

INDIRECT & CUMULATIVE EFFECTS (ICE)

DESK REFERENCE



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EXECUTIVE SUMMARY

Assessment of Indirect and Cumulative Effects (ICE) is a requirement under the National Environmental Policy Act (NEPA) of 1969, as amended, and under the Council on Environmental Quality (CEQ) regulations implementing NEPA. ICE analysis is rooted in the environmental analysis performed as a natural part of the Transportation Development Process. This desk reference is designed to provide suggestions and examples of how to incorporate ICE analysis into the Transportation Development Process and to provide analytical outlines and suggestions of how ICE analysis data may be gathered and considered simultaneously with other information that contributes to project decisions. The level of detail employed to assess indirect and cumulative effects will vary based on the type and complexity of the project.

Indirect Effects are generally defined as those that are caused by a project, but unlike direct effects, occur later in time or are farther removed in distance. These effects are often called “but for” actions, because they would not or could not occur “but for” the implementation of the project.

Cumulative Effects include “... 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...” Cumulative Effects include the proposed project’s direct and indirect effects in combination with the effects due to past, present, and reasonably foreseeable future activities or actions of Federal, non-federal, public, and private entities.

The ICE Desk Reference provides practitioners with a suggested structure on which to base their analysis of ICE and thereby will allow more effective consideration of the full range of consequences associated with transportation actions. This, in turn, will improve decision-making and better fulfill the intent of Federal and state laws, regulations, and policies concerning ICE, while better serving Pennsylvania’s communities.

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I. INTRODUCTION TO INDIRECT AND CUMULATIVE EFFECTS (ICE) ANALYSIS

The following procedures represent a compilation of best practices/approaches being used throughout the country to assess indirect and cumulative effects (ICE). The suggested analysis process provided in this desk reference does not represent regulation or formal PennDOT policy. *The approach provided in this desk reference is for informational purposes only; it is not regulatory.*

ICE analysis is not a new requirement and is currently being conducted throughout Pennsylvania. This Desk Reference supplements and clarifies existing transportation planning and environmental processes



and encourages transportation partners to effectively consider the full range of consequences associated with transportation actions. The purpose of the information provided is to improve decision-making through the early consideration of environmental effects.

The following regulations, policies, and guidance documents provide the regulatory background for the consideration of ICE.

A. Federal Legislation and Policy

1. National Environmental Policy Act (NEPA) of 1969

The Federal statute most relevant to the assessment of ICE is NEPA. While NEPA does not specifically refer to ICE, it contains two sections that are related to ICE as a concern for Federal projects. First, in Section 101(b), NEPA makes it the responsibility of the Federal Government to:

“... assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings ...attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences...[and] preserve important historic, cultural, and natural aspects of our national heritage...” (NEPA 1969, 42 USC 4331 Section 101(b)).

In addition, it states that:

“...the Federal Government shall include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on the environmental impact of the proposed action [and] any adverse environmental effects which cannot be avoided should the proposal be implemented.” (NEPA 1969, 42 USC 4332 Section 102(c)).

The meaning of these sections was clarified when the Council on Environmental Quality (CEQ) issued its NEPA regulation in 1978, as part of its mission to provide assistance to Federal agencies on implementing NEPA. In the terminology section of the regulation, the CEQ provides definitions of “effects”. Specifically, effects are defined as having two components: direct and indirect effects.

Direct effects “...are caused by the action and occur at the same time and place,” and **indirect effects** “...are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable” (CEQ 1986, 40 CFR 1508.8).

The CEQ regulation adds that **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.”

The CEQ differentiates direct and indirect effects from the term “**cumulative effect**”, which “...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...”

2. Other Federal Laws, Regulations, Policies, and Guidance Documents

On September 18, 2002, President George W. Bush signed Executive Order (EO) 13274, Environmental Stewardship and Transportation Infrastructure Project Reviews. This EO established an Interagency Task Force to advance environmental stewardship and streamlining efforts, to coordinate expedited transportation decision-making, and to address priority projects. The Task Force established an Interagency Work Group on ICE to evaluate this topic and identify opportunities where greater interagency coordination and collaboration could lead to improvements in the decision-making process for projects. The Work Group released its Draft Baseline Report on March 15, 2005. The appendices of the Draft Baseline Report include a comprehensive annotated bibliography and links to guidance documents, annotations on case law, and other helpful materials. The Draft Baseline Report can be found at <http://www.fhwa.dot.gov/stewardshipeo/icireport.htm>.

Additionally, the following guidance documents and regulations provide information on ICE:

- FHWA's Regulations: 23 CFR 771 and 23 CFR 450 at <http://www.fhwa.dot.gov/legsregs/directives/fapg/cfr0771.htm> and <http://www.fhwa.dot.gov/hep/23cfr450.htm> respectively.
- FHWA's 2003 Interim Guidance: Questions and Answers Regarding Indirect and Cumulative Impact Considerations in the NEPA Process found at <http://www.environment.fhwa.dot.gov/projdev/qaimpact.asp>.
- FHWA's Technical Advisory TA 6640.8A found at <http://environment.fhwa.dot.gov/projdev/impTA6640.asp>.
- EPA's 1999 Policy Paper: Consideration of Cumulative Impacts in EPA Review of NEPA Documents, found at <http://www.epa.gov/compliance/resources/policies/nepa/cumulative.pdf>.
- CEQ's 1997 Handbook: Considering Cumulative Effects Under NEPA, found at <http://ceq.eh.doe.gov/nepa/regs/40/40p3.htm>.
- FHWA's 1992 Policy Paper: Indirect and Cumulative Effect Assessment in the Highway Development Process, found at http://www.fhwa.dot.gov/environment/2_c_imp.htm.

B. State Legislation and Policy

Pennsylvania Act 120 requires PennDOT to consider environmental and community impacts in the preliminary planning and design of transportation projects.

Pennsylvania EO 1999-1, *Land Use Planning*, seeks to promote sound land use planning practices at all levels of government and notes that "infrastructure maintenance

and improvement plans should be consistent with sound land use practices.”

The *Keystone Principles for Growth, Investment & Resource Conservation* also lay out general goals and objectives and ways for measuring how economic development and resource conservation decisions support those goals and objectives (<ftp://ftp.dot.state.pa.us/public/bureaus/ProgCenter/KeystonePrinciplesandCriteria.pdf>).

C. PennDOT Policy on ICE

It is the policy of the Pennsylvania Department of Transportation (PennDOT) to work proactively to implement the Council on Environmental Quality (CEQ) and Federal Highway Administration (FHWA) regulations concerning Indirect and Cumulative Effects (ICE) throughout the Transportation Development Process.



II. CONSIDERATION AND EVALUATION OF INDIRECT EFFECTS

What are Indirect Effects?

Those effects caused by an action and occurring later in time or farther removed in distance, but 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 (40 CFR 1508.8).

What are Indirect Effects?

Indirect effects are generally defined as those that are caused by a project, but unlike direct effects, occur later in time or are farther removed in distance. These effects are often called “but for” actions, because they would not, or could not, occur but for the implementation of the project. Indirect effects can range from growth-related effects resulting from changes in accessibility, to physical environmental effects,

such as downstream sedimentation resulting from project construction. While a project’s potential direct effects form the initial set of resources to examine for indirect effects, analysis should consider adjacent resources to determine if indirect effects to those resources are likely.

When to Assess Indirect Effects?

