

# VISION 2050

## **Draft Supplemental Environmental Impact Statement**

### **Appendix C Modeling Methodology and Analysis Tools**



Puget Sound Regional Council

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# Appendix C: Modeling Methodology and Analysis Tools

*This appendix provides a detailed description of the modeling process and analysis of the three VISION 2050 alternatives – Stay the Course, Transit Focused Growth, and Reset Urban Growth – for this Supplemental Environmental Impact Statement (SEIS).*

Section C.1 provides an overview of models and tools used in the modeling process. Section C.2 documents key technical assumptions and methodologies used to develop and model the three alternatives. Section C.3 presents the data indicators generated through the modeling process used to evaluate the differential outcomes and impacts of the alternatives.

## C.1 Models and Tools

This section provides an overview of the full suite of PSRC forecasting tools used to model the SEIS alternatives and generate the evaluation metrics used to analyze the alternatives.

Figure C.1-1. PSRC Model Suite for Analyzing SEIS Alternatives



### C.1.1 Regional Macroeconomic Model and Forecast

#### Purpose

The Puget Sound Regional Macroeconomic Model was used to produce PSRC's 2018 Regional Macroeconomic Forecast, which establishes long-range regional growth assumptions for population, households, and employment out to the year 2050. The regional forecast values serve as control totals for developing the population and employment growth allocations by county and regional geography that define the three SEIS alternatives. The regional forecast and subregional growth assumptions for each alternative then serve as controls and key inputs to the UrbanSim land use model.

#### Model/Tool

The Puget Sound Regional Macroeconomic Model and 2018 Regional Macroeconomic Forecast were developed by the economic consulting firm ECONorthwest. The regional model

is structured in a top-down manner, with productivity, aggregate employment, income, and inflation forecast initially, followed by subsequent modules for demographic composition and industry detail. The model equations are estimated using over four decades of historical data. It also utilizes two key exogenous elements: a) an extension of results from the well-regarded national macroeconomic model developed and maintained by Yale University professor Ray Fair, and b) an Aerospace employment forecast based on global demand projections and labor productivity trends. The current model has been refined to better capture the effects of the demographic aging transition underway nationally and its workforce implications. The model now also includes a new housing supply module that explicitly accounts for the role of housing price in the behavior of the regional economy and demographics.

## **Key Assumptions**

The latest 2018 Regional Macroeconomic Forecast assumes:

- The region is projected to reach a total of 5.8 million people and 3.4 million jobs by the year 2050. This translates into an additional 1.8 million people and 1.2 million jobs being added to the region between 2017 and 2050.
- The jobs forecast reflects a slight upward increase from PSRC's preceding forecast (2014), attributable to the strength of the regional economy relative to the broader U.S. economy in the economic recovery period following the last recession.
- The population forecast reflects a more substantial upward adjustment from the previous forecast series, in part due to the higher jobs forecast but primarily due to model adjustments that better account for the relationship between job growth, the workforce population, and the aging of the boomer generation in the forthcoming decades.
- The region is projected to add 830,000 households to reach a total of 2.4 million households by the year 2050. Average household size, which has been relatively stable over the last two and a half decades, is anticipated to begin declining again as boomers age and the number of empty-nester and one-person households increases. Decreasing fertility rates also contribute to this trend. A smaller persons-per-household ratio translates into a greater demand for housing to meet the needs of a growing population.

## **C.1.2 UrbanSim Land Use Model**

### **Purpose**

PSRC used its UrbanSim model as a tool for modeling the population and employment growth allocations that define each SEIS alternative. The model simulates how the growth is likely to occur within the development parameters established through local current comprehensive plans and zoning regulations. As such, it is a helpful predictor of growth patterns, but it cannot account for growth that may be influenced by future comprehensive plan and zoning updates. The land parcel-level output supports several land use evaluation metrics used to analyze the

differential impacts of each SEIS alternative. The UrbanSim output also serve as inputs to the regional travel demand model and other analyses.

## **Model/Tool**

UrbanSim is an agent-based microsimulation model that predicts land development and the location choices of households and jobs over time at the land parcel level. Land development is a function of zoned land uses, allowable densities, and market forces (e.g., demand, real estate prices, profitability of new development). Location choice decisions are simulated based on various factors that households/persons and firms/jobs consider when moving to or relocating within the region (e.g., price, building size, proximity to other types of land use, commute times).

UrbanSim is run parallel to the SoundCast travel model (described below) within an integrated model framework that incorporates feedback loops from SoundCast at selected intervals (years). The feedback loop is comprised of accessibility factors from SoundCast that are used by various UrbanSim sub-models. To learn more, visit: <https://www.psrc.org/urbansim-parcel-based-land-use-model>.

## **Key Assumptions**

Key assumptions embedded in the UrbanSim model and simulation of the SEIS alternatives include:

- Jurisdiction-level growth assumptions (population, households, employment) for individual cities, urban unincorporated planning areas, and rural areas serve as control totals and key demand drivers in the UrbanSim model framework. These assumptions are derived from the county and regional geography-level growth allocations for each alternative in conjunction with locally developed growth targets.
- Development parameters in the model were established based on local comprehensive plans and zoning regulations circa 2015/2016, with selected updates for major rezones. The model does not account for anticipated plan and zoning updates required under GMA and that may be expected at transit station areas to support transit-oriented development.
- Accessibility factors from the SoundCast travel model inform the location choices of households and jobs and the attractiveness of available land for development within UrbanSim.

## **C.1.3 SoundCast Travel Model**

### **Purpose**

PSRC has developed a customized set of software programs and mathematical procedures to simulate current and future travel patterns and conditions within the central Puget Sound region. These programs and procedures are collectively referred to as the “SoundCast regional travel demand forecasting model” or simply as the “SoundCast travel model.” The travel model produces detailed spatial and network data that are used to analyze how the

region's transportation infrastructure and environment are likely to be impacted by future growth and development as represented by the VISION 2050 growth alternatives. Model outputs are useful for identifying differences in alternative performance, but do not fully predict future behavior. Selected travel model outputs also serve as inputs to both UrbanSim and the regional air quality model and analysis.

## **Model/Tool**

PSRC used its SoundCast travel model to analyze the transportation-related impacts of the three growth alternatives. SoundCast is an activity-based model which represents how individual people travel to conduct their daily activities, as compared to the previous zone-based model which aggregately represented trips between zones. As an activity-based model, SoundCast allows for improved representation of travel behavior as well as greater temporal and spatial resolution to better evaluate the impacts of alternative land use and development patterns. To learn more, visit: <https://www.psrc.org/activity-based-travel-model-soundcast>.

The current SoundCast model operates on a 2014 base year, with key variables validated against PSRC's 2014 regional household travel survey. The analysis of alternatives is not significantly impacted by the base year being in 2014 (versus 2017) since any differences would be small compared to the expected change by the year 2050.

## **Key Assumptions**

The key input assumptions for any travel demand analysis framework include a set of land use growth allocations (representing demand conditions) along with transportation projects, policies, and network attributes (representing supply conditions):

- For the travel demand analysis conducted on the three growth alternatives, parcel-level population, household, and employment outputs from the UrbanSim model for each of the SEIS alternatives comprise the key land use assumptions.
- The set of transportation projects and policies enumerated in the [2018 Regional Transportation Plan](#) provide the future (year 2040) transportation network assumptions used by SoundCast for this analysis.

## **Limitations of the Model**

SoundCast is estimated using transportation mode choice data from PSRC's Regional Household Travel Survey. However, bus rapid transit and light rail services in the Puget Sound region are still in their infancy and available survey data may not yet fully predict user behavior in response to high capacity transit. Additionally, planning and improvements that may occur to make stations more accessible are not accounted for in the model. Subarea planning, local street improvements, and supportive bus service may be employed at future stations to enhance performance. Local planning and improvements are likely to result in greater transit ridership at station areas than reported in the modeling results.

## **C.1.4. MOVES Mobile Source Emissions Model**

### **Purpose**

The air quality model estimates future regional motor vehicle emissions of criteria pollutants and greenhouse gases. The analysis combines mobile source emissions factors from the U.S. Environmental Protection Agency's latest Motor Vehicle Emission Simulator (MOVES) model and output from the travel demand model, including link-specific vehicle miles traveled and vehicle speed.

### **Model/Tool**

PSRC used the most recent version of the MOVES model, [MOVES2014a](#), to develop emissions factors used to conduct the air quality analysis of the SEIS alternatives. The MOVES2014a model represents EPA's most up-to-date assessment of on-road mobile source emissions, including incorporation of the most current vehicle, fuel, and emissions standards and new and updated emissions data from a variety of test programs and other resources. Metropolitan planning organizations are required to use this updated tool for regional emissions analyses for transportation conformity determinations.

### **Key Assumptions**

The assumptions underlying the air quality analysis are as follows:

- The fleet mix and age distribution from the base year are used.
- The model accounts for the phase-in of current emissions standards, inspection/maintenance programs, fuel standards, and engine technology, and contains assumptions regarding the rate of vehicle changeout and fleet turnover for each forecast year.
- The model does not predict future changes in regulations or technological advances, and PSRC does not make any additional assumptions about the future vehicle fleet inputs to the model.

## **C.2 Modeling the VISION 2050 SEIS Alternatives**

The VISION 2050 SEIS alternatives represent distinct patterns of future growth. The alternatives were designed to allow this environmental analysis to consider the effects of extending the current growth strategy to 2050 and the potential impacts of adjustments to that strategy. This section describes the key technical assumptions and methodologies applied in developing and modeling the three alternatives. For a full description of the VISION 2050 alternatives, see Chapter 3 – Alternatives Evaluated.

