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5.24 Indirect and Cumulative Impacts

Since the Draft Environmental Impact Statement (DEIS) was published, this section has been updated to include impacts of the Refined Preferred Alternative (RPA). The indirect impacts as well as the impacts due to other actions for the RPA are identical to those for Alternatives C1, C3, and C4. The cumulative impacts of the RPA differ from the other alternatives due to differences in its direct impacts.

5.24.1 Introduction

The cumulative impacts of I-69 Section 6 are the sum of its direct and reasonably foreseeable indirect impacts added to the impacts of the past, present, and reasonably foreseeable future actions of others. The basis for this project’s indirect effects analysis is the anticipated change in land use that the project alternatives are predicted to cause in Hendricks, Morgan, Johnson, and Marion counties. The cumulative impacts analysis is conducted for the study area.

Major highway projects generally have indirect impacts because they change the transportation network. For example, new businesses and industries stimulated by access to the interstate create jobs that attract employees into the area. The job growth spurs residential development, which tends to increase school enrollment and the need for community services. This population growth then creates demand for additional businesses, thereby increasing development potential. Indirectly, the project could influence the location of new development and the rate of growth, resulting in induced growth.

A typical scenario for induced growth is the conversion of farmland or undeveloped land to residential, commercial, or a mix of uses. This occurs particularly near interchanges. Induced growth is the amount of housing or employment in the build scenario that is higher than for the no-build scenario. The amount of agricultural land that is anticipated to be converted for induced development in the foreseeable future, as well as impacts from other reasonably foreseeable actions, is added to the amount of agricultural land required for right of way to determine the estimated cumulative total effect of the project.

Highway-induced development could lead to more road improvements or new roads, which could, in turn, result in additional use of currently undeveloped land. These direct and indirect impacts also occur against the background of the effects of “other” larger scale development trends which affect resources in the project area. These “other” trends have resulted in impacts to resources in the past, and may continue to affect resources in the future.

Direct effects are described in **Chapter 5, Environmental Consequences**. Council on Environmental Quality (CEQ) regulations define direct impacts as “effects which are caused by the action and occur at the same time and place.” An example of a direct impact for I-69 Section 6 would be the use of a piece of property for right of way for a project alternative.



CEQ regulations define indirect impacts as “effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.” These changes in land use are anticipated to occur in areas that are currently undeveloped and have not been identified as part of a proposed development, but are reasonably foreseeable as a result of the proposed action. Also, some development is forecasted to occur on already-developed land. See **Table 5.24-6**, which shows relative levels of development by county on undeveloped and already-developed acreage.

Cumulative effects are impacts 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 (40 CFR 1508.7). Cumulative effects are the environmental impacts resulting from both the I-69 Section 6 project (including both direct and indirect impacts) and from other past, present, and reasonably foreseeable future actions.

5.24.2 Methodology

The methods detailed in the following documents were used to determine the cumulative impacts in both the Tier 1 and Tier 2 Environmental Impact Statements (EIS):

- *Interim Guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process* (FHWA, 2003)
- *Indirect and Cumulative Impact Assessment in the Highway Project Development Process* (FHWA Position Paper, HEP-32, 1992)
- *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ, 1997)
- *Guidance for Estimating the Indirect Effects of Proposed Transportation Projects* (National Cooperative Highway Research Program Report (NCHRP) Report 403, 1998)
- *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects* (NCHRP Report 466, 2002)
- *Consideration of Cumulative Impacts in EPA Review of NEPA Documents* (United States Environmental Protection Agency (USEPA) 315-R-99-002, 1999)
- *The National Environmental Policy Act – Conducting Quality Cumulative Effects Analyses* (materials from workshop conducted by Environmental Planning Strategies, Inc., for USEPA Region 5, August 8-11, 2000)

The Tier 1 I-69 Evansville to Indianapolis FEIS analyzed cumulative impacts using the 11-step method described in the CEQ handbook entitled *Considering Cumulative Effects Under the National Environmental Policy Act*. Three major resources were identified and analyzed for cumulative impacts. Farmland, forests, and wetlands were selected based on their importance in



Southwestern Indiana and input from various resource agencies (see Section 5.26 of the Tier 1 FEIS).

Tier 1 analyzed the 26-county Tier 1 region through a forecast year of 2025. The Tier 1 FEIS compared the overall projected loss of farmland, forest, and wetlands to the loss resulting from direct and indirect I-69 project impacts. It was found that I-69 losses would account for a very small percentage of overall losses for these three resources. The selected alternative—Alternative 3C—accounted for an additional 1.1 percent loss in farmland, 0.1 percent loss in forest, and 0.04 percent loss in wetlands throughout the 26-county project area. The impacts of the selected alternative were typical of the alternatives studied in the Tier 1 FEIS; see Figure 5.26-8, Figure 5.26-9, and Figure 5.26-10 (pp. 5-292 through pp. 5-294) in the Tier 1 FEIS.

The eleven-step process for conducting the cumulative impacts analysis is as follows:

1. Identify the significant cumulative effects issues associated with I-69.
2. Establish the geographic scope for the analysis.
3. Establish the timeframe 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 communities.
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 Tier 2 analysis follows a similar methodology in determining resources, impacts, and significant effects. Unlike Tier 1, the Tier 2 process considers a smaller study area with a more detailed analysis. The data from the Tier 1 analysis is carried through Tier 2 and further refined. Per CEQ guidance, not all resources directly impacted by a project require cumulative impact analysis. The resources identified for the cumulative analysis in I-69 Section 6 are farmland,



forests, wetlands, and streams.¹ Other direct and indirect impact analyses are provided in other sections of **Chapter 5, Environmental Consequences**. For example, historic resources and Section 106 analysis and consultation details are included in **Section 5.13**.

Traffic analysis zone (TAZ)² data were found to be appropriate for the analyses of indirect impacts because (1) TAZs are small in size, which permits a detailed analysis; (2) the socioeconomic data for the TAZs (including population and employment statistics) are readily available, having been developed for each section of the Tier 2 I-69 project for use in forecasting traffic volumes; and (3) these analyses involve indirect impacts that may extend beyond the immediate vicinity of the project itself. In all Tier 2 EISs, the study area for indirect effects has followed TAZ boundaries.

To determine what land use changes—and therefore, what impacts to existing resources—could occur as a result of predicted induced development, it was necessary to identify existing land cover. Land cover was identified using the National Land Cover Database (NLCD) 2011 Land Cover layer obtained from the Multi-Resolution Land Characteristics Consortium (MRLC). This 2011 NLCD for the conterminous United States was made publicly available on October 10, 2014. Based on the land cover codes in this data set, the land area of each TAZ with the potential for induced growth was categorized, and land cover types within the categories were identified as follows:³

- **Developed:** Open Water; Developed, Open Space; Developed, Low Intensity; Developed, Medium Intensity; and Developed, High Intensity.
- **Unusable:** Woody Wetlands; and Emergent Herbaceous Wetlands.
- **Agriculture Land/Other:** Barren Land (Rock/Sand/Clay); Shrub/Scrub; Grassland/Herbaceous; Pasture/Hay; and Cultivated Crops.
- **Agriculture Land/Other in Floodplain:** Barren Land (Rock/Sand/Clay); Shrub/Scrub; Grassland/Herbaceous; Pasture/Hay; and Cultivated Crops.
- **Forest Land:** Deciduous Forest; Evergreen Forest; and Mixed Forest.
- **Forest Land in Floodplain:** Deciduous Forest; Evergreen Forest; and Mixed Forest.

¹ Streams were added as a resource of concern though agency coordination early in Tier 2 studies. All previous Tier 2 EISs have considered cumulative impacts to streams.

² A TAZ is one of many small areas within a larger geographical study area that has been subdivided for purposes of obtaining socioeconomic and traffic data in a manageable fashion. The geographical scope of I-69 Section 6 was identified as Hendricks, Morgan, Johnson, and Marion counties. Changes in growth induced (positive or negative) by the I-69 Section 6 project (indirect impact) was predicted to occur in a total of 55 TAZs for Alternatives C1, C3, C4, and the RPA, and a total of 54 TAZs for Alternative C2 distributed within these four counties. See “2. Establish geographic scope for the analysis,” herein, for additional discussion.

³ Later in the process, the Land Use Panel reviewed the development allocations made by this analytical procedure and modified them to account for factors such as presence of utilities and zoning constraints.



5.24.3 Analysis

To facilitate the analysis of the direct, indirect, and cumulative impacts of the project on farmland, forests, wetlands and streams, the historic and future trends of each resource have been researched, along with anticipated land use changes identified by the “Land Use Panel” (described in Step 3, below). The analysis is further described in the steps outlined below. These trends and potentially foreseeable land use changes were used in determining the cumulative and indirect impacts on these resources. The following discussion uses the 11-step process identified in Section 5.24.2 to assess the overall cumulative impacts for I-69 Section 6. (Note that the first of these 11 steps includes its own nine-step process to identify indirect impacts. To avoid confusion, references to the latter nine-step process for indirect impacts employ the word “Step” followed by its designation, underlined, e.g., Step 1A.)

1. Identify the significant cumulative effects issues associated with I-69

Based on coordination with resource agencies in Tier 1 and early in Tier 2, the resources potentially affected in I-69 Section 6 are farmland, forests, wetlands, and streams. Review of existing data, mapping, and local coordination indicates that streams and wetlands account for a smaller acreage than the agricultural land or forests in any given induced growth TAZ. An induced growth TAZ is a TAZ with growth caused by I-69 Section 6 that exceeds the year 2045 no-build growth. Ratios of available agricultural and forest land within TAZs with induced growth were used to estimate induced growth trends in each county in the study area. This information also identified resources which would be impacted in each county. Table 5.24-1 shows the percentages that were used for estimating impacts of induced growth to agricultural and forest land. These percentages are applied where growth is expected to occur on non-developed land, as described below.

Table 5.24-1: Percentages to Apply Growth to Non-Developed Land

County	Agricultural Land	Forest Land
Hendricks	80%	20%
Johnson	85%	15%
Marion	90%	10%
Morgan	60%	40%

Table 5.24-2 shows the total amount of land, by land type and county, within the TAZs that are predicted to experience positive growth as a result of the I-69 Section 6 project. Growth is expected to occur in 55 TAZs in Alternatives C1, C3, C4, and the RPA, and 54 TAZs for Alternative C2. The varying interchange options between the alternatives cause a different number of TAZs to be forecasted for induced growth. In some TAZs, the land is so attractive for future development that growth (based upon the household or jobs development ratios) exceeds the amount of “available” agricultural and forest land. In these situations, development occurs on land that is already developed, resulting in greater densities.



Table 5.24-3 shows the acreage⁴ of projected induced growth that is expected to occur on developed land, along with that which would occur on agricultural and forest land. Examples of induced growth on developed land include development of a high-rise apartment building that exceeds the 4.38 households/acre value or construction of larger or taller buildings to replace existing buildings.⁵ In each county, the anticipated percentages of agricultural and forest impacts from Table 5.24-1 were applied to determine indirect impacts in that county.

Table 5.24-2: Amount of Land Cover Types in Induced Growth TAZs

County (# TAZ represented)	Developed Area (acres)	Unusable Area (acres)	Ag/Other in Floodplain (acres)	Avail. Ag/Other (acres)	Forest in Floodplain (acres)	Avail. Forest (acres)	Acres in TAZ
Alternatives C1, C3, C4, and the RPA							
Hendricks (3)*	574	--	392	976	125	212	2,279
Johnson (11)**	1,273	11	692	4,635	289	823	7,723
Marion (8)***	2,394	8	1,112	2,555	361	261	6,691
Morgan (33)****	2,912	13	1,286	9,152	755	5,847	19,965
Total Acres (%)	7,153 (19%)	32 (0%)	20,800 (57%)		8,673 (24%)		36,658
Alternative C2							
Hendricks (3)*	574	--	392	976	125	212	2,279
Johnson (11)**	1,273	11	692	4,635	289	823	7,723
Marion (8)***	2,394	8	1,112	2,555	361	261	6,691
Morgan (32)****	2,909	13	1,274	9,113	744	6,136	20,189
Total Acres (%)	7,150 (20%)	32 (0%)	20,749 (56%)		8,951 (24%)		36,882

Source: USGS 2011 NLCD for the conterminous United States (based on the October 10, 2014 re-released edition)

Cover types: **Developed:** Open Water; Developed, Open Space; Developed, Low Intensity; Developed, Medium Intensity; and Developed, High Intensity / **Unusable:** Woody Wetlands; and Emergent Herbaceous Wetlands. / **Agriculture Land/Other:** Barren Land (Rock/Sand/Clay); Shrub/Scrub; Grassland/Herbaceous; Pasture/Hay; and Cultivated Crops. / **Forest Land:** Deciduous Forest; Evergreen Forest; and Mixed Forest.

The following percentages are applied where growth is expected to occur on non-developed land:

* Hendricks County: Induced growth in these TAZs is anticipated to impact 80% agricultural land / 20% forest.

** Johnson County: Induced growth in these TAZs is anticipated to impact 85% agricultural land / 15% forest.

*** Marion County: Induced growth in these TAZs is anticipated to impact 90% agricultural land / 10% forest

**** Morgan County: Induced growth in these TAZs is anticipated to impact 60% agricultural land / 40% forest.

⁴ This “acreage” is an analytical “placeholder” to represent the acreage which would be used if residential or businesses development occurred on undeveloped land. It does not represent the actual geographic extent of more intense development on already developed land. For economy of expression, this placeholder is referred to simply as “acreage.”

⁵ The following discussion gives the acreage percentages to individual TAZs. An individual TAZ’s vacant land may not accommodate growth at the target percentages shown for that county. For example, consider a TAZ with 2 acres of farmland and 6 acres of forest land in a county where the target percentages are 50% forest land and 50% farmland. The TAZ receives 5 acres of induced growth. Once 2 acres of farmland are impacted (along with 2 acres of forested land) the remaining 1 acre of development impacts forested land. The induced growth in that TAZ is forecasted as impacting 2 acres of farmland and 3 acres of forested land. The ratio of impacts for that TAZ will be 40% farmland and 60% forested land. Such instances may result in county-wide percentages of forest and farmland impacted differing slightly from the overall target for that county.



Table 5.24-3: Acres of Land Use Type Potentially Converted with I-69 Section 6 Induced Growth, by Alternative

County	Alternatives C1, C3, C4, and the RPA			Alternative C2		
	Developed	Agricultural	Forested	Developed	Agricultural	Forested
Hendricks Co.	--	25	6	--	25	6
Johnson Co.	11	35	6	11	35	6
Marion Co.	40	66	7	40	66	7
Morgan Co.	14	83	44	32	81	47
Total	65	209	63	83	207	66

Sources: **Appendix V**, Indirect Impact Analysis.

Table 5.24-4, Induced growth in Hendricks County TAZs is anticipated to convert 80% agricultural / 20% forest land.

Table 5.24-4, Induced growth in Johnson County TAZs is anticipated to convert 85% agricultural / 15% forest land.

Table 5.24-4, Induced growth in Marion County TAZs is anticipated to convert 90% agricultural / 10% forest land.

Table 5.24-4, Induced growth in Morgan County TAZs is anticipated to convert 60% agricultural / 40% forest land.

For Hendricks County, it is projected that 31 acres of induced growth would occur on agricultural and forest lands, while no induced growth would occur on developed land. Using the percentages from **Table 5.24-1**, 80 percent of the anticipated 31 acres of induced growth caused by I-69 Section 6 would occur on available agricultural lands. The predicted impact to agricultural lands is therefore 25 acres. The remaining 20 percent of the 31 acres of growth would occur on forest lands, with a predicted impact of 6 acres.

For Johnson County, it is projected that 41 acres of induced growth would occur on agricultural and forest lands, while 11 acres would occur on developed land. 85 percent of the anticipated 41 acres of induced growth caused by I-69 Section 6 would occur on available agricultural lands. The predicted impact to agricultural lands is therefore 35 acres. The remaining 15 percent of the 41 acres of growth would occur on forest lands, with a predicted impact of 6 acres.

For Marion County, it is projected that 73 acres of induced growth would occur on agricultural and forest lands, while 40 acres would occur on developed land. From **Table 5.24-1**, 90 percent of the anticipated 73 acres of induced growth caused by I-69 Section 6 is expected occur on available agricultural lands, resulting in a predicted impact of 66 acres. The remaining 10 percent of the 73 acres of growth would occur on forest lands, resulting in a predicted impact of 7 acres.

For Morgan County, it is projected that 127 acres (Alternatives C1, C3, C4, and the RPA) and 128 acres (Alternative C2) of induced growth would occur on agricultural and forest lands, while 14 acres (Alternatives C1, C3, C4, and the RPA) and 32 acres (Alternative C2) would occur on developed land. With an estimated 60 percent of the anticipated 127 or 128 acres of induced growth caused by I-69 Section 6 occurring on available agricultural lands, the predicted impact to agricultural lands is 83 acres for Alternatives C1, C3, C4, and the RPA, and 81 acres for Alternative C2. The remaining 40 percent of the 127 or 128 acres of growth would occur on forest lands, with a predicted impact of 44 acres for Alternatives C1, C3, C4, and the RPA, and 47 acres for Alternative C2.



Table 5.24-3 summarizes the acres of land use type potentially converted by induced growth with each I-69 Section 6 alternative. The total estimated induced growth impacts for the I-69 Section 6 project are 337 acres for Alternatives C1, C3, C4, and the RPA, of which 65 acres are increased densities on developed land, 209 acres are agricultural land, and 63 acres are forest land. The total estimated induced growth impacts for Alternative C2 is 356 acres, of which 83 acres are increased densities on developed land, 207 acres are agricultural land, and 66 acres are forest land.⁶

To estimate indirect impacts to land use, the following nine-step process was used. This process was developed in Tier 2, Section 1, and used in previous Tier 2 EISs:

Step 1A: Obtain the economic forecasts for 2045 from the TREDIS⁷ analysis. This provides the induced or indirect growth resulting from I-69 for the forecast year for I-69 Section 6.

Prior to determining the magnitude and significance of the cumulative effects in I-69 Section 6, an analysis was completed which provided anticipated land use changes in the I-69 Section 6 study area. See **Appendix Y** for information regarding the TREDIS analysis performed for I-69 Section 6.

Several land use scenarios were identified by reviewing the TAZ data estimates for the no-build scenario and for the five build alternatives. Forecasts from the TREDIS economic model were used to forecast increases in jobs and households resulting from economic growth. These increases were then assumed to result in impacts.

Maps of TAZs within Hendricks, Johnson, Marion, and Morgan counties were used to identify where project-induced land use changes would be expected to occur. The number of new houses and new jobs for the year 2045 were forecasted for the no-build scenario and for the five build alternatives. Induced growth is anticipated where the number of houses or jobs for the build alternatives is higher than for the no-build scenario.

As expected, the build alternatives were found to result in more employment and housing than the no-build scenario for the four-county area. The TREDIS forecasts indicated that building I-69 Section 6 would induce 785 new housing units and 1,347 new jobs within the four-county geographic scope of the I-69 Section 6 project. **Figure 5.24-1** and **Figure 5.24-2** show the location of the TAZs with predicted growth in the no-build scenario. **Figure 5.24-3**

⁶ The geographic scopes of the cumulative impact analyses in adjacent sections of I-69 of necessity overlap. As a result, some actions will be counted as cumulative impacts in more than one Tier 2 EIS. Thus, the cumulative impacts of the I-69 project as a whole cannot be calculated by “adding up” the cumulative impacts totals that are given in each Tier 2 EIS. In addition, the cumulative impact analysis for I-69 Section 5 was performed for a forecast year of 2035, which differs from the 2045 forecast year used for I-69 Section 6.

⁷ TREDIS (www.tredis.com) is an economic model which is computerized representation of the economy of a region. It models the interaction of components such as labor, capital, markets, and government policy. It provides benefit-cost analysis, economic impact analysis, and financial impact analysis for transportation planning. It is used in this study to evaluate alternatives’ relative performance on purpose and need indicators. It also provides forecasts of added households and employment that occur due to the I-69 Section 6 project.



through **Figure 5.24-6** show the location of predicted growth in the build scenario for the four-county study area.

Step 1B: Allocate the induced growth to individual counties.

