a few individual trees identified with the alignment that would be cleared as a result of Alternatives 1 and 1A.

Bald Cypress (*Taxodium distichum*)
IDNR – Threatened
KSNPC – not listed

A few large naturally occurring bald cypress were identified within a wetland woods along the south side of Eagle Creek, roughly midway between Weinbach Avenue and South Green River Road. The alignment for the Alternative 2 interchange with I-164 would avoid this wetland woods. However, there is also a large isolated individual bald cypress at the edge of the middle borrow pit south of Eagle Creek which is within the alignment assessed for the Alternative 2 interchange ramps. Several other small bald cypress have been planted along the edge of the borrow pits of this area as well. Bald cypress identified within or immediately adjacent to any of the alignments in Kentucky were limited to those that had been planted on a nursery or tree farm between the Breathitt Parkway and an Elam Ditch tributary. The proposed interchange between the parkway and Alternatives 2 and 3 has the potential to impact some of these planted bald cypress. An occasional small bald cypress was also noted along the perimeter of ponds encountered by Alternatives 1 and 1A in Indiana as well.

Summary

Coordination with the U.S. Fish and Wildlife Service identified five federally listed species of concern within the I-69 project study area. These included the Indiana bat, gray bat, bald eagle, American burying beetle, and fat pocketbook mussel. Additionally, no critical habitat was identified in the project study area. Field studies for I-69 produced a lactating female Indiana bat within the Ohio/Green River floodplain woods north of Wolf Hills in Kentucky, evidence that a nursery colony was established in the vicinity of the alignments of Alternatives 2 and 3. Informal consultation with the Service indicates that efforts to avoid “take” of individuals through seasonal tree clearing restrictions and mitigation of preferred roost habitat loss through replacement would be appropriate for the project. Species studies indicated that the project would have no adverse effect to gray bat, bald eagle, American burying beetle, or fat pocketbook mussel populations or individuals. The Service does however request that a follow-up pre-construction study for federally listed mussel species be conducted at identified pier location sites within the Ohio and/or Green River once a bridge design has been developed.

Coordination with the Indiana Department of Natural Resources including a search of the Natural Heritage database indicated that there are previous records for 47 state listed species within the I-69 project study area. Similar coordination with the Kentucky Department of Fish and Wildlife Resources and the Kentucky State Nature Preserves Commission produced project study area records for 32 species in Kentucky. I-69 field studies identified seven state listed species from within or near the alignments. These included the evening bat, masked shrew, great blue heron, spottail darter, northern catalpa, bald cypress, and green flatsedge. The copperbelly watersnake is also a state listed species for both Indiana (endangered) and Kentucky (special concern). It is known to occur within the floodplain forested wetlands along the Ohio and Green Rivers of Henderson County. Alternatives 2 and 3 traverse this habitat, but are not assessed to result in an adverse impact to the species since these areas would be bridged using pier supports.

5.14 FLOODPLAIN IMPACTS

Introduction

Floodplains are a vital part of the river or stream ecosystem. They act as flood buffers, water filters, nurseries, and are major centers of biological life in the river or stream ecosystem. They are important for maintenance of water quality as they provide fresh water to wetlands and backwaters, dilute salts and nutrients, and improve the overall health of the habitat of many species of birds, fish, and plants. They are important biologically as they represent areas where many species reproduce and are important for breeding and regeneration cycles.

A floodplain is defined as the area around a stream or river that frequently floods during heavy rain. The Federal Emergency Management Agency (FEMA) 100-year floodplain was analyzed for this project. This is the area around the streams and rivers that will be under water whenever the 100-year storm occurs. Floodplains are composed of two general areas, shown in **Figures 5-24** and **5-25**. The first area is the floodway, which is the channel of a river or stream and those portions of the floodplain adjoining the channel which are reasonably required to efficiently carry and discharge the peak flow of the regulatory flood (100-year flood) of any river or stream. The second area is the remaining area of the floodplain, which is often referred to as "backwater". This "backwater" area is essentially a holding area providing storage of floodwater. This project will not significantly impact the floodway of any streams or rivers located within the alternatives.

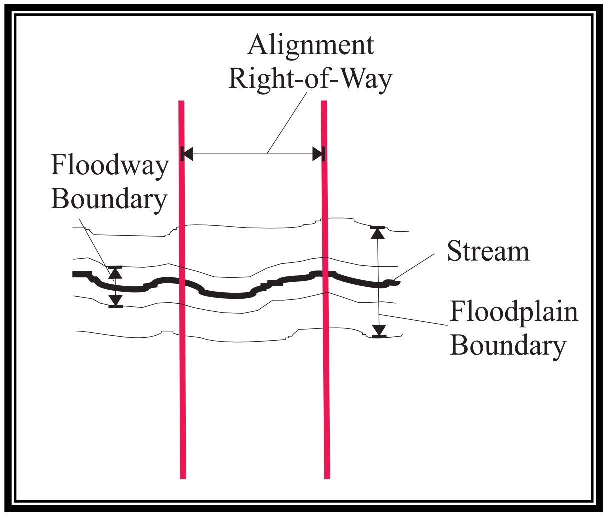


Figure 5-30: Upland Woods Crossed by Alternatives 1 and 1A

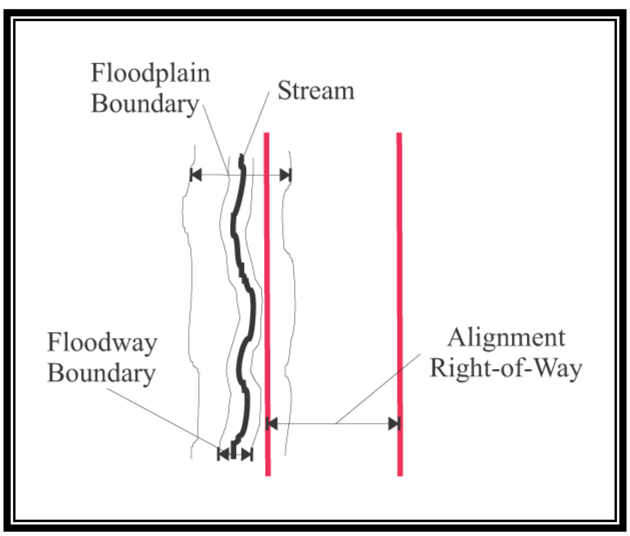


Figure 5-25: Longitudinal Floodplain Encroachment

Projects that directly cross or are adjacent to a stream or river will have some type of floodplain encroachment. When an alternative crosses perpendicularly over a stream or river, it is referred to as a transverse floodplain encroachment, demonstrated in **Figure 5-24**. Likewise, when a project is located adjacent and parallel to a stream or river it is referred to as a longitudinal floodplain encroachment, demonstrated in **Figure 5-25**. The I-69 project has both transverse and longitudinal floodplain encroachments. Because a transverse floodplain encroachment has a higher probability of affecting the floodway of a stream or river, transverse floodplain encroachments have a greater overall impact than longitudinal floodplain encroachments, with the exception of longitudinal encroachments that impact the channel or floodway. For the Kentucky portion the No-Rise Certification will be received prior to construction. For the Indiana portion the Construction in a Floodway Permit will be received prior to construction assuring that the design conform to state regulations.

Methodology

The approximate linear feet of each floodplain crossed by each of the four alternatives was derived from measuring the approximate length of floodplain crossed by the alternative's centerline or right-of-way depending on the type of encroachment. The floodplain data came from FEMA, Flood Insurance Rate Map (FIRM) panels, and the associated electronic Q3 Flood Data, with the approximate bounds of the 100 Year Floodplain used for analysis.

The floodplain impacts were split into two different categories (1) floodplains with a transverse encroachment (alignment goes across the stream or river); and (2) floodplains with a longitudinal encroachment (alignment is located adjacent to the stream or river, but never crosses it). In general, the transverse floodplain encroachments will have a greater potential for floodplain impacts than the longitudinal encroachments because the transverse encroachments have a much greater chance of affecting the floodway. However, some longitudinal impacts identified in the evaluation also include a crossing of the main channel which would also potentially impact the floodway.

In addition, each floodplain encroachment within the alternative's right-of-way was analyzed to identify the potential amount of acres that may be impacted in each of the four alternatives. The Federal Emergency Management Agency (FEMA) Q3 Flood Data layer was used for this calculation. The right-of-way for each alternative ranged from approximately 300 to 500 feet. These areas did not include floodplain encroachments located within the existing I-164 right-of-way.

Analysis

Figure 5-26 depicts the FEMA-defined floodplains in the study area. The four alternatives were compared for (1) transverse floodplain encroachments measured in linear feet, (2) longitudinal floodplain encroachments measured in linear feet, and (3) potential floodplain acres to be impacted measured within the alternatives' right-of-way, excluding the areas within the existing I-164 right-of-way. **Table 5-28** shows the summary of the analysis results.

Table 5-28: Potential 100-Year Floodplain Impacts

Alternative	Transverse length (ft)	Longitudinal length (ft)	Total length (ft)	Area (acres)
1	48,531	19,745	68,276	481
1A	54,223	22,708	76,931	521
2	22,165	14,931	37,096	440
3	24,951	16,627	41,578	352

Source: FEMA Q3 Flood Data

FEMA, FIRM, and the associated electronic Q3 Flood Data have been evaluated to estimate potential floodplain impacts of the various alternatives being considered for this project. All Build alternatives being considered entail a crossing of the Ohio River, the major drainage for the entire project study area, as well as the majority of both the states of Indiana and Kentucky. The Green River, a major tributary of the Ohio River which drains a large portion of Central Kentucky, will be crossed only by Alternative 3. Both the Ohio and Green Rivers have locks and dams operated and maintained by the US Army Corps of Engineers (USACE) for flood protection and navigation.

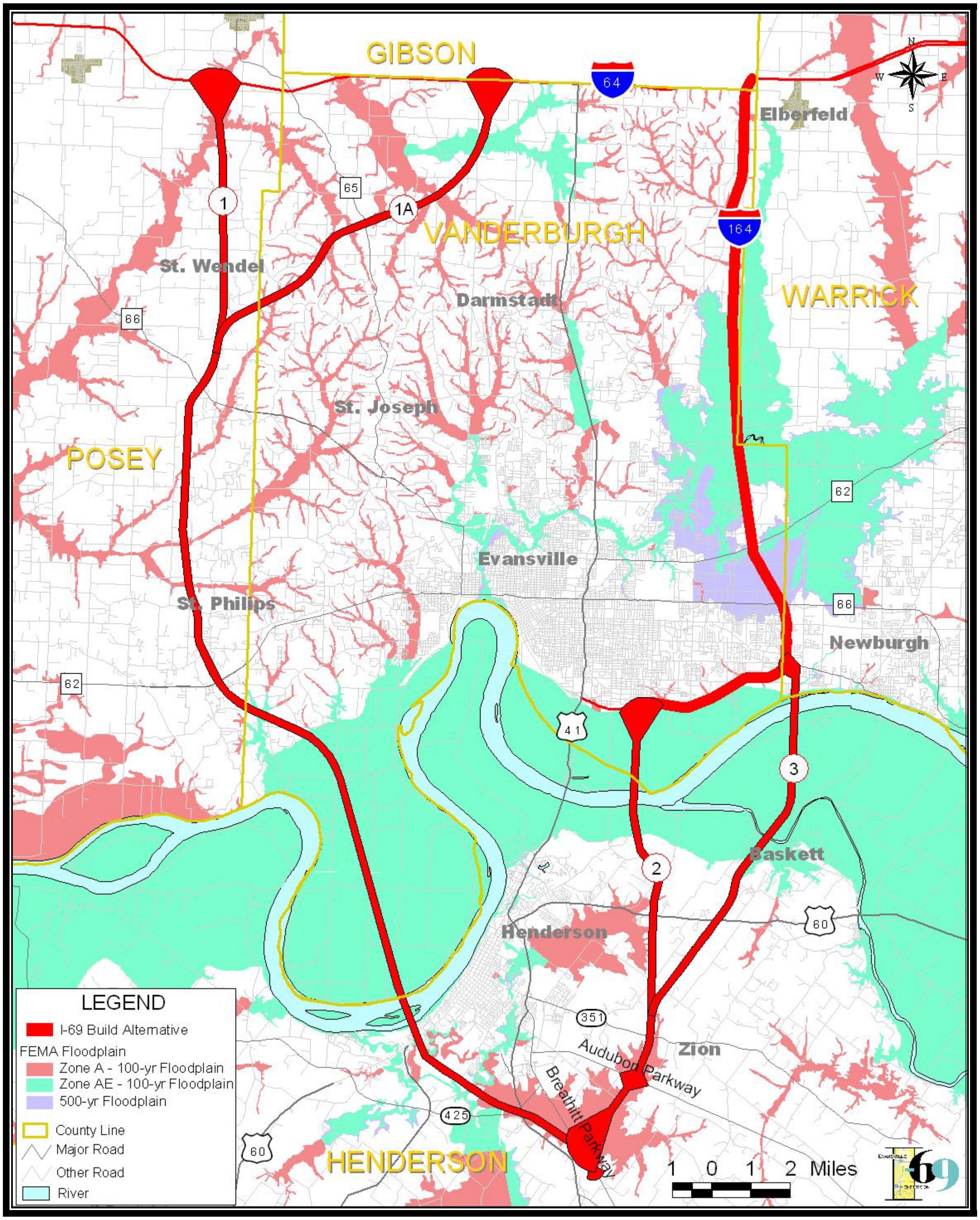


Figure 5-26: Federal Emergency Management Agency (FEMA) Floodplains

The Newburgh Lock and Dam is located at river mile 776 with a normal pool elevation of 342 feet above mean sea level (MSL) below the dam and 347 feet above MSL above the dam. The Uniontown Lock and Dam is located at river mile 845.89 with a normal pool elevation of 342 feet above MSL above the dam and 324 feet above MSL below the dam. The entire project study area is included within the section of the river between these dams where the normal pool elevation is 342 feet. The 100 year flood elevations reported on the FIRM panels for this area range from approximately 374 feet where Alternatives 1 and 1A enter the floodplain on the north side to approximately 382 feet just upstream of the Alternative 3 crossing location. The floodplain ranges in width through this area from approximately 3.3 miles in the vicinity of Alternative 2 between the mouth of the Green River and Horseshoe Bend to approximately 8.0 miles in the vicinity of Alternatives 1 and 1A where the floodplain encompasses the entire oxbow peninsula of southwestern Vanderburgh County, Indiana.

Alternatives 1 and 1A cross the Ohio River at river mile 805.75. At this location the main channel of the river is approximately 3,900 feet wide incorporating Henderson Island, which will also be crossed by these alternatives. Alternatives 1 and 1A cross 8.02 miles (42,360 feet) of Ohio River Floodplain, nearly all of which is in the oxbow area of Vanderburgh County, Indiana. Flood elevations across this section of floodplain range from just over 376 feet where the alternatives cross the main channel near Henderson to just below 374 feet where the alternatives come out of the floodplain on the north end. Nearly all of this length of floodplain impact is generally perpendicular to the flow patterns. However, on the north end of the floodplain crossing, the alternatives make a bend to the northwest just before they exit the floodplain, which puts the alignment at a more defined skew to the flow patterns. The current plan for all alternatives is to bridge the entire Ohio River Floodplain to reduce floodplain and associated impacts.

Alternative 2 crosses the Ohio River at river mile 785.05. At this location, the main channel is approximately 1,990 feet wide. Alternative 2 crosses 2.59 miles (13,693 feet) of Ohio River Floodplain, not including the interchange with existing I-164, which will be entirely within the Ohio River Floodplain. Approximately 1.46 miles (7,700 feet) of the impacts will be in Henderson County, Kentucky including the main channel itself and a portion of Green River Island on the north bank of the river. The remaining 1.13 miles (6,000 feet) and the interchange with I-164 are in Indiana. The entire length of new construction for this alternative in Indiana will be in the Ohio River Floodplain. The 100 year flood elevation is approximately 379.5 feet at this crossing location. The floodplain crossing is generally perpendicular to the flow patterns with the exception of the ramps for the interchange with existing I-164, which are within the floodplain. As stated previously, the current plan is to bridge the entire Ohio River Floodplain.

Alternative 3 crosses the Ohio River at RM 780.22. At this location the main channel is approximately 2,300 feet wide. Alternative 3 crosses 4.65 miles (24,537 feet) of Ohio River Floodplain, which incorporates the Green River Floodplain as well in this area. Nearly all of these floodplain impacts will be in Kentucky. Alternative 3 crosses the Green River at river mile 3.25. At this location the main channel of the Green River is approximately 300 feet wide. The 100 year flood elevations at this crossing location range from approximately 381.3 feet on the north side to just below 381 feet south of the Green River. The northern 2.6 miles of the floodplain crossing is generally perpendicular to the flow patterns. However, the southern portion of the crossing makes a bend to the southwest to cross the main channel of the Green River perpendicularly, but this approximately 2 mile portion of the alignment is at a skew to the flood flow patterns.

Other large floodplain encroachments include longitudinal encroachments to the Elam Ditch floodplain on Alternative 1 and 1A and of Elam Ditch and tributaries on Alternatives 2 and 3. The impacts broken down by alternative are presented in **Appendix C-7**.

Summary

The overall results of the floodplain analysis show that Alternative 3 has the potential to impact the least total area of floodplains compared to the other alternatives. However, the linear length of impacts for Alternative 3 are slightly higher than that of Alternative 2. This discrepancy is largely due to the fact that the interchange with existing I-164 and Alternative 2 is located completely within the Ohio River Floodplain, incorporating significantly higher area than the typical linear impacts. This analysis also showed that Alternative 1A has the highest amount of potential floodplain acres as well as linear impacts within the right-of-way. Alternative 1 also has considerably more length crossing floodplains than Alternatives 2 and 3. The higher impacts for Alternatives 1 and 1A are due to the considerably longer construction length as well as Ohio River floodplain crossing which is nearly twice as long as either of the eastern Alternatives. This analysis does not take into consideration the amount of floodplain areas located within the existing I-164 right-of-way. No modifications are planned for the portion of existing I-164 that will be utilized for Alternatives 2 and 3, but this section does have significant crossings of the floodplains of Pigeon Creek and Bluegrass Creek and their tributaries.

5.15 WETLANDS IMPACTS

Introduction

Wetlands are very important ecosystems which are instrumental in primary production and nutrient transport, and function as wildlife breeding and foraging habitat, sanctuaries for animals, hydrological support for adjacent ecological communities, storm/flood storage and peak reduction, groundwater recharge, and water purification. Wetlands are those areas that are inundated or saturated by surface or ground water 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. Wetlands generally include swamps, marshes, bogs and similar areas.

Wetlands that are under United States Army Corps of Engineers (USACE) jurisdiction must meet three wetland parameters including hydrophytic vegetation, hydric soils and wetland hydrology. In addition, the wetland must be connected to or adjacent to a water course displaying an ordinary high water mark which is connected to other waters of the United States.

Wetlands meeting the three parameters (soils, vegetation and hydrology) but not connected to or adjacent to other waters of the US do not fall within the jurisdiction of the USACE and are identified as isolated.

Final USACE jurisdiction determinations are made on a case by case basis by the USACE prior to permitting. Jurisdictional determinations presented in the DEIS are based on the interpretation of parameters identified in the field initially identified by National Wetland Inventory (NWI) maps.

Numerous open water wetlands in the form of ponds and lakes are scattered throughout the I-69 project study area landscape. These open water resources are of various size and form, but are typically created through the construction of dams and dikes across intermittent headwater streams or shallow swales, excavation of depressions in upland or bottomland terrain, or a combination of both. Ponds and lakes encountered within the alignments for the I-69 alternatives displayed various morphological characteristics resulting from their type of creation, size, surrounding land uses, age, and current stage of succession.

In general, farmed wetlands (FW) and farmed wetland pastures (FWP) are designated areas that were partially drained or altered to improve crop production before Swampbuster was enacted as part of the December 23, 1985 farm bill. Swampbuster is the wetlands conservation provision of the farm bill requiring agriculturalists to protect wetlands on lands they own or operate in order to maintain eligibility for USDA program benefits. Just as with all other wetland classifications, farmed wetlands and farmed wetland pastures are potentially subject to Section 404 requirements of the Clean Water Act as administered through the U.S. Army Corps of Engineers. Prior converted croplands (PC), wetlands that were drained, dredged, filled, leveled, or otherwise manipulated before December 23, 1985 for use in production agriculture, are not protected by Swampbuster.

Methodology

Wetlands, other than open water ponds/lakes and farmed wetlands, within the alignment for each of the proposed I-69 alternatives were identified using U. S. Fish and Wildlife 7.5 minute National Wetland Inventory (NWI) maps supplemented with field observations. These determinations were made in the field in accordance with the technical guidelines established in the U.S. Army Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory, 1987) based on the multi-parameter approach in which positive evidence of hydrophytic vegetation, hydric soils, and suitable hydrology is required. Areas that displayed a predominance of wetland vegetation and showed primary and secondary signs of hydrology were noted and their area of potential impact estimated on aerial photographs. The appropriate county soil survey was referenced to determine the mapped soil unit for the area and cross-referenced against county hydric soil lists to verify the potential presence of hydric soils at the site. Jurisdictional wetlands encountered along each of the proposed alternatives were not delineated for the DEIS phase of the project. Detailed delineations including documentation using the customary U.S. Army Corps of Engineers wetland determination forms will be completed for the preferred alternative and included in the Final Environmental Impact Statement (FEIS).

Open water pond and lake wetlands were identified and characterized in the field during the reconnaissance (i.e. alignment walking) phase of the I-69 study. The perimeter of each open water site within the alignment was traced over aerial images using CAD software. Subsequently, the total area of the open water area and the area of that portion within the proposed alignment were calculated and inventoried on the tables of **Appendix C-8**. Field delineations of ponds and lakes will be completed for the preferred alternative and included in the FEIS. Preliminary jurisdictional wetland determinations have been made to estimate waters of the U.S. falling under USACE jurisdiction as reported in Table 5-28.

Wetlands traversed by segments of build alternatives on structure are included in the total wetlands acreages. Build alternatives traversing the Green River and Ohio River floodplains would be elevated on piers above the existing ground. As such, it is possible that no fill material would be required within wetlands in these areas, depending on pier placement, and the current hydrology could be maintained under the bridge. Thus, the actual acreage of wetlands displaced by a build alternative will be less than the total acreage within the estimated right-of-way.

The analysis of farmed wetland and farmed wetland pastures was initiated through coordination with the local NRCS offices in Vanderburgh County, Indiana and Henderson County, Kentucky to develop an appropriate assessment methodology for the alignments in each state. Farmed wetlands within the Ohio River and Green River floodplains were determined using flooding elevations at appropriate river mile locations derived from 15 day flooding profiles obtained from the USDA-NRCS for each respective state. Using USGS topographic quadrangle maps, mapped hydric soil units from the county soil survey that are below the 15 day flooding elevation and are currently farmed, were considered as farmed wetlands. In Kentucky, farmed wetland pastures within the Ohio and Green River 100-year floodplains included all land that is comprised of hydric soils that has been cleared for agriculture. Farmed wetland and farmed wetland pasture areas within the footprint of the alignments were subsequently calculated and tallied for each alternative.

Analysis

Figure 5-27 depicts the National Wetland Inventory (NWI) defined wetlands in the study area. **Appendix C-8** inventories the potential impacts to individual wetlands identified within each of the proposed alignments. The tables in **Appendix C-8** inventory the pond/lake wetlands encountered along each of the study alternatives through Henderson, Vanderburgh, and Posey counties. **Table 5-29** summarizes potential direct wetland losses resulting from each alternative.

Alternatives 1 and 1A

Anticipated total wetland impacts for Alternatives 1 and 1A are estimated at 26 to 30 acres and 25 to 29 acres respectively. Potential impacts to forested, scrub/shrub and emergent wetlands were identified at 17 sites totaling 16 to 20 acres for Alternative 1 and at 15 locations totaling 14 to 18 acres for Alternative 1A. Many of these potential impacts involve either small remnant bottomland palustrine forest tracts like those in the Union Township bottoms of southwestern Vanderburgh County, or small, flat, poorly drained areas in the headwater reaches of upland woods. Wetland encroachment at each of these sites is typically one acre or less.

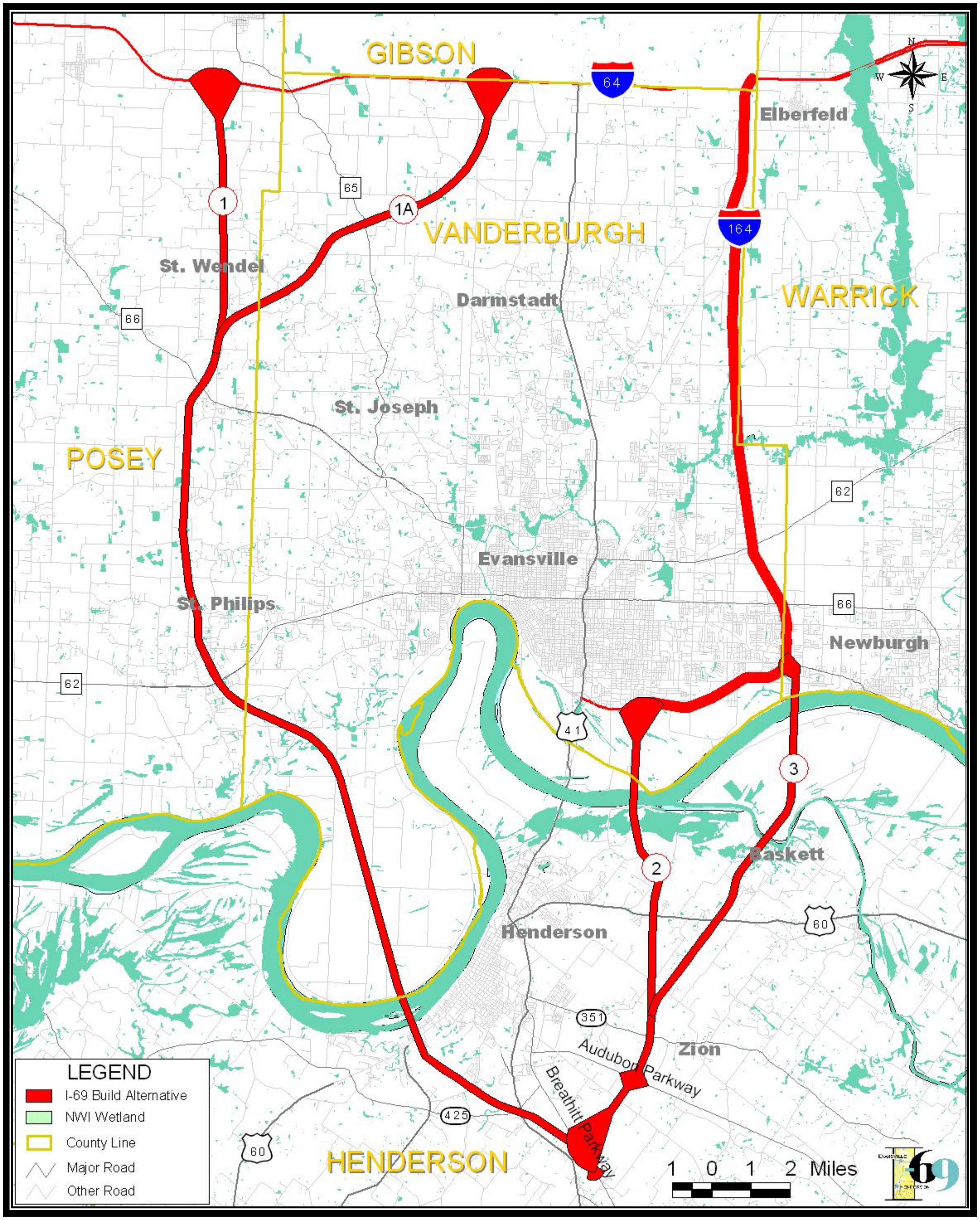


Figure 5-27: National Wetland Inventory (NWI) Wetlands

Table 5-29: Summary of Potential USACE Jurisdictional Wetland Impacts

		Wetland Areas[1]			
	Wetland Type	**Alt. 1 (acres)**	**Alt. 1A (acres)**	**Alt. 2[2] (acres)**	**Alt. 3 (acres)**
Indiana	ponds/lakes	4.90	5.70	8.00	0.00
	emergent	0.30 – 0.60	0.20 – 0.50	0.00	0.00
	emergent & scrub/shrub	1.75 – 2.00	0.00	0.00	0.00
	scrub/shrub	0.00	0.00	0.00	0.00
	forested & scrub/shrub	0.00	0.00	14.50 – 19.00	0.00
	forested	10.05 – 12.60	9.80 – 12.35	0.0	0.00
	farmed wetland and farmed wetland pasture	1.60-2.00	1.60-2.00	0.00	0.00
	Indiana Total	**18.60 – 22.10**	**17.30– 20.55**	**22.50 – 27.00**	**0.00**
Kentucky	ponds/lakes	3.30	3.30	0.80	1.70
	emergent	0.00	0.00	0.60 – 0.85	0.20 – 0.35
	emergent & scrub/shrub	0.10 – 0.25	0.10 – 0.25	0.25 – 0.50	0.00
	scrub/shrub	0.10 – 0.25	0.10 – 0.25	0.00	0.00
	forested & scrub/shrub	0.00	0.00	0.00	0.00
	forested	3.75 – 4.50	3.75 – 4.50	6.00 – 7.25	0.75 – 1.00
	farmed wetland and farmed wetland pasture	0.00	0.00	0.00	33.75-37.25
	Kentucky Total	**7.25 – 8.30**	**7.25 – 8.30**	**7.65 – 9.4**	**36.45 – 40.35**
Indiana & Kentucky	ponds/lakes	8.20	9.00	8.80	1.70
	emergent	0.30 – 0.60	0.20 – 0.50	0.60 – 0.85	0.20-0.35
	emergent & scrub/shrub	1.85 – 2.25	0.10 – 0.25	0.25 – 0.50	0.00
	scrub/shrub	0.10 – 0.25	0.10 – 0.25	0.00	0.00
	forested & scrub/shrub	0.00	0.00	14.50 – 19.00	0.00
	forested	13.80 – 17.10	13.55 – 16.85	8.00 – 9.75	0.75 – 1.00
	farmed wetland and farmed wetland pasture	1.60-2.00	1.60-2.00	0.00	33.75-37.25
	Indiana+Kentucky Total	**25.85 - 30.40**	**24.55 – 28.85**	**30.15 – 36.40**	**36.45 - 40.35**
	USACE Jurisdictional	**22.74 – 27.29**	**20.40 – 24.70**	**29.35 – 35.60**	**35.16 – 39.06**
	USACE Non-Jurisdictional (isolated)[3]	**3.11**	**4.15**	**0.80**	**1.29**

1. Wetland acreage reported for the study represents a maximum potential impact for each alternative. Many of the wetlands, especially farmed wetlands, in the Ohio and Green River floodplains may be bridged with an elevated roadway on piers. Under such a scenario, some wetland functions (i.e., flood storage capacity, wildlife habitat) could be preserved within the right-of-way under the roadway.
2. Wetland acreages reported for Alternative 2 in Indiana are based on total right-of-way for the I-164 interchange which includes wetland areas within the right-of-way that will not likely be impacted by the mainline or ramp construction.
3. Wetlands that are under USACE Jurisdiction must meet three wetland parameters including hydrophytic vegetation, hydric soils and wetland hydrology. In addition, the wetland must be connected to or adjacent to a water course displaying an ordinary high water mark which is connected to other waters of the US. Wetlands meeting the three parameters (soils, vegetation and hydrology) but not connected to or adjacent to other waters of the US do not fall within the jurisdiction of the USACE and are identified as isolated. Final USACE jurisdiction determinations are made on a case by case basis by the USACE prior to permitting. Jurisdictional determinations presented in the DEIS are based on our interpretation of parameters identified in the field.

The four largest and/or higher quality wetland impacts associated with Alternatives 1 and/or 1A involve the crossing of Henderson Island, Bayou Creek and an adjacent bottomland wetland, a palustrine forest in the Little Creek watershed north of Upper Mt. Vernon Road, and a palustrine scrub/shrub-emergent complex associated with a Big Creek tributary. Spanning the Ohio River across the eastern tip of Henderson Island is expected to require right-of-way acquisition involving 3 to 3.5 acres of palustrine forest within the interior portion of the land mass and along the northern edge. The island is made up of fine sandy loam soils (Bruno and Huntington) and riverwash. Over time, such large river islands typically change shape, form and composition, especially following big floods. This wetland functions primarily as an isolated island habitat for wetland dependant birds, as well as potential breeding habitat for amphibians. Although there is currently no proposed bridge type or design for this crossing, the bridge will be elevated above the ground level of the island such that fill material within the wetland portion of the island would be avoided. However, the island is a likely location for a bridge pier and potentially all of the woody vegetation within the required right-of-way would need to be cleared for construction and post-construction maintenance purposes.

The Bayou Creek wetland is located at the northern extent of the Ohio River FEMA 100-year floodplain and consists of a shallow low-banked channel averaging 12 feet wide that easily overflows into the 100± feet wide bottomland woods along both sides of the stream. Large and small micro-depressions within the bottomland woods along the stream capture and retain water after flood waters have receded, thus making for inundated and/or saturated conditions following most moderate to heavy rain events. The wetlands along Bayou Creek are approximately four to five feet lower than the adjacent agricultural fields. The change in elevation from the wetland floor to the outer wooded edge of this long, sinuous riparian corridor ranges from a moderate incline to an abrupt steep slope. The depressional palustrine forested wetland to the southeast of Bayou Creek receives runoff from the adjacent agricultural fields, and under high water conditions overflows into Bayou Creek via a small channel to the southwest of the Alternative 1 and 1A proposed right-of-way. In 2002, the northwestern portion of these woods were inundated. Both woods are mapped as Newark silty clay loam soils which are considered to have possible hydric inclusions. Red maple, silver, maple, hackberry, sugarberry, ash, sycamore, cottonwood (including swamp cottonwood), and elm were the dominant tree species. Common shrubs included buttonbush, coralberry, burning bush, rose, and blackberry. Ground cover included several vines (crossvine, poison ivy, Japanese honeysuckle, trumpet creeper, moonseed, summer grape, etc.), grasses (Virginia rye, Indian woodoats, barnyard grass, giant cane, whitegrass, fall panicgrass, etc.), sedges, and a variety of forbs (asters, false nettle, late boneset, clearweed, goldenrod, ragweed, pokeweed, lizard’s tail, etc.). Both of these wetlands function to convey and/or store Bayou Creek floodwaters, provide excellent habitat conditions for a variety of hydrophytic woodland plant species, and are part of a contiguous wetland corridor utilized by wetland dependant animal species for movement and breeding in the bottoms. These wetlands also help to reduce the amount of agricultural sediment entering the Ohio River from within this watershed. Alternatives 1 and 1A would likely be elevated on piers throughout the Ohio River floodplain, including the crossing of Bayou Creek and the adjacent palustrine forest. Therefore, it is not expected that roadbed fill material would be placed in these wetlands or that the crossing of Bayou Creek would require a culvert. Nonetheless, the 176 feet wide right-of-way used for the analysis would collectively result in the removal of woody vegetation from 0.75 to 1.25 acres of palustrine forest wetland beneath the proposed elevated Interstate.

At an estimated impact of seven to eight acres, the palustrine forest within the Little Creek watershed north of Upper Mt. Vernon Road is the single largest potential wetland acreage loss identified for the proposed project. This is due in part to the expansion of the right-of-way to accommodate a possible diamond interchange with Upper Mt. Vernon Road. Alternatives 1 and 1A would encroach upon 300 to 580 feet of the western half of this bottomland wetland woods. Surface water appears to move southwest through this woods and ultimately drains into Little Creek some 2,000 feet away. The entire woods and surrounding agriculture fields are mapped as Birds silt loam. This poorly drained hydric soil is typically associated with broad floodplains of large streams and is frequently flooded. Shellbark hickory, red maple, green ash, eastern cottonwood, hackberry, sweetgum, swamp chestnut oak, and slippery elm are the common canopy species. The understory is composed in part of pawpaw, boxelder, and younger individuals of canopy species. Ground cover in the fall of 2002 was moderate and included various facultative forbs, vines, grasses, and sedges. The functions of this wetland include floodwater storage, palustrine forest habitat, and possibly groundwater recharge.

The old pasture palustrine emergent-scrub/shrub complex south of Emge Road and the railroad is within the proposed right-of-way for Alternative 1, but would not be impacted by Alternative 1A. It is estimated that as much as two acres of wetland would be impacted by Alternative 1 through the placement of fill material. The lower lying portions of this successional old pasture are within the floodplain associated with Big Creek and one of its tributaries that flows to the west along the south side of the railroad. The site includes an old cattle pond formed by a dike across a swale in the hillside to the south. The dike has long since been breached and the pond no longer holds water of any appreciable depth. Runoff water that once was retained in the pond now flows into, and spreads out through the lower lying areas of the northern extent of the pasture. Standing water throughout the site is limited to shallow micro-depressions. The Wakeland silt loam soils of the lower regions of the field appear to remain saturated for a sufficient period of the growing season to allow for hydrophytic vegetation to prosper. Wakeland soils have the potential for hydric inclusions within the soils unit. Young green ash, black willow, American elm, sweetgum, hackberry, river birch, red maple, and boxelder have begun to establish themselves. In some areas these young trees are growing in dense stands. Herbaceous cover includes a variety of grasses (Virginia rye, barnyard grass, fescue, foxtail, deertongue, orchard grass, panic grass, etc.), sedges (green bullrush, straw-colored flatsedge, fox sedge, Frank's sedge), and forbs (swamp agrimony, false nettle, milkweed, ragweed, common dayflower, jewelweed, seedbox, white-panicled aster, etc.). This wetland functions primarily as habitat for species with wetland affinities.

In Kentucky, the alternatives also cross the original main channel of Canoe Creek southeast of KY 285. The construction of Sellers Ditch established a new channel which essentially diverted water received from East Fork and West Fork Canoe Creek away from a 1.2 mile long segment of the original Canoe Creek channel. Although the old channel no longer carries perennial flow, it still maintains a hydrologic connection with the mainstem of Canoe Creek, and now displays characteristics of a narrow linear palustrine woods. The alternatives cross the old channel in the middle of a meander roughly 500 feet southeast of KY 285. The primary function of this 0.75 to 1 acre wetland site is floodwater storage. Additionally, two small palustrine scrub/shrub depressions (former ponds) adjacent to the Breathitt Parkway and US 41A in Kentucky are also within these alignments. Due to their small size (0.10 to 0.25 acre), the functions of these sites are limited to isolated aquatic habitat for wetland dependant species, especially during periods of drought. They may also act as groundwater recharge area, but on a very limited scale.

Alternative 1 would also impact 17 wetland ponds/lakes ranging in size from roughly a tenth of an acre to just over five acres. Five of the ponds measuring approximately 0.5 acre or less are entirely within the alignment. With the exception of one pond and a borrow pit in Kentucky, each of the ponds/lakes measuring two or more acres have 15 percent or less of their surface area within the preliminary right-of-way. Alternative 1A would also impact 17 ponds/lakes, 13 of which are common to Alternative 1. As currently proposed the two ponds southwest of Canoe Creek would possibly be crossed by an elevated section of the roadway. However, they would likely still be filled in to accommodate the right-of-way needs of the project.

The alignments of Alternative 1 and 1A have an estimated 1.6 to 2.0 acres of farmed wetlands in the Union Township bottoms of southwestern Indiana. These included hydric soil areas with surface elevations below 350 feet that are currently farmed. This is roughly twice as much as that of Alternative 2 but considerably less that than expected for Alternative 3. The primary function of these wetlands is flood storage and to a lesser extent temporary open water habitat for wildlife. Impacts to farmed wetlands will be avoided and or minimized in the Union Township bottoms since the roadway will be elevated above the ground surface on piers. No farmed wetlands were identified for the Kentucky portions of Alternatives 1 and 1A.

Alternative 2

A total estimated 32 to 39 acres of wetlands exist within the alignment for Alternative 2. Potential impacts to forested, scrub/shrub and emergent wetlands were identified at eleven sites totaling 23 to 30 acres. Of these eleven wetland sites identified, three occur in Indiana in association with the Eagle Creek drainage south of I-164 and account for approximately half of the total expected wetlands impacts. These wetlands function to both store flood waters and provide a variety of aquatic habitats for wetland dependant species. It is assumed that in order to accommodate the proposed system-to-system interchange configuration, at least some additional fill material will be required within wetlands between I-164 and Eagle Creek. South of Eagle Creek, the proposed interchange ramps may be elevated on piers above the Ohio River floodplain, thus reducing the overall impact to the wetland communities. The long narrow strip of land between the I-164 levee and Eagle Creek supports intermittently broken stretches of palustrine forest, scrub/shrub and emergent through the entire interchange area. Wetland losses here may approach 17 acres. This strip is wooded on the east end dominated by silver maple, but includs two mature bald cypress. Based on the current ramp configuration, it is likely that these bald cypress will be impacted by the alternative.

To the south of Eagle Creek there are three borrow pits that were used for sand and gravel extraction. Until 1989, this site was primarily agricultural. These borrow pits consist primarily of open water with perimeters of scrub/shrub vegetation. However, the eastern-most borrow pit is comprised of a complex of young trees, scrub vegetation, and open water. A 1987 aerial photograph suggests that within this agricultural field, pockets of standing water or surface saturation may have existed. Water depth throughout much of this borrow pit is generally 2 to 3 feet deep. This wetland would sustain the least acreage impact of the Eagle Creek wetlands affected by this proposed alternative. East of the eastern most borrow pit is a 9 acre palustrine forest that under normal hydrologic conditions (i.e., excluding very long, near drought dry periods) typically displays some level of inundation. Within this woods are no less than six large bald cypress trees. It does not appear that any of the large bald cypress in this area would be impacted. The western most borrow pit and northern edge of the central borrow pit will be impacted by the interchange with 7.7 and 0.4 acres of open water impacted respectively. The inundated and saturated fringes of these borrow pits are dominated by black willow, and sandbar willow of varying age, with occasional occurrences of young silver maple and river birch as well as planted bald cypress ranging from 2 cm to 15 cm DBH. (See **Table 5-29** for wetlands summary).

In Kentucky, the greatest potential for impacts to wetlands involves crossing two hydrologically connected palustrine forested areas within the Ohio River floodplain between Green River Road and the Wolf Hills area. The proposed alignment follows along the western edge of a Texas Gas pipeline easement and, in so doing, cuts across the eastern tip of palustrine forest associated with a long, moderately broad slough. The alignment would also traverse a smaller, linear wetland woods roughly 300 feet farther south. Collectively, as much as 1.25 acres of wetland from these two adjacent sites would fall within the 176 feet wide right-of-way use to assess potential project impacts. Approximately 1,300 feet to the south, the proposed elevated roadway for Alternative 2 would cross a broader band of palustrine forest that locally trends east-northeast through the cleared Texas Gas easement. The poorly drained hydric Melvin silty clay loam soils are locally widespread throughout the lower-lying wooded portions of the Ohio River floodplain. The palustrine forest wetland and adjacent bottomland woods east of the Texas Gas easement consist of red maple, hackberry, ash, sycamore, eastern and swamp cottonwood, sweetgum, American and slippery elm, black gum, and six species of oak (red, pin, Shumard's, bur, blackjack, and cherrybark). Typical understory species include boxelder, spicebush, buttonbush, and red mulberry. The functions of these wetlands include flood storage, wildlife habitat (including the copperbelly water snake and Indiana bat) and nutrient recycling. Alternative 2 would cross this wetland woods essentially perpendicular to its axis where the width of the jurisdictional limits are estimated at no greater than 650 feet. The resulting area of impact is therefore not expected to exceed 3 acres. As with the other floodplain wetlands described, the roadway for Alternative 2 would likely be elevated above the floodplain as far south as the base of Wolf Hills, potentially limiting fill material within the wetland to bridge piers.

Wetlands documented elsewhere within the Alternative 2 right-of-way are restricted to small woodlands in poorly drained upper reaches of small tributaries in the Canoe Creek watershed, or an occasional, small (<1 acre) emergent site in a wet swale or along an intermittent tributary. These areas function primarily as smaller habitat oasis for wetland dependant species.

Alternative 2 encounters six open water wetland ponds/lakes, four in Kentucky and two in Indiana. In Kentucky such impacts are confined to two small ponds (0.25 acre) on either side of the Breathitt Parkway, a cattle pond south of KY 351 (Zion Road), a small wooded pond in the upper reaches of an intermittent drainage along the Texas Gas easement, just over a mile south of Green River Road. In Indiana, open water encroachments resulting from Alternative 2 would be confined to two large borrow pits created when I-164 was constructed.. Over the years the edges of the pits have been colonized by trees and shrubs adapted to wet conditions including some bald cypress plantings. Preliminary design of the system-to-system interchange between I-164 and Alternative 2 consists of access ramps elevated primarily on piers keeping the roadway above the floodplain. The right-of-way required for the interchange includes 7.7 and 0.4 acres of these borrow pits. However, given this design, it is not currently known if any of the borrow pits would need to be filled or drained for construction or post-construction maintenance access. No farmed wetlands were identified for the Indiana or Kentucky portions of Alternative 2.

Alternative 3

Alternative 3 would have the greatest overall impact to wetlands with an estimated total acreage of between 36 and 40 acres. Potential impacts to forested, scrub/shrub and emergent wetlands were identified at four sites totaling 1 to 1.4 acres. The four wetlands identified for this alternative are all within Kentucky. The first consists of a narrow wet emergent draw northeast of the Breathitt Parkway that would be crossed by the proposed northbound ramp from the Parkway to Alternative 3. This site functions as a filter strip collecting runoff and reducing erosion from adjacent agricultural fields. The second is a small, poorly drained emergent in the upper reaches of a small Race Creek intermittent tributary located in a pasture north of Baskett, Kentucky. This site functions primarily as a potential temporary source of water for livestock and may play a minor role in nutrient recycling. The lack of sufficient drainage along this shallow tributary allows local saturation of the immediate surrounding ground sufficient enough for propagation of wetland herbaceous grasses, sedges, and forbs. The largest of the four sites is the palustrine emergent in the Green River floodplain midway between Green River Road and the hillside that locally defines the southwestern edge of the floodplain. Aerial photographs depict this area as wooded; however, the vast majority of the trees through this area were cleared two years ago (per communication with the landowner) such that what was once a linear band of palustrine forest now exists as a broad emergent wetland of irregular width through a pasture. The entire pasture is mapped as Ginat silt loam, a poorly drained hydric soil with a fragipan. This site plays a minor role in flood storage and functions as a wet corridor for species' movements between wetland complexes to the east and west within the Green River floodplain. Based on field observations and NWI mapping, the 176 feet wide working alignment for Alternative 3 would cross as much as 2.25 acres of emergent wetland. As noted previously for Alternatives 1, 1A and 2, the roadway for Alternative 3 across the Green River and Ohio River floodplains would be elevated on piers above the existing ground. As such, it is possible that no fill material would be required within this wetland, depending on pier placement, and the current hydrology of the emergent could be maintained under the bridge. Nonetheless, for the purposes of this study, the 2 to 2.25 acre wetland impact is included in the total. The fourth site includes up to one acre of palustrine forest associated with Threemile Island on the north side of the Ohio River. This site functions primarily as near shore forested habitat for wetland dependant species along the Ohio River.

Alternative 3 impacts six wetland ponds, the southern three of which are common with Alternative 2. The three additional ponds include a farm pond of approximately 1.5 acres south of Larue Road, a 0.5 acre residential pond along the western edge of an upland woods and a cattle pond under 0.1 acre in the Green River floodplain approximately 3,000 feet southwest of Green River Road in Kentucky.

Alternative 3 crosses the greatest acreage of farmed wetlands. The alignment of Alternative 3 would span approximately 34 to 37 acres of farmed wetland and farmed wetland pasture within the Ohio and Green River floodplains in Henderson County, Kentucky. This acreage is comprised of Melvin silt loam, Melvin silty clay loam and Egam silty clay loam hydric soils subject to flooding at elevations below 362 feet, and Ginat silt loam hydric soils which possess a fragipan creating a perched water table. The primary function of these wetlands is flood storage although collectively they serve as temporary open water habitat for wildlife. No farmed wetlands were identified for the Indiana portion of Alternative 3. Impacts to farmed wetlands within the alignment of Alternative 3 would be minimized since the roadway would be elevated above the ground surface on piers.

No-Build Alternative

The No-Build Alternative would have no adverse impact (i.e., no loss) to wetlands in the I-69 project study area.

Summary

Each of the proposed alternatives would result in impacts to wetlands, either in the form of forested, scrub/shrub or emergent sites, open water ponds and lakes, or farmed wetlands and farmed wetland pastures. (Wetlands are shown in **Figure 5-27**) Due to the large number of farmed wetlands within the floodplain between the Ohio River and the Green River, Alternative 3 crosses the greatest acreage of total wetlands (36 to 40 acres), although it includes the smallest acreage of forested, scrub/shrub and emergent wetlands, as well as ponds and lakes. Alternative 2 has the second greatest acreage of total wetland impacts at an estimated 30 to 36 acres with approximately 75 percent of this being forested, scrub/shrub or emergent, while no farmed wetlands were encountered. However, this total includes wetlands within the right-of-way for the proposed I-164 interchange that would likely not be impacted by the construction. Total wetland acreage for Alternatives 1 and 1A are relatively comparable to one another and have slightly lower total anticipated wetland acreage impacts (Alternative 1 = 26 to 30 acres; Alternative 1A = 25 to 29 acres;) than Alternative 2. Roughly two-thirds of the wetlands for either alternative are forested, scrub/shrub or emergent. The eight to nine acres of ponds and lakes impacted are the result of several small open water body encroachments, compared to just a few large open water borrow pit impacts as is the case with Alternative 2. At an estimated two acres, farmed wetland impacts associated with Alternatives 1 and 1A within the Union Township bottoms of Vanderburgh County, Indiana are far less than that expected for Alternative 3 and approximately twice that of Alternative 2.

Although over 70 percent of the Alternative 2 and 3 alignments in Indiana are within the Pigeon Creek watershed, no direct impacts will occur to any wetlands associated with this drainage since both alternatives would use existing I-164, requiring no additional right-of-way.

See Chapter 7 for a discussion of permit requirements including Section 404, Section 10 and Section 401 permits that will be required for this project.

5.16 AGRICULTURAL IMPACTS

Introduction

Farmland is one of the most important natural resources in Indiana and Kentucky. The principle crops in Indiana and Kentucky are corn, soybeans, and wheat. Livestock is also an important element of Indiana and Kentucky agricultural industry.

Methodology

According to the U.S. Department of Agriculture's 1997 Census of Agriculture see **Table 5-29,** below, Henderson County, Kentucky, has a total land area of 281,600 acres, of which approximately 70 percent is farmland, well above the state's 52 percent; and Posey, Vanderburgh, and Warrick Counties, Indiana, have a combined total land area of 657,406 acres of which approximately 55.6 percent (365,966 acres) is farmland, compared to the state's 65.8 percent. However, two of the three counties—Vanderburgh and Warrick—are well under the state's average (48 and 40 percent, respectively), while Posey County is notably above that of the state, at almost 75 percent. Developed areas, including towns and cities, make up the remaining predominant land uses. Of the farmland in all four counties, a total of 490,948 acres is cultivated cropland—primarily corn, soybeans, wheat, hay and, in Henderson County, tobacco (see **Table 5-30 & 5-31**, below). The remainder of the agricultural land is woodland and pastureland.

Table 5-30: Agricultural Land Use, 1997

Description	Henderson Co.	Kentucky	Posey Co.	Vanderburgh Co.	Warrick Co.	Indiana
Total Land Area (acres)	281,600	25,428,480	261,454	150,135	245,817	22,956,877
Land in Farms (and % of Total Area)	196,277 (69.7%)	13,334,234 (52.4%)	195,305 (74.7%)	72,112 (48.0%)	98,549 (40.1%)	15,111,000 (65.8%)
Number of Farms	526	82,273	437	271	356	57,916
Average Size of Farms	373	162	447	266	277	261
Average Value of Land, Buildings per Acre	$1,593	$1,450	$1,718	$2,533	$1,616	$2,064
Cultivated Cropland (acres)	163,408	8,549,027	180,104	66,532	80,901	12,848,950
Harvested Cropland (acres)	145,238	68,953	175,881	64,540	73,939	11,716,704
Pastureland (acres)	13,593	3,101,480	4,173	1,925	6,873	1,254,525
Woodland (acres)	23,250	3,012,001	8,700	1,910	6,928	1,283,246

Source: U.S. Department of Agriculture, 1997 Census of Agriculture. This census is taken every five years covering the years ending in "2" and "7." Therefore, the 1997 census is the most current.

The project is being developed in compliance with the *Farmland Protection Policy Act of 1981* and in accordance with the state and federal regulations concerning farmland protection. Formal consultation with the U.S. Department of Agriculture, Natural Resources Conservation Service for compliance with the *Farmland Protection Policy Act* has been initiated.

In accordance Farmland Protection Policy Act of 1981, the Farmland Impact Conversion Rating (Form AD-1006) evaluation performed in both Indiana and Kentucky for Alternatives 1, 1A, 2 and 3. The purpose of AD-1006 is to identify approximate farmland conversions that will take place if an alternative is constructed.

Analysis

KENTUCKY FARMLAND CONVERSION IMPACT RATING

The Farmland Impact Conversion Rating (Form AD-1006) was sent to the Henderson County National Resource Conservation Service (NRCS) office, in Henderson, Kentucky with Parts I and III completed. In addition, to the form, the local office also received a GIS based soils maps with each of the alternatives superimposed, a collection of aerial photographs with alignments, and a table with total acreage for each soil series encountered by each alternative. **Table 5-32** presents the results.

