3.23 CUMULATIVE AND SECONDARY EFFECTS

The Council on Environmental Quality's regulations implementing NEPA define cumulative effects as the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR Section 1508.7). Indirect, or secondary, impacts are defined as effects that are caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable (40 CFR Section 1508.8). For the I-405 Corridor Program, the actions evaluated here are the proposed programmatic transportation improvements throughout the I-405 corridor in combination with past, present, and future land use development and other relevant non-project actions primarily within the four-county central Puget Sound region comprised of King, Kitsap, Pierce, and Snohomish counties. The evaluation of cumulative and secondary (indirect) effects described here relied on the CEQ publication, "Considering Cumulative Effects Under the National Environmental Policy Act" (January 1997) and the USEPA guidance, "Consideration of Cumulative Impacts in EPA Review of NEPA Documents" (May 1999b) which are incorporated herein by reference.

3.23.1 Scope of Cumulative Effects Analysis

Scoping for the cumulative effects analyses was conducted to identify: (1) important cumulative effects issues; (2) critical resources that should be evaluated for potential cumulative effects; (3) geographic (spatial) boundaries for evaluating potential effects; (4) temporal (time frame) boundaries for each analysis; and (5) relevant past, present, and future actions that could affect the resources, ecosystems, and human communities of concern. This scoping ensured that the analyses were focused on those effects that were truly meaningful, and is consistent with guidelines that recommend cumulative effects analyses "count what counts."

Scoping for the cumulative effects analyses relied on information gained throughout the I-405 Corridor Program EIS process. The scope of the analyses was based on public and agency input requested during formal scoping meetings early in the EIS process; informal input received from the public and agencies as a result of public meetings; responses to I-405 Corridor Program newsletters and questionnaires; feedback from the Steering, Citizens, and Executive committees; the results of prior research and technical analyses of direct and secondary effects conducted as part of the I-405 Corridor Program EIS discipline studies; and review comments received on the I-405 Corridor Program Draft EIS.

3.23.1.1 Critical Resources

Critical resources scoped for detailed evaluation of cumulative effects included: air quality; energy; surface water; wetlands; fish and aquatic habitat; and farmlands. These were scoped based on their heightened importance within the central Puget Sound region and/or I-405 corridor and their potential for substantial cumulative effects related to proposed I-405 Corridor Program improvements in combination with other foreseeable actions. Several reviewing agencies questioned whether energy and farmlands rose to the level that they should be scoped for analysis of potential cumulative effects. After further consideration it was agreed that analysis of these two elements would be included.

3.23.1.2 Geographic Boundaries

Geographic boundaries for evaluating potential cumulative effects were identified for each critical resource based on a number of factors. First, a geographic boundary for each resource analysis was identified by expanding the area of analysis to the point at which all potentially significant cumulative effects would be captured, and beyond which the resource would not be substantially affected. For analyses of natural environment elements such as fish and aquatic habitat, the most meaningful natural boundary (in this case, the affected watershed[s]) was then identified and used as the geographic boundary for analyses. This does not mean that substantial cumulative effects were necessarily found to occur within these geographic units. Where natural boundaries were not meaningful, such as for energy, a different analytical boundary was selected that would be meaningful. The regulatory interests of agencies with jurisdiction also influenced some analytical boundaries, such as for air quality.

3.23.1.3 Temporal Boundaries

Similar to the geographic boundaries for evaluating potential cumulative effects, temporal boundaries also were identified for each resource analysis depending on the accumulation characteristics of the effects being assessed and the regulatory interests of agencies with jurisdiction. For most analyses of critical resources, year 2030 was selected as the future temporal boundary because it is the horizon year for *Destination 2030*, the 2001 update of the Metropolitan Transportation Plan, and it encompasses *VISION 2020*, the region's long-range growth management, economic development, and transportation strategy. As discussed below, implementation of *VISION 2020* and the planned land use development that would result are by far the most consequential reasonable foreseeable actions that overlap geographically and temporally with the I-405 Corridor Program alternatives.

The cumulative effects of the No Action Alternative, which assumes implementation of *VISION 2020* and programmed and funded transportation improvements, were identified as the most meaningful baseline for comparing potential cumulative effects of the action alternatives on critical resources, ecosystems, and human communities of concern.

3.23.1.4 Framework for Cumulative Effects Analyses

The 2001 update of the Metropolitan Transportation Plan (MTP), referred to as *Destination 2030*, includes many of the transit, freeway, and arterial improvements contained in the I-405 Corridor Program Draft EIS action alternatives. With the Spring 2002 update of the MTP, the Puget Sound Regional Council (PSRC) refined *Destination 2030* to fully reflect and incorporate the transportation improvements contained in the I-405 Corridor Program Preferred Alternative. The environmental effects of these I-405 Corridor Program improvements and all other proposed transportation investments in the region were reviewed at a programmatic level in the *Final EIS for Destination 2030, The Metropolitan Transportation Plan for the Central Puget Sound Region* (Puget Sound Regional Council, May 2001b), which is incorporated here by reference. The potential cumulative effects of these improvements are re-evaluated here in slightly different combinations than in *Destination 2030* (as the I-405 Corridor Program Draft EIS action alternatives), and they are combined with some transportation improvements that were not included in *Destination 2030* prior to its update in Spring 2002. Thus, the *Final EIS for Destination 2030* provides a useful point of reference for assessing the magnitude and significance of the I-405 Corridor Program alternatives.

The Puget Sound Regional Council (PSRC) 20-year projections of growth in households and employment within the central Puget Sound region provided a partial basis for evaluating the geographic distribution of potential cumulative effects on critical resources, ecosystems, and human communities. In order to accomplish this, the PSRC land use forecasting model (DRAM/EMPAL) was used because the study area is located within the four counties covered by the PSRC. This is the forecasting model used by the PSRC to develop and update the *Destination 2030* MTP. For the I-405 Corridor Program forecasts and analyses, the proposed transportation improvements contained within each Draft EIS alternative were entered into the DRAM/EMPAL model in the form of increased access and mobility. King County, Snohomish County, and the PSRC were consulted extensively in order to gain an understanding of modeling inputs and results.

The potential effects of other notable and reasonably foreseeable transportation investments on the scoped critical resources were considered cumulatively with the projects and actions contained in *Destination 2030* and the PSRC land use forecasting model. The other transportation investments that were addressed in the cumulative analysis are identified and described in Section 3.23.2, which follows. It was not feasible to code these other investments for inclusion in the DRAM/EMPAL model runs because they were not adequately defined at such early stages of planning. Instead, the effects of these improvements were considered using best professional judgement based upon the general project descriptions that were available at the time the secondary and cumulative effects analyses were conducted. Because of the programmatic level of analysis and the overwhelming influence of the DRAM/EMPAL-modeled cumulative actions, this approach is believed to be reasonable and appropriate.

The cumulative and secondary effects of the Preferred Alternative were not modeled by the PSRC because the modeling analyses conducted previously for the Draft EIS alternatives revealed that the results would not be meaningfully different for the Preferred Alternative than for Alternative 3. This is because the two alternatives are very similar and because the overall magnitude of modeled secondary and cumulative effects are relatively insensitive to the transportation improvements contained in the action alternatives.

3.23.2 Relationship to Metropolitan Transportation Plan and Other Regional Actions

3.23.2.1 Metropolitan Transportation Plan

Destination 2030 is the 2001 update of the 1995 Metropolitan Transportation Plan (MTP). *Destination 2030,* the transportation element of *VISION 2020*, emphasizes an integrated multimodal transportation system and describes the regionally significant modal components of that system. The MTP serves as a planning tool used to identify regional transportation problems and analyze and develop regional solutions, and it serves as a focus for required state and regional transportation system performance monitoring, particularly for the federally mandated congestion management system. In Spring 2002, *Destination 2030* was updated and refined by the PSRC to fully reflect and incorporate the transportation improvements contained in the I-405 Corridor Program Preferred Alternative.

Destination 2030 supports a balanced multimodal transportation system that provides options to users, but the plan recognizes that capacity enhancements are needed to improve mobility on the region's roadways. Under *Destination 2030*, vehicle miles traveled (VMT) is expected to

increase by 45 percent and population by 50 percent over the next 30 years. To address this growth, the plan calls for an aggressive program of transportation investments. With these investments, the growth in travel demand can be accommodated with relatively minor impacts on system performance, such as a 2 percent increase in congestion (P.M. peak) in 2030.

The Metropolitan Transportation System (MTS), which is the system component of *Destination 2030*, includes the following major elements.

Roadways. The roadway and high-occupancy vehicle (HOV) systems are integral components of the region's transportation system and will continue to be into the foreseeable future. Individual streets and roads do not function independently, but rather form a network through which traffic flows and connects to regional freeways. *Destination 2030* includes improvements on principal arterials and arterial HOV lanes, and it adds general purpose and HOV lane miles to the interstate and state route system in the four-county region.

Transit. The transit component is comprised of major regional transit services and facilities that provide public transportation access between major regional activities centers, connecting designated Urban Centers and major regional employment locations. Regional transit services can provide an alternate travel mode in congested corridors. In addition to the region's planned fixed-guideway HCT (light rail and commuter rail) and passenger-only ferry service, transit services are also represented by the transportation facilities they use – general purpose lanes, HOV lanes, and exclusive transit rights-of-way. Regional transit facilities include major park-and-ride lots, transit centers, and ferry terminals.

Non-Motorized Transportation System. This component of the MTS includes pedestrian improvement zones located in designated Urban Centers and regional transit station areas including bus, rail, and ferry facilities.

3.23.2.2 I-405 Corridor Program Improvements Contained in Destination 2030

All of the core projects and strategies in the four Draft EIS action alternatives developed for the I-405 Corridor Program are included in *Destination 2030*. In addition, the PSRC refined *Destination 2030* in Spring 2002 to fully reflect and incorporate the transportation improvements contained in the I-405 Corridor Program Preferred Alternative. These adopted transportation improvement projects and strategies are in response to the planned growth under the existing jurisdictional comprehensive plans, which in turn conform to the regional planned growth under *VISION 2020*.

The I-405 Corridor Program alternatives do not include all the HCT facilities that are included in *Destination 2030.* Links completing the HCT network around the region, such as north to Everett by 2030, are not included. Alternatives 1 and 2 do include the following fixed-guideway HCT routes and stations: Seattle to Issaquah across Mercer Island/I-90; SeaTac to Totem Lake in the I-405 corridor; and Bellevue to Redmond. The HCT facilities that are not included in the action alternatives are ones beyond the 2020 horizon of the I-405 Corridor Program; however, the action alternatives would accommodate implementation of these future HCT facilities during the 2020 to 2030 time period. With some project elements, such the bus rapid transit system in Alternative 3 and the Preferred Alternative, the I-405 Corridor Program improvements could actually serve as a transitional solution that could enhance implementation of a more intensive or higher-order HCT system in the corridor in the future.

In addition, the MTP uses HOV 2+, while the I-405 Corridor Program study uses HOV 3+ in the alternatives. Analysis showed that the HOV use along I-405 does not vary much among the study alternatives since the number of HOV lanes remains constant across alternatives. HOV 3+ use ranges from 3 to 4 percent of vehicles in the north end, and up to 10 percent in the south end of the corridor.

Appendix B identifies the projects within each alternative for the I-405 Corridor Program. The lists of projects included in *Destination 2030* are found in Appendix 9 – Project List and the Supplemental *Destination 2030* Project List of *Destination 2030*.

Other notable, reasonably foreseeable federal, non-federal, and private actions identified during scoping that could be cumulative with the I-405 Corridor Program action alternatives include the following, which are discussed in greater detail below:

- Trans-Lake Washington Project
- I-90 HOV transit improvements and lane additions between I-5 and I-405
- Sound Transit future investments
- *VISION 2020* proposed long-term regional land use plan

3.23.2.3 Trans-Lake Washington Project

WSDOT and Sound Transit have moved into the environmental analysis, documentation, and review phase of the Trans-Lake project to study options for crossing Lake Washington in the SR 520 corridor. In this phase, the recommendations from the study committee, as well as alternatives suggested by other community members, agencies, and advocacy groups, will be evaluated to determine the recommendations' value in improving mobility, their impacts on the environment and affected communities, and the steps that may need to be taken to avoid or mitigate negative impacts or to add positive impacts. An EIS will be prepared as part of the review process. The environmental analysis, documentation, and review process is expected to conclude in 2003. HCT across Lake Washington north of I-90 is not included in the I-405 Corridor Program or *Destination 2030*; the HCT is on the I-90 facility from the I-405 Interchange to downtown Seattle in Alternatives 1 and 2.

3.23.2.4 I-90 Transit Improvements and Lane Additions

HCT is assumed to operate along I-90 from Seattle to Issaquah by 2020 in the I-405 Corridor Program Alternatives 1 and 2, and in *Destination 2030*. A Sound Transit study is currently looking at ways to improve transit on the I-90 Lake Washington bridges. It is not clear at this point if I-90 will convert the reversible express lanes to two-way transit operation, or whether they will remain as reversible lanes.

3.23.2.5 Sound Transit Future Investments

Since 1996, Sound Transit has been implementing Sound Move, the first phase of the voter-approved regional transit long-range vision that includes regional bus service, HOV access improvements, park-and-ride lots, and commuter rail and light rail. Except for commuter and light rail facilities, a variety of these regional HCT investments are being implemented along the I-405 corridor. The majority of Sound Move commitments programmed for the I-405 corridor should be completed by 2006, the original completion year for Phase I. All Sound Move commitments are included in *Destination 2030* and the I-405 Corridor Program alternatives.

Sound Transit began Phase II planning in mid-2001 and expects technical work to continue over several years to enable a Phase II public vote. A Phase II public vote is necessary to build a new set of proposed regional HCT improvements beyond 2006. Assuming a positive vote outcome, the plan would provide additional (but as yet unspecified) HCT facilities and services to east King County jurisdictions within the I-405 corridor. The I-405 Corridor Program FEIS is a programmatic source of potential HCT-related projects to be included in a future Phase II implementation plan proposal.

In the I-405 Corridor Program Alternatives 1 and 2, HCT was assumed to operate as a center-to-center fixed-guideway system utilizing BNSF and I-405 right-of-way along the length of I-405, with extensions to Redmond via SR 520 and to Issaquah via I-90 corridor alignments. Alternative 3 assumes that the high-capacity transit element would take the form of an advanced bus rapid transit system, primarily using HOV lanes, operating on I-405, SR 520, and I-90.

3.23.2.6 VISION 2020

Destination 2030 functions as the transportation element of *VISION 2020*. *VISION 2020* describes a regional land use pattern consistent with and supportive of the state's GMA (Growth Management Act) policies. *Destination 2030* provides the regional transportation system to support the planned growth. With the Spring 2002 update of the MTP, *Destination 2030* fully reflects the transportation improvements contained in the I-405 Corridor Program Preferred Alternative. The local comprehensive plans for cities in the study area were developed within the framework of *VISION 2020*. The alternatives for the I-405 study are consistent with all local jurisdictions' adopted land use zoning. The I-405 Corridor Program action alternatives are consistent with GMA in that they support implementation of the envisioned regional land use pattern.

3.23.3 Land Use, Development, and Transportation in the Region and Study Area

3.23.3.1 Regulatory Trends

Through the late 1980s and 1990s, new regulatory policies at the state, regional, and local levels were enacted that defined the boundaries within which growth would be accommodated and the amount of density that each city will need to accommodate over a 20-year horizon.

Washington State Growth Management Act

Before the GMA was adopted in 1990, there was little statewide or regional direction on growth, and a growth pattern of continual sprawl into rural areas. The Act defined urban and rural growth areas (UGAs), designated Urban Centers (which came about through *VISION 2020* and Countywide Planning Policies), established density targets in those Urban Centers, and established minimum levels of services on statewide infrastructure. For further detail see Section 3.13 and the *I-405 Corridor Program Draft Land Use Plans and Policies Expertise Report* (DEA, 2001a).

VISION 2020

The Puget Sound Regional Council (PSRC) adopted the update of *VISION 2020* in 1995. *VISION 2020* serves as a long-range growth management, economic, and transportation strategy.

It establishes a multiple-center approach to development that promotes a jobs/housing balance and plans for needed transportation improvements, specifying that improvements should occur at the same time as employment growth to implement the infrastructure concurrency requirements of GMA. *VISION 2020* focuses growth into the Urban Growth Area (UGA) defined by each county. The Metropolitan Transportation Plan (MTP) was adopted in 1995 as the transportation element of *VISION 2020*.

Metropolitan Transportation Plan

As noted above, the MTP was initially adopted in 1995. The MTP is a long-range plan to guide transportation investments in the central Puget Sound region. It includes specific provisions relevant to the I-405 corridor, including policies to support development of dense centers and a greater mix of land uses, connected by a network of transit and non-motorized modes of travel. Key components of the MTP include regional transportation pricing strategies, freeway and arterial HOV systems, facilities for pedestrians and bicycles, travel demand management, and establishment of high-capacity transit modes along congested corridors that connect Urban Centers. The Puget Sound Regional Council updated the 1995 MTP in a revised plan titled *Destination 2030* in May 2001. In Spring 2002, *Destination 2030* was updated and refined by the PSRC to fully reflect and incorporate the transportation improvements contained in the I-405 Corridor Program Preferred Alternative.

As an integral part of *VISION 2020*, *Destination 2030* has the same emphasis on coordinated city, county, port, and transit agency plans, and adopted multi-county and countywide planning policies. *Destination 2030* takes into account the different growth patterns in the region and calls for focused growth in the Urban Centers. It also acknowledges implementation of a light rail system in the 2010 horizon with subsequent phases. *Destination 2030* takes an important step in calling for reduction of congestion points and includes many of the I-405 corridor improvements within the 2010 and 2030 horizons. The plan took the existing list of projects from the MTP and revised them based on PSRC modeling. It also includes a 2001–2010 "action strategy," which calls for a regional phasing plan to determine which transportation projects should be built first for the best land use effect.

County-Wide Planning Policies

King County, Pierce County, and Snohomish County, working with the local cities, took the lead in developing and adopting County-Wide Planning Policies (CWPP), which integrated land use planning with transportation planning policies. Cities, including the Eastside cities within the I-405 study area, adopted the CWPP as one regional implementation tool of the GMA and *VISION 2020* policies.

The CWPP establish the Urban Center concept, which is beginning to take form within the designated UGA. Some of the Urban Centers are in the I-405 corridor area and planned infrastructure improvements will affect their long-term viability.

All of the local jurisdictions in the I-405 Corridor Program study area have adopted comprehensive plans in accordance with requirements of GMA, the CWPP, and the PSRC Multi-county Planning Policies. These comprehensive plans include transportation elements that are reviewed and certified by the PSRC as conforming to the transportation planning elements of the GMA, *VISION 2020*, and the MTP. There are 80 adopted comprehensive plans in the Puget Sound region, 74 of which have certified transportation elements. The concurrency requirements

of transportation elements require that key infrastructures be built or planned for within a 6-year time frame of any proposed development. The I-405 Corridor Program alternatives are generally supportive of the applicable jurisdictional local transportation plans.

3.23.3.2 Historical Land Use Changes and Trends

The Puget Sound region has experienced tremendous growth in two large cycles**,** one in the 1960s and another in the 1980s and 1990s. The Puget Sound region is still growing in 2001, with annual growth rates projected at 1.1 to 2.0 percent out to 2030 (PSRC, 2001a). Prior to the 1970s there was strong growth in the region with federal spending on aviation, expansion of military installations, import/export services, and related industrial goods. In the mid-1970s, the growth slowed and the Puget Sound region felt the "brakes" of the economy. In the mid-1980s, the region experienced a revival of the economy with the arrival of Microsoft and the "high-tech" industry, increased spending on military technology with Boeing, and an upturn in the national economy. While the growth rate was substantial in the 1960s, the current predominant Eastside land uses did not emerge until the 1980s when the area transitioned from rural/suburban, to suburban/urban with identifiable Urban Centers.

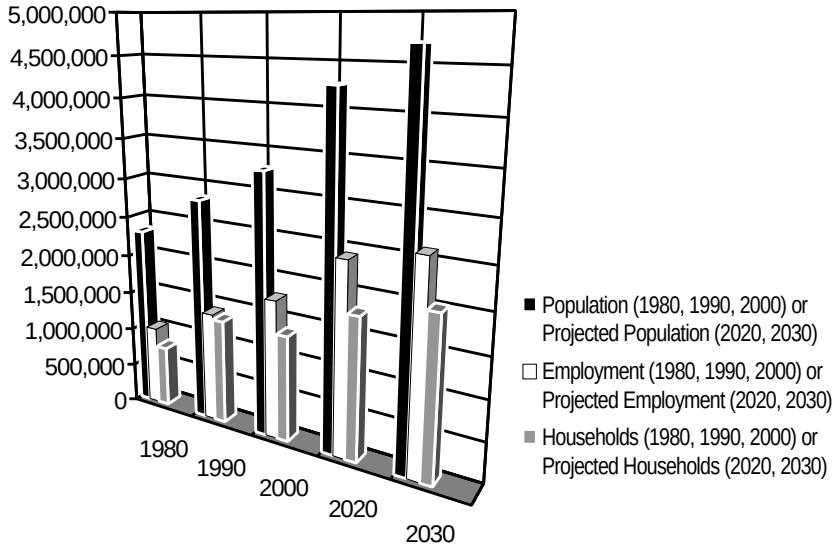
The Eastside (communities east of Lake Washington) began the Twentieth Century as a rural area. Development did not begin in earnest until after the completion of the first Lake Washington floating bridge across Mercer Island in 1940. The bridge dramatically decreased the time it took to travel between Seattle and the Eastside. During the next twenty years the previously rural Eastside was transformed into a major suburb of Seattle, with development focused in Bellevue and the other neighborhoods having easy access to U.S. 10 (now I-90). The second major phase in the contemporary development of the Eastside began when the second Lake Washington floating bridge was completed in 1963. The opening of SR 520 facilitated access and development in the 1970s and early 1980s of the northern and northeastern portions of the Eastside areas that had previously been difficult to access from Seattle. During the period the Eastside also became an important location for businesses and jobs, which increased 400 percent between 1960 and 1980.

The first businesses were retail, serving the needs of the residents, but from 1990 to 1997 the population increased by nearly 60,000 people and employment increased by 80,000 jobs as major international companies like Microsoft located on the Eastside and Boeing, the Eastside's biggest employer, expanded. Roadways were expanded and built in response to the employment and population growth. The land use plans and zoning currently approved for the Eastside anticipate considerable development over the next 30 years as well.

In the 1990s, towns that were once "bedroom" communities, such as Bellevue and Redmond, were transformed into major employment and commercial centers. The long-term regional growth trend has been toward population dispersion outward from Seattle and, late in the 1990s, from the Eastside cities eastward into agricultural and forested areas.

The I-405 corridor experienced the greatest growth between 1980 and 2000 as reflected in Figure 3.23-1. The growth that took place in employment and households was above the regional average.

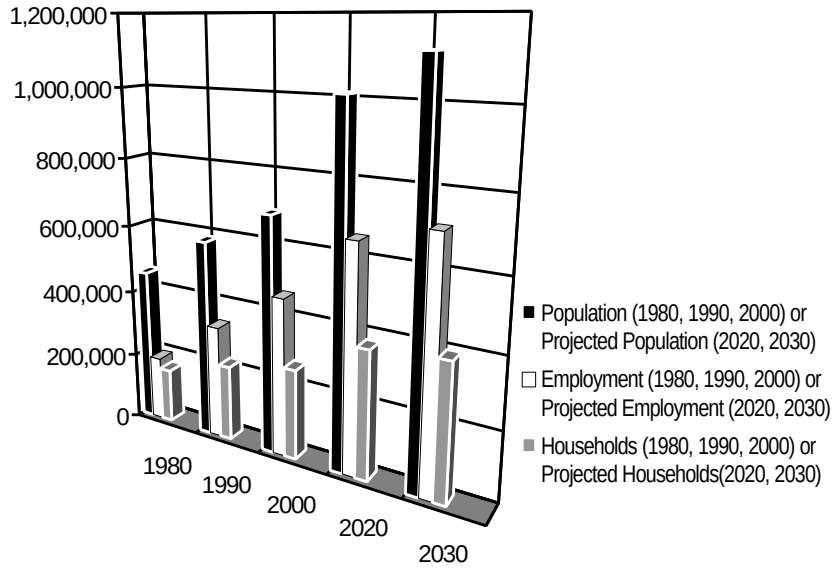
Figure 3.23-1: Population, Employment, and Household Trends from 1980 to 2000 and Projections at 2020 and 2030, I-405 Study Area



Between 2000 and 2030 the region is projected to add about 1.5 million people, 780,000 new households, and 700,000 new jobs. The population in the region is expected to grow at an annual rate of 1.2 percent over the next 30 years, a substantial slowdown from the 2.0 percent pace of the 1960-00 period. By 2030, the population, as shown in Figure 3.23-2 is expected to reach 4.7 million, a 44 percent increase from the 2000 level.