TREDIS forecasted an increased number of jobs and housing units for the four-county area for the year 2045 (build and no-build), as described in the previous step. These forecasts were allocated to each of the four counties, as follows:

- 382 jobs and 217 housing units within Morgan County⁸
- 243 jobs and 156 housing units within Johnson County
- 117 jobs and 100 housing units in Hendricks County
- 605 jobs and 312 housing units within Marion County

Consultant staff used a manual allocation process⁹ to provide induced employment and population growth forecasts for each county using forecasts for the four-county region. Allocation percentages for each county were based on both land use and transportation factors. The land use factors consider the baseline growth forecasts (2010-2045) as well as the total 2045 no-build employment and households within each county. Both serve as proxies for the economic activity occurring within each county. The transportation factors are represented by the number of I-69 Section 6 vehicle miles traveled (VMT) forecasted within Marion, Johnson, and Morgan counties (Hendricks County has no VMT on I-69). This VMT measure represents the use and geographic proximity to I-69 Section 6.

These forecasts of induced jobs and housing units at the county level reflect only the induced growth effects of I-69 Section 6. The effects of induced jobs and housing units due to the completion of Sections 1 through 5 of I-69 are included in the estimates of no build growth.¹⁰ These forecasts are shown in **Figure 5.24-1** and **Figure 5.24-2**.

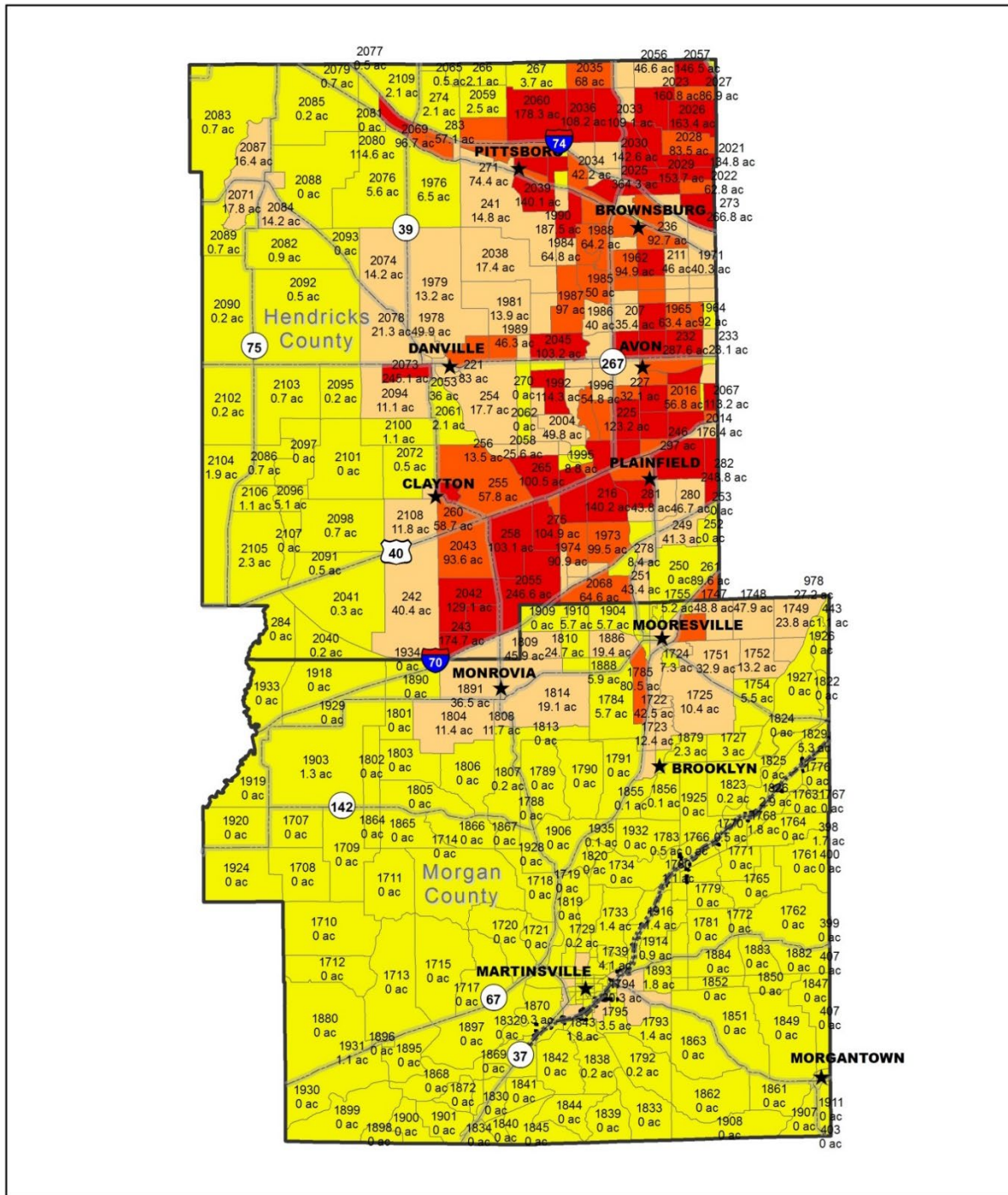
⁸ In Morgan County only, the land use panel reallocated no-build growth to other TAZs in the build scenario. The induced households and jobs for Morgan County shown here represent the net increase in the build scenario over the no-build scenario. **Table 5.24-4** shows all TAZs where there is more growth in the build scenario than in the no-build. For this reason, the total induced households and jobs in Morgan County shown in **Table 5.24-4** are greater than these shown here. All calculations of cumulative effects (as shown in **Table 5.24-8**, **Table 5.24-9**, and **Table 5.24-10**) use the net induced households and jobs shown here.

⁹ This allocation process was developed in consultation with TREDIS technical staff.

¹⁰ The sources of the no-build forecasts (Indiana Business Research Center and Woods/Poole) considered broad regional economic trends in influences in making these forecasts of county-level growth. The technical tools and land use panels which allocated these county-level forecasts to individual TAZs took into account significant local undertakings (such as the completion of Sections 1 through 5 of I-69).



Figure 5.24-1: Land Use Changes Year 2045 No-Build Growth - Hendricks and Morgan Counties



	Legend Primary Roads Preferred Alternative County Boundary	TAZ Boundary with No Build Growth 2045 0.1 - 9.9 acres 10.0 - 49.9 acres 50.0 - 99.9 acres 100.0 - 364.3 acres	1 inch equals 4.62 miles
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Figure 5.24-2: Land Use Changes Year 2045 No-Build Growth - Marion and Johnson Counties

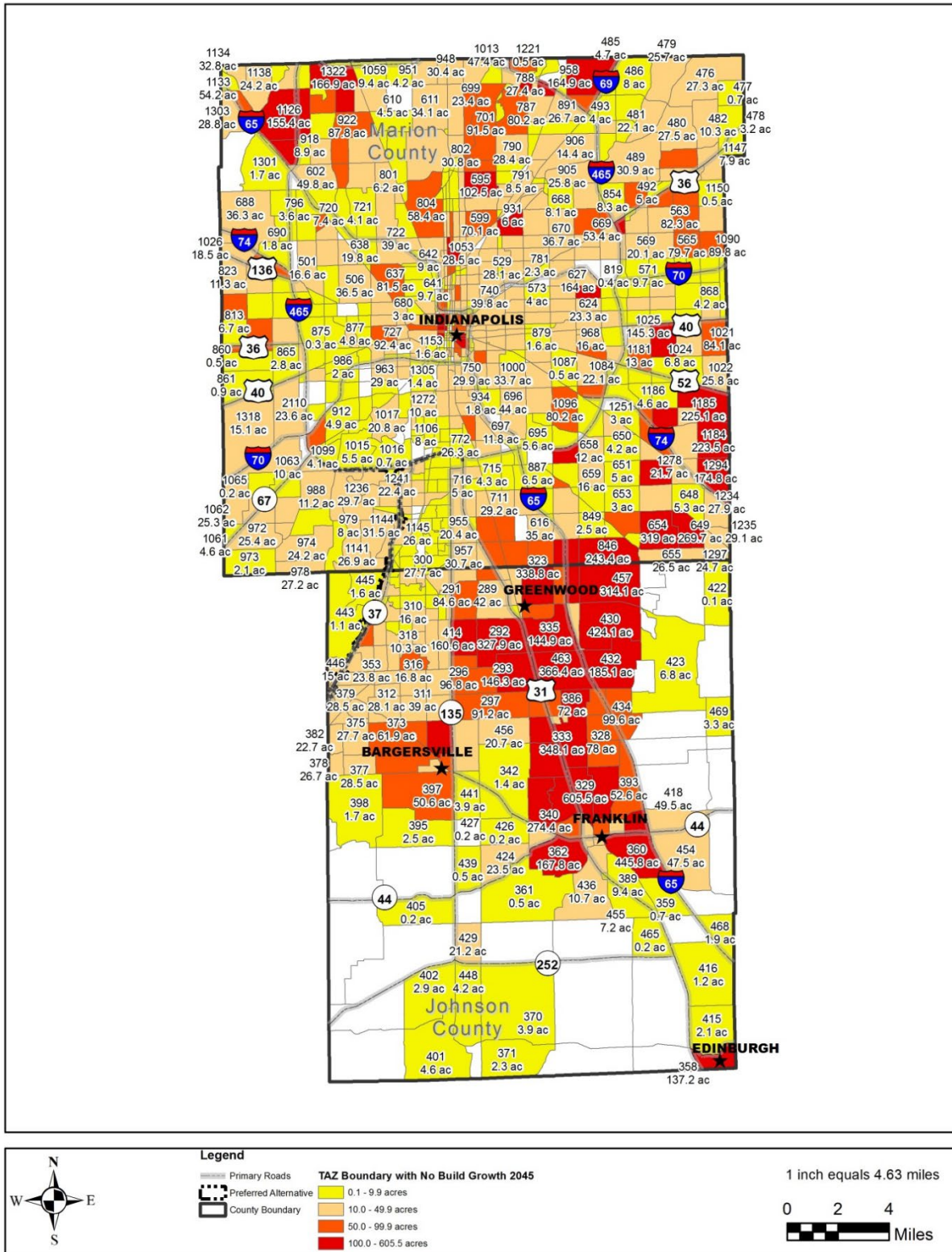




Figure 5.24-3: Indirect Land Use Changes 2045 Growth, C1, C3, C4, RPA - Hendricks and Morgan Counties

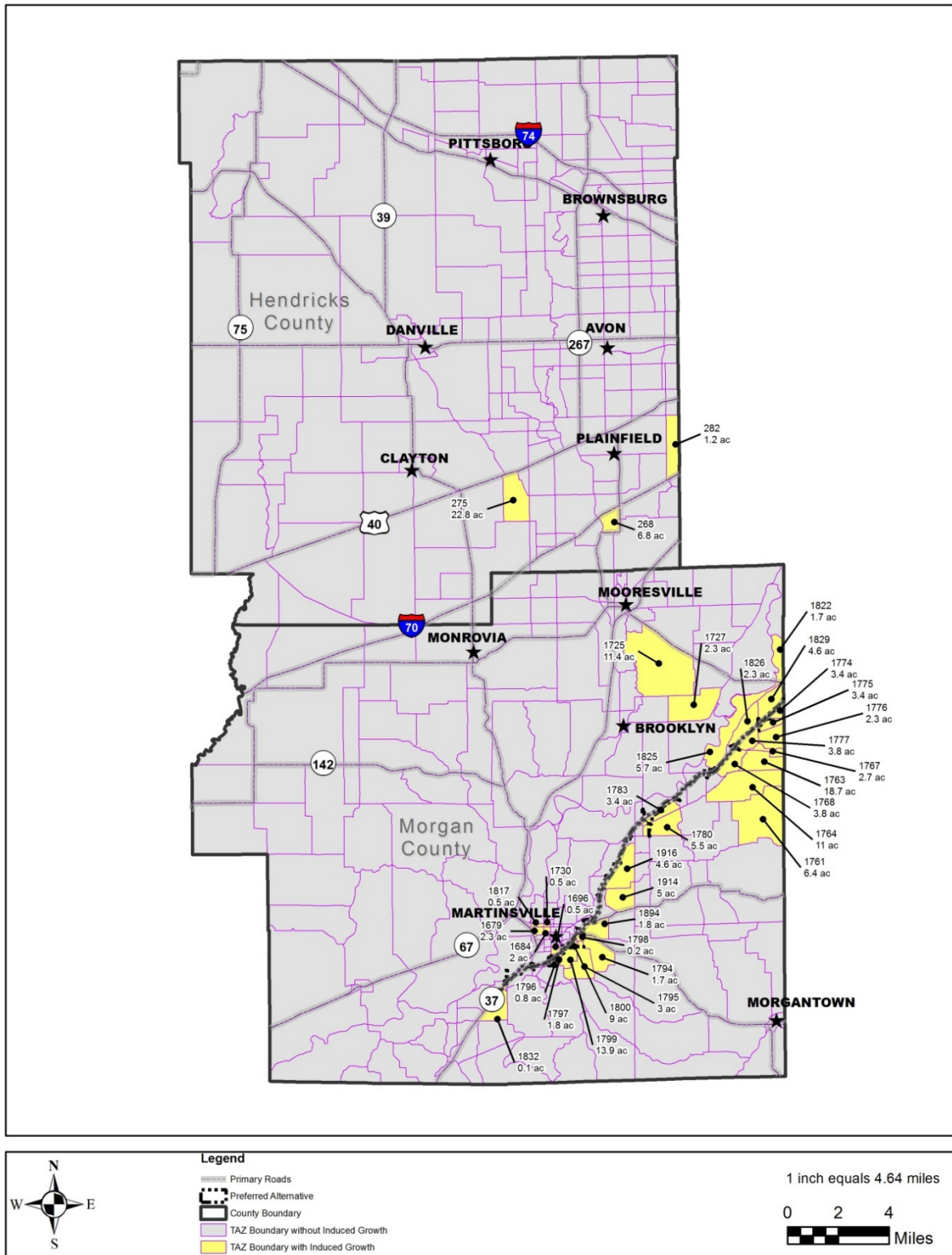


Figure 5.24-4: Indirect Land Use Changes 2045 Growth, C1, C3, C4, RPA - Marion and Johnson Counties

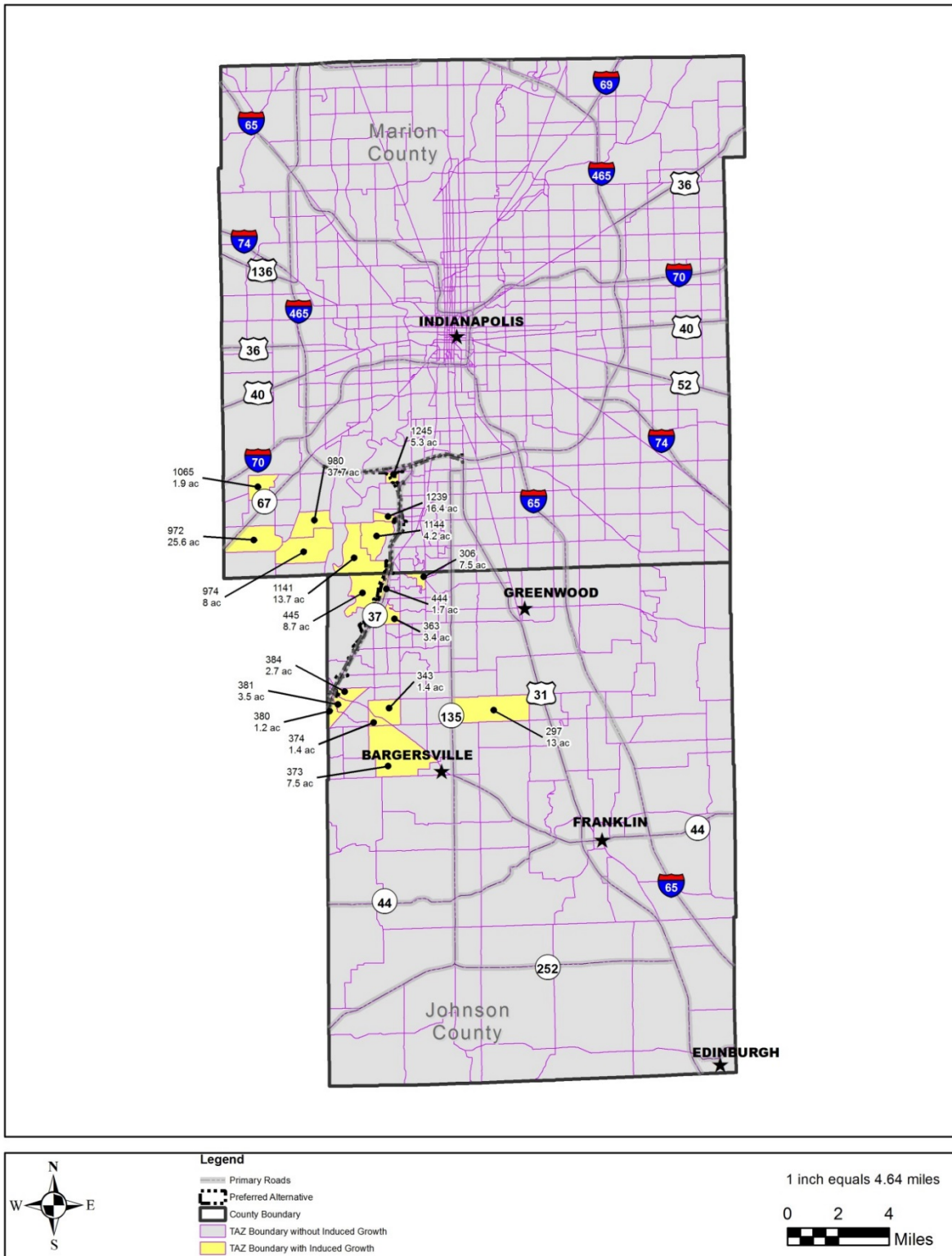




Figure 5.24-5: Indirect Land Use Changes 2045 Growth, C2 – Hendricks and Morgan Counties