Table 5-31: Principal Crops: Harvested Acres and Production

Year	Corn (grain/seed)				Soybeans				Wheat				Hay				Tobacco	
	P	V	W	H	P	V	W	H	P	V	W	H	P	V	W	H	IN	H
Harvested Acres																		
1992	82,003	37,762	35,420	67,850	77,961	27,948	30,722	68,475	30,546	7,176	4,375	6,483	3,337	1,391	4,261	10,036		657
1997	81,561	31,645	33,671	63,868	82,709	29,518	34,408	70,643	34,300	7,217	5,867	13,887	2,717	1,348	5,504	8,814	(n/a)	426
% Change	-0.5%	-16.2%	-4.9%	-5.9%	6.1%	5.6%	12.0%	3.2%	12.3%	0.6%	34.1%	114.2%	-18.6%	-3.1%	29.2%	-12.2%		-35.2%
Production																		
	Bushels (Million)				Bushels (Million)				Bushels (Million)				Tons					Pounds (Million)
1992	12.1	5.4	4.6	9.3	3.3	1.1	1.2	2.6	1.7	0.4	0.2	0.3	8,934	4,361	8,729	20,167	(n/a)	1.4
1997	8.7	3.3	3.5	6.3	3.2	1.1	1.3	2.6	2.0	0.4	0.3	0.7	7,443	3,635	11,547	18,836		0.8
% Change	-28.1%	-38.9%	-23.9%	-32.3%	-3.0%	0.0%	8.3%	0.0%	17.6%	0.0%	50.0%	133.3%	-16.7%	-16.6%	32.3%	-6.6%		-42.9%

Source: U.S. Department of Agriculture, 1997 Census of Agriculture
Abbreviations: **P** = Posey County **V** = Vanderburgh County **W** = Warrick County **H** = Henderson County.
Shading indicates instances when 1997 acreage and production showed either no reduction or an increase over 1992.

Table 5-32: Kentucky Farmland Assessment

	Alt. 1	Alt. 1A	Alt. 2	Alt. 3
Prime Farmland (acres)	274.8	274.8	498.1	541.0
% Convert	0.10%	0.10%	0.20%	0.30%
Statewide Important Farmland (acres)	9.2	9.2	38.6	41.0
NRCS Relative Value Rating	84.0	84.0	87.0	85.0
Site Assessment	63.0	63.0	69.0	69.0

Combining the Land Evaluation Criterion and Site Assessment Criteria scores for the Kentucky portion of the proposed project yielded total point scores of 147 for Alternatives 1 and 1A, and 156 and 154 for Alternatives 2 and 3 (Part VIII). As stated in 7 CRF Part 658.3, the USDA recommends that "sites receiving a total score of less than 160 be given a minimal level of consideration for protection and no additional sites be evaluated." Since each of the alternatives considered in this project received a total point value less than 160 points, none will receive any further consideration for farmland protection. No other alternatives other than those already discussed in this study will be considered without a re-evaluation of the project's potential impacts upon farmland.

Since each of the proposed alternatives require the conversion of 50 acres or more of farmland as defined by the USDA and 7 CRF Part 658, House Bill 34 (KR 262.875) requires that the project be presented to the Inter-Agency Farmland Advisory Committee for review and approval. Therefore, additional work in preparing the Committee report may be warranted upon selection of preferred alternative.

INDIANA FARMLAND CONVERSION IMPACT RATING

Coordination with the Indiana headquarters of the NRCS concluded that since the Build Alternatives collectively include portions of four Indiana counties (Posey, Vanderburgh, Warrick and Gibson), and in the case of Alternatives 1 and 1A, involve portions two or three Indiana counties respectively, the best means by which to compare the alternatives against each other for the Indiana portion would be to evaluate and score prime farmland impacts for each alternative as opposed to four county based evaluations for fragments of each alternative. The ramps at I-64 for Alternative 1A may actually encroach in Gibson County whereas they will not in Alternative 1. The Indiana Farmland Impact Conversion Rating (Form AD-1006) was therefore submitted to the Indiana headquarters office in Indianapolis for completion of Parts II, IV, and V. In addition to the Form AD-1006, a NRCS questionnaire was sent to the Vanderburgh County field office for completion (**Appendix C-9**). It was decided that a single questionnaire would suffice for the project (as opposed to four separate questionnaires sent to each of the Indiana counties), since Vanderburgh and Warrick counties share a District Conservationist who is very familiar with the soils and agriculture in Posey and Gibson counties. Upon completion, the District Conservationist forwarded the questionnaire to the Indiana headquarters in Indianapolis, to be included with the return of the Farmland Conversion Impact Rating. **Table 5-33** presents the results.

Table 5-33: Indiana Farmland Assessment

	Alt. 1	Alt. 1A	Alt. 2	Alt. 3
Prime Farmland (acres)	702.6	960.6	125.8	104.2
Statewide Important Farmland (acres)	--	--	--	--
% Convert	0.3%	0.2%	0.2%	<0.1%
NRCS Relative Value Rating	63.0	65.0	66.0	73.0
Site Assessment	70.0	70.0	51.0	5.0

Combining the land Evaluation Criterion and Site Assessment Criteria scores yielded total point scores of 133 and 135 for Alternatives 1 and 1A, and 117 and 78 for Alternatives 2 and 3 (Part VII). As stated in 7 CRF Part 658.3, the USDA recommends that "sites receiving a total score of less than 160 be given minimal level of consideration for protection and no additional sites be evaluated." Since each of the alternatives considered in this project received a total point value of less than 160 points, none will receive any further consideration for farmland protection. No other alternatives other than those already discussed in this study will be considered without a re-evaluation of the project's potential impacts upon farmland. The AD-1006 forms are attached in **Appendix C-9.**

Summary

Direct impacts of the Build Alternatives on farmland will result from the acquisition of farmland for additional right-of-way needed for road construction. **Table 5-34** presents a summary of the potential impacts to agricultural lands. The project will require the acquisition of from approximately 663 acres (Alternative 2) to 987 acres (Alternative 1) of prime and unique, and statewide important farmland for additional right-of-way, depending on the alternative selected. These amounts would range from less than 0.001 percent to slightly more than 0.3 percent of agricultural land in the four counties within the project study area. The majority of this acreage would be prime/unique farmland. Impacts include removal of the acquired land from agricultural production, and the creation of "uneconomic remnant" and/or landlocked parcels. In the event this occurs, a right-of-way acquisition specialist would be assigned to deal specifically with those farms affected to help resolve problems that may result from splitting farms. It is unlikely that all or most such parcels would have no viable use. Most of the parcels would be adjacent to other farm parcels owned either by the same individual or by a neighbor who might wish to acquire and farm the land. The state could buy the uneconomic remnant to offer for resale. Also, where compatible with local land use plans, some parcels might be suitable for residential or other development, while other parcels might be suitable for wetland mitigation or other uses.

Table 5-34: Potential Agricultural Impacts by Alternatives

Impacts	Alt. 1	Alt. 1A	Alt. 2	Alt. 3
A. Total Acres Prime + Unique Farmland	**977.4**	**1235.4**	**623.9**	**645.2**
Henderson County, Kentucky	274.8	274.8	498.1	541.0
Posey, Vanderburgh, Warrick Counties, Indiana	702.6	960.6	125.8	104.2
B. Total Acres Statewide + Local Important Farmland	**9.2**	**9.2**	**38.6**	**41.0**
Henderson County, Kentucky	9.2	9.2	38.6	41.0
Posey, Vanderburgh, Warrick Counties, Indiana	0	0	0	0
Total A + B	**986.6**	**1244.6**	**662.5**	**686.2**
TOTAL AD-1006 Impact Rating				
Henderson County	147	147	156	154
Posey, Vanderburgh, Warrick Counties, Indiana	133	135	117	78
Percentage of Prime Farmland In County To Be Converted				
Henderson County, Kentucky	0.1%	0.1%	0.2%	0.3%
Posey, Vanderburgh, Warrick Counties, Indiana	0.3%	0.2%	0.2%	<0.1%

Source: USDA Form AD-1006 Data

The ability to access parcels severed by the new road is also a consideration when determining direct impacts to farmland. The proposed action would result in an Interstate highway with interchanges at widely spaced locations. While access to most severed parcels would be available via adjacent roads/driveways, some parcels would be landlocked. The state would also analyze the feasibility of providing a frontage road for access. The disposition of uneconomic remnants and severed parcels would be addressed during final design. Indirect impacts may include, among other things, roadside development along the new I-69. Indirect impacts are discussed more fully in **Section 5.24** on Indirect and Cumulative Impacts.

5.17 FOREST IMPACTS

Introduction

Forests are a large and important resource in Indiana and Kentucky. Forests make significant environmental and economic contributions, including: timber, employment, outdoor recreation, protection of soil and water resources, and habitat for many plant and animal species. The majority of forests in the project area are composed of hardwood species. The primary hardwood forest types in the project area are oak-hickory and maple-beech. Woodland ecosystems of various types dominated the landscape of the project study area prior to settlement. Over time, agriculture, mining, and urban development has resulted in a landscape of highly fragmented woodland habitat consisting primarily of small isolated tracts, narrow linear strips or rural tracts with minimal residential intrusions in southwestern Indiana and northwestern Kentucky. The major concentrations of forest land in the study area exist in central and southwestern Vanderburgh County, as well as northern and eastern Warrick County in Indiana. In Kentucky, the largest concentrations are in eastern Henderson County as well as larger blocks of bottomland forests that exist near the mouth of the Green River and in the vicinity of Sloughs Wildlife Management Area in northwestern Henderson County.

Habitat fragmentation is the steady transformation of once large and continuous tracts of natural habitats into smaller and more isolated patches or fragments surrounded by disturbed areas (Temple and Wilcox, 1986). Many species that require interior woodland habitat are sensitive to the effects of fragmentation and creation of additional edge habitat. Studies have shown that birds requiring large tracts of forest are adversely affected by fragmentation because of nest predation and parasitism that follow the influx of edge species. Nest predators like raccoons, skunks, crows, and blue jays are often associated with edges, as well as the parasitic brown-headed cowbirds which lays eggs in the nests of other birds, often to the detriment of the host's young.

Methodology

The forest impact assessment included two tasks. The first included an accounting of total acreage of forestland within the footprint of the alignment for each alternative. This was accomplished by identifying forested areas within the alignment of each alternative on aerial photographs and characterizing them during the field reconnaissance phase of the study. Each of these regions were delineated on aerials in the GIS developed for the project, after which individual woodland encroachment areas were calculated and totaled.

The second task involved an assessment of impacts to core forestland resulting from fragmentation anticipated for each alternative. **Figure 5-28** illustrates a forest before fragmentation and one after fragmentation occurs. Core habitat is the interior portion of a particular habitat. In woodlands or forests, core forest is generally accepted to be the portion of the forest that is 100 meters from the edge (Temple, 1986). The outer portion of the forest is considered the edge habitat, illustrated in **Figure 5-29**. Direct core forest loss occurs when the alignment encroachment upon a woods is such that it results in the loss of existing core habitat. Converted loss occurs when the alignment requirements do not necessarily encroach upon core forest habitat, but result in the loss of existing edge habitat thus redefining the boundaries of edge and core habitat upon project completion.

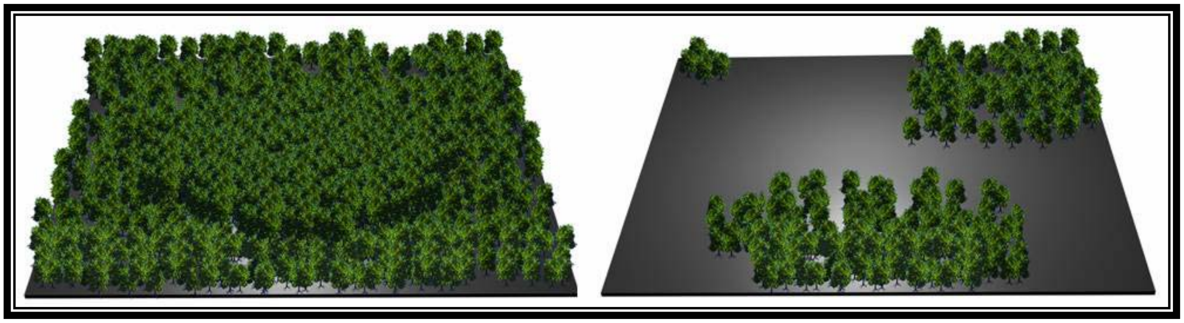


Figure 5-28: Left - Forest Before Fragmentation. Right - Forest After Fragmentation

Core forest within woodland areas crossed by the alignments of this study were determined by first delineating all large tracts onto aerial photographs using CAD (computer aided design) software. These boundaries were subsequently offset by 100 meters towards the center of the woods, thus establishing a boundary between the perimeter edge habitat and the core habitat portion of the woods. Direct core forest impacts were then calculated in all instances where the alignment limits intersected the core forest portion of the woodland. If the alignment did not directly encroach upon the core forest region, but did however create a new edge for a woods, thus redefining the core forest portion, then the loss of core forest due to conversion was also determined and included in the impact analysis.

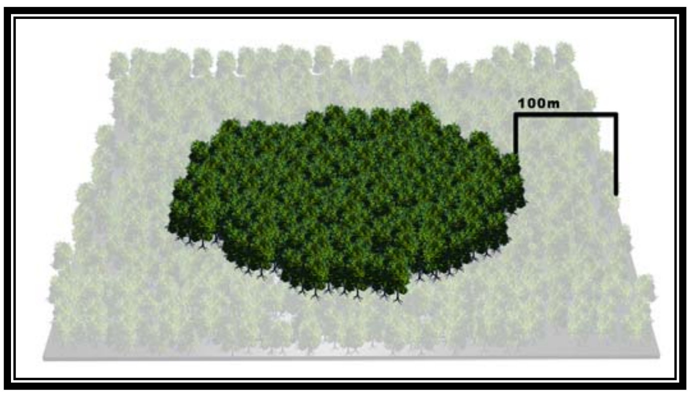


Figure 5-29: Diagram of Core Forest Habitat

Analysis

Forestland encountered at no less than 33 sites within the alignment for Alternative 1 totals approximately 243 acres (**Table 5-35**). The Alternative 1A analysis yielded a slightly higher total of 258 acres from roughly 31 sites. While both alignments encounter a number of small woodlots throughout their lengths, the majority of the woodland impacts associated with these alternatives are concentrated in the rolling hills between Bayou Creek and SR 62, as shown in **Figure 5-30**, and north of SR 62 for a distance of just over one mile, as shown in **Figure 5-31**. The mixed deciduous hardwoods in this area have been fragmented to some degree by local roads and numerous residences. The alignment of Alternatives 1 and 1A attempts to avoid impacts to the larger expanses of undisturbed forestland in this area; nonetheless, complete avoidance of woodland with an alignment across this terrain is not possible.

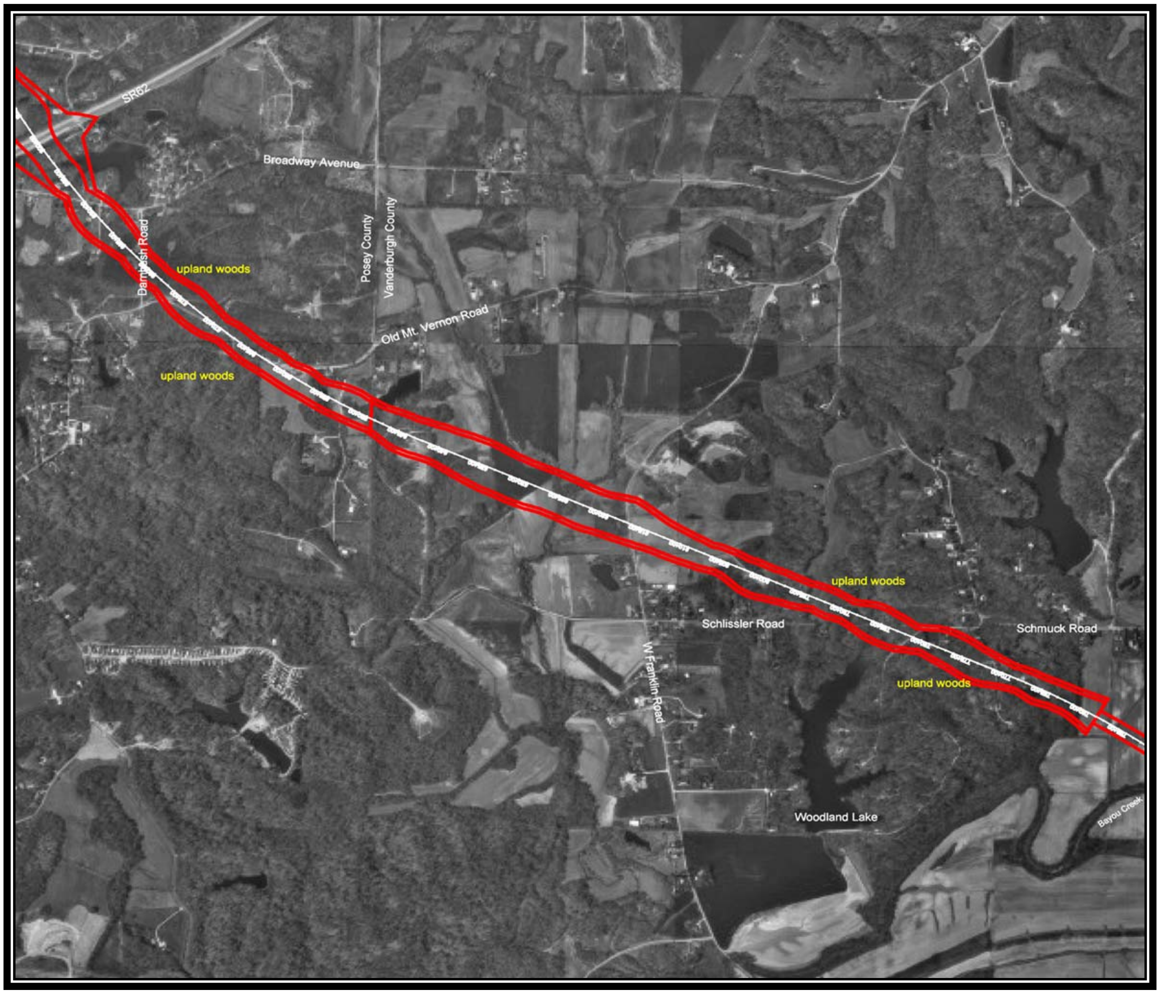


Figure 5-30: Upland Woods Crossed by Alternatives 1 and 1A

Table 5-35: Summary of Total Forest Acreage Impacts

	Approximate Number of Sites	Total Acreage
Alternative 1	33	243 acres
Alternative 1A	31	258 acres
Alternative 2	11	55 acres
Alternative 3	9	44 acres

The second most notable impact to woodland associated with Alternatives 1 and 1A involves the crossing of Henderson Island, a mid channel island of the Ohio River in Kentucky. The proposed bridge across the northeastern tip of this island would result in the loss of no less than five acres of wetland and floodplain woods if clearing is required for pier placement on the island. Elsewhere in Kentucky, woodland loss for Alternatives 1 and 1A would be associated with three segments of riparian woods along Canoe Creek and a small linear band of woods along the Ohio River.

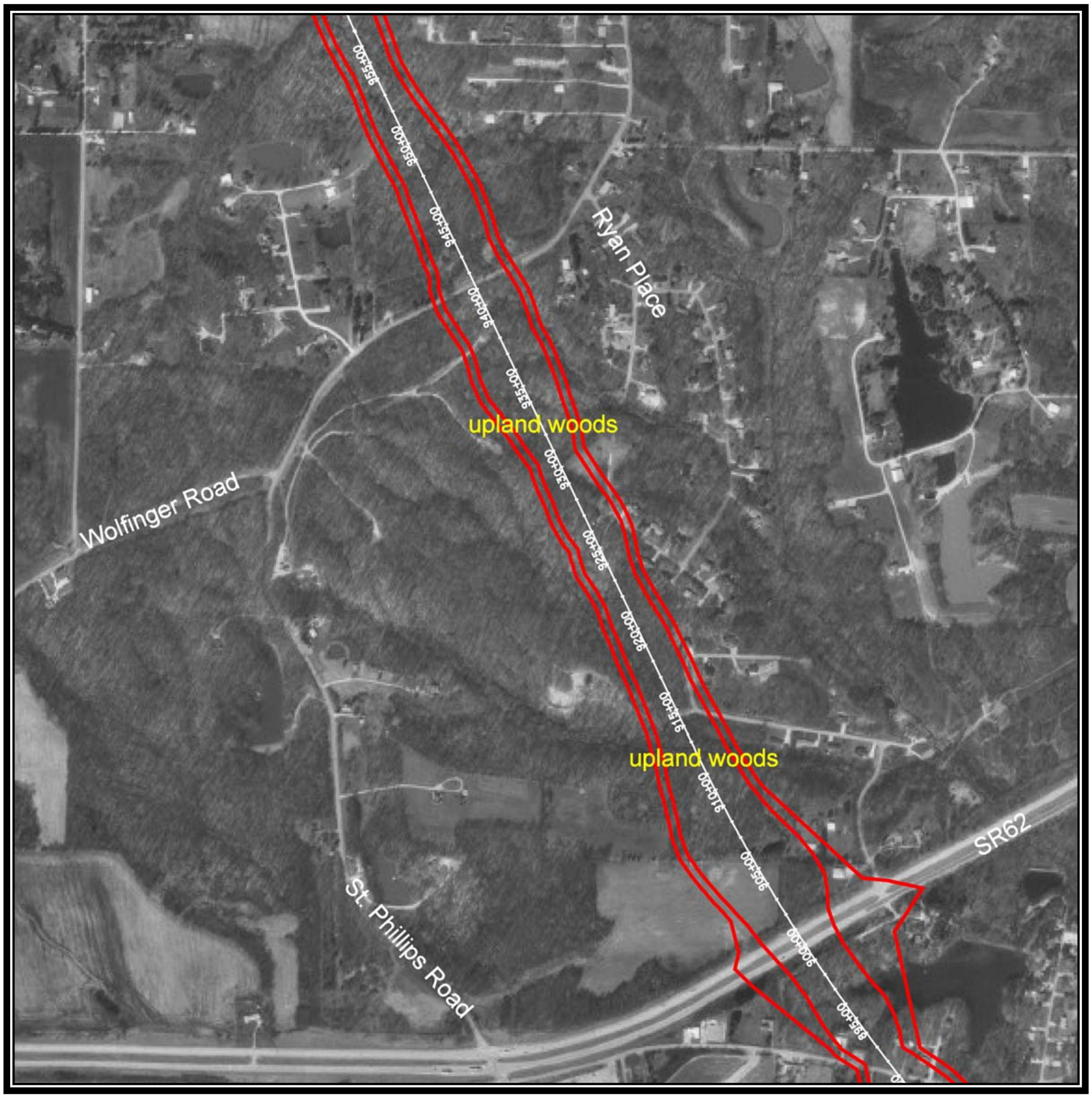


Figure 5-31: Upland Woods Crossed by Alternatives 1 and 1A North of SR 62

Anticipated woodland impacts associated with the eastern Alternative 2 and 3 alignments are considerably less than those expected for Alternatives 1 and 1A. Alternative 2 woodland encroachments are estimated at 55 acres, the largest of which occurs in the Wolf Hills area and adjacent bottomland woods in northern Henderson County south of Green River Road **(Figure 5-32)**. The remaining Alternative 2 woodland impacts are spread throughout the alignment at approximately 10 additional sites where entire or partial woodlot losses of one to five acres per site were identified within the predominantly agricultural landscape. Forest loss for Alternative 2 in Indiana would be restricted to the bottomland and wetland woods required along Eagle Creek for the system-to-system interchange with I-164.

At approximately 44 acres, woodland loss expected for Alternative 3 is the least of all the alignments considered. Woodland impacts associated with this alignment, excluding thin riparian corridors along ditches, essentially involves encroachment at nine sites. The single largest impact would occur between Rucker No. 1 and Rucker No. 2 roads where Alternative 3 would clear approximately 15 acres over a distance of 2,300 feet along the northwestern edge of a 48 acre upland woods located in the headwater reaches of Race Creek **(Figure 5-33)**. This alignment would leave approximately 23 acres of woods southeast of Alternative 3 and a smaller 8 acre stand to the northwest. Elsewhere, a pair of small upland woodlots roughly 3 and 5.5 acres in size located northeast of the Breathitt Parkway are within the right-of-way footprint for the system-to-system interchange with the parkway. The remaining woodland impacts associated with Alternative 3 involve crossing the narrow bands of forest that exist along the south and north shores of the Ohio River. Roughly 1.5 acres on the southern bank and 2.5 acres of woodland on the north bank would be within the 176 foot bridge right-of-way used for the analysis.

Table 5-36 profiles the four woodland locations where direct and/or converted core forest impacts are anticipated by the proposed I-69 alternatives.

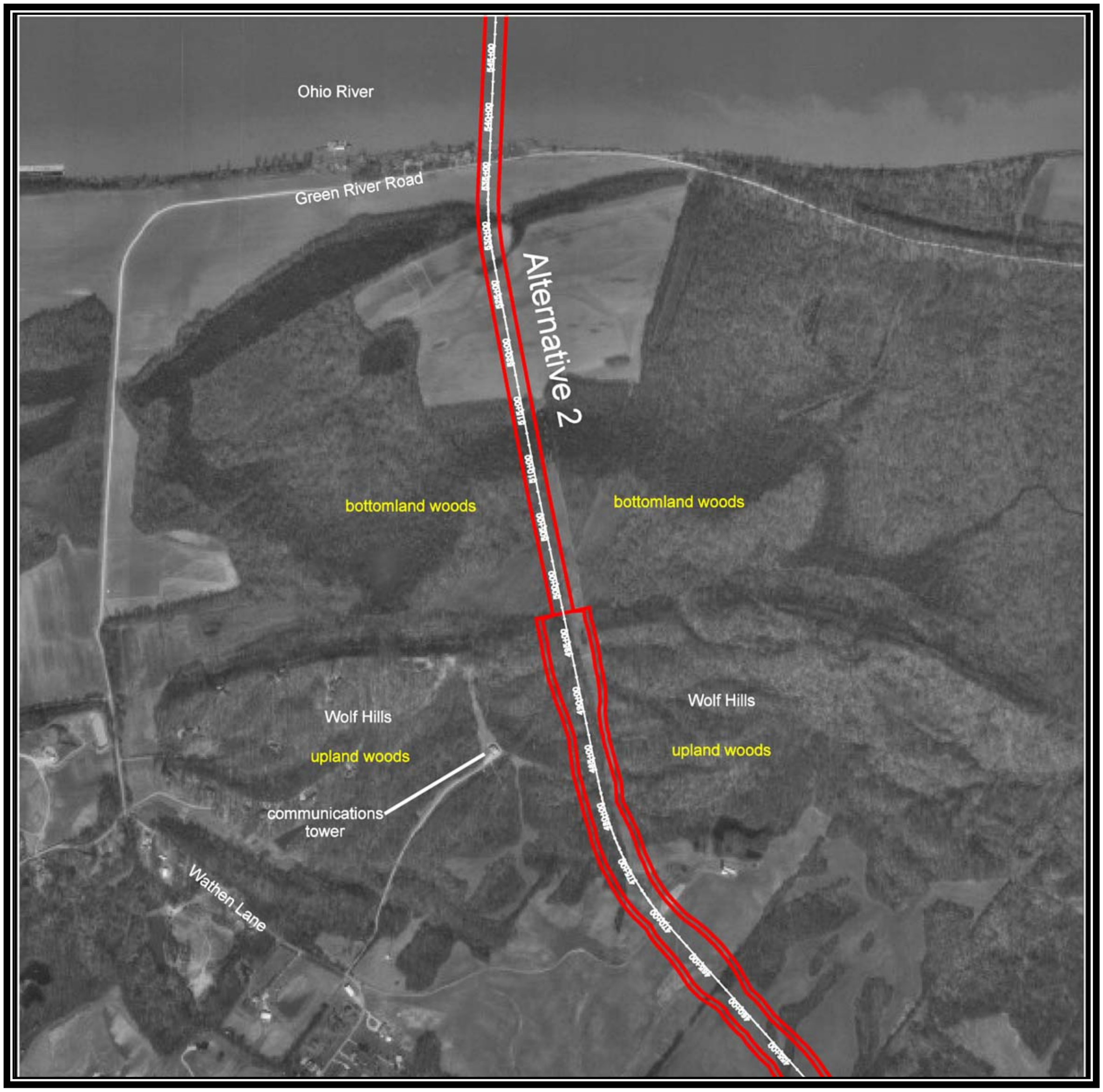


Figure 5-32: Bottomland and Upland Woods Crossed by Alternative 2 at Wolf Hills Area

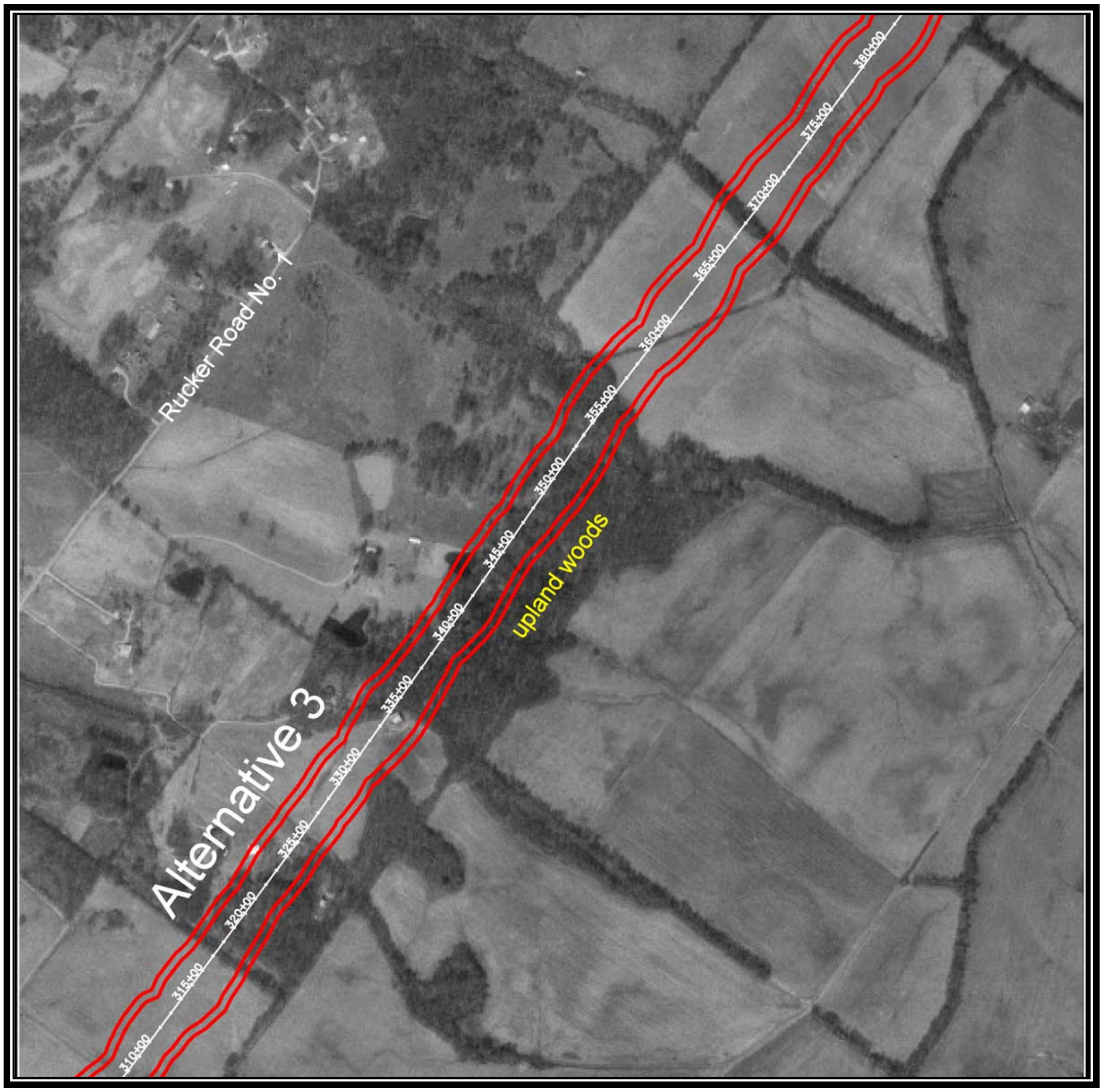


Figure 5-33: Upland Woods Impacted by Alternative 3 South of US 60

Table 5-36: Summary of Direct and Converted Core Forest Impacts for I-69 Proposed Alternatives

Alternative	General Location	Existing Core Forest	Remaining Core Forest	Direct Loss of Core Forest	Converted Loss of Core Forest	Net Loss of Core Forest	Percent of Core Forest Loss
Alt. 1/1A	Henderson Island (east end)	17.9 acres	7.3 acres	2.3 acres	8.3 acres	10.6 acres	59%
Alt. 1/1A	Upper Mt. Vernon Road (north)	6.6 acres	2.5 acres	0.5 acres	3.6 acres	4.1 acres	62%
Alt. 1A	Rexing Road (east)	8.3 acres	2.9 acres	0.9 acres	4.5 acres	5.4 acres	65%
Alt. 2	South of Green River Road (KY)	114.4 acres	101.0 acres	0.0 acres	13.4 acres	13.4 acres	12%
Alt. 3	N/A	0.0 acres	0.0 acres	0.0 acres	0.0 acres	0.0 acres	0%

.

For Alternatives 1 and 1A, core forest losses would occur on Henderson Island and a bottomland wetland woods north of Upper Mt. Vernon Road in the Little Creek drainage. Henderson Island is located in the Ohio River just southwest of the downtown area of Henderson, Kentucky. The eastern end of Henderson Island would experience a loss of approximately 10.6 acres of core forest, as shown in **Figure 5-34**. This represents a 30 percent reduction in core forest on the island based on the 100 meter edge habitat criteria of Temple (1986). This encroachment cannot be avoided through minor alignment shifts without causing additional impacts to social resources along US 60 in Henderson. In the event that a bridge pier is not required on the island, then consideration could be given to spanning the island without tree removal.

Encroachments at the Upper Mt. Vernon Road site involve the net loss of approximately 4.1 acres or 62 percent of the existing core forest, illustrated in **Figure 5-35**. In addition to these two locations, Alternative 1A would also result in the loss of approximately 5.4 acres of core forest at a third site east of Rexing Road, shown in **Figure 5-36**. This 75+ acre woods has a very irregular boundary due to residential development along and off of Rexing Road and selective clearing for farmland. Because of this irregular boundary this woods only has an existing core of approximately 8.3 acres. Therefore, the 5.4 acre direct and converted loss anticipated for Alternative 1A represents a 65 percent reduction in core forest at this location.

The loss of core forest habitat associated with Alternative 2 is limited to the Wolf Hills area in northeastern Henderson County, south of Green River Road, as shown in **Figure 5-37**. Although alignment limits suggest that following along the west side of the Texas Gas pipeline easement would not likely result in the direct loss of core forest habitat, the anticipated loss of existing edge habitat and the subsequent redefinition of the core habitat boundary following construction would result in the converted loss of approximately 13.4 acres of core forest. This represents roughly 12 percent of the 114 acres of core forest that currently exists at this site.

Alternative 3 would require approximately 15 acres along the northwest side of a 48 acre, mixed deciduous woods located east of Rucker No. 1 Road. Despite the fact that approximately 32 percent of this woods would be impacted, the shape and linear nature of this feature is such that no core forest habitat exists based on the 100 meter criteria. Therefore, Alternative 3 would result in no direct or converted impacts to core forest.

The No-Build Alternative would not result in the loss of forestland, nor would it affect core forest habitat.

Figure 5-34: Direct and Converted Core Forest Impacts at Henderson Island Forest

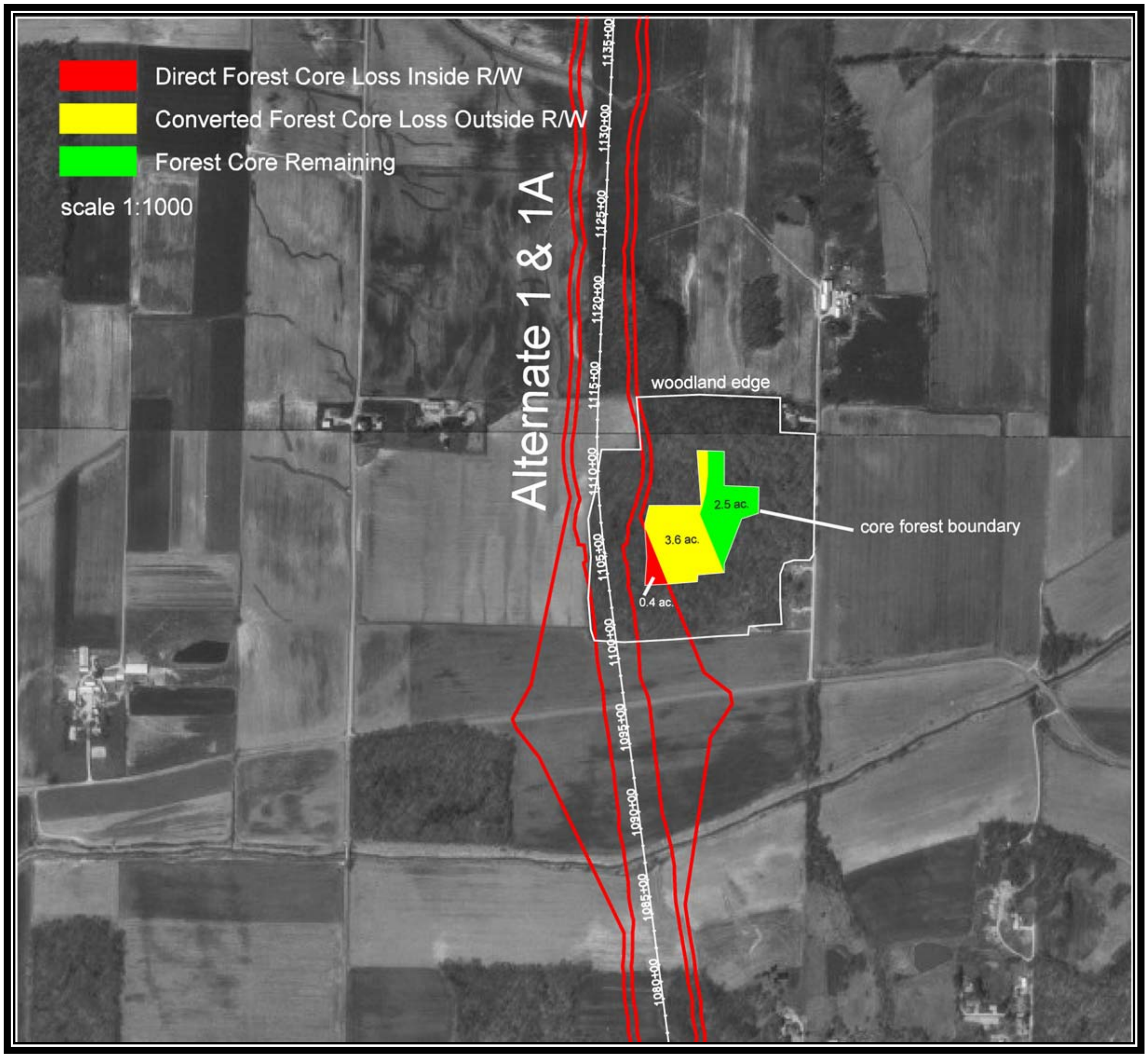


Figure 5-35: Direct and Converted Core Forest Impacts at Upper Mt. Vernon Road

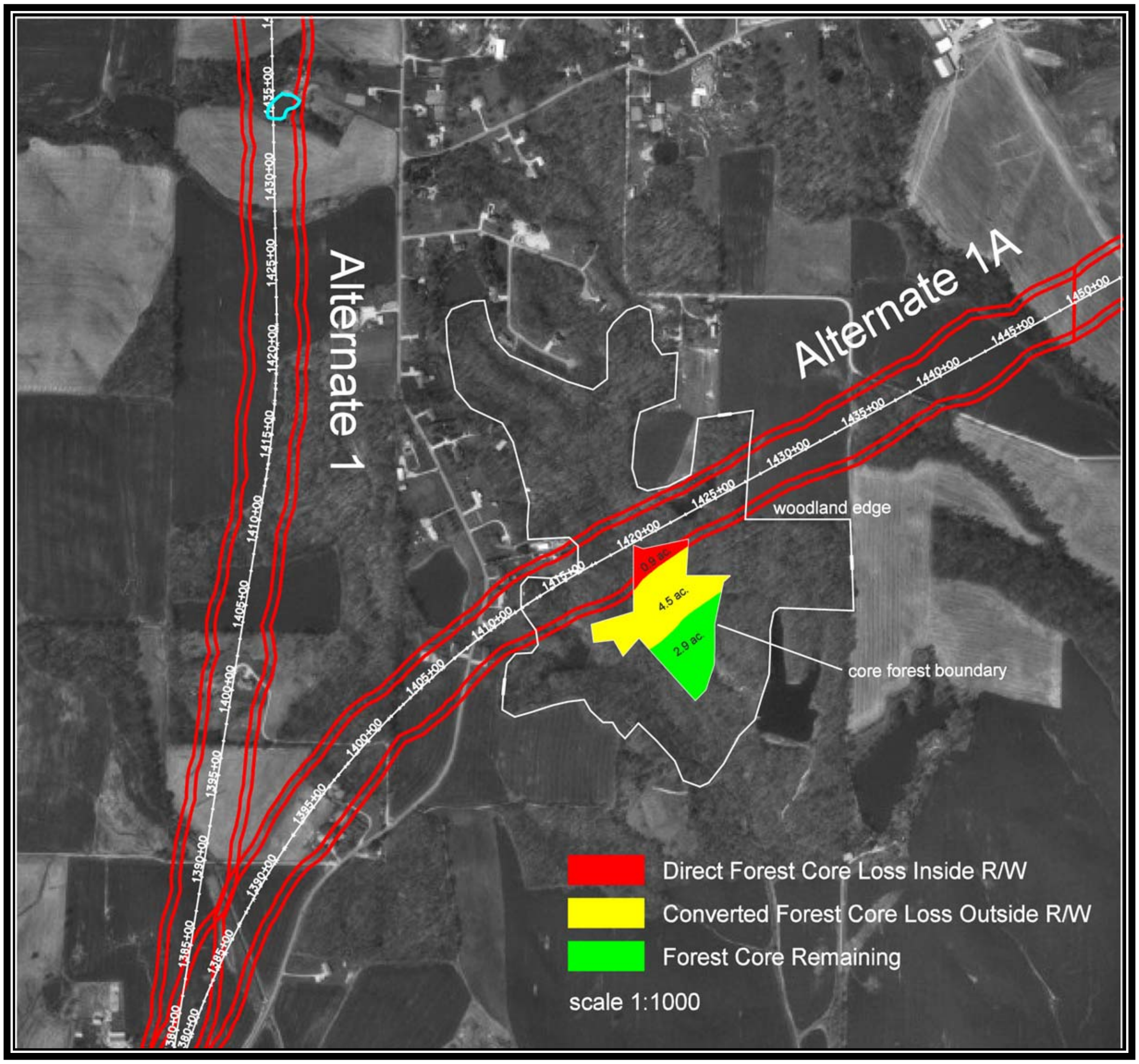


Figure 5-36: Direct and Converted Core Forest Impacts at Rexing Road Forest

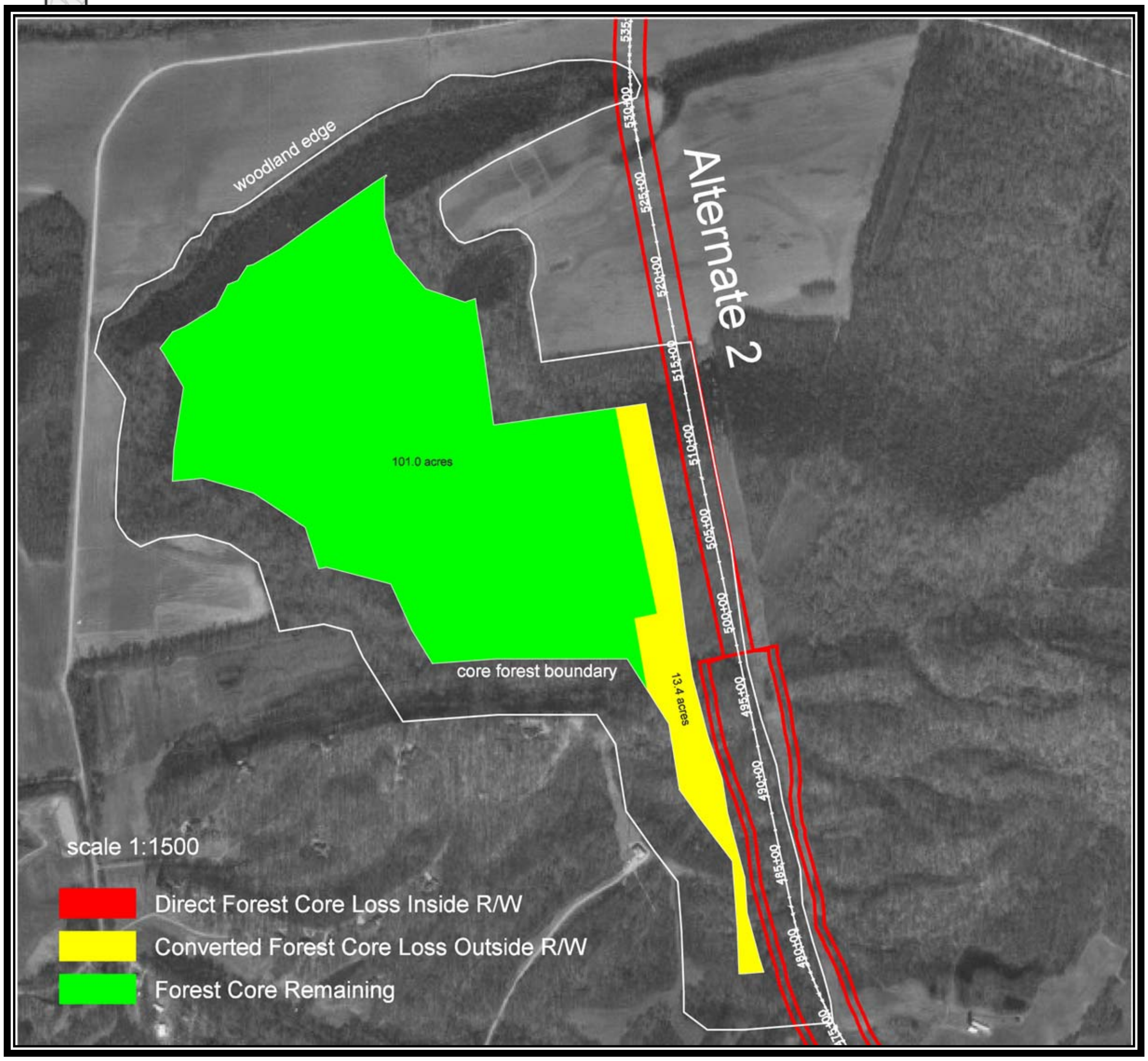


Figure 5-37: Direct and Converted Core Forest Impacts at Green River Road Forest

Summary

The land use analysis for the proposed project indicates that each of the proposed alternatives would result in the loss of forestland in the project study area. Alternative 3 would result in the least number (9) and least acreage (approx. 44 acres) of woodland loss within the alignment and would involve no loss of core forest habitat. With the exception of one woods, most of this acreage is attributed to the crossing of narrow wooded corridors or the complete loss of small isolated woodlots. The estimated loss of 55 acres of woodland at eleven locations along Alternative 2 is slightly greater than Alternative 3. The majority of this occurs within bottomland floodplain woods south of Green River Road and the adjacent upland woods known as Wolf Hills. The remaining woodland impacts occur at wooded corridor crossings and small woodlots. Encroachment through the Wolf Hills area would also result in the converted loss of approximately 13 acres of core forest habitat. In contrast, Alternatives 1 and 1A are estimated to cause the loss of 243 and 258 acres at over 30 locations along the proposed alignments, as much as 4.4 to 5.8 times as much as expected for either Alternative 2 or 3. In addition, core forest impacts are expected at three locations (one in Kentucky and two in Indiana) resulting in the collective loss of 20 acres of core forest habitat. Woodland loss along Alternatives 1 and 1A occur throughout the alignment in Indiana, but is generally confined to the riparian area of Canoe Creek in Kentucky.

5.18 WATER BODY MODIFICATIONS

Introduction

The rivers and streams of Indiana and Kentucky serve as a water supply for irrigation and consumption, centers for recreation, and habitats for both terrestrial and aquatic wildlife. These waterways also promote tourism, which provides revenue for the surrounding areas. Riparian woods along these waterways provide a filtration system for the water that resides within their banks.

A water body modification as defined in this document is an intentional alteration to a body of water due to encroachment of the proposed project by construction of bridges, corrugated culverts or concrete box culverts. This section addresses alterations to rivers and streams. Impacts to open water ponds and lakes are addressed in the wetlands section. Types of modification that may occur include channel relocation, channel deepening, and cutting of trees and other vegetation that may cause erosion of stream banks.

Methodology

The assessment of potential physical impacts to rivers, streams, creeks and ditches was performed using digital imagery in conjunction with field reconnaissance observations and collected data. An analysis of Ohio and Green River crossings was limited to an approximation of the bank-to-bank distance at each proposed bridge and observations of commercial/industrial facilities located along the river both upstream and downstream of the proposed crossing. Since no proposed bridge type currently exists for the project, the extent of impacts at each bank and below the ordinary high water mark could not be determined. The number, type and location of piers for each of the proposed crossings is not currently known.

All perennial, intermittent and ephemeral stream crossed or otherwise encroached upon by the alignment for each alternative were documented on aerial photographs in the field. These three channel classifications are defined in terms of flow regimes as follows (Rosgen, 1996):

Perennial – stream water persists year long

Intermittent – flows only seasonally, or sporadically

Ephemeral – flows only in response to precipitation

For each site the average ordinary high water mark was determined and the surrounding land use at the point of crossing was noted. The centerline of each channel within the alignment was digitized onto aerial photographs such that the linear distance of probable alternation could be determined. The linear distance of impact included the length of channel from the upstream point of contact with the alignment boundary to the downstream point of contact. The type of structure to be used for bridging each channel or the proposed course of any channel realignments along the alignment are not currently known for the project. The tables in **Appendix C-8** list each of the proposed crossings by station number and include information concerning the linear distance affected, average ordinary high water mark, vegetative cover, and possible means of crossing. The means of crossing is denoted as either at-grade or elevated. At-grade crossings include culverts and bridges where work within the channel is likely. Elevated crossings include those streams and ditches within the Ohio and Green River floodplain or at the system-to-system interchanges where potential exists to span the waterbody by placement of the roadway on piers.

Analysis

Rivers

The Ohio River and Green River are the central riverine aquatic features of the project study area. The Ohio River drains 203,910 square miles prior to its confluence with the Mississippi

River, including all or portions of fourteen states in the mid-western and northeastern United States. At Evansville, the Ohio River drains approximately 107,000 square miles including all or parts of ten states. The project study area spans the Uniontown pool of the Ohio River, defined by the Newburgh Lock and Dam upstream at river mile 776 and the John T. Myers Lock and Dam (formerly Uniontown Lock and Dam) downstream at river mile 846. Normal pool elevation for the Uniontown pool is 342 feet with ordinary high water designated at 354.5 feet. One feature of the proposed project would be a new bridge spanning the Ohio River. At present, the type of bridge (i.e. suspended, cable stayed, steel truss) has not been determined, nor has it been decided the number and placement of bridge support piers in the channel. Bridge design details cannot be finalized prior to the design phase of the selected alternative due to the lack of data that would be necessary to support such decisions (i.e. survey information, geotechnical analyses, etc.). Additionally, the U.S. Coast Guard will guide the location of pier placements within the Ohio River.

Alternatives 1 and 1A cross the Ohio River down river of the City of Henderson at river mile 805.7 across the northern end of Henderson Island. The island divides the river into two channels, both of which are used for navigation. The overall bank-to-bank distance across the river at this location is approximately 3,970 feet **(Table 5-37)**. The north channel is the wider of the two with a bank-to-bank width of roughly 1,890 feet. The south channel, the main navigation channel through this area, has a bank-to-bank width of approximately 830 feet. Central Soya of Henderson, Inc. and Henderson County Sand & Gravel Co., Inc. operate docks on the southeastern bank of the river approximately 1.4 miles upstream of the proposed alignment. Docks and ports along the south bank 1.5 miles or more downstream of the proposed crossing include Agrico Chemical Co. (inactive), Henderson Dock, Henderson County Riverport Authority, Ellis Grain Co. Sun Refining & Marketing Co., and Henderson Materials, Inc. (Blue Water Enterprises, Inc., 1993).

Table 5-37: Summary of River Widths at Proposed Alternative Crossings

	Ohio River bank-to-bank crossing	Green River bank-to-bank crossing
Alternatives 1 and 1A	3,970 feet	not crossed
Alternative 2	2,040 feet	not crossed
Alternative 3	2,130 feet	470 feet

Source: Bernardin, Lochmueller & Associates, Inc.

Alternative 2 would cross the Ohio River at river mile 785 less than a mile down river of the Green River confluence. The bank-to-bank distance across the river at this location is approximately 2,040 feet. C & C Welding and Marine Services operates fleeting areas along the south shores of the Ohio within 0.25 miles downstream of the proposed alignment and just over a mile upstream at the mouth of the Green River. The Evansville Terminal Co. operates a fleeting area along the north banks, roughly 4,000 feet up river (Blue Water Enterprises, Inc.).

Alternative 3 crosses the Ohio River at river mile 782. The bank-to-bank width of the Ohio River perpendicular to the axis of the channel is approximately 2,130 feet; however, because the alignment crosses at a skewed angle, the width of river spanned is roughly 2,300 feet from bank-to-bank. Mulzer Crushed Stone Co. and Mulzer Grain operate loading facilities just over a mile up river of the proposed crossing (Blue Water Enterprises, Inc.).

At 9,230 square miles, the Green River drains the entire central portion of the state and is the largest drainage in Kentucky (Burr and Warren, 1986). It joins the Ohio River between river mile 784 and 785. Lock and Dam No. 1 at Spottsville (river mile 9.1) is the lowest navigational structure on the Green River and serves to regulate water flow in the lower portion of the drainage. Alternative 3 crosses the Green River at river mile 3.3 with a bank-to-bank distance of approximately 470 feet.

Although bridge pier placement for each of the proposed alternatives will undoubtedly have a local influence on riverbed sediment deposition and scouring, none of the proposed river crossings are expected to have an appreciable adverse effect on the morphology or stability of these rivers. Furthermore, the construction of a new bridge across the Ohio and Green Rivers is not expected to adversely affect the recreation and commerce functions of these rivers.