Figure 3.23-2: Population, Employment, and Household Trends from 1980 to 2000 and Projections at 2020 and 2030, Puget Sound Region

(King, Kitsap, Pierce, and Snohomish)



The trend of declining household size is expected to continue in the future, but at a more moderate pace. The updated forecasts project that, by 2030, there will be two million households in the region, a 50 percent increase above the 2000 total. The region's average household size is expected to be 2.3 people per household by the year 2030, down from the 2000 level of 2.5 persons per household (2001 MTP Baseline Technical Report – June 2000).

In the 1990s, aerospace was a major sector of the Puget Sound area's employment and economic base. In 1999, aerospace employment represented 40 percent of the total manufacturing sector jobs. Yet while aerospace was a substantial factor in the economy, the pre-packaged software industry accounted for 13 percent of the region's earnings in 1999. Recent forecasts indicate a shift in the regional economy to a new and growing sector – trade and service industries.

The forecast for 2030 economic performance will be tied to the growth in the trade and service industries. Projections suggest that trade and services will be the main growth sectors at an annual growth rate of about 1 percent or more between 2000 and 2030. The region is projected to have 1.5 million trade and service jobs, about 58 percent of all employment forecast through the year 2030 (2001 MTP Baseline Technical Report – June 2000).

3.23.3.3 Regional Land Use Trends and Growth

Summary of Population and Housing Trends in the Region

The Puget Sound region has experienced substantial growth in population during the past four decades. In the 1980s, the annual growth rate was approximately 2 percent with an estimated population of 2.7 million in 1990. The actual population ended up at more than 3 million in 1990, due to the in-migration drawn by a strong economy.

The substantial growth of in-migration of people took place between 1988 and 1989, when nearly 50,000 more people moved into this region than moved out. This exceeded the region's average of 20,000 for the previous 5 years. Population projections (Figure 3.23-2) indicate that by 2030, nearly 5 million people will be living within the region.

The housing trends are shown in Figure 3.23-2 from 1980 to 2030 for the region. Between 1995 and 1997 the number of residential units permitted increased regionally, with the number in King and Snohomish counties rising the fastest. Pierce and Kitsap counties experienced increases in permits from 1995 to 1996, but in 1997 fell 6 and 18 percent, respectively. Permits for single-family housing continued at a high level during the late 1990s and constituted the largest share of residential dwelling units.

The Growth Management Act (GMA), as discussed in regulatory trends, led to the establishment of the Urban Growth Area (UGA), a boundary for growth and designation of Urban Centers to absorb the growth. The UGA is likely to become denser as an additional million people populate the Puget Sound region by 2020. By the year 2030, a total of 1.7 million additional people are forecast to live in the region (Central Puget Sound region - Growth Context Paper - PSRC Oct. 1999).

The UGA requires an effective transportation infrastructure to provide access to the employment centers as well as the low-density suburban areas. The suburban areas are attractive due to lower land costs, but are often remote from employment opportunities. When housing is developed near employment centers, it may not be affordable to local employees, who then look further out – an ongoing development trend in east King County.

Summary of Employment in the Region

The Puget Sound region has experienced continued growth of both the manufacturing (aerospace and aviation) and service-oriented (software, computer technologies, and biotechnology) economic sectors. The I-405 corridor has a mix of both sectors, with aerospace manufacturing concentrated in the Kent and Renton areas and the software/high technology firms in Redmond, Bellevue, and the central and eastern areas. Both sectors generate high volumes of traffic on the freeway system.

Location analysis of selected industry clusters in the central Puget Sound region shows that certain industry groups tend to concentrate within particular parts of the region. Concentration of particular types of employment activity offer opportunities to examine transformations in the economic geography and travel behavior associated with different employment patterns, as discussed below (Central Puget Sound Region - Growth Context Paper - PSRC Oct. 1999).

In 1998, there were 190 aerospace firms in the region employing over 112,000 persons. The Boeing Company employs nearly 100,000 of these employees. Aerospace is concentrated, even after recent transfers among facilities, in south Seattle, Renton, Everett, and the Kent Valley. Non-Boeing aerospace employment (around 15,000 employees) tends to be located near the existing Boeing facilities.

Software firms employed nearly 30,000 persons in 1998. There were over 900 firms, 93 percent of which are small firms employing fewer than 50 employees. Half of all software employment is with Microsoft and 17 percent of the employment is with firms employing fewer than 50 employees. This has been an extremely high growth industry during the 1990s, with employment increasing by over 400 percent. These firms are primarily concentrated in downtown Seattle, Bellevue, Redmond, and to a lesser degree in other parts of east King County.

Biotechnology employment is concentrated primarily in downtown Seattle and around the University of Washington; some employment is located in the "high tech corridor" along I-405 in north King County and in Snohomish County. In 1998, biotechnology had an employment of 8,500 in 323 firms.

Temporary agency employment has seen high growth since 1990. Employment increased from 16,800 to 37,500. The size of temporary employment firms has increased much faster than the number of firms. These firms are highly concentrated and are primarily located in downtown Seattle and Bellevue.

These employment patterns and locations provide an insight into the many different pressures on the I-405 corridor to provide the means of movement of goods and people.

3.23.3.4 I-405 Study Area Land Use Trends and Growth

Summary of Population and Housing Trends in the I-405 Study Area

The I-405 area experienced substantial growth in the 1980s as shown in Figure 3.23-1. The projections for the I-405 study area in population growth, assuming an annual growth rate in the range of 1.4 to 2.0 percent, increase from 687,300 in 2000 to 1,010,500 in 2020 and 1,116,300 by 2030.

The household growth in the study area is expected to continue with a greater proportion living in multi-family units in the Urban Centers. Assuming an annual growth rate in the range of 0.5 percent to 1.2 percent, the households would increase from 265,200 in 2000 to 369,300 in 2020 and 390,500 by 2030. On a broader eastside view, PSRC forecasts indicate a growth rate in 2000 at 1.7 percent and dropping to 0.7 percent in 2030 for single-family households. The growth rate for multi-family units is forecast to range from 3.6 percent in 2000 to 0.7 percent in 2020, rising back up to 1.7 percent by 2030.

As discussed previously, the I-405 corridor has transitioned from a rural/suburban community into an urban area, focusing the continued growth into the Urban Centers of Bellevue, Redmond, Tukwila, Kirkland, and Renton. At the same time, the transportation infrastructure of I-405, SR 520, I-90, and the associated east/west major arterials are at capacity during peak hours.

The land use pattern in the I-405 corridor has followed the regional patterns, with focused employment centers and low-density suburban expansion outside of the downtown cores of Bellevue, Redmond, and Kirkland. Large residential subdivisions served by major arterials have experienced growth, with a parallel growth in the downtown cores of the eastside cities.

Summary of Employment in the I-405 Study Area

The I-405 study area, in comparison to the Puget Sound region (Figure 3.23-2), has grown at a greater pace in employment in the 1990s (Figure 3.23-1), and estimates project continued growth in the employment base. Projections, assuming an annual growth rate in the range of 0.8 to 1.5 percent, show employment rising from 462,300 in 2000 to 653,000 in 2020 and 708,400 by 2030.

The land use pattern on the Eastside is dependent upon the automobile. The potential for reducing single occupant vehicle trips and congestion is addressed in *Destination 2030* and the I-405 Corridor Program by continuing to develop HOV modes. Strategies include HOV priority lanes, high-capacity transit improvements (increased bus service and light rail), expanded commute trip reduction programs, and transportation demand management programs.

3.23.3.5 Results of DRAM/EMPAL Modeling for Region and Study Area

The PSRC land use forecasting model (DRAM/EMPAL) covers the four-county central Puget Sound region of Snohomish, King, Pierce, and Kitsap counties. This forecasting model is used by the PSRC to develop and update the MTP, including *Destination 2030*. State law requires the transportation elements of local comprehensive plans to be certified as consistent with the MTP. See the *I-405 Corridor Program Draft Land Use Expertise Report* (DEA, 2001b) for a more detailed discussion of the assumptions in the modeling process.

Based on the above trends, it was important in analyzing cumulative effects to view the population, employment, and households within the context of the regional plans, and therefore the PSRC model was utilized on small geographic areas known as forecast analysis zones (FAZ). The model projected employment and household growth within the FAZ geographical areas over the next 20 years. The basis for the projections is generated by PSRC from the regional forecasts of population and employment, which are allocated to the Forecast Analysis Zones (FAZs) using the DRAM/EMPAL model. The county forecast totals are not controlled, but are aggregations of the FAZs. The Regional Council's forecasts are consistent with the OFM's minimum and maximum projections.

Each county and its cities are mandated by GMA to work collaboratively to plan for the coordinated accommodation of this projected growth in their respective comprehensive plans and ensuing implementation actions. Evaluating the I-405 Corridor Program alternatives necessitated adding the proposed transportation improvements (for example, miles of additional I-405 freeway general_purpose lanes) to the DRAM/EMPAL model in the form of increased access and mobility. In addition, King County, Snohomish County, and the PSRC were consulted in order to gain an understanding of issues related to projected growth and planned land use changes.

The results of the modeling were used to identify the cumulative effects, if any, on pressure for growth and development within the forecast analysis zones. Changes in mobility and accessibility within the study area could influence the locational preferences of individuals, businesses, and households. The sum of these individual preferences regarding where people live and work translates into changes in pressure for growth and assumed development activities, as regulated by local comprehensive plans and zoning codes. These potential development activities are the cumulative effects from the I-405 Corridor Program combined with other regional corridor programs. When the action alternatives are compared to the No Action Alternative, there is a nominal range of decreases and increases in pressure for growth and development. This is assumed to be influenced by variations in the way each alternative enhances access to different portions of the I-405 corridor.

Destination 2030 includes many of the I-405 Corridor Program, SR 520, I-90, and SR 522 improvements. The cumulative effects of these transportation improvements on land use could be positive, with growth in population, employment, and households locating in the Urban Centers and in-fill development along the I-405 corridor where it is planned to occur.

The No Action Alternative does show a 24 percent increase in the projected growth from 2000 to 2020, but that is still within the range of projected growth for the region and the area, as defined by PSRC modeling. The No Action Alternative is an existing element within the PSRC model, as it includes existing and committed transportation projects.

The I-405 Corridor Program alternatives are compatible with existing regional and local land use plans, which already address growth.

It is important to remember that the No Action Alternative includes the committed projects that are likely to be built in the near future, and therefore are used for comparison purposes. The DRAM/EMPAL model forecasts the changes of the No Action Alternative from 2000 to 2020, and the action alternatives are compared to the No Action Alternative at 2020. These changes in pressures are detailed in the following sections, by county, FAZ maps, and detailed tables for each alternative.

No Action Alternative

The No Action Alternative could influence potential limited, localized effects in the form of increased pressure for growth in households outside of the Urban Growth Area. Figure 3.23-3 shows the existing land use in the study area and Figures 3.23-4 and 3.23-5, based on the PSRC model, show the projected growth of employment and households that are forecast to take place by 2020 under the No Action Alternative. Table 3.23-1 lists areas of increase in employment and households in the central Puget Sound region. The employment growth within the study area is expected to occur along the I-405 corridor and throughout Seattle, the Sammamish

Plateau, Kent Valley, Pierce County, North Bend, and Snoqualmie. Some household growth would occur outside of the UGA in south Snohomish County, east King County, northwest Pierce County, and Kitsap County.

Table 3.23-1: No Action Alternative Areas of Projected Increase in Employment and Households

Regional Jurisdictions	Local Jurisdiction with Employment Growth over 3000 Employees in 2020	Local Jurisdiction with Household Growth over 3000 units in 2020
Snohomish County	Everett and Lynnwood	Lynnwood, Mill Creek, Mukilteo
King County	Kirkland, Redmond, Bellevue, Issaquah, Newcastle, Renton, Tukwila, SeaTac, Kent, Auburn, and Federal Way	Woodinville, Redmond, Bothell, Carnation, Bellevue, Issaquah, Tukwila, SeaTac, Kent, Auburn, Covington, Federal Way
Pierce County	Algona, Pacific, Tacoma, Lakewood	Puyallup, Algona, Pacific, Bonney Lake, Sumner, Lakewood

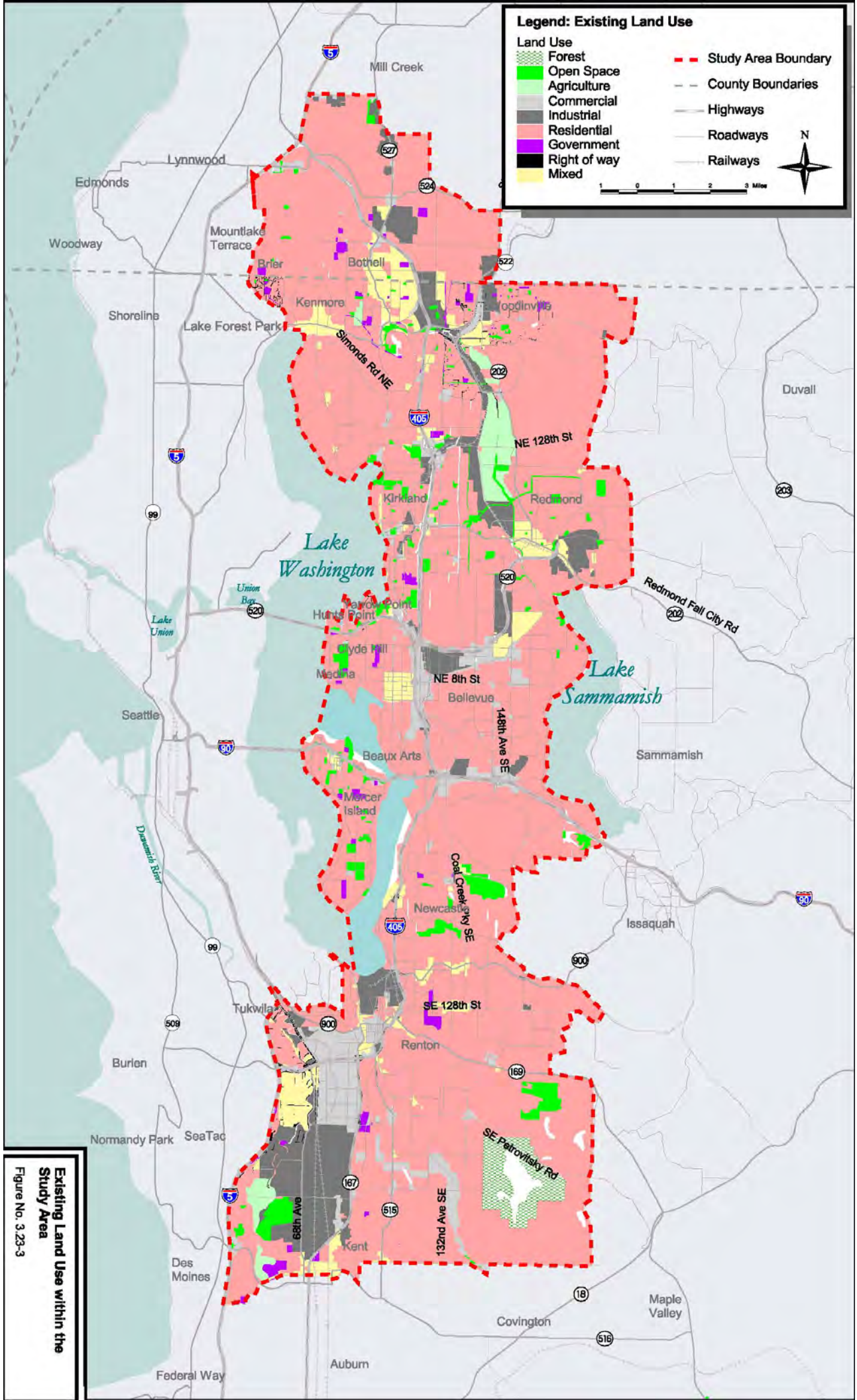
Despite pressure for additional growth on the fringe outside of the UGA, substantial growth (Figures 3.23-4 and 3.23-5) still would occur within designated Urban Centers. The designated Urban Centers that are expected to receive the highest level of employment growth are Everett, Lynnwood, Redmond, Bellevue, Tukwila/South Center, Kent, SeaTac, Auburn, and Federal Way.

The designated Urban Centers that would receive the highest level of household growth are Lynnwood, Redmond, Tukwila/South Center, SeaTac, Kent, Federal Way, and Puyallup.

Table 3.23-2 shows current and projected employment and households in 2020 for the counties and study area. It is important to note that the 2020 regional growth projections for the No Action Alternative are nearly the same (within 2 percent) as those for the action alternatives, indicating that there is very little change in overall pressure for growth and development among the alternatives.

Table 3.23-2: No Action Alternative Projected Changes in Employment and Households

Location	Employment				Households			
	2000	2020	Change	Percent Change	2000	2020	Change	Percent Change
	(a)	(b)	(b)-(a)	2000-2020	(a)	(b)	(b)-(a)	2000-2020
King County	1,180,564	1,474,469	293,905	24.9	741,167	967,180	226,013	30.5
Kitsap County	90,962	120,954	29,992	33.0	96,257	137,421	41,164	42.8
Pierce County	294,393	365,085	70,692	24.0	272,835	348,078	75,243	27.6
Snohomish Co.	233,289	300,568	67,279	28.8	227,522	334,335	106,813	46.9
Regional Total	1,799,208	2,261,076	461,868	25.7	1,337,781	1,787,014	449,233	33.6
Study Area	**447,936**	**576,335**	**128,399**	**28.7**	**270,037**	**360,603**	**90,566**	**33.5**



Existing Land Use within the Study Area

Figure No. 3.23-3

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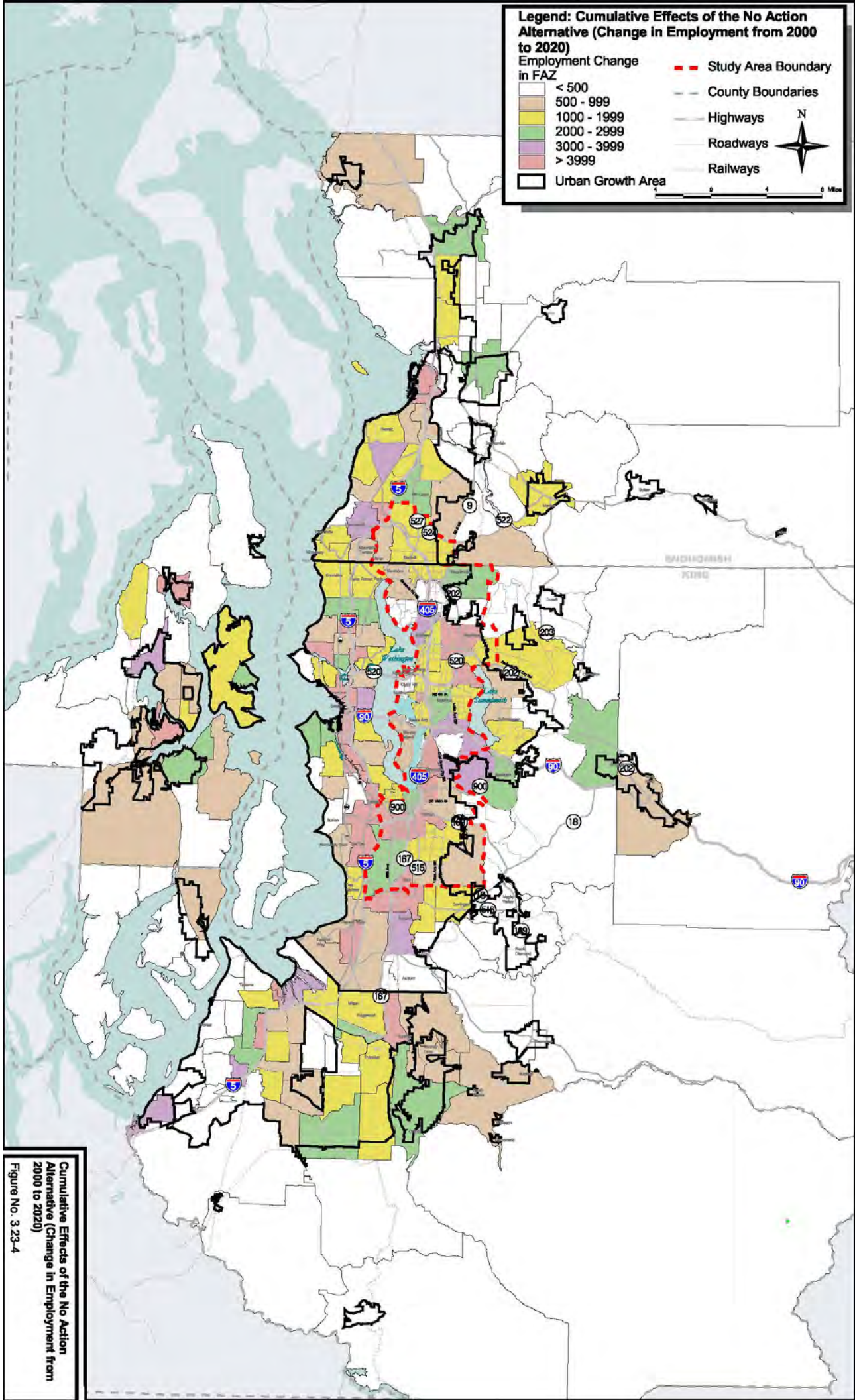

Cumulative Effects of the No Action Alternative (Change in Employment from 2000 to 2020)

Figure No. 3.23-4

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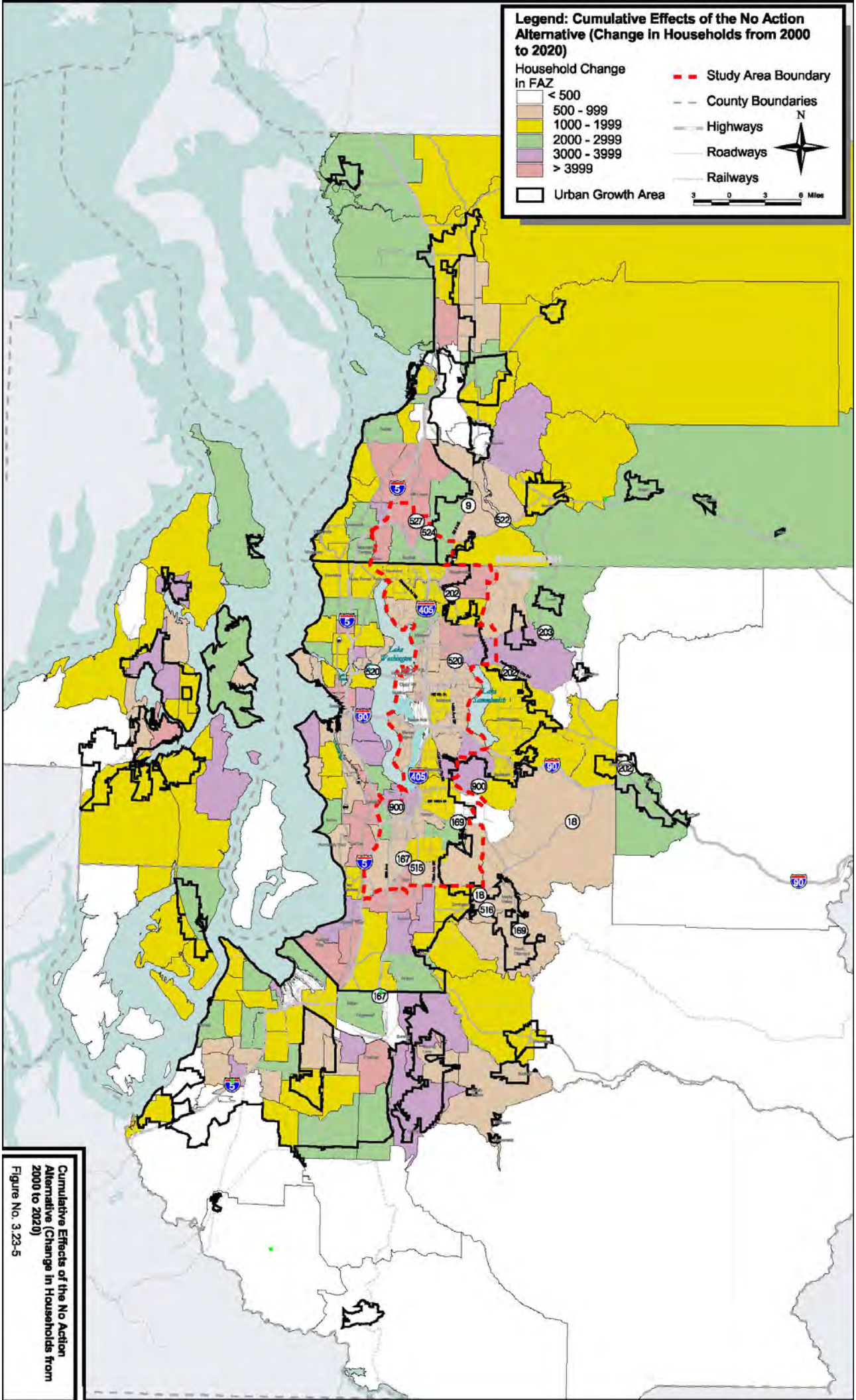
Legend: Cumulative Effects of the No Action Alternative (Change in Households from 2000 to 2020)
Household Change in FAZ
< 500
500 - 999
1000 - 1999
2000 - 2999
3000 - 3999
> 3999
Urban Growth Area
Study Area Boundary
County Boundaries
Highways
Roadways
Railways
N
3 0 3 6 Miles
Cumulative Effects of the No Action Alternative (Change in Households from 2000 to 2020)
Figure No. 3.23-5

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Another cumulative effect of the No Action Alternative is the effect on land use and transportation concurrency. For a detailed discussion on concurrency, please see the *Draft Land Use Plan and Policies Expertise Report* (DEA, 2001a). The local jurisdictions in the I-405 study area are facing serious traffic concurrency problems. If those issues are not managed effectively and addressed adequately by 2020, it is possible that the planned growth might not be able to be accommodated by local jurisdictions. The existing concurrency problems in most of the local jurisdictions would be exacerbated in the future under the No Action Alternative.