## C.2.1 Key Technical Assumptions

### Regional Growth Assumptions

Future assumptions of regional population and employment growth for the 2017 to 2050 planning period—1.8 million additional people and 1.2 million additional jobs—were held constant under all three alternatives. These growth assumptions were derived from PSRC’s 2018 Regional Macroeconomic Forecast.

Table C.2-1. Regional Population and Employment Growth Assumptions

	Forecast Growth 2017-2050
Regional Population	1,756,000
Regional Employment	1,158,000

### County Growth Shares

The distribution of forecast population and employment growth across the region’s four counties represents another important technical assumption applied in developing the SEIS alternatives.

**Stay the Course.** The Stay the Course (or no action) alternative, by definition, uses county population and employment growth shares from the adopted VISION 2040 Regional Growth Strategy. The VISION 2040 county growth shares, which are for the 2000 to 2040 time period, were applied to regional growth assumptions from the 2018 Macroeconomic Forecast for an extended 2000 to 2050 time frame, then adjusted to account for the growth that has already occurred from 2000 through 2017.

The resulting county growth shares for the 2017 to 2050 period represent what is needed for the region to achieve the desired distribution of population and employment growth across counties as expressed in the current strategy by the year 2050 starting from a 2000 base year. In other words, if a county grew faster or slower over the past 17 years than envisioned by the current strategy, then its 2017 to 2050 growth share rebalances the county’s trajectory to achieve the 2050 goal.

Table C.2-2. County Population and Employment Growth Shares – Stay the Course

	Population			Employment		
	VISION 2040	Stay the Course		VISION 2040	Stay the Course	
	% Share 2000-2040	% Share 2017-2050	Growth 2017-2050	% Share 2000-2040	% Share 2017-2050	Growth 2017-2050
King County	42%	38%	661,000	57%	57%	662,000
Kitsap County	9%	11%	189,000	5%	6%	66,000
Pierce County	23%	24%	426,000	17%	17%	203,000
Snohomish County	26%	27%	480,000	20%	20%	228,000
Region	100%	100%	1,756,000	100%	100%	1,158,000

**Action Alternatives.** The county growth shares in the adopted Regional Growth Strategy were developed using trend data and forecasts circa 2005/06. Recognizing that these assumptions warranted reevaluation, PSRC reviewed a range of available data resources to establish a revised set of baseline county growth shares for the two action alternatives—Transit Focused Growth and Reset Urban Growth. These assumptions were discussed and vetted with PSRC’s Land Use Technical Advisory Committee (LUTAC).

**Population.** To update county population growth assumptions, PSRC turned to the Washington Office of Financial Management’s (OFM) [2017 Supplemental Population Projections](#), which extended the latest Growth Management Act (GMA) Population Projections for Counties from 2040 out to 2050. Counties are required under the state GMA to plan for future growth using OFM projections; therefore they are a widely recognized and relevant forecast resource to inform VISION 2050.

PSRC derived 2017 to 2050 county percent growth shares from OFM’s supplemental population projections (Medium series) and applied them to the regional population growth assumptions from PSRC’s Macroeconomic Forecast to arrive at the 2017 to 2050 county population growth assumptions used in the Transit Focused Growth and Reset Urban Growth alternatives.

Table C.2-3. County Population Growth Shares by Alternative

	Stay the Course		Transit Focused Growth		Reset Urban Growth	
	% Share 2017-2050	Growth 2017-2050	% Share 2017-2050	Growth 2017-2050	% Share 2017-2050	Growth 2017-2050
King County	38%	661,000	50%	872,000	50%	872,000
Kitsap County	11%	189,000	5%	97,000	5%	97,000
Pierce County	24%	426,000	21%	364,000	21%	364,000
Snohomish County	27%	480,000	24%	424,000	24%	424,000
Region	100%	1,756,000	100%	1,756,000	100%	1,756,000

The revised baseline county population growth assumptions used in the action alternatives redistribute a substantial share of future growth into King County (+211,000) when compared to allocations under Stay the Course, primarily from Kitsap County (-93,000), but also from Pierce County (-63,000) and Snohomish County (-56,000). These assumptions were

compared to and evaluated for reasonableness against several historical reference data points and were determined to be realistic.

**Table C.2-4. Actual and Forecast County Population Growth Shares**

	Actual			VISION 2040	Action Alternatives
	% Share 1990-2017	% Share 2000-2017	% Share 2010-2017	% Share 2000-2040	% Share 2017-2050
King County	49%	53%	59%	42%	50%
Kitsap County	6%	4%	4%	9%	5%
Pierce County	21%	20%	17%	23%	21%
Snohomish County	25%	23%	20%	26%	24%
Region	100%	100%	100%	100%	100%

**Employment.** On the employment side, with no comparable forecast resource available, PSRC chose to use county-level population-to-job ratios derived from present conditions to convert the revised baseline county population assumptions to employment. This approach assumes the current distributional pattern of population and jobs across the region today will carry into the future.

PSRC boards and committees provided guidance that the employment shares should be further adjusted to encourage additional employment growth in Kitsap, Pierce, and Snohomish counties to promote a better balance of jobs and housing across the region. As a result, the final version of the county employment growth shares in the action alternatives reflects a 5 percentage point shift of regional employment from King County to Kitsap (+1 percentage point), Pierce (+2 percentage points), and Snohomish (+2 percentage points) counties. The development of the VISION 2040 Regional Growth Strategy included a similar adjustment for population and employment to support a better balance across the counties.

**Table C.2-5. County Employment Growth Shares by Alternative**

	Stay the Course		Transit Focused Growth		Reset Urban Growth	
	% Share 2017-2050	Growth 2017-2050	% Share 2017-2050	Growth 2017-2050	% Share 2017-2050	Growth 2017-2050
King County	57%	662,000	59%	682,000	59%	682,000
Kitsap County	6%	66,000	5%	57,000	5%	57,000
Pierce County	17%	203,000	17%	195,000	17%	195,000
Snohomish County	20%	228,000	19%	225,000	19%	225,000
Region	100%	1,158,000	100%	1,158,000	100%	1,158,000

The updated county employment growth assumptions for the 2017 to 2050 period were determined to be consistent with historical trends as well as with the subregional forecast assumptions used to develop the VISION 2040 Regional Growth Strategy for employment.

Table C.2-6. Actual and Forecast County Employment Growth Shares

	Actual			VISION 2040	New Baseline	Action Alternatives
	% Share 1990-2017	% Share 2000-2017	% Share 2010-2017	% Share 2000-2040	% Share 2017-2050	% Share 2017-2050
King County	N/A	57%	73%	57%	64%	59%
Kitsap County	N/A	4%	2%	5%	4%	5%
Pierce County	N/A	17%	11%	17%	15%	17%
Snohomish County	N/A	22%	14%	20%	17%	19%
Region	N/A	100%	100%	100%	100%	100%

**Regional Geographies.** Regional geographies provide a central organizing framework for the Regional Growth Strategy, in which cities, unincorporated urban communities, rural areas, and resource lands are classified according to the roles each are expected to play in accommodating future growth and implementing the strategy.

VISION 2040 defines regional geographies among cities primarily based on regional growth centers and jurisdictional size. Since VISION 2040 was adopted, eight cities have been reclassified from Small Cities to Larger Cities. City reclassifications and member feedback about the geographies generated significant board discussion about the criteria and expectations for different types of places and prompted a new look at definitions of regional geographies for the VISION 2050 update.

Based on scoping comments and direction from the Growth Management Policy Board, PSRC developed an updated classification of cities and unincorporated urban areas. Changes are intended to clarify distinctions between places based on access to high-capacity transit; for urban unincorporated areas, planning status regarding annexation or incorporation is also taken into account.

The VISION 2050 SEIS alternatives use the revised classification system presented in the table below to express how county population and employment growth allocations are distributed across the region.

Table C.2-7. VISION 2050 Regional Geographies

<b>Metropolitan Cities</b>   Central cities in the county that serve as civic, cultural, economic and transportation hubs and have at least one regional growth center				
Bellevue	Bremerton	Everett	Seattle	Tacoma
<b>Core Cities</b>   Major cities and urban areas with transit and designated regional growth centers				
Auburn Bothell Burien Federal Way	Issaquah Kent Kirkland	Lakewood Lynnwood Puyallup	Redmond Renton SeaTac	Silverdale Tukwila University Place
<b>High-Capacity Transit (HCT) Communities</b>   Other cities and unincorporated urban areas (planned for annexation or incorporation) with high-capacity transit. High-capacity transit is defined as existing or planned light rail, commuter rail, ferry, streetcar, and/or bus rapid transit.				
Arlington Bainbridge Island Bothell MUGA Des Moines DuPont Edmonds Edmonds MUGA	Everett MUGA Federal Way PAA Fife Fircrest Kenmore Lake Forest Park	Larch Way Overlap Lynnwood MUGA Marysville Mercer Island Mill Creek Mill Creek MUGA	Mountlake Terrace Mukilteo Mukilteo MUGA Newcastle North Highline Renton PAA	Port Orchard Poulsbo Shoreline Sumner Tacoma PAA Woodinville
<b>Cities &amp; Towns</b>   Cities and towns with local transit access or without fixed-route transit				
Algona Beaux Arts Black Diamond Bonney Lake Brier Buckley Carbonado Carnation Clyde Hill	Covington Darrington Duvall Eatonville Edgewood Enumclaw Gig Harbor Gold Bar Granite Falls	Hunts Point Index Lake Stevens Maple Valley Medina Milton Monroe Normandy Park North Bend	Orting Pacific Roy Ruston Sammamish Skykomish Snohomish Snoqualmie South Prairie	Stanwood Steilacoom Sultan Wilkeson Woodway Yarrow Point
<b>Urban Unincorporated Areas</b>   Urban unincorporated areas without high-capacity transit and/or not affiliated for annexation or planned for incorporation				
All Remaining Unincorporated Areas				
<b>Rural</b>   Designated rural lands				
All Designated Rural Areas				
<b>Resource Lands</b>   Designated agricultural, mineral, and forest resource lands				
All Designated Resource Lands				
<b>Major Military Installations</b>   Installations with more than 5,000 enlisted and service personnel				
Joint Base Lewis McChord Naval Base Kitsap – Bangor Naval Base Kitsap – Bremerton Naval Station Everett				

Source: PSRC

MUGA = Municipal Urban Growth Area; PAA = Potential Annexation Area

Similar to Resource Lands, Major Military Installations are assumed to maintain existing levels of population and employment across all alternatives. PSRC does not forecast change on military bases, which plan outside the framework of state and regional policy and are dependent on national and international circumstances.