Streams

Each of the I-69 alternatives encounter several smaller watersheds. In Indiana, the project study area includes all or portions of four primary watersheds and a few minor Ohio River tributaries. Indiana watersheds include Pigeon Creek, Big Creek, Bayou Creek, and Eagle Creek. The minor tributaries include Kolb Ditch and Willow Pond Ditch in southeastern Vanderburgh and southwestern Warrick counties, and a series of agricultural ditches in the Union Township bottoms of southwestern Vanderburgh County, namely Frenchmans Slough, Stround Branch, Rahm Vickery Ditch, Goose Pond Ditch, Helfrich and Happe Ditch, and Camp Ditch. In Kentucky, virtually all of the project study area is within the Canoe Creek watershed, with the exception of the northeastern part where the smaller Race Creek, Cypress Slough, and Negro Creek watersheds are encountered.

The largest of the Indiana watersheds for the project is Pigeon Creek with a drainage area of 368 square miles encompassing portions of Vanderburgh, Warrick, and Gibson counties. Pigeon Creek empties into the Ohio River at the northern end of the horseshoe oxbow section of the Ohio River upon which Evansville was settled. It extends as far north as Princeton, beyond Fort Branch to the west, to the east just beyond Lynnville, and southeast to Chandler. Existing I-164, which forms the link between I-64 and US 41, crosses Pigeon Creek and several of its perennial and intermittent tributaries in eastern Vanderburgh and western Warrick County. Alternatives 2 and 3 would utilize 75 percent or more of this existing Interstate facility from I-64 down to the system-to-system interchanges proposed for each alignment. Because existing I-164 would not likely require significant modification to be incorporated into the I-69 Interstate design for Alternatives 2 and 3, no additional stream impacts within the Pigeon Creek watershed are anticipated.

Big Creek, with a drainage area of 256 square miles is the next largest watershed in the project study area. It generally flows from northeast to southwest and drains vast expanses of agricultural land in northwestern Vanderburgh County and throughout northeastern, central, and western Posey County where it empties into the Wabash River. Alternatives 1 and 1A cross the Big Creek watershed within the upper third of its drainage. Principal perennial streams encountered include Pond Flat Ditch, Maidlow Creek, Barr Creek, Clear Creek, Neu Creek, Wolf Creek, and Little Creek. Many of these creeks have been channelized and possess very limited or no riparian cover. However, some of the first and even second order creeks exhibit some sinuosity with low to moderate gradients and display fragmented riparian cover.

Bayou Creek drains a large portion of southwestern Vanderburgh County and is unique in that it runs across the top of the large oxbow portion of the Ohio River and has two points of confluence. The upriver mouth is on the west bank of the Ohio River at mile point 796.5 and the downriver mouth is along the north bank at mile point 815. Bayou Creek receives water from three principal north-south flowing tributaries (Carpentier Creek, Sanders Creek, and an unnamed stream) and from three east-west trending agricultural ditches (Edmond Ditch, Cypress Dale Ditch, and Barnett Ditch). A large portion of the Bayou Creek watershed north of the creek is wooded although many of the ridgetops and stream valleys have been cleared for residential development, roads, and limited agriculture. With the exception of a few small remaining tracts of wetland woods, all of the Bayou Creek drainage south of the creek has been converted to agriculture.

Eagle Creek watershed drains approximately 12.8 square miles of floodplain south of the Evansville levee system in southeastern Vanderburgh County. The creek has been channelized throughout its entire length and flows west-northwest from near Angel Mounds State Historic Site to Inland Marina where it empties into the Ohio River at river mile 791. Land use within the watershed is predominantly farmland. Exceptions include the bottomland and wetland woods along Eagle Creek west of Green River Road, the mosaic of sloughs associated with the creek both east and west of US41 and south of I-164, an Ohio River terminal for off-loading coal from barges, a salvage yard, a sand quarry, an asphalt plant, a mobile home park, and Ellis Park horse track. Under non-flood conditions Eagle Creek receives water from the north in the form of run-off from I-164 and via controlled flow culverts under the levee. From the south, water is drained toward the creek by way of numerous parallel shallow swales through the farmland and previously noted sloughs. Under flooding conditions, a large portion of this watershed becomes inundated by the Ohio River.

The minor tributary ditches of the Ohio River encountered in the Union Township bottoms of Vanderburgh County drain from east to west and southeast to northwest across the nearly flat landscape of the oxbow. Frenchman's Slough and Stroud Branch join together to form Logsdon-Stroud Branch before their confluence with the Ohio River at river mile 813.2. Logsdon-Stroud Branch has a drainage area of approximately nine square miles. Likewise, Bahm Vickery Ditch and Goose Pond Ditch merge into a single channel before they empty into the Ohio River at river mile 813.4. Helfrich and Happe Ditch and Camp Ditch both exist as separate direct tributaries to the Ohio River at river mile 813.5 and river mile 814.7 respectively. All of these Ohio River tributaries are low gradient and represent the typical agricultural ditch with a trapezoidal channel, characteristic herbaceous cover along the banks, and usually a small berm at the top of the bank along each side.

In the southwest corner of Warrick County, Willow Pond Ditch is the only remaining waterbody within the Indiana portion of the project study area that would be affected by at least one of the proposed alternatives. The upper portion of the watershed begins just south of Outer Lincoln Avenue and trends southwest under Covert Avenue and Pollack Avenue before emptying into the Ohio River. Willow Pond Ditch is a low gradient waterway with a drainage area under three square miles and does not discharge directly into the main channel of the Ohio River. The confluence is also a long narrow backwater area of the Ohio River separated from the main channel by the two mile long linear strip of land referenced as Threemile Island. Land use in the lower portion of this small watershed is predominantly residential with small remnant agricultural tracts. The upper portion is a combination of residential neighborhoods, fragmented woods, and agricultural fields that are continuously being developed into additional residential sites. The bottom mile of the ditch is sinuous and possesses a narrow to moderately developed riparian corridor. North of Pollack Avenue, much of the stream is exposed, with portions of the channel entirely rip-rapped.

In Kentucky, Canoe Creek drains approximately 120 square miles of north-central Henderson County, including the City of Henderson. Its confluence with the Ohio River is southwest of Henderson at the bottom of the large oxbow bend in the river at river mile 806.7. The principal perennial tributaries of the Canoe Creek watershed include (from east to west) North Fork Canoe Creek, Elam Ditch, East Fork Canoe Creek, West Fork Canoe Creek, Barrett Ditch, and Wilson Creek. Excluding the lower 14 miles of Canoe Creek and Wilson Creek, the majority of the perennial streams of this watershed have been heavily channelized. The lower 14 miles of Canoe Creek north of SR 425 exhibits a relatively high degree of sinuosity and much of this section includes a well developed riparian corridor with occasional expanses of wetland and bottomland woods. As a flood control measure, a 1.3 mile long connector named Sellers Ditch was constructed between mile point 4.2 and mile point 13.9 on Canoe Creek. In effect, water carried by Barrett Ditch, West Fork Canoe Creek, Canoe Creek, and East Fork Canoe Creek south of KY 285 bypasses approximately 9.7 miles of Canoe Creek which now receives water from Elam Ditch and North Fork Canoe Creek only. As a result, the 1.2 mile segment of Canoe Creek between Sellers Ditch and Elam Ditch no longer carries appreciable flow and acts strictly as a local tributary and backwater area. Land use for the vast majority of the watershed is rural agriculture, rural residential, urban development, or industrial. Many of the rural perennial streams of Canoe Creek and their tributaries lack wooded riparian corridors. Most of the streams and creeks which do have trees and shrubs along and atop the banks have corridor widths of 50 to 75 feet or less.

Race Creek drains 11.5 square miles of land in northeastern Henderson County supporting row crops, pasture, rural residential development, the town of Baskett, and the Henderson County Club. Its headwaters are just north of Larue Road and the community of Zion, it flows north-northeast under US 60 and down to its confluence with the Green River at river mile 3.7. Much like Canoe Creek, the lower 2.3 miles of Race Creek is sinuous and displays a well developed riparian corridor, including palustrine forested wetlands. The remainder of the main channel and its tributaries to the south appear to have been channelized. Although a great deal of the channel south of KY1078 contains trees and scrub vegetation along and atop the banks, the width of this corridor is generally limited to less than 100 feet. None of the proposed alternatives cross Race Creek, but a number of its perennial and intermittent tributaries are encountered by Alternative 3.

Cypress Slough, as well as the other palustrine forested regions in the Ohio River and Green River floodplain east of US 41 receive surface runoff from John James Audubon State Park and the Wolf Hills upland area to the south. Overflow from Cypress Slough and drainage from Wolf Hills east of Tillman Bethel Road flow west and north respectively, ultimately converging into a single, wide channel that empties into the Green River at river mile 0.7. There is also a small intermittent stream that runs from south to north down into the Ohio River floodplain along the Texas Gas pipeline easement through Wolf Hills. This tributary crosses the cleared easement and carries water to a palustrine forest, which under high water conditions overflows into a shallow channel that conveys water east, under Tillman Bethel Road and ultimately into the Cypress Slough system described above. Much of the land use in this floodplain area along the Ohio and Green Rivers is bottomland woods and palustrine forested wetlands, however, some tracts have been cleared and are planted in row crops.

The western end of the agricultural land between the Ohio and Green Rivers in northeastern Henderson County is drained from northeast to southwest via Negro Creek into the Green River at river mile 2.4. USGS maps only depict two converging intermittent channels totaling approximately 1.5 miles of ditch. Runoff from the farm fields is drawn to these channels through a series of shallow parallel and converging swales. Alternative 3 is aligned north-south across these swales, but does not encroach upon either of the converging channels.

Field work for the proposed action included identification and general description of each of the USGS blueline streams crossed by each of the proposed alternatives as well as any non-blueline creeks or ditches encountered which appeared to display an ordinary high water (OHW) mark. For the purposes of this evaluation, USGS solid blueline streams and creeks were designated as perennial, broken blueline streams and creeks were designated as intermittent, and non-blueline creeks and ditches were classified as ephemeral. At each waterbody crossing, the average width of the OHW was measured based on vegetative and cross-sectional features of the channel. The vegetative character of the banks and atop the banks was also noted for the particular section of the stream or creek crossed (i.e., herbaceous, scrub, wooded, or combinations thereof). The tables of **Appendix C-8** inventory the streams encountered by the proposed right-of-way for Alternatives 1, 1A, 2, and 3. A stream need not be actually crossed by an alternative to be included. Streams which have a portion of their channel within the proposed right-of-way and are aligned parallel to the centerline, but not actually crossed by the alignment are regarded as potential stream rechannelizations and are also included. The inventory lists run from south to north along each alternative, are grouped by the watersheds described above, and indicate the approximate length of channel displaying an OHW that would be impacted by the preliminary design right-of-way limits. **Table 5-38** summarizes the number of potential stream crossings/realignments for each of the proposed alternatives. The streams crossed by existing I-164 are included for Alternatives 2 and 3, but should not be regarded as channels requiring any physical alterations.

Table 5-38: Summary of Potential Perennial, Intermittent and Ephemeral Stream Crossings for I-69 Alternatives

	All Encroachments		< 200 ft.	200 – 500 ft.	500 – 1000 ft.	> 1000 ft.
Alternative 1	perennial	14	3	7	3	1
	intermediate	28	8	12	4	4
	ephemeral	16	1	6	7	2
	total	**58**	**12**	**25**	**14**	**7**
Alternative 1A	perennial	16	3	9	3	1
	intermediate	33	7	15	6	5
	ephemeral	17	1	8	7	1
	total	**66**	**11**	**32**	**16**	**7**
Alternative 2	perennial	13	0	1	6	1
	intermediate	23	3	3	1	4
	ephemeral	5	0	2	1	2
	total	**41**	**3**	**6**	**8**	**7**
Alternative 3	perennial	12	2	1	3	1
	intermediate	27	4	6	1	3
	ephemeral	3	0	0	1	2
	total	**42**	**6**	**7**	**5**	**6**

Source: Bernardin, Lochmueller & Associates, Inc.

Alternative 1 would encounter an estimated 58 streams, creeks, and ditches displaying an ordinary high water (OHW) mark along its 32.1 mile length, fourteen of these are perennial streams. Additionally, fourteen have the potential to involve channel impacts between 500 and 1,000 feet in length with an additional seven channel realignments over 1,000 feet in length. Perennial streams with potential channel impacts greater than 500 feet include Sanders Creek (Bayou Creek watershed), Little Creek, Clear Creek, and Big Creek (all in the Big Creek watershed). In addition to the perennial stream impacts, Alternative 1 would cross or realign as many as 28 intermediate and 16 ephemeral stream channels.

The 35.4 miles of Alternative 1A would cross an estimated 66 streams, creeks, or ditches with an OHW. Sixteen of these are perennial streams. This alignment has the potential to impact 500 to 1,000 feet of sixteen different channel segments. Perennial streams with potential channel impacts greater than 500 feet include Sanders Creek (Bayou Creek watershed), Little Creek (Big Creek watershed), and two sections of Barr Creek (Big Creek watershed). In addition to the perennial stream impacts, Alternative 1A would cross or realign as many as 33 intermediate and 17 ephemeral stream channels.

The 31.5 miles of Alternative 2 would cross an estimated 41 streams, creeks, or ditches with an OHW; however, seventeen of these are intermittent and perennial streams already crossed by the 18.5 miles of existing I-164 that would be utilized (unaltered) for the majority of the Indiana portion of the alignment. Therefore, only 24 stream segments would be impacted by this alignment. Of these, eight are perennial streams, six of which involve lengths between 500 and 1,000 feet within the right-of-way. A seventh perennial stream may involve channel realignment over 1,000 feet. Three of the perennial streams with greater than 500 feet of their channel within the proposed right-of-way are Elam Ditch tributaries in Kentucky. The southernmost of these is located at the proposed system-to-system interchange with the Breathitt Parkway. Because this interchange will likely require one or more elevated ramps, it is possible that the 900+ feet of encroachment reported in this study is an over estimate and that the ditch may be spanned with no impact to the existing channel. The 1,500+ feet section of the Elam Ditch tributary north and south of the Audubon Parkway is located within the proposed system-to-system interchange. Two perennial stream encroachments between 525 and 550 feet are located on North Fork Canoe Creek tributaries. The remaining two perennial stream encroachments greater than 500 feet occur on Eagle Creek in Indiana. As described for the system-to-system interchange with the Breathitt Parkway, the interchange with I-164 involves ramps that may be placed on piers, in which case channel modifications to one or both sections of Eagle Creek may be avoided. In addition to the perennial stream impacts, Alternative 2 would cross or realign as many as 11 intermediate and 5 ephemeral stream channels.

The 29.7 miles of Alternative 3 would cross an estimated 42 streams, creeks, or ditches with an OHW. As with Alternative 3, seventeen of these are intermittent and perennial streams crossed by the 14.8 miles of existing I-164 that would be used for the majority of the Indiana portion of the alignment. Of the remaining 25 streams encountered by Alternative 3, six are perennial streams in Kentucky and one in Indiana. Two of the perennial streams in Kentucky involve 500 to 1,000 feet of channel in the proposed right-of-way, while a third involves a 1,500+ feet section of an Elam Ditch tributary north and south of the Audubon Parkway where an interchange is proposed. As described for Alternative 2, the southernmost perennial Elam Ditch tributary is located where the system-to-system interchange with the Breathitt Parkway is proposed. The potential for elevated ramps in this vicinity may result in far less encroachment to the existing change than the 900+ feet reported. The Willow Pond Ditch perennial stream in Indiana south of Pollack Avenue would be crossed perpendicularly once by Alternative 3. A second longitudinal encroachment of 800+ feet just south of Pollack Avenue is also expected to occur within the proposed right-of-way. The roadway for this section of Alternative 3 may be elevated on piers, thus reducing potential impacts to the Willow Pond Ditch channel. In addition to the perennial stream impacts, Alternative 3 would cross or realign as many as 14 intermediate and 3 ephemeral stream channels.

The No-Build Alternative would not require a new bridge across the Ohio and/or Green River, nor would it result in the physical alteration to any perennial, intermittent or ephemeral streams.

Summary

All of the proposed alternatives require the construction of a new bridge across the Ohio River, and in the case of Alternative 3, a span across the Green River. Each of the bridge crossings would require considerable construction activities on the banks and below the ordinary high water mark of both rivers for pier and deck construction. In addition, each of the proposed alternatives would result in alterations (i.e., culvert/bridge crossings or realignments) to multiple streams, creek and ditches. Alternatives 1 and 1A would affect an estimated 58 and 66 waterbodies displaying an ordinary high water mark, 14 and 16 respectively of which are perennial. Twenty-one of the streams encountered by Alternative 1 and 23 of those encountered by Alternative 1A involve an estimated 500 feet or more of channel impact. In contrast, Alternative 2 and 3 would require alterations to 24 and 25 streams, creeks or ditches respectively, the majority of which are within the Canoe Creek drainage in Henderson County, Kentucky. Thirteen Alternative 2 crossings and twelve Alternative 3 crossings are perennial streams. Fifteen of those encountered by Alternative 2 and eleven of those encountered by Alternative 3 have anticipated linear impacts greater than 500 feet. Since both of these alternatives would utilize existing I-164 without modifications, the 17 water bodies of the Pigeon Creek watershed crossed by the existing 4-lane facility would not be physically altered by the proposed action.

5.19 WATER QUALITY IMPACTS

Introduction

The Federal Water Pollution Control Act (P.L. 92-500) as amended by the Clean Water Act of 1977 (P.L. 95-217) establishes the standards for water quality in Indiana and Kentucky. The Indiana Water Pollution Control Board and Kentucky Division of Water are responsible for water quality management and have established programs to work with the federal and local governments to implement water quality standards.

Water Quality impacts are an important consideration in any proposed action. To determine such probable impacts, the following criteria were evaluated:

Ambient conditions of rivers/streams which are likely to be impacted by the proposed action; sole source aquifers under Section 141(e) of the Safe Drinking Water Act; water quality issues such as public water supply intakes, public water supply wells, and wellhead protection areas as authorized under the 1986 Amendments to the Safe Drinking Water Act; and Environmentally sensitive areas for each alternative, such as karst related caves, sinking stream basins, sinkholes, and management lands for wildlife.

The major Indiana drainages in the project study area include Pigeon Creek, Big Creek, Bayou Creek and Eagle Creek. Since Alternatives 2 and 3 utilize existing I-164, the Pigeon Creek drainage would not be crossed by new alignment. However, Pigeon Creek would continue to be affected by highway runoff generated from anticipated increases in traffic volume on I-164. In Kentucky, Ohio River drainages include the Green River, Canoe Creek and Race Creek.

Methodology

Water quality impacts were evaluated by reviewing information from a number of sources including associated GIS data layers. Information on public drinking water supply sites, both surface and groundwater supplies, comes from the United States Environmental Protection Agency (USEPA), while information on impaired streams, wellhead protection areas, and public water supply wells comes the Indiana Department of Environmental Management (IDEM) and the Kentucky Division of Water.

In addition to these sources, a number of local studies and papers have been reviewed for ambient conditions coupled with previous and current biotic sampling data. As part of the proposed action, general water quality sampling was conducted at 15 perennial stream sites (10 in Indiana and 5 in Kentucky) to establish baseline information for existing conditions. The combination of the GIS information with the references provides a general review for water quality issues.

Impacts to aquatic resources and water quality were evaluated for both short term impacts resulting from the construction of the highway as well as long term impacts of runoff and continual maintenance of the highway.

Analysis

Although the water quality of the Ohio River, Green River and Pigeon Creek is well documented and monitored regularly, drainages such as Big Creek, Bayou Creek, Canoe Creek and Race Creek have received little attention with regard to water quality investigations. Many of the streams in the project study area have become degraded through poor management strategies such as loss/minimization of riparian corridor, channelization, point source and non-point source pollution. As part of the proposed action, general water quality sampling was conducted at 15 perennial stream sites (10 in Indiana and 5 in Kentucky) **Appendix C-10**. The Big Creek system, the southern portion of the Bayou Creek system, the southern portion of the Eagle Creek system and the majority of the Canoe Creek and Race Creek systems exhibit extensive agricultural land use within their drainages. Many of these streams have been channelized and/or are farmed to near the edge of the stream bank in order to maximize farming opportunities. This generally leads to higher sedimentation, turbidity and non-point source nutrient enrichment from runoff, and streambank erosion due to a lack of vegetation. These streams have also lost most of their tree canopy resulting in high water temperatures. Without this tree cover some streams become too warm and can stress aquatic life.

The upper Big Creek drainage including Barr Creek in Vanderburgh and Posey counties has been characterized as a highly channelized system with steep, sometimes slumping bank slopes, stream bottoms composed mostly of sand and silt, and generally lacking natural riparian vegetation and shade (Commonwealth Biomonitoring, 1994). Although the Neu Creek, Little Creek and Wolf Creek tributaries were not included in the 1994 Big Creek bioassessment, similar land use conditions and problematic practices occur within these drainages as well. Benthic communities in these drainages are slightly to moderately impacted compared to a similar sized high quality drainage within the watershed. Barr Creek shows signs of higher than normal nutrient enrichment, while Big Creek reportedly has slightly degraded water quality and habitat. Daytime dissolved oxygen levels are generally within acceptable limits, sometimes above saturation. In 2002 percent saturation of dissolved oxygen ranged from 50 percent to just over 100 percent saturation. However, Barr Creek, Clear Creek and Neu Creek were at or below 5 mg/l, generally regarded as the lowest acceptable level to support warm water aquatic life. The 1994 bioassessment pH readings ranged from 8.0 to 9.3 for Big Creek and Barr Creek, the upper limit of tolerance for many aquatic species. IDEM data from 1999 also showed relatively high pH levels of 9.5 on both Little Creek and Wolf Creek. In 2002 however, pH in Little, Wolf and Neu Creeks ranged between 7.4 and 7.8, slightly reduced from those recorded at Big Creek (8.9) and Barr Creek (8.0 and 8.2). The iron content at Neu Creek was comparatively high in the 2002 sample. IDEM turbidity readings in the upper portion of the watershed during August 1999 ranged from 31 to 131 NTU. Although, turbidity and sedimentation are believed to be periodically high in these streams, the relative abundance of sediment intolerant macroinvertebrate species in Barr Creek is possible evidence that sedimentation is not exceptionally high. In the summer of 1994, low biotic index scores indicated moderate impairment within Big Creek, possibly attributed to high water temperatures (Commonwealth Biomonitoring, 1994). Intolerant fish species identified in 2002 I-69 investigation and previous studies in the upper Big Creek watershed (BLA, Inc., 1990 unpublished, Grannan and Lodato, 1986; Kozel *et al.*, 1981) include steelcolor shiner, brook silverside, sand shiner, mimic shiner and longear sunfish. Each sample site would typically produce one or no intolerant species, with the occasional site yielding two such species. However, four of the fourteen species collected at the 2002 Little Creek site were intolerant species and comprised 30 percent of the collection. The 1994 bioassessment hypothesized that without watershed management water quality and habitat value would sharply decline and so too would the resident biota.

The water quality of Bayou Creek is affected by both urban runoff from Evansville via Carpentier Creek and rural runoff from agricultural and wooded landscapes in western Vanderburgh County. Unlike several of the streams in the Big Creek drainage, Bayou Creek displays very little rechannelization and is provided shade from tree cover throughout most of its length, thus reducing water temperatures during hot summer periods. In 2000, the IDEM analyzed Bayou Creek for basic water quality parameters. The pH averaged around 7.0 compared to the 8.1 to 8.2 range recorded in 2002 for the proposed action. Turbidity was comparatively low at 4 to 10 NTU. July and August 2000 dissolved oxygen levels of IDEM were very low (0.4 to 1.9 mg/l). However, the 2002 field readings of 7.8 and 8.1 mg/l are more suitable for warm water aquatic life. Of the 34 species of fish identified from the collective works of the I-69 field studies, Cervone *et al.* (1989), and Grannan and Lodato (1986), the mimic shiner, southern redbelly dace, golden redhorse and spottail darter are the only intolerant fish species known from the Bayou Creek watershed. Bayou Creek data suggests that typically zero to two intolerant fish species were collected per sample site.

Eagle Creek is a highly channelized legal drain that follows along the south side of I-164 in southeastern Vanderburgh County. It displays a typical trapezoidal cross section and is generally kept clear of woody vegetation for a distance of 50 feet or more from the top of each bank. No previous water quality data from IDEM was available. Due to the lack of tree cover, water temperatures are likely to be high during the summer months. This stream typically displays some degree of turbidity, in part due to agricultural runoff from the floodplain fields to the south.

Canoe Creek (including North Fork and Elam Ditch tributaries) has been extensively channelized with the exception of the lower 14 miles of Canoe Creek (excluding Sellers Ditch). In 1980, land use in the Canoe Creek watershed was estimated at 95 percent agriculture with just 3 percent in forest and 2 percent urban (Harker *et al.*, 1981). Like most of the other agricultural streams described, there is usually very little, if any, tree cover along the ditches of this drainage to assist in keeping water temperatures down. Harker et al. (1981) described the data from previous water analyses conducted by the United States Geological Survey as indicative of "relatively good water quality". The 1980 Canoe Creek site sampled by the KSNPC displayed a moderately high pH of 8.0 with a quite low dissolved oxygen concentration of 3.6 mg/l and mild turbidity. Data from the four 2002 I-69 sample sites in the Canoe Creek drainage showed that pH ranged from near neutral at 7.2 on Canoe Creek itself to as high as 9.3 at an Elam Ditch tributary. Dissolved oxygen was extremely low at Canoe Creek (0.5 mg/l) causing stressed conditions for warm water aquatic life. In contrast, supersaturated oxygen levels (16.3 mg/l) were recorded at the Elam Ditch site. Using algal, macroinvertebrate and fish diversity and composition data to assess the water quality of Canoe Creek, Harker *et al.* (1981) found high diversity and equitability among diatoms, macroinvertebrate samples of moderate index values, and a relatively diverse assemblage of seventeen species of fish. The large number of juvenile commercial and game fish found in 1980 suggests that Canoe Creek is an important nursery area. None of the eleven fish species collected within the Canoe Creek watershed in 2002 were intolerant species. The only two intolerant species documented from the Canoe Creek site sampled by KSNPC (Harker *et al.*, 1981) were the steelcolor shiner and longear sunfish. Nearly all of the permitted point source dischargers on North Fork are downstream of the Alternative 2 crossing.

The surface water quality of the small Race Creek watershed in northeastern Henderson County has apparently not been previously investigated. The lower floodplain portion of Race Creek still retains much of its natural sinuosity. Although agriculture (row crop and livestock) is the predominant land use, sizable tracts of wetland woods drain into Race Creek north of Baskett, Kentucky. The majority of Race Creek and its tributaries above the Green River floodplain have been altered through channelization, and generally support very narrow riparian cover along their banks. The 2002 I-69 summer sample site on Race Creek showed a slightly elevated pH of 8.2 and dissolved oxygen concentrations just above the acceptability threshold. There were no intolerant fish among the nine species collected at the Race Creek site in 2002. Erosion, siltation, stream bank stabilization and the collection of man-made debris are continuing water quality issues for Race Creek. Alternative 3 is the only proposed alignment that traverses the Race Creek watershed. It essentially parallels the main axis of the drainage to the northwest, crossing but a few of the upper headwater intermittent and ephemeral streams within the watershed.

Sole Source Aquifers and Wellhead Protection Program

The St. Joseph Aquifer along the Indiana/Michigan border is the only sole source aquifer designated in Indiana and due to its distance from the project study area, will not be affected by this project. There are no sole source aquifers designated within Kentucky. As part of the 1986 amendments to the Safe Drinking Water Act, the EPA requires states to adopt a Wellhead Protection Program to protect public water wells and springs from contamination. Wellhead Protection Areas (WHPA) currently under development within or near the project study area in Indiana include one at the town of Chandler (Warrick County) east of the project study area and a second near Cynthiana (Gibson County) north of the project study area. Neither of these would be encountered by any of the proposed routes. In Henderson County, Kentucky there are currently two WHPA sites with plans under review for entry into the program. Alternative 2, the nearest of the three alternatives, is over one mile east of both of these wellhead protection zones.

Potential Highway Related Water Quality Impacts
Roadway runoff can have significant impacts to the water quality of streams crossed by highways as well as water quality downstream. Roadway runoff constituents generally include particulates, nitrogen, phosphorus, metals, cyanide, deicing salts (sodium, calcium, chloride), sulfates, petroleum, pesticides, PCBs, rubber, pathogenic bacteria, and asbestos. Primary sources of these constituents include deicing chemicals, tire wear, engine and moving part wear, exhaust, motor lubricant leaks and blow-by, roadside fertilizing and spraying, and atmospheric deposition.
The use of deicing chemicals is the most economical method available to provide bare pavement conditions for safer winter driving on highways. However, a variety of environmental consequences have been associated with the use of these materials and their associated additives. Deicing salts and chemicals draining from roads into nearby streams can cause changes in water quality, especially under low flow conditions. Weak biodegradable acids like calcium magnesium acetate and potassium acetate are more environmentally sensitive deicing compounds compared to sodium chloride, calcium chloride and magnesium chloride. Increased salt concentrations can cause osmoregulatory problems and toxicity in freshwater aquatic animal life that lack effective means of eliminating salt from their bodies and have difficulty adapting to sudden increases in salinity. The effects of salt concentrations on aquatic life vary considerably. Concentrations as high as 2,000 to 3,000 ppm have been tolerated by freshwater species such as largemouth bass and brown trout (California State Water Quality Control Board). On the other hand, concentrations as low as 400 ppm cannot be tolerated by some species of fish (FHWA Environmental Technology Brief). Salt concentrations of 1,500 ppm are generally considered suitable for use as drinking water for livestock and wildlife (California State Water Quality Control Board). Concentrations greater than 1 percent will endanger the health, reproduction and longevity in all species adapted to freshwater environments (Terry, 1974). Elevated salt concentrations also increase the suspended solid load, thus increasing water temperature and reducing dissolved oxygen.

In addition to aquatic animals, trees, shrubs and other vegetation along or near a roadway treated with deicing salts can also be adversely affected by runoff and airborne deposits. Damage generally occurs through two mechanisms: increased salt concentration in soil and soil water, which can result in salt absorption through roots, and salt accumulation on foliage and branches due to splash and spray (Transportation Research Board, 1991). Salt inhibits plant growth by changing soil structure, changing naturally occurring osmotic gradients and through chloride ion toxicity (NCHRP, 1976). Excess salinity causes moisture stress in plants, suppresses proper nutrient uptake, and leads to deficiencies in plant nutrition (NCHRP, 1978). As with aquatic animals, some species of trees such as red oak, white oak, red cedar, black locust, quaking aspen, and birches are more salt tolerant than are other species like red pine, speckled alder, sugar maple, hemlock (Transportation Research Board, 1991).

Deicing chemical additives in roadway runoff can also result in adverse effects to organisms or undesirable side effects in adjacent lands. Cyanide ion byproducts from sodium ferrocyanide used to prevent caking of deicing chemicals may be toxic to humans, animals and fish when it occurs in sufficient concentrations. Phosphorus used as a rust inhibitor in road salts can promote the growth of unwanted aquatic plants or algae in lakes (FHWA Environmental Technology Brief).
A predictive analysis of roadway runoff salt concentrations for a typical mid-western Interstate was conducted as part of the Southwest Indiana Highway Corridor study (DEIS, 1996). The results of this study are considered comparable to that expected for the Evansville to Henderson segment of the I-69 corridor. Constants used in the analysis were a 300 foot roadway width called (r); ¼ ton of salt per mile per roadway lane (since the proposed Interstate is a 4-lane facility) or 1 ton per mile called (S); and a drainage length of 1 mile. Assumptions used in this analysis were: (1) 100 percent precipitation runoff (no absorption); (2) 100 percent of applied salt is dissolved in precipitation runoff; (3) no overland flow (runoff) from adjacent land; (4) density of runoff water carrying dissolved salt is 1 mg/l; (5) concentration of salt equals concentration of chloride; and (6) 1 inch of liquid (water) equals approximately 10 inches of snow.

Runoff from a 10-inch to 1-inch snowfall (1 inch to 0.1 inch of water respectively) representative of the range of typical snow events in this region is calculated to have in excess of 243 to 2,427 ppm of salt respectively. These results are considered a worse case scenario. Although assumptions 1, 2 and 3 simplify the analysis, they do not take into consideration factors such as runoff from areas adjacent to the roadway that provide dilution, absorption of a certain amount of salt in the soil before it can reach the nearest waterway, and the amount of water in the waterway. These factors would combine to reduce the salt concentrations below the 243 to 2,427 ppm range reported. Such levels are not considered significant and it is unlikely that roadway runoff would elevate chloride concentrations in receiving waters resulting in harm to fish, wildlife or livestock.

The FHWA “Predictive Procedure for Determining Pollutant Characteristics in Highway Runoff” (Kobriger *et al.*, 1981) indicates that pollutant accumulation rates within highway systems can be best predicted using average daily traffic values. The analysis showed that highway facilities with low to medium traffic volumes of approximately 30,000 ADT or less exert minimal to no impact on receiving waters. In consideration of existing and committed (E+C) transportation projects for the I-69 project study area, 2025 ADTs along Alternative 1 are expected to range from 4,069 to 17,952 vpd depending on location. For Alternative 1A the range is from 4,163 to 13,267 vpd with the maximums predicted between the interchanges of SR 66 and Upper Mt. Vernon Road in Indiana (Wolf Creek and Little Creek drainages) and between US 60 and KY285 interchanges in Kentucky (lower Canoe Creek drainage). 2025 ADTs for the bridge section from SR62 in Indiana to US60 in Henderson, Kentucky are estimated at 12,348 and 11,997 vpd respectively. Based on the ADT criteria of 30,000 vpd, roadway runoff containing pollutants derived from traffic on Alternatives 1 and 1A would not likely pose a significant impact to the water quality of any receiving waters/drainages crossed by the Interstate.

Predicted design year ADT volumes (E+C) for Alternative 2 exhibit a wide range from 19,513 to 46,459 vpd. In general, 2025 volumes along the entire I-164 segment of the alternative will be above or just below the 30,000 vpd mark. The Alternative 2 bridge over the Ohio River, which would span the Kentucky Division of Forestry’s proposed Green River State Forest purchase area, has a 2025 ADT of 28,891 vpd. A point of concern with the Division of Forestry is that runoff pollutants, including road salts, would drain vertically off the bridge via a bridge deck drop drain into the bottomland hardwood forest and other habitats within and immediately adjacent to the Interstate right-of-way resulting in adverse effects to the biota of the area. Since the migration path of pollutants released from such a drainage system to the ground below does not allow for soil absorption along the edge of the pavement or dilution through release into a nearby stream, the potential exists for localized negative impacts to herbaceous and woody vegetation within the floodplain. Such impacts could be avoided by incorporating a drainage collection system into the bridge which releases roadway runoff into a catch basin, thus controlling the dispersal of pollutants off of the bridge through the proposed Green River State Forest property.

Anticipated water quality impacts associated with Alternative 3 based on traffic volumes are generally similar to those expected for Alternative 2. 2025 ADT volumes range from 10,822 to 47,551 vpd. The 34,980 to 47,551 vpd traffic volumes for the various interchange-to-interchange segments along I-164 for Alternative 3 are all above the 30,000 vpd threshold posed by Kobriger *et al.* (1981). 2025 ADT for the bridge section that spans the Ohio and Green River floodplains and traverses the Race Creek drainage from I-164 to US 60 is estimated at 22,443 vpd. As with Alternative 2, control and/or treatment of roadway runoff from the bridge section may require additional consideration. At 10,822 to 18,324 vpd design year traffic volumes for the Kentucky portion of Alternative 3 from US60 to the Breathitt Parkway are well below the 30,000 vpd mark, indicating that runoff pollutant impacts are not of particular concern through the largely agricultural areas of the North Fork Canoe Creek and Elam Ditch drainages.

Summary

Based on a review of available water quality data, water quality impacts resulting from construction and continued maintenance (e.g., deicing, patching, repaving) of a build alternative are generally expected to be minimal, so long as appropriate erosion control measures are implemented and roadway runoff from the bridge and higher volume segments of the alternatives is appropriately discharged from the source into the surrounding terrestrial and aquatic environment. None of the alternatives are perceived to pose a threat to water quality standards concerning the support of warm water aquatic life, public drinking water supply, the continued use of the Ohio and Green Rivers and their tributaries as a source of fish for human consumption, or their continued use for primary and secondary recreation contact.

5.20 ECOSYSTEM IMPACTS

Introduction

An ecosystem is defined as "a biotic community and its abiotic environment, functioning as a system" (Smith, 1996). Biotic refers to the living components, while abiotic refers to the non-living components of the ecosystem. Ecosystems include the plants, animals, and microbes of an area plus nonliving components such as minerals, nutrients, soils, water, and energy, and the interactions of all of these components. Ecosystems may be aquatic or terrestrial; and ecosystems may be large or small. The ecosystems of the project study area are limited to some degree due to the size of the project study area and the fact that within the project study area there are large expanses of land that display uniform conditions.

In addition to impacts from the direct taking of land, ecosystems such as forests, grasslands, wetlands and others may be adversely affected by habitat fragmentation. Habitat fragmentation is perhaps the most pervasive type of habitat alteration taking place in the world today. The steady transformation of once large and continuous tracks of natural landscape into smaller and more isolated patches or fragments can degrade the quality of the ecosystem for use by certain species which require relatively large areas for refuge, foraging, breeding, etc. **Section 5.17 Forest Impacts** provides a discussion on the effects of forest fragmentation and an analysis of fragmented woods for the project study area.

Methodology

The GIS State Significant (SG) high quality natural community data layer provided by the Indiana Natural Heritage Data Center was utilized to identify any unique natural communities such as forests, flatwoods, prairies, wetlands, cliffs, glades, barrens, seeps, sand flats, and caves that have been previously documented within the project study area. Likewise, a data request from the KSNPC Natural Heritage Program Database was reviewed for high quality natural communities located in Henderson County, Kentucky. The assessment of potential ecosystem impacts also relied on observations of community types encountered during field reconnaissance.

Analysis

The Indiana Natural Heritage Data Center includes documentation of quality upland mesic forests at two locations (one in southwestern Vanderburgh County and another in northeastern Posey County) and a wet floodplain forest at Angel Mounds State Historic Site within the project study area. High quality natural communities within the project study area identified through the Kentucky Natural Heritage Program Database include the Sloughs Wildlife Management area in northwestern Henderson County and the bottomland marsh/slough south of the Green River in north central Henderson County. None of these high quality natural communities would be impacted by any of the proposed alternative alignments.

The Ohio and Green Rivers form the dominant aquatic ecosystem of the project study area. Both rivers support a diverse assemblage of aquatic and benthic species, and are rich in nutrients that are seasonally deposited upon the adjacent floodplains. Potential impacts to these big river systems focus primarily on bank stabilization and the effects of pier placement on the stability of the rivers substrate. The riverbanks need to be protected against heavy erosion during and after construction of the bridge to prevent heavy silt loads from entering the river. Additionally, pier design and placement should take into account the potential for scour on the river bottom and the potential effects of downstream sedimentation or changes in water flow patterns that could adversely affect components of the ecosystem such as mussel beds. These are potential ecosystem effects associated with all of the bridge crossings proposed. Another ecosystem feature of the Ohio River is the forested mid channel island just downstream of Henderson. Henderson Island is one of several Ohio River islands downstream of Henderson that provide isolated habitat for a variety of aquatic and wetland dependant species. Alternatives 1 and 1A would cut across the northern tip of the island; however, since the bridge would be elevated on piers roughly 90+ feet above normal pool elevation effects to this unique landform are expected to be minimal.

In the southwestern Indiana and northwestern Kentucky portion of the project study area the big river floodplain ecosystem consists of bottomland hardwood forested wetlands and sloughs within or adjacent to large agricultural expanses. All three alternatives would traverse various regions of the Ohio and Green River floodplain ecosystem in Indiana and/or Kentucky. One of the principal functions of this ecosystem is its use for agriculture. The corn and soybeans grown not only provide a much needed commodity and source of income for people, but also serve as refuge, habitat and a food source for wildlife associated with floodplains. Alternatives 1 and 1A encounter this system in the largely agriculture setting of southwestern Vanderburgh County. Here, row crops dominate the landscape up to Bayou Creek where a nearly contiguous system of forested palustrine wetlands are found along the creek. This vast agricultural alluvial plain with its very low gradient open ditches offers very little habitat diversity. However, during the wet season, portions of these fields become flooded and provide aquatic habitat for amphibians and migratory birds.

Alternative 2 encounters the big river floodplain ecosystem in Indiana and Kentucky. In Indiana this involves the land between I-164 and the Ohio River including large tracts of agricultural fields as well as Eagle Creek and its associated wetlands and borrow pits. On the Kentucky side Alternative 2 would span additional row crop fields and a large, broad west-east oriented bottomland woods and forested wetlands complex north of Wolf Hills. Finally, Alternative 3 would span exclusively agricultural landscape between the Ohio and Green Rivers. As described for Alternatives 1 and 1A, these fields flood regularly providing seasonal aquatic habitat during the spring wet season. Southwest of the Green River, the floodplain ecosystem consists of a mix of pasture, isolated small to medium sized open water ponds, bottomland wetland woods, and limited residential occupation. Impacts anticipated to each of these floodplain ecosystem areas resulting from fragmentation would be minimized substantially through construction of the roadway on piers above the floodplain.

The upland mesic woods ecosystem found along roughly 3.5 miles of Alternatives 1 and 1A between Bayou Creek and SR 62, as well as just north of SR 62 consist of numerous single household structures dispersed along secondary roads and dead end lanes that penetrate the rolling to moderately steep oak/hickory wooded hills of western Vanderburgh and eastern Posey counties. Within this ecosystem the proposed alternatives would require local changes to drainage patterns formed by the network of moderate to steep gradient ephemeral and intermittent tributary streams of Sanders Creek and Wolf Creek. The at-grade alignment of these alternatives will likely require moderate cut and fill activities through the several hillsides and small valleys of this landscape. As is the case with most at-grade transportation corridors through woodland, Alternatives 1 and 1A will locally fragment this ecosystem to the northeast and southwest, much the same way that existing SR 62 has split the area to the northwest and southeast. Alternatives 1 and 1A have the potential to act as a barrier that would restrict the local southwest to northeast movements (and visa versa) of some woodland species in the area that have adapted to co-habitation with people. Upland forested and grass/weed field ecosystem encountered along Alternative 2 are essentially confined to the Wolf Hills area in Kentucky immediately south of the Ohio River floodplain. The extent of this encroachment is limited to approximately 2500 feet along the alternative with no residential occupation. As with Alternatives 1 and 1A wildlife west to east wildlife movement through this ecosystem may be compromised. This system would also likely sustain the loss of an upland pond that serves as a breeding site and reliable source of water within the woods during dry periods.

The remainder of the Alternative 1 and 1A alignment in Indiana traverses an ecosystem consisting of a mosaic of small upland woodlots and grass/weed fields irregularly interspersed among agricultural fields on rolling hills. Residential occupation within this system is widespread but sparse consisting primarily of isolated lots or small clusters of homes. Much of the drainage of this landscape has previously been altered through rechannelization. In general the effects to this ecosystem would be additional loss and/or fragmentation of limited woodland and fallow field communities, as well as row crop and to a lesser extent pasture land. In Kentucky, Alternative 1 and 1A ecosystem impacts would be limited to the riparian woods along Canoe Creek and the nearly flat, extensive agricultural fields within the Canoe Creek and Elam Ditch floodplain areas south of Henderson.

Ecosystem impacts associated with Alternative 2 in Kentucky south of the Wolf Hills area would be limited to fragmentation of multiple tracts of row cropland in the headwater reaches of North Fork Canoe Creek and the flatter floodplain areas of Elam Ditch and its tributaries. The clearing of thin riparian corridors along channelized ditches are also expected. Similar agricultural ecosystem impacts are expected for Alternative 3 south of the Green River floodplain in the Race Creek and Elam Ditch drainages.

The No-Build Alternative would result in no adverse impacts to any of the existing ecosystems of the project study area.

Summary

Ecosystems represent all the living and nonliving portions of a natural community, as well as their interactions. Bottomland forests, upland forests, wetlands, old fields and agricultural cropland/woodlot mosaics are examples of the ecosystems that exist within the project study area. The Indiana Natural Heritage Data Center includes documentation of upland mesic forests at two locations and a wet floodplain forest at Angel Mounds State Historic Site within the project study area. High quality natural communities within the project study area identified through the Kentucky Natural Heritage Program Database include the Sloughs Wildlife Management area in northwestern Henderson County and the bottomland marsh/slough south of the Green River in north central Henderson County. None of Indiana or Kentucky sites recorded would be adversely impacted by any of the Build Alternatives or the No-Build Alternative. The I-69 field reconnaissance showed that on an ecosystem level, none of the proposed alternatives are expected to result in any outstanding adverse effects.

5.21 ENERGY IMPACTS

Introduction

The energy impacts of the various alternatives will be assessed in this section. A brief description of the methodology used to calculate energy consumption is provided, and the comparative energy consumption data is summarized and discussed. Finally, the conclusions of the analysis are given.

Methodology

As a part of the transportation and economic analysis of the alternatives, a traffic model was developed to assess the no-build and build alternatives. The traffic model simulates overall traffic conditions throughout the highway network, which encompasses the five county region around Evansville and Henderson (Vanderburgh, Warrick, Posey, Gibson, and Henderson). This model was run for the no-build and the four build alternatives for the study's base year of 2000 and forecast year of 2025. Data that was output by the model included auto and truck volumes-per-day, vehicle-miles of traffic, and typical daily speeds on each link in the highway system. This data was then used to compute the daily vehicle-operating cost for gasoline and diesel fuel that are forecasted to be consumed in the base year of 2000 and forecast year of 2025 for each alternative. Factors were then used to convert from dollars to gallons and from gallons of fuel to BTUs. The 1990 to 1999 annual average fuel cost was $1.208 per gallon of gasoline and $1.142 per gallon of diesel fuel. One million BTUs is approximately equivalent to 8.007 gallons of gasoline or 7.201 gallons of diesel fuel. Daily energy consumption was also converted to an annual basis. For the purposes of this analysis, it is assumed that passenger vehicles and single-unit trucks use gasoline and heavy-duty trucks use diesel fuel.

It should be noted that the analysis includes all elements of induced travel resulting from: (1) longer average trip lengths; (2) more trips generated regionally as a result of new economic and residential development stimulated by I-69; and (3) more trips generated regionally as a result of added connectivity from a new Ohio River crossing.

Analysis

Table 5-39 summarizes the results of the energy analysis for the study's forecast-year 2025. Additional energy consumed by the alternatives range from a low of 0.51 percent increase over the No-Build to 2.80 percent increase for Alternatives 2 and 1, respectively. Energy impacts are a function of several variables including: average running speed, vehicle-miles of travel, and the mix of vehicle types in the system (i.e., autos versus heavy trucks). Generally, the eastern alternatives that make use of existing I-164 would consume less energy than the western alternatives that would be entirely new construction. These routes draw more traffic off of congested existing routes such as US 41 as well as being shorter than the western alternatives.

Table 5-39: Annual Fuel Consumed in Excess of the No-Build Condition in Year 2025 by Build Alternative

Alternative	Annual Additional Energy Consumed above No-Build (2025)		
	Gallons (in millions)	BTUs (in billions)	% Increase
1	4.94	634	2.80%
1A	4.24	543	2.40%
2	0.88	116	0.51%
3	1.40	183	0.81%

Source: Bernardin Lochmueller & Associates, Inc.

Energy consumption for construction of the roadway has not been included in these calculations; however, this consumption would be anticipated to be directly related to the length of new construction. Given this assumption, Alternatives 2 and 3 would also consume considerably less energy for construction than Alternatives 1 and 1A.

Summary

Based on this analysis, all build alternatives would increase energy consumption over the no-build alternative. However, Alternatives 2 and 3 would have substantially smaller increases compared to Alternatives 1 and 1A. Additionally, user benefits such as accident reduction and travel time savings realized by the build alternatives significantly outweigh the increased energy consumption.

5.22 IRRETRIEVABLE AND IRREVERSIBLE RESOURCES

Introduction

Constructing I-69 from Henderson to Evansville will involve a commitment of many resources. Some of these resources include land, construction materials, and manpower. Land used in the construction of the proposed highway is considered an irretrievable resource that includes everything below the surface. Resources in the project study area that are irretrievable include farmland, coal, oil, and other mineral deposits.

Methodology

Each of the four build alternatives were analyzed with respect to the each possible loss.

Analysis

The project study area is within the Illinois Basin, which is synonymous with coal and oil deposits. Much of the coal in the project study area is deep beneath the surface and must be extracted by deep shaft mining techniques. Oil pools occur throughout the project study area in the eastern Posey and western Vanderburgh County regions in Indiana and in various locations in western and eastern parts of Henderson County Kentucky. Farmland is abundant in every county within the project study area, but most common in the open rolling land in Alternatives 1 and 1A where an entirely new terrain route would be needed. Alternative 1 is approximately 32.1 miles in length and uses no existing roadway facilities. Alternative 1A is approximately 35.4 miles long and also uses no existing roadway facilities.

Alternatives 2 and 3 utilize a substantial amount of existing roadway, which is included in the alternatives. Alternative 2 is about 31.5 miles in length and uses approximately 18.5 miles of existing I-164, which constitutes about 59 percent of the corridor. Alternative 3 is approximately 29.7 miles long and uses about 14.8 miles of existing I-164, approximately 50 percent of the total corridor. These shorter alternatives would consume less construction materials, labor, farmland, and other irretrievable resources. Alternative 2 may take a portion of the Weinbach Sand and Gravel Pit, which is currently being quarried.

The use of below ground extraction could access coal deposits, while keeping a sufficient overburden above to ensure the stability of the road. The continuing use of deep shaft mining and the use of horizontal and directional drilling methods for oil will ensure the future use of these resources wherever possible. Farmland is probably one of the most vulnerable and diminishing resources within the project study area and it cannot be used once covered by the roadway. As development associated with the new highway begins to flourish, oil and coal will become more difficult to obtain and farmland will be covered by homes and businesses.

Summary

The use of these resources is warranted in this project because the construction of this Interstate will produce an overall improved transportation system. All efforts will be made to minimize the covering of these irretrievable resources and to encourage planned development with the proper infrastructure for future generations.

5.23 THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USE OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Introduction

Constructing I-69 from Henderson to Evansville will have varying effects. Comparisons of these effects are needed to see the advantages and disadvantages of each build alternative.

Methodology

Each of the four build alternatives were evaluated with respect to short-term effects and long-term effects. Considerations for both positive and negative effects were taken into consideration with these ranges.

Analysis

There will be a considerable amount of resources allocated to the creation of the proposed Interstate from Henderson to Evansville. Resources such as rock, cement, steel, sand, earth, fossil fuels, and labor will be needed, and with any construction will come temporary disturbances. Such disturbances would consist of construction noise and visual impacts, wildlife disturbances along with home and business relocations. Alternatives 1 and 1A will impose greater amounts of disturbance due to the amount of newly constructed roadway that will be needed in comparison to Alternatives 2 and 3 where much of the routes would use existing facilities. Allowed time, these consequences of construction will go unnoticed and will be part of the new landscape.

Summary

The negative short-term effects stated above are of minor concern when compared with the positive effects of the proposed project. The long-term effects will be a shorter and safer route from Henderson to Evansville including a second river crossing. The long-term benefits of the proposed I-69 are consistent with the use of resources, the short-term impacts upon the areas involved, and by far outweigh the negative aspects.

5.24 INDIRECT AND CUMULATIVE IMPACTS

Introduction

Cumulative impacts are defined by the Council on Environmental Quality (CEQ) Regulations as "*the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.*" (CEQ Regulations) Cumulative impacts include the direct and indirect impacts of a project together with the reasonably foreseeable future actions of others.

Direct impacts are defined by the CEQ Regulations as "*effects which are caused by the action and occur at the same time and place.*" (CEQ Regulations) For this project, an example of a direct impact would be the taking of a wetland for right-of-way for an interchange.

Indirect impacts are defined by the CEQ Regulations as "*effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate…*" (CEQ Regulations) For this project, an example of an indirect impact would be farmland bought by a developer to build a service station at an interchange.

The impacts of reasonably foreseeable future actions of others not associated with the proposed project include the impacts of other federal, state, and private actions with the No-Build alternative for I-69. For this project, an example would be a forest located several miles away from I-69 that would be bought by a developer to construct a subdivision. This subdivision would not be associated with I-69, but it would be a reasonably foreseeable future action.

The assessment of cumulative impacts is required by the CEQ Regulations. These regulations ensure that the proposed I-69 project and other federal, state, and private actions will be evaluated with regard to cumulative impacts.

Methodology

The methodology for determining cumulative impacts of the proposed I-69 project follows an eleven step process. These steps are as follows:

1. **Identify the significant cumulative effects and issues associated with I-69**
2. **Establish the geographic scope for the analysis**
3. **Establish the time frame for the analysis**
4. **Identify other actions affecting the resources, ecosystems, and human communities of concern**
5. **Characterize the resources, ecosystems, and human communities identified in scoping and explain how they have historically changed**
6. **Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds**
7. **Define a baseline condition for the resources, ecosystems, and human communities**
8. **Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human community**
9. **Determine the magnitude and significance of cumulative effects by identifying the changes as a result of I-69**
10. **Modify or add alternatives to avoid, minimize, or mitigate significant cumulative impacts**

11. **Monitor the cumulative effects of the alternatives and provide documentation**

The eleven step process was developed using the following three documents:

"Considering Cumulative Effects Under the National Environmental Policy Act", (Council on Environmental Quality, 1997);

"Conducting Quality Cumulative Effects Analysis for the Federal Highway Administration and the Indiana Department of Transportation", (U. S. Department of Transportation and the Indiana Department of Transportation, 2000); and

"Consideration of Cumulative Impacts In EPA Review of NEPA Documents", (United States Environmental Protection Agency, 1999).

The direct impacts of the No-Build Alternative and four Build Alternatives consist of the right of way needs for the alignment. The indirect impacts were calculated using a combination of the Regional Travel Model and methodology developed by Hartgen and Kim for freeway service interchange development. The freeway service interchange development considers a national study of commercial development at rural and small town Interstate exits. Using these models, forecasts of residential, commercial, and industrial activity were computed and the activities were converted into acres using standard land use densities.

Analysis

The following sections discuss the analysis and results of each of the eleven steps for determining cumulative impacts.

1. **Identify the significant cumulative effects associated with I-69** - For the proposed I-69 project, three major resources, ecosystems and human communities were identified that are being analyzed for cumulative impacts. These three areas are (1) farmland, (2) forests, and (3) wetlands. These three resources were selected based upon their importance in the project study area as well as input from various resource agencies and were discussed at a December 13, 2001 meeting with various resource agencies. Analyzing these three areas also provides information on land use impacts of the project alternatives. The conversion of farmland, forests, and wetlands to developed land is reflected in the direct, indirect, and cumulative impacts discussed in this section.

