VIRGINIA DEPARTMENT OF TRANSPORTATION
ENVIRONMENTAL DIVISION
LOCATION STUDIES

INDIRECT AND CUMULATIVE EFFECTS ANALYSIS

CONSULTANT GUIDANCE

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1.0 Introduction

This document provides guidance on completing Indirect and Cumulative Effects (ICE) analyses for the Virginia Department of Transportation's (VDOT) Location Studies. The document includes a worksheet (Appendix A) for the VDOT Project Manager (PM) to assess and agree uponthe level of effort required for the ICE analysis, a discussion of some of these decision points, and an annotated outline to guide in the development of the ICE technical report. This guidance document is a "living document" and the VDOT PM is encouraged to confer with the Location Studies team to discuss any recent developments that could influence the development of this document. Furthermore, the consultant team is welcome to present any improvements/deviations that may apply for the given study. Such changes should not be made without written approval by the VDOT PM. Approved changes will be considered in future updates to this document.

2.0 Background

The current methodology for Location Studies ICE analyses was initiated during the Federal Highway Administration's (FHWA) legal review of the *Interstate 64 Peninsula Study Environmental Impact Statement* (I-64 EIS). Prior to the legal review of the I-64 EIS, VDOT and the FHWA Virginia Division had an agreed upon approach to ICE analyses. This approach was used in numerous EISs and Environmental Assessments (EAs) and had held up to specific legal challenges in the *Route 250 Interchange at McIntire Road EA*. Although no comments related to the ICE analysis were received during the public review of the I-64 Draft EIS, FHWA legal counsel provided direction that the ICE analysis must be based on a published methodology to be legally defensible. The Transportation Research Board's (TRB) National Cooperative Highway Research Program (NCHRP) Report 466, *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects* (TRB, 2002) was recommended as an appropriate methodology for the indirect effect analysis. FHWA and VDOT agreed that the guidance provided in the five-part evaluation process outlined in Fritiofson v. Alexander, 772 F.2d 1225 (5th Cir., 1985), as described in FHWA's guidance: *Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process* (FHWA, 2014), was an appropriate methodology for the cumulative effect analysis. These methodologies were used to revise the ICE Technical Report and associated chapter in the I-64 Final EIS.

Following the publication of the I-64Final EIS, VDOT continued to work to refine the methodology for future ICE analyses. In its comments on the I-64 Draft EIS, FHWA legal counsel made specific mention of how the Texas Department of Transportation (TxDOT) incorporates the NCHRP guidance into ICE analyses. VDOT reviewed the TxDOT *Trinity Parkway Final EIS* (TxDOT, 2014) and identified means of making the NCHRP process more specific and analytical than the approach taken in the I-64 Final EIS. This approach was presented to the FHWA Virginia Division who concurred on the revised approach, while

agreeing to maintain the approach to cumulative effect analysis that was incorporated into the I-64 FEIS. It is important to note that this concurrence meant that the ICE methodology used in the I-64 Final EIS was no longer a model for how future ICE analyses would be conducted in Virginia. Therefore, the I-64 Final EIS and associated technical document should not be referenced as an example of how to implement the current methodology.

Following the completion of the High Rise EA and Route 460 Draft SEIS, VDOT discussed the ICE methodology with its federal partners at the February 2015 federal partnering meeting and initiated the development of this document. The federal partners concurred that the specific methodologies, including the use of planning judgment and the means by which induced growth is documented, were the appropriate tools for VDOT Location Studies. VDOT will continue to update the federal partners on the refinement of this methodology at the quarterly federal partnering meetings.

The following sections include a discussion on different items included in the Level of Effort worksheet and provide guidance on how the analyses should be performed.

3.0 Discussion

The following sections discuss some of the decision points that should be made in documenting the level of effort required for the ICE analysis. The discussion also includes direction on how VDOT prefers to conduct some of the unique steps in the ICE analysis.