Tribes are also not subject to the planning requirements of GMA. Counties take differing approaches to account for growth on tribal lands, therefore Tribes are not allocated specific levels of growth under the Regional Growth Strategy.

## C.2.2 Stay the Course (No Action) Alternative

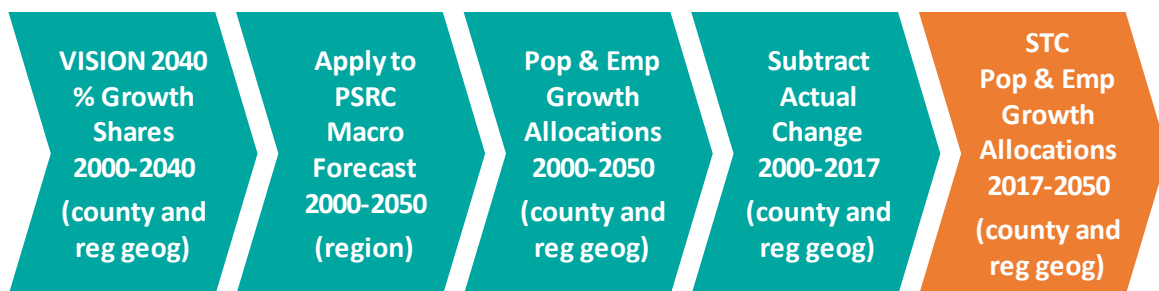
The Stay the Course alternative is a direct extension of the VISION 2040 Regional Growth Strategy. The alternative assumes compact growth, focused in the largest and most transit-connected cities in the region and within the region’s 29 designated regional growth centers. It is the required “no action alternative” that would maintain current policy and must be evaluated under SEPA.

Stay the Course continues to direct the largest shares of the region’s future growth to the region’s five major Metropolitan Cities and their designated centers—Seattle, Bellevue, Everett, Bremerton and Tacoma. It also focuses growth into the region’s Core Cities—other cities with regional growth centers that are concentrations of growth and serve as economic and transportation hubs for the region. Compared to historical trends, this alternative allocates less growth to urban unincorporated and rural areas and more growth to cities.

### Methodology

The Stay the Course alternative is developed using the current Regional Growth Strategy’s assumed distribution of future growth across counties and regional geographies. First, VISION 2040 population and employment growth shares for the 2000 to 2040 time frame were applied to regional growth assumptions derived from PSRC’s Macroeconomic Forecast for an extended 50-year time frame out to 2050. Then, the 2000 to 2050 growth allocations for counties and regional geographies were adjusted to subtract out growth that already occurred between 2000 and 2017.

Figure C.2-1. Stay the Course Methodology



In regional geographies where actual 2000 to 2017 growth was greater than the 2000 to 2050 growth allocation, the 2017 to 2050 allocation was reset from the negative value to zero and the remaining shortfall was proportionally distributed across other regional geographies within the county. The resulting growth assumptions for the remaining 2017 to 2050 period represent what is needed for the region to achieve the desired development pattern expressed in the current growth strategy by the year 2050 starting from a 2000 base year.

**Table C.2-8. 2017-2050 Population and Employment Growth Allocations – Stay the Course**

<b>POPULATION</b>	<b>Metro Cities</b>	<b>Core Cities</b>	<b>HCT Comm</b>	<b>Cities &amp; Towns</b>	<b>Urban Uninc</b>	<b>Rural</b>	<b>Total</b>
King County	39% (259,000)	41% (272,000)	9% (58,000)	8% (53,000)	0% (0)	3% (18,000)	100% (661,000)
Kitsap County	29% (54,000)	15% (28,000)	29% (55,000)	N/A N/A	16% (31,000)	11% (21,000)	100% (189,000)
Pierce County	41% (174,000)	31% (134,000)	6% (26,000)	11% (48,000)	8% (33,000)	3% (11,000)	100% (426,000)
Snohomish County	25% (120,000)	11% (54,000)	35% (169,000)	13% (61,000)	7% (32,000)	9% (44,000)	100% (480,000)
Region	35% (608,000)	28% (488,000)	18% (308,000)	9% (162,000)	5% (96,000)	5% (95,000)	100% (1,756,000)

<b>EMPLOYMENT</b>	<b>Metro Cities</b>	<b>Core Cities</b>	<b>HCT Comm</b>	<b>Cities &amp; Towns</b>	<b>Urban Uninc</b>	<b>Rural</b>	<b>Total</b>
King County	42% (280,000)	48% (317,000)	6% (38,000)	4% (24,000)	0% (1,000)	0% (3,000)	100% (662,000)
Kitsap County	31% (20,000)	26% (17,000)	26% (17,000)	N/A N/A	14% (9,000)	3% (2,000)	100% (66,000)
Pierce County	56% (113,000)	22% (45,000)	10% (19,000)	5% (9,000)	5% (11,000)	2% (4,000)	100% (203,000)
Snohomish County	42% (96,000)	15% (34,000)	26% (58,000)	10% (22,000)	5% (12,000)	2% (5,000)	100% (228,000)
Region	44% (509,000)	36% (413,000)	12% (133,000)	5% (55,000)	3% (33,000)	1% (14,000)	100% (1,158,000)

Some counties and regional geographies have been growing faster or slower than VISION 2040 assumed. The following charts illustrate how the Stay the Course alternative accounts for the lesser or extra amount of growth needed between 2017 and 2050 to ultimately achieve the VISION 2040 growth shares by 2050.

Figure C.2-2. Regional Growth Strategy for Population vs. Growth Trends vs. Stay the Course

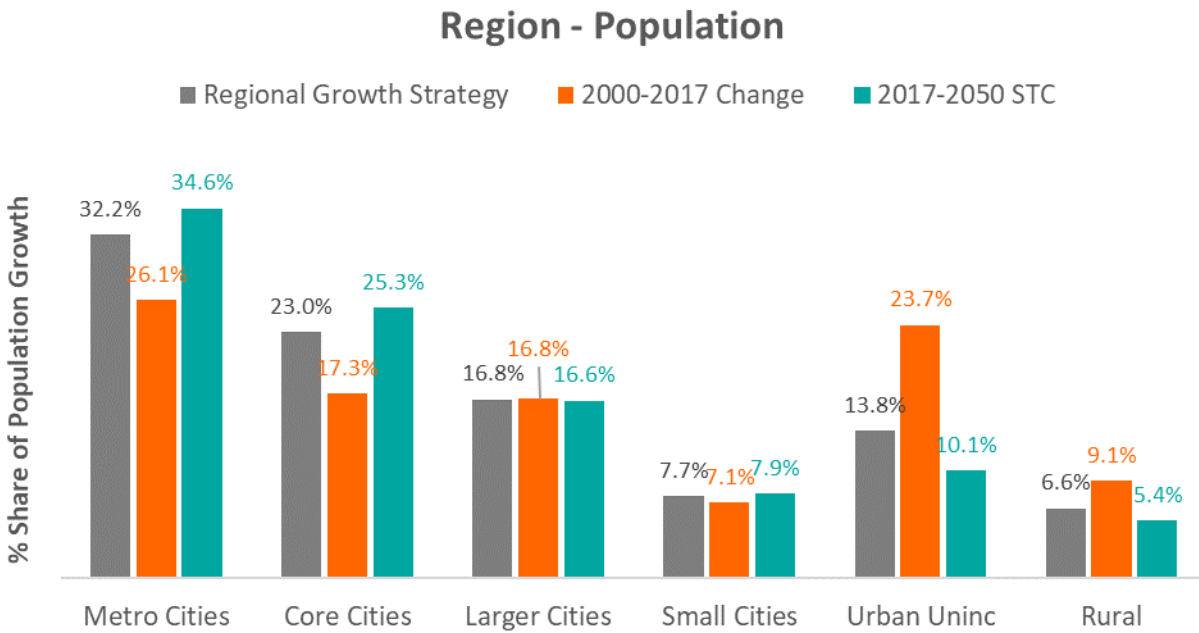
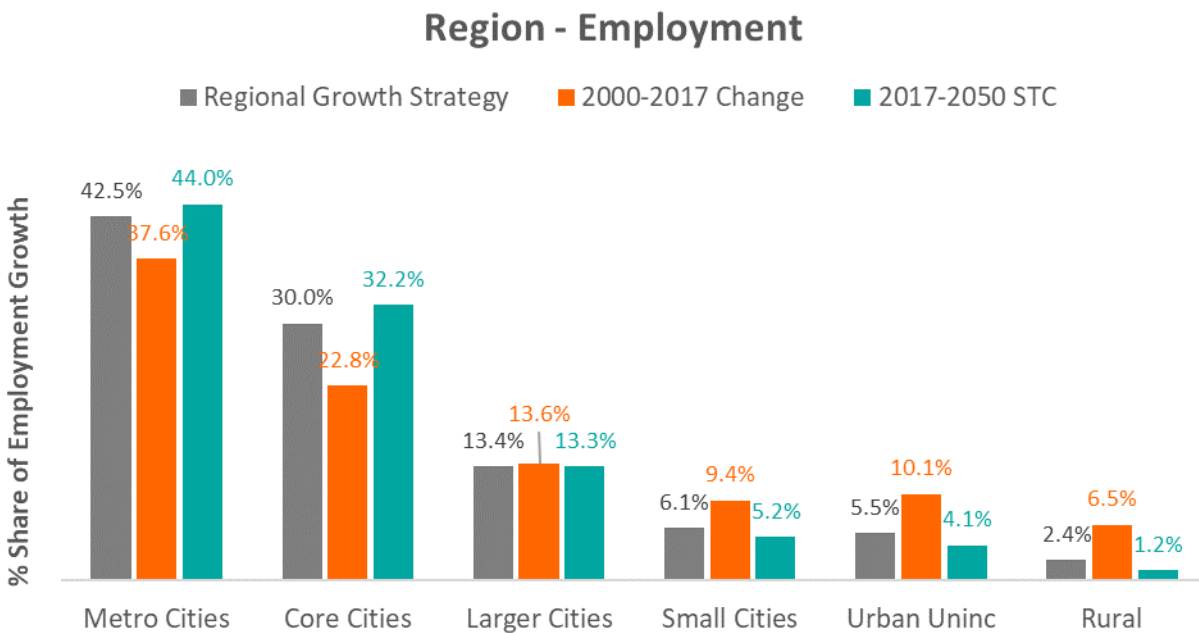