The scope of the indirect effects analysis should match the project complexity, size, and National Environmental Policy Act (NEPA) document level. In other words, more detailed analysis will be required for larger projects requiring an Environmental Assessment (EA) or Environmental Impact Statement (EIS). For Categorical Exclusion (CE) projects, indirect and cumulative effects analyses are considered when making the determination that a CE applies to the project. Application of a CE indicates that impacts, including indirect effects, are not significant. Therefore, a detailed, quantitative indirect effects analysis is generally not needed for CE projects. However, a qualitative analysis may be performed to assess, verify, and document that a project does not, in fact, result in significant indirect effects. The degree of

analysis for a CE should be commensurate with the level of impacts and complexity of the project.

Consideration of indirect effects should begin early in the Project Development Process, generally as part of early coordination or scoping. By beginning the process early, input from a well-represented audience can be gathered and indirect effects can be examined and considered during development of preliminary alternatives.

How to Assess Indirect Effects?

Growth-related indirect effects should examine changes to the rate, type, location, or amount of growth that can be attributed to the project. The key to analyzing growth-related indirect effects is to:

- 1) Determine the potential amount and pattern of growth that is anticipated for the study area regardless of the project (i.e. under the No-Build Alternative).
- 2) Determine whether the Build Alternatives could influence the amount or pattern of future development for the study area.
- 3) Identify the difference in the amount, or pattern of growth. This represents the potential for growth-related indirect effects. This potential may be mitigated or encouraged based on county and/or municipal plans, policies, and/or ordinances.



(Note: Growth-related indirect effects are calculated as the difference between the growth that would occur regardless

of the project (No-Build) and that which would occur if the project is built (Build Alternative). Growth that would occur under the No-Build Alternative is **not** considered an indirect effect.)

Projects must also be analyzed for other types of non-growth-related indirect effects, such as downstream sedimentation, water quality issues caused by future road runoff or spillage-type accidents, or the eventual loss or diminishment of wetland habitats downstream of the project area due to changes in hydrology. The list of potential non-growth-related indirect effects can be extensive and can vary widely depending on the type and location of a project.

The following steps serve as guidelines for identifying and assessing indirect effects:

- 1) Determine the project's potential for indirect effects. If no potential, then no analysis is required.
- 2) Develop the Study Area Boundary for indirect effects.
- 3) Establish and document the baseline conditions in the indirect effects study area.
- 4) Identify and analyze the indirect effects.
- 5) Determine the significance of the indirect effects.
- 6) Develop solutions or mitigation, if needed.
- 7) Document the findings of the indirect effects analysis.

A. Steps 1 & 2 – Potential for Indirect Effects and Study Area Boundary

The first steps to considering indirect effects involve identifying the proposed transportation action's potential for indirect effects, and establishing the preliminary indirect effects study area. Engaging a well-represented audience (planners, environmentalists, designers, and the public) early in the transportation decision-making process affords these individuals a strong, active role in defining conceptual

ideas for a project, including the development of an action's purpose and need and potential alternatives, as well as identifying possible environmental impacts.

As part of the project understanding, it is necessary to determine whether a project would have the potential to cause indirect effects and whether an analysis is even necessary. As stated, one of the most likely causes of indirect effects is project-related growth. **Chart 1** should help in determining whether a project would have the potential to cause growth-related indirect effects. However, even if the project does not appear to have a high potential for growth-related indirect effects, the possibility of other non-growth-related indirect effects should still be considered. Also, note that it is possible for a project to have growth and non-growth related indirect effects on resources that are not directly affected by a project, such as resources located just outside of the direct effects project area in a growth area, or downstream of a project area.

The following are examples of issues to consider when analyzing a project's potential for indirect effects. It is by no means an exhaustive list. Professional judgment and analysis should be utilized to develop a list of the project's potential indirect effects. Consider multi-disciplinary brainstorming sessions for this purpose.

Aquatic resources:

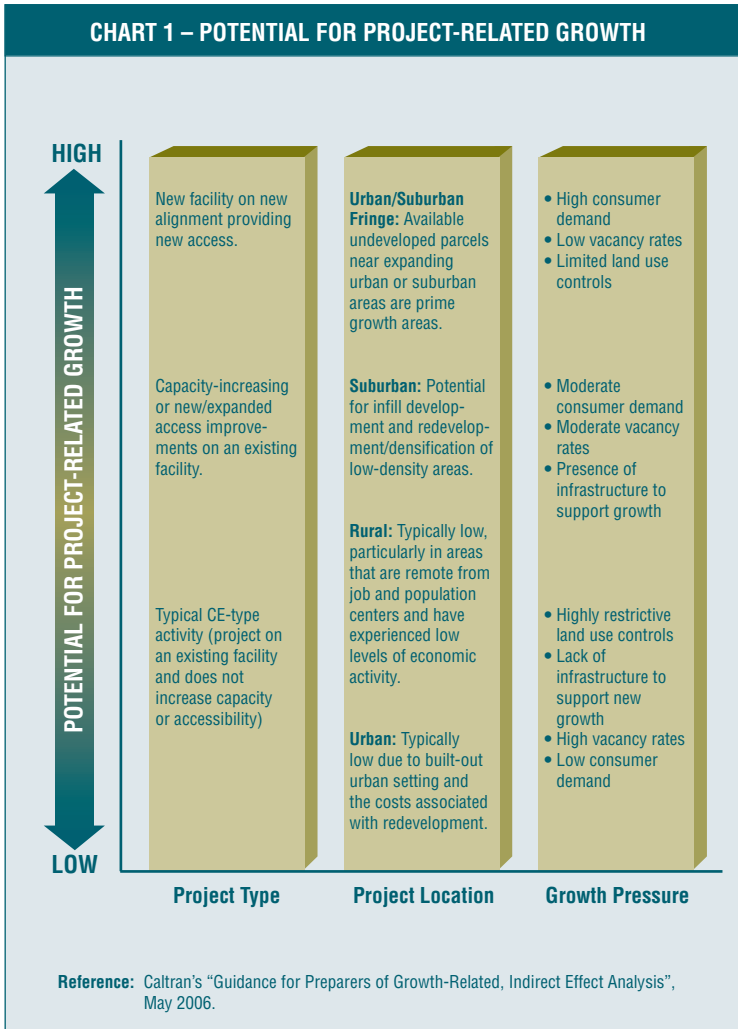
- What is the project's potential to disrupt or diminish hydrology that supports aquatic resources, possibly causing their eventual loss or decreasing their value to wildlife?
- What is the potential for future runoff from the facility to affect water quality, either due to materials



washing off the road surface or due to increased potential for sedimentation caused by concentration of runoff?

- What is the potential for shading to cause a future change in stream temperature, plant life, etc.?

CHART 1 – POTENTIAL FOR PROJECT-RELATED GROWTH



Reference: Caltran's "Guidance for Preparers of Growth-Related, Indirect Effect Analysis", May 2006.

Terrestrial resources:

- Does the project have the potential to isolate wildlife habitats? Consider whether existing barriers, such as other roads or wide rivers, already sever access to portions of a habitat area and whether the project would “complete” the box, confining wildlife inside, resulting in possible increased mortality due to gene pool depletion, reduced food supplies, or other effects.
- Does the project have the potential to cause wildlife to move out of the area due to highway disruptions, separating foraging areas from nesting areas, or other effects?

**Cultural Resources:**

- Does the project have the potential for growth-related effects that would impact a historic site, historic resource, or archaeological resource? This could include effects that would promote development that would demolish a historic structure, increase traffic through a historic district, improve access to a historic site for visitors, etc.

Community Resources:

- Does the project have the potential to make important community resources, such as grocery stores, social facilities, schools, or places of worship, less accessible?



Economic Resources:

- Does the project have the potential to provide accessibility to an economic expansion area?
- Does the project have the potential to cut off access for industry to get materials or goods to market?

