

Chapter 25

INDIRECT (SECONDARY) AND CUMULATIVE IMPACTS

MDT ENVIRONMENTAL MANUAL

October 2010

Table of Contents

<u>Section</u>	<u>Page</u>
25.1 OVERVIEW.....	25-1
25.2 LAWS, REGULATIONS AND GUIDANCE.....	25-4
25.2.1 23 USC 139 “Efficient Environmental Reviews for Project Decision-Making”.....	25-4
25.2.2 40 CFR 1500 through 1508 <i>CEQ Regulations</i>	25-4
25.2.3 ARM 18.2.235 et seq., “Rules Implementing the <i>Montana Environmental Policy Act</i> ”.....	25-4
25.2.4 FHWA “Interim Guidance: Questions and Answers Regarding Indirect and Cumulative Impact Considerations in the NEPA Process”.....	25-5
25.2.5 FHWA “Position Paper: Secondary and Cumulative Impact Assessment in the Highway Project Development Process”.....	25-5
25.2.6 <i>CEQ Considering Cumulative Effects Under the National Environmental Policy Act</i>	25-5
25.2.7 FHWA Technical Advisory T 6640.8A.....	25-6
25.2.8 NCHRP 25-25 Task 11 – <i>Indirect and Cumulative Impact Analysis</i>	25-6
25.2.9 NCHRP Reports 403 and 466 – Indirect Effects.....	25-6
25.2.10 Transportation Research Record 1880: “Eight-Step Process for Assessing Indirect and Cumulative Impacts of Transportation Projects”.....	25-6
25.3 PROCEDURES.....	25-7
25.3.1 Initiation of the Analysis Process.....	25-7
25.3.2 CEQ Regulation Compliance.....	25-7
25.3.3 Processes for Analysis of Indirect Effects and Cumulative Effects.....	25-7
25.3.3.1 Indirect Effects Analysis.....	25-8
25.3.3.2 Cumulative Effects Analysis.....	25-10
25.3.4 Induced Growth Effects.....	25-13
25.3.4.1 Projects Planned to Serve Specific Land Development.....	25-14
25.3.4.2 Projects Likely to Stimulate Complementary Land Development.....	25-14
25.3.4.3 Projects Likely to Influence Intraregional Land Development.....	25-15
25.3.5 Documentation.....	25-16
25.3.6 Mitigation and Commitments.....	25-17

Chapter 25

INDIRECT (SECONDARY) AND CUMULATIVE IMPACTS

25.1 OVERVIEW

The *Council on Environmental Quality (CEQ) Regulations* for implementing the *National Environmental Policy Act (NEPA)* (42 USC 4321, et seq.) and the MDT rules for implementing the *Montana Environmental Policy Act (MEPA)* (MCA 75-1-101, et seq.), require consideration of direct, indirect (also referred to as secondary) and cumulative impacts associated with proposed projects or actions that are subject to NEPA and/or MEPA.

Direct effects are caused by an action and occur at the same time and place. Indirect effects are caused by an action and are later in time or farther removed in distance, but are still reasonably foreseeable. Cumulative impacts are impacts on the environment that result from the incremental impact of an action when added to other past, present and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes those actions. Include an action's indirect effects in the analysis of cumulative impacts where those indirect effects would impact resources in the project area affected by other past, present or reasonably foreseeable future actions.

A cumulative impact includes the total effect on a natural resource, ecosystem or human community due to past, present and future activities or actions of Federal, non-Federal, public and private entities. Cumulative effects may also include the effects of natural processes and events, depending on the specific resource in question.

Cumulative impact analysis is resource specific and generally performed for the environmental resources directly impacted by a particular project or action under study. However, not all of the resources directly impacted by a project require a cumulative impact analysis. The resources subject to a cumulative impact assessment should be determined on a case-by-case basis early in the NEPA/MEPA process, generally as part of early coordination or scoping.

Indirect impacts and direct impacts can be considered a subset of cumulative impacts, but are distinguished by a cause-and-effect relationship to a proposed project. Indirect impacts are caused by another action or actions that have an established relationship or connection to the project under study. These induced actions are those that would not or could not occur except for the implementation of the project.

The potential for indirect and cumulative impacts must be considered for all projects, regardless of the level of environmental documentation. Projects involving preparation of an environmental impact statement (EIS) generally may have greater potential for these types of impacts and, therefore, require a higher level of analysis. Indirect and cumulative impact analysis also should be pursued for projects processed with an environmental assessment (EA) or as categorical exclusions (CE), commensurate with the potential for the project to involve those types of impacts.