Figure C.2-3. Regional Growth Strategy for Employment vs. Growth Trends vs. Stay the Course



The [Regional Growth Strategy Background Paper](#) (PSRC 2018a) provides more information on growth trends for individual regional geographies, regionally and by county, in comparison to the policy goals of the adopted strategy.

**Regional Geographies in Stay the Course.** PSRC developed preliminary Stay the Course growth allocations based on VISION 2040 regional geographies in which places are classified as Metropolitan Cities, Core Cities, Larger Cities (cities with combined population and employment of 22,500 or higher), Small Cities (cities with population and employment less than 22,500), Unincorporated Urban Growth Areas, and Rural.

For purposes of this environmental analysis and to facilitate comparability across SEIS alternatives, Stay the Course—as presented in Table C.2-8 above—was translated into the revised VISION 2050 regional geographies classification system. To model the Stay the Course alternative, PSRC developed jurisdiction-level growth assumptions based on VISION 2040 regional geographies. (This process is discussed in more detail in section C.2.5 Modeling the Alternatives in UrbanSim – Jurisdiction-Level Control Totals). The jurisdiction-level model inputs, as well as all subsequent model outputs, were then reaggregated for reporting purposes using the revised regional geographies.

For comparison purposes, Stay the Course growth allocations using the VISION 2040 regional geographies are provided in the table below.

**Table C.2-9. 2017-2050 Population and Employment Growth Allocations – Stay the Course by VISION 2040 Regional Geography**

<b>POPULATION</b>	<b>Metro Cities</b>	<b>Core Cities</b>	<b>Larger Cities</b>	<b>Small Cities</b>	<b>Urban Uninc</b>	<b>Rural</b>	<b>Total</b>
King County	39% (259,000)	38% (254,000)	16% (104,000)	4% (25,000)	0% (0)	3% (18,000)	100% (661,000)
Kitsap County	29% (54,000)	15% (28,000)	11% (20,000)	18% (35,000)	16% (31,000)	11% (21,000)	100% (189,000)
Pierce County	41% (174,000)	26% (109,000)	11% (47,000)	11% (48,000)	9% (37,000)	3% (11,000)	100% (426,000)
Snohomish County	25% (120,000)	11% (54,000)	25% (122,000)	6% (31,000)	23% (109,000)	9% (44,000)	100% (480,000)
Region	35% (608,000)	25% (445,000)	17% (292,000)	8% (139,000)	10% (177,000)	5% (95,000)	100% (1,756,000)
<b>EMPLOYMENT</b>	<b>Metro Cities</b>	<b>Core Cities</b>	<b>Larger Cities</b>	<b>Small Cities</b>	<b>Urban Uninc</b>	<b>Rural</b>	<b>Total</b>
King County	42% (280,000)	43% (282,000)	12% (79,000)	3% (17,000)	0% (2,000)	0% (3,000)	100% (662,000)
Kitsap County	31% (20,000)	26% (17,000)	6% (4,000)	20% (13,000)	14% (9,000)	3% (2,000)	100% (66,000)
Pierce County	56% (113,000)	20% (40,000)	8% (16,000)	8% (17,000)	6% (12,000)	2% (4,000)	100% (203,000)
Snohomish County	42% (96,000)	15% (34,000)	24% (55,000)	6% (13,000)	11% (25,000)	2% (5,000)	100% (228,000)
Region	44% (509,000)	32% (373,000)	13% (154,000)	5% (60,000)	4% (48,000)	1% (14,000)	100% (1,158,000)

**Regional Growth Strategy Adjustments.** The VISION 2040 Regional Growth Strategy was adopted by the PSRC General Assembly in April 2008, and has since been updated by the Executive Board via a series of technical amendments to reflect annexations, urban growth area boundary adjustments, and city reclassifications. For purposes of developing the Stay the Course alternative, the current Regional Growth Strategy was adjusted to reflect additional annexations and boundary changes through April 2017, as well as the reclassifications of Bonney Lake, Covington, and Lake Stevens from the Small Cities to Larger Cities category.

The Executive Board has also designated new regional growth centers in the cities of Issaquah and University Place since VISION 2040 was adopted, but the board has not yet formally reclassified those jurisdictions as Core Cities. Issaquah and University Place are reported with other Core Cities in all three SEIS alternatives to reflect their future planning role in implementing VISION 2050, but Stay the Course assumes levels of growth for these cities based on their adopted classification as Larger Cities.

### **C.2.3 Transit Focused Growth Alternative**

The Transit Focused Growth alternative is based on VISION 2040 and assumes accelerated growth near the region's existing and planned transit investments. The alternative assumes that 75 percent of the region's population and employment growth occurs in regional growth centers and areas within a quarter- to a half-mile from current and planned high-capacity transit stations, including light rail, bus rapid transit, commuter rail, ferries, and streetcar. Transit Focused Growth directs the largest shares of growth to Metropolitan Cities, Core Cities, and HCT Communities, and assumes a greater role for areas served by high-capacity transit outside of Metropolitan and Core cities. The remaining balance of growth is distributed largely within the urban growth area among areas not served by high-capacity transit. Growth in Rural and Urban Unincorporated areas is the lowest in this alternative.

Unlike Stay the Course, this alternative (and Reset Urban Growth) uses the revised county growth distributions discussed in the County Growth Shares – Action Alternatives section (see section C.2.1) above, which assumes higher levels of (primarily population) growth in King County and comparatively lower shares of growth to Kitsap, Pierce, and Snohomish counties. It also reflects a more aggressive improvement in the balance of jobs and housing across the region's counties by 2050 relative to Stay the Course.

### **Methodology**

The methodology for developing the Transit Focused Growth alternative begins with Stay the Course population and employment growth allocations for regional geographies at the regional summary level. Transit Focused Growth pivots off Stay the Course by shifting additional growth to Metropolitan Cities, Core Cities, and HCT Communities from Cities Towns, Urban Unincorporated, and Rural areas.

**Table C.2-10. 2017-2050 Population and Employment Growth Allocations – Regional Geography**

<b>POPULATION</b>	<b>Metro Cities</b>	<b>Core Cities</b>	<b>HCT Comm</b>	<b>Cities &amp; Towns</b>	<b>Urban Uninc</b>	<b>Rural</b>	<b>Total</b>
Stay the Course	35%	28%	18%	9%	5%	5%	100%
Transit Focused Growth	36%	29%	23%	6%	4%	2%	100%
<b>EMPLOYMENT</b>	<b>Metro Cities</b>	<b>Core Cities</b>	<b>HCT Comm</b>	<b>Cities &amp; Towns</b>	<b>Urban Uninc</b>	<b>Rural</b>	<b>Total</b>
Stay the Course	44%	36%	12%	5%	3%	1%	100%
Transit Focused Growth	44%	36%	12%	4%	2%	1%	100%

As mentioned above, the Transit Focused Growth alternative also uses a revised set of assumptions regarding how regional population and employment growth is distributed among the region’s counties. The initial calculations use the revised baseline county employment shares (discussed in section C.2.1) without the 5 percentage point jobs shift to improve the balance of jobs and housing across counties.