Once it is determined that a project has the potential for indirect effects, a study area boundary should be set to examine and analyze effects on those resources of concern. Effects will only be examined for resources of concern. At a minimum, the indirect effects boundary should be broad enough to accommodate all transportation alternatives that would satisfy the project needs and complement community land use goals that could interact with transportation facilities. It should also include any other reasonably foreseeable projects or actions in the vicinity. When determining actions that are reasonably foreseeable, the analyst should not engage in speculation of any impact that can be conceived. This means that the action must be probable, not merely possible. This determination will require informed judgments based on existing plans, recent trends, and coordination with local officials and state and Federal agencies.

(Note: it is recommended that the boundary focus on a reasonable area in which to determine indirect effects without undue influence of unrelated projects). The indirect effects study area may be larger than the direct effects study area (project area).

B. Step 3 – Establishing Baseline Conditions

After the indirect effects study area is established, the next step involves identifying county and local planning initiatives, local development activity, natural, cultural, and socioeconomic resources, and other issues that exist within that study area. **Table 1** provides suggested sources of

TABLE 1 – SOURCES OF ENVIRONMENTAL DATA FOR ICE ANALYSES

ENVIRONMENTAL FEATURES	INFORMATION SOURCE
Natural Resources	
Floodplains	FEMA Mapping, USGS Mapping
Wetlands	NWI Mapping, Soils Surveys, Color Infrared Aerial Photography, Cursory Field View
Surface Waters/Water Quality	USGS Mapping, Aerial Photographs, Cursory Field Views, DEP's Chapter 93, STORET Data, PFBC Files
Prime and Statewide Important Farmland Soils	NRCS, County Conservation District, PA Dept. of Agriculture, County Soil Surveys
Productive Agricultural Land	Aerial Photographs, Cursory Field View, Municipal Mapping and Tax Parcel Information for Act 43, 319 and 515 Lands
Critical Habitat Areas/Threatened and Endangered Species	DCNR's PNDI List, PA Game Commission, PFBC, USFWS, NMFS, Recovery Plans
Geological Resources	County Soil Survey, Geologic Publications, Cursory Field View, USGS, DCNR's Bureau of Topographic and Geologic Survey
Terrestrial Habitat	USGS Mapping, Aerial Photographs, Cursory Field View
Cultural Resources	
Historic Resources, Historic Structures, Historical Data	State Historic Preservation Office Files, County Survey Files, Field Reconnaissance, Historical Societies, National, State or Local Archives, Courthouse, Library, Historic Bridge Survey, CRGIS
Archaeological Resources	Local Informants, PASS Files, Local Historical Society, Society for PA Archaeology Chapters, Field Reconnaissance, CRGIS
Socioeconomic Resources	
Population	US Bureau of Census, Local Municipalities, State Data Center, Regional/County Planning Commission
Properties – Residential, Commercial, Industrial	Preliminary Engineering Plans, Parcel Maps, Aerial Photography, Local Tax Assessment Office, Local Municipalities, Cursory Field Views, Comprehensive Plans
Proposed Development Areas	Regional/County Planning Commission, Aerial Photographs, Local Municipalities, Cursory Field View, Comprehensive Plans, Zoning
Community Facilities and Services (Schools, Emergency Services, Utilities, Public Buildings, etc.)	Local Municipalities, Regional/County Planning Commission, Parcel Maps, Cursory Field View, PA One Call, Local Utility Companies
Cemeteries	Local Municipalities, USGS Mapping, Aerial Photographs, Cursory Field View, Parcel Boundary Mapping
Potential Air and Noise Receptor Sites	Preliminary Engineering Plans, Subdivision Plans, Aerial Photographs, Cursory Field View
Potential Waste Sites	PADEP 100 and 300 Lists, EPA CERCLIS, Cursory Field View, Federal and State Records of Waste Site Inventories, and Waste Management Permit Programs
Parks and Recreation Sites	Local Municipalities, Regional/County Planning Commission, DCNR, PGC, Cursory Field View, NPS

data for gathering this information. This information is intended to provide an overview of the study area (or baseline conditions) and is used as a basis for identifying potential impacts of a proposed transportation action. Important information will also be gathered through field views and as part of the public and stakeholder involvement process.

Early definition of the indirect effects study area baseline conditions is very useful to the indirect effects assessment, because it creates a broad inventory of environmental resources (including statutorily protected resources, as well as those identified by a community as important or valuable) that can guide the development of transportation alternatives. Moreover, this inventory serves as critical input for determining the potential for indirect effects. To identify the indirect effects study area baseline conditions:

- 1) Expand the data collected for the direct effects analysis to cover those areas located outside of that boundary but within the indirect effects study area boundary as well as any other data pertinent to the indirect effects analysis. (By identifying both the direct and indirect effects study area boundaries early in the transportation development process, baseline conditions can be collected simultaneously, reducing efforts and increasing efficiency.)
- 2) Include information related to items such as, but not limited to, natural resources, land use, development activity, local ordinances, etc.
- 3) Identify the regulations and laws governing each resource (i.e., agricultural preservation zones, Section 404 of the Clean Water Act, etc.). This should include contacting local jurisdictions for their applicable regulations and ordinances.

- 4) Utilizing the baseline conditions information, review, and, if necessary, update the resource map. (Land uses are generally identified as agricultural, residential, business, industrial, open space, etc. and include information about schools, roads, etc. Map, if available, where sewer and water services exist or are proposed, since areas with sewer and water services support greater development densities than areas with wells and septic systems.)

When identifying land use, developments, etc., project staff should become familiar with planning goals, objectives, policies, and ordinances that will guide the future development of project area communities. While these items may or may not be recent, and will often vary in their specificity, strength, and level of implementation, they will often state an intent for how land in the study area should be used or conserved in the future. Whether these are vital planning documents or not depends on the level of interest, awareness, and involvement at multiple levels of government and within the communities. However, it is important to begin with what study area communities have

In addition to natural resources and existing community conditions, consider exploring the following areas of inquiry with county and local officials as you establish baseline conditions:

- Is the area growing or declining? Examine forecasts for population and employment growth.
- Where is there recent interest in development? Identify recent development (residential & non-residential).
- What development has been approved recently? Document pending development (approved plans - not yet constructed).
- Where would developers like to build in the near future? Identify proposed development (submitted plans – not yet approved).



expressed as their desired future. Sources for this information include comprehensive plans and any other documentation that describes the preferred future for the study area, any means for implementation of that future, and documentation regarding the progress of implementation. Project staff should look for these documents from municipal, county, regional, and state sources.

C. Step 4 – Identify and Analyze Potential Beneficial and Adverse Indirect Effects

Degree of Analysis:

Choose the method of analysis, tools, and level of effort based on the:

- Scale of the proposed project.
- Magnitude of potential impacts.
- Available data.
- Resources available.

The identification and analysis of indirect effects to determine the magnitude of those effects should be performed using only existing, readily available data. In addition, varying levels of analysis may be used for different resources and can be both qualitative and/or quantitative. Both beneficial and adverse effects should be considered.

Based on substantial research, it is clear that no one technique (qualitative or quantitative) has received universal acceptance by transportation or environmental professionals for assessing these impacts. As such, there is no “single” blanket approach for conducting indirect effects analyses.

Indirect Effect analyses should only be performed for resources of concern, as identified in Step 1. For the **indirect effects** analysis:

- Briefly describe the location of the transportation alternatives in relation to the built and natural environment.