Because projects approved with CEs are generally minor in nature and have less than significant impacts, detailed indirect and cumulative impact assessments generally are not warranted. There may be exceptions, which are evaluated on a case-by-case basis.

The degree to which indirect and cumulative impacts need to be addressed in an EA depends on the potential for the impacts to be significant and varies by resource, project type, geographic location and other factors. Address this issue with other agencies and NEPA participants during early coordination activities or scoping.

The potential for indirect and cumulative effects and the need to conduct specific analyses to determine the nature and magnitude of the impacts also depends upon the type of proposed project. Capacity improvements, additional interchanges and construction on new location generally have a greater potential for indirect and/or cumulative effects than projects to rehabilitate existing facilities. New access into undeveloped locations can contribute to subsequent development activity. Generally, MDT's philosophy is to build to match demand. However, in some instances, the stated purpose for proposed projects may be to promote economic development in depressed areas needing overall infrastructure improvement. In these cases, the analyses should take into account reasonably foreseeable induced growth (40 CFR 1508.8(b)).

The appropriate identification, analysis and documentation of indirect impacts and cumulative impacts present many challenges during the NEPA/MEPA decision-making process. Indirect and cumulative impacts include less obvious environmental consequences than direct impacts of a project. In addition, analysis of indirect and cumulative impacts requires forecasting uncertain but reasonably foreseeable events. Further complexities may arise when determining the appropriate and reasonable project scope, temporal and resource boundaries and analytical methodologies for addressing indirect and cumulative impacts. Potential changes in land use, development or other reasonably foreseeable actions that may be associated with project-induced growth are not easy to predict, but must be considered. Estimates may be arrived at with surveys, discussions with appropriate local entities, examination of trends, use of sophisticated computer models or other appropriate methodology.

Other important considerations include the existence of a formal planning process, local zoning regulations, land-use codes or regulations and other land-use controls. Make decisions on the type of methodology for estimating potential changes in land use, development or other reasonably foreseeable actions on a case-by-case basis during early coordination or scoping. Coordinate the issues related to selection of the appropriate methodology for a particular study with the cooperating agencies and participants in the NEPA process during early coordination and scoping.

Where indirect and cumulative impacts are a concern, recognize that other statutory and regulatory mandates include requirements addressing secondary, indirect and/or cumulative impacts. For the other statutory and regulatory mandates, these terms may have different meanings and procedural expectations than those of the NEPA/MEPA process. Examples include the regulations implementing the *Endangered Species Act* and the regulations implementing Section 404 of the *Clean Water Act*. Differences in the approach for addressing secondary, indirect and/or cumulative impacts under requirements other than NEPA/MEPA are addressed in the appropriate resource-specific chapters of this *Manual* (e.g., [Chapter 38 "Threatened and Endangered Species"](#) and [Chapter 45 "404\(b\)\(1\) Analysis"](#)).

This Chapter provides guidance and procedures for identifying, evaluating and documenting indirect and cumulative impacts of proposed MDT highway projects in compliance with NEPA and MEPA, implementing regulations and associated guidance. (In applying the guidance and procedures, keep in mind that the objective of the NEPA and MEPA processes is to identify and

consider all impacts caused by a proposed project, including direct, indirect and cumulative effects. Focus primarily on ensuring that all potential impacts are identified and considered in project decision-making. The determination of whether a specific impact is classified as direct, indirect or cumulative should be a secondary concern.)

25.2 LAWS, REGULATIONS AND GUIDANCE

25.2.1 23 USC 139 “Efficient Environmental Reviews for Project Decision-Making”

For projects involving preparation of an EIS and for EAs being prepared in accordance with the FHWA “SAFETEA-LU Environmental Review Process Final Guidance,” this Part of the *United States Code* (USC) requires that, at appropriate times during the study process, the lead agency or agencies for the project collaborate with agencies serving as participating agencies to determine the methodologies to be used and the level of detail required for assessing impacts, including indirect (secondary) and cumulative impacts. See [Chapters 11 “Preparing Environmental Documentation,”](#) [13 “Environmental Assessment/FONSI”](#) and [14 “Environmental Impact Statement/ROD”](#) for further guidance on this requirement.

25.2.2 40 CFR 1500 through 1508 CEQ Regulations

These Parts of the *Code of Federal Regulations* (CFR) include the following definitions:

1. Cumulative Impact. 40 CFR 1508.7 defines cumulative impact as the impact on the environment that results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time.
2. Effects. 40 CFR 1508.8 provides the following definitions for Effects:
 - a. Direct Effects. These effects are caused by the action and occur at the same time and place.
 - b. Indirect Effects. These effects are caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate and related effects on air and water and other natural systems, including ecosystems.
3. Scope. 40 CFR 1508.25 defines Scope as a range of actions, alternatives and impacts to be considered in an environmental impact statement. In determining the scope of environmental impact statements, agencies are required to consider direct, indirect and cumulative impacts.