2. **Establish the geographic scope for the analysis** - The geographic scope of the cumulative impacts analysis covers the entire five county project study area. This project study area includes Posey, Vanderburgh, and Warrick Counties in Indiana and Henderson County in Kentucky. The past, present, and future analysis of farmland, forests, and wetlands will look at this four county project study area.

3. **Establish the time frame for the analysis** - The time period studied for the cumulative impact analysis includes past years to present day. Available information has guided the extent of the past analysis, limiting the time frame for the study of farmlands and forests from 1950, and wetlands from 1992. Impacts were forecasted to the reasonably foreseeable year of 2025. Future analysis for the economic modeling and the transportation modeling is 2025 as well.

4. **Identify other actions affecting the resources, ecosystems, and human communities of concern** - The analysis of cumulative impacts for the proposed I-69 project considered the cumulative effects on the resources of farmland, forests, and wetlands. This included I-69 (direct and indirect impacts) as well as impacts from other major federal, state, and private actions in the project study area not related to I-69. With the growth in residential, commercial, and industrial

development in the five county project study area, the potential for cumulative impacts from these private development ventures has been included in the analysis. The major federal and state projects identified as other actions to be considered are shown in **Figure 5-38** and include:

I-69 from Evansville, Indiana to Indianapolis, Indiana
I-69 from Henderson, Kentucky to Western Kentucky and I-24
Green River State Forest
Proposed Green River National Wildlife Refuge
University Parkway from SR 62 to SR 66
Pigeon Creek Greenway Passage
Potential Added Travel Lanes on I-164

I-69 from Evansville to Indianapolis – The National I-69 project connects Canada to Mexico via the United States. Along the National I-69 corridor, Segments of Independent Utility (SIU) were identified. SIU #3 of the National I-69 project is a section that extends from Evansville, Indiana to Indianapolis, Indiana.

The proposed I-69 between Evansville and Indianapolis will have 4 to 8 lanes with a median and total control of access. The preferred Alternative 3C for this project is estimated to impact, both directly and indirectly, approximately 4,470 acres of farmland; 1,150 acres of forests; and 75 acres of wetlands. The Tier 1 Final Environmental Impact Statement for the Evansville to Indianapolis project was approved by the Federal Highway Administration on December 5, 2003.

I-69 from Henderson, Kentucky to Western Kentucky and I-24 - SIU #5 of the National I-69 project is a section that extends from Henderson, Kentucky to Western Kentucky and I-24. The Kentucky Transportation Cabinet is sponsoring a planning study for the project.

Green River State Forest - The Green River State Forest was originally purchased for synthetic fuels research and production by the Kentucky Center for Research between 1978 and 1981. The property was subsequently turned over to the Kentucky Division of Forestry for the development of the State Forest in 1998. This original tract was approximately 700 acres, 372 of which are currently in agricultural land use with the remainder being forested swampland and young bottomland hardwoods. As part of the State Forest development, the Kentucky Division of Forestry has plans to acquire several tracts adjoining and contiguous to the original tract, primarily to the west. To date, one additional 140-acre tract adjoining the northeast portion of the original tract has been purchased. Approximately 112 acres of trees have been planted for reforestation.

Ohio River Floodplain

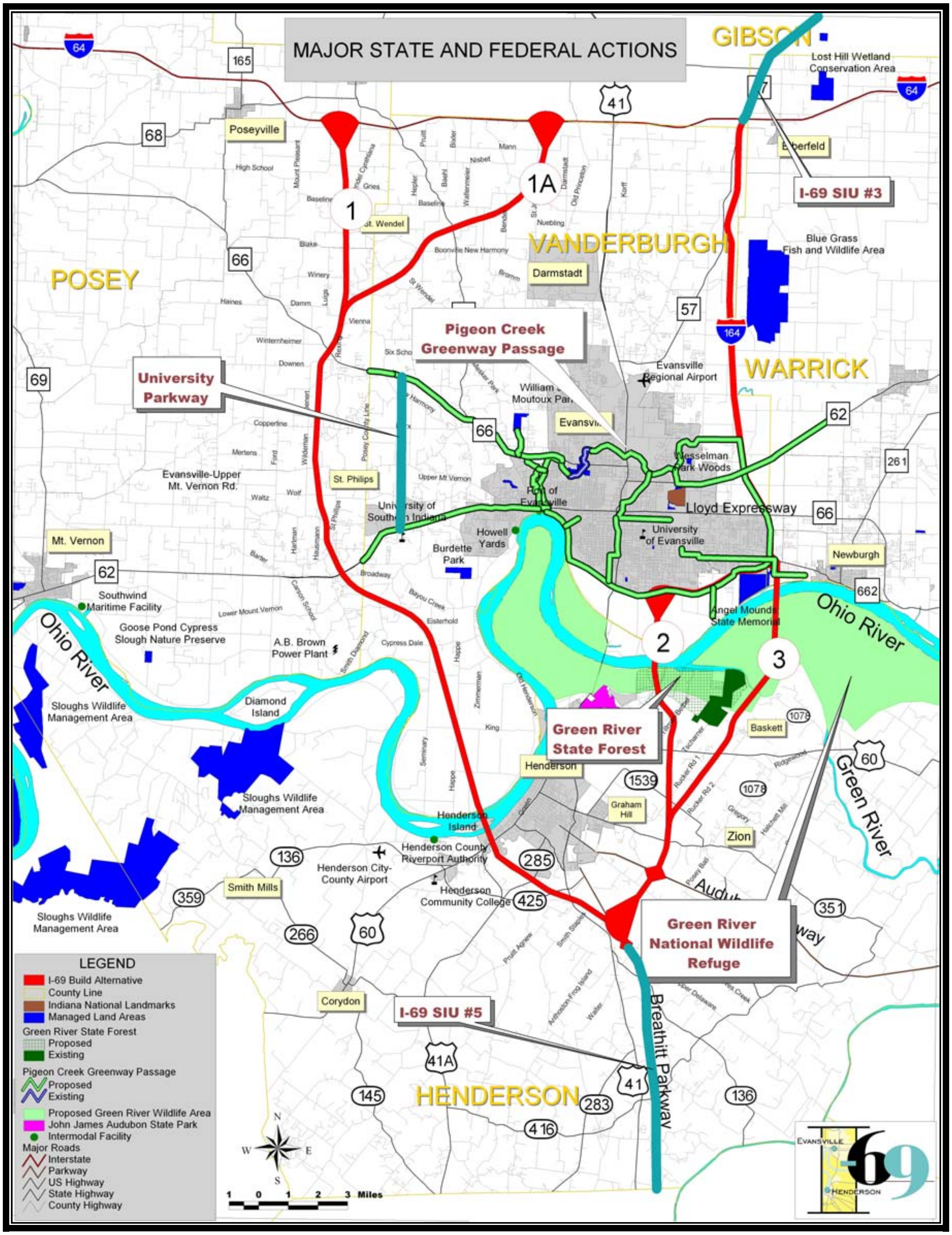


Figure 5-38: Major Federal and State Projects in the Project Study Area

Proposed Green River National Wildlife Refuge - The proposed Green River National Wildlife Refuge has not been established as of the date of this report. The Final Environmental Assessment and Finding of No Significant Impact (FONSI) were published in June of 2001 and the proposed Refuge is awaiting designation. Approximately 23,000 acres of the proposed acquisition boundary is within Henderson County, Kentucky in the floodplain of the Ohio River. This area was first identified by the USFWS in 1958 as an acquisition priority and has subsequently been reviewed in 1978 and 1989 in the *Bottomland Hardwood Preservation Program Report* and the New Madrid Wetlands Project subsection of the North American Waterfowl Management Plan respectively. Once predominantly bottomland forest in the floodplain of the Ohio River, the majority of the area (approximately 80 percent) has been converted to agricultural use with only remnants of the bottomland forests remaining. A management priority for all units of the Proposed Refuge will be the restoration of bottomland hardwood forests. The Scuffletown Bottoms area was identified by the State of Kentucky as top priority for restoration in the Interim Feasibility Report for the Ohio River Ecosystem Restoration Project.

University Parkway from SR 62 to SR 66 – The Vanderburgh County Commissioners are sponsoring the improvements to University Parkway. The project begins at the entrance to the University of Southern Indiana at SR 62 on the west side of Evansville and continues north to end at SR 66, a distance of approximately 5 miles. The proposed action will have 4 lanes with a median and will be a limited access facility. This project is estimated to impact approximately 85 acres of farmland and 27 acres of forests. No wetlands acreage will be required.

Pigeon Creek Greenway Passage – The Evansville Department of Parks and Recreation is sponsoring a system of planned and existing bicycle and pedestrian trails connecting green space in and around Evansville. The total Greenway project would be approximately 40 miles in length. Approximately 1.5 miles of trail are currently fully developed and in use in the system with additional segments in various stages of planning or development. Much of the project would follow Pigeon Creek, the I-164 corridor, and the Ohio River Levee. No land currently utilized for this project would be impacted by the proposed I-69 alternatives.

Potential Added Travel Lanes on I-164 – The Evansville Urban Transportation Study (EUTS), the Evansville area MPO has recently updated their Long Range Transportation Plan to the year 2030. In this plan, EUTS has identified added travel lanes for I-164 in the long range planning between 2025 and 2030. Although this plan goes beyond the design year for this study, additional consideration has been given to the potential traffic impacts on this section of I-164 and proposed I-69. This evaluation, included in **Section 3.3.5**, confirms that the existing four-lane section will provide an acceptable LOS in the design year of 2025 with added traffic from the national I-69 corridor including the construction of this section. If additional travel lanes are ever needed along I-164, these could be considered within existing right-of-way.

5. Characterize the resources, ecosystems, and human communities identified in scoping and explain how they have historically changed - Excerpts of the baseline and trends reports on farmland, forests, and wetlands are found in the **Appendix C-11** for this document. These reports discuss the past and present status of the resources. The baseline reports also forecast reasonably foreseeable future trends and their anticipated impacts upon the resource.

Farmland – Excerpts of the baseline report in **Appendix C-11** shows that farmland in the four county project study area has declined from 778,822 acres in 1950 to 562,243 acres in 1997, representing a decline of nearly 28 percent over 47 years. **Figure 5-39** shows this decline in farmland as part of the past history of the project study area.

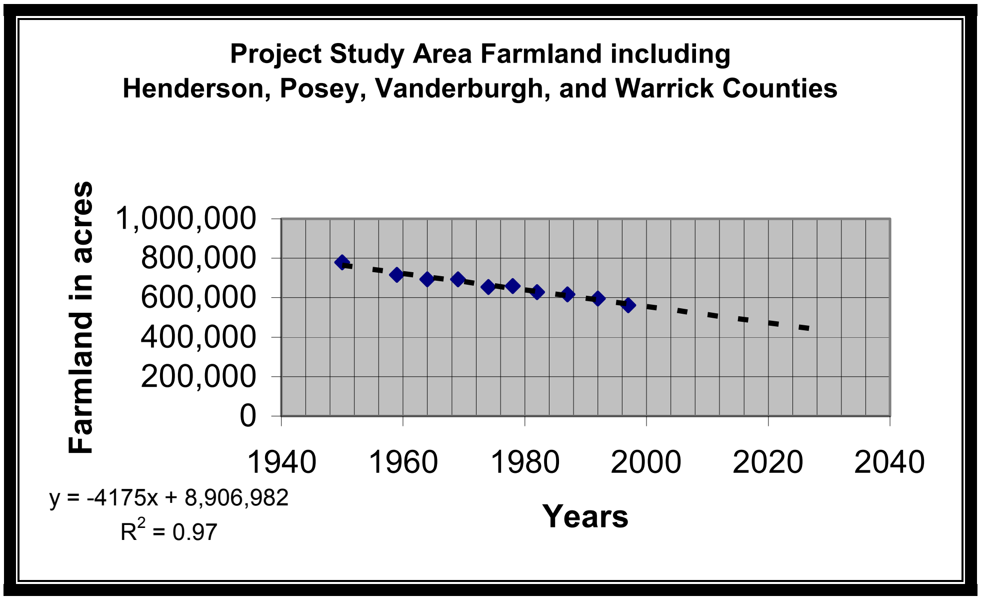


Figure 5-39: Decline in Farmland

Forests – The forest baseline report indicates that from 1950 to 1986, forest acreage increased in the project study area. Forest acreage grew from 160,000 acres in 1950 to over 205,000 acres in 1986. Since 1986, forest acreage has declined in the project study area. In conversations with both Indiana and Kentucky representatives of the Natural Resources Conservation Service of the US Department of Agriculture, current land use trends appear to indicate that forest acreage may have reached a plateau by the 1990's. **Figure 5-40** shows these changes in forest land in the project study area.

Wetlands – Excerpts of the wetlands baseline report in the **Appendix C-11** shows that there is little information on wetland acreage in the project study area over the past years. According to the 1992 National Wetland Inventory, the total wetland acreage in the project study area is approximately 40,808 acres.

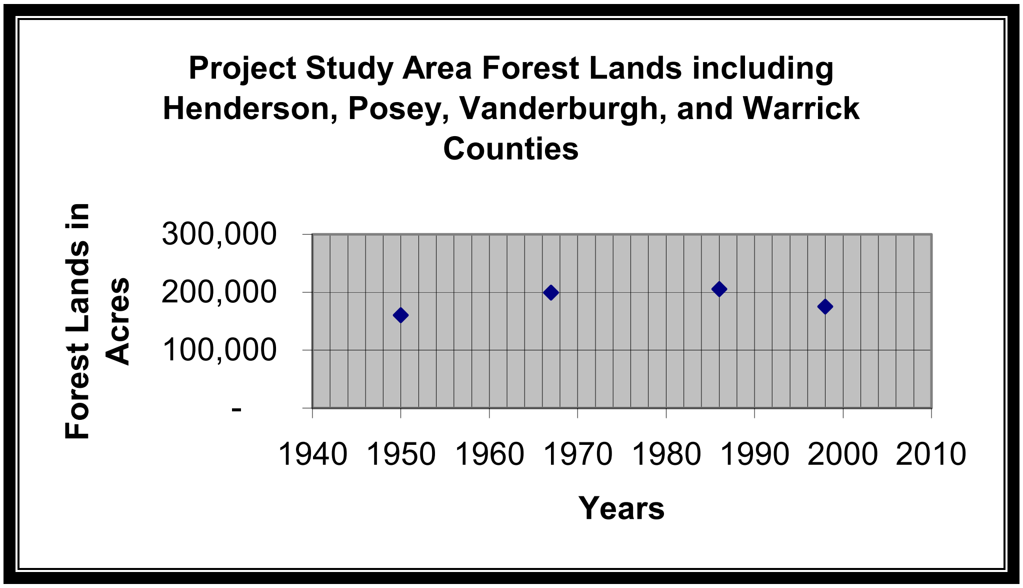


Figure 5-40: Project Study Area Forest Acreages

6. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds-

Farmland - The conversion of farmland to urban development has been the result of several demographic trends, including more single person households, smaller households, bigger commercial facilities, larger, single level industrial plants, and increasing size of housing units. As **Figure 5-39** and the information in the **Appendix C-11** shows, there has been a steady loss of farmland since 1950. While some of this loss reflected population and employment growth, the stresses on farmland are the demographic trends towards more single person households, larger housing units, and smaller households. These trends mean more and larger housing units and more land but not more people (Turner, 1996). With respect to commercial development, the trend is towards bigger stores in suburban areas. In industrial development, the trend is towards larger, single story plants (Jerry Glassberg, 1998).

In light of these trends, one of the goals of the Natural Resources Conservation Service Farmland Protection Program is to protect and slow the loss of farmland. Preservation strategies concentrate direct effects from industrial, residential, and commercial growth to areas less suitable for farming.

Forests - Over the past 50 years, forests have increased in the project study area although forest acreage may have reached a plateau. Changing land management practices have contributed to this trend of increased forests as some cropland and pasture are allowed to revert to forest and existing narrow wooded strips were allowed to expand. The increase in forests due to these changing practices has been greater than losses from the conversion of forests to agriculture, urban/suburban expansion, and other uses in the past 50 years.

The primary stress on forests is the fragmentation of forested areas. Fragmentation of forests may affect core forest habitat which in turn may adversely affect a variety of species living in this core habitat. Wildlife dependent upon this habitat will be affected should these forests decline or continue to become fragmented. The goal of the Forest Service of the US Department of Agriculture is to continue the conservation programs and protect the forests.

Wetlands – Indiana and Kentucky policies mandate disturbances to wetlands are to be avoided or impacts be minimized whenever possible. Moreover, there is a longstanding policy of "no net loss of wetlands" underlying the Section 404 program of the Clean Water Act.

The stresses on wetlands in Indiana and Kentucky include impacts to water quality, alterations of water levels, and other surface disturbances. As a result, the biological diversity of natural wetlands has been degraded. The seriousness of this degradation is best recognized by the large numbers of plants and animals listed as either endangered, threatened, or of special concern by the Indiana Department of Natural Resources that occur naturally in wetlands (Indiana Department of Natural Resources, 1994). Of all wetland types, the palustrine forested wetlands (bottomland hardwoods) have been identified in Indiana as the state wetland priority type (Indiana Department of Natural Resources, 1988).

7. Define a baseline condition for the resources, ecosystems, and human communities without I-69

Farmland - The future trend for farmland in the four counties in the project study area is continued loss of land for use in agriculture. A linear regression analysis for land in farms in the project study area from 1950 to 1997 shows a significant downward trend (see **Figure 5-39**). At this rate, the land in farms in Posey, Vanderburgh, and Warrick Counties in Indiana and Henderson County in Kentucky in 2025 would be approximately 450,000 acres, representing a loss of approximately 20 percent of the total farmland since 1997. In terms of a loss per year of farmland, this decline is approximately 4,000 acres per year in the four county project study area.

To help determine the reasonableness of this future analysis, the Vanderburgh County District Conservationist of the U.S. Department of Agriculture, Natural Resources Conservation Service was consulted. The District Conservationist stated that if the current trends of low interest rates and a growing economy continue, this forecast of 4,000 acres of farmland lost per year in the 4 county project study area is reasonable.

Forests - The future trend for forests in Posey, Vanderburgh, and Warrick Counties in Indiana and Henderson County in Kentucky seems to indicate that forests have reached a plateau. A linear regression analysis for forests is less accurate as a forecast tool as a result of the recent fluctuations in acreages for the project study area. Information from the Forest Service indicates a balance between forest interests and users may have been reached. With such a balance, there may be little change in the amount of forests in the next few years.

Wetlands – Legislation in the 1970's and 1980's, coupled with permit requirements for construction in wetland areas, has reversed the downward trend in wetlands. While trend line analysis for Indiana did not result in accurate forecast information, the goals at both the federal level and the state level are "no net loss of wetlands". Conversations with officials at the state level indicate that this statement currently provides the best information as to the future direction of wetlands. Therefore, it can be assumed that there will be no change in the acreage of wetlands within the project study area.

8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human community - The most frequent cause-and-effect issue is land conversion from farmland, forests, and wetlands to other uses, of which the primary use is related to urbanization. Transportation projects can influence this land use conversion process by providing or improving access to areas that were previously not desirable for such conversion. As previously stated, direct impacts are defined by the CEQ Regulations as "*effects which are caused by the action and occur at the same time and place.*" (CEQ Regulations).

9. Determine the magnitude and significance of cumulative effects by identifying the changes as a result of I-69 – The methodology section of this cumulative effects analysis presented the steps in generating the direct and indirect impacts of the various alternatives. These impacts were calculated using the Southwestern Indiana Geographic Information System and the economic and transportation planning modeling combination.

The results are shown in a set of three tables. Each table shows the current acreage of the resource, the direct impacts to the resource, the indirect impacts to the resource, and the other impacts (determined by the trend analysis). The total of these impacts results in a forecasted 2025 acreage for the resource. The impacts upon farmland, forest, and wetlands are shown in **Table 5-40**, **Table 5-41**, and **Table 5-42**, respectively.

Table 5-40: Cumulative Impacts of I-69 Upon Farmland

	Alternative 1	Alternative 1A	Alternative 2	Alternative 3
1997 Census Farmland Acreage for Project Study Area	562,243	562,243	562,243	562,243
Direct Impacts to Farmland	(1,087)	(1,293)	(593)	(538)
Indirect Impacts to Farmland	(27)	(30)	(42)	(40)
Total Direct/Indirect Farmland Impacts	(1,105)	(1,323)	(635)	(578)
Percent Farmland Acreage in Project Study Area Impacted by the Project	0.20%	0.24%	0.11%	0.10%

Table 5-41: Cumulative Impacts of I-69 Upon Forests

	Alternative 1	Alternative 1A	Alternative 2	Alternative 3
1998 Forest Acreage for Project Study Area	175,100	175,100	175,100	175,100
Direct Impacts to Forests	(243)	(258)	(55)	(44)
Indirect Impacts to Forests	(7)	(7)	<1	<1
Total Direct/Indirect Forest Impacts	(250)	(265)	(56)	(45)
Percent Forest Acreage in Project Study Area Impacted by the Project	0.14%	0.15%	0.03%	0.03%

Table 5-42: Cumulative Impacts of I-69 Upon Wetlands

	Alternative 1	Alternative 1A	Alternative 2	Alternative 3
1992 NWI Acreage for Project Study Area	40,808	40,808	40,808	40,808
Direct Impacts to Wetlands	(26-30)	(25-29)	(32-39)	(36-40)
Indirect Impacts to Wetlands	0	0	0	0
Total Direct/Indirect Wetland Impacts	(26-30)	(25-29)	(32-39)	(36-40)
Percent Wetland Acreage in Project Study Area Impacted by the Project	0.07%	0.07%	0.10%	0.10%
NWI refers to the National Wetland Inventory data				

Farmland – **Table 5-40** and **Figure 5-41** indicate that impacts from the I-69 alternatives, including both direct and indirect impacts, account for at most 1.2 percent of the anticipated total cumulative farmland loss that is forecasted to occur by the year 2025. The loss from direct and indirect impacts of the I-69 alternatives accounts for at most 0.24 percent of the total 1997 farmland acreage in Henderson, Posey, Vanderburgh, and Warrick Counties. Using regression analysis, future farmland trends show that by the year 2025 approximately 112,000 acres of farmland will be lost to production. On a per year value, this loss is equivalent to approximately 4,000 acres of farmland per year in the 4 county project study area. For the I-69 alternatives, the direct farmland loss ranges from 538 acres (Alternative 3) to 1293 acres (Alternative 1A). The indirect farmland loss ranges from 27 acres (Alternative 1) to 42 acres (Alternative 2).
Figure 5-37 shows that the loss from direct and indirect impacts for all the alternatives is a small percentage of the total farmland in the project area. In addition, based on trend analysis, unrelated farmland losses in the project area are anticipated to exceed 111,200 acres by the year 2025. Thus, this trend analysis indicates that the farmland loss from direct and indirect impacts for all the alternatives would be less than 1 percent of the total loss from other actions.

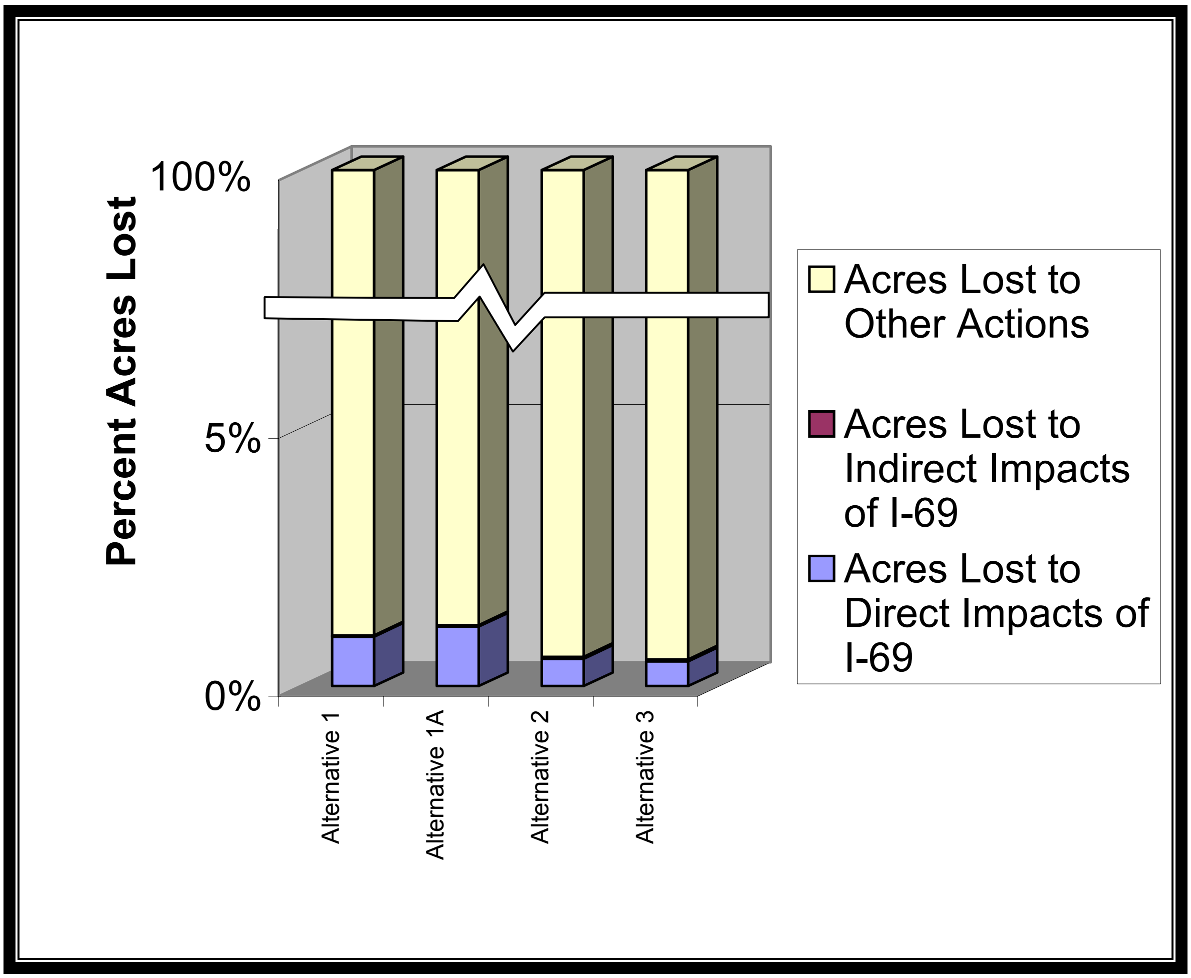


Figure 5-41: Cumulative Impacts of I-69 Upon Farmland

The population and employment growth trends and demographic changes that have led to the stresses upon farmland will continue in the reasonably foreseeable future. These trends include all the major federal and state projects shown in **Figure 5-38** as well as all other development activities that are forecasted to occur in the 4 county project study area. The demographic trend towards more single person households means more housing units and more land being used for residential purposes. The size of the housing unit is increasing while the size of the household is decreasing. Commercial development in suburban areas will continue to be more attractive to developers than in downtown areas.

Forests – **Table 5-41** shows that the I-69 alternatives, including both direct and indirect impacts, account for between 44 acres and 274 acres of forests taken for I-69. Since the trend shows forests reaching a plateau, it is anticipated that while some other actions will take forest acres, this will be offset by other actions that increase forest acres (for example, the gains in forest acres from the proposed Green River National Wildlife Refuge and the Green River State Forest). This loss from direct and indirect impacts of the I-69 alternatives accounts for at most 0.16 percent of the total forest acreage in 1998 of 175,100 acres for Henderson, Posey, Vanderburgh, and Warrick Counties.

For the I-69 alternatives, the direct forest loss ranges from 44 acres (Alternative 3) to 258 acres (Alternative 1A). The indirect forest loss ranges from less than 1 acre (Alternatives 2 and 3) to 7 acres (Alternatives 1 and 1A).

The future analysis of forested acres in the project study area indicates that a balance between forest interests and users may have occurred. With such a balance, there maybe little change in the amount of forests in the coming years.

Wetlands – **Table 5-42** shows that direct and indirect impacts from I-69 account for 40 acres or less of wetlands that would be taken. With federal and state policies of “no net loss of wetlands”, the impacts of other actions should not involve the net loss of wetlands. In fact, the proposed Green River National Wildlife Refuge should result in the increase in wetlands in northwestern Kentucky (both north and south of the Ohio River). This loss from direct and indirect impacts of the I-69 alternatives accounts for at most 0.10 percent of the total 1992 NWI wetland acreage of 40,808 acres in Henderson, Posey, Vanderburgh, and Warrick Counties. This loss represents a temporary loss because the Indiana Department of Transportation and Kentucky Transportation Cabinet will mitigate this loss with wetland replacement at approved rates.

For the I-69 alternatives, the direct wetland loss ranges from 25-29 acres (Alternative 1A) to 36-40 acres (Alternative 3). There would be minimal, temporary loss of wetland acres due to indirect impacts since the wetland permitting process makes it very difficult to develop in wetland areas. The “no net loss of wetlands” would be accomplished by migitative replacement of impacted wetlands impacted by the proposed project and other projects. Based on these requirements, estimated 2025 wetland acreage would be very similar to the 1992 wetland acreage for the project study area.

Alternative 2 and 3 will impact the proposed Green River National Wildlife Refuge and its associated wetland complex (see **Figure 5-38**). Coordination with the U.S. Fish and Wildlife Service has worked to minimize the impacts to the refuge from the I-69 alternatives that cross the refuge. The proposed refuge is part of the other actions that are considered in this cumulative analysis.

10. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative impacts – The alternatives impacting the proposed Green River National Wildlife Refuge have been modified in consultation with the U.S. Fish and Wildlife Service to minimize the impacts to the refuge. Both Alternatives 2 and 3 have been adjusted to minimize impacts to the refuge.

The control of development is within each local government’s jurisdiction through land use planning, and subdivision and zoning regulations. Such tools provide support for the project with respect to the indirect impacts to farmland by 1) providing guidance for land use changes in and around the proposed highway corridor and interchanges, and 2) providing support for the continuance of agricultural land uses throughout most of the project study area. Through these regulations and coordination with local officials, indirect impacts to farmland, forest, and wetlands may be reduced.

11. Monitor the cumulative effects of the alternatives and provide documentation - The cumulative effects of the proposed alternatives, including the preferred alternative, have been documented in this section as part of the evaluation.

Summary

Each of the I-69 Henderson to Evansville Build alternatives will have both direct and indirect impacts upon the manmade and natural environment. However, compared to existing trends towards the loss of farmland in the coming years, and the minimal anticipated impacts to existing wetland and forest resources, these cumulative impacts will not cause significant resource loss. Efforts have been made to ensure that the alternatives avoid, minimize impacts to, or mitigate for impacts to these valuable resources.

Chapter 6 – SECTION 4(f) ANALYSIS

Section 4(f) of the Department of Transportation Act of 1966, 49 USC Section 303 requires that prior to the use of any land from a publicly owned park, recreational area, wildlife or waterfowl refuge, or historic property or archaeological site on or eligible for the National Register of Historic Places (NRHP), it must be determined that there is no prudent or feasible alternative which avoids such use and that the project includes all possible planning to minimize harm to these resources.

According to the Federal Highway Administration's (FHWA) Section 4(f) Policy Paper a Section 4(f) resource is "used" as follows (1) a direct use occurs when land from a Section 4(f) site is permanently incorporated into a transportation project, (2) a temporary use occurs when there is a temporary occupancy of Section 4(f) property that is adverse in terms of the statute's preservationist purposes, or (3) a constructive use occurs when the proximity impacts of the transportation project on the Section 4(f) site are so severe that the protected activities, features, or attributes that qualify the resource for protection under Section 4(f) are substantially impaired (USDOT, 1989).

In order for a park, recreational area, or wildlife or waterfowl refuge to qualify for protection under Section 4(f), it must be publicly owned and officially designated as a park, recreational area, or wildlife or waterfowl refuge. When these areas are owned by private institutions and individuals, even if such areas are open to the public, Section 4(f) does not apply. The FHWA does however strongly encourage the preservation of such privately owned lands (USDOT, 1989).

Historic resources that are listed in, or eligible for listing in, the NRHP are not required to be publicly owned in order to be protected under Section 4(f). Archaeological sites must also be in or eligible for the NRHP and important for preservation in-place in order to be considered a Section 4(f) site. Determinations of eligibility for the NRHP have been coordinated with the Indiana and Kentucky State Historic Preservation Officers.

6.1 PROPOSED ACTION

This project has been described in detail in previous chapters. The purpose and need for the project and the alternatives evaluated are briefly summarized in the following text.

Purpose and Need

The purposes of the I-69, Henderson to Evansville project are as follows:

- Purpose # 1: Support the completion of the National I-69;
- Purpose # 2: Provide sufficient cross-river mobility in the Evansville/Henderson area;
- Purpose # 3: Strengthen the transportation network in the Evansville/Henderson area.

In December 2000, the FHWA announced that the National I-69 project was "moving from the corridor planning and feasibility study stages into the state project planning, development, and FHWA NEPA process and decision making stages". The announcement revealed that "each state will study viable sections identified (Sections of Independent Utility or SIUs) addressing state and local needs, schedules, and funding constraints in accordance with the FHWA NEPA process. The I-69 Evansville to Henderson project would be SIU#4 for the National I-69 project.

Alternatives Selected for Study in the DEIS

Early in the project development, meetings were held with federal and state review agencies to frame the major issues and to scope the range of alternatives that should be studied. Two corridor concepts originated from suggestions made in those meetings. Similarly, two public meetings were held to scope the range of alternatives, and new corridor concepts developed from those meetings.

As a result of these meetings, ten corridors represented by 2,000-foot wide study corridors were identified. These route concepts were evaluated using a series of performance measures relating to the purpose and need for the project. In addition to the performance measures, the route concepts were also evaluated on environmental and engineering impacts. The ten route concepts were grouped into the following three groups: western, central, and eastern.

The evaluation process identified 3 corridors, and a variation of one of these corridors, to be carried forward for more-detailed study. These four alternatives are:

Corridor J (renamed Alternative 1)
Corridor J1 (a variation of Corridor J, renamed Alternative 1A)
Corridor H (renamed Alternative 2)
Corridor I (renamed Alternative 3)

Since that time, further data collection and analyses of those data have resulted in modifications to and refinement of the four alternatives. Additionally, the alternatives have been narrowed from 2,000 feet to 1,000-foot corridors, and alignments have been developed within those 1,000' corridors representing alternatives within which a highway alignment (with necessary right-of-way) is deemed feasible.

6.2 SECTION 4(f) RESOURCE – ANGEL MOUNDS

The Angel Mounds State Historic Site consists of approximately 600 acres listed on the NRHP as well as approximately 10 acres northeast of the NRHP boundary and approximately 98 acres west of the NRHP boundary, shown in **Figure 6-1**. While the NRHP boundary will be included as a Section 4(f) resource, the recreational aspects of the entire State Historic Site are considered for Section 4(f) resource potential. During the development of alternatives, regular coordination occurred with Angel Mounds State Historic Site regarding the location of I-69 alternatives. Currently, recreational uses including hiking and bicycling trails exists within the area identified as the NRHP boundary. This recreational use would be considered as a Section 4(f) resource, regardless of the historic status of the property. Additionally, the 98 acres recently purchased west of the NRHP boundary may potentially be converted to recreational use in the future. The development of recreational trails within this additional property would expand Section 4(f) applicability to this tract as well. Currently there is no recreational use and no plan for recreational use in the tract located northeast of the National Register boundary. No alternative will require right-of-way from within NRHP-eligible boundary for this resource. Additionally, no land currently owned by Angel Mounds State Historic Site will be used by the proposed project. Thus, there is no direct use of this resource.

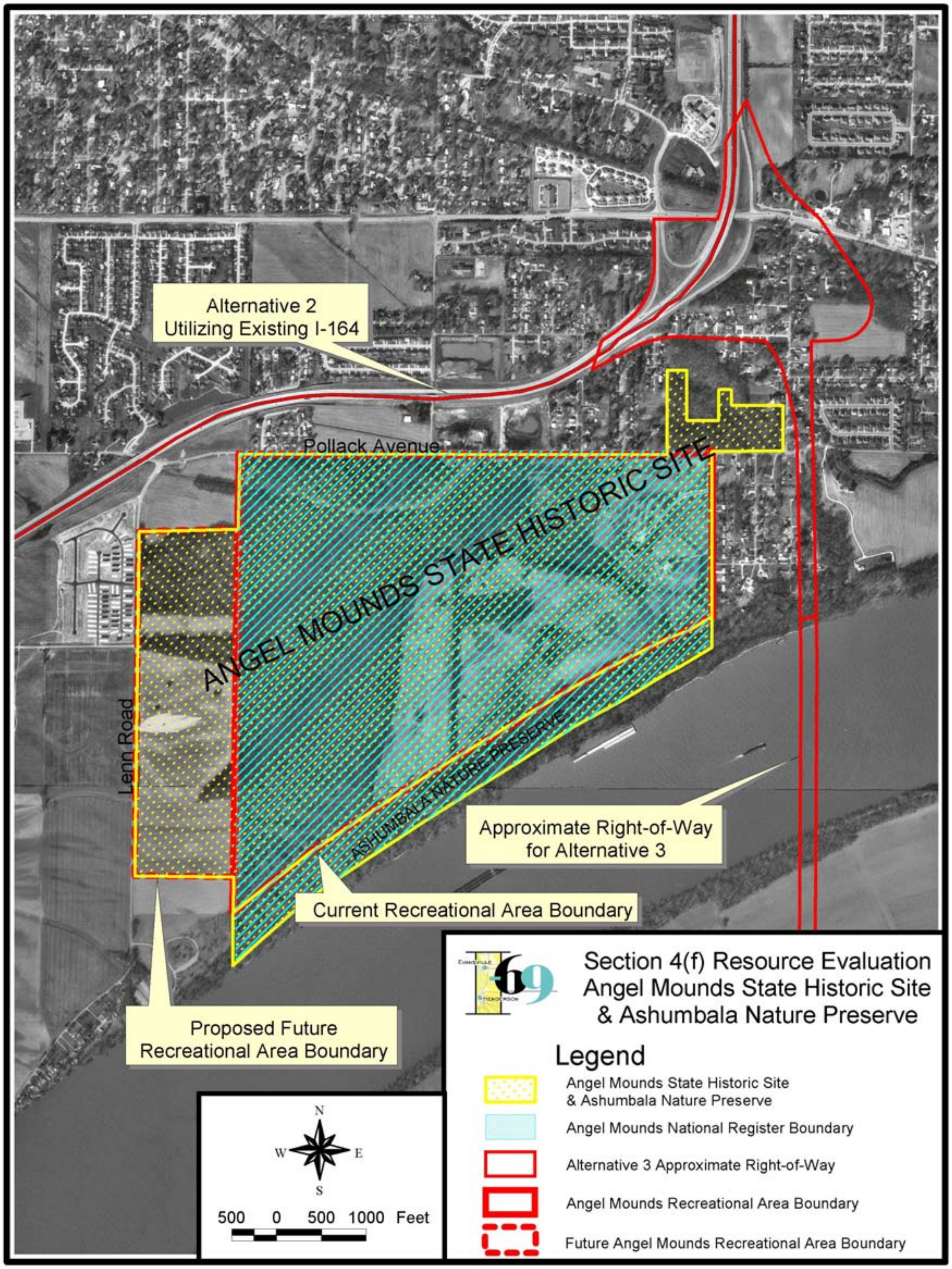


Figure 6-1: Angel Mounds State Historic Site

Angel Mounds

Because of the proximity of the I-69 Build Alternatives 2 and 3 to Angel Mounds, a National Historic Landmark, potential visual, noise, and vibration effects were examined. Mound A located on the complex grounds, and Mound G located just north of Pollack Avenue near the entrance to the complex were designated as reference points from which the studies were based. No adverse visual effects were found for Alternative 2. However the new bridge structure of Alternative 3 would be above the existing tree line visible from Mound A and could be considered an adverse visual effect on the property.

Noise levels at Mound A and Mound G were modeled to estimate noise level increases for the various alternatives. Alternative 2 will have no audible effect on noise levels, while Alternative 3 would create an audible increase in noise levels constituting an adverse effect, exceeding the abatement criteria.

Concerns were also expressed about the potential adverse effects of both construction and traffic vibration to the earthworks at the Angel Mounds site from Alternative 3. Mound A would be approximately 2,800 feet and Mound G would be about 970 feet from the proposed Alternate 3 right-of-way and construction limits. Although the FHWA has no established vibration criteria, the Federal Transit Administration (FTA) has established a threshold of 0.12 peak particle velocity or PPV for extremely fragile (historical) structures. The vibration study projected a PPV range of 0.0003 to 0.0062 for Mound G and a PPV range of 0.0001 to 0.0021 for Mound A by traffic from I-69 Alternative 3. During construction pile driving vibration is projected at 0.0026 to 0.0062 for Mound G, and 0.0005 to 0.0013 PPV for Mound A. Neither construction vibration nor traffic vibration from I-69 Alternative 3 could be considered to be an adverse effect on the mounds based upon established FTA criteria.

Based on the evaluation of potential impacts to Angel Mounds **(See Section 5.5),** there would be no constructive use of this Section 4(f) resource by any of the alternatives. The proximity impacts of Alternative 3 would create a visual intrusion in the form of bridge towers visible in the skyline to the east, and elevated noise levels that exceed the abatement threshold for use Criterion A. However, these proximity impacts would not substantially diminish the recreational activities or interpretive attributes that qualify the property for Section 4(f) protection, nor would it affect the archaeological resources that are listed in the National Register of Historic Places and also qualify the property for Section 4(f) protection. Therefore, the proximity impacts would not constitute a constructive use of this Section 4(f) resource. No other alternative will significantly impact Angel Mounds.

6.3 SECTION 4(f) RESOURCES – PARKS, RECREATION AREAS AND WILDLIFE REFUGES

With development of all the alternatives, efforts were made to avoid and/or minimize impacts to Section 4(f) properties such as parks, recreational areas, and waterfowl and wildlife refuges wherever possible. As a result of these efforts, the use of any Section 4(f) resources was avoided. **Figure 6-2** shows the location of these resources in relation to the four alternatives under consideration.

Figure 6-2 shows the potential Section 4(f) sites that are publicly owned lands managed as parks, recreation areas, and refuges. In addition, privately owned lands that are subject to a publicly owned easement in perpetuity may be subject to Section 4(f). Section 4(f) does not apply to all lands shown on **Figure 6-2.** For example, incidental, secondary, occasional, or dispersed recreational activities do not constitute a major purpose, and do not make a property subject to the requirements of Section 4(f). Having shifted the alternatives to avoid Section 4(f) impacts to all parks, recreational areas, waterfowl and wildlife refuges, and historic properties, there remains several potential Section 4(f) properties within proximity to the alternatives. For these areas, additional coordination was conducted to identify the nature of the use of the property as well as any potential future purchases or modifications that could create additional Section 4(f) properties. Coordination has been conducted with U.S. Fish and Wildlife Service, the Kentucky Division of Forestry, the Indiana Department of Natural Resources Division of Fish and Wildlife, Indiana Department of Natural Resources - State Museum and Historic Sites, Burdette Park, the Evansville Department of Parks and Recreation, and the State Historic Preservation Officers of both Indiana and Kentucky to help assist in this analysis. A more detailed analysis was conducted in the following areas:

1. Proposed Green River National Wildlife Refuge
2. Green River State Forest
3. Evansville Greenway Passage
4. Ashumbala State Nature Preserve
5. Burdette Park
6. Blue Grass Fish and Wildlife Area

1. Proposed Green River National Wildlife Refuge: The Proposed Green River National Wildlife Refuge is located completely within Henderson County, Kentucky along the Ohio and Green Rivers. The refuge has not been formally established; however, a Final Environmental Assessment has been approved with a Finding of No Significant Impact (FONSI), a copy of which is included in **Appendix C-2**. The Final Environmental Assessment identifies an ultimate acquisition boundary of 23,000 acres (USFWS). **Figure 6-3** shows the proposed acquisition boundary of the refuge in relation to Alternatives 2 and 3 that are located in the proposed refuge area.

The Final Environmental Assessment for the Proposed Green River National Wildlife Refuge prepared by the U.S. Fish and Wildlife Service in 2001 discussed I-69 and states that "*the Service will work with the Federal Highway Administration and state transportation officials in identifying the best corridor for I-69.*"

During the development of the alternatives, regular coordination occurred with the U.S. Fish and Wildlife Service (USFWS) regarding the location of I-69 alternatives in the vicinity of the proposed refuge. **Figure 6-4** shows the area through which Alternatives 2 and 3 would pass. In addition to regular coordination with USFWS, additional meetings were held on August 13, 2002 and March 12, 2003 to discuss construction methods to minimize potential impacts and identify potential crossing locations. At the suggestion of USFWS, the first meeting included a field visit to the Wheeler National Wildlife Refuge in Decatur, Alabama which is traversed by an I-65 bridge crossing the Tennessee River and adjacent floodplain and refuge, similar to that proposed for the I-69 Ohio River crossing.

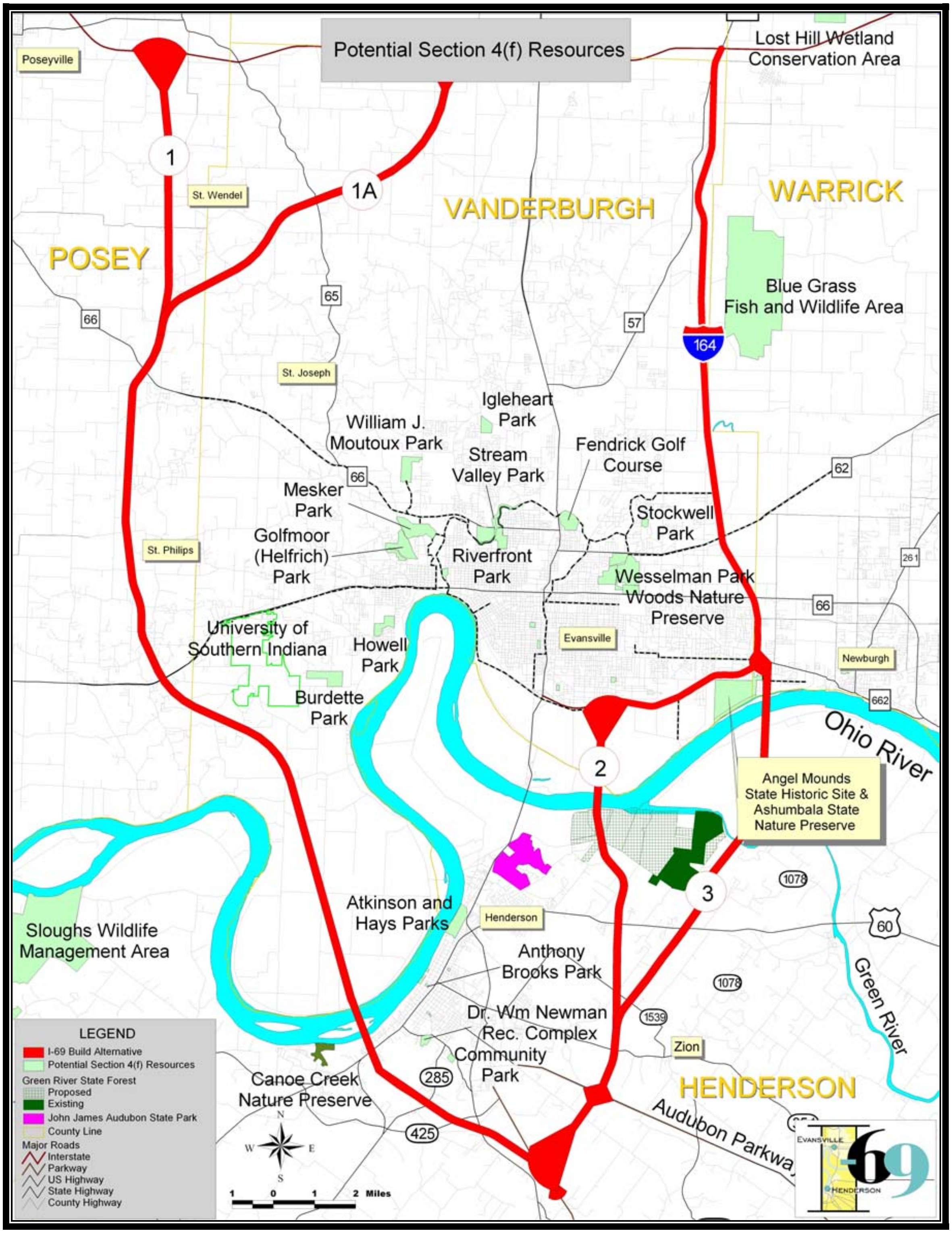


Figure 6-2: Publicly Owned Potential Section 4(f) Resources

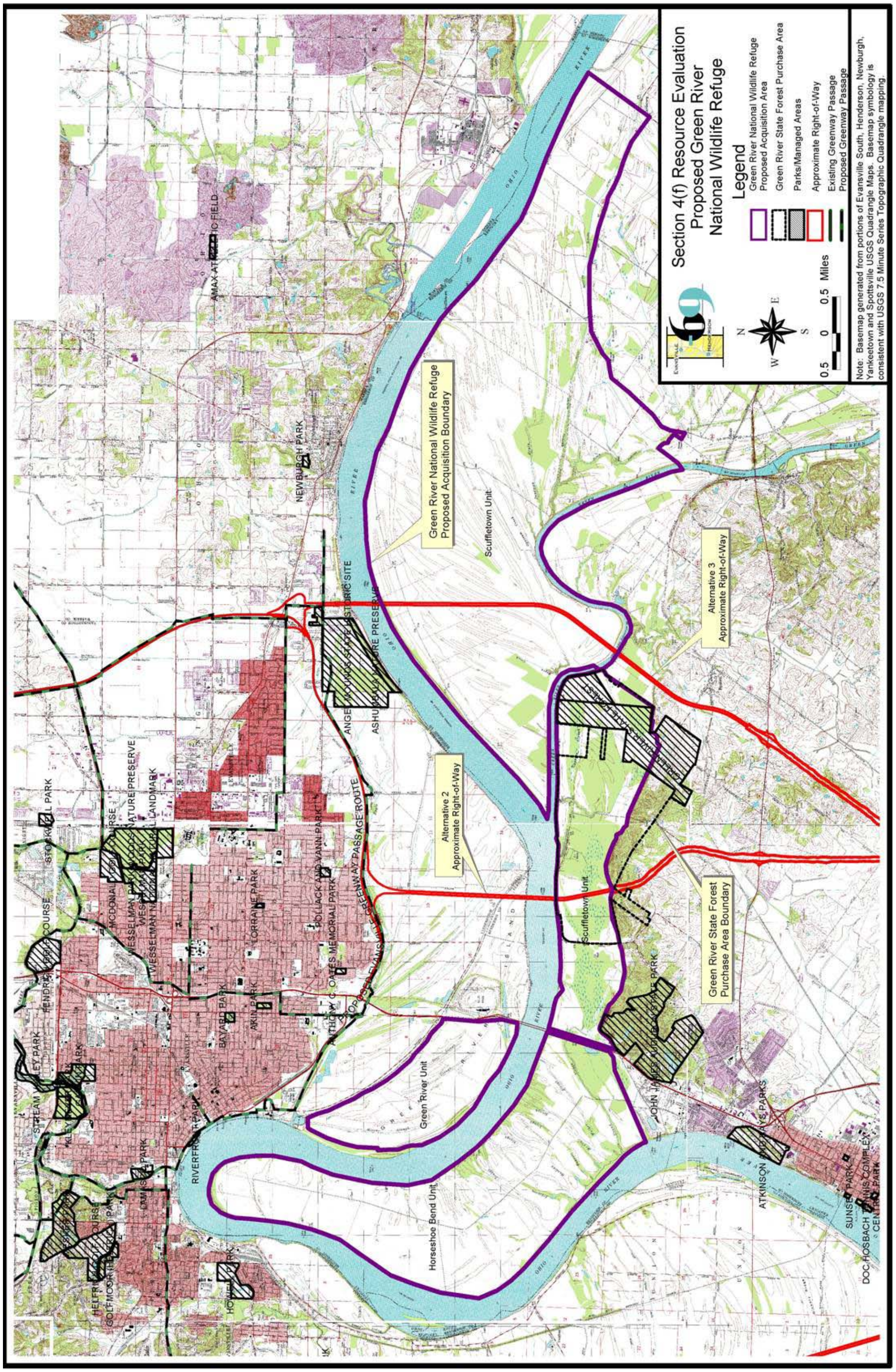


Figure 6-3: Proposed Green River National Wildlife Refuge

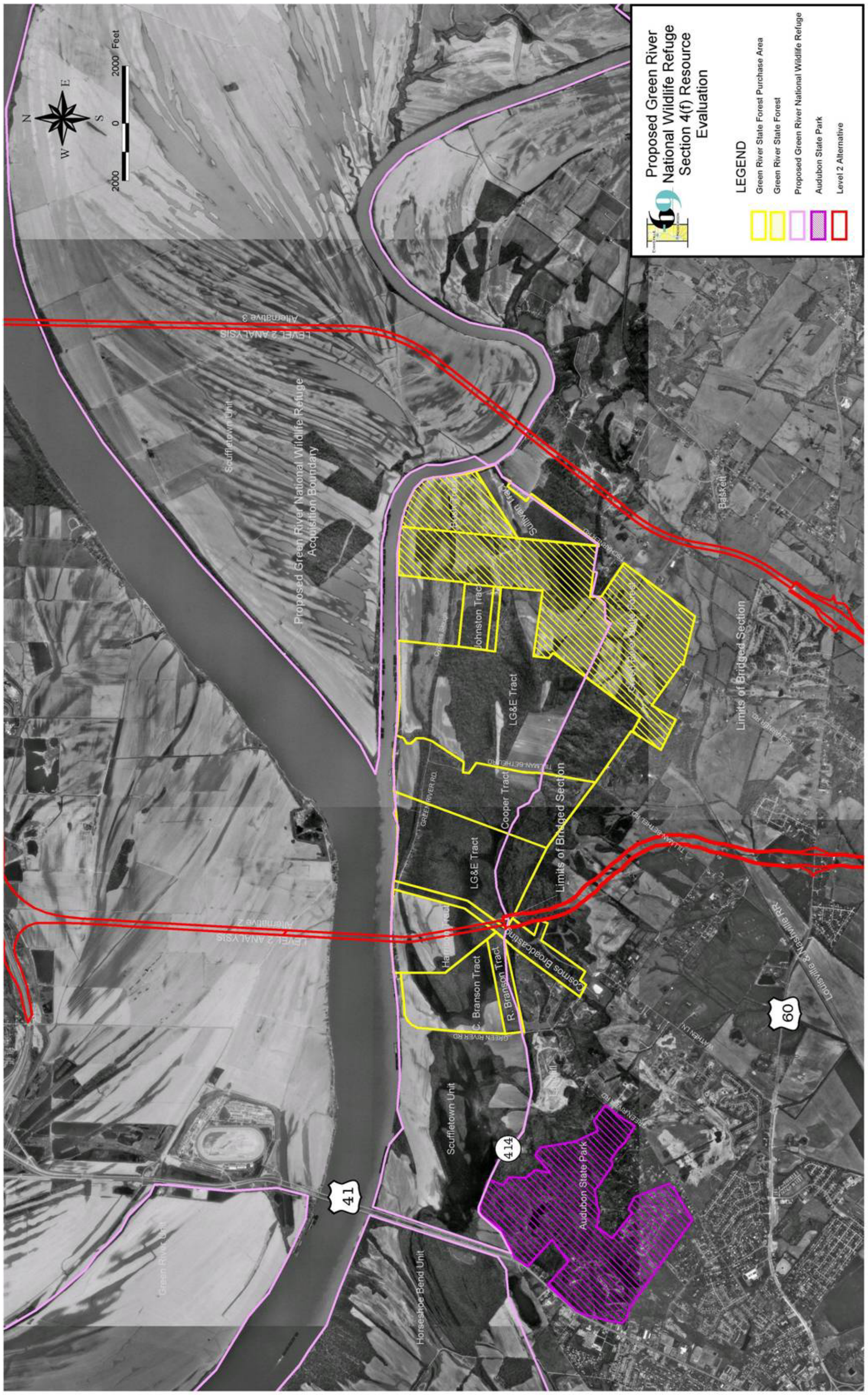


Figure 6-4: I-69 Corridor through the Proposed Green River National Wildlife Refuge

Correspondence received from the USFWS regarding Section 4(f) applicability confirms that the refuge has not received final approval from the Director and has no authority to acquire property within the vicinity of the proposed alternatives. Furthermore, the correspondence indicates that USFWS will continue to coordinate with FHWA on the joint development of the Proposed Green River National Wildlife Refuge as it relates to the I-69 project.