- Discuss in detail any changes in the amount and/or distribution of land development that may occur as a result of the No-Build Alternative and each Build Alternative retained for detailed study (this should also include any subsequent avoidance alternatives). CEQ requires that any known indirect effects and those that are “reasonably foreseeable” be identified for resources of concern. The analyst should not engage in speculation or contemplation, but should identify those changes that are likely to occur or are probable, rather than those that are merely possible. It may be helpful in this step to engage study area communities and other stakeholders in a careful consideration of how the transportation alternatives may have the potential for changing or creating new land development patterns, and whether they perceive these changes to be positive or negative.
- Clearly identify known development that is dependent upon each proposed project alternative retained for detailed study (i.e., it would only occur “but for” the project). An example of such development would be the construction of a distribution warehouse planned for the vicinity of a new interstate highway interchange. The warehouse requires the ease of access that would be provided by an interstate interchange.

Consider how regional, county, and local planning and zoning could affect growth-related indirect effects:

- Do plans, policies, and ordinances seek to encourage or limit development?
- What is local public sentiment about the type and location of future development?
- Is the area targeted for growth or conservation?
- Have municipalities designated growth areas?
- Do economic incentive zones exist?
- Are ordinances consistent with land use goals and policies?
- Is there a local precedent for upholding or providing exceptions for ordinances?

How Transportation May Affect Growth:

Amount – a change in the overall amount of growth.

Pace – a change in the rate of growth.

Location – a change in the direction or location of growth.

Pattern – a change in the type of growth (density and use).



- Access control – or lack of it – is also a factor in assessing indirect effects. Projects with uncontrolled access alternatives are more likely to result in indirect effects, such as the potential for development along the length of the roadway. For those alternatives with access controls, the focus will likely be at the intersections/interchanges. Therefore, it is important to discuss how improved access and access controls could affect land development with multiple stakeholders throughout the project development process. (Additional information on access management can be found in *PennDOT's Access Management Handbook, Publication No. 574.*)

- Identify future changes in the surrounding ecosystem, such as those discussed in the previous section. This should include construction and post-construction activities (e.g. stormwater discharge). Look for areas where the proposed drainage structures would relocate and/or concentrate flow, terrestrial areas that would be cut-off from the surrounding ecosystem, habitat types that would be separated, etc. This list only provides a starting point for analysis; consideration should be given to specific project types and the surrounding environment.

It is important to look for both positive and negative indirect effects. Keep the depth of the indirect effects analysis in scale with the project and its potential effects. Aim for a

level of effort that is time-efficient, but tells the story with clarity and accuracy.

D. Step 5 – Determine Significance of Potential Indirect Effects

Based on the analysis of potential indirect effects, the analyst should draw conclusions about the indirect effects to resources. Apply professional judgment to the results and coordinate with technical experts as warranted.

- 1) Answer the question, “Is there the potential for an indirect effect?”
- 2) Use the results of the analysis to characterize whether the effects are positive or negative.
- 3) Discuss their magnitude.
- 4) Determine whether mitigation is needed.

The discussion of significance should address how any potentially positive effects would help advance the local, county, regional, or state goals. If the potential effects are negative, consider the following question: “What do decision-makers need to know about the status of this resource?” It is necessary to look at the current health or condition of the resource(s) in question and determine whether the project’s indirect effects would have a substantial enough impact to require mitigation. Professional judgment and coordination with technical experts will be necessary to make this determination. If it is determined that although the project

Approach for Developing a Growth-Related Impact Analysis:

1. Review previous project information and decide on the approach/level of effort needed for the analysis.
2. Identify the potential for growth for each alternative that is studied, including the No-Build.
3. Assess the positive and negative growth-related effects of each alternative to resources of concern.
4. Consider additional opportunities to avoid and minimize growth-related impacts or direct them to designated growth areas.
5. Compare the results of the analysis for all alternatives.
6. Document the process and findings of the analysis.

would cause an indirect effect to a resource, the effect would not be substantial enough to further impair or deteriorate the resource to irretrievable levels, mitigation may not be necessary. Otherwise, mitigation measures should be developed, as discussed in the following section.

E. Step 6 – Identify Solutions or Mitigation

After identifying the possible indirect effects of each project alternative on resources of concern, it is important to consider whether additional opportunities exist to further avoid or minimize these impacts.

Some key avoidance and minimization measures include alignment choices, the location and/or configuration of access points, and mode choices. Decisions about alternative alignment choices are often made very early in the project development process to address transportation needs within a particular corridor. However, project alternatives may be modified to avoid or minimize indirect effects. Transportation choices that increase accessibility could place pressure on sensitive resources in the vicinity of the access point. Although modifying the location and/or configuration of access points is typically considered as a measure to avoid or minimize direct impacts, this approach also may be effective in redirecting future development that could affect resources in the vicinity of the access point. Also, transit projects, in combination with land use policies, can encourage compact development (“smart growth”). Redesign of a drainage system or alignment shifts could minimize or eliminate some environmental or socioeconomic-related indirect effects.

By CEQ definition (40 CFR 1508.20), mitigation of impacts means avoiding, minimizing, rectifying, reducing and/or compensating with a substitute. This hierarchy is referred to as “sequencing”, which means that actions to avoid and

minimize adverse impacts should be considered first. This mitigation-sequencing theme is carried forward into the regulations and policies of FHWA and PennDOT. If avoidance or minimization of adverse effects to resources is not possible, then other mitigation strategies will need to be considered in the environmental document. It is suggested that a dialogue be initiated with the appropriate local agencies and resource agencies regarding other mitigation strategies.



Making a determination that mitigation is required for an indirect effect can be complicated. Because these effects usually occur in combination with other actions by local agencies and private entities, PennDOT is not required to mitigate indirect effects that are outside of its control. Project-related land development is almost always under the control of local governments and the private sector. Therefore, the most effective way to mitigate or reduce the potential adverse resource effects from changes in land use is often through the application of controls by local governments, who have the authority to reject land use proposals that are inconsistent with local zoning and subdivision/land development ordinances. Purchasing access rights or conservation easements can also prevent or minimize growth by limiting land accessibility and can help protect areas containing sensitive resources. Conservation easements also can be established to protect resources in perpetuity. Similar strategies include land banking and developing habitat conservation plans or resource conservation plans. Transportation agencies can contribute to these measures with technical assistance and/or funding for planning and zoning initiatives.

In addition to mitigation efforts of local governments, PennDOT should use their expertise in environmental planning and stewardship for transportation projects to alleviate the need for mitigation (other than avoidance or minimization) of growth-related indirect effects. This approach would include:

- Early collaborative planning between Federal, state, and local agencies (see FHWA's web site on scenario planning, an approach that integrates land use and transportation).
- Incorporating reasonable avoidance and minimization opportunities for identified resource impacts.
- Thoroughly documenting analysis results.
- Assuring consistency with regional habitat/restoration planning efforts.
- Identifying opportunities for project stakeholders to become involved in regional planning efforts.

Stewardship and early planning efforts are further supported by Section 6001 of the 2005 transportation bill Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), which requires Metropolitan Planning Organizations/Rural Planning Organizations (MPO/RPO) to discuss potential mitigation activities and locations in the Long-Range Transportation Plan. In addition, FHWA's Linking Planning and NEPA Initiative provides tools for interagency collaborative transportation, land use, and environmental planning.