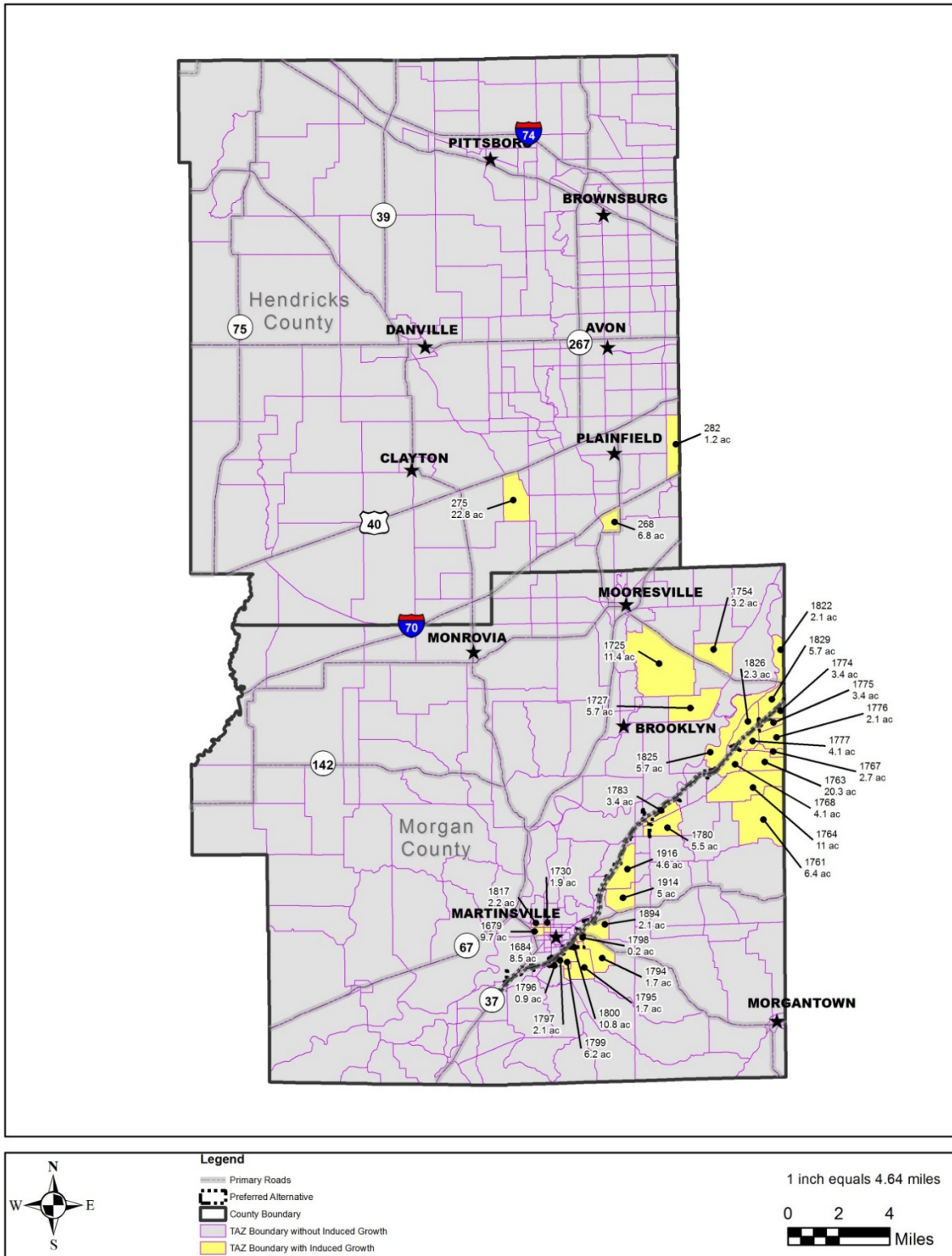
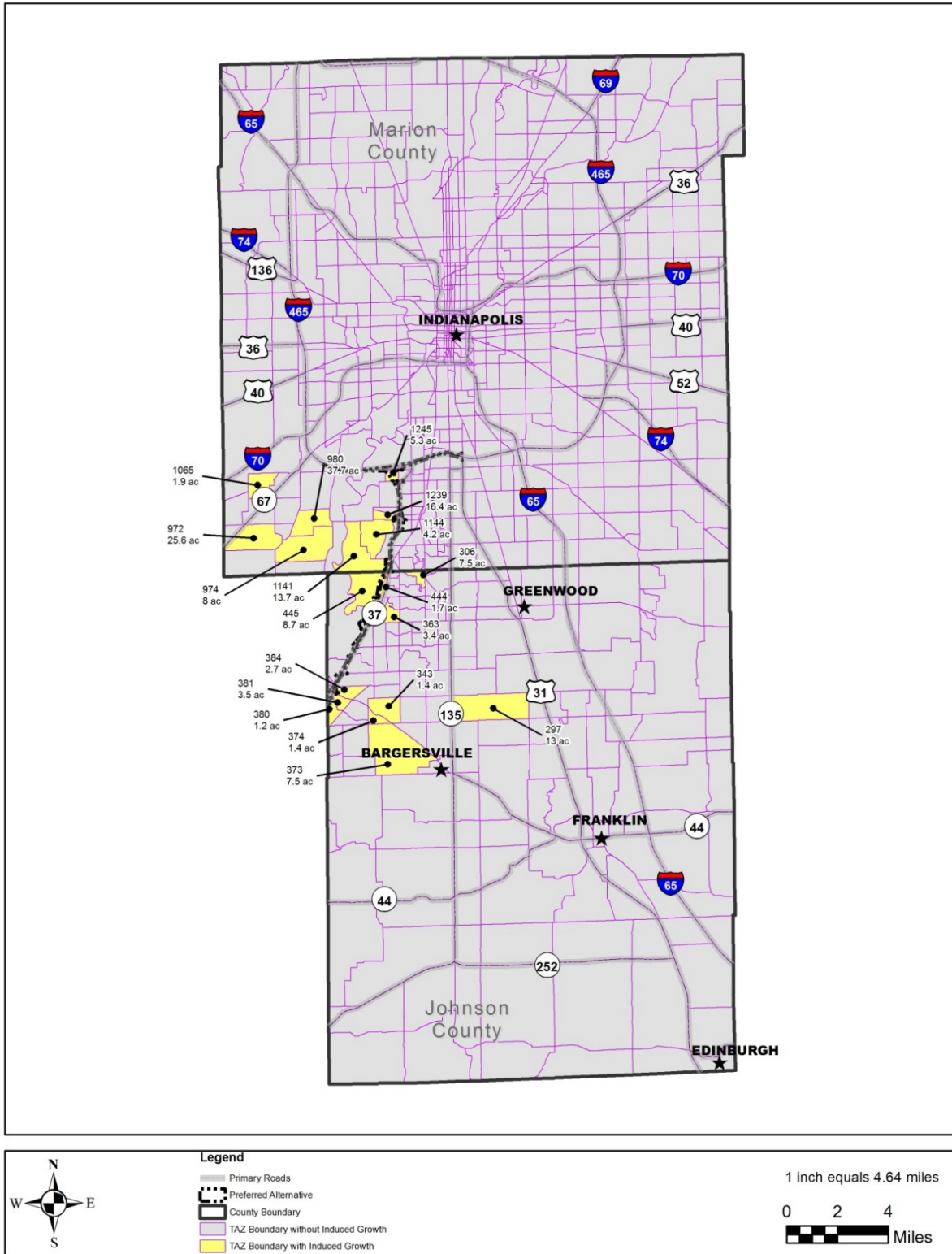


Figure 5.24-6: Indirect Land Use Changes 2045 Growth, C2 – Marion and Johnson Counties



**Step 1C: Meet with the Land Use Panel to determine the location and comparative order of magnitude of growth by TAZ.**

Estimating indirect impacts relied upon input from a Land Use Panel assembled for I-69 Section 6. According to a United States Department of Transportation (USDOT) report,¹¹ “Expert panels can be a very effective way to organize input and gain general consensus on the range of impacts that might be expected. The use of expert panels seems to be an effective way to determine what is ‘reasonably foreseeable’ since it utilized the judgments of reasonable people.”

The I-69 Section 6 Land Use Panel included representatives from Indianapolis Department of Metropolitan Development, Develop Indy, Mooresville Redevelopment Commission, Morgan County Planning and Zoning, Johnson County Planning and Zoning, Indianapolis Metropolitan Planning Organization (MPO), Morgan County Economic Development Corporation, Johnson County Economic Development Corporation, Hendricks County Planning and Zoning, Mid-Indiana Board of Realtors (MIBOR), and Bargersville Planning and Development. (See **Chapter 11, Comments, Coordination, and Public Involvement.**)

The Land Use Panel was first convened in September 2015¹² to review the 2045 employment and household forecasts no-build scenario. A second Land Use Panel meeting was held in February 2016 to review the no-build re-allocation and to distribute the 2045 employment and household allocations totals for the build alternatives.

In both meetings described above, the Land Use Panel provided guidance about the potential for I-69 Section 6 to influence the location and intensity of future growth in the study area. The panel identified those TAZs that they felt would be most likely to experience induced growth with the new interchanges to be provided by I-69 Section 6. They determined that indirect impacts would differ among alternatives based on different interchange locations.

Step 1D: Using these growth guidelines from the Land Use panel, allocate the induced growth for the counties to individual TAZs in proportion to the relative order of magnitude established by the panel.

The Land Use Panel focused on TAZs within the four counties to determine the level of growth that can be expected within each TAZ. The panels then allocated the anticipated induced growth in housing units and employment into each TAZ, as shown in **Table 5.24-4** and **Figure 5.24-3** through **Figure 5.24-6**.

¹¹ “Environmental Stewardship and Transportation Infrastructure Project Review: Executive Order 13274 Indirect and Cumulative Impacts Work Group Draft Baseline Report.” ICF Consulting for USDOT. March 15, 2005.

¹² Land Use Panels met for I-69 Section 6 in 2005. Given the passage of time between then and the resumption of I-69 Section 6 studies in late 2014, the Land Use Panel process was restarted and the previous Land Use Panel’s findings were not considered in this effort.



Table 5.24-4: Induced Land Use Changes by Alternative

Traffic Analysis Zone	Alternatives C1, C3, C4, and the RPA						Alternative C2					
	TAZ Size (acres)	Induced No. Housing Units	Induced No. Jobs	Induced Acres for Housing*	Induced Acres for Jobs**	Total Induced Acres (% Total TAZ Acres)	TAZ Size (acres)	Induced No. Housing Units	Induced No. Jobs	Induced Acres for Housing*	Induced Acres for Jobs**	Total Induced Acres (% Total TAZ Acres)
268	419	--	100	--	6.8	6.8	419	--	100	--	6.8	6.8
275	1096	100	--	22.8	--	22.8	1096	100	--	22.8	--	22.8
282	764	--	17	0.0	1.2	1.2	764	--	17	--	1.2	1.2
Hendricks County	2279	100	117	22.8	8.0	30.8 (1.4%)	2279	100	117	22.8	8.0	30.8 (1.4%)
297	1981	57	--	13.0	--	13.0	1981	57	--	13.0	--	13.0
306	190	33	--	7.5	--	7.5	190	33	--	7.5	--	7.5
343	637	--	20	--	1.4	1.4	637	--	20	--	1.4	1.4
363	363	--	50	--	3.4	3.4	363	--	50	--	3.4	3.4
373	2401	33	--	7.5	--	7.5	2401	33	--	7.5	--	7.5
374	186	--	21	--	1.4	1.4	186	--	21	--	1.4	1.4
380	232	--	18	--	1.2	1.2	232	--	18	--	1.2	1.2
381	183	--	51	--	3.5	3.5	183	--	51	--	3.5	3.5
384	304	--	40	--	2.7	2.7	304	--	40	--	2.7	2.7
444	124	--	25	--	1.7	1.7	124	--	25	--	1.7	1.7
445	1126	33	18	7.5	1.2	8.7	1126	33	18	7.5	1.2	8.7
Johnson County	7727	156	243	35.5	16.5	52.0 (0.7%)	7727	156	243	35.5	16.5	52.0 (0.7%)
972	1167	112	--	25.6	--	25.6	1167	112	--	25.6	--	25.6
974	1475	35	--	8.0	--	8.0	1475	35	--	8.0	--	8.0

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Traffic Analysis Zone	Alternatives C1, C3, C4, and the RPA						Alternative C2					
	TAZ Size (acres)	Induced No. Housing Units	Induced No. Jobs	Induced Acres for Housing*	Induced Acres for Jobs**	Total Induced Acres (% Total TAZ Acres)	TAZ Size (acres)	Induced No. Housing Units	Induced No. Jobs	Induced Acres for Housing*	Induced Acres for Jobs**	Total Induced Acres (% Total TAZ Acres)
980	795	165	--	37.7	--	37.7	795	165	--	37.7	--	37.7
1065	626	--	28	--	1.9	1.9	626	--	28	--	1.9	1.9
1141	1415	--	200	--	13.7	13.7	1415	--	200	--	13.7	13.7
1144	868	--	61	--	4.2	4.2	868	--	61	--	4.2	4.2
1239	195	--	239	--	16.4	16.4	195	--	239	--	16.4	16.4
1245	151	--	77	--	5.3	5.3	151	--	77	--	5.3	5.3
Marion County	6692	312	605	71.3	41.5	112.8 (1.7%)	6692	312	605	71.3	41.5	112.8 (1.7%)
1679	100	--	34	--	2.3	2.3	100	--	142	--	9.7	9.7
1684	33	--	29	--	2.0	2.0	33	--	124	--	8.5	8.5
1696	70	--	8	--	0.5	0.5	-	-	-	-	-	-
1725	3524	50	--	11.4	--	11.4	3524	50	--	11.4	--	11.4
1727	1311	10	--	2.3	--	2.3	1311	25	--	5.7	--	5.7
1730	21	--	7	--	0.5	0.5	21	--	28	--	1.9	1.9
1754	-	-	-	-	-	-	898	14	--	3.2	--	3.2
1761	2344	28	--	6.4	--	6.4	2344	28	--	6.4	--	6.4
1763	724	82	--	18.7	--	18.7	724	89	--	20.3	--	20.3
1764	1668	48	--	11.0	--	11.0	1668	48	--	11.0	--	11.0
1767	199	12	--	2.7	--	2.7	199	12	--	2.7	--	2.7
1768	460	--	55	--	3.8	3.8	460	--	60	--	4.1	4.1
1774	160	--	50	--	3.4	3.4	160	--	50	--	3.4	3.4
1775	218	--	50	--	3.4	3.4	218	--	50	--	3.4	3.4
1776	512	10	--	2.3	--	2.3	512	9	--	2.1	--	2.1
1777	338	--	55	--	3.8	3.8	338	--	60	--	4.1	4.1



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Traffic Analysis Zone	Alternatives C1, C3, C4, and the RPA						Alternative C2					
	TAZ Size (acres)	Induced No. Housing Units	Induced No. Jobs	Induced Acres for Housing*	Induced Acres for Jobs**	Total Induced Acres (% Total TAZ Acres)	TAZ Size (acres)	Induced No. Housing Units	Induced No. Jobs	Induced Acres for Housing*	Induced Acres for Jobs**	Total Induced Acres (% Total TAZ Acres)
1780	691	--	80	--	5.5	5.5	691	--	80	--	5.5	5.5
1783	337	--	50	--	3.4	3.4	337	--	50	--	3.4	3.4
1794	701	--	25	--	1.7	1.7	701	--	25	--	1.7	1.7
1795	686	4	30	0.9	2.1	3.0	686	--	25	--	1.7	1.7
1796	69	--	11	--	0.8	0.8	69	--	13	--	0.9	0.9
1797	19	--	27	--	1.8	1.8	19	--	31	--	2.1	2.1
1798	68	--	3	--	0.2	0.2	68	--	3	--	0.2	0.2
1799	281	38	76	8.7	5.2	13.9	281	--	90	--	6.2	6.2
1800	64	--	132	--	9.0	9.0	64	--	157	--	10.8	10.8
1817	41	--	8	--	0.5	0.5	41	--	32	--	2.2	2.2
1822	428	--	25	--	1.7	1.7	428	--	30	--	2.1	2.1
1825	1227	25	--	5.7	--	5.7	1227	25	--	5.7	--	5.7
1826	562	10	--	2.3	--	2.3	562	10	--	2.3	--	2.3
1829	571	20	--	4.6	--	4.6	571	25	--	5.7	--	5.7
1832	604	--	2	--	0.1	0.1	-	-	-	-	-	-
1894	425	--	26	--	1.8	1.8	425	--	31	--	2.1	2.1
1914	640	22	--	5.0	--	5.0	640	22	--	5.0	--	5.0
1916	865	20	--	4.6	--	4.6	865	20	--	4.6	--	4.6
Morgan County	19,961	379	783	86.6	53.5	140.1 (0.7%)	20,185	377	1081	86.1	74.0	160.1 (0.8%)
Total	36,659	947	1748	216.2	119.5	335.7 (0.9%)	36,883	945	2046	215.7	140.0	355.7 (1.0%)

*Utilized 4.38 units/acre.

**Utilized 14.6 jobs/acre.



Steps 1E and 1F: Determine any shifts in development resulting from accessibility changes as a result of interchanges. Allocate any shifts in development to the TAZs; and, determine a value for I-69-induced growth and growth from development shifts resulting from changes in accessibility for each TAZ.

Shifts in employment resulting from accessibility changes are anticipated in the induced growth TAZs surrounding the new interchanges. For example, shifting may occur as a result of new businesses such as medical, science and technology, engineering, manufacturing, assembly, distribution, gas stations, hotels, and restaurants which may choose to locate at these interchanges creating new jobs in the area. The Land Use Panel in Morgan County also determined that some of the no-build growth in Morgan County would shift due to the added accessibility of I-69 Section 6. The panel determined that this would result in the shift of 700 employees for Alternative C2 and 400 employees for Alternatives C1, C3, C4, and the RPA. The panel also determined that 160 housing units would shift. The effects of these shifts in growth are reflected in the TAZ induced growth in **Table 5.24-4** and **Figure 5.24-3** through **Figure 5.24-6**.

Step 1G: Convert the growth into acres of developed land uses based on values from “Trip Generation – 6th Edition” from the Institute of Transportation Engineers (ITE), 1997.

The number of induced housing units and new jobs was converted to acres of induced new development based on the following assumptions:

Since Tier 1, the economic analysis determined that within Hendricks, Johnson, Marion, and Morgan counties the average number of dwelling units per acre was 4.38. This estimate was based on a combination of three single-family dwelling units per acre and seven multi-family units per acre, weighted by the percent of single-family verses multi-family units. This estimate was recently reconfirmed and is used in this analysis.

The Tier 1 economic analysis determined that within the counties of Hendricks, Johnson, Marion, and Morgan, the average number of jobs per acre was 14.6. The Tier 1 economic analysis for jobs was based on a weighted average of the standard employees per acre by employment type. The data for employees per acre, per employment type were developed from the ITE Trip Generation Manual 6th Edition,¹³ and are as follows: 18.5 employees per acre for Durable Manufacturing and Non-Durable Manufacturing jobs; 8.2 employees per acre for Mining, Construction, Transportation Public & Utilities, and Agricultural Service jobs; 55.8 employees per acre for Finance, Insurance, Real Estate, and Services jobs; 8.7 employees per acre Retail Trade jobs; and 14.7 employees per acre for Wholesale Trade jobs.

The forecasted 947 new housing units in I-69 Section 6 for Alternatives C1, C3, C4, and the RPA would require conversion of 216.2 acres, and the forecasted 1,748 jobs would require conversion of 119.5 acres. Combined, a total of 335.7 acres of indirect land use changes are

¹³ These ratios were confirmed using the most recent (9th Edition, 2012) of the ITE Trip Generation Manual.



anticipated to occur as a result of Alternative C1, C3, C4, or the RPA. The forecasted 945 new housing units in I-69 Section 6 for Alternative C2 would require conversion of 215.7 acres, and the forecasted 2,046 jobs would require conversion of 140.0 acres. Combined, a total of 355.7 acres of indirect land use changes are anticipated to occur as a result of Alternative C2. The geographic scope of the cumulative impact analysis for I-69 Section 6 overlaps with that of adjacent Section 5 of I-69. As a result, some cumulative impacts would be counted in both Tier 2 EISs.

Step 1H: Determine which resources will be impacted by these changes in land use in each TAZ.

Farmland, forest, streams, and wetlands are the principal resources that the project's indirect land use changes would potentially affect. I-69 Section 6 is more developed than Sections 1 through 4, where it was anticipated that all induced growth would occur on farmland or forests. Long-term development patterns (in particular, where and how development occurs) would be similar to the more developed Section 5. Due to the existing development patterns, the amount of "available" farmland or forest is limited in some TAZs, and induced growth would result in some higher densities on already developed lands. A conservative estimate of the amount of available farmland and forested land was developed based on 2011 NLCD in each TAZ with induced development.

As previously described, percentages of land use types for undeveloped land were analyzed for TAZs forecasted to receive induced growth. Based on this analysis, percentages of induced development on undeveloped land are forecasted as follows: Hendricks County 80 percent farmland and 20 percent forested land; Johnson County 85 percent farmland and 15 percent forested land; Marion County 90 percent farmland and 10 percent forested land; and Morgan County 60 percent farmland and 40 percent forested land.

The equivalent of 336 acres of induced growth would be anticipated for Alternatives C1, C3, C4, and the RPA, and 356 acres for Alternative C2. Of this, the equivalent of 65 acres (Alternatives C1, C3, C4, and the RPA) and 83 acres (Alternative C2) of induced development would result in higher densities on already developed land. The remaining 272 acres (Alternatives C1, C3, C4, and the RPA) and 273 acres (Alternative C2) of induced growth would result in the conversion of agricultural lands and forests to housing units and employment areas (see **Table 5.24-3**).

In Hendricks County, the predicted impact is 25 acres of agricultural land and 6 acres of forest impacts for all build alternatives. In Johnson County, the predicted impact is 35 acres of agricultural land and 6 acres of forest impacts for all build alternatives. In Marion County, the predicted impact is 66 acres of agricultural land and 7 acres of forest impacts for all build alternatives. In Morgan County, the predicted impact is 83 acres of agricultural land and 44 acres of forest impacts in Alternatives C1, C3, C4, and the RPA, and 81 acres of agricultural land and 47 acres of forest impacts in Alternative C2. Collectively in the TAZs that are anticipated to experience induced growth, agricultural lands and forest are the predominant land uses, with ranges between 24 and 57 percent (see **Table 5.24-2**).

**Step 1I: Use these indirect impacts to the resources in the cumulative impact analysis.**

The cumulative impact analysis includes the consideration of direct and other impacts to farmland, forests, streams, and wetlands, as well as the indirect impacts quantified above.