Alternatives 2 and 3 would pass through the boundaries of the Proposed Green River National Wildlife Refuge. However, the Proposed Green River National Wildlife Refuge has not yet been formally established, and none of the land within its boundaries that would be impacted by Alternatives 2 and 3 is publicly owned. In addition, the U.S. Fish and Wildlife Service indicated in its EA its understanding that I-69 would pass through the refuge and also indicated its intention to work with FHWA, INDOT, and KYTC in jointly planning these two facilities. Thus, the construction of I-69 within its boundaries of the Proposed Green River National Wildlife Refuge would not result in the use of a Section 4(f)-protected resource. Additionally, because no Section 4(f) resource currently exists as the Green River National Wildlife Refuge, no constructive use would occur by the development of this project.

2. Green River State Forest: The Green River State Forest contains approximately 843 acres adjacent to the intersection of Tscharner Road and Green River Road in Henderson County (**Figure 6-5**). Nine additional tracts totaling 1,980 acres are also targeted for acquisition. Eight of the nine additional tracts lie west of the current State Forest and would extend the property to Green River Road to the west. The acquisition of all nine of the additional tracts would protect a total land area of approximately 2,820 acres, including all but about 120 acres of the bottomlands south of the Green River and Ohio River between Tscharner Road and Green River Road and encompassing the majority of the existing Cypress Slough.

The Kentucky Division of Forestry has secured a North American Wetlands Conservation Act (NAWCA) grant as well as partnering funds from several state and private organizations for the purchase of the additional property. No condemnation powers will be used for the formation of the forest, and all purchases must strictly be from willing sellers. At the time of this report, purchase offers had been extended by the Kentucky Division of Forestry to the property owners of all but one of the nine remaining tracts. None of the offers have been accepted at the time.

During the development of the alternatives, regular coordination occurred with the Kentucky Division of Forestry regarding the location of I-69 alternatives in the vicinity of the proposed forest. In addition to regular coordination with all the federal and state resource agencies, additional meetings were held on May 23, 2002 and March 12, 2003 (**Appendix D-2)** to discuss alternative locations in proximity to the forest and construction methods to minimize potential impacts.

These meetings led to the adjustment of Alternative 2 as it crosses the potential acquisition area. In addition, the Kentucky Division of Forestry has indicated it will continue to coordinate with FHWA on the development of the Green River State Forest as it relates to I-69.

No land currently publicly owned as part of the Green River State Forest would be used as part of the proposed project. No use of a Section 4(f) resource would be created by the development of any proposed alternative in relation to the Green River State Forest. Alternatives 2 and 3 are located approximately 3,000 and 1,500 feet respectively from the current Green River State Forest. The proximity impacts from these alternatives would have no effect on the recreational activities that qualify the property for Section 4(f) protection, therefore, there would be no constructive use of this Section 4(f) resource.

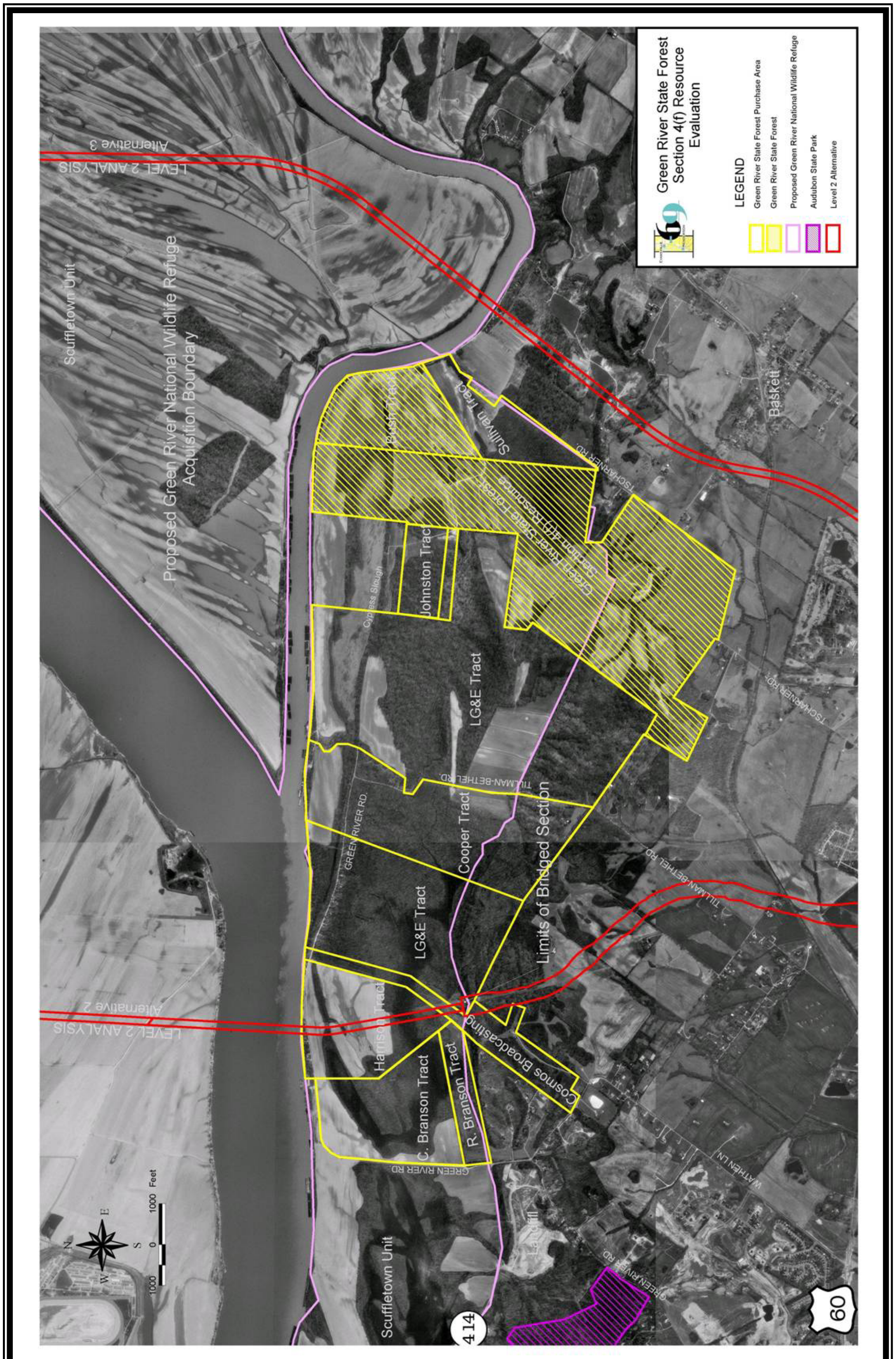


Figure 6-5: Green River State Forest

3. Evansville Greenway Passage: The Evansville Greenway Passage is a system of planned and existing bicycle and pedestrian trails connecting green space in and around Evansville. Approximately 1.5 miles of trail are currently fully developed and in use in the system, with additional segments in various stages of planning or development (**Figure 6-6**). Coordination with the Evansville Department of Parks and Recreation has identified that the Phase III section along I-164 is the only segment potentially affected by the proposed I-69 project **(Figure 6-7)**. A shared use agreement with INDOT is currently in place for the utilization of a portion of the I-164 right-of-way for development of the trail. However, no property on the I-164 corridor is open to the general public for recreational use.

Coordination with the Evansville Department of Parks and Recreation indicates that this section is in the early planning stages. Based on the current plans for the proposed Alternatives 2 and 3 in this vicinity, development of these alternatives would not preclude the development of the proposed Greenway Passage trail.

No land currently utilized for recreational purposes as part of the Evansville Greenway Passage would be used by the proposed project. No use of a Section 4(f) resource would be created by the development of any proposed alternative in relation to the Evansville Greenway Passage. In addition, no proximity impacts would be created on existing public use portions of the Evansville Greenway Passage; therefore, there would be no constructive use of the Section 4(f) resource.

4. Ashumbala State Nature Preserve: The Ashumbala State Nature Preserve is located within the NRHP listed boundary of Angel Mounds State Historic Site. For this reason, the Ashumbala State Nature Preserve will be included as a Section 4(f) resource by virtue of its status as a significant historic site and is included in the Angel Mounds evaluation (Section 6.2) by virtue of being within NRHP listed boundary. The Ashumbala State Nature Preserve has also been considered for its potential as a wildlife or waterfowl refuge for applicability under Section 4(f). Based on coordination with the Indiana Department of Natural Resources, Division of Nature Preserves and Division of Historic Sites, which manages the Nature Preserve, the major use of the property is to protect the floodplain forest and rare plant species contained within it. This property does not constitute a wildlife or waterfowl refuge that would be subject to Section 4(f) applicability.

Nonetheless, no land within the Ashumbala State Nature Preserve will be used by the proposed project.

5. Burdette Park: Burdette Park is a local park located in southwest Vanderburgh County (shown in **Figure 6-8**), owned and managed by Vanderburgh County. Coordination with Burdette Park has identified that this area was dedicated as a park in September 1934, and the major use of the facility continues to be as a park. In addition, the park is open to the public and meets the criteria for Section 4(f) applicability. The designation and major use as a park identify Burdette Park as a Section 4(f) resource.

No land within Burdette Park will be used by the proposed project. No use of a Section 4(f) resource would be created by the development of any proposed alternative in relation to Burdette Park. Alternatives 1 and 1A are located approximately two miles from Burdette Park. The proximity impacts from these alternatives would have no affect on the recreational activities that qualify the property for Section 4(f) protection, therefore, there would be no constructive use of this Section 4(f) resource.

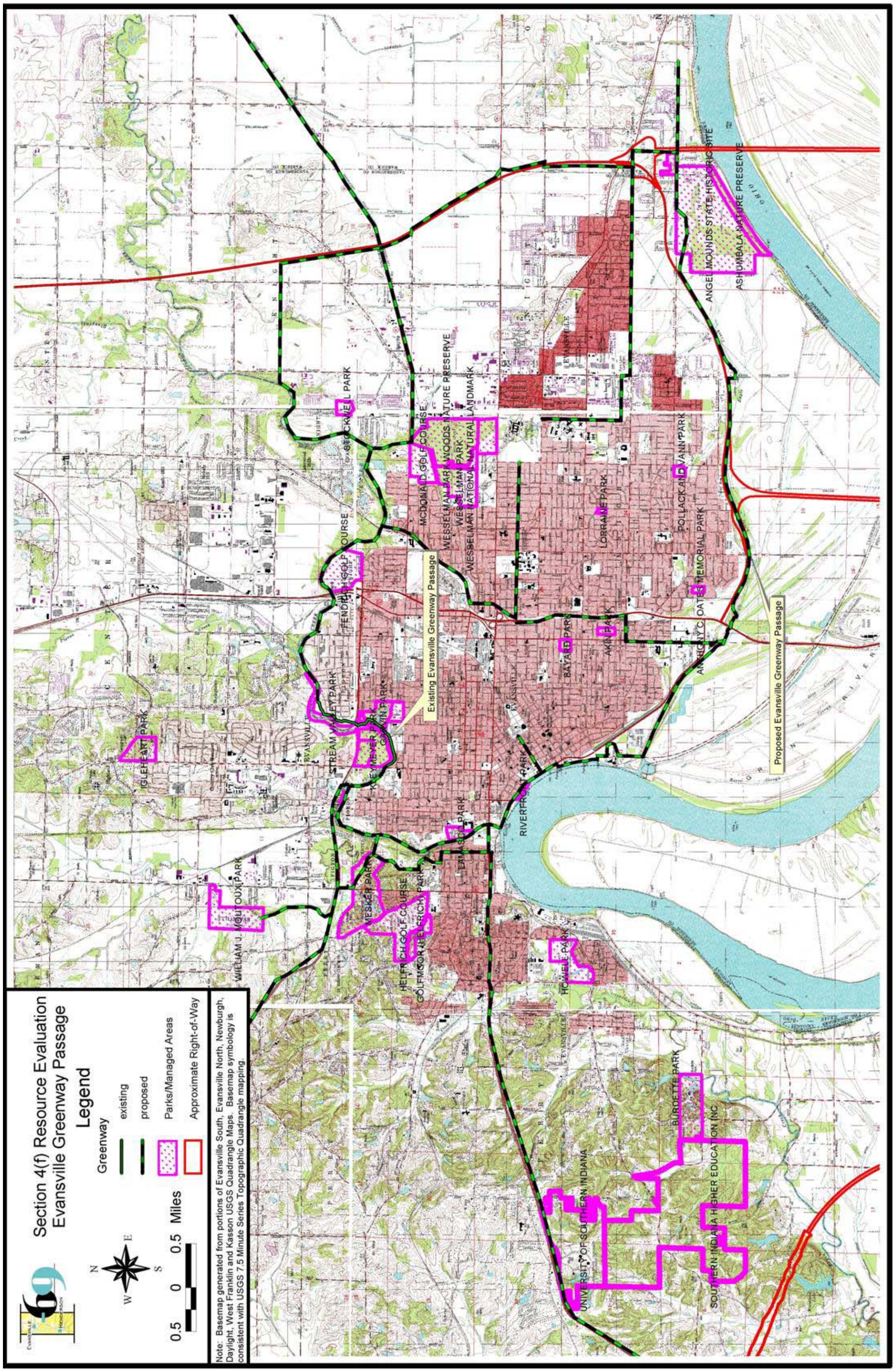


Figure 6-6: Evansville Greenway Passage

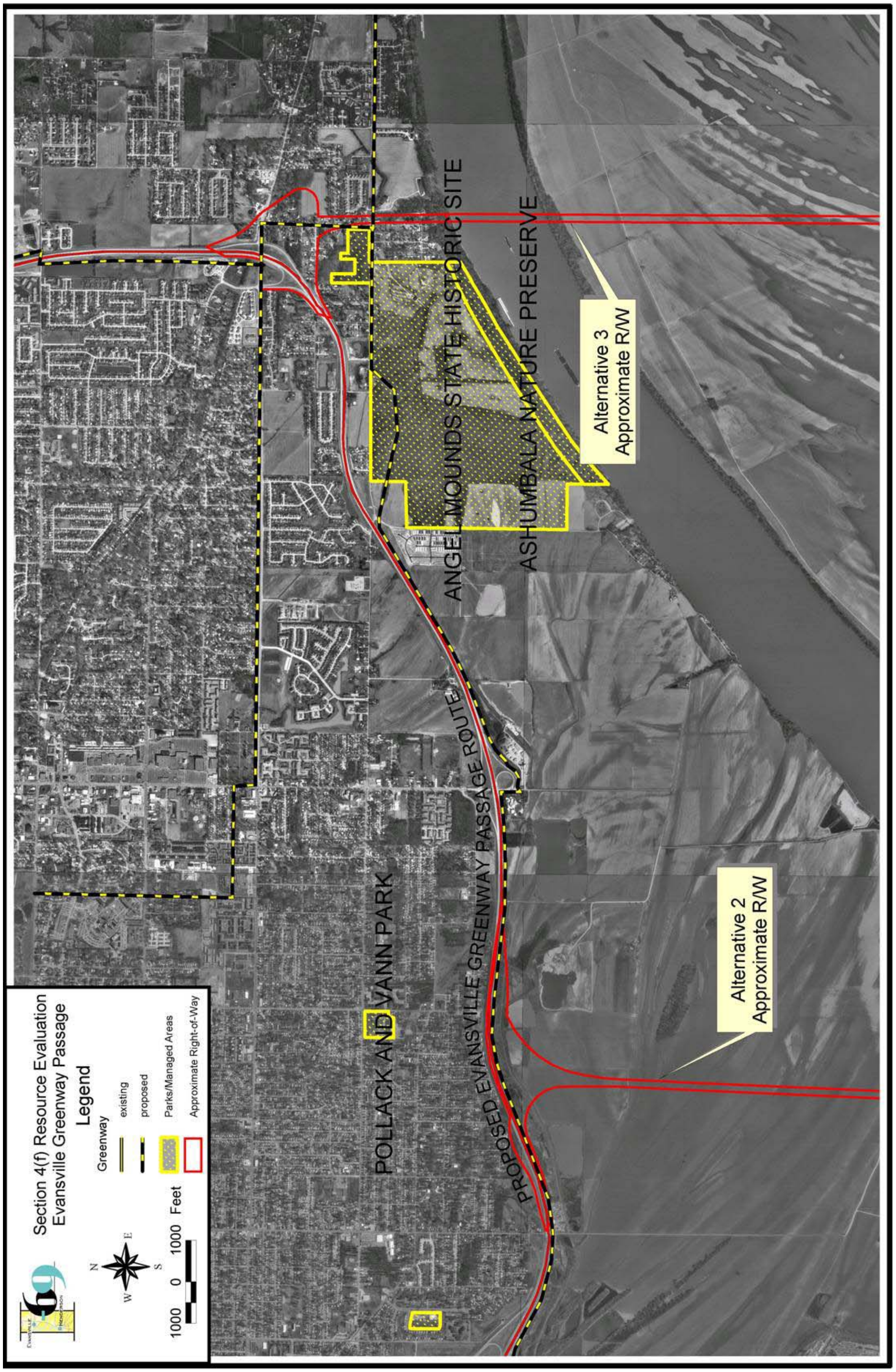


Figure 6-7: Evansville Greenway Passage 2

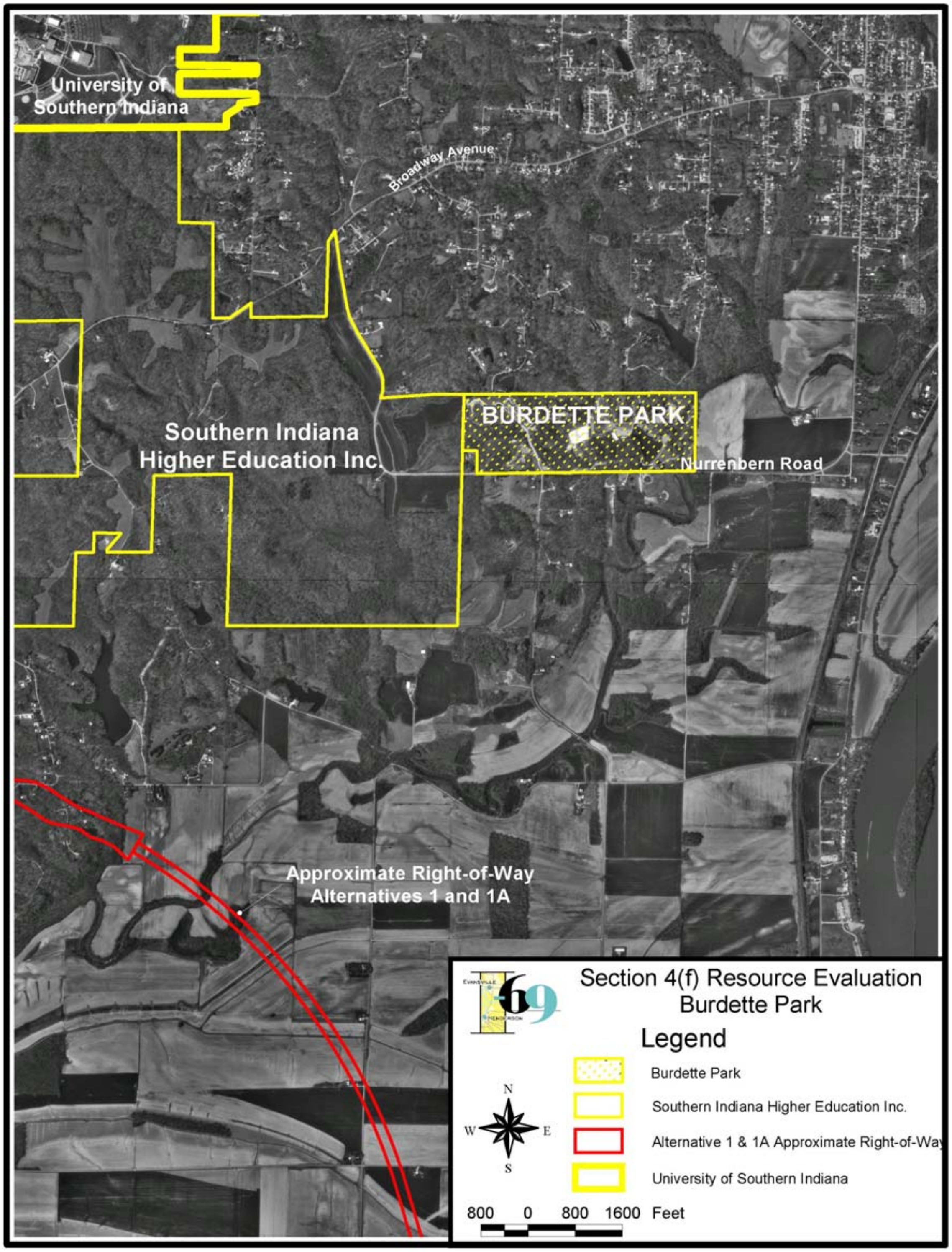


Figure 6-8: Burdette Park

6. Blue Grass Fish and Wildlife Area: Blue Grass Fish and Wildlife Area consists of 2,500 acres in western Warrick County, approximately ½ mile east of existing I-164. The property, shown in **Figure 6-9**, is owned and managed by the Indiana Department of Natural Resources, Division of Fish and Wildlife. Coordination with the Division of Fish and Wildlife identified that this entire property is managed as a recreational area. The coordination with the Division of Fish and Wildlife concluded that the major use of the Blue Grass Fish and Wildlife Area as a recreational area constitutes a Section 4(f) resource. There are currently no plans to expand the boundaries of the property or modify the use of the property.

No land within the Blue Grass Fish and Wildlife Area will be used by the proposed project. No use of a Section 4(f) resource would be created by the development of any proposed alternative in relation to the Blue Grass Fish and Wildlife Area. Alternatives 2 and 3 will pass approximately 2,400 feet west of the Blue Grass Fish and Wildlife Area along the existing I-164. The proximity impacts from these alternatives would have no affect on the recreational activities that qualify the property for Section 4(f) protection, therefore, there would be no constructive use of this Section 4(f) resource.

6.4 SECTION 4(f) RESOURCES – HISTORIC AND ARCHAEOLOGICAL RESOURCES

Section 4(f) protects historic sites and archaeological resources that are listed in or eligible for the NRHP. However, the Section 4(f) Policy Paper of the Federal Highway Administration (FHWA) also states that, "*Section 4(f) does not apply if FHWA after consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation determines that the archaeological resource is important chiefly because of what can be learned by data recovery… and has minimal value for preservation in place.*"

6.4.1 Historic Resources

Based on the Section 106 analysis in **Chapter 5**, 31 historic resources listed on or eligible for the NRHP were identified within the APE of the four alternatives with 21 and 10 located in Indiana and Kentucky, respectively. Of these 31 sites, 17 (6 in Kentucky and 11 in Indiana) include an adverse effects finding based on the Section 106 review. The respective State Historic Preservation Officers (SHPO) have reviewed these findings and have concurred on the determinations of eligibility. In addition to these, one archaeological site, Angel Mounds National Historic Landmark, is also listed on the NRHP. These sites are identified on **Figure 6-10**. The effects of each alternative upon these properties are outlined in Chapter 5, and a discussion of Angel Mounds is included in Section 6.2. As per FHWA regulations, there is no constructive use when the Section 106 analysis results in a finding of no effect or no adverse effect (23 CFR 771.135(p)(5)). Based on this determination, the following evaluation reviews those properties identified as having adverse effects from one or more of the alternatives in the context of Section 4(f) regulations to determine if a "use" or "constructive use" of the property would be required by one of the alternatives. **Table 6-1** lists all of the adversely affected properties and indicates the alternative or alternatives which may potentially affect them.

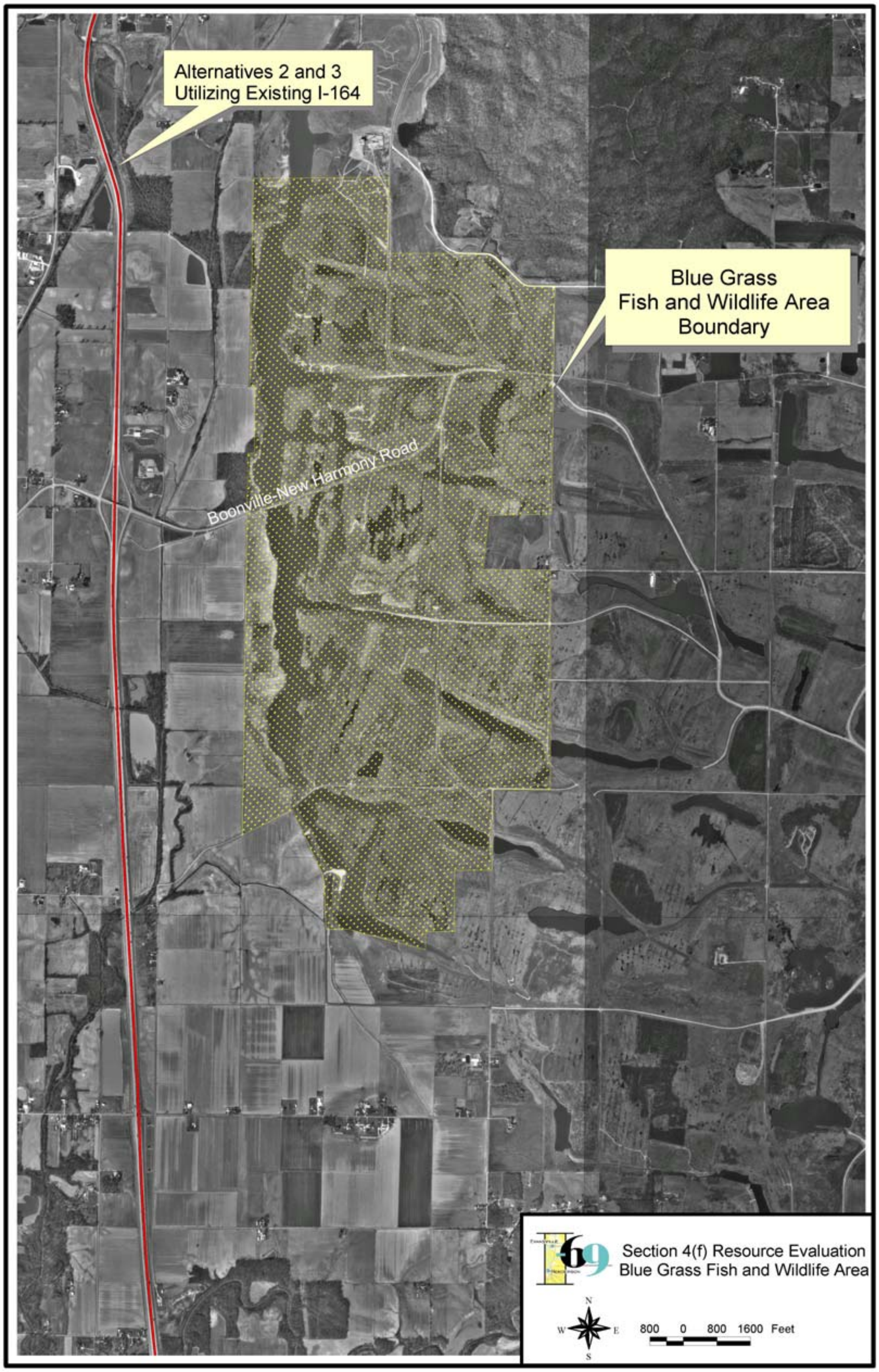


Figure 6-9: Blue Grass Fish and Wildlife Area

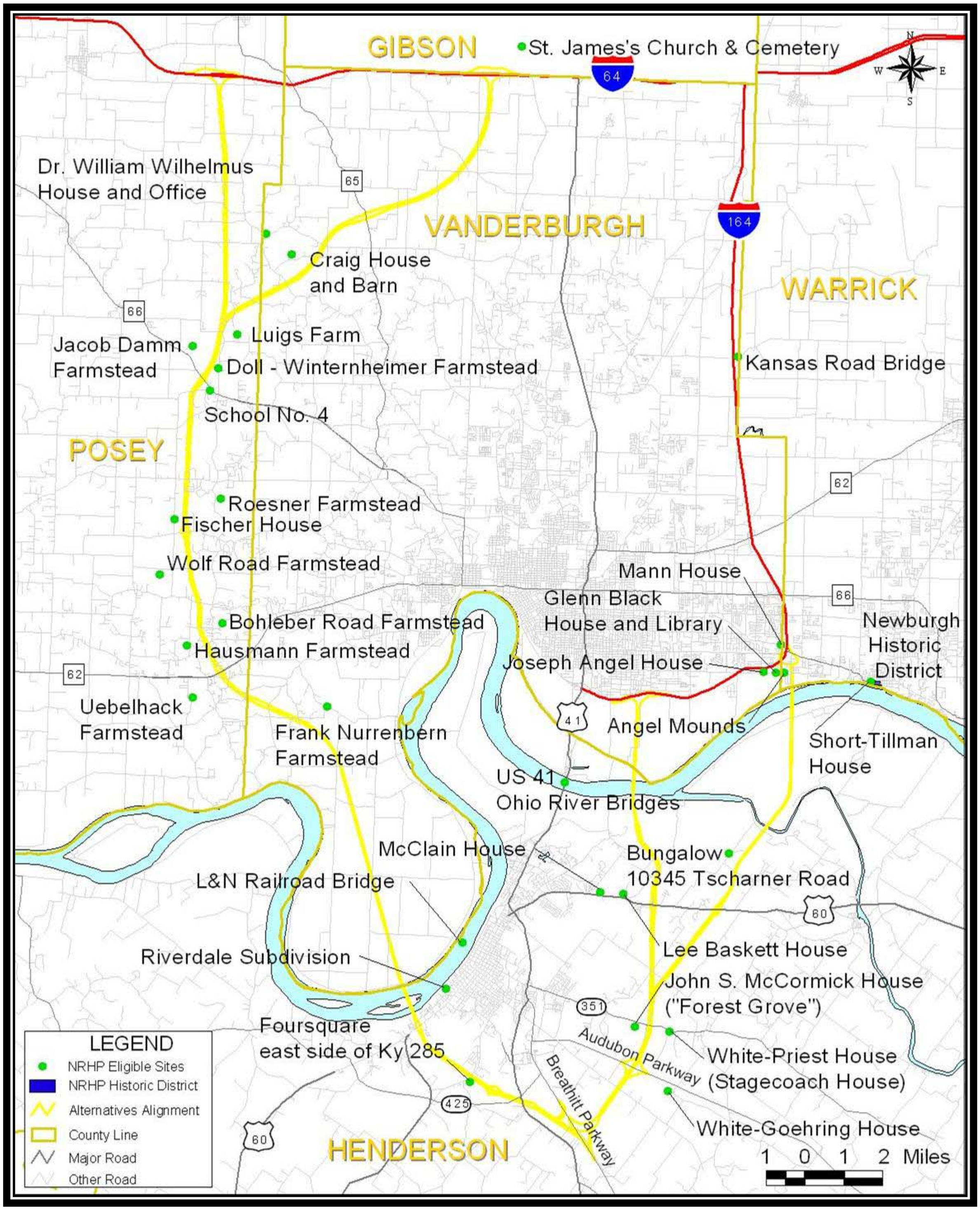


Figure 6-10: Sites Listed On or Eligible for the National Register of Historic Places Within the Area of Potential Effect of an I-69 Build Alternative

Table 6-1: Adversely Affected Sites Listed on or Eligible for the NRHP

State	Site Name	Alternative with Adverse Effect			
		Alt. 1 APE	Alt. 1A APE	Alt. 2 APE	Alt. 3 APE
IN	Jacob Damm Farmstead (Posey 25017)	X	X		
IN	Wolf Road Farmstead (Posey 40017)	X	X		
IN	Fischer House (Posey 40020)	X	X		
IN	Doll-Winternheimer Farmstead (Posey 25020)	X	X		
IN	Posey County School No. 4 (Posey 25023)	X	X		
IN	Luigs Farm (Posey 25048)	X	X		
IN	Nurrenbern Farmstead (Vanderburgh 25146)	X	X		
IN	Craig House & Barn (Vanderburgh 05078)		X		
IN	Glenn Black House & Library (Vanderburgh 20030)				X
IN	Newburgh Historic District				X
IN	St. Philip Historic District	X	X		
IN	Angel Mounds National Historic Landmark				X
KY	Foursquare House KY 285 (Site 99)	X	X		
KY	White-Goehring House (Site 108)			X	X
KY	John S. McCormick House (Site 116)			X	X
KY	White-Priest House (Site 119)			X	X
KY	Lee Baskett House (Site 129)			X	
KY	Bungalow House Tscharner Rd. (Site 148)				X

KENTUCKY SITES

1. Foursquare House (Site 99): This foursquare house located on KY 285 was identified as eligible for the NRHP under Criterion C as an example of a significant architectural form. The Section 106 review identified that no direct effects would occur to this property by any of the alternatives; however, Alternatives 1 and 1A would create an adverse visual effect on the property.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion C.

2. White-Goehring House (Site 108): The White-Goehring House was identified as eligible for the NRHP under Criterion C as an example of a significant architectural form. The Section 106 review identified that no direct effects would occur to this property by any of the alternatives; however, Alternatives 2 and 3 would create an adverse visual effect on the property due to visibility of the Audubon Parkway interchange and additional roadway.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion C.

3. John S. McCormick House, "Forest Grove" (Site 116): The John S. McCormick House was identified as eligible for the NRHP under Criterion B for its association with John S. McCormick a person significant in the history of Henderson County as well as Criterion C as an example of a significant architectural form. The Section 106 review identified that no property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives. The Section 106 review identifies an adverse visual effect from Alternatives 2 and 3. The adverse effect would be created where they are visible between KY 351 and the Audubon Parkway as well as the proposed interchange of Alternatives 2 and 3 with KY 351.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts would not constitute a constructive use of this Section 4(f) resource. The adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under both Criterion B and C. The original setting from the historically significant era has been altered by modern development.

4. White-Priest House (Site 119): The White-Priest House served as a stagecoach stop on the Owensboro-Henderson-Uniontown route, and is an example of a significant architectural form for Criterion C. Alternatives 2 and 3 would create an adverse visual effect on the property due to visibility of the KY 351 interchange and additional roadway between KY 351 and the Audubon Parkway.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts would not constitute a constructive use of this Section 4(f) resource as the roadway would be approximately 2,200 feet away and partially screened by a wooded creek. The adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion C.

5. Lee Baskett House (Site 129): The Lee Baskett House was identified as eligible for the NRHP under Criterion B for its association with Lee Baskett, a person significant in the history of Henderson County, as well as under Criterion C as an example of a significant architectural form. The Section 106 review identified that Alternative 2 would create an adverse visual effect on the property due to visibility of the US 60 interchange.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion B and C. A modern bridge carrying US 60 across an existing railroad has already altered the setting of this property and partially obstructs the view from the house.

6. Bungalow House (Site 148): The Bungalow House (Site 148) located on Tschsarner Road was identified as eligible for the NRHP under Criterion C as an example of a significant architectural form. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives. In response to the Section 106 review coordination, the KY SHPO identified that Alternative 3 may create an adverse visual effect on the property due to visibility of the roadway.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion C. In addition, the view of Alternative 3 from the house would be partially obstructed by vegetation and terrain.

INDIANA SITES

1. Jacob Damm Farmstead (Posey 25017): The Jacob Damm Farmstead was considered eligible for the NRHP under Criterion A and C as the Damm family is representative of the immigration of German Lutherans who came to this county in the mid-nineteenth century, and as an example of a significant architectural form. No property listed on or eligible for the NRHP associated with the farmstead will be taken for any of the alternatives. The Section 106 review identified that Alternatives 1 and 1A would create an adverse visual effect on the property due to visibility of the IN 66 interchange.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion A and C. In addition, the view of Alternatives 1 and 1A from the house would be partially obstructed by intervening vegetation.

2. Wolf Road Farmstead (Posey 40017): The Wolf Road Farmstead was considered eligible for the NRHP under Criterion A and C. No property listed on or eligible for the NRHP associated with the farmstead will be taken for any of the alternatives. The property will be adversely affected by Alternatives 1 and 1A. The lack of masking terrain features to the northeast and east would result in visual intrusion into the relative serenity of the farmstead, diminishing its contextual integrity. Additionally, noise levels will increase, but remain below the abatement criteria.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion A and C. In addition, the view of Alternatives 1 and 1A from the house would be partially obstructed by intervening vegetation.

3. Fischer House (Posey 40020): The Fischer House was identified as eligible for the NRHP under Criterion C as an example of a significant architectural form. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives. The Section 106 review identified that the lack of masking terrain features would result in visual intrusion. Additionally, noise levels will increase, but remain below the abatement criteria. This impact would not substantially impair the features that qualify the property for Section 4(f) protection; therefore, the proximity impacts would not constitute a constructive use of this Section 4(f) resource.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts and potential visual impacts from Alternatives 1 and 1A would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion C.

4. Doll-Winternheimer Farmstead (Posey 25020): The Doll-Winternheimer Farmstead was considered eligible for the NRHP under Criterion A and C. No property listed on or eligible for the NRHP associated with the farmstead will be taken for any of the alternatives. The Section 106 review identified that Alternatives 1 and 1A would create an adverse visual effect on the property due to visibility of the roadway. Noise levels are expected to increase for Alternatives 1 and 1A; however, the increased levels do not exceed the threshold for residential dwellings.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The existence of modern buildings nearby and IN 66 in close proximity alter the existing setting of this property. The proximity impacts from Alternatives 1 and 1A would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion A and C.

5. Posey County School No. 4 (Posey 25023): School No. 4 was considered eligible for the NRHP under Criterion A and C. The schoolhouse, which was built in 1892, has a high degree of integrity. No property listed on or eligible for the NRHP associated with the school will be taken for any of the alternatives. The Section 106 review identified that the visual intrusion to the school would result in an adverse effect. The context of the schoolhouse has already been altered by modern construction and by IN 66 which runs nearby.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts and potential visual impacts from Alternatives 1 and 1A would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion A and C.

6. Luigs Farm (Posey 25048): The Luigs Farm was considered eligible for the NRHP under Criterion A and C. No property listed on or eligible for the NRHP associated with the farm will be taken for any of the alternatives. The Section 106 review identified that the visual intrusion of elevated sections for overpasses would result in an adverse effect on this property. Terrain features and seasonal foliage will mask visual intrusion of the new roadway through most of the area. Modeling indicates that there will be minimal noise impacts from Alternatives 1 and 1A.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. On-site evaluation of viewsheds from the farmhouse revealed that terrain features and seasonal foliage will mask visual intrusion of the new roadway. The proximity impacts from Alternatives 1 and 1A would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion A and C.

7. Nurrenbern Farmstead (Vanderburgh 25146): The Nurrenbern Farmstead was considered eligible for the NRHP under Criterion A and C. No property listed on or eligible for the NRHP associated with the farm will be taken for any of the alternatives. The Section 106 review identified that the visual intrusion of elevated sections through the floodplain would result in an adverse effect on this property. The roadway in this area will be located more than 3,000 feet away from the property.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts from Alternatives 1 and 1A would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion A and C.

8. Craig House & Barn (Vanderburgh 05078): The Craig House and Barn were considered eligible for the NRHP under Criterion C as an example of a significant architectural form. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives. The Section 106 review identified that the removal of masking vegetation would result in visual intrusion. Additionally, noise levels will increase, but remain below the abatement criteria.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts from Alternative 1A would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion C. During the summer months the property cannot be seen from Emge Road (which passes directly in front of it) due to dense foliage. Presently, the house and barn are isolated, a fact that contributes to their contextual integrity. Even during the winter months, the dense stand of trees to the east and to the south will mask Alternative 1A.

9. Glenn Black House & Library (Vanderburgh 20030): The Glenn Black House and Library are significant in their connection to WPA archaeological work in southern Indiana at nearby Angel Mounds. The buildings are eligible for the NRHP under Criterion A and B. No property listed on or eligible for the NRHP associated with the house will be taken for any of the alternatives. The Section 106 review identified that the Ohio River bridge portion of Alternative 3 would result in an adverse visual effect. The elevated bridge will be located approximately 1,885 feet from the house and library to the east and to the southeast. The buildings are currently located within 1,200 feet of I-164 which is visually screened by development and vegetation.

No alternative will require right-of-way from within the NRHP-eligible boundary for this resource. Thus, there is no direct use of this resource. The proximity impacts from Alternative 3 would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect of the bridge over the Ohio River would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion A and B.

10. Newburgh Historic District: The Newburgh Historic District was placed on the NRHP in 1983. The district is located more than two miles from the proposed Alternative 3. No property listed on or eligible for the NRHP associated with the district will be taken for any of the alternatives. The Section 106 review identified that the Ohio River bridge portion of Alternative 3 would result in an adverse visual effect. The elevated bridge will be visible at a distance of two miles from some parts of the district.

No alternative will require right-of-way from within the NRHP-eligible boundary for the Newburgh Historic District. Thus, there is no direct use of this resource. The proximity impacts from Alternative 3 would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion A and C.

11. St. Philip German Community Settlement: The St. Philip German Community Settlement Historic District is an example of a German ethnic settlement beginning in the middle decades of the nineteenth century. The district represents a historic rural, ethnic settlement area and is eligible for inclusion in the National Register under Criterion A and C. No property listed on or eligible for the NRHP associated with the district will be taken for any of the alternatives. The Section 106 review identified that the lack of any intervening terrain or any other masking features to obscure Alternatives 1 and 1A would result in an adverse visual effect. The nearest construction limit of the proposed Alternatives 1 and 1A is approximately 3,200 feet southwest of the district boundary.

No alternative will require right-of-way from within the NRHP-eligible boundary for the St. Philip Settlement. Thus, there is no direct use of this resource. The proximity impacts from Alternatives 1 and 1A would not constitute a constructive use of this Section 4(f) resource because the adverse visual effect would not substantially impair the features that qualify the property for Section 4(f) protection under Criterion A and C.

Conclusion
Based on this evaluation, there will be no use of a property listed on or eligible for the NRHP by the four alternatives carried through detailed study. Likewise, the No-Build Alternative would not require the use of any of these properties.

6.4.2 Archaeological Resources

Within the I-69 APE, the only known archaeological site listed on the NRHP is the Angel Mounds State Historic Site. This site has been discussed previously in Section 6.2 relative to its status as a public park and as a significant archaeological site. There are no other known archaeological sites that are within the APE and are listed in the NRHP or determined eligible for inclusion in the NRHP.

Previously identified archaeological sites have been researched and the results reviewed by the Indiana and Kentucky SHPO. Archaeological field surveys will be conducted along the preferred alternative.

Archaeological sites, even if eligible for the NRHP, usually are not protected under Section 4(f). Rather under FHWA policy, archaeological sites are protected under Section 4(f) only if warranted by protection in place. No currently identified archaeological sites within the proposed alternatives estimated right-of-ways warrant protection in place.

6.5 COORDINATION

This project has been coordinated with the agencies and officials having jurisdiction over the Section 4(f) resources that could be affected. Agency coordination is described in Chapter 11. Archaeological and historical reports were coordinated with the Indiana and Kentucky SHPOs for determination of eligibility and effects. Reviews of parks, preserves, recreational areas, and refuges were coordinated with the agencies and officials having jurisdiction over each resource. In addition to formal coordination meetings, there were numerous informal meetings, discussions and telephone conversations with local officials and park representatives to solicit information and concerns about individual resources.

A summary of formal coordination efforts are as follows:

1. Agency Coordination Meeting and Request for Comments on December 13, 2001 **(Appendix D-1)**

2. Agency Coordination Meeting and Request for Comments on July 30, 2002 **(Appendix D-1)**

3. Section 106 and Section 4(f) Meetings on January 17, 2003 **(Appendix C-4)**

4. Section 4(f) Coordination Letters January 2003 **(Appendix C-2)**

6.6 CONCLUSION

Based on coordination with officials having jurisdiction over Section 4(f) properties potentially affected by the alternatives, and a review of potential impacts of the proposed alternatives upon these resources, this evaluation has determined that no use—direct, temporary or constructive—of a Section 4(f) resource would be created by the development of any of the proposed alternatives.

6.7 SECTION 6(f) RESOURCES

The Land and Water Conservation Fund Act of 1965 established Grants-In-Aid funds to assist states in the planning, acquisition, and development of outdoor recreational land and water areas and facilities. Section 6(f) of the Act prohibits the conversion of any property acquired or developed with the assistance of the fund to anything other than public outdoor recreation use without the approval of the Secretary of the Department of the Interior.

The listings of properties incorporating Land and Water Conservation Fund Act funds within the project study area have been provided by the Indiana Department of Natural Resources Division of Outdoor Recreation, and the Kentucky Office of the Governor, Department for Public Recreation. There are no known Section 6(f) resources located in proximity to any of the alternatives. Therefore, no right of way will be acquired from such resources.

Chapter 7 – COMMITMENTS AND MITIGATION MEASURES

One purpose of an Environmental Impact Statement is to identify resources and their significance, describe potential impacts to such resources, and formulate appropriate measures to mitigate unavoidable impacts. Throughout the development of alternatives, efforts have been made to avoid environmentally sensitive resources. Resource information and anticipated impacts have been incorporated in the decision making process to identify a preferred build alternative. Detailed mitigation measures will be developed for inclusion in the *Final Environmental Impact Statement*. The following discussion includes mitigation requirements or considerations concerning impacts associated with the alternatives described in **Chapter 5 - Environmental Consequences**.

7.1 LAND USE IMPACTS

Mitigation measures need to focus on coordination with regional planning commissions and local officials concerning land use controls. Secondary land use impacts could arise as a result of private developers who are subject to local ordinances and codes. If the preferred build alternative is identified as traversing a sensitive development area, the Indiana Department of Transportation (INDOT) and the Kentucky Transportation Cabinet (KYTC) will contact local officials to encourage them to initiate planning mechanisms that will review development requests in light of impacts to sensitive resources.

7.2 RELOCATION IMPACTS

The acquisition of property and the subsequent relocation of all displacements will be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. INDOT and KYTC will carry out the appraisal and relocation process for their respective states in accordance with Federal and State law.

7.3 PEDESTRIANS AND BICYCLISTS IMPACTS

Alternatives 2 and 3 should not affect the proposed route of the Pigeon Creek Greenway Passage on the southeast side of Evansville. If either Alternative 2 or 3 is identified as the preferred build alternative, the design of the system interchanges will provide access accommodations for the future development of the Pigeon Creek Greenway Passage along I-164 on the southeast side of Evansville.

7.4 AIR QUALITY IMPACTS

Pursuant to the 1990 Clean Air Act Amendments, Vanderburgh County in Indiana was designated as being in maintenance for all transportation related pollutants. The other counties in the project study area, both in Indiana and Kentucky, were designated as being in attainment for all transportation related pollutants. According to the calculated existing and future emissions of Carbon monoxide (CO), Hydrocarbon (HC), and Nitrogen oxide (NO_x), the proposed extension of I-69 is not expected to adversely affect the air quality within the Evansville-Owensboro-Henderson Interstate Air Quality Control Region. All existing and predicted CO concentrations are below the one-hour and eight-hour National Ambient Air Quality Standards (NAAQS).

In accordance with the Amended Final Conformity Guidelines issued by both the U.S. Department of Transportation (DOT) and U.S. Environmental Protection Agency (EPA), in effect as of September 15, 1997, the project is located in an air quality area that does not require transportation control measures. With respect to the latest conforming Indiana Statewide Transportation Improvement Program (STIP), the proposed project is located in Region 15, page

6-6 of the Statewide Transportation Improvement Program, Fiscal Years 2002-2004, approved November 2001. With respect to the latest conforming Kentucky STIP, the proposed project is located on page 100 of the STIP, Fiscal Years 1999-2004, approved October 1998. The I-69 project is also identified on pages 41 and 59 in the "Program of Projects" section of the FY 2003-2005 Evansville Urban Transportation Study (EUTS, the MPO) Transportation Improvement Program (TIP). Upon selection of a preferred build alternative, a conformity analysis will be conducted by the MPO. Subsequently, the analysis will be submitted to the FHWA for approval prior to signing of the Record of Decision (ROD) for this project.

7.5 NOISE IMPACTS

The noise analysis conducted for the DEIS was of sufficient detail to identify potential impact areas associated with each study alternative. The FEIS will identify reasonable and feasible noise abatement measures for the preferred alternative; however noise barriers and other abatement measures will be analyzed in more detail during the design phase. The assessment will utilize plans, profiles and cross sections based on accurate survey data to determine the number of impacted receivers according to the appropriate noise abatement criteria (NAC). This analysis will evaluate the feasibility of noise mitigation in the form of:

1) Alteration of horizontal and/or vertical alignments.
2) Noise insulation of public use or non-profit institutional structures.
3) Construction of highway noise barriers or other mitigation measures.

If noise barrier walls are considered to be feasible and the most appropriate means of mitigating adverse highway noise impacts then it will become necessary to determine the reasonableness of such abatement according to each state's criteria. In general, factors considered when determining reasonableness in both states include:

1) Number of receivers that will experience a benefit.
2) Cost of abatement per benefited receiver.
3) Severity of impact in terms of future traffic noise levels and anticipated increases relative to existing levels.
4) Timing of development near the project.
5) Views of noise impacted residents.

Construction noise impacts are to be mitigated through one or more of the following measures:

1) Provide noise-dampening equipment housing or enclosures for stationary noise producing machinery (drills, augers, cranes, derricks, compactors, pile drivers, generators, etc.).
2) Provide efficient silencers on air intakes of equipment.
3) Provide efficient intake and exhaust mufflers on internal combustion engines.
4) Perform proper maintenance on all noise producing equipment to prevent excessive rattling and vibration of metal surfaces.

The construction of noise barriers between the shoulder and the right-of-way limits is generally one of the most feasible and reasonable abatement measures available. Based on the criteria for determining the reasonableness and feasibility of barrier construction, it is possible that noise barriers would be constructed along Alternative 1 between SR 62 and Evansville-Upper Mt. Vernon Rd. and along Alternative 3 between Lincoln Avenue and Newburgh Road (SR 662). Alternative 2 may require noise barriers. Final decisions on noise barrier locations and lengths will be determined in the design phase.

7.6 SECTION 106 IMPACTS - HISTORIC AND ARCHAEOLOGICAL RESOURCES

An adverse effect occurs when “an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property” [36 CFR 800.5(a)(1)]. Specifically, the introduction of “visual, audible, or atmospheric elements” constitutes indirect adverse effects. If adverse effects are unavoidable, there are several ways to mitigate these effects. Specific mitigation will be designed to address the particular effects upon each individual property in the FEIS. These measures, which will be included in a Memorandum of Agreement (MOA), may include concepts such as plant screenings to screen visual impacts of the proposed highway. Earth embankments may also be utilized to create noise and sight buffers.

If a build alternative is selected, on-site Phase 1a (Phase 1 per Kentucky SHPO specifications) archaeological investigation will be undertaken to assess impacts to previously unrecorded archaeological resources. Phase 1c subsurface investigations (i.e., trenching) for buried archaeological resources, Phase 2 testing of potentially significant archaeological sites, and possibly Phase 3 mitigation (i.e., data recovery) of archaeological sites determined to be of National or State Register significance will be conducted prior to construction. Mitigation strategies will be developed as needed for impacts to archaeological resources discovered and documented in the FEIS.

7.7 VISUAL IMPACTS

Where appropriate, the proposed action will incorporate context sensitive solutions to create positive impacts and reduce negative impacts without compromising safety. Visual and aesthetic resource issues will be addressed in greater detail if a build alternative is selected in the Final Environmental Impact Statement. Once visual impacts have been identified for the preferred build alternative, consideration will be given to a host of mitigation measures, including vegetative screening along right-of-way and strategically positioning the vertical profile (grade line) to minimize visual impacts.

7.8 HAZARDOUS WASTE SITES IMPACTS

The DEIS identifies four sites of suspected contamination for Alternative 1, five sites for Alternative 1A, zero sites for Alternative 2, and four sites for Alternative 3. These sites include underground storage tanks (USTs), above ground storage tanks (ASTs), railroad crossings, salvage yards, and waste stockpiling on private property. If a build alternative is selected, additional investigation will be required prior to construction to determine if on-site contamination exists and develop appropriate cleanup procedures.