F. Step 7 – Document Findings

When documenting the findings of the indirect effects analysis, summarize how and to what extent the No-Build and Build Alternatives would potentially indirectly affect resources of concern. The results of this comparison will be used to contribute to the identification of the preferred

alternative, which best balances all resource impacts (social, economic, and environmental). Key items to include in the documentation include:

- 1) Clearly document the analysis process and its findings. This will clarify for decision-makers, the public, and resource agencies that the pertinent issues have been examined.
- 2) Include information about the methods and assumptions used, the agencies and experts consulted, and any other research.
- 3) Briefly state how the analysis was conducted. For example, indicate whether a specific traffic forecast or a general plan was used, or maps were provided by resource agencies that show known wetland locations.
- 4) Briefly state the approach that was used, identify the source and year of the data used, and describe any data gaps. If qualitative analytical approaches were used, such as questionnaires or interview panels, describe them.
- 5) Explain any assumptions used and limitations that were faced when conducting the analysis. Readers will need to know how conclusions were drawn in situations for which there were data gaps, lack of information, or limitations on obtaining data (e.g., data were cost prohibitive). If evaluating significant adverse effects in an EIS, refer to CEQ's regulations at 40 CFR 1502.22 for principles regarding incomplete or unavailable information. If models were used, summarize the assumptions on which the models were based. Also, be sure to include any assumptions made with regard to uncertainty or the likelihood of potential development.

- 6) Based on the analysis, provide a conclusion about whether the project would cause indirect effects, and what effect, if any, these indirect effects would have on resources of concern. The conclusions should quantify the effect of each alternative using the data developed during the analysis.

- 7) Describe avoidance and minimization measures incorporated into the project and document any commitments made.



III. CONSIDERATION AND EVALUATION OF CUMULATIVE EFFECTS

Council on Environmental Quality (CEQ) regulations require all Federal agencies to consider the cumulative effects of all proposed agency actions. The scope of the cumulative effects analysis should match the project complexity, size, and National Environmental Policy Act (NEPA) document level. In other words, more detailed quantitative analysis will be required for larger projects requiring an Environmental Assessment (EA) or Environmental Impact Statement (EIS). For Categorical Exclusion (CE) projects, indirect and cumulative effects analyses are considered when making the determination that a CE applies to the project. Application of a CE indicates that impacts, including cumulative effects, are not significant. Therefore, a detailed, quantitative cumulative effects analysis is generally not needed for CE projects. However, a qualitative analysis may be performed to assess, verify, and document that a project does not, in fact, result in significant cumulative effects. The degree of analysis for a CE should be commensurate with the level of impacts and complexity of the project.

Cumulative Impacts

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 impacts may also include the effects of natural processes and events... Accordingly, there may be different cumulative impacts on different environmental resources.

Source: FHWA, 2003. Interim Guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process.

When to Assess Cumulative Effects

No single formula is available for determining the appropriate scope and extent of a cumulative effect analysis. Ultimately, the practitioner must determine the methods and extent of the analysis based on the size and type of the project proposed, its location, potential to affect environmental resources, and the health of any potentially affected resource.

The cumulative effect analysis builds upon information derived from the direct and indirect effects analyses. This makes it tempting to postpone the cumulative effect analysis until the direct and indirect effect analyses are well under way. However, CEQ recommends that potential cumulative effects be considered as early as possible, preferably during scoping. Such early consideration of cumulative effects may also facilitate the design of alternatives so as to avoid or minimize impacts. Therefore, the consideration of cumulative effects should not be deferred until after indirect effects are analyzed. Instead, coordinate with PennDOT environmental staff about potential direct and indirect effects, and ask for their input about potential cumulative effects. Keep in mind that the process will be iterative. As more information about direct and indirect effects becomes available, it should be used to further refine the cumulative effect analysis.

How to Assess Cumulative Effects

The following steps serve as guidelines for identifying and assessing cumulative effects:

- 1) Identify resources with direct and/or indirect effects from the project for which cumulative effects could occur.
- 2) Identify boundaries for each individual resource.
- 3) Identify past and future time frames for each individual resource.
- 4) Identify the current availability/status for the resources in question.
- 5) For past effects, research historic trends, data, etc. on the status of the resource within the chosen boundary.
- 6) For future projects, identify potential types and general quantities of impacts to resources in question.
- 7) Combine project impacts with past trends and future effects to determine a potential cumulative effect.

- 8) Analyze whether predicted cumulative effects would have a substantial effect on the resource.
- 9) Develop solutions or mitigation, if needed.
- 10) Report the results of the cumulative effect analysis.

These steps provide a framework for practitioners rather than a formula. The level of detail required at each step will vary based on the type of project.

A. Steps 1 & 2 – Resources To Consider and Study Area Boundary

Step 1: The first step in performing the cumulative effect analysis is to identify which resources to consider in the analysis. List each resource for which the project could cause direct or indirect effects. If a project will not cause direct or indirect effects on a resource, it will not contribute to a cumulative effect on that resource. The cumulative effect analysis should focus only on: 1) those resources significantly impacted by the project; and 2) resources currently in poor or declining health or at risk even if project impacts are relatively small (less than significant).

“The resources subject to a cumulative effect assessment should be determined on a case-by-case basis early in the NEPA process, generally as part of early coordination or scoping” (FHWA 2003 Guidance).

A cumulative effect analysis must look at the impacts of a proposed project in combination with the impacts of other past, present, and reasonably foreseeable projects. If the environmental impacts of the project alternatives are similar, the discussion of project impacts may be represented by one alternative. However, if impacts vary substantially between alternatives, it is important to differentiate each alternative’s potential to contribute to cumulative effects.

Step 2: Cumulative effects are considered within spatial (geographic) and temporal boundaries. By defining a Research Study Area (RSA) for each resource, you will identify the geographic boundaries for each resource to be included in the cumulative effect analysis.

Define a unique study area for each resource rather than a single, consolidated study area.

To clearly understand the health of a resource, you must view the resource in its appropriate geographical context. A study area large enough to provide context for water quality impacts (e.g., an entire watershed) might be unnecessarily large for consideration with another resource, such as historic structures.

PennDOT resource specialists (biologists, archaeologists, architectural historians, landscape architects, and environmental planners) can help to identify appropriate RSA boundaries for each resource in the cumulative effect analysis based on their knowledge of the resources and regulatory mandates. Resource agency representatives and interested citizens may also offer input during the scoping process.

Many approaches are available to define an RSA for a cumulative effect analysis. The following examples describe ways to identify the RSA for a few specific resources:

Wetlands and Water Quality: Identify the drainage basin (watershed) or sub-basins in which the project would be located. If necessary, consult with PennDOT specialists to discuss potential RSAs.

Archaeological Resources: Identify high probability areas with potential prehistoric and/or historic archaeological sites in the project vicinity. Determine the geographic context for the type of archaeological resources being affected. This is most efficiently done by consulting with cultural resource professionals and the project's historic structures survey report. A context will be described in this document, typically including a discussion of geographic range or distribution of sites.

Historic Architectural

Resources: Identify areas with potentially eligible historic districts and neighborhoods with affected buildings or structures. Project-specific historical resource analyses typically define the geographic context needed to understand the historic significance of a structure (e.g., period of significance and neighborhood, community, or resource type).



Threatened and Endangered Species: Determine the local population of individual species and a general study area by considering the range, sub-range, or population distribution for the species. Consult biologists specializing in particular species for assistance in defining reasonable RSAs. (This guidance is for NEPA compliance; it is not intended to be performed to the level of detail needed for the cumulative effect analyses associated with the Biological Assessments prepared to comply with Section 7 of the Endangered Species Act.)

Community Disruption/Displacement: Consult the project's community impact assessment to identify neighborhood or community boundaries or potential environmental justice populations using census tract or other data. General plans and specific or sub-area plans will also suggest study area boundaries. Local websites can identify the boundaries for local neighborhood associations.