The average traffic level of service was calculated for jurisdictions within the I-405 study area. The results show virtually every jurisdiction within the study area would reach or exceed currently adopted transportation concurrency levels by 2020, including:

- Tukwila (Southcenter area)
- Renton (most areas)
- Newcastle (western portion)
- Bellevue (downtown, Factoria, Bel-Red)
- Mercer Island
- Kirkland (most areas)
- Redmond (western portions, including Overlake)
- Bothell (Snohomish County portion)
- Mill Creek (most areas)
- Lynnwood (most areas)

If concurrency cannot be achieved, growth would be expected to disperse elsewhere within or outside of the study area where it can be permitted and allowed under comprehensive plan policies.

This could exacerbate pressure for growth in rural areas outside the UGA or premature growth at the urban fringe of the UGA. If allowed to occur by local land use agencies, this pattern of growth would have potential cumulative effects such as increased demand on the transportation infrastructure, demand on public services, adverse impacts on the environment, vehicular congestion, and long-term increases in the cost of providing public services.

Alternative 1: HCT/TDM Emphasis

Compared to the No Action Alternative growth projections, under Alternative 1 the I-405 corridor could experience a slightly greater concentration of employment within the study area and a greater number of households within the designated Urban Centers and around the HCT stations within the corridor. See Table 3.23-3 for general county numbers, and Table 3.23-4 for a breakdown by geographic areas.

Table 3.23-3: Alternative 1 Changes in Employment and Households from the No Action Alternative

Location	2020 Employment				2020 Households			
	No Action Alternative	Alternative 1	Change	Percent Change From No Action Alternative	No Action Alternative	Alternative 1	Change	Percent Change From No Action Alternative
	(a)	(b)	(b) – (a)		(a)	(b)	(b) – (a)	
King County	1,474,469	1,471,969	-2,500	-0.2	967,180	965,682	-1,498	-0.2
Kitsap County	120,954	120,921	-33	0.0	137,421	137,543	122	0.1
Pierce County	365,085	364,995	-90	0.0	348,078	348,063	-15	0.0
Snohomish Co.	300,568	303,204	2,636	0.9	334,335	335,855	1,520	0.5
Regional Total	2,261,076	2,261,089	13	0.0	1,787,014	1,787,143	129	0.0
Study Area	**576,335**	**575,882**	**-453**	**-0.1**	**360,603**	**360,573**	**-30**	**0.0**

Note: The percent difference of "0.0" reflects rounding due to significant numbers in the FEIS.

Table 3.23-4: Alternative 1 Changes in Employment and Households by Area and County

Geographic Area	Employment	Households
Change from the No Action Alt. @ 2020	(Fig.3.23-6)	(Fig.3.23-7)
PIERCE COUNTY		
Fircrest / Lakewood	-10	20
Parkland / Spanaway	-4	1
Puyallup / Frederickson	-10	-5
Sumner / Bonney Lake	-13	-10
Tacoma Eastside	-9	5
Tacoma South	-20	-6
Tacoma North End	-16	-4
Tacoma CBD	3	1
Port of Tacoma / NE Tacoma / Fife	-4	5
Gig Harbor / Longbranch	-5	-4
Ft. Lewis / McCord / Dupont	-1	-14
SE Pierce County	-1	-4
Pierce County TOTAL	**-90**	**-15**
KING COUNTY		
Federal Way	-14	4
Auburn	-9	-20
Enumclaw	0	18
Tahoma / Raven Heights	-1	-7
Soos Creek	18	13
Kent	1431	628
Highline / Des Moines / SeaTac	-1437	-642
Tukwila	7	10
Renton / Skyway	95	20
Newcastle	-69	-426
Issaquah / E. Sammamish	13	0
Mercer Island	-1	-6
Bellevue	-3328	-1550
Point Cities	24	134
Kirkland Area	2961	2242

Geographic Area	Employment	Households
Change from the No Action Alt. @ 2020	(Fig.3.23-6)	(Fig.3.23-7)
Redmond Area	50	92
Northshore	-2106	-1803
Bothell	2	1
Seattle South	-16	-38
Seattle CBD	-52	-1
Seattle Central	-14	-55
Seattle North	-44	-96
Shoreline	-8	-12
Snoqualmie Valley	0	4
External Zones King	0	1
Vashon Island	-1	-9
King County TOTAL	**-2500**	**-1498**
SNOHOMISH COUNTY		
Edmonds / Esperance	-5	-14
Mountlake Terrace	0	-6
Lynwood Area	2652	1532
Mill Creek	0	-4
Clearview / Cathcart / Maltby	3	4
Paine Field Area	-5	5
Snohomish / Monroe	-1	-12
Lake Stevens Area	0	-4
Mukilteo / SW Everett	0	-3
Everett South	-2	7
Everett Central	-7	-4
Marysville / Arlington	0	16
SE Snohomish	1	13
NE Snohomish	0	-3
NW Snohomish	0	-7
Snohomish County TOTAL	**2636**	**1520**
KITSAP COUNTY		
Port Orchard / Southworth	42	245
Keyport / Central Kitsap	-5	-20
Silverdale / Bangor	-16	-22
Poulsbo / Kingston	-15	-30
Bremerton Area	-31	-34
Bainbridge Island	-8	-17
Kitsap County TOTAL	**-33**	**122**

Figure 3.23-6 shows projected employment under Alternative 1. Employment growth could result along the I-405 and SR 167 corridors where new fixed-guideway HCT and TDM strategies would be implemented.

Figure 3.23-7 shows projected households under Alternative 1. On a sub-regional level, Alternative 1 could influence pressure on Renton, Kent, Kirkland, and Lynnwood regarding additional employment and housing. The household growth could take place around the Urban

Centers with an improved range of multimodal transportation choices to regional employment centers, coupled with the future station area planning and implementation of Sound Transit's Sound Move program. This trend is supported by, and in support of, regional and local plans and implementation programs which call for transit-supportive land uses.

However, since Alternative 1 would not reduce the levels of traffic congestion in much of the study area, compared to the No Action Alternative, it would not be effective in addressing the concurrency problems at the local level. The increased pressure for employment and population growth described above would need to be matched with local actions to maintain adequate transportation levels of service. Without effective transportation improvements, projected growth might not be realized as planned and development could disperse to less suitable areas outside the Urban Centers and UGA.

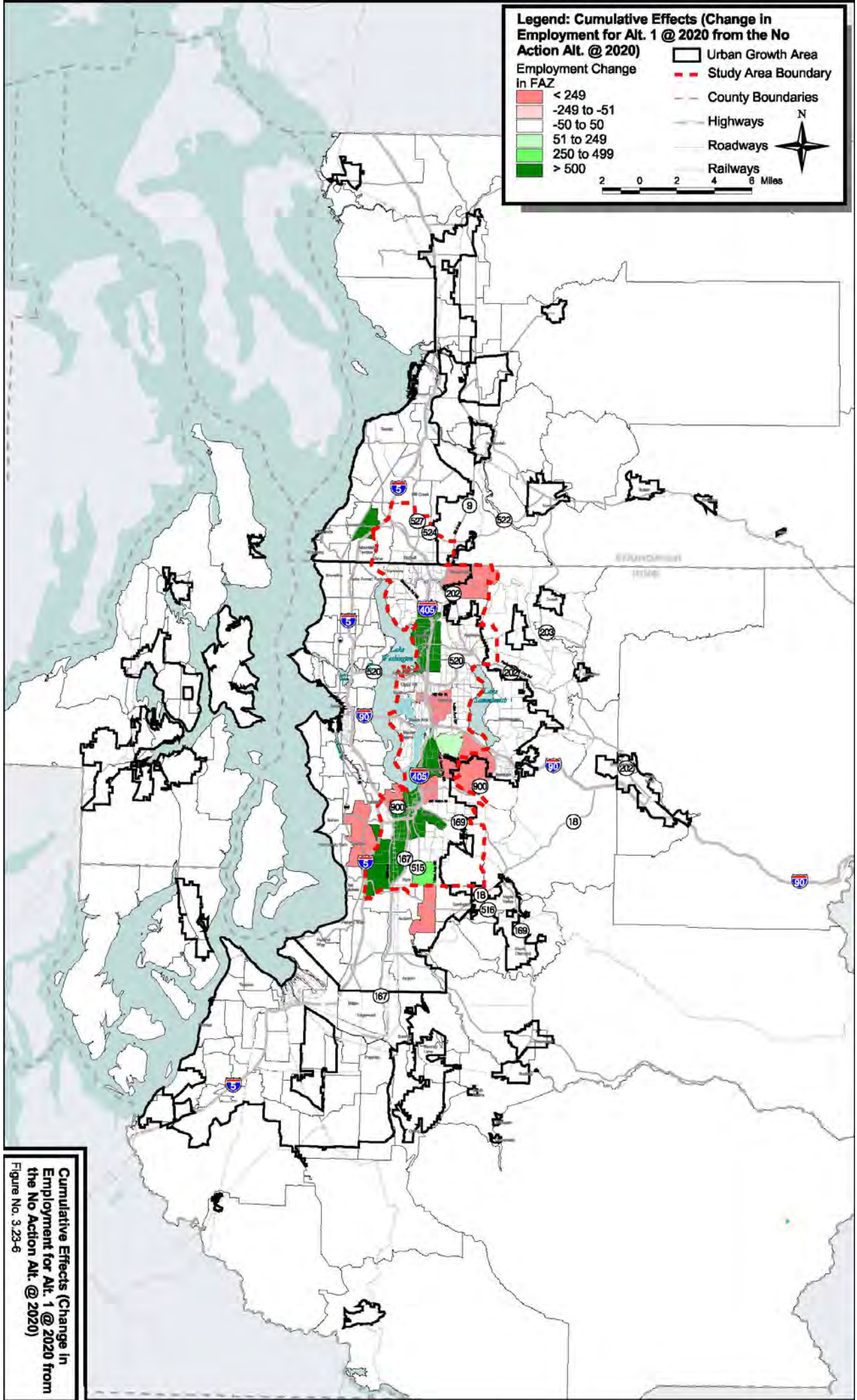
Alternative 2: Transit Emphasis

Compared to the No Action Alternative, pressure for growth in employment would be expected to increase in the I-405 corridor and decrease for City of Seattle, Pierce County, and, to a lesser degree, Kitsap County. Figure 3.23-8 shows the projected employment pattern in the region under Alternative 2. The future employment is forecast to increase in the northeastern and southern portions of the I-405 corridor, specifically in Redmond, Kirkland, Renton, Kent, Tukwila, and the Monroe UGA. See Table 3.23-5 for the county changes, and Table 3.23-6 for the breakdown by geographic areas.

Table 3.23-5: Alternative 2 Changes in Employment and Households from the No Action Alternative

	2020 Employment				2020 Households			
Location	No Action Alternative (a)	Alternative 2 (b)	Change (b) – (a)	Percent Change From No Action Alternative	No Action Alternative (a)	Alternative 2 (b)	Change (b) – (a)	Percent Change From No Action Alternative
King County	1,474,469	1,473,785	-684	0.0	967,180	966,821	-359	0.0
Kitsap County	120,954	120,068	-886	-0.7	137,421	135,956	-1,465	-1.1
Pierce County	365,085	363,894	-1,191	-0.3	348,078	347,789	-289	-0.1
Snohomish Co.	300,568	303,343	2,775	0.9	334,335	336,574	2,239	0.7
Regional Total	2,261,076	2,261,090	14	0.0	1,787,014	1,787,140	126	0.0
Study Area	**576,335**	**579,866**	**3,351**	**0.6**	**360,603**	**364,554**	**3,951**	**1.1**

Note: The percent difference of "0.0" reflects rounding due to significant numbers in the FEIS.



Cumulative Effects (Change in Employment for Alt. 1 @ 2020 from the No Action Alt. @ 2020)

Figure No. 3.23-6

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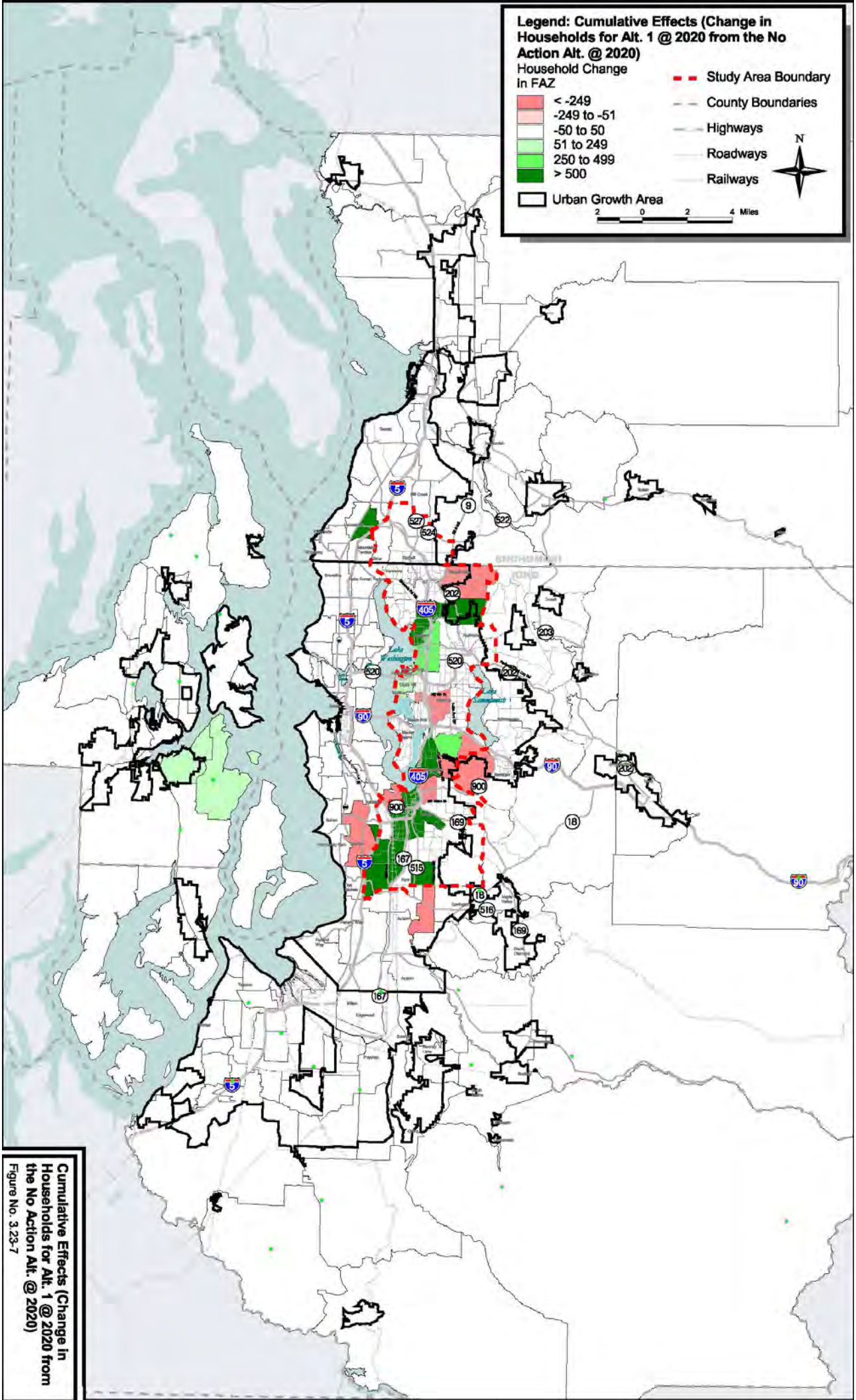

Cumulative Effects (Change in Households for Alt. 1 @ 2020 from the No Action Alt. @ 2020)

Figure No. 3.23-7

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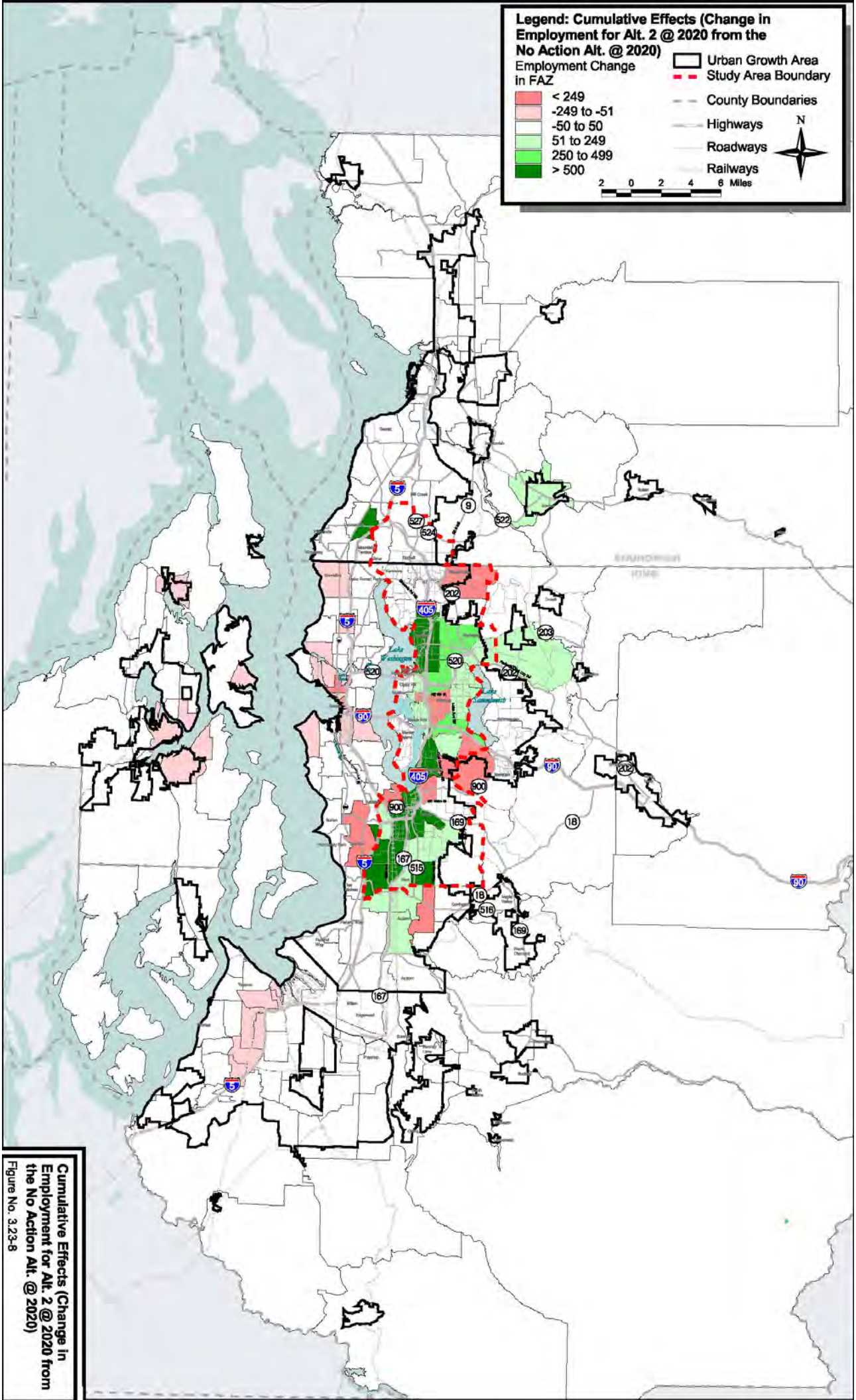

Cumulative Effects (Change in Employment for Alt. 2 @ 2020 from the No Action Alt. @ 2020)

Figure No. 3.23-8

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Table 3.23-6: Alternative 2 Changes in Employment and Households by Area and County

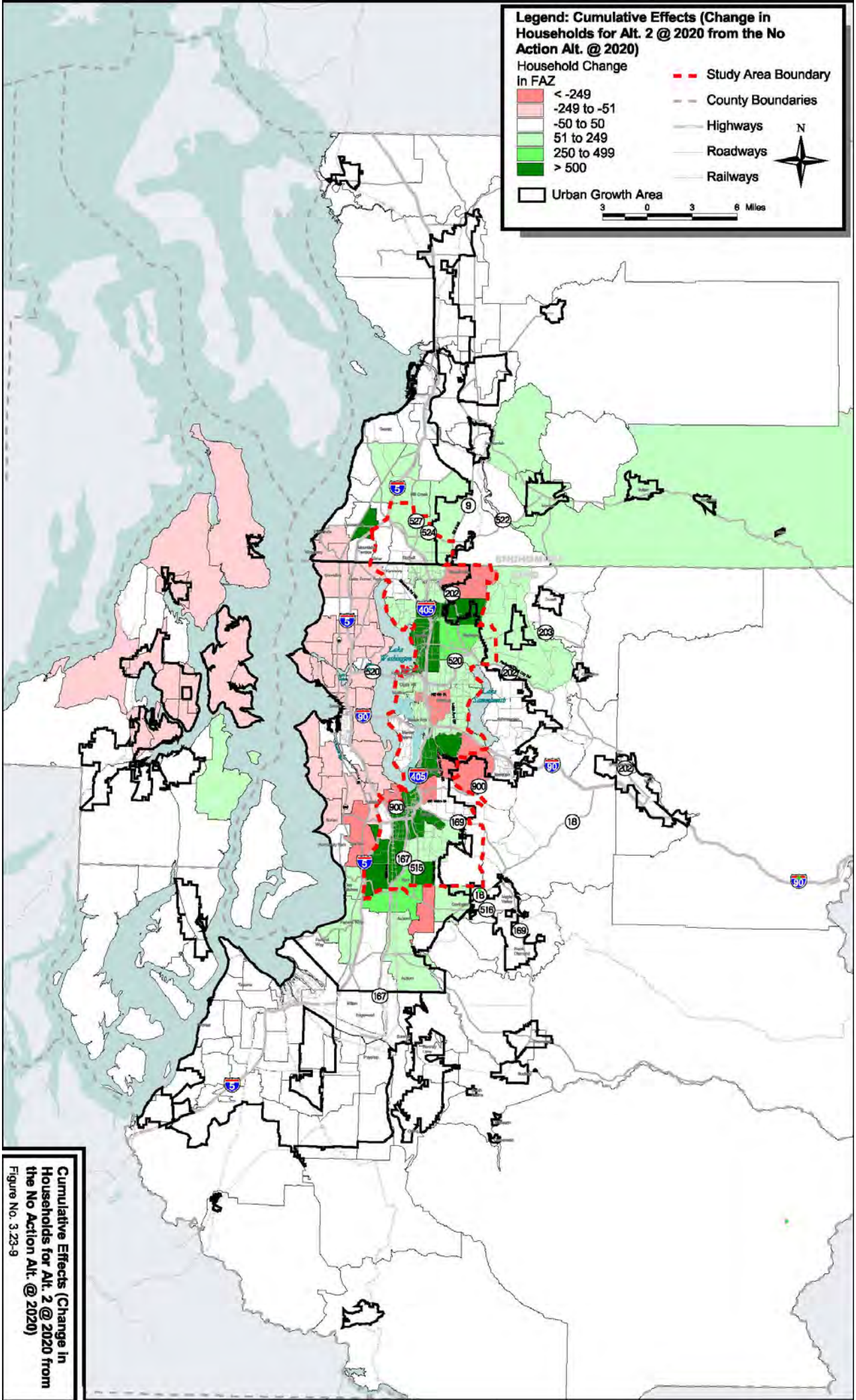
Geographic Area	Employment	Households
Change from the No Action Alt. @ 2020	(Fig.3.23-8)	(Fig.3.23-9)
PIERCE COUNTY		
Fircrest / Lakewood	-185	-92
Parkland / Spanaway	-75	-82
Puyallup / Frederickson	-146	-60
Sumner / Bonney Lake	-19	158
Tacoma Eastside	-87	-2
Tacoma South	-186	-13
Tacoma North End	-161	-56
Tacoma CBD	-220	-8
Port of Tacoma / NE Tacoma / Fife	-45	44
Gig Harbor / Longbranch	-46	-114
Ft. Lewis / McCord / Dupont	-12	-16
SE Pierce County	-9	-48
Pierce County TOTAL	**-1191**	**-289**
KING COUNTY		
Federal Way	-42	211
Auburn	97	292
Enumclaw	-9	28
Tahoma / Raven Heights	0	14
Soos Creek	273	690
Kent	1653	1026
Highline / Des Moines / SeaTac	-1515	-896
Tukwila	74	-43
Renton / Skyway	552	479
Newcastle	-37	-240
Issaquah / E. Sammamish	78	40
Mercer Island	50	23
Bellevue	-1657	-722
Point Cities	36	154
Kirkland Area	3374	2580
Redmond Area	555	803
Northshore	-1902	-1357
Bothell	47	89
Seattle South	-350	-769
Seattle CBD	-799	-265
Seattle Central	-528	-1021
Seattle North	-515	-1149
Shoreline	-93	-259
Snoqualmie Valley	-16	-49
External Zones King	2	-3
Vashon Island	-11	-15
King County TOTAL	**-683**	**-359**
SNOHOMISH COUNTY		
Edmonds / Esperance	-53	-168
Mountlake Terrace	-6	-13

Geographic Area	Employment	Households
Change from the No Action Alt. @ 2020	(Fig.3.23-8)	(Fig.3.23-9)
Lynwood Area	2604	1567
Mill Creek	57	160
Clearview / Cathcart / Maltby	72	262
Paine Field Area	33	131
Snohomish / Monroe	96	104
Lake Stevens Area	-11	-61
Mukilteo / SW Everett	9	11
Everett South	22	147
Everett Central	-7	-3
Marysville / Arlington	-49	-22
SE Snohomish	27	226
NE Snohomish	-5	-40
NW Snohomish	-14	-62
Snohomish County TOTAL	**2775**	**2239**
KITSAP COUNTY		
Port Orchard / Southworth	-72	6
Keyport / Central Kitsap	-70	-234
Silverdale / Bangor	-63	-308
Poulsbo / Kingston	-165	-283
Bremerton Area	-431	-488
Bainbridge Island	-85	-158
Kitsap County TOTAL	**-886**	**-1465**

The overall pattern of change in households under Alternative 2 would be similar to that in Alternative 1, although additional pressure for household growth may occur in the Mill Creek, Lynnwood, and Bothell areas in the north, and additionally in Renton, Kent, Federal Way, and to the south in Bonney Lake/Sumner. Figure 3.23-9 shows the projected pattern of households under Alternative 2. It is projected that the number of households would increase in south Snohomish County, Redmond, Kirkland, Kent, Auburn, and Federal Way. It is expected that the Urban Centers (Canyon Park, Lynnwood, SeaTac, Kent, and Federal Way) would absorb much of the growth.

