

The I-69 Evansville-to-Indianapolis Study
Tier 1 Environmental Impact Statement

Task 4.2 Technical Report
Methods for Cumulative Effects
Analysis

April 9, 2002



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I. Introduction

A. Purpose of this Technical Memorandum

This technical report was prepared for the I-69 Evansville-to-Indianapolis Study Tier 1 Environmental Impact Statement (EIS), Task 4.2, Identify Cumulative Effects Issues. The objective of this technical memorandum is to discuss the approach that will be used to complete the cumulative effects analysis. A format for identifying likely cumulative effects issues and methods for measuring or assessing the potential impacts of these issues will be presented. The intent of this technical memorandum is to present a Cumulative Effects Analysis (CEA) format so that involved agencies will have opportunities to provide comments and/or suggestions.

B. Project Description

The Indiana Department of Transportation (INDOT) has initiated an environmental impact statement to complete I-69 as an Interstate highway from I-64, north of Evansville, Indiana, to I-465, south of Indianapolis, Indiana. This project is a potential component of a proposed international highway, Corridor 18 (now known as National I-69), which would span from Texas to Michigan.

A Tier 1 Environmental Impact Statement is currently underway for the proposed I-69 project. Within this EIS there are three levels of study to be completed. In Levels 1 and 2 a number of possible “conceptual routes” were identified for study (Figure 1). These routes are in various locations between Evansville and Indianapolis, covering an area of 26 counties within southwestern Indiana (Figure 2). The environmental emphasis in Levels 1 and 2 is data collection. Some “conceptual routes” have been discarded in Levels 1 and 2 based on early analysis. In Level 3, the five (5) conceptual routes which have been retained (Figure 3) will become 2-mile wide “study bands”. Within each study band, environmental avoidance areas will be identified. A 2,000 foot wide study corridor designed to avoid these environmental areas will be established. Within each corridor a 400-foot wide “working alignment” will be developed. Once the Tier 1 Environmental Impact Study (EIS) is completed, Tier 2 environmental studies will be initiated. The Tier 2 studies will focus on independent utility sections of the corridor selected in Tier 1. The Tier 2 studies may be Environmental Impact Statements (EIS’s), Environmental Assessments (EA’s), or possibly Categorical Exclusions (CE’s).

C. Format of this Technical Memorandum

The handbook “*Considering Cumulative Effects Under the National Environmental Policy Act*” (Council on Environmental Quality, January 1997), hereafter referred to as the “CEQ Handbook,” and “*Conducting Quality Cumulative Effects Analysis for the Federal Highway Administration and Indiana Department of Transportation*” are the main references relied upon for developing this technical memorandum. The definition of cumulative effects from the Council on Environmental Quality’s (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) is:



the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions (40 CFR 1508.7).

The cumulative effects analysis is a process to disclose all impacts to major resources, ecosystems, and human communities in the study area. The goal of the cumulative effects analysis is to disclose impacts rather than to mitigate impacts. All actions within the study area that could result in impacts to major resources, ecosystems, and human communities are addressed. These actions include not only I-69, but other transportation projects, other public works projects, and major private projects such as subdivision growth, industrial park expansions, and new recreational areas. These “other actions” must be considered in the cumulative effects analysis regardless of whether they are causally related to the I-69 project.

By definition, cumulative effects are the sum total of direct effects of the I-69 project, the indirect (secondary) effects of the I-69 project, and the effects of the “other actions”. For I-69 the direct effects would be the actual effects due to the taking of land for the highway. Indirect (secondary) effects are broadly defined by the CEQ as those that are:

caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable (40 CFR 1508.8).

The “other actions” are defined as other transportation projects, public works projects, or private development projects. Together, the direct, indirect, and “other actions” make up the cumulative effects. The process for completing such an analysis is outlined in this Technical Memorandum.

In regards to the Cumulative Effects Analysis, this Tier 1 study reports on the direct impacts, indirect impacts, and “other actions” within the context of all 26 counties in the project area (Figure 2). These will be analyzed by using general trends identified for the major resources potentially affected. The project area will be narrowed in the Tier 2 Cumulative Effects Analysis to focus on the Counties/areas in or near the preferred alternate. At this level, information on direct and indirect impacts as well as other actions will be more local in nature.