3.1 Scoping

In many cases, NEPA scoping can be a passive activity. Letters are sent out, responses are received, and information is incorporated when appropriate. For VDOT Location Studies, scoping has become a more driven and interactive process. Scoping letters should be accompanied by questionnaires tailored to the recipient. These questionnaires may be recipient specific or grouped to address several recipients. Questionnaires should address the following topics:

- Input on the appropriate ICE study area: for natural resources, regulatory agencies may suggest a watershed approach. In other cases, a local or regional planning group may identify a community that should be included in the ICE study area.
- Input on existing data/reports for resources within the proposed ICE study area(s): In order to conduct meaningful analysis of a broader study area, agencies should be asked to identify available data to document the proposed ICE study area. This may include data on existing wetlands and streams or population and employment trends.
- Validate data within the study area: Scoping letters sent to local/regional planning agencies should be accompanied by or reference recent Census data to ensure it is the best/most accurate data to be using for the ICE analysis. This also supports socioeconomic and environmental justice analysis in the NEPA document.

- Other: As is the case with many questionnaires, it is appropriate to allow the recipient to provide unspecified input for consideration in the ICE analysis.

This form of scoping may extend through a Citizen Information Meeting or agency meeting. At the end of the process, the findings would be summarized and presented to VDOT's federal partners at a quarterly partnering meeting or at a study-specific meeting. At that time, VDOT would summarize input collected and report planned ICE study areas and induced growth study areas (see below), and identify resource topics where enough data exists to provide qualitative or quantitative analyses. This presentation would provide the lead and cooperating agencies with a final opportunity to provide any data to inform the analysis. VDOT would document the final decisions for concurrence and advance with the ICE analyses. This approach will allow for all data/input to be identified during scoping and used to develop a complete ICE technical report that can be presented to the agencies without any data gaps or discrepancies. VDOT anticipates this presentation and concurrence process would occur relatively quickly following the end of scoping.

3.2 Natural Resources ICE Study Area

The natural resources ICE study area consists of Waters of the U.S., habitat, species, etc. that may be indirectly affected by a proposed action or by the cumulative effects of other past, present, and reasonably foreseeable future actions. In most cases, the natural resources ICE study area will be larger than the direct impact study area. The analyses of these resources are important to USACE, U.S. Environmental Protection Agency, and other agencies that regularly support or participate in VDOT studies. In most cases, the natural resources ICE study area will be defined at a watershed level. Coordination between VDOT and its federal partners should allow for the identification of the appropriate level of Hydrologic Unit Code (HUC) to focus the analysis. Given the potential size of the natural resources ICE study area, the data used to analyze direct impacts will not be the same as those used to inform the ICE analysis. For example, direct impacts to wetlands may be calculated based on field verified resources, while the ICE analysis will most likely be informed by NWI data. This distinction should be discussed with the federal partners to ensure everyone understands the basis of the analysis before it is initiated.

3.3 Socioeconomic ICE Study Area

The socioeconomic ICE study area includes the people, properties, businesses, and community facilities that may be indirectly affected by a proposed action or by the cumulative effects of other past, present, and reasonably foreseeable future actions. An example of an indirect effect to socioeconomics includes a land owner who does not have property directly impacted by the proposed action but opts to leave the area based on the proximity of impacts or change in access. It is less likely that the socioeconomic ICE study area will extend to as a great range as the natural resources ICE study area. In many cases, the socioeconomic ICE study area may be the same as the direct impact study area, or extend only enough to include areas identified for

induced growth (see below). When a study will analyze alternatives that include tolling, it may be necessary to include a specific tolling study area as a subset to the overall socioeconomic study area. This would allow for a discussion on the impact of tolling on a larger region, while acknowledging that general indirect effects would be limited in their geographic range. Including this level of analysis should be made by the VDOT PM after consulting with the Location Studies team.

In cases where the socioeconomic ICE study area extends beyond the direct impact study area, it is important that the necessary data be collected and analyzed in the same manner as the data for the direct impact study area. For example, population and employment data should be collected at the same time to ensure consistency. These data should be vetted for accuracy and omissions the same way that data used for the direct impact area is reviewed.

3.4 Other ICE Study Areas

In most cases, the ICE technical document also will include analysis of historic properties and recreational resources. As Section 106 of the National Historic Preservation Act requires analysis of indirect effects, the Area of Potential Effect (APE) for the study represents the historic properties ICE study area. Therefore, information presented in this historic properties technical report(s) can be summarized in the ICE technical report to document the APE.

While it is not appropriate to analyze non-historic 4(f) resources in the ICE technical report, recreational resources may be analyzed. Most likely the recreational resources ICE study area will be the same as the socioeconomic ICE study area; however, the PM should determine if this is appropriate on a study-by-study basis.