In Alternative 2, the Urban Centers and future HCT stations would likely become stronger focal points for growth in employment and households, based on adopted land use strategies of the region, and in relation to transit-oriented development (TOD). TOD would be likely in the Urban Centers and in the corridor between the centers regardless of the timing of light rail, as it is regional policy and an economic tool for local jurisdictions.

The overall effects under Alternative 2 would be similar to Alternative 1, except that Alternative 2 would add capacity to I-405 and provide some reduction in study area traffic congestion. This would support local jurisdictions in getting closer to meeting concurrency requirements in a manner that would facilitate the clustering of growth and development within Urban Centers and the UGA. Alternative 2 would conform to local plans to help reduce the spillover or continued pattern of growth outside of the UGA; however, the increased pressure for employment and population growth would still need to be matched with local actions to



Cumulative Effects (Change in Households for Alt. 2 @ 2020 from the No Action Alt. @ 2020)

Figure No. 3.23-9

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maintain adequate transportation levels of service. Without effective transportation improvements, projected growth might not be realized as planned and development could disperse to less suitable areas outside the Urban Centers and UGA.

Alternative 3: Mixed Mode Emphasis

Compared to the No Action Alternative, pressure for employment and housing growth would be expected to increase in the study area and UGA in Alternative 3. This would support planned development in designated Urban Centers and around the HCT stations. Alternative 3, as shown in Table 3.23-7 (changes at the county level) and Table 3.23-8 (breakdown by geographic areas), would have effects similar to Alternative 2, but with increased pressure for employment and households within the corridor. From a regional perspective, the added capacity on I-405, the BRT system, increased reliance on HOV projects, arterial improvements, and implementation of TDM strategies would create improved accessibility to those portions of the I-405 corridor already planned for higher urban densities.

Table 3.23-7: Alternative 3 Changes in Employment and Households from the No Action Alternative

	2020 Employment				2020 Households			
Location	No Action Alternative (a)	Alternative 3 (b)	Change (b) – (a)	Percentage Change From No Action Alternative	No Action Alternative (a)	Alternative 3 (b)	Change (b) – (a)	Percent Change From No Action Alternative
King County	1,474,469	1,474,905	436	0.0	967,180	967,883	703	0.1
Kitsap County	120,954	119,289	-1,665	-1.4	137,421	134,539	2,882	-2.1
Pierce County	365,085	363,257	-1,828	-0.5	348,078	346,729	1,349	-0.4
Snohomish Co.	300,568	303,650	3,082	1.0	334,335	338,008	3,673	1.1
Regional Total	2,261,076	2,261,101	25	0.0	1,787,014	1,787,159	145	0.0
Study Area	**576,335**	**582,455**	**6,120**	**1.1**	**360,603**	**367,600**	**6,997**	**1.9**

Note: The percent difference of "0.0" reflects rounding due to significant numbers in the FEIS.

Table 3.23-8: Alternative 3 Changes in Employment and Households by Area and County

Geographic Area	Employment	Households
Change from the No Action Alt. @ 2020	(Fig.3.23-10)	(Fig.3.23-11)
PIERCE COUNTY		
Fircrest / Lakewood	-310	-358
Parkland / Spanaway	-115	-190
Puyallup / Frederickson	-179	-156
Sumner / Bonney Lake	-32	165
Tacoma Eastside	-148	-119
Tacoma South	-290	-57
Tacoma North End	-256	-206
Tacoma CBD	-326	-47

Geographic Area	Employment	Households
Change from the No Action Alt. @ 2020	(Fig.3.23-10)	(Fig.3.23-11)
Port of Tacoma / NE Tacoma / Fife	-78	5
Gig Harbor / Longbranch	-68	-261
Ft. Lewis / McCord / Dupont	-17	-51
SE Pierce County	-10	-74
Pierce County TOTAL	**-1829**	**-1349**
KING COUNTY		
Federal Way	-94	192
Auburn	165	496
Enumclaw	-17	34
Tahoma / Raven Heights	0	10
Soos Creek	371	1019
Kent	1729	1213
Highline / Des Moines / SeaTac	-1506	-926
Tukwila	205	-50
Renton / Skyway	765	701
Newcastle	-20	-105
Issaquah / E. Sammamish	132	154
Mercer Island	81	35
Bellevue	-518	-70
Point Cities	46	183
Kirkland Area	3757	2921
Redmond Area	784	1170
Northshore	-1737	-921
Bothell	79	188
Seattle South	-552	-1256
Seattle CBD	-1325	-389
Seattle Central	-897	-1578
Seattle North	-821	-1855
Shoreline	-135	-342
Snoqualmie Valley	-30	-33
External Zones King	5	-2
Vashon Island	-30	-86
King County TOTAL	**437**	**703**
SNOHOMISH COUNTY		
Edmonds / Esperance	-69	-159
Mountlake Terrace	-7	-8
Lynwood Area	2679	1691
Mill Creek	150	635

Geographic Area	Employment	Households
Change from the No Action Alt. @ 2020	(Fig.3.23-10)	(Fig.3.23-11)
Clearview / Cathcart / Maltby	125	513
Paine Field Area	57	284
Snohomish / Monroe	168	234
Lake Stevens Area	-8	-47
Mukilteo / SW Everett	23	41
Everett South	41	217
Everett Central	-21	4
Marysville / Arlington	-74	-65
SE Snohomish	41	417
NE Snohomish	-1	-23
NW Snohomish	-22	-61
Snohomish County TOTAL	**3082**	**3673**
KITSAP COUNTY		
Port Orchard / Southworth	-187	-426
Keyport / Central Kitsap	-106	-375
Silverdale / Bangor	-305	-535
Poulsbo / Kingston	-260	-487
Bremerton Area	-678	-809
Bainbridge Island	-129	-250
Kitsap County TOTAL	**-1665**	**-2882**

Figures 3.23-10 and 3.23-11 show the differences in the projected pattern of employment and households under Alternative 3. The projected pressure for growth would be similar to Alternative 2, but with greater forecast employment and households in the northern and southern portions of the I-405 corridor.

Alternative 3 is similar to Alternative 2 in that the Urban Centers and the transit stations would become stronger focal points for growth in employment and households. There are two areas within the corridor area (Kirkland/Redmond and Renton/Kent/Auburn) that would be expected to experience greater pressure for growth in employment and households as seen under Alternative 3 (Figures 3.23-10 and 3.23-11). Alternative 3 could enhance planned growth within key portions of the UGA planned for higher density development. This alternative supports regional policies seeking to create connectivity, density, and TOD to reduce growth impacts outside the UGA. The growth pattern associated with Alternative 3, when compared to the No Action Alternative, suggests that overall it may result in lessening of growth pressures on lands outside the UGA or premature development on the fringes of the UGA.

Alternative 3 provides for greater implementation of projects that are supportive of *Destination 2030* policies and locally adopted comprehensive plans than the No Action Alternative or Alternatives 1, 2, or 4. All of these regional and local policies call for the improvement of the regional transportation infrastructure and reduction in traffic congestion. The capacity

expansions on I-405 included in Alternative 3 would shift some traffic onto I-405 from the arterials and provide reduction in study area traffic congestion. Thus, this alternative would provide a better opportunity for local agencies to meet concurrency standards, implement clustering of development, and increase density within the Urban Centers, and a transportation infrastructure within the UGA that serves a need as stated under the Growth Management Act.

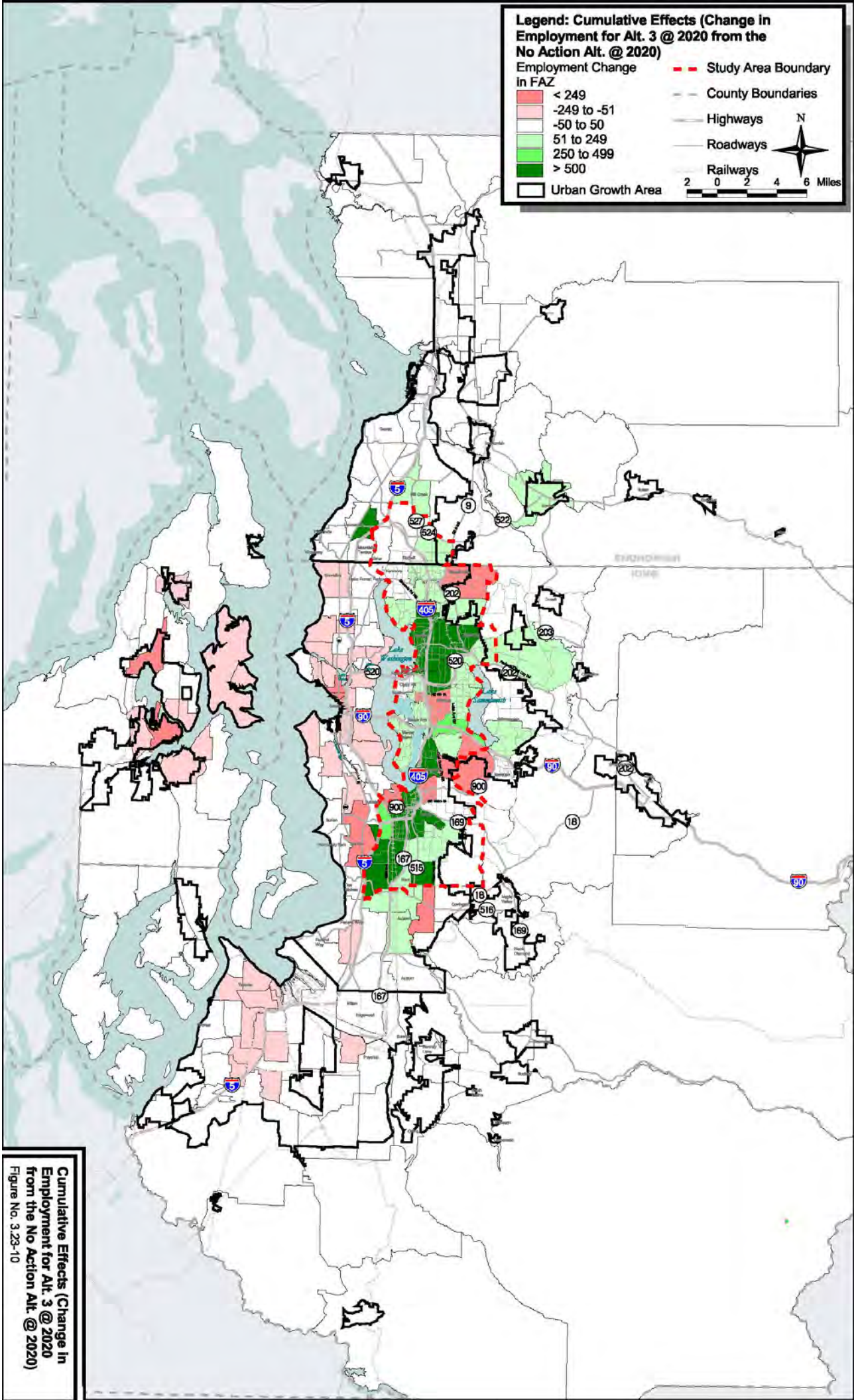
Alternative 4: Roadway Capacity Emphasis

Under Alternative 4, as shown in Table 3.23-9, pressure for employment and housing would be expected to increase in the I-405 corridor as compared to the No Action Alternative. Figure 3.23-12 shows the projected employment pattern in the region under Alternative 4. As shown in Table 3.23-10, additional pressure in the Kirkland, Redmond, Lynnwood, and Renton/Kent Valley area would be expected partially due to increased accessibility. Alternative 4 is forecast to result in less employment outside of the UGA compared to the No Action Alternative condition.

Table 3.23-9: Alternative 4 Changes in Employment and Households from the No Action Alternative

	2020 Employment				2020 Households			
Location	No Action Alternative (a)	Alternative 4 (b)	Change (b) – (a)	Percent Change From No Action Alternative	No Action Alternative (a)	Alternative 4 (b)	Change (b) – (a)	Percent Change From No Action Alternative
King County	1,474,469	1,474,966	497	0.0	967,180	966,953	-227	0.0
Kitsap County	120,954	119,076	-1,878	-1.6	137,421	134,410	-3,011	-2.2
Pierce County	365,085	362,941	-2,144	-0.6	348,078	346,376	-1,702	-0.5
Snohomish Co.	300,568	304,111	3,543	1.2	334,335	339,399	5,064	1.5
Regional Total	2,261,076	2,261,094	18	0.0	1,787,014	1,787,138	124	0.0
Study Area	**576,335**	**583,044**	**6,709**	**1.2**	**360,603**	**368,218**	**7,615**	**2.1**

Note: The percent difference of "0.0" reflects rounding due to significant numbers in the FEIS.



Cumulative Effects (Change in Employment for Alt. 3 @ 2020 from the No Action Alt. @ 2020)

Figure No. 3.23-10

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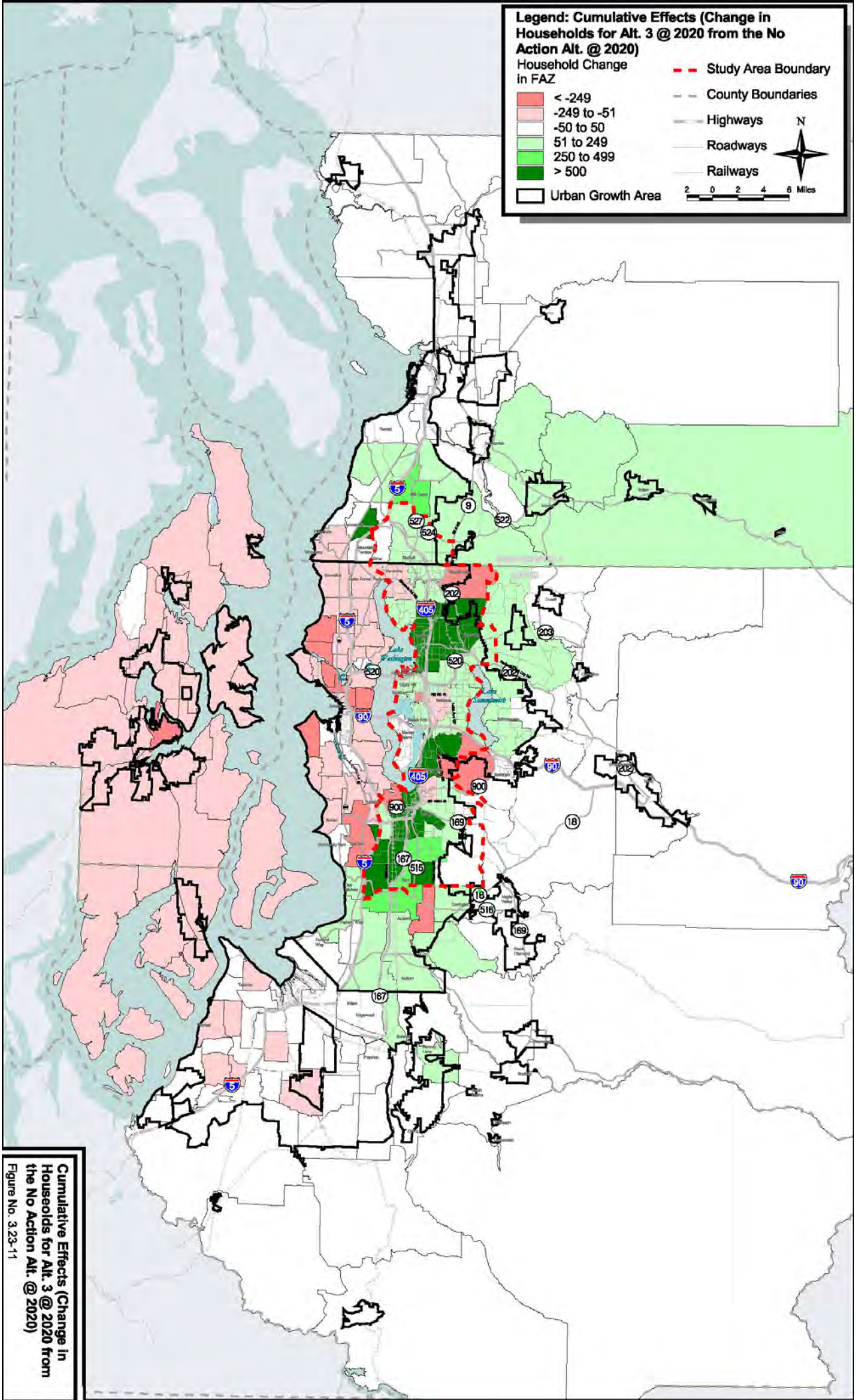

Cumulative Effects (Change in Houseolds for Alt. 3 @ 2020 from the No Action Alt. @ 2020)

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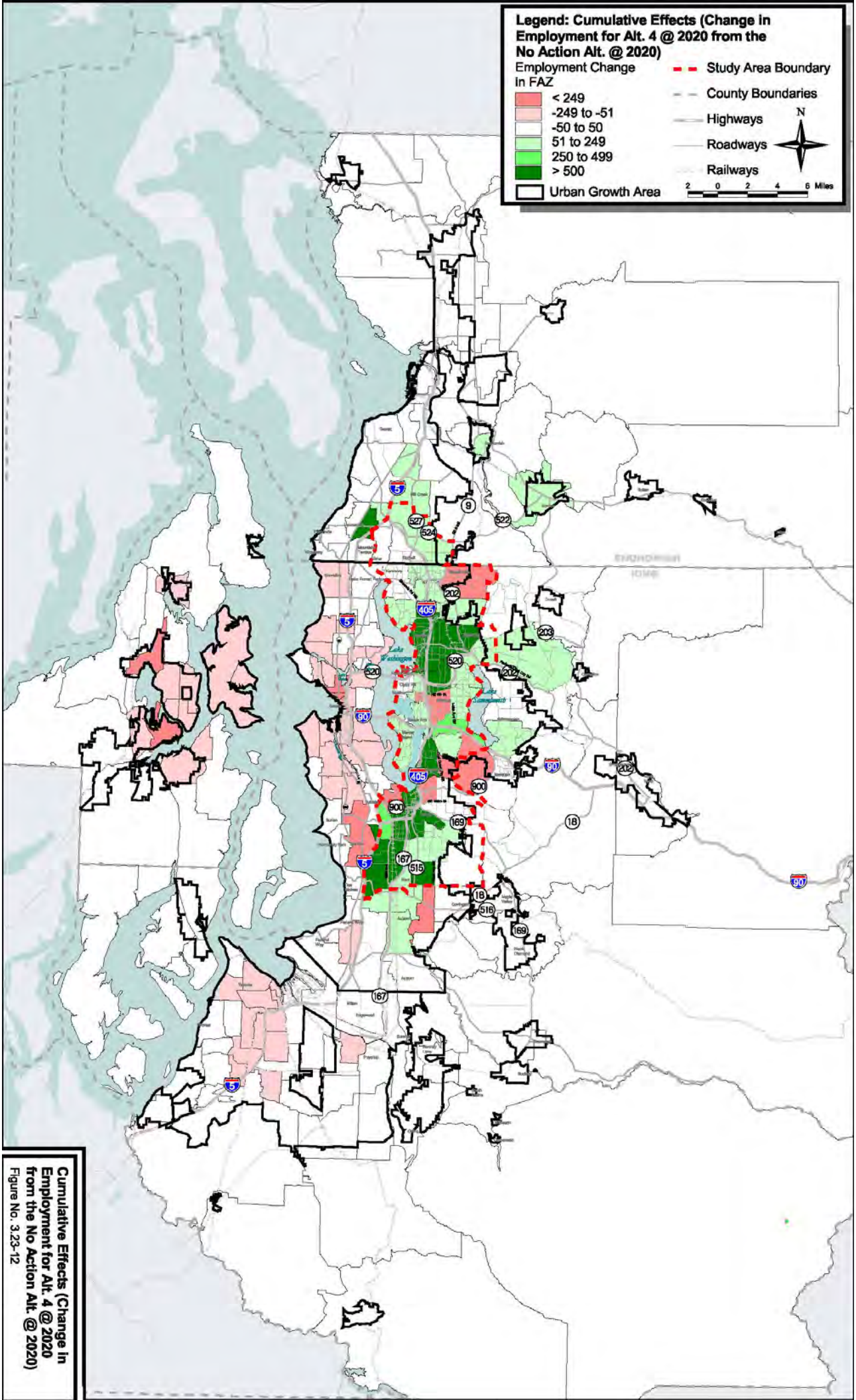

Cumulative Effects (Change in Employment for Alt. 4 @ 2020 from the No Action Alt. @ 2020)

Figure No. 3.23-12

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Table 3.23-10: Alternative 4 Changes in Employment and Households by Area and County

Geographic Area	Employment	Households
Change from the No Action Alt. @ 2020	(Fig.3.23-12)	(Fig.3.23-13)
PIERCE COUNTY		
Fircrest / Lakewood	-346	-374
Parkland / Spanaway	-137	-251
Puyallup / Frederickson	-222	-209
Sumner / Bonney Lake	-70	52
Tacoma Eastside	-166	-128
Tacoma South	-335	-72
Tacoma North End	-297	-239
Tacoma CBD	-372	-37
Port of Tacoma / NE Tacoma / Fife	-85	-5
Gig Harbor / Longbranch	-83	-301
Ft. Lewis / McCord / Dupont	-18	-37
SE Pierce County	-13	-101
Pierce County TOTAL	**-2144**	**-1702**
KING COUNTY		
Federal Way	-104	240
Auburn	116	415
Enumclaw	-28	-6
Tahoma / Raven Heights	-6	12
Soos Creek	390	1040
Kent	1754	1252
Highline / Des Moines / SeaTac	-1529	-1086
Tukwila	342	-19
Renton / Skyway	902	795
Newcastle	-19	-138
Issaquah / E. Sammamish	141	128
Mercer Island	91	31
Bellevue	-483	-123
Point Cities	47	180
Kirkland Area	3796	2969
Redmond Area	828	1236
Northshore	-1691	-854
Bothell	88	212
Seattle South	-649	-1548
Seattle CBD	-1464	-514
Seattle Central	-1002	-1957
Seattle North	-836	-1963
Shoreline	-103	-302
Snoqualmie Valley	-51	-106
External Zones King	7	-7
Vashon Island	-39	-114
King County TOTAL	**498**	**-227**
SNOHOMISH COUNTY		
Edmonds / Esperance	-53	-105
Mountlake Terrace	2	40