25.2.3 ARM 18.2.235 et seq., “Rules Implementing the Montana Environmental Policy Act”

The following *Administrative Rules of Montana* (ARM) Sections apply to Chapter 25:

1. Definitions. ARM Section 18.2.236 includes the following definitions:
 - a. Cumulative Impacts. These are collective impacts on the human environment of the proposed action when considered in conjunction with other past and present actions related to the proposed action by location or generic type. Related future

actions must be considered when these actions are under concurrent consideration by any State agency through pre-impact statement studies, separate impact evaluation or permit processing procedures.

- b. **Secondary Impacts.** These are further impacts to the human environment that may be stimulated or induced by, or otherwise result from, a direct impact of the action.
2. **Determining the Significance of Impacts.** Section 18.2.238 in the ARM provides that, in order to implement MEPA, agencies shall determine the significance of impacts associated with a proposed action. The determination is the basis for the agency's decision concerning the need to prepare an environmental impact statement and refers to the agency's evaluation of individual and cumulative impacts in either environmental assessments or environmental impact statements. One of the criteria agencies must consider in determining the significance of each impact on the quality of the human environment is growth-inducing or growth-inhibiting aspects of the impact. This includes the relationship or contribution of the impact to cumulative impacts.

25.2.4 FHWA "Interim Guidance: Questions and Answers Regarding Indirect and Cumulative Impact Considerations in the NEPA Process"

This guidance, dated January 31, 2003, is available via the FHWA website. It focuses on existing NEPA requirements specific to indirect and cumulative impacts. The questions and answers provide a review of existing NEPA requirements regarding consideration, analysis, documentation and mitigation of direct, indirect and cumulative impacts. The guidance also includes references to other sources of information and training on indirect and cumulative impact.

25.2.5 FHWA "Position Paper: Secondary and Cumulative Impact Assessment in the Highway Project Development Process"

This paper, dated April 1992, is available via the FHWA website. It provides background on the reasons for addressing secondary and cumulative impacts and guidance on approaching secondary and cumulative impact assessment, when secondary and cumulative impact analyses are appropriate, and secondary and cumulative analyses.

25.2.6 CEQ Considering Cumulative Effects Under the National Environmental Policy Act

This Handbook, dated January 1997, presents the results of research and consultations by CEQ concerning the consideration of cumulative effects in analyses prepared under NEPA. It provides introductory information regarding the complex issue of cumulative effects, outlines general principles, presents useful steps and provides information on methods of cumulative effects analysis and data sources.

25.2.7 FHWA Technical Advisory T 6640.8A.

The Technical Advisory, dated October 30, 1987, does not specifically address cumulative impacts and only discusses indirect/secondary impacts with respect to the land use impacts, farmland impacts, social impacts, coastal barriers and energy sections of the environmental consequences chapter of an environmental impact statement (or environmental assessment).

25.2.8 NCHRP 25-25 Task 11 – Indirect and Cumulative Impact Analysis

This Report, dated January 2006, is the product of research for the NCHRP Project 25-25, Research for the AASHTO Standing Committee on the Environment. The purpose of the Report is to synthesize definitions and requirements under NEPA and other environmental laws for indirect and cumulative impacts analysis and mitigation for transportation projects, and to recommend an approach to satisfying Federal agency expectations. The Report is designed for transportation agency project sponsors, FHWA, resource agency regulatory staff, consultants and other environmental practitioners.

25.2.9 NCHRP Reports 403 and 466 – Indirect Effects

NCHRP Report 403: *Guidance for Estimating the Indirect Effects of Proposed Transportation Projects* (1998) and the accompanying Desk Reference contained in NCHRP Report 466 *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects* give background and a suggested approach to indirect effects only. These resources include comprehensive discussions on regulations, case law, published literature and current experience with indirect effects analysis. These Reports present a framework for identifying and analyzing indirect impacts of transportation projects, with particular emphasis on development effects. NCHRP Reports 403 and 466 primarily focus on meeting NEPA requirements and do not emphasize coordination with other agency regulations.

25.2.10 Transportation Research Record 1880: “Eight-Step Process for Assessing Indirect and Cumulative Impacts of Transportation Projects”

This article provides helpful discussion of the eight-step indirect effect evaluation process detailed in NCHRP Report 466: *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects*.

