# Trans-Lake Washington Project EIS Methodology Report - 6/19/02

## Indirect and Cumulative Impacts

Indirect Impacts (sometimes called secondary impacts or effects) are defined as impacts that:

> 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 Section 1508.8)

Cumulative impacts are defined 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. (40 CFR Section 1508.7)

Indirect and cumulative impacts will be discussed in a separate chapter of the environmental impact statement (EIS). The methodology for analyzing indirect and cumulative impacts will be similar, except that the cumulative impacts analysis will also look back in history and analyze the cumulative impacts of the Trans-Lake Washington Project alternatives when added to other reasonably foreseeable developments and transportation projects.

### Guiding Plans and Policies

- Council on Environmental Quality (CEQ), *Considering Cumulative Effects Under the National Environmental Policy Act*, 1997.
- FHWA, Position Paper on Secondary and Cumulative Impact Assessment in the Highway Project Development Process, 1992.
- Washington State Department of Transportation (WSDOT), Environmental Procedures Manual, Section 411, July 2001.
- WSDOT, ESA, Transportation and Development, Assessing Indirect Effects, Guidance Paper, Washington State Department of Transportation, Environmental Affairs Office, Olympia, Washington, May 14, 2001.

### Data Needs and Sources

- Sound Transit – North Link Light Rail Supplemental EIS

- Puget Sound Regional Council (PSRC) – Forecasts for population and employment for Snohomish, King, Pierce, and Kitsap counties and Disaggregate Residential Allocation Model and Employment Allocation Model (DRAM/EMPAL) model.
- PSRC – *Vision 2020*, 1995.
- PSRC – *Destination 2030, The Metropolitan Transportation Plan for the Central Puget Sound Region*, and accompanying EIS, 2001.
- CommEnSpace – Impervious surface data in geographic information system (GIS) layer, 2001.
- Historical photographs and maps of study area, such as before and after construction of the Montlake Cut and SR 520, and historical and recent aerial photographs showing the progression of growth along the corridor.
- Arboretum Master Plan and EIS.
- University of Washington Master Plan.
- Regional land use plans as mapped by PSRC.
- PSRC – Regional economic and demographic database, modeling, and forecasting: specification of STEP97, 1997.

## Proposed Coordination with Agencies

Jurisdictions, major institutions, and large employers along the project corridor will be contacted to determine if there are pending permits or reasonably foreseeable plans for development or redevelopment within approximately 1/4 mile of the corridor that should be included in the cumulative impacts analysis. These include:

- University of Washington
- Washington Park Arboretum
- U.S. Army Corps of Engineers – Any potential plans for Ship Canal/Montlake Cut
- King County Department of Natural Resources – Any potential plans for restoration of streams and other waterways in Water Research Inventory Area (WRIA) 8
- City of Seattle
- City of Medina
- Town of Hunts Point
- Town of Yarrow Point
- City of Clyde Hill
- City of Kirkland
- City of Bellevue

- City of Redmond
- Microsoft, Safeco, and other large employers along the corridor

In addition, close coordination will be required with PSRC , who will do the population and employment forecasting.

## Proposed Coordination with Team, WSDOT, and Sound Transit

To assess the indirect and cumulative impacts of the project, close coordination with and substantive contributions will be required from the team leads of the environmental elements being assessed. These include:

- Air Quality
- Cultural Resources
- Ecosystems (including Fish Resources, Wetlands, and Vegetation and Wildlife)
- Geology and Soils
- Land Use and Economics
- Public Services and Utilities
- Social (including Recreation)
- Transportation
- Visual Quality
- Water Resources
- WSDOT and Sound Transit – to determine the list of reasonably foreseeable future actions to be included in the cumulative impacts analysis
- Sound Transit – to coordinate cumulative impacts analysis for North Link Supplemental EIS and Trans-Lake Washington Project

## Indirect and Cumulative Impacts Analysis

Generally, the methodology for the analysis will be the same for analyzing both indirect and cumulative impacts. However, the cumulative impact analysis is more complex because it requires both looking back as well as forward in time, and adding other foreseeable projects into the analyses. Both the indirect and cumulative impacts analyses will use PSRC models to forecast potential changes in the distribution of population and employment.