Table 1 will serve as an outline for this technical memorandum. There are three traditional components to the Environmental Impact Analysis (EIA): the Scoping phase, the description of the Affected Environment, and the determination of the Environmental Consequences. Table 1 shows the three traditional EIA components along with eleven steps for cumulative effects analysis. The timing of the work as it corresponds to the three Levels in the Tier 1 of the I-69 Study is shown in the left column.



Table 1. Steps in cumulative effects analysis (CEA) to be addressed in each component of environmental impact assessment (EIA)

EIA Components And Timing of Work	CEA Steps
<p>Scoping</p> <p><i>(Work Completed in Levels 1 to 3 of I-69 Tier I EIS)</i></p>	<ol style="list-style-type: none"> 1. Identify the major resources, ecosystems, and human communities that have significant cumulative effects issues associated with the proposed action. 2. Establish the geographic scope for the analysis 3. Establish the time frame for the analysis 4. Identify other actions affecting these major resources, ecosystems, and human communities of concern
<p>Describing the Affected Environment</p> <p><i>(Work Completed in Levels 1 to 3 of I-69 Tier I EIS)</i></p>	<ol style="list-style-type: none"> 5. Describe how these major resources, ecosystems, and human communities identified in scoping have historically changed and the stresses regarding these changes. 6. Characterize the stresses affecting these major resources, ecosystems and human communities and their relation to regulatory thresholds. 7. Identify a baseline condition as to how these major resources, ecosystems, and human communities will change in the future without the proposed I-69.
<p>Determining the Environmental Consequences</p> <p><i>(Work Completed in Level 3 of I-69 Tier I EIS)</i></p>	<ol style="list-style-type: none"> 8. Identify the condition of these major resources, ecosystems, and human communities in the future with the proposed I-69. 9. Determine the changes between the baseline condition and the condition as a result of the proposed I-69. 10. Modify or add alternates to avoid, minimize, or mitigate significant cumulative effects. 11. Document the cumulative impacts in the DEIS.



II. EIA Component: Scoping

Scoping, which involves gathering data on the 26 County project area, was begun in Level 1 of this study and will continue into Level 3. As the project progresses into Level 3, the focus will become more specific from 2 mile wide study bands to 2000' wide corridors and eventually to working alignments. A GIS database of environmental information will be utilized throughout this study along with ongoing public and agency coordination. The Scoping phase of the Environmental Impact Analysis will follow four steps in cumulative effects analysis. These are shown in Table 1 and discussed below.

A. Identify the major resources, ecosystems, and human communities that have significant cumulative effects issues associated with the proposed action.

The first step of this process is to identify the major resources, ecosystems, and human communities where cumulative effects will be a major issue. The Environmental Impact Statement for this project will discuss the impacts of the I-69 project on the following impact areas:

Land Use/Conversion Impacts	Noise Impacts	Ecosystem Impacts
Social/Economic Impacts	Scenic Rivers Impacts	Threatened/Endangered Species
Secondary Impacts	Construction Impacts	Geologic Resources and Features
Joint Development	Visual Impacts	Floodplains
Pedestrian/Bicyclist Considerations	Hazardous Waste Impacts	Wetlands
Farmland Impacts	Relocation Impacts	Water Body Modifications
Air Quality Impacts	Energy Impacts	Water Quality
Historic & Archaeological	Short-term Uses -vs- Long-term	Irreversible and Irretrievable
Preservation	Productivity	Resources
Forest Impacts	Wildlife Impacts	

In some sense, the potential for cumulative impacts exists for each of these impact categories. However, the focus of the cumulative effects analysis will be narrowed to address the major resources, ecosystems and human communities that will be significantly impacted. These resources, ecosystems, and human communities will be identified through data analysis, agency coordination, and public comments. In addition, the past history of this project may be helpful in identifying these areas of concern in the project area. In addition, public and agency comments from previous studies will be used in the Scoping Phase.



As resources, ecosystems, and human communities with potential cumulative effects are identified during the Scoping phase, the intent is to prepare “informational papers” presenting information specific to an area. The goal of these papers is to begin gathering data that will ultimately assist in documenting the cumulative effects analysis. In doing so, consideration will be given to: (1) whether the resource, ecosystem, or human community is expected to receive direct or indirect (secondary) impacts from the proposed action, and (2) whether other actions or projects may produce additional stress on the resource, ecosystem, or human community. These informational papers will also be used to compile information that will be useful in steps 5-7 of the cumulative effects analysis (Table 1).