25.3 PROCEDURES

25.3.1 Initiation of the Analysis Process

The Preliminary Field Review (PFR) is the initial step in the analysis of indirect and cumulative project impacts. The Design Team (DT) notifies and invites appropriate MDT personnel, including the Project Development Engineer (PDE) within the Environmental Services Bureau (ESB), to the field review. The PDE reviews the list of ESB attendees and includes others as necessary to ensure appropriate ESB personnel are in attendance. The PDE participates in the PFR to make a preliminary evaluation of available information on the project scope and the project's potential indirect and cumulative impacts. Following the field review, the DT prepares a PFR Report summarizing the issues discussed during the PFR, including indirect and cumulative impact issues. The DT distributes the final PFR Report for review and comment. Within ESB, the PDE serves as the document champion to collect and coordinate comments from the other Sections. The PDE compiles the comments into a PFR review memorandum for signature by the Environmental Services Bureau Chief.

For projects subject to the requirements of 23 USC 139 "Efficient Environmental Reviews for Project Decision-Making," the PDE, in cooperation with FHWA, collaborates with participating agencies in determining the appropriate methodologies to be used and the level of detail required in the analysis of indirect and cumulative impacts of project alternatives.

25.3.2 CEQ Regulation Compliance

In conducting the analysis of indirect and/or cumulative effects, the PDE ensures compliance with the intent of the CEQ Regulations (e.g., that reasonably foreseeable actions and effects are considered). In accordance with CEQ and FHWA guidance, the PDE considers the following principles in applying the term reasonably foreseeable:

- indirect and cumulative impact analyses are appropriately concerned with impacts that are sufficiently likely to occur and not with the speculation of any impact that can be conceived of or imagined;
- reasonably foreseeable events, although still uncertain, must be probable (e.g., those effects considered possible, but not probable, may be excluded from analysis); and
- judgments concerning the probability of future impacts are informed, rather than based on speculation.

25.3.3 Processes for Analysis of Indirect Effects and Cumulative Effects

The following Sections describe the processes used for analyzing indirect effects and cumulative effects. The processes involve some overlapping steps that can be conducted concurrently to support both the indirect effect and cumulative effect analyses. Examples include the steps for establishing the boundary for the analyses, determining baseline conditions, and identifying trends, goals and resources of concern.

If at any point in the application of these processes for a proposed project it is determined that further analysis of potential indirect and/or cumulative effects is not warranted (e.g., based on findings regarding the project scope or the nature of the affected environment), the PDE compiles the results of the analyses up to that point and documents the rationale for no further analysis.

25.3.3.1 Indirect Effects Analysis

The following steps describe the process for analysis of indirect effects:

1. Define the Study Area Boundaries. The purpose of this step is to set appropriate study area boundaries for the analysis of indirect effects and the timeframe for the analysis. The PDE coordinates with the DT and appropriate ESB personnel to define the scope of the study area (considering project scope, purpose and need, traffic forecast data). An acceptable guideline for determining the area of influence is the geographic extent to which a project affects traffic levels. This could be through changes to current levels on existing highways and/or by providing the impetus for new facilities in undeveloped areas. The PDE has the preliminary study area boundaries delineated on a map or maps of the project area. Generally, the design life of the proposed project is used to establish the timeframe for the indirect effects analysis, recognizing that further in the future the analysis extends, the more difficult it may be to accurately determine reasonably foreseeable effects.
2. Identify the Trends and Goals of Communities within the Study Area. The objective of this step is to gather information on community trends and goals in the study area, focusing on socio-economic and land use issues. The PDE contacts county and city offices and other development agencies in the project study area to request information on other programmed development. In cases where an area has conducted little or no resource planning, the PDE initiates additional efforts (e.g., phone calls, office visits) to contact and coordinate with various sources having knowledge about changes occurring in the area of the project. Local entities (e.g., zoning boards, water quality control departments, building inspection agencies) can be invaluable sources of information for this purpose. Examples of information for identifying changes include State/regional growth forecasts, building permits, variance/zoning change history, subdivision applications, septic permits, new applications for phone lines, census data and school enrollment. In these circumstances, past history can sometimes be the best indicator of future development patterns. The PDE may also use surveys and consultation with local landowners, developers, real estate agencies or other individuals with special expertise within the proximity of the project study area to obtain information. The PDE documents the identified study area goals and trends and coordinates with interested/affected entities to ensure that the information is accurate and complete.
3. Inventory Notable Features. The purpose of this step is to identify specific valued, vulnerable or unique elements of the natural environment that will be analyzed in the assessment of indirect effects. The PDE coordinates with appropriate ESB personnel to review baseline environmental resource information gathered for the project area. The PDE also coordinates with appropriate ESB personnel in contacting resource protection agencies for the project study area to request information on area-wide resource management plans for wetlands, water quality, etc. In addition, the PDE may schedule early coordination and/or scoping activities with Federal, State and local agencies,

Indian Tribes and the public to gather information for identifying the locations and types of notable features. The PDE works with other appropriate ESB personnel to document (e.g., map and describe) the inventory of notable features.