For UST sites, the following mitigation is recommended:

1) Conduct soil sampling and profile site if evidence of soil staining, noxious odors or contamination is detected during demolition and tank removal activities.
2) Investigate and confirm source of contamination. Where appropriate, perform remedial action according to profile and properly close tank system in accordance with appropriate state protocol.

For railroad track crossings where oil, grease, and other unknown chemical substances from leaking freight may occur, it is recommended that these areas be inspected for visual signs of contamination through coordination with the railroad owner.

For salvage yards, the area should be screened for signs of contaminants leaking from salvage automobiles, conduct appropriate soil sampling, conduct remedial actions including the removal of any contaminated soils discovered and properly dispose of them in an approved landfill prior to the beginning of construction activities.

Other potential hazardous material sites within the project study area included power pole-mounted electrical transformers with PCBs, agriculture operations possibly containing stored pesticides and herbicides, and commercial buildings and older homes which may contain asbestos or lead-based paints. During relocation, transformers should be inspected for evidence of leaking contents through coordination with the appropriate utility company. The condition of stored agricultural chemicals should be evaluated prior to relocation and or disposal in accordance with applicable laws and regulations. Structures within the right-of-way of the preferred build alternative that are to be demolished prior to construction should be screened for asbestos and lead paint. If present, these materials should be handled and disposed of according to profile and prior to demolition.

7.9 FLOODPLAIN IMPACTS

The largest floodplain impacts of the proposed project will be in crossing the Ohio River and its associated floodplain. All proposed alternatives include a crossing of the Ohio River. The design of this crossing will include a bridged structure across the entire 100 year floodplain or a series of bridges (main channel bridge and approach overflow bridges) to provide for acceptable hydraulics. Details of bridge requirements will be developed in later phases of project development.

7.10 WETLAND IMPACTS

In accordance with the “no net loss” goals of Executive Order 11990, wetland impacts resulting from project implementation would require that mitigation be planned and scheduled to the approval of the U.S. Army Corps Engineers (USACE), U.S. Fish and Wildlife Services (USFWS), Indiana Department of Environmental Management (IDEM), and Kentucky Department for Environmental Protection, Division of Water (KDOW). Recommendations of the National Governor's Association Provision to the Wetlands Conservation and Regulatory Improvements Act (Senate Bill 1304) stated “that regulatory policies should include a clear preferred sequence of mitigation options that begins with avoidance of adverse impacts on wetlands and the reduction of unavoidable adverse impacts and allows the use of environmental compensation only as a last resort, while allowing regulators sufficient flexibility to approve practical options that provide the most protection to the resource and that balance the effects of such actions on the total human environment, recognizing socioeconomic factors.” Section 7 of the Watershed Management Act of 1993 provides for a clear sequence of mitigation options.

If a build alternative is selected, wetlands identified in the DEIS will be delineated, documented, and surveyed. A wetland delineation report will be prepared and included in the FEIS. The delineation report will be submitted for approval to the USACE at the time of permit application, which will occur during the design phase. It is anticipated that the Section 404 permit will require mitigation measures in the form of wetland replacement. Impacted wetlands of different community types (i.e. forested, scrub/shrub, emergent, open water) will be mitigated at different ratios. The Memorandum of Understanding dated between INDOT, IDNR, and USFWS (January 28, 1991) establishes the following mitigation ratios for wetland replacement in Indiana: **(Appendix E-1)**

1) Exceptional, unique, critical (i.e. cypress swamp) - 4 and above:1
2) Bottomland hardwood forest – 3:1 or 4:1
3) Scrub/shrub and emergent – 2:1 or 3:1
4) Farmed wetland – 1:1

Once impacted wetland acreage has been determined and the appropriate mitigation ratios have been applied, the total acreage of required wetland mitigation can be established and an Indiana “Wetland Mitigation and Monitoring Plan” will be developed and implemented prior to construction.

Kentucky wetland replacement ratios are established on a per-impact basis through coordination with the USACE and the KDOW. Kentucky’s “Wetland Mitigation and Monitoring Plan” will be drafted by the KYTC Division of Environmental Analysis. KYTC proposes to create an advanced wetland mitigation site in the Ohio/Green River floodplain by restoring hydrology to property currently utilized for agriculture. The I-69 project is expected to be one of the projects utilizing the site. Properties sought for wetland mitigation purposes should provide the best opportunities for replacement of wetland habitat and functions, and should be screened for suitable hydrology and soil conditions conducive to the germination and sustained growth requirements of native woody and/or herbaceous wetland vegetation. Emphasis will be focused on the selection to floodplain farmland sites consisting of hydric soils where hydrology can be restored to pre-agricultural status. Prior Converted Cropland is typically ideal for the creation of mitigation sites. Enhancing existing wetlands by adding to them will provide a better habitat for wildlife and improve the existing wetlands and also improve the chance of success of the mitigation site.

Where appropriate, property deeds used for I-69 wetland mitigation may include a perpetuity clause that protects the property from future development and land use change indefinitely. Continued coordination with review agencies will assure that the wetland mitigation sites are suitable and that they are located in areas which assure the greatest potential for successful wetland habitat development.

7.11 AGRICULTURAL IMPACTS

Where reasonable, the design of the preferred build alternative should attempt to follow existing property lines and minimize splitting large tracts of farmland or the creation of uneconomic remnants. Consideration should also be given to continued coordination between INDOT, KYTC, and the National Resources Conservative Service (NRCS) to develop a mitigation plan for prime farmland losses.

7.12 FOREST IMPACTS

Forest impacts, specifically woodland loss, associated with the preferred build alternative will be minimized as much as possible during the design phase of the process. INDOT and KYTC will consult with appropriate resource agencies regarding measures to minimize forest impacts.

7.13 WATER BODY MODIFICATIONS IMPACTS

Mitigation measures for potential water quality impacts should be followed, where reasonable. Some such measures are:

1) Tree clearing shall be kept to a minimum and limited to the construction limits within the permanent right-of-way.
2) Trees or under story vegetation outside the construction zone boundaries shall not be cleared.
3) As much as possible, low-water work shall be restricted to placement of piers, pilings and/or footings, shaping of the spill slopes around the bridge abutments, and placement of riprap.
4) As much as possible, channel work and vegetation clearing shall be restricted to within the width of the normal approach road right-of-way.

5) The extent of artificial bank stabilization will be minimized to provide for adequate scour protection.
6) If riprap is utilized for bank stabilization, it shall be extended below low-water elevation to provide aquatic habitat.
7) Temporary erosion control devices such as burlap, jute mattering, grading, seeding and sodding shall be used to minimize sediment and debris in tributaries of the project.
8) Culverts and other hydraulic devices will be used to preserve existing drainage patterns.

7.14 ECOSYSTEM IMPACTS

All efforts have been made to minimize ecosystem impacts by identifying such resources and avoiding them as much as possible. As subcomponents of the ecosystems that comprise the project study area, wetland, stream, and forest impacts will be mitigated as determined through consultation with resource agencies.

7.15 WATER QUALITY IMPACTS

Mitigation measures for potential water quality impacts are:

1) Develop stream mitigation plans that provide for the relocated stream "in like kind or better kind" with the impacted stream.
2) Disturbed in-stream habitat should be returned to as near to original conditions as reasonably possible.
3) Minimize tree clearing near streams and rivers.
4) Avoid wetlands wherever possible.
5) Replace all wetlands at appropriate mitigation ratios.
6) Follow Best Management Practices for erosion control in the project.
7) Provide in the highway design for "filter strips" and detention basins to help control the release of pollutants into wetlands, streams, and rivers.

7.16 THREATENED AND ENDANGERED SPECIES IMPACTS

Federally Listed Species

Informal consultation with the USFWS concluded that the project has the potential to impact Indiana bat summer maternity roost habitat, and possible federally listed mussel species (namely the fat pocketbook mussel). As part of the Section 7 Endangered Species Act coordination process, the USFWS indicated on March 12, 2003 that formal consultation was not required for the I-69 project at this time, but suggested the following mitigation measures be implemented. **(Appendix D-2)**

Indiana bat

1) Prohibit the clearing of trees over 4" in diameter or areas containing such trees between March 31 and October 15.
2) Replace the loss of Indiana bat roost habitat through the planting of appropriate tree species (shagbark hickory, shellbark hickory, swamp chestnut oak, and swamp white oak).
3) If during construction roosting Indiana bats are discovered in an area not previously designated for restricted seasonal clearing, cease operations and resume informal and/or formal consultation with the USFWS to resolve issues concerning "take" of the species.

Fat Pocketbook and other federally listed mussels

1) Pier design and pier placement, to be determined by the U.S. Coast Guard, for the preferred build alternative should minimize scour and sediment deposition upon mussel beds downstream of the Ohio and Green River bridge crossings.
2) Once a preferred build alternative has been selected and designed, conduct a follow-up scuba mussel survey (preferably in the season before construction) to verify that no mussel beds containing federally endangered or threatened species exist within the zone of impact for the bridge piers and/or avoid the incidental take of any isolated individual(s) that might occur outside of a mussel bed, but within the pier footprint.
3) Should federally endangered or threatened mussels be discovered in the pre-construction survey, resume informal consultation with the USFWS to resolve anticipated impacts.
4) Maintain strict adherences to Best Management Practices concerning bank stabilization on the Ohio and Green Rivers during and after construction so as to avoid adverse indirect effects to mussel beds due to silt deposition.

State Listed Species

Copperbelly water snake

1) Maintain travel corridors of the copperbelly water snake in bottomland wetland habitats as much as possible during pier and bridge construction.
2) Inform field personnel (contractors, KYTC and INDOT employees) of the potential presence of the copperbelly water snake in these areas and stress avoidance of the indiscriminate “take” of this species.

7.17 GREEN RIVER STATE FOREST AND PROPOSED GREEN RIVER NATIONAL WILDLIFE REFUGE

A site visit was arranged and conducted on August 13, 2002 with USFWS at the Wheeler National Refuge in Decatur, Alabama. The purpose of this site visit was to investigate potential mitigation measures for an Interstate through the Green River State Forest and proposed Green River National Wildlife Refuge. I-65 traverses a portion of the Wheeler refuge on bridged structure, similar to what is proposed for the preferred build alternative for I-69 Henderson to Evansville. USFWS noted that the I-65 bridge, approximately two miles in length, does not act as a barrier impeding wildlife movement. Mitigation utilized during the bridge construction included limiting the construction season to minimize impacts to migratory species between November and February. Additional mitigation suggested for I-69 was to incorporate treatment facilities for runoff prior to discharge, and possibly the inclusion of a spill recovery system. Meeting minutes from this site visit are included in **Appendix E-2.**

Coordination on mitigating measures will continue through the public involvement stage. Memoranda of Agreement (MOA), Memoranda of Understanding (MOU), and other documentation on mitigation commitments will be included in the Final Environmental Impact Statement.

7.18 PERMITS

Each of the I-69 build alternatives will impact numerous waterways including the Ohio River. Permits that will be required include: the United States Army Corps of Engineers’ (USACE) Section 404 and Section 10 permit; Section 401 Water Quality Certification (WQC) from the IDEM and the KDOW; Construction in a Floodway Permit from Indiana Department of Natural

Resources (IDNR); No-Rise Certification through the Kentucky Department for Environmental Protection, Division of Water; IDEM Section 402 permit; IDEM National Pollution Discharge Elimination System (NPDES) Rule 5 permit; United States Coast Guard (USCG) Section 9 Bridge Permit;

The Section 404 permit, Section 401 WQC and Section 402 permit are authorized under the federal Clean Water Act (CWA), and the decisions are subject to the state of Indiana's water quality standards under IAC Title 327 of the Water Pollution Control Board (WPCB). Also, IDNR will require permit approvals for floodplain impacts under the State of Indiana's Flood Control Act IC 14-28-1 and Navigable Waterways Act IC 14-29-1. Rule 5 of the National Pollution Discharge Elimination System (NPDES) regulates contaminant discharge via storm water runoff. Sections 9 and 10 of the Rivers and Harbors Act of 1899 authorized regulation of navigable waters of the United States pertaining to bridge crossings, and dredging and filling, respectively.

All necessary permits will be applied for and obtained prior to the construction of this project, and the terms and conditions of these permits will be adhered to during the construction and maintenance of this facility.

Section 404 and Section 10 Permit

For projects involving excavation and/or discharges of dredged or fill material into waters of the United States (including wetlands), or placement of structures or any activity that disturbs soil/sediments below the ordinary high water elevation of a navigable waterway, and not authorized under either a general or a nationwide permit, an Individual USACE Section 404/Section 10 Permit or letter of permission must be obtained prior to the commencement of construction. Section 404 Permit(s) will be applied for during the design phase of the project.

Section 401 Water Quality Certification

The Section 401 Water Quality Certification is a state's review of applications for Section 404 USACE permits for compliance with water quality standards. Any activity involving dredging, excavation, or filling within waters of the United States may need a Section 401 Water Quality Certification. The IDEM is responsible for the Section 401 Water Quality Certifications review process in Indiana. The KDOW is responsible for the Section 401 Water Quality Certification review in Kentucky. Section 401 Water Quality Certifications will be applied for during the design phase of the I-69 project.

While the USACE 404 permit concerns broad national waterway issues, the Section 401 review focuses on how the project may impact the water quality of the waters of the United States as applied under the Clean Water Act within the jurisdiction of Indiana's water quality standards under IAC 327. Indiana's water quality standards have been reviewed and approved by the US Environmental Protection Agency which maintains oversight of IDEM's approvals of 401 water quality certifications. The IDEM review of water quality impacts, while focusing primarily on wetland impacts, also must include a review of the physical, biological, and chemical impacts to the water quality. Likewise, water quality standards under Kentucky Administrative Regulations Title 401, Chapter 5, must not be violated as a result of the designated activity. In conformity with the requirements of Section 401 of the Clean Water Act of 1977, Kentucky Statute KRS 224.16-070 specifies water quality standards that must be met in Kentucky.

Construction within a Floodway Permit

The Indiana Department of Natural Resources (IDNR) has the jurisdictional responsibility within the State of Indiana for approving any construction within a floodway or navigable waterway under the Flood Control Act (IC 14-28-1). A No-Rise Certification through KDOW, will also need to be coordinated with the U. S. Army Corps of Engineers Hydrology and Hydraulics Section for any encroachments within a floodway in Kentucky. The proposed I-69 will have numerous stream and river crossings requiring approval of construction within a floodway. A Construction in a Floodway Permit and a No-Rise Certification will be applied for during the design phase of this project.

National Pollution Discharge Elimination Permit
Water pollution degrades surface waters making them unsafe for drinking, fishing, swimming, and other activities. As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. The NPDES permit required for this project is included under Rule 5.

Rule 5 – Erosion Control
The requirements of Rule 5 (327 IAC 15-5 and 401 KAR 5:055) apply to all persons who are involved in construction activity that results in the disturbance of 1 acre or more of total land area. Contractors disturbing more than an acre of land from a non-commercial borrow site are also required to comply with rule 5. IDEM is the Indiana agency that governs over Rule 5, KDOW, KPDES Branch oversees Rule 5 permitting in Kentucky.

The erosion control plan is developed during the design phase. The plan will incorporate Best Management Practices (BMP) for the elimination of erosion and subsequent pollutant discharges leaving the construction site. This plan, after being filed and reviewed by IDEM, IDNR, and the appropriate Soil and Water Conservation District (SWCD) is incorporated into the plans and is included in the contract documents. A Notice of Intent will be submitted to IDEM, IDNR, and KDOW, KPDES Branch.

Sedimentation Basin, Typical BMP for Erosion Control on a Construction Site

Section 9 Permit – Crossing a Navigable Waterway
The River and Harbors Act of 1899 and the General Bridge Act of 1946 give the U. S. Coast Guard the authority to protect navigable waters of the United States. Navigable waters are those waters that at some time, in the past, present, or future are used or will be used to transport interstate or foreign commerce. The 8th Coast Guard District regulates activities within the I-69

project study area. The Section 9 Permit will be applied for during the design phase of the I-69 project.

Chapter 8 – COMMENTS AND COORDINATION

The Federal Highway Administration (FHWA), Indiana Department of Transportation (INDOT), Kentucky Transportation Cabinet (KYTC), Evansville Urban Transportation Study (EUTS), and the HNTB Team, comprising the I-69 Study Team, conducted extensive coordination with both local, state, and federal resource agencies and the public. As of the spring of 2003, more than 50 coordination meetings have taken place. A summary of the coordination meetings is shown in **Appendix F-1.**

8.1 STUDY ADVISORY COMMITTEE (SAC)

The I-69 Study Advisory Committee (SAC) was established in early 2001. The purpose of establishing a SAC was to provide an additional mechanism of public involvement and public input during the project study. Invitation for SAC participation was open to the general public. Approximately 60 people are members of the SAC. The first SAC meeting took place on February 14, 2001, and members have been asked to provide input throughout the study process.

The SAC meetings generally involved discussion of project status, along with question and answer sessions. The February 12, 2002 meeting included a bus tour of portions of the project study area, including wetlands adjacent to the Ohio River, Angel Mounds State Historic Site, and portions of both Evansville and Henderson. The purpose of the tour was to illustrate some of the key environmental considerations and potential corridor impacts. The May 1, 2002 meeting included an evaluation process where each SAC member was asked to prioritize several criteria that were to be used during the screening of the study corridors. The results of this exercise were used as a means of validating findings from the *Level 1 Alternatives Analysis Report*. Meeting minutes from each SAC meeting can be found in **Appendix F-2**.

8.2 PROJECT WEBSITE

In August, 2001, a project web site was developed (http://www.i69in-ky.com). The web site contains project documents, such as the *Purpose and Need Statement*, and project study area maps, and provides announcements for upcoming meetings. The site also provides links to the project sponsors' web sites and to sites for other sections of National I-69 currently under study. A key element of the project web site is the link to the project email address (i69in-ky@hntb.com), which provides one technique of gathering public input and resolving questions as they arise. Responses to posts to the study email address are typically provided within two business days.

The project website has been a successful tool in providing information to the public. The website had 52,606 "hits" between August 1, 2001 and December 31, 2003. In addition, over 9,484 MB of downloads were extracted from the website during the same time period. The project website will continue to be utilized throughout the duration of the project.

8.3 SUMMARY OF PUBLIC INFORMATION MEETINGS

The significance of a meaningful exchange of information with the public was recognized and a commitment to the process was demonstrated by conducting six public information meetings during the development of the *Draft Environmental Impact Statement* (DEIS). These public information meetings were held in conjunction with the preparation of the DEIS. The date, location, and approximate attendance of the public information meetings were as follows:

November 14, 2001
Reitz High School
350 Dreier Boulevard
Evansville, Indiana
Approximate Attendance: 75

November 15, 2001
Henderson South Elementary School
Cherry Street
Henderson, KY
Approximate Attendance: 75

June 26, 2002
Reitz High School
350 Dreier Boulevard
Evansville, Indiana
Approximate Attendance: 75

June 27, 2002
Henderson County High School
2424 Zion Road
Henderson, KY
Approximate Attendance: 150

September 26, 2002
Reitz High School
350 Dreier Boulevard
Evansville, IN
Approximate Attendance: 200

September 27, 2002
Henderson County High School
2424 Zion Road
Henderson, KY
Approximate Attendance: 300

In order to comply with the public involvement policies of both Indiana and Kentucky, the standard format of each respective state was utilized for the information meetings. Each information meeting in Indiana consisted of a formal presentation, followed by a public statement session, and then adjourned to an open house format where attendees could view displays and ask questions. The information meetings in Kentucky adhered to the open house format and were supplemented with a video presentation. Both meeting formats allowed attendees to ask questions throughout the evening. Handouts were provided at each meeting with details of the status of the study.

In addition to the underlying goal of seeking public input and feedback, each public information meeting had a *targeted* message and purpose. The purpose of the November 2001 meetings was to solicit input from the public on the project's *Draft Purpose and Need Statement,* copies of which were provided to each attendee, and to inform the public on the identification of the potential study corridors. These potential corridors included five two-mile study bands on the west side of Evansville, two one-mile study bands on the east side of Evansville, and two study bands utilizing existing transportation corridors, and were on display at the meetings.

The purpose of the June 2002 public information meetings was to discuss the findings of the *Level One Alternative Analysis Report*. The ten 2,000 foot corridors (one West Side corridor was added after the November public meetings) and their respective potential impacts were discussed at these meetings, along with the rationale behind the selection of the three corridors that were carried forward to the Level 2 Analysis.

The purpose of the September 2002 public information meetings was to update the community on the progress of the study since the June 2002 public meetings. These meetings included initial findings on Alternatives 1, 2, and 3, some of which resulted in the need to alter the original alternative locations. Displays included GIS-developed depictions of the corridors with digital ortho-photographic quadrangle (DOQ) images at 1"=500' scale. The September 2002 public information meetings saw the highest level of attendance, with approximately 500 citizens attending the two meetings.

Public Information Meetings notices, sample comment forms, and copies of the presentations are included in **Appendix F-3.**

8.4 RESOURCE AGENCY MEETINGS

Two Resource Agency meetings were held during the development of the DEIS. Meeting invitations were sent to numerous agencies representing a variety of expertise. **Appendix D-1** contains a copy of the invitation letter that was sent to the agencies.

The first Resource Agency meeting, held in December 2001, was to discuss the *Draft Purpose and Need Statement* and the preliminary 2-mile wide study bands. Approximately 30 individuals attended the meeting, representing the following Resource Agencies:

- Henderson County Historical Society
- Historic Landmarks Foundation of Indiana
- Historic Preservation Society of Evansville
- Indiana Division of Natural Resources (IDNR) - Fish & Wildlife
- Indiana Farm Bureau
- Indiana Geological Survey
- KY Department of Fish and Wildlife Resources (KDFWR)
- KY Division of Forestry
- KY Division of Waste Management
- KY Geological Survey (KGS)
- KYTC-Division of Environmental Analysis
- US Army Corps of Engineers (USACE) - Louisville District
- Natural Resources Conservation Service (NRCS)
- US Coast Guard (USCG)
- US Fish and Wildlife Service (USFWS)
- US Environmental Protection Agency (EPA)

Three important topics were discussed at the first Resource Agency Meeting. First, the *Draft Purpose and Need Statement* was distributed and discussed. Resource agencies were encouraged to read the *Draft Purpose and Need Statement* and provide comments. The second topic was the consideration of a nearer-to-Evansville western corridor as a means of minimizing potential impacts to prime wetlands anticipated with the original western corridors (Corridors A-E). This discussion resulted in the inclusion of Corridor J (later renamed Alternative 1) for consideration in the Level 1 Analysis.

The third topic that arose at the December 2001 Resource Agency meeting was the consideration of an additional corridor(s) located east of I-164. Given the existence of the Newburgh Lock and Dam on the Ohio River, any new freeway (Interstate) facility located east of I-164 would have to be located well to the east of the City of Newburgh and, therefore, well to the east of I-164 and the Evansville/Henderson area. As a result, any new facility constructed to the east of I-164 would do little to address transportation needs within the Evansville/Henderson area, which are identified in the *Draft Purpose and Need Statement*. By contrast, I-164 itself provides an existing Interstate connection with sufficient capacity to handle both local and through-traffic for I-69 in the 2025 Future Year. Taking these factors into consideration, the I-69 Management Team determined that alternatives located east of I-164 would not be reasonable and therefore should not be developed.

Approximately 15 resource agency representatives attended the July 30, 2002 meeting, which was held to discuss the results of the First Level Screening Analysis. However, the primary focus of the July 30, 2002 resource agency meeting was to present the Level 1 study corridors. Meeting minutes are in **Appendix D-1**. The July 30 resource agency meeting included a tour of key areas of interest relative to the 1,000 foot corridors, including:

- Angel Mounds
- Henderson Sloughs
- University of Southern Indiana
- I-164

Resource agencies were encouraged to submit comments during the development of the Purpose and Need and throughout the Alternative development process. Agency correspondence and comments are included in **Appendix F-5.**

July 30, 2002 Resource Agency Tour

8.5 COMMENTS

Numerous comments were received as a result of the six public information meetings. All comments submitted were compiled in a public information meeting transcript and reviewed for consideration. Meeting participants provided both supporting and opposing views of the project.

8.5.1 Public Comments

Comments relative to the development of a loop around the Evansville-Henderson area were received prior to the release of the *Level 1 Alternatives Analysis* report. The possibility of developing an additional alternative consisting of a loop around the cities of Evansville and Henderson was considered. A loop would require two crossings of the Ohio River and nearly doubles the footprint of the proposed action, relative to the other alternatives being considered. As a result, the cost of building a loop and the impacts to resources are nearly double those associated with any single direct route. On this basis, it was decided not to examine further the possibility of a loop alternative. Although a loop is not being considered as an alternative for this project, this study will not restrict the future consideration of a loop.

At both the June and September, 2002 Public Information Meetings held in Henderson, a number of citizens raised the question of why an alternative east of Alternative 3 in Kentucky was not under consideration. The perceived impacts to currently flood-prone areas east and southeast of Henderson by Build Alternatives 2 and 3 was one issue brought up by local citizens supporting the consideration of a further-east alternative. The decision to not pursue an eastern I-69 alternative further east than Alternative 3 is based on a number of issues, primarily concerning such an option’s inability to satisfactorily address the I-69 Henderson to Evansville Purpose and Need. These issues are briefly discussed below.

There are a limited number of locations that would be acceptable for the construction of an interchange on US 60. The location of Spottsville Elementary School and historic farms (i.e. “potentially eligible” for the National Register of Historic Places) along Rucker Road No. 2 and KY 1078 would require a further-east corridor to cross US 60 between Old US 60 and Spottsville. The topography complicates the construction of an interchange through most of this area, and the areas that could allow for an interchange to be constructed would result in substantial impacts to residential areas. Additionally, the desire for an interchange between I-69 and the Audubon Parkway would be problematic due to the location of the existing KY 1078 interchange. The KY 1078 interchange is at Milepost (MP) 5.39 on the Audubon Parkway, with MP 0.0 occurring at the Breathitt Parkway. The desired two miles of separation between rural interchanges would require I-69 to intersect the Parkway (at a minimum) just west of the KY 2249-Tom Smith Road underpass (MP 7.95 on the Parkway). If KY 2249 is to remain open as an overpass, an interchange would need to be developed further east, but likely prior to KY 6110-Alves Ferry Road at MP 8.98. Thus, an Audubon Parkway interchange would be 8-9 miles from the Breathitt Parkway and would not provide an efficient connection to the City of Henderson (see **Figure 1-2** for reference).

There has been no significant data collection with respect to historic properties east of Zion, although one Historic Register farm lies just east of KY 812 on the south side of the Audubon Parkway. Other sites are likely to exist; however, the number and their locations and boundaries are currently unknown.

The distance from the City of Henderson will have a significant impact on the amount of traffic that would utilize I-69. In demonstrating this fact, the results of the *Level 1 Alternatives Analysis Traffic Report*, with respect to traffic utilizing a new I-69 bridge over the Ohio River and the existing US 41 bridges in the 2025 No-Build scenario (i.e. no I-69 North), are summarized below.

Traffic (VPD)	I-69 Bridge (new)			US 41 Bridge		
	Auto	Truck	Total	Auto	Truck	Total
H (Alt. 2)	23,254	3,646	26,900	18,870	4,070	22,940
I (Alt. 3)	16,079	3,648	19,727	26,044	4,063	30,107

In 2025, the new Ohio River crossing on Alternative 3 carries approximately 73.3% of the total traffic carried by a new crossing on Alternative 2 because of its increased distance from the developed areas of Henderson. It can be reasoned that a further-east corridor will worsen this situation and will not significantly lessen the dependence on the existing US 41 river crossing.

The terrain east of Zion is much different than the flat areas to the west. The increased earthwork necessary to construct an Interstate through this area, as well as the increased overall length, will likely increase cost. Additionally, the right-of-way required may increase east of Zion due to the terrain, as a divided roadway section could be necessary. There is also a large concentration of both existing and abandoned oil and gas wells throughout the area east of Zion that would require further consideration during geotechnical explorations prior to the design phase.

A comment was also received relative to the development of an alternative (or alternatives) further west of the Evansville/Henderson area. However, similar to the argument against a further east alternative, it was decided that a further west corridor would not adequately address the goals of the Purpose and Need Statement. Specifically, it would be less capable of providing an efficient connection between Evansville and Henderson, and therefore would not sufficiently improve the regional transportation system.

Prior to the September 2002 public meetings, the service interchange at KY 351 for Alternatives 2 and 3 was removed from study because of its proximity to the Audubon Parkway and historic properties. However, due to public comment in favor of an interchange at that location, it was reassessed and is again considered as a potential interchange.

A 10-year old student from Evansville submitted a petition, dated November 4, 2002, with 155 classmates' signatures. The petition indicates the students' disapproval of Corridor J, now known as Alternative 1 (and therefore Alternative 1A as well), because it "will forever change our community culture". A copy of the petition is included in **Appendix F-4**.

8.5.2 Resource Agency Comments

Resource agencies were encouraged to provide comments at the December 13, 2001 and July 30, 2002 meetings, and were provided a 30-day period following each of the meetings to provide additional written or oral comments. Letters were received from the following agencies:

- Cherokee Nation
- Indiana Department of Natural Resources (IDNR)
- United States Coast Guard
- United States Fish and Wildlife Service (USFWS)

Copies of agency response letters and general agency comments are included in **Appendix F-5**. The U.S. Coast Guard provided some clarification of information included in the *Level 1 Alternatives Analysis* relative to Ohio River bridge clearances. IDNR noted that final agency approval must be received before construction can begin within any floodway. IDNR comments noted that the western corridors would result in the highest level of impacts to fish, wildlife, and botanical resources, mimicking the results of the *Level 1 Alternatives Analysis*. Additionally, it was noted that of the Build Alternatives under consideration, Alternative 1 (and consequently Alternative 1A) would have the most severe impacts to fish and wildlife habitat.

USFWS stated that the following species should be considered in the environmental evaluation:

- American burying beetle (Nicrophorus americanus) – Federally endangered
- Bald eagle (Haliaeetus leucocephalus) – Federally threatened
- Fat pocketbook mussel (Potamilus capax) – Federally endangered
- Gray bat (Myotis Grisescens) – Federally endangered
- Indiana bat (Myotis Sodalis) – Federally endangered

The USFWS noted that the selection of Corridors J, H, and I (now known as Alternatives 1, 2, and 3, respectively) eliminated those alternatives with the greatest impacts on wildlife resources from further consideration.

The Cherokee Nation stated it was not presently aware of or able to identify any cultural resources affiliated with the Cherokee Nation within the project study area.

8.5.3 Community Organization Comments

Various civic and community organizations have been represented in a number of ways throughout the study process. This representation has varied from membership on the SAC Committee to verbal and written comments. The following local or regional agencies have provided written feedback for consideration in the development of this document:

- Henderson County Conservation District
- Henderson Economic Development Council
- Henderson-Henderson County Chamber of Commerce
- Indiana Port Commission
- Mt. Vernon Area Chamber of Commerce
- Posey County Commission
- The Chamber of Commerce and Industry, Inc. (Owensboro-Daviess County)
- The Voices for I-69
- University of Southern Indiana

Specific comments submitted by these organizations are included in their entirety in the **Appendix F-5**. Generally speaking, community leaders have expressed support for the project. There are some differences of opinion with respect to preferred location for an eventual I-69 corridor (i.e. west of Evansville-Henderson versus east), and this study has worked to develop consensus amongst the various organizations.

8.5.4 Public Official Comments

Elected and public officials were encouraged to submit comments at the public information meetings. Comments submitted by elected officials from the following organizations are included in **Appendix F-6**.

- City of Evansville, Mayor's Office
- City of Mt. Vernon, Mayor's Office
- City of Owensboro, Mayor's Office
- Daviess County Fiscal Court

Much like the comments received from community organizations, the public officials' comments demonstrated strong support for the construction of I-69 between Evansville and Henderson. The City of Evansville and Mt. Vernon representatives stated a preference for a western alternative, while the City of Owensboro and Daviess County Fiscal Court favored Alternative 2.

Chapter 9 - LIST OF PREPARERS

NAME	TITLE	EXPERIENCE
FEDERAL HIGHWAY ADMINISTRATION		
Robert Dirks, P.E.	Environmental Engineer	Bachelor of Science in Civil Engineering, 15 years experience
Anthony DeSimone, P.E.	Environmental Engineer	Bachelor of Science in Civil Engineering with Minor in Environmental Engineering, 7 years experience
Mary Murray	Area Engineer	Bachelor of Science in Civil Engineering, Master of Public Administration, 26 years experience
INDIANA DEPARTMENT OF TRANSPORTATION		
Janice Osadczuk	Chief, Division of Environment, Planning, and Engineering	Bachelor of Arts in Biology, Master of Arts in Ecology/NEPA, 29 years experience
Lyle Sadler	Project Manager	Bachelor of Science in Management and Administration, 22 years experience
Jim Juricic	Manager, Environmental Assessment	Bachelor of Science in Forestry, 31 years experience
Robert Buskirk	Supervisor, Environmental Assessment	Bachelor of Science in Wildlife Management, 31 years experience
Brad Steckler, P.E.	Manager, Engineering Assessment	Master of Science in Engineering, Bachelor of Science in Civil Engineering,18 years experience
Karl Leet, P.E.	Senior Highway Engineer	Bachelor of Science in Civil Engineering, 11 years experience
Amie Gregory	Environmental Scientist	Bachelor of Science in Plant and Soil Science, 1 year experience
Jay Mitchell	Development Specialist I	Master of Public Administration, 22 years of experience
KENTUCKY TRANSPORTATION CABINET		
Doug Taylor	Environmental Coordinator	Bachelor of Science in Engineering Technology, 13 years experience

Everett Green, P.E.	Pre-Construction Branch Manager	Bachelor of Science in Civil Engineering, 24 years experience
David Waldner, P.E.	Director, Division of Environmental Analysis	Bachelor of Science in Civil Engineering
Tony Vinegar, CPM	Branch Manager, Project Coordination and Remediation	Bachelor of Science in Biology/Health Education, 15 years experience
Robert Keiser, P.G.	Administrative Section Supervisor	Bachelor of Arts in Business Administration, Bachelor of Science in Geology, 15 years of experience
Tom Koos	Noise Impact Specialist	A.S., Architectural Technology 11 years of environmental compliance background
Sharmista Dutta	Environmental Scientist	B.S. University of Kentucky, 4 years experience in air quality
Kurt Fiegel	Archaeologist	M.A. Public Archaeology; 25 years conducting CRM archaeological surveys; 22 years of review of CRM reports
John L. Mettille, Jr.	Deputy Executive Director/Office of Project Development	B.S. Geography and Political Science, M.A. Urban and Transportation Geography
Carl R. Shields	Archaeologist	B.A. Anthropology. 8 years of archaeology in Kentucky; 2+ years as Transportation Archaeologist
Randall J. Thomas, P.G.	Assistant Director, Division of Environmental Analysis	M.S., Geology 15 years of environmental science
Rebecca H. Turner	Historic Preservation Coordinator	Bachelor of Arts in Business Administration, 12 years experience
Pam Kolze	Transportation Engineer Technologist I	Associate Degree, 5 years experience
EVANSVILLE URBAN TRANSPORTATON STUDY		
Rose Zigenfus	EUTS Director	Master of Public Administration, 22 years Experience
HNTB CORPORATION		
Tim Miller	Project Manager	Master of Public Administration, 11 years experience
Karen Mohammadi, P.E., A.I.C.P.	Project Manager	Bachelor of Science Civil Engineering, Master in Transportation Engineering, 13 years experience

Bill Denhardt, P.E.	Project Engineer II	Bachelor of Science in Civil Engineering, 21 years experience
Brian Aldridge, P.E.	Engineer	Bachelor of Science in Civil Engineering, Master of Science in Civil Engineering, 6 years experience
Susan Rich, P.E.	Engineer	Bachelor of Science in Civil Engineering, Master of Civil Engineering, 10 years experience
Caron Kloser	Environmental Planner	Bachelor of Science in Agronomy, Master of Science in Horticulture, 18 years experience
Caroline Wolter, EIT	Engineer	Bachelor of Science in Civil Engineering, 6 months experience
BERNARDIN, LOCHMUELLER AND ASSOCIATES		
Vince Bernardin, A.I.C.P.	Vice President, Principal	Masters in Urban Planning Transportation, Bachelor of Arts in Sociology/Economics 28 years experience
David Isley	Director of Environmental Studies, Principal	Masters in Urban Planning, Bachelor of Science in Computer Science, 26 years experience
Thomas Cervone, Ph.D.	Environmental Manager, Principal	Bachelor of Science, Ph.D. Post Doctorate in Biology, 30 years experience
Jason Dupont, P.E.	Project Engineer	Bachelor of Science in Civil Engineering, 5 years experience
Rusty Yeager	Field Biologist	Bachelor of Science in Biology, 12 years experience
David Ripple, Ph.D.	Traffic Planner	Bachelor of Science in Civil Engineering, Master of Science in Engineering, Ph.D. in Urban Planning and Transportation Engineering, 32 years experience
Qk4		
David Smith, P.E.	Vice President of Transportation Planning & Engineering	Bachelor of Science in Civil Engineering, Master in Public Administration, 34 years experience

Tom Springer, A.I.C.P.	Environmental Planner	Bachelor of Science in Geography, Master in Public Administration, 10 years experience
Kirk Reinke	Environmental Technician	Bachelor of Science in Geography, 6 years experience
Tim Presnell	Environmental Technician	14 years experience
Scott Stepro	GIS Technician	12 years experience
Jane Wehner	Technical Writer	Bachelor of Arts in English, 29 years experience
BIOTIC CONSULTANTS		
Robert H. Mohlenbrock, Ph.D.	Botanist	Ph. D. in Botany, 50 years experience
ECOLOGICAL SPECIALISTS		
Heidi Dunn	President	Master of Science, 23 years experience
Jacquie Lee	Aquatic Ecologist	Master of Science, 15 years experience
LANDMARK ARCHAEOLOGY		
Tom Beard	President	Master of Science in Anthropology, 28 years experience
Jeff Plunkett	Vice President	Master of Arts, 12 years experience
ECONOMIC DEVELOPMENT RESEARCH GROUP		
Glen Weisbrod	President	Master of City Planning, Master of Science in Civil Engineering, 20 years experience
Steven Landau	Director of Planning	Master of City Planning, 15 years experience
Lisa Petraglia	Director of Economic Research	Master of Science in Economics, 10 years experience
UNIVERSITY OF KENTUCKY		
Don Linebaugh, Ph.D.	Director, UK Archaeology	Master of Arts in Anthropology, Ph.D. in American Studies, 18 years experience
Patrick Trader	Project Archaeologist	Bachelor of Arts in Anthropology, Master of Arts in Anthropology, 15 years experience

WEINTRAUT AND ASSOCIATES		
Linda Weintraut, Ph.D.	Historian, Principal	Ph.D. Twentieth Century American Social & Cultural History, Minor in Urban Policy,16 years experience
John Warner	Historian	Master of Arts in Public History, 7 years experience
Kelly Lally Molloy	Historian	Master of Arts in Folklore, 14 years experience
Connie Zeigler	Historian	Bachelor of Arts in History, 5 years experience
HELEN POWELL AND COMPANY, INC		
Helen C. Powell	Historian, Principal	Bachelor of Arts in Art History, Masters of Landscape Architecture, 25 years experience
ENVIROKINETICS		
James Mosley	President	Bachelor Degree in Public Administration, 14 years experience
AKIN, GUMP, STRAUSS, HAUER and FELD		
Bill Malley	Legal Counsel	J.D., Yale, M.S.C. Harvard, experience in preparation of environmental documents under NEPA and other related Federal and State laws.
Angela Dusenbury	Legal Counsel	J. D., Bachelor of Arts in Economics and Political Science. Experience in preparation of environmental documents under NEPA and other related Federal and State laws.

Chapter 10 – CIRCULATION LIST

H – Hard Copy, **CD** – PDF Version on CD

Address

Federal Agencies

Mr. Lamar Smith — **H**
Federal Highway Administration
Office of NEPA Facilitation, HEPE-1 (Midwest Division)
400 7th Street, S.W.
Room 3222
Washington, D.C. 20590

Mr. Robert Black — **H**
Federal Highway Administration
Office of NEPA Facilitation, HEPE-1 (Midwest Division)
400 7th Street, S.W.
Room 3222
Washington, D.C. 20590

Ms. Ruth Rentch — **H**
Federal Highway Administration
Office of NEPA Facilitation, HEPE-1 (Southeast Division)
400 7th Street, S.W.
Room 3222
Washington, D.C. 20590

Mr. Joseph Toole — **H**
Director of Field Services - South
FHWA Southern Resource Center
61 Forsyth Street, SW
Suite 17T26
Atlanta, GA 30303

Mr. Willie R. Taylor, Director — **12H**[1]
Office of Environmental Policy and Compliance
U.S. Department of Interior
Main Interior Building, MS 2340
1849 C Street, N.W.
Washington, D. C. 20240

Scott Pruitt, Field Supervisor — **H**
U.S. Department of Interior
Fish and Wildlife Services
Indiana Field Office
620 South Walker Street
Bloomington, IN 47403-2121

[1] To be sent via certified mail.

Mr. Lee Andrews, Field Supervisor **5 H**
U.S. Department of Interior
Fish and Wildlife Services
Kentucky Field Office
Frankfort, KY 40601

Assistant Secretary **2 H**
Natural Resources and Environment
U.S. Department of Agriculture
Office of the Secretary
Room 217 E.
Washington, D.C. 20250

Mr. Dale Bosworth, Chief **H**
USDA Forest Service
P.O. Box 96090
Washington, D.C. 20090-6090

Ms. Jane Hardisty, Director **H**
U.S. Department of Agriculture
Natural Resources Conservation Service - Indiana
6013 Lakeside Boulevard
Indianapolis, IN 46278

Mr. David Sawyer, State Conservationist **H**
U.S. Department of Agriculture
Natural Resources Conservation Service - Kentucky
771 Corporate Drive, Suite 110
Lexington Kentucky 40503-4579

Regional Administrator, Region 5 **H**
U.S. Environmental Protection Agency
Region 5, B-19J
77 West Jackson Boulevard
Chicago, IL 60604-3507

Regional Administrator, Region 4 **3 H**
U.S. Environmental Protection Agency
Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303-3104

Ms. Ann Miller **5 H**[2]
US Environmental Protection Agency
Office of Federal Activities
EIS Filing Section
1200 Pennsylvania Avenue, NW2251A
Washington, DC 20460

[2] This office requests that 5 copies be sent with an EIS Filing Station Letter via certified mail.

Mr. Craig Hooks, Director **CD**
Office of Environmental Compliance
Department of Energy
Room 4G-064
1000 Independence Avenue, S. W.
Washington, D. C. 20585

Mr. Eugene Goldfarb **CD**
Environmental Officer
U.S. Department of Housing & Urban Development
Ralph Metcalfe Federal Building
77 West Jackson Boulevard
Chicago, IL 60604

Mr. Robert F. Poffenberger **CD**
CPD Division Director
HUD-Indiana State Office
151 North Delaware Street
Indianapolis, IN 46204-2526

Ms. Virginia Peck **CD**
CPD Division Director
HUD-Kentucky State Office
601 West Broadway
P.O. Box 1044
Louisville, KY 40201-1044

Ms. Linda Poythress **CD**
Field Environmental Officer
HUD-Georgia State Office
75 Spring Street, SW
Atlanta, GA 30303-3388

Director **CD**
Office of Policy and Strategic Planning
U.S. Department of Commerce, HCHB
Rm. 8121
14th and Constitution Avenue, N.W.
Washington, D.C. 20230

Edward G. Buikema, Regional Director **CD**
Federal Emergency Management Agency Region 5,
536 South Clark Street, 6th Floor
Chicago, IL 60605

Kenneth O. Burris, Jr., Regional Director **CD**
Federal Emergency Management Agency Region 4
3003 Chamblee Tucker Road
Atlanta, GA 30341

Dr. Julie Gerbonding
Office of Director
Center for Disease Control
Center for Environmental Health and Injury Control
Special Programs Group, Mail Stop F-29
1600 Clifton Road
Atlanta, GA 30333
CD

Mr. Preston Snyder,
Airports Environmental Program Manager
Federal Aviation Administration
Great Lakes Region
2300 East Devon Avenue
Des Plaines, IL 60018
CD

Mr. Louis H. Yates, Chief Planning Staff
Federal Aviation Administration
Great Lakes Region
2300 East Devon Avenue
Des Plaines, IL 60018
CD

Carolyn Blum, Regional Administrator
Federal Aviation Administration
Southern Regional Office
1701 Columbia Avenue
College Park, Georgia 30337
CD

Mr. James Townsend
U.S. Department of Army
Louisville District Army Corps of Engineers
P.O. Box 59
Louisville, KY 40201-0059
H

Roger K. Weibusch, Chief, Bridge Administrator
U.S. Coast Guard, Eighth District
Western Rivers Operation (obr)
1222 Spruce Street Room 2-107G
St. Louis, MO 63103-2832
H

The U.S. Department of Health and Human Services
200 Independence Avenue, S.W.
Washington, D.C. 20201
CD

Natural Resources Conservation Service
Attn: Conservation Communications Staff
P.O. Box 2890
Washington, DC 20013
CD

Mr. Charles G. Groat, Director **CD**
100 U.S. Geological Survey
John W. Powell Federal Building
12201 Sunrise Valley Drive
Reston, Virginia 20192

Mr. Don Klima, Eastern Office Director **CD**
Office of Federal Agency Programs
1100 Pennsylvania Avenue, NW
Suite 803
Washington, DC 20004

Ms. Ann Veneman, Secretary **H**
U.S. Department of Agriculture
14th St. & Independence Avenue, SW
Washington, DC 20250

Mr. Thomas M. Hunter, Executive Director **CD**
Appalachian Regional Commission
1666 Connecticut Avenue, NW
Suite 700
Washington, DC 20009-1068

Mr. Donald L. Evans, Secretary **H**
US Department of Commerce
14th Street Constitution/Pennsylvania Avenue, NW
Washington, DC 20201

Ms. Marlene H. Dortch, Secretary **H**
Federal Communications Commission
445 7th Street, SW
Washington, DC 20554

Mr. Randy Dzialo, Regional Director **CD**
Southern Area Coordination Center
1954 Airport Road, Suite 105
Chamblee, Georgia 30341

Ms. Pat Boucher **CD**
Fish & Wildlife Service
Southern Area Coordination Center
1954 Airport Road, Suite 105
Chamblee, Georgia 30341

Mr. Tommy Thompson, Secretary **H**
US Department of Health & Human Service
200 Independence Avenue, SW
Washington, DC 20201

Mr. Brian Noyes, Regional Director **CD**
US Department of Housing and Urban Development
40 Marietta Street, NW, 2nd Floor
Atlanta, GA 30303-2806

Mr. Jose Sepulveda, Division Administrator H
FHWA
330 West Broadway Street
Frankfort, KY 40601

Mr. Dennis Luhrs, Assistant Division Administrator H
FHWA
330 West Broadway Street
Frankfort, KY 40601

Ms. Mary Murray, Project Manager H
FHWA
330 West Broadway Street
Frankfort, KY 40601

Mr. Evan Wisniewski H
Project Delivery Team Leader
FHWA
330 West Broadway Street
Frankfort, KY 40601

Ms. Katherine H. Quinn, Division Administrator H
FHWA 2 CD
575 North Pennsylvania Street
Room 254
Indianapolis, IN 46204

Mr. Anthony DeSimone H
Field Operations Engineer
FHWA
575 North Pennsylvania Street
Room 254
Indianapolis, IN 46204

Mr. Robert Dirks H
Environmental Engineer
FHWA
575 North Pennsylvania Street
Room 254
Indianapolis, IN 46204

Ms. Fran Mainella, Director H
National Park Service
1849 C Street NW
Washington, DC 20240

Mr. Don H. Castleberg H
Midwest Regional Director
National Park Service
1709 Jackson Street
Omaha, NE 68102

Mr. Jerry Belson H
Southeast Regional Director
National Park Service
1924 Building
Atlanta, GA 30303

Indiana State Offices/Agencies

Honorable Joe Kernan H
Office of the Governor
State House
Room 206
Indianapolis, IN 46204-2797

Mr. J. Bryan Nicol, Commissioner H
Indiana Department of Transportation
100 N. Senate Avenue
Room N755
Indianapolis, IN 46204

Mr. Rickie Clark H
Public Hearing Examiner
Indiana Department of Transportation
100 North Senate Avenue
Room 901
Indianapolis, IN 46204

Mr. Gary Mroczka, Chief H
Division of Design
Indiana Department of Transportation
100 North Senate Avenue
Room 642
Indianapolis, IN 46204

Ms. Lori Kaplan, Commissioner H
Indiana Department of Environmental Management
100 North Senate Avenue
P.O. Box 6015
Indianapolis, IN. 46204-6015

Ms. Felicia Robinson H
Deputy Commissioner of Legal Affairs
Indiana Government Center North
100 North Senate Avenue
P.O. Box 6015
Indianapolis, IN 46206-6015

Mr. Steve Carter CD
Attorney General
Attn: Yasmin Lamberson
Division Chief-Departments
5th Floor Ind. Gov. Center South
Indianapolis, IN 46204-2267

Dr. Gregory Wilson, Commissioner CD
Indiana State Department of Health
2 North Meridian Street
Indianapolis, IN 46204

Mr. John Goss, Director H
Indiana Department of Natural Resources
402 W. Washington Street
Indiana Government Center South
Indianapolis, IN 46204-2267

Dr. John C. Steinmartz, Director H
Indiana Geological Survey
611 North Walnut Grove
Bloomington, IN 47405

Indiana State Emergency Management Agency H
302 West Washington Street
Room E-208 A
Indianapolis, Indiana 46204-2767

Kentucky State Offices/Agencies

Honorable Ernie Fletcher H
Office of the Governor
700 Capitol Avenue, Suite 100
Frankfort, KY 40601

Mr. Maxwell C. Bailey, Secretary H
Kentucky Transportation Cabinet
State Office Building 10th Floor
501 High Street
Frankfort, KY 40601

Mr. James M Yowell, State Highway Engineer CD
Kentucky Transportation Cabinet
State Office Building 10th Floor
501 High Street
Frankfort, KY 40601

Mr. John L. Metille, Jr., CEPA CD
Kentucky Transportation Cabinet
State Office Building 10th Floor
501 High Street
Frankfort, KY 40601

Mr. Ted Merryman, Chief District Engineer 3 H
District 2, Kentucky Transportation Cabinet 3 CD
1840 North Main Street
PO Box 600
Madisonville, KY 42431-5003

Mr. Dexter Newman, P.E., Director CD
Kentucky Transportation Cabinet
Division of Construction
501 High Street, Mail Code 4-1
Room 408
Frankfort, KY. 40622

Mr. Gary W. Sharpe, P.E, Director H
Kentucky Transportation Cabinet
Division of Design
501 High Street
Room 602
Frankfort, KY 40622

Mr. Chuck Knowles, P.E., Director CD
Kentucky Transportation Cabinet
Division of Operations
501 High Street, Mail Code 7-2
Frankfort, KY 40622

Ms. Annette Coffey, P.E., Director H
Kentucky Transportation Cabinet
Division of Planning
125 Holmes St.
Mail Code A-2
Frankfort, KY 40601

Mr. Ralph Divine, Director CD
Kentucky Transportation Cabinet
Division of Right of Way and Utilities
State Office Building 4th Floor
501 High Street
Frankfort, KY 40601

Mr. Jody A. Lassiter CD
Office of the Governor
Department for Local Government
1024 Capital Center Drive
Suite 340
Frankfort, Kentucky 40601

Mr. Boyce Wells H
State Environmental Review Officer (SERO)
Department for Environmental Protection
14 Reilly Road
Frankfort, KY 40601

Mr. Robert W. Logan, Commissioner H
Department for Environmental Protection
14 Reilly Rd
Frankfort, KY 40601

Ms. Ann R. Latta, Secretary H
Kentucky Department of Tourism
Capita Plaza Tower 24thFloor
500 Mero Street
Frankfort, KY 40601

Mr. Henry C. List, Secretary H
Kentucky Natural Resources & Environmental Protection Cabinet
Capital Plaza Tower
500 Mero Street
Frankfort, KY 40601

Mr. Jeff Pratt, Director CD
Department for Environmental Protection
Kentucky Division of Water
14 Reilly Rd
Frankfort, KY 40601

Mr. Robert H. Daniell, Director H
Department for Environmental Protection
Kentucky Division of Waste Management
14 Reilly Rd
Frankfort, KY 40601

Mr. John Lyons, Director CD
Department for Environmental Protection
Kentucky Division of Air Quality
14 Reilly Rd
Frankfort, KY 40601

Ms. Leah MacSwords, Director H
Kentucky Department of Natural Resources
Kentucky Division of Forestry
663 Teton Trail
Frankfort, KY 40601

Mr. Stephen A. Coleman, Director **CD**
Kentucky Department of Natural Resources
Kentucky Division of Conservation
663 Teton Trail
Frankfort, KY 40601

Ms. Marcia R. Morgan, Secretary **CD**
Kentucky Cabinet for Health Services
275 East Main Street
HS1GWA
Frankfort, KY 40621

Mr. Carl E. Campbell, Commissioner **CD**
Kentucky Department of Surface Mining, Reclamation and Enforcement
#2 Hudson Hollow Rd.
Frankfort, KY 40601

Mr. Billy Ray Smith, Commissioner **CD**
Kentucky Department of Agriculture
Capital Plaza Tower, 7th Floor
500 Mero Street
Frankfort, KY 40601

Mr. Hugh Archer, Commissioner **H**
Kentucky Department of Natural Resources
663 Teton Trail
Frankfort, KY 40601

Mr. C. Thomas Bennett, Commissioner **H**
Kentucky Department of Fish and Wildlife Resources
#1 Game Farm Road
Frankfort, Kentucky 40601

BG James E. Shane (retired), Executive Director **CD**
Kentucky Department of Military Affairs
Boone National Guard Center
Frankfort, KY 40601-6168

Mr. David L. Morgan **H**
Executive Director and State Historic Preservation Officer
Kentucky Heritage Council
300 Washington Street
Frankfort, Kentucky 40601

Mr. Don Dott, Director **CD**
Kentucky State Nature Preserves Commission
801 Schenkel Lane
Frankfort KY 40601

Mr. Gene Strong, Secretary CD
Kentucky Department of Economic Development
Capital Plaza Tower
500 Mero Street
Frankfort, KY 40601