At the present time, four major resources, ecosystems, and human communities have been identified in the study area. These include farmland, forests, wetlands, and Threatened and Endangered Species (TES). While other resources, ecosystems, and human communities may emerge during cumulative Effects analysis, these four resources have been initially identified. Informational papers have been started for the resources of farmland, forests, wetlands, and Threatened and Endangered Species (TES).

One example of a cumulative effects issue that currently appears to be of significance for the proposed I-69 project is land use conversion. In the area of land use conversion, the major issues identified to date involve: (1) whether there will be a need for additional right-of-way for I-69; (2) whether extending I-69 will encourage more industrial, commercial, and residential land development in the 26 county area as well as in the rest of Indiana; and (3) what other actions will result in land use conversion including other transportation projects on county and State roads, the economic impact of additional jobs, possible social/neighborhood impacts, the conversion of agricultural and/or forested land to development, development within existing floodplains or wetlands, habitat loss, etc.

Cumulative effects analysis for land use conversion will include the use of traffic models and economic models. The change in future traffic with I-69 extended to Mexico will assist in determining if there will be a need for additional right-of-way on I-69. The economic model can provide employment and dwelling unit figures, which can be converted into acreages to determine the potential for land development in the 26 counties. This can be used along with existing land use trends to determine where and how land use conversion may occur.

B. Establish the geographic scope for the analysis

The geographic boundaries for cumulative effects analyses go beyond project-specific analyses. The study area for the I-69 project is shown in Figure 2 and encompasses 26 counties in Southwestern Indiana. Much of the information regarding land use changes for the Cumulative Effects analysis will be generated by the REMI economic simulation model and the transportation model. For the REMI model, the I-69 study area was divided into five regions consisting of one or more counties:



1. Indianapolis and western and southern suburbs (Hendricks, Johnson, Marion, and Morgan counties);
2. Bloomington (Monroe County);
3. Greater Terre Haute (Vigo and Clay counties);
4. Greater Evansville (Gibson, Posey, Vanderburgh, and Warrick counties); and
5. Rural Southwest Indiana (Brown, Crawford, Daviess, Dubois, Greene, Knox, Lawrence, Martin, Orange, Owen, Pike, Putnam, Spencer, and Sullivan counties).

These five regions (shown in Figure 4) that together comprise the I-69 study area are proposed to be the geographic basis for the Cumulative Effects analysis. A GIS Atlas of Southwestern Indiana is near completion which identifies resources within these 5 regions based on available databases, literature, maps, aerial photographs, coordination with appropriate agencies, and other data collection.

C. Establish the time frame for the analysis

The assessment of cumulative effects requires an analysis of past, present and reasonably foreseeable future actions. The introduction of I-69 in southwestern Indiana will involve impacts to land use through direct right-of-way conversion. Indirect (secondary) impacts may involve the introduction of commercial, industrial and/or residential development in the vicinity of the new I-69 in forested or agricultural areas. Cumulative impacts may occur due to factories attracted to the National I-69 Corridor due to its interstate and international access. Past land use trends, current rates of development, and future projections will be useful in assessing such impacts.

The REMI economic model and the transportation model being utilized for the I-69 Study are using a future time frame based on the year 2025. Information from the economic model will be used to identify projected increases in the number of jobs, which could be used to project an increase in development and converted acres. Traffic models will be used to identify if more lanes may be needed to carry projected traffic, which again could translate into additional right-of-way conversion. The future time frame for cumulative impact analysis should be consistent with that used in the planning models, which will be 2025. When it is necessary to determine “past” and “current” trends, the availability of data is a limiting factor. A ten year time frame will be used to express current trends (i.e., 1990 to 1999) and a twenty year time frame will be used to show past trends (i.e., 1970 to 1989). Adjustments may be necessary depending on the data available and the resource issue being discussed.

D. Identify other actions affecting these resources, ecosystems and human communities of concern

Part of the Scoping process will involve identifying present and reasonably foreseeable future actions by government agencies, private organizations, or individuals that are important in the cumulative effects analysis. Present and future actions will be identified through close coordination with other agencies, private organizations and individuals during the Scoping process. Indiana Department of Transportation (INDOT) and Federal Highway Administration (FHWA) projects that may be important to the cumulative effects



analysis (CEA) will be identified. The completion of the National I-69 Corridor from Texas to Michigan is a major project that will likely have cumulative effects upon resources, ecosystems, and human communities. Local government planning agencies will be contacted, as appropriate, to provide information on future development of the region (i.e., land use plans), local zoning requirements, economic development plans, water supply plans, etc.