B. Steps 3, 4, 5, & 6 – Establishing Baseline Conditions and Time Frame

Step 3: Data availability for activities in the cumulative effects boundary is key for establishing the past time frame. The early 1970s is the earliest time frame for

which organized data is usually available, as this is when NEPA was passed. Some of the types of data that may be collected for use in determining the past time frame include:

- Dates when state roadways were built through resources in the cumulative effects boundary.
- Changes in land use (dates, types, etc.).
- Dates of major population/employment changes (review census tract data to determine when population and/or employment increased or decreased).
- Dates of key events in the historical context of the area (i.e., opening of a major transportation facility, opening of a military base, opening of a factory or major employment center).

Generally, the project's design year should be used for the reasonably foreseeable future time frame because design year traffic is based, in part, on future land use assumptions. This practice is consistent with FHWA's April 1992 guidance paper. The future time frame could also be when the impacted resource will have recovered, based on coordination with resource specialists/agencies. This future time frame may be longer than the design life of the project.

Step 4: The purpose of Step 4 is to begin to "tell the story of the resource" by: a) describing the current health, condition, or status of the resource within the RSA; and, b) describe recent trends affecting it.

"Health," as it is used here, refers very broadly to the overall condition, stability, or vitality of a resource, regardless of whether it is natural (e.g., a species or a wetland), cultural, (e.g., an archaeological site) or social (e.g., a community). There are a variety of ways to determine the current health or status of the resource within the RSA. The practitioner may rely on his or her professional expertise, consult the

technical specialists on the project team, consult other resource specialists, access data sources, review other environmental documents for other actions near the project, or use any combination of methods to gather information. The information in the “Affected Environment” section of the proposed project’s environmental document can provide a useful starting point for the assessment. However, rather than using the project study area as the geographic boundary, use the RSA determined in Step 2.

Health of a Resource

The health of a resource refers very broadly to its overall condition, stability, or vitality. For a species, health could refer to sustainability. For archaeological resources, health could refer to their continued ability to convey important information about the past. In the case of a community, health could refer to its ability to retain its character despite changes to neighborhood connectivity, types of businesses, or the number of residences.

The health or status of the resource should include a description of recent trends affecting it. These recent trends are meant to help complete the picture of the current condition of the resource. Many kinds of circumstances might indicate a trend that could affect the resource. Examples include: government decisions (e.g., a recent zoning change or preparation of a Habitat Conservation Plan), community preferences (e.g., passage of a measure to protect a historical downtown neighborhood), demographic changes (e.g., a shift in population growth rate), or natural phenomena (e.g., changes resulting from an earthquake, flood, or fire).

These trends may indicate whether the health of the resource is improving, stable, or in decline. This is valuable to the analysis in two ways: first, it will help the practitioner to focus the cumulative effect analysis more closely on the resources that are in decline; and



second, it may help the practitioner to propose more effective mitigation later.

In some cases it is clear that a resource is in good health. For example, if a historic district consists of multiple buildings that have retained their original character, this would indicate that the health of the historic district is good or excellent. In some cases it is also clear that a resource is in poor health, such as when a species is listed as Threatened or Endangered, or when major streams within the proposed project's RSA are listed on the 303(d) list of impaired waters.

Similarly, in some cases it will be easy to determine the effect of recent trends on the health of a resource. If a historic district includes many abandoned historic buildings, and the local City Council has recently approved building permits that will demolish some of them and construct new high-rise or other modern buildings in their place, these trends would indicate that the condition of the historic district is declining. If an organization funded and implemented a plan to clean up a polluted stream, including protecting riparian habitat, providing an appropriate buffer, and committing to long-term monitoring and adaptive management, this might lead to an improvement in the stream's water quality.

Counting What Counts

"A cumulative effects analysis should 'count what counts', not produce superficial analyses or a long laundry list of issues that have little relevance to the effect of the proposed action or the eventual decisions." (CEQ, 1997)

Step 5: In Step 5, the historical context of a resource is identified. The goal of the historical context is to give the reader (decision-maker) a reasonable explanation of how the resource got to its current state. Providing historical context is not the same as providing a list of every project or action that has

affected the resource over time. It is not realistic or necessary to provide an exhaustive "laundry list" of projects

throughout the years. Rather, the historical context should identify key historical patterns or activities that have contributed to the current condition of the resource.

To describe the historical context of a resource:

- 1) Identify key patterns or activities in the past that have influenced it. These will often be notable changes to the region's land use or demographic patterns.
- 2) Characterize the nature of the influence that these patterns or activities have had on the resource. To focus the inquiry about past patterns or activities, use the time frame established in Step 3.

This information may be quantitative, qualitative, or both. Quantitative information is useful for determining trends over time, but it is not always available. A qualitative description can also be



useful in providing historical context. The goal is to tell the story about the resource. If there is not enough quantitative data, then use qualitative information. Conversely, even if a large amount of quantitative information is available, it may not all be relevant to the analysis. Unless it is useful to the analysis, do not include it. For each resource, the practitioner uses his or her professional judgment to decide how to best communicate the historical context.

Step 6: The purpose of this step is to identify other current and reasonably foreseeable projects to be considered in the cumulative effect analysis. First, identify current and reasonably foreseeable transportation and non-transportation projects within the RSA for each resource



in the cumulative effect analysis. Keep in mind that CEQ regulations, as reflected in Federal Highway Administration (FHWA) guidance, require cumulative effect analyses to focus on actions “that are likely or probable, rather than those that are merely possible” (FHWA, 2003). When identifying reasonably foreseeable actions, contact municipal, county, and MPO sources, among others. These sources will aid in developing a list of planned transportation projects, land development activity (proposed and approved) and proposed infrastructure projects such as changes to wastewater disposal or water supply systems. It will be necessary to discuss each of these projects in sufficient detail to determine whether it is probable enough to be evaluated or too speculative to warrant consideration.

CEQ advises practitioners to consult with the staff of an appropriate agency to identify reasonably foreseeable future actions based on that agency’s planning process. Project scoping can provide an opportunity for these agency discussions. For further information, refer to Chapter 2 of CEQ’s guidance document, *Considering Cumulative Effects Under the National Environmental Policy Act* (<http://ceq.eh.doe.gov/nepa/ccenepa/ccenepa.htm>). Once a list of projects has been developed, determine whether they would have a direct or indirect effect on the resource.

Quantitative data are preferable, and they should be used whenever relevant data are available. However, quantitative data are not applicable to all analyses (e.g., visual change or community disruption). The use of quantitative data and analysis is especially valuable when Section 404 resources or biological resources are involved, because such data can

be critical to identifying avoidance and mitigation measures and preparing permit applications. If quantitative data are not available, consult with appropriate agencies as soon as possible.

Use the best data you have available. In cases where data are incomplete or unavailable, FHWA encourages practitioners to communicate with project participants and participating agencies as soon as possible, because such communication can lead to additional opportunities for data collection and help all participants reach an understanding concerning the availability and acceptability of relevant information.



When preparing a NEPA document where there is incomplete or unavailable information for a reasonably foreseeable significant adverse effect, refer to CEQ's guidance at 40 CFR 1502.22. It lays out principles regarding what to say about the incomplete or unavailable information, and when to obtain additional information.

Be sure to document the assumptions and methods used to identify projects/actions included in the analysis, the agencies and experts consulted, and any other research. It may not be necessary to identify the sources that were consulted in the final document, but it is important to maintain a record of methods, assumptions, and analyses. This is especially important when data are scarce.