Geographic Area	Employment	Households
Change from the No Action Alt. @ 2020	(Fig.3.23-12)	(Fig.3.23-13)
Lynwood Area	2823	1889
Mill Creek	241	1090
Clearview / Cathcart / Maltby	141	596
Paine Field Area	89	388
Snohomish / Monroe	196	288
Lake Stevens Area	2	26
Mukilteo / SW Everett	30	55
Everett South	86	331
Everett Central	17	38
Marysville / Arlington	-59	-10
SE Snohomish	44	449
NE Snohomish	1	16
NW Snohomish	-17	-27
Snohomish County TOTAL	**3543**	**5064**
KITSAP COUNTY		
Port Orchard / Southworth	-152	-156
Keyport / Central Kitsap	-125	-435
Silverdale / Bangor	-355	-623
Poulsbo / Kingston	-301	-555
Bremerton Area	-793	-945
Bainbridge Island	-152	-297
Kitsap County TOTAL	**-1878**	**-3011**

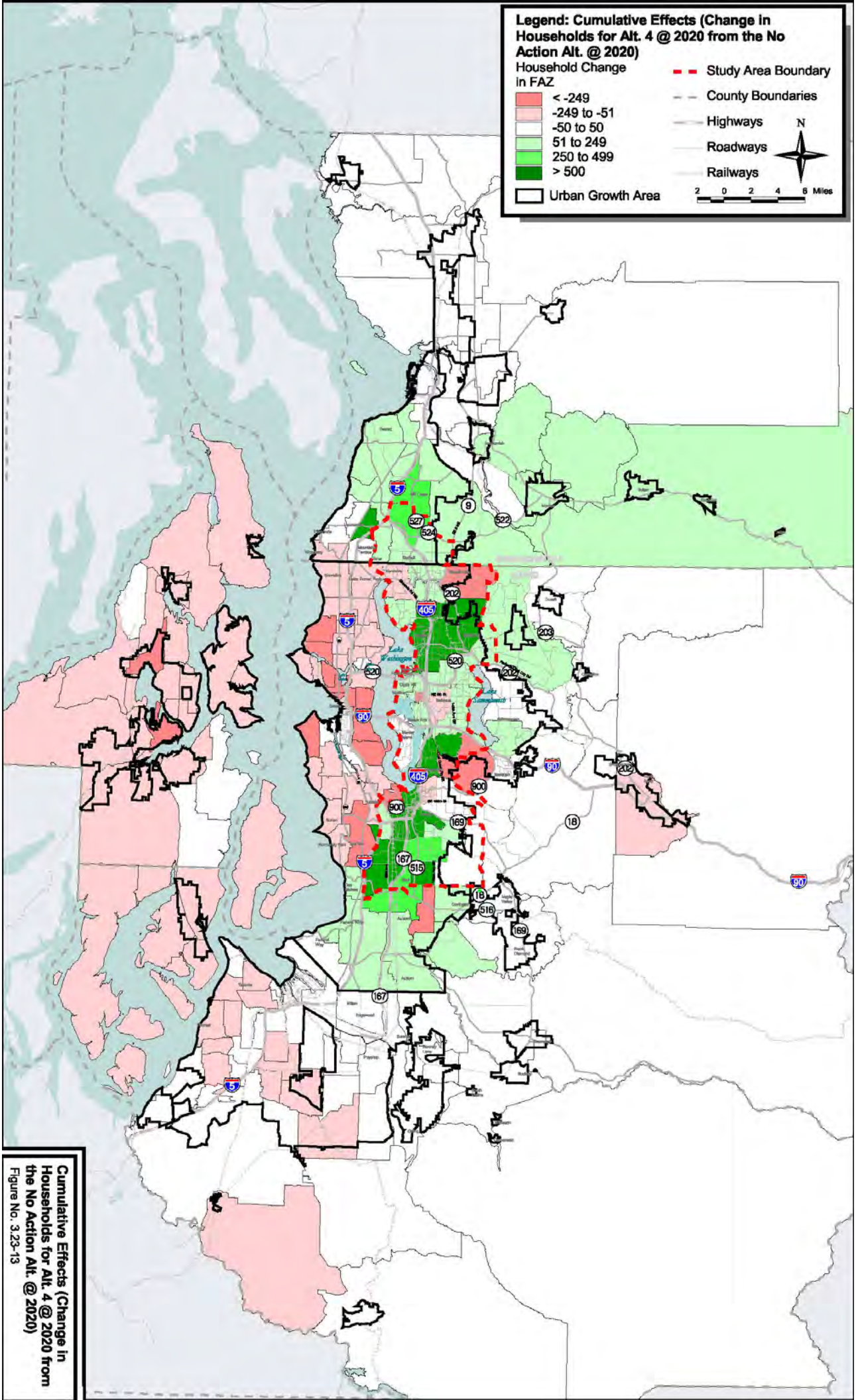
Figure 3.23-13 shows the projected household pattern in the region. The number of households is forecast to increase within the UGA compared to the No Action Alternative, but there also could be more growth at the outer edges of the UGA or premature development on the fringes of the UGA.

The forecast growth pattern under Alternative 4 when compared to the No Action Alternative suggests a different trend for pressure to occur outside of the UGA, which also could result in increased growth pressure on the fringe areas of the UGA not currently designated for higher urban densities. This would be considered a negative impact on land use outside of the UGA, and is not as consistent with the policies of *VISION 2020* and subsequently *Destination 2030*.

Alternative 4 would perform similar to Alternative 3 with regard to addressing the long-term concurrency problems facing local jurisdictions. The capacity expansions on I-405 included in Alternative 4 would shift traffic onto I-405 from the arterials and reduce study area traffic congestion. This would improve opportunities relative to Alternatives 1 and 2 for clustering of development and increasing density within the Urban Centers and the UGA without triggering limitations under concurrency ordinances.

Preferred Alternative

Compared to the No Action Alternative, employment and household growth would be expected to increase in the study area and UGA under the Preferred Alternative. This would support planned development in designated Urban Centers and around the HCT stations. The overall effects under the Preferred Alternative would be similar to Alternative 3. As in Alternative 3,


Legend: Cumulative Effects (Change in Households for Alt. 4 @ 2020 from the No Action Alt. @ 2020)
Household Change in FAZ
< -249
-249 to -51
-50 to 50
51 to 249
250 to 499
> 500
Urban Growth Area
Study Area Boundary
County Boundaries
Highways
Roadways
Railways
N
2 0 2 4 8 Miles
Cumulative Effects (Change in Households for Alt. 4 @ 2020 from the No Action Alt. @ 2020)
Figure No. 3.23-13

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Urban Centers and the transit stations would become stronger focal points for growth in employment and households. Alternative 3 and the Preferred Alternative also provide the best opportunities to reduce pressure for unplanned development at the urban fringe or in rural areas outside the UGA.

The Preferred Alternative includes the balanced system of multimodal transportation improvements that best accommodates the projected growth in the UGA. The transportation investments proposed by the Preferred Alternative are also focused exclusively within the UGA to support efficient access and improved mobility within and between the designated Urban Centers, Activity Centers, and Industrial/Manufacturing Centers. The Preferred Alternative would provide the highest level of benefit in accommodating continuous and orderly development by congestion reduction, air quality improvement, HOV reliability, and improved urban accessibility of the action alternatives analyzed.

3.23.3.6 Traffic and Transportation

Roadway Network

The I-405 corridor is one of many transportation corridors within the regional network of roadways connecting communities throughout the Puget Sound. The four-county region has more than 11,400 lane miles. The I-405 corridor study area has about 13 percent of the region's roadways. Because of the relatively sparse roadway network in the I-405 study area (about 1,500 lane-miles in the 250-square-mile area), there is greater reliance on state highways to serve non-regional trips than would normally be the case. Interstate 405 is the transportation backbone of the study area, and travel demand within the study area is heaviest on I-405 itself.

Figure 3.23-14 shows the growth of freeway lane miles and daily VMT in the region over the past 20 years. Figure 3.23-15 shows the result, increasing percentage of lanes with peak period congestion. Extreme congestion continues to increase each year, as the freeways have become more crowded during the peak hours.

Figure 3.23-14: Growth in Freeway Region-wide Daily VMT (000's) and Freeway Lane Miles 1982-1999

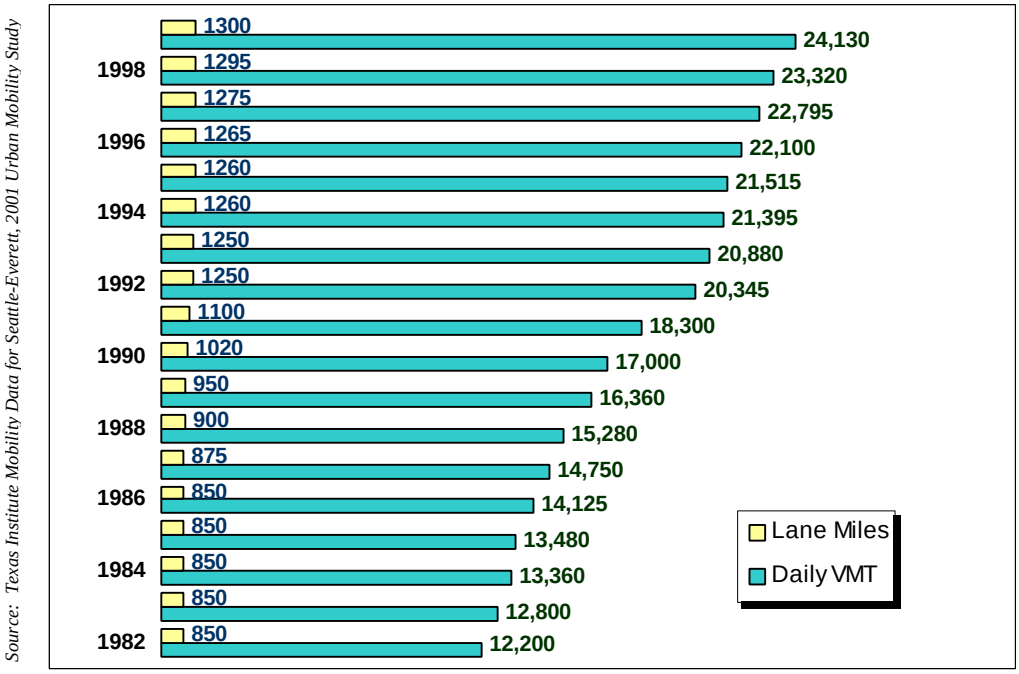
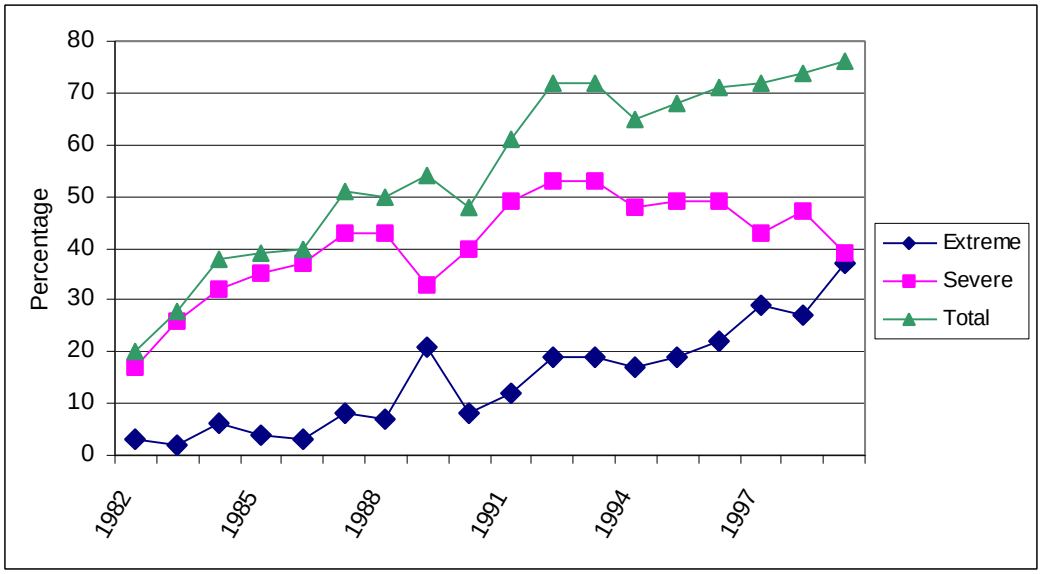


Figure 3.23-15: Percent of Peak Period Travel in Severe or Extreme Congestion (1982-1999)



Source: Texas Institute Mobility Data for Seattle-Everett, 2001 Urban Mobility Study

Traffic Volumes and Travel Demand

In evaluating the regional cumulative effects of the I-405 Corridor Program, the forecasts for population, employment, and travel demand in the corridor were compared to forecasts for the four-county central Puget Sound region. Several observations were made. As the Eastside has grown, traffic volumes have increased dramatically. From 1970 to 1999, the average daily traffic on I-405 north of I-90 increased nearly five-fold, growing from 41,000 to 198,000 cars per day. The roadway network has not expanded at the same rate, resulting in increased congestion on all the roads, especially on the I-405 freeway.

While the entire corridor experienced almost a 400 percent increase in traffic volumes from 1970-1999, various sections of I-405 show different rates of traffic growth. From 1980 to 2000, the increase in the corridor was 150 percent, as capacity was reached on several sections of I-405. Table 3.23-11 presents a historical summary of the average annual daily traffic on selected arterials and state roads in the I-405 Corridor Program study area.

Table 3.23-11: Average Annual Daily Traffic on Selected Arterial and State Roads in I-405 Study Area (1965 to 1999)

Measurement Location	1965	1970	1975	1980	1985	1990	1995 baseline	1999
I-405 north of I-90	24,400[a]	41,000[a]	53,400[a]	80,100[a]	115,400[a]	137,600[c]	164,832	198,000[c]
I-405 north of SR 520	12,100[a]	33,400[a]	48,400[a]	76,400[a]	107,400[a]	146,800[c]	152,174	178,000[c]
I-405 north of SR 522	N/A	15,000[a]	20,300[a]	37,200[a]	52,700[a]	88,400[c]	92,822	94,000[c]
I-405 south of I-90	24,000	N/A	N/A	76,000[c]	115,400[c]	129000	116,525	168,000[c]
SR 522 west of I-405	N/A	N/A	N/A	21,500[c]	24,800[c]	30000	32,000[c]	38,000[c]
SR 908 east of I-405 (Rose Hill)	N/A	N/A	N/A	24,800[c]	28,300[c]	30000	31,000[c]	46,300[d]
148th Ave SE north I-90	N/A	15,000[a]	18,400[a]	22,600[a]	30,200[a]	N/A	N/A	39,700[e]
Lake Wa Blvd north of SR 520	2,200[a]	11,800[a]	11,700[a]	23,000[a]	27,500[a]	N/A	N/A	N/A
I-90 Mercer Island Bridge	17,900[b] 42,892[a]	48,352[a]	48,655[a]	52,283[a]	68,500[a]	112,400[c]	128,000[c]	121,000[c]
SR 520 Lake Wash. Bridge	22,998[a]	37,744[a]	47,544[a]	72,130[a]	99,500[a]	97,700[c]	100,000[c]	110,000[c]

a Eastside Transportation Program, Background Report, October 1988, p. 4.
b Number of vehicles in 1961, Puget Sound Regional Transportation Study
c WSDOT Annual Traffic Report, 1983, 1985, 1991, 1994, 1996
d City of Kirkland, 1999 traffic counts
e City of Bellevue , 2000 traffic counts

The forecasts for VMT and VHT in the study area are expected to follow the region's forecasted trend of a greater than 50 percent increase between 1999 and 2020. Table 3.23-12 presents the historical growth in VMT and VHT for the I-405 study area from 1980 to 2000, including the 2020 No Action Alternative, and the growth for the four-county region during the same time period.

Table 3.23-12: VMT and VHT for Study Area and Region

Alternative	VMT (Daily)		VHT (Daily)	
	Study Area (trips within)	Region-wide	Study Area (trips within)	Region-wide
1980	9,322,000	39,500,000	359,800	1,411,000
1990	14,962,400	63,400,000	529,100	2,075,000
1995	16,346,000	69,412,000	586,000	2,295,000
2020 No Action Alternative	22,510,000	100,571,000	1,156,000	3,948,000
Change vs. 1995 (%)	37.7%	44.9%	97.3%	72.0%
Alternative 1	22,563,000	100,497,000	1,155,000	3,941,000
Change vs. No Action Alternative (%) Change vs. 1995	0.2% 38.0%	-0.1% 44.7%	-0.1% 97.2%	-0.2% 71.7%
Alternative 2	24,215,000	101,560,000	1,164,000	3,922,000
Change vs. No Action Alternative (%) Change vs. 1995	7.6% 48.1%	1.0% 46.3%	0.7% 98.6%	–0.7% 70.9%
Alternative 3	25,346,000	102,263,000	1,170,000	3,907,000
Change vs. No Action Alternative (%) Change vs. 1995	12.6% 55.0%	1.7% 47.3%	1.2% 99.7%	-1.0% 70.2%
Alternative 4	26,208,000	102,730,000	1,184,000	3,903,000
Change vs. No Action Alternative (%) Change vs. 1995	16.4% 60.3%	2.1% 48.9%	2.4% 102.0%	-1.14% 70.1%
2020 No Action Alternative (Mar 2002)*	23,927,000	102,770,000	834,000	3,389,000
2020 Preferred Alternative (Mar 2002)*	26,208,000	104,459,000	853,000	3,366,000
Change vs. No Action Alternative (%)*	11.5%	1.6%	2.3%	0.7%

Source: PSRC Model

* Compared with updated travel forecasts. (See Section 3.12)

Without accounting for the potential effects of TDM, VMT in the study area is expected to increase under each alternative. Alternatives 3 and 4 show the largest increases in the study area VMT (13 percent and 16 percent, respectively). The Preferred Alternative shows around a 12 percent increase. Regional VMT increases by 1 to 2 percent for Alternatives 2 through 4, while Alternative 1 reduces regional VMT slightly. When the TDM program is included in the action alternatives, study area VMT could be reduced for each of the action alternatives by 5 percent or more.

Study area VHT decreases slightly with Alternative 1 (not including TDM effects). Alternatives 2, 3, and 4 and the Preferred Alternative result in increases in VHT because of the additional travel within the corridor. Regional VHT decreases with most alternatives, up to slightly more than 1 percent under Alternative 4. The effects are most pronounced during the P.M. peak

period. Region-wide VHT increases slightly with the Preferred Alternative. The TDM program could further reduce study area VHT for each of the action alternatives.

Trips in the study area are forecasted to increase by 50 percent between 1999 and 2020, similar to the regional increase. For the year 2020, the trip pattern percentages in the region are expected to be similar to those currently in the region. In the I-405 Corridor Program study area, the relative shares of each trip purpose are expected to be similar in 2020 to those currently in the corridor. Trip distribution, i.e., where trips are going to and coming from in relation to the study area, is also forecasted to change very little by year 2020 in the I-405 corridor. More than 55 percent of daily trips begin and end within the study area, with the remaining 45 percent of trips beginning or ending outside the study area. Over 70 percent of the total daily person-trips are less than 10 miles within the study area; less than 10 percent of the trips are over 30 miles in length. These trip patterns are expected to continue in the corridor in the year 2020, although there could be a slightly higher percentage of trips averaging over 30 miles in length.

Performance of I-405 Corridor Program Improvements in the Region

As previously discussed, the I-405 Corridor Program study area includes 21 percent of the regional population, and produces about 24 percent of the region's trips. This percentage has held relatively constant for the past 30 years and is forecasted to continue for the next 30 years given the current plans and policies in the region. As part of the second level screening for the four action alternatives, the travel demand model was used to examine the effects of improvements by forecasting performance measures such as transit ridership, highway congestion, traffic volumes, and mode share shifts on I-405 and the study area. The transportation performance measures for the region in *Destination 2030* include the cumulative effects of the more prominent transportation improvements proposed in the I-405 Corridor Program, as noted above. Table 3.23-13 provides a comparison of performance measures.

Table 3.23-13: Performance Measures for *Destination 2030* (Regional) and I-405 Study Area

	Destination 2030 (MTP)[a]	1995 Baseline[b]	2020 No Action[b]	Alternative 1[b]	Alternative 2[b]	Alternative 3[b]	Alternative 4[b]	Preferred Alternative[c]
VMT (daily total) Region-wide	93,562,322	69,412,000	100,571,000	100,497,000	101,560,000	102,263,000	102,730,000	104,459,000
VMT (daily total) Study area	N/A	16,346,000	22,510,000	22,563,000	24,215,000	25,346,000	26,208,000	26,208,000
VHT (daily) Region-wide	3,226,300	2,295,000	3,948,000	3,941,000	3,922,000	3,907,000	3,903,000	3,366,000
VHT (daily) Study area	N/A	586,000	1,156,000	1,155,000	1,164,000	1,170,000	1,184,000	1,184,000
Mode Share - all trips (weekday)								
SOV	55%	99%	96.00%	96.00%	96.00%	95.00%	96.00%	96.00%
2+ Carpool	39%	Included above	Included above	Included above	Included above	Included above	Included above	Included above
3+ Carpool		1%	2%	2%	2%	2%	2%	2%
Transit	5%	1%	2%	2%	2%	3%	2%	2%
Mode Share – commute								
SOV	56%	95%	84%	83%	83%	83%	83%	83%
2+ Carpool	32%	Included above	Included above	Included above	Included above	Included above	Included above	Included above
3+ Carpool	Included above	2%	9%	9%	9%	9%	9%	9%
Transit	12%	3%	7%	8%	8%	8%	8%	8%
Average Speeds in MPH								
A.M. Peak	35	30	26	26	27	28	29	34
P.M. Peak	32	24	13	13	13	14	14	26
Daily	34	28	19	20	21	22	22	31

a Source: *Destination 2030* adopted May 24, 2001 (Metropolitan Transportation Plan for the Central Puget Sound Region); Technical Appendix 8: *Destination 2030* System Performance.
b Source: *I-405 Corridor Program Draft Transportation Expertise Report* (Mirai and DEA, 2001), February 2001.
c Forecasts for Preferred Alternative used an updated modeling base. Refer to Section 3.12 for description. Results may not be directly comparable with other action alternatives.

3.23.4 Cumulative and Secondary Effects on Critical Resources

3.23.4.1 Air Quality

National Regulatory Perspective

Actions proposed as part of the I-405 Corridor Program will be subject to regulations of numerous agencies at several jurisdictional levels. Existing regulations establish standards and/or thresholds that affect the level of impact and mitigation associated with these actions. A description of regulations known to affect the impacts of the I-405 Corridor Program is provided here and within similar sections under the other scoped critical resources to provide a better understanding of the context and extent of anticipated impacts.

In response to the Clean Air Act, the U.S. Environmental Protection Agency (USEPA) established National Ambient Air Quality Standards (NAAQS) for various pollutants—known as "criteria" pollutants—that adversely affect human health and welfare. The major transportation-related criteria pollutants are (See Table 3.1-1 in Section 3.1):

- Ozone (O_3) and its precursors, volatile organic compounds (VOC) and oxides of nitrogen (NO_x);
- Particulate matter (PM); and
- Carbon monoxide (CO).

In July 1997, USEPA issued revised standards for ozone and particulate matter that reflect improved understanding of the health effects of these pollutants. The new 8-hour ozone standard is more stringent than the old standard and will replace the 1-hour standard as the old standard is met. Two new $PM_{2.5}$ standards (annual and 24-hour standards) were added to the existing standards for PM_{10}. The new standards focus on fine particles under 2.5 microns in diameter, which are believed to be most closely associated with acute health effects. The new standards were recently upheld by the U.S. Supreme Court.

Areas that do not meet the NAAQS have been designated as non-attainment areas. These areas must submit air quality plans, known as State Implementation Plans (SIPs), showing how they will attain the standards. If they do not meet these and other requirements, they face Clean Air Act required sanctions and other penalties, including possible loss of highway funds. Metropolitan planning organizations and the U.S. Department of Transportation must ensure that transportation plans, programs, and projects conform to these SIPs. Air quality maintenance areas are regions that have recently attained compliance with the NAAQS. These areas must develop and submit air quality maintenance plans (AQMPs) showing how they will continue to stay within the standards.