3.5 Assuming Induced Growth

All studies should assume some type of induced growth. In some cases, that type of induced growth could be confined to infill development, however the potential for this type of development and the associated impacts should still be discussed. This is an evolving topic that is important to VDOT, FHWA, and our federal partners. Consultant teams should review recently completed EISs and EAs for recently completed analyses and discuss strategies and resource considerations with the VDOT PM before finalizing a scope and/or initiating work on the documentation. Given the continuing development of this topic, it should be assumed that internal discussion at VDOT and/or between VDOT and FHWA may need to occur to finalize an agreed upon strategy. The consultant should build in time to their schedule for developing a scope and the supporting documentation..

3.6 Planning Judgment

The NCDOT guidance discussed above suggests a number of data intensive methods for informing the ICE analysis. VDOT's incorporation of the NCDOT method for identifying induced growth does not constitute the adoption of these data intensive methods. These methods are based on having extensive sets of data related to human populations, wetlands, streams, water

quality, wildlife populations, etc. In order to collect these data, the study area must be identified and inventoried regularly for years, if not decades. While these data may be available in other states, complete data for all resources rarely are available for VDOT location studies. When they are available, they are documented; however, data intensive modeling is not performed as it does not inform a location decision. Data intensive models also do not lead to the streamlined documents that FHWA requires or present data that are understandable or relevant to the average reader. As noted in the NCHRP 25-25 program, Task 22, *Forecasting Indirect Land Use Effects on Transportation Projects* (TRB, 2007), the use of data intensive methods often results in findings that are not necessary and/or not wanted for NEPA analysis. NCHRP 25-25 presents an alternative to data intensive analysis, planning judgment. Planning judgment relies on experience and expertise of the study team combined with previously published reports and data. Planning judgment is commonly used for NEPA documents and should be documented in the Technical Report as the basis for the ICE analysis.

Based on this guidance, VDOT has adopted planning judgment as its tool for conducting ICE analyses in Location Studies. Planning judgment is consistent with previous VDOT/FHWA studies, but provides a more formal framework for future efforts. Planning judgment does not preclude the inclusion of data driven reports or analysis from the process. While these quantitative elements may be brought into the planning judgment process, they are not to be analyzed using any type of modeling or require the creation of any new data. VDOT relies on published NEPA documents, plans, reports, and data presented by federal partnering agencies to inform ICE analyses. A decision as to what analysis can be accomplished qualitatively versus quantitatively should be made on a study-by-study basis. This decision should be coordinated with the Location Studies team and the federal partners and cannot be fully informed until the scoping process is complete.

It is recommended, but not required, for consultants and VDOT Project Managers to review NCHRP 25-25 program, Task 22 to familiarize themselves with the scope of planning judgment.

4.0 Annotated Outline

The following outline provides the general layout, as well as some boilerplate text that can be inserted directly into the ICE Technical Report. Blue text is used for boilerplate text. The consultant should confirm with the VDOT PM that there have been no program level updates to this outline before initiating scoping.

General Outline for a VDOT Location Studies ICE Technical Report

I. Introduction

This section is assumed to be consistent with other technical reports/NEPA document to introduce the study and study area.

II. General boilerplate

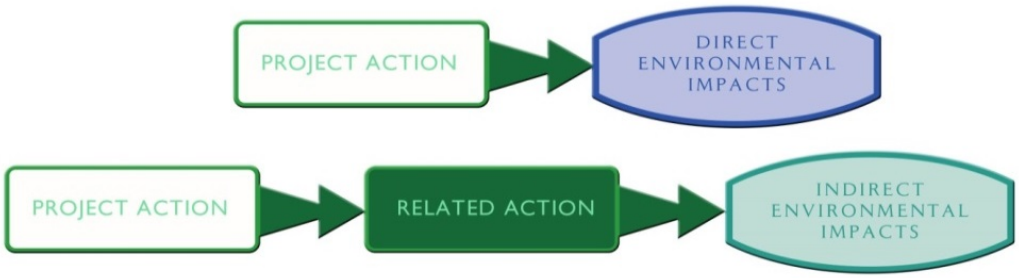
This section is optional but provides space for further consistency with other technical reports. In some cases, this section is used to explain the alternatives that are under consideration

III. Methodology

The NEPA legislation does not mention indirect or cumulative impacts. The Council on Environmental Quality (CEQ) regulations for implementing NEPA, however, address federal agency responsibilities applicable to indirect and cumulative impacts considerations, analysis, and documentation (40 CFR § 1508.25) in the content requirements for the environmental consequences section of an EIS (40 CFR § 1502.16) (FHWA 2014).