2. Establish the geographic scope for the analysis

The I-69 Section 6 study area used for both the economic impact analysis (**Section 5.5**) and this cumulative impact analysis is different than the year 2010 Census Block Group or Census Tract boundaries that define the socioeconomic study area in other sections of this document. The study area defined for the cumulative impacts analysis is referred to as the “geographic scope,” which for I-69 Section 6 consists of Hendricks, Johnson, Marion, and Morgan counties. The geographic scope is also referred to as the indirect impact study area, which includes all 1525 TAZs within Hendricks, Johnson, Marion, and Morgan counties. Of these TAZs, 55 (Alternatives C1, C3, C4, and the RPA) and 54 (Alternative C2) are projected to experience induced growth with each of the build alternatives (see **Figure 5.24-3** through **Figure 5.24-6**).

Maps of TAZs within Hendricks, Johnson, Marion, and Morgan counties were used to identify where project-induced land use changes would be expected to occur. The number of new homes and new jobs by the year 2045 were forecasted by TAZ for both the no-build scenario and for the build scenario.

The Land Use Panel, described in Step 1C above, was consulted to analyze project impacts within the geographic scope. These local representatives used knowledge of local property conditions, development patterns, vacant land development constraints, vacant lots, and availability of infrastructure to establish the anticipated magnitude of population and employment growth by TAZ. Maps of the TAZs within Hendricks, Johnson, Marion, and Morgan counties were presented to the Land Use Panel for verification or revision and to determine the probable location and order of magnitude of the growth in population and employment. The panel gave specific consideration to the areas surrounding proposed interchanges as having high potential for development.

The information provided by the Land Use Panel helped to determine which TAZs would be more likely to experience future growth as a result of I-69 Section 6. As described in Steps 1D through 1F above, the panel allocated the induced growth to TAZs, distributing the forecasted households and employment induced growth among the 1525 TAZs in Hendricks, Johnson, Marion, and Morgan counties. The panels allocated this growth to 55 TAZs (Alternatives C1, C3, C4, and the RPA) and 54 TAZs (Alternative C2), generally in the vicinity of the proposed interchanges. See **Figure 5.24-3** through **Figure 5.24-6**. For the purpose of estimating the induced growth caused by each build alternative in I-69 Section 6, the Land Use Panel assumed that the following interchanges would be constructed:

- Alternatives C1, C3, C4, and the RPA: SR 39, Ohio Street, SR 252 and SR 44, Henderson Ford Road, SR 144, Smith Valley Road, County Line Road, Southport Road, and I-465.



- Alternative C2: SR 39, SR 252 and SR 44, Henderson Ford Road, SR 144, Smith Valley Road, County Line Road, Southport Road, and I-465.

The Land Use Panel also provided insight on where land use changes would likely occur with the no-build scenario. As expected, the build scenario shows more employment and housing than the no-build scenario for the four-county area.

3. Establish the time frame for the analysis.

The period for this cumulative impact analysis includes historical, current, and future (to year 2045). Available information has guided the extent of the past analysis. Information for farmland was available beginning with the year 1900. Information for forests and wetlands were estimated for the past 200 years. Stream data was available from the past 100 years.

The year 2045 is the future analysis horizon for the transportation modeling and the population and employment forecasts, and is therefore the time horizon for the Tier 2 cumulative effects analysis. The Tier 2 process used the same base traffic modeling tools as the Tier 1 study. The I-69 Section 6 project used the TREDIS model to provide updated economic development forecasts for the I-69 Section 6 forecast year (2045). The Tier 1 economic forecasts did not extend past the year 2035. The various GIS layers of information used in Tier 1 have been updated with new information, which was used in the cumulative impacts analysis for Tier 2.

4. Identify other actions affecting the resources, ecosystems, and human communities of concern.

The analysis of cumulative impacts for Tier 2 I-69 Section 6 considered the I-69 direct and indirect impacts as well as the impacts from other major federal, state, and private sector actions in the study area not related to the I-69 project.

Foremost among the “other actions” that would affect the geographic scope are the normal changes and natural growth in both population and employment that are expected to occur by the year 2045 whether I-69 is built or not. These population and employment forecasts form the baseline condition for land use changes by 2045. The “no-build” population forecasts¹⁴ have been determined based on birth rate, death rate, in migration, and out migration, and are independent of the I-69 project. This component of growth is referred to in this chapter as “other projected growth.” **Table 5.24-5** is based on the change from base year 2010 TAZs to the 2045 no-build TAZ forecasts.

¹⁴ The “no-build” term refers only to the assumption regarding construction of the new I-69 highway. The normal growth and minor incremental changes expected during the time period, referred to here as “other projected growth,” are understood to be included in the “no-build” scenario, but not any growth induced by the construction of I-69 or the major “other” projects discussed in this chapter.



Table 5.24-5: Other Projected Growth in I-69 Section 6 Geographic Scope (No-Build Scenario)

Projected Growth	Hendricks	Johnson	Marion	Morgan	Totals
Year 2010 (by TAZ)					
Population	145,447	139,654	903,393	68,894	1,257,388
Households	52,367	52,242	366,176	25,765	496,550
Total Employment	74,959	65,149	642,525	18,923	801,556
Year 2045 (by TAZ)					
Population	256,403	198,080	1,048,371	74,446	1,577,300
Households	90,755	74,056	405,131	28,716	598,658
Total Employment	146,521	135,376	818,595	25,843	1,126,335
Increase by Year 2045					
Population	110,956 (76%)	58,426 (42%)	144,978 (16%)	5,552 (8%)	319,912 (25%)
Households	38,388 (73%)	21,814 (42%)	38,955 (11%)	2,951 (11%)	102,108 (21%)
Total Employment	71,562 (95%)	70,227 (108%)	176,070 (27%)	6,920 (37%)	324,779 (41%)

Source: Lochmueller Group TAZ Shapefiles, June 2016 (Year 2010) and July 2016 (Year 2045)

As shown in **Table 5.24-5** the I-69 Section 6 geographic scope would see a 25 percent increase in population, a 21 percent increase in households, and a 41 percent increase in total employment with the no-build scenario.

Using the same land conversion ratios presented in Step 1G of the indirect impact analysis (above), estimates were prepared for the amount of undeveloped land that would need to be converted to accommodate these totals of new households and employment expected to occur with the no-build scenario, whether I-69 is constructed or not. The Land Use Panel reviewed the TAZ maps to provide insight on where these land use changes would likely occur.

Table 5.24-6 computes “total acres for no-build growth (unconstrained).” A detailed review of the TAZs where this growth was forecasted to occur indicated that applying these factors in 30 of the Hendricks County TAZs, 55 of the Johnson County TAZs, 602 of the Marion County TAZs, and 51 of the Morgan County TAZs resulted in forecasted impacts to land use which exceed the availability of undeveloped land, as shown in the year 2011 NLCD.

For this analysis, it was assumed (for those TAZs where the forecasted impacts to open land exceeded the available amount of open land) that the added population and employment would use all available open (non-developed) land, but that these TAZs would also see developed land go to a higher level of development. For example, single-story office buildings may be replaced by a two- or three-story office building. The 1,077 acres subtracted from the “unconstrained” no-



build growth in Hendricks County, the 1,565 acres in Johnson County, the 14,992 acres in Marion County, and the 137 acres in Morgan County takes into account that population and employment growth in a TAZ can affect no more than the remainder of any available land. **Appendix V** provides more details about these calculations.

Table 5.24-6: Land Use Changes by 2045 for the No-Build Scenario

Land Use Changes	Hendricks	Johnson	Marion	Morgan	Totals
Increase in Households	38,388	21,814	38,955	2,951	102,108
Acres for New Housing *	8,765	4,981	8,896	674	23,316
Increase in Employment	71,562	70,227	176,070	6,920	324,779
Acres for New Employment **	4,901	4,810	12,089	474	22,274
Total Acres for No Build Growth (Unconstrained)	13,666	9,791	20,985	1,148	45,590
Equivalent Development Acres in TAZs without Open Land	-1,077	-1,565	-14,992	-137	-17,771
Total Acres of No-Build Growth (Constrained)	12,589	8,226	5,993	1,011	27,819

*Utilized 4.38 units/acre.

**Utilized 14.6 jobs/acre.

Foreseeable Future Actions

Information on other major development projected to occur (whether or not the project is constructed) was obtained through a review of local land use plans where such plans exist and from discussions with representatives of local governments, local and regional economic development groups/agencies, and major employers. The results of this review indicated “other” reasonably foreseeable major future actions (by the year 2045) that could add to potential direct and indirect impacts of this project. Projects included in the Indiana Statewide Transportation Improvement Plan and Indianapolis MPO Transportation Improvement Plan in 2016 when the analysis was completed are included. See **Appendix Y** for a complete list of projects.

- I-69 Evansville to Indianapolis: Section 5.** The March 2004 Tier 1 Record of Decision (ROD) selected a corridor for I-69 between Evansville and Indianapolis. In addition, the Tier 1 ROD divided the Evansville to Indianapolis project into six separate sections for more detailed Tier 2 studies. Section 5 begins at the intersection of Victor Pike Road and SR 37 in Monroe County, and ends at the Indian Creek Bridge south of Martinsville in Morgan County, which is the beginning of I-69 Section 6. All traffic modeling conducted for the I-69 Evansville to Indianapolis project assumes that this project would be completed. It currently is under construction, and is expected to open to traffic in 2018.

The I-69 Section 6 geographic scope consists of Hendricks, Johnson, Marion, and Morgan counties. Potential direct impacts to the four identified resources within the I-69 Section 6 geographic scope as a result of the Section 5 project (based on Table 6-8 in the Section 5 FEIS) are:



- Farmland 44.3 acres
- Forests 40.45 acres
- Wetlands 0.28 acres (not including open water features)
- Streams 19,900 linear feet

These direct impacts would be offset by mitigation measures incorporated into the Section 5 project, with both forest and wetland impacts being mitigated at ratios greater than 1 to 1. The totals presented in this I-69 Section 6 cumulative impact analysis do not include mitigation in Section 5.

- **Limestone and Sand/Gravel Quarrying.** There are active limestone and sand/gravel quarries in the project area, as described in **Section 5.15**. Active quarry sites are Hanson Aggregates, Irving Materials, and Jones Gravel Pit. The impacts of these active quarries to forest and agricultural land are included as other projected growth in the cumulative impact analysis.
- **Tax Increment Finance (TIF) Districts.** TIF is a type of financing that permits local governments to finance the redevelopment of target areas and enhance the economic development of rapidly developing areas. Land Use Panel members took TIF districts into consideration when allocating growth. Additional TIF district context is provided in **Section 2.3.4**. For I-69 Section 6, 11 TIF districts have been identified as relevant to the I-69 project. Among these, four are in the City of Martinsville and four are located just outside the city limits in Morgan County (described below). **Figure 4.2-8** depicts the location of the 11 TIF Districts. Information on the TIF Districts was obtained from the Indiana Gateway for Local Government TIFViewer website.¹⁵ All values are as of September 19, 2017.
 - *Ohio Street (City of Martinsville) TIF.* This TIF District is located on the south side of Martinsville. The TIF District runs along the west side of Ohio Street to Poston Road. From that intersection, the TIF areas are located on the east side of Ohio Street to York Street. The District includes Artesian Square Shopping Center, the site of the former Harman-Becker plant and Twigg Corp. The Ohio Street TIF District includes 37 properties and a base value \$18,363,000.
 - *Morgan Street (City of Martinsville) TIF.* The Morgan Street TIF District is located the along Morgan Street from SR 39 east to SR 37. The depth of the TIF from the Morgan Street varies from one half block to six blocks deep along Main Street. It includes downtown Martinsville, Morgan Hospital, Medical Center, and the Morgan County Fairgrounds. The Morgan Street TIF District includes 393 properties and a base value of \$33,615,000.
 - *SR 39 (City of Martinsville) TIF.* The SR 39 TIF District is located near the southern limits of Martinsville. The district runs along SR 39/Morton Avenue

¹⁵ <http://gateway.ifionline.org/TIFviewer>



from the SR 39/SR 37 split, north and east along Morton Avenue, then north of SR 39 to Morgan Street. The SR 39 TIF District includes 260 parcels and a base value of \$30,381,000.

- *Southeast 37 (City of Martinsville) TIF.* The Southeast 37 TIF District is located along the south side of SR 37 between Mahalasville Road and the northern terminus of Birk Road. This district includes the Grand Valley Boulevard shopping area and a variety of other restaurants and retail establishments. The district includes 60 parcels and a base value of \$38,819,000.
- *Eagle Valley (Morgan County) TIF.* The Eagle Valley TIF District is located north of Martinsville, to the west of the intersection of SR 67 and Centerton Road/Robb Hill Road. The property contained in the TIF district is associated with the Indianapolis Power and Light (IPL) electric generation plant. This district includes 18 properties and a base value of \$30,823,000.
- *Henderson Ford Interchange (Morgan County) TIF.* The Henderson Ford Interchange TIF district is located at the intersection of SR 37 and Henderson Ford Road. North of SR 37, the TIF runs along either side of Henderson Ford Road. On the south side of SR 37, the district is only present on the east side of Henderson Ford Road. There are 11 properties in the district and base value of \$1,079,000.
- *Old Morgan Town Road (Morgan County) TIF.* The Old Morgan Town Road TIF District is located along north side of Indiana Highway 252, 1 mile east of SR 37. There are two properties in the district and a base value of \$123,000.
- *Waverly (Morgan County) TIF.* The Waverly TIF District is located near the intersection of SR 37 and Waverly Road. The TIF boundaries extend into the north, east and south quadrants of this intersection. The TIF District also extends north to an area between the White River and Old SR 37. This is the area identified for development of the Old Town Waverly Park. There are 60 properties in the district and a base value of \$1,543,000.
- *Mooreville Redevelopment Area TIF.* The Mooreville Redevelopment Area TIF is located along State Roads 42, 67, 144, and 267. It includes much of the Town of Mooreville. There are 630 properties in the district with a base value of \$36,607,000.
- *Mooreville Redevelopment and Economic Development Area Expanded TIF.* The Mooreville Redevelopment and Economic Development Area Expanded TIF is located along and near to SR 67 south of the Town of Mooreville. There are 90 properties in the district with a base value of \$9,436,000.
- *West Point TIF.* The West Point TIF is located in northwest Morgan County near Exit 69 on I-70. There are three properties in the district with a base value of \$227,000.



5. Characterize the resources, ecosystems, and human communities of concern and explain how they have historically changed.

Based on coordination with resource agencies during Tier 1 and Tier 2, the resources potentially affected in I-69 Section 6 are farmland, forest, streams, and wetlands. Baseline reports for each resource were evaluated to analyze the quantitative historic changes for each resource in the four counties of the I-69 Section 6 study corridor. (Refer to the discussion of these specific resources in **Chapter 4, Affected Environment**, and **Chapter 5, Environmental Consequences**, for their respective baseline data sources.) Data for a baseline analysis were unavailable at the TAZ level. The best available data are at the county level.

The following data give historic trends for farmland, forests, wetlands, and streams for each county, which does not include changes from the direct or indirect impacts of I-69. Future trends for these resources are discussed in Step 7.

Farmland

This cumulative effects analysis focuses on the direct, indirect, and other changes in agricultural land resulting from road construction. Past trends in agricultural land in farms and future projections were evaluated to analyze these changes. **Figure 5.24-7** shows acres of farmland in Hendricks, Johnson, Marion, and Morgan counties from 1974 to present, and a projection (from a linear regression analysis) of acres of land in farms to the year 2045.

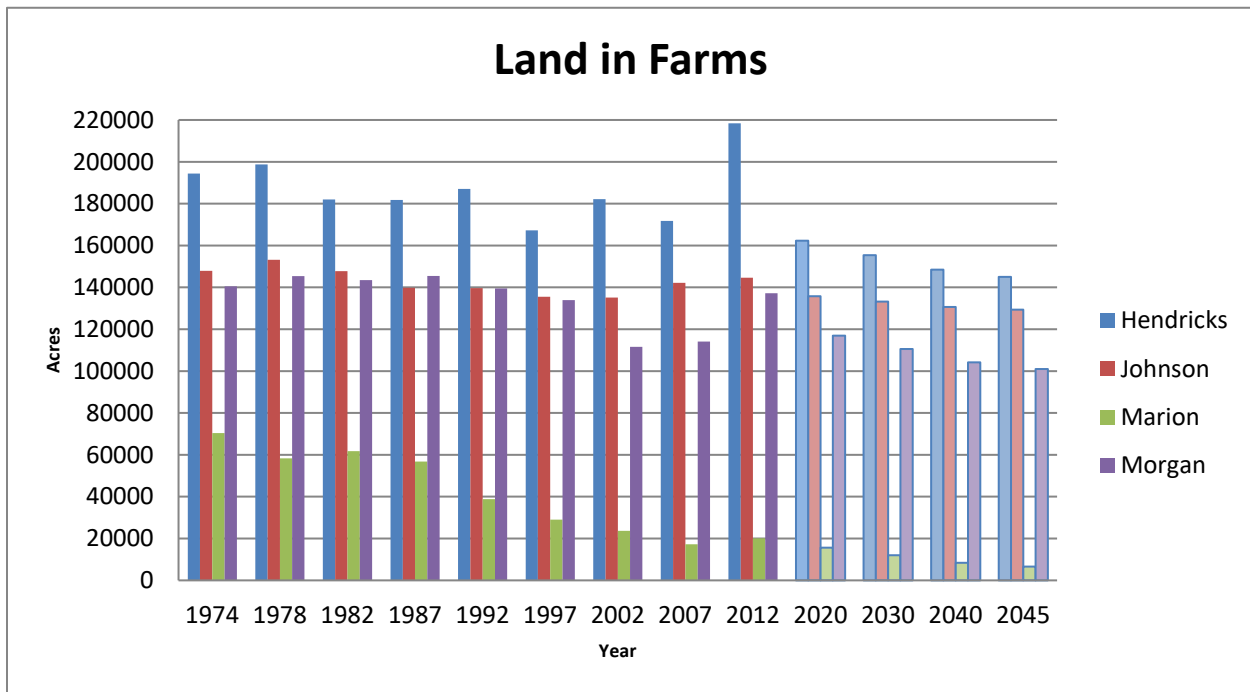
Between 1974 and 2016 in Hendricks County, the acres of land in farms decreased by 22,666 acres, or 12 percent (from 194,407 to 171,741 acres). The data from 2020 onward are taken from a linear regression of historic data. This forecast for Hendricks County projects the acres of land in farms to decrease from 171,741 acres in 2007 to 145,021 acres in 2045, a loss of approximately 26,720 acres or 16 percent.¹⁷

From 1974 to 2012, Johnson County experienced a 2 percent reduction in farmland acreage. The forecast for Johnson County projects the acres of land in farms to continue to decrease from 144,646 in 2012 to 129,365 by 2045, a loss of an additional 11 percent.

¹⁶ The U.S. Agricultural Census published a 2012 farmland acreage for Hendricks County of 218,398 acres. This is an increase of over 46,000 acres (more than 27%) during a five-year period when significant development continued to occur in Hendricks County. The reported 2012 farmland acreage was much larger than the 194,407 acres reported in 1974 (the largest acreage reported during the last 40 years). This 2012 acreage was disregarded in making forecasts of future trends in farmland acreage, which were made based upon data from 2007 and earlier years.

¹⁷ Source: U.S. Agricultural Census 1974 through 2012.

Figure 5.24-7: Land in Farms by County - History and Trends



Source: U.S. Agricultural Census 1974 through 2012, Lochmueller Group Inc. linear regression projections for years 2020 through 2045

Note: Shaded bars identify forecasted acreages for future years

From 1974 to 2012, Marion County experienced a 71 percent reduction in farmland acreage. The forecast for Marion County projects farmland acreage to continue to decrease from 20,075 in 2012 to 6,589 by 2045, a loss of an additional 67 percent.¹⁸

From 1974 to 2012, Morgan County experienced a 2 percent reduction in farmland acreage. The forecast for Morgan County projects the acres of land in farms to continue to decrease from 137,189 in 2012 to 100,992 by 2045, a loss of an additional 26 percent.