Based on scoping comments and ongoing interaction with affected neighborhoods and stakeholders about the resources that are of most concern and are most likely to have indirect and/or cumulative impacts, the following resources will be the focus of the indirect and cumulative impact analysis, and thus also the focus of the description of affected environment:

- Air Quality

- Cultural Resources
- Ecosystems (including Fish Resources, Wetlands, and Vegetation and Wildlife)
- Geology and Soils
- Land Use and Economics
- Public Services and Utilities
- Social (including Recreation)
- Transportation
- Visual Quality
- Water Resources

### Indirect Impacts Analysis

The goal of the indirect impact analysis is to determine the relative differences in the indirect effects caused by the No Action Alternative and the three build alternatives.

Four alternatives will be analyzed for the indirect impacts analysis:

1. No Action
2. SR 520 4-lane alternative (Safety and Preservation)
3. SR 520 6-lane alternative (high-occupancy vehicle [HOV]/bus rapid transit [BRT])
4. SR 520 8-lane alternative (HOV/BRT and general purpose [GP])

### Cumulative Impacts Analysis

The goal of the cumulative impacts analysis is "to determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative impacts of other past, present, and future actions" (Council on Environmental Quality, *Considering Cumulative Effects Under the National Environmental Policy Act*, 1997). Both adverse and beneficial effects will be discussed (if there are both). A combination of quantitative and qualitative analysis will be used to make a relative comparison among the alternatives. PSRC's DRAM/EMPAL models will be used to predict differences in employment and population distribution. (Modeling is discussed in more detail on page 6). A conceptual graphic of the important resources and their cause-and-effect relationships will be prepared to illustrate the important cumulative ecological connections. The cumulative impacts of other known future projects within 1/4 mile of the Trans-Lake Washington Project will be discussed qualitatively.

Four alternatives will be analyzed for the cumulative impacts analysis:

1. No Action on SR 520 plus other foreseeable projects
2. SR 520 4-lane alternative plus other foreseeable projects
3. SR 520 6-lane alternative plus other foreseeable projects

4. SR 520 8-lane alternative plus other foreseeable projects

## Study Area

The study area will vary from resource to resource. The Land Use and Economics, Air Quality, and Transportation analyses, based on PSRC's population and employment models, will look on a macro-scale at the indirect impacts of the project alternatives and cumulative impacts of the project alternatives combined with other regional transportation projects. Ecosystems and Water Resources will focus on impacts on the WRIA 8 (Cedar/Lake Washington/Sammamish watershed), but will also note how differences in population and employment distribution would affect other watersheds in the four-county region. On a micro-scale, cumulative impacts with other future projects within approximately 1/4 mile of the project corridor will also be assessed qualitatively.

## Affected Environment Methodology

### Identify Projects to Include in Cumulative Impacts Analysis

A list of past, present, and reasonably foreseeable future actions, which, along with the Trans-Lake Washington Project, have or will affect the study area , will be developed in consultation with the agencies listed under *Proposed Coordination with Agencies*. Local government transportation improvement plans and capital improvement plans will be reviewed and local jurisdictions, major institutions, and large employers along the project corridor will be queried about pending permits or reasonably foreseeable plans for street improvements, development, or redevelopment within approximately 1/4 mile of the project. The proposed list of projects will be taken to Sound Transit and WSDOT for final approval before analysis begins. The transportation projects that are assumed to be on the list to be modeled are I-405 Corridor Program, I-5 Operations Study, Sound Transit Phase II (HCT across the lake on I-90), I-90 Two-Way Transit and HOV Operations Project, and Alaskan Way Viaduct. The cumulative impacts of the North Link Light Rail Project and the Trans-Lake Washington Project in the vicinity of the proposed Montlake Station at Montlake/University of Washington will also be addressed. A GIS map will be prepared showing the location of all projects to be included in the cumulative impacts analysis.