4. Identify Impact-Causing Activities of the Proposed Action and Alternatives. This step is intended to identify the cause and effect relationships between the features of the proposed project alternatives and associated potential indirect impacts that may conflict with community trends and goals or affect notable features of the project area. The PDE coordinates with the DT and appropriate ESB personnel to identify activities associated with the project alternatives that may result in indirect effects, including encroachment-alteration effects and/or access-alteration effects. Encroachment-alteration effects alter the behavior and functioning of the physical environment. They are related to project design and construction but are indirect in nature because they can be separated from the project in time or distance. Access-alteration effects change traffic patterns or accessibility because of design features of the project. Induced growth effects, another type of indirect impact, are attributable to induced growth itself and not to design or construction aspects of the project. Induced growth effects are discussed in more detail in [Section 25.3.4](#). Examples of impact-causing activities associated with project design/construction include:

- modification of regime (e.g., modification of habitat, alteration of drainage, noise and vibration impacts);
- land transformation and construction (e.g., new or expanded transportation facility, channel dredging and straightening, cut and fill);
- resource extraction (e.g., surface excavation, subsurface excavation, dredging);
- processing (e.g., product storage);
- land alteration (e.g., erosion control and terracing, landscaping, wetland or open water fill and drainage);
- resource renewal (e.g., reforestation, groundwater recharge, site remediation);
- changes in traffic (e.g., automobile, trucking, river and canal traffic);
- waste emplacement and treatment (e.g., landfill, emplacement of spoil and overburden);
- chemical treatment (e.g., fertilization, chemical deicing, weed and pest control); and
- access alteration (alter travel lane circulation patterns, new or expanded access to activity center, new or expanded access to undeveloped land).

The PDE coordinates with the DT and appropriate ESB personnel to compile a comprehensive list of the impact-causing actions of the proposed project alternatives in as much detail as practical.

5. Identify Potential Impacts for Analysis. This step involves comparing the impact-causing activities identified in the preceding step, and anticipated induced growth effects (see [Section 25.3.4](#)), with the baseline inventory of trends, goals and notable features. The purpose of the comparison is to establish which indirect effects are potentially significant and merit subsequent detailed analysis or, conversely, which effects are not potentially significant and do not require further assessment. The PDE coordinates with the DT and appropriate ESB personnel in accomplishing this step. The PDE also may conduct coordination with outside agencies, organizations and the public to obtain input for consideration in the evaluation of the potential indirect effects. The PDE ensures consideration of the full range of potential effects (e.g., encroachment-alteration effects, access-alteration effects, induced growth effects). The PDE coordinates with appropriate ESB personnel to prepare a tabulated summary and discussion of the potential indirect impacts, including an indication of those determined to warrant further analysis and those dismissed from further study.
6. Analyze Impacts. This step is for determining the magnitude and location of the potential indirect impacts identified in the preceding step. The PDE coordinates with other appropriate ESB personnel to accomplish the assessment of significance of the indirect effects. This involves determining magnitude, probability of occurrence, timing and duration and degree to which the effect can be controlled or mitigated. The PDE also coordinates with appropriate ESB personnel to document the results of the impact analysis.
7. Evaluate Analysis Results. The purpose of the preceding step is to assess the magnitude of indirect effects. Achieving this goal involves making several types of assumptions regarding the nature of impact-causing activities, the nature of the cause-effect relationships and how the environment will be affected. The objective of this step is to evaluate the assumptions, and the level of uncertainty they involve to better understand the indirect effects. The PDE coordinates with other appropriate ESB personnel to accomplish the necessary evaluations and to document the level of uncertainty regarding the estimate of indirect effects. This information is communicated to decision-makers and the public for consideration along with the results of the indirect effects analysis.
8. Assess Consequences and Develop Mitigation. The purpose of this step is to evaluate the consequences of the indirect effects and to develop strategies to avoid or reduce unacceptable impacts (e.g., when indirect impacts conflict with community goals and/or affect a notable feature). The PDE coordinates with appropriate ESB personnel and the DT to assess the consequences of the indirect effects and to identify and evaluate measures for avoiding or mitigating unacceptable indirect impacts. If measures are identified that can be incorporated in the project, the PDE ensures they are documented in the results of the indirect effects analysis.