These data and straight-line projection forecasts provide baseline trends and projections of farmland for each county. They do not include changes resulting from the direct or indirect impacts of I-69 or other future activities. A survey of land in farms in 2012, by the United States Agricultural Census, identified a total of 520,308 acres of agricultural lands in the four counties that represent the geographic scope in I-69 Section 6, as follows

¹⁸ Farmland acreage in Marion County decreased significantly between 1974 and 2002, from 70,396 acres in 1974 to 23,692 acres in 2002. The rate of decrease in farmland in Marion County significantly lessened in subsequent years; 2012 farm acreage in Marion County was 20,075. For forecasting future trends in farmland, only acreages between 2002 and 2012 were used.



- Hendricks County – 218,398 acres
- Johnson County – 144,646 acres
- Marion County – 20,075 acres
- Morgan County – 137,189 acres

Forests

Approximately 4.5 million acres, or 20 percent, of Indiana is forested. Most forests are located in the southern half of the state (Tormoehlen et al., 2000). As noted in the Tier 1 FEIS (*Appendix G*), 200 years ago forests covered about 85 percent of Indiana land area. As farming became a central part of the Indiana economy, forests began to be replaced by farmland. Estimates indicate that by the mid-1800s, Indiana had lost almost 50 percent of its forest land. However, as the data in the Tier 1 FEIS showed, in southwestern Indiana between 1950 and 1998 forests increased from 1,904,000 to 2,026,500 acres (6.4 percent). A survey of Indiana forests, published by the United States Department of Agriculture (USDA) Forest Service identified a total of 129,700 acres of forest in the four counties in the I-69 Section 6 study area in the year 1998, as follows:

- Hendricks County – 20,500 acres
- Johnson County – 23,200 acres
- Marion County – 2,100 acres
- Morgan County – 83,900 acres

These data define forest as follows: “Land that is at least 1 acre in area, 120 feet wide, and 10 percent covered by trees of any size.”¹⁹

Beginning in 2001, the Analysis of National Land Cover Database (NLCD 2011) became available. It is published by the Multi-Resolution Land Characteristics (MLRC) Consortium under the auspices of the United States Geological Survey (USGS). NLCD serves as the definitive Landsat-based, 30-meter resolution, land cover database for the Nation. NLCD provides spatial reference and descriptive data for characteristics of the land surface such as thematic class (for example, urban, agriculture, and forest), percent impervious surface, and percent tree canopy cover.²⁰ It provides data at a 30-meter resolution (approximately 0.22 acre). NLCD data are available for 2001, 2006, and 2011.

Due to the higher level of resolution in the NLCD, it generally shows higher levels of forest acreage than the data cited in the Tier 1 FEIS. Following are the acreages for the four-county area from the 2001 and 2011 NLCD. Projections for the year 2045 also are shown.

¹⁹ Tier 1 FEIS Appendix G, Cumulative Effects Issues Baseline Information for Forests Past, Present and Future, p. G-4.

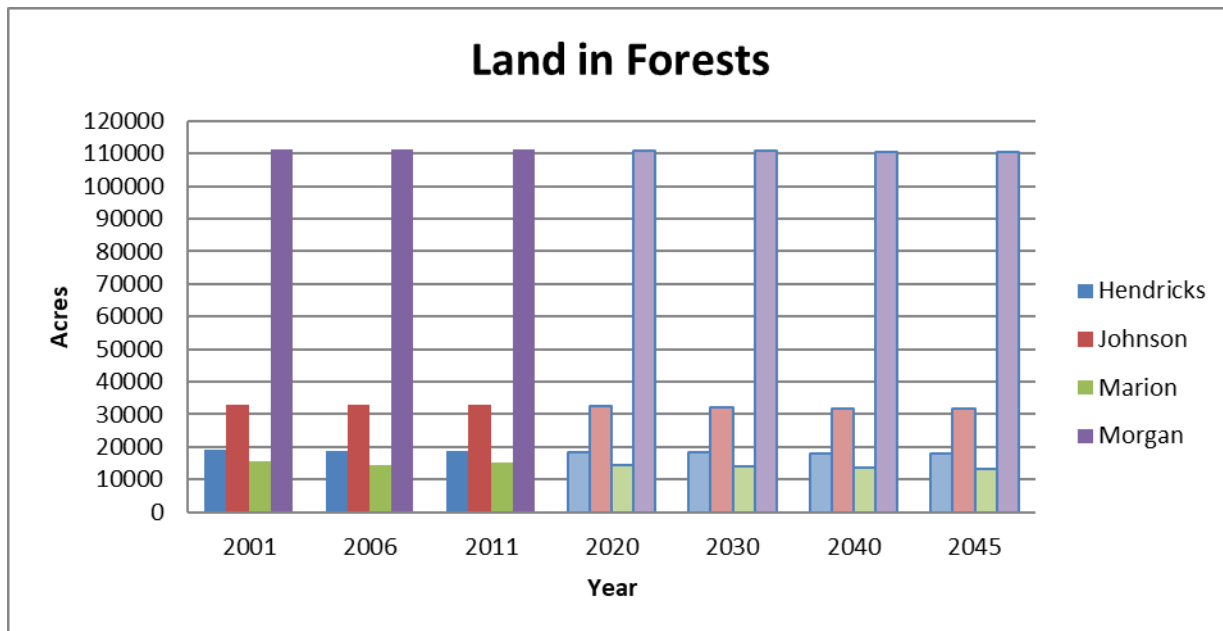
²⁰ NLCD Fact Sheet, at <http://pubs.usgs.gov/fs/2012/3020/>.



- Hendricks County forest acres – 19,100 (2001), 18,800 (2011), 17,800 (2045)
- Johnson County forest acres – 33,100 (2001), 32,800 (2011), 31,800 (2045)
- Marion County forest acres – 15,800 (2001), 15,300 (2011), 13,200 (2045)
- Morgan County forest acres – 111,400 (2001), 111,200 (2011), 110,500 (2045)

Figure 5.24-8 shows the land in forest in Hendricks, Johnson, Marion, and Morgan counties from 2001 to 2011, with projections through 2045.²¹ As noted in the Tier 1 FEIS, future trends of forests in the I-69 Section 6 study area are anticipated to be similar to that of the State of Indiana, i.e., it is expected that there would be little change in the total forestland.

Figure 5.24-8: Land in Forest - Hendricks, Johnson, Marion, and Morgan Counties



Source: National Land Cover Database

Note: Shaded bars identify forecasted acreages for future years

Wetlands

USFWS estimates that between 1780 and 1950, Indiana lost millions of acres of wetlands (see the Tier 1 FEIS Appendix H). There were 813,000 acres remaining in Indiana by the mid-1980s, according to the most recent and complete analysis by the Department of Natural Resources in 1991. The Indiana Wetlands Conservation Plan states that with the majority of wetland resources having been lost or converted, all remaining wetlands are important and should be considered important for conservation (IDNR, 1996). The stresses on wetlands include impacts to water

²¹ Sources: 2001 to 2011, NCLD; Lochmueller Group linear regression projections for years 2020 through 2045.



quality, alterations of water levels, and other surface disturbances. As a result, the biological diversity of Indiana’s natural wetlands has been degraded. Of all wetland types, the palustrine forested (PFO) wetlands (bottomland hardwoods) have been identified in Indiana as the state wetland priority type (IDNR, 1988).

The Tier 1 FEIS (*Appendix H*) identified a total of 18,401 acres in wetlands for Hendricks, Johnson, Marion, and Morgan counties:

- Hendricks County – 2,763 acres
- Johnson County – 4,246 acres
- Marion County – 3,560 acres
- Morgan County – 7,832 acres

These acreages are expected to be similar today. The wetlands in these areas generally are in floodplains, which developers typically avoid. In addition, state and federal regulations, along with the requirements of the Clean Water Act and the IDNR goal of “No Net Loss” for wetlands have curbed their loss. Programs such as the Wetland Reserve Program are expected to increase wetland acreages.

An INWRAP evaluation of wetlands within the right of way of I-69 Section 6 alternatives is included in **Appendix E**. There is no county-by-county level information that can serve as the basis of forecasting future wetland trends. Current mitigation measures generally require between a 2 to 1 and a 4 to 1 replacement for any wetland loss, depending upon the quality of the wetland impacted. These measures both reduce the amount of existing wetland being drained and increase the overall wetland acreage for the area.

Streams

The Upper White River is the major watershed traversed by the project corridor. Information regarding water quality in this major watershed and its sub-watersheds within the project corridor is summarized below.

Upper White River Watershed

All the streams crossed by the project are within the Upper White River watershed. These streams are tributaries to the White River, which drains to the Wabash River. Several streams in the watershed are included in the State of Indiana Draft 2014 CWA Section 303(d) list of impaired water bodies (IDEM, 2014), including the White River, State Ditch, Pleasant Run Creek, Crooked Creek, and Stotts Creek. The alternatives cross all of these impaired streams.

State Ditch is listed as impaired due to *Escherichia coli* (*E. coli*) bacteria and impaired biotic communities. The White River is listed as impaired due to nutrients, free cyanide, polychlorinated biphenyls (PCBs), and impaired biotic communities. Pleasant Run Creek is listed as impaired due to *E. coli* and impaired biotic communities. Crooked Creek and Stotts



Creek are listed as impaired due to *E. coli*. **Section 5.19.3** identifies major streams and tributaries within the right of way of each alternative.

- **State Ditch:** The State Ditch sub-watershed encompasses approximately 6,863 acres. This sub-watershed drains the northwestern terminus of I-69 Section 6 east to just west of the White River along I-465. There are no National Pollutant Discharge Elimination System (NPDES) discharge points in this sub-watershed.
- **Lick Creek–Beech Creek:** The Lick Creek–Beech Creek sub-watershed encompasses approximately 9,765 acres. This sub-watershed drains the northeastern terminus of I-69 Section 6 west to just west of Bluff Road along I-465. There are no NPDES discharge points in this sub-watershed.
- **White River–Hide Creek:** The White River–Hide Creek sub-watershed encompasses approximately 10,128 acres. This sub-watershed drains the northern 1.57 miles of I-69 Section 6 from the I-465 interchange to Banta Road. There is one NPDES discharge point in this sub-watershed located on the White River.
- **Little Buck Creek (Southport):** The Little Buck Creek (Southport) sub-watershed encompasses approximately 11,073 acres. This sub-watershed drains I-69 Section 6 from Banta Road south to Southport Road. There is one NPDES discharge point in this sub-watershed located on Little Buck Creek.
- **White River–Mann Creek/Harness Ditch:** The White River–Mann Creek/Harness Ditch sub-watershed encompasses approximately 8,684 acres. This sub-watershed drains I-69 Section 6 from Southport Road south to just north of Wicker Road. There are no NPDES discharge points in this sub-watershed.
- **Pleasant Run Creek–Buffalo Creek:** The Pleasant Run Creek–Buffalo Creek sub-watershed encompasses approximately 15,111 acres. This sub-watershed drains I-69 Section 6 from just north of Wicker Road south to just south of Fairview Road. There are no NPDES discharge points in this sub-watershed.
- **Honey Creek–Turkey Pen Creek:** The Honey Creek–Turkey Pen Creek sub-watershed encompasses approximately 11,853 acres. This sub-watershed drains I-69 Section 6 from just south of Fairview Road south to Smith Valley Road. There are no NPDES discharge points in this sub-watershed.
- **White River–North Bluff/Bluff Creeks:** The White River–North Bluff/Bluff Creeks sub-watershed encompasses approximately 10,140 acres. This sub-watershed drains I-69 Section 6 from Smith Valley Road south to just north of Whiteland Road. There is one NPDES discharge point in this sub-watershed located on Travis Creek.
- **White River–Sinking Creek:** The White River–Sinking Creek sub-watershed encompasses approximately 8,976 acres. This sub-watershed drains I-69 Section 6 from just north of Whiteland Road south to just north of Crooked Creek. There are no NPDES discharge points in this sub-watershed.

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- Crooked Creek–Banta Creek: The Crooked Creek–Banta Creek sub-watershed encompasses approximately 10,179 acres. This sub-watershed drains I-69 Section 6 from just north of Crooked Creek south to Perry Road. There are no NPDES discharge points in this sub-watershed.
- White River–North Tributary (Centenary Church): The White River–North Tributary (Centenary Church) sub-watershed encompasses approximately 4,533 acres. This sub-watershed drains I-69 Section 6 from Perry Road south to Stotts Creek. There are no NPDES discharge points in this sub-watershed.
- Stotts Creek–Exchange: The Stotts Creek–Exchange sub-watershed encompasses approximately 2,897 acres. This sub-watershed drains I-69 Section 6 at the confluence of Stotts Creek and the White River. There are no NPDES discharge points in this sub-watershed.
- White River–Henderson Bridge: The White River–Henderson Bridge sub-watershed encompasses approximately 3,743 acres. This sub-watershed drains I-69 Section 6 from Stotts Creek south to Egbert Road. There are no NPDES discharge points in this sub-watershed.
- Clear Creek–East/West/Grassy Forks: The Clear Creek–East/West/Grassy Forks sub-watershed encompasses approximately 14,666 acres. This sub-watershed drains I-69 Section 6 from Egbert Road south to SR 44. There are no NPDES discharge points in this sub-watershed.
- Indian Creek–Sand Creek: The Indian Creek–Sand Creek sub-watershed encompasses approximately 7,835 acres. This sub-watershed drains I-69 Section 6 from SR 44 south to the southern terminus of I-69 Section 6. There are no NPDES discharge points in this sub-watershed.
- White River–Martinsville: The White River–Martinsville sub-watershed encompasses approximately 10,072 acres. This sub-watershed drains I-69 Section 6 west of SR 37 in Martinsville near proposed access roads adjacent to Rogers Road and Morton Avenue. There is one NPDES discharge point in this sub-watershed located south of Rogers Road.

IndianaMap stream data shapefiles were used to estimate the total length of streams within the four-county area. There are approximately 12,495 miles (65,696,000 linear feet) of streams within the four counties, distributed as follows:

- Hendricks County – 3,244 miles (17,126,000 linear feet)
- Morgan County – 3,339 miles (17,628,000 linear feet)
- Johnson County – 2,556 miles (13,496,000 linear feet)
- Marion County – 3,356 miles (17,719,000 linear feet)



6. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds.

Farmland

The conversion of agricultural land to urban development has been the result of several demographic trends including more single person households, smaller households, bigger commercial facilities, and larger, single level industrial plants. In light of this trend, the Natural Resources Conservation Service (NRCS) Agricultural Conservation Easement Program (ACEP) works cooperatively with state, tribal, and local government entities, and non-governmental organizations to help them protect working agricultural lands and limit non-agricultural uses of the land.

Forest

Over the past 50 years, forests have been increasing in Indiana. Changing land management practices are contributing to this trend of increased forestation as some cropland and pasture land are allowed to revert to forest and existing narrow wooded strips are 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. Although total amounts of forest have been increasing, development pressures stress forests, and the fragmentation of forest areas by development adversely affects some wildlife species and benefits others. 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 would be affected if these forests decline or continue to become fragmented.

The goal of the USDA Forest Service is to continue the conservation programs and protect the forests. In the four-county geographic scope, agriculture and commercial and residential development have been and continue to be the principal stressors of this resource.

Wetlands

In the four-county geographic scope, agriculture and to a lesser extent residential and commercial development have been and continue to be the principal stressors of wetland resources. This includes the use of fertilizers, insecticides, and pesticides, and the presence of contaminated runoff from agricultural operations, all of which contribute to water quality impacts. Also, in Marion and Johnson counties along the SR 37 corridor south of I-465, urbanization has been extending southward from Indianapolis, further stressing this resource.

Streams

Within the corridor, portions of Haueisen Ditch, Lick Creek, North Buck Creek, Sartor Ditch, and unnamed tributaries of multiple streams (Bluff Creek, Indian Creek, Sartor Ditch, Travis Creek, West Fork Clear Creek, and White River) have been channelized and/or artificially drained. Stream channelization increases soil erosion, turbidity (with siltation), water temperature, risks to public health, and degradation to habitat and water quality. Additional



stresses on these waterways, as well as on others in the corridor, include sewage (particularly in locations where septic systems operate poorly or are not maintained properly), agricultural runoff, contaminated road salt in surface water runoff from roadways/parking areas, and other industrial practices such as mineral quarry activities.

7. Define a baseline condition for the resources, ecosystems, and human communities.

Farmland

The future trend for agricultural land in the four-county geographic scope is continued loss of land in farms. A linear regression analysis for land in farms in the study area from 1974 to 2012 shows a downward trend (see **Figure 5.24-7**). At this rate, the land in farms in Hendricks, Johnson, Marion, and Morgan counties would be approximately 382,000 acres by 2045 representing a projected loss of approximately 27 percent of the total agricultural land from the year 2012. In terms of a loss per year of agricultural land, this decline is approximately 4,200 acres per year in the four counties.

Forest

The future trend for forests in Hendricks, Johnson, Marion, and Morgan counties seems to indicate that the increase in forest acres in recent decades has begun to plateau. That trend is expected to continue with little increase in forest acres anticipated for the foreseeable future (see **Figure 5.24-8**).

Wetlands

Appendix E contains detailed INWRAP data on 53 of the wetland complexes (67 individual polygons) that would be impacted by the alternatives, including a description of each wetland and its rating (“poor,” “fair,” or “good”) for quality of animal habitat, botanical measures, and hydrology. No quality assessments were completed on wetland complexes consisting entirely of open waters. **Table 5.19-7** lists the general quality of each wetland or wetland complex and provides a comparison of wetlands affected by each proposed alternative. **Table 5.24-7** includes the INWRAP evaluation ratings for animal habitat, botanical measures, and hydrology for each of the 67 wetland polygons potentially impacted by the project.

Table 5.24-7: INWRAP Evaluation Ratings for the 67 Wetland Polygons

Category	Poor	Fair	Good
Animal Habitat	33	30	4
Botanical	58	9	--
Hydrology	9	48	10



The general quality of the wetlands impacted by alternatives is poor to fair. The majority of the wetlands show poor to fair quality in their regard to animal habitat, poor to fair in botanical quality, and poor to good quality in their hydrology measure.

Streams

The Qualitative Habitat Evaluation Index (QHEI) and Headwater Habitat Evaluation Index (HHEI) have been completed on all streams within the project corridor, as appropriate. The QHEI/HHEI data and maps are provided in **Appendix L**. A total of 275 stream segments, including existing culverts, were identified in the I-69 Section 6 field survey study area. An assessment was completed for potentially impacted segments, as appropriate. Concrete gutters and roadside ditches were assessed, but no assessments were completed for the bridged or culverted segments. As the QHEI/HHEI scores indicate, approximately eight percent of streams crossed by the alternatives have at least moderate water quality. Only one of the 49 crossing locations (White River at I-465) using QHEI to score fell into the highest quality category. About nine percent of the HHEI scores (12 of the 132 stream segments) fell into the highest quality categories.

Perennial stream segments evaluated using HHEI include tributaries of Bluff Creek, Sartor Ditch, West Fork Clear Creek, and the White River. Intermittent stream segments include tributaries of Bluff Creek, Crooked Creek, Sartor Ditch, West Fork Clear Creek, and the White River. Ephemeral stream segments include tributaries of Bluff Creek, Crooked Creek, Indian Creek, Sartor Ditch, State Ditch, Buck Creek, a lake, Travis Creek, West Fork Clear Creek, and the White River.

The majority of the perennial streams met the criteria for evaluation using QHEI protocol. Bluff Creek, Clear Creek, Crooked Creek, Honey Creek, Indian Creek, Lick Creek, North Bluff Creek, Pleasant Run Creek, Sartor Ditch, State Ditch, Stotts Creek, Travis Creek, tributary of West Fork Clear Creek, tributary of White River, West Fork Clear Creek, Little Buck Creek, and White River are the perennial streams in the I-69 Section 6 corridor identified as being potentially impacted by the alternatives. These perennial streams are located throughout the I-69 Section 6 corridor. Haueisen Ditch, Little Buck Creek, Orme Ditch, Travis Creek, tributary of Indian Creek, and tributary of White River designated as intermittent streams on USGS mapping, were also assessed using the QHEI methodology. Ephemeral streams evaluated using QHEI include Haueisen Ditch and Orme Ditch.

Thirty-five of the 49 segments assessed using the QHEI method scored less than 51, indicating that the stream may be non-supportive of its aquatic life use designation. These segments include one or more portions of Bluff Creek, Clear Creek, Crooked Creek, Haueisen Ditch, Honey Creek, Lick Creek, Little Buck Creek, North Bluff Creek, Orme Ditch, Sartor Ditch, Travis Creek, tributary of Indian Creek, tributary of West Fork Clear Creek, tributary of White River, and West Fork Clear Creek.