### Describe the Affected Environment

For the indirect impacts analysis, the existing conditions from the Affected Environment sections of the EIS will be summarized and put into the regional land use context. For the cumulative impacts analysis, the study area will be described as it has changed historically, with focus on the response to change and a resource's ability to withstand the stresses that have been imposed by those changes over time. The time period to be included in this analysis will be from approximately 1900 to 2001. Changes will include the construction of the Ship Canal and the lowering of Lake Washington water levels in the early 1900s, the construction of SR 520 and I-405 in the 1960s, and the high growth rate of Eastside cities and large employers in the 1990s.

Charts showing population and employment growth, photographs showing the comparison between pre- and post-Ship Canal and pre-and post-SR 520 construction, and maps or aerial photographs will be used to illustrate the historic impacts of development.

The current status of the various resources, ecosystems, and human communities will be described. The characterization will focus on identifying the socioeconomic factors in the study area, and the indicators of stress on the resources. The baseline condition is assumed to be the No Action Alternative.

Local and regional comprehensive land use plans for the area will be described (or referenced from the *Land Use and Economics* chapter), with predictions for how the study area will continue to change in the future based on the plans and the constraints of governmental regulations and standards.

## Modeling Future Development that Could Result from the Proposed Alternatives

### Introduction

The Trans-Lake Washington Project could affect the timing of planned growth; therefore the pattern of land use in 2030 could be different among the proposed alternatives. Both the impacts on land use of the project alternatives by themselves (indirect impacts) and the impacts of the project alternatives combined with other foreseeable development and transportation projects (cumulative impacts) will be studied.

To predict these differences, PSRC's DRAM/EMPAL model will be used to forecast the location of population and employment growth in the region for each alternative. Changes in the development pattern (increases or decreases in population and employment density) will be mapped. Qualitative analysis will then be done for each of the affected built and natural resources to determine the indirect and cumulative impacts on the resource from the changes in development pattern.

### PSRC Population and Employment Model Forecast

The first step is for PSRC to forecast the population, employment, and income for the four-county region as a whole using Synchronized Translator of Economic Projections 1997 (STEP97), PSRC's econometric model. The STEP97 model is designed to simulate the basic dynamics of the central Puget Sound region's economy and provide long-term economic and demographic forecasting for analysis of transportation project and policy impacts

After regional totals are forecast, the totals are allocated to Forecast Analysis Zones (FAZs) using DRAM/EMPAL models and a process of review by local jurisdictions. The models are designed to simulate some of the basic locational dynamics among and within the various geographic subareas of the region to make long-range forecasts of the locations of households and jobs within the region, and to provide an easily applied tool for analyzing location impacts of projects and policy changes (PSRC 1995). The models forecast changes in the location of population and employment within the four-county area of King, Kitsap, Pierce, and Snohomish counties, but do not change the regional totals for a given forecast year.

The 219 FAZs within King, Kitsap, Pierce, and Snohomish counties were created using 1990 census geography (tract and blocks) and generally approximate relevant boundaries such as municipal jurisdictions and community planning areas. Household and job locations for the FAZs are predicted from zone-to-zone travel times and a set of zone attractiveness variables,

subject to regional totals of population, households, and jobs derived from PSRC regional forecasts.

### Travel Demand Modeling

Forecasted regional population and employment will be input into the travel demand model. Output from the travel demand model will be used to forecast travel times for each of the project alternatives. The travel times for each of the alternatives would be applied to the model that forecasts the allocation of employment throughout the four-county region to analyze the direction and relative magnitude of the change in growth.

The PSRC's four-county travel demand forecasting model was selected as the appropriate tool for forecasting automobile, carpool, and transit demand for highway alternatives. Information on a number of different performance measures, average travel times between activity centers, mode shares, vehicle miles of travel, and vehicle hours of travel can be obtained from this model. The PSRC model, which is multimodal and captures both regional and corridor-level tripmaking, has been recalibrated to better represent observed traffic volumes and transit ridership in the project corridor.

### Population/Employment Distribution

Next, the analysis will reallocate population, households, and employment throughout the region based on the Trans-Lake alternatives' travel times using the DRAM/EMPAL models.