C. Step 7 – Identify And Analyze Potential Cumulative Effects

Step 7: After the direct and indirect effects of the proposed project and other reasonably foreseeable

actions have been assessed for the resources within the RSA, the information is now ready for analysis. The proposed project's cumulative effects can be assessed using a variety of methods and tools that are suited to different levels of analysis. The practitioner, with appropriate input as needed, will select the method(s) and tool(s) on a case-by-case basis for each resource being analyzed. Chapter 5 of CEQ's *Considering Cumulative Effects Under the National Environmental Policy Act* (<http://ceq.eh.doe.gov/nepa/ccenepa/ccenepa.htm>) describes a variety of methods or tools – both qualitative and quantitative – for evaluating cumulative effects. These range from simpler methods that may require less time and financial resources, such as matrices or mapping overlays, to data-intensive methods such as modeling or trends analysis. Table 5-3 on pages 56-57 of the CEQ Guidance describes these methods, as well as their strengths and weaknesses.

The method(s) used may vary depending on the resource considered, the type of available information, and the scale of the proposed project. More than one method can be used to assess cumulative effects on a single resource. For example, the cumulative effects analysis of a species could combine Geographic Information Systems (GIS) mapping and consultation with species experts. The GIS would show historical and anticipated changes in the size and location of species habitat, and the consultation would provide information on the condition of the species, and the species' ability to adapt to anticipated biological stressors.

Also, note that no net loss does not necessarily mean no cumulative effects. A practitioner may determine that each action contributing to a cumulative effect will be mitigated and that no net loss would occur. However, a conclusion of no net loss can still result in notable cumulative effects to a resource. For example, the cumulative effect analysis for wetlands should also address:

- The loss of locally important wetland functions and values.
- The potential for successful compensatory mitigation, particularly with artificially constructed wetlands.
- The time required for compensatory wetlands to achieve functions and the related temporary loss of wetlands.
- The potential for increased habitat fragmentation.
- The potential to reverse a trend for systematic wetlands or related ecosystem restoration within the RSA.
- The potential for cumulative effects to wetlands to affect other resources, such as animal or plant species that depend on healthy wetland habitat.

Choosing a Method

There are a variety of methods or analytic tools available. Select a method, with appropriate input as needed, which makes sense considering the condition of and anticipated impacts to the resource, the type and amount of available information, and the type and size of the proposed project.



D. Step 8 – Determine Significance Of Potential Cumulative Effects

Step 8: In previous steps, the practitioner collected data and information and applied a method(s) to analyze this information. Based on that analysis, the practitioner draws conclusions about the cumulative effects to resources by applying professional judgment to the results, and by coordinating with technical experts as warranted.

Reality Check

Compare the results of the cumulative impact analysis with the analysis of the direct and indirect impacts of the proposed project.

First, the practitioner answers the question, “Is there a cumulative effect?” If the results of the analysis indicate that the proposed project, in combination with other actions, would affect the health of the resource or a trend associated with a resource, the practitioner can conclude that the proposed project would contribute to a cumulative effect (either beneficial or adverse).

Next, the practitioner uses the results of the analysis to characterize the severity or magnitude of the cumulative effect. Consider the following question: “What do decision-makers need to know about the status of this resource within the RSA?” The practitioner should document the following for each resource:

- The health, status, or condition of the resource as a result of past, present, and reasonably foreseeable impacts.
- The contribution of the proposed project to the overall cumulative effect to the resource, in support of a significance determination.
- Any project design changes that were made, or additional opportunities that could be taken, to avoid or minimize potential impacts in light of cumulative effect concerns.

Consider the context and intensity of the proposed project’s cumulative effects. This will help the practitioner to make conclusions about the severity of these impacts. Chapter 4 of CEQ’s *Considering Cumulative Effects Under the National Environmental Policy Act* (<http://ceq.eh.doe.gov/nepa/ccenepa/ccenepa.htm>) provides additional information on assessing the magnitude and significance of cumulative effects. For most resources, the NEPA cumulative effect analysis conclusion will not require a description of the severity of impact (e.g., substantial, moderate, minor, significant) unless the method specifically reports results in such terms. However, noise and air

quality impacts must be categorized using specific criteria. For example, noise impacts are described as severe if they exceed certain decibel levels and result in levels much higher than existing conditions.

Once the cumulative effect analysis is complete, do a “reality check”: compare the results of the cumulative effect analysis with the results of the direct and indirect effect analyses of the proposed project. This comparison can test the soundness of the conclusions about each resource. For example, if the direct project impacts would result in a 0.2-acre loss of wetland habitat in an RSA that contains more than 100 acres of similar habitat, a severe cumulative effect would not be anticipated. However, recognize that if this same 0.2-acre impact happens to affect an extremely rare or limited resource, the cumulative effect may be substantial.

E. Step 9 – Identify Solutions

Step 9: FHWA’s NEPA implementing regulations call for the consideration of mitigation for all adverse impacts. Mitigation should be considered for any impact disclosed in the environmental document — direct, indirect, or cumulative. For more information about presenting mitigation, see CEQ’s discussion of mitigation in NEPA’s *Forty Most Asked Questions*, Numbers 19a and 19b, found at <http://ceq.eh.doe.gov/nepa/regs/40/40p3.htm>.

Determining the feasible mitigation measures for a cumulative effect can be difficult. In many cases, a cumulative effect results from the combined actions of numerous agencies and private entities. The requirement to implement a potential mitigation measure to address a cumulative effect is often beyond the jurisdiction of FHWA, PennDOT, or the resource agencies typically involved in the process. For example, successful mitigation measures for air quality impacts might require numerous local

communities to modify their general plans to reduce the amount of planned development and reduce the number of vehicle miles traveled within the geographic study area. PennDOT and FHWA do not have the authority to implement the necessary planning decisions, obtain local legislative approvals, or change the regional distribution of future development. Therefore, disclosure of mitigation for cumulative effects is not based on or limited to specific mitigation measures that can be implemented by the Lead Agency(s).



However, a project may provide opportunities for the project proponent to propose innovative cumulative effects solutions. Working in collaboration with resource and land use agencies, FHWA and PennDOT

have supported and implemented innovative solutions to enhance environmental stewardship and ecosystem sustainability. FHWA's Exemplary Ecosystem Initiatives provide examples of successful ecosystem and habitat conservation strategies.

If it was not possible to identify a mitigation measure, the discussion may consist of listing the agencies that have regulatory authority over the resource and recommending actions those agencies could take to influence the sustainability of the resource. By doing so, the needed mitigation would be disclosed to the public and reviewing agencies even though it could not be implemented by the Lead Agency(s). Once disclosed, the information could be used to influence future decisions or to help identify opportunities for avoidance and minimization when other projects are proposed. For more information about mitigation by others, see CEQ's discussion of mitigation

in NEPA's *Forty Most Asked Questions*, number 19b, found at <http://ceq.eh.doe.gov/nepa/regs/40/40p3.htm>.

F. Step 10 – Document Findings

Step 10: The purpose of this step is to document the results of the cumulative effects analysis process. The audience for the information presented in this step is decision-makers and interested members of the public. The product will typically be the information included in the NEPA document. It is a summary of the analysis approach and conclusions. This summary should include:

- The identification of resources considered in the analysis.
- The RSA for each resource.
- The conclusions concerning the health and historical context of the resource.
- Project impacts that might contribute to a cumulative effect.
- Other reasonably foreseeable actions considered in the cumulative effect analysis.
- The conclusions of the analysis.

The information presented is a summary, consistent with NEPA disclosure requirements, to present information to decision-makers and the interested public. Therefore, it is important for the practitioner to clearly state the conclusions of the analysis. Include information about the methods and assumptions underlying the analysis. Briefly state how the impact analysis was conducted. For example, you may have plotted GIS overlays of proposed actions (developments) and known locations of an endangered plant species. Briefly explain this

Part of Your Document

A cumulative impact analysis is part of the environmental document. It contributes to the analysis of all of your project's impacts. The level of detail is commensurate with the level of detail for the entire environmental document.

approach and include any of the figures or data used to draw conclusions if they provide illustration or clarification. Provide references or footnotes as needed to document sources. Explain any limitations that were faced in conducting the analysis. Reviewers will need to know how conclusions were reached in situations for which there were data gaps, scarce information, or limitations or obstacles associated with obtaining the data (e.g., data were cost prohibitive). If models were used, summarize the assumptions on which the models are based.