The QHEI scores at the crossings of one or more portions of Clear Creek, Crooked Creek, Indian Creek, Pleasant Run Creek, State Ditch, Stotts Creek, Travis Creek, and West Fork Clear Creek



range from 51 to 61.5. This indicates that these 13 stream segments are only partially supportive of their aquatic life use designations.

The QHEI score at the segment of White River received a score of 64.5. Based on IDEM criteria, a score over 64 indicates that a stream may be capable of supporting a balanced warm water community.

8. Identify the important cause and effect relationships between human activities and resources, ecosystems, and human communities.

The four major resources considered in this cumulative effects analysis are farmland, forest, wetlands, and streams. The most common cause and effect issue is conversion of agricultural land, forests, and wetlands to other uses, (primarily residential and commercial development). Continued urbanization is occurring in Marion, Hendricks, and Johnson counties as part of the growth of the Indianapolis metropolitan area.

The following plans, some of which were developed in full or in part as a result of the I-69 Planning Grant Program, are applicable to the four-county indirect impact study area. These plans identify sensitive environmental areas and recommend further measures including zoning ordinances to protect water quality, ecosystems, and natural resources. For more details on these plans, see **Section 2.2.3**.

- Indianapolis 2035 Long Range Transportation Plan: 2017 Update
- Comprehensive Plan of Johnson County (2011)
- Johnson County Comprehensive Plan Update (2003 – East-West Corridor)
- 2016 Official Thoroughfare Plan for Marion County
- Comprehensive Plan for the City of Martinsville (2010)
- Morgan County Comprehensive Plan – Phase 1 and Phase 2 (2007 & 2010)
- SR 37/SR 144 Overlay Plan (2010)
- Morgan County SR 37/SR 144 Corridor Plan (2010)
- Mooresville Comprehensive Plan (2009)
- Town of Avon Thoroughfare Plan (2006)
- Plainfield Comprehensive Plan (2016)
- Hendricks County Quality Growth Strategy (2006)

Farming practices can adversely affect the ecosystem in certain situations. Land clearing can fragment or denude forested land. Tilling can lead to erosion and stream sedimentation. Irrigation runoff can deposit fertilizers, herbicides, and insecticides into streams and aquifers, thereby affecting water quality. Regarding conversion of forest and agricultural land for quarry



operations, there are no regulations requiring the reclamation of quarry lands. Therefore, no assumption is made that these lands would be restored to forest or agricultural use.

9. Determine the magnitude and significance of cumulative effects by identifying the changes in I-69 Section 6 as a result of I-69.

The cumulative changes (direct, indirect, and other) in I-69 Section 6 as a result of I-69 for each of the four identified resources are as follows:

Farmland

A survey of agricultural lands in 2012, by the U.S. Agricultural Census, identified a total of 520,308 acres of agricultural lands in the four counties in the I-69 Section 6 geographic scope.

Direct Farmland Impacts

The direct conversion of agricultural land to highway right of way is an estimated 263 acres for Alternative C1, 356 acres for Alternative C2, 254 acres for Alternative C3, 330 acres for Alternative C4, and 382 acres for the RPA (see **Table 5.4-7**). The I-69 Section 6 mainline does not bisect existing agricultural parcels due to the use of existing SR 37. Impacts include removal of agricultural land from production for right of way and the creation of uneconomic remnants and/or parcels landlocked as a result of loss of access. The number of agricultural parcels remaining after severance is estimated at 201 parcels for Alternative C1, 232 parcels for Alternative C2, 201 parcels for Alternative C3, 219 parcels for Alternative C4, and 234 parcels for the RPA. The majority of these parcels would be less than 5 acres in size (see **Table 5.24-7**).

During the parcel impact analysis process, uneconomic farmland remnants were considered and categorized as potential full parcel acquisitions assuming those parcels would lose all utility. However, it is unlikely that all of these parcels would have no productive use. In the case of landlocked parcels, many parcels that would have lost access as a result of the project would be provided new access via existing local roads or new access roads as features of the project. Depending on the alternative, providing access was not deemed reasonable from an economic standpoint. The disposition of landlocked parcels and uneconomic remnants will be addressed during final design.

Potential impacts to agricultural lands are summarized in **Section 5.3.3** and impacts to farmland are addressed in detail in **Section 5.4**. Mitigation measures for impacts to farmland are described in **Section 7.3.10**.

Indirect Farmland Impacts

I-69 Section 6, similar to Section 5, is more urbanized than Sections 1 through 4 and a portion of induced growth is anticipated to occur on parcels that currently are fully developed, resulting in increased densities on existing land. **Table 5.24-3** shows the acreage of projected induced growth that is expected to occur on developed land rather than agricultural or forest land. In



these TAZs, the land is so attractive for future development that the no-build and/or build growth (based upon the household or jobs development ratios) exceeds the amount of “available” agricultural and forest land. Examples of induced development resulting in greater densities includes a high-rise apartment building exceeding the 4.38 households/acre value or when existing buildings would be replaced by larger or taller buildings (see **Appendix V**).

Within each TAZ, the remaining induced growth converts agricultural land and forest to households and commercial developments. In Hendricks County, an estimate of 80 percent of induced growth occurring on available agricultural land and 20 percent of the induced growth occurring on available forested land. In Johnson County, an estimate of 85 percent of induced growth occurring on available agricultural land and 15 percent of the induced growth occurring on available forested land. In Marion County, an estimate of 90 percent of induced growth occurring on available agricultural land and 10 percent of the induced growth occurring on available forested land. In Morgan County, an estimate of 60 percent of induced growth occurring on available agricultural land and 40 percent of the induced growth occurring on available forested land. These values were established based on an analysis of development of specific land uses by county within the I-69 Section 6 project.

A total of 209 acres (Alternatives C1, C3, C4, and the RPA) and 207 acres (Alternative C2) of agricultural land is forecasted to be converted within I-69 Section 6 as a result of induced growth from I-69 (**Table 5.24-3** and **Table 5.24-8**). These indirect land use changes vary slightly between the alternatives based on the locations of interchanges and the amount of available agricultural land within the induced growth TAZ. The location of interchanges is most closely related to the location of induced growth. Forecasted traffic patterns, which create much of the economic demand for indirect land use changes, differs by alternative based on the access provided. Combined, the interchange locations and traffic volumes generally affect the location and amount of indirect land use changes and as such would result in different growth patterns to occur.

The average number of housing units per acre in the counties of Hendricks, Johnson, Marion, and Morgan is 4.38 units per acre. The estimated number of households that would be established as a result of the I-69 project in I-69 Section 6 is 100 in Hendricks County, 156 in Johnson County, 312 in Marion County and 379 in Morgan County for Alternatives C1, C3, C4, and the RPA. For Alternative C2, the estimated number of households that would be established as a result of the I-69 project in I-69 Section 6 is 100 in Hendricks County, 156 in Johnson County, 312 in Marion County and 377 in Morgan County. See **Table 5.24-4**.

The average number of jobs per acre is 14.6 for the counties of Hendricks, Johnson, Marion, and Morgan. The estimated number of jobs that would be established as a result of the I-69 project in I-69 Section 6 is 117 in Hendricks County, 243 in Johnson County, 605 in Marion County and 783 in Morgan County for Alternatives C1, C3, C4, and the RPA. For Alternative C2, the estimated number of jobs that would be established as a result of the I-69 project in I-69 Section 6 is 117 in Hendricks County, 243 in Johnson County, 605 in Marion County and 1,081 in Morgan County. See **Table 5.24-4**.



The total number of acres converted as a result of induced growth compared with the total number of acres in the TAZs where induced growth is predicted to occur is as follows:

- **Hendricks County:** 31 acres (1.4 percent of the 2,279 acres in the induced TAZs in the build alternatives) would be converted for the induced development of households and jobs as a result of I-69 Section 6. For all build alternatives, it is estimated that none of this induced growth would result in increased densities on developed land. For Hendricks County, assuming 80 percent of the anticipated 31 acres of induced growth caused by I-69 Section 6 would occur on available agricultural lands, the predicted impact to agricultural lands is 25 acres for all build alternatives.
- **Johnson County:** 52 acres (0.7 percent of the 7,727 acres in the induced TAZs in the build alternatives) would be converted for the induced development of households and jobs as a result of I-69 Section 6. For all build alternatives, it is estimated that 11 acres of this induced growth would result in increased densities on developed land. For Johnson County, assuming 85 percent of the remaining 41 acres of induced growth caused by I-69 Section 6 would occur on available agricultural lands, the predicted impact to agricultural lands is 35 acres for all build alternatives.
- **Marion County:** 113 acres (1.7 percent of the 6,692 acres in the induced TAZs in the build alternatives) would be converted for the induced development of households and jobs as a result of I-69 Section 6. For all build alternatives, it is estimated that 40 acres of this induced growth would result in increased densities on developed land. For Marion County, assuming 90 percent of the remaining 73 acres of induced growth caused by I-69 Section 6 would occur on available agricultural lands, the predicted impact to agricultural lands is 66 acres for all build alternatives.
- **Morgan County:** 141 acres for Alternatives C1, C3, C4, and the RPA (0.7 percent of the 19,961 acres in the induced TAZs) would be converted for the induced development of households and jobs as a result of I-69 Section 6. For Alternatives C1, C3, C4, and the RPA, it is estimated that 14 acres of this induced growth would result in increased densities on developed land. The remaining 127 acres of induced growth caused by I-69 Section 6 are targeted to have 60 percent of the impact occurring on available agricultural land. Depending on availability within each TAZ with induced growth, the actual percentage of agricultural land impacted may vary. Based on the analysis, the predicted impact to agricultural land due to I-69 Section 6 induced growth is 83 acres for Alternatives C1, C3, C4, and the RPA. For Alternative C2, 160 acres (0.8 percent of the 20,185 acres in the induced TAZs) would be converted for the induced development of households and jobs in Morgan County as a result of I-69 Section 6. For Alternative C2, it is estimated that 32 acres of this induced growth would result in increased densities on developed land. For Alternative C2, the remaining 128 acres of induced growth caused by I-69 Section 6 is targeted to have 60 percent of the impact occurring on available agricultural land. Depending on availability within each TAZ with induced growth, the actual percentage of agricultural land impacted may vary. Based on the analysis, the predicted impact to agricultural land due to I-69 Section 6 induced growth is 81 acres for Alternative C2.



As noted in **Table 5.24-8**, 209 acres (Alternatives C1, C3, C4, and the RPA) and 207 acres (Alternative C2) of induced growth in the four counties is forecasted to occur on agricultural land. In addition, 152 acres (Alternative C1), 173 acres (Alternative C2), 127 acres (Alternative C3), 158 acres (Alternative C4), and 172 acres (the RPA) of agricultural land is proposed for mitigation of direct impacts (for wetlands and reforestation of upland forests). The combined induced growth and mitigation would result in 361 acres (Alternative C1), 380 acres (Alternative C2), 336 acres (Alternative C3), 367 acres (Alternative C4), and 381 acres (the RPA) of impacts to agricultural lands—less than 0.1 percent of the four-county total agricultural land area of 520,308 acres for each alternative. As shown by **Figure 5.24-3** through **Figure 5.24-6**, most the predicted development would occur near I-69 Section 6. This table shows that the cumulative impacts of all alternatives are similar.

Table 5.24-8: Impacts of I-69 Section 6 and Other Major Projects, by Alternative

Impacted Resource	I-69 Section 6, Tier 2			I-69 Section 5, Tier 2 (Selected Alternative)	Other Projected Growth (Ag/Forest no-build)	Estimated Total Impacts for I-69 Section 6
	Direct	Indirect	Mitigation*			
Alternative C1						
Agricultural Land (acres)	-263	-209	-152	-44	-23,939	24,607 reduction
Upland Forests (acres)	-136	-63	136	-40	-5,070	5,173 reduction
Wetlands (acres)	-5.0	0	16	-0.3	0**	10.7 net gain
Streams (L.F.)	42,780	0	BMPs	19,900	0**	62,680
Alternative C2						
Agricultural Land (acres)	-356	-207	-173	-44	-23,939	24,719 reduction
Upland Forests (acres)	-146	-66	146	-40	-5,070	5,176 reduction
Wetlands (acres)	-9.8	0	27	-0.3	0**	16.9 net gain
Streams (L.F.)	44,599	0	BMPs	19,900	0**	64,499
Alternative C3						
Agricultural Land (acres)	-254	-209	-127	-44	-23,939	24,573 reduction
Upland Forests (acres)	-102	-63	102	-40	-5,070	5,173 reduction
Wetlands (acres)	-8.8	0	25	-0.3	0**	15.9 net gain
Streams (L.F.)	42,375	0	BMPs	19,900	0**	62,275
Alternative C4						
Agricultural Land (acres)	-330	-209	-158	-44	-23,939	24,680 reduction



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Impacted Resource	I-69 Section 6, Tier 2			I-69 Section 5, Tier 2 (Selected Alternative)	Other Projected Growth (Ag/Forest no-build)	Estimated Total Impacts for I-69 Section 6
	Direct	Indirect	Mitigation*			
Upland Forests (acres)	-145	-63	145	-40	-5,070	5,173 reduction
Wetlands (acres)	-4.1	0	13	-0.3	0**	8.6 net gain
Streams (L.F.)	43,356	0	BMPs	19,900	0**	63,256
RPA						
Agricultural Land (acres)	-382	-209	-172	-44	-23,939	24,725 reduction
Upland Forests (acres)	-156	-63	-156	-40	-5,070	5,173 reduction
Wetlands (acres)	-4.0	0	13	-0.3	0**	8.7 net gain
Streams (L.F.)	47,253	0	BMPs	19,900	0**	67,153

Sources: Agricultural Land, see **Table 5.3-1**, and **Table 5.24-3**; Upland Forests, see **Table 5.20-2** and **Table 5.24-3**; Wetlands, see **Table 5.19-19**; Streams, see **Table 5.19-19** / Section 5 impacts (within Section 6's geographic scope) are based on FEIS right of way from August 2013 FEIS/ROD.

*Mitigation: Agricultural land would be used to provide forest and wetland mitigation. Upland Forest mitigation is provided at a 3:1 ratio, however reforestation (requiring the conversion of agricultural land) will be at 1:1 ratio and preservation of existing forest at 2:1 ratio. See **Table 5.20-5** for total forest mitigation. See **Table 5.19-16** for wetland mitigation. **Section 5.19, Water Resource** and **Section 5.20, Forest Impacts** describe the methodology used to identify appropriate mitigation measures for impacts to water resources and forests, respectively.

**Quantifiable data for these impacts are not available for "Other" projects. However, as with Section 6 of I-69, direct impacts to wetlands and streams would be mitigated at appropriate ratios in consultation with resource agencies and as required by permitting stipulations.

Stream impacts are not treated as reductions or gains. Impacts and mitigation for other resources (farmland, forest, and wetlands) result in a net change in the amount of that resource. Stream impacts and associated mitigation affect stream function and quality; they do not cause a meaningful change in the linear feet of streams.

Subtotals have been rounded.

As indicated above, it is anticipated that mitigation within the I-69 Section 6 geographic scope for direct impacts of the I-69 Section 6 project to forests and wetlands would require further acquisition and conversion of agricultural land. INDOT and FHWA have voluntarily committed to mitigate impacts to upland forests at a 3 to 1 ratio averaged over the entire length of the I-69 corridor, which includes a 1 to 1 ratio of replacement plus a 2 to 1 ratio of forest preservation (see **Section 7.2**). Actual ratios within each individual section may vary from the overall average. For purposes of this analysis, a 1 to 1 replacement of upland forest impacts is assumed within the I-69 Section 6 geographic scope. (The 2 to 1 conservation of existing forest land would not require new conversion of any agricultural land.) Thus, it is estimated that approximately 136 acres (Alternative C1), 146 acres (Alternative C2), 102 (Alternative C3), 145 (Alternative C4), and 156 acres (the RPA) of agricultural land would be converted for the I-69 Section 6 upland forest reforestation portion of the mitigation program. See Table 5.24-8.

There would be conversion of agricultural land for the mitigation of direct impacts to wetlands, including forested wetlands, within the I-69 Section 6 geographic scope. An MOU executed



between INDOT, USFWS, and IDNR in 1991 (see **Appendix S**) established mitigation ratios for a variety of wetland types. Based on those ratios, it is estimated that approximately 16 acres (Alternative C1), 27 acres (Alternative C2), 25 acres (Alternative C3), 13 acres (Alternative C4), and 13 acres (the RPA) of agricultural land would be converted to wetlands as part of the wetland mitigation program of I-69 Section 6. See **Table 5.24-8**.

Total loss of agricultural land due to mitigation for forest and wetland losses is 152 acres (Alternative C1), 173 acres (Alternative C2), 127 acres (Alternative C3), 158 acres (Alternative C4), and 172 acres (the RPA). Total indirect impacts due to induced development are 209 acres for Alternatives C1, C3, C4, and the RPA, and 207 acres for Alternative C2. See **Table 5.24-8**.

Alternative C1 would convert a total of 624 acres of agricultural lands based on 263 acres of direct impact, 209 acres of indirect impact, and 152 acres of mitigation for forests and wetlands. Alternative C2 would convert a total of 736 acres of agricultural lands based on 356 acres of direct impact, 207 acres of indirect impact, and 173 acres of mitigation for forests and wetlands. Alternative C3 would convert a total of 590 acres of agricultural lands based on 254 acres of direct impact, 209 acres of indirect impact, and 127 acres of mitigation for forests and wetlands. Alternative C4 would convert a total of 697 acres of agricultural lands based on 330 acres of direct impact, 209 acres of indirect impact, and 158 acres of mitigation for forests and wetlands. The RPA would convert a total of 742 acres of agricultural lands based on 382 acres of direct impact, 209 acres of indirect impact, and 172 acres of mitigation for forests and wetlands. See **Table 5.24-9**.

Table 5.24-9: Acres of Cumulative Land Use Changes to Agricultural Land

Cause of Land Use Change	I-69 Section 6, Tier 2 (by county)					Other Projects			Cumulative Impacts (I-69 plus "Other" Projects)
	Hendricks	Johnson	Marion	Morgan	All I-69 Section 6	I-69 Section 5	"Other" Projected Growth	Total "Other" Projects	
Alternative C1									
Direct Conversion	0	-102	-19	-142	-263	-44	-23,939	-23,983	-24,246
Indirect / Induced Conversion	-25	-35	-66	-83	-209	N/A	N/A	N/A	-209
Mitigation	0	-26	0	-126	-152	N/A	N/A	N/A	-152
Alt C1 Total	-25	-163	-85	-351	-624	-44	-23,939	-23,983	-24,607
Alternative C2									
Direct Conversion	0	-127	-26	-203	-356	-44	-23,939	-23,983	-24,339
Indirect / Induced Conversion	-25	-35	-66	-81	-207	N/A	N/A	N/A	-207



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Cause of Land Use Change	I-69 Section 6, Tier 2 (by county)					Other Projects			Cumulative Impacts (I-69 plus "Other" Projects)
	Hendricks	Johnson	Marion	Morgan	All I-69 Section 6	I-69 Section 5	"Other" Projected Growth	Total "Other" Projects	
Mitigation	0	-32	0	-141	-173	N/A	N/A	N/A	-173
Alt C2 Total	-25	-194	-92	-425	-736	-44	-23,939	23,983	-24,719
Alternative C3									
Direct Conversion	0	-106	-21	-127	-254	-44	-23,939	-23,983	-24,237
Indirect / Induced Conversion	-25	-35	-66	-83	-209	N/A	N/A	N/A	-209
Mitigation	0	-26	0	-101	-127	N/A	N/A	N/A	-127
Alt C3 Total	-25	-167	-87	-311	-590	-44	-23,939	-23,983	-24,573
Alternative C4									
Direct Conversion	0	-129	-26	-175	-330	-44	-23,939	-23,983	-24,313
Indirect / Induced Conversion	-25	-35	-66	-83	-209	N/A	N/A	N/A	-209
Mitigation	0	-31	0	-127	-158	N/A	N/A	N/A	-158
Alt C4 Total	-25	-195	-92	-385	-697	-44	-23,939	-23,983	-24,680
RPA									
Direct Conversion	0	-141	-29	-191	-382	-44	-23,939	-23,983	24,344
Indirect / Induced Conversion	-25	-35	-66	-83	-209	N/A	N/A	N/A	-209
Mitigation	0	-34	0	-138	-172	N/A	N/A	N/A	-172
RPA Total	-25	-210	-95	-412	-742	-44	-23,939	-23,983	-24,725

Notes:

N/A = not applicable

Mitigation conversion of agricultural lands by I-69 Section 6 includes conversion of agricultural land to provide forest and wetland mitigation. For these purposes, mitigation is assumed to take place within the same county as the direct impact for Morgan and Johnson counties, although this may not necessarily be the case. Mitigation for the direct impacts in Marion County has been included with Johnson County as the mitigation focus area does not include Marion County.