**Table C.2-11. 2017-2050 Population and Employment Growth Allocations – County**

<b>POPULATION</b>	<b>King County</b>	<b>Kitsap County</b>	<b>Pierce County</b>	<b>Snohomish County</b>	<b>Total</b>
Stay the Course	38%	11%	24%	27%	100%
Transit Focused Growth	50%	5%	21%	24%	100%
<b>EMPLOYMENT</b>	<b>King County</b>	<b>Kitsap County</b>	<b>Pierce County</b>	<b>Snohomish County</b>	<b>Total</b>
Stay the Course	57%	6%	17%	20%	100%
Transit Focused Growth	64%	4%	15%	17%	100%

Regional population and employment growth for the 2017 to 2050 period is first apportioned to counties and regional geographies (at the regional summary level), based on the shares established above. To further allocate growth across regional geographies in each county, the methodology sought to account for the unique role regional geographies play within each county. For example, Core Cities today account for a substantially greater share of total population in King County (33 percent) than in Pierce County (17 percent) and especially Kitsap and Snohomish counties (7 percent).

The methodology uses current (2017) distributions of population and employment by county and regional geography as a proxy for the distinct development patterns that characterize each county in terms of its regional geographies. An iterative proportional fitting process was then applied to adjust the 2017 population and employment distributions to match the county and regional geography-level growth allocations established in the preceding step.

Figure C.2-4. Iterative Proportional Fitting Process

POPULATION	Metro Cities	Core Cities	HCT Comm	Cities & Towns	Urban Uninc	Rural	Total
King County	2017 pop	2017 pop	2017 pop	2017 pop	2017 pop	2017 pop	50%
Kitsap County	2017 pop	2017 pop	2017 pop	2017 pop	2017 pop	2017 pop	5%
Pierce County	2017 pop	2017 pop	2017 pop	2017 pop	2017 pop	2017 pop	21%
Snohomish County	2017 pop	2017 pop	2017 pop	2017 pop	2017 pop	2017 pop	24%
<b>Total</b>	<b>36%</b>	<b>29%</b>	<b>23%</b>	<b>6%</b>	<b>4%</b>	<b>2%</b>	<b>1,756,000</b>

Selected manual adjustments were made to the employment growth allocations to better reflect the intended policy goals of the Transit Focused Growth alternative. And in one last step, the 5 percentage point jobs shift across counties was implemented, which shifts more future job growth to Kitsap, Pierce, and Snohomish counties from King County.

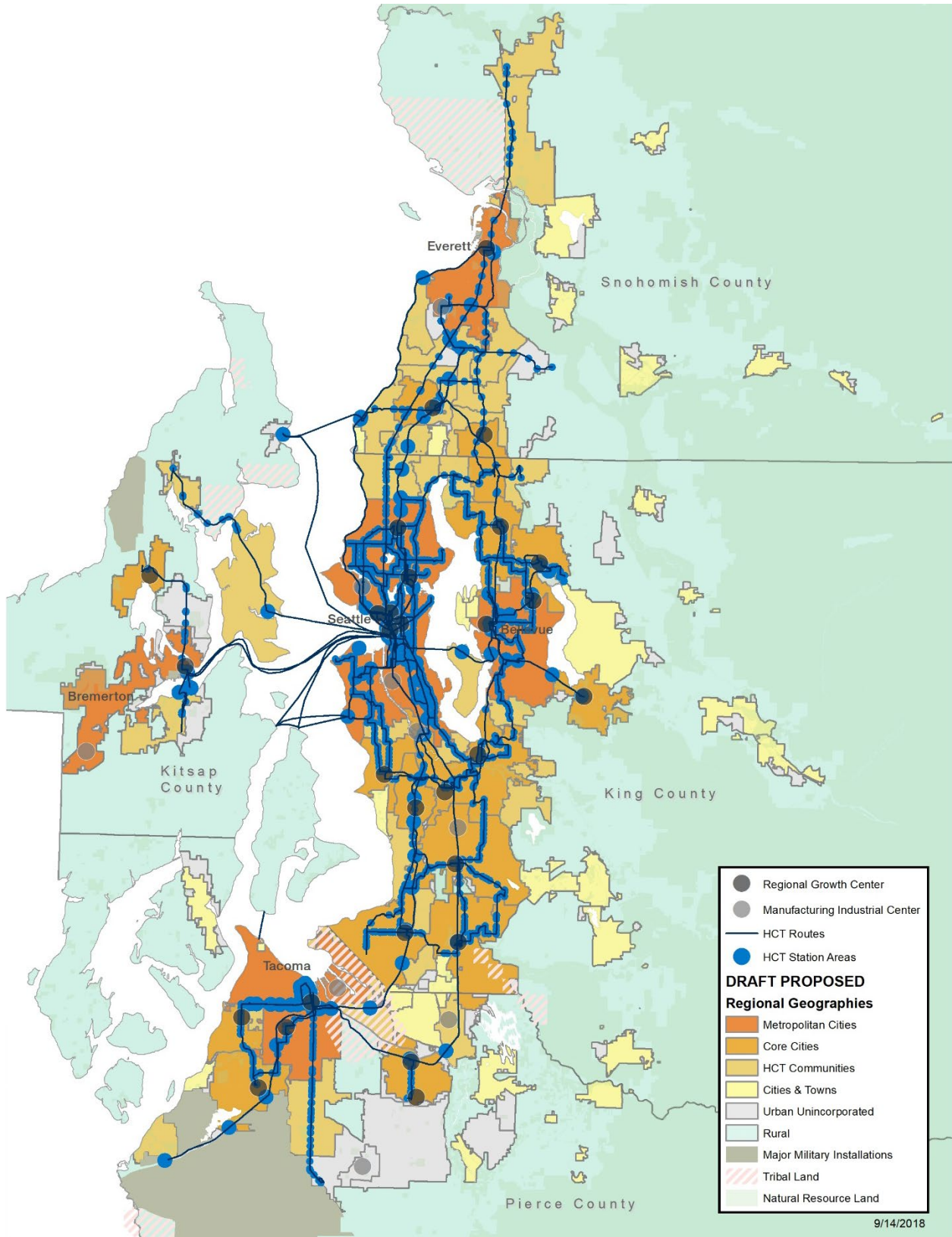
Table C.2-12. 2017-2050 Population and Employment Growth Allocations – Transit Focused Growth

POPULATION	Metro Cities	Core Cities	HCT Comm	Cities & Towns	Urban Uninc	Rural	Total
King County	44%	40%	11%	5%	0%	1%	100%
	(381,000)	(346,000)	(92,000)	(44,000)	(4,000)	(6,000)	(872,000)
Kitsap County	32%	16%	30%	N/A	15%	8%	100%
	(30,000)	(15,000)	(29,000)	N/A	(14,000)	(8,000)	(97,000)
Pierce County	37%	28%	14%	7%	11%	3%	100%
	(134,000)	(101,000)	(52,000)	(25,000)	(41,000)	(11,000)	(364,000)
Snohomish County	20%	11%	54%	9%	3%	2%	100%
	(87,000)	(47,000)	(231,000)	(37,000)	(12,000)	(10,000)	(424,000)
Region	36%	29%	23%	6%	4%	2%	100%
	(632,000)	(509,000)	(404,000)	(105,000)	(70,000)	(35,000)	(1,756,000)
EMPLOYMENT	Metro Cities	Core Cities	HCT Comm	Cities & Towns	Urban Uninc	Rural	Total
King County	46%	45%	6%	3%	0%	0%	100%
	(311,000)	(310,000)	(40,000)	(18,000)	(1,000)	(3,000)	(682,000)
Kitsap County	33%	26%	29%	N/A	6%	5%	100%
	(19,000)	(15,000)	(17,000)	N/A	(4,000)	(3,000)	(57,000)
Pierce County	48%	23%	13%	6%	8%	2%	100%
	(94,000)	(44,000)	(26,000)	(13,000)	(15,000)	(3,000)	(195,000)
Snohomish County	39%	17%	30%	8%	3%	2%	100%
	(89,000)	(39,000)	(68,000)	(18,000)	(7,000)	(4,000)	(225,000)
Region	44%	35%	13%	4%	2%	1%	100%
	(513,000)	(407,000)	(151,000)	(49,000)	(27,000)	(13,000)	(1,158,000)

**Centers and Transit Station Areas.** In addition to directing a greater share of future growth to Metropolitan Cities, Core Cities, and HCT Communities, the Transit Focused Growth alternative has an explicit goal of directing 75 percent of the region’s anticipated population and employment growth to regional growth centers and areas served by existing and planned high-capacity transit investments.

High-capacity transit station areas are defined as areas (parcels) within a one-half mile walk of existing/planned light rail and streetcar stations, commuter rail stations, and ferry terminals within the region's designated urban growth areas (UGA), and/or areas within a one-quarter mile walk of existing/planned bus rapid transit stations in the UGA. Parcels are selected using transportation network-based distances. That is, half- and quarter-mile distances from transit stations are measured using existing street network walking distances. The high-capacity transit stations are locations identified in the 2018 Regional Transportation Plan and are based on the long-range plans adopted by transit agencies. These station areas are likely to see future planning changes and access improvements that expand the one quarter- and half-mile walksheds and are not accounted for in the modeling analysis of the alternatives.

Figure C.2-5. High-Capacity Transit Station Areas



The high-capacity transit station area definition described above was also used to establish the revised VISION 2050 regional geographies classification system discussed in section C.2.1 Key Technical Assumptions and Concepts – Regional Geographies. For that application, urban unincorporated places with high-capacity transit stations are classified as HCT Communities only if they are affiliated for annexation or planning for incorporation.