For the purposes of NEPA disclosure, the cumulative effects discussion should compare the cumulative effects of each project alternative. A typical statement might say, “Alternative A would adversely affect 0.4 acre of scrub shrub wetlands in the RSA. Alternative B would not affect scrub shrub wetlands. Alternative A, in combination with other actions, would contribute to an adverse cumulative effect to the scrub shrub wetland community type. Alternative B would not contribute to a cumulative effect to this resource.” Cumulative effects should be summarized in the “Environmental Consequences” chapter of an EIS or an EA.



IV. RELATIONSHIP BETWEEN INDIRECT AND CUMULATIVE EFFECTS ASSESSMENT

A project's direct effects are predictable; however, indirect and cumulative effects are not as easy to predict. Both indirect and cumulative effects must be reasonably foreseeable and probable. Indirect effects are caused by the project, but occur at some future time after the project's direct effects. Cumulative effects are the combination of the project's direct and indirect effects and the effects of other activities. Cumulative effects can occur at the time the project is completed or at a later date/time. The following table summarizes the relationships between direct, indirect, and cumulative effects.

SUMMARY OF DIRECT, INDIRECT, AND CUMULATIVE EFFECTS			
TYPE OF EFFECT	DIRECT	INDIRECT	CUMULATIVE
Nature of Effect	Typical/Inevitable/Predictable	Reasonably foreseeable/ Probable	Reasonably foreseeable/ Probable
Cause of Effect	Project	Project's direct and indirect effects	Project's direct and indirect effects and the effects of other activities
Timing of Effect	Project Construction and Implementation	At some future time after direct effects *	At time of project's construction or in the future*
Location of Effect	Within project impact area	Within boundaries of systems affected by project	Within boundaries of systems affected by project
<p>* Indirect and cumulative effects could potentially occur before the project is built (i.e. speculators initiating land use actions in anticipation of project construction).</p> <p>Source: A Guidebook for Evaluating Indirect Land Use and Growth Impacts of Highway Improvements, Final Report APR 327, Oregon Department of Transportation and FHWA, April 2001</p>			

V. REFERENCES AND OTHER INFORMATION SOURCES

Other valuable resources, not previously mentioned in this desk reference, which discuss ICE analyses can be found as follows:

California Department of Transportation web site, Guidance for Preparers of Growth-related, Indirect Impact Analyses. Available at http://www.dot.ca.gov/ser/Growth-related_IndirectImpactAnalysis/gri_guidance.htm

California Department of Transportation web site, Guidance for Preparers of Cumulative Impact Analyses. Available at http://www.dot.ca.gov/ser/cumulative_guidance/approach.htm

Federal Highway Administration web site, Re:NEPA. FHWA's online community of practice supporting an open exchange of knowledge, information, experience, and ideas about NEPA, related environmental issues, and transportation decision-making. Available at <http://nepa.fhwa.dot.gov/renepa/renepa.nsf/home>.

Federal Highway Administration. December 2004. Influence of Transportation Infrastructure on Land Use. Available at <http://www.fhwa.dot.gov/planning/tranlanduse.htm>

Federal Highway Administration. Indirect and Cumulative Impacts information from FHWA's Environmental Guidebook. Available at <http://www.environment.fhwa.dot.gov/guidebook/index.asp>

Federal Highway Administration. February 2006. Indirect Effects Analysis and Cumulative Effect Analysis Checklists. Available at <http://nepa.fhwa.dot.gov/ReNEPA/ReNepa.nsf/docs/7412AEC9CA4872EF85257108006CB342?opendocument&Group=Cumulative%20and%20Indirect%20Impacts&tab=REFERENCE>.

Idaho Transportation Department. September 2003. Draft: Environmental Process Manual-Section 2200: Secondary and Cumulative Effects. Available at http://itd.idaho.gov/manuals/Online_Manuals/Environmental/HTML%20Files/2200.htm.

Maryland State Highway Administration. June 2000. Maryland State Highway Administration Secondary and Cumulative Effects Analysis Guidelines for Environmental Impact Statements and Environmental Assessments. Available at <http://www.sha.state.md.us/ImprovingOurCommunity/oppe/scea/>

National Cooperative Highway Research Program (NCHRP). 1998. NCHRP Report 403 - Guidance for Estimating the Indirect Effects of Proposed Transportation Projects. Available at http://trb.org/news/blurbs_detail.asp?id=3004.

National Cooperative Highway Research Program (NCHRP). 1999. NCHRP Report 423A - Land Use Impacts of Transportation: A Guidebook. Available at [http://nepa.fhwa.dot.gov/ReNEPA/ReNepa.nsf/All+Documents/CCECF4D789DB510E85256CE6006142A0/\\$FILE/land_use_guidebook.pdf](http://nepa.fhwa.dot.gov/ReNEPA/ReNepa.nsf/All+Documents/CCECF4D789DB510E85256CE6006142A0/$FILE/land_use_guidebook.pdf).

National Cooperative Highway Research Program (NCHRP). 2001. NCHRP Report 456 - Guidebook for Assessing the Social and Economic Effects of Transportation Projects. Available at http://gulliver.trb.org/publications/nchrp/nchrp_rpt_456-a.pdf.

National Cooperative Highway Research Program (NCHRP). 2002. NCHRP Report 466 - Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects. Available at http://gulliver.trb.org/publications/nchrp/nchrp_rpt_466.pdf.

North Carolina Department of Transportation and North Carolina Department of Environmental and Natural Resources. 2004. Indirect and Cumulative Effect Assessment Guidance: Integrated NEPA/SEPA/ 401 Eight-Step ICI Assessment Process. Prepared by The Louis Berger Group, Inc. Available at <http://www.ncdot.org/doh/preconstruct/pe/NEPA401Guidance.doc>.

North Carolina Department of Transportation. November 2001. Guidance for Assessing Indirect and Cumulative Effects of Transportation Projects in North Carolina, Volume I: Guidance Policy Report and Volume II Practitioner's Handbook. Available at http://www.ncdot.org/doh/preconstruct/pe/ICI_Guidance_Volume1.pdf and http://www.ncdot.org/doh/preconstruct/pe/ICI_Guidance_Volume2.pdf.

Oregon Department of Transportation. April 2001. Final Report, SPR 327: A Guidebook for Evaluating Indirect and Cumulative Growth Impacts of Highway Improvements. Available at http://egov.oregon.gov/ODOT/TD/TP_RES/docs/Reports/AGuidebookforUsingIndirLand.pdf.

U.S. Environmental Protection Agency (EPA). 2000. Our Built and Natural Environments: A Technical Review of the Interactions between Land Use, Transportation, and Environmental Quality. EPA/231/R-01/002. Washington D.C.

U.S. Environmental Protection Agency (EPA). 2000. Projecting Land-Use Change: A Summary of Models for Assessing the Effects of Community Growth and Change on Land-use Patterns. EPA/600/R-00/098. Washington D.C.

Washington State Department of Transportation. March 2004. Environmental Procedures Manual-Revision 2004-1, Section 480: Secondary and Cumulative Effects. Available at <http://www.wsdot.wa.gov/fasc/EngineeringPublications/Manuals/EPM/480.pdf>







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