Multiple iterations of the DRAM/EMPAL model are planned for the EIS analysis. This process will allow the model to calibrate the changes in traffic patterns and accurately forecast changes in the location of population and employment within the four-county area. Such modeling will not change the regional growth totals for a given forecast year. The DRAM/EMPAL runs will show the differences in population and employment distribution for the year 2030 under each alternative. After receiving the DRAM/EMPAL model forecasts for population and employment for the No Action Alternative and the build alternatives by FAZ, the percent change from the baseline (the No Action Alternative) to each build alternative will be calculated. The analysis will also consider the overall percent change in the sum of population and employment [(PopA+EmpA) - (PopB+EmpB) / (PopB+EmpB)] for each alternative. This simplifies the comparison between alternatives by combining population and employment into one figure. The changes forecast by the models are considered indicative of how changes in capacity on the project corridor could influence the timing of future development and provide a valid means of comparing the alternatives to each other.

### Changes in Impervious Surface

Increases in development generally mean increases in the percentage of impervious surface area in a watershed. Increases in impervious surface are considered an adverse indirect effect on water resources, fish resources, vegetation, wildlife, and wetlands. To gain an understanding of how changes in population and employment would affect natural resources in the project corridor, results of the DRAM/EMPAL modeling will be applied to GIS data layers showing zoning data and the extent to which impervious surface covers the project area. The impervious surface data will be obtained from the Community and Environment Spatial Analysis Center (CommEnSpace), a nonprofit organization that

provides mapping and geographic information technologies to environmental and community organizations in the Pacific Northwest.

Zoning data have been collected by PSRC from local jurisdictions and regional comprehensive plans. Land that is not developable by zoning ordinance includes parks/open space, agriculture, commercial forest, and resource extraction. Land zoned commercial; industrial; mixed use; residential; and tribal, government, and military will be considered developable. Comparing the zoning and current level of impervious surface to the population and employment distribution gives an indication of how much new impervious surface might be created on developable land under each alternative scenario.

The results will be presented as a scatter plot and trend line (linear regression) comparing population and employment growth (overall percent change) to the current impervious surface area. The percentage of impervious surface area for each FAZ will be calculated based on the area of developable land; areas zoned undevelopable (parks/open spaces, agriculture, resource extraction, and commercial forest) will not be considered. A positive trend line (increasing from left to right) would indicate relatively more development in areas with higher amounts of existing impervious surface. A negative trend line (decreasing from left to right) would show relatively more development in areas with less impervious surface.

## Determining Environmental Consequences for Each Environmental Element

### Air Quality

Indirect impacts on air quality are included in the analysis of direct impacts. This is because the air emission burden and ambient CO concentration analyses are based on traffic forecast data, which include impacts from growth in the region. The air quality analysis will be done for the cumulative impacts of the Trans-Lake alternatives combined with other foreseeable projects.

### Cultural Resources

Indirect and cumulative impacts could include heightened danger to archaeological sites and traditional cultural properties from increased human access to an area, which might increase chances for vandalism, looting, or inadvertent degradation of the resources.

### Ecosystems (including Fish Resources, Wetlands, and Vegetation and Wildlife)

Indirect and cumulative impacts on fish resources will be qualitatively evaluated based on predicted changes in land use under each proposed alternative, as this relates to expected changes in water quantity and quality or stream habitat. Results of the water resources, wetlands, vegetation, and land use analysis will be used to qualitatively estimate the expected impacts on fish resources.

Indirect and cumulative impacts on vegetation and wildlife will be assessed based on information from other environmental element analyses (land use, water resources, and fish resources, as these elements analyze the impacts of predicted population and employment growth per DRAM/EMPAL). The assessment of indirect and cumulative impacts on wildlife will consider changes in water quality, habitat fragmentation, fish prey, and long-

term noise and other disturbances. Indirect and cumulative impacts on vegetation will be based on potential long-term changes in hydrology, land use, and human disturbance.

Indirect and cumulative impacts on wetlands will be qualitatively analyzed based on the results of DRAM/EMPAL modeling and consideration of changes in hydrology, increases in noise and light, increased intrusion into wetlands by people and domestic animals or invasive plants, decreases or degradation in buffers, and potential changes in land use or density that may cause future impacts. In addition, direct impacts on wetlands in the study area that may cause indirect impacts on downstream wetlands will be considered.