## **C.2.4 Reset Urban Growth Alternative**

The Reset Urban Growth alternative shares similarities with actual growth patterns that occurred from 2000 to 2017, and assumes a more distributed growth pattern throughout the urban area. Reset Urban Growth generally continues to allocate the largest shares of growth to Metropolitan Cities, Core Cities, and HCT Communities, although the overall growth to these places is less compared to Stay the Course or Transit Focused Growth. Growth in Rural and Urban Unincorporated areas is the highest in this alternative.

This alternative (like Transit Focused Growth) uses the revised county growth distributions discussed in the County Growth Shares – Action Alternatives section (see section C.2.1). The revised county assumptions direct higher levels of (primarily population) growth to King County from the region's other counties. The future balance of jobs and housing across the region's counties shows greater improvement compared to Stay the Course.

### **Methodology**

The Reset Urban Growth alternative begins by allocating 2017 to 2050 forecast regional population and employment growth down to counties using the revised baseline county growth shares discussed in the County Growth Shares – Action Alternatives section. The 5 percentage point jobs shift to improve the balance of jobs and housing across counties is not applied in this initial step. The methodology then uses VISION 2040 population and employment growth shares to further disaggregate the county allocations down to regional geographies.

The key ramification of this approach compared to Stay the Course is that, by the year 2050, regional geographies that grew faster over the last seventeen years (2000 to 2017) than assumed under VISION 2040 would absorb a greater share of the region's growth than called for by the current Regional Growth Strategy, and regional geographies that grew slower would capture a smaller share. The difference can be pronounced for certain regional geographies. The revised baseline county growth shares can accentuate this effect on growth allocations for some regional geographies, while dampening it in others.

Table C.2-13. 2017-2050 Population and Employment Growth Allocations –  
Reset Urban Growth (Preliminary)

POPULATION	Metro Cities	Core Cities	HCT Comm	Cities & Towns	Urban Uninc	Rural	Total
King County	41% (355,000)	38% (332,000)	10% (84,000)	8% (74,000)	0% (3,000)	3% (24,000)	100% (872,000)
Kitsap County	26% (25,000)	13% (12,000)	29% (28,000)	N/A N/A	16% (15,000)	16% (15,000)	100% (97,000)
Pierce County	32% (118,000)	26% (94,000)	7% (27,000)	11% (41,000)	17% (62,000)	6% (22,000)	100% (364,000)
Snohomish County	20% (86,000)	9% (38,000)	40% (170,000)	12% (52,000)	8% (36,000)	10% (43,000)	100% (424,000)
Region	33% (583,000)	27% (477,000)	18% (309,000)	10% (167,000)	7% (116,000)	6% (104,000)	100% (1,756,000)
EMPLOYMENT	Metro Cities	Core Cities	HCT Comm	Cities & Towns	Urban Uninc	Rural	Total
King County	45% (331,000)	44% (328,000)	6% (42,000)	4% (29,000)	1% (4,000)	1% (5,000)	100% (740,000)
Kitsap County	28% (13,000)	23% (11,000)	28% (12,000)	N/A N/A	13% (6,000)	8% (3,000)	100% (45,000)
Pierce County	46% (79,000)	23% (39,000)	13% (23,000)	7% (12,000)	9% (15,000)	3% (6,000)	100% (172,000)
Snohomish County	37% (75,000)	14% (29,000)	28% (56,000)	9% (19,000)	6% (13,000)	5% (10,000)	100% (202,000)
Region	43% (497,000)	35% (406,000)	11% (133,000)	5% (60,000)	3% (37,000)	2% (25,000)	100% (1,158,000)

The methodology then resets the growth allocations for the Cities & Towns and Urban Unincorporated regional geographies using Buildable Lands capacity estimates factored upward by a 10 percent margin. The 10 percent capacity increase assumes that, over the 30-year VISION 2050 planning horizon, these regional geographies are likely to see some limited amount of redevelopment and/or upzones that would increase local development capacities beyond what was assumed in each county's most recent Buildable Lands analysis.

Table C.2-14. Buildable Lands-Based 2017-2050 Population and Employment Growth Allocations

POPULATION	Population		Employment	
	Cities & Towns	Urban Uninc	Cities & Towns	Urban Uninc
King County	74,820	4,390	34,860	1,410
Kitsap County	N/A	23,440	N/A	7,400
Pierce County	49,620	108,340	23,120	26,960
Snohomish County	14,540	69,070	16,350	35,090
Region	138,990	205,240	74,340	70,860

For this application, King County’s Buildable Lands estimates for urban unincorporated communities were adjusted using parcel-level UrbanSim capacity estimates to account for areas that had been annexed since the estimates were published. Pierce County’s summary Buildable Lands estimates for its entire urban unincorporated area were apportioned to individual urban unincorporated planning communities using the county’s parcel-level Buildable Lands database. In both counties, housing capacity estimates were converted to population using a series of jurisdiction-specific factors for vacancy, average household size, and group quarter population.

The final Reset Urban Growth alternative uses the preliminary Rural growth allocations along with the Buildable Lands-based growth allocations for Cities & Towns and Urban Unincorporated. The balance of remaining growth within each county is then proportionally reallocated to Metropolitan Cities, Core Cities, and HCT Communities based on the preliminary growth distributions. Selected manual adjustments were made to the employment growth allocations to better reflect the intended policy goals of the Reset Urban Growth alternative. Lastly, the 5 percentage point jobs shift to improve the balance of jobs and housing across counties was implemented, which shifts more job growth to Kitsap, Pierce, and Snohomish counties from King County. During this final adjustment, the growth allocations for Cities & Towns, Urban Unincorporated, and Rural were held constant such that the shift only impacted Metropolitan Cities, Core Cities, and HCT Communities.

Table C.2-15. 2017-2050 Population and Employment Growth Allocations –  
Reset Urban Growth

POPULATION	Metro Cities	Core Cities	HCT Comm	Cities & Towns	Urban Uninc	Rural	Total
King County	41% (354,000)	38% (331,000)	10% (83,000)	9% (75,000)	1% (4,000)	3% (24,000)	100% (872,000)
Kitsap County	21% (20,000)	9% (9,000)	30% (29,000)	N/A N/A	24% (23,000)	16% (15,000)	100% (97,000)
Pierce County	26% (96,000)	17% (62,000)	7% (26,000)	14% (50,000)	30% (108,000)	6% (22,000)	100% (364,000)
Snohomish County	19% (82,000)	8% (36,000)	42% (180,000)	3% (15,000)	16% (69,000)	10% (43,000)	100% (424,000)
Region	31% (551,000)	25% (438,000)	18% (318,000)	8% (139,000)	12% (205,000)	6% (104,000)	100% (1,756,000)
EMPLOYMENT	Metro Cities	Core Cities	HCT Comm	Cities & Towns	Urban Uninc	Rural	Total
King County	44% (303,000)	44% (300,000)	6% (38,000)	5% (35,000)	0% (1,000)	1% (5,000)	100% (682,000)
Kitsap County	29% (16,000)	24% (13,000)	28% (16,000)	N/A N/A	13% (7,000)	6% (3,000)	100% (57,000)
Pierce County	40% (78,000)	19% (36,000)	13% (25,000)	12% (23,000)	14% (27,000)	3% (6,000)	100% (195,000)
Snohomish County	34% (76,000)	11% (25,000)	28% (62,000)	7% (16,000)	16% (35,000)	5% (10,000)	100% (225,000)
Region	41% (473,000)	32% (374,000)	12% (141,000)	6% (74,000)	6% (71,000)	2% (25,000)	100% (1,158,000)

## C.2.5 Modeling the Alternatives in UrbanSim

Once the growth assumptions for each SEIS alternative are defined at the county and regional geography levels, additional steps are taken to prepare the alternatives for simulation in the UrbanSim model framework.

### Jurisdiction-Level Control Totals

To model the SEIS alternatives, UrbanSim uses jurisdiction-level growth assumptions for population, households, and employment as intermediate inputs for disaggregating county and regional geography-level growth allocations down to parcels. Within each jurisdiction, the model then simulates how the growth is likely to occur at the parcel level given the development parameters set by the jurisdiction’s comprehensive plan and/or zoning regulations.

**Local Growth Targets.** PSRC used the latest available local population and employment growth targets established through countywide target-setting processes to proportionally disaggregate the 2017 to 2050 growth assumptions for each alternative from county regional geographies down to individual jurisdictions. In this approach, growth targets serve as a proxy for shared understanding between local jurisdictions as to the relative role each plays in accommodating their respective county’s future growth.

In King County, where growth targets are established in housing units in lieu of population, a series of jurisdiction-specific factors for vacancy, average household size, and group quarter population are applied to convert local housing targets to population. In King and Snohomish counties, where employment targets do not include jobs in the construction & resource sector, those jobs are estimated and added so the targets represent total employment.

**Base and Future Year Controls.** Throughout the annual simulation process, jurisdiction-level controls are instituted in the 2017 base year and in 5-year increments from 2020 to 2050. The 2017 base year controls are based on actual population, household, and employment estimates. Jurisdictional growth assumptions (2017 to 2050) for each alternative are added to the base year estimates to produce 2050 horizon year controls. Controls for the remaining future year increments from 2020 to 2045 are interpolated on a straight-line basis from the 2017 and 2050 values, then adjusted to match regional controls from PSRC's Macroeconomic Forecast. All jurisdiction-level control totals reflect municipal and planning boundaries as of April 1, 2017.