Ms. Janie A. Miller, Secretary CD
Kentucky Department of Public Protection & Regulation
90 Airport Road
Frankfort, KY 40601

Ms. Leslie Cole, Executive Director CD
Kentucky Department of Environmental Quality Commission
14 Reilly Rd
Frankfort, KY 40601

Mr. Pat Simpson, Commissioner CD
Kentucky State Police
919 Versailles Road
Frankfort, KY 40601

Mr. Malcolm Franklin, Director CD
Kentucky Emergency Management
EOC Building
100 Minuteman Parkway Bldg. 100
Frankfort, Kentucky 40601-6168

Mr. Gordon C. Duke, Secretary H
Kentucky Department of Finance & Administration
Room 383, Capitol Annex
Frankfort 40601

Dr. James C, Cobb, State Geologist and Director CD
Kentucky Geological Survey
228 Mining and Mineral Resources Building
University of Kentucky
Lexington, Kentucky 40506-0107

Local Agencies

Metropolitan Planning Organization

Ms. Rose Zigenfus, Director H
Evansville Transportation Urban Study
Civic Center Room 316
1 N.W. Martin Luther King Boulevard
Evansville, IN 47708-1833

Schools

Dr. Bart McCandless, Superintendent **H**
Evansville Vanderburgh School Corporation
1 S.E. 9th Street
Evansville, IN 47708

Dr. Brad Schneider, Superintendent **H**
Warrick County School Corporation
300 East Gum Street
Boonville, IN 47601

Dr. John W. Vaughan, Superintendent **H**
Henderson County Schools
1805 Second Street.
Henderson, KY 42420

Dr. H. Ray Hoops, President **CD**
University of Southern Indiana
8600 University Boulevard
Evansville, IN 47712

Dr. Dan Schenk, Chancellor **CD**
Ivy Tech State College/Community College of Indiana
3501 First Avenue
Evansville, Indiana 47710

Stephen G. Jennings, President **CD**
University of Evansville
1800 Lincoln Avenue
Evansville, Indiana 47722

Dr. Patrick Lake, President **CD**
Henderson Community College
2660 S. Green Street
Henderson, KY 42420

County Officials

Area Plan Commission **H**
1 N.W. Martin Luther King Jr. Blvd.
Civic Center Complex
Evansville, IN 47708

Warrick County Commission **H**
107 W. Locust Street
Boonville, IN 47601

Posey County Commission **H**
126 E. Third Street, Coliseum Building
Mount Vernon, IN 47620

Henderson City-County Commission H
County Courthouse
222 First St.
Henderson, KY 42419

The Honorable Sandy Watkins H
Henderson County Judge Executive
County Courthouse
222 First St.
Henderson, KY 42419

The Honorable Reid Haire H
Daviess County Judge Executive
P.O. Box 1716
Owensboro, KY 42302-1716

Cities

Mayor Jonathan Weinzapfel H
Office of the Mayor, City of Evansville
302 Civic Center Complex
1 N.W. Martin Luther King, Jr. Boulevard
Evansville, IN 47708

Mayor Jackson Higgins H
Office of the Mayor
City of Mount Vernon
520 Main Street
Mount Vernon, IN 47620

Mayor Pam Hendrickson H
Office of the Mayor
City of Booneville
Post Office Box 585
Booneville, IN 47601

Mayor Henry Lackey H
Office of the Mayor
City of Henderson
P.O. Box 716
Henderson, KY 42419

Mayor Waymond Morris H
Office of the Mayor
City of Owensboro
P.O. Box 10003
Owensboro, KY 42302-9003

Towns

Ms. Mae Mason H
Newburgh Town Manager
200 State Street
Newburgh, IN 47630

State Representatives – Indiana

The Honorable Russ Stilwell CD
State Representative
Indiana House of Representatives
200 W. Washington Street
Indianapolis, IN 46204

The Honorable Dennis Avery CD
State Representative
Indiana House of Representatives
200 W. Washington Street
Indianapolis, IN 46204

The Honorable Jonathan Weinzapfel CD
State Representative
Indiana House of Representatives
200 W. Washington Street
Indianapolis, IN 46204

The Honorable Brian Hasler CD
State Representative
Indiana House of Representatives
200 W. Washington Street
Indianapolis, IN 46204

The Honorable Vaneta G. Becker CD
State Representative
Indiana House of Representatives
200 W. Washington Street
Indianapolis, IN 46204

The Honorable John Frenz CD
State Representative
Indiana House of Representatives
200 W. Washington Street
Indianapolis, IN 46204

State Representatives – Kentucky

The Honorable Gross C. Lindsay CD
Kentucky State Representative
P.O. Box 19
Henderson, KY 42420-0019

The Honorable John A. Arnold, Jr. CD
Kentucky State Representative
1301 North Lee
P.O. Box 124
Sturgis, KY 42459

State Senators – Indiana

The Honorable Richard Young CD
State Senator
Indiana State Senate
200 W. Washington Street
Indianapolis, IN 46204

The Honorable Larry Lutz CD
State Senator
Indiana State Senate
200 W. Washington Street
Indianapolis, IN 46204

The Honorable Greg D. Server CD
State Senator
Indiana State Senate
200 W. Washington Street
Indianapolis, IN 46204

The Honorable Lindel Hume CD
State Senator
Indiana State Senate
200 W. Washington Street
Indianapolis, IN 46204

State Senators – Kentucky

The Honorable Paul Herron, Jr. CD
Kentucky State Senate
700 Capital Ave., Room 230
Frankfort, KY 40601

U.S Representatives

The Honorable John Hostettler **CD**
United States House of Representatives
Evansville District Office
101 NW Martin Luther King Jr Blvd, Room 124
Evansville, Indiana 47708

The Honorable Ed Whitfield **CD**
United States House of Representatives
Room 307
222 First Street
Henderson, KY 42420

U.S Senators

The Honorable Evan Bayh **CD**
United States Senate
463 Russell Building
Washington, DC 20510

The Honorable Richard G. Lugar **CD**
United States Senate
101 NW Martin Luther King Boulevard, Room 122
Evansville, Indiana 47708

The Honorable A.M. “Mitch’ McConnell **CD**
United States Senate
Professional Arts Building
2320 Broadway, Suite 100
Paducah, KY 42001

The Honorable Jim Bunning **CD**
United States Senate
1100 S. Main Street
Suite 12
Hopkinsville, KY 42240

Libraries

Evansville Vanderburgh Public Library **H**
Central Library
22 S.E. 5th Street
Evansville, IN 47708

Alexandrian Public Library **H**
115 W. Fifth Street
Mount Vernon, IN 47620

Poseyville Carnegy Public Library H
Box 220
55 South Cale Street
Poseyville, Indiana 47633

Fort Branch-Johnson Township Public Library H
107 E. Locust St.
Fort Branch, IN 47648

Boonville-Warrick County Public Library H
611 West Main Street
Boonville, IN 47601-1544

Evansville Public Library H
McCollough Branch
5115 Washington Avenue
Evansville, IN 47715

Evansville Public Library H
North Park Branch
750 North Park Drive
Evansville, IN 47710

Evansville Public Library H
Oaklyn Branch
3820 Oak Hill Road
Evansville, IN 47711

Evansville Public Library H
Red Bank Brank
120 S. Red Bank Road
Evansville, IN 47712

Evansville Public Library H
2100 Stringtown Road
Evansville, IN 47711

Evansville Public Library H
West Branch
2000 W. Franklin Street
Evansville, IN 47712

Evansville Public Library H
East Branch
840 E. Chandler Avenue
Evansville, IN 47713

Henderson County Public Library H
101 South Main Street
Henderson, KY 42420

Others

Mr. Matt Meadows, President **H**
Evansville Chamber of Commerce
102 NW 2nd Street
Evansville, IN 47708

Ms. Nancy Burns **H**
Mt. Vernon Chamber of Commerce
915 East 4th Street
Mount Vernon, IN 46720

Mr. Keith Utley, President **H**
Henderson Chamber of Commerce
PO Box 376
Henderson, KY 42419

Evansville Fire Department **H**
550 S.E. Eighth Street
Evansville, IN 47713

Henderson Fire Department **H**
332 Washington Street
Henderson KY 42420

Mr. Bud Farmer **H**
Indiana Port Commissioner
Southwind Maritime Centre
4219 Weaver Road
Evansville, IN 47711

Mr. Randy Kron **H**
Indiana Farm Bureau
17425 Owensville Road
Evansville, IN 47720

Mr. Niles Rosenquist **2H**
Hoosier Environmental Council
732 South Willow Road
Evansville, IN 47714

Mr. Robert H. Working, Airport Manager **CD**
Evansville Regional Airport
7801 Bussing Drive
Evansville, IN 47711-6799

Chapter 11 – REFERENCES

AASHTO
A Policy on Geometric Design of Highways and Streets

"About Ellis Park". www.ellisparkracing.com

About the Ohio River. Available @ americanrivers.org/ohioriver/aboutohio/html.

A History of American Agriculture 1776–1990. Available @ usda.gov/history2/text4.htm.

Abrell, Brian D.
1997. A Taste of the South: The Southern Bottomlands Natural Region. Indiana University Press, Bloomington, Indiana. In *The Natural Heritage of Indiana*, edited by Marion T. Jackson, pp.177-183,

Alerich, Carol L.
1990. Forest Statistics for Kentucky -- 1975 and 1988. USDA, Forest Service, Northeastern Forest Experiment Station, Radnor, Pennsylvania. Resource Bulletin NE-117. 295 pp.

American Bird Conservancy's Field Guide
1997. *All the Birds of North America*. Harper Perennial, New York. 182 pp.
Anderson, J.M.

2000. *An Archaeological Reconnaissance of the Proposed Southwest Henderson Cellular Communication Tower Location in Henderson County, Kentucky.* Cultural Resource Analysts, Inc, Lexington, Kentucky.

Ammerman, Nancy
1997. *Congregation and Community*. New Brunswick, NJ: Rutgers University Press.

Arnett, Maralea
1976. *The Annals and Scandals of Henderson County, Kentucky, 1775-1975.* Fremar Publishing Company, Corydon, Kentucky.

Arnett, Maralea, Kathryn Basket, and J.W. Duncan
1974. *A Pictorial History of Henderson County, 1775-1950.* Gleamer Print Shop, Inc., Henderson, Kentucky.

Asch, David L. and Nancy B.
1982. A Chronology for the Development of Prehistoric Horticulture in West Central Illinois. Paper presented at the Society for American Archaeology, Minneapolis, Minnesota.

Au, Dennis. "Newfound Style has German Roots," *Indiana Preservationist* 2 (March/April 1994):

Baker, Ronald L. and Marvin Carmony
1975. *Indiana Place Names*. Indiana University Press, Bloomington, Indiana.

Ball, Donald
2002. *Phase I Cultural Resources Reconnaissance of the Atkinson Park Public Access Sites (Tracts Nos. 1406 & 1406E). Uniontown Pool, Henderson County, Kentucky.* United States Corps of Engineers, Louisville District, Louisville.

Bandoli, James H.
1997. Factors Influencing Reproductive Success in Male Spottail Darters (*Etheostoma squamiceps*, Pisces, Percidae). Proceedings of the Indiana Academy of Science. Volume 106:145-157.

Bandoli, James H., James T. Lanigan III, and Tod A. Sheckles.
1991. Reproduction in the Spottail Darter in Indiana: Use of Artificial Nest Sites. Proceedings of the Indiana Academy of Science. Volume 100:65-75.

Barbour, Roger W.
1971. Amphibians and Reptiles of Kentucky. The University Press of Kentucky. 334 pp.

Barbour, R. W., and W. H. Davis.
1969. Bats of America. The Univ. Press Kentucky. 286 pp.
Barbour, Roger W. and Wayne H. Davis.
1974. Mammals of Kentucky. University Press of Kentucky. 322 pp.

Barnes, William B.
Natural Resources and the Great Depression in Martin County and South Central Indiana, Linda B. Weintraut, ed. Indianapolis: Indiana Historical Bureau Collections, forthcoming.

Barnhart, John D. and Donald F. Carmon.
1965. *Indiana: From Frontier to Industrial Commonwealth, I.* Indianapolis: Indiana Historical Bureau & Indiana Historical Society.

Barnhart, John D. and Dorothy L. Riker
1971. *Indiana to 1816: The Colonial Period.* Indiana Historical Society, Indianapolis.

Barrows, Robert G.
2000. *Albion Fellows Bacon*. Bloomington: Indiana University Press.

Barry T.M. and Reagan, J.A.
1978. *FHWA Highway Traffic Noise Prediction Model* . Federal Highway Administration, Washington, D.C.. Report No. FHWA-RD-77-108

Beal, Ernest O. and John W. Thieret.
1986. Aquatic and Wetland Plants of Kentucky. Kentucky State Nature Preserves Commission, Scientific and Technical Series Number 5. 312 pp.

Berg, Donald J.
1997. *American Country Building Design*. New York: Sterling Publishing Company, Inc.

Bergman, Christopher A., D.A. Miller, John F. Doershuk, D. Duerksen, and T.W. Tune
1998. Early Woodland Occupation of the Northern Bluegrass: The West Runway Site (15BE391), Boone County, Kentucky. *North American Archaeologist* 19(1):13-33.

Bernardin Lochmueller & Associates Inc.
2002. Draft Ecological Assessment. Environmental Impacts and Engineering Assessment. *Henderson, Kentucky to Evansville, Indiana.*

Bergquist, James M. “Tracing the Origins of a Midwestern Culture: The Case of Central Indiana.” *Indiana Magazine of History* 77 (March 1986): 1-32.
Bial, Raymond.

1995. *Visit to Amish Country*. Urbana, IL: Phoenix Publishing.

Bigham, Darrel
1987. *We Ask Only a Fair Trial: A History of the Black Community of Evansville, Indiana*. Bloomington: Indiana University Press.

Bigham, Darrel
2000.*Images of America, Evansville*. Charleston, SC: Tempus Publishing, Inc.

Bigham, Darrel
2000. *Images of America, Southern Indiana*. Chicago: Arcadia Publishing,

Black, Glenn A.
1967. *Angel Site: An Archaeological, Historical, and Ethnological Study*. Indianapolis: Indiana Historical Society.

Blackburn, Tom
1962. *Evansville, Indiana: 1812-1962.* Evansville, IN: Evansville Sesquicentennial Commission.

Blanchard, Charles, ed.
1884. *Counties of Morgan, Monroe and Brown, Indiana*. Chicago: F. A. Battey.

Blasingham, E.J.
1953. Temporal and Spatial Distribution of the Yankeetown Cultural Manifestation. Unpublished M.A. Thesis, on file at the Glen A. Black Laboratory of Archaeology, Indiana University, Bloomington.

Blue Water Enterprises, Inc.
1993. The Original Kentucky Boater's Almanac. United Graphics of Louisville. 273 pp.

Blumenson, John J.
1981. *Identifying American Architecture: A Pictorial Guide to Styles and Terms, 1600-1945*. New York: W. W. Norton & Co.

Bodenhamer, David J. and Robert G. Barrows, eds.,
1994. *The Encyclopedia of Indianapolis*. Bloomington: Indiana University Press.

Born, Emily
1985. *Power to the People: A History of Rural Electrification in Indiana*. Indiana Statewide Association of Rural Electric Cooperatives.

Boswell, Jessie P.
1954. *Index to the Journals and Debates of the Indiana Constitutional Convention 1850-1851*. Indianapolis: Indiana Historical Society.

Boynton, M., Jr.
1992. Henderson. In *The Kentucky Encyclopedia*, edited by J.E. Kleber, pp. 423-424. The University Press of Kentucky, Lexington.

Braasch, M. E. and R. L. Mayden.
1985. Review of the subgenus *Catonotus* (Percidae) with descriptions of two new darters of the *Etheostoma squamiceps* species group. Occasional Papers of the Museum of Natural History, University of Kansas 119:1-13.

Brack, Virgil and Karen Tyrell.
1990. A Model of the Habitat Used by the Indiana Bat (*Myotis sodalis*) During the Summer in Indiana: 1990 Field Studies. Indiana Department of Natural Resources, Division of Fish and Wildlife.

Brady, J.T., R. K. LaVal, T. H. Kunz, M. D. Tuttle, D. E. Wilson, and R. L. Clawson.
1983. Recovery plan for the Indiana bat. U. S. Department of Interior, Fish and Wildlife Service, Reference No. 80/848 0112. Fish and Wildlife Reference Service, Bethesda, MD. 94 pp.

Brant and Fuller Publishers
1889 *History of Vanderburgh County, Indiana*. Brant and Fuller Publishers.

Braun, David P.
1983. Pots as Tools. In *Archaeological Hammers and Theories,* edited by J.A. Moore and A.S. Keene, pp. 107-134. Academic Press, Inc., New York.

Braun, Lucy E.
1959. *Deciduous Forests of Eastern North America.* Blakiston, Philadelphia.

Brinkley, Alan
1993. *Unfinished Nation: A Concise History of the American People, II*. New York: McGraw Hill.

Brose, David
1990. Toward a Model of Exchange Values for the Eastern Woodlands. *Midcontinental Journal of Archaeology* 15:100-136.

Brown, Claudia R.
1989. *North Main Street Historic District, Henderson, Ky*. National Register nomination on file, Kentucky Heritage Council.

Brown, Claudia R.
1991. *South Main Street Historic District, Henderson, Ky*. National Register nomination on file, Kentucky Heritage Council.

Brown, James A. and Robert K. Vierra
1983. What Happened in tthe Middle Archaic? Introductions to an Ecological Approach to Koster Site Archaeology. In *Archaic Hunters and Gatherers in the American Midwest,* edited by J.L. Phillips and J.A. Brown, pp. 165-196. Academic Press, New York.

Burr, Brooks M. and Melvin L. Warren.
1986. A Distributional Atlas of Kentucky Fishes. Kentucky Nature Preserves Commission. Scientific and Technical Series Number 4. 398 pp.

Burt, William H. and Richard P. Grossenheider.
1976. A Field Guide to the Mammals. Houghton Mifflin Company, Boston, MA. 289 pp.

Bush, Leslie L.
1994. Botanical Remains from the Morell-Sheets Site, 12-My-87, An Albee Phase Occupation in West-Central Indiana (Abstract). In *Current Research in Indiana Archaeology and Prehistory*, edited by B.G. Redmond, pp. 6-9. Research Reports 15, Glenn A. Black Laboratory of Archaeology, Indiana University, Bloomington, Indiana.

Butler, Brian M. and Richard W. Jefferies
1986. Crab Orchard and Early Woodland Cultures in the Middle South. In *Early Woodland Archaeology,* edited by K.B. Farnsworth and T.E. Emerson, pp. 523-524. Kampsville Seminars in Archeology No. 2. Center for American Archeology, Kampsville, Illinois.

CCC History. Available @ cccalumni.org/history1.html.

Camp, Mark J. and Grahm T. Richardson.
1999. Roadside Geology of Indiana. Mountain Press Publishing Company, Missoula, MT. 315 pp.

Cantin, Mark
1994. *Provenience, Description, and Archaeological Use of Selected Chert Types of Indiana*. Indiana State University Anthropology Laboratory, Terre Haute, Indiana.

Carmichael, D.L.
1977. Preliminary Archaeological Survey of Illinois Uplands and Some Behavioral Implications. *Midcontinental Journal of Archaeology* 2:219-251.

Carmony, Donald F. Indiana,
1998. *1816-1850: The Pioneer Era*. Indianapolis: Indiana Historical Society.

Carstens, Kenneth C. and Nancy J. Carstens
2000. *A Phase I Archaeological Reconnaissance of a 100 x 100 Square Foot Cell Tower, Henderson County, Kentucky.* Archaeological Services. Murray, Kentucky. Report on file at the OSA, Lexington, Kentucky.

Carstens, Kenneth C. and Nancy J. Carstens
2001. *A Phase I Archaeological Reconnaissance of House Lots 46-48 Klutey Avenue, Henderson, (Henderson County), Kentucky.* Archaeological Services. Murray, Kentucky. Report on file at the OSA, Lexington, Kentucky.

Carstens, Kenneth C. and Nancy J. Carstens
2002. *A Phase I Archaeological Reconnaissance of an Elevated Water Tank Site in Henderson County, Kentucky.* Archaeological Services. Murray, Kentucky. Report on file at the OSA, Lexington, Kentucky.

Castrale, J. S.
1991. Bald eagle restoration efforts in Indiana, 1989-1990. Indiana Audubon Quarterly 69(3):167-176.

Castrale, John S., Edward M. Hopkins, and Charles E. Keller.
1998. Atlas of Breeding Birds of Indiana. Indiana Department of Natural Resources, Division of Fish and Wildlife, Nongame and Endangered Wildlife Program.

Cayton, Andrew and Peter Onuf.
1990. *The Midwest and the Nation: Rethinking the History of an American Region*. Bloomington: Indiana University Press.

Cervone, Thomas H., Scott A. Leatherland, James T. Lanigan III, Thomas K. Spindler and Richard A. Pace.
1989. Winter Fishes in the Bayou Creek Drainage, Indiana. Journal of the Pennsylvania Academy of Science. Volume 63(1): 20-24.

Chandler, Ora.
1966.*Fairmont Cemetery, US 41A South and US 60W*. Evansville:Reproduced from typewritten copy.

Chandler, Ora
1965. *St. Louis Cemetery, Catholic, located South Green St.. US 41A and US 60, Henderson County, Ky*. Evansville: Reproduced from typewritten copy.

Charles, Douglass K. and Jane E. Buikstra
1983. Archaic Mortuary Sites in the Central Mississippi Drainage: Distribution, Structure, and Behavioral Implications. In *Archaic Hunters and Gatherers In the American Midwest,* edited by J.L. Phillips and J.A. Brown, pp. 117-146. Academic Press, New York.

Chomko, Stephen A. and G.W. Crawford
1978. Plant Husbandry in Eastern North America: New Evidence for its Development. *American Antiquity* 43:405-408.

Cicerello, Ronald R., Melvin L. Warren, Jr. and Guenter A. Schuster.
1991. A Distributional Checklist of the Freshwater Unionids (Bivalvia: Unionoidea) of Kentucky. American Malacological Bulletin, Vol. 8(2):113-129.

Clark, John G.
1966.*Grain Trade of the Old Northwest*. Urbana: University of Illinois Press,

Clay, Berle R.
1976. Tactics, Strategy, and Operations: The Mississippian System Responds to its Environment.
Midcontinental Journal of Archaeology 1:137-162.

Clay, Berle R.
1986. Adena Ritual Spaces. In *Early Woodland Archaeology,* edited by K. Farnsworth and T. Emerson, pp. 581-595. Center for American Archaeology, Kampsville, Illinois

Clements, John
1990. Kentucky Facts: A Comprehensive look at Kentucky today, County by County. Clements Research II, Inc. Dallas.

Cochran, Donald R.
1992. Adena and Hopewell Cosmology: New Evidence from East Central Indiana. In *Native American Cultures in Indiana*: *Proceedings of the First Minnetrista Council for Great Lakes Native American Studies*, edited by Roland Hicks, pp. 26-40. Minnetrista Cultural Center & Ball State University, Muncie, Indiana.

Cockrum, William M.,
1915. *History of the Underground Railroad as it was Conducted by the Anti-slavery League*. Oakland City, IN: J.W. Cockrum Printing Company.

Colby, Edna Moore
1968. *Hoosier Farmers in a New Day*. Indianapolis: Indiana Farm Bureau.

Collins, Michael B. (editor)
1979. *Excavations at Four Sites in the Lower Ohio Valley, Jefferson County, Kentucky, Vol. II.* Department of Anthropology, University of Kentucky, Lexington.

Commonwealth Biomonitoring.
1994. Rapid Bioassessment of the Barr Creek and Big Creek Watersheds Using Benthic Macroinvertebrates. Prepared for Soil and Water Conservation Districts of Vanderburgh and Posey Counties. 21 pp.

Conaty, G.T.
1985. *Middle and Late Archaic Hunter-Gatherer Mobility Strategies in Western Kentucky.* Unpublished Ph.D. dissertation, Department of Archaeology, Simon Fraser University, Burnaby.

Converse, Henry T., Jr. and Frank R. Cox, Jr.
1967. *Soil Survey of Henderson County, Kentucky.* USDA, Soil Conservation Service, Washington D.C.

Coon, Diane P. Southeastern Indiana's Underground Railroad Routes and Operations. Indianapolis: Indiana Department of Natural Resources, 2001.

Cooper, James L.
1987. *Iron Monuments to Distant Prosperity: Indiana's Metal Bridges, 1870-1930*. Indianapolis: Indiana Department of Natural Resources,.

Cope, J. B., and S. R. Humphrey.
1977. Spring and autumn swarming behavior in the Indiana Bat, Myotis sodalis. J. Mammal., 58:93-95.

Copperbelly Water Snake Conservation Team and Technical Advisors.
1996. Copperbelly water snake (*Nerodia erythrogaster neglecta*) Conservation Agreement and Strategy. Kentucky Department of Fish and Wildlife Resources. 47 pp.

Council on Environmental Quality.
1997. Considering Cumulative Effects Under the National Environment Policy Act.

Cowan, C. Wesley
1985. *From Foraging to Incipient Food Production: Subsistence Change and Continuity on the Cumberland Plateau of Eastern Kentucky.* Unpublished Ph.D. dissertation,

Cowardin, Lewis M., Virginia Carter, Francis C. Golet and Edward T. LaRoe.
1979. Classification of Wetlands and Deepwater Habitats of the United States. Office of Biological Services, Fish and Wildlife Service, U.S. Department of the Interior. Washington, D.C. FWS/OBS-79/31. 103 pp.

Crenshaw, Gwendolyn.
1986. *Bury Me in a Free Land: The Abolitionist Movement in Indiana, 1816 –1865*. Indianapolis: Indiana Historical Bureau.

Crisler, Jane, Kris Mitchell, and Carol Gleichman, "Working Together for Better Solutions," *Cultural Resource Management* (1999): 3-5.

Cummings, K. S. and C. A. Mayer.
1992. Field Guide to Freshwater Mussels of the Midwest. Illinois Natural History Survey, Champaign, IL. Manual 5. 194 pp.

Dannheiser, Frieda (editor).
1980. History of Henderson County, Kentucky: 1888-1978. Evansville:Unigraphic.

Dannheiser, Frieda J. and D. Hazelwood
1980 *The History of Henderson County, Kentucky.* The Henderson County Genealogical and Historical Society. Unigraphic, Evansville, Indiana.

Davis, Dan B.
2000. *A Phase I Archaeological Survey of Two Cellular Telephone Tower Parcels (Divine Tower Site EV018-A and EV031-A) Henderson County, Kentucky.* University of Kentucky, Program for Archaeological Research, Technical Report No. 435, Lexington, Kentucky.

Deam, Charles C.
1940. Flora of Indiana. Department of Conservation, Division of Forestry. Indianapolis, IN. 1236 pp.

Decennial Census of the United States- 1840 through 1920

Deed, Wills, Property Valuation Administrator's records, Henderson County Courthouse.

Delcourt, Paul A. and Hazel R. Delcourt
1985. Quaternary Palynology and Vegetational History of the Southeastern United States. In *Pollen Records of Late Quaternary North American Sediments,* edited by V. Bryant and R. Holloway, pp. 1-28. American Association of Sedimentary Palynologists Foundation. Department of Anthropology, University of Michigan, Ann Arbor.

Dietze, Charles E.
1988. *A History of Baskett, Kentucky 1888-1988.* Published by Baskett Centennial Committee, Baskett, Kentucky.

Driscoll, Eugene D., Philip E. Shelley and Eric W. Strecker.
1990. Pollutant Loadings and Impacts from Highway Stormwater Runoff: Volume 3. Analytical Investigation and Research Report. FHWA-RD-88-008. 150 pp.

Drobney and Clawson.
no date. http://biology.usgs.gov/s+t/frame/c164.htm

Elder, William H. and Wilbur J. Gunier.
1978. Sex ratios and seasonal movements of gray bats (*Myotis grisescens*) in southwestern Missouri and adjacent states. The American Midland Naturalist, 99(2):463-472.

Elliot, Joseph P.
A History of Evansville and Vanderburgh County, Indiana (Evansville: Keller Printing Company, 1897),

Environmental Laboratory.
1987. “Corps of Engineers Wetlands Delineation Manual,” Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Esarey, Logan.
1922. *History of Indiana from its Exploration to 1922* including “An Account of Vigo County from its Organization,” edited by William F. Cronin. Dayton. OH: Dayton Historical Publishing Company.

Etnier, David A., and Wayne C. Starnes.
1993. The Fishes of Tennessee. The University of Tennessee Press, Knoxville, TN. 681 pp.

Evans, Martin C.
1996. Phase I Archaeological Reconnaissance of the Proposed Texas Gas Gibb’s Meta *Station in Henderson County, Kentucky.* Archaeology Resources Consultant Services. Louisville, Kentucky. Report on file at the OSA, Lexington, Kentucky.

Evansville Department of Parks and Recreation.
1993. The Evansville Greenway Passage Master Plan. Prepared by The Storrow Kinsella Partnership Inc., Columbus, IN.

Farm Journal Inc., Market Research Department, *Indiana County Basic Data*
Philadelphia: Farm Journal Inc., 1945), passim.

Fenelon, Joseph M. and Keith E. Bobay, and others.
1994. Hydrogeologic Atlas of Aquifers in Indiana. U.S. Geological Survey, Water-Resources Investigations Report 92-4142. 197 pp.

Fiegel, Kurt
1988. *A Report of Archaeological Investigations at the Holly Howard Farm Complex, 15HE656 in the Henderson Connector Road, Henderson, Kentucky.* Kentucky Transportation Cabinet, Frankfort, Kentucky. Report on filed at the OSA, Lexington, KY.

Fisher, David Hackett
1989. *Albion’s Seed: Four British Folkways In America*. New York: Oxford University Press.

Fitting, James E.
1978. Regional Cultural Development, 300 B.C. to A.D. 1000. In *Northeast*, edited by B.G. Trigger, pp. 44-57. Handbook of North American Indians, vol. 15, W.C. Sturtevant, general editor, Smithsonian Institution, Washington, D.C.

Ford, Richard I.
1974. Northeastern Archaeology: Past and Future Directions. *Annual Review of Anthropology* 3:384-413.

Ford, Richard I.
1981. Gardening and Farming Before A.D. 1000: Patterns of Prehistoric Cultivation North of Mexico. *Journal of Ethnobiology.* 1:6-27.

Ford, Richard I.
1985 Patterns of Prehistoric Food Production in North America. In *Prehistoric Food Production in North America,* edited by R.I. Ford, pp. 341-364. Museum of Anthropology, University of Michigan, Anthropological Papers 75, Ann Arbor.

Foster, G.S., J. Ray, and J.M. Schock
1976. *An Archaeological Survey for the Proposed Construction of the Henderson By-Pass, Henderson, Kentucky.* Western Kentucky University. Report on file at OSA, Lexington, Kentucky.

Fowler, Melvin L.
1971. The Origin of Plant Cultivation in the Central Mississippi Valley: A Hypothesis. In *PrehistoricAgriculture,* edited by S. Struever, pp. 122-128. The American Museum of Natural History, New York.

Fox, George.
1921. Three Archaeological Maps of Indiana. n.p.

Funkhauser, W.D. and W.S. Webb.
1928. *Ancient Life in Kentucky.* The Kentucky Geological Survey, Series 6, Volume 34. Frankfort, Kentucky.

Gansner, David.
1968. The Timber Resources of Kentucky. Resource Bulletin NE-9. North Eastern Forest Experiment Station, USDA Forest Service, Upper Darby, Pennsylvania. 97 pp.

Gardner, James E.
1992. Evaluations of Habitats for Threatened, Endangered, and Special Concern Bat Species, Land Between The Lakes, Tennessee Valley Authority. Final Report, Contract No. TV-89622V, TVA, Golden Pond, Kentucky. 45 pp.

Garner, James D. and James E. Gardner.
1992. Determination of Summer Distribution and Habitat Utilization of the Indiana Bat (*Myotis sodalis*) in Illinois. Final Report: Project E-3. Illinois Department of Conservation and Illinois Natural History Survey.

Gerking, Shelby D.
1945. The distribution of the fishes of Indiana. Indiana Department of Conservation, Investigations of Indiana Lakes and Streams 3(1):1-137.

Gibbons, J. W., and R. D. Semlitsch.
1982. Terrestrial drift fences with pitfall traps: An effective technique for quantitative sampling of animal populations. Brimleyana (7):1-16.

Gilbert, Frank M.
1910. *History of the City of Evansville and Vanderburgh County*. Chicago: Pioneer Publishing Company.

Gilmore, Melvin R.
1931. Vegetal Remains of the Ozark Bluff-Dwellers Culture. The Michigan Academy of Science, Arts and Letters, *Papers* 14:83-103.

Gimmestad, Dennis. "Documenting Minnesota's Agricultural Heritage: The Nansen Historic District." *Cultural Resource Management* (2002): 28-30.

Glassberg, Jeffry.
1998. Exploring Sprawl: 5th Issue in a Series, Renaissance Development Co., Vergennes, VT. http://vtsprawl.org/Newsletter5/CompletePrt.htm.

Gleason, Henry A., Arthur Cronquist.
1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. Second Edition. The New York Botanical Garden, New York. 910 pp.

Gray, Henry H., William J. Wayne, and Charles E. Wier.
1970. Geologic Map of the 1 x 2 Vincennes Quadrangle and Parts of Adjoining Quadrangles, Indiana and Illinois, Showing Bedrock and Unconsolidated Deposits. Indiana Department of Natural Resources. Regional Geologic Map 3.

Greber, Naomi.
1979. Variations in Social Structure of Ohio Hopewell Peoples. *Midcontinental Journal of Archaeology* 4(1):35-78

Green, N. Bayard and Thomas K. Pauley.
1987. Amphibians and Reptiles of West Virginia. University of Pittsburgh Press. Pittsburgh. 241 pp.

Green, Thomas J. and Cheryl A. Munson.
1978. Mississippian Settlement Patterns in South-Western Indiana. In *Mississippian Settlement Patterns,* edited by B.D. Smith, pp. 293-330. Academic Press, New York.

Griffin, James B.
1967. Eastern North American Archaeology: A Summary. *Science* 156(3772):175-191.

Griffin, James B.
1978. Late Prehistory of the Ohio Valley. In *Northeast,* edited by B.G. Trigger, pp. 547-559. Handbook of North American Indians, vol. 15, W.C. Sturtevant, general editor, Smithsonian Institution, Washington, DC.

Griffin, James B.
1983. The Midlands. In *Ancient North Americans*, edited by J.D. Jennings, pp. 243-302. W.H. Freeman, New York.

Griffing, B.N.
1880. *An Illustrated Historical Atlas of Henderson and Union Counties, Kentucky.* D.J. Lake and Co., Philadelphia.

Grimm, William Carey.
1983. The Illustrated Book of Trees. Stackpole Books, Mechanicsburg, PA. 487 pp.

Goad, Sharon L.
1980. Patterns of Late Archaic Exchange. *Tennessee Anthropologist* 5:1-16.

Goetcheus, Cari. "Cultural Landscapes and the National Register," *Cultural Resource Management* (2002): 24-25.

Goodall, Hurley C. The Underground Railroad: The Invisible Road to Freedom Through Indiana. Indianapolis: Indiana Department of Natural Resources, 2000.

Goodspeed Publishers
1885. *History of Warrick, Spencer and Perry Counties, Indiana*. Goodspeed Publishing Company, Chicago.

Goodspeed.
1886. *History of Knox and Daviess Counties, Indiana*. Chicago: Goodspeed Brothers Publishing.

Goodspeed Publishers
1886. *History of Posey County, Indiana*. Goodspeed Publishing Company, Chicago.

Goodspeed Publishers
1886. *History of Warrick, Spencer and Perry Counties, Indiana*. Goodspeed Publishing Company, Chicago.

Gowns, Alan. 1986.The Comfortable House: North American Suburban Architecture. Boston: MIT Press.

Gray, Ralph D.
1982. "The Canal Era in Indiana," *Transportation and the Early Nation.* Indianapolis: Indiana Historical Society.

Gutschick, Raymond C.
1966. Bedrock Geology. In *Natural Features of Indiana*, edited by Alton A. Lindley, pp. 1-20. Indiana Academy of Science, Indianapolis.

H. Powell and Co., Inc.
2002. A cultural Resource Survey for I-69 South in Henderson County, Kentucky. Environmental Impacts and Engineering Assessment. *Henderson, Kentucky to Evansville, Indiana.*

Hall, John S.
1962. A life history and taxonomic study of the Indiana bat, *Myotis sodalis*. Reading Public Mus. and Art Gallery, Scientific Publ. No. 12. 68 pp.

Hall, John S., and Nixon Wilson.
1966. Seasonal populations and movements of the gray bat in the Kentucky area. The American Midland Naturalist, 75(2):317-324.

Halstead, Byron D., ed. *Barns, Sheds & Outbuildings: Placement, Design, and Construction.* Chambersburg, PA: Alan C. Hood & Company, Inc.,1881, reprint 1994.

Hanou, John T.
1993. *A Round Indiana: Round Barns in the Hoosier State*. West Lafayette, IN: Purdue University Press.

Harker, Donald F., Melvin L. Warren, Jr., Keith E. Camburn, and Ronald R. Cicerello.
1981. Aquatic Biota and water quality survey of the Western Kentucky Coal Field. Kentucky Nature Preserves Commission, Frankfort, Kentucky. Technical Report.

Harlow, W. M., E. S. Harrar, J. W. Hardin, and F. M. White.
1991. Textbook of Dendrology, 7th edition. McGraw-Hill, Inc., New York, NY. 501 pp.

Hedge, Roger L.
1997. Sandhills and Old Till: The Southwestern Lowlands Natural Region. In *The Natural Heritage of Indiana*, edited by Marion T. Jackson, pp.184-187, Indiana University Press, Bloomington, Indiana.

Henderson, A. Gwynn
1988. *Archaeological Assessment of John James Audubon State Park Nature Preserve.* University of Kentucky. University of Kentucky, PCRA. Letter Report on file at the OSA, Lexington, Kentucky.

Henderson County Genealogical Society.
1967.One Hundred Seventy-Fifth Anniversary of Kentucky: History and Genealogical Notes. Henderson: Henderson Genealogical Society.

Henderson County Historical Society
1982. *Gone But Not Forgotten: Cemetery and Grave Plots in Henderson County, Kentucky.* Henderson, Kentucky.

Henderson County Survey and National Register Files. Kentucky Heritage Council, Frankfort.

Hendricks, William D., Landon E. McKinney, Bainard L. Palmer-Ball, Jr., and Marc Evans.
1991. Biological Inventory of the Jackson Purchase Region of Kentucky Final Report. Kentucky State Nature Preserves Commission.

Hicks, Ronald (editor)
1992. Native American Cultures in Indiana: Proceedings of the First Minnetrista Council for Great Lakes Native American Studies. Minnetrista Cultural Center & Ball State University, Muncie, Indiana.

4H History. Available @ 4hcentennial.org/history.

History of the Evansville Shipyard. Available http://emuseum.org/virtual.museum/evansville.shipyard/index.html

History of the Railroad in Henderson County. Union Station Depot Historical Scrapbook. www.usgennet/usa/ky/county/henderson/deporhistory

Hobbs, Horton, Jr.
1972. Biota of Freshwater Ecosystems: Crayfishes (Astacidae) of North and Middle America. Identification Manual No. 9. U. S. Environmental Protection Agency, Project No. 18050 ELD. 173 pp.

Hobson, R.C.
1989. *A Phase One Archaeological Assessment of a Proposed Green River Independent Living III, Inc. Group Home Complex in Henderson, Henderson County, Kentucky.* Cultural Resource Analysts, Inc., Lexington, Kentucky. Report on file at the OSA, Lexington, Kentucky.

Homoya, Michael A., Bryan Abrell, James R. Aldrich and Thomas W. Post
1985. Natural Regions of Indiana. In *Proceedings of the Indiana Academy of Science For 1984, Vol. 94*, edited by Donald R. Winslow, pp. 245-268, Indiana Academy of Science, Indianapolis.

"Hoosier Scrapbook," Clipping File OIL – Indiana Historical Society.

Howe, Robert C.
1997. Of Time, Rocks, and Ancient Life: Bedrock Geology. In *The Natural Heritage of Indiana*, edited by Marion T. Jackson, pp.3-13, Indiana University Press, Bloomington, Indiana.

Humphrey, S. R., A. R. Richter, and J. B. Cope.
1977. Summer habitat and ecology of the endangered Indiana bat, *Myotis sodalis*. Journal of Mammalogy, 58:334-346.

Hutchison, O. Keith.
1956. Indiana's Forest Resources and Industries. Forest Resource Report No. 10. Central States Forest Experiment Station, USDA Forest Service. U.S. Government Printing Office, Washington, D.C. 44 pp.

Hutchison, O. Keith and Robert Winters.
1953. Kentucky's Forest Resources and Industries. Forest Resource Report No. 7. Central States Forest Experiment Station, USDA Forest Service. U.S. Government Printing Office, Washington, D.C. 55 pp.

Illustrated Historical Atlas of Vanderburgh and Warrick Counties. Evansville, IN: Tillman and Fuller Publishing, 1899.

Indiana Agricultural Statistics Service.
2002. www.nass.usda.gov/in/historic,.

Indiana Agricultural Statistics Service.
2001. Indiana Agricultural Statistics: 2000-2001. Issued cooperatively by United States Department of Agriculture and the Purdue University Agricultural Research Programs, West Lafayette, IN.

Indiana Department of Environmental Management.
2002. 2002 303(d) List for Indiana. http://www.in.gov/idem/owm/planbr/wqs/sched.pdf

Indiana Division of Forestry.
1991. Indiana Big Tree Register 1991. Indiana Department of Natural Resources. 21 pp.

Indiana Department of Natural Resources.
1996. Indiana's Wetlands Conservation Plan

Indiana Department of Transportation
1997. "INDOT's Highway 1997. Traffic Noise Policy," Indiana Department of Transportation, Environmental Assessment Section.

Indiana Historical Bureau
1971. "60 Years of Schoolhouse Architecture in Posey County." Indianapolis: Indiana Junior Historical Society.

Indiana Historical Society
1968. *Illustrated Historical Atlas of the State of Indiana.* Reprinted. Indiana Historical Society, Indianapolis. Originally published 1876, Baskin, Forster & Company, Chicago.

Interim Reports
Gibson County
Posey County
Vanderburgh County
Warrick County

Jacobi, Lori. "More than a Church: The Educational Role of the African Methodist Episcopal Church in Indiana, 1844-1861." *Black History News and Notes* (February 1988): 4-7.

Janzen, D.E.
1982. *A Cultural Resources Assessment of the W.R. Grace and Company Proposed Coal-to-Methanol-to-Gasoline Plant Expansion Area: An Addendum Report.* Janzen, Inc., Danville, Kentucky. Report on file at the OSA, Lexington, KY.

Jefferies, Richard W.
1982. Debitage as an Indicator of Intraregional Activity Diversity in Northwest Georgia. *Midcontinental Journal of Archaeology* 7:99-132.

Jefferies, Richard W.
1983. Middle Archaic-Late Archaic Transition in Southern Illinois. An Example from the Carrier Mills Archaeological District. *American Archaeology* 3:199-206

Jefferies, Richard W.
1990. Archaic Period. In *The Archeology of Kentucky: Past Accomplishments and Future Directions, Volume I,* edited by D. Pollack, pp. 143-246. Kentucky Heritage Council, State Historic Preservation Plan, Report No. 1. Frankfort, Kentucky.

Jefferies, Richard W.
1996. Hunters and Gatherers after the Ice Age. In *Kentucky Archaeology,* edited by R.B. Lewis, pp. 39-78. The University Press of Kentucky, Lexington, Kentucky.

Jefferies, Richard W. and B. M. Lynch
1983. Dimensions of Middle Archaic Cultural Adaptation at the Black Earth Site, Saline County, Illinois. In *Archaic Hunters and Gatherers in the American Midwest,* edited by J.L. Phillips and J. A. Brown, Pp. 299-322. Academic Press.
Jenkins, Robert E., and Noel M. Burkhead.
1993. Freshwater Fishes of Virginia. American Fisheries Society, Bethesda, MD. 1079 pp.

Jillson Willard Rouse.
1929.Geology and Mineral Resources of Kentucky. Frankfort: The State Journal.

Johannessen, Sissel
1984. Paleothnobotany. In *American Bottom Archaeology: A Summary of the FAI-270 Project Contribution to the Culture History of the Mississippi River Valley,* edited by C.J. Baries and J.W. Porter, pp. 197-214. University of Illinois Press, Urbana.

Johnson, Hildegard Binder
1976. *Order upon the Land*. New York: Oxford University Press.

Johnson, Janet L.
2000. *Henderson County Historic Farms Survey*. Kentucky Heritage Council.

Johnson, William D. Jr.
1972. Geologic Map of Part of the Newburgh and Yankeetown Quadrangles, Henderson and Daviess Counties, Kentucky. U. S. Geological Survey, Map GQ-1045.
1973 Geologic Map of the Delaware Quadrangle, Western Kentucky. U.S. Geologic Survey Map CQ-1087, Washington, D.C.
1973. Geologic Map of Part of the Evansville South Quadrangle, Henderson County, Kentucky. U. S. Geological Survey, Map GQ-1089.
1973. Geologic Map of Part of the Wilson Quadrangle, Henderson County, Kentucky. U. S. Geological Survey, Map GQ-1136.
1973. Geologic Map of the Henderson Quadrangle, Henderson County, Kentucky. U. S. Geological Survey, Map GQ-1074.
1973. Geologic Map of the Spottsville Quadrangle, Henderson County, Kentucky. U. S. Geological Survey, Map GQ-1090.

Jones, George Neville, and George Damon Fuller.
1955. Vascular Plants of Illinois. The University of Illinois Press, Urbana and the Illinois State Museum, Springfield, IL. (Museum Scientific Series, Vo. VI)

Jones, Volney H.
1936. The Vegetal Remains of the Newt Kash Hollow Shelter. In Rockshelters in Menifee County, Kentucky, by W.S. Webb and W.D. Funkhauser, pp. 147-165. *University of Kentucky Reports in Archeology and Anthropology* 3(4):101-167.

Justice, Noel D.
1987. *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States, a Modern Survey and Reference*. Indiana University Press, Bloomington, Indiana.

Karl, Barry
1983.*Uneasy State: The United States from 1915 to 1945*. Chicago: University of Chicago Press.

Kellar, James H.
1979. The Mann Site and "Hopewell" in the Lower Wabash-Ohio Valley. In *Hopewell Archaeology: The Chillicothe Conference,* edited by D. Brose and N. Greber, pp. 100-107. Kent State University Press. Kent, Ohio.

Kellar, James H.
1983. *An Introduction to the Prehistory of Indiana*. Indiana Historical Society, Indianapolis.

Kelly, Leo A.
1976. Soil Survey of Vanderburgh County, Indiana. U.S. Department of Agriculture, Soil Conservation Service, in cooperation with Purdue University Agricultural Experiment Station. U.S. Government Printing Office, Washington, D.C.

Kentucky Agricultural Statistics Service.
2003. www.nass.usda.gov/ky/coa

Kentucky Agricultural Statistics Service.
1997. Kentucky Agricultural Statistics: 1996-1997. Issued by United States Department of Agriculture and the Kentucky Department of Agriculture. Louisville, KY. 140 pp.

Kentucky Division of Forestry.
1978. Kentucky's Big Trees. Natural Resources and Environmental Protection Cabinet, Department for Natural Resources, Frankfort, KY. 24 pp.

Kentucky Division of Water.
1993. Methods for assessing biological integrity of surface waters. Kentucky Natural Resources and Environmental Protection Cabinet, Department of Environmental Protection, Division of Water. 139 pp.

Kentucky Division of Water.
1996. 1996 Kentucky report to congress on water quality. Kentucky Natural Resources and Environmental Protection Cabinet, Department for Environmental Protection, Division of Water.

Kentucky Division of Water.
1998. 1998 303(d) List of waters for Kentucky. Kentucky Natural Resources and Environmental Protection Cabinet.

Kentucky Division of Water.
2002. 2002 303(d) List of waters for Kentucky. Kentucky Natural Resources and Environmental Protection Cabinet. 261 pp.

Kentucky Transportation Cabinet
2000. "Noise Abatement Policy," Commonwealth of Kentucky Transportation Cabinet, Division of Environmental Analysis.

Kerr, Charles (editor)
1922. *History of Kentucky.* American History Society, Chicago.

Kessler, F.M. and Alexander, M. (As edited by William Bowlby)
1981. "Sound Procedures For Measuring Highway Noise: Final Report," Report No. FHWA-DP-45-IR, Federal Highway Administration, Washington, D.C.

King, Anthony D.
1995. *The Bungalow*. New York: Oxford University Press.

Kingsbury, Bruce A.
1998. The Copperbelly Water Snake in Kentucky: Habitat Requirements and Management. Prepared for the Kentucky Department of Fish and Wildlife Resources. 78 pp.

Kleber, John E. (editor).
1992. *The Kentucky Encyclopedia*. Lexington: University of Kentucky Press.

Knobel, Edward.
1980. Field Guide to the Grasses, Sedges and Rushes of the United States. Revised by Mildred E. Faust. Dover Publications, Inc., New York. 83 pp.

Kobringer, N.P., T. L. Meinholz, M. K. Gupta, and R. W. Agnew.
1981. Constituents of Highway Runoff Volume III: Predictive Procedure for Determining Pollutant Characteristics in Highway Runoff. Federal Highway Administration, Washington, DC.

Kozel, Thomas R., Gordon K. Weddle, Kathy L. Welborn, John T. Dailey, Don C. Dailey and Melvin W. Denner.
1981. A Fish Faunal Survey of Posey County, Indiana. Proceedings of the Indiana Academy of Science. Volume 90:446-453.

Kuehne, Robert A. and Roger W. Barbour.
1983. The American Darter. The University Press of Kentucky, Lexington, KY. 177 pp.
Lacki, Michael J.
1994. Metal concentrations in quano from a gray bat summer roost. Kentucky Academy of Science, 55(3-4):124-126.

Lake, D.J.
1880.*Illustrated Historical Atlas of Henderson and Union Counties, Kentucky. From actual surveys under the direction of B.N. Griffing*. Philadelphia: D.J. Lake & Co.

Landmark, Archaeological and Environmental Services, Inc.
2003. Draft Archaeological Resources Overview for the Indiana Portion of the Proposed I-69 Evansville, Indianan to Henderson, Kentucky Study Corridors. Environmental Impacts and Engineering Assessment. *Henderson, Kentucky to Evansville, Indiana.*

Latta, W.C.
1938. *Outline History of Indiana Agriculture*. Lafayette, IN: Lafayette Printing Company.

LaVal, R. K., R. L. Clawson, W. Clare, L. R. Wingate and M. L. LaVal.
1977. An Evaluation of the Status of Myotine Bats in the Proposed Meramec Park Lake and Union Lake Project Areas, Missouri. Unpublished Report, St. Louis District, U. S. Army Corps of Engineers. pp. 136.

Leach, Elizabeth K.
1986. *Environmental and Anthropological Studies in the Little River-Christian and Trigg Counties, Kentucky.* Unpublished manuscript on file at Kentucky Heritage Council, Frankfort.

Leonard, W. P.
1882. *History and Directory of Posey County*. A. C. Isaacs, Evansville, Indiana.

Lewis, R. Barry
1983. The Mississippi Period in the Cairo Lowland, Missouri. Paper presented to the 48th Annual Meeting of the Society for American Archaeology, Pittsburgh.

Lewis, R. Barry
1996. Mississippian Farmers. In *Kentucky Archaeology,* edited by R. B. Lewis, pp.. 126-160. The University Press of Kentucky, Lexington, Kentucky.

Lewis, R. Barry (editor)
1986. *Mississippian Towns of the Western Kentucky Border: The Adams, Wickliffe, and Sassafras Ridge Sites.* Kentucky Heritage Council, Frankfort.

Lindsey, Alton A. ed.
1966.*Natural Features of Indiana*. Indianapolis: Indiana Academy of Science.

Lindsey, Alton A.
1997. Walking in the Wilderness. In *The Natural Heritage of Indiana*, edited by Marion T. Jackson, pp.113-123, Indiana University Press, Bloomington, Indiana.

Lindsey, Alton A., Damian V. Schmelz and Stanley A. Nichols.
1969. Natural Areas in Indiana and Their Preservation. Indiana Natural Areas Survey. Department of Biological Sciences, Purdue University, Lafayette, IN. 594 pp.

Logsdon, Donna G.
1998. Final *Survey Summary Report, Henderson, Kentucky*. Kentucky Heritage Council and Downtown Henderson Project.

Madison, James H.
1982. *Indiana Through Tradition and Change: A History of the Hoosier State and Its People*. Indianapolis: Indiana Historical Society.

Madison, James H.
1986. *The Indiana Way: A State History*. Indianapolis: Indiana Historical Society and Indiana University Press.

Mainfort, R. C.
1989. Adena Chiefdoms? Evidence from the Wright Mounds. *Midcontinental Journal of Archaeology* 14(2):164-178.

Mainfort, Robert C., Jr. and Kenneth C. Carstens
1987. A Middle Woodland Embankment and Mound Complex in Western Kentucky. *SoutheasternArchaeology* 6:57-61.

Map - Railroads in Indiana in 1880. Available @ php.iupui.edu/~kmbeidel/Indiana/images.

Maps- Railroads in Indiana 1910-20. Available@ php.iupui.edu/~kmbeidel/indiana/images.

Map, "Roads and Towns," Indiana 1845. Available @ php.iupui.edu/~kmbeidel/Indiana/images.

Martin, John Bartlow
1992 reprint. *Indiana, An Interpretation*. Bloomington, Indiana: Indiana University Press.

Marquardt, William H. and Patty Jo Watson
1983. The Shell Mound Archaic of Western Kentucky. In *Archaic Hunters and Gatherers in the American Midwest,* edited by J.L. Phillips and J.A. Brown, pp. 323-339. Academic Press, New York.

Martin, Charles.
1988. *The Pennyrile Cultural Landscape*. Typewritten manuscript on file at the Kentucky Heritage Council.

Martin, Paul S.
1958. Pleistocene Ecology and Biogeography of North America. In *Zoogeography*, edited by C. L. Hubbs, pp. 375-420. Publications 51. American Association for the Advancement of Science, Washington, D.C.

McAllister, Virginia and Lee.
1984. *A Field Guide to American Houses*. New York: Alfred Knopf.

McConnell, Stuart.
1997. *Glorious Contentment*. Chapel Hill: University of North Carolina Press.