25.3.3.2 Cumulative Effects Analysis

The following steps describe the process for cumulative effects analysis:

1. Identify Significant Cumulative Effect Issues. The purpose of this step is to identify the major cumulative effect issues of a project. To accomplish this objective, the PDE

coordinates with the DT and appropriate ESB personnel to define and document the following factors:

- the direct and indirect effects of the proposed action;
- which resources, ecosystems and human communities are affected; and
- which effects on these resources are important from a cumulative effects perspective (e.g., based on the importance of the affected resource, the magnitude of the cumulative effects).

2. Establish Geographic Scope for Analysis. This step is intended to define the geographic boundaries for analyzing cumulative effects. The PDE coordinates with the DT and appropriate ESB personnel to accomplish the following actions for this step:

- determine and document (e.g., map and/or describe) the project impact zone (i.e., the area that would be affected by the proposed action, including reasonable alternatives);
- compile a list of resources within that zone that could be affected by the proposed action;
- determine and document (e.g., map) the geographic area occupied by each resource, including areas outside of the project impact zone. In most cases, the appropriate area for the analysis of cumulative effects on a particular resource should include the part(s) of the resource beyond the impact zone; and
- determine and document the affected institutional jurisdictions.

Project impact zones for a proposed action are likely to vary for different resources. For water, the project impact zone would be limited to the hydrologic system that would be affected by the proposed action. For air, the zone may be the physiographic basin in which the proposed project would be located. The applicable geographic scope should be defined on a case-by-case basis and should be an iterative process, as necessary.

3. Establish Time Frame for Analysis. As with analysis of indirect effects, generally, the design life of the proposed project is used to establish the timeframe for the analysis of cumulative effects. In applying this timeframe, the focus must be on reasonably foreseeable effects, recognizing that further into the future the analysis extends, the more difficult it may be to determine reasonably foreseeable effects.

4. Identify Other Pertinent Actions. The objective of this step is to identify other actions affecting the resources, ecosystems and human communities of concern (i.e., the proposed project may affect). For this step, the PDE coordinates with county and city offices and other development agencies in the project study area to request information on other programmed development. Local entities (e.g., zoning boards, water quality control departments, building inspection agencies) can be invaluable sources of information for this purpose. Examples of information for identifying other reasonably foreseeable future actions include building permits and subdivision applications. The PDE also may consult with local landowners, developers, real estate agencies or other

individuals with special expertise within the proximity of the project study area to obtain information on planned developments. The PDE documents the information obtained on future actions that are within the geographic boundaries for the cumulative effects analysis and that will affect resources subject to the cumulative effects analysis.

5. Characterize Affected Environment. The purpose of this step is to characterize important resources, ecosystems and human communities the project may affect in terms of how their conditions have been altered by human activities. The PDE coordinates with appropriate ESB personnel for the evaluation and documentation of the current condition of existing resources (e.g., vegetative cover, fish and wildlife, water quality and quantity, geology and geomorphology, recreational uses, cultural resources and socio-economic factors) likely to involve cumulative effects. The analysis focuses on how existing conditions of key resources, ecosystems and human communities reflect their response to past human actions and their ability to withstand those impacts. The analysis includes identification and consideration of pertinent environmental laws, regulations and standards that have a bearing on the resources involved. Where possible, the evaluation and documentation identify trends in the condition of resources, ecosystems and human communities.
6. Characterize Stresses on Affected Environment. This step is intended to identify and inventory actions and activities (stresses) affecting each resource, ecosystem and human community the project would affect. The goal is to determine whether the resources, ecosystems or human communities of concern are approaching conditions where additional impacts/stresses will have an important cumulative impact. The PDE coordinates with the appropriate ESB personnel to identify and document the types, distribution and intensity of key social and economic activities within the area the project would affect. The PDE also coordinates with the appropriate ESB personnel to look for and document individual indicators of stress on specific resources, ecosystems and human communities (e.g., contamination levels, loss or degradation of a fishery).
7. Define Baseline Conditions. The objective of this step is to define the current (baseline) condition for resources, ecosystems and human communities of concern for use in evaluating the environmental consequences of cumulative effects. The PDE works with appropriate ESB personnel to use information from the preceding steps to accomplish and document the following actions:
 - identify common cumulative effects issues within the region;
 - characterize the current status of the resources, ecosystems and human communities of concern;
 - identify socio-economic driving variables and indicators of stress on these resources;
 - characterize the regional landscape in terms of historical and planned development and the constraints of regulations and standards; and
 - define a baseline condition for the resources using historical trends.