Emission Trends

Fuel combustion by motor vehicles and other sources releases carbon dioxide (CO_2), which is a "greenhouse gas" that traps heat within the earth's atmosphere. CO_2 is not directly harmful to human health and is not a criteria pollutant. Significant progress has been made in reducing criteria air pollutant emissions from motor vehicles and improving air quality since the 1970s, even as vehicle travel has increased rapidly. Nationally, the 1996 air quality levels (the most recent at the time of publication) are the best on record for all six criteria pollutants. The air is noticeably cleaner than in 1970, and all criteria pollutant emissions from motor vehicles are less

than they were in 1970, despite a more than doubling of vehicle miles of travel. Still, challenges remain. Based on monitored data, approximately 46 million people in the U.S. reside in counties that did not meet the air quality standard for a least one NAAQS pollutant in 1996 (adapted from USEPA, 1999a).

Nationwide, air pollutant emissions from motor vehicles have dropped considerably since 1970. VOC emissions (also referred to as hydrocarbon (HC) emissions) are down 58 percent, NO_x emissions are down 3 percent, PM_{10} emissions are down 38 percent, and CO emissions are down 40 percent. These reductions in emissions have occurred along with increasing population, economic growth, and vehicle travel (USEPA, 1999a).

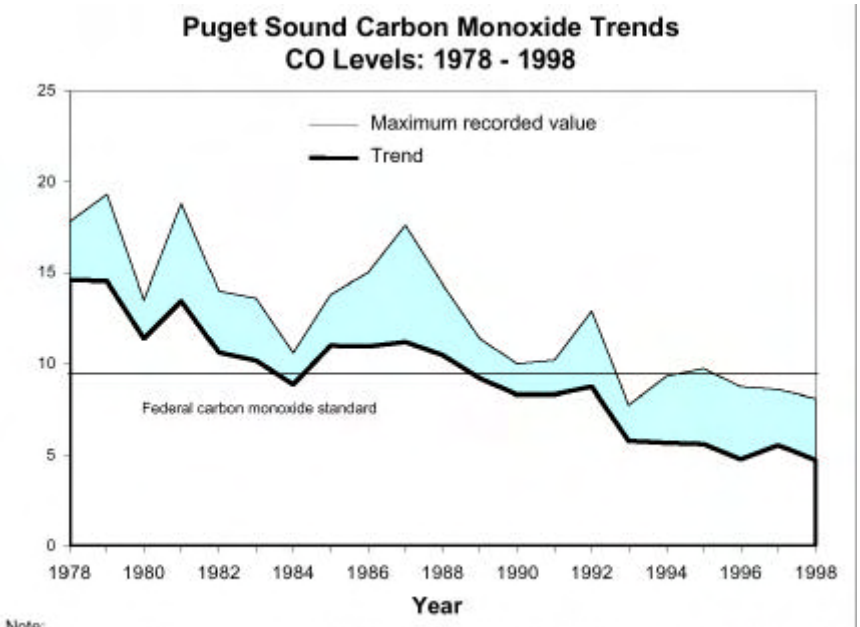
Regional Regulation

Air quality in the project area is regulated locally by the Washington State Department of Ecology (Ecology), and Puget Sound Clean Air Agency (PSCAA). The I-405 corridor lies within ozone and CO maintenance areas managed under the provisions of AQMPs for ozone and CO. The current plans were developed by PSCAA and Ecology and approved by the USEPA in 1996. Any regionally significant transportation project in the Puget Sound air quality maintenance areas must conform to the AQMPs. Conformity is evaluated by the local metropolitan planning organization (MPO), the Puget Sound Regional Council.

Regional Air Pollution Trends

Regional pollutant trends have generally followed the national patterns over the last 20 years. While the average weekday vehicle miles traveled in the central Puget Sound region has increased from 30 million miles in 1981 to 65 million in 1999 (PSRC, 2000), the emissions of pollutants associated with transportation sources has decreased. Carbon monoxide is the criteria pollutant most closely tied to transportation, with over 90 percent of the CO emissions in the Puget Sound urban areas coming from transportation sources. Regionally, maximum measured CO concentrations have decreased over the past 20 years (Figure 3.23-16). Other transportation pollutants have followed similar but less pronounced trends (Figure 3.23-17 and Figure 3.23-18).

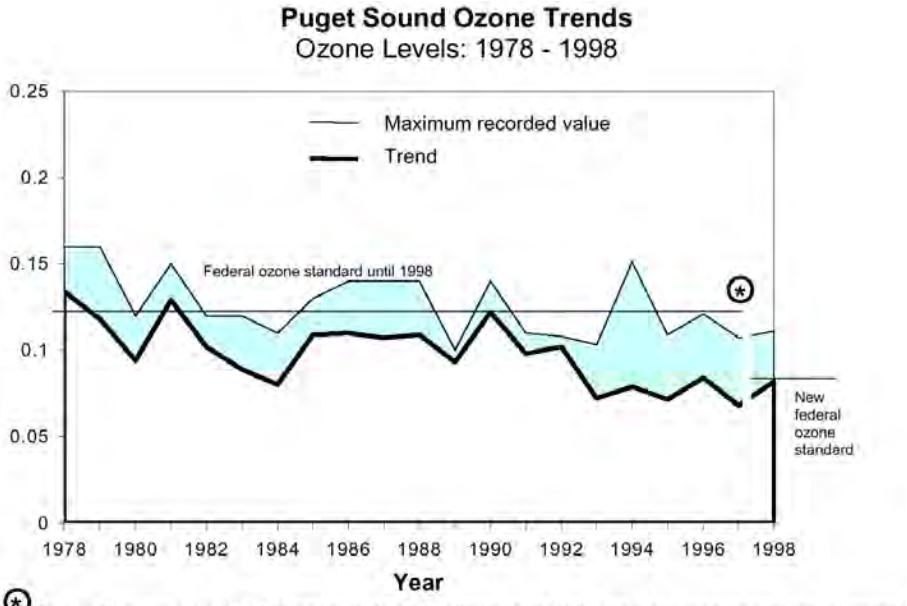
Figure 3.23-16: Central Puget Sound Region Carbon Monoxide Trends



Note:
The trend line represents the average of the carbon monoxide values that fall within the upper one percent of the observations.

Source: Ecology, 1999.

Figure 3.23-17: Central Puget Sound Region Ozone Trends

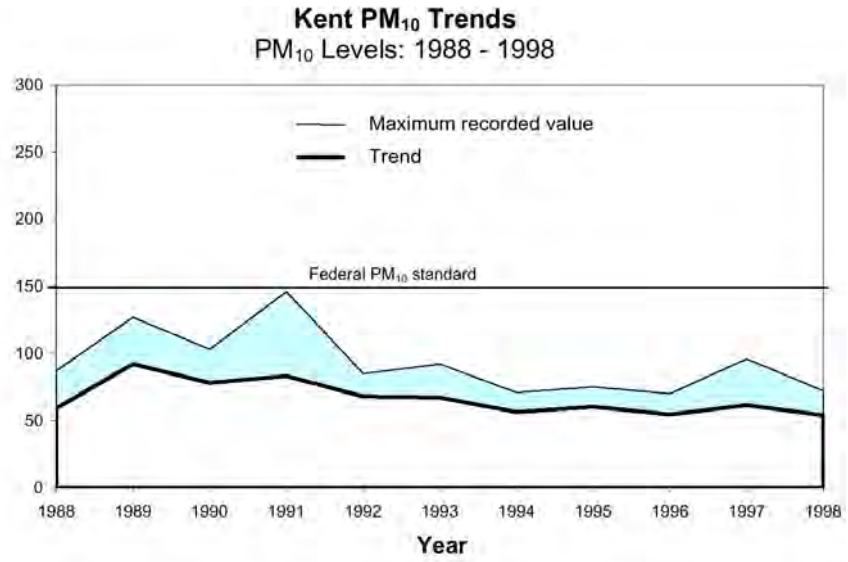


(*) The new 8-hour ozone standard of .08 ppm went into effect on September 16, 1997. The 1-hour ozone standard was not revoked for Washington State until June 5, 1998. Although part of the 1997 and 1998 ozone seasons were under two standards, we have decided for the purpose of this graph to show the 1997 ozone as 1-hour averages and the 1998 ozone as 8-hour averages.

Note:
The trend line represents the average of the ozone values that fall within the upper one percent of the observations.

Source: Ecology, 1999.

Figure 3.23-18: Kent Valley Particulate Matter Trends



Note:
The trend line represents the average of the PM_{10} that fall within the upper five percent of the observations.

Source: Ecology, 1999.

The historical trends toward improvement in air quality are growing increasingly difficult to maintain. The 1998 update to the 2020 MTP forecast 2020 CO emissions of 1,311 metric tons of CO per winter day and HC and NOx emissions of 148 and 186 metric tons per summer day compared to motor vehicle emission budgets of 1,358 metric tons of CO per winter day and 225 and 239 metric tons of HC and NOx per summer day (PSRC, 1998). These values and modeling procedures are consistent with the analysis completed for the I-405 Corridor Program EIS.

More recently, PSRC has revised the regional emission analysis to evaluate the air quality effects of *Destination 2030*, the new MTP for the central Puget Sound region through 2030. The new analysis includes updates to reflect new USEPA emission requirements, including the Tier II Gasoline/Sulfur Rule. The revised emission budget from the latest AQMP and the modeling of emission trends for *Destination 2030* completed in 2001 are shown in Table 3.23-14.

Table 3.23-14: *Destination 2030* Air Pollutant Emission Projections (metric tons per day)

Pollutant	AQMP Budget	2010 PSRC MTP Forecast	2020 PSRC MTP Forecast	2030 PSRC MTP Forecast
Carbon monoxide	1,497	860	718	735
Hydrocarbons	248	164	171	202
Nitrogen oxides	263	206	199	217

Source: PSRC, 2001

From the *Destination 2030* analysis, none of the future transportation emissions scenarios is expected to exceed the AQMP transportation emissions budgets. The downward trend in CO is expected to continue for the region through 2020, but is expected to begin increasing again by

2030. For ozone, the future trend is not as positive. Hydrocarbon emissions, which largely drive ozone formation in the central Puget Sound region, are projected to increase between 2010 and 2020.

Cumulative and Secondary Effects of I-405 Corridor Program Alternatives

Regional emissions for each of the alternatives for the I-405 Corridor Program were modeled using a methodology and assumptions consistent with the 1998 MTP update. The analysis methodology included the cumulative effects on transportation emissions of planned transportation improvements throughout the central Puget Sound region. The newer (2001a) *Destination 2030* modeling results are not directly comparable to the I-405 Corridor Program analysis or to the older MTP analysis; however, the trends viewed in the *Destination 2030* analysis would tend to be applicable to the range of alternatives. *Destination 2030* assumes substantial transit, freeway, and arterial improvements within the I-405 corridor. Because the results from the I-405 Corridor Program analysis reflect older planning and emission assumptions than those used for *Destination 2030*, and the newer assumptions result in a substantial reduction in predicted CO emissions relative to the older assumptions, the actual 2020 regional CO emissions for each of the alternatives are expected to be substantially lower than modeled in the I-405 Corridor Program analysis. This is a positive effect.

No Action Alternative

Regional transportation air pollutant emissions modeled for 2020 under the No Action Alternative (Table 3.23-15) were modeled to be slightly greater than those modeled by PSRC for their 1998 MTP Plan update (PSRC, 1998). The minor difference between the modeling scenarios is a result of other transportation projects planned outside the I-405 corridor that have been included in the PSRC model for the MTP.

Table 3.23-15: 2020 Air Pollutant Emissions for the Alternatives (metric tons per day)

Pollutant	2020 No Action Alternative	2020 Alternative 1 HCT/TDM	2020 Alternative 2 Transit	2020 Alternative 3 Mixed	2020 Alternative 4 Roadway	2020 Preferred Alternative
Carbon monoxide	1,315	1,313	1,302	1,294	1,256	1,260 to 1,290
Hydrocarbons	143	143	143	142	139	139 to 142
Nitrogen oxides	182	182	184	186	181	181 to 186

Source: Parsons Brinckerhoff, 2000

Comparing the results of the No Action Alternative evaluation to those of the *Destination 2030* analysis suggests that CO levels in both 2010 and 2030 would be higher than those in 2020. While conformity to the MTP and TIP can not be determined without including the alternative in the official PSRC analysis, emissions are not expected to exceed the transportation CO budget. Emissions of other criteria pollutants are also not expected to exceed the AQMP budgets in any year out to 2030.

Alternative 1: HCT/TDM Emphasis

Regional transportation air pollutant emissions for 2020 for Alternative 1 (Table 3.23-15) are expected to be slightly less than for the No Action Alternative. As a result of shifting person-trips from the congested I-405 corridor under the No Action Alternative to high-capacity transit,

there would be a small regional decrease in VMT relative to the No Action Alternative, resulting in a minor emissions reduction. The difference in emissions between Alternative 1 and the No Action Alternative for other years would be similar to that modeled for 2020. As under the other alternatives, CO levels in both 2010 and 2030 are expected to be higher than those in 2020, but emissions are not expected to exceed the transportation CO budget in any year. Emissions of other criteria pollutants are also not expected to exceed the AQMP budgets in any year out to 2030.

Alternative 2: Transit Emphasis

Regional transportation air pollutant emissions for 2020 for Alternative 2 (Table 3.23-15) are expected to be slightly less than for the No Action Alternative and Alternative 1 for CO and slightly higher for NO_x. While VMT would increase relative to the No Action Alternative, average speed would also increase, resulting in decreased emissions per mile traveled relative to the No Action Alternative. Regional emissions modeled for Alternative 2 are generally lower than those modeled for the No Action Alternative. The difference in emissions between Alternative 2 and the other alternatives for other years would be similar to that modeled for 2020. As under the other alternatives, CO levels in both 2010 and 2030 are expected to be higher than those in 2020, but emissions are not expected to exceed the transportation CO budget in any year. Emissions of other criteria pollutants are also not expected to exceed the AQMP budgets in any year out to 2030.

Alternative 3: Mixed Mode Emphasis

Regional transportation air pollutant emissions for 2020 for Alternative 3 (Table 3.23-15) are expected to be less than for the No Action Alternative and Alternatives 1 and 2 for CO and slightly higher for NO_x. While VMT would increase relative to the No Action Alternative, average speed would increase substantially, resulting in decreased emissions per mile traveled relative to the No Action Alternative. Regional emissions modeled for Alternative 3 are generally lower than those modeled for the No Action Alternative. As under the other alternatives, CO levels in both 2010 and 2030 are expected to be higher than those in 2020, but emissions are not expected to exceed the transportation CO budget in any year. Emissions of other criteria pollutants are also not expected to exceed the AQMP budgets in any year out to 2030.

Alternative 4: Roadway Capacity Emphasis

Regional transportation air pollutant emissions for 2020 for Alternative 4 (Table 3.23-15) are expected to be less than for the other alternatives. The substantial increase in capacity in the I-405 corridor under Alternative 4 would result in a shift in traffic from the I-5 corridor. While VMT would increase relative to the No Action Alternative, average speed would increase substantially, resulting in decreased emissions per mile traveled relative to the No Action Alternative. As under the other alternatives CO levels in both 2010 and 2030 are expected to be higher than those in 2020, but emissions are not expected to exceed the transportation CO budget in any year. Emissions of other criteria pollutants are also not expected to exceed the AQMP budgets in any year out to 2030.

Preferred Alternative

Regional transportation air pollutant emissions for 2020 for the Preferred Alternative (Table 3.23-15) are expected to be between those for Alternatives 3 and 4. The substantial

increase in capacity in the I-405 corridor under the Preferred Alternative would result in a shift in traffic from the I-5 corridor. While VMT would increase relative to the No Action Alternative, average speed would increase substantially, resulting in decreased emissions per mile traveled relative to the No Action Alternative.

In the Spring of 2002, PSRC refined the MTP adopted in 2001 (*Destination 2030*) to fully reflect and incorporate the transportation improvements contained in the Preferred Alternative. The revised modeling runs show regional emissions below the emission budgets for all pollutants in 2010, 2020, and 2030. PSRC's modeling demonstrates that air quality in the Puget Sound Region, including implementation of the Preferred Alternative, would conform to the regional air quality maintenance plans.

3.23.4.2 Energy

Energy consumption from transportation is a function of vehicle fuel economy, vehicle miles traveled, and operating conditions.

Fuel Economy

Since the early 1970s, USEPA has analyzed light vehicle fuel economy data. Fuel economy continues to be a major area of public and policy interest for several reasons, including:

1. Fuel economy is directly related to carbon dioxide emissions, the most prevalent pollutant associated with global warming. Light vehicles contribute about 20 percent of all U.S. carbon dioxide emissions.
2. Light vehicles account for approximately 40 percent of all U.S. oil consumption. Crude oil, from which nearly all light vehicle fuels are made, is considered to be a finite natural resource.
3. Fuel economy is directly related to the cost of fueling a vehicle and is of greater interest when oil and gasoline prices rise, as has happened recently.

Since 1988, average new light vehicle fuel economy has declined 1.9 miles per gallon (mpg), i.e., more than seven percent, primarily because light truck market share has increased and because fuel economy has been traded off for increased vehicle weight and performance (USEPA, 2000).

Fleet-wide improvement in new light vehicle fuel economy occurred from the middle 1970s through the late 1980s, but it has been consistently falling since then. Viewed separately, the average fuel economy for new cars has been essentially flat over the last 15 years, varying only from 27.6 mpg to 28.6 mpg. Similarly, the average fuel economy for new light trucks has been largely unchanged for the past 20 years, ranging from 20.1 mpg to 21.6 mpg (USEPA, 2000).

The increasing market share of light trucks, which have lower average fuel economy than cars, accounts for much of the decline in fuel economy of the overall new light vehicle fleet. Growth in the light truck market has been led recently by the explosive popularity of sport utility vehicles (SUVs). SUV sales have increased by more than a factor of ten from 2 percent of the overall market in 1975 to 20 percent of the market in 2000. Over the same period, the market share for vans doubled from 4.5 to 9 percent, and for pickup trucks, grew from 13 to 17 percent. For model year 2000, cars average 28.1 mpg, vans 22.5, pickups 20.1, and SUVs 20.0 (USEPA, 2000).

More efficient technologies, such as engines with more valves and more sophisticated fuel injection systems, and transmissions with lockup torque converters and extra gears, continue to penetrate the new light vehicle fleet. The trend has clearly been to apply these new technologies to increase average new vehicle weight, power, and performance while maintaining fuel economy.

While historical trends over the last 10 to 15 years reflect a lack of progress in fuel economy, new technologies used in hybrid vehicles change the horizon for fuel economy projections and indicate that improvements on the order of 100 to 200 percent may be possible (USEPA, 2000). Recent developments suggest various potential pathways for possible future fleetwide fuel economy improvements, including voluntary commitments by some manufacturers to improve the fuel economy of certain portions of their fleets by as much as 25 percent.

Travel Patterns

In the 1980s VMT increased nearly three times faster than population and jobs. In the eight years from 1981 to 1989, the population of the central Puget Sound region increased 15 percent, the number of employed persons increased 34 percent, and the amount of automobile traffic, measured by total VMT, increased 71 percent (PSRC, 2000). More recently, traffic in the central Puget Sound region has grown at a similar rate to population and employment. Between 1989 and 1999, population grew 19 percent and employment grew 27 percent, while VMT increased a comparable 26 percent.

The regional daily VMT in 1999 was 65 million miles per weekday (PSRC, 2000). The regional daily VMT is expected to increase to 79 million miles per weekday by 2010, but then level off to 94 million miles per weekday by 2030 under the *Destination 2030* plan (PSRC, 2001a).

Cumulative and Secondary Effects of I-405 Corridor Program Alternatives

Energy use in the Puget Sound region would vary between the alternatives depending on the VMT and travel operations under each of the alternatives (Table 3.23-16). The values calculated are for the I-405 Corridor Program study area and include the influence of other projects in the Puget Sound region. Fuel consumption is expected to decrease between 2020 and 2030 as a result of programs under the *Destination 2030* plan; the relative differences in energy consumption among the alternatives are expected to remain the same.

Table 3.23-16: Energy Consumption for Motor Vehicles

Alternative	Daily Study Area Vehicle Miles Traveled (2020)	Study Area Average Speed (mph)	Fuel Consumption Rate (gallons per mile)	Gasoline Consumption in Liters (gallons)
No Action Alternative	22,510,000	19	0.042	3,577,000 (945,000)
1: HCT/TDM	22,563,000	20	0.041	3,501,000 (925,000)
2: Mixed Mode with HCT	24,215,000	21	0.040	3,668,000 (969,000)
3: Mixed Mode	25,346,000	22	0.039	3,740,000 (988,000)
4: General Capacity	26,208,000	22	0.039	3,868,000 (1,022,000)
Preferred Alternative	25,697,000	22	0.039	3,793,000 (1,002,000)

3.23.4.3 Surface Water

Past Conditions

The rivers and major lakes in the study area have been extensively altered due to development during the past century. For instance, in 1916 Lake Washington was lowered by 16 feet as a result of construction of a ship canal and locks to allow ship passage between Puget Sound and the lake. To assure adequate water for the newly constructed ship locks, the Cedar River was diverted into the south end of Lake Washington. Before 1916, the Cedar River discharged directly to the Black River, and Lake Washington discharged to the Duwamish through the Black River. The Duwamish was formed by the confluence of the Green and Black rivers. The Black was a short, low-gradient river, and Lake Washington had no other outlet. The Green River lost another significant source of water early last century when the White River (located just south of the study area) was permanently diverted south into the Puyallup River.

The riverbeds of both the lower Green River and the Sammamish River have been extensively lowered and channelized for flood control purposes. These rivers have lost the formerly extensive connection they once had with their respective floodplains and wetlands.

As development increased around Lake Washington in the 1950s, a number of sewage treatment plants were constructed and began discharging to the lake. By the 1960s, a definite trend in declining water quality was documented in the lake. Nutrient levels in the lake increased. Lake water clarity declined and nuisance algae blooms became a regular occurrence. The citizens in the region voted to create the Municipality of Metropolitan Seattle (King County). During the 1960s, two large, regional sewage treatment plants were constructed and municipal wastewater discharges to Lake Washington were completely eliminated. Dramatic improvements in lake water quality resulted. By the 1970s Lake Washington stood as a world-wide example of water quality restoration.

One of the two King County wastewater treatment plants was constructed in Renton and initially discharged treated effluent to the Green-Duwamish River. This resulted in water quality problems (ammonia and dissolved oxygen) during periods of low flow. In the 1980s, a long outfall pipe was constructed to convey treatment plant effluent directly to Puget Sound. River quality improved as a result.

Much of the sewer system serving the older urban areas of Seattle carries both sanitary wastes and storm runoff. This type of system is termed a combined sewer system. During periods of heavy rainfall and runoff, the pipe capacity of some of these combined systems can be exceeded. When this happens, the system discharges excess, untreated sewage directly to water bodies. These combined sewer overflows occur primarily downstream of the study area, in the Duwamish River and Elliott Bay and along the ship canal, west of Lake Washington. Over the past several decades the local municipalities and King County have installed a series of projects to eliminate or reduce the magnitude and frequency of combined sewer overflows. This program is scheduled to meet the state goal of one overflow event per year within the next decade.

The streams within the study area have also undergone considerable change. Most of the development within the stream basins has occurred in the past 50 years. There have been some declines in the quality of the streams. These include the typical pollutants associated with urban development: nitrogen, phosphorus, oil and grease, coliform bacteria, and detectable levels of some herbicides and pesticides. However, the more serious and pervasive effects upon streams

have been physical. Direct stream impacts resulting from past development include bank armoring and widening for flood control. Local landowners have commonly cleared, armored, re-routed, or otherwise modified streams passing through their properties to achieve a variety of highly localized and uncoordinated effects. In the past, it was common practice to route a stream into an underground culvert for hundreds or even thousands of feet in order to pass under a highway or through a commercially valuable piece of real estate.

Many forested areas within the study area have been replaced by a high percentage of impervious area. Much of the riparian canopy has been removed, along with large instream wood. Streams now typically experience higher peak flows than they historically did. As a result, channel scouring and widening are common. Channel scour and bank erosion often lead to heavy sedimentation in low-gradient and downstream sections, particularly at stream mouths. Reduced infiltration in the basin reduces long-term water storage; summer streamflows are often considerably reduced, as well. Reduced forest canopy along many of the streams results in elevated summer stream temperatures.

By the 1970s there was recognition among the local municipalities that some form of stormwater controls for new development was needed. The Section 208 Areawide Wastewater Management Plans produced by King and Snohomish counties in the mid-1970s clearly demonstrated the deleterious effects that both urban and agricultural runoff were having on water quality. It was at this time that the concept of best management practices (BMPs) for control of stormwater runoff became well established. Some of the first stormwater utilities in the country were established in the central Puget Sound region, including Bellevue and King County. Stormwater detention, which limits increases in peak runoff that otherwise would result from new construction, began to be required in portions of the study area. The publishing of the landmark *Puget Sound Water Quality Management Plan* in the late 1980s gave further impetus to urban stormwater management.