**Population and Household Controls.** The UrbanSim household location choice model simulates the placement of new households and persons allocated to each jurisdiction, as well as a subset of movers, into vacant housing units. It does not account for persons in group quarter facilities (e.g., college dormitories, nursing homes, correctional facilities, etc.).

Preliminary jurisdiction-level controls for total population are adjusted to remove the group quarters component. Jurisdiction-specific factors for average household size are then applied to convert the household population controls into households. Lastly, household population is sorted into households by size of household (e.g., 1-person, 2-person, 3-person, etc.), which serve as the final inputs to the model. The group quarters component is added back in as a post-processing step subsequent to the modeling process to develop the evaluation metrics used in analyzing the modeling results.

**Employment Controls.** Similarly, the UrbanSim employment location choice model works to place new jobs as well as a subset of relocating firms/jobs into available commercial and industrial space. The model accounts for jobs by sector, home-based employment, and civilian military employment, but does not address non-civilian military employment (i.e., enlisted and service personnel).

PSRC does not forecast change on military bases which are assumed to maintain existing levels of non-civilian military employment across all alternatives. Uniformed military personnel counts are added back in as a post-processing step subsequent to the modeling process for reporting purposes.

## **Additional Modeling Assumptions**

In simulating the three SEIS alternatives, the following adjustments to the UrbanSim model and model inputs were applied:

**Capacity Adjustments.** PSRC uses local zoning and development regulations to represent allowable future land uses. Future land use assumptions for local jurisdictions were compiled

from 2015/16 comprehensive plan updates and revised where significant zoning changes were adopted following the update. In some instances, the jurisdiction-level control totals resulting from the methodology described above may exceed the maximum development capacity as interpreted from local comprehensive plans and/or zoning. In these cases, PSRC increases capacity equally across all zones within the jurisdiction to accommodate the control total. These assumed capacity adjustments are for modeling and analysis purposes only – actual growth targets and future changes in development capacity would differ based on local circumstances and planning.

**Stay the Course and Reset Urban Growth Alternatives.** For jurisdictions with a designated regional growth center or centers, capacity is increased for all parcels located within centers to increase the likelihood of higher-density projects being developed through the simulation. The capacity boost is intended to direct a greater share of each jurisdiction's growth to its growth center or centers per VISION 2040 policy.

**Transit Focused Growth Alternative.** The Transit Focused Growth alternative explicitly directs 75 percent of future population and employment growth to designated regional growth centers and high-capacity transit station areas. To operationalize this concept within the UrbanSim model framework, PSRC used the following approach:

***HCT Area Control Totals.*** First, jurisdictional population and employment control totals for each Metropolitan City, Core City, and HCT Community were apportioned to HCT and non-HCT areas within each jurisdiction based on estimated development capacity. In an iterative process, the growth assumptions for individual HCT areas were increased until the sum across all HCT areas met the 75 percent regional threshold. The non-HCT component of each jurisdiction's control totals were adjusted downward accordingly – but no lower than a 10 percent share – to maintain the original jurisdiction-wide control values. This approach ensures that the simulation process is guided by controls that place exactly 75 percent of regional population and employment growth into HCT areas.

***HCT Area Capacity Adjustments.*** Secondly, capacity assumptions for HCT areas were scaled upwards in some jurisdictions as needed to accommodate the assigned growth.

## **UrbanSim Model Output**

The UrbanSim land use modeling outputs serve as inputs to the regional travel demand forecasting model, and the travel modeling outputs in turn support the air quality analysis tool. Outputs from all three modeling processes were used to produce a set of evaluation metrics—presented in the Evaluating the VISION 2050 SEIS Alternatives section that follows—that quantify the differential environmental impacts of each SEIS alternative.

# C.3 Evaluating the VISION 2050 SEIS Alternatives

## C.3.1 Model-Based Evaluation Metrics

The analysis of the environmental impacts of the VISION 2050 SEIS alternatives—documented in the Environmental Effects and Mitigation chapter (Chapter 4) of this document—relied upon a series of quantitative evaluation metrics developed from PSRC’s land use, travel demand, and air quality models. These metrics will also serve as evaluation criteria to inform the selection of the preferred growth alternative as described in Appendix D.

The full set of model-derived indicators is presented below in Table C.3-1.

Table C.3-1. Model-Based Indicators for Evaluating VISION 2050 SEIS Alternatives

Indicator	Definition	Unit	Reporting Geography or Category
<b>Population, Employment &amp; Housing</b>			
Population and Employment Density Change (map)	Change in activity unit density per acre – 2017-2050	Activity units (i.e., persons + jobs) per acre	Hexagonal (90-acre) grid cells
Population and Employment Density (map)	Activity unit density per acre – 2050	Activity units (i.e., persons + jobs) per acre	Hexagonal (90-acre) grid cells
Jobs-Housing Ratio	Jobs per housing unit ratios – 2017 and 2050; ratios indexed to regional average jobs-housing ratio	Jobs per housing unit	Region Regional subareas Equity geographies
Housing Choice	Housing units in areas zoned for low density (<12 units/acre), moderate density (12-49 units/acre), and high density (50+ units/acre) residential and mixed-use development – 2017 and 2017-2050 change	Housing units, percent share	Region Counties Equity geographies
<b>Land Use</b>			
Population and Employment Density Change (map)	(Same as Population, Employment & Housing indicator above)		
Population and Employment Density (map)	(Same as Population, Employment & Housing indicator above)		

Table C.3-1. Model-Based Indicators for Evaluating VISION 2050 SEIS Alternatives  
(continued)

Indicator	Definition	Unit	Reporting Geography or Category
Developed Land	Land area (acres) developed on vacant parcels vs. redeveloped parcels – 2017 (total developed land only) and 2017-2050 change; development types are defined as low density (<12 units/acre), moderate density (12-49 units/acre), and high density (50+ units/acre) residential and mixed-use development	Acres	Region Counties Development types Equity geographies
Development Proximity to UGA Boundary	Activity units within (inside and outside) one-quarter mile of urban growth area boundary – 2017 and 2017-2050 change	Activity units (i.e. persons + jobs), total and percent	Region Counties
Access to Transit Service	Activity units within one-half mile of light rail stations, commuter rail stations, and ferry terminals and/or within one-quarter mile of bus rapid transit and local transit stations – 2017 and 2017-2050 change	Activity units (i.e., persons + jobs), total and percent	Region Counties Equity geographies
Growth in TOD Areas	Activity units in regional growth centers and/or within one-half mile of light rail stations, commuter rail stations, and ferry terminals in urban growth areas and/or within one-quarter mile of bus rapid transit in urban growth areas – 2017 and 2017-2050 change	Activity units (i.e., persons + jobs), total and percent	Region Counties Equity geographies
<b>Transportation</b>			
Average Trip Distance – Commute Trips	Average weekday commute trip distance from home to work for residents – 2014 and 2050; excludes truck, visitor, external, and airport trips	Miles	Region Counties Regional subareas Equity geographies
Average Trip Distance – Non-Commute Trips	Average weekday non-commute trip distance for residents – 2014 and 2050; excludes truck, visitor, external, and airport trips	Miles	Region Counties Regional subareas Equity geographies
Mode Share – Commute Trips	Average weekday resident home to work commute mode share (SOV, HOV, Transit, Walk, Bike) – 2014 and 2050	Trips, percent share	Region Counties Equity geographies
Mode Share – Non-Commute Trips	Average weekday resident non-commute mode share (SOV, HOV, Transit and School Bus, Walk, Bike) – 2014 and 2050	Trips, percent share	Region Counties Equity geographies
Vehicle Miles Traveled – Residents	Average daily weekday vehicle miles traveled per resident – 2014 and 2050; excludes truck, visitor, and airport trips	Miles	Region Counties Regional subareas Equity geographies

Table C.3-1. Model-Based Indicators for Evaluating VISION 2050 SEIS Alternatives  
(continued)

Indicator	Definition	Unit	Reporting Geography or Category
Vehicle Miles Traveled – System	Total daily weekday vehicle miles on the PSRC roadway network – 2014 and 2050; includes resident, truck, visitor, and airport trips	Miles	Region Counties
Vehicle Time Traveled – Residents	Average daily weekday vehicle minutes traveled per resident – 2014 and 2050; excludes truck, visitor, and airport trips	Minutes	Region Counties Regional subareas Equity geographies
Vehicle Time Traveled – System	Total daily weekday vehicle hours on the PSRC roadway network – 2014 and 2050; includes resident, truck, visitor, and airport trips	Hours	Region Counties
Vehicle Delay – Residents	Average annual delay hours per resident – 2014 and 2050; excludes truck, visitor, and airport trips	Hours	Region Counties Regional subareas Equity geographies
Vehicle Delay – System	Total daily weekday vehicle delay hours on the PSRC roadway network – 2014 and 2050; includes resident, truck, visitor, and airport trips	Hours	Region Counties
Transit Boardings	Annual PSRC region transit network boardings by operator – 2014 and 2050; excludes ferry boardings	Transit boardings	Region Transit agencies
Residents Walking, Biking, or Using Transit	Percent of residents walking, biking, or using transit on an average weekday – 2014 and 2050	Persons, percent	Region Counties Equity geographies
Job Accessibility by Travel Mode	Average number of jobs within a 45-minute transit trip, 1-mile walk, or 3-mile bike ride – 2014 and 2050; weighted by number of people in each zone	Jobs	Counties Equity geographies
Travel Time for Major Corridors	Average 2050 weekday travel times for passenger vehicles between select locations during peak morning (AM) and afternoon (PM) periods	Minutes	Travel Corridor
<b>Air Quality</b>			
Projected Pollutant Emissions	Total daily tons of emissions from all passenger vehicles and trucks on a typical weekday across the region for CO, NO <sub>x</sub> , VOCs, CO <sub>2</sub> e, PM <sub>10</sub> , and PM <sub>2.5</sub> – 2014 and 2050	Tons	Region