8. Identify Important Cause-and-Effect Relationships. The purpose of this step is to identify the important cause-and-effect relationships between human activities and resources, ecosystems and human communities. The PDE coordinates with appropriate ESB personnel to determine and document which cumulative environmental changes will result from the proposed action and other actions and how those changes will affect resources, ecosystems and human communities. The PDE and appropriate ESB personnel analyze information gathered for describing the affected environment to identify the factors that affect resources (e.g., the causes in the cause-and-effect relationships). The PDE and ESB personnel also develop conceptual cause-and-effect models, focusing on important relationships that can be supported by information from the study area. These models are used to aid in identifying past, present and future actions to be considered in the analysis (e.g., other actions that would affect any of the cause-and-effect relationships the proposed project would affect). The PDE and ESB personnel then determine what the effects of the identified causes would be on the resources, ecosystems and human communities of concern. One of the most useful approaches for determining the likely effects on resources, ecosystems and human communities is to evaluate the historical effects of activities similar to those under consideration.
9. Evaluate Cumulative Effects. The primary goal of this step is to determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative effects of other past, present and future actions. The PDE and appropriate ESB personnel compare the baseline condition of affected resources, ecosystems and human communities with the condition expected to result from impacts of the proposed action and other actions in the same geographic area. They evaluate magnitude of the cumulative effects based on the extent of the difference between the baseline condition and the condition as altered by the anticipated effects. They evaluate significance of the cumulative effects based on the extent to which they would affect the long-term sustainability of the resource, ecosystem or human community. The PDE and ESB personnel document the results of the cumulative effects analysis, including an indication of the extent to which the proposed project contributes to the cumulative effects on each affected resource, ecosystem and/or human community.
10. Evaluate Impact Avoidance, Minimization and Mitigation. If the analysis identifies potentially significant cumulative effects that would result from the proposed action, this step is used to evaluate opportunities for avoiding, minimizing or mitigating those effects. This is accomplished by avoiding or reducing the proposed action's contribution to the cumulative effects through modification or addition of alternatives. The PDE coordinates with the DT and appropriate ESB personnel in identifying, evaluating and documenting cumulative impact avoidance, minimization and/or mitigation alternatives for the proposed action.

25.3.4 Induced Growth Effects

The following guidance from NCHRP Report 466: *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects* is provided to assist in the identification and evaluation of induced growth effects associated with proposed transportation projects.

Among the potential consequences of project-influenced growth are increased population, increased traffic, increased pollution and increased demands for services (e.g., utilities, education, police and fire protection, recreational facilities). If a project's justification depends in whole or part on marketing induced growth or other project-generated benefits to the area (e.g., access to a major activity center) then there is no question that such effects are reasonably foreseeable and must be included in NEPA documentation for the project.

Induced growth effects fall into the following general categories:

- effects from projects planned to serve specific land development,
- effects from projects likely to stimulate complementary development, and
- effects from projects likely to influence intraregional land development.

25.3.4.1 Projects Planned to Serve Specific Land Development

Transportation projects designed specifically to serve existing or planned large land development projects or groups of projects require a thorough analysis of induced growth and related effects. This is necessary because:

- land development is not just probable but highly likely,
- the magnitude and timing of the development are known or generally predictable, and
- details of development projects are known and can be analyzed for environmental effects.

Because the land development projects are known, analysis of this type of growth is of importance to cumulative effects analysis and indirect effects analysis. With details about development in hand, analysis will focus on impacts related to the magnitude and timing of development, rather than its probability of occurrence.

25.3.4.2 Projects Likely to Stimulate Complementary Land Development

Complementary land development such as highway oriented businesses (e.g., gas stations, rest stops, motels) is more likely near interchanges in rural areas where property values were originally low. Interchanges in suburban or urban areas where property values were higher before project planning and implementation are more likely to support a greater proportion of higher density uses, as well as a greater mix of uses. Factors influencing the likelihood and rate of development near rural interchanges include the following:

- distance to major urban area or regional center (e.g., proximity corresponds to higher probability of development);
- traffic volume on the intersecting road (e.g., higher volumes correspond to higher probability of development);
- presence of frontage road (e.g., greater potential for intensive development); and

- availability of water and sewer and other infrastructure (e.g., greater potential for development).

If these factors are present, induced growth effects of this type warrant analysis.

Common patterns of development include the following characteristics:

- interchange quadrants on the right-hand side of motorists approaching the interchange from the main road have higher visibility and are often developed first; and
- transit projects with stops in suburban or urban areas may produce higher density commercial and residential uses and complementary retail and service development (e.g., coffee shops, dry cleaners, newsstands).