CEQ defines indirect effects as "…effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (40 CFR 1508(a)). These induced actions are those that would or could not occur without the implementation of the proposed project, as illustrated in Figure x.

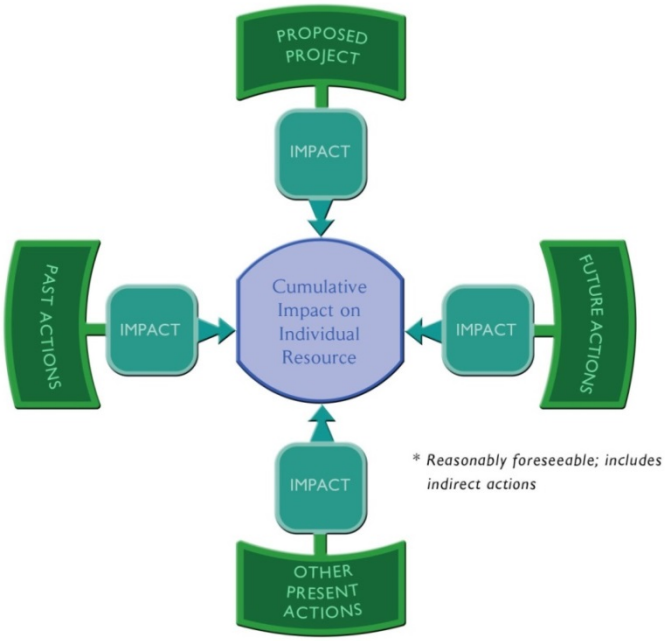
Figure x Direct vs. Indirect Environmental Impacts



Source: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process, FHWA, 2014.

CEQ defines cumulative effects (or impacts) as, "…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR § 1508.7). Cumulative effects include the total of all impacts, direct and indirect, experienced by a particular resource that have occurred, are occurring, and would likely occur as a result of any action or influence, including effects of a federal activity (EPA, 1999), as illustrated in Figure Y.

Figure Y Cumulative Impacts



Source: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process, FHWA, 2014.

Because indirect and cumulative effects may be influenced by actions including those taken by others outside of the immediate study area, assumptions must be made to estimate the result of these actions. The CEQ regulation cited above states that the analysis must include all the indirect effects that are known, and make a good faith effort to explain the impacts that are not known but which are "reasonably foreseeable." Court decisions on this topic indicate that indirect impact analysis should consider impacts that are sufficiently "likely" to occur and not those that only may be conceived or imagined (FHWA, 2014). NEPA does not define what constitutes "reasonably foreseeable actions." CEQ has provided guidance on how to define reasonably foreseeable actions, based upon court opinions. CEQ makes it clear that actions that are probable should be considered while actions that are merely possible, conceptual, or speculative in nature are not reasonably foreseeable and need not be considered in the context of cumulative impacts (CEQ 1981, FHWA 2014).

Therefore, while reasonably foreseeable events may be uncertain, they must still be probable. As such, those events that are considered possible, but not probable, may be excluded from NEPA analysis. There is an expectation in the CEQ guidance that judgments concerning the probability of future impacts will be informed, rather than based on speculation (FHWA, 2014). This direction on identifying reasonably foreseeable actions is taken into account in both the analysis

described in the following sections. Specific methodologies on how these analyses were conducted are presented for indirect and cumulative effects, respectively.

The means by which these regulations are applied to this Technical Report are explained in the sections below.

a. Indirect Effects

This section presents an analysis of the potential indirect impacts related to the proposed alternatives described in Section A. For the purposes of this Technical Report and the associated EA, the methodology followed for analyzing indirect effects are prescribed in the Transportation Research Board's (TRB) National Cooperative Highway Research Program (NCHRP) Report 466, *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects* (TRB, 2002).