Section 5 impacts (within Section 6's geographic scope) FEIS right of way from August 2013 FEIS/ROD.

Other Projected Growth is the growth expected in the Section 6 geographic scope that is expected to occur even if I-69 is not constructed (the no-build scenario) and which is not attributed to the remaining Other projects listed in the table.

Subtotals have been rounded.



Other Farmland Impacts

Other developments are anticipated to convert agricultural land to developed land resulting from household and employment growth projected for the no-build scenario. An additional potential conversion of agricultural land is limestone and sand/gravel quarrying, which is a prominent land use in Marion, Johnson, and Morgan counties. Most impacts to agricultural land from quarrying occur when the land surface is stripped (rather than mining occurring underground). Based on NLCD 2011 data it is estimated that active quarries would impact approximately 1,050 acres of agricultural land. The portion of Section 5 of I-69 from Evansville to Indianapolis within I-69 Section 6's geographic scope would directly impact 44 acres of agricultural land.

The population and employment forecasts form the baseline condition for land usage needed by the 2045 population (**Table 5.24-3**, **Table 5.24-4**, and **Table 5.24-5**). The no-build population forecasts have been determined based on birth rate, death rate, in migration, and out migration, and are independent of the I-69 project. They are as follows:

- Hendricks County: New households by 2045: 38,388; employment: 71,562. These added households and jobs result in 13,666 acres of total impacts (or no-build unconstrained growth). An estimated 1,077 equivalent acres of this growth would result in increased densities on developed lands, leaving 12,589 acres to be converted from other uses. Impacts to agricultural land are estimated to be 10,791 acres (86 percent of 12,589 acres).
- Johnson County: New households by 2045: 21,814; employment: 70,227. These added households and jobs result in 9,791 acres of total impacts (or no-build unconstrained growth). An estimated 1,565 equivalent acres of this growth would result in increased densities on developed lands, leaving 8,226 acres to be converted from other uses. Impacts to agricultural land are estimated to be 7,347 acres (89 percent of 8,226 acres).
- Marion County: New households by 2045: 38,955; employment: 176,070. These added households and jobs result in 20,985 acres of total impacts (or no-build unconstrained growth). An estimated 14,992 equivalent acres of this growth would result in increased densities on developed lands, leaving 5,993 acres to be converted from other uses. Impacts to agricultural land are estimated to be 4,136 acres (69 percent of 5,993 acres).
- Morgan County: New households by 2045: 2,951; employment: 6,920. These additional households and jobs result in 1,148 acres of impacts. An estimated 137 equivalent acres of this growth would result in increased densities on developed lands, leaving 1,011 acres to be converted from other uses. Impacts to agricultural land within Morgan County are estimated to be 615 acres (61 percent of 1,011 acres).

Total impact to agricultural land from the projected no-build growth for Hendricks, Johnson, Marion, and Morgan counties is estimated to be 22,889 acres (rounded). Taken with the 1,050 acres for quarrying activities produces a total forecast of 23,939 acres for other projected growth. See **Table 5.24-9**.



Summary of Farmland Cumulative Effects

Direct impacts to agricultural land in I-69 Section 6 is estimated to be 263 acres for Alternative C1, 356 acres for Alternative C2, 254 acres for Alternative C3, 330 acres for Alternative C4, and 382 acres for the RPA. Within the four-county area, induced growth resulting from I-69 Section 6 is estimated to require the conversion of 209 additional acres of agricultural land for Alternatives C1, C3, C4, and the RPA, and 207 additional acres of agricultural land for Alternative C2. Indirect impacts to agricultural land would also include approximately 152 acres (Alternative C1), 173 acres (Alternative C2), 127 acres (Alternative C3), 158 acres (Alternative C4), and 172 acres (the RPA) for mitigation of impacts to forests and wetlands.

Growth expected to occur within the four-county area even if I-69 is not constructed is estimated to require the conversion of 22,889 acres of agricultural land (39 percent in Hendricks County, 26 percent in Johnson County, 15 percent in Marion County and 2 percent in Morgan County of the 27,819 acre total no-build growth estimate). Limestone and sand/gravel quarry activities are estimated to directly impact 1,050 acres of agricultural land. Other major projects that have been identified within the geographic scope of this analysis that would have a permanent effect on land use include Section 5 of I-69 in Morgan County. Direct impacts to agricultural land due to these other projects are estimated to be 44 acres.

The total of direct, indirect, other impacts, and mitigation to agricultural land within the four-county area is 24,607 acres (Alternative C1), 24,719 acres (Alternative C2), 24,573 acres (Alternative C3), 24,680 acres (Alternative C4), and 24,725 acres (the RPA). The cumulative effects would thus convert approximately 4.8 percent of the total of 520,308 acres of agricultural land within the four-county area for 2045. This is not considered to be a significant impact due to extensive area of farmland available within the study area.

Alternative C1 would result in 263 acres (direct), 209 acres (indirect), 152 acres (mitigation for forests and wetlands), and 23,983 acres (other) for a total loss of 24,607 acres of agricultural land. Alternative C2 would result in 356 acres (direct), 207 acres (indirect), 173 acres (mitigation for forests and wetlands), and 23,983 acres (other) for a total loss of 24,719 acres of agricultural land. Alternative C3 would result in 254 acres (direct), 209 acres (indirect), 127 acres (mitigation for forests and wetlands), and 23,983 acres (other) for a total loss of 24,573 acres of agricultural land. Alternative C4 would result in 330 acres (direct), 209 acres (indirect), 158 acres (mitigation for forests and wetlands), and 23,983 acres (other) for a total loss of 24,680 acres of agricultural land. The RPA would result in 382 acres (direct), 209 acres (indirect), 172 acres (mitigation for forests and wetlands), and 23,983 acres (other) for a total loss of 24,725 acres of agricultural land. **Table 5.24-8** and **Figure 5.24-7** summarize the cumulative land use changes for agricultural land.

Forest

GIS analysis of the NLCD 2011 data included 178,100 acres of forest in the four counties in the I-69 Section 6 study area. Exact comparisons between the forest areas in the most recent NLCD (2011) and the forest areas identified during 2015 field surveys in I-69 Section 6 cannot be made



due to the different levels of precision in the two methods. The NLCD uses aerial surveys to assign land use to one of 16 categories, with a spatial resolution of 30 meters.²² Field surveys are more precise, and will not agree with the lower-resolution mapping in the NLCD. In addition, some forested areas identified in the 2011 NLCD survey may have been altered prior to the 2015 field surveys. However, following are generalizations that can be made based on the available data.

Direct Forest Impacts

The direct conversion of forest land to highway right of way is estimated to be 136 acres for Alternative C1, 146 acres for Alternative C2, 102 acres for Alternative C3, 145 acres for Alternative C4, and 156 acres for the RPA. Potential impacts to forests are addressed in detail in **Section 5.20**.

Upland forest impacts would be mitigated at a 3 to 1 ratio, including 1 to 1 replacement and 2 to 1 preservation for the I-69 Section 6 project. These ratios may vary for individual sections depending on the mitigation opportunities presented. Proposed mitigation for I-69 Section 6 would provide 136 acres for Alternative C1, 146 acres for Alternative C2, 102 acres for Alternative C3, 145 acres for Alternative C4, and 156 acres for the RPA. Replacement acres of upland forest would be developed by converting agricultural land (see **Table 5.24-8**). Forested wetlands would be mitigated as wetlands, at a ratio of 3 to 1. These are included in the wetlands totals to avoid double counting. Mitigation measures for impacts to forests are described in **Section 7.3.11**.

Indirect Forest Impacts

Indirect impacts to forests would result from land converted to commercial or residential development, as a result of additional access provided by I-69. Development expected to occur as a result of I-69 Section 6 is 337 acres (Alternatives C1, C3, C4, and the RPA) or 356 acres (Alternative C2). Within the approximately 36,659 total acres of TAZs identified as potential locations for project-induced development in the four-county study area, 120 acres are projected for job induced development and 216 acres are projected for induced residential development with Alternatives C1, C3, C4, and the RPA. Within the approximately 36,883 total acres of TAZs identified as potential locations for project-induced development in the four-county study area with Alternative C2, 140 acres are projected for job induced development and 216 acres are projected for induced residential development (see **Table 5.24-4**).

Timber harvest by landowners potentially affected by the I-69 Section 6 project may occur due to the potential of land being acquired for this project and uncertainty regarding the right of way acquisition limits and process. The amount of this private harvesting cannot be quantified because whether a particular parcel is harvested depends on the marketability of the timber and the landowner's interest in harvesting, neither of which can be reliably predicted. Timber

²² See description of National Land Cover Database at <https://www.mrlc.gov/nlcd2011.php>.



salvage, which may also occur, is timber recovery by the construction contractor that occurs as land is cleared for construction.

I-69 Section 6, similar to Section 5, is more urbanized than Sections 1 through 4 and a portion of induced growth (equivalent to 65 and 83 acres) is anticipated to occur on parcels that are currently developed, resulting in increased densities. Within each TAZ, the remaining induced growth on undeveloped land (272 and 273 acres in the four counties) would convert agricultural land and forest to residential and commercial developments. Within I-69 Section 6, growth on forest land is estimated to be 20 percent in Hendricks County, 15 percent in Johnson County, 10 percent in Marion County, and 40 percent in Morgan County.

In Hendricks County, 20 percent of the induced growth would convert 6 acres of forest for the build alternatives. In Johnson County, 11 of the anticipated 52 acres of induced growth would occur as increased density of already developed land. Of the remaining 41 acres, 15 percent of the induced growth would convert 6 acres of forest for the build alternatives. In Marion County, 40 of the anticipated 113 acres of induced growth would occur as increased density on already developed land. Of the remaining 73 acres, 10 percent of the induced growth would convert 7 acres of forest for the build alternatives. In Morgan County, 14 of the 141 acres (Alternatives C1, C3, C4, and the RPA) and 32 of the 160 acres (Alternative C2) of induced growth would occur as increased density on already developed land. Of the remaining 127 acres (Alternatives C1, C3, C4, and the RPA) and 128 acres (Alternative C2), 40 percent of the induced growth would convert 44 acres of forest for Alternatives C1, C3, C4, and the RPA, and 47 acres of forest for Alternative C2. See **Table 5.24-3** and **Table 5.24-10**.

The total estimated indirect impact to forest for the four counties is 63 acres for Alternatives C1, C3, C4, and the RPA; and 66 acres for Alternative C2.

Other Forest Impacts

The portion of I-69 Section 5 within the I-69 Section 6 geographic scope would directly impact 40 acres of forest. No-build growth within the I-69 Section 6 project area is anticipated to impact about 4,930 acres of forest. This no-build growth would result from the conversion of 20 percent of 12,589 acres in Hendricks County resulting in 1,798 acres of forest impact, 15 percent of 8,226 acres in Hendricks County resulting in 879 acres of forest impact, 10 percent of 5,994 acres in Marion County resulting in 1,858 acres of forest impact, and 40 percent of 1,010 acres in Morgan County resulting in 395 acres of forest impact. Active limestone and sand/gravel quarry operations are estimated to directly impact 140 acres of forest based on NLCD 2011 land cover data. Together, the no-build growth along with the quarrying activity is estimated to result in the conversion of 5,070 acres of forest.

Summary of Forest Cumulative Effects

The project would require the acquisition of about 136 acres (Alternative C1), 146 acres (Alternative C2), 102 acres (Alternative C3), 145 acres (Alternative C4), or 156 acres (the RPA) of upland forest for right of way.



Combined direct (101 to 149 acre reductions), indirect (66- or 63-acre reduction), and other (5,110-acre reduction) impacts reasonably foreseeable to occur equal a total cumulative conversion of 5,173 or 5,176 acres of forest to non-forest use (see Table 5.24-10).

Potential cumulative conversion totals include measures proposed to mitigate direct impacts to forests due to the I-69 Section 6 project. Approximately 102 to 149 acres of forest mitigation are proposed for the 1 to 1 replacement to offset the approximate 101 to 159 acres of direct impacts. Of this amount, all would be replacement (planted non-wetland bottomland forest), thereby resulting in no direct loss to forest.

Alternative C1 forest impacts would be direct (136-acre reduction), indirect (63-acre reduction), and other (5,110-acre reduction). After accounting for the 136 acres of replacement forest from mitigation, the total cumulative conversion of forest acreage is a 5,173-acre loss for Alternative C1 (see Table 5.24-8 and Table 5.24-10). Using the same data from the tables, the total cumulative conversion of forest would be 5,176 acres for Alternative C2 and 5,173 acres for Alternatives C3, C4, and the RPA.

GIS analysis of the NLCD 2011 includes 178,100 acres of forest in the four counties (18,800 in Hendricks County; 32,800 in Johnson County; 15,300 in Marion County; and 111,200 in Morgan County). Therefore, the cumulative impact of forest lost due to conversion is approximately 2.9 percent of the current amount of land in forest within these counties for 2045. These impacts are not considered significant due to the amount of forest land within the study area.

Table 5.24-10: Acres of Cumulative Land Use Changes to Upland Forest

Cause of Land Use Change to Upland Forest	I-69 Section 6, Tier 2 (by county)					Other Projects			Cumulative Impacts (I-69 plus "Other" Projects)
	Hendricks	Johnson	Marion	Morgan	All I-69 Section 6	I-69 Section 5	"Other" Projected Growth	Total "Other" Projects	
Alternative C1									
Direct Conversion	0	-18	-10	-108	-136	-40	-5,070	-5,110	-5,246
Indirect / Induced Conversion	-6	-6	-7	-44	-63	N/A	N/A	N/A	-63
Mitigation	0	28	0	108	136	N/A	N/A	N/A	136
Alt C1 Total	-6	4	-17	-44	-63	-40	-5,070	-5,110	-5,173
Alternative C2									
Direct Conversion	0	-22	-12	-112	-146	-40	-5,070	-5,110	-5,256
Indirect / Induced Conversion	-6	-6	-7	-47	-66	N/A	N/A	N/A	-66
Mitigation	0	34	0	112	146	N/A	N/A	N/A	146
Alt C2 Total	-6	6	-19	-47	-66	-40	-5,070	-5,110	-5,176



I-69 EVANSVILLE TO INDIANAPOLIS TIER 2 STUDIES

Section 6—Final Environmental Impact Statement

Cause of Land Use Change to Upland Forest	I-69 Section 6, Tier 2 (by county)					Other Projects			Cumulative Impacts (I-69 plus "Other" Projects)
	Hendricks	Johnson	Marion	Morgan	All I-69 Section 6	I-69 Section 5	"Other" Projected Growth	Total "Other" Projects	
Alternative C3									
Direct Conversion	0	-15	-11	-76	-102	-40	-5,070	-5,110	-5,212
Indirect / Induced Conversion	-6	-6	-7	-44	-63	N/A	N/A	N/A	-63
Mitigation	0	26	0	76	102	N/A	N/A	N/A	102
Alt C3 Total	-6	5	-18	-44	-63	-40	-5,070	-5,110	-5,173
Alternative C4									
Direct Conversion	0	-18	-16	-111	-145	-40	-5,070	-5,110	-5,255
Indirect / Induced Conversion	-6	-6	-7	-44	-63	N/A	N/A	N/A	-63
Mitigation	0	34	0	111	145	N/A	N/A	N/A	145
Alt C4 Total	-6	10	-23	-44	-63	-40	-5,070	-5,110	-5,173
RPA									
Direct Conversion	0	-21	-17	-121	-156	-40	-5,070	-5,110	-5,269
Indirect / Induced Conversion	-6	-6	-7	-44	-63	N/A	N/A	N/A	-63
Mitigation	0	38	0	121	156	N/A	N/A	N/A	156
RPA Total	-6	11	-24	-44	-63	-40	-5,070	-5,110	-5,173

Notes:

N/A = Not Applicable

Section 5 impacts (within Section 6's geographic scope) FEIS right of way from August 2013 FEIS/ROD.

Other Projected Growth is the growth expected in the Section 6 geographic scope that is expected to occur even if I-69 is not constructed (the no-build scenario) and which is not attributed to the remaining Other projects listed in the table.

Mitigation conversion of agricultural lands by I-69 Section 6 includes conversion of agricultural land to provide forest and wetland mitigation. For these purposes, mitigation is assumed to take place within the same county as the direct impact, although this may not necessarily be the case.

Subtotals have been rounded.

Wetlands

The Tier 1 FEIS (*Appendix H*) identified a total of 18,401 acres of wetlands in Hendricks, Johnson, Marion, and Morgan counties. Field reconnaissance conducted for I-69 Section 6 identified and assessed a total of 97 wetlands in the field survey study area, comprised of 41 palustrine emergent wetlands (PEM) (19.95 acres), 14 palustrine forested wetlands (PFO) (3.48 acres), seven palustrine scrub-shrub wetlands (PSS) (1.12 acre), and 33 palustrine unconsolidated bottom wetlands (PUB) (100.16 acres). In addition, 66.60 acres of open water wetlands



(lacustrine limnetic unconsolidated bottom wetland (LIUB)) were identified in the field survey study area. See **Table 5.19-1**.

Direct Wetland Impacts

Direct impacts to wetlands, not including open waters, are 4.97 acres (Alternative C1), 9.76 acres (Alternative C2), 8.77 acres (Alternative C3), 4.07 acres (Alternative C4), and 3.99 acres (the RPA). See **Table 5.24-8**.

Surface water runoff of pollutants (including de-icing chemicals) and erosion and siltation from the roadway construction could also be considered as a direct impact to adjacent wetlands. The pollutant loadings in surface water runoff have been analyzed by the FHWA with the results showing that pollutant concentrations due to runoff from the highway are below the applicable EPA criteria. Permits required for I-69 construction would include a detailed mitigation and monitoring plan for wetland and stream impacts.

Section 5.23 provides detailed information about permits that may be required. Best Management Practices (BMPs) would be used to prevent non-point source pollution, to control surface water runoff, and to minimize sediment damage to water quality and aquatic habitats. INDOT Standard Specifications and Special Provisions would govern construction activities to control erosion and subsequent water pollution. Consequently, it is expected that the project would have minimal impact due to runoff to wetlands and streams.

Potential impacts to wetlands are addressed in **Section 5.19**. The Revised Tier 1 Conceptual Forest and Wetland Mitigation and Enhancement Plan (Tier 1 Appendix S) includes a commitment to replace wetlands at a ratio of 3 to 1 for forested and scrub/shrub wetlands, and 2 to 1 for emergent wetlands. Mitigation for open water impacts would be 1 to 1. The no net loss policy coupled with mitigation requirements have, based on coordination with local officials, increased the area of wetlands in the area. Mitigation for wetland impacts in I-69 Section 6 could include approximately 16 acres (Alternative C1), 27 acres (Alternative C2), 25 acres (Alternative C3), and 13 acres (Alternative C4 and the RPA). Mitigation for open water impacts in I-69 Section 6 could include approximately 59 acres for Alternative C1, 28 acres for Alternative C2, 22 acres for Alternative C3, 23 acres for Alternative C4, and 3 acres for the RPA. Mitigation quantities for impacts to wetlands are given in **Table 5.19-16** and **Table 5.19-17**. Mitigation measures for wetlands are described in **Section 7.3.9**.

Indirect Wetland Impacts

Anticipated indirect impacts could be wetlands bought by a developer to build a service facility such as a gas station and/or convenience food mart. Development near wetlands could result in impacts to wetlands due to pollutants (including de-icing chemicals) in runoff from impervious surfaces such as access roads and parking lots, or due to erosion and siltation from construction activities. However, with few exceptions (some of which are direct impacts of the I-69 Section 6 project), wetlands within the geographic scope of I-69 Section 6 are not in the immediate vicinity



of interchanges, where most of the project-induced development is predicted to occur. No indirect acreage impacts to wetlands are anticipated due to the implementation of I-69 Section 6.