Table C.3-1. Model-Based Indicators for Evaluating VISION 2050 SEIS Alternatives  
(continued)

Indicator	Definition	Unit	Reporting Geography or Category
<b>Water Quality &amp; Hydrology</b>			
Impervious Surface	Acres of impervious surface – 2017 and 2017-2050 change; age of development is categorized as built before 1996, built 1996 or after, and built before 1996 but redeveloped 1996 or after	Acres	Region Counties Age of development
Developed Land	(Same as Land Use indicator above)		
<b>Parks &amp; Recreation</b>			
Access to Parks	Population within one-quarter mile of “parks providing local urban access,” defined as parks, trails, and other open space facilities located in or within one-quarter mile of urban growth areas – 2017 and 2017-2050 change	Persons, total and percent	Region Counties Equity geographies
<b>Social Equity &amp; Environmental Justice</b>			
Access to Opportunity	Population in census tracts defined as having moderate, high, or very high access to opportunity; i.e., tracts with the highest 60% of Opportunity Index scores per PSRC’s 2018 Opportunity Index	Persons, total and percent	Region Counties Equity geographies
Displacement Risk	Population in census tracts defined as having higher displacement risk; i.e., tracts with the highest 10% of Displacement Risk Index scores per PSRC’s 2018 Displacement Risk Index	Persons, total and percent	Region Counties Equity geographies

CO = carbon monoxide; CO<sub>2e</sub> = carbon dioxide equivalent; HOV = high-occupancy vehicle; NO<sub>x</sub> = nitrogen oxides; PM<sub>2.5</sub> = fine particulates; PM<sub>10</sub> = coarse particulates; SOV = single-occupant vehicle; TOD = transit-oriented development; VOC = volatile organic compound

In addition to the model-based evaluation metrics detailed above, the analysis of the SEIS alternatives was also supplemented by a variety of non-modeled quantitative data metrics and qualitative assessments provided by the consultants at Parametrix.

### C.3.2 Equity Geographies

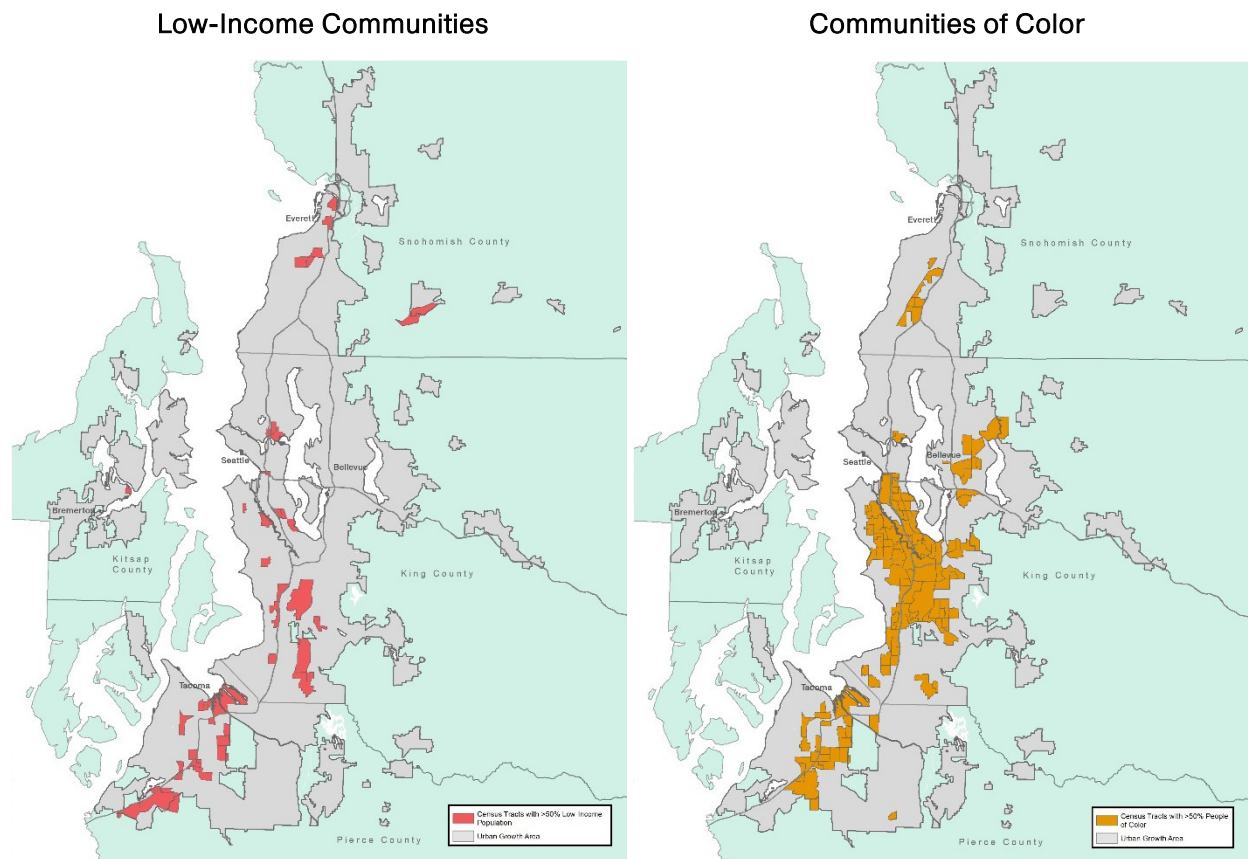
To support the Environmental Justice impacts analysis and social equity considerations described in Chapters 4 and 5 of this document, as well as the broader Social Equity Analysis presented in Appendix H, a subset of the evaluation metrics was produced for four “equity geographies” to facilitate an assessment of how the alternatives may differentially impact the region’s low-income communities and people of color.

The four equity geographies were defined as follows:

- **Low-Income Communities:** Census tracts in which more than half the population today is at or below 200 percent of the federal poverty threshold
- **Non-Low Income:** Census tracts in which 50 percent or less of the population today is at or below 200 percent of the federal poverty threshold
- **Communities of Color:** Census tracts in which more than half the population today is non-White, including White Hispanics
- **Non-Minority:** Census tracts in which 50 percent or less of the population today is non-White, including White Hispanics

The region's census tracts were assigned to the four equity geographies using data from the 2012 to 2016 American Community Survey 5-year estimates series.

Figure C.3-1. Equity Geographies



### C.3.3 Access to Opportunity and Displacement Risk

Two metrics were developed to facilitate discussions regarding social equity and environmental justice in the evaluation of the alternatives. “Access to Opportunity” measures population growth for the different alternatives in “Areas of Moderate to Very High Opportunity,”

defined as census tracts with the highest 60 percent of Opportunity Index scores per PSRC's 2018 Opportunity Index.

"Displacement Risk" measures population growth in "Areas of Higher Displacement Risk," defined as census tracts with the highest 10 percent of Displacement Risk Index scores per PSRC's 2018 Displacement Risk Index. Both measures were calculated for the region, the four counties, and the four equity geographies. The methodologies for the Opportunity Index and the Displacement Risk Index are described below.

## **Opportunity Index**

The Access to Opportunity measure is based on PSRC's 2018 Opportunity Index, which was originally developed as part of the Growing Transit Communities work done by PSRC and the Kirwan Institute for the Study of Race and Ethnicity at The Ohio State University and published in May 2012.

In 2011, a variety of stakeholders and advocates throughout the region contributed to the development of the regional Opportunity Index. This participation process resulted in a set of opportunity indicators representing five key elements of neighborhood opportunity: Education, Economic Health, Housing and Neighborhood Quality, Mobility and Transportation, and Health and Environment. The data from these five opportunity indicators were compiled into a comprehensive index of opportunity for all census tracts within the urbanized growth area of the region. A background report with a more detailed discussion of individual metrics and data sources, and an interactive online map are available on PSRC's website:

<https://www.psrc.org/opportunity-mapping>.

In 2018, the Opportunity Index was updated with the most recent applicable data and expanded to include all census tracts in the region. The level of opportunity (very low, low, moderate, high, very high) is determined by sorting all census tracts into quintiles based on their index scores. The census tracts identified as having "very high" opportunity represent the top 20 percent of scores among all tracts, "high" the next 20 percent, etc. As such, "Areas of Moderate to Very High Opportunity" represent the top 60 percent of scores among all tracts.

## **Displacement Risk Index**

The Displacement Risk measure is based on a new regional Displacement Risk Index, which was developed by PSRC following a similar approach used by the City of Seattle for their analysis in the 2035 Growth and Equity report. The index is a composite of displacement indicators representing five elements of neighborhood displacement risks: Socio-Demographics, Transportation Qualities, Neighborhood Characteristics, Housing, and Civic Engagement. The data from these five groups of displacement indicators were compiled into a comprehensive index of displacement risk for all census tracts in the region. "Areas of Higher Displacement Risk" is determined by sorting all census tracts based on their index scores and represent the top 10 percent of scores among all tracts.