In NCHRP Report 466, TRB states that indirect effects can occur in three broad categories:

1) Encroachment-Alteration Impacts – Alteration of the behavior and functioning of the affected environment caused by project encroachment (physical, biological, socioeconomics) on the environment;
2) Induced Growth Impacts – Project-influenced development effects (land use); and,
3) Impacts Related to Induced Growth – Effects related to project-influenced development effects (impacts of the change of land use on the human and natural environment).

For the purposes of this analysis, the term "indirect effects" refers to all three of these categories. [Note: this combination of all three categories would only occur if induced growth was not assumed to occur. If induced growth is assumed to occur, these categories should not be lumped together and the impacts of induced growth and indirect effects should be discussed throughout the technical document.] Transportation improvements often reduce time and cost of travel, as well as providing new access to properties, enhancing the attractiveness of surrounding land to developers and consumers. Development of vacant land, or conversion of the built environment to more intensive uses, is often a consequence of highway projects. Important characteristics for induced growth are described in North Carolina Department of Transportation's (NCDOT) *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina, Vol. II: Practitioners Handbook* (NCDOT, 2001). These characteristics include existing land use conditions in the project area, increased accessibility that may result from new transportation improvements, local political and economic conditions, and the availability of other infrastructure and the rate of urbanization in the region. The study area is in an advanced land use progression and is therefore likely to experience more infill development that urban/suburban sprawl. [Note: This final sentence applies to areas that are highly developed and would not support induced growth. In other cases, this sentence(s) may need to be refined to speak to the study area's location on the NCDOT land progression model].

Based on these principles, the indirect effects analysis focuses on the potential for ecological and socioeconomic impacts that could occur as a result of the proposed alternatives outside of the area of direct impact. The stepwise process TRB recommends in NCHRP Report 466 for assessing indirect effects has been used as the structure for the analysis, and considers the following steps:

Step 1 Scoping
Step 2 Identify Study Area Direction and Goals
Step 3 Inventory Notable Features in the Study Area
Step 4 Identify Impact-Causing Activities of the Proposed Alternatives
Step 5 Identify Indirect Effects for Analysis
Step 6 Analyze Indirect Effects and Evaluate Analysis Results
Step 7 Assess Consequences and Develop Mitigation

To complete these steps, the required analysis rely on planning judgment. The NCHRP 25-25 program, Task 22, Forecasting Indirect Land Use Effects on Transportation Projects, documents means of applying planning judgment to indirect and cumulative effects analysis (TRB 2007). The direction provided in the TRB document is the basis for the indirect effects analysis presented in this technical report.

b. Cumulative Effects

To document cumulative effects for this study, the analysis followed the five-part evaluation process outlined in Fritiofson v. Alexander, 772 F.2d 1225 (5th Cir. 1985), as described in FHWA's Guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process (FHWA, 2014):

1. What is the geographic area affected by the study?
2. What are the resources affected by the study?
3. What are the other past, present, and reasonably foreseeable actions that have impacted these resources?
4. What were those impacts?
5. What is the overall impact on these various resources from the accumulation of the actions?

Each of these parts of the evaluation process is discussed in Section xx of this Technical Report.

IV. Indirect Effect Analysis

a. Step 1 – Scoping

This section is used to document the scoping efforts that were specifically used to inform the ICE analysis (this section applies to cumulative effects, so writing it in the appropriate manner will allow for it to be referenced back to in the cumulative effects section of the document).

This section should not only speak to the scoping letters/responses, but all forms of data collection and the input these efforts had on the ICE analysis. This could include summarizing any Citizen Information Meetings or other outreach that was held and the input these activities had on ICE analysis (see Section 3.1). This section also should identify local planning documents and other resources that were reviewed and used to inform the ICE analysis. While the findings of these efforts could be summarized in this section, it is important to clearly define the scoping efforts that were taken and wait for the next step in the process to explain the results.

b. Step 2 Identify Study Area Direction and Goals

The beginning of this section is the most appropriate point to discuss the ICE study areas (in some cases the author may opt to include this discussion under Step 1). This section presents the results of the scoping effort in a manner that attempts to "tell the story" of the study area over the temporal bounds of the ICE analysis. The use of historic aerial photography, Census data, employment records, and (in some cases) information from historic property documentation allows the reader to understand what has occurred in the study area. This "story" should include discussions on population centers, growth, and other trends; the level of development and subsequent impacts; how employers/level of employment has changed over time; where the study area currently is on this story line; and, how local planning documents and reasonably foreseeable future actions will advance this storyline. The goal of this section is to provide the background for the reader to understand the influences on current resource conditions discussed in the next step.