Other Wetland Impacts

Quarry activities and other projected growth from the 2045 no-build condition are not expected to have direct impacts to wetlands due to current policies and regulations requiring mitigation of wetlands. I-69 Section 5 would potentially impact approximately 0.28 acre of wetlands (not including open water resources) in the geographic scope of I-69 Section 6. Mitigation would be required for wetland impacts resulting from these projects.

Summary of Wetland Cumulative Effects

Measures proposed to mitigate direct impacts to wetlands due to the I-69 Section 6 project would produce gains in wetland acreage in the four-county area. This mitigation would be 16 acres for Alternative C1, 27 acres for Alternative C2, 25 acres for Alternative C3, and 13 acres for Alternative C4 and the RPA. This mitigation would be for direct impacts of 4.97 acres for Alternative C1, 9.76 acres for Alternative C2, 8.77 acres for Alternative C3, 4.07 acres for Alternative C4, and 3.99 acres for the RPA. Impacts from “other” projects include a total of 0.28 acres of wetland loss from Section 5 of I-69 within the I-69 Section 6 geographic scope.

Combined direct, indirect, mitigation, and other impacts total a cumulative wetland impact gain of 10.7 acres for Alternative C1, 16.9 acres for Alternative C2, 15.9 acres for Alternative C3, 8.6 acres for Alternative C4, and 8.7 acres for the RPA (see **Table 5.24-8**). The Tier 1 FEIS identifies 18,401 acres of wetlands in the four-county study area. The impacts and mitigation for the impacts would occur during construction. The cumulative wetland impact represents a gain of 0.05 percent to 0.09 percent of wetland acreage for the four-county area. Mitigation of wetlands impacts, determined in coordination with regulatory agencies, would be required of the other projects causing the impacts.

Streams

Direct Stream Impacts

Approximately 12,494 miles (approximately 65,696,000 linear feet) of streams were identified in Hendricks, Johnson, Marion, and Morgan counties. By way of comparison, the linear feet of streams within the I-69 Section 6 right of way are 42,780 linear feet (Alternative C1), 44,599 linear feet (Alternative C2), 42,375 linear feet (Alternative C3), 43,356 (Alternative C4), and 47,253 (the RPA). See **Table 5.24-8**.

A habitat assessment of the perennial streams directly impacted by the project produced generally low scores, suggesting they may not provide suitable habitat to sustain the plants and animals typically found in this region of Indiana, or that they may be partially supportive of their aquatic life use designations. Only one of the 49 stream segments (the White River) fell into the QHEI highest quality category, indicating that a stream segment may be capable of supporting a



balanced warm water community. (See **Section 5.19.2** for a detailed discussion of the stream assessments conducted for I-69 Section 6.)

Draft water quality data provided by IDEM (2014 303(d) list) indicated that there are five impaired waters within the I-69 Section 6 corridor, including the White River, State Ditch, Pleasant Run Creek, Crooked Creek, and Stotts Creek. The White River is listed as impaired due to nutrients, free cyanide, polychlorinated biphenyls (PCBs), and impaired biotic communities. State Ditch is listed as impaired due to *Escherichia coli* (*E. coli*) bacteria and impaired biotic communities. Pleasant Run Creek is listed as impaired due to *E. coli* and impaired biotic communities. Crooked Creek and Stotts Creek are listed as impaired due to *E. coli*. The alternatives cross all of these impaired watercourses. **Section 4.3.2.3** identifies the impaired water bodies in the vicinity of I-69 Section 6 and the causes of their impairment.

Stresses on the waterways in the project area include sewage, agricultural practices, contaminants/road salt in surface water runoff from roadways/parking areas, and historically poor industrial practices.

Potential impacts to streams are addressed in detail in **Section 5.19**. Mitigation measures for impacts to streams, aquatic habitat, and water quality are described in **Section 7.3.12**, **Section 7.3.13**, and **Section 7.3.14**.

Indirect Stream Impacts

Streams could have the same indirect impacts as wetlands, whereby land surrounding the streams could be bought by a developer to build a commercial or residential establishment, and impacts could occur from surface water runoff and construction activities. However, development near streams tends to be adjacent to a stream rather than interrupting the stream to create a proposed development. Depending on the location, type of development, and potential stream/water quality impact, various permit requirements would have to be met, such as a CWA Section 404 Permit, CWA Section 401 Water Quality Certification, IDEM Isolated Wetlands Permit, and NPDES permits authorized under the CWA; IDNR permit approvals for floodway and below the high-water line of lake impacts under the state of Indiana's Flood Control Act IC 14-28-1 and Navigable Waterways Act IC 14-29-1; construction plan to fulfill Rule 5 requirements (327 IAC 15-5) under NPDES guidelines. See **Section 5.23** for a description of these permits.

As noted in "Wetlands," above, the results of FHWA analysis of surface water runoff shows that pollutant concentrations due to runoff are within the applicable USEPA criteria. BMPs would be used to prevent non-point source pollution, to control surface water runoff, and to minimize sediment damage to water quality and aquatic habitats. INDOT Standard Specifications would govern construction activities to control erosion and subsequent water pollution.

Following resource agency review and comments on the I-69 Section 2 Tier 2 DEIS, additional analysis of potential indirect impacts to streams was conducted. In particular, the USFWS requested more information regarding indirect water quality impacts to streams resulting from induced development associated with the Section 2 project. Based on this comment, additional



evaluation was conducted regarding indirect or induced development from I-69 and its associated effect on stream and water quality. This additional evaluation indicated that it is more accurate to state, “while there will inevitably be some indirect impact to streams, any such indirect impact will be insignificant.” USFWS provided this statement as a comment on the I-69 Section 2, Tier 2 DEIS. The USFWS referenced a publication entitled *Measuring the Impact of Development on Maine Surface Waters* (Morse, Chandler, and S. Kahl, 2003) in its comment. This publication discusses the threshold of land disturbance above which ecological damage to surface waters occurs. The publication states (pages 2-4):

[t]he percentage of the total impervious area (PTIA), or the amount of the watershed covered by surfaces preventing water infiltration, has been found to be predictive of the amount of stress and degradation to the stream Studies from many places in the US have identified a threshold for development at about 10 percent (PTIA) of the watershed area, above which surface waters become degraded Watershed imperviousness (caused by pavement, gravel, roads, sidewalks, driveways, and roofs which prevent water from soaking into the soil) was found to be a good predictor of the level of degradation of the overall stream condition....

In addition, the Center of Watershed Protection (CWP) developed the Impervious Cover Model (ICM) as discussed in the *Impacts of Impervious Cover on Aquatic Systems* (March 2003). The ICM agrees with the study completed in Maine that when a watershed reaches 10 percent impervious surface most stream water qualities decline. While the CWP identifies that this model applies to mid-Atlantic, northeast, southeast, upper Midwest, and Pacific Northwest portions of the US where the model has been tested, they also state that limited testing in the lower Midwest agrees with the ICM.

While the publication studied the PTIA thresholds in Maine and the impervious threshold of degradation can be somewhat variable across the nation, the ICM agreed with the study completed in Maine for the upper Midwest and limited testing shows agreement in the lower Midwest. Therefore, an analysis of the PTIA (using the methodology used in the publication) was completed within the I-69 Section 6 study area for watersheds that were impacted by I-69 Section 6 directly or indirectly.

An analysis was conducted of the 28 14-digit watersheds crossed by I-69 Section 6 and its induced growth and calculated both high and low range estimates of PTIA for them based on the 2011 USGS NLCD, a subset of the Multi-Resolution Land Characteristics (MRLC) Consortium NLCD. The high and low estimates were based on the ranges that separated the development into different classes. These classes were defined by the NLCD 2011 land cover class definitions as follows: high development 80 to 100 percent impervious surfaces, medium development 50 to 79 percent impervious surfaces, low development 20 to 49 percent impervious surfaces, and open-development less than 20 percent impervious surfaces. These are the ranges used in the analysis for percent impervious. For open development, 20 percent impervious was used for the high calculation and 10 percent (rather than 0.1 percent) was used for the low calculation.



The analysis was done by calculating the PTIA for each watershed using the above data. Induced growth and no-build growth were included in the analysis by using 25 to 50 percent impervious surfaces as the range when there is ample available land for the development. In TAZs where anticipated development exceeded available land, the excess development was included by adding 10 to 30 percent impervious surface to the existing developed land only for those acreages of indirect and no-build development predicted to occur on already developed land. The intent was to increase the PTIA to accommodate the increased density of development. The direct impact (estimated I-69 pavement in each watershed) was also included in each total. The analysis was performed for existing conditions, 2045 no-build conditions, and 2045 build conditions.

The analysis indicated that all alternatives had approximately the same PTIA for each specific watershed. The largest difference in any of the watersheds PTIA between alternatives was 0.09 percent. Fifteen of the 28 watersheds fell below the generally accepted PTIA threshold of 10 percent. Although 13 of the watersheds fell above the generally accepted PTIA threshold of 10 percent, it is believed that I-69 Section 6 would not result in significant degradation to surface waters.

The following watersheds are currently over the 10 percent threshold in both the low and high PTIA ranges for existing conditions: Clarks Creek, East Fork White Lick Creek-Silon Creek, East Fork White Lick Creek-Sterling Run, Grassy Creek-East Grassy Creek, Honey Creek-Turkey Pen Creek, Lick Creek-Beech Creek, Little Buck Creek (Southport), Pleasant Run Creek-Buffalo Creek, State Ditch, White Lick Creek-Plainfield, White River-Hide Creek, and White River-Mann Creek/Harness Ditch. The other watershed, Indian Creek-Sand Creek, fell above the 10 percent threshold for the no-build growth high range but did not exceed the 10 percent threshold for the low range estimate.

The direct and/or indirect impacts to streams resulting from the I-69 Section 6 project would not result in a significant degradation to surface waters based on an analysis of the PTIA threshold. This conclusion was reached because all thirteen of the watersheds that were over the 10 percent threshold were already anticipated to be over the 10 percent threshold without I-69 being built. I-69 would have only increased the no-build PTIA ranges 0.42 percent to 0.52 percent in these watersheds.

Other Stream Impacts

Tier 2 I-69 Section 5 would potentially impact 19,900 linear feet of streams in the I-69 Section 6 geographic scope. Limestone and sand/gravel quarry activities and other projected growth from the 2045 no-build scenario are not expected to have direct impacts to streams due to current policies and regulations requiring mitigation of streams.

Summary of Streams Cumulative Effects

Direct impacts to streams would result from the crossing of streams by the roadway, requiring the construction of bridges or the placement of culverts/pipes to carry the streams under the road.



Direct stream impacts would be 42,780 linear feet for Alternative C1, 44,599 linear feet for Alternative C2, 42,375 linear feet for Alternative C3, 43,356 linear feet for Alternative C4, and 47,253 linear feet for the RPA. Indirect impacts are concluded to be negligible. Other impacts include I-69 Section 5 (19,900 linear feet).

Combined direct, indirect, and other impacts equal 62,680 linear feet for Alternative C1, 64,499 linear feet for Alternative C2, 62,275 linear feet for Alternative C3, 63,256 linear feet for Alternative C4, and 67,153 linear feet for the RPA. Approximately 12,494 miles (approximately 65,696,000 linear feet) of streams were identified in Hendricks, Johnson, Marion, and Morgan counties. The impacts represent about 0.1 percent of linear feet of streams available within the study area. This is not considered to be a significant impact. Compensatory stream mitigation would be a part of this project. In addition, the plan proposes on-site mitigation that would be completed in most areas suitable within the I-69 Section 6 right of way to help offset the stream impacts. Mitigation will also be considered in I-69 Section 5 if resource agencies (such as USFWS) have a strong desire to obtain a particular site.

A QHEI of 16 perennial streams and four intermittent streams directly impacted by the project indicated the majority of the streams received generally low scores, suggesting they may not provide suitable habitat to sustain the plants and animals typically found in this region of Indiana, or that they may be partially supportive of their aquatic life use designations. The QHEI score of the White River indicates that it may be the only stream segment capable of supporting a balanced warm water community.

Water quality data provided by IDEM (CWA Draft 2014 303(d) list) indicated that there are five impaired waters within the I-69 Section 6 corridor, including the White River, State Ditch, Pleasant Run Creek, Crooked Creek, and Stotts Creek. The alternatives cross all of these impaired watercourses.

10. Modify or add alternatives to avoid, minimize or mitigate significant cumulative impacts.

Efforts to avoid and minimize impacts to farmland, forests, wetlands, and streams have been incorporated throughout preliminary design and would continue to be considered in final design. However, some indirect and cumulative impacts are unavoidable when considering the overall size and magnitude of I-69 Section 6. These efforts are discussed in the respective resource sections and in **Chapter 6, Comparison of Alternatives**. Mitigation commitments for direct impacts are summarized in **Chapter 7, Mitigation, and Commitments**. A summary is provided on the following pages.

Morgan County, the Town of Mooresville, the City of Martinsville, and Johnson County participated in the I-69 Community Planning Program (I-69 CPP). FHWA and INDOT provided financial and technical assistance for local land use planning through the I-69 Community Planning Program. This program included grants to local governments to support land use and economic development planning. This program also assisted local governments in developing plans that encourage positive development and protect natural resources. See **Section 7.2.5**.



Farmland

Potential impacts to forests are addressed in **Section 5.3**. Permanent conversion of farmland to non-farmland use generally cannot be mitigated easily by the creation of new farmland elsewhere. For this reason, the mitigation of agricultural impacts focuses on practices that assist in avoiding and/or minimizing conversion, or designing alignments to minimize disruption to existing agricultural patterns. General practices considered in developing alternatives for I-69 Section 6 included the following:

- The mainline for I-69 Section 6 uses land already designated for transportation use (existing SR 37), thereby minimizing farmland impacts and disruption of existing agricultural patterns.
- When reasonable, alignments for local access roads follow existing property lines and minimize dividing or splitting of large tracts of farmland.
- Agricultural property lines were followed where practicable and feasible or fields were crossed at perpendicular angles to reduce point rows and other uneconomic remnants.
- Where cost-effective, access is provided to parcels that would otherwise be landlocked due to the project. Overpasses or underpasses are proposed to maintain the connectivity of many county roads, thereby facilitating access to farm fields and farm operations.

Forest

Potential impacts to forests are addressed in **Section 5.20**. Direct upland forest impacts would be mitigated at a 3 to 1 ratio, including 1 to 1 replacement and 2 to 1 preservation for the I-69 Evansville to Indianapolis project as a whole. Within individual sections these ratios may vary depending on the mitigation opportunities presented. It is anticipated that agricultural lands near the corridor would be reforested to provide direct forest replacement mitigation, thereby resulting in no direct loss to forest from I-69 construction. Cumulative land use changes to upland forest are shown in **Table 5.24-10** for each alternative.

Wetlands and Streams

I-69 Section 6 will be designed to avoid and minimize direct impacts to wetlands and streams where feasible. Mitigation for open water impacts in I-69 Section 6 would also be provided.

The Revised Tier 1 Conceptual Forest and Wetland Mitigation and Enhancement Plan (**Appendix Q**) proposes on-site mitigation in all areas suitable within the I-69 Section 6 right of way to help offset the wetland impacts. BMPs would be used to prevent non-point source pollution, to control surface water runoff, and to minimize sediment damage to water quality and aquatic habitats. INDOT Standard Specifications and Special Provisions would govern construction activities to control erosion and subsequent water pollution to streams and wetlands. Consequently, it is expected that the project would have minimal impact as a result of sediment entering streams.



11. Monitor the cumulative effects of the alternatives and provide documentation.

Since it has been determined through this analysis that there are no significant indirect or cumulative impacts to farmland, forests, wetlands, or streams, no monitoring system will be put in place for these resources. It should be noted that several of the mitigation commitments detailed in **Chapter 7, Mitigation and Commitments**, would have ongoing monitoring of resources associated with the commitments. Mitigation is only for direct impacts. Every attempt will be made to minimize indirect project impacts.

5.24.4 Summary

Four resources were identified for further analysis of cumulative impacts in I-69 Section 6. These resources were farmland, forests, wetlands, and streams. Identification of indirect and cumulative impacts to these resources followed the 11-step process for indirect and cumulative impact analysis developed by the CEQ and identified in Tier 1. The process resulted in the identification of forest land and farmland as the most affected resources in I-69 Section 6. This is because the majority of the land use within Section 6 is forest land and farmland.

Potential impacts to forest and farmland resources warranted a more detailed quantitative analysis of the cumulative impacts of the project. Because forest and farmland are measurable land uses, a more quantitative analysis of direct, indirect, and other impacts was completed for these resources. The cumulative analysis of wetlands and streams included a quantitative analysis of direct impacts where possible, but a more qualitative analysis of impacts from indirect and other projected growth. The summary of cumulative impacts within the geographic scope of I-69 Section 6 for all four resources can be found in **Table 5.24-8**.

Alternative C1 is estimated to result in the cumulative conversion of 24,607 acres of agricultural land, including direct (263 acres), indirect (209 acres), mitigation (152 acres), and other (23,983 acres). Alternative C2 is estimated to result in the cumulative conversion of 24,719 acres of agricultural land, including direct (356 acres), indirect (207 acres), mitigation (173 acres) and other (23,983 acres). Alternative C3 is estimated to result in the cumulative conversion of 24,573 acres of agricultural land, including direct (254 acres), indirect (209 acres), mitigation (127 acres) and other (23,983 acres). Alternative C4 is estimated to result in the cumulative conversion of 24,680 acres of agricultural land, including direct (330 acres), indirect (209 acres), mitigation (158 acres), and other (23,983 acres). The RPA is estimated to result in the cumulative conversion of 24,725 acres of agricultural land, including direct (382 acres), indirect (209 acres), mitigation (172 acres), and other (23,983 acres).

In 2012, within Hendricks, Johnson, Marion and Morgan counties, there was a total of 520,308 acres of agricultural land. Therefore, the estimated cumulative impact is approximately 4.8 percent of the amount of agricultural lands within the four counties in 2012. **Table 5.24-8** and **Figure 5.24-7** summarize the cumulative land use changes for agricultural land. See **Section 5.4** for more information regarding farmland impacts.



Combined direct, indirect, and other forest impacts that are reasonably foreseeable would result in the cumulative conversion from forest use to non-forest use of 5,309 acres for Alternative C1, 5,322 acres for Alternative C2, 5,275 acres for Alternative C3, 5,318 acres for Alternative C4, and 5,332 acres for the RPA. Forest mitigation of 102 to 159 acres would offset the direct impact, reducing total cumulative forest conversion to 5,173 acres for Alternative C1, C3, C4, and the RPA, and 5,176 acres for Alternative C2. **Table 5.24-8** and **Table 5.24-10** summarize the cumulative land use changes for forest land.

GIS analysis of the NLCD 2011 includes 178,100 acres of forest in the four counties. Therefore, the cumulative impact of forest lost due to conversion is approximately 2.9 percent of the most current amount of land in forest within these counties. Given the amount of available forest land, this is not considered a significant impact.

Combined direct, indirect, mitigation, and other impacts total a cumulative wetland impact gain of 10.7 acres for Alternative C1, 16.9 acres for Alternative C2, 15.9 acres for Alternative C3, 8.6 acres for Alternative C4, and 8.7 acres for the RPA. **Table 5.24-8** summarizes the cumulative land use changes for wetlands. The Tier 1 FEIS identifies 18,401 acres of wetlands in the four-county study area. The impacts and mitigation for them would occur during construction. The cumulative wetland impact (gain) represents a gain of 0.05 percent to 0.09 percent of wetland acreage for the four-county area.

Combined direct, indirect, and other impacts would be 62,680 linear feet for Alternative C1, 64,499 linear feet for Alternative C2, 62,275 linear feet for Alternative C3, 63,256 linear feet for Alternative C4, and 67,153 linear feet for the RPA. Stream mitigation would be determined during final design. **Table 5.24-8** summarizes the cumulative land use changes for streams.

Hendricks, Johnson, Marion, and Morgan counties have structured land use planning, and subdivision and zoning regulations. With these tools in place, communities can promote desired land uses and protect natural resources. Local governments can regulate the indirect effects of the project on farmland, forest, wetlands and streams through zoning and subdivision regulations.

Table 5.24-8 shows the direct and indirect impacts to all four resources associated with I-69 Section 6, and the direct impacts associated with other major projects within the geographic scope of I-69 Section 6. The results of the analysis of cumulative impacts to agricultural and forest resources are summarized on **Table 5.24-9** and **Table 5.24-10**, respectively.