In 1990, King County published its *Surface Water Design Manual*, which contained more stringent detention requirements and a requirement for stormwater treatment aimed at reducing suspended solids (sediment). In 1992, Ecology published the *Stormwater Management Manual for the Puget Sound Basin*. Stormwater detention and water quality treatment were mandated for all projects within areas draining to the Puget Sound Basin. In 1998, King County updated its stormwater management requirements. A higher level of stormwater management was prescribed for sensitive water bodies. Control of flow durations (not just peak flows) was now required. A higher level of water quality treatment was required for sensitive receiving waters. Ecology will publish a revised stormwater manual this year containing similar requirements. The new state stormwater management requirements will be extended to all of western Washington (i.e., that part of the state lying west of the crest of the Cascade Mountain Range).

Table 3.23-17 shows a simplified tabulation of the stormwater detention volume required for the development of one acre of forested land into one acre of impervious surface, such as a road, parking lot or rooftop. Prior to the early 1990s, there was no regional standard method for calculating detention. The then commonly used detention calculation method was used for Table 3.23-17.

Table 3.23-17: Detention Volumes Typically Required in the Study Area Over the Past 25 Years

Timeframe	Geographic Coverage	Detention Volume[a] (cu ft)	Size of Typical 4-ft Deep Pond (sq ft)
Pre-1970s	Sporadic	Varied	Varied
1980s	King County, several cities	1,800	1,080
1990s	Puget Sound Basin	11,750[b]	3,950
2001 +	Western Washington	15,800	5,170

[a] Stormwater detention volume required for development of 1 acre of forested land into 1 acre of impervious surface.

[b] 15,000 ft^3 with commonly applied safety factor.

Within the past several decades, a number of regulatory programs have evolved that control stormwater and restrict direct disturbance of water bodies. The 1987 revisions to the Clean Water Act placed new emphasis on the requirement for larger cities and counties to obtain permits for stormwater discharges. (By 2003, Phase 2 of this program will require smaller municipalities to also obtain stormwater discharge permits, greatly expanding the federal requirements for stormwater management.) The 1990 Growth Management Act required cities and counties in the study area to, among other things, define, map, and protect (environment- and hazard-related) sensitive areas. This led to the establishment of buffers of various widths around streams, lakes, and wetlands. These buffers typically range from 25 to 100 feet from the edge of the stream or wetland. Within these buffers new development or disturbance is restricted. Where disturbance is unavoidable, mitigation may be required.

The State Department of Fish and Wildlife must issue a Hydraulic Project Approval (HPA) for any project that proposes to disturb any area within the ordinary high water mark of a stream or lake. These HPAs typically control the amount of allowable disturbance and set seasonal time limits to minimize interference with fish using the stream. They also contain requirements for restoration after construction and frequently attach mitigation requirements. Recent revisions to the State's Shoreline Management Act also restrict the level of disturbance or manipulation allowed along the shores of the major marine and freshwater bodies. At the federal level, the U.S. Army Corps of Engineers often reviews projects for wetland effects or effects upon navigable waters under Section 404 of the Clean Water Act. Here too, restoration and mitigation requirements are typically placed upon projects where stream or wetland disturbance is unavoidable.

Numerous stream restoration projects have been constructed in virtually all of the streams within the study area and many more are planned. Many of these projects are funded by the local municipalities, either through direct capital improvement projects or through grants. An example of the latter is the King County Water Works Program, which has committed millions of dollars to local business and education partnerships for stream restoration projects. The state has been an important contributor through the Centennial Fund and the Salmon Recovery Board. The state Department of Fish and Wildlife and Department of Transportation have ongoing programs for culvert upgrades. The U.S. Army Corps of Engineers also has contributed significantly to restoration measures along the rivers and larger streams. The state is split into 62 large watersheds known as Water Resource Inventory Areas (WRIAs). The state is encouraging and funding watershed assessments for each of these WRIAs. WRIA studies are underway for WRIA 8 (Cedar-Sammamish [Lake Washington]) and WRIA 9 (Green-Duwamish), parts of which are within the I-405 corridor. Among other things, these studies will culminate in

prioritized lists of stream and watershed restoration projects. This will help guide future federal, state, and local expenditures for stream restoration projects.

Future Trends

The regulatory programs briefly summarized above assure that the rate of hydrologic and water quality degradation in developing areas will be greatly reduced from those which historically occurred.

Low-impact development is an emerging approach for reducing the runoff impacts of development. This approach emphasizes narrow streets, efficient layout, dispersed runoff, and retention of a large percentage of undisturbed land (typically 65 percent). An alternative form of low-impact development is high-rise condominiums and mixed retail-residential developments that are appearing in the most densely developed areas of the study area: downtown Bellevue and Kirkland. By concentrating many residents in a small area, these types of development minimize additional impact upon stream basins. While effective in reducing the level of impact of urban development, it is not at all clear whether there is any set of practical measures that can entirely avoid the hydrologic impacts of urban development. Research in the central Puget Sound region and elsewhere suggests that substantial stream impacts can occur with as little as 10 percent impervious area across a basin. This corresponds to about one house per 5 acres, a level associated with rural development.

Few of the regulatory programs discussed above address existing development. State and local stormwater regulations contain specific requirements for adding stormwater runoff controls to redevelopment of existing, developed areas. However there are also exclusions that are allowed. With few exceptions (state highways are notable exceptions), there are no requirements for the retrofit of stormwater controls to existing development. Given the relatively slow rate of large-scale redevelopment typical of existing urbanized areas and the difficulty of incorporating effective stormwater control measures in densely developed areas, it is unlikely that the hydrologic conditions of the urbanized portions of streams in the study area will greatly improve within the 2030 timeframe. With continued growth in the study area, it is likely that stream conditions in the I-405 corridor will continue to decline.

Future water resource conditions in the study area are difficult to predict with any accuracy. Stormwater regulations will undoubtedly continue to evolve. Two areas of evolution that seem reasonably assured are stricter treatment requirements for runoff from construction sites and more widespread application of proprietary stormwater treatment devices such as swirl concentrators and filters. With regard to the latter, there has, to date, been only limited experience in their application, regionally. As verifiable performance data become available and stormwater treatment requirements for targeted pollutants, such as nutrients and heavy metals, become more prevalent, installation of advanced stormwater treatment devices is likely to increase dramatically. Given their need for relatively high levels of maintenance, local stormwater utility budgets will rise as well.

There is a debate going on that may greatly affect long-term expenditures for stream and watershed protection. While a primary focus of these expenditures is restoring fish habitat, many projects also benefit the streams themselves. Funds can be spent in an effort to restore degraded streams to their former hydrologic and water quality conditions. However, monies can also be spent to protect streams and the watersheds that currently support important fish runs. Easements or land purchases can be made to enhance buffers, protect sensitive areas, and

preserve large portions of watersheds from future development. Which of these approaches (or possibly a hybrid) will emerge in the coming years is not possible to predict at this time. The basic strategy of watershed protection versus stream restoration will likely be heavily influenced by the National Marine Fisheries Service chinook recovery strategy, which is still several years from completion.

Large-scale inter-basin transfers of water are not common in this region. The use of Green River water by the City of Tacoma (which lies largely within or near the Puyallup River Basin) is a notable exception, as is the Tolt River supply for the City of Seattle. Since the state long ago declared most of the rivers in the region fully-appropriated, inter-basin transfers have not been encouraged in recent decades. There are two inter-basin transfers currently under consideration. The recently formed Cascade Water Alliance is proposing to transfer water from the White River, immediately south of the project area, for municipal use among cities and water districts east and south of Lake Washington. A proposal for transfer of water from the Snoqualmie River Basin near North Bend has also emerged in recent years. As continued population increases in the region place pressure on existing water supplies, further proposals for inter-basin transfers will likely be made.

Municipal wastewater reuse, extensive in some arid portions of the country, has seen only limited application in the Puget Sound region. Both of the regional wastewater treatment plants discussed early in this section use only limited amounts of reclaimed water for local irrigation and some industrial use. This situation seems to be changing. A third regional wastewater treatment plant, called Brightwater, is proposed to be located somewhere within or near the northern portion of the study area, near the King-Snohomish county line. Substantial water reclamation is planned when this plant comes online in 2010. Other possible reclamation projects are under consideration. For instance, King County is considering a reclamation project to irrigate farms and a golf course in the Sammamish River Valley. It seems likely that water reuse will play a much larger future role in the regional water supply.

Cumulative and Secondary Effects of I-405 Corridor Program Alternatives

The I-405 corridor is continuing to experience the rapid growth that is occurring throughout much of the central Puget Sound region. Between 2000 and 2020, the population within the corridor is projected to grow by more than 200,000. Households within the study area will increase by about 90,600 while employment will increase by about 128,400. Relatively large increases in households are projected in virtually all of the FAZs within the study area, so this analysis deals with general surface water impact across the entire study area. Several factors are used to convert these numbers into equivalent impervious surface area. A medium-low (average) housing density of 4 homes per acre with an impervious factor of 40 percent is conservatively assumed. Each new employee is assumed to occupy roughly 500 square feet of new impervious area. Employee building-occupancy typically falls within the range of 200-500 square feet per employee. The upper end of this range was adopted for this analysis and assumed to include access/parking area.

This analysis is summarized in Table 3.23-18. There is an estimated increase of about 9,000 acres of impervious surface associated with the projected new housing. The projected new employment would result in nearly 1,500 acres of new impervious surface. Combined, the future growth in the study area is estimated to result in an additional 10,500 acres of new impervious surface. By comparison, the current impervious surface area within the study area is about

43,000 acres. Cumulative development, including the proposed I-405 Corridor Program improvements, would increase this to around 53,500 acres, a 25 percent increase. Overall, impervious area coverage in the study area would increase from the current 32 percent to 40 percent.

Table 3.23-18: Cumulative Increase in Impervious Area within the Study Area: 2000 to 2020

Housing increase:	90,600 units
Homes per acre:	4
New housing coverage:	90,600/4 = 22,650 acres – medium-low density
Impervious coverage by medium-low density housing:	40%
22,650 acres x 0.40 =	9,060 acres
Employment increase:	128,400 employees (commercial and industrial)
500 square feet (0.0115 acre) per employee	
128,400 x 0.0115 =	1,474 acres
Impervious area	
Existing impervious area within study area:	43,000 acres
New impervious area:	9,060 + 1,474 = 10,534 acres
Total future impervious area: 43,000 + 10,534 =	53,500 acres (rounded)
Future increase in impervious area:	43,000 + 10,500 = 1.25 → 25% increase
Impervious area as a percentage of the total study area	
Study area:	134,000 acres
Current impervious area:	43,000/134,000 = 32%
Future impervious area:	53,500/134,000 = 40%

Even with implementation of stormwater detention and treatment measures for all new development, increases in pollutant loads and substantial changes in existing hydrology are likely to occur in many of the streams draining the I-405 corridor. In particular, reductions in seasonal base flows and associated increases in summer stream temperature may result. The cumulative effect upon water resources is therefore judged to be substantial and adverse.

The amount of new impervious area contributed by the I-405 Corridor Program ranges from 166 acres for the No Action Alternative to 908 acres for Alternative 4. Thus the I-405 Corridor Program can be expected to contribute between 1 to 8 percent of the area's new impervious surface over the next 20 years.

The temperature and heavy metals impacts to Springbrook Creek (discussed in Section 3.5) are likely to be further aggravated due to other development occurring within this basin.

Alternative 1 would result in modest cumulative effects related to additional development in the following basins: Middle Swamp, Sammamish River, Juanita, East Lake Washington, Lower Cedar, Springbrook, and Upper Soos. The Bear and Kelsey creek basins would experience modest beneficial reductions in baseline development. Just beyond the project area boundaries, the Lower Soos Creek and Lower Issaquah creek basins would also experience reduced development, as would the drainages around Sea-Tac Airport.

Alternative 2 would influence a slight increase in pressure for growth in the same basins mentioned under Alternative 1, as well as in North Creek Basin.

Alternative 3 would contribute to substantially greater cumulative effects within the study area, compared to Alternatives 1 and 2. Pressure for growth would occur in the Juanita, Forbes, and

Sammamish River basins. In the southern portion of the project area, the Lower Cedar and Soos Creek basins would also experience pressure for additional growth. Cumulative effects would also occur outside of the project area. The upper portions of North and Swamp creek basins, Upper Soos Creek Basin and the Green River, and the Lower White River south of Auburn would all experience modest additional pressure for growth. Pressure for minor growth would occur in the Lower Skykomish and Snohomish river basins within Snohomish County.

Basins experiencing decreased pressure for growth under Alternative 3 would be the same as mentioned under Alternative 1. The Bear and South Kelsey creek basins would experience modest reductions in pressure for growth. Just beyond the project area boundaries, the Lower Soos Creek and Lower Issaquah Creek basins would also experience reduced pressure growth, as would the drainages around Sea-Tac Airport. In addition, basins in central and western Seattle would experience somewhat lower levels of pressure for growth, as well as the City of Bremerton in Kitsap County. Given the relatively high level of existing development in these two cities, reduced levels of new pressure for growth are unlikely to translate into substantial changes in hydrologic conditions within the urbanized basins.

Cumulative effects on the basins under Alternative 4 would be similar to those under Alternative 3. Slightly higher pressure for growth effects would occur in the basins north and south of the project area. These include North and Swamp creek basins in the north and the Lower Green River, Soos Creek, and Lower White River basins in the south. Compared to Alternative 3, this alternative would further reduce pressure for growth in basins located in the Seattle area and the more populated portions of Kitsap County such as Bremerton. As stated earlier, these reduced growth pressure effects are not likely to result in substantial improvements in the current hydrologic conditions of these areas, given their relatively high degree of existing development.

Cumulative effects on the basins under the Preferred Alternative would be similar to those under Alternative 3. Slightly higher pressure for growth effects would occur north and south of the study area. The reduced growth pressure effects in the study area similar to Alternative 3 are not likely to result in substantial improvements in the current hydrologic conditions of these areas, given their relatively high degree of existing development.

3.23.4.4 Wetlands

Regulatory Trends

Wetlands have not been recognized historically for their ecological importance. Many of these areas were filled, dredged, or developed to make the land useful for housing, industry, and agriculture. Between 1780 and 1980, the state of Washington lost an estimated 31 percent of its wetlands. Since that time, wetlands have been identified as providing important economic and environmental functions, such as protection from floodwaters, filtering sediment and pollutants, and providing spawning areas for commercially important fish as well as habitat for many important species of plants and wildlife.

In 1989, Washington adopted state goals for no net loss of acreage or ecological function of wetlands. These goals reflect the Clean Water Act, federal legislation that prohibits the discharge of soil into waters of the United States unless authorized by a permit issued under Section 404 of the Act. The U.S. Army Corps of Engineers (USACOE) has authority over such actions and requires the permittee to restore, create, enhance, or preserve nearby wetlands as compensation for the damage. This means of compensatory mitigation is intended to comply

with the general goals of the Clean Water Act and the specific goal of "no net loss" of wetlands. Several regulations have been enacted on a federal and local level to achieve these goals.

The Washington State Growth Management Act was passed in 1990 to address environmental, land use, and sustainable economic development issues related to unplanned growth in specific areas. In 1991, an amendment to the GMA required all counties and cities to adopt regulations for controlling development pressures on wetlands and other critical areas. These critical or sensitive areas ordinances provide restrictions on wetland and stream disturbance and are continually evolving as regulating agencies gain further understanding of the consequences related to these types of disturbance.

Because wetlands provide habitat for several endangered species, the federal Endangered Species Act of 1973 inspired further regulation of impacts to specific types of wetland resources. As the numbers of species listed for protection increase, the extent of protection is evolving and directly connected to growth and subsequent habitat disturbance.

Wetland Resource Trends

Urbanization is the primary cause of wetland loss within the central Puget Sound region and the I-405 corridor. According to a 1998 Washington State Department of Natural Resources publication, more than 90 percent of the wetlands in urban areas in Washington have been lost. Despite the goal of "no net loss," studies show that these goals are not being met. The magnitude of impacts to wetland functions is unknown. Primary wetland functions lost in the study area are due to an increase of impervious surfaces and a decrease in overall wetland area and functional capability. These functions primarily include fish and wildlife habitat, stormwater retention, and sediment and toxics retention.

The lack of available data on wetland loss and replacement as a result of compensatory mitigation makes it difficult to determine the extent of ecological impacts due to wetland loss. However, as research and expertise develop in the field of wetland ecology, the rate of wetland loss is decreasing while the effectiveness of wetland restoration and replacement activities is increasing.

Ongoing and Proposed Programs for Wetlands Protection and Restoration

Future trends in wetland regulation are likely to focus on compensatory mitigation requirements. Although there has been a great deal of progress in the last 20 years, the goal of no net loss for wetland function has not been accomplished. The degree to which wetland loss is taking place is unknown because not enough data are available to make this determination. Regulatory agencies are expected to develop procedures to track the success and completion of mitigation efforts as this information becomes increasingly more valuable to maintain effective regulatory practices. The focus of mitigation efforts is moving towards emphasizing the replacement of wetland functions, rather than replacement of wetland area. In addition, research and publications show strong indication that mitigation banking is becoming a more favored means of mitigating wetland loss.

Based on preliminary findings from a wetland mitigation banking study released by the Environmental Law Institute, great expansion in mitigation banking has occurred as new states have developed banking programs. The study shows that in 1992, "banks existed in only 17 states, but today, active or pending banks exist in 41 states." As time allows further analysis of

the ecological trends in wetlands and associated ecosystems, regulatory agencies will continue to respond to these issues.

Ongoing programs occurring on a local level include proposed revisions to King County's sensitive areas code as well as other codes that regulate sensitive areas such as the clearing and grading code and the shoreline code. Revisions include modifications of definitions, exemptions, and mitigation as well as permit requirements. Snohomish County is also preparing to propose changes to its critical areas code.

Cumulative and Secondary Effects of I-405 Corridor Program Alternatives

Cumulative effects could occur as a result of the increased pressure for growth and development within the Urban Centers along the I-405, SR 167, and I-90 corridors and reduced pressure in rural areas outside the study area. Thus, effects on wetlands could be reduced outside the UGA relative to the more urbanized areas within the study area.

In contrast, the No Action Alternative would result in the continuation of pressure for growth in rural areas or at the fringe of the UGA. If allowed to occur by local land use regulatory agencies, that pattern of growth would have the potential to influence some impacts on wetlands from inside the UGA to outside the UGA or from more urbanized areas within the study area to the less developed fringe portions of the UGA.

Under the No Action Alternative, future growth in employment and households, and resulting development, is forecasted to be concentrated in Seattle, southwest Snohomish County, Tukwila, Federal Way, Woodinville, and Bothell. While the more central of these areas are nearer build-out, cumulative effects may pose a threat to high-quality wetlands in the southwest Snohomish County and Woodinville areas where more undeveloped land occurs.

Cumulative effects due to implementation of any of the action alternatives would be similar. Under Alternative 1, pressure for growth increases in the Kent, Renton, and Redmond areas. Wetlands are common in these areas, and cumulative effects could be expected.

Pressure for growth occurring under Alternative 2 would be similar to that under Alternative 1, with greater pressure in the wetlands-rich southwest portion of the study area and the Redmond area, and some added growth pressure on parts of Bellevue. In addition, this alternative shows some pressure for growth in the northern tip of the study area, where high priority wetlands are concentrated. Cumulative effects could be more pronounced in these areas under Alternative 2.

Pressure for growth toward the southwestern, Redmond, and northern portions of the study area would increase under Alternative 3. Cumulative effects could be expected to increase accordingly.

Pressure for growth under Alternative 4 would increase in the northern and south central parts of the study area. Potential cumulative effects on the dense wetlands of these areas would be highest of all action alternatives.

Cumulative effects under the Preferred Alternative would be similar to those under Alternative 3. Slightly higher pressure for growth effects would occur north and south of the study area. The growth pressure effects in the study area are not likely to result in substantial effects to wetlands.

If cumulative effects on high priority wetlands were weighted most heavily, wetland effects would be greatest for Alternative 2 and least for the No Action Alternative and Alternative 1. High priority wetlands near the growth areas of Alternative 1 occur in Kent between SR 167 and

I-405 and in Woodinville. High priority wetlands near the growth areas of Alternative 3 and the Preferred Alternative occur in Redmond, west of SR 202 and east of the railroad tracks. High priority wetlands near the growth areas of Alternative 4 occur in Redmond and Kent.

The most notable potential cumulative wetland effects associated with construction and development would occur through increases in impervious surfaces, potentially altering runoff volumes and the timing of flood pulses. Project-level design would partially address these issues by designing stormwater control structures to minimize hydrologic effects. Hydrologic effects cannot be completely avoided, as increases in impervious surfaces result in increased stormwater volumes. Alternatives with greater quantities of impervious surface would potentially have a greater effect on wetland hydrology and biologic functions.

3.23.4.5 Fish and Aquatic Habitat

Regulatory Trends

There has been a longstanding trend in Washington and the study area of increasing regulation of fish harvesting and habitat alteration. In 1949, the state legislature passed a law now known as the "Hydraulic Code" giving the WDFW jurisdiction over activities in or near state waters (RCW 75.20.100-160). Although the law has been amended occasionally since it was originally enacted, the basic authority has been retained.

The law requires that any person, organization, or government agency wishing to conduct any construction activity in or near state waters must do so under the terms of a permit called the Hydraulic Project Approval (HPA) issued by the WDFW. State waters include all marine waters and fresh waters of the state.

The Growth Management Act addresses the negative consequences of unprecedented population growth and suburban sprawl in Washington State. The GMA requires all cities and counties in the state to conduct planning for growth and protection of sensitive areas, and has more extensive requirements for the largest and fastest-growing counties and cities in the state. Its requirements include guaranteeing the consistency of transportation and capital facilities plans with land use plans. The GMA also required definition of Urban Growth Areas (UGAs) which would absorb increased population and economic growth, thus relieving environmental pressure on rural areas that contain the most viable fish habitat. Local regulations and policies established in response to the Act often include protection of stream and wetland salmon habitat.

In the 1980s and 1990s, all local municipal jurisdictions in the I-405 study area adopted some form of sensitive areas ordinance. These ordinances typically establish restrictions on disturbance of aquatic habitat including stream disturbance, wetland filling, and buffer encroachment.

Puget Sound chinook salmon and bull trout are listed as “threatened” under the federal Endangered Species Act (ESA). The Puget Sound/Strait of Georgia coho salmon is currently a “candidate” species for federal listing.

The National Marine Fisheries Service (NMFS), in conjunction with state and local jurisdictions as documented in the Federal Register (50 CFR Part 223) issued on July 10, 2000, identified 13 programs and criteria for future programs for which it is not necessary and advisable to impose ESA Section 9(a)(1) prohibitions because they contribute to conserving the Evolutionarily Significant Unit (ESU) upon which listed species rely. These programs and criteria for future

programs are commonly referred to as Section 4(d) rules. NMFS can provide ESA coverage through Section 4(d) rules, Section 10 research and enhancement permits, incidental take permits, or through Section 7 consultations with federal agencies. WSDOT and the cooperating agencies propose to work with NMFS to identify and modify project-specific actions that could result in the take of listed species on the program as a whole through the programmatic Biological Assessment process. WSDOT is pursuing a similar consultation process with the U.S. Fish and Wildlife Service (USFWS), even though USFWS has indicated they might wait until project-level details have been documented before entering into consultation with WSDOT. Potential impacts to listed species will be fully addressed during the consultation process with both federal agencies, but as mentioned above, this discussion may occur on the programmatic level with NMFS and the project level with USFWS.

Fish Population Trends

Agencies including the NMFS and the WDFW have tracked population trends for anadromous salmonids. Although fish populations naturally fluctuate in response to factors such as climate variations, nearly all native salmonid populations in the region have undergone a severe declining trend since the human population began rapidly increasing over the past century.

Chinook salmon runs for the overall Puget Sound evolutionarily significant unit (ESU) have declined from the recorded peak of 690,000 fish in 1908, to the most recent average of approximately 160,000 fish, leading to the federal "threatened" listing for this species as described previously. The "threatened" Puget Sound chinook salmon ESU "species" is composed of over twenty chinook salmon "stocks" specific to various watersheds draining to Puget Sound. This includes the two stocks within the study area specific to the Cedar River/Lake Washington and Green River watersheds.

The Cedar River/Lake Washington chinook salmon stocks are at or near historic minimums. An escapement (number of fish returning to spawn annually) goal of 1,200 fish was established by the WDFW based on historic escapement data. This goal has been met only three times since 1973, and the 1997 escapement was only 227 fish, or one-sixth of the goal (NMFS, 2000).

The Green River summer/fall chinook population is composed of both naturally spawning fish and hatchery production. Naturally spawning fish include both wild, native salmon and "strays" from hatchery stock. The downward population trend typical of many Puget Sound stocks is not apparent for Green River stocks. The escapement goal had been set at 5,800 fish in the 1970s. Annual spawning escapement (number of fish returning to spawn) has averaged about 5,700 fish during 1968-1977, and 7,280 fish during 1988-1997 (WRIA 9, 2001).