c. Step 3 - Inventory of Notable Features in the Study Area

This section should be laid out consistent with the order/type of resources included in the Affected Environment/Environmental Consequences section of the EA or EIS. The goal of this section is not to cut and paste the language from each respective technical report, but to identify the notable features that occur within the ICE study area that will be analyzed. As with the previous two steps, this step is important to the cumulative effects analysis and should be written in a way that allows for it to be referred to in the cumulative effects section of the document. Notable features are those social, ecological, recreational, or historical resources which are considered valuable and/or unique and which may be less able to bear impacts from a transportation improvement. Separating notable features from other resources identified in the different technical reports can be different and the approach would vary between studies. It is recommended to error on the side of caution and include any resource for which the author believes that there would be an indirect effect that could be analyzed through planning judgment (Federal partner agencies expect that all Waters of the U.S. found within the natural resource ICE study area be considered notable features.) Because planning judgment is based on qualitative analysis, it is more difficult to say that a resource would not be indirectly affected by a proposed transportation improvement.

d. Step 4 – Identify Impact Causing Activities

NCHRP Report 466 provides a large table that groups different impact causing activities into different categories. The TxDOT example takes this table a step further by providing the direct impacts of each alternative that are associated with the NCHRP defined actions. For VDOT documents, it is not necessary to recreate the NCHRP table. Rather, some introductory text can be drafted to explain the general actions that would occur to result in the impacts documented in the EA or EIS (grading, cut, fill, impervious surfaces, runoff, traffic patterns, etc.). This text can lead in to a recreation of the resource impact summary table from the EA or EIS. This is an opportunity to document all of these impacts in the ICE technical document. The goal of this section is to explain the impacts that the proposed alternatives are having in the direct impact area, so that their implication on indirect effects can be discussed in the following sections.

e. Step 5 – Identify Impact Causing Activities of the Proposed Alternatives

Like Step 3, this step should be laid out to match the Affected Environment/Environmental Consequences section of the EA or EIS. For each resource topic, the author should explain how the impact causing activities discussed in Step 4 may result in indirect effects to the notable features discussed in Step 3. This is not the appropriate place to analyze the indirect effects. In some cases, it may be possible to state that impact causing activities would not result in indirect effects to a resource and dismiss that resource from further consideration in the indirect effects analysis. As stated earlier, however, it is difficult to make such a dismissal when relying solely on planning judgment. It is better to take one of the following steps:

1) Address future analysis under another resource topic: The study may investigate environmental justice populations and find that the alternatives would not have a disproportionate impact on these populations. If this was the case, it would be appropriate in this section to state that, explain that any impact to these populations would then be the same as those described under socioeconomics and land use, and note that the discussion of indirect effects to socioeconomics and land use applies to environmental justice populations.
2) Carry the resource topic forward for analysis: In some cases, direct impacts to a resource may be so limited and/or any potential indirect effects may be so speculative that the author would prefer to dismiss the topic here rather than carry it forward for analysis. By advancing the resource topic for analysis, the author can describe the limited level of impact to further inform the reader.

f. Step 6 – Analyze Indirect Effects and Evaluate Results

The NCHRP Report 466 presents this step as two separate steps. This results in some disjointed discussions and repetitive language within the document. Following the TxDOT example, VDOT has combined these two processes into one step.

Like Step 3 and 5, this step should be laid out to match the Affected Environment/Environmental Consequences section of the EA or EIS. The discussion under each resource topic should fully explore the indirect effects that may result from each of the alternatives. When induced growth is anticipated, the impacts associated with induced growth should be identified separately from general indirect effects.

It is advisable to provide separate discussions for each alternative (including the No Action Alternative) to ensure a consistent and thorough review. Prior to starting this section, it is advisable the consultant and VDOT Project Manager discuss potential indirect effects to each resource to ensure all possibilities are addressed and that the team is on the same page about what the resultant discussions may include.

g. Step 7 – Assess Consequences and Develop Mitigation

This section will likely be the most variable between different studies. In the case of an EA level analysis, the consequences will most likely be minor and no significant consequences will be identified. At the EIS level, consequences may be more measurable. In either case, this section should summarize what the impacts identified in the previous section mean to the overall resource and/or study area.