This information will be used in the transportation model and the REMI model for determining the “No-Build” condition for the year 2025. The “No-Build” condition will show the economic and transportation impacts for the year 2025 without I-69. These values represent the “other actions” that will occur in Southwest Indiana over the coming years that are not related to I-69.

According to the CEQ (1997), future actions can be excluded from the analysis of cumulative effects if:

the action is outside the geographic boundaries or time frame established for the cumulative effects analysis;
the action will not affect resources that are the subject of the cumulative effects analysis; or
including of the action would be arbitrary

E. Scoping Summary

Scoping for cumulative effect analysis will involve a thorough evaluation of the proposed action and its environmental context. The following steps will be completed as outlined by the CEQ (1997):

- *evaluate the proposed action and reasonable alternates (shown in Figure 3) to confirm that farmland, forested land, wetlands, and threatened and endangered species (TES) are the resources upon which the proposed action or alternates may have potential cumulative effects;*
- *finalize the recommended 5 regions for the geographic boundaries for analysis of the cumulative effects on farmland, forested land, wetlands, and threatened and endangered species (TES);*
- *finalize the 2025 time frame for the analysis of the cumulative effects on farmland, forested land, wetlands, and threatened and endangered species (TES); and*
- *develop the “No-Build” alternative for the proposed 2025 time frame which will identify the “other actions” which will be included in the Cumulative Effects analysis.*



III. EIA Component: Affected Environment

The Affected Environment phase of an Environmental Impact Analysis will follow three steps in cumulative effects analysis. These are shown in Table 1 and discussed below. The groundwork for the Affected Environment will begin in Levels 1 and 2 with the majority of this work completed early in Level 3 of this study.

A. Describe the current status of the major resources, ecosystems, and human communities identified in scoping and explain how they have historically changed and the stresses regarding these changes

Cumulative effects upon major resources, ecosystems, and human communities are analyzed from a disclosure point of view. The goal of an environmental impact analysis is to identify those major resources, ecosystems, and human communities that will be impacted by cumulative effects and to disclose the extent of these effects. As a part of this analysis, one needs to have an understanding of the history of these resources, ecosystems, and human communities and what stresses have occurred during this history.

The informational papers for farmland, forested land, wetlands, and threatened and endangered species (TES) will discuss these in terms of the historical context, past trends, and current stresses for the 5 regions.

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

The goal of characterizing stresses is to determine whether the major resources, ecosystems, and human communities of concern are approaching conditions where additional stresses or changes will push these resources, ecosystems, and human communities to levels or thresholds where significant damage or deterioration could occur. For example, some small towns or villages could be at a point where the loss of additional homes, businesses, or industries could result in the end of that town or village as a viable place to live.



Data will be compiled on stress factors pertaining to the farmland, forested land, wetlands, and threatened and endangered species (TES) over the 5 regions. Information on population growth, land use plans, and land use changes will be beneficial in showing the condition of the region and areas experiencing development pressures.

C. Identify a baseline condition as to how these major resources, ecosystems, and human communities will change in the future without the proposed I-69.

The cumulative effects analysis will disclose impacts of all actions including I-69 upon the identified major resources, ecosystems, and human communities. As part of this disclosure, the analysis will work to separate the impacts of I-69 from the impacts of all “other actions” in the area. For this to happen, a baseline condition must be identified of future changes to these major resources, ecosystems, and human communities due to these “other actions”. This baseline condition will not include any portion of the proposed I-69, meaning a “No-Build” alternative. The time frame selected is the year 2025. The Cumulative Effects Analysis (CEA) must forecast over the next 25 years the impacts to these major resources, ecosystems, and human communities.

Once these “other actions” are identified, the impacts of these actions in terms of changes in population, dwelling units, and employment will be forecasted for the 5 regions. These forecasts will be converted into acreages of land using dwelling unit densities and employees per acre based upon urban and rural planning values. For each of the 5 regions these land acreages will then be translated into impacts upon farmland, forested land, wetlands, and threatened and endangered species (TES).