McGimsey, Charles III, and Hester A. Davis (editors)
1977. *The Management of Archaeological Resources, The Airlie House Report.* Special Publication of the Society for American Archaeology and the National Park Services Division of Interagency Archaeological Services, Washington, D.C.

McGrain, Preston
1983. The Geologic Story of Kentucky. *Series Publications 8, Series XI.* The Kentucky, Geological Survey, University of Kentucky, Lexington.

McGrain, Preston.
1983. The Geological Story of Kentucky. Kentucky Geological Survey, University of Kentucky, Lexington, KY. Special Publication 8, Series XI. 74 pp.

McGrain, Preston
1983. The Geologic Story of Kentucky. *Series Publications 8, Series XI.* The Kentucky, Geological Survey, University of Kentucky, Lexington.

McGrain, Preston and James C. Currens.
1978. Topography of Kentucky. Kentucky Geological Survey, University of Kentucky, Lexington. Special Publication 25, Series X. 76 pp.

McGraw, Betty J.
1983. *Archaeological Site Evaluation and Testing, Henderson Bypass Highway Project, Henderson County, Kentucky.* Kentucky Transportation Cabinet, Frankfort, Kentucky. Report on file at OSA, Lexington, Kentucky.

McLaughlin, Mabel Nisbet. “The Endicotts of Indiana,” *Indiana Magazine of History* XXIX, (1933): 32-33

McShane, Roger P. Roess.
1990. Traffic Engineering. Prentice Hall, Englewood Cliffs, New Jersey.

McWilliams, Kendall M.
1979. *Soil Survey of Posey County, Indiana*. U.S. Department of Agriculture, Soil Conservation Service, in cooperation with Purdue University Agricultural Experiment Station. U.S. Government Printing Office, Washington, D.C.

Melhorn, Wilton N.
1997. Indiana on Ice: The Late Tertiary and Ice Age History of Indiana Landscapes. In *The Natural Heritage of Indiana*, edited by Marion T. Jackson, pp.15-27, Indiana University Press, Bloomington, Indiana.

Merrill, Boynton (editor).
1985. *Old Henderson Homes and Buildings*. Henderson: Historic Henderson Publishing.

Meyer, Balthasar H.
1948. *History of Transportation in the United States Before 1860.* Forge Village, MA: The Murray Printing Company.

Miller, Keith L. "Willis S. Blatchley and Raymond S. Blatchley on Petroleum in Indiana and Illinois: A Note," *Indiana Magazine of History*, Volume XCV (Indianapolis: Indiana Historical Society, 1999).

Miller, Milford M. "Evansville Steamboats during the Civil War," *Indiana Magazine of History* XXXVII (1941).

Mills, Dr. Randy, Mark Coomer, Leslie Conway Coomer, and Sandy McBeth.
A Report Concerning Underground Railroad Activity in Southwestern Indiana. Indianapolis: Indiana Department of Natural Resources, 2001.

Minton, Sherman A. Jr.
1972. Amphibians and Reptiles of Indiana. Indiana Academy of Science, Indianapolis, IN. 346 pp.

Mitchell, John
1775. A Map of the British and French Dominions in North America. London.

Mohlenbrock, Robert H.
1986. Guide to the Vascular Flora of Illinois. Southern Illinois University Press, Carbondale, IL. 507 pp.

Mohlenbrock, Robert H. and John W. Voigt.
1959. A Flora of Southern Illinois. Southern Illinois University Press, Carbondale, IL. 390 pp.

Mohow, James
1992. A Brief Overview of Early Archaic Settlement in East Central Indiana. In *Native American Cultures in Indiana*: *Proceedings of the First Minnetrista Council for Great Lakes Native American Studies*, edited by Ronald Hicks, pp. 15-22. Minnetrista Cultural Center & Ball State University, Muncie, Indiana.

Moldenhauer, D.R. and Steve D. Creasman,
2001. *An Archaeological Survey of the Proposed Upgrade of U.S. 60 From the Intersection of U.S. 60 from the Intersection of KY 425 to the Intersection of U.S. 41 (Item Number 2-126) in Henderson County, Kentucky.* Cultural Resource Analysts, Inc, Lexington, Kentucky. Report on file at OSA, Lexington, Kentucky.

Moore, Leonard J.
1991. *Citizen Klansman: The Ku Klux Klan in Indiana, 1921-1928*. Chapel Hill: The University of North Carolina Press.

Muller, Jon
1986. *Archaeology in the Lower Ohio River Valley.* Academic Press, Inc. Florida.

Mumford, R. E., and L. L. Calvert
1960. *Myotis sodalis* evidently breeding in Indiana. Journal of Mammalology, 41:512.

Mumford, Russell E.
1966. Mammals. In *Natural Features of Indiana*, edited by Alton A. Lindley, pp. 474-488.

Indiana Academy of Science, Indianapolis.
1997. Our Native Mammals. In *The Natural Heritage of Indiana*, edited by Marion T. Jackson, pp.341-349, Indiana University Press, Bloomington, Indiana.

Mumford, Russell E., and John O. Whitaker, Jr.
1982. Mammals of Indiana. Indiana University Press, Bloomington, IN. 537 pp.

Munson, C. A. and T. G. Cook
1980. The French Lick Phase: A Dimensional Description. In *Archaeological Salvage Excavations at Patoka Lake, Indiana*, edited by C.A. Munson, pp. 721-740. Glenn A. Black Laboratory of Archaeology, Indiana University, Bloomington.

Nance, Jack D.
1987. The Archaic Sequence in the Lower Tennessee-Cumberland-Ohio Region. *Southeastern Archaeology* 6:129-140.

National Park Service Publications.
How to Apply the National Register Criteria for Evaluation (#15)
How to Complete the National Register Form (#16A)
Guidelines for Evaluating and Documenting Rural Historic Landscapes (#30)
Guidelines for Evaluating and Documenting Traditional Cultural Properties (#38)

NCHRP.
1976. Effects of Deicing Salts on Plant Biota and Soil. Report #170. 88 pp.
1978. Ecological Effects of Highway Fills on Wetlands. Project HR20-15. Department of Civil Engineering and Department of Forestry and Wildlife Management, University of Massachusetts, Amherst, MA. 121 pp.

Newcomb and Ackert.
1871. *New Topographical Atlas and Gazetteer of Indiana,* Vol. 10. New York: George H. Adams and Company.

Neumann, G.K. and M.L. Fowler
1952. Hopewellian Sites in the Wabash Valley. In *Hopewellian Communities in Illinois,* edited by T. Deuel, pp. 175-248. Illinois State Museum Scientific Papers, Vol. V, Springfield, Illinois

Newman, James E.
1997. Our Changing Climate. In *The Natural Heritage of Indiana*, edited by Marion T. Jackson, pp.85-99, Indiana University Press, Bloomington, Indiana.

Niquette, Charles M.
1985. *Deep Testing of Henderson Materials, Inc's. Proposed Barge Loading Facility, Henderson County, Kentucky.* Cultural Resource Analysts, Inc. Lexington, Kentucky. Report on file at the OSA, Lexington, Kentucky.

Noble, Allen G. and Hubert G. H. Wilhelm, ed.
1995. *Barns of the Midwest*. Athens: Ohio University Press.

Noble, Allen G. and Richard K Cleek
1997. *The Old Barn Book: A Field Guild to North American Barns & Other Farm Structures*. New Brunswick, NJ: Rutgers University Press.

Nolan, Jane.
1988. "Agricultural Development in Seventeen Counties of Southwestern Indiana." Unpublished manuscript, Indiana State Library.

Oaks, F. Lawerence. "The National Register: A Road Map to Preserving a Sense of

Place." *Cultural Resource Management* (2002): 18-19.

Oesch, Ronald D.
1984. Missouri Naiades: A guide to the mussels of Missouri. Missouri Department of Conservation. Jefferson, MI. 270 pp.

ORSANCO.
2001. Quality Monitor, An appraisal of conditions in the Ohio River and some of its tributaries. Published by The Ohio River Valley Water Sanitation Commission (ORSANCO).

ORSANCO.
1998-1999. Water Quality of the Ohio River, Summary Biennial Assessment of the Ohio River and its Tributaries. ORSANCO, Cincinnati, OH.

Oved, Yaacov.
1988. *Two Hundred Years of American Communes*. New Brunswick: Transaction Books.

Page, Lawrence M.
1983. Handbook of Darters. TFH Publications, Inc. Illinois Natural History Survey, Champaign, Illinois. 271 pp.

Palmer-Ball, Brainard L. Jr.
1996. The Kentucky Breeding Bird Atlas. The University Press of Kentucky, Lexington, Kentucky. 372 pp.

Parmalee, Paul W.
1967. The Fresh-Water Mussels of Illinois. Popular Science Series, Vol. VIII. Illinois State Museum, Springfield, IL. 108 pp.

Pears ,Thomas Clinton, Jr.
1933. *New Harmony: An Adventure in Happiness, Papers of Thomas and Sarah Pears*. Indianapolis: Indiana Historical Society.

Peterjohn, B. G. and D. Rice.
1991. The Ohio Breeding Bird Atlas. Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Columbus, OH.

Peterson, Roger Tory.
1980. Eastern Birds. Houghton Mifflin Company, Boston. 384 pp.

Peterson, Roger Tory and Virginia Marie Peterson.
1980. A Field Guide to the Birds East of the Rockies. Houghton Mifflin Company, Boston. 384 pp.

Pflieger, William L.
1975. The Fishes of Missouri. Missouri Department of Conservation, Jefferson City, MS. 343 pp.

Phillips, J. Clifton.
1968. *Indiana in Transition: The Emergence of an Industrial Commonwealth, 1880-1920.* Indianapolis: Indiana Historical Bureau and Indiana Historical Society.

Pollack, David (editor)
1990. The Archaeology of Kentucky: Past Accomplishments and Future Directions, Volumes *I and II*, State Historic Preservation Comprehensive Plan Report No. 1. Kentucky Heritage Council, Frankfort, Kentucky.
Pollack, David (editor)
1998 Intraregional and intersocietal relationships of the Late Mississippian Caborn-Wellborn Phase of the Lower Ohio River Valley. Unpublished Ph.D. dissertation. Department of Anthropology, University of Kentucky, Lexington.

Powell, Helen C.
1991. *Historic Themes for the Evaluation of Kentucky Highway Bridges, 1780-1940*. Report prepared for the Division of Environmental Analysis, Kentucky Transportation Cabinet.

Power, Richard Lyle
1953. *Planting Corn Belt Culture: The Impress of the Upland Southerner and Yankee in the Old Northwest*. Indianapolis: Indiana Historical Society.

Propp-LoGrasso, P.J., and Jim Asher.
1993. Kentucky Boater's Almanac. Blue Waters Enterprises, Inc. 273 pp.

Putnam, F. W. "The Ancient Fortifications on the Wabash River, Indiana," *Transactions of the Indianapolis Academy of Sciences,* July 1, 1872.

QK4
2002. Draft Air Quality Analysis. Environmental Impacts and Engineering Assessment. *Henderson, Kentucky to Evansville, Indiana.*

QK4
2002. Draft Noise Impact Analysis. Environmental Impacts and Engineering Assessment. *Henderson, Kentucky to Evansville, Indiana.*

QK4
2003. Draft Socioeconomic Analysis. Environmental Impacts and Engineering Assessment. *Henderson, Kentucky to Evansville, Indiana.*

QK4
2002. Hazardous Material Screening Assessment. Environmental Impacts and Engineering Assessment. *Henderson, Kentucky to Evansville, Indiana.*

Railey, Jimmy A.
1996. Woodland Cultivators. In *Kentucky Archaeology,* edited by. R. B. Lewis, pp. 79-126. The University Press of Kentucky, Lexington, Kentucky.

Raithel, C.
1991. American Burying Beetle (*Nicrophorus americanus*) Recovery Plan. United States Fish and Wildlife Service, West Kingtson, RI. 62 pp.

Ray, Louis L.
1965 *Geomorphology and Quaternary Geology of the Owensboro Quadrangle, Indiana and Kentucky. Geological* Survey Professional Paper 488, U.S. Department of The Interior, Washington, D.C.

Redman, B.G.
1986. A Study of Yankeetown Phase Settlement Patterns in the Lower Ohio Valley. Prepared for Indiana Department of Natural Resources, Division of Historic Preservation and Archaeology. Glenn A. Black Laboratory of Archaeology, Indiana University.

Reid, K.C.
1983. The Nebo Hill Phase: Late Archaic Prehistory in the Lower Missouri Valley. In *Archaic Hunters and Gatherers in the American Midwest,* edited by J. L. Phillips and J.A. Brown, pp. 11-40. Academic Press, New York.

Rennick, Robert.
1984. *Kentucky Place Names*. Lexington: University of Kentucky Press.

Richards, Ronald L. and John O. Whitaker
1997. Indiana's Vertebrate Fauna: Origins and Change. In *The Natural Heritage of Indiana*, edited by Marion T. Jackson, pp.144-156, Indiana University Press, Bloomington, Indiana.

Richmond, Michael D. and D. M. Wingfield
1999. *An Archaeological Reconnaissance of the Proposed Upgrade of U.S. 60 from the Waverly Bypass to the Henderson Bypass in Union and Henderson Counties, Kentucky.* Cultural Resource Analysts, Inc. Lexington, Kentucky. Report on file at OSA, Lexington, Kentucky.

Ringwalt, J.L.
1888. *The Development of Transportation Systems in the United States*. Philadelphia: Railway World Office.

Roberts, Warren.
1984. *Log Buildings of Southern Indiana*. Bloomington, IN: Trickster Press.

Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott.
1991. Common and Scientific Names of Fishes from the United States and Canada. American Fisheries Society, Special Publication 20. Bethesda, Maryland. 183 pp.

Robinson, Kenneth, W., Steven D. Smith and Michael B. Collins
1978. *A Cultural Resource Survey and Limited Subsurface Reconnaissance of the Proposed Synthesis Gas Demonstration Plant Area, Baskett, Henderson County, Kentucky.* University of Kentucky, Program for Cultural Resource Assessment. Lexington, Kentucky.

Robinson, Maggie Greenwood
2000. *Evansville: Crossroads of the Midwest.* Montgomery, AL: Community Communications, Inc.

Rohrbough, Malcolm J.
1978. *The Trans-Appalachian Frontier: People, Societies, and Institutions, 1775-1850*. New York: Oxford University Press.

Rolingson, Martha A. and D.W. Schwartz
1966. Late Paleo-Indian and Early Archaic Manifestations in Western Kentucky. *University of Kentucky Studies in Anthropology 3.* Lexington.

Rone, Martha and S.W. Schwartz
1965. *An Historical Atlas of Kentucky and Her Counties.* Mayfield Printing Co. Mayfield, Kentucky.

Rose, Gregory. "Upland Southerners: The County Origins of Southern Migrants to Indiana by 1850," *Indiana Magazine of History* LXXXII (September 1986): 242-262.

Rose, Gregory. "Distribution of Ethnic and Racial Minorities in 1850," *Indiana Magazine of History* LXXXVII (Sept 1991).
Roth, Leland M.
1980. *A Concise History of American Architecture*. New York: Harper & Row, Publishers.

Sanborn Map Company.
Insurance Maps of Henderson, Henderson County, Kentucky. New York: Sanborn Map Co., 1885, 1892, 1897, 1901, 1906, 1913, 1931-35.

Sanders, Tom N.
1988. The Adams Site: A Paleoindian Manufacturing and Habitation Site in Christian County, Kentucky. In *Paleoindian and Archaic Research in Kentucky,* edited by C.D. Hockensmith, D. Pollack, and T.N. Sanders, pp. 1-41, Kentucky Heritage Council, Frankfort.

Schenian, Pamela A.
1987. *There Was a Mine Under Every Little Hill: An Archeological Reconnaissance of the Upland Area of Permit 851-001 and the Investigation of the Onionville Mine Complex at Approximate Green River Mile 31.8, Henderson County, Kentucky.* Murray State University, Murray. Report on file at OSA, Lexington, Kentucky.

Schmidt, Thomas L., Mark H. Hansen, and James A. Solomakos. 2000. Indiana's Forests in 1998. North Central Research Station, U. S. Department of Agriculture, Forest Service. 139 pp.

Schneider, Allan F.
1966. Physiography. In *Natural Features of Indiana*, edited by Alton A. Lindley, pp. 40-56. Indiana Academy of Science, Indianapolis.

Schock, Jack M.
1977. *An Archaeological Survey for the Henderson County Riverport Wharf and Transit Shed Improvements in Henderson County, Kentucky.* Arrow Enterprises. Bowling Green, Kentucky. Report on file at OSA, Lexington, Kentucky.

Schock, Jack M.
1986. *A Cultural Reconnaissance of Six Pump or Water Tank Site Locations for the Henderson County Water District, in Henderson County, Kentucky Arrow* Enterprises. Bowling Green, Kentucky. Report on file at OSA, Lexington, Kentucky.
Schock, Jack M.
1993. *A Cultural Resource Reconnaissance of Approximately 8 Acres for One Proposed Highway Soil Borrow Pit, East of Henderson, Henderson County, Kentucky.* Arrow Enterprises. Bowling Green, Kentucky. Report on file at OSA, Lexington, Kentucky.

Schock, Jack M.
1993. *A Cultural Reconnaissance of Approximately 16 Acres for Two Proposed Highway Soil Borrow Pits, East of Henderson in Henderson County, Kentucky,* Arrow Enterprises. Bowling Green, Kentucky. Report on file at OSA, Lexington, Kentucky;

Schock, Jack M.
1996. *A Cultural Reconnaissance of Approximately 3 Acres for the Proposed Henderson Manor Apartments At Henderson in Henderson County, Kentucky.* Arrow Enterprise. Bowling Green, Kentucky. Report on file at OSA, Lexington, Kentucky.

Schock, Jack M.
1998. *A Cultural Reconnaissance of Approximately 15 Acres for the Proposed Senior Cottages of Henderson in Henderson County, Kentucky.* Arrow Enterprises. Bowling Green, Kentucky. Report on file at OSA, Lexington, Kentucky.
Smith, Bruce D. (editor)

Schock, Jack M.
1978. *Mississippian Settlement Patterns.* Academic Press, New York.
Stafford, C. Russell

Schock, Jack M.
1994. *Archaeological Reconnaissance of Molzer Crushed Stone, Inc., Proposed Fleeting Facility and Bank Stabilization on Three Mile Island in the Ohio River, Henderson County, Kentucky.* Indiana State University, CRM Report No. 94-35. Terre Haute, Indiana. Report on file at OSA, Lexington, Kentucky.

Schultheis, Susan J., Kenneth D. Berger, Rusty K. Yeager, David M. Agee and Thomas H. Cervone.
1987. Summer Fishes of Pigeon Creek Drainage. Proceedings of the Indiana Academy of Science. Volume 96:523-530.

Schweitzer, Robert and Michael W.R. Davis.
1990. *America's Favorite Homes: Mail Order Catalogues as Guide to Popular Early Twentieth Century Houses*. Detroit: Wayne State University Press.

Sealander, John A. and Gary A. Heidt.
1990. Arkansas Mammals: Their Natural History, Classification, and Distribution. The University of Arkansas Press. 308 pp.

Shaw, Samuel P. and Fredine, C. Gordon.
No year. Wetlands of the United States - their extent and their value to waterfowl and other wildlife. U. S. Department of the Interior, Washington D.C. Circular 39.

Shively, Jerold L.
1979. Soil Survey of Warrick County, Indiana. U.S. Department of Agriculture, Soil Conservation Service, in cooperation with Purdue University Agricultural Experiment Station. 135 pp.

Sieber, Ellen and Cheryl Ann Munson
1994. *Looking at History, Indiana's Hoosier National Forest Region, 1600 to 1950*. Bloomington: Indiana University Press.

Slade, Thomas M
1983. *Historic American Buildings Survey in Indiana*. Bloomington: Indiana University Press.

Smith, Philip W.
1979. The Fishes of Illinois. Illinois State Natural History Survey, University of Illinois Press. 314 pp.

Smith, Robert Leo.
1996. Ecology and Field Biology 5th Edition. Harper Collins College Publishers. New York, NY. 740 pp.

Smith, W. B., and M. F. Golitz.
1988. Indiana Forest Statistics, 1986. Resource Bulletin NC-108. North Central Forest Experiment Station, USDA Forest Service, St. Paul, Minnesota. 139 pp.

Soil Conversation Service.
1991. Hydric Soils of the United States. U. S. Department of Agriculture in cooperation with the National Technical Committee for Hydric Soils. Miscellaneous Publication Number 1491.

Spencer, John S., Jr.
1969. Indiana's Timber. Resource Bulletin NC-7. North Central Forest Experiment Station, USDA Forest Service, St. Paul, Minnesota. 61 pp.

Spude, Robert L. "Mining History: A New Dialogue." *Cultural Resource Management* (1998): 3.

Stafford, C. R.
1994. Structural Changes in Archaic Landscape Use in the Dissected Uplands of Southwestern Indiana. *American Antiquity* 59(2):219-237.

Stafford, C. R.
1997. Prehistoric Peoples of Indiana. In *The Natural Heritage of Indiana*, edited by Marion T. Jackson, pp.361-367, Indiana University Press, Bloomington, Indiana.

Starling, Edmund L.
1887. *History of Henderson County, Kentucky.* Henderson, Kentucky. A Reproduction by Unigraphic, Inc., Evansville.
Starrett, William C. 1971. A Survey of the Mussels (Unioncacea) of the Illinois River: A Polluted Stream. Illinois Natural History Survey Bulletin, Volume 30, Article 5. 403 pp.

Stoltman, J. B.
1978. Temporal Models in Prehistory: An Example from Eastern North America. *Current Anthropology* 19(4):703-746.

Stoltman, J. B. and D. A. Baerreis
1983. The Evolution of Human Ecosystems in the Eastern United States. In *Late Quaternary Environments of the United States, Vol. 2, The Holocene*, edited by H.E. Wright, Jr., pp. 252-268. University of Minnesota Press, Minneapolis.

Sturmond, Gil R.
1914, 1977 reprint. *History of Gibson County, Indiana.* Indianapolis: B. F. Bowen & Company, Inc.

Sussenbach, Tom
1991. *Cultural Resource Assessment of a Planned Bridge Replacement on Green River Road No. 2 Over Race Creek in Henderson County, Kentucky.* University of Kentucky, Program for Cultural Resource Assessment, Archaeological Report No. 255, Lexington, Kentucky.

Sussenbach, Tom, P.P. Kreisa, and C.B. Stout
1986. Redefining the Late Woodland Ceramic Assemblage in the Northern Lower Mississippi

Valley. Paper presented at The 43rd Annual Southeastern Archaeological Conference Meeting, Nashville, TN.

Sussenbach, Tom, J.A. Morgan, and P.A. Schenian
1990. *Cultural Resource Assessment of a 1355 Acre Mine Permit Area, Henderson County, Kentucky.* University of Kentucky, Program for Cultural Resource Assessment, Archaeological Report 227, Lexington, Kentucky.

Tankersley, Kenneth B.
1990. Paleoindian Period. In *The Archaeology of Kentucky: Past Accomplishments and Future Directions, Volume One,* edited by D. Pollack, pp. 72-142. State Historic Preservation Comprehensive Plan Report No. 1, Kentucky Heritage Council, Frankfort, Kentucky.

Tankersley, Kenneth B.
1992. The Archaeology of Early Paleoindians: A View from Indiana. In *Native American Cultures in Indiana*: *Proceedings of the First Minnetrista Council for Great Lakes Native American Studies*, edited by Ronald Hicks, pp. 7-12. Minnetrista Cultural Center & Ball State University, Muncie, Indiana.

Tankersley, Kenneth B.
1996. Ice Age Hunters and Gatherers. *In Kentucky Archaeology,* edited by R.B. Lewis, pp. 21-38. The University Press of Kentucky, Lexington.

Taylor, Robert M., Errol W. Stevens, Mary Ann Ponder, and Paul Brockman
1989. I*ndiana: A New Historical Guide.* Indiana Historical Society, Indianapolis.

Temple, S. A.
1986. Predicting Impacts of Habitat Fragmentation on Forest Birds: A Comparison of Two Models. Wildlife 2000 - Modeling Habitat Relationships of Terrestrial Vertebrates. University of Wisconsin Press. pp. 301- 304.

Temple, S. A. and B. A. Wilcox.
1984. Introduction: Predicting Effects of Habitat Patchiness and Fragmentation. Wildlife 2000 - Modeling Habitat Relationships of Terrestrial Vertebrates. University of Wisconsin Press. p. 261-262.

Terry, R. C., Jr.
1974. Road Salt, Drinking Water and Safety. Ballinger Publishing Co. 156 pp.

The Copperbelly Watersnake Conservation Team and the Technical Advisors.
1996. Copperbelly Water Snake (*Nerodia erythrogaster neglecta*) Conservation Agreement and Strategy. 47 pp.

Thornbrough, Emma Lou
1957. *The Negro in Indiana Before 1900*. Bloomington: Indiana University Press.

Thornbrough, Emma Lou
1963. S*ince Emancipation: A Short History of Indiana Negroes, 1863-1963*. Indiana State Library, Indianapolis: American Negro Emancipation Centennial Authority.

Thornbrough, Emma Lou.
1965. *Indiana in the Civil War Era, 1850-1880*. Indianapolis: Indiana Historical Bureau & Indiana Historical Society,

Threatened and Endangered Species Information Institute.
1993. United States Threatened and Endangered Species: Volume I - Animals. Golden, CO.

Tindall, George Brown.
1992. *America: A Narrative History*. Volume One. New York: W.W. Norton & Company.

Tormoehlen, Barbara, Joey Gallion and Thomas L. Schmidt.
2000. Forests of Indiana: A 1998 Overview. Northeastern Area State and Private Forestry, Forest Service, United States Department of Agriculture. NA-TP-03-00. 17 pp.

Transportation Research Board.
1991. Highway Deicing: Comparing Salt and Calcium Magnesium Acetate. Committee on the Comparative Costs of Rock Salt and Calcium Magnesium Acetate (CMA) for Highway Deicing. Special Report 325. 170 pp.

Towles, S.S.
No date. Henderson: A Guide to Audubon's Home in Kentucky. Rhode Printing-Publishing Co.

Trader, Patrick
2002. Phase I Archaeological Background Review of the Kentucky Study Portion of the Proposed I-69 Evansville, Indiana, to Henderson, Kentucky, Study Corridors, Henderson County, Kentucky. Environmental Impacts and Engineering Assessment. *Henderson, Kentucky to Evansville, Indiana.*

Turner, Garth.
1996. Boomer nightmare plunging home values. Southam New Media.
http://www.planersweb.com/sprawl/solutions/demog.html

Tuttle, M. D.
1975. Population Ecology of the Gray bat (*Myotis grisescens*): Philopatry, timing and patterns of movement, weight loss during migration, and seasonal adaptive strategies. Occasional Papers Museum Natural History, University of Kansas 54:1-38.

Tuttle, M. D., and D. E. Stevenson.
1977. An analysis of migration as a mortality factor in the Gray bat based on public recoveries of banded bats. The American Midland Naturalist 97(1):235-240.

U. S. Army Corps of Engineers.
2000. Final Integrated Decision Document and Environmental Assessment, Ohio River Ecosystem Restoration Program. Department of the Army, U. S. Army Engineer Division, Great Lakes and Ohio River Division Corps of Engineers, Cincinnati, OH.

U.S. Census Bureau 2000.

U.S. Department of Agriculture.
No date. Wetlands and Agriculture: Private Interests and Public Benefits. AER-765

U.S. Department of Housing and Urban Development.
2000. The State of the Cities

U. S. Fish and Wildlife Service.
1982. Gray Bat Recovery Plan. U. S. Fish and Wildlife Service, Reference No. 80/838 0004. Fish and Wildlife Reference Service, Bethesda, MD.

U. S. Fish and Wildlife Service.
1983. Northern States Bald Eagle Recovery Plan. United States Fish and Wildlife Service, Bethesda, MD. 124 pp.

U. S. Fish and Wildlife Service.
1985. Fat Pocketbook Pearly Mussel Recovery Plan. U. S. Fish and Wildlife Service, Reference No. 80/874 0099. Fish and Wildlife Reference Service, Bethesda, MD. 57 pp.

U. S. Fish and Wildlife Service.
2001. Final Environmental Assessment and Land Protection Plan for the Proposed Establishment of Green River National Wildlife Refuge. U. S. Department of Interior, Fish and Wildlife Service. U. S. Fish and Wildlife Service, Atlanta, GA. 51 pp.

U. S. Fish and Wildlife Service.
1987 (revised). Habitat Management Guidelines for the Bald Eagle in the Southeast Region. 3rd revision, January 1987. 11 pp.

United States Corps of Engineers
2001 *A Phase I Cultural Resources Survey of the Kentucky Peninsula Revetment Repair Project. J.T. Myers Pool, Henderson County, Kentucky.* Louisville, Kentucky. Report on file at OSA, Lexington, Kentucky.

United States Department of Transportation and Indiana Department of Transportation.
2000. Conducting Quality Cumulative Effects Analysis for the Federal Highway Administration and the Indiana Department of Transportation.

U.S. Department of Transportation, Federal Highway Administration
1982. "Procedures For Abatement of Highway Traffic Noise and Construction Noise." 23 CFR 772, 47 FR 29654

United States Engineer Office
1930. Chart No. 5, Green River, Mouth to Dunnville, Kentucky. United States Engineer Office, U.S. Army Corps of Engineers, Louisville.

United States Environmental Protection Agency.
1999. Consideration of Cumulative Impacts in EPA Review of NEPA Documents.

United States Environmental Protection Agency
1995. "User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections." Document #EPA-454/R-92-006 (Revised). Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency

United States Environmental Protection Agency
2002. "User's Guide to MOBILE 6.1 and MOBILE 6.2: Mobile Source Emission Factor Model." Document #EPA420-R-02-028. Assessment and Standards Division, Office of Transportation and Air Quality, U.S. Environmental Protection Agency.

Vickery, Kent D.
1970. *Excavation of Yankeetown Site, 1968 Season.* Unpublished report on file at the Glen A. Black Laboratory of Archaeology, Indiana University.

Vincent, Stephen A.
1999. *Southern Seed, Northern Soil: African-American Farm Communities in the Midwest 1765-1900*. Bloomington: Indiana University Press.

Walker, T. J.
1957. Ecological studies of the arthropods associated with certain decaying materials in four habitats. Ecology 38: 262-276.

Walsh, Justin E.
1987. *The Centennial History of the Indiana General Assembly, 1816–1978*. Indianapolis: Indiana Historical Bureau.

Warner, John
1996. "The Influence of the Wabash and Erie Canal on the Development of Two Northern Indiana Communities, 1830-1860." Indianapolis: Master's Thesis, Indiana University.

Wayne, William J.
1966. Ice and Land. In *Natural Features of Indiana*, edited by Alton A. Lindley, pp. 21-39. Indiana Academy of Science, Indianapolis.

Weintraut & Associates Historians, Inc.
2002. A Cultural Resource Survey for I-69 South in Posey, Vanderburg and Warren County, Indiana. Environmental Impacts and Engineering Assessment. *Henderson, Kentucky to Evansville, Indiana.*

Weintraut, Linda
1989. "Settlement in the Sixteen Counties of Southwestern Indiana." Historic Context Report prepared for the Division of Historic Preservation and Archaeology.

Weintraut, Linda
1991. "Transportation Overview for Indiana, 1890-1940".

Weintraut, Linda
2001. "The Limits of Enlightened Self-Interest: Business Interest in Indianapolis, Indiana." Ph.D. Dissertation, Indiana University.

Weintraut, Linda and Jane R. Nolan.
1994. *Pioneers in Banking*. Indianapolis: Indiana National Bank.

Wharton, M.E. and Roger W. Barbour.
1973. Trees and Shrubs of Kentucky. The University Press of Kentucky. Lexington, KY. 582 pp.

Wheeler-Voegelin, Erminie, Emily J. Blasingham, and Dorothy R. Libby
1974. *Miami, Wea, and Eel-River Indians of Southern Indiana*. Garland Publishing, Inc., New York.

Whitaker, John O. Jr., Lori Pruitt and Scott Pruitt.
2002. The Gray Bat, *Myotis grisescens*, in Indiana. Proceedings of the Indiana Academy of Science. Volume 110:114-122.

Whitaker, John O. Jr., Virgil Brack, Jr., and James B. Cope.
2001. Are Bats in Indiana Declining? Proceedings of the Indiana Academy of Science. Volume 111:95-106.

Whitaker, John O. Jr., and Sherry L. Gummer.
1993. The Status of the Evening Bat, *Nycticeius humeralis*, in Indiana. Proceedings of the Indiana Academy of Science. Volume 110:126-140.

Whitaker, John O. Jr., and Sherry L. Gummer.
2001. Bats of the Wabash and Ohio River Basins of Southwestern Indiana. Proceedings of the Indiana Academy of Science. Volume 110:126-140.

Wier, Charles E.
No date. *Our Indiana Coal*. Indiana Geologic Survey, Bloomington, Indiana.

Williams, J. C.
1969. Mussell fishery investigation Tennessee, Ohio and Green Rivers: Final Report. Murray State University Press, Murray, KY. 107 pp.

Wilson, George R.
1919. *Early Trails and Surveys.* Indianapolis: Indiana Historical Society.

Winters, Howard D.
1968. Value Systems and Trade Cycles of the Late Archaic in the Midwest. In *New Perspectives in Archeology,* edited by S.R. Binford and L.R. Binford. Aldine Publishing Company.

Winters, Howard D.
1969. *The Riverton Culture: A Second Millennium Occupation in the Central Wabash Valley.* Illinois State Museum, Report of Investigations 13, and Illinois Archaeological Survey Monograph 1, Springfield.

Winters, Howard D.
1974. Introduction to the New Edition. In *Indian Knoll,* by W. Webb, pp. v-xxvii. University of Tennessee Press, Knoxville.

Women's Club of Newburgh.
1996. *Historical Markers erected by the Women's Club of Newburgh, Indiana, 1975-1996*. Newburgh, IN.

Writers' Program.
1941. Henderson: a guide to Audubon's home town in Kentucky compiled by the workers of the Writers' Program of the Work Projects Administration in the State of Kentucky. Northport, Long Island: Bacon, Pergy, and Daggett.

Wymer, Dee Ann
1987. The Archaeobotanic Record of the Lower Tennessee-Cumberland Region. *Southeastern Archaeology.* 6:93-155.

Zeigler, Connie J.
1992. "Divorce and Reform in Indiana." Unpublished manuscript presented to the Indiana Association of Historians.

ACRONYMS

TERMS

AASHTO	American Association of State Highways and Transportation Officials
ACBM	Asbestos Containing Building Materials
ADT	Average Daily Traffic
AML	Abandoned Mine Lands
APE	Area of Potential Effect
AST	Above Ground Storage Tanks
BA	Biological Assessment
BFE	Base Flood Elevation
BS	Biological Survey
BOD	Biochemical Oxygen Demand
BMP's	Best Management Practices
BTU	Britsh Thermal Unit
CBP	County Business Patterns
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Hazardous Waste Sites)
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System (Hazardous Waste Sites)
CVM	Commercial Vehicle Monitoring
CORRACTS	Corrective Action Reports, EPA
CRP	Conservation Reserve Program
CWNS	Clean Water Needs Survey (wastewater collection/treatment)
DOQQ	Digital Orthographic Quarter-Quadrangle (registered aerial photograph)
DRG	Digital Raster Graphic (often refers to digital USGS 7.5' quadrangles)
DEMs	Digital Elevation Models (from U.S. Geological Survey)
DEIS	Draft Environmental Impact Statement
DHV	Design Hourly Volume
E+C	Existing and Committed
EARNS	Emergency Response Notification Systems, EPA
EIS	Environmental Impact Statement
ESPI	Efficient Service Performance Index
EJ	Environmental Justice
FEIS	Final Environmental Impact Statement
FONSI	Finding of No Significant Impact
FIRM	Flood Insurance Rate Maps
FTA	Federal Transit Administration
GIS	Geographic Information System
HazMat	Hazardous Material
IRHSS	Indiana Register of Historic Sites and Structures
ISTEA	Intermodal Surface Transportation Efficiency Act
ITS	Intelligent Transportation Systems
L_{eq}	Level of Equivalent
LOS	Level of Service
LQ	Location Quotient
MOA	Memorandum of Agreement
MOU	Memorandum of Undestanding
MPO	Metropolitan Planning Organization
MSA	Metropolitan Statistical Area

MSL	Mean Sea Level
MUTCD	Manual on Uniform Traffic Control Devices
NAAQS	National Ambient Air Quality Standards
NAC	Noise Abatement Criteria
NAFTA	North American Free Trade Agreement
NAICS	North American Industrial Classification System
NAWCA	North American Wetlands Conservation Act
NEPA	N North American Wetlands Conservation Act ational Environmental Policy Act
NFRAP	No Further Remedial Action Planned, EPA CERCLIS
NFIP	National Flood Insurance Program
NHS	National Highway System
NHSDA	National Highway System Designation Act
NPDES	National Pollution Discharge Elimination System
NPL	National Priority List, EPA
NPL	National Priorities List (Hazardous Waste Sites)
NRI	National Resources Inventory, 1997
NRIS	Naional Register Information Service
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Unit
NWI	National Wetland Inventory
OHW	Ordinary High Water
OMB	Office of Management and Budget
OSA	Office of the State Archaeology (KY)
PCB	Polychlorinated Biphenyls
PNPL	Proposed National Priority, EPA
PPV	Peak Particle Velocities
RCRA	Resource Conservation and Recovery Act
RCRIS	Resource Conservation and Recovery Information System
ROD	Record of Decision
RM	River Mile
SAC	Study Advisory Committee
SFHA	Special Flood Hazard Area
SHPO	State Historic Preservation Officer
SIU	Segment of Independent Utility
SIC	Standard Industrial Classification
SLL	State Landfill List, EPA
SPL	State Priority Listing, EPA
STIP	Statewide Transportation Improvement Plans
STRAHNET	Strategic Highway Corridor Network
TEA-21	Transportation Equity Act for the 21st Century of 1998
TES	Threatened and Endangered Species
TNM	Traffic Noise Model
TRI	Toxic Release Inventory, EPA
TSA	Transportation Satellite Accounts
TSM	Transportation Systems Management
UST	Underground Storage Tank
VHT	Vehicle-Hours of Travel
VMT	Vehicle-Miles of Travel
VPD	Vehicles Per Day
WHPA	Wellhead Protection Areas
WMA	Wildlife Management Area, Sloughs
WQC	Water Quality Certification

AGENCIES

CEQ	Council on Environmental Quality
DHPA	Indiana Department of Natural Resources, Division of Historic Preservation & Archaeology
DHHS	U.S. Department of Health and Human Service
ESRI	Environmental Systems Research Institute, Inc.
EUTS	Evansville Urban Transportation Study
FAA	Federal Aviation Administration
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
HART	Henderson Area Rapid Transit
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IDOR	Indiana Division of Reclamation
IGS	Indiana Geological Survey
INDOT	Indiana Department of Transportation
IU	Indiana University
KDFWR	Kentucky Department of Fish and Wildlife Resources
KDOF	Kentucky Division of Forestry
KYDOW	Kentucky Division of Water
KGS	Kentucky Geological Survey
KNREPC	Kentucky Natural Resources and Environmental Protection Cabinet
KSNPC	Kentucky State Nature Preserves Commission
KYTC	Kentucky Transportation Cabinet
METS	Metropolitan Evansville Transit System
MPO	Metropolitan Planning Organization
MSA	Metropolitan Statstical Area
NAC	Native American Consultation
NAAQS	National Ambient Air Quality Standards
NHS	National Highway System
NPS	National Park Service
NRCS	Natural Resource Conservation Service
OMB	Office of Management and Budget, (U.S.)
OSA	Office of the State Archaeology
SHPO	State Historic Preservation Office
UK	University of Kentucky
USACE	US Army Corps of Engineers
USCG	United States Coast Guard
USDA	US Department of Agriculture
USDOT	US Department of Transansportation
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
USFS	US Forest Service
USGS	US Geological Survey
WPCB	Water Pollution Control Board

GLOSSARY OF TERMS

PROJECT TERMS

Alternatives - Four possible routes for I-69 to connect Evansville, Indiana to Henderson, Kentucky, plus a No-Build alternative and any mitigation measures not included with the proposed action

Corridors - Study bands originally 2000 feet wide narrowed to 1000 feet.

Preliminary Construction Limits - The estimated limits of construction based on preliminary, conceptual line and grade of the alternative as developed from USGS topography data, plus a buffer area of 50 feet on either side to accommodate temporary construction impacts, used to quantify and compare the environmental impacts of the various alternatives.

Impact Length - Length of an alternative that does not include the length of existing roadway facilities (i.e. I-164) within the alternative. It represents the length of the alternative that will be new right-of-way for the proposed I-69 project.

Sections of Independent Utility (SIU) - A designated constructible segment of the National I-69 Corridor that can function independently within its own termini while providing benefits to those it serves. The entire National I-69 project consists of 32 Sections of Independent Utility (SIU), and SIU #4 was studied for this project.

Total Length - Length of an alternative between project termini from south of Henderson to north of Evansville, including existing roadways (i.e. I-164).

GENERAL TERMS

- A -

Accessibility - The ability of people to reach desired destinations (such as employment, shopping, recreational facilities, etc.). Accessible regions allow resident to reach many destinations in a shorter period of time. Inaccessible regions allow residents to reach fewer destinations, and require longer periods of time.

Adverse Effect - The unwanted and sometimes inevitable side effect of an action.

Amorphous - Without specific shape or form.

At-Grade - The intersection of two or more roadways without a change of elevation (bridge structure). Example: 4-way stop intersection.

- B -

Biological Assessment (BA) - A detailed biological analysis of the project area that may have the potential of impacting habitats of any endangered species or threatened species using biological surveys and other direct measurements.

Biological Survey (BS) or (Biosurvey) - Consists of collecting, processing and analyzing representative portions of a species community to determine the community structure and function.

Biological Opinion - After formal consultation, the USFWS will issue a biological opinion document stating their opinion whether or not the proposed action is likely to adversely affect listed species, proposed species, or designated critical habitats.

- C -

CERCLA Site (CERCLA) - a site contaminated with a hazardous substance and being remediated as part of the Comprehensive Environmental Response, Compensation, and Liability Act.

CERCLIS - Comprehensive Environmental Response, Compensation, and Liability Information System - is a database that includes all sites currently on the National Priorities List, or being considered for it.

Committed Project - A project that is expected to occur regardless of the proposed I-69 project is constructed.

Congestion - A condition in which the number of vehicles using a road approaches the capacity of that road. It is characterized by reduced travel speeds and (at high levels of congestion) stop-and-go conditions.

Construction Limits - Area that will be disturbed during construction.

Constructive Use - When the proximity impacts of the transportation project on the Section 4(f) site are so severe that the protected activities, features, or attributes that qualify the resource for protection under Section 4(f) are substantially impaired (USDOT, 1989)

Core Forest - Forestland that has a circumferential buffer zone of 100 meters of similar forestland.

Cumulative Impacts - The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

- D -

Decennial - Being done (revised) every ten years.

Digital Elevation Models (DEMs) - A DEM, produced by the US Geological Survey, is a digital file consisting of terrain elevations for ground positions at regularly spaced horizontal intervals.

Direct Access - Access gained without the use of alternative roads, bridges or right-of-way. Example- A business along a highway would have direct access if you exist the highway and directly enter the business)

Direct Impacts - Defined by the CEQ Regulations as "*effects which are caused by the action and occur at the same time and place*" (CEQ Regulations). For the project, an example of a direct impact would be the taking of a wetland for right-of-way for an interchange.

- E -

Economic Model - A computerized representation of the economy of a region. It models the interaction of components such as labor, capital, markets, and government policy. The model used in this study (the Regional Economic Model Inc. REMI Model) analyzes the interaction of 53 industry categories with available markets, labor, and capital resources. It is used to forecast the economic effects of a significant change in policies which affect the economy.

Efficient Service Performance Index (ESPI) - The index measures the effectiveness in reducing congestion for different roadway networks. The higher the index, the lower the congestion. This is calculated by 10 times the total vehicle-miles of travel (or vehicle-hours of travel) divided by the vehicle-miles of travel (or vehicle-hours of travel) with a volume-to-capacity ratio greater than 0.75 (LOS = D, E and F) and volume-to-capacity ratio greater than 0.99 (LOS = F).

Environmental Impact Statement (EIS) - A detailed document prepared as part of the NEPA process fro major Federal actions that significantly affect the quality of the human environment.

Ephemeral Stream - A stream where water flows only in response to precipitation

- F -

Farmed Wetland - Wetlands that were drainded, dredged, filled, leveled or otherwise manipulated before December 23, 1985, for the purpose of, or to have effect of, making the production of an agricultural commodity possible, and continue to meet specific hydrologic criteria.

Fatality Rate - Percentage of highway crashes resulting in one or more fatalities, typically stated in terms of frequency per 100 million vehicle miles of travel (VMT).

Floodplain - The area around a stream or river that frequently floods during heavy rain.

Floodway - The channel of a river or stream and those portions of the floodplain adjoining the channel which are reasonably required to efficiently carry and discharge the peak flow of the regulatory flood (100-year flood) of any river or stream.

Freeway - A divided, controlled access highway, can exist solely in a region or state.

Finding of No Significant Impact (FONSI) - A document by a Federal agency briefly presenting the reasons why an action, not otherwise excluded (Sec. 1508.4), will not have a significant effect on the human environment and for which an environmental impact statement therefore will not be prepared. It shall include the environmental assessment or a summary of it and shall note any other environmental documents related to it (Sec. 1501.7(a)(5)). If the assessment is included, the finding need not repeat any of the discussion in the assessment but may incorporate it by reference.

Future Year - A year 20 to 25 years in the future. The design of a transportation facility must accommodate the predicted traffic of this year. For this project the future year is 2025.

- G -

Geographic Information System (GIS) - Organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information.

Grade Separation - The use of an overpass or underpass to physically separate two opposing traffic streams in lieu of an intersection.

Grid - Raster data format depicting the feature in pixel squares.

- H -

Historic Property - Buildings, structures, sites, objects or districts, which are important, part of the historical and cultural heritage of the area.

Horizontal Alignment - The location of the road as it can be moved from side to side, usually accomplished through curves.

- I -

Impaired Stream - A stream listed in the IDEM 1998 303 (d) List of Impaired Water bodies, and the KDOW 303 (d) List of Waters. These streams do not meet water quality standards. Streams may be impaired due to chemical or biological contaminants.

Indirect Impact - Defined by the CEQ Regulations as "*which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems"* (CEQ Regulations). For this project, an example of an indirect impact would be farmland bought by a developer to build a service station at an interchange.

Injury Rate - Percentage of highway crashes resulting in one or more injuries, typically stated in terms of frequency per 100 million vehicle miles of travel (VMT).

Intelligent Transportation Systems (ITS) - Transportation systems which apply emerging hard and soft information systems technologies to address and alleviate transportation congestion problems. Some typical ITS components include highway advisory radio, variable message signs, and highway milepost reference markers.

Intermittent Stream - A stream where water flows only seasonally, or sporadically.

Interstate - Type of freeway that traverses between states.

- J -

Jurisdictional Wetland - A wetland regulated by the Army Corps of Engineers as a "water of the United States" under the Clean Water Act. Jurisdictional wetlands must be mitigated (recreated, restored, or enhanced) if impacted.

- L -

Lacustrine Deposits - Lake sediment, mainly material consistent with that of clay.

Layer - An individual digital GIS data file. Many layers (i.e. roads, rivers, buildings, etc.) are used in a project to create one map.

Level of Service (LOS) - A scale measure of the level of congestion on a road. LOS ranges from A (free flowing traffic) to F (severe congestion).

Liquefaction - An occurrence during an earthquake (or other means of sudden drastic load changes) in which the strength and stability of a soil is diminished. Liquefaction usually occurs in ground that is saturated with water.

- M -

Managed Lands - Lands that are actively managed by federal, state, and local, agencies and private land trusts. Includes areas such as state parks, refuges, nature preserves, local parks, river access and fishing sites.

Metropolitan Statistical Area (MSA) - An area defined by the United States Office of Management and Budget (OMB) consisting of a core area containing a large population nucleus, surrounded by communities having a high degree of economic and social integration with that core (U.S. Census Bureau). In order for an area to qualify, it must contain one city with 50,000 or more inhabitants, or a Census Bureau-defined urbanized area (of at least 50,000 inhabitants) and a total metropolitan population of at least 100,000 (75,000 in New England).

Mitigation - An effort to lessen the severity of an impact or problem through avoidance, minimization, rectification, reduction, or compensation.

Multi-modal Facility - A hub that is utilized by more than one mode of transportation.

- N -

National Natural Landmark - A site that is one of the best examples of a type of biotic community or geologic features in its physiographic province.

Natural Region - A major, generalized unit of the landscape where a distinctive assemblage of natural features is present. The natural region classification system includes several natural features, such as: climate, soils, glacial history, topography, exposed bedrock, pre-settlement vegetation, species composition, physiography, and plant and animal distribution.

National Environmental Policy Act (NEPA) - A federal law stating that before a federal agency can undertake an action that might adversely affect the environment, the agency must consider the potential effects of the actions and any possible alternative course of action that might minimize those effects. The I-69 EIS is being prepared as part of the NEPA process.

No-Build Scenario - The scenario in which a proposed project is not built. Benefits and impacts are forecasted with reference to the "No-Build" scenario. The No-Build scenario must remain under consideration throughout the study process.

National Wetlands Inventory (NWI) - Repository of information on the characteristics, extent, and status of the Nation's wetlands and deepwater habitats maintained by the US Fish and Wildlife Service.

- P -

Palustrine Emergent - Combines Cowardin et al. (1979) Palustrine system with the emergent wetland class. "The Emergent Wetland class is characterized by erect, rooted, herbaceous hydrophytes (excluding mosses and lichens) which are present for most of the growing season in most years. These wetlands are usually dominated by herbaceous plants." Cowardin et al. (1979).

Performance Measure - A rating (typically numerical) which assesses the degree to which an alternative satisfies a project goal.

Perennial Stream - A stream where water persists year round.

Physiographic Region - A region of similar topography and land use.

Prime Farmland - Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses (the landuse could be cropland, pastureland, rangeland, forestland, or other land, but not urban built-up land or water).

Prior Converted Cropland - Prior converted croplands (PC) are wetlands that were drained, dredged, filled, leveled, or otherwise manipulated, including the removal of woody vegetation, before December 23, 1985, to make production of an agricultural commodity possible, and that (1) do not meet specific hydrologic criteria, (2) have had an agricultural commodity planted or produced at least once prior to December 23, 1985, and (3) have not since been abandoned. Activities in prior converted cropland are not regulated under Swampbuster or CWA Section 404.

Project Area - The general, physical location of the proposed action.

- Q -

Queue - A line of waiting vehicles.

- R -

RCRA Site - A site that is regulated by the Resource Conservation and Recovery Act to either generate, transport, store, or dispose of hazardous waste.

Record of Decision (ROD) - Formal statement released by supervisory agency in response to the submission of an Environmental Impact Statement (EIS). In the case of the I-69 Henderson to Evansville study, the ROD will be released by the Federal Highway Administration and will document the agency's final decisions with respect to the EIS and the findings contained within.

- S -

Scoping - The initial step of an environmental study. It includes the determination of a range of possible alternatives, and analysis of Purpose and Need for the project.

Screening - The second step of an environmental study. It applies Purpose and Need criteria to all alternatives to arrive at a selected set of alternatives for more detailed study.

Section 4(f) - FHWA will not approve any program or project which requires the use of any publicly owned public park, recreation area, or wildlife or waterfowl refuge, or any land from an historic site of national, state, or local significance unless: (1) there is no feasible and prudent alternative to the use, and (2) all possible planning to minimize harm resulting from such use is included.

Severed – The result of an intersection of two roadways with the secondary roadway usually ending up with cul-de-sacs. An example of this would be if a new interstate intersected a local roadway and the local roadway ended up with no access to the interstate. The local roadway simply would terminate on either side of the interstate with no direct access.

Strategic Highway Network (STRAHNET) - System of public highways designated to provide access, continuity, and emergency transportation of military personnel and equipment in times of peace and war.

Study Area - Area considered for the development of the proposed action. For I-69 from Henderson to Evanville the study area consists of an area bounded by the Breathitt Parkway in Henderson County to the south, I-64 to the north, I-164 to the east, and an area west of the Posey/Vanderburgh County line to the west.

Superfund Site - Site identified thorugh CERCLA involving inactive and abandoned hazardous waste sites or accidentally spilled or illegally dumped hazardous materials. “Superfund” is a nickname for CERCLA.

Swampbuster - The Wetland Conservation provision (Swampbuster) of the 1985 farm bill that requires all agricultural producers to protect the wetlands on the farms they own or operate if they want to be eligible for USDA farm program benefits. Producers will not be eligible if they plant an agricultural commodity on a converted wetland that was converted by drainage, leveling, or any other means after December 23, 1985, or convert a wetland for the purpose of or to make agricultural commodity production possible after November 28, 1990.

- T -

Travel Demand Model - A computerized representation of the population, employment, socioeconomic characteristics, and transportation network of a region. Travel on the transportation network is forecasted as a function of these characteristics.

Typical Section - A section cut through a roadway that shows the typical configuration and design features. This will usually include lane and shoulder widths, profile grade and construction centerline location, roadway cross slopes, side slopes, ditches and clear zones. Right-of-way width estimations were developed from typical sections.

- U -

Unique Farmland - Land that is able to produce a commercial amount of specialty crops with respect to the region, independent from prime farmland.

- V -

Vertical Alignment - Location of the road as it can be moved up or down through hills and valleys.

Vehicle Hours of Travel (VHT) - The total number of hours of vehicle travel per weekday

Vehicle Miles of Travel (VMT) - The total number of miles of vehicle travel per weekday.

- W -

Wellhead Protection Area - The surface and subsurface area which contributes water to a public water supply well and through which contaminants are likely to move toward, and reach, the well over a specified period of time. A wellhead protection area may be delineated by a fixed radius, hydrogeologic/geomorphic mapping, analytical, semi-analytical, or numerical flow/ solute transport methods.

Wetland - Areas that are inundated or saturated by surface or ground water 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. Wetlands generally include swamps, marshes, bogs and similar areas.

Working Alignment - A conceptual footprint of the right-of-way within a corridor used to estimate and compare the environmental impact of the various alternatives. These working alignments vary in width from approximately 350’ to just under 600’.

INDEX –

(The following references page numbers)

A

B

C

G

H

I

J

K

L

M

N

O

P

R

S

W

Z