Developing mitigation at the NEPA level is somewhat premature. The 460 ICE analysis includes some discussion on levels of mitigation that are routinely incorporated into the NEPA process. For example, alternatives with excessive indirect effects were not retained for analysis and design corridors were laid out to minimize indirect effects to surrounding resources. Depending on the study, this section may be updated as part of a Final EIS to provide additional commitments/discussion on mitigation.

V. Cumulative Effect Analysis

The first few steps of the cumulative effect analysis build off what was done under the indirect effect analysis and, at can be referenced rather than repeated.

a. Geographic Area

The geographic area for the cumulative effects analysis should be the same as the indirect effects analysis. Therefore, this section can incorporate information from the previous section in the document.

This section also requires the temporal boundary for the analysis to be set. This decision sets the boundaries for what timeframe “past” actions will be considered in the analysis. The temporal boundary should not be set based on the availability of past project data. Both the High Rise and 460 documents provide examples of qualitative discussions of past actions that accompany more quantitative project data. If the proposed action includes improvements/modifications to an existing road system, it is advisable to extend the temporal boundary to the original construction

of that given road system. This will allow the author to document the impacts that the original construction and use of the road system have had on the surrounding resources. For green fields projects, the VDOT PM should confer with the federal partners and Location Studies team to identify an appropriate temporal boundary.

b. Affected Resources

This section introduces the resources that are under consideration in the cumulative effects analysis and then describes how these resources have been impacted by past, present, and reasonably foreseeable future actions. The discussion of the affected resources can be completed by referencing the discussion of notable features that was included in the indirect effects analysis. Assessing the impacts of past, present, and reasonably foreseeable future actions is an area that VDOT has focused on enhancing with recent studies. While there is no prescribed format for this discussion, there are several things that need to be addressed.

It is not in VDOT or FHWA's purview to estimate or publish potential wetland or stream impacts for a past, present, or reasonably foreseeable future action. VDOT is committed to reviewing previous NEPA studies or other local planning documents to identify estimated or permitted wetland and stream impacts within the natural resource ICE study area. In addition, USACE can provide the permitted wetland and stream impacts within the given watershed(s) for a select time period. This input from the agency with jurisdiction over the resource fulfills the scope of planning judgment and allows for some quantitative data to be used to support a qualitative discussion of impacts related to past, present, and reasonably foreseeable future actions. If enough information is available to provide estimated impacts for more than a few of these actions, then the traditional table that is used to list these actions should be amended to include columns for known wetland and stream impacts. If there is not enough data to quantify impacts for these actions, than the lack of available data should be disclosed in the technical document.

In the absence of enough data to quantify impacts to past, present, and reasonably foreseeable actions, it is recommended that this stage of the analysis include a review of historic aerial photographs and topographic maps. This review can allow for a qualitative discussion about the location and progression of development within the study area. The discussion should specifically focus on changes to resources that are visible in the different photographs/maps. For example, if there is a forest or undisturbed stream in one aerial photograph and a photograph of the same area five years later shows this resource has been displaced by development, the text should describe this loss of resource and, when possible, estimate the area that has been converted. These general impacts may not be attributed to a specific action on the table described above but can be tied to more general patterns of growth or resource harvest. The 460 SEIS did not follow this specific methodology; however, it contains additional examples on how these general discussions may be presented.

c. Impacts

There are a number of different styles for fulfilling this section and at this time VDOT does not have a preferred method. The High Rise document provides one example on how this section may be written. The 460 SEIS did not follow the FHWA methodology; however, it contains additional examples on how this section may be presented.

With regards to wetlands and streams, the impact discussion should include reference to/inclusion of historic aerials and topographic maps. These maps can be reviewed and compared to identify wet areas within the ICE study area that are impacted/eliminated within the temporal bounds of the ICE analysis. In the absence of NEPA documents and permits, it is not necessary to report specific historic impacts. Instead the discussion can focus on impact trends, locations, and general magnitude of visual impacts. The mapping that is reference for this analysis should be appended to the ICE technical report. The EPA has provided VDOT with a web site that presents a great deal of historic aerial and topographic mapping (http://www.historicaerials.com). In some cases, this source may be supplemented with Google Earth, VDOT hard copy aerial mapping (available from Central Office Location and Design) or other local sources. The revised ICE technical report for the High Rise Bridge study illustrates the first attempt at incorporating this mapping approach into the technical document.

d. Overall impacts

There are a number of different styles for fulfilling this section and at this time VDOT does not have a preferred method. The High Rise document provides one example on how this section may be written. The 460 SEIS did not follow the FHWA methodology; however, it contains additional examples on how this section may be presented.