The information papers that address the historical context and existing conditions for resources will be very useful in this process. The data on agricultural land and forested land shows past and present land use trends within the 5 regions as compared to the State as a whole as a part of this effort. Such data will be used to present the historical context of the project and aid in making determinations for present and future trends. Since the baseline condition includes the “No-Build” alternative (no I-69), there are no direct or indirect impacts as a result of I-69. The only impacts are from the “other actions” that will take place in each of the 5 regions. So the cumulative impacts of the baseline condition will include only these impacts from “other actions”.

D. Affected Environment Summary

The purpose of the Affected Environment is to describe the current conditions, historical context, stresses, and baseline conditions of the farmland, forested land, wetlands, and threatened and endangered species (TES). The following steps will be completed:



- *characterize the status of the farmland, forested land, wetlands, and threatened and endangered species within the 5 regions;*
- *identify the levels of stress on farmland, forested land, wetlands, and threatened and endangered species (TES);*
- *define a baseline condition for the farmland, forested land, wetlands, and threatened and endangered species (TES) in the 5 regions with the other actions and I-69 not built.*



IV. EIA Component: Environmental Consequences

The Environmental Consequences phase of an Environmental Impact Analysis will follow four steps in cumulative effects analysis. These are shown in Table 1 and discussed below. This work will begin in Level 3 once the primary two-mile wide study bands have been identified.

A. Identify the condition of these major resources, ecosystems, and human communities in the future with each of the Tier 1 I-69 alternatives

At this stage, the analysis is ready to identify the cumulative effects upon the major resources, ecosystems and human communities as a result of I-69 and its various alternates. Important cause-and-effect pathways will be identified between various alternate routes for I-69 and the major resources, ecosystems, and human communities for cumulative effects analysis. Cause-and-effect evaluation techniques will be used to determine the likely response of the major resource, ecosystem, and human communities to environmental change as a result of I-69.

The magnitude and significance of environmental consequences of the various alternates for the proposed I-69 roadway will be determined. It will be determined whether the proposed action will affect the potential for a resource to sustain itself. This involves determining the current condition of the resource, its resistance to stress and ability to recover considering historical degradation and current trends.

To determine magnitude, the direct impacts of I-69 can be determined from the estimated right-of-way needs. The indirect impacts of I-69 will be forecasted using the REMI model and the transportation model. The models will forecast population, dwelling unit, and employment changes in the 5 regions. These changes will be converted to land acreages and then to farmland, forested land, wetlands, and threatened and endangered species (TES) impacts for each of the 5 regions.

In addition to knowing the direct and indirect impacts for each of the 5 regions, the impacts around the interchanges will be calculated. The Department of Geography and Earth Sciences at the University of North Carolina (Charlotte) have developed a tool to estimate the indirect development impacts near interchanges on limited access highways (David Hartgen, Ph. D., P.E., et al. Department of Geography and Earth Sciences, University of North Carolina at Charlotte, 1990).



The UNC research involved the development of stepwise regression models. The models can provide general guidance in estimating development at rural interchanges on the Interstate system. The models predict the number of land developments that might be expected to occur if an interchange was to be constructed. Development types include: residential subdivisions, gasoline stations, motels, fast-food restaurants, and sit-down restaurants.

To convert the number of land developments into employment, assumptions are made regarding the average number of persons employed by each type of establishment. Gas stations are assumed to employ 6 retail employees; both restaurant types – 30 retail employees; and motels – 30 employees. Residential subdivisions are sized as small (25 housing units) and large (50 housing units).

The land developments will be converted into employees and into land acreages and then into farmland, forested land, wetlands, and threatened and endangered species (TES) impacts for each of the interchanges. The results will be shown in the following three tables for each of the 5 alternatives. The tables show the impacts by region and by interchange for direct and indirect impacts. Thus we will be able to estimate the direct and indirect impacts upon farmland, forested lands, wetlands, and TES for each interchange within a region.