### Geology and Soils

Indirect impacts to geology and soil that are caused by the proposed action and are later in time or farther removed in distance, but still reasonably foreseeable could include the following, which will be analyzed conceptually:

- Seismic impacts on slope stability
- Seismic-induced liquefaction, lateral spreading, and surface fault rupture
- Settlement due to consolidation of subsurface materials or movement of retaining structures
- Long-term soil erosion and transport of eroded materials downstream. Changes in surface water runoff due to construction of drainage facilities and added impervious surface associated with the proposed project will be covered in the water resources section.
- Permanent alteration of the groundwater table due to topographic alteration or subsurface drainage. Long-term impacts on groundwater quality and impacts on groundwater levels due to changes in impervious surface will be covered in the water resources section.

### Land Use and Economics

Indirect and cumulative impacts on land use and economics on a broad scale will be determined by forecasting changes in the distribution of population and employment in the region for each proposed alternative and comparing the changes to the No Action Alternative. Indirect impacts will be evaluated by interpreting the results of PSRC's land use model (DRAM/EMPAL). GIS maps will be used to illustrate where and how much the population density is increasing or decreasing.

In addition to discussing the results of DRAM/EMPAL, potential land use changes that may occur over time as a result of localized impacts, such as changes to access, increases in noise, and degradation of air, water, and visual quality, will be discussed. Existing land use conditions and zoning codes and the results of research into factors that promote transit-oriented development will be used to estimate the extent to which bus rapid transit stations are likely to increase pressure for zoning changes around the transit stations.

### Public Services and Utilities

Indirect and cumulative impacts on public services and utilities will be based on the population and employment forecasts from the DRAM/EMPAL modeling. Public service providers will be consulted to determine if future population and employment projections would exceed the planned service capacity.

### Social (including Recreation)

Indirect and cumulative impacts on regional and community growth will be based on the indirect impacts analysis contained in the land use and economics, public services and utilities, and recreation sections. The social analysis will assess how those indirect and cumulative impacts may or may not affect the communities within the study area.

It is assumed that no indirect impacts on community cohesion will occur; cumulative impacts on community cohesion will be analyzed to determine the effects of development of the Trans-Lake Washington Project and other projects included in the cumulative impacts assessment. Indirect and cumulative impacts on recreational facilities from population and employment growth will be analyzed to determine their effect on project neighborhoods.

### Transportation

The methodology for analyzing indirect impacts on the regional transportation system is described in the *Transportation Methodology* (pages 6 and 7). Cumulative impacts will be similarly analyzed. In addition to analyzing the cumulative impacts of all the foreseeable regional transportation projects, sensitivity testing will be done to analyze the effects of: 1) Trans-Lake Washington Project preferred alternative with the I-405 Corridor Program preferred alternative; and 2) the Trans-Lake Washington Project preferred alternative with the I-405 and I-90 Two-Way Transit and HOV Operations Project preferred alternative. The results of the sensitivity testing will be documented in the Transportation Discipline Report.

GMA concurrency requirements do not apply to transportation facilities and services of state-wide significance (except for island counties) and thus will not be discussed for SR 520 improvements. See the *Transportation Methodology* for discussion of analysis of the effects of the project on local streets.

### Visual Quality

Indirect and cumulative impacts will be assessed based on information from other environmental element analyses, in particular the water resources, recreation, vegetation and wildlife, and land use sections.

### Water Resources

Indirect and cumulative impacts on water resources will be qualitatively evaluated based on the results of the DRAM/EMPAL modeling and a literature review. The literature will include studies that evaluate the relationship between basin impervious surfaces, watershed soil types, flow regime, and estimated changes in basin (sub-watershed or watershed) impervious surface due to predicted changes in land use and development patterns.

## Mitigation Measure Methodology

Strategies to avoid, minimize, or mitigate indirect and cumulative impacts will be discussed. Some of these strategies may be outside of the authority of the lead agencies to implement, in which case they will be stated as recommendations to the jurisdiction(s) or agencies that would have authority to implement the strategy. That agency or jurisdiction will be conferred with before such strategies are included in the recommendations.

**Lorie Parker**
**CH2M HILL**
**425-233-3437**
**lparker1@ch2m.com**