Under the federal Endangered Species Act (ESA), bull trout are listed as “threatened”. Bull trout are known to occur in both of the two major watersheds that compose the study area, but spawning has been documented only in locations far upstream of the study area (WDFW, 1998). The WDFW current GIS database shows bull trout presence in the study area to be limited to the mainstem Green River (WDFW, 2000). Other sources have documented bull trout presence within the study area in the Cedar River and Lake Washington (USFWS, 1999; USFWS, 2000). Bull trout were not found in the Sammamish River basin during a specific one-year bull trout survey of Lake Sammamish (USFWS, 1999; WDFW, 1998).

The 1996 Sustainable Fisheries Act amended federal fisheries management regulations to require identification and conservation of habitat that is "essential" to federally managed fish species. Essential habitat is defined as “those waters and substrate necessary to fish for spawning,

breeding, feeding, or growth to maturity." The Pacific Fishery Management Council (PFMC) is the body responsible to review relevant habitat issues in the Pacific Northwest, including the study area. The PFMC has designated Essential Fish Habitat (EFH) for the Pacific salmon fishery, federally managed groundfish, and coastal pelagic fisheries (NMFS, 1999a; PFMC, 1999). Federal agencies must consult with NMFS on all activities, or proposed activities, authorized, funded, or undertaken by the agency that may adversely affect EFH.

The Pacific salmon management unit includes chinook (*Oncorhynchus tshawytscha*), coho (*Oncorhynchus kisutch*), and pink salmon (*Oncorhynchus gorbuscha*). This designation is not limited to listed species. The EFH designation for the Pacific salmon fishery includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except above the impassible barriers identified by PFMC (1999). In the estuarine and marine areas, proposed designated EFH for salmon extends from nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone offshore of Washington, Oregon, and California north of Point Conception (PFMC, 1999).

The west coast groundfish management unit includes 83 species that typically live on or near the bottom of the ocean. Species groups include skates and sharks, rockfish, flatfish, and groundfish.

The west coast pelagic management unit includes the pacific sardine (*Sardinops sagax*), pacific chub *(Scomber japonicus*), northern anchovy (*Engraulis mordax*), jack mackerel (*Trachurus symmetricus*), and market squid (*Loligo opalescens*). These fish are primarily associated with the open ocean and coastal areas (PFMC, 1998).

The EFH designation for groundfish and coastal pelagics is defined as those waters and substrate necessary to ensure the production needed to support a long-term sustainable fishery. The marine extent of groundfish and coastal pelagic EFH includes those waters from the nearshore and tidal submerged environment within Washington, Oregon, and California state territorial waters out to the exclusive economic zone (370. 4 km [231.5 miles]) offshore between Canada and the Mexican border.

The Washington State Salmonid Stock Inventory (WDFW, 1992) identifies five salmonid stocks within the study area as "depressed": Cedar River sockeye, Lake Washington beach sockeye, Lake Washington/Sammamish tributary sockeye, Lake Washington/Sammamish tributary coho, and Lake Washington winter steelhead. A depressed stock is defined as "one whose production is below expected levels, based on available habitat and natural variation in survival rates, but above where permanent damage is likely." Escapement for each of these stocks is on a declining trend (WDFW, 1992). Any cumulative adverse effects of the I-405 Corridor Program projects would be likely to contribute to such declining trends.

Detailed information on the current state of fish populations and habitats is presented under the "affected environment" in Section 3.8, and in the *I-405 Corridor Program Draft Fish and Aquatic Habitat Expertise Report* (DEA, 2001c).

Cumulative and Secondary Effects of I-405 Corridor Program Alternatives

In comparing the I-405 Corridor Program alternatives, the No Action Alternative scenario is identical to the baseline conditions for the study area. This is because the baseline conditions do not reflect current conditions, but instead assume completion of currently committed projects.

Based on these estimates, planned growth in human populations and land use development will undoubtedly increase the likelihood of substantial unavoidable adverse cumulative effects to fish habitat and populations. Transportation programs included in *Destination 2030*, including I-405, I-5, and Trans-Lake Washington programs, are expected to increase pressure for growth along major transportation corridors within the UGA, thus relieving pressure and reducing adverse effects on the rural areas that contain the most functional fish habitat. All of the action alternatives for the I-405 Corridor Program would influence pressure for growth in this manner. However, since the proposed I-405 Corridor Program improvements are only a portion of the overall MTP, the differences among the I-405 action alternatives would not alter the overall cumulative effect of the MTP and planned growth and development to a meaningful degree.

One quantitative way to compare potential cumulative effects among alternatives is to compare each alternative's share of the projected total new impervious surface created. As described previously, new impervious surface is the most reliable predictor of aquatic habitat degradation. By this measure, Alternative 4 would have the greatest cumulative effect, creating 24 percent of new roadway miles in the study area. Alternatives 2 and 3 would have much lower levels of cumulative effects, creating 13 percent and 16 percent of new roadway miles, respectively. Alternative 1 would have the lowest impact, creating 4 percent of new roadway miles.

Cumulative effects under the Preferred Alternative would be similar to those under Alternative 3. Slightly higher pressure for growth effects would occur north and south of the study area. The growth pressure effects in the study area are not likely to result in substantial effects to fish.

In contrast, the No Action Alternative (baseline condition) would result in the continuation of pressure for growth in rural areas or at the fringe of the UGA. If allowed to occur by local land use regulatory agencies, that pattern of growth would have the potential to shift effects on fish and aquatic habitat from inside the UGA to outside the UGA or from more urbanized areas within the study area to the less developed fringe portions of the UGA. Under the No Action Alternative, future growth in employment and households and resulting development is forecast to be concentrated in Seattle, southwest Snohomish County, Tukwila, Federal Way, Woodinville, and Bothell. While the first four of these areas are nearer build-out, cumulative effects may pose a threat to fish and aquatic habitat, particularly in the southwest Snohomish County and Woodinville areas.

None of the action alternatives would contribute substantially to altering the negative trends in salmon populations discussed in Section 3.8.5.2. After several tens of thousands of years of sustained viability through natural fluctuations, the recent sharp downward trend in salmon populations has corresponded to the rapid increase in human population. The high rate of population growth has driven all of the acute adverse impact mechanisms in the study area and the Puget Sound ESU, including, most notably, habitat alteration. Because the human population of the Puget Sound ESU is expected to increase by well over one million in the next 30 years, reverses in the decline of salmonid populations cannot reliably be assumed, regardless of which I-405 Corridor Program alternative is implemented.

3.23.4.6 Farmlands

Farmland Trends

Prime farmlands in Washington have decreased about 5 percent in the 1982 to 1997 time period, mostly because of urban development, transportation, and rural residential development. Most

of the losses have occurred in counties other than King and Snohomish. Trends in western Washington are expected to continue, and gains and losses in eastern Washington (the Columbia Basin) likely will create a balance. Since 1959, almost 60 percent of King County's prime agricultural land has been lost to urban and suburban development. Of the 100,000 acres available for farming 40 years ago, today only 42,000 acres remain in agriculture. However, the amount of agricultural land has stabilized due, in large part, to a variety of federal regulations and county policies and initiatives to conserve these commercially viable resource-based lands (King County, 2001).

Agricultural lands and farming provide many benefits to the citizens of King County including scenic open space, a connection to cultural heritage, fresh local foods, and a diverse economy. In 1992, farmers in King County produced over $84 million in agricultural sales. Commercial agricultural production, however, has declined by 30 percent in gross sales since 1978. All indicators of farmlands and agricultural activity in King County have been decreasing.

Between 1987 and 1992 (the latest year for which figures are available), the number of farms and orchards, the total amount of land devoted to farming, and the income of agricultural production all decreased within the county. The average size of farms in the county remained stable at about 36 acres. The rate of farmland loss is decreasing, however, with 22 percent of farm acreage lost between 1987 and 1992, but only 2 percent lost between 1992 and 1997. See Figures 3.23-19 and 3.23-20 for illustrations of the count of farms and acreage devoted to farming between 1982 and 1997 in King County.

Figure 3.23-19: Census Count of Farms

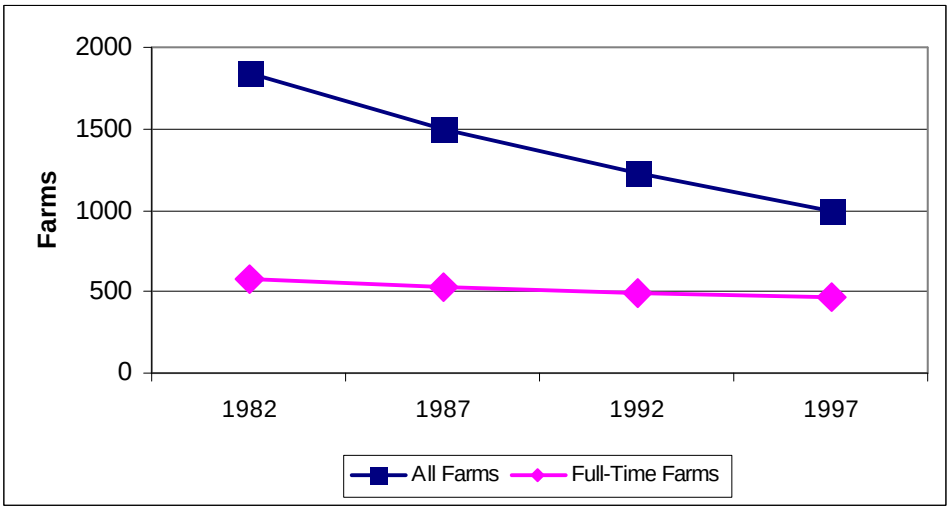
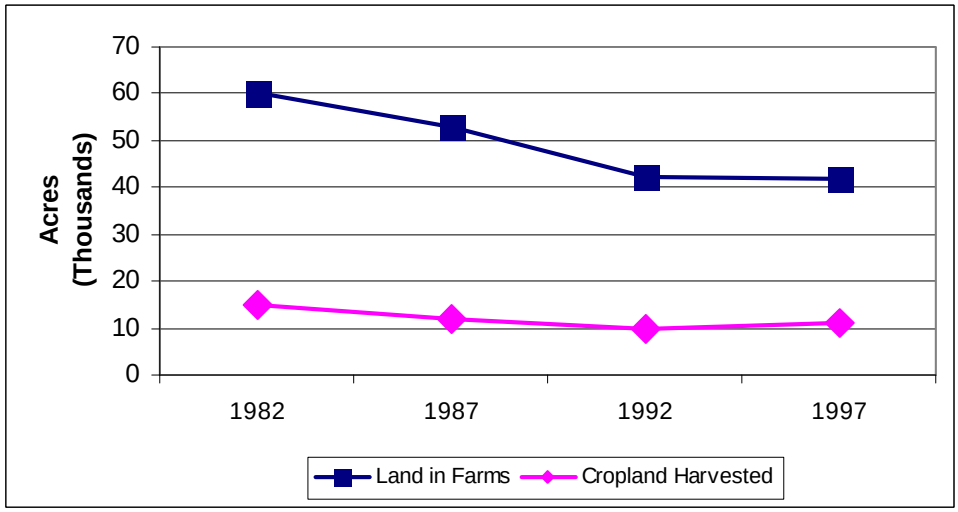


Figure 3.23-20: Land in Farming Use



In other parts of the central Puget Sound region the farmlands picture is mixed. Both Snohomish County farmland acreage and number of farms are decreasing more rapidly than in King County. Pierce County farmland and farms continue to decrease, but only moderately, while in Kitsap County the farms are rapidly increasing in number and size. Overall, the future trend in preservation of farmlands is expected to remain constant due to regulatory influence.

Regulatory Trends

The only farmlands in the I-405 Corridor Program study area, the Sammamish Valley farmlands, are not considered "prime" farmlands and therefore are not governed by the federal Farmland Protection Policy Act. They are, however, governed by local regulations, including the Washington State Growth Management Act. To meet the GMA requirement to maintain and enhance agricultural lands, several methods and programs were established. Detailed strategies were included in the King County Comprehensive Plan, which addresses agricultural lands both within and outside of the King County Urban Growth Area (UGA).

Within the UGA, in 1995 King County established Agricultural Production Districts (APDs) to preserve designated farmland. Agricultural Production Districts present the least number of land use conflicts for agriculture, contain agricultural support activities, and provide the best environment for farming in King County. King County has committed to maintaining Agricultural Production District parcels in or near the UGA fringe because of their high production capabilities, their proximity to markets, and their value as open space. The five Agricultural Production Districts within King County are: the Sammamish Valley (where program improvements are expected), the Snoqualmie Valley, the Lower Green River Valley, the Upper Green River Valley, and the Enumclaw Plateau. The Comprehensive Plan requires use of multiple strategies to protect farmlands within the UGA, such as agricultural zoning, minimum parcel size, limits on new construction, and limits on road and utility construction.

The County has developed specific incentives to encourage agricultural activities in the remaining prime farmlands. In 1979, the Farmland Preservation Program (FPP) became the first voter-approved measure in the nation to protect farmland in a metropolitan area. By purchasing

the development rights with public funds, the FPP keeps farmland open and available through covenants that restrict development and limit the properties' uses exclusively for agriculture and open space. The covenants "run with the land" in perpetuity so the land is protected regardless of ownership. Under the FPP, the County owns the development rights; however, the lands remain in the private ownership of over 200 property owners. The County cannot sell or remove its interest in FPP lands with the exception of conveying public road or utility easements.

In 1995, the County approved an additional $3 million for the purchase of additional development rights under the Farmland Preservation Program. In October 1999, the County formally recognized the 20th anniversary of the Farmland Preservation Program and its success to date in preserving over 12,800 acres of farmland for the generations of today and tomorrow. FPP lands lie mostly within Agricultural Protection Districts.

Outside the UGA, the most intensive efforts to preserve agricultural lands in King County are concentrated in the rural areas. The Growth Management Act requires that urban development occur within the UGA, and that rural development remain contained and controlled to protect natural resources uses such as farming. In addition, King County refrains from providing an urban level of infrastructure and services to the rural area. Improvements to the transportation system by King County and Washington State to serve the designated Rural Area are limited to improvements needed for safety and environmental quality. Improvements to existing interstate or state highways, King County roads in the Rural Area, and new connections between the UGAs that pass through Rural Areas, are designed to avoid pressure to convert to urban uses. King County does not construct and opposes the construction by other agencies of any new arterials or freeways in the Rural Area or Natural Resource Lands except in rare circumstances.

In addition to infrastructure restrictions, King County has also developed a market-based approach to preserve farmland outside the UGA. Through the Transfer of Development Credits Program, individuals sell the right to develop their land, but development takes place at another, more appropriate location. The agricultural land must then remain in a natural state.

Future trends expected in agricultural land policy include the following:

- Government budgetary pressure: The pressure to control budget expenses will likely continue to increase. Agricultural conservation has generally not done well in competition with other budget objectives. However, one recent study found that suburban residents' willingness to pay for the conservation of agricultural lands is considerable (Long, 1999). This is the case in King County, where the Farmlands Preservation Program is publicly financed.
- Rising income and population shift from rural to urban and suburban areas: Ervin (1998) cites government surveys which show the majority of the public want to preserve agricultural lands. This is consistent with the demands of relatively wealthy urban King County residents for greenspace and outdoor recreation areas. Unavailability of land may force the public to choose between preservation of private farmland and acquisition and development of land for active recreational use.
- Increasing public attention to and understanding of environmental protection and greenspace issues: The public increasingly understands the role open space and natural areas play in environmental protection and wildlife conservation. This contrasts with their perception of farming as an industrialized activity and a source of pollution. However, in King County,

most farms are under 50 acres, which may contribute to their image as natural lands rather than industrial areas.

- Public demand for organic and locally produced food: Primarily for health reasons, organic foods have captured increasing market share. Certified organic cropland in the United States more than doubled from 1992 to 1997, and two organic livestock sectors, eggs and dairy, grew even faster (Economic Research Service, 2001). Rising income, worries about food-borne illness, and the adoption of the Organic Foods Production Act of 1990 can be expected to fuel this increase. Public perception of foods grown locally as safer and more palatable may explain the public's willingness to preserve local farmland.
- Increasing use of market mechanisms and public/private partnerships to preserve agricultural lands: King County is a national leader in the use of market mechanism to preserve agricultural land. Through the Transfer of Developments Credits Program, the market drives individual farm owners to sell their development rights, thus transferring development to more appropriate areas of the county. Critics of this market-based approach note that the haphazard preservation of small parcels will not save land in a way that makes it feasible to farm profitably (Ervin, 1998). However, given the public's preference for market-driven solutions, the use of this type of program is likely to continue or increase.
- Streamlined regulatory process: Washington State is already beginning to experiment with streamlining multiple, often conflicting environmental programs. The hope is that streamlined processes would decrease the costs of participating in farmland preservation programs. Again, the public's desire for reduced government makes this trend likely to expand and continue, although the involvement of multiple government agencies at local, state, and federal levels makes the challenge considerable.

Cumulative and Secondary Effects of the I-405 Corridor Program Alternatives

Several key factors are important to note in the evaluation of cumulative effects on farmlands:

- No prime farmlands are located in the I-405 Corridor Program study area.
- Farmlands in the corridor are protected by the FPP, but are allowed to be converted.
- Regulations have slowed the conversion of farmlands.
- All of the I-405 Corridor Program alternatives are compatible with existing regional and local land use plans that already address planned growth.

All of the effects on farmlands within the I-405 Corridor Program study area are in the Sammamish Valley region. The effects all result from road widening improvements, which have a linear impact on farmlands without affecting the majority of the farms or causing additional fragmentation of local farms.

Cumulative effects on farmlands within the study area are a result of assumed increases in pressure for development relative to other parts of the study area in and near the Sammamish Valley farmlands. For those farmlands not converted, the increased pressure for development could result in an increase in adjacent land uses that are not compatible with agriculture, reduction or loss of the economic and business infrastructure necessary to support viable agricultural uses, and increased impervious surface run-off that could effect the additional farmlands. Again, these farmlands are low quality farmlands of statewide or local importance only, and are not federal prime or unique farmlands.

Effects on farmlands outside the UGA could be reduced relative to the more urbanized areas within the study area because of the decreased development pressures there and because of the emphasis on the FPPA and the King County FPP, that protect all potentially affected farms from development and conversion to other land uses.

The No Action Alternative could result in somewhat greater pressure for growth in rural areas or at the fringe of the UGA than the action alternatives, although the difference would be small. If allowed to occur by local land use regulatory agencies, that pattern of development would have the potential to influence some additional effects on farmlands outside the study area. Under the No Action Alternative, planned growth in employment and households and resulting development is forecasted to be concentrated in Seattle, southwest Snohomish County, Tukwila, Federal Way, Woodinville, and Bothell. While the more central of these areas are nearer build-out, farmlands located closest to the southwest Snohomish County and Woodinville areas may experience some cumulative effects from this growth.

Under the No Action Alternative, two areas of farmland would potentially be directly affected. Widening improvements could impinge on a total of 5.9 acres of farmland. In addition, 4,000 households with associated development could contribute to the effects on the Sammamish Valley farmlands. No prime or unique farmlands would be affected during construction or operation.

Cumulative effects under Alternative 1 would be the same as those discussed under the No Action Alternative.

Under Alternative 2, two areas of protected farmland potentially would be directly affected beyond those identified in the No Action Alternative. Improvements could impinge on a total of 6.1 acres of farmland. This effect is nearly as low as for the No Action Alternative and Alternative 1. In addition, 4,500 households with associated development could contribute to the effects on the Sammamish Valley farmlands. No prime or unique farmlands would be affected during construction or operation.

Under Alternative 3, three areas of protected farmland potentially would be directly affected beyond those identified in the No Action Alternative. The improvements could impinge on a total of 12.9 acres of farmland. This level of impact is about midway between the best- and worst-ranked action alternatives. In addition, 4,500 households with associated development could contribute to the effects on the Sammamish Valley farmlands. No prime or unique farmlands would be affected by construction or operation.

Alternative 4 includes seven areas of farmland potentially directly affected beyond those identified in the No Action Alternative. These improvements could impinge on a total of 20.1 acres of farmland. In addition, 4,500 households with associated development could contribute to the effects on the Sammamish Valley farmlands. No prime or unique farmlands would be affected during construction or operation.

Cumulative effects under the Preferred Alternative would be similar to those under Alternative 4. The Preferred Alternative includes seven areas of farmland potentially directly affected beyond those identified in the No Action Alternative. These improvements could impinge on a total of approximately 20 acres of farmland. Slightly higher pressure for growth effects would occur north and south of the study area. The growth pressure effects in the study area are not likely to result in substantial effects to farmlands.

3.23.5 Conclusion

The analysis of cumulative and secondary effects indicates that planned growth in population and employment, as expressed through *VISION 2020* and *Destination 2030*, and the development that will be associated with this growth are by far the most substantial actions affecting the magnitude and severity of cumulative effects in the central Puget Sound region and I-405 corridor. Although the *direct* effects of the I-405 Corridor Program alternatives are expected to be substantial for some critical resources such as fish and aquatic habitat, their incremental contribution to overall *cumulative* effects within the region would generally be very small when compared to the combined effects of other past, present, and reasonably foreseeable future actions.

The I-405 Corridor Program alternatives that are expected to have greater direct impacts on the scoped critical resources would also have greater cumulative effects; however, for the reasons discussed above, the differences in cumulative effects among the alternatives would be minor relative to the overall level of cumulative effect anticipated due to other past, present, and reasonably foreseeable future actions. In addition, proposed mitigation for direct effects coupled with other federal, state, and local permitting and preservation activities will reduce any cumulative and secondary effects.

The review of potential cumulative and indirect effects also shows the following:

- The daily VMT in the central Puget Sound region is expected to increase to 79 million miles per weekday by 2010, but then level off to 94 million miles per weekday by 2030 under the *Destination 2030* plan (PSRC, 2001a).
- Hydrocarbon emissions, which largely drive ozone formation in the central Puget Sound region, are projected to increase between 2010 and 2020.
- Cumulative and secondary effects on air pollutant emission levels in 2020 are very similar under all of the alternatives, and are not expected to be substantial.
- While historical trends over the last 10 to 15 years reflect a lack of progress in fuel economy, new technologies used in hybrid vehicles indicate improvements on the order of 100 to 200 percent may be possible (USEPA, 2000).
- Fuel consumption is expected to decrease between 2020 and 2030 as a result of programs under the *Destination 2030* plan.
- Cumulative and secondary effects on fuel consumed due to operation of surface transportation are similar under all alternatives, and are not expected to be substantial. The I-405 Corridor Program action alternatives could contribute up to 9 percent of the increase in fuel consumption in the region over the next 20 years.
- Recent and anticipated regulatory programs assure that the rate of hydrologic and water quality degradation in developing areas will be greatly reduced from those that historically occurred.
- The relatively slow rate of large-scale redevelopment in urbanized areas and the difficulty of incorporating effective stormwater control measures in densely developed areas makes it unlikely that the hydrologic conditions of the urbanized portions of streams in the study area will greatly improve within the 2030 timeframe.

- Even with implementation of stormwater detention and treatment measures for all new development, increases in pollutant loads and reductions in seasonal base flows and associated increases in summer stream temperature may occur in many of the streams draining the I-405 corridor. This is expected to be a substantial adverse cumulative effect.
- Cumulative and secondary effects on surface water are similar under all alternatives, with the I-405 Corridor Program improvements potentially contributing between 1 and 8 percent of the new impervious surface in the study area over the next 20 years.
- Planned household and employment growth is estimated to result in a 26 percent increase in impervious coverage in the study area over the next 20 years.
- More than 90 percent of the wetlands in urban areas in Washington have been lost. Despite the goal of "no net loss," studies show that these goals are not being met.
- Cumulative and secondary effects on wetlands within the more urbanized study area and UGA could increase as a result of greater pressure for growth and development within the Urban Centers along the I-405, SR 167, and I-90 corridors. This would be partially offset by a reduction in impacts on wetlands in rural areas outside the UGA resulting from reduced pressure for growth and development in those areas.
- Cumulative and secondary effects on wetlands are similar under all action alternatives, and are not expected to be substantial.
- Nearly all native salmonid populations in the region have experienced a severe declining trend since the human population began rapidly increasing over the past century.
- Planned population growth and land use development in the central Puget Sound region will increase the likelihood of substantial adverse cumulative effects to fish habitat and populations.
- Transportation programs included in *Destination 2030*, including the I-405 Corridor Program action alternatives, are expected to increase pressure for growth along major transportation corridors within the UGA, thus relieving pressure and reducing adverse effects on the rural areas that contain the most functional fish habitat.
- None of the action alternatives would contribute substantially to altering the negative trends in salmon populations in the central Puget Sound region. Reverses in the decline of salmonid populations cannot reliably be assumed, regardless of which I-405 Corridor Program alternative is implemented.
- Cumulative and secondary effects on farmlands are nearly identical under all of the alternatives, and are not expected to be substantial.