Table 2: Direct Impacts by Region and by Interchanges within Regions

Direct Impacts	Farmland	Forested Land	Wetlands	TES
Region 1-3 interchanges				
Interchange 1				
Interchange 2				
Interchange 3				
Other				
Total Region 1				
Region 2-2 Interchanges				
Interchange 1				
Interchange 2				
Other				
Total Region 2				
Region 3-4 interchanges				
Interchange 1				
Interchange 2				
Interchange 3				
Interchange 4				
Other				
Total Region 3				
Region 4-2 Interchanges				
Interchange 1				
Interchange 2				
Other				
Total Region 4				
Region 5-1 Interchange				
Interchange 1				
Other				



Direct Impacts	Farmland	Forested Land	Wetlands	TES
Total Region 5				
Total all Regions				

Table 3: Indirect Impacts by Region and by Interchanges

Indirect Impacts	Farmland	Forested Land	Wetlands	TES
Region 1-3 Interchanges				
Interchange 1				
Interchange 2				
Interchange 3				
Other				
Total Region 1				
Region 2-2 Interchanges				
Interchange 1				
Interchange 2				
Other				
Total Region 2				
Region 3-4 interchanges				
Interchange 1				
Interchange 2				
Interchange 3				
Interchange 4				
Other				
Total Region 3				
Region 4-2 Interchanges				
Interchange 1				
Interchange 2				
Other				



Indirect Impacts	Farmland	Forested Land	Wetlands	TES
Total Region 4				
Region 5-1 Interchange				
Interchange 1				
Other				
Total Region 5				
Total all Regions				

Table 4: “Other Action” Impacts by Region

“Other Actions”	Farmland	Forested Land	Wetlands	TES
Region 1				
Region 2				
Region 3				
Region 4				
Region 5				
Total all Regions				

To the direct and indirect impacts will be added the impacts from the “other actions” giving the total picture of cumulative impacts upon farmland, forested land, wetlands, and threatened and endangered species (TES)

B. Determine the changes between the baseline condition and the condition as a result of each of the Tier 1 alternatives.

Disclosing the cumulative effects upon the major resources, ecosystems, and human communities involves comparing the impacts upon these areas with and without I-69. The forecasted effects of I-69 will be compared against the baseline condition, the “No-Build” alternate, to determine whether the effects to a resource are significantly beneficial or adverse.

For each of the 5 regions, Tables 2, 3, and 4 will be used to compare the impacts of each of the I-69 alternatives (the direct and indirect impacts) with the impacts of the baseline condition or the “No-Build” alternative (the “other actions”) on farmland, forested land, wetlands, and threatened and endangered species (TES).



The analysis will determine to what degree I-69 is creating stresses on farmland, forested lands, wetlands, and threatened and endangered species (TES) within these 5 regions. The area around interchanges will also be analyzed to determine if the estimated development at these rural interchanges will create stresses on the farmland, forested lands, wetlands, and threatened and endangered species (TES) at these locations.

C. Modify or add to the Tier 1 alternatives to avoid, minimize, or mitigate significant cumulative effects or enhance resources.

If it is determined that significant effects will occur upon major resources, ecosystems, or human communities as a result of various I-69 alternates, steps for avoidance, minimization, and/or mitigation will be analyzed. This may involve adding or modifying alternates to avoid or minimize effects as well as developing strategies to mitigate effects or enhance resources.

The cause-and-effect relationships previously identified will be used to assist in determining where to focus mitigation and/or enhancement strategies in order to reduce cumulative effects. In some cases, such as if significant cumulative effects are the result of several actions, mitigation methods may be complex and involve several different entities. Such an example may arise in the case of potential land use and development pressures that result from both the I-69 project and other factors, such as private development, local land use and economic development policies, and other transportation projects in and outside the study area.

Mitigation may involve training of local entities such as cities and counties to protect farmland, forested land, wetlands, and threatened and endangered species (TES). Access to the geographic information system by cities and counties may help them to identify and protect these areas.

D. Document the cumulative effects in the DEIS

All results of the analysis will be documented in the Environmental Consequences section of the Draft Environmental Impact Statement (DEIS). Supporting data will be included in the appropriate Appendices.



E. Environmental Consequences Summary

Determining the environmental, social, and economic consequences of cumulative effects will involve:

- *identify the important cause-and-effect relationships between human activities and resources of concern using a network or systems diagram that focuses on the important cumulative effects pathways*
- *determine the magnitude and significance of cumulative effects based on context and intensity and present tables comparing the effects of the proposed action and alternates to facilitate decision-making*
- *verify the geographic and time boundaries of the analysis based on cumulative cause-and-effect relationships*
- *modify or add alternates to avoid, minimize, or mitigate cumulative effects based on the cause-and-effect pathways that contribute most to the cumulative effect on a resource*

Figures

1. Preliminary Route Concepts
2. 26 County Project Area
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