Appendix A: ICE Level of Effort Determination Worksheet

1) Natural Resources ICE Study Area:
   _____

2) Socioeconomic ICE Study Area:
   _____

3) Other ICE study areas that may extend beyond direct impact study are:
   _____

4) Assuming induced growth?
   _____
   a. Number of interchanges to assess:
      _____
   b. Range of anticipated induced growth:
      _____
      (Based on current guidance, a decision should be made as to how far from a given interchange induced growth is anticipated: 2-5 miles)
   c. Resources within the induced growth study areas that will need to be analyzed and level of analysis:
      _____
      _____
      _____
      _____

5) Data that will be used for analysis:
   _____
   (Will different data be used for ICE study area compared to direct impact study area? Will this difference affect level of effort)

6) Have the federal partners agreed on the level of planning judgment that should be used for the analysis?
   _____
   a. Increased scoping/public involvement_____

b. Level of published data/reports
_____

c. Qualitative vs. quantitative analysis
_____

7) Any recent VDOT documents that have identified appropriate changes to the standard ICE methodology?
_____

8) Have the VDOT PM and Consultant PM familiarized themselves with NCHRP 466, NCHRP 25-25 Task 12, and NCDOT guidance related to induced growth?
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Appendix B: VDOT Literature Review

In October 2014, the VDOT Research Library completed a literature review of reports/articles that could provide additional guidance on analyzing induced growth. The Research Library identified over 130 documents that addressed this topic. The majority of these were focused on linking planning and NEPA, conducting a data intensive ICE analysis, or examining how specific resources may be indirectly impacted by a proposed alternative. While these files were helpful, they did not provide any additional support to focus the induced growth study area prescribed in the NCDOT guidance. The literature review did provide examples of how other State Departments of Transportation are documenting ICE analysis. These findings are summarized in the following bullets:

- **California DOT:** does not prescribe a specific method for ICE analysis. The published guidance suggests that resources that will be analyzed for ICE can be selected based on the proposed alternatives and location of the study.
- **Florida DOT:** has an extensive process for analyzing cumulative effects. Indirect effect analysis is not as clearly prescribed.
- **Montana DOT:** has new guidance that provides different metrics for establishing ICE study areas (physical, political, natural, travelshed); however, there is no guidance on establishing an induced growth study area.
- **NCDOT:** induced growth may occur up to one mile around a freeway interchange and/or two to five miles along major feeder roadways to the interchange. There is no guidance provided on how to determine where on this range a given study may fall.
- **Pennsylvania DOT:** has published ICE guidance, but does not speak to specific ranges/distances for induced growth.
- **Oregon DOT:** ICE study areas are based on a delineated area of travel time savings.
- **TxDOT:** Uses the NCHRP process described above but does not provide specific guidance on identifying induced growth study areas.
- **Wisconsin DOT:** incorporates a variation of the NCHRP guidance but does not speak to specific ranges/distances for induced growth. Suggests that a full analysis is necessary for an EIS but leaves the room for some variation in an EA-level analysis.

The Montana DOT guidance document proved most informative, as the DOT had recently completed a review of other state's ICE analysis to formulate its own approach. A number of the states listed above were reviewed as part of the Montana DOT document. The document points to the NCDOT method as the most precise in terms of specific study areas and data inputs. While the inclusion of data inputs is discussed previously in this document, these findings provide VDOT with the confidence that following the NCDOT method is the most proven means of identifying the potential for induced growth. VDOT will continue to have some flexibility, in consultation with FHWA, to determine the size of the ICE study areas and the induced growth study areas. Consultants and VDOT Project Managers should discuss ICE study areas and

induced growth study areas during project initiation to ensure these areas are included in scoping and data collection efforts.

This literature review was presented to VDOT's federal partners in February 2015. VDOT is committed to periodically updating this literature review to determine if any additional sources or methodologies have become available.