25.3.4.3 Projects Likely to Influence Intraregional Land Development

Apart from the complementary development described in [Section 25.3.4.2](#), on a regional basis, the impact of highway and transit projects is generally minimal. However, the localized effect of projects on land use can be substantial. If the conditions for development are generally favorable in a region (i.e., the region is undergoing urbanization), highway and transit projects can become one of the major factors that influence where development will occur and project-influenced effects warrant evaluation.

Where transportation projects do influence land development, the general tendency is toward relatively high-density commercial or multifamily residential development near facility nodes in urban and suburban areas and single-family residential development in the urban fringe.

According to information in NCHRP Report 466, *Desk Reference for Estimating the Indirect Effects of Transportation Projects*, development effects are most often found up to one mile (1.6 km) around a freeway interchange, up to two to five miles (3.2 km to 8 km) along major feeder roadways to the interchange and up to one-half mile (800 m) around a transit station.

General circumstances influencing the likelihood of induced development shifts include the following:

1. Extent and Maturity of Existing Transportation Infrastructure. The influence of highway projects diminishes with successive improvements, because each new improvement brings a successively smaller increase in accessibility. Improved roads in a developing region attract more land use development, population growth and traffic, which soon leads to congestion, reduced accessibility and air quality impacts.
2. Land Availability and Price. Development cannot take place without the availability of land of a quality and price suitable for development. Property values are de-facto indicators of the potential for land use change because investment decisions revolve around market prices. Land prices are likely to reflect a parcel's suitability for development (favorable topography), the availability of other suitable parcels in the area, the attractiveness of the location and many of the other factors listed below. An abundance of suitable, low-priced land may be indicative of potential development if other factors are present. However, a scarcity of land or high price does not necessarily

indicate a lower probability of development. If other factors are favorable, high-density development may occur where land is scarce or high priced.

3. State of the Regional Economy. Even if changes in accessibility are great, development is not likely to occur if the regional economy will not support new jobs and households, if credit or financing is not readily available, or if firms conclude that the availability of labor, suppliers or local markets for goods are not sufficient.
4. Area Vacancy Rates. High local vacancy rates in housing or commercial space of good quality may be absorbed before any shift in development to the project area is seen.
5. Location Attractiveness. The quality of existing development, local politics and growth history are all factors considered in addition to transportation availability and cost.
6. Local Political/Regulatory Conditions. Low business, property and sales tax rates; the availability of incentives for development (e.g., tax abatements); and a regulatory environment that is favorable to business are factors favorable to development. The speed, ease or predictability of the development review process can also impact development costs.
7. Land Use Controls. Development is shaped by zoning ordinances and other land use controls that influence the amount of land available for various uses, the densities permitted and the costs of development. Pressures for development can prompt communities to alter land use controls and an evaluation should be made which considers the likelihood that changes in land use controls will occur. The evaluation can consider the historical record of zoning enforcement and granting of variances, whether the controls are rooted in long-range comprehensive plans and the existing amount of undeveloped land for each use.

If these conditions are favorable for development, a detailed analysis of induced growth and its potential for impact on important area goals or notable features is warranted.

25.3.5 Documentation

After completing the indirect and cumulative effect analyses, the PDE compiles documentation of the results. If the project is expected to cause indirect and/or cumulative impacts, the PDE ensures the documentation includes information on the following:

- the analysis methodology;
- nature and magnitude of the impacts including whether the impacts would be temporary (e.g., occurring only during construction) or would be more permanent;
- the resources affected;
- the information used in the identification and assessment of the indirect and/or cumulative impacts and its source, including results of early coordination and/or scoping; and

- measures to be implemented to avoid, minimize or mitigate indirect and/or cumulative impacts.

If the analyses determined the project will not cause indirect and/or cumulative impacts, the PDE ensures the documentation provides information to support the basis for that determination.

The PDE ensures the results of the analysis of indirect and cumulative effects, including proposed mitigation measures, are appropriately reflected in the project environmental documentation (see [Chapters 11 “Preparing Environmental Documentation,” 12 “Categorical Exclusion,” 13 “Environmental Assessment/FONSI”](#) and [14 “Environmental Impact Statement/ROD”](#)) and included in the project file.

25.3.6 Mitigation and Commitments

The PDE and DT ensure the project plans accurately reflect mitigation measures that are to be implemented for the project. To the extent possible, the PDE and DT should prepare the contract documents using the *MDT Standard Specifications* to minimize the need for special provisions.

The District Environmental Engineering Specialist monitors the project construction to ensure that all mitigation measures are implemented in accordance with